Voxengo PHA-979 User Guide

Software version 2.3

http://www.voxengo.com/

Contents

Introduction

PHA-979 is a professional audio plug-in which allows you to apply an arbitrary phase shift to sound material. What is meant by the phase shift here is simultaneous shifting of all frequencies across the active frequency range of the signal by the given value in degrees. This is achieved by linear-phase design.

PHA-979 is useful during mixing sessions, especially when working with the sound material recorded through an array of microphones. In many cases this allows you to solve various phasing problems arising from the microphone placement chosen during the tracking session. In other cases this process may help you to align drums and other instruments to each other bringing punch and time coherence not attainable by the ordinary time-aligning alone.

Beside the phase shifting, PHA-979 features positive and negative time delaying that eliminates the need to move in-track events in the sequencer when doing time alignment over any set of recorded tracks. PHA-979 also provides mid/side channel balance and panning controls that permit you to record stereo microphone pairs into a single stereo track without resorting to dual mono recording (on separate tracks) which usually becomes time-consuming in a further editing.

PHA-979 features multi-band analog-style correlation meter that greatly simplifies phase- and time-aligning process. Moreover, you can use functionality PHA-979 provides to setup headphone monitoring so that it closer resembles sound stage produced by stereo speaker monitoring.

Features

- Arbitrary signal phase control
- Linear-phase design
- Multi-band correlation meter
- Positive/negative time delaying
- Delay time calculator
- Mid/side channel balance control
- Stereo output panning
- Stereo and mono processing
- 64-bit floating point processing
- Preset manager
- Undo/redo history
- A/B comparisons
- Contextual hint messages
- All sample rates support
- 48 ms compensated processing latency

Compatibility

This audio plug-in can be loaded into any audio host application that conforms to the AudioUnit or VST plug-in specification.

This plug-in is compatible with Windows (32- and 64-bit Windows 7, Vista, XP) and Mac OS X (10.5 and later versions, 32- and 64-bit, Intel processor-based) computers

(2 GHz dual-core or faster processor with at least 1 GB of system RAM required). A separate binary distribution file is available for each target computer platform for each audio plug-in specification.

User Interface Elements

Note: Most interface elements (buttons, labels) located on the top of the user interface and on the bottom are standard among all Voxengo plug-ins and do not require much learning effort. For an in-depth description of these and other standard user interface elements and features please refer to the "Voxengo Primary User Guide". Learned once it will allow you to feel comfortable with all pro audio plug-ins from Voxengo.

Delay

The "Enable" switch enables delay line processing. When you do not need to use delaying you may leave the module disabled to conserve CPU resources.

The "Left" and "Right" knobs control the delay time (in milliseconds) independently applied to the left and right channels, respectively. The plug-in is able to apply negative time delay (shift the channels "back in time") due to constant technical processing latency the delay module introduces in the first place.

To setup delay times easier you may use the "Delay Time Calculator" provided with the plug-in. In this calculator you need to enter sample positions of any two sound events (transients) you would like to time-align to each other.

Sample position can be usually seen in the audio host application's cursor time position readout by switching it to sample offset display mode. Note that you usually need to use host's track waveform magnifying functions to be able to acquire event's sample position precisely.

After entering sample positions of both events you will see the delay you should apply to event that is lagging relative to the "earlier" event. If this "later" event is present in the left channel, you should use the "Copy Delay to L" button to assign this delay value to the left channel. The "Copy Delay to R" button is used to assign the delay value to the right channel.

To make time alignment easier and precise it is suggested to record a sharp sound (clap or stick stroke) that can then be used to locate relative sample offsets of the microphones within the multi-microphone setup. If you are working with drum recording you do not need any special sound since each drum hit produces a clear transient. It is not suggested to perform time-aligning by cymbal hits or any other sounds that naturally do not have popping transients.

Phase

The "Enable" switch enables arbitrary phase shift processing. When you do not need to use arbitrary phase shifting you may leave the module disabled to considerably conserve CPU resources.

This set of controls allows you to perform phase alignment of mono or stereo audio material. Phase alignment is a second step after time alignment on the way to achieving a clear sound.

The "Left" and "Right" knobs specify the phase shift value (in degrees) for the left and right audio channels, respectively.

Phase shifting process of this plug-in does not skew the phase relationship within the signal being processed. For example, with this process you can shift the phase of the signal twice: at first, by 90 degrees and then by 180+90 degrees (totaling 360 degrees), to get the original signal as a result.

The “L 180” and “R 180” switches enable 180 degree phase inversion (flip) of the left and right channel, respectively.

The “Corr” button opens the “Correlometer” pop-up window.

Output

This block controls output stage parameters.

The “Side Mix” knob adjusts the amount of side channel signal present in the output signal (in percent). When the knob is at 100% (no mid channel present) the resulting full side channel output will be 6 dB louder in comparison to 50% position to account for a usually quieter side channel signal.

The “Pan” knob controls output signal panning (in percent L-R). The plug-in uses “0 dB” pan law for stereo panning.

The “Out Gain” knob adjusts the overall output signal gain (in decibel).

The “Force Mono” switch enables processing of the left audio channel only. This switch is designed to be used on mono tracks (for example, during multi-microphone drum kit mixing) since in such cases this will save some CPU resources. When this switch is enabled it dims the right channel knobs on the user interface making it clear that the plug-in is working on a mono source. Input right channel signal will be discarded completely when this mode is engaged.

The “L/R Swap” switch enables left and right channel swapping **before** the “Side Mix” and “Pan” adjustments are applied.

The “Mono Mix” switch enables mixing of left and right channels to mono on output.

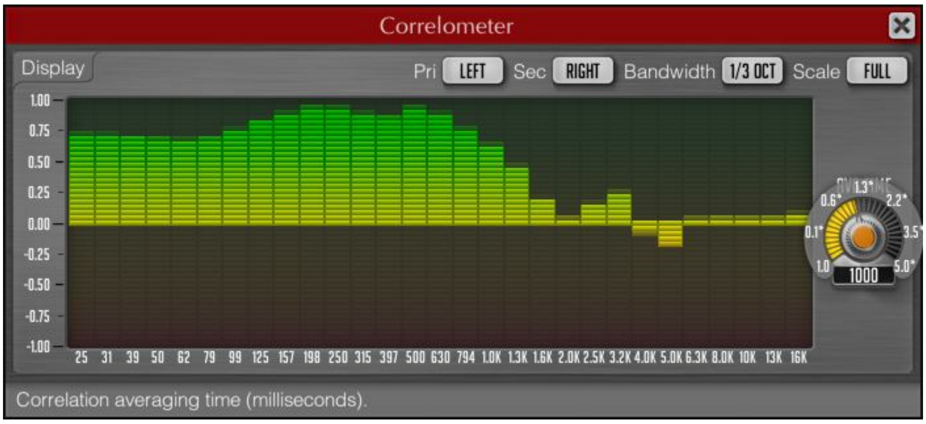
The “L/R Diff” readout shows signal loudness difference between the left and right channels in decibel (3-second integration). This readout shows negative values if the left channel is louder than the right channel. Note that this readout does not have means to display channel phase difference which may make a given channel sound louder even if its loudness level is equal to an opposite channel.

The “RMS” readout shows output RMS signal level (3-second integration) of the left and right channels (in decibel).

Correlometer

Introduction

PHA-979 features a flexible multi-band correlation meter which you can routinely use to configure delay and phase parameters with a highest level of precision possible. You may adjust plug-in's delay and phase parameters while examining the information the correlation meter is displaying. Correlation meter is placed before the "Mono Mix" switch in the plug-in's signal chain.



PHA-979's correlation meter works by splitting the incoming signal into bands that are close to ISO frequencies. Band-splitting is performed by means of an array of band-pass filters (the Q factor of the filters depends on the number of bands). This correlation meter can be called an "analog-style" correlation meter.

Please read the topic named the "Knowledge Bit – Correlation" in the "Voxengo Primary User Guide" for specific information about correlation values and their possible meaning.

As a general rule, when phase-aligning a track to another track it is desirable to achieve correlation values near 1.0 for frequencies below 1 kHz while allowing the correlation for the higher frequencies to be between 1.0 and 0.0.

Parameters

PHA-979's correlation meter (correlometer) features the following user-selectable parameters:

The "Pri" parameter selects primary signal source.

The "Sec" parameter selects secondary signal source. You may select side-chain inputs here.

If either "Pri" or "Sec" parameter refers to a non-existent or equal channel the correlation meter will display 1.0 constant for all bands.

The "Bandwidth" selector is used to select single band's width (expressed in octaves) used in the band-splitting.

The "Scale" selector chooses vertical (correlation value) scale range. The "Full" option displays full correlation range (-1.0 to 1.0), the "Pos" option focuses on positive correlation values (0.5 to 1.0), the "Neg" option focuses on negative correlation values (-1.0 to -0.5), the "Null" option focuses on null-correlation values (-0.25 to 0.25).

The "Avg Time" knob controls correlation meter's averaging time (in milliseconds). This value is used in each band.

Credits

This plug-in was produced by Aleksey Vaneev in Syktyvkar, Komi Republic, Russia.

DSP algorithms and internal signal routing code were created by Aleksey Vaneev.

Graphics user interface code and the “standard” graphics design were created by Vladimir Stolypko.

Plug-in is implemented in multi-platform C++ code form and uses “zlib” compression library (written by Jean-loup Gailly and Mark Adler), FFT code by Takuya Ooura, VST plug-in technology by Steinberg, AudioUnit plug-in SDK by Apple, Inc. (used under the corresponding licenses granted by these parties).

Beta-Testers

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Questions and Answers

Q. I am wondering if there is a set latency amount in milliseconds or samples that this plug-in introduces to a track so I can compensate for it?

A. PHA-979's latency in samples depends on the project's sample rate. The latency at 44100 Hz is equal to 48 milliseconds. It becomes a bit lower at higher sample rates (46 ms at 96000 Hz).

Q. I don't like latency! Can you please get it to zero?

A. This is simply impossible, in the case of PHA-979, since it uses linear-phase design.

Q. I was wondering is the technology of this plug-in is the same as in the Little Labs IBP? http://www.littlelabs.com/ibp.html

A. PHA-979 is probably very close to IBP in the idea. However, since IBP is an analog box, it is not linear-phase and thus it may add some additional "analog" coloration, it may also shift some range of frequencies more than the rest (it has a lo/hi switch for this). This may or may not be good in a particular situation. PHA-979 is neutral in this respect. When applying PHA-979 you can be sure nothing sonically-important is being destroyed in the process.

Q. How PHA-979 is different from a simple delay plug-in?

A. PHA-979's phase shifting halves the time shift of the signal when frequency doubles. For some it might be interesting to know that at 90 degree phase shift, PHA-979 works as a Hilbert transformer. This makes this plug-in totally different to a delay plug-in. You may look at PHA-979 as a frequency-dependent delaying plug-in. PHA-979 won't cure every possible problem, but in a way it works, it covers more bases than normal time shifting (time aligning). I.e. with the latter you may still get some "problem spots" while with PHA-979 you can minimize this number to one or none.

More in-depth information:

Phase alignment should never be analyzed without a time anchor. There should always be a time anchor. Then, all frequency-dependent phase/time changes should be compared to this anchor. You may perceive the anchor as a sound wave with all frequencies at unity loudness level at once. This anchor stays untouched while you are adjusting another signal.

What a simple time shifting does to the signal relative to the anchor? For example, we are at the sample rate of 96000 samples per second, and shifting the audio signal forward by 500 samples (5 milliseconds). What does that mean to the audio frequencies relative to the anchor sound? Let's introduce "phase shift per sample" value for each audio frequency. This will be:

- 48kHz: 2*pi*48000/96000 = pi (means if we shift audio forward by 1 sample we get this "pi" value shift for this "48kHz" audio frequency, relative to the anchor).
- 24kHz: 2*pi*24000/96000 = pi/2

- 12kHz: 2*pi*12000/96000 = pi/4
- 6kHz: 2*pi*6000/96000 = pi/8
- etc.

So, in our case, when you are time shifting the audio signal forward by 500 samples, audio frequencies in it are shifted relative to the anchor by:

- 48kHz: 500*pi
- 24kHz: 250*pi
- 12kHz: 125*pi
- 6kHz: 62.5*pi
- 3kHz: 31.25*pi
- 1.5kHz: 15.63*pi
- 750Hz: 7.81*pi
- 375Hz: 3.8*pi
- 187.5Hz: 1.95*pi
- etc.

Hopefully, you get the idea. Nobody knows what you'll get when you sum this shifted signal with the anchor sound: comb filtering at the least. While process like PHA-979 rotates ALL frequencies for the same phase amount, and it never exceeds “pi” (unlike the ordinary time shift outlined above). Acoustically speaking, PHA-979 does nothing to the signal since it preserves phase linearity and basically a flat frequency response. Its effect can be heard only compared to the anchor sound, when summed with that anchor sound. And the result is simple: out of phase frequencies get reduced, in-phase frequencies get amplified, all in a very precise manner. This is the same as getting an optimal balance between two sounds without equalization or frequency-dependent phase-shifting.

Q. Would PHA-979 be used more for individual instruments tracks, or more for whole mixes?

A. PHA-979 is not usable for the whole stereo mixes unless you want to mix these stereo mixes with each other. PHA-979 is meant to be used during mixing, for aligning instruments to each other: overhead mics to drum mics, drums to bass, acoustic guitars to each other, overdriven guitars to each other, and so on.

When used over the whole stereo mix, PHA-979 can be used to imitate room speaker monitoring with headphones.

Q. If PHA-979 is just used on single sounds/instruments, would it only be used on stereo sources?

A. It can be used on individual stereo sources like double-mic stereo recordings. But probably you will use it on mono sources the most: vocals, guitars, bass, drums. PHA-979 helps things to mix together better. When PHA-979 is being used on a mono source, there is a special “Force Mono” switch available which you can enable to save CPU resources.

Q. Should PHA-979 be used first or last in the effect chain?

A. It depends on your taste mainly. In either case, when you apply additional processing on the signal, in most instances you will have to re-adjust phase adjustment after every change you make to the processing chain since the processes you have on the track may produce different phase shifting at their different settings.

Q. Would the PHA-979 be the best tool for aligning the microphone bleed that occurs when I record acoustic guitar and vocals at the same time?

A. Sure thing, PHA-979 can be used for such task, but since microphone bleed has “distance” component (distance between two mics and two sound sources), you may also need to use PHA-979’s time-shifting feature.

Q. I'm slightly frustrated. I am trying the plug-in on one mic track from a spaced stereo pair. I'm hearing no change at all.

A. When evaluating PHA-979 changes makes to the signal, you should always use two tracks – one unchanged and the other affected by PHA-979. When applying PHA-979 on a single track its effect cannot be heard, at all. The effect can be heard only when you mix (or listen) the affected and unaffected tracks together.

Q. I would like to reproduce a sound coming “out” of the stereo field, like sometimes when watching TV we feel that sound coming “extra wide”. The source is mono. Is this relative to phase?

A. I guess what you are describing as “extra wide” can be created using differing phase shift on every channel. So, it is possible to get such effect with PHA-979, but the closer your approach to the 180 degrees phase shift between the channels, the less “mono-compatible” your sound will be. Phase-shifting of channels of a stereo signal may produce phase cancellation when stereo signal is mixed to mono, and it generally sounds too “surround”. Getting mono-compatible “extra wide” sound usually requires use of some additional processing like delaying, chorusing, etc.

Q. I'm assuming that the correlation meter monitors the effect of phase adjustments across two or more tracks simultaneously. Is this assumption correct?

A. By default, the correlation meter measures correlation of Left and Right channels of the same stereo track. But in certain hosts like Ableton Live, Logic Pro, Cakewalk Sonar and others you may route a side-chain signal to it – in that case you can measure correlation across tracks. In no way PHA-979 measures correlation across several tracks “automatically” – you have to configure it first.

Q. Is the stereo correlation meter the same plug instance as the one that manipulates phase?

A. Yes, it is the same plug-in. The meter is shown in a separate window, though.

Q. Is there any real difference between using PHA-979's delay, or manually time advancing or setting back the track in the DAW?

A. PHA-979 performs usual positive or negative time delaying via its "Delay" control – it is not different from e.g. Cubase's built-in track delay. But not all audio host applications have such feature: that is why PHA-979 implements it.

Q. PHA-979's description says it can be used "to setup headphone monitoring so that it closer resembles sound stage produced by stereo speaker monitoring". That sounds interesting but I don't see how this functionality is implemented?

A. A corresponding preset is available. PHA-979 only models speaker phase positioning – 60 degrees phase difference between speakers. It is not about time difference – the speakers are located at equal distances from the listener, so there is no delay between arrival of signal from both speakers. At the same time phase difference between speakers is constant for all frequencies, it is equal to 60 degrees and it changes perception of the stereo field greatly.

Q. I'm trying to figure out exactly how PHA-979 is properly used for phase aligning drum mixes. I'm routing overhead signal to the left channel and snare signal to the right channel of PHA-979. Is this correct?

A. PHA-979 should not be used that way, that is, with one track panned left, and the other track panned right. PHA-979 should be used on separate tracks. Optionally, you may route external side-chain signal to PHA-979 to perform correlation analysis. Stereo processing capability of PHA-979 was mainly designed for adjusting stereo field information of stereo microphone pairs, and for speaker placement simulation during headphone monitoring.

Happy Mixing!