



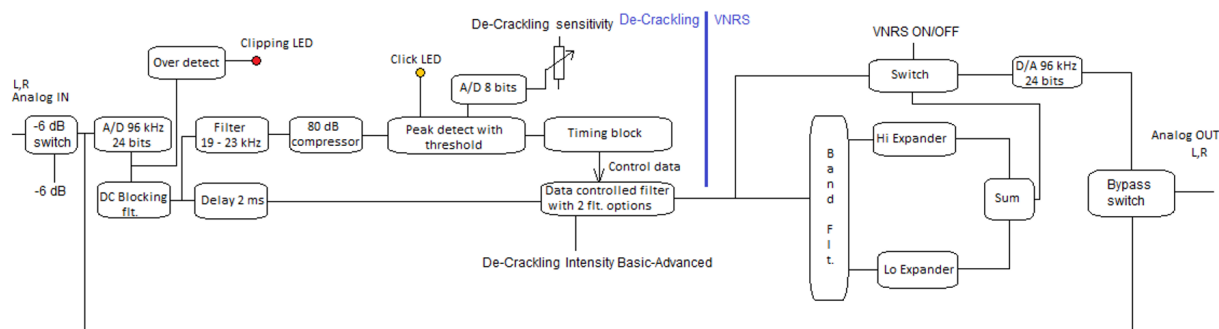
## The Technology of Vinyl NRS Box S3

### A brief overview:

- Dual function – separate De-Crackling and separate Noise Reduction (VNRS)
- Breaks down the complicated topic of vinyl restoration and makes it easy to use
- De-Crackling reduces crackling and clicks
- VNRS reduces noise and turntable drive noise
- Processing based on DSP with 24 bits A/D and D/A converters
- 96 kHz system sampling rate for precise processing in the complete audio band
- All DSP computations use double precision 56 bits accumulator
- Galvanic pure bypass if switched OFF – ideal transfer characteristic and linearity
- De-Crackling with adjustable sensitivity and two intensity levels
- Line-level operation
- Compact design in full aluminium S3 case

First, the line signal gets digitized with a bit depth of 24-bits and a sampling rate of 96 kHz. If the input is too loud, the overflow LED will show it to you. Then we go to the De-Crackling and VNRS systems, which are both separated from each other.

### Simplified block diagram:



## De-Crackling

DC components are removed from by a DC filter, as not to interfere with the processing. The signal is then fed through a 2 miliseconds delay block to the input of a data controlled filter.

The main aspect of the De-Crackling starts with filtering the signal so that only a small band of high frequency components remains. These components are used as markes and ensures that clicks can be seen very accurately by looking at this high frequency content.

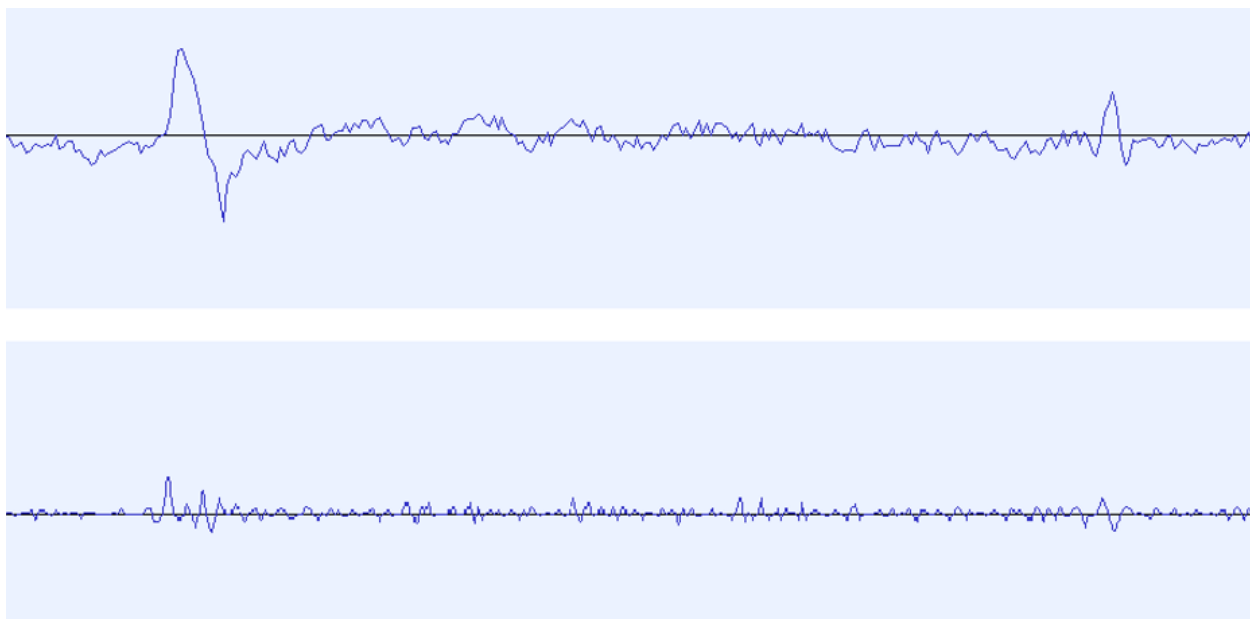
After this comes a compressor. This compressor is working really hard; we see a gain reduction of up to 80dB. This is important, because the result is that the click is even more pronounced and even easier to read. It enables us to work in a wider dynamic range; it makes super loud clicks and super silent clicks equally detectable by the peak detecting algorithm that follows. This Peak Detection algorithm is controlled with the front panel potentiometer and sensitivity button.

The next step is a timing algorithm which figures out the exact length of the click, and with this information (peak detection and timing) we feed a data controlled filter (IMPORTANT: we don't feed any of the compressed audio etc. to this filter...; completely new, "non audio" control data is generated). This is a low pass sliding band filter which in the moment of the crack/click slides to minimum frequency and creates between 5 - 8dB of click reduction depending on settings. This minimum frequency is actually chosen by the intensity button. Off is 3kHz/-5dB and On is 2kHz/-8dB (ON is way more aggressive). This way only the upper mid/high frequency ranges where clicks are most dominant and human hearing is most sensitive are affected.

To put things in perspective: a decrease of 6dB means halving the actual voltage. So if a click before was around 2V strong, then after the processing with -8dB, the click is only 0,5V strong. The strenght of the click has been reduced by 300%! So while the number in dB seems „small“, if you calculate it out, the difference is huge!

De-crackling takes 2ms of processing time and is happening as a side chain. The main signal is delayed by 2ms, and this signal is the actual audio input of the data controlled filter.

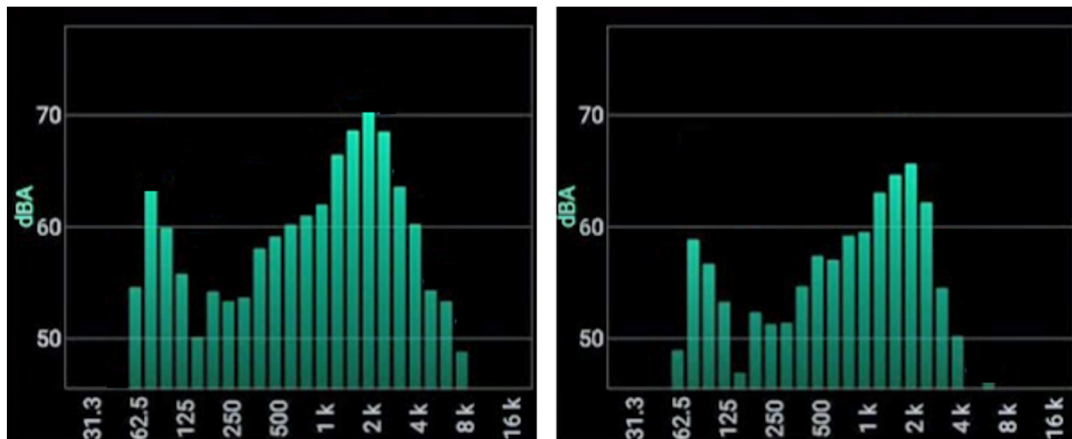
**Noise and crackling reduction: both De-crackling and VNRS activated.**  
**Top original, bottom reduced:**



## VNRS (Vinyl Noise Reduction System)

The signal is first separated into two frequency bands with a Linkwitz-Riley type filter, 24dB/oct at 243 Hz, and then fed into two expanders, which increase the signal-to-noise ratio. There are no noise modulations audible using this technique! It also allows us to treat turntable drive noise separately from vinyl background noise. The VNRS system achieves an improvement in the signal to noise ratio by 5 - 8dB.

### Spectrum of silent groove: both De-crackling and VNRS activated. Left - OFF and Right- ON



Reduction of vinyl surface noise (peak at 2 kHz) by approximately 6 dB, reduction of turntable drive noise (peak at 80 Hz) by approximately 5 dB

## True Bypass

If the Vinyl NRS Box S3 is switched off, the De-Crackling and VNRS systems are bypassed galvanically. This means the input RCA connectors are galvanically linked to output RCA connectors. At the same time, the A/D converter is also disconnected from input for ideal linearity.

## Vinyl NRS Box S3 - Final summary

**Sophisticated DSP algorithms** - Our DSP algorithms are the result of many years of developing studio-level audio devices for recording and broadcast industries. The entire system and all computations run on 96 kHz sampling rate for maximum resolution. All processes are driven by true RMS value computations. They used filters with Linkwitz-Riley approximation have an IIR structure with infinite response, guaranteeing handling of all sound detail as smooth as possible. All computations are realized with double precision in a 56 bits accumulator, resulting in a high precision representation of the audio signal.

**Dual system conception** – De-Crackling part is realized independently from VNRS. This dual conception strictly separates particular calculations. You can separately use De-Crackling or VNRS or both functions.

**One PCB design** – There are no wired connections or internal connectors in the design. It is a pure one PCB solution for the best signal-to-noise ratio and lowest possible distortion. Galvanic pure bypass when OFF means the Vinyl NRS Box S3 can comfortably stay in the signal chain when not in use.

**High quality linear power source** – The power input is filtered and linearly stabilized for the internal voltage bus (no switching power source inside). It allows maximum purity for the circuitry resulting in proper high quality sound.