KNIF SORA

MASTERING SATURATION & DISTORTION DEVICE

USER'S MANUAL

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1 OVERVIEW

Knif Sora is a versatile push-pull tube saturation and distortion device intended for audio mastering and mixing applications. Due to the wide range of precision controls it excels in mastering and master bus use, but the use range covers many other grounds as well. Sora is equipped with MS encoding and decoding, two sets of different interstage transformers, and a wide variety of precision adjustments for ultimate versatility. The character of the unit is created solely by the SQ Phillips NOS pentode tubes and the Lundahl interstage transformers. There are two C-core transformers available, a silicone iron core and a nanocrystalline, and the Sora design allows the user to toggle from one to the other during operation. While the silicon iron represents a "normal" transformer with some character, the nanocrystalline has virtually no hysteresis, thus adding no coloration throughout the audio range. The rest of the circuit utilizes the best available JFET input IC operational amplifiers (OPA828) for absolute transparency. One of the key features of Sora is the opportunity to select the frequency range to be processed using the X-Over filters while retaining a flat frequency response. Sora also features a parallel processing capability and an unprecedented ability to tailor the distortion spectra. All rotary controls, except X-Fade, utilize Elma rotary switches for ultimate precision and longevity. X-Fade is an Alps Blue potentiometer which is known for an excellent channel balance. There are three regulated low voltage supplies and no less than six regulated high voltage supplies. The voltage supplies consist of a separate anode HV supply for each channel and an adjustable HV supply for each tube's screen grid, allowing for individual bias current setting without compromises in dynamic response.

2 SIGNAL FLOW

After de-balancing the input signal is processed in the following order:

- MS encoding circuit (MS Input), which is bypassed by default but can be activated from the toggle switch in the front panel.

- EQ filter, which is bypassed by default but can be activated from the Mode control in the front panel, selects the frequency range that is fed to the distortion circuit. The mode switch represents the first order EQ curve type used for the distortion path:

    - High-pass & low-pass
    - Band-pass
    - Band-reject
    - Wide mid band-pass
      (see Appendix 1 for filter response curves)

  The clean path which bypasses the distortion is fed with a complementary filtered signal.
  The summing of these signals at unity gain results in a flat frequency response.

- Divided into parallel and distortion paths. These are mixed at X-Fade potentiometer which allows for smooth fades from unprocessed to processed.

- Input Gain for adjusting the drive level to tube circuits.

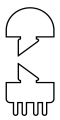
- Symmetry adjustment that controls the signal drive balance to the push-pull tube circuits.

- Tube amplifier which is where the magic happens. The negative feedback of this circuit is disabled by default, but can be activated to either a 5 dB or 10 dB level from the front panel toggle switch. Note, that for the sake of convenience, the feedback gain loss (5 dB or 10 dB) is compensated automatically prior to the tube stage.

- Transformer type switching, in which the user can choose between a nanocrystalline and silicon iron core.

- Output Attenuator for the tube stage.

- X-Fade potentiometer for controlling the blend of distorted and parallel signals.



- Mixer circuit for summing the filtered and complementary signals.

- MS decoding circuit (MS Out), which is bypassed by default but can be activated from the toggle switch in the front panel.

- Output amplifiers for drive and balancing.

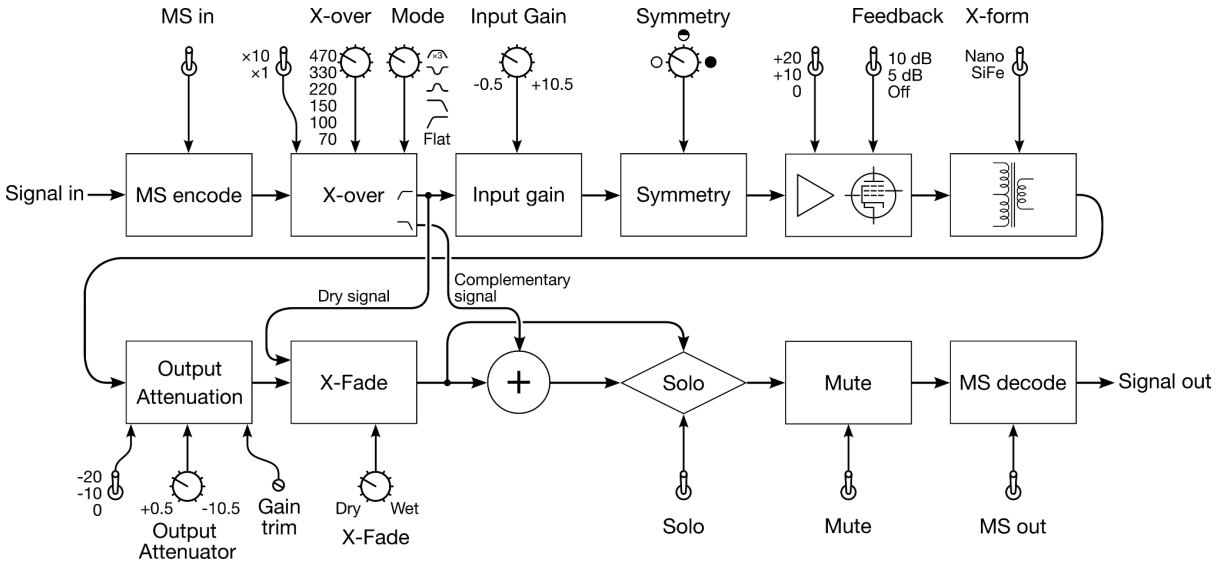


Figure 1. Flowchart.

3 FRONT PANEL

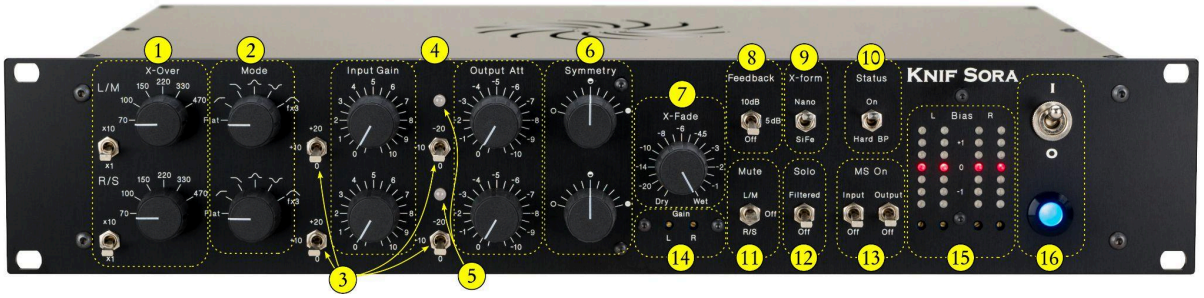


Figure 2. Sora front panel.

Most controls on the front panel are self-explanatory but some require clarification. Starting from the left:

1 **×1/×10** and **X-Over** control the frequency range of the filters. **×10** results in frequencies one decade above the numbers given on the dial.

2 **Mode** selects the frequency range that is fed to the distortion circuit. Positions 2–5 are obvious. The last position is a very broad mid range pass filter. When in use the frequency values are tripled and the ×10 switch is automatically disabled.

3 **0/+10/+20** and **0/-10/-20**. Since **Input Gain** and **Output Attenuator** utilize 0.5 dB steps for precision tasks there are gain range extension switches for scaling purposes.

4 **Input Gain** and **Output Attenuation**. Control the signal level prior and after the tube circuitry. Note the direction of the rotary switches. Clockwise is more gain and more attenuation.

5 **Tube stage signal level LEDs**. These tri-color LEDs indicate the following conditions:

color	3rd harmonic, typical at onset	condition
green	0.2%	signal peak level is adequate for very mild saturation
yellow	2%	intermediate levels are reached
red	11%	the tube amplifier has reached class AB and is clipping heavily but still with a soft character

6 **Symmetry** is a bit more difficult to describe in simple terms, but in general it controls the symmetry of the wave shaping transfer curve, in simple cases just the amount and phase of second harmonic distortion. In the middle position there are no second or higher even order distortion components. Clockwise the even order components increase and are in phase with the signal, counterclockwise they are out of phase.

7 **X-Fade** simply adjusts the desired blend of undistorted signal and the distorted one. Look at the signal flow diagram to understand the signal routes.

8 **Feedback** modifies the distortion level and transfer curve type. At moderate signal levels it simply decreases the amount of third harmonic (but not even order harmonics) and at higher levels it modifies the curve to clipping from very soft to a bit harder (but still not a brick wall type). It also affects the transformer coloration amount due to a more controlled drive impedance.

9 **X-Form** toggles between the two interstage transformers. Changing the position of the switch triggers Sora to switch on hard bypass for a period of roughly 500 ms to avoid any switching pops, allowing this control to be used while the unit is operating.

10 **Status** switches off the hard bypass.

11 **Mute** allows each channel to be muted individually.

12 **Solo** filtered path. Note that you will also hear the parallel path, since that is also filtered. To only hear the filtered and distorted tube amp path turn X-Fade fully clockwise.

13 **MS On** switches turn on MS encoder and decoder.

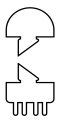
14 **Gain trimmers**. Since Sora is a precision tool, basic gain calibration is provided at the front panel.

(Note! Before performing any gain adjustments, it's recommended to check the bias currents and adjust if needed. This procedure is explained in the following paragraph.)

Procedure:

a Turn all controls to zero
b Turn Mode to flat
c Make sure MS in and MS out are switched off
d Turn X-Fade to Wet (fully clockwise)
e Adjust gain to unity from the trimmers

The gain trimmers only affect the tube amplifier, nothing else requires trimming.



15 **Bias meters** and **Bias adjustment trimmers**. These meters show the average current flow through the tubes. If the bias current of an individual tube varies more than one step from the 0 value on the bias meter, adjusting is recommended.

Trimmers from left to right: Left channel tubes 1 and 2 and right channel tubes 1 and 2.

Procedure:

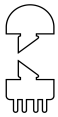
a Let the unit warm up for 15 minutes
b Make sure no audio is present at the input
c Adjust the current of each tube using a small flathead screwdriver until the LEDs indicate 0 (middle of range)

(Note! when feeding the unit with audio, the bias currents will also change according to the audio signal level.)

Once the tubes age it is required to adjust the bias every now and then. Each device is shipped from the factory with one spare set of tubes. When it is no longer possible to adjust the bias to zero it is time to retube. Once these are worn out, contact Knif Audio for a matched set on new tubes.

For the tube replacement procedure refer to chapter 9.

16 **Power switch** and **Indicator**



4 REAR PANEL

Figure 3. Sora rear panel.

1 **Audio connections**. All inputs and outputs are balanced and non-floating. If output is converted to unbalanced, leave pin 3 floating. Do not ground output pin 2 or 3. Converting to unbalanced reduces output by 6dB.

2 **Mains power**. CAUTION! Sora has a mains voltage selector for use with either 115 VAC or 230 VAC mains voltage.

Before connecting mains power, always make sure that the voltage selector switch is set to the appropriate voltage and the fuse is selected accordingly!
115 VAC and 800 mA (T) / 230 VAC and 400 mA (T)

In case the mains fuse blows, only replace it with a slow blow fuse of the correct value.

5 RACK MOUNTING

The power supply and tubes in Sora dissipate a lot of heat. Care should be taken to provide sufficient means of ventilation. At least one half rack unit empty space is required above the device and placing other hot-running gear right below Sora is not recommended. If the front panel or sides of the device are uncomfortable to touch (above 50 °C or 120 °F), further actions are required.

6 BEGINNER'S GUIDE

Due to the multitude of features, Sora can be a bit intimidating to approach at first. It is suggested to first disengage **MS**, **X-Over**, **Feedback** and set **Symmetry** to the middle position and **X-Fade** fully clockwise. Now you can start to increase **Input Gain** and **Output Attenuation** synchronously and listen to pure, symmetrical tube push pull saturation, which resembles soft clippers or tape saturation. Typical 3rd harmonic distortion values (without feedback) at the onset of signal level LED illumination are:

color	3rd harmonic, typical at onset
green	0.2%
yellow	2%
red	11%

At higher signal levels the 5th harmonic component will begin to increase, using feedback will further make the change from linear range to clipping more abrupt and thus increase higher harmonic content. Once you get used to the symmetrical distortion it is time to start to tweak the **Symmetry** control. At extreme ends of the control and low to medium drive levels the amount of second harmonic will be much higher than the third and the character is quite soft and warm. Probably the next logical step for mastering and mixing purposes is high pass or low pass filtering. And then parallel. And then MS.

Tips and tricks

The filters are extremely useful in many situations. Don't forget to experiment. Using opposite phases of even order harmonics in Left and Right channels can be used for achieving unusual widening effects of mono sources or even in some mixes (symmetry switches in opposite directions). The phase of the even order harmonics do make an audible difference. Sometimes less, sometimes more. Remember to check it out (symmetry switches in CW direction for in phase and CCW for out-of-phase harmonics).

7 TECHNICAL SPECIFICATIONS

INPUT		
Impedance		20 kΩ
Maximum Level		+26 dBu
Connectors		XLR female, Neutrik, 3-pin, gold-plated
OUTPUT		
Impedance		100 Ω
Maximum Level		+26 dBu
Connectors		XLR male, Neutrik, 3-pin, gold-plated
GAIN RANGE		
Input Gain	*Distortion Path*	-0.5 dB ... +30.5 dB
Output Attenuation		-30.5 dB ... +0.5 dB
PERFORMANCE		
Frequency Response	*-1 dB, Without Filter, Ref. 1 kHz*	10 Hz ... 50 kHz
Phase Response, Distortion Path	*0 dB Feedback* *10 dB Feedback*	-10° ... +21° -1° ... +13°
Third Harmonic Distortion at Unity, Symmetry at 50/50, +18 dBu	*0 dB Feedback* *5 dB Feedback* *10 dB Feedback*	0.4% 0.3% 0.2%
Second Harmonic Distortion Adjustment Range	*Unity Gain, +18 dBu*	0.1% ... 10%
Noise Level	*A-weighting, unity gain* *A-weighting, typical usage*	-85 dBu ≤ -90 dBu
Crosstalk	*1 kHz* *10 kHz*	-95dB -75dB
MAINS		
Mains Voltage		115 / 230 VAC, selectable
Mains Frequency		50 / 60 Hz
Power Consumption		54 W
Connector		IEC, C13
GENERAL		
Dimensions	*w* × *l* × *h*	430 × 352 × 88 mm (2U)
Weight		10.2 kg
CONTENT		
Sora Saturation Device		1 pcs
Spare tubes		1 set

WARRANTY
2 years (Refer to chapter 10 for terms and conditions)

8 SOME DISTORTION SPECTRA

These charts represent some typical settings, but obviously are not meant to be all-inclusive.

X-axis range:

- 0 dB on the X-axis refers to a level of +18 dBu inside the unit (i.e. a typical studio environment maximum) and **Input Gain** and **Output Attenuator** controls are at unity.
- 20 dB means the input level switch has been turned to +20 and the level fed to Sora is +18 dBu.

Symmetry 0% (or 100%)

- results in maximally non-symmetrical drive.
- produces the largest amount of even harmonic distortion before odd harmonics begin to dominate (see Figure 4).

Symmetry 50%

- Drive is as symmetrical as tube balance permits, hence very little even harmonics are produced.
- Clipping is approached very gracefully and softly (see Figure 5).
- adding 10 dB of feedback (see Figure 6) increases linearity at moderate levels and makes clipping more acute, producing more higher harmonics.

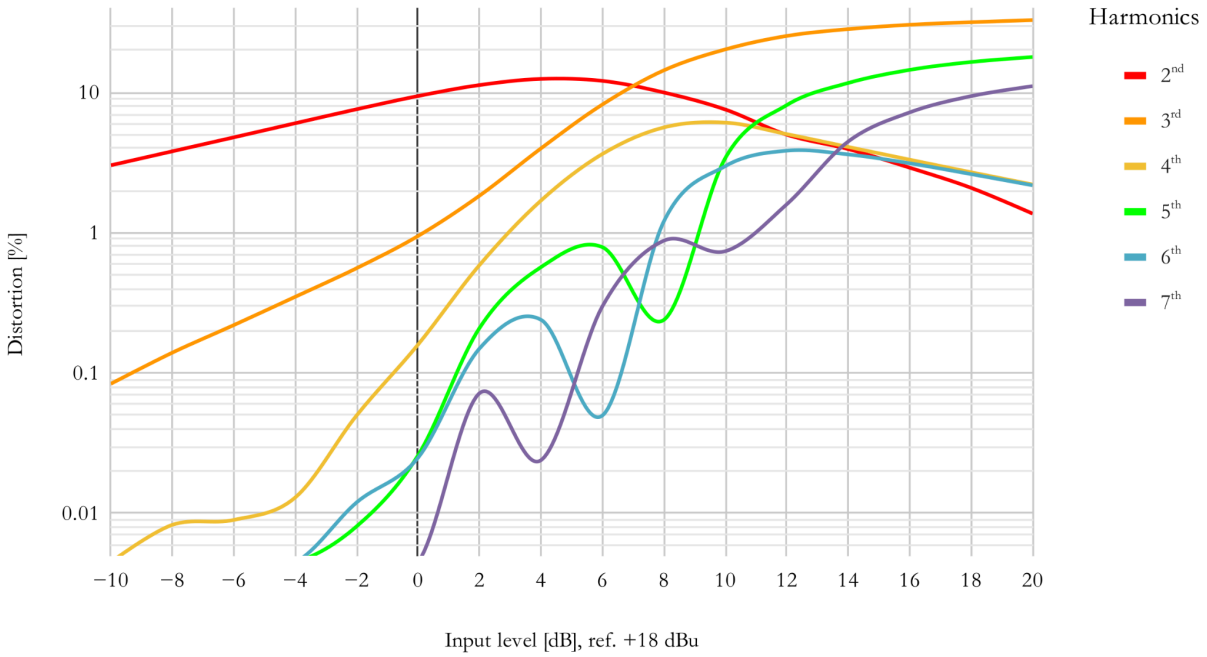


Figure 4. Symmetry 0%, no feedback.
Asymmetric drive produces the largest amount of even harmonics.

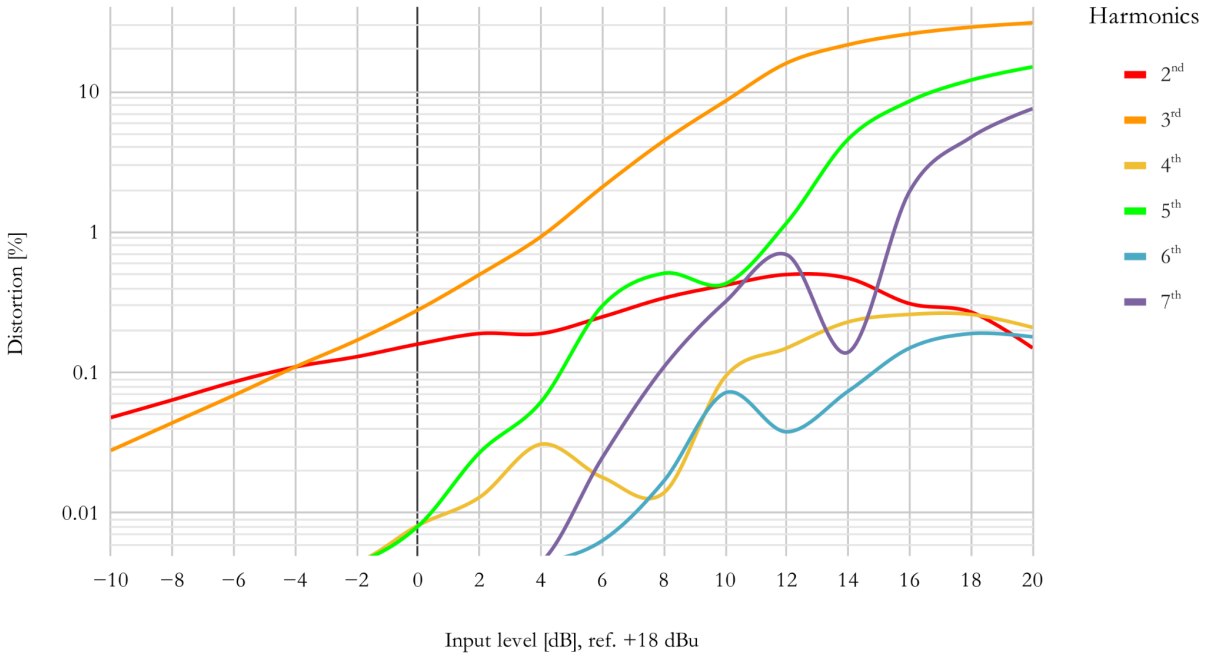


Figure 5. Symmetry 50%, no feedback.
Fully symmetric drive results in low levels of even harmonics.

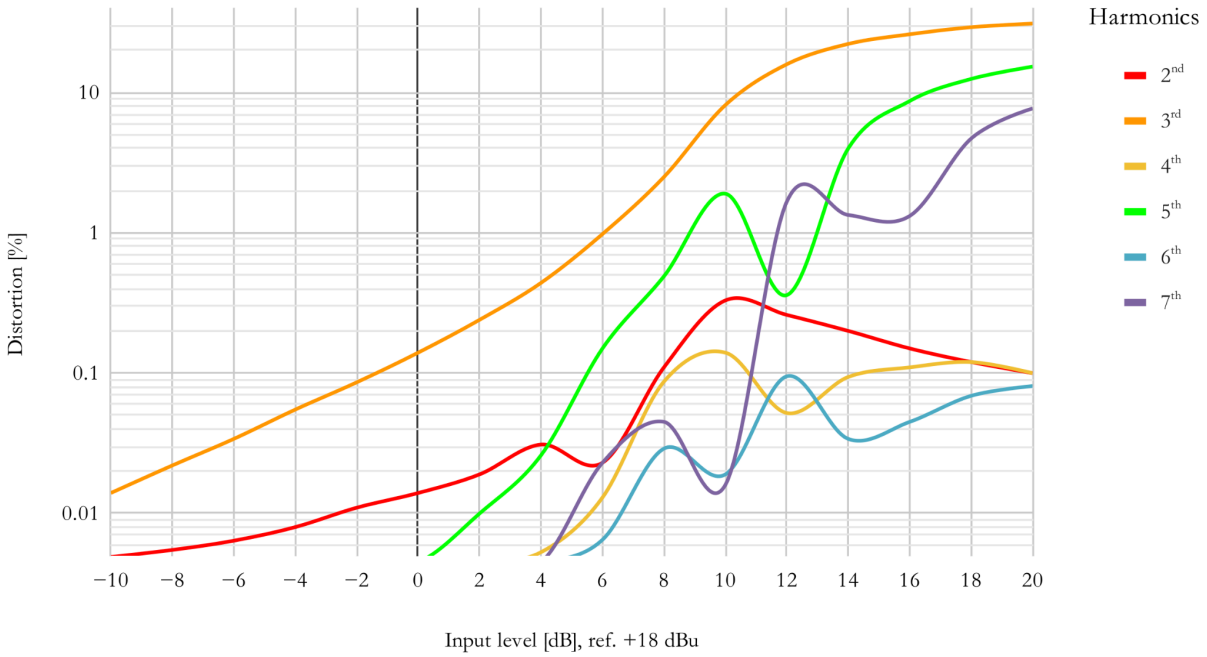


Figure 6. Symmetry 50%, 10 dB feedback.
Adding 10 dB of feedback increases linearity at low levels.

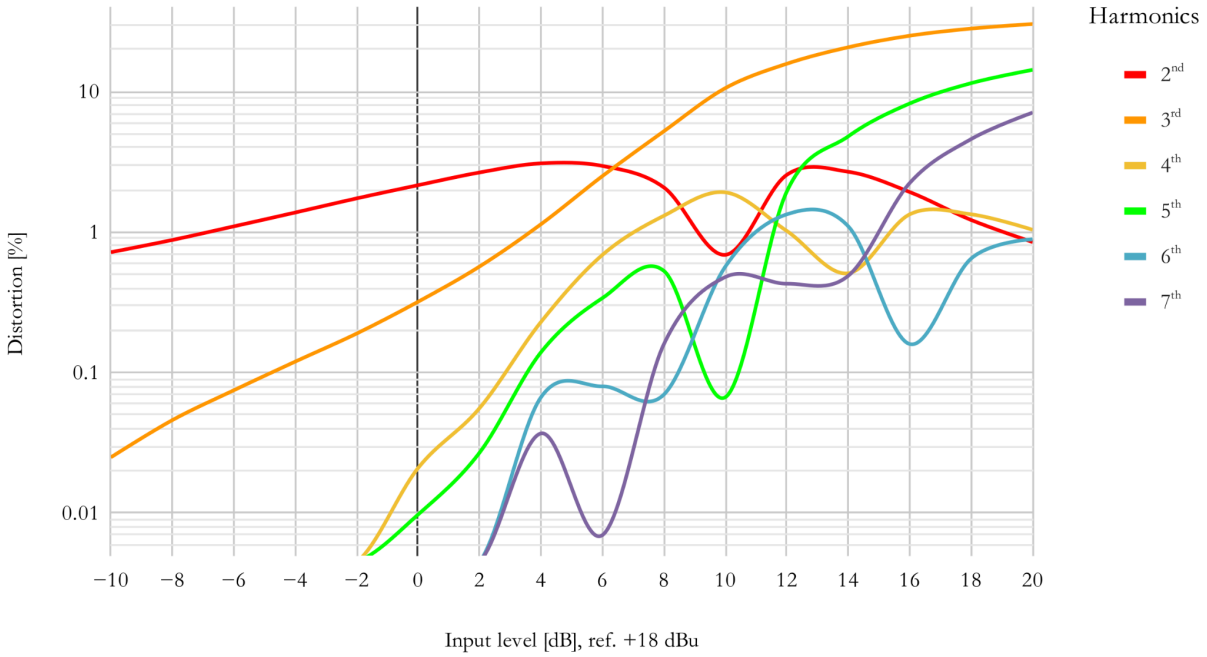


Figure 7. Symmetry 20%, no feedback.

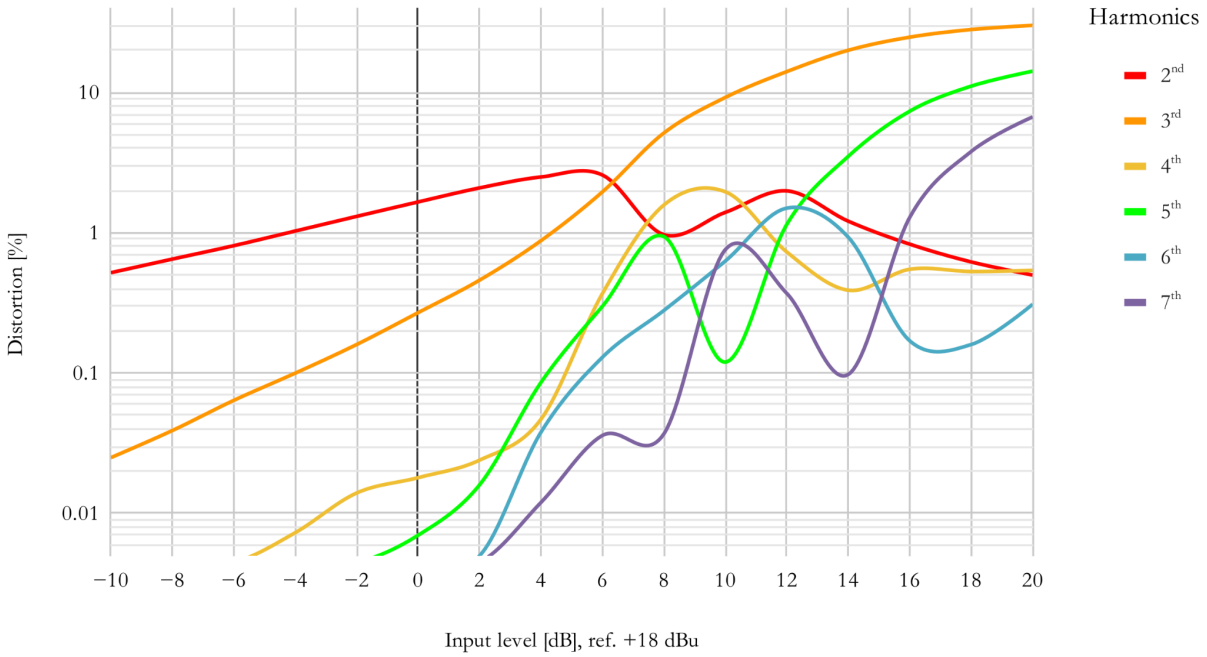


Figure 8. Symmetry 20%, 10 dB feedback.

9 REPLACING THE TUBES

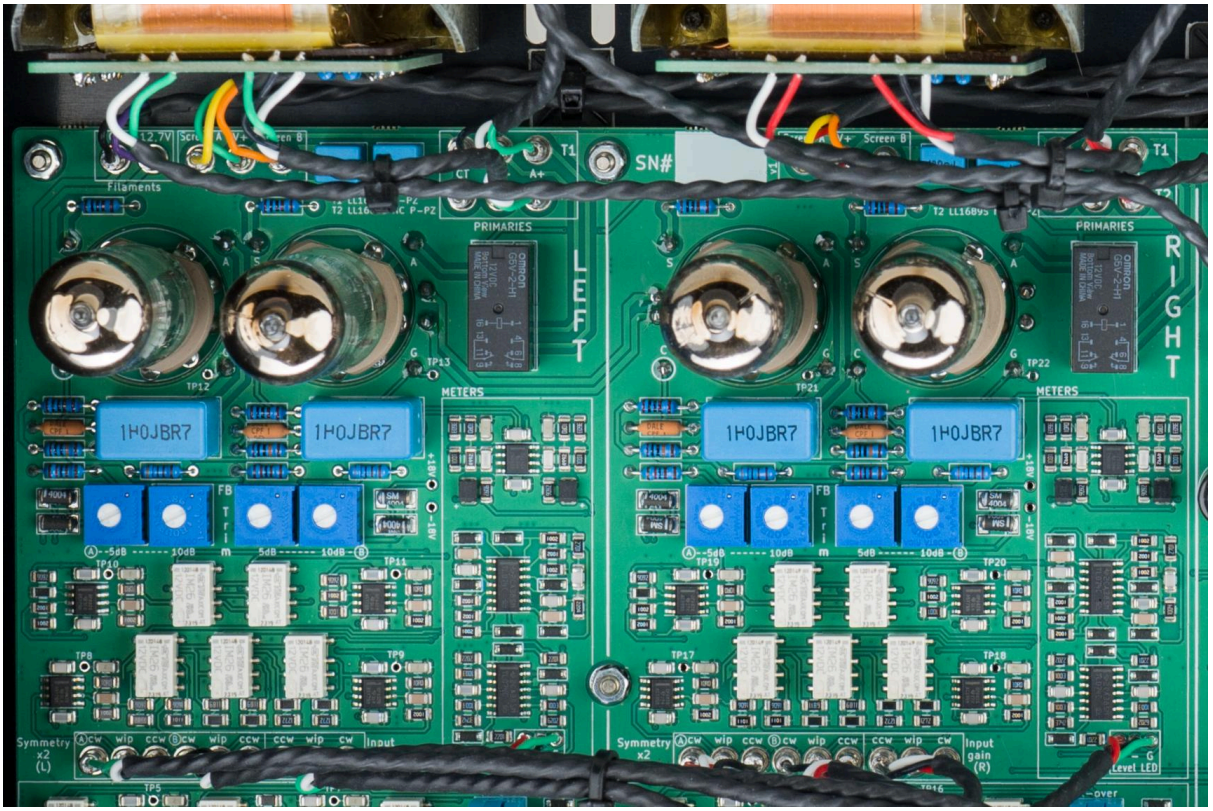


Figure 9. The location of the tubes and feedback trimmers

Replacement of the vacuum tubes can only be performed by a qualified technician. The procedure requires operating and adjusting the device with the cover removed and there are **lethal voltages** present in the device.

In order for Sora to reach its full potential a set of tightly matched vacuum tubes is required. Please contact Knif Audio for a set of replacement tubes matched specially for this particular circuit based on several parameters.

Procedure:

- Remove the top cover using 2.0 mm and 2.5 mm hex keys.
- Work the old tubes out by gently rolling them until they come out of the socket. Insert new ones in the same fashion. Do not force it! The set is a matched quad, so order doesn't matter.
- Set all gains to 0 dB for unity gain. Make sure MS, Solo and Mutes are disengaged.
- Adjust the bias point of the tubes as described in chapter 3.
- Insert a test signal of 0dBu to the input of both channels and turn the **Status** switch to **On**. The actual signal level is not critical as long as it's around 20 dB below the maximum signal level in order for the device to operate below the distorting range.

- Set **Feedback** to 0 dB ("Off") and adjust the gain trimmers in the front panel for unity gain (0 dBu) at the output.
- There are four feedback trimmers per channel on the main PCB as can be seen in figure 9. The ones marked with 5 dB (one on "A" side and one on "B" side) adjust the feedback on the positive and negative sides of the push-pull configuration when 5 dB feedback is selected. The same applies to 10 dB trimmers. Adjust the trimmers in pairs i.e. pointing in the same direction.
- Set **Feedback** to 5 dB and adjust the trimmers marked with 5 dB until unity gain is achieved.
- Set **Feedback** to 10 dB and repeat for the 10 dB trimmers.

10 WARRANTY TERMS AND CONDITIONS

- Each Knif Product is covered by a two (2) year limited warranty from the original date of purchase, covering faulty workmanship and defective materials. The warranty is assigned to the first buyer and backed by the original invoice.

- During the warranty period, Knif Audio and/or their appointed resellers, will repair or replace, at Knif's discretion, any defective part that fails to meet factory specifications.

- Warranty related shipping charges will be split equally between Knif Audio and the buyer.

- The Knif Audio warranty is provided only to the first user/buyer of the product, and cannot be passed on to a third party. Knif Audio has no warranty obligation to users that have not purchased the product from an authorized Knif Audio dealer or Knif Audio directly.

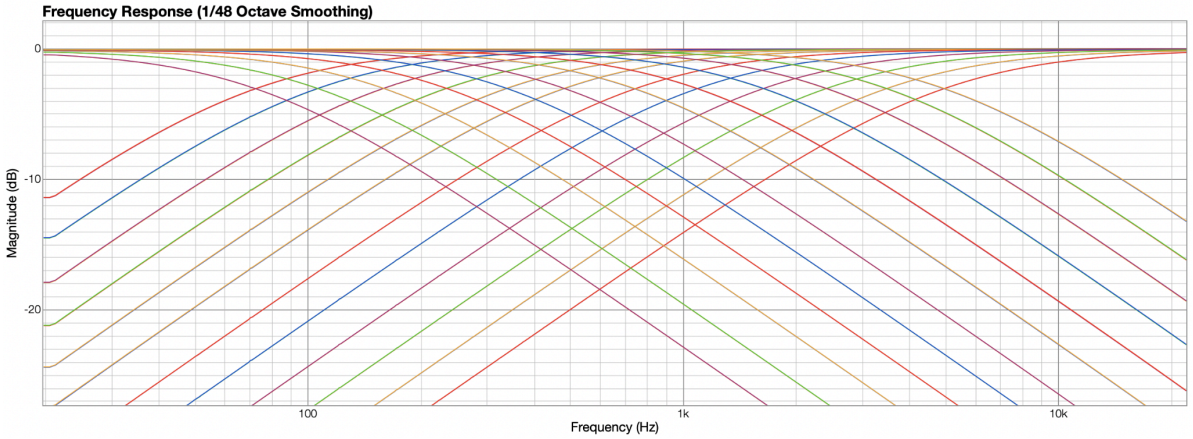
- Any warranty claim should be submitted to the selling dealer or distributor, and if this situation is not possible, to Knif Audio directly.

- The warranty does not apply in case of defects caused by the following events:
    - accident, flood, fire, or other acts of nature.
    - normal wear and tear.
    - abuse, misuse, negligence or failure to observe the instructions contained in the user's manual obtained at the time of purchase.
    - the product has been altered or repaired by anyone other than Knif authorized service facility.

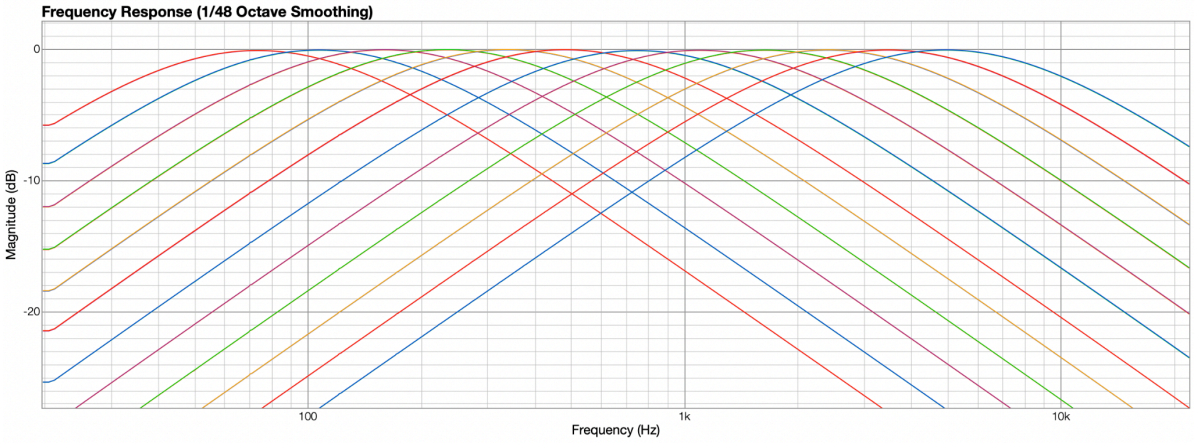
- In the continued effort to improve products, Knif Audio reserves the right to make improvements without notice. Specifications are subject to change without notice.

- No other written or oral warranty applies.

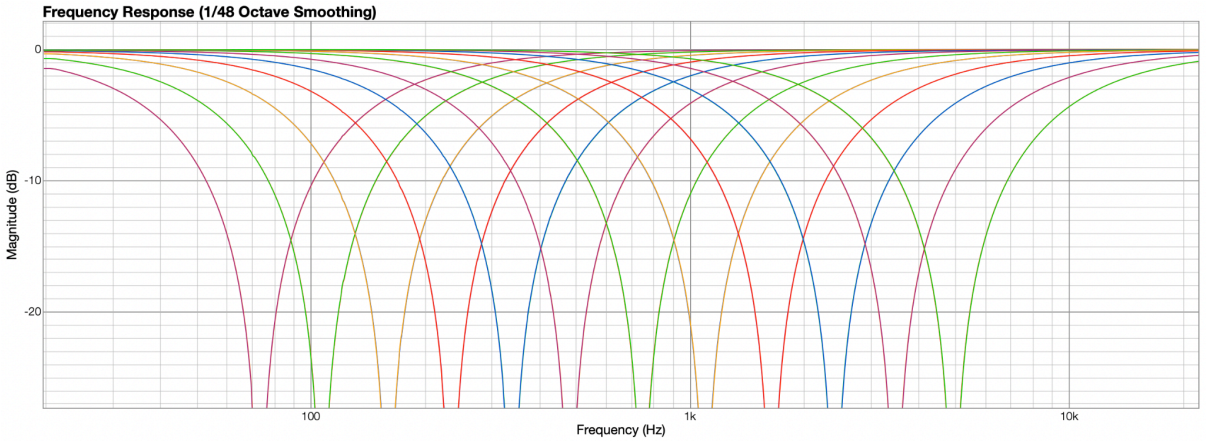
APPENDIX 1 X-OVER CURVES



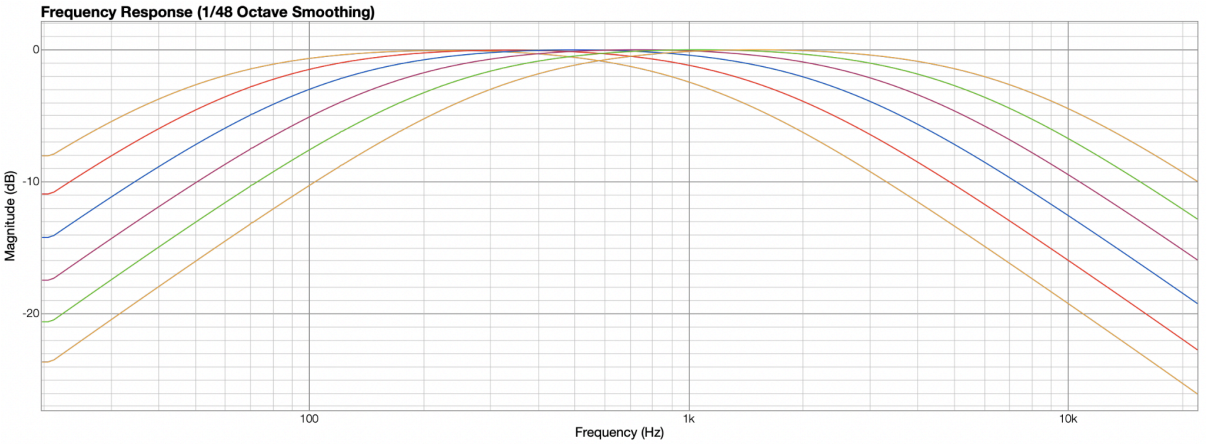
Low-pass and high-pass filters



Band-pass filter



Band-reject filter



Wide band-pass filter