CAIN CZ

A PD-synthesis user oscillator for the KORG multi-engine.

Overview

The **CAIN CZ** user oscillator is an oscillator, which is strongly inspired by the CASIO COSMOS synthesizers, which were first introduced in the early 80s as an answer to Yamaha's FM synthesizers.

The oscillator adds a digital form of synthesis, called phase distortion (PD) to your Prologue, Minilogue XD or NUTEKT NTS1. It is a very close relative of the FM synthesis, where a signal is created using a carrier and a modulator. In the case of PD a simple sine wave is transformed into a different shape, by varying the read out speed.

It features

- 21 combinations of phase distortions
- Resonance like amplitude modulation for each combination
- 14 envelope presets for the 8-step envelope generator with loop, sustain and end points
- Control for the amount of phase distortion, resonance and the envelope depth
- Control for the envelope speed

Phase Distortion in a Nutshell

The concept of phase distortion can easily be understood when looking at a saw phase distortion. Instead of using a constant read out speed (blue), the initial speed is higher until it reaches a threshold and then slowed down to complete the cycle (orange).
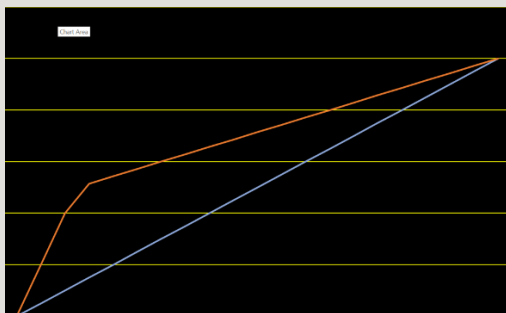
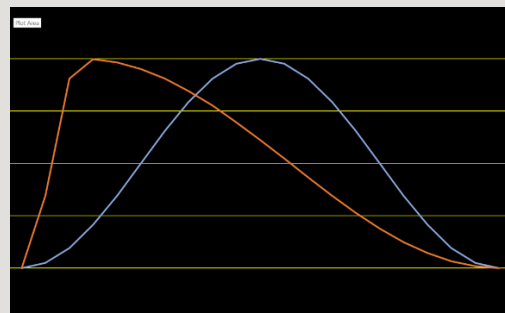

Figure 1 The read out speed of a sine is varied.

Figure 2 Resulting wave after distortion.

The intensity of the phase distortion defines the deviation from a linear read out to the distorted read out. This has a similar effect as if a filter was opened or closed on a signal with a complex wave form.

Phase Distortion Shapes

For the **CAIN** ⎔⎰ user oscillator, six different basic phase distortion curves are implemented.
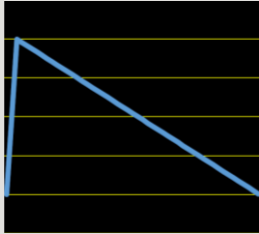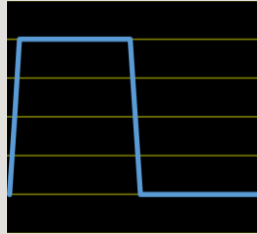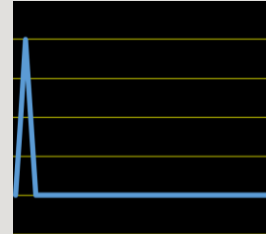

Figure 3 Saw PD

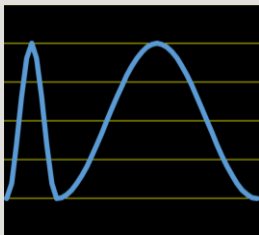*Figure 4 Square PD*

Figure 5 Pulse PD
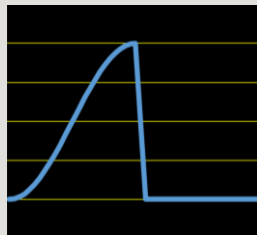

Figure 6 Double Sine PD
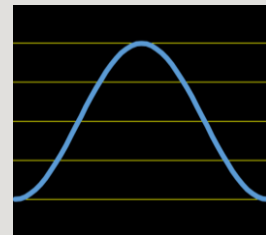

Figure 7 Half Sine PD

Figure 8 Linear Sine PD

In addition, 15 further PD combinations can be dialed in, resulting in a total of 21 shapes.
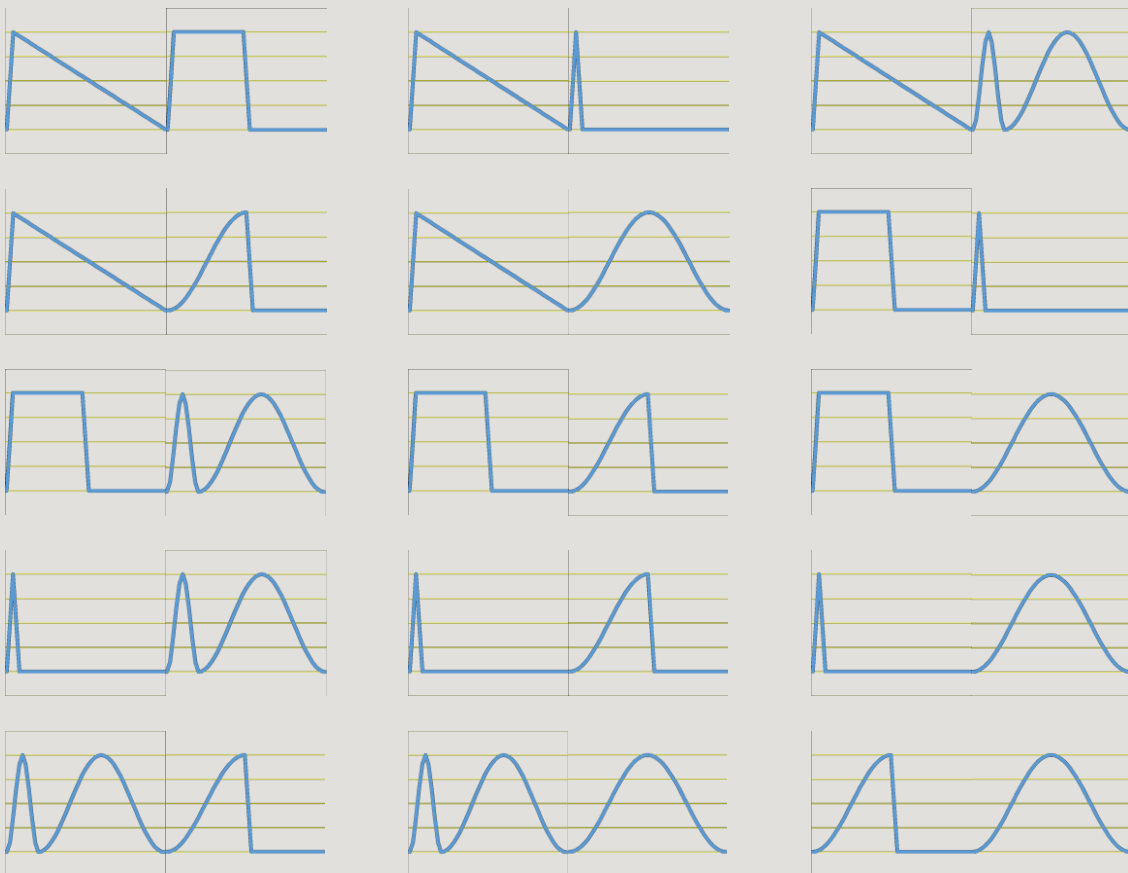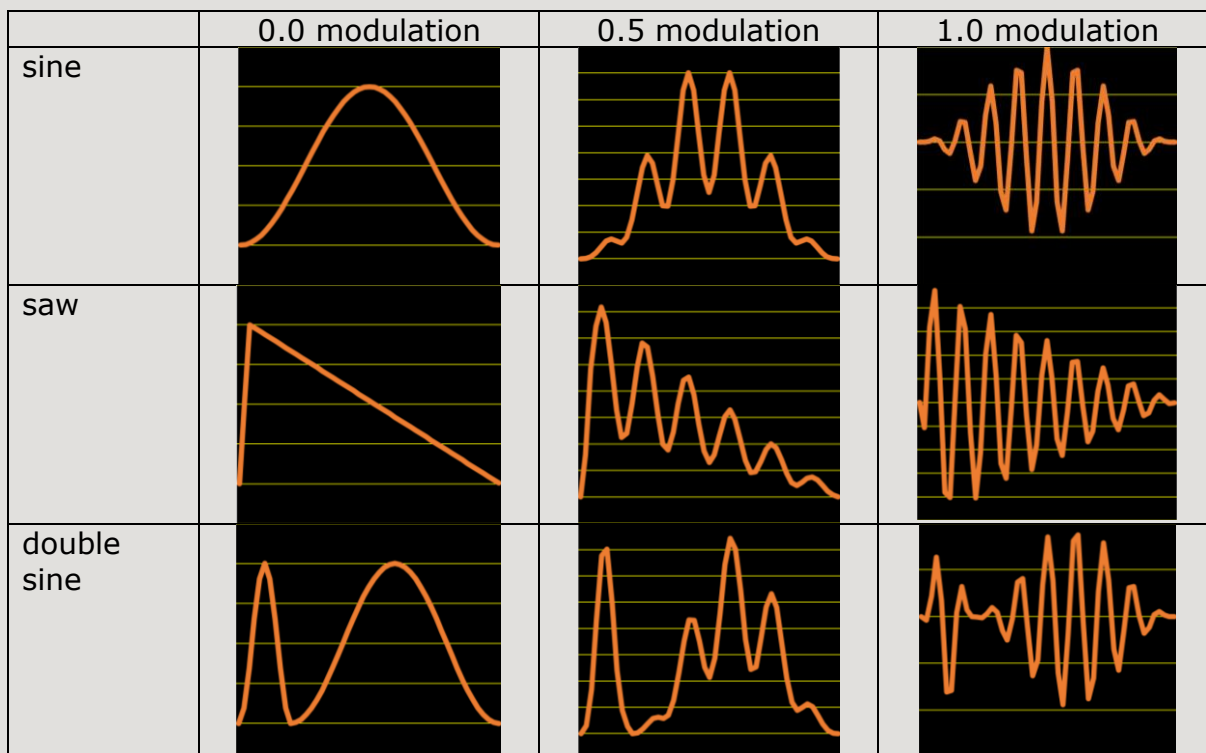

Figure 9 Combination PDs

CAIN ℂℤ version 1.3.0 and higher allows to also select a carrier, different from the standard sine wave. There are a total of 91 carrier waves available. Depending on the chosen carrier and phase distortion type, the spectrum of the oscillator can vary from soft phase distortion sounding to PWM or sync-like sounds.

Amplitude Modulation

Since the synthesis does not use filters, but changes the number of overtones via phase distortion, there is no resonance available for the shapes.

In order to compensate that a resonant like sound can be applied to the resulting waves, which is based on an amplitude modulation.

	0.0 modulation	0.5 modulation	1.0 modulation
sine			
saw			
double sine			

The modulation can be applied from 0.0 to 1.0

Envelopes

Currently a total of 14 envelope shapes are available. The envelopes can be applied to the phase distortion, where the envelope depth can be positive or negative.

ADSR

Swell

Bass

ADSR with D=R

Trumpet

Echo

Multi Attack

Multi Attack Inverted

Triangle Loop

Saw Loop

Square Loop

Rhythmic Loop 1

Rhythmic Loop 2

Rhythmic Loop 3

Key Tracking

CAIN GZ version 1.3.0 and higher has a key tracking implemented. The amount of phase distortion, which is applied to a note, depends on the key which was pressed.

This feature can be used to emulate the dampening of high notes, as it can be heard on natural instruments.

Implemented Controls

Parameter	Function
Shape	Controls the amount of phase distortion.
Shift Shape	Adds a pseudo resonance to the wave forms. Both, the distortion as well as the resonance amount affect both alternating slots.
User Parameter 1	Selects the wave shape from a total of 21 available phase distortion combinations.
User Parameter 2	Selects the wave shape of the carrier. Shape 1 is the standard sine wave. Waves 2 – 91 are wavetable waves.
User Parameter 3	Select one of 8 different 8-state-envelopes for the phase distortion
User Parameter 4	Defines the envelope depth (-100% to +100%)
User Parameter 5	Defines the speed of the envelope
User Parameter 6	Defines the key tracking behavior of the phase distortion

If you find the oscillator useful and want to support my work then feel free to visit www.cain-synthesizer.com to donate.

Here are some ideas on what you could donate if you are thinking…

"Improves my NUTEKT NTS-1 by 1%"   1€

"I'll buy you a coffee for your efforts"   2€

"Did I put my pants on before leaving the house?"   5€

"Improves my minilogue XD by 1 %"   6€

"Improves my prologue by 1%"   10€

"I'll buy you a minilogue XD, so you can work out the details on the parameters for that unit."   600€