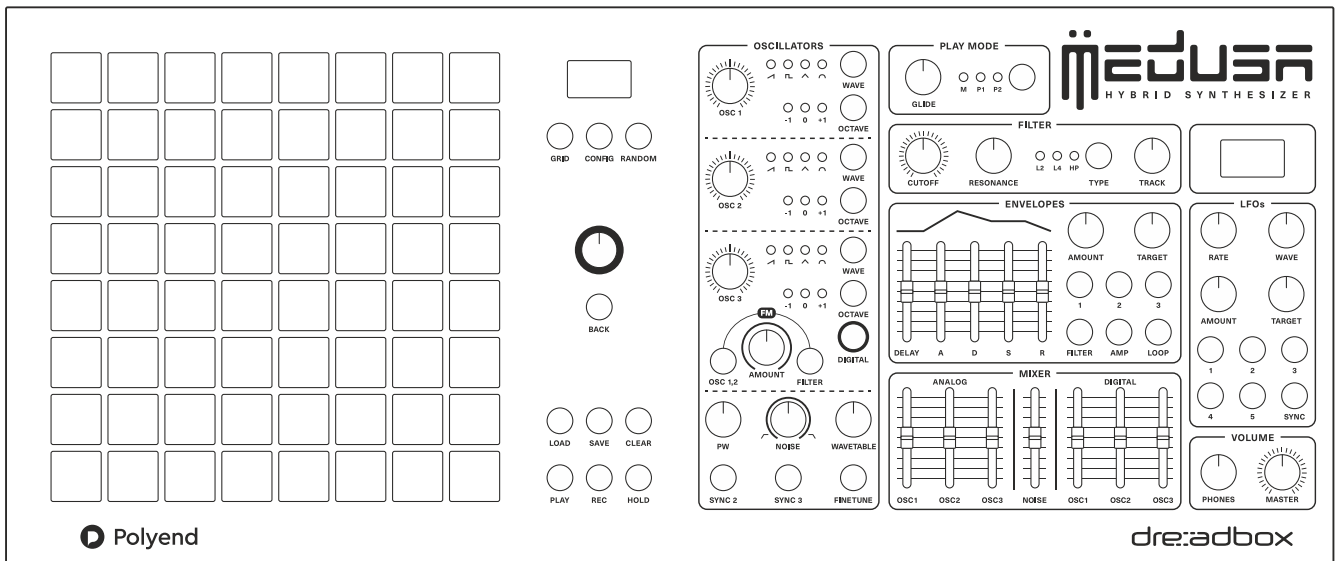


# Medusa

## 4.0 Manual Addendum



# A new play mode

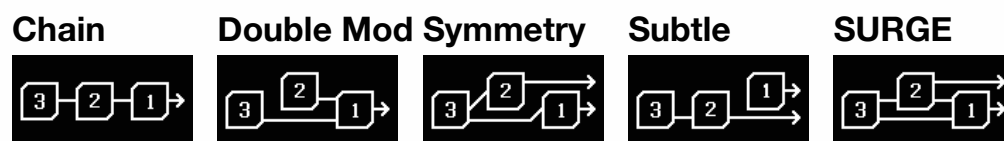
**Fourth mode: gritty 6-voice 3-operator digital FM with a 12-bit colored classic vibe. Pairs incredibly well with Tracker.**

To turn it on, press the Play Mode button until all three mode diodes are pulsating.

In this mode Medusa delivers **6 digital voices of polyphony**. Each voice is a separate mix of Medusa's digital oscillators. In FM terms, DOSC1, DOSC2, and DOSC3 serve as 3 FM Operators where frequency is specified in ratios between 1/12 and 16. Envelopes 1 - 3 are the dedicated per-Operator envelopes.

The Operators are mixed using what's called an Algorithm in FM terms. When an Operator's output is connected to another Operator, it's called a Modulator. It's not directly producing sound, instead it's modulating the phase of the other Operator's waveform. When an Operator's output is not connected to another Operator, it's producing sound. This kind of operator is called a Carrier in FM terms.

The sound engine supports the following **digital FM Algorithms**:



Operator levels are shaped by Envelopes 1 - 3 as well as the Mixer values for digital oscillators 1 - 3.

If you have trouble getting any sound out, note the following: in the first two DFM Algorithms only Operator 1 produces sound while the other Operators serve as Modulators. So if you turn off Envelope 1, or turn the Mixer DOSC1 level all the way down, you will hear no sound. In the other three DFM Algorithms both Operator 1 and Operator 2 produce sound, while Operator 3 is modulating them. So if you turn off Envelope 1, or turn the Mixer DOSC1 level all the way down, you should still be hearing Operator 2. Unless of course the levels and envelopes of Operator 2 are all the way down as well.

Envelopes 1 - 3 can still be used to **modulate arbitrary targets**. Select a target using the Target knob, and the amount of modulation using the Amount knob. Note that Operators ignore the Amount knob, if you want to turn down Operator levels, use the Mixer DOSC levels.

The FILT envelope works like in other modes.

CC3 controls the DFM algorithm. 0-31 is Chain, 32-63 is Double Mod, 64-95 is Symmetry, 96-126 is Subtle, 127 is SURGE.

## An extra analog voice

In DFM mode the three *analog* oscillators form a mono synth that you can play through **MIDI IN Channel 9**. This extra voice uses the AMP envelope, just like in M mode. This means that any modulation you set to target AMP will modulate the volume of the mono synth. Just like the six digital voices, a new note on the mono synth causes re-triggering of envelopes and phase reset of synchronized LFOs. The analog oscillator levels are controlled in the Mixer, like in other play modes.

With six complex digital voices and a fat analog mono voice, Medusa in DFM mode reaches the **full potential** of her hybrid design.

## How to start a DFM patch from scratch

The included example DFM preset pack leaves the last three preset rows for your own use. They are pre-loaded with a decent initial patch that already utilizes three operators. That being said, it's good to at least once go through the procedure below to **understand how the DFM mode operates**.

### 1. Let's reset everything we won't be using first:

1. Turn all analog oscillators down in the mixer, you won't be using them.
2. Turn FILTER KEY TRACK all the way down.
3. Turn off the FILTER envelope.
4. Turn off all LFOs for now.

### 2. Configure the Operator envelopes:

1. Turn on ENVELOPE 1, ENVELOPE 2, and ENVELOPE 3 so their buttons are lit up.
2. But change the TARGET on all three envelopes to NONE and AMOUNT to 0 to avoid unrelated modulation.
3. Put Attack on ENVELOPE 1 to 15 or so, no Sustain, Decay to 90, and Release to 30.
4. Put Attack on ENVELOPE 2 to 30 or so, Sustain to 30, Decay to 30, Release to 50.
5. Put Attack on ENVELOPE 3 to 0, Sustain to 0, Decay and Release to 15.

### 3. Configure the Operator oscillators:

1. Switch to DFM mode now by switching play modes until all three LEDs pulsate.
2. Turn DOSC1 in the mixer all the way up, DOSC2 and DOSC3 all the way down.
3. Change the waveforms of DOSC1, DOSC2, and DOSC3 to sines.
4. Switch Frequency Ratio (Tune) of DOSC1 to 1, Ratio of DOSC2 to 2, and Ratio of DOSC3 to 16.
5. Switch Octave settings for all DOSC to 0.
6. Switch Finetune of DOSC1 to 0, Finetune of DOSC2 to 5. and Finetune of DOSC3 to -3.

### 4. Tune the timbre:

1. Turn the FILTER CUTOFF all the way up, RESONANCE at a quarter or less. L2 or L4.
2. Now when you play sounds you should be hearing a nice polyphonic sinewave.
3. Press the endless encoder below the left screen and choose the option DFM Algorithm at the end of the list.
4. Choose the "Subtle" algorithm.
5. Now turn up the DOSC2 mixer. You will hear the sound change.
6. Mix in DOSC3 and you should be hearing a glass e-piano.

Now you're ready to experiment and get to know this form of synthesis. First, without touching any other settings, try out the DFM algorithms to see how different they sound. Then try different Ratios on the oscillators, see how changing the envelopes changes the timbre.

## Additional sound design tips

- Medusa supports 5 LFOs that you can use to create very rich motion within digital FM patches, including further frequency modulation. This can be used both as subtle vibrato/tremolo effect, as well as more drastic timbre changes if you think of your LFOs as additional FM operators (which can also affect each other!);
- Medusa's analog filter is a rare occurrence in digital FM synthesizers, you can use it to your advantage;
- Medusa's EG1 to EG3 are used as Operator envelopes in DFM Play Mode but unlike the AMP envelope you can turn them off - you can use this creatively. Note that you can still assign those envelopes to arbitrary Targets and control the levels of such modulation using the Amount knob, this will not interfere with the DFM functionality;

- In other Medusa play modes each digital oscillator is one voice. Those are tuned to have similar loudness to the analog oscillators. However, the additional voices of polyphony in DFM Play Mode require further down-mixing to avoid clipping. This would make each voice much quieter compared to other modes! Fortunately, most of the time it's rare to blast full signal from all voices of polyphony at once. So Medusa over-amplifies those voices digitally by 50% which we found gives the best results most of the time. Yes, this will clip if all voices are fully open, this is intentional. If needed, you can turn down the Operator levels in the mixer;
- most traditional digital FM synthesis is using sine waveforms, you can achieve a lot of different timbres with those alone, try out other waveforms as well but be aware that they can get real harsh real quick – don't discount the humble sine too quick;
- while Medusa's DFM Operators don't support feedback, you can easily achieve the same result by using non-sine waveforms as any of the operators. It works especially well with subtle wavetables;
- Medusa's DFM has a distinct color achieved by 12-bit processing and linear anti-aliasing, expect some noise and phase distortion. You can mask or highlight those timbres using Medusa's analog resonant filter. They also pair well with external FX;
- When using the lowest frequency ratios on your Operators, Medusa's digital oscillators break down into beating artifacts. When combined with the right DFM Algorithm and LFO combination, this can produce unique other-worldly timbres;
- Similarly, while the ratios can be set between 1/12 and 16, Medusa's +/- octave control on each operator effectively doubles or halves the used ratio which can be used to extend the ratio range in musically meaningful ways;
- If you're looking to achieve effects that are not your typical '80s e-piano patches, try the SURGE algorithm which is the most unpredictable of the bunch;
- The envelopes in DFM mode are tuned to allow aggressive transients; if you want fully smooth clickless polyphony, set Attack to 8 or higher, and watch out for other envelopes affecting sound like the FILTER envelope;
- FM nerds out there might be wondering why we chose not to support the typical 1+2+3 additive DFM Algorithm. It's because it contains no phase modulation. It would require more than 3 operators for interesting results like a proper drawbar organ implementation. Decisively, this one algorithm requires more audio memory than the others.

# Reworked pitch bend and glide

Pitch bend now is always -oct/+oct for both analog and digital oscillators in all modes and stays in tune between analog and digital oscillators. It also works in the full range for digital oscillators.

Glide has seen an upgrade, too. Glide value 127 is now always 6 seconds and its pitch curve is now always “frequency linear” which sounds better in low frequencies. The pitch curve is the same across analog and digital oscillators. Glide’s start is now always the last previous note which in polyphonic modes helps soloing over steady background holds. In Mono mode, unfinished glide now gracefully returns to the initial note. Finally, changing the GLIDE knob value while glide is in progress continues with current pitch.

# Better “Channel per Voice” mode

“Channel per voice” mode selected in MIDI Channel In configuration is now specific to the current selected Play Mode:

- in Mono mode it responds on CH1;
- in P1 mode it responds on CH1 - CH3;
- in P2 mode it responds on CH1 - CH6;
- in DFM mode it responds on CH1 - CH6.

In other words, each channel is now truly “per voice”, not “per oscillator”.

Incoming CC messages are now processed in “voice per channel” mode; but note that they are still synth-global, which includes pitch bend and the sustain pedal. Be careful: you can overwhelm Medusa with incoming CC if you send lots of it from all channels at once.

# Program Change

When CC input is enabled, now Medusa responds to Program Change messages sent on the right MIDI channels. Values 0 - 63 are presets from Bank A, values 64 - 127 are presets from Bank B. This is a global message, like other CC messages.

Note: Medusa doesn’t use Bank CC messages, only the Program Change message.

# LFO Synchronization with MIDI Clock

When using external MIDI clock, LFOs which have Sync enabled now properly sync to the clock. For best results, be aware of three things.

Synced LFOs reset phase on first held note. If that first note is out of phase with your MIDI clock, the synced LFO will be out of phase as well. This is deliberate as it allows for greater artistic expression. If you need LFO phases to be in sync with the clock, quantize your MIDI notes.

As long as you keep at least one note pressed, synced LFOs will keep flowing. This is important for LFOs with longer periods. If you let go of the only key held and then press it again, the phase of the LFO resets. This is deliberate as it ensures that the timbre of the preset stays consistent while playing.

Finally, the quality of your external MIDI clock is important, if it fluctuates a lot internally you'll be hearing inconsistencies in LFO phase, even if the average tempo seems fine.

## Other fixes

- Fixed digital clicking at note start;
- Improved analog AMP envelope release handling (no clicking on release of the last held note);
- Long note releases are no longer cut short when no notes are held;
- When a second held note is released in Mono mode, the first one returns with the last one's volume instead of full volume;
- When a note is pressed when no voices are available in Next voice priority, the least recently used voice is taken over; note that in the First voice priority Medusa will not play another note if all voices are used, this is deliberate;
- Auto-calibration now uses a smart timer that increases intervals as the device warms up;
- Increased responsiveness when a lot of USB MIDI data is incoming;
- Incoming "all notes off" and "all sound off" MIDI CC messages are now respected;
- Sustain pedal (CC64) is now supported in all play modes (MIDI hold mode);
- Changing Pads Root Note, Layout, Scale, or MIDI Middle C while notes are held no longer causes hanging notes;
- MIDI aftertouch no longer causes hanging notes in Mono mode;
- Amp envelope in all polyphonic modes is now updating on the screen.

# Backwards Incompatible Changes in 4.0

Some of your old projects might need adjustment:

- CC64 used to control ENV2 AMOUNT, now it controls the sustain pedal; ENV 2 AMOUNT is now controlled by CC39;
- CC39 used to control GLIDE, now it controls ENV 2 AMOUNT; GLIDE is now controlled by CC5.

*Enjoy your refreshed instrument!*

*– Polyend Team*