# FMco

https://busycircuits.com/alm045

The FMco is a compact FM synthesis based VCO and voice. It features our own original 2-operator FM synthesis DSP implementation inspired by our 'Akemie' modules but tuned for more immediate use and a more modern sound. It includes both manual and voltage control over FM Index, Ratio and a selection of classic operator waveforms for a wide pallete of FM sounds from a simple set of controls. A built-in decay envelope is routed to both FM depth and output level, allowing the FMco to function as a full synth voice when triggered. The FMco also includes CV-controlled four-voice chords, an encoder-based tuning system for easy accurate pitch control, and a stereo-widened output, delivering a large amount of FM synthesis all in just 8HP.

## ALM045 / FMco

*TECHNICAL SPECIFICATIONS*

*Power:* +12V 65mA / -12V 25mA
*Size:* 8 HP
*Depth: 32*mm

### *Module Installation*

With your modular synth powered **off**, connect the 10 pin end of the supplied standard eurorack power connector cable to the 10 pin power connector on the rear of the module.
The red stripe on the cable should be orientated to match the text 'RED' marked on the rear of the module near the power connector (this is -12V).
Connect the other 16 pin end of the cable to your eurorack bus board (Refer to your bus board documentation for the correct orientation).
You are now safe to power up your modular synth. If the module fails to power up, check that you have the power cable correctly orientated and have carefully read the manual.
All ALM modules feature reverse power protection.


### *FREQUENCY*

FMco uses an 'endless' clickable encoder to set its base frequency.

Clicking the encoder changes the increment amount between octaves, semitones and cents (approx).

Quickly double clicking the encoder initialises the base frequency to C3 (approx 261.63Hz) and returns to octave increments.

### *WAVE*

Cycles through waveshapes for both operators. CV Input voltage (0-5v) via attenuation control is added to the offset knob position.

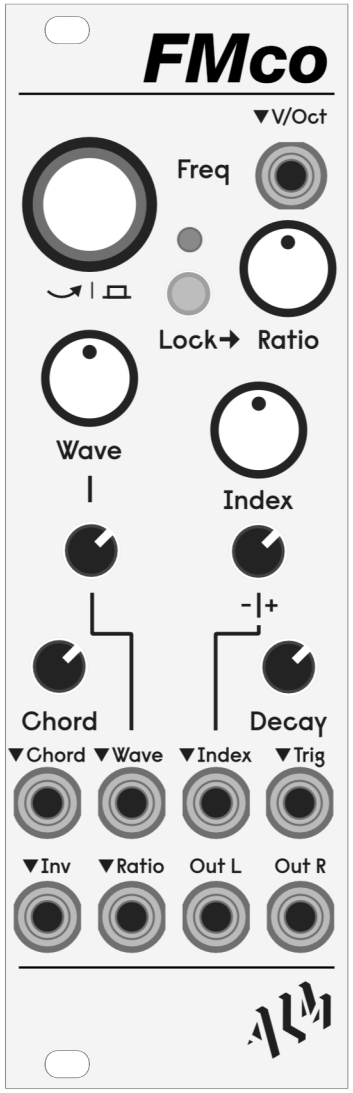
Single Note
Octaves
Fifths
Major Triad
Dominant 7th
Major 7th
Major 9th
Minor 9th
Minor 7th
Minor 6th
Minor 4
Minor Triad
Suspended 4
Unison Detune 1
Unison Detune 2
Unison Detune 3
Castle Detune

### *CHORD*

The FMco is able to produce up to 4 voice chords. The Chord control engages this and combined with its associated CV input (0-5v) selects a chord from the inbuilt list as shown on the left.

### *INV*

Causes the active Chord (if any) to have inversion. Higher voltages (0-5v) increase the amount of inversion.




### *FREQUENCY INPUT*

The V/Oct pitch input is added to the base frequency set by the encoder.

The total range is approx 8 octaves *~32hz to ~8.3kHz*

### *RATIO*

The frequency ratio between the carrier and modulator.

### *LOCK*

Restricts the Ratio to integer multiples when the switch engaged and LED lit.

### *INDEX*

Depth of the frequency modulation. CV Input voltage (0-5v) via attenuversion control is added/subtracted with the offset knob position.

### *DECAY / Trig*

When Trig input is patched the module becomes a self contained voice with VCA and FM depth controlled by a simple internal decay only envelope. It will then need to be triggered to produce a sound.

### *OUTPUTS*

Stereo widened outputs.

### *Firmware Updates*

With the unit unpowered, connect a USB cable from the port at the left side of the PCB to a computer. The FMco will appear as a standard removable storage device.
Copy a valid firmware file to the root directory to update. When complete, FMCo will eject once the update completed and is ready to use powered normally (any 'unmount' errors from the computer can be safely ignored).

### *Limited Warranty*

From the date of manufacture this device is guaranteed for a period of 2 years against any manufacturing or material defects. Any such defects will be repaired or replaced at the discretion of ALM. This does not apply to;
• Physical damage arising from mis treating (i.e dropping, submerging, 'modding' etc).
• Damage caused by incorrect power connections.
• Overexposure to heat or direct sunlight.
• Damage caused by inappropriate or misuse.
• Use of incorrect or non official firmware
No responsibility is implied or accepted for harm to person or apparatus caused through operation of this product. By using this product you agree to these terms.

### *Support*

Need help? Email your questions to help@busycircuits.com
Visit busycircuits.com and follow @busycircuits on Instagram and YouTube for ideas, tutorials and more.

*ALM045 manual version: 0.4*

## Calibration Instructions

All FMco modules are shipped with the V/Oct expertly calibrated at the factory. If you wish to recalibrate, please follow these instructions.

- With the FMco powered off, turn all knobs full counter clockwise (CCW) to 0. Have all jacks unplugged.
- Power on the module with the encoder pressed down. The yellow  LED will be flashing.
- Patch 1V into the V/Oct input.
- Click the encoder. The yellow LED will flash faster to indicate the voltage is accepted.
- Patch 3V into the V/Oct input.
- Click the encoder. The calibration is complete and the FMco will reboot into normal operation.
- If at any point the LED is flashing and unresponsive there is a calibration error, start the procedure over.

The ALM002 Beast's Chalkboard is recommended to be used to generate required precise voltage offsets (1V & 3V) for calibration.

Alternatively Pams NEW or PRO workout can also be used by setting an outputs level parameter to 0% and then its offset parameter to 20% (1V) or 60% (3V).