

# New Instruments Guide - MetaSynth 5.0

Many powerful new options were added to the MetaSynth instrument architecture in version 5.0.

## New Feature Summary

- ❑ 11 new multiwaves instrument modes. The new modes are especially great for techno and hard-techno but are useful for all types of electronic music as well.
- ❑ Ability to swap samples during playback. You can now load new samples into Sampler instruments during playback.
- ❑ Open new instrument during playback.
- ❑ New velocity mapping. Velocity can now be mapped to control instrument parameters.
- ❑ New attack mode filters. The attack mode filters provide filter envelopes for the notes played by the instrument.
- ❑ Attack mode available for samplers and multisamplers.
- ❑ New Sampler/MultiSampler Start offset options.
- ❑ Envelope control of many MultiWaveSynth parameters.
- ❑ New Granular Synth modes have been added that expand the range of sounds that can be created.
- ❑ Three new instrument effects have been added: Ping Pong Echo, Vox Enhancer, Reverb. See the Montage Room section of the “What’s New” guide for more details.
- ❑ WaveTable: An Edit popup menu and several new tools have been added to the wavetable editor.
- ❑ A fine-tuning parameter has been implemented for the wavetable synth.
- ❑ Instruments are now allowed to have an attack of 0 ms.
- ❑ Improved live-switching between presets. It is possible to switch between presets with different instrument types when presets have the same dimensions. Live-switching of presets happens when you use the [ and ] keys to move through presets while they play.

## New Feature Details

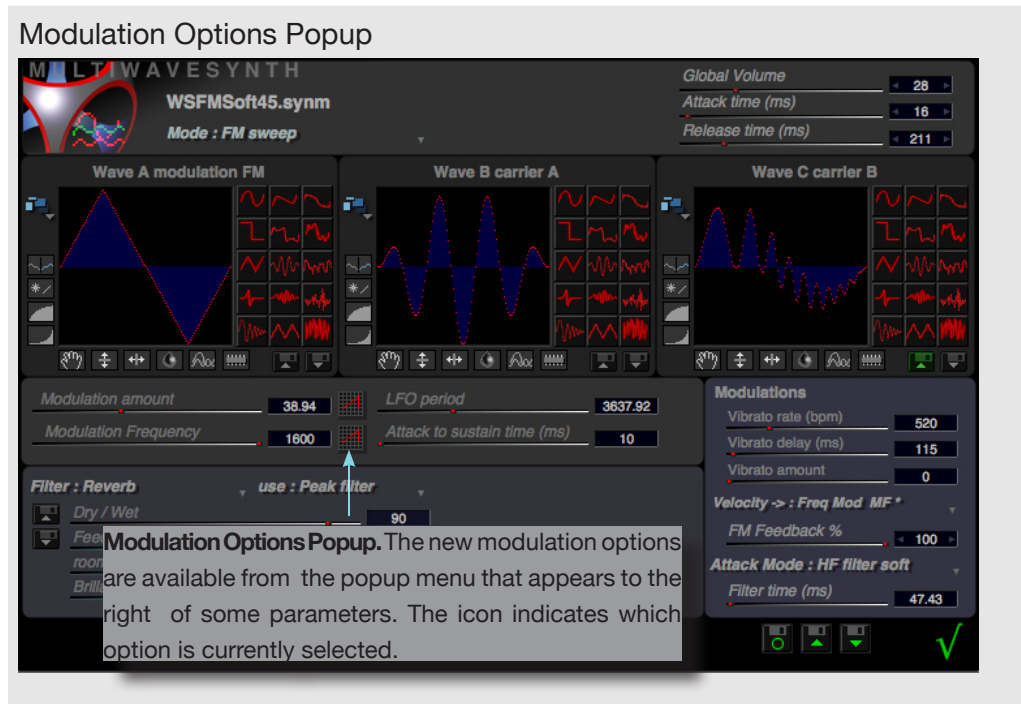
### New Multiwave modes

Several new options have been added to the **Mode** popup menu available in the MultiWaves instrument edit dialog. Modulation options are available for the new modes that allow an LFO or Attack-to-Sustain ramp to control some parameters. The new MultiWaves modes are:

- |                         |                              |
|-------------------------|------------------------------|
| ❑ FM Cascade            | ❑ Parallel Sweep             |
| ❑ FM Sweep              | ❑ Phase Distorted            |
| ❑ WaveShaper            | ❑ PW (Pulse Width) Modulated |
| ❑ WaveShaper LFO        | ❑ PW Mix                     |
| ❑ Dual WaveShaper Sweep | ❑ Fuzzy                      |
| ❑ WaveShaper FM         |                              |

**Modulation Options.** Modulation options. Each of the new MWS modes provides modulation options that allow one or more parameters to be controlled by either a simple envelope or an LFO (low frequency

oscillator). Modulation options have also been added to the old FM MultiWaveSynth modes. The modulation options are available from a popup menu that appears next to the parameter to which they apply.



The modulation options are:

- ❑ **Constant.** The parameter value is constant.
- ❑ **Decrease by Attack.** The parameter's value decreases as the attack increases. When this option is selected an Attack to sustain time slider will appear that defines the duration of the Decrease By Attack ramp.
- ❑ **Increase by Attack.** The parameter's value increases as the attack increases. When this option is selected an Attack to sustain time slider will appear that defines the duration of the Increase By Attack ramp.
- ❑ **Sweep by LFO.** Use an LFO (low frequency oscillator) to modulate the parameter. When this option is selected, an LFO Period slider appears to determine the rate at which the LFO cycles. The slider's value is the LFO's period (the time it takes to play one cycle) in milliseconds.
- ❑ **Sweep by inverse LFO.** This option is similar to Sweep by LFO but uses the inverse of the LFO. (For example, when the LFO is at 1, the inverse is -1). Use the LFO for one parameter and the inverse for another parameter for dramatic effects.
- ❑ **Half-sweep by lfo.** This is like a sine sweep at half amplitude (range 0.5 to 1 rather than 0 to 1).
- ❑ **Slanted Bell.** A bell curve where the down slope is 10 times slower than the up slope.
- ❑ **Bell.** A symmetrical bell curve.
- ❑ **Decrease to half.** Like decrease but stops at 0.5.

**Velocity mapping.** A new popup menu is available above the Attack Mode filter popup. It allows you to map velocity (which is normally mapped to volume) to another synth parameter such as Modulation amount. The available options are: Modulation Amount \*, Modulation Frequency \*, FM Feedback \*, Mod Attack +, Mod Attack -, Randomize Modulation Amount & FM Feedback. \*, + and - indicate the operation used to modify the existing parameter (multiply, add to or subtract from).

### FM CASCADE (MULTI WAVES)

This is an FM synth. In this mode, wavetable A modulates wavetable B which modulates the carrier (wave C).

- **Wavetables.** A - modulation 1; B - modulation 2; C - carrier
- **Parameters.** Modulation amount, Modulation frequency. The modulation options are available for both parameters.

### FM SWEEP

This is an FM synth. An LFO is used to sweep between two carrier waveforms (wavetables B and C) that are modulated by wavetable A.

- **Wavetables.** A - modulation; B - carrier 1; C - Carrier 2
- **Parameters.** Modulation amount, Modulation frequency. The modulation options are available for both parameters. The same LFO is used to sweep the modulation as is used to sweep between the two carriers.

### WAVESHAPER FAMILY

All of the members of the Waveshaper MultiWaves synth family use wavetable C (and in some cases an additional wavetable) to remap the waveform defined in the other wavetables. Waveshaping can create rich warm waveforms and nicely distorted sounds. Waveshaping tends to create high harmonics.

The remapping is done the same way as in the Effects Room's **WaveShaper Effect**. The waveshaper wavetable's x-axis represents the original wavetable's amplitude value (the height) and the y-axis represents the value to which it will be mapped. A ramp wave has no effect since the x and y values are the same. A straight line with a gentle slope reduces the amplitude of the reshaped waveform. Waveshaping curves with steep slopes introduce clipping and distortion. Other waveshapes can have very interesting effects that depend on the wavetables being remapped. The best way to become familiar with this new synthesis mode is to experiment.

### WAVESHAPER

This synth crossfades between Wave A and Wave B and uses Wave C to remap (waveshape) the result. Attack to Sustain Time determines the time taken to fade from Wave A to Wave B

- **Wavetables.** A - attack waveform; B - sustain waveform; C - waveshaper
- **Parameters.** Shaping Amount, Modulation Frequency. The modulation options are available for both parameters.

**Shaping Amount** determines the mix of waveshaped and unshaped signal. When the Shaping amount is 100, only the waveshaped signal is heard. **Modulation Frequency** determines the frequency of the waveshaping wavetable relative to the Waves being reshaped. When the Modulation Frequency is 100%, one cycle of the waveshaper is the same duration as one cycle of waves A and B. When the Modulation Frequency is 200%. One cycle of waves A and B are mapped against 2 cycles of the waveshaping wavetable. When the frequency is greater than 100%, even a ramp wave (which has no effect when the frequency is 100%) will introduce high-order harmonics.

### WAVESHAPER LFO

This mode is essentially the same as **Waveshaper** but with an LFO controlling the crossfade from wave A to wave B.

### DUAL WAVE SHAPER SWEEP

This synth uses one carrier wavetable (A) and crossfades between two different waveshaping curves. Wave B performs waveshaping during the attack phase and Wave C performs waveshaping during the sustain phase. Attack to Sustain Time determines the time taken to fade from Wave A to Wave B

- **Wavetables.** A - carrier waveform; B - attack phase waveshaper; C - sustain phase waveshaper.
- **Parameters.** Shaping Amount, Modulation Frequency. See the **Waveshaper** description above for a description of the parameters.

### WAVE SHAPER FM

This is a Waveshaper synth with wave B acting as an LFO to modulate the pitch of wave A. Wave C performs waveshaping on the resulting waveform.

- **Wavetables.** A - carrier; B - pitch modulation LFO; C - waveshaper. Wavetable B's influence is +/- 1 octave. The time that it takes to play wave B is determined by both the PitchModTime setting and the Modulation Frequency #.
- **Parameters.** Shaping Amount, Modulation Frequency. See the Waveshaper description above for a description of the parameters. The Attack to Sustain time controls how long it takes for the pitch modulation to be faded out which allows you to have pitch modulation during the attack only.


### PARALLEL SWEEP

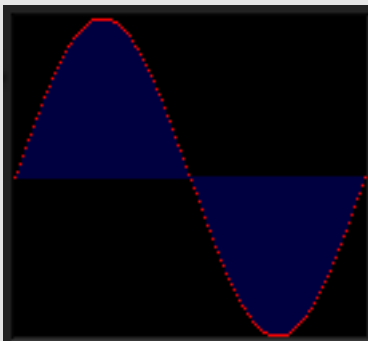
The three oscillators play in parallel and are modulated. The input frequency is scaled by the modulation frequency before the wave table loop and allows for improved control of the final timbre.

## PHASE DISTORTED

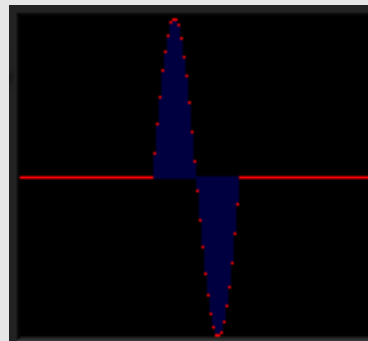
Phase distortion synthesis, like FM synthesis, uses one modulator waveform to transform the carrier waveform. The modulator is used to shift the phase of the carrier wave. PD synthesis allows the creation of fat sounds that have filter sweep-like effects with only a couple of oscillators. The modulation signal is composed of waves A and B blended using the LFO. Waveform C is the carrier wave. PD synthesis was used in early Casio synthesizers and is capable of some very surprising sounds. For more information on PD synthesis, do a Google search. The page <http://www.analoguesque.com/modsynthesis.htm> has some excellent information about PD synthesis.

### ABOUT THE PULSE WIDTH MODULATED SYNTHS

The pulse width modulated synths “squeeze” the width of one or more of the wavetables. This squeezing shifts the harmonics up in pitch while leaving the fundamental unchanged. You can explore the results of squeezing waveforms by using a simple waveform in a wavetable and option-click dragging on the scale frequencies icon  to hear how it changes the wave’s sound.



Sine wave



Sine wave squeezed

### PULSE WIDTH MODULATED (PW MODULATED)

Wave A is the Attack wavetable and Wave B is the Sustain wavetable. The amount of pulse width modulation (squeezing) is set by the PW Modulation Amount slider. Wavetable C is squeezed using the modulation frequency slider and is used to modulate waves A and B -- to create a hybrid pulse width/fm synth.

### PULSE WIDTH MIX (PW MIX)

Waves A and B are pulse width modulated (squeezed) independently and crossfaded with the LFO and have independent pulse width modulation amounts. Wave C performs low frequency pitch modulation.

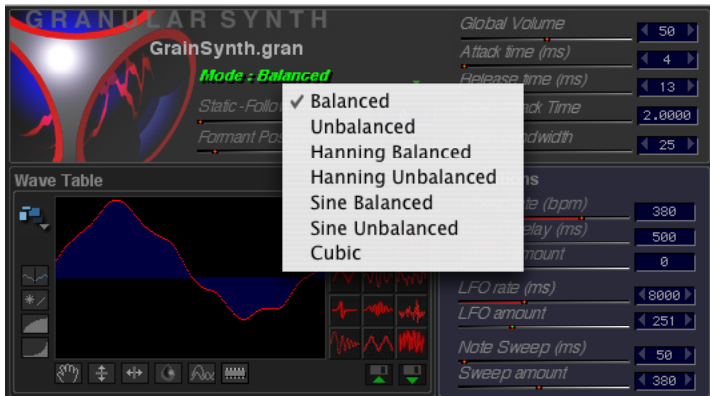
### FUZZY

This mode is similar to Parallel mode but adds envelope control of parameters and pitch randomization. This mode is great for sound effects and pads. Check out the examples in the MWT Sound Effects

preset library.

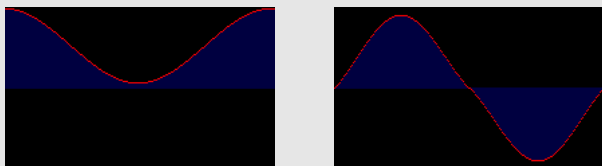
## Granular Synth

This synth now has mode options that determine the grain shape and increase the variety and richness of the sounds that can be created. Balanced modes invert every other grain to ensure that there is no DC offset whereas unbalanced modes repeat the grains without inversion.



The unbalanced modes are often more pleasing to the ear than the balanced modes but there is the risk of DC Offset. When using an Unbalanced mode, it is advisable to use a well-balanced waveform (one that has as much energy above the 0 line as below it) since DC offset can cause problems when mixing or applying Effects even if the raw sound does not have any obvious artifacts. The new **Balance** command in the Wave Table popup (also new) can be used to ensure that the waveform is balanced.

**DC OFFSET!** What is DC Offset? Sound waves can be thought of as curves with values between -1 and +1. DC offset is a situation where a waveform is not balanced with respect to 0. Waveforms with DC Offset can cause problems when they are processed. Clicks and distortion can result from processing waveforms with DC Offset even if the unprocessed waveform sounds fine. So, it is best to avoid DC Offset. Below are images of the unbalanced and balanced versions of the same waveform:



The Granular Synth generates waveforms by multiplying a grain (a small pre-defined waveshape) against the wavetable visible in the editor. The difference between this synth's modes is the grain shape used. Different grain shapes result in different harmonics. The interaction of the parameters, grain shape and the wavetable can be unpredictable. We recommend trying different modes with the same settings to get a sense of the difference between the different modes. The grain bandwidth determines the size of the grain. In Hanning, Sine and Cubic modes, high frequencies are brought out when the attack time is set low. When the value is 15, the grain is symmetrical.



You can see the grain shape by rendering a sound where the wavetable is a constant 1 (the maximum value) and the bandwidth set to a low value.

The grain shape is revealed in the rendered sound (in the Sample Editor). Note the severe DC Offset since we are using an unbalanced waveform and an unbalanced synth mode.

The modes are:



**Balanced/Unbalanced** - Formerly, Balanced was the only mode used by the Grain Synth. In the Balanced mode, every other grain is inverted to avoid DC offset. Unbalanced repeats the grains without inversion. The result with a well-balanced waveform is often preferable to the balanced grain but care must be taken to avoid DC offset by using a well-balanced waveform.



**Hanning Balanced/Unbalanced**

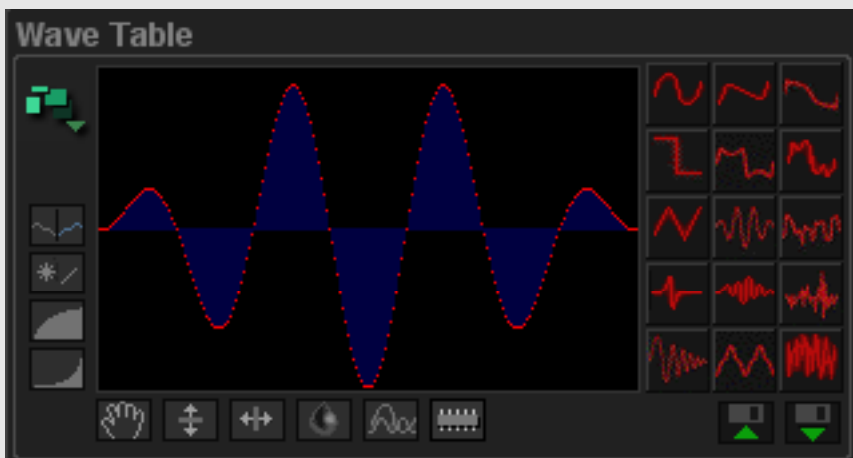


**Sine Balanced/Unbalanced**



**Cubic** - There is only one form of this mode which is balanced.

### Wavetable Editor Update



The Wavetable Editor's user interface has been updated to provide several new tools and an Edit popup menu to provide a clearer user interface for wavetable copy/paste.

**New tools:**



Edit popup menu:

- ❑ **Copy (c)**
- ❑ **Paste (v)**
- ❑ **Balance.** Adjust the waveform so that it is vertically well-balanced with respect to 0. (Wavetable values range of -1 to +1).
- ❑ **Reverse.** Flip the waveform horizontally.
- ❑ **Ramp (r).** Create a ramp from -1 to +1. This is especially useful for the WaveShaper instruments.
- ❑ **Low Pass (l).** Filter out high frequencies
- ❑ **High Pass.** Filter out low frequencies
- ❑ **Normalize.** Re-scale all values to fill the range from -1 to 1.



The **Blend with Clipboard** tool has been added. To use this tool, copy a wavetable to the clipboard. Click and drag on a different wavetable's Blend with Clipboard tool to blend the wavetable with the one that you copied to the clipboard. Hold down the control key and drag to multiply (modulate) the waveform with the clipboard waveform.

## Other New Features

### ATTACK MODE FILTERS

The Attack Mode popup has many new envelopes. These are used to control the frequency evolution of individual notes. Two constant filters have been added: constant hard and constant soft. Filters with envelopes that have been added are: bell curve, slanted bell, soft saw, cubic hard, cubic soft, exponential decay, gated hard, sine soft, sine hard.

### INSTRUMENT OUTPUT EFFECTS

Several new effects are available and a new filter parameter has been added to the old Distortion and Filter & Feedback effects. These effects are performed at the output stage of the synth. The choice of filter & center frequency can dramatically change the color of the effect. The new effects are: PingPong Echo, Reverb, Vox Enhancer, WS Distortion & EQ, and Parametric EQ. These effects are also now available in the Montage Room. See the Montage Room chapter for more information about these effects.