



USER MANUAL

February 1st 2022

We always value feedback and ideas, so feel free to reach out.
Please check the website for the latest firmware!

THANK-YOU!

Thank-you for adopting MEGAfm, the product of several years of work & play. We are particularly fond of the YM2612 as they offer a unique gritty texture that is uncommon in the FM world, plus hands-on FM experience that is unprecedented in the hardware FM synthesiser world.

We hope that you will enjoy making music with MEGAfm as much as we have enjoyed and continue to enjoy developing it!

YM2612 Overview

“The Yamaha 2612 Frequency Modulation (FM) sound synthesis IC resembles the Yamaha 2151 (used in Sega’s coin-op machines) and the chips used in Yamaha’s synthesisers.

It is famously known as the Sega Megadrive’s voice.

An FM channel is capable of expressing, with a high degree of realism, a single note in almost any instrument’s voice. Chords are generally created by using multiple FM channels.

The standard FM channels each have a single overall frequency and data for how to turn this frequency into the complex final wave form (the voice). This conversion process uses four dedicated channel components called ‘operators’, each possessing a frequency (a variant of the overall frequency), an envelope, and the capability to modulate its input using the frequency and envelope. The operator frequencies are offsets of integral multiples of the overall frequency.

There are 6 FM channels. Channels 3 and 6, have the capability to use a totally separate frequency for each operator rather than offsets of integral multiples (ch3 special mode). This works well for sound effects and experimental instruments. ”

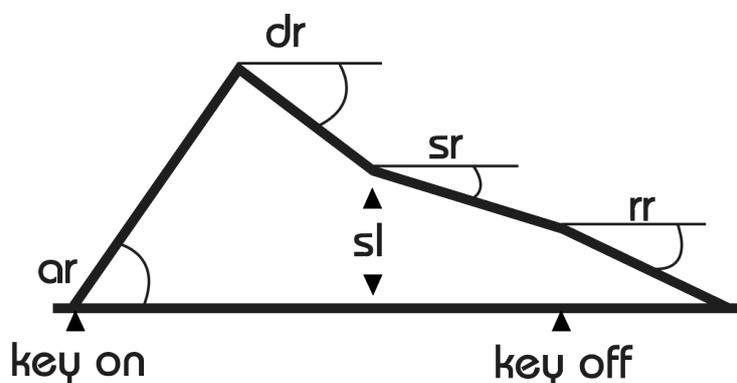
Operators

There are four dedicated operators per voice which may be arranged in eight different configurations, called "algorithms". Following is a diagram of the algorithms.

Algorithm #	Layout	Suggested uses
0		Distortion guitar, "high hat chopper" (?) bass
1		Harp, PSG (programmable sound generator) sound
2		Bass, electric guitar, brass, piano, woods
3		Strings, folk guitar, chimes
4		Flute, bells, chorus, bass drum, snare drum, tom-tom
5		Brass, organ
6		Xylophone, tom-tom, organ, vibraphone, snare drum, base drum
7		Pipe organ

Slots are indicated by shading.

Envelope Specification



Understanding the envelopes

The YM2612 envelopes are powerful and original compared to the ADSR we are all used to, but they can be confusing at first.

Since we are used to attack decay and release times taking longer as we increase their knobs, MEGAfm uses the "higher the fader the longer it takes" approach.

As a result all the faders are decreasing the angles printed on the silkscreen as they are moved upwards, except for attack faders which increase it.

For example:

-during the AR (Attack Rate) Phase: The higher the fader, the longer it takes for the attack phase to complete aka for the volume to reach TL aka **T**otal **L**evel (rising fader = increasing the angle displayed on the silkscreen)

-during the DR (Decay Rate) Phase: The higher the fader, the longer it takes for the decay phase to complete aka for the volume to reach SL aka **S**ustain **L**evel (rising fader = decreasing the angle displayed on the silkscreen)

-during the SR (Sustain Rate) Phase: The higher the fader, the longer it takes for the level to fall from sl to zero (rising fader = decreasing the angle displayed on the silkscreen)

-during the RR (Release Rate) Phase: The higher the fader, the longer it takes for the release complete aka drop to zero after key release (rising fader = decreasing the angle displayed on the silkscreen)

Below is the official description as found on the data sheets

Thanks MAXIM for the excerpts: <https://www.smspower.org/maxim/Documents/YM2612>

The sound starts when the key is depressed, a process called 'key on'. The sound has an attack, a strong primary decay, followed by a slow secondary decay. The sound continues this secondary decay until the key is released, a process called 'key off'. The sound then begins a rapid final decay, representing for example a piano note after the key has been released and the damper has come down on the strings. The envelope is represented by the above amplitudes and angles, used in the above diagram are:

TL	Total level, the highest amplitude of the waveform.
AR	Attack rate, the angle of initial amplitude increase. This can be made very steep if desired. The problem with slow attack rates is that if the notes are short, the release (called 'key off') occurs before the note has reached a reasonable level.
DR	The angle of initial amplitude decrease.
SL	The amplitude at which the slower amplitude decrease starts.
SR	The angle of secondary amplitude decrease. This will continue indefinitely unless 'key off' occurs.
RR	The final angle of amplitude decrease, after 'key off'.

Voicing



MEGAfm offers up to 12 voice polyphony.
The 12 voices are spread across two YM2612 chips.
In all modes you can use the fat knob to detune the voices.

Hold voicing mode button and the fat knob becomes glide.
Glide knob determines the time it takes for each voice to change pitch when a new note is played.

Mono Mode:

When a single TS 6.35mm jack is plugged into output1, both chips are summed to output1.

Stereo Mode:

When a second TS 6.35mm jack is plugged into output2, the 2 chips will be split between outputs 1 and 2 (6 voices per chip/output)

There are 4 Voicing modes available. Press the voicing button to change the current voice Voicing mode.

Poly12

12 voice polyphony scattered between both chips in a Left/right/left/right etc manner

Wide6

Both chips play the same 6 notes but can be detuned with the fat knob

Dual ch3

YM2612 offers a special mode where the 4 operators of channel3 can be individually detuned to arbitrary frequencies as described above in the YM2612 Overview. Recommended for experimental / percussive sounds. Dual ch3 has 2 possible modes: duo phonic (alternating between chip 1 and 2) and monophonic stereo (firing both chips at once). Press LFO3 chain button to toggle between modes. Display will show **d3** for duo phonic mode and **S3** for stereo mode.

Unison

All voices are played at once in unison and detuned using the fat knob. Turn the fat knob clockwise to gradually detune all 12 voices. At maximum fat, the 12 voices are arranged in a chord. 3 Note priority modes are available: Highest, Lowest (factory default) and Last note priority. Press retrig in setup mode to toggle between the 3 modes. Display will show **Hi**, **Lo(w)** or **LA(st)** accordingly.

Fat

Use the fat knob to detune the 12 voices in any voice mode. In Unison mode you can detune the voices from slightly detuned (aka fat) all the way to a grand chord, THX style!

In all other modes, you can detune the voices either by 1 semitone or 1 octave. See setup to choose between the 2 options.

Glide

When you hold the voicing button the fat knob becomes glide. Adding glide increases the time it takes each voice to reach its new pitch.

Volume

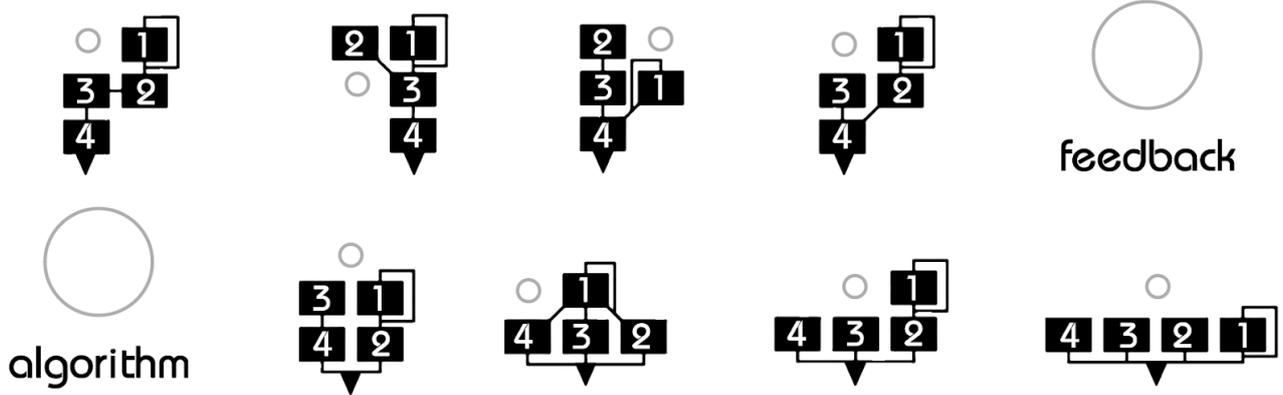
Use the volume knob to set the volume of the current preset.

Note about volume: A digital potentiometer is used to set the volume so that it can be recalled between presets. Digital potentiometers can make a click noise known as zipper noise when changing values, in order to reduce this noise the volume is only updated after the knob has been adjusted, not during so please allow a quarter second for the volume to change.

Preset tuning

Hold voicing and use the VOL knob to tune your preset within a 1 octave range.

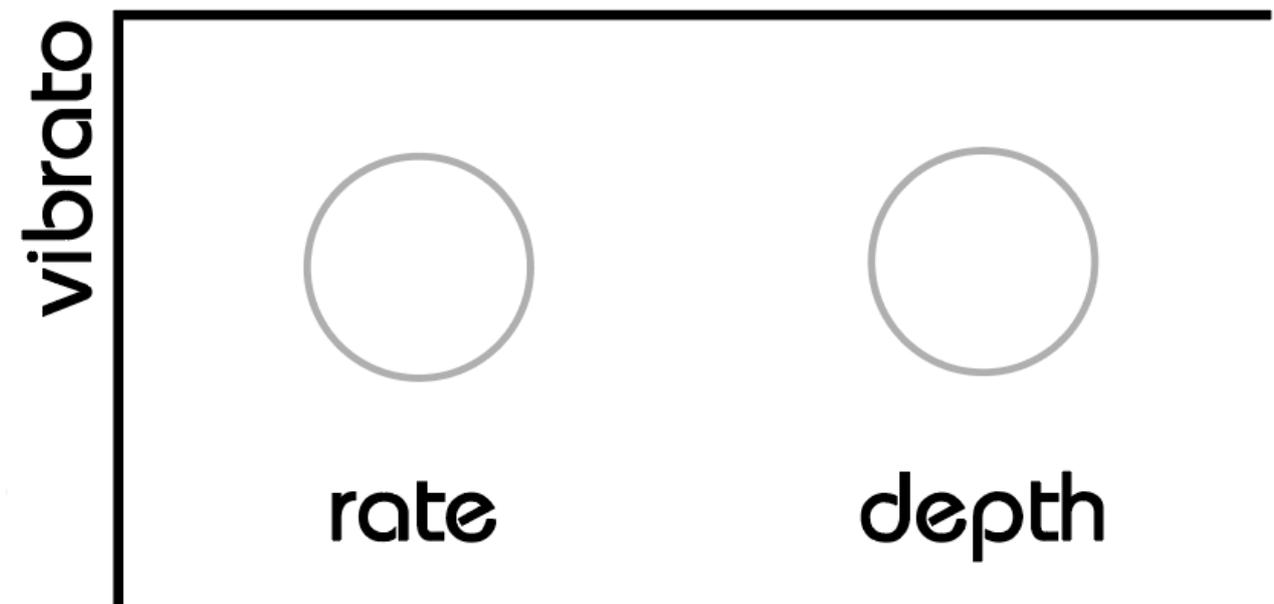
Algorithms & Feedback



Use the algorithm knob to select any of the 8 algorithms and the feedback knob to set the amount of operator1 feedback.

Note: both parameters can be modulated by LFO!

Vibrato



Use the depth knob to add vibrato to the overall pitch of MEGAfm.
Use the vibrato rate knob to set the vibrato's speed.

The vibrato can be configured to sync to incoming MIDI clock at 8 different speeds, please refer to SETUP instructions for more details.

Arpeggiator and Sequencer



When unison voice mode is active the arpeggiator can be used.

The arpeggiator has 7 modes:

Up (shown as "UP" on the numeric display)

Down (shown as "dn" on the numeric display)

Up/Down aka pendulum (shown as "Ud" on the numeric display)

Random1 (shown as "r1" on the numeric display)

The arpeggiator chooses and plays any of the held keys at random.

Random2 (shown as "r2" on the numeric display)

The arpeggiator chooses and plays any notes at random.

Sequencer1 and 2 (shown as "S1" and "S2" on the numeric display)

The arpeggiator acts as a sequencer playing up to 16 notes that can be recorded via MIDI.

In S2 mode, the sequencer advances a step every time a key is pressed and not in S1. Similarly to a Casio VL Tone.

Reminder: The Arp is only active when in unison mode

Recording a sequence

To record a sequence press **rec** to activate recording mode. The **rec** LED will flash.

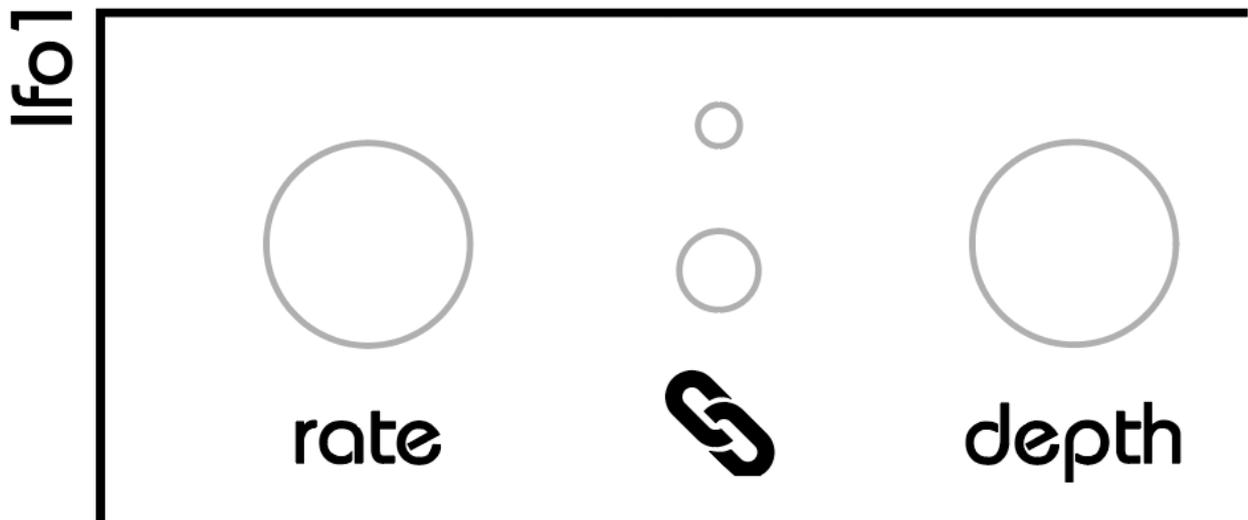
Now play up to 16 notes via MIDI. Each preset can store up to 16 notes. Every time you input a note, the step recorder will advance and the numeric display will show the current step.

You can use the **preset up** button to skip a step. No note will be played.

You can also go back a step with the **preset down** button if you wish to correct a note.

The arpeggiator can be set to sync to incoming MIDI clock at 8 different speeds defined by the **rate** knob. Please refer to Setup for details.

Modulators (Lfo 1 to 3)



Any knob or fader can be modulated by up to 3 lfo modulators at once.

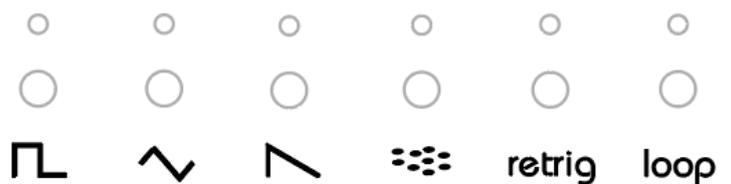
- To link a knob or fader to an lfo**
move a knob or fader and press a chain link button. Click the chain button a second time to unlink a knob or fader from an lfo.
- The LED above the chain button indicates whether the modulator is linked or not. Each knob or fader can link to up to 3 LFOs at once.

To unlink all the knobs/faders from an lfo

hold the chain button for 4 seconds, until the letters CL appear on the numeric display.

Selecting an lfo waveform

To select any of the 3 LFOs simply move one of the LFO **rate** or **depth** knobs.



Use the 4 waveform buttons to

select a waveform. The saw can be converted to a ramp. Press the saw

button several times to toggle between version. (display will indicate Sa(w) or rA(mp) accordingly).

The Square can be inverted (high for the first or second half of the LFO cycle), press the square button to invert it.

LFO depth

Set the depth of an LFO with its **depth** knob. This defines the amount of effect the lfo will have on the associated knobs or faders.

LFO rate

Set the rate of an LFO with its **rate** knob. Each LFO can also individually be configured to sync to incoming MIDI clock at 8 different speeds, please refer to SETUP instructions for more details. The LFO waveform LED will blink to indicate the rate of the LFO.

Note: an LFO can modulate both rates and depths of other LFOs but not those of itself.

retrig

When this feature is active each keypress will retrigger the LFO from the beginning of its cycle. Otherwise the lfo will only trigger on the first key.

loop

When this feature is active the LFO will loop endlessly instead of in a one-shot manner.

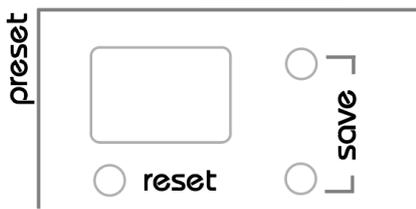
Looping noise

When an LFO is set to noise, it can send a loop through a table of randomly generated values. The table length can be 8, 16, 32, or infinite values. Press the noise waveform multiple times to set the table length.

The screen will show 8, 16,32 or blank (a new random). Every time you press the noise waveform, the tables are regenerated.

The table length setting is stored globally for each LFO.

Presets



MEGAfm has 600 a preset memory capacity arranged in six banks of 100 presets.

MEGAfm currently ships with 50 factory presets (0-49) organised according to the following chart.

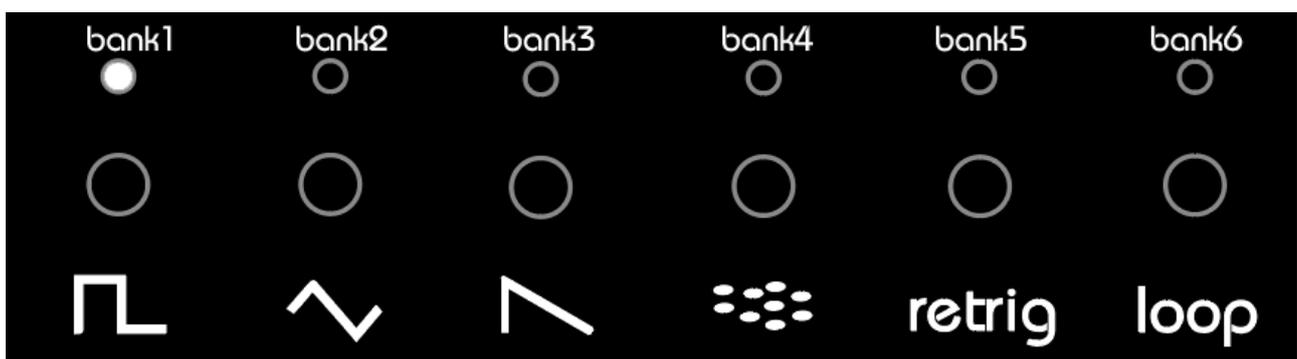
Misc	<i>0-9</i>
Bass	10-19
Lead	<i>20-29</i>
Pads	<i>30-38</i>
Rhythmic	<i>39-44</i>
SFX	<i>45-49</i>

Each preset can be edited and stored and preset banks can be transferred to and from a computer via MIDI SYSEX.

Loading a Preset

Simply press the preset up and down buttons to load a preset.

To change bank press preset up or down, and use the 6 LFO waveform buttons to select a bank within 3 seconds (the current bank is flashing during this time).



Saving a preset

You can save the current preset to any of the 100 slots, first press preset up + preset down simultaneously to enter save mode.

The numeric display will flash the current slot number. This starts a 3 second countdown before automatically saving the preset at the same slot. At this time you can also skip the countdown and immediately save by pressing the **arp rec** button.

But you can change the destination slot by pressing the preset up or down buttons.

Each time you select a new slot the 3 second timer is reset.

Once you have selected the destination slot number you can either press preset up+down again to confirm or wait a few seconds for the numeric display to stop flashing.

Preset reset / panel update

Sometimes a fresh start is nice! Press reset at any time to replace the current preset with preset 0. The numeric display will indicate "P0" for preset zero.

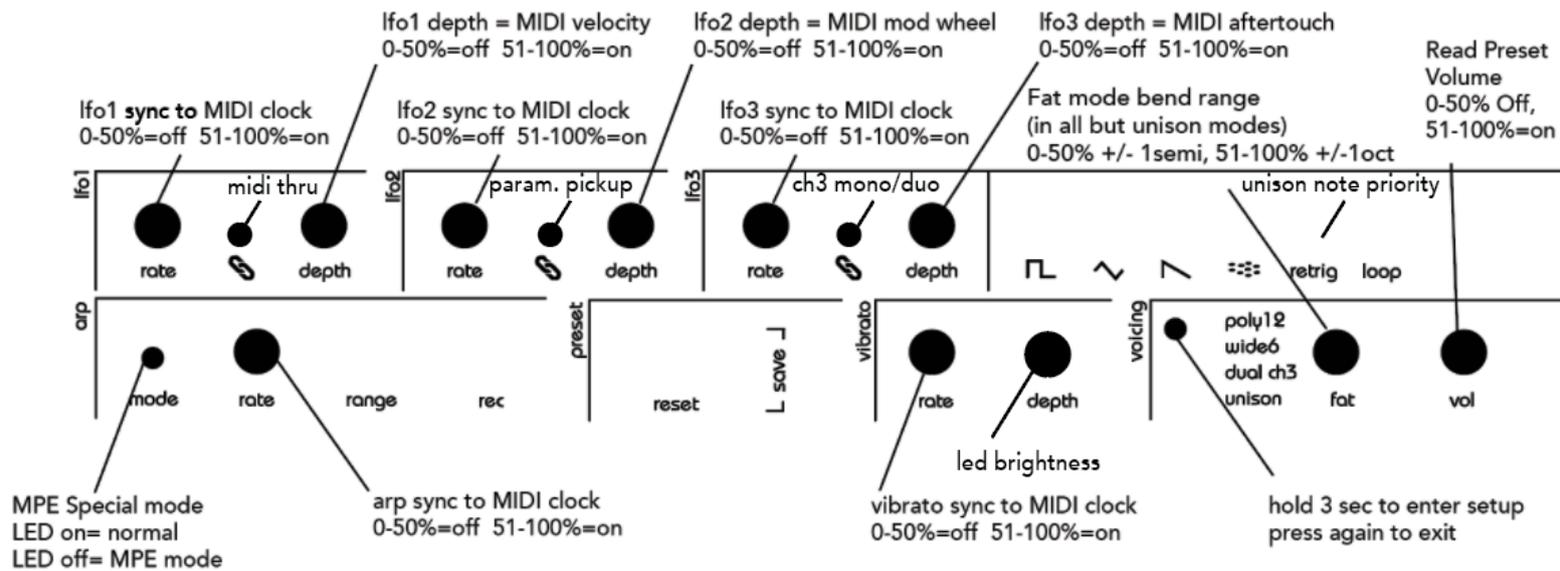
Press reset a second time and MEGAfm will read all the faders and knobs as they are set on the control panel. The numeric display will indicate "PA" for panel.

Preset randomiser

Hold reset a couple seconds to completely randomise your preset, anything could happen!

Setup Mode

Hold voicing at startup or anytime for 3 seconds to enter setup mode.
"SE" appears on the numeric display



LED Brightness

Turn the vibrato depth knob to adjust brightness

LFO1 to 3 sync to incoming MIDI clock

Turn the respective LFO **rate** knob to choose whether to link LFO1,2 or 3 to the MIDI clock.

Above 12 o'clock the setting is on, below the setting is off.

The setting is indicated by ON/OFF on the numeric display

Vibrato sync to incoming MIDI clock

Turn the vibrato **rate** knob to choose whether to link the vibrato to the MIDI clock.

Above 12 o'clock the setting is on, below the setting is off.

The setting is indicated by ON/OFF on the numeric display

Velocity controls LFO1

Turn the vibrato **depth** knob to choose whether to control lfo1 with MIDI velocity. With this option activated, the MIDI velocity will control the

depth of lfo1 when the rate of lfo1 is above zero. When the rate is zero (stopped lfo) MIDI velocity will override the lfo and directly modulate all parameters associated to the lfo. Use the depth knob to adjust the amount of effect.

Above 12 o'clock the setting is on, below the setting is off.

The setting is indicated by ON/OFF on the numeric display

The numeric display will indicate "Ve" followed by "On" or "Of"

Mod wheel controls LFO2

Turn the vibrato **depth** knob to choose whether to control lfo2 with the mod wheel. With this option activated, the mod wheel (CC1) will control the depth of lfo2 when the rate of lfo2 is above zero. When the rate is zero (stopped lfo) the mod wheel will override the lfo and directly modulate all parameters associated to the lfo. Use the depth knob to adjust the amount of effect.

Above 12 o'clock the setting is on, below the setting is off.

The setting is indicated by ON/OFF on the numeric display

The numeric display will indicate "C1" (for MIDI CC1) followed by "On" or "Of"

MIDI Aftertouch controls LFO3

Turn the vibrato **depth** knob to choose whether to control lfo3 with the mod wheel. With this option activated, MIDI aftertouch will control the depth of lfo3 when the rate of lfo3 is above zero. When the rate is zero (stopped lfo) Aftertouch will override the lfo and directly modulate all parameters associated to the lfo. Use the depth knob to adjust the amount of effect.

Above 12 o'clock the setting is on, below the setting is off.

The setting is indicated by ON/OFF on the numeric display

The numeric display will indicate "At" followed by "On" or "Of"

Arp sync to incoming MIDI clock

Turn the arp **rate** knob to choose whether to link the arp to the MIDI clock.

Preset Volume on/off

Turn the volume knob to turn preset volume loading on or off.

When set to off, the preset volume will be ignored when changing preset.

Above 12 o'clock the setting is on, below the setting is off.

The setting is indicated by ON/OFF on the numeric display

MIDI THRU

Press the LFO1 link button to toggle MIDI THRU on/off.

When on, all incoming MIDI is sent to the MIDI output.

By default this setting is OFF.

Important: When MIDI Thru is ON, MEGAfm will no longer generate MIDI & will only echo the incoming MIDI - it will no longer transmit on preset change or fader movement for example.

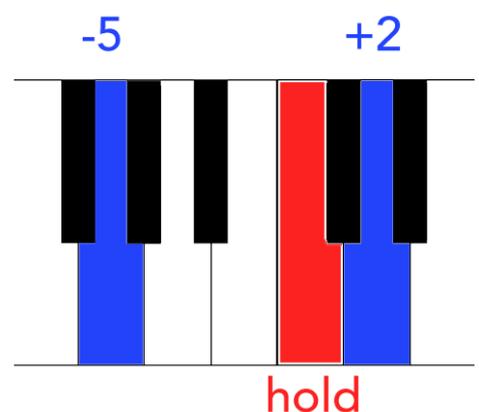
Midi Channel ,Pitch bend up & down Learn

In setup mode you can set the input channel simply by sending MEGAfm a NOTE ON message on any midi channel. When a new Midi channel is registered, it is displayed on the numeric display after the letters "Ch"

MEGAfm can also learn the pitch bend ranges.

Pitch up and down can be any value from 1 to 48. Hold any key then press a key above the first key to define the pitch bend up range or a key below it to define the pitch down range (without releasing the first key).

For example if you wish for MEGAfm to bend up 2 semitones and down 5 semitones, hold C and press D then G without releasing C.



Note Priority in unison voicing mode.

Press the retrig button to choose:

- Low Note priority (**Lo** on screen). This is the factory default and most
- high Note priority (**hi** on screen)
- Last Note Priority

Ch3 special mode: Dual or Stereo

Press LFO3 link button to toggle between these modes, refer to voicing modes page 6 for details about this special mode.

Fat mode range (in all modes but unison)

When you are in all voice modes but unison, the fat knob will detune the 12 voices in 2 possible ways: by 1 semitone (set the fat/glide knob below 51%) or by 1 octave (set the fat/glide knob above 50%).

The LED display will indicated 1S (1 semi) or 1o (1 octave) as you adjust the setting.

MultiChannel MPE mode

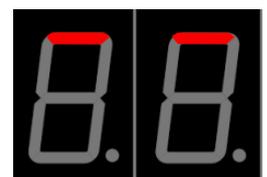
MEGAfm has a special multichannel mode that allows you to control it with an MPE device with multichannel pitch bends, in this mode you can continuously bend each voice within up to 4 octaves.

Press arp mode button to toggle this special mode on or off. When the LED is on, MEGAfm is in normal single channel mode, when LED is off MPE mode is active. When you choose MPE mode, the pitch bend range is set to +/-48semi by default, you are free to change it before exiting setup.

IMPORTANT: MPE mode only uses poly12 voice mode at this time. The voice mode button won't respond when MPE mode is active...

Parameter Pickup

This function allows the faders and knobs to update the synthesiser only when they have first reached the preset value. When Parameter Pickup is enabled, the LED screen will indicate if the preset value is higher or lower than the current position of the knob by use of 2 lines at the top or



Preset value
is higher

bottom of the display. Once the preset value is reached, the lines will be replaced by numbers and the synthesiser will update.



Preset value
is lower

Press the second LFO link button to toggle PP on or off.

Exit setup

Press voice mode button again to exit setup.

MIDI Implementation

MEGAfm responds to the following MIDI controls.

You can also control it with the Plugin (available for free download on the website) which uses the following MIDI parameters. Note some volume related parameters have been disabled after reports of Ableton Live 11 muting them unexpectedly.

Parameter	MIDI CC	Range
GLOBAL		
FM Algorithm	4	1-8
Feedback	3	0-127
Fat	28	0-127
OPERATOR 1		
Op1 Detune	18	0-127
Op1 Multiplier	27	0-127
Op1 Attack Rate	29	0-127
Op1 Decay Rate	21	0-127
Op1 Sustain Level	25	0-127
Op1 Sustain Rate	17	0-127
Op1 Release Rate	30	0-127
OPERATOR 2		
Op3 Detune	31	0-127
Op3 Multiplier	32	0-127
Op3 Attack Rate	36	0-127
Op3 Decay Rate	44	0-127

Parameter	MIDI CC	Range
Op3 Sustain Level	42	0-127
Op3 Sustain Rate	34	0-127
Op3 Release Rate	11	0-127
OPERATOR 3		
Op2 Detune	20	0-127
Op2 Multiplier	24	0-127
Op2 Attack Rate	49	0-127
Op2 Decay Rate	50	0-127
Op2 Sustain Level	51	0-127
Op2 Sustain Rate	45	0-127
Op2 Release Rate	37	0-127
OPERATOR 4		
Op4 Detune	47	0-127
Op4 Multiplier	39	0-127
Op4 Attack Rate	46	0-127
Op4 Decay Rate	33	0-127
Op4 Sustain Level	41	0-127
Op4 Sustain Rate	43	0-127
Op4 Release Rate	35	0-127
LFO		
LFO1 Rate	15	0-127
LFO1 Depth	12	0-127
LFO1 Depth (When Active in setup)	Velocity	0-127
LFO2 Rate	10	0-127
LFO2 Depth	9	0-127
LFO2 Depth (When Active in setup)	1 (mod wheel)	0-127
LFO3 Rate	14	0-127
LFO3 Depth	2	0-127
LFO3 Depth (When Active in setup)	Aftertouch	0-127
ARP		
ARP Rate	6	0-127

Parameter	MIDI CC	Range
ARP Range	5	0-127
VIBRATO		
Arp Rate	48	0-127
Arp Depth	13	0-127

Preset Upload/Download (SYSEX DUMP)

MEGAfm holds 600 presets in its memory. The presets are divided into 6 banks of 100 presets.

You can transfer 50 presets at a time (or half a bank) to and from MEGAfm via MIDI SYSEX.

To download a half bank from MEGAfm to a computer hold preset DOWN at startup. Then choose a BANK using the 6 LFO waveform buttons. Press the BANK button to toggle between A (first half / presets 0-49) or B (second half / presets 50-99).

When ready press preset DOWN again to send the presets. MEGAfm will reboot when finished.

To upload a half bank to MEGAfm from a computer hold preset UP at startup. Then choose a BANK using the 6 LFO waveform buttons. Press the BANK button again to toggle between A (first half / presets 0-49) or B (second half / presets 50-99).

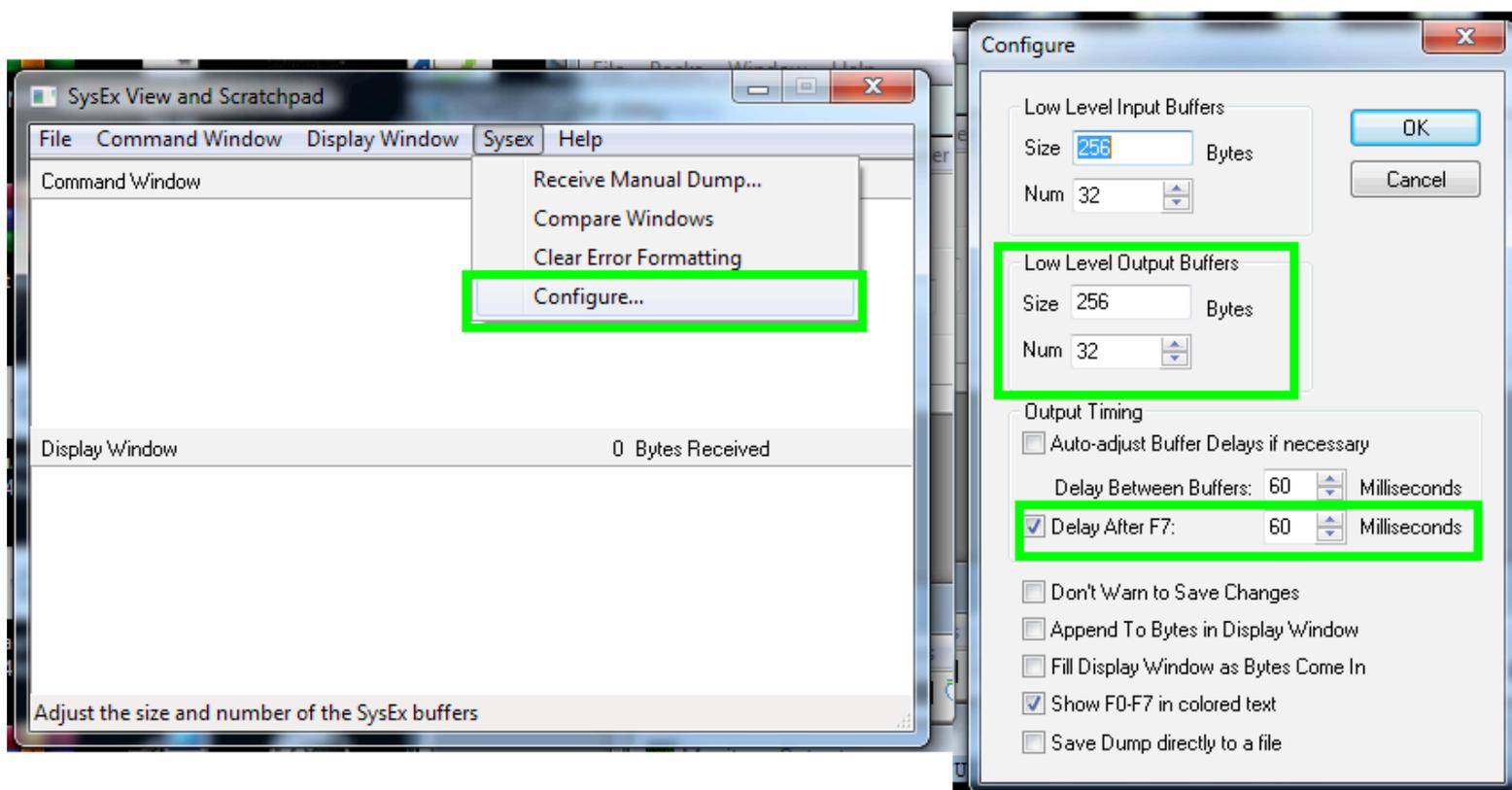
When ready press preset UP again to prepare MEGAfm for the presets. Now send the presets from your computer via a recommended MIDI SYSEX software. MEGAfm count to 99 while it stores the presets and will reboot when finished.

Firmware update

You can transfer new (or old) firmware to MEGAfm via MIDI SYSEX. Hold Arp MODE at startup. This will boot MEGAfm in update mode with all LEDs on. Now transfer the SYSEX file with recommended software via a MIDI interface. The LEDs will blink during the transfer, and MEGAfm will reboot when complete.

For SYSEX transfers we recommend [SYSEX LIBRARIAN](#) for MAC and [MIDIIOX](#) for Windows.

Note to MIDIIOX users: It has been reported that some versions of MIDIIOX set the default output buffers to 1024, please select 256 (this setting is available through the Sysex > Configure menu. Some MIDI interfaces require a larger **Delay After F7** setting for a successful transfer.



It is also recommended to close the DAW or any other applications that send and receive MIDI during a software update.

Note: the firmware version is displayed as X.X for a half second at startup for revisions 1.1 and onwards.

Firmware files are independent. You can safely install any version on to any other, earlier or later.

Factory Reset

If you wish to restore the device to factory state, hold reset at startup. This will erase internal EEPROM and replace presets 0-50 with built-in factory presets. During the procedure MEGAfm will display "RE" for reset. Then it will play a test tune in an endless loop (some chords and notes at various volume levels). When you hear the sound, it is safe to turn the unit off and on again.

Power specifications

The recommended PSU is DC 9V 450mA Centre Positive

Frequently Asked Questions

1: Q: I can no longer change voice mode!

A: Please check that you haven't activated MPE mode in setup.

Indeed MPE mode only uses poly 12 mode.

If you wish to use other voice modes Please return setup and press arp mode to turn MPE off (display should show 1C aka single channel).