

Humble Audio – Quad Operator Algo Extension

• [Manual PDF](#)

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Humble Audio Quad Operator Cheat Sheet

What it is

A **4-operator digital linear FM oscillator/LFO bank** with: - 4 independently usable operators - continuously variable waveshape per operator: **sine** → **triangle** → **square** → **saw** - full **modulation matrix**: each operator can modulate any operator, including itself - **AR FM external audio-rate mod input** with its own modulation sends - optional **Algo expander** for saving/crossfading FM routing setups

Quick-start patch

For classic, harmonic FM: 1. Set **VCO/LFO** to **VCO** 2. Put all 4 operators in **LOCK** 3. Set all **Detune** knobs to **12 o'clock** 4. Set all **Shape** knobs fully CCW (**sine**) 5. Turn all **Mod 1–4** knobs fully CCW 6. Patch **1V/Oct** and take audio from one or more **Op outputs** 7. Raise one operator's **Mod** send into another operator 8. Use the modulating operator's **Gain CV/level** to animate FM depth

Core concept

Each row = one **operator**.

Each operator has: - a tuning control (**Ratio** in LOCK, coarse tuning in FREE) - **Detune** - **Shape** - **Gain** - four **Mod sends** to Operators 1–4

LOCK vs FREE

LOCK - Operator follows master pitch at an **integer ratio** - Best for classic harmonic FM - Ratio knob selects **1/11 to 11x** relative to master tuning, in integer steps

FREE - Operator becomes an independent oscillator/LFO - Ratio knob becomes the operator's own coarse tuning - Ratio CV becomes **1V/oct** for that operator - Better for independent oscillators / inharmonic FM

Master controls

Coarse knob

- Master tuning for all operators in **LOCK**
- Exponential response across **8 octaves**
- Range:
- **VCO mode: 16.35 Hz (C0) to 2093 Hz (C7)**
- **LFO mode: 0.511 Hz (C-5) to 65.41 Hz (C2)**

Fine knob

- Master fine tune for all locked operators
- Range: **±6 semitones**

VCO / LFO toggle

- Changes base frequency range of the whole module

1V / Oct input

- Master pitch CV for all operators in **LOCK**
- **Voltage range: -1V to +5V**
- Normal: **0V**
- Sample rate: **6 kHz**

LF FM input

- Low-frequency pitch modulation input for all locked operators
- Good for vibrato, bends, pitch envelopes
- **Voltage range: -5V to +5V**
- Normal: **0V**
- Sample rate: **6 kHz**

AR FM input

- External **audio-rate modulation input**
- Lets external audio modulate internal operators
- Especially useful for feedback/complex FM patches
- **Voltage range:** trimmable for **-5V to +5V** or **-10V to +10V**
- Normal: **0V**
- Sample rate: **48 kHz**

Reset input

- Resets phase of all operators
- Useful in LFO mode / as a modulation source
- Works regardless of lock/free state
- **Gate input: 0V / 5V**, threshold about **2.5V**
- Normal: **0V**
- Sample rate: **6 kHz**

Per-operator controls

For each operator 1–4:

Lock/Free toggle

- **LOCK**: ratio-based tuning relative to master pitch
- **FREE**: independent oscillator/LFO

Ratio knob + Ratio CV

- **LOCK**: integer multiplier of master pitch
- Range: **x1/11 to x11**
- **FREE**: continuous coarse tune for that operator
- **VCO mode: 16.35 Hz to 2093 Hz**
- **LFO mode: 0.511 Hz to 65.41 Hz**

Ratio CV input - In **FREE**, acts as **1V/oct** for that operator - **Voltage range: -5V to +5V** - Normal: **0V** - Sample rate: **6 kHz**

Detune knob

- Fine tune per operator
- Range: **±6 semitones**

Shape knob + Shape CV

- Morphs waveform:
- **sine** → **triangle** → **square** → **saw**
- Good starting point for clean FM: full CCW = **sine**

Shape CV input - **Voltage range: -5V to +5V** - Normal: **0V** - Sample rate: **6 kHz**

Gain CV

- Controls operator level **and** how strongly it modulates destinations
- Think of it like a built-in VCA for both audio output and FM send intensity
- Normalled to **full gain**

Gain CV input - Voltage range: 0V to +5V - Normal: +5V - Sample rate: 6 kHz

Mod 1 / 2 / 3 / 4 knobs

- FM send amounts from this operator to Operators **1–4**
 - Includes **self-modulation**
 - Effective send level depends on operator **Gain**
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External AR FM section

The external AR FM source behaves like another modulator with its own send row.

AR FM Gain knob

- Sets incoming external modulation level
- Adjust to avoid clipping

AR FM clipping LED

- Red LED = input clipping/distortion
- Reduce AR FM Gain if it lights

Gain AR FM CV input

- VCA for external modulation amount
- Normalled to full gain
- **Voltage range: 0V to +5V**
- Normal: **+5V**
- Sample rate: **6 kHz**

AR FM Mod 1–4 knobs

- Amount of external audio-rate modulation sent to Operators **1–4**
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Algo expander

Adds saved FM-routing “algorithms” and crossfading.

What it stores

Only the **modulation matrix settings**: - all **Mod 1–4** knobs for the 4 operators - **AR FM Mod 1–4** knobs

Slots

- **A**
- **B**
- **C**
- **Live** = current actual knob positions

Buttons

- **Long press A/B/C**: save into that slot
- **Short press a slot**: select it into the crossfade pair
- Press two slots to define left/right endpoints
- Double-tap **Live** to use only current knob positions

Crossfade knob / CV

- Crossfades between selected left/right algorithms
- Manual text does not specify CV voltage range for expander crossfade jack

Important behavior

- If using only **A/B/C** and not **Live**, the physical Mod knobs on Quad Operator are ignored
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Input / output reference

Inputs

Master inputs

Jack	Function	Voltage Range	Normal	Sample Rate
Reset	Phase reset trigger/gate for all operators	0V to 5V (threshold ~ 2.5V)	0V	6 kHz
1V / Oct	Master pitch CV for locked operators	-1V to +5V	0V	6 kHz
LF FM	Global low-frequency FM/pitch modulation	-5V to +5V	0V	6 kHz
AR FM	External audio-rate modulator input	trimmable -5V to +5V or -10V to +10V	0V	48 kHz

Per-operator inputs

Jack	Function	Voltage Range	Normal	Sample Rate
Ratio 1–4	Ratio CV in LOCK / 1V-oct in FREE	-5V to +5V	0V	6 kHz
Shape 1–4	Wave shape CV	-5V to +5V	0V	6 kHz
Gain 1–4		0V to +5V	+5V	6 kHz

Jack	Function	Voltage Range	Normal	Sample Rate
	Operator gain / FM index VCA			
Gain AR FM	External mod input gain CV	0V to +5V	+5V	6 kHz

Outputs

Jack	Function	Voltage Range	Sample Rate
Op 1	Operator 1 output	-5V to +5V	48 kHz
Op 2	Operator 2 output	-5V to +5V	48 kHz
Op 3	Operator 3 output	-5V to +5V	48 kHz
Op 4	Operator 4 output	-5V to +5V	48 kHz

Full control reference

Knobs

Master

- **Coarse** – master tuning
- **Fine** – master fine tuning

Per operator 1–4

- **Ratio**
- **Detune**

- Shape
- Mod 1
- Mod 2
- Mod 3
- Mod 4

External AR FM

- AR FM Gain
- AR FM Mod 1
- AR FM Mod 2
- AR FM Mod 3
- AR FM Mod 4

Algo expander

- Crossfade

Toggles

- VCO/LFO
- Operator 1 Lock/Free
- Operator 2 Lock/Free
- Operator 3 Lock/Free
- Operator 4 Lock/Free

Buttons

- Algo A
 - Algo B
 - Algo C
 - Algo Live
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Practical patch tips

For clean/harmonic FM

- Keep operators in **LOCK**
- Use **integer ratios**
- Keep **Detune at noon**
- Start with **sine waves**
- Add modulation slowly

For animated FM

- Patch envelopes/LFOs to **Gain 1–4**
- This changes both output level and FM depth dynamically

For independent oscillator bank use

- Put operators in **FREE**
- Use each output separately
- Ratio CV becomes per-operator **pitch CV**

For gnarlier tones

- Use:
- non-sine shapes
- self-modulation
- FREE mode
- detuning
- external **AR FM**
- feedback-style patches with locked operators

Calibration

If pitch tracking seems off:

Patch:

- **Op 1** → **Ratio 1**
- **Op 2** → **Ratio 2**
- **Op 3** → **Ratio 3**
- **Op 4** → **Ratio 4** and **1V/Oct** via **unbuffered split**

Important: - Use **Op 4** for the split to 1V/Oct - Use an **unbuffered** mult/splitter

Trigger calibration:

1. Flip Operator 1 Lock/Free once
2. Flip Operator 2 Lock/Free once
3. Flip Operator 3 Lock/Free once
4. Flip Operator 4 Lock/Free once
5. Flip **VCO/LFO** switch **5 times quickly**

Success indication: - Gain indicator LEDs blink **twice**

Specs

Quad Operator

- **Width:** 30 hp
- **Depth:** 25 mm
- **Power:** +12V **140 mA**, -12V **13 mA**

Algo expander

- **Width:** 4 hp
- **Depth:** 25 mm
- **Power:** +12V **5 mA**, -12V **0 mA**

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