COBALT

v1.5.1

Created by
Leslie Sanford

http://www.lesliesanford.com/Cobalt/Cobalt.shtml

Graphics created by
Grymmjack

http://designermonkey.rekkerd.org/index.php

Table of Contents

User Interface

Acknowledgements

A lot of people helped make Cobalt possible. Working with them has been a thoroughly positive experience. I am very grateful for their time and effort.

Special thanks to:

Rick Christy (a/k/a grymmjack) of DesignerMonkey:
http://designermonkey.rekkerd.org
Rick designed the UI; he did the background image as well as all of the graphical elements. He also provided a lot of helpful advice early on. Contacting him was one of the best things I ever did for this project as I'm not sure Cobalt would have seen the light of day without his help.

Donovan Stringer: http://vaesolis.org/f2/index.php
Donovan set up a web forum for Cobalt beta testers to post bugs, comments, and anything else relating to Cobalt's development. He also provided a lot of helpful advice and suggestions. Like Rick, his contribution has been invaluable.

Shannon:
Shannon beta tested Cobalt and found a few problems early on that would have slipped right by me without her help.

Mike McFarland:
Mike has helped with everything from beta testing to proof reading the manual. He's been a great source of help, always there when I needed an opinion or insight.

Mitchell Burdette:
Mitchell did quite a bit of beta testing and created a wonderful demo song for Cobalt:
http://www.lesliesanford.com/Cobalt/SoundDemos/Mitchell/Song.mp3

sinkmusic: http://www.sinkmusic.com
sinkmusic did extensive beta testing of Cobalt and created a few of the factory presets.

Alexander Stoica (a/k/a Beatslaughter): http://www.beatslaughter.de

Alexander did some beta testing for me and created a set of wonderful patches.

Roby Burgas (a/k/a swett_trip)

Roby beta tested Cobalt in its later stages and provided a lot of help and support. He belongs to a band called Sweet Trip. You can check them out here and here.

Atomsplitter: http://www.atomsplitteraudio.com

Atomsplitter provided a set of very cool and interesting patches. He wrote an evocative demo, "Are You Read," using sounds he created with Cobalt.

Introduction

Cobalt is a VSTi software synthesizer inspired by many of the digital synthesizers from the 1980s.

In the early 80s as digital technology became cheaper, many manufacturers designed synthesizers that combined earlier analog technology with newer digital technology. These were known as hybrid synthesizers. Well-known hybrid synthesizers are the Korg DW8000 and DW6000, the Ensoniq ESQ-1, and the Kawai K3.

In analog/digital hybrid synthesizers, the oscillators responsible for generating waveforms are digital while the filter section remains analog. This approach freed designers to use any kind of waveform; they were no longer restricted to traditional analog waveforms such as sawtooth, triangle, and pulse. However, by using an analog filter, these synthesizers retained the warmth earlier analog synthesizers were known for.

Though Cobalt is a purely digital synthesizer, its overall architecture is very much like those early hybrid synthesizers. It features a wide selection of waveforms, most of which were resynthesized from actual hybrid synthesizers, while providing traditional subtractive synthesis capabilities for sculpting its sound.

Installation

Installing Cobalt is done easily by simply copying the Cobalt.dll to your VST plugin folder. You may need to tell your VST host to rescan the folder so that Cobalt shows up in your host's list of VST plugins. Please see your host's documentation for details.

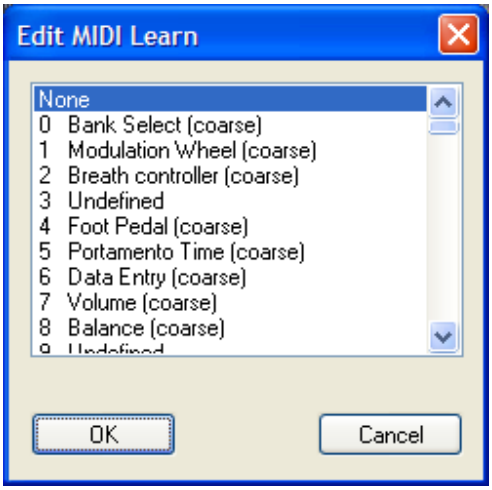
MIDI Learn

MIDI Learn is the ability to associate a MIDI control change message with a specific parameter. This feature let's you control a parameter's value in real-time using a MIDI controller.

Cobalt has extensive support for MIDI Learn. To have Cobalt "learn" which MIDI control change message to associate with a specific parameter, right-click with the mouse on the parameter's control. A pop-menu will appear with two choices: Start MIDI Learn and Edit MIDI Learn.

Choosing Start MIDI Learn will put Cobalt into a learning state. It will associate the next MIDI control change message it receives with the specified parameter. So after choosing Start MIDI Learn manipulate the control on your MIDI controller that you wish to associate with the parameter. Cobalt will do the rest. From then on any control change message it receives from that control will affect the parameter's value.

You can manually set which controller change message is associated with a parameter by right clicking on a control and choosing Edit MIDI Learn from the pop-menu. A dialog box will appear with a list of all128 MIDI control change messages types. Choose a message type from the list and click OK. From then on Cobalt will associate that control change message with the specified parameter.



You can select None if you don't wish any MIDI control change message to be associated with the specified parameter.

MIDI Learn settings are saved with the bank file. When you load a bank file, it will automatically configure Cobalt's MIDI control change mapping to the bank's MIDI Learn settings. In fact, you can import MIDI Learn settings from a bank without loading the rest of the bank's data. Just click on Cobalt's logo. A pop-up menu will appear with several choices.

Choose Import MIDI Learn from the choices, and an open file dialog box will appear. Choose a bank file with the MIDI Learn data you wish to import, and click OK. Cobalt will then import the MIDI Learn data.

Note: the bank file must be a Cobalt bank file and it must have been saved as a v1.5 Cobalt bank file or greater.

You can clear all MIDI Learn from a bank by clicking on Cobalt's logo and choosing Clear All MIDI Learn.

And if Cobalt is currently in MIDI Learn mode, you can cancel MIDI Learn by clicking on Cobalt's logo and choosing Cancel MIDI Learn.

Changing Parameter Values

Changing Cobalt's parameters is straightforward. To change a parameter value, first click on the control that represents the parameter with the left mouse button. In response, the cursor will disappear. This is to enhance the sense of "grabbing" the control. While keeping the left mouse button held down, move the mouse up or down for knobs, switches and vertical sliders. For horizontal sliders, you move the mouse to the left or right.

As you change a knob or slider's value, the change to the corresponding parameter is displayed in the status box. The status box is in the upper right-hand corner. Once you are done changing a control's value, release the left mouse button (the cursor will reappear).

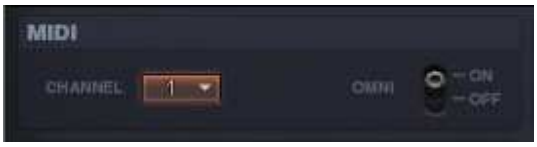
Fine-tuning a parameter value can be easily done by holding down the Shift key while manipulating a control. If you press the Ctrl key while holding down the Shift key, you can use an even finer resolution when adjusting parameter values.

You can quickly reset a control to its default value by holding down the Ctrl key while clicking once on the control with the left mouse button.

Dropdown boxes work by clicking on the box. A list of choices will then appear below. Clicking on the dropdown box again without making a choice let's you scroll through the choices with the mouse wheel. Also, by holding the Shift key down, you can iterate through the list of choices by using the left and right mouse buttons; the left button moves down one item at a time and the right mouse button moves up.

Parameter Reference

MIDI



CHANNEL: Selects the MIDI channel Cobalt responds to.

OMNI: Turns OMNI mode on/off. When turned on, Cobalt will respond to any MIDI channel. When turned off, Cobalt will only respond to the currently selected MIDI channel.

MISC

POLYPHONY: Sets the polyphony mode. When set to POLY, Cobalt provides sixteen note polyphony. When set to MONO, Cobalt behaves like a monophonic synthesizer, playing only one note at a time.

PORTAMENTO TIME: Sets the portamento time in milliseconds.

MASTER LEVEL: Sets the overall amplitude.

Oscillators 1 and 2

Cobalt provides two oscillators per voice. Each oscillator is capable of producing twenty-six waveforms. This gives Cobalt the ability to create a wide range of sounds. Pulse width modulation (PWM) can be applied to any waveform, not just sawtooth. You can also route any modulation source to modulate an oscillator's frequency. In addition, oscillator 2 gives you the ability to synchronize its phase to that of oscillator 1.

WAVEFORM: Selects the current waveform. There are 26 waveforms in all, ranging from traditional waveforms such as Sawtooth and Triangle to non-traditional waveforms such as Sharp Wave and Digital Bell.

LEVEL: Sets the oscillator's amplitude level.

TRANSPOSE: Sets the number of semitones the oscillator is transposed up/down in pitch.

DETUNE: Sets the number of cents the oscillator is detuned up/down in pitch.

PB RANGE: Sets the number of semitones the oscillator's pitch can be bent in response to the pitch bend wheel.

PORTAMENTO: Turns on/off portamento.

PWM SWITCH: Turns on/off pulse width modulation. Note, that pulse width modulation can be applied to any waveform, not just sawtooth.

PWM SOURCE: Selects the modulation source for pulse width modulation. The modulation sources are LFO 1 & 2 and ENV 1 & 2.

PWM LEVEL: Sets the amount of pulse width modulation.

PWM POLARITY: Sets the polarity of the pulse width modulation source. For example, using one of the envelopes as the modulation source with the polarity set to negative inverts the envelope's modulation.

PULSE WIDTH: Sets the pulse width of the waveform. For example, if the sawtooth waveform is selected and PWM has been turned on, setting the pulse width to 50% will create a square waveform.

FM1 SOURCE: Selects the first frequency modulation source. The modulation sources are LFO 1 & 2 and ENV 1 & 2. For example, to create vibrato, select either LFO 1 or LFO 2 as the modulation source, making sure that the LFO is using a triangle or sine waveform. Next, set the FM1 LEVEL to a modest modulation level.

FM1 LEVEL: Sets the amount of frequency modulation.

FM1 POLARITY: Sets the polarity of the frequency modulation source (see PWM POLARITY).

FM2 SOURCE: Selects the second frequency modulation source. The modulation sources are LFO 1 & 2 and ENV 1 & 2.

FM2 LEVEL: Sets the amount of frequency modulation.

FM2 POLARITY: Sets the polarity of the second frequency modulation source (see PWM POLARITY).

OSC 2 SYNC: Oscillator 2 allows you to sync the phase of its waveform to that of oscillator 1.

Filter

Cobalt uses a classic –12dB per octave filter. The filter is used to mold the sound by removing certain frequencies. This approach is known as subtractive synthesis. You begin with a raw waveform that has many frequencies present and use the filter to change the synthesizer's timbre by subtracting frequencies you don't want.

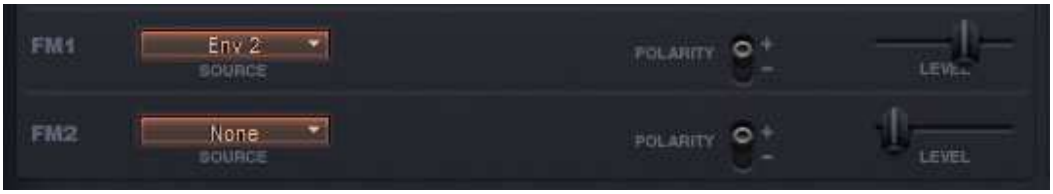
TYPE: Selects the filter type. There are four types: Lowpass, Highpass, Bandpass, and Notch

CUTOFF: Sets the filter's cutoff frequency. This parameter's effect depends on which filter TYPE is currently selected. When the Lowpass type is selected, the filter lets frequencies below the cutoff frequency through while attenuating frequencies above it. The Highpass type is just the opposite in that it lets higher frequencies through while attenuating frequencies below the cutoff. Bandpass lets a range of frequencies centered on the cutoff through while attenuating frequencies above and below the frequency range. Notch is just the opposite of Bandpass. It notches out a group of frequencies centered on the cutoff frequency while letting frequencies above and below the notch through.

RESONANCE: Sets the resonance amount. Resonance emphasizes the frequencies centered on the cutoff frequency.

CH. PRESSURE: Turns on/off the filter's ability to respond to MIDI channel pressure messages. When turned on, channel pressure messages modulate the filter's cutoff frequency. Pressing a key harder after it has been struck will open up the filter more.

KEY TRACKING: Sets how the filter's cutoff frequency changes as you play up and down the keyboard. The higher the setting, the more the filter will open as you play higher notes.



FM1 SOURCE: Selects the filter's first frequency modulation source. Modulating the filter's frequency lets you change the cutoff frequency over time. The modulation sources are LFO 1 & 2 and ENV 1 & 2.

FM1 LEVEL: Sets the amount of frequency modulation.

FM1 POLARITY: Sets the polarity of the frequency modulation source.

FM2 SOURCE: Selects the filter's second frequency modulation source. The modulation sources are LFO 1 & 2 and ENV 1 & 2.

FM2 LEVEL: Sets the amount of frequency modulation.

FM2 POLARITY: Sets the polarity of the second frequency modulation.

Envelopes 1 and 2

Cobalt's two envelopes allow you to control how a sound changes over time. Both envelopes can be assigned to modulate filter cutoff, oscillator frequency, and oscillator pulse width. In addition, envelope 1 is "hard-wired" to modulate the overall amplitude.

A: Sets the time it takes the envelope to reach its maximum amplitude. An attack time of zero will have an instant attack. This gives the sound a very percussive quality. As the attack time is increased, the attack takes longer, giving the sound a softer quality.

Note that envelope 1 modulates the overall amplitude. In some circumstances setting envelope 1's attack time to zero will cause clicks or pops. If you encounter this, increase the attack time by two or three milliseconds.

D: Sets the time it takes for the envelope to reach its sustain level. Once an envelope reaches its maximum amplitude, it begins its decay stage. The decay time determines how quickly the envelope's amplitude falls until reaching the sustain level. A value of zero will give the envelope an instant decay time. Larger values will cause the envelope to decay at a slower rate.

S: Sets the envelope's sustain level. The sustain level is the amplitude the envelope reaches once it has completed its decay segment. The envelope remains at this amplitude until the note that triggered it is released. A value of zero causes the envelope to decay to zero amplitude. Larger values increase the final amplitude the envelope reaches after its decay segment completes.

R: Sets the time it takes the envelope to reach zero amplitude after the note that triggered it is released. Once the note that triggered the envelope is released, the envelope begins its release segment. The envelope's amplitude continues falling until reaching zero. A value of zero gives the envelope an instant release. Larger values increase the time it takes for the envelope to reach zero amplitude.

Note that envelope 1 modulates the overall amplitude. In some circumstances setting envelope 1's release time to zero will cause clicks or pops. If you encounter this, increase the release time by two or three milliseconds.

VEL. DEPTH: Sets how the envelope's amplitude responds to MIDI note velocity. With a value of zero, the envelope does not respond to velocity at all. Larger values cause the envelope to become more sensitive to velocity. Depending on the setting, striking a note hard will open the envelope more, getting it closer to its maximum amplitude. Softer struck notes will have less of an effect.

KEY TRACKING: Sets how the rate at which the envelope goes through its segments responds to which note is being played. The higher the setting, the faster the envelope will complete its segments in response to higher played notes.

TRIGGER MODE: Sets the trigger mode. Set to retrigger, the envelope will reset itself to the beginning of its attack segment in response to a new note. Set to legato, the envelope will not retrigger when a new note is played but will continue from its current point if the envelope is in its attack, decay, or sustain segment.

LFOs 1 and 2

Cobalt features two LFOs (low frequency oscillators). An LFO is an oscillator that produces periodic waveforms below the range of human hearing. They make excellent modulation sources. For example, an LFO can modulate an oscillator's frequency in order to create vibrato.

SHAPE: Selects the waveform the LFO produces. There are six shapes in all: Sine, Triangle, Down Ramp, Up Ramp, Square, and Sample & Hold.

SPEED: When LFO SYNC is turned off, the SPEED parameter represents the LFO speed in hertz. When LFO SYNC is turned on, the SPEED parameter represents the LFO speed in beats.

DELAY: Sets the time it takes for the LFO to reach its maximum amplitude.

SYNC: Turns on/off LFO MIDI synchronization. When turned on, the LFO is synchronized to the current MIDI tempo. The SPEED is then measured in beats, which can be set to one of the following values:

1. 16/1
2. 8/1
3. 4/1
4. 2/1
5. 1/1
6. 1/2
7. 1/4

The numerator is the number of beats and the denominator represents the number of sub-beats. For example, at a setting of 16/1 the LFO will complete one cycle every 16 beats. At a setting of 1/1, the LFO will

complete one cycle every beat. And at a setting of 1/4, the LFO will complete four cycles every beat.

MW: Turns on/off modulation wheel routing to the LFOs amplitude. When turned on, the modulation wheel controls the LFOs amplitude. This can be useful for controlling vibrato intensity.

Effects

Cobalt features five effects to further enhance its sound. The OVERDRIVE effect creates distortion much like a distortion pedal a guitarist might use. The NOISE effect adds white noise, useful for creating wind and percussion effects. The PANNER effect lets you control and modulate the sound's position in the stereo spectrum. The CHORUS effect layers and modulates the sound to create the illusion of more than one sound playing at once. Finally, the DELAY effect lets you created stereo "echoes" to make the sound more spacious.

OVERDRIVE SWITCH: Turns on/off the OVERDRIVE effect.

LEVEL: Sets the OVERDRIVE's level. Larger values create more distortion.

NOISE SWITCH: Turns on/off the NOISE effect.

LEVEL: Sets the NOISE's amplitude level.

PANNER SWITCH: Turns on/off the PANNER effect.

MOD. SOURCE: Selects the pan position's modulation source. The modulation sources are LFO 1 and LFO 2.

MOD. LEVEL: Sets the amount of pan position modulation.

POLARITY: Sets the pan modulation source's polarity.

L/R: Sets the sound's pan position. Note that this does not have any effect if a modulation source has been chosen.

CHORUS SWITCH: Turns on/off the CHORUS effect.

DELAY: Sets the delay time in milliseconds. Smaller delay times create a more flange like effect while larger values create a traditional chorus effect.

DEPTH: Sets the CHORUS LFO modulation depth. Larger values create a vibrato effect while smaller values create a more subtle doubling effect.

FB: Sets the amount of feedback. When the DELAY time is set to a small value, larger feedback values create a flange effect.

FREQ: Sets the CHORUS LFO frequency.

MIX: Sets the CHORUS's amplitude. Larger values make the CHORUS effect more prominent.

DELAY SWITCH: Turns on/off the DELAY effect.

FB: Sets the amount of feedback. Feedback controls the number of times the echo repeats itself while fading into the distance.

SYNC: Turns on/off MIDI synchronization. When turned on, the DELAY is synchronized to MIDI tempo. The left and right delay times are then measured in beats, which can be set to one of the following values:

1. 1/8
2. 1/7
3. 1/6
4. 1/5
5. 1/4
6. 1/3
7. 1/2
8. 1/1

The numerator is the number of beats and the denominator represents the number of sub-beats. For example, at a setting of 1/1 there will be one echo per beat. At a setting of 1/8, there will be eight echoes per beat.

L: Sets the left delay time.

R: Sets the right delay time.

MIX: Sets the DELAY's amplitude. Larger values make the DELAY effect more prominent.

PAN DELAY: Turns on/off pan delay. When turned on, the feedback off both left and right delay lines switch back and forth between each other, causing the echoes to pan back and forth across the stereo spectrum.

Tutorial

One of the best ways to become familiar with a new synthesizer is to create a patch. So we'll step through creating a simple strings patch. You can download the finished patch here:

http://www.lesliesanford.com/Cobalt/Strings.fxp

First, let's begin with a blank patch. To create a blank patch, just load the blank preset into Cobalt. You can find the blank preset here:

http://www.lesliesanford.com/Cobalt/Blank.fxp

Strings are an ensemble sound. To simulate an ensemble sound with a synthesizer, a typical first step is to detune the oscillators. Let's begin there:

1. Detune OSC1 by adjusting the Detune knob. "Turn" the knob to the left by moving the mouse down while holding down the Shift key; this will let us fine tune the detune amount. Continue moving the mouse down until you've reached a value of –2.50 cents; it doesn't have to be exact.
2. Detune OSC2 by following the previous step, only move the mouse up to adjust OSC2's detune value to a positive value. Continue moving the mouse up until you've reached a value of 2.50 cents. Again, the value doesn't have to be exact.

The choice of waveforms is always important as it defines the overall tonality. For strings, the usual choice is the sawtooth waveform:

1. Click on OSC1's WAVEFORM dropdown box. A list of waveforms should appear below. Choose Sawtooth.
2. Do the same with OSC2; we're using the sawtooth waveform for both oscillators.

One key to imitating any sound is analyzing how the sound's amplitude evolves over time. A slow strings sound begins with a soft attack followed by a long decay that reaches a moderate sustain level. We'll use ENV 1, which is hardwired to the overall amplitude to imitate this.

1. Set ENV 1's Attack parameter to 2 seconds or so.
2. Do the same for the Decay parameter; set it to 2 seconds.

3. We need a moderate sustain level, so set the Sustain parameter to around –8.00dB.
4. Set the Release parameter to about 1 second.

That takes care of the overall amplitude characteristics of our strings patch.

Before leaving ENV 1, let's look at its Velocity Depth parameter. Velocity Depth controls how sensitive an envelope's amplitude is MIDI note velocity. MIDI note velocity represents how hard a note is struck. The harder a note is played, the higher its velocity value will be.

Since ENV 1 controls the overall amplitude of the sound, adjusting its Velocity Depth determines how sensitive the overall amplitude is to velocity. At a value of zero, ENV 1's amplitude it not affected by velocity at all; no matter how hard or softly you play a note ENV 1's amplitude will remain the same. At a maximum setting ENV 1 will be very sensitive to MIDI note velocity; softly played notes will be barely audible. Many times a Velocity Depth set somewhere between zero and the maximum setting is the most practical.

1. Set ENV 1's Velocity Depth to about 0.75.

String players usually play with a certain amount of vibrato, so let's add vibrato to OSC 1.

1. Select LFO 1 from OSC 1 FM 1's dropdown menu.
2. Set FM 1's level to about 0.015 octaves.
3. Select the Triangle waveform in LFO 1's Waveform dropdown menu.
4. Set LFO 1's Speed to about 4.7Hz.
5. Set LFO 1's Delay to about 1 second.

We should have something that is starting to resemble a typical string ensemble sound.

Another device synthesizers use to imitate strings is pulse width modulation (PWM). PWM takes an oscillator with a pulse waveform and modulates the waveform's pulse width, usually with an LFO. The result is a very rich and sonorous sound. Let's set up OSC 2 to use PWM.

1. Switch on OSC 2's PWM.
2. Choose LFO 2 as the modulation source in OSC 2 PWM's dropdown menu.
3. Set the PWM level to about 0.5.

4. Set OSC 2's Pulse Width to about 0.5 (50%).
5. Select the Triangle waveform in LFO 2's Waveform dropdown menu.
6. Set LFO 2's Speed to about 1Hz.

The combination of OSC 1's vibrato and OSC 2's PWM creates a good deal of motion in the sound, which helps in imitating an ensemble sound.

Filters play an important role in shaping a patch's sound. They affect the frequency content of a synthesizer's output. For our strings patch, we want a Lowpass filter with its cutoff frequency set moderately high.

1. Select the Lowpass filter type in the Filter Type dropdown menu.
2. Set the Cutoff Frequency to about 9,000Hz.
3. Set the Resonance to 0.15.
4. Set the Filter's Key Tracking to about 0.15.

The Resonance adds a bit of bite to the sound. The Key Tracking opens up the Filter's cutoff frequency as we play higher notes. This helps keep the overall Filter response even across the synthesizer's range.

We're just about finished with our strings sound. To add a bit of frosting to the cake, let's add the Chorus and Delay effects.

For the Chorus:

1. Switch on the Chorus.
2. Set the Mix to about –5.00dB
3. Set the Delay to the maximum amount.
4. Set the Depth to about 0.083.
5. Set the Feedback (FB) to zero.
6. Set the Frequency to about 0.6Hz.

This gives us a nice, moderate chorus sound.

For the Delay:

1. Switch on the Delay.
2. Set the Mix to about –10.00dB.
3. Set the Feedback (FB) to 0.5.
4. Set the Left Delay Time (L) to 250ms.
5. Set the Right Delay Time (R) to 500ms.
6. Switch Pan Delay on.

The delay adds a spacious quality to our sound.

Well, that's it! We have a nice string ensemble patch. Don't be afraid to experiment with different settings. Try different waveforms, filter settings, envelope settings, etc. Often, starting with an existing patch, such as the one we just created, is a great way to create your own sounds. I hope you've found this tutorial helpful. I wish you the best of luck in using Cobalt for your own sonic explorations.

Appendix A – Waveforms

1. Sawtooth
2. Triangle
3. Sine
4. Piano
5. Electric Piano
6. Tine
7. Harpsichord
8. Organ
9. Bell
10. Digital Bell
11. Glocken
12. Oriental Bell
13. Plucked String
14. Electric Bass
15. Slap Bass
16. Synth Bass
17. Brass
18. Oboe
19. Sax
20. Vocal 1
21. Vocal 2
22. Vox Humana
23. Sharp Wave
24. Metallic Wave
25. FzReed
26. Digital Harmonics