

FLAME FM KOSMOS

QUAD POLYPHONIC FM VOICE
EURO RACK MODULE

for firmware version 1.00 release and above

last change: November 16, 2024



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SHORT DESCRIPTION

Thank you for acquiring the FLAME FM KOSMOS eurorack module.

This module is a versatile, four-voice polyphonic FM synthesizer, interwoven with a potent multi-effects processor. Each voice is endowed with six operators, interconnected through thirty-two selectable algorithms, visually represented on the graphic display. Every operator possesses an ADSR envelope, capable of looping. A remarkable feature is the ability to morph seamlessly between two distinct sound variants, A and B. This transformative power extends to the effects parameters, allowing for dynamic sonic evolution.

The multi-effects processor presents a trio of effects, arranged in a sequential configuration: stereo chorus, stereo delay, and reverb. Notably, the stereo delay offers synchronization capabilities via MIDI clock or analog clock.

The MASTER page provides a suite of parameters for global sound manipulation. The envelope of all operators can be collectively compressed or stretched, while a low-pass and high-pass filter are available for sculpting the audio sum.

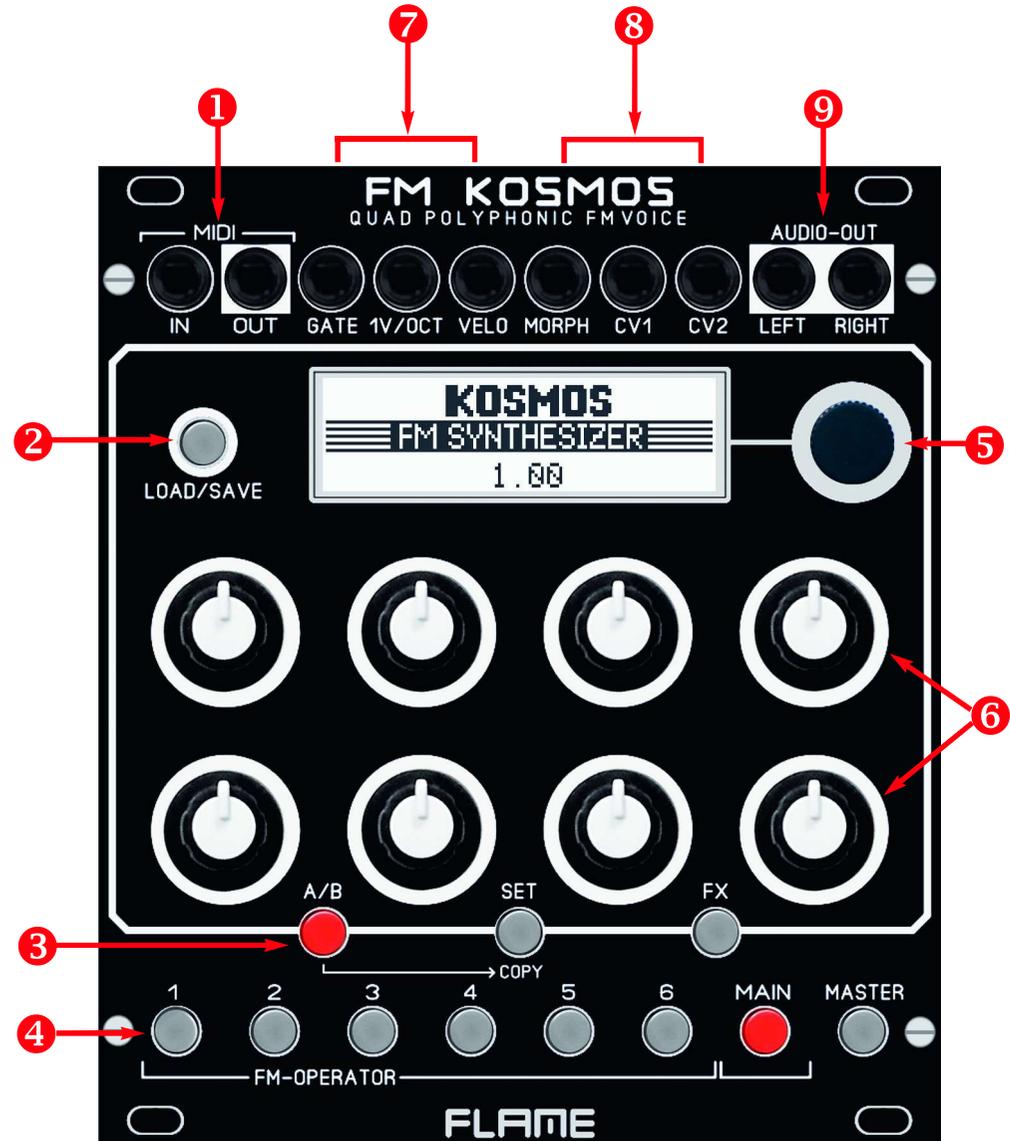
During its development, meticulous attention was paid to ensuring intuitive and direct operation, particularly for live performance. The eight potentiometers offer immediate control over page parameters, while the menus are designed for effortless access, eliminating unnecessary detours. This streamlined approach prioritizes efficient sound editing. A library of one hundred twenty-eight preset sounds, organized into eight groups, is readily available. Additionally, one hundred twenty-eight memory locations are reserved for user-created sounds.

The module supports both analog and digital triggering. Analog inputs, comprising Gate, 1V/Octave, and Velocity CV, provide a classic approach. For expanded control, a CV input dedicated to the Morph function and two programmable CV inputs are included. Regardless of the triggering method, the module offers comprehensive MIDI functionality. The MIDI input and output facilitate seamless integration into external MIDI setups, utilizing the MIDI-TRS-B standard.

The firmware is updatable via MIDI Sysex, enabling future enhancements and customization. Furthermore, the created sound data can be preserved or shared with others.

MODUL OVERVIEW

- ① 1x MIDI-In, 1x MIDI-out (Typ: TRS-B)
- ② Button: LOAD/SAVE
- ③ Buttons: A/B, SETUP, MULTIEFFECT (FX)
- ④ Buttons: OPERATOR 1-6, MAIN, MASTER
- ⑤ DISPLAY / PUSH ENCODER
- ⑥ 8x KNOBS (POTENTIOMETERS)
- ⑦ 3x Inputs: Gate, 1V/Octave CV, Velocity CV
- ⑧ 3x CV inputs: Morph, User CV1 and CV2
- ⑨ Stereo AUDIO output



CONNECTION TO THE MODULAR SYSTEM

DOEPFER POWER CONNECTOR

The module is delivered with a ribbon cable connected to the Doepfer bus. The color-coded wire (usually red) represents minus 12 volts.

It is important to ensure that the polarity is correct when connecting. If the module is accidentally connected incorrectly, protective diodes prevent the module from being destroyed immediately (but it cannot be ruled out that damage may still occur).

Therefore, be careful: Check the connection several times before switching on for the first time!

The module's maximum current consumption at 12V is approx. +120mA / - 60mA (peak +140mA-70mA). The 5V supply is not used.

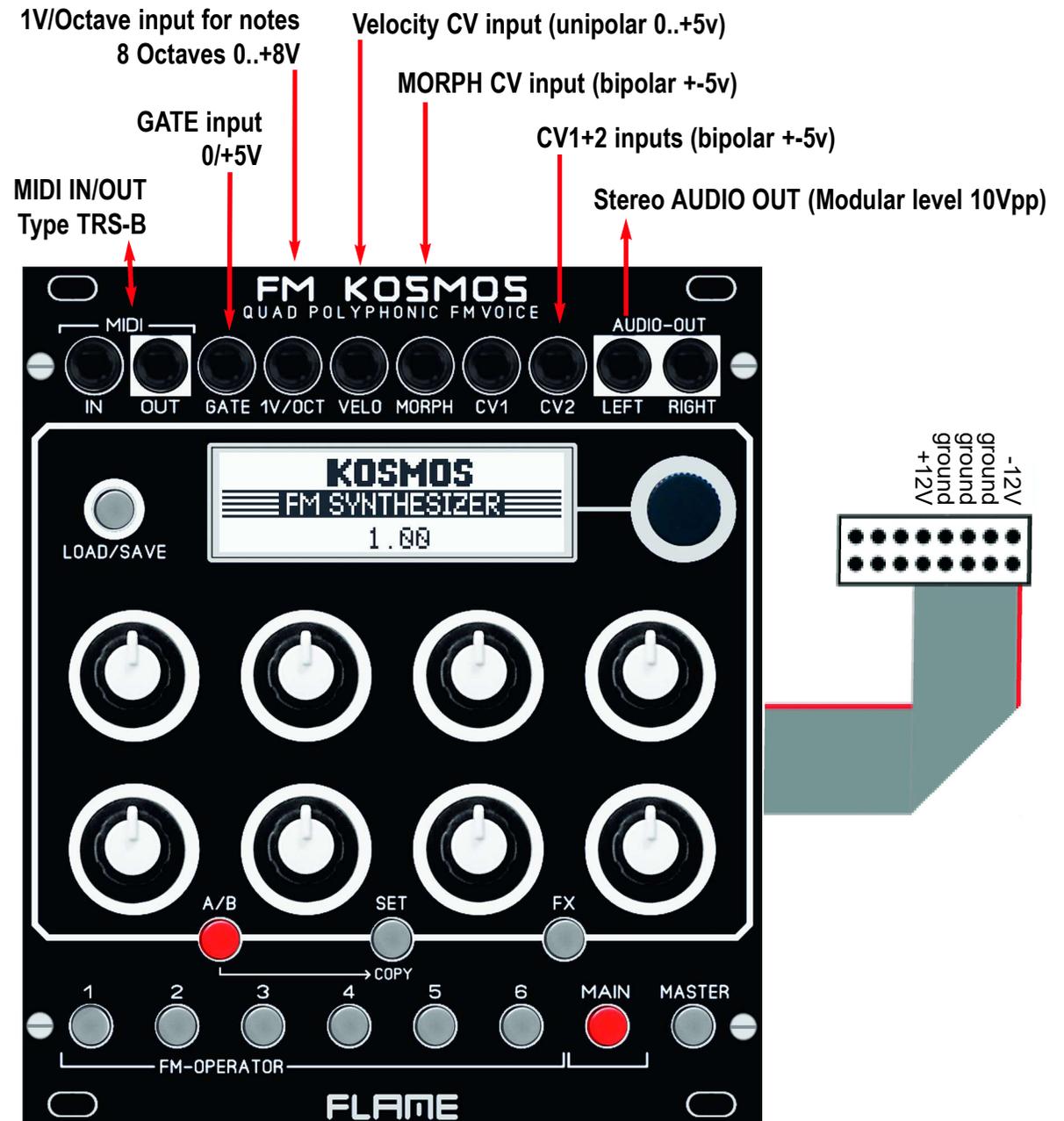
NOTE!

Do not accidentally connect high CV voltages to the MIDI-IN! This may damage the hardware!

CV INPUTS

The CV inputs are normalized as follows when the cable is not plugged in:

- CV Velocity: +5v (input level range 0..+5v)
- CV Morph: -5v (input level range -5v..+5v)
- CV 1+2: -5v (input level range -5v..+5v)



FIRST STEPS

OPERATION

Direct access to key menus is achieved through dedicated buttons. Six buttons control the operators, while separate buttons activate the MAIN menu (global sound settings) and the MASTER menu. The FX button grants immediate access to the multi-effects, with subsequent presses cycling through the three FX pages. (Refer to the FX PAGES - MULTI-EFFECTS chapter for detailed information.)

The SETUP menu is invoked using the SET button, with further presses navigating through various settings. Returning to the FX or SET function promptly brings you back to the last accessed page. Specific parameter descriptions within each page can be found in the corresponding chapters.

Loading and saving sounds are handled by a single button. A brief press activates the Load menu, while a longer press initiates the Save menu. (Refer to the LOADING/SAVING SOUNDS chapter for more details.)

The A/B button doesn't directly access a page but toggles between sound variants A and B within the Operator and FX menus. All parameter adjustments within these menus affect the selected variant, with no immediate morphing between A and B. However, the Morph setting, controlled by the MASTER menu's Morph parameter, the Morph CV input, or MIDI Controller 1 (Mod wheel), enables smooth transitions between variants.

DISPLAY ALGORITHM GRAPHIC

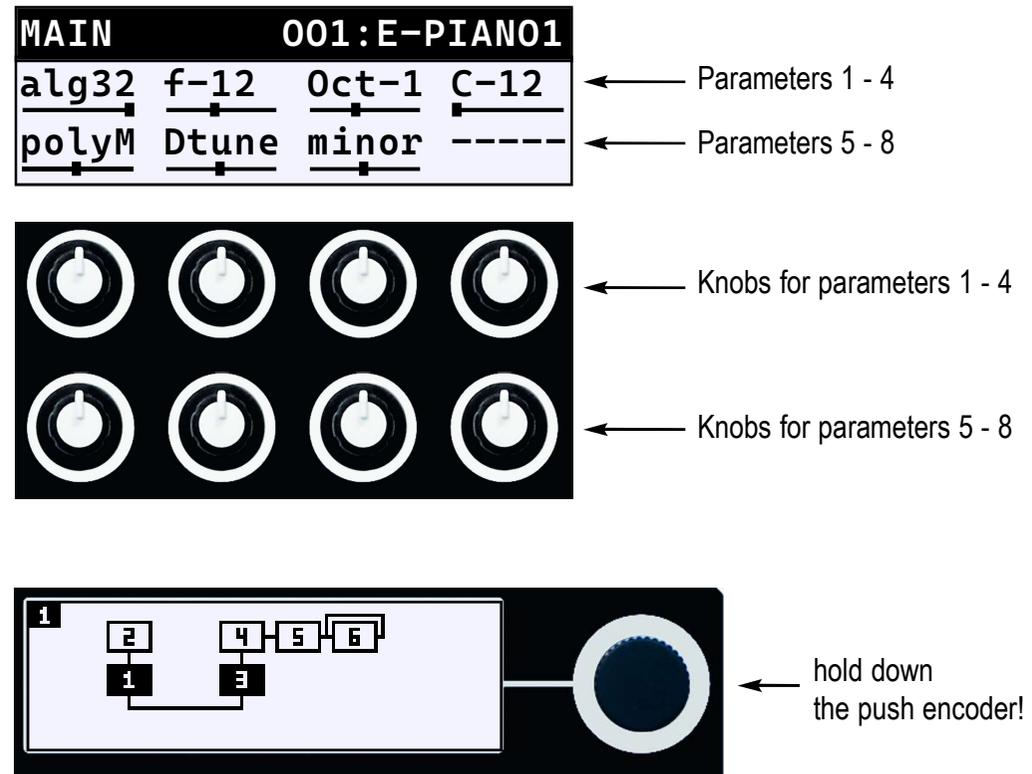
Holding down the data wheel in the Operator 1-6, Main, and Master menus reveals a graphical representation of the active FM algorithm.

TUNING TO FUNDAMENTAL NOTE C

To globally tune the module, access the MASTER menu and set parameters 2-4 to their middle positions while a sound is loaded in the MAIN page (**f0 Oct0 c0**). Send a MIDI note C and then fine-tune the module using the Mastertune parameter in the SETUP menu (default setting: 30).

CONTROL INTERFACE

The eight knobs control up to eight parameters displayed on the screen. When switching pages, the knob settings are preserved to avoid sudden value jumps. The current parameter value is indicated by a small slider graphic below the name and/or directly within the parameter name (e.g., parameter 7 chord in the MAIN menu). Unused parameters are marked with a dashed line (e.g., parameter 8 in the MAIN menu).



LOAD / SAVE SOUNDS

LOAD SOUNDS

LOAD USER SOUND:

The module provides 128 USER memory locations for storing your custom sounds. These sounds can also be recalled using MIDI Program Change commands.

To load a USER sound, briefly press the LOAD/SAVE button to access the LOAD menu. Use the DATA control to select the desired USER sound (001-128). Pressing the DATA control again will load the selected sound. To cancel the loading process, press the LOAD button or another menu button.

LOAD PRESET SOUND:

The module offers 128 PRESET sounds, organized into 8 groups of 16 sounds each. These presets serve as templates for your own sound creations but cannot be overwritten. The 8 banks are assigned to the 8 rotary controls.

To load a PRESET sound, briefly press the LOAD/SAVE button to enter the LOAD menu. Then, use one of the 8 potentiometers (bank A-H) to select a sound (01-16) from the corresponding bank. Press the DATA control to load the selected PRESET sound. To cancel the loading process, press the LOAD button or another menu button.

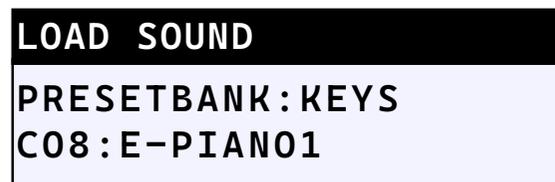
BANKS OF PRESET SOUNDS:

- A LEAD (synths)
- B BASS (various basses)
- C KEYS (solo voices, EPiano, organ etc.)
- D PERCUSSIVE (tonal and noisy drum sounds)
- E PADS (pads)
- F DRONE (more pads)
- G MOVING (pad sounds with loops and movements)
- H FX+NOISE (effect and noise sounds)

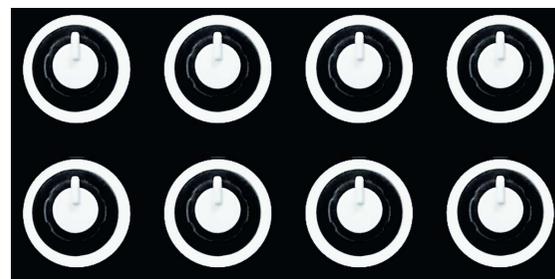
The complete list of all preset sounds can be found on page 26!



← User Bank
← No. and sound name



← Preset Bank
← No. and sound name



← Knobs for Bank A .. D
← Knobs for Bank E .. H

LOAD / SAVE SOUNDS

SAVE SOUND

SAVING USER SOUND:

The module provides 128 USER memory locations for storing your custom sound programs. Please note that the preset sound banks cannot be modified.

To save a sound, press and hold the LOAD/SAVE button to access the SAVE menu. Use the DATA control to select the desired USER memory location (001-128) where you want to store the currently loaded sound. The bottom line of the display shows the memory location number and the name of the sound program that is currently stored there. To save the sound, press the DATA control. You can cancel the saving process by pressing the LOAD button or another menu button.

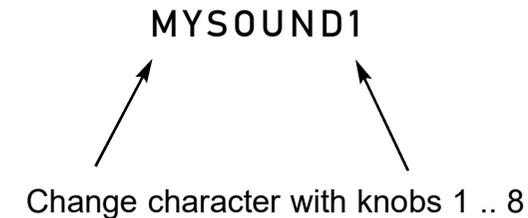
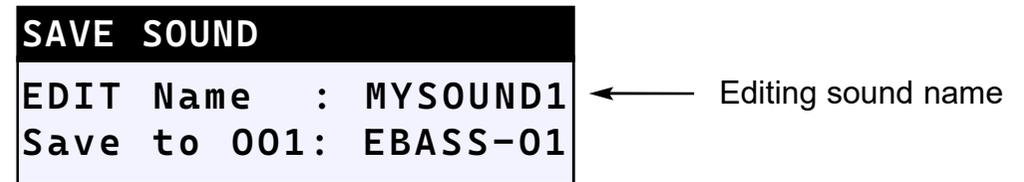
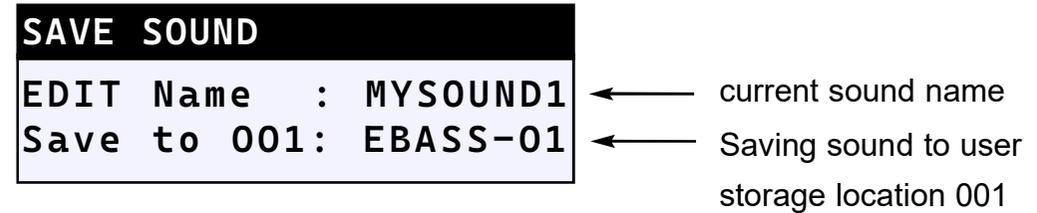
EDITING SOUND NAME

Within the SAVE SOUND menu, you can assign a name of up to eight characters to the sound you wish to save. This sound name appears on the second line of the display. The third line displays the memory location number and the name of the sound that is currently stored there.

To modify the characters in the name on the second line, use the eight potentiometers to adjust character positions 1-8.

By turning the knobs, you can set spaces, capital letters A-Z, numbers 0-9, and a hyphen (when turned to the right).

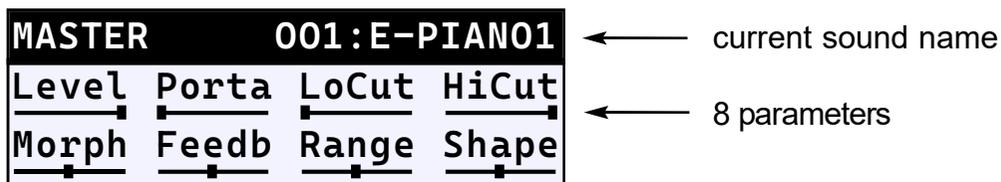
In the example on the right, the current sound "MYSOUND1" is being saved to location 001, overwriting the existing sound "EBASS-01."



MASTER MENU

After powering on, the MASTER menu is activated (indicated by the illuminated MASTER button). The Autoload sound, specified in the SETUP menu, is automatically loaded. The memory location and name of this sound are displayed in the top left corner of the screen. This Autoload setting is configured on page 4 of the SETUP menu and is saved permanently upon exiting the menu.

The parameters within the Master menu offer a powerful tool for creating dynamic sound variations during live performance, eliminating the need for deep sound programming. Adjust the values using the corresponding potentiometers to explore a wide range of sonic possibilities.



The MASTER menu contains the following parameters:

Level	overall volume audio output
Porta	portamento time (Glide) of notes
LoCut	HighPass filter
HiCut	LowPass filter
Morph	Mix between the sound/FX variants A / B
Feedb	level of feedback operator
Range	envelope time of all operators
Shape	envelope shape of all operators

Level

Adjusts the overall volume of the stereo audio output using Knob 1.

Porta (Glide)

Controls the portamento time (glide) between notes using Knob 2. Turning the knob fully left disables glide, while turning it fully right sets the longest portamento time (slowest glide).

LoCut / HiCut

Use Knobs 3 and 4 to limit the low and/or high frequency range with these non-resonant filters. These filters are designed to reduce unwanted frequency components rather than shaping the sound.

Morph

Knob 5 mixes between the two sound/FX variants A and B. Turn the knob fully left to prioritize control via the Morph CV input.

Feedb (Operator feedback)

Every algorithm includes at least one operator with feedback. Knob 6 globally adjusts the feedback level, which can be used to create noise-like effects.

Range (Envelopes)

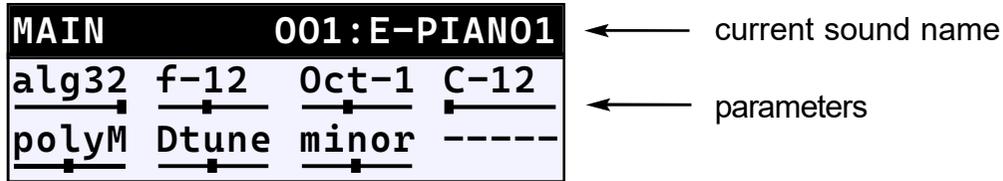
Knob 7 compresses or stretches all operator envelopes simultaneously, preserving their relative ratios. This allows you to create sounds ranging from percussive to sustained.

Shape (Envelopes)

Knob 8 modifies the curve shapes of all operator envelopes without altering their duration. This can significantly impact the overall sound character.

MAIN MENU

The parameters within the main menu are used to define global sound characteristics, excluding Morph effects. Here, you'll select the FM algorithm (the operator wiring) and fine-tune the sound relative to the global master tuning. All parameter settings are specific to the current sound. Adjust values using the corresponding knobs.



The MAIN menu contains the following parameters:

Algo	Operator algorithm of the current sound
f	Tuning: Fine tune of the current sound
Oct	Tuning: Octave of the current sound
C	Tuning: Semitone of the current sound
Mode	Playmode (monophon / polyphon, MIDI / analog)
Dtune	Detuning of the four voices
Chord	Chords for monophone sounds

Algo (No. of algorithm)

Knob 1 selects the FM algorithm for this sound. Turning the knob visually displays the algorithm connection on the screen. To view the graphic of the currently selected algorithm, hold down the data wheel. Refer to the "List of Operator Algorithms" chapter for a comprehensive overview of the 32 available variants.

f - Finetune (f-100 to f100)

Knob 2 fine-tunes the sound's pitch from the center position - positive values raise the pitch, while negative values lower it. Tuning is measured in cents, always relative to the master tuning (set in the Setup Menu).

Oct - Octave shift (Oct-2 to Oct2)

Knob 3 shifts the sound's pitch in octaves, relative to the master tuning. Starting from the center position, positive values shift the pitch up and negative values shift it down.

C - Semitone shift (C-12 to C12)

Knob 4 shifts the sound's pitch in semitones, relative to the fundamental note C of the master tuning. Starting of center position, positive values shift the pitch up and negative values shift it down.

Mode - Playmode of current sound (mono /poly)

Knob 5 selects the sound's play mode: monophonic or polyphonic. The sound can be triggered via MIDI or the Gate+1V/Oct inputs. The GATE input determines the mode:

- GATE=0: MIDI triggering
- Active MIDI Note: MIDI triggering takes precedence over Gate+1V/Oct inputs

In polyphonic mode, up to four voices can sustain simultaneously during the release phase. In monophonic mode, notes are cut off, but you can still create chords.

Detune (Detuning of the four voices)

Knob 6 detunes the individual voices relative to each other, creating chorus effects for monophonic sounds and unison chords for polyphonic sounds.

Chord (Chords for monophone sounds)

Knob 7 selects a chord for monophonic play mode.

A list of available chords is provided on the next page. →

LIST OF CHORDS

Chord name	Display	Intervals
1. unisono	unisn	0,0,0,0
2. octave 1	oct1	0,12,0,12
3. octave 2	oct2	0,12,24,0
4. octave 3	oct3	0,12,24,36
5. fifth 1	5th 1	0,7,0,7
6. fifth 2	5th 2	0,7,14,21
7. fourth 1	4th 1	0,5,0,5
8. fourth 2	4th 2	0,5,10,15
9. third major	maj 3	0,4,0,4
10. third minor	min 3	0,3,0,3
11. augmented	augm	0,4,8,12
12. diminished	dim	0,3,6,12
13. diminished flat seven	dimb7	0,3,6,10 (= m7 b5)
14. diminished doubleflat	dim 7	0,3,6,9
15. minor add9	m+9	0,3,7,14
16. minor 7 add 9	m7+9	0,3,10,14
17. minor 7 add 11	m7+11	0,3,10,17
18. minor 7 b5	m7 b5	0,3,6,10 (= dim b7)
19. minor maj7	m M7	0,3,7,11 (=dominant 7th)
20. minor 6	m6	0,3,7,9
21. minor 6 add9	m6+9	0,3,9,14
22. minor	minor	0,3,7,12

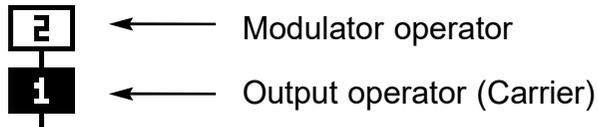
Chord name	Display	Intervals
23. major	Major	0,4,7,12
24. major add9	Madd9	0,4,7,14
25. major 7	M7	0,4,7,10
26. major maj7	M M7	0,4,7,11 (= dominant 7th)
27. major 6	M6	0,3,7,9
28. major sus4	Msus4	0,5,7,12
29. major sus2	Msus2	0,2,7,12
30. major 6 add9	M6+9	0,4,9,14
31. major #5	M #5	0,4,8,12
32. major b5	M b5	0,4,6,12
33. major 7 sus4	M7su4	0,5,7,10
34. major 7 #5	M7 #5	0,4,8,10
35. major 7 b5	M7 b5	0,4,6,10
36. major 7 add 9	M7/9	0,4,11,14
37. major 7 add b9	M7 #9	0,4,11,13
38. major 7 add #9	M7 b9	0,4,11,15
39. major 7/9/11	M7911	0,11,14,17
40. major 7/13	M7/13	0,11,16,21
41. major 7/9/13	M7913	0,11,14,21
42. major 11	M11	0,4,10,17
43. major 7/11	maj11	0,4,11,17
44. minor 11	m11	0,3,10,17

FM OPERATOR ALGORITHM

DESCRIPTION

The simplest form of FM synthesis (Frequency Modulation) involves two sine wave oscillators, known as operators. One oscillator, the modulator, influences the frequency of the other, the carrier. By adjusting the intensity (level) and frequency of the modulator, a wide range of overtones can be generated, often distorting the original sine wave of the carrier beyond recognition.

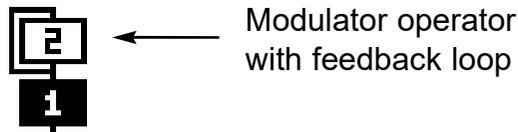
KOSMOS boasts six operators per voice, interconnected in 32 fixed algorithms. These algorithms are visually represented as diagrams, with black boxes symbolizing carrier (output) operators and white boxes representing modulator operators.



These diverse algorithms offer a broad spectrum of sound generation possibilities. Multi-stage modulation techniques yield harmonically rich sounds, while multiple output operators enable the blending of distinct timbres. For instance, an electric piano sound might combine three separate tones: one for the hammer strike, another for the body resonance, and a third for the vibrating tine, all evolving over time.

FEEDBACK OPERATOR

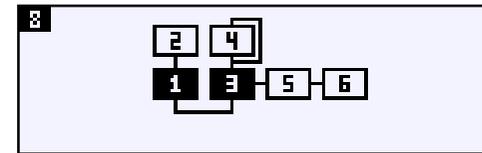
Certain algorithms incorporate feedback loops within individual operators. Parameter 6 (Feedb) in the MASTER page controls the level of feedback, allowing for the generation of even more overtones, distortion, and noise-like textures..



EXAMPLE 1

Algorithm 8 provides a clear illustration of a complex FM structure. Operators 1 and 3 (black) combine to form the output. Operators 2, 4, 5, and 6 contribute to the modulation process:

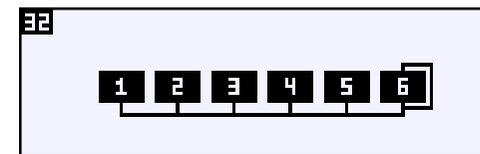
- Operator 2 modulates Operator 1.
- Operators 4 and 5 combine to modulate Operator 3.
- Operator 6 modulates Operator 5.
- Operator 4 has a self-modulation feedback loop.



The dynamic nature of envelope levels further enhances the complexity of the resulting sound.

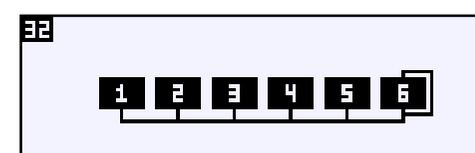
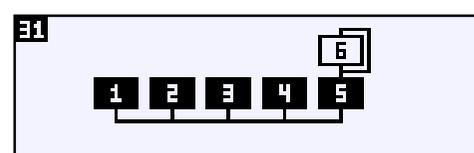
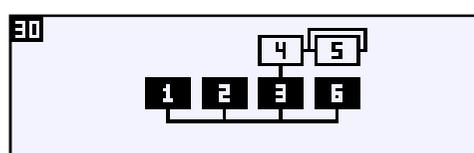
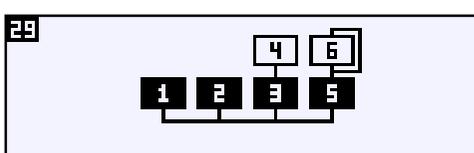
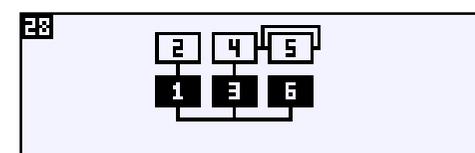
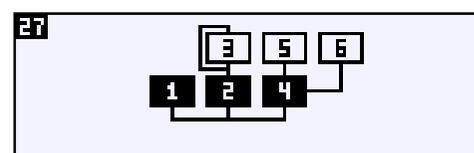
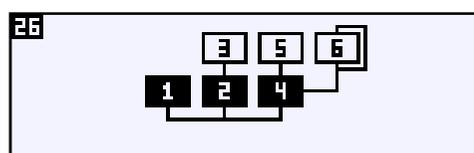
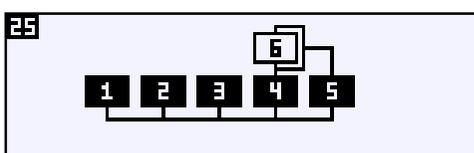
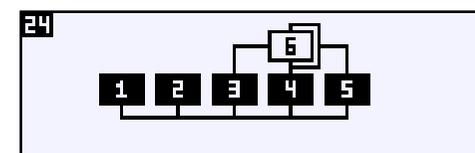
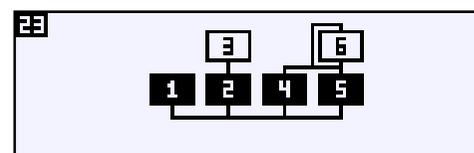
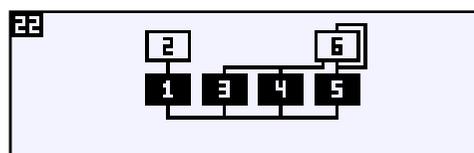
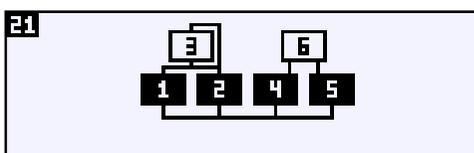
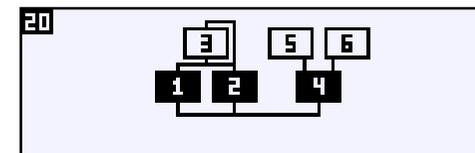
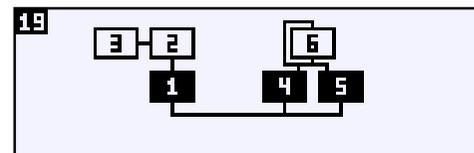
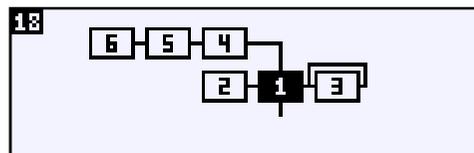
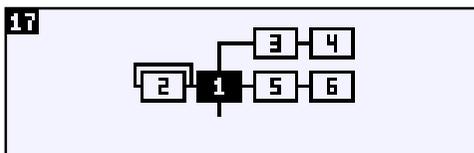
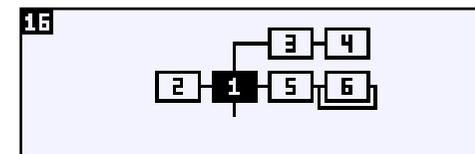
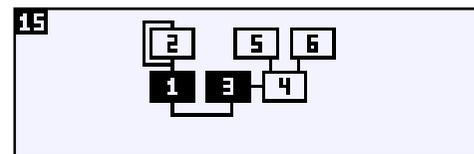
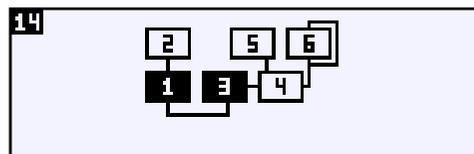
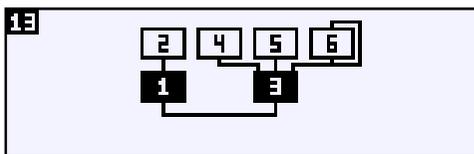
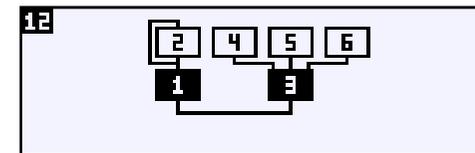
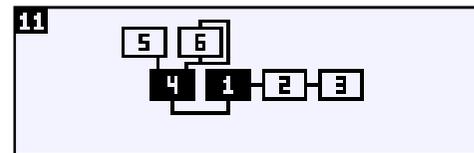
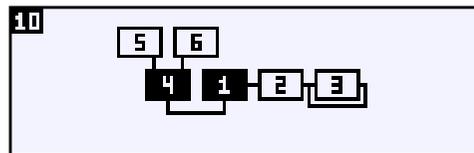
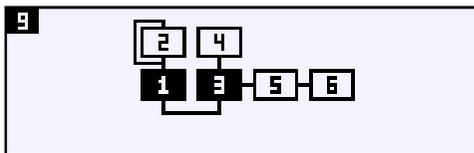
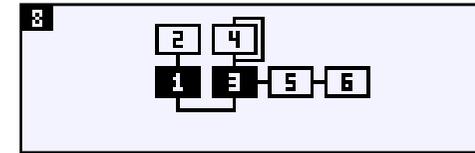
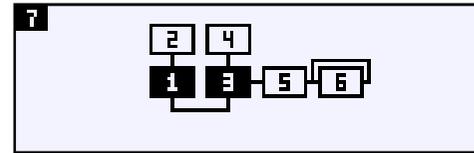
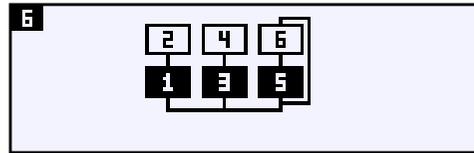
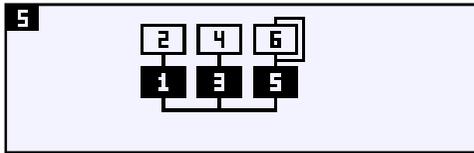
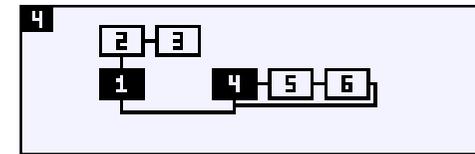
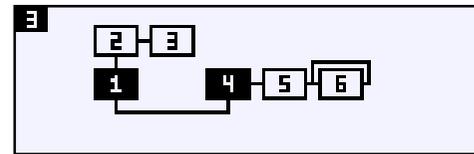
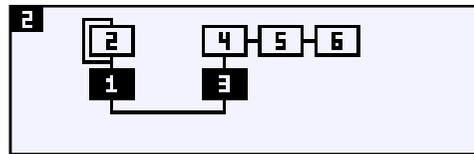
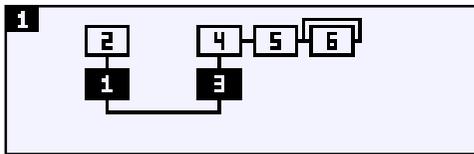
EXAMPLE 2

Algorithm 32 represents a different approach, where all operators connect directly to the output in parallel. In this case, there's no modulation between operators.



This configuration, known as additive synthesis, is well-suited for creating a variety of organ-like sounds. By designating one operator as the primary tone and tuning the others to specific frequencies, you can generate rich overtone structures.

LIST OF OPERATOR ALGORITHM

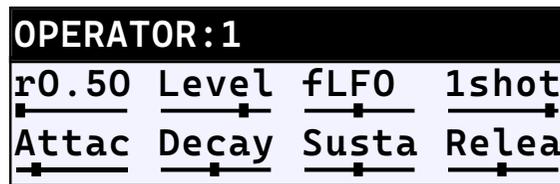


OPERATOR 1-6 PAGES

The module features six sine wave oscillators, referred to as operators. Each operator has its dedicated page, accessible via a specific button. These operator pages are identical, each containing eight parameters.

The interconnection of these six operators, determining the signal flow, is defined by one of the 32 available algorithms. The algorithm can be selected in the MAIN menu using parameter 1 (and Knob 1). To visualize the current algorithm's graphic representation on the operator pages, simply hold down the encoder (data wheel).

It's important to note that you can create two distinct sound variants, A and B, for morphing purposes. The A/B button toggles between these variants (a lit button indicates variant B). For more details, refer to the "A/B MORPH FUNCTION" chapter.



1 - Ratio

Knob 1 sets the frequency ratio of the operator in discrete steps. This parameter is active only when parameter 3 (LFO) is off. If LFO mode is enabled (indicated by "fLFO" on the display), the Ratio setting is ignored.

2 - Level

Knob 2 controls the volume or intensity of the operator. Its function depends on the operator's role in the algorithm:

- Modulator (white box): Determines the modulation depth.
- Output Operator (black box): Determines the volume.
- Feedback Operator (box with a self-loop):
The Feedback parameter in the MAIN menu affects the level.

3 - LFO (fix LFO frequency instead of ratio)

Instead of using the Ratio parameter, you can set a fixed LFO frequency that is not influenced by note pitch. To enable this mode, set the parameter to "fLFO" (frequency LFO). In this mode, the Ratio parameter is inactive. To return to Ratio control, set the LFO to "off". The LFO frequency can be adjusted using Knob 3.

4 - Loop on/off

The ADSR envelope can be set to either play once (1Shot) or repeat continuously (Loop) as long as the note is held. The entire envelope, including the release phase, is looped. This setting can be adjusted using Knob 4.

5-8 Attac, Decay, Susta, Relea (ADSR envelope parameters)

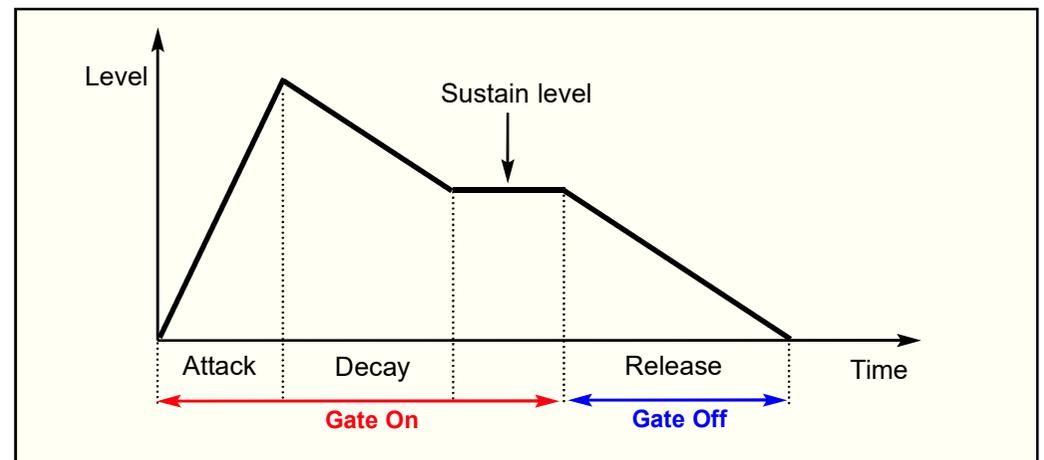
Use Knob 5-8 to adjust the 4 parameters of the ADSR volume envelope:

Attac = Attack: temporal rise of the envelope

Decay = Decay: temporal descent to sustain level

Susta = Sustain: Hold Level at Gate=On

Relea = Release: temporal decay to zero at Gate=Off



FX PAGES - MULTIEFFECTS

The FX multi-effects menu offers three effects that are applied to the master output. You can cycle through these three pages using the FX button. Within the FX menu, you can separately adjust parameters for sound variants A and B. This means you'll always hear either variant A or B, with no morphing between the two.

For more information on morphing, refer to the "A/B MORPH FUNCTION" chapter.

FX1 CHORUS (Stereo Chorus)

mixCh: Dry-Wet control between original signal and effect

min: min Delay time

Feedb: Feedback

Depth: Intensity of the effect

IFreq: LFO frequency = Rate of modulation

FX1 CHORUS

mixCh	min	Feedb	Depth
IFreq	-----	-----	-----

FX2 DELAY (Stereo Delay)

mixDl: Dry-Wet control between original signal and effect

timeL: Delay time left channel

Feedb: Feedback

timeR: Delay time right channel

Sync: Sync off: Delay time fix (in msec),
Sync on: sync per MIDI-Clock or per analog clock via CV1 or CV2 input
(CV parameter: "del Clock" analoge Clock with 24ppqn = 96 impulses per bar)

FX2 DELAY

mixDl	timeL	Feedb	timeR
Sync	-----	-----	-----

FX3 REVERB

mixRv: Dry-Wet control between original signal and effect

loCut: Highpass on reverb signal (suppress low frequencies)

Decay: reverberation time

Mod: modulation

Bandw: bandwidth of the input signal

Damp: Frequency attenuation of the reverb signal (reverberation becomes duller)

FX3 REVERB

mixRv	loCut	Decay	Mod
Bandw	Damp	-----	-----

A / B MORPH FUNCTIONS

DESCRIPTION

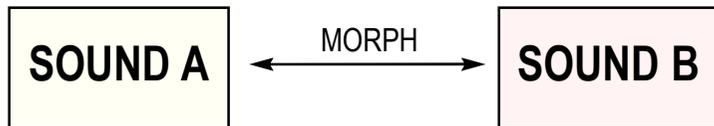
The MORPH function, controlled by Knob 5 in the MASTER menu, allows for seamless transitions between the two sound variants A and B. By adjusting parameters individually for each variant, you can create smooth transformations between drastically different sounds.

In the FM KOSMOS module, all parameters within the six operator pages and the FX parameters can be edited separately for both sound variants A and B. When you morph between these variants, the module smoothly interpolates between the two sets of parameter values.

For instance, you might create a short, percussive sound for variant A and a long, sustained sound for variant B. As you increase the morph control, the sound gradually transitions from short and percussive to long and sustained. Similarly, you could adjust modulation levels in one variant to create significant sonic changes during the morphing process.

When the A/B button is not lit, sound variant A is active. If the A/B button is lit, sound variant B is active. While in the Operator or FX Pages, you'll only hear the currently active variant, without any morphing.

To switch between variants, simply toggle the A/B button. To initiate the morphing process, use the morph control, CV input, MIDI controller, or the dedicated knob in the MAIN or MASTER menus.



COPY A<>B

You can copy one sound variant (A or B) to the other. This creates identical variants, which you can then modify individually.

SEPARATE COPYING FOR FX & OPERATORS

The copying process is separate for operator and effect parameters. To copy within a specific menu:

1. Hold down the A/B button.
2. Briefly press the SET button.

- Copying from A to B: If variant A is active, copying will duplicate A into B.
- Copying from B to A: If variant B is active, copying will duplicate B into A.

After copying, the opposite variant becomes active.

IMPORTANT NOTE:

• Operator and FX Parameters are Copied Separately:

Copying within an Operator page affects all six operators but not the effects. Conversely, copying within an FX page only affects the effects, leaving the operator variants unchanged.

• Copying is Limited to Operator and FX Pages:

You can only copy while within an Operator or FX page.

MORPH CV control and MIDI control:

The values from the Morph CV input and the MASTER menu's morph controller are combined. To fully control the morph range with the CV input, ensure the MASTER menu's morph controller is set to its minimum value. If the controller is set to a higher value, the CV input will control a portion of the morph range.

Additionally, the MORPH parameter can be controlled via MIDI using the modulation wheel (set to Control Change 1, Mod wheel).

SETUP MENU

DESCRIPTION

The SETUP menu contains global settings for the module. These settings are automatically saved when you exit the menu, except for the parameter assignments for the CV1+2 inputs, which are saved individually for each sound.

To access the SETUP menu, press the SET button. The last visited page within the SETUP menu will be displayed. The first time you enter the SETUP menu, you'll see the page for assigning parameters to the CV1+2 inputs (CV destination).

LIST OF SETUP PAGES

Page1:	cv1 destination cv2 destination	Parameter assignment for input CV1 Parameter assignment for input CV2
Page2:	MIDI chan Clk Thru	MIDI receive channel for notes forward received MIDI clock via MIDI out
Page3:	progCh Rx progCh Tx	MIDI receive channel for program change MIDI transmit channel for program change
Page4:	Autoload Mst tune	sound that loads automatically when power on global master tune (on fundamental note C)
Page5:	Lcd Contr	contrast of the LCD display
Page6:	DUMP	Sysex Dump menu
Page7:	CALIBRATE	Calibration menu for the 1V/Oct input

SETUP PAGE 1: CV DESTINATION

Here, you can assign parameters to the two CV1+2 inputs using Knobs 1 and 5. These assignments are saved within the sound itself (using the SAVE menu) and are not automatically saved when you exit the SETUP menu. This means that each loaded sound can be modulated by the CV inputs in unique ways.

The CV1+2 inputs accept bipolar voltages in the range of +/-5V, allowing for the use of bipolar LFOs. Most parameters from the FX, MAIN, and MASTER menus can be controlled via MIDI. All other parameters, including those from the operator pages, can also be controlled via MIDI.

SETUP1

```
cv 1 Dest:main chord
cv 2 Dest:no dest
```

CV1+2 LIST OF PARAMETERS

NAME	PARAMETER	NAME	PARAMETER
no dest	no function!	rvb decay	FX Reverb decay
chor depth	FX Chorus depth	rvb mod	FX Reverb mode
chor min	FX Chorus min delay	rvb bw	FX Reverb bandwidth
chor fb	FX Chorus feedback	rvb damp	FX Reverb damp
chor mix	FX Chorus dry/wet mix	main detune	MAIN Detune
chor lfreq	FX Chorus lfo rate	main chord	MAIN Chord
del mix	FX Delay dry/wet mix	mst level	MASTER Level
del time1	FX Delay time left	mst locut	MASTER LoCut
del fb	FX Delay feedback	mst hicut	MASTER HiCut
del time2	FX Delay time right	mst fb	MASTER Feedback
del clock	FX Delay clock 24ppq	mst range	MASTER Range
rvb mix	FX Reverb dry/wet mix	mst shape	MASTER Shape
rvb locut	FX Reverb low cut filter		

SETUP MENU

SETUP PAGE 2

With Knob 1: MIDI receive channel for notes: 1-16

With Knob 5: forward received MIDI clock data via MIDI out: on/off

SETUP PAGE 3

With Knob 1: MIDI receive channel for program change commands: off,1-16

With Knob 5: MIDI send channel for program change commands: off,1-16

SETUP PAGE 4

With Knob 1: Autoload (number of the user sound that is automatically loaded): 1-128

With Knob 5: Global master tune to fundamental note C (in cents): -100 .. 100
(default: 30)

SETUP PAGE 5

With Knob 1: Contrast of LCD display: 32-63

SETUP PAGE 6

SYSEX MIDI DUMP (sending or loading sound programs)

See the chapter: MIDI DUMP SOUNDS

SETUP PAGE 7

CV CALIBRATE - here the 1V/Oct input is calibrated (the input is already calibrated at the factory).

If necessary, see the chapter: 1V/OCT CALIBRATION

SETUP2

Midi Chan:1

Clk Thru:off

SETUP3

progCh Rx:1

progCh Tx:off

SETUP4

Autoload:1

Mst tune:30

SETUP5

Lcd Contr:47

SETUP6 MIDI DUMP

USER

Sysex Rx: all

CV CALIBRATE

push encoder to start

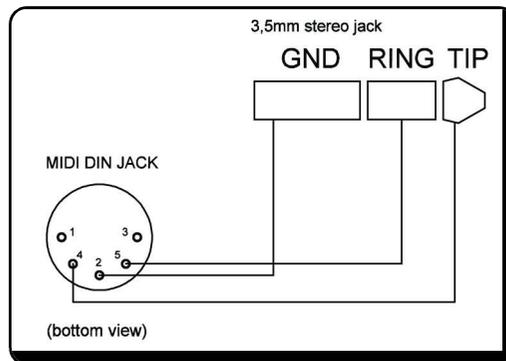
MIDI

OVERVIEW

The module can be controlled extensively using MIDI commands. In addition to standard MIDI note commands, it can also respond to pitch bend, portamento, master volume, and modulation wheel messages. Furthermore, all parameters within the operator pages can be controlled using specific MIDI Control Change commands. A detailed list of these control change messages can be found on the next page of this manual.

NOTE: Note that the MIDI sockets are of the MIDI-TRS-B type.

Adapter diagrams
MIDI DIN socket to
3.5mm mini jack
in MIDI-TRS-B standard



MIDI RECEIVE CHANNEL FOR NOTE ON/OFF

The module will only respond to note on/off commands on the specific MIDI channel set in the SETUP2 menu.

MIDI RECEIVE CHANNEL FOR PROGRAM CHANGE

The MIDI channel for receiving program change commands is configured in the SETUP3 menu. This channel can be independent of the MIDI channel for notes or sending program change commands.

MIDI TRANSMIT CHANNEL FOR PROGRAM CHANGE

The MIDI channel for sending program change commands is also set in the SETUP3 menu. This channel can be independent of the MIDI channel for notes or receiving program change commands.

MIDI CLOCK for FX3 SYNC DELAY

The module can synchronize the delay time of the FX3 stereo delay using MIDI clock commands. These clock commands can also be forwarded through the MIDI output.

CONTROL CHANGE NUMBERS

The module can be controlled using MIDI Control Change commands. A list of the corresponding control change numbers is provided on the next page. The MIDI channel for these commands is determined by the MIDI channel set for note reception.

PITCHBEND

The module can receive pitch bend commands. The MIDI channel for pitch bend is the same as the MIDI channel for note reception.

MIDI SYSEX

The SETUP menu includes MIDI DUMP functions for saving and loading sounds via SYSEX. You can load individual sounds into specific memory locations or save/load multiple sounds at once (ALL).

LIST OF MIDI CONTROLLERS

MIDI CONTROL CHANGE NUMBERS (CC-Nr)

MASTER

CC	Parameter
1	Master Morph
5	Portamento Amount
7	Master Volume
64	Sustain pedal
65	Portamento On/Off
104	Master LoCut
105	Master HiCut
106	Master FeedB
107	Master Range
108	Master Shape

MAIN

CC	Parameter
97	Main Algorithm
98	Main fFine
99	Main fOct
100	Main fCoar
101	Main mode
102	Main detune
103	Main chord

OPERATOR 1-3

CC	Parameter
16	OP1 ratio
17	OP1 Level
18	OP1 Loop
19	OP1 Attack
20	OP1 Decay
21	OP1 Sustain
22	OP1 Release
23	OP2 ratio
24	OP2 Level
25	OP2 Loop
26	OP2 Attack
27	OP2 Decay
28	OP2 Sustain
29	OP2 Release
30	OP3 ratio
31	OP3 Level
32	OP3 Loop
33	OP3 Attack
34	OP3 Decay
35	OP3 Sustain
36	OP3 Release

OPERATOR 4-6

CC	Parameter
37	OP4 ratio
38	OP4 Level
39	OP4 Loop
40	OP4 Attack
41	OP4 Decay
42	OP4 Sustain
43	OP4 Release
44	OP5 ratio
45	OP5 Level
46	OP5 Loop
47	OP5 Attack
48	OP5 Decay
49	OP5 Sustain
50	OP5 Release
51	OP6 ratio
52	OP6 Level
53	OP6 Loop
54	OP6 Attack
55	OP6 Decay
56	OP6 Sustain
57	OP6 Release

FX CHORUS

CC	Parameter
80	Chorus Mix
81	Chorus min
82	Chorus fb
83	Chorus depth
85	Chorus lfo Rate

FX DELAY

CC	Parameter
86	Delay Mix
87	Delay timeL
88	Delay fb
89	Delay TimeR
90	Delay sync

FX REVERB

CC	Parameter
91	Rvb Mix
92	Rvb loCut
93	Rvb decay
94	Rvb mod
95	Rvb bw
96	Rvb damp

MIDI

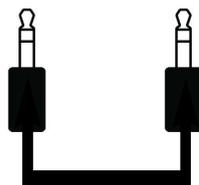
MIDI CONNECTIONS

The module features MIDI IN/OUT sockets (3.5mm mini jack in TRS-B standard) for controlling parameters, loading/editing sequences, or performing firmware updates via Sysex.

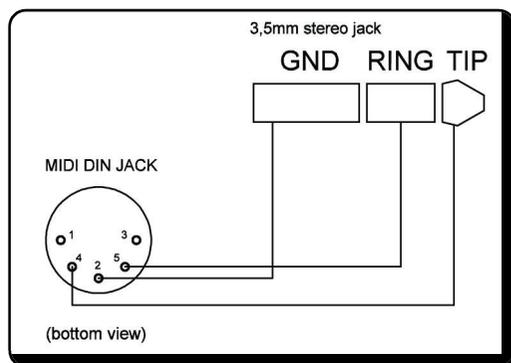
To connect the module to your keyboard/controller or computer, use a MIDI cable (either a MIDI-DIN to mini TRS-B adapter or a 3.5mm stereo jack cable) to connect the module's MIDI input to the MIDI output of your device.

A detailed overview of MIDI commands is provided in the MIDI chapter.

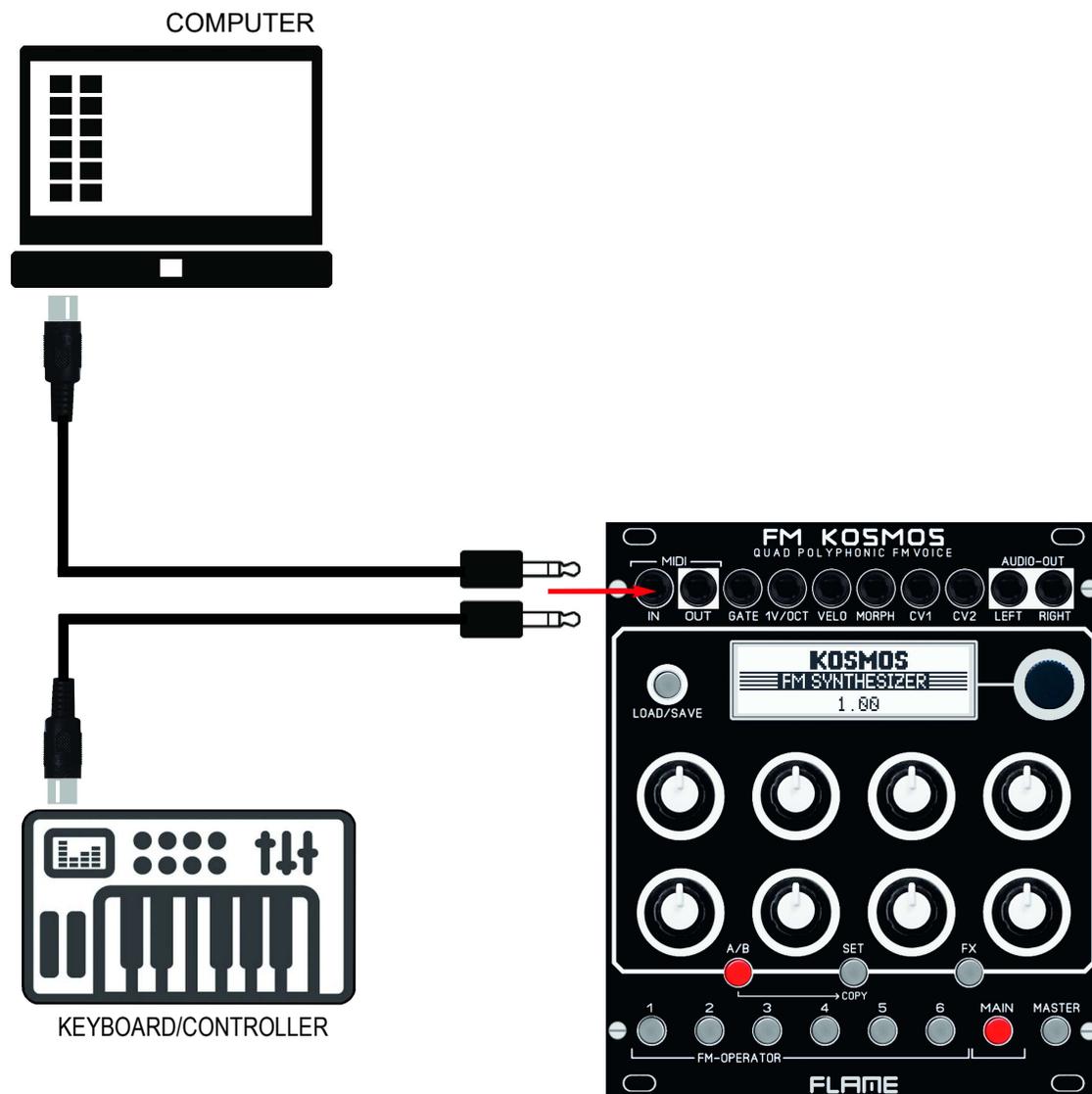
3.5mm mini jack stereo cable
for direct MIDI connection between
two TRS-B sockets



Adapter diagrams
MIDI DIN socket to
3.5mm mini jack
in MIDI-TRS-B standard



Examples of possible connections:



MIDI DUMP SOUND DATA

RECOMMENDED SOFTWARE

- **PC:** MIDI-OX (freeware)
- **Mac:** SYSEX LIBRARIAN

DUMPING SOUNDS

1. Access the SETUP menu.
2. Navigate to the "SETUP 6 - MIDI DUMP" menu using the SET button.

TRANSMITTING SOUNDS - CONNECTION AND TRANSFER

1. Set Knob 5 to "**Sysex Tx**".
2. Set Knob 6 to the desired sound number (001-128) or "**all**" for all 128 sounds.
3. Connect the MIDI output of the FM KOSMOS to the MIDI input of your computer.
4. Use a Sysex program on your computer to receive the SYSEX file.
5. Set the "Delay" parameter in the Sysex program to at least **10-20ms**.

Using MIDI-OX on PC:

6. Activate Menu View > Sysex.
7. Start the Sysex reception with Menu "Sysex > Receive Manual Dump...".
8. Send the Sysex data from the module (using LOAD button).
9. After successful transmission, the module's display will indicate the transmitted sound.
10. Stop the Sysex recording on the computer
11. Save the received Sysex file on the computer

Using SYSEX LIBRARIAN on Mac:

6. Start the Sysex reception with the "Record Many" button.
7. Send the Sysex data from the module (using LOAD button).
8. After successful transmission, the module's display will indicate the transmitted sound.
9. Stop the Sysex recording on the computer
10. Save the received Sysex file on the computer

RECEIVING SOUNDS - CONNECTION AND TRANSFER

1. Set Knob 5 to "**Sysex Rx**".
2. Set Knob 6 to the desired memory location (001-128) or "**all**" for all 128 sounds.
3. Connect the MIDI input of the FM KOSMOS to the MIDI output of your computer.
4. Use a Sysex program on your computer to send the SYSEX file.
5. Set the "Delay" parameter in the Sysex program to at least **100ms**.
6. After successful transmission, the module's display will indicate the received sound.

(Receiving an ALL file (128 sounds) takes about 4 minutes)

IMPORTANT NOTE!

To hear a sound loaded via SYSEX, you must load it into the internal memory using the LOAD function.

FIRMWARE UPDATE

A firmware update requires a computer with a MIDI interface and a SYSEX program. For PCs we recommend the freeware software MIDI-OX, for MACs the software "SYSEX LIBRARIAN". Set the parameter "Delay..." in the SYSEX program to 20ms.

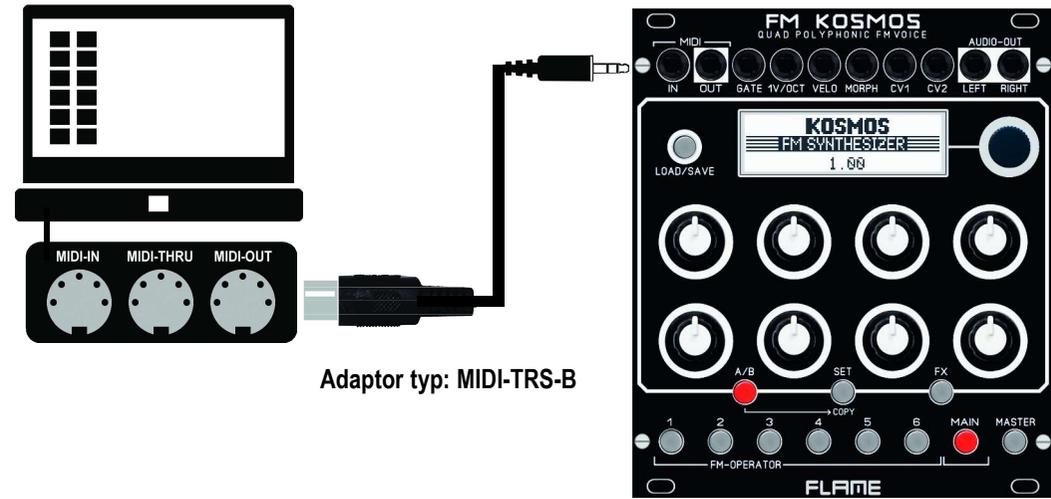
Proceed as follows:

- 1 Load the firmware file (e.g. FlameKosmosV1_00.syx) onto the computer.
- 2 Connect the MIDI input of the module directly to the MIDI output of your computer or MIDI interface using a MIDI-TRS-B adapter (avoid detours, e.g. via USB hubs).
Attention: A MIDI-TRS-B adapter is required for the MIDI connection!
- 3 Switch the module on while holding down buttons 1 (Operator 1) and 8 (MASTER). The module now starts in the bootloader menu and waits for the SYX file at the MIDI input.

- 4 Send the firmware file from the SYSEX program to the module. The module's display should now show that the data has been received (a counter counts up). If nothing is shown on the display when the file is sent, the MIDI connection is not correct (please check the cables, MIDI interface settings and the SYSEX program settings).

- 5 If the upload was successful, the module first saves the new program and then automatically starts with the new firmware.

Attention: Do not switch off the module before it has rebooted!



```
fm bootloader V1.0
update: wait for data
on midi input
```

```
fm bootloader V1.0
update: 0593/3750
```

```
fm bootloader V1.0
write firmware
Do not turn off!
```

```
=====
KOSMOS
=====
FM SYNTHESIZER
=====
1.00
```

When booting, the new version number is displayed on the start screen →

1V/OCT CALIBRATION

The CV input 1V/OCT must be calibrated so that the 1V per octave semitone scaling is accurate. This is already done at the factory when the module is delivered.

If you want to calibrate again later, the SETUP Page 7 “CV CALIBRATE” is available. You need an exact external CV voltage of 0.000V and 2.000V (or a calibrated MIDI-to-CV interface that can generate the two voltages).

To call up the “CV CALIBRATE” menu, press the SET button (several times) until the menu is displayed. Then press the data wheel to start the calibration and follow the text on the display:

- 1** Plug a cable into the 1V/OCT input and apply a voltage as close to 0.000V as possible. Then press the data wheel.
- 2** Now apply a voltage as close to 2.000V as possible to the input. Then press the data wheel again.
- 3** To save the calibration values, press the data wheel again. To cancel the process without saving, press another menu button.

After calibration, the input should be playable over 8 octaves in exact semitones. Note that the 1V/OCT input resistance is 100kohm.

CV CALIBRATE
push encoder to start

CV CALIBRATE
set cv to 0V and
push encoder

CV CALIBRATE
set cv to 2V and
push encoder

CV CALIBRATE
to save
push encoder

FAQ / TROUBLESHOOTING

CV Control

- **Controllable Parameters:** Most parameters in the MAIN, MASTER, and FX menus can be controlled via the two CV inputs.
- **Parameter Assignment:** Individual parameter assignments for each sound can be defined in the SETUP menu.
- **Morph CV Input:** A separate CV input is dedicated to controlling the Morph function.

MIDI Control

- **Modulation Wheel:** Controls Morph (Control Change 1).
- **Other MIDI Controls:** Pitch bend, portamento, and master volume can also be controlled via MIDI.
- **Operator Parameter Control:** All operator parameters can be controlled using specific MIDI Control Change commands (refer to the MIDI chapter for a detailed list).

Firmware Update and MIDI Dump Issues

- **Check MIDI Connections:** Ensure correct MIDI cable connections (TRS-B adapter) and a direct connection to the computer, avoiding USB hubs or similar devices.
- **Verify Sysex Program:** Confirm that the correct MIDI connection is selected in the Sysex program.
- **Mac Users:** Use the "Record Many" button in SYSEX LIBRARIAN to capture Sysex data.
- **Sound Card Compatibility:** Older sound cards might be more reliable than newer, cheaper models, which may have power supply issues on the MIDI socket.

1V/Oct Input and Triggering

- **Gate Input:** The GATE input is essential for triggering notes. The 1V/Oct input only controls pitch.
- **Note Signal Indication:** The LED on the SETUP button indicates the presence of a note signal.
- **Velocity Input:** The Velocity input affects volume and other parameters.
- **Master Level:** Ensure the Master Level in the Master Menu is set correctly.
- **MIDI and Gate Input:** Avoid using both MIDI notes and the GATE input simultaneously.

MIDI Input and Triggering

- **MIDI Channel:** Verify the MIDI receive channel in the SETUP menu and ensure notes are sent on this channel.
- **Note Signal Indication:** The LED on the SETUP button indicates the reception of note commands.
- **Master Level:** Check the Master Level in the Master Menu.
- **Gate Input and MIDI:** Avoid using both simultaneously.

CV Control Range

- **Parameter Range:** To fully utilize the CV control range, set the controlled parameter to its minimum value. The CV input will then cover the entire range.
- **Input Voltage:** Ensure the CV input voltage is within the bipolar range of +/-5V.

MIDI Output Function

- **Sysex Data Transmission:** The MIDI output is used to transmit sound Sysex data during the dump process.
- **Program Change Transmission:** The module can send program change commands when loading sounds.
- **MIDI Clock Forwarding:** Incoming MIDI clock commands can be forwarded through the MIDI output.

Stereo Delay Synchronization

- **MIDI Clock Sync:** The stereo delay can be synchronized to a MIDI clock.
- **Analog Clock Sync:** Alternatively, the delay can be synchronized to an analog clock signal connected to the CV1 or CV2 input. Refer to the CV1 and CV2 parameter list for details.

LIST OF PRESET SOUNDS

BANK A: LEAD

- 1 BRASSING
- 2 CHEAPSYN
- 3 CHIPLEAD
- 4 DETVIBRA
- 5 EVOLVER
- 6 FAIRLITE
- 7 FLUTLEAD
- 8 MOTORACE
- 9 SAWCLOUD
- 10 SAWFUZZY
- 11 SUPIBOO1
- 12 SUPIBOO2
- 13 TRANSIT
- 14 VELOLEAD
- 15 VINTLEAD
- 16 XERXLEAD

BANK B: BASS

- 1 BASS SAT
- 2 BASSBRUT
- 3 BASSGHOS
- 4 BASSPERC
- 5 BELLBASS
- 6 DISCO-73
- 7 DISCO-75
- 8 E-BASS02
- 9 EBASS-N1
- 10 IDM BASS
- 11 INDUBASS
- 12 KNARZ N
- 13 LEMMY
- 14 SOLIDPRC
- 15 SOLIDPUR
- 16 SOLIDSAW

BANK C: KEYS

- 1 BELLYFEX
- 2 BLITZEYS
- 3 CELLO N1
- 4 CHORDRAV
- 5 CINEBELL
- 6 DYNOFOLD
- 7 EP-KOSMO
- 8 E-PIANO1
- 9 FMFXORGA
- 10 HAMMO B3
- 11 ORGADETU
- 12 ORGAN-X1
- 13 ORGMORPH
- 14 PORTAKEY
- 15 SPINETT
- 16 WONKHIT

BANK D: PERCUSSIVE

- 1 ASIAMETL
- 2 CHRDPERC
- 3 ECOLOTO1
- 4 ELECTRIP
- 5 FATANA 2
- 6 FM-METAL
- 7 FM-PERC2
- 8 FMPLUCK1
- 9 FXPERCSY
- 10 GITSNARE
- 11 MOTRACE2
- 12 PCECO-HI
- 13 PERCMELO
- 14 STEEL-DR
- 15 TOMGHOS2
- 16 WOODPERC

BANK E: PADS

- 1 BOC-PAD1
- 2 BRASSPAD
- 3 DREAM-ON
- 4 EP-PAD
- 5 FATBRASS
- 6 IDM-PAD
- 7 ORCHPAD
- 8 PLEXUS
- 9 REVEPAD
- 10 SAW-PAD
- 11 SAW-RING
- 12 SPOOKPAD
- 13 SUPERUSS
- 14 TRANSEXP
- 15 WINDRONE
- 16 BLADERUN

BANK F: DRONE

- 1 XERXES
- 2 CERNVIBE
- 3 DARKNESS
- 4 DRONSAW2
- 5 DRONSAW3
- 6 ERAZER-2
- 7 FX-GHOST
- 8 GHOSDRON
- 9 INDUTIME
- 10 LFODRONE
- 11 LHASA
- 12 MEZZBZ-2
- 13 MISODROM
- 14 NUCLEON
- 15 TRPGHOST
- 16 UKWEH-2

BANK G: MOVING

- 1 AIRCRAFT
- 2 BASSORG
- 3 CARPENTR
- 4 CAT-PAD1
- 5 COMPLEX
- 6 DETUNPAD
- 7 ECODRONE
- 8 ELECORGN
- 9 FXCHIME
- 10 JUX LON3
- 11 JUX LOOP
- 12 LOFIMOVE
- 13 LOOIPAD
- 14 OLD CAVE
- 15 PLUG RNG
- 16 WIZZARD

BANK H: FX+NOISE

- 1 CRACKLE
- 2 DARKTIME
- 3 DUNG FLY
- 4 ELECDRON
- 5 ELECPOPE
- 6 FX-TRAPP
- 7 INDUSTRY
- 8 JUX AMBI
- 9 MARSATAC
- 10 MARSFON
- 11 MELONOIZ
- 12 NOISEORG
- 13 NOISEQU1
- 14 NOISEQU2
- 15 OLDRVINYL
- 16 SYSALARM

PRESET SOUND BANKS:

- A LEAD (synths)
- B BASS (various basses)
- C KEYS (solo voices, EPiano, organ...)
- D PERCUSSIVE (various percussive sounds)
- E PADS (pads)
- F DRONE (more pads)
- G MOVING (pads with loops and movement)
- H FX+NOISE (effect and noise sounds)

LOAD PRESET SOUNDS:

There are 128 PRESET sounds, organized in 8 groups with 16 sounds each. These sounds cannot be changed, but serve as templates for your own sound programs. The 8 banks are assigned to the 8 rotary controls.

Each rotary control can be used to select one of 16 PRESET sounds from bank as follows:

Briefly pressing the LOAD/SAVE button calls up the LOAD menu. Then use one of the 8 potentiometers (bank A-H) to select a sound (01-16) from the respective bank. Pressing the DATA control loads the PRESET sound. You can cancel (without loading) using the LOAD button or another menu button.

When the module is delivered, all preset sounds are also copied to the 128 USER memory locations. There they can be changed and saved, for example. The originals are then still in the preset banks... see next page



LIST OF USER SOUNDS (Copy of the preset sounds at factory delivery)

1	BRASSING
2	CHEAPSYN
3	CHIPLEAD
4	DETVIBRA
5	EVOLVER
6	FAIRLITE
7	FLUTLEAD
8	MOTORACE
9	SAWCLOUD
10	SAWFUZZY
11	SUPIBOO1
12	SUPIBOO2
13	TRANSIT
14	VELOLEAD
15	VINTLEAD
16	XERXLEAD
17	BASS SAT
18	BASSBRUT
19	BASSGHOS
20	BASSPERC
21	BELLBASS
22	DISCO-73
23	DISCO-75
24	E-BASS02
25	EBASS-N1
26	IDM BASS
27	INDUBASS
28	KNARZ N
29	LEMMY
30	SOLIDPRC
31	SOLIDPUR
32	SOLIDSAW

33	BELLYFEX
34	BLITZEYS
35	CELLO N1
36	CHORDRAV
37	CINEBELL
38	DYNOFOLD
39	EP-KOSMO
40	E-PIANO1
41	FMFXORGA
42	HAMMO B3
43	ORGADETU
44	ORGAN-X1
45	ORGMORPH
46	PORTAKEY
47	SPINETT
48	WONKHIT
49	ASIAMETL
50	CHRDPERC
51	ECOLOTO1
52	ELECTRIP
53	FATANA 2
54	FM-METAL
55	FM-PERC2
56	FMPLUCK1
57	FXPERCSY
58	GITSNARE
59	MOTRACE2
60	PCECO-HI
61	PERCMELO
62	STEEL-DR
63	TOMGHOS2
64	WOODPERC

65	BOC-PAD1
66	BRASSPAD
67	DREAM-ON
68	EP-PAD
69	FATBRASS
70	IDM-PAD
71	ORCHPAD
72	PLEXUS
73	REVEPAD
74	SAW-PAD
75	SAW-RING
76	SPOOKPAD
77	SUPERUSS
78	TRANSEXP
79	WINDRONE
80	BLADERUN
81	XERXES
82	CERNVIBE
83	DARKNESS
84	DRONSAW2
85	DRONSAW3
86	ERAZER-2
87	FX-GHOST
88	GHOSDRON
89	INDUTIME
90	LFODRONE
91	LHASA
92	MEZZBZ-2
93	MISODROM
94	NUCLEON
95	TRPGHOST
96	UKWEH-2

97	AIRCRAFT
98	BASSORG
99	CARPENTR
100	CAT-PAD1
101	COMPLEX
102	DETUNPAD
103	ECODRONE
104	ELECORGN
105	FXCHIME
106	JUX LON3
107	JUX LOOP
108	LOFIMOVE
109	LOOIPAD
110	OLD CAVE
111	PLUG RNG
112	WIZZARD
113	CRACKLE
114	DARKTIME
115	DUNG FLY
116	ELECDRON
117	ELECOPE
118	FX-TRAPP
119	INDUSTRY
120	JUX AMBI
121	MARSATAC
122	MARSFON
123	MELONOIZ
124	NOISEORG
125	NOISEQU1
126	NOISEQU2
127	OLDVINYL
128	SYSALARM

When the module is delivered, all preset sounds are copied one after the other to the 128 USER memory locations. There they can be changed, given a different name and saved. The originals are still in the preset banks.

The user sounds can also be selected via MIDI program change and loaded automatically.

APPENDIX & TECHNICAL DETAILS

Technical details

Connections:

Ribbon cable adapter for Doepfer bus +/-12Volt

Inputs: 1x MIDI-TRS-B, 5x CV, 1x Gate, 3,5mm Mono/stereo jacks

Outputs: 1xMIDI-TRS-B, 2x Audio 3,5mm Mono/stereo jacks

Controls:

12 illuminated buttons

8 Potentiometer, 1 Encoder

1 LCD graphic display

Resolution: DA-Wandler: 16Bit, Audio output: +/-5V

Current consumption: +/-12v: +120mA / -60mA

Size: Euro Format 3U / 22HP 110x128,5x33mm, Installation depth: 30mm

Warrenty

Beginning from the date of purchase a 2-year warranty is guaranteed for this device in case of any manufacturing errors or other functional deficiencies during runtime.

The warranty does not apply in case of:

- damage caused by misuse
- mechanical damage arising from careless treatment (dropping, vigorous shaking, mishandling, etc)
- damage caused by liquids penetrating the device
- heat damage caused by overexposure to sunlight or heating
- electric damage caused by improper connecting (wrong power supply/ jacks/ MIDI connections/ voltage problems).

If you have any complaints please contact your dealer or send an e-mail to:

service@flame-instruments.de

Terms of production

conformity: CE, RoHS, UL

Disposal

The device is produced with RoHS-conformity (subject to the regulations of the European Union) and is free of hazardous substances (like mercury, plumb, cadmium and hexavalent chrome). But electronical scrap is hazardous waste. Please don't add this to consumer waste. For an environment friendly disposal of waste please contact your distributor or specialist dealer.

Support

Updated and additional informations, updates, downloads and more see:

<http://www.flame-instruments.de>

Instagram: @flame_instruments

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