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CHAPTER 1 – INTRODUCTION

1.1 Welcome

Thank you for choosing Waves! In order to get the most out of your new Waves plugin, please take a moment to read this user guide.

To install software and manage your licenses, you need to have a free Waves account. Sign up at www.waves.com. With a Waves account you can keep track of your products, renew your Waves Update Plan, participate in bonus programs, and keep up to date with important information.

We suggest that you become familiar with the Waves Support pages: www.waves.com/support. There are technical articles about installation, troubleshooting, specifications, and more. Plus, you’ll find company contact information and Waves Support news.

1.2 Product Overview

Waves CODEX is an advanced polyphonic granular wavetable synthesizer designed to provide complex evolving sounds that can range from acoustic and analog emulations, to completely new, previously unheard sounds. CODEX’s controls are highly inviting, combining tradition with intuitive interaction in a way that lets users easily customize existing presets and build custom patches from the ground up. The unique wavetable oscillators are embedded in a subtractive synthesis engine that allows further shaping of the sound using traditional analog subtractive components and layout.

1.3 Concepts and Terminology

CODEX is powered by Virtual Voltage™ technology, which connects its various generators and transformation filters, envelopes and modulators. CODEX therefore uses many of the same terms used by its hardware forerunners: VCF (Voltage-Controlled Filter), VCA (Voltage-Controlled Amplifier), and so on.

While anyone acquainted with synthesis should feel right at home with the subtractive
section of CODEX, the advanced oscillators might at first seem daunting. Please browse through the oscillator section of this manual to become better acquainted with the unique features and vast possibilities of CODEX’s oscillators. The learning curve will pay off when encountering other synthesizers, whether software or hardware, analog or digital.

All users can partake in the instant gratification of CODEX’s vast selection of factory presets. CODEX’s team of experienced preset developers created hundreds of presets, sorted by category, so you can quickly find the exact sound you need—leads, pads, basses, sound effects, sequences, gated rhythmic lines, motions, and more. Or just browse around until something catches your ear and captures your imagination.

Whether in the studio or live on stage, many musicians like to control their synth parameters in real time for enhanced creativity and expression. While CODEX supports the basic automation features of plugin hosting technologies such as VST, it also supports MIDI Learn. Assigning a CODEX control to a knob on your MIDI controller is as easy as right-click > Learn > knob turn, done!

Granular wavetable synthesis, analog modeling, and supreme sound quality do come at a price. CODEX can be rather CPU- and RAM-hungry compared to other software synthesizers. During the days of analog hardware, less expensive oscillators were often considered “dirty,” while accurate oscillators were costlier than was practical for most musicians. Ironically, in today’s digital world, creating a pristine oscillator is relatively easy; it’s the “dirtiness” that takes more CPU calculations to recreate. To conserve CPU power, CODEX lets you select the maximal number of simultaneous voices.

### 1.4 Components

CODEX has one component: CODEX Stereo.

CODEX is a virtual instrument plugin and will appear under the related selection menus for virtual instruments under all supported DAW host applications.

Waves CODEX also works as a standalone application, using ASIO (Windows) or Core Audio (Mac) drivers to play through your audio device of choice. CODEX receives MIDI data to trigger notes and control changes.
CHAPTER 2 – QUICK START GUIDE

Open CODEX on an instrument track in your DAW of choice, or launch the CODEX standalone application.

1. Select a preset from CODEX’s factory presets.
2. Play!

Use the next/previous preset arrow controls on the toolbar to scroll through presets. If you're looking for a certain type of sound, click the Presets button to reveal the factory presets, sorted by category.
CHAPTER 3 – INTERFACE AND CONTROLS

3.1 Interface
3.2 Controls

The CODEX interface is arranged into four sections grouped according to function:

- Voice generation and subtractive elements (blue)
- Modulation sources and patches (purple)
- Effects, EQ, global and output sections (green)
- Arpeggiator/sequencer (red)

3.2.1 Oscillators

CODEX has two wavetable oscillators which are labeled 1 and 2.

**OCTAVE** determines the pitch range.
   Range: 32, 16, 8, 4, 2 (from lowest to highest pitch)

**TUNE** determines the pitch.
   Range: -12 to +12 semitones

**FINE** fine-tunes the pitch.
   Range: -100 to +100 cents

**RESOLUTION** determines the resolution of the oscillator.
   Range: 0 to 100
**TABLE** selects one of 64 internal or imported wavetables.
   Range: 1 to 64

**WAVE** selects a specific section of the wavetable to be used as the oscillator.
   Range: 0 to 10

**FORMANT** controls the formant of the oscillator by altering the spectral peaks of the sound spectrum.
   Range: -100 to 100

**START** determines the start point of the wavetable scan.
   Range: 1 to 64

**MID** determines the midpoint of the wavetable scan.
   Range: 1 to 64

**END** determines the endpoint of the wavetable scan.
   Range: 1 to 64

**SPEED** determines the wavetable scanning speed.
   Range: 0 to 100 (free-running), 4/1 to 1/32 (synched)

**SCAN SYNC** determines whether the wavetable scanning is synchronized to the host clock.

**LOOP** – When enabled, wavetable scanning loops continuously between ‘MID’ and ‘END’ points.

**IMPORT** allows the integration of user-selectable WAV files. Imported WAV files are automatically converted into wavetables by CODEX. These new wavetables are saved along with presets. CODEX supports WAV files of any length, bit-depth and sampling frequency. For optimal results, samples of between one and five seconds are recommended.
**FC** enables CODEX's advanced formant correction algorithms. When enabled, formant can be controlled using the 'FRMNT' knob.

**OSC SYNC** synchronizes the pitch of OSC 2 to that of OSC 1. When SYNC is activated, the OSC 2 pitch controls (OCT, TUNE, FINE) affect only its timbre, not its pitch.

  Range: On/Off

**FM** (Frequency Modulation) controls the amount by which the frequency of OSC 2 is modulated by OSC 1. *(OSC 2 only)*

  Range: 0 to 100

### 3.2.2 Additional Oscillators & Mix Section

![Additional Oscillators & Mix Section](image)

This section is used to combine OSC 1 and OSC 2, and to add noise, sub-oscillation and ring modulation.

**SUB** mixes in a triangle wave one octave below OSC 1.

  Range: 0 to 100

**NOISE** mixes in white noise.

  Range: 0 to 100

**RING** controls the ring modulation of OSC 1 and OSC 2.

  Range: 0 to 100

**OSC 1 / OSC 2** activate each oscillator.

  Range: In/Out
**MIX** balances the mix between OSC 1 and OSC 2.

Range: -50 to +50

**MONO** toggles between monophonic and polyphonic modes.

Range: On (mono) / Off (polyphonic)

**RTRG** controls envelope re-triggering. When activated, every note restarts the envelopes. *(Mono mode only)*

Range: On/Off

**UNISON** activates a doubling effect which creates a richer sound.

Range: On/Off

**PORT** determines the glide time (portamento) between notes.

Range: 0.5 to 2500 ms (0 to 2.5 seconds)

**ALWAYS/LEGATO** determines whether glide will occur always, or only when the previous note is still held.

Range: Legato, Always

### 3.2.3 Voltage Controlled Filter (VCF)

The VCF section includes selectable filter slope, frequency and resonance parameters as well as a filter envelope which determines the filter movement on each trigger.
**TYPE** determines the filter type.
   Range: High Pass, Low Pass, Band Pass, Band Reject

**SLOPE** toggles between two types of pole filters.
   Range: 2-pole/12 dB per octave, 4-pole/24 dB per octave

**CUTOFF** controls the VCF cutoff frequency.
   Range: 0 to 100 (20 Hz to 20 kHz)

**RES** controls the amount of filter resonance.
   Range: 0 to 100

**ENV** determines the envelope’s cutoff modulation depth.
   Range: -100 to 100

**KBD** controls keyboard tracking using C3 as its reference point.
   Range: 0 to 100

**FM** controls the amount of frequency modulation on filter cutoff by OSC 1.
   Range: 0 – 100

**ADSR** determines the filter’s envelope cutoff behavior after a note is triggered:

   A (Attack): 1 to 10,000 (1 millisecond to 10 seconds)
   D (Decay): 1 to 10,000 (1 millisecond to 10 seconds)
   S (Sustain): 0% to 100% amplitude
   R (Release): 1 to 10,000 (1 millisecond to 10 seconds)

At 0, time constants are linear; at positive values, the envelope slopes become more concave (below, in black), for a punchier response. Negative values result in a more convex slope shape, for smoother response (below, in red.)
VEL sets the VCF cutoff in relation to the Note On velocity.
Range: 0 to 100

SHAPE determines the contour of the envelope time constants.
Range: -50 to 50

### 3.2.4 Voltage Controlled Amplifier (VCA)

The VCA envelope controls the note level from trigger to release:

- **A** (Attack): 1 to 10,000 (1 millisecond to 10 seconds)
- **D** (Decay): 1 to 10,000 (1 millisecond to 10 seconds)
- **S** (Sustain): 0% to 100% amplitude
- **R** (Release): 1 to 10,000 (1 millisecond to 10 seconds)

VEL sets the envelope depth in relation to the Note On velocity.
Range: 0 to 100
SHAPE determines the contour of the envelope time constants.
   Range: -50 to 50

PUNCH controls the dynamic transient enhancer which makes for a “snappier’ attack.
   Range: On/Off

3.2.5 Low-Frequency Oscillators (LFOS)

CODEX features four LFOs: two free and two synchronized. The free LFOs have a continuous cycle time control, while the synched LFOs are voice-triggered and use musical note values (based on the host BPM) to determine the oscillation rate.

TYPE controls the LFO waveform shape.
   Range: Sine, Saw Down, Saw Up, Triangle, Pulse, S&H (random)

RATE controls the frequency of the free LFO.
   Range: 0.1 to 100 Hz

TIME controls the rate of the synched LFO, locked to the project’s BPM.
   Range: 4/1, 3/1, 2/1, 1/1, 1/2, 3/8, 1/3, 1/4, 3/16, 1/6, 1/8, 3/32, 1/12, 1/16, 3/64, 1/24, 1/32

LED pulsates at the same rate as the LFO.
3.2.6 Envelope 3

In addition to the filter and the VCA envelopes, CODEX includes an envelope generator that can be freely assigned to selectable destinations via the modulation matrix.

- **A** (Attack): 1 to 10,000 (1 millisecond to 10 seconds)
- **D** (Decay): 1 to 10,000 (1 millisecond to 10 seconds)
- **S** (Sustain): 0% to 100% amplitude
- **R** (Release): 1 to 10,000 (1 millisecond to 10 seconds)

**VEL** sets the envelope depth in relation to the Note On velocity.
- Range: 0 to 100

**SHAPE** determines the contour of the envelope time constants.
- Range: -50 to 50
3.2.7 Modulation Matrix

The Modulation Matrix allows the patching of modulation sources to selectable destinations.

**PHASE** inverts the phase, per assignment. Depending on the phase setting, this will change the direction of the modulation.

   Range: On/Off

**SRC** determines the modulation source.

   Range: LFO1, LFO2, LFO3, LFO4, Env3, Modwheel, Keyboard, Velocity, Aftertouch, Bender, VCF Envelope, Sequencer

**DEST** determines the destination of the modulation source.

   Range: Global Pitch, OSC 1 Freq, OSC 1 Resolution, OSC 1 Formant, OSC 1 Table, Scan 1 Start, Scan 1 Mid, Scan 1 End, Scan 1 Speed, OSC 2 Freq, OSC 2 Resolution, OSC 2 Formant, OSC 2 Table, Scan 2 Start, Scan 2 Mid, Scan 2 End, Scan 2 Speed, OSC 2 FM, Sub, Noise, Ring, OSC Mix, VCF Cutoff, VCF Res, VCF FM, VCF Env, VCF A, VCF D, VCF R, VCF Crv, VCA, VCA A, VCA D, VCA R, VCA Crv, Pan, HP, LP, Dist, Crusher, Chorus, Delay Mix, Delay Rate, Reverb, Porta, LFO 1 Rate, LFO 2 Rate, LFO 3 Rate, LFO 4 Rate, Env3 A, Env3 D, Env3 S, Env3 R, Env3 Crv, Arp/Seq Rate, Arp/Seq Gate, Mod 1, Mod 2, Mod 3, Mod 4, Mod 5, Mod 6
**MOD** sets the degree to which the modulation source affects the destination.

Range: 0% to 100%

### 3.2.8 Arpeggiator/Sequencer (ARP/SEQ)

The ARP/SEQ section functions both as a traditional arpeggiator and as a 16-step sequencer. Each sequencer step has an In/Out toggle as well as a pitch control which may be set +/-24 semitones from the currently held note.

**MODE** determines the operational mode.


**OCT** determines the range, in octaves, of the arpeggiator.

Range: 1, 2, 3, 4

**RATE** sets the arpeggiator rate. The drop-down menu activates the host BPM sync function and sets the rate using note values. When the rate is set to Free, the host BPM sync is off and the rate is set manually using the knob on the right.

Range: Free (host BPM sync off; range 1 to 50 Hz), 1/2, 3/8, 1/3, 1/4, 3/16, 1/6, 1/8, 3/32, 1/12, 1/16, 3/64, 1/24, 1/32

**GATE** determines the length of each sequencer step as a percentage of its note length.

Range: 5% to 100%

**STEPS** determines the number of steps in the current sequence.

Range: 1 to 16

**HOLD** enables latching of arpeggiator and sequencer notes after the keys are released.
**RTRG** enables re-triggering of arpeggiator and sequencer notes when new notes are played.

**SWING** pushes even-numbered notes/steps toward the next odd-numbered note/step, to create a shuffle/swing feel.

   Range: 0 to 100

### 3.2.9 Effects (FX)

![FX Panel](image)

**DIST** controls the amount of distortion effect. Distortion is applied per voice, eliminating IMD (inter-modulation distortion.) Settings below 50% create a warm, saturated drive effect; settings above 50% result in a more aggressive, “crunchier” sound.

   Range: 0% to 100%

**PRE VCF** is a toggle control which determines the placement of the distortion effect in the signal path, either pre-VCF or post-VCF.

   Range: Pre/Post

**CRSHR** is a distortion-like effect which simulates a reduction in the sample-rate and resolution of the sound.

   Range: 0 to 100

**DELAY** is a stereo delay which allows separate delay times for left and right channels, using note values.
- **LEFT** sets the delay time for the left channel.
  
  Range: 1/2, 3/8, 1/3, 1/4, 3/16, 1/6, 1/8, 3/32, 1/12, 1/16, 3/64, 1/24, 1/32

- **RIGHT** sets the delay time for the right channel.
  
  Range: 1/2, 3/8, 1/3, 1/4, 3/16, 1/6, 1/8, 3/32, 1/12, 1/16, 3/64, 1/24, 1/32

- **MIX** determines the amount of delay effect in the mix.
  
  Range: 0 to 100

- **FEEDBACK** determines the amount of gain fed back to the delay input.
  
  Range: 0 to 100

**REVERB** controls both the amount and size of the virtual plate reverb sound. In addition to increasing the amount of reverb, higher values also increase the reverb size and time.

Range: 0 to 100

**CHORUS** determines the amount of chorus modulation.

Range: 0 to 100

### 3.2.10 EQ

![EQ](image)

The EQ section is a 4-band fixed-frequency graphic equalizer with high-pass and low-pass filters. At high boost levels, the EQ saturates with different tonal qualities than the Distortion module.
**HiPASS** controls the high-pass filter frequency.

Range: 20 to 20,000 Hz

**LoPASS** controls the low-pass filter frequency.

Range: 20 to 20,000 Hz

**100** controls equalization at 100 Hz.

Range: -30 to +30 dB

**600** controls equalization at 600 Hz.

Range: -20 to +20 dB

**1500** controls equalization at 1500 Hz.

Range: -20 to +20 dB

**9000** controls equalization at 9000 Hz.

Range: -25 to +25 dB

### 3.2.11 Global and Out Sections

**TEMPO** displays the current tempo.

Range: 1 to 300

**SOURCE** determines the clock source.
Range: Host, Internal

**BEND RANGE** determines the range of the pitch bender.
  Range: 0 to 12

**VOICES** determines the number of voices that can be played simultaneously.
  Range: 1 to 32

**GAIN** sets CODEX's overall output volume, after all generators and processors.
  Range: -80 to 0 dBFS

**METER** displays CODEX's overall output energy.
CHAPTER 4 – STANDALONE APPLICATION

The CODEX standalone application requires an ASIO driver for Windows or a Core Audio driver for Mac OS-X.

CODEX.exe (Win) or CODEX.app (MAC) loads the CODEX instrument and configuration preferences dialogs.

The standalone application’s menu file contains three items:

- **All Notes Off** – sends an All Notes Off MIDI command to the CODEX synthesizer, useful in cases of “stuck” sustaining notes.
- **Preferences** – displays the preferences dialog for Audio, MIDI, and user settings.
- **Exit**

THE PREFERENCES DIALOG

The preferences dialog allows configuration of Audio, MIDI, and user settings.

**Audio** offers control over the following parameters:

- **Output Channels** allows selection of audio outputs from the selected device.
- **Sample Rate** displays and sets the sample rate.*
- **Buffer Size** displays and sets the buffer size, which influences latency.*

  *In Windows, sample rate and buffer size cannot be changed from this panel. To modify these settings: close the application, adjust sample rate and buffer size with your driver's control panel, and relaunch.

**MIDI** offers control over the following parameters:

- **MIDI Input Device** displays a list of available MIDI input devices on the current system. Select the MIDI device through which to receive MIDI data.
- **Input Channel** - CODEX standalone is ready to receive MIDI in OMNI mode from all channels. The MIDI channel control allows the selection to receive MIDI input only from certain channels as selected in the checkboxes.
- **Output Device** - Not used
Chapter 5 - WaveSystem Toolbar

Use the bar at the top of the plugin to save and load presets, compare settings, undo and redo steps, and resize the plugin. To learn more, click the icon at the upper-right corner of the window and open the WaveSystem Guide.

Load with Preset – MIDI, Arp/Seq and Tempo

The Load with Preset filter is a CODEX-exclusive custom toolbar that lets you choose whether or not to load certain preset characteristics such as MIDI assignments, arpeggiator/sequencer settings, and tempo. When checked, these parameters are loaded. Here are some practical examples:

**MIDI** – Let’s say you’ve assigned a MIDI controller knob to CODEX’s VCF cutoff. Loading the next preset will reset this parameter; you will then have to redo the MIDI Learn routine in order to attach the knob to the control. However, if you uncheck the MIDI checkbox, the next preset will be loaded, but the current MIDI assignment will remain in place.

**Arp-Seq** – Let’s say you have a bass line arpeggio that you like, and you want to test the pattern using a different sound. Uncheck the Arp/Seq checkbox, and the preset will be loaded without any associated Arp/Seq settings, leaving the pattern as is.

**Tempo** – Let’s say you are working on an arpeggio with an internal tempo of 140. Loading presets may set the tempo to a different value or to the value determined by your host computer. To ignore tempo settings saved with other presets, uncheck the Tempo box, and your current tempo setting will remain in place when other presets are loaded.