

Humble Audio – Quad Operator

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Humble Audio Quad Operator + Algo Expander Cheat Sheet

What it is

A 4-operator digital linear FM oscillator bank for Eurorack.

- 4 operators, each with:
 - variable waveform: **sine** → **triangle** → **square** → **saw**
 - independent output
 - per-operator gain/VCA behavior
 - modulation sends to any operator, including self
 - Can run as:
 - **classic ratio-locked FM voice**
 - **4 independent oscillators** in free mode
 - **quad/LFO modulation source**
 - Optional **Algo expander**:
 - save/recall FM matrices
 - crossfade between saved/live algorithms
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Quick start

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. Set all **Mod 1–4** knobs fully CCW
6. Tune with **Coarse** and **Fine**
7. Use each operator's **Ratio** to choose integer harmonic relationships
8. Turn up modulation sends gradually

For 4 independent oscillators

1. Put operator(s) in **FREE**
2. In free mode:
3. **Ratio knob** becomes coarse tuning
4. **Ratio CV** becomes **1V/oct** for that operator
5. Patch from individual **Op 1–4 outputs**

For modulation/LFO use

1. Set **VCO/LFO** to **LFO**
2. Use **Reset** to restart phase
3. Keep operators in **LOCK** if you want phase-related complex modulation

Core concepts

LOCK vs FREE

LOCK - Operator frequency is an **integer ratio** of master pitch - Best for harmonic / classic FM sounds - **Ratio knob** selects approx **x1/11 to x11** in integer steps - **1V/Oct**, **Coarse**, and **Fine** affect all locked operators

FREE - Each operator becomes its own oscillator - **Ratio knob** = operator coarse tuning - **Ratio CV** = **1V/oct** for that operator - Better for independent voices or inharmonic FM

Gain behavior

Each operator's **Gain CV** controls: - its output level - how strongly it modulates other operators via its sends

So gain acts like a built-in VCA for both carrier level and modulation depth.

Mod matrix

Each row is a source: - Operator 1 - Operator 2 - Operator 3 - Operator 4 - AR FM external input

Each **Mod 1–4** knob sends that source to the destination operator.

Example: - In Operator 2 row, **Mod 1** = amount Operator 2 modulates Operator 1 - Self-modulation is allowed

Front panel controls

Master controls

- **Coarse**
 - Master tuning
 - Affects all operators in **LOCK**
 - Exponential response over **8 octaves**
- **Fine**
 - Master fine tune
 - Range: **±6 semitones**
- **VCO/LFO switch**
 - Sets frequency range for master tuning
- **1V/Oct input**
 - Pitch CV for all operators in **LOCK**
- **LF FM input**

- Low-frequency pitch modulation
 - Best for vibrato, bends, envelopes
 - Range corresponds to **±6 semitones**
 - **AR FM input**
 - External audio-rate modulator input
 - **Reset input**
 - Resets phase of all operators
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Per-operator controls

Each operator has:

- **Lock/Free toggle**
 - LOCK = ratio-locked FM operator
 - FREE = independent oscillator
 - **Ratio knob**
 - LOCK: integer ratio relative to master pitch
 - FREE: operator coarse tuning
 - **Ratio CV jack**
 - LOCK: modulates ratio parameter
 - FREE: becomes **1V/oct** for that operator
 - **Detune knob**
 - Fine tuning
 - Range: **±6 semitones**
 - **Shape knob**
 - Crossfades **sine** → **triangle** → **square** → **saw**
 - **Shape CV jack**
 - CV over waveshape
 - **Gain CV jack**
 - Controls operator level and modulation intensity
 - Normalled high, so operator is active without patching
 - **Mod 1–4 knobs**
 - Send this operator as FM to Operators 1–4
 - **Op output jack**
 - Individual output for that operator
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External modulation section

For the dedicated **AR FM** input:

- **AR FM jack**
 - External audio-rate modulator input
 - **AR FM Gain knob**
 - Adjusts external input level
 - Set to avoid clipping
 - **Clip LED**
 - Red LED = external input clipping
 - **Gain AR FM CV jack**
 - VC over external modulation depth
 - Normalled high
 - **Mod 1–4 knobs**
 - Send external AR FM source to Operators 1–4
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Algo expander

Adds algorithm save/recall and crossfading of the modulation matrix.

What gets stored

Only modulation matrix values: - all **Mod 1–4** knobs for: - Operator 1 - Operator 2 - Operator 3 - Operator 4 - AR FM input row

Slots

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

Buttons / controls

- **A / B / C / Live buttons**

- **Long press A/B/C** until LED blinks twice = save to slot
- **Short press** = assign slot into crossfade selection
- **Crossfade knob**
- Morph between left/right selected algorithms
- **Crossfade CV input**
- CV control of algorithm morph

Important behavior

- If using only **A/B/C** slots, the physical **Mod** knob positions are ignored
 - Double-tap **Live** if you want only current panel settings
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Patch tips

Simple 2-op FM voice

- Op1 = carrier, monitor **Op1 out**
- Op2 = modulator
- Both in **LOCK**
- Op1 ratio = 1
- Op2 ratio = 2 or 3
- Op2 row: raise **Mod 1**
- Keep shapes near sine for cleaner FM

Feedback FM

- Use self-modulation by turning up an operator's own destination knob
- Or patch an output externally and return it via **AR FM**

Layered outputs

- Since each operator has its own output, you can:
- mix multiple carriers
- process operators separately

- use one operator as audible carrier and others as CV/audio modulators

Voltage ranges and signal reference

Inputs

Jack	Type	Voltage Range	Normal	Notes
Reset	Gate in	0V / 5V, threshold ~2.5V	0V	Phase reset for all operators
1V/Oct	CV in	-1V to +5V	0V	Master pitch for locked operators
LF FM	CV in	-5V to +5V	0V	Low-frequency pitch modulation
Ratio 1-4	CV in	-5V to +5V	0V	Ratio control in lock; 1V/oct in free
Shape 1-4	CV in	-5V to +5V	0V	Wave shape modulation
Gain 1-4	CV in	0V to +5V	+5V	Controls output level and FM send intensity
Gain AR FM	CV in	0V to +5V	+5V	External modulation depth
AR FM	Audio in	Trimmable for -5V to +5V or -10V to +10V	0V	External audio-rate FM source
	CV in		—	

Jack	Type	Voltage Range	Normal	Notes
Algo Crossfade		Not specified in manual		CV over algorithm crossfade

Outputs

Jack	Type	Voltage Range	Sample Rate	Notes
Op 1– 4	Audio/CV out	-5V to +5V	48 kHz	Individual operator outputs

Parameter ranges

Parameter	Range
Coarse (VCO mode)	16.35 Hz (C0) to 2093 Hz (C7)
Coarse (LFO mode)	0.511 Hz (C-5) to 65.41 Hz (C2)
Fine	±6 semitones
Ratio 1–4 (LOCK)	x1/11 to x11 relative to master coarse/fine
Ratio 1–4 (FREE, VCO)	16.35 Hz (C0) to 2093 Hz (C7)
Ratio 1–4 (FREE, LFO)	0.511 Hz (C-5) to 65.41 Hz (C2)
Detune 1–4	±6 semitones
Shape	Crossfade: sine / triangle / square / saw
Gain 1–4	0 to 1 multiplier

CV scaling note

For **Ratio** and **Shape** parameters: - **5V of CV = full knob travel** - Bipolar CV can sweep beyond current knob setting in either direction

Calibration

Use if pitch tracking seems off.

Patch:

- **Op1** → **Ratio1**
- **Op2** → **Ratio2**
- **Op3** → **Ratio3**
- **Op4** → **Ratio4** and **1V/Oct** via **unbuffered split**
- Important: use **Op4** for the split

Trigger calibration:

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

Success indication: - Gain LEDs blink twice

Firmware / physical specs

- Firmware update via **micro USB** on back
- Manual mentions firmware version **1.0.4**
- **Quad Operator**
- **30 hp**
- **25 mm deep**
- **+12V: 140 mA**

- -12V: 13 mA
 - Algo expander
 - 4 hp
 - 25 mm deep
 - +12V: 5 mA
 - -12V: 0 mA
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Best-use summary

- Use **LOCK + sine + no detune** for stable, harmonic FM
- Use **FREE** for separate oscillators or inharmonic textures
- Use **Gain CV** like a modulation VCA
- Use **AR FM** for external operators, feedback, or wild FM
- Use **Reset** in LFO mode for repeatable modulation shapes
- Use **Algo** to store and morph FM routings

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