IDR360° Bit Requantizer

Software Audio Processor

User's Guide

IDR – Increased Digital Resolution

IDR stands for *Increased Digital Resolution*. This technology, developed by Waves and the late Michael Gerzon, incorporates Dithering and Noise Shaping to make optimal bit depth re-quantization happen with minimal loss of audio information. In fact, if you are taking a 24-bit source down to 16 bits, you will get perceived audio resolution equal to a 19-bit word length.

IDR technology has been incorporated into the **Waves L1 and L2 Ultramaximizers**. In those cases where CD audio mastering (16-bit at 44.1kHz) was a definite goal, the incorporation of IDR into the Peak Limiter was obvious because, in most cases, the process would need to go down to 16-bit. In Surround we believe that a 24-bit master is the common format but we provided this multichannel version of IDR for special cases where bit depth reduction is still required.
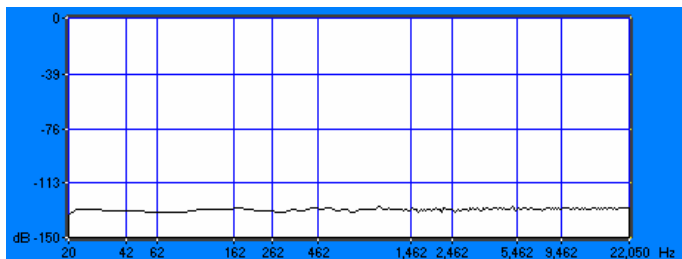
Dither

The Dither generates low-level random noise and forces quantization error to become part of the dither noise rather than add program-correlated noise distortion. The dither will appear in the last two bits of the audio sample, or the *least significant bits*. Hence, the noise generated will be apparent only at the lowest 12dB of the signal's dynamic range. In a 16-bit file this is between 96 and 84dBfs.
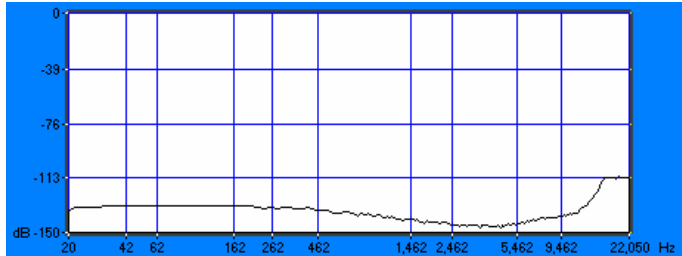
Noise Shaping

Noise shaping makes the dither and quantization noise even less audible by shaping the noise so that it is lower in the most audible frequency ranges and higher in the less audible frequency ranges.

The following pictures illustrate the effect of noise shaping on pure dither.

Dither without noise shaping

Dither with Normal Noise shaping

You can clearly see how the noise is especially low between 800Hz – 12kHz, while above 16kHz, it is higher than in the non-shaped dither noise.

Using IDR360°

Use IDR only when you need to reduce the bit depth of a 24-bit (or higher) master. In example we know a few studios that backup their multichannel mixdowns to a 20-bit digital tape format. In this case, using IDR will assure that virtually no audio information is lost.

When the material you dither is designated to undergo further processing or editing, it is recommended to use *None* or *Moderate* noise shaping. If the IDR is the final process that this material will go through then applying *Normal* or *Ultra* Noise Shaping is quite safe.

You can choose to use the Noise Shaping without Dither. When the Dither is turned off and the Noise Shaping engaged, quantization error noise will still be shifted to the less audible ranges. In any case, the noise level will be very low. When you try to listen to dither, in most cases you will need to amplify the output so that the actual dither noise can be heard over your playback system's working noise floor. When listening for dither in musical content you should try to listen to the effect of the dither on the overall sound rather than trying to separate them. It's easier to measure dither noise than to actually hear it, but listening to the same music with and without dither may reveal subtle differences.

When the Dither is off and the Noise Shaping is set to *None*, the IDR logo will turn gray. This shows that Increased Digital Resolution is off and the audio will be *rounded* to the indicated bit depth. This is still better then straightforward *truncation*.

IDR360° Controls

**Dither: On/Off. Default: On.**

The dither is either on or off. This dither is a wide-band dither. It adds a certain amount of noise causing a 5dB increase in background noise compared to no dither. It completely eliminates all low-level distortion and signal-dependent modulation effects. The result is a very transparent and clean low-level sound with high resolution, most resembling the steady low-level hiss of an excellent quality analog system, minus digital quantization noise. This is the "purist" technology. It is designed for no nonlinear distortion or modulation noise at low levels, and combines optimal dither noise with psychoacoustic noise shaping.

Quantize: 24, 22, 20, 18, 16, 12. Default: 24 bits.
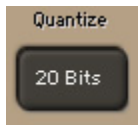
Sets the final target bit resolution of your audio. IDR technology actually enhances the perceptual resolution for the output to greater than the normal capacity of the word length. It is still very important to set the correct target bit resolution so that data is not truncated and lost later. For example, if your final output is a 16-bit format and you set your quantize value to 20-bit then 4 bits of data will be *truncated* to 16 bits, (creating a new generation of error and noise which IDR can reduce or eliminate). In other words, be sure to set the *Quantize* value to the same word length as your target bit resolution!

Shaping: None, Moderate, Normal and Ultra. Default: Normal.
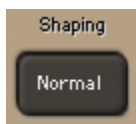
Another way to decrease the perceived amount of noise and increase perceived resolution is to "shape" the frequency content of the noise so it matches the ear's sensitivity curves. In basic terms, *noise shaping* shifts the energy of the noise to the frequency ranges where we hear it the least. Even if the dither is off, the *shaping* can still make quantization noise less audible and content related. This is most recommended when inserting L360° within the mix where many gain stages and processes can later boost the dither noise.