SM630 AWS: User's guide

Thank you for purchasing an SSSR Labs module! We wish you a long and fruitful experience with this module. On pages of this manual, we will explain how to use the SM630 AWS.

The AWS is an analogue non-linear waveshaper with voltage controlled gain and symmetry, and three selectable modes of shaping.

Warning!

Do not connect the unit to a modular system having 15-volt power lines. This unit was not tested for proper operation with 15-volt systems and there is a possibility of overheating and further damaging certain components of the unit.

Do not connect any voltage or current sources that are not intended to be used as musical instrument sound or voltage control outputs to the unit's inputs/outputs! Although this module has 100 kOhm input resistance at each input, protecting it from any reasonable misuse, connecting low-impedance current sources such as power sources of any kind can cause damage to the unit. Under no circumstances do not put the AC Line power, lightning rod, tesla coils, defibrillators, electro-shockers and Thor's fingers to the input.

Not observing the above instructions cancels the warranty!

CONNECTING THE UNIT

The unit is equipped with a 10-16 pin Eurorack power/control cable. The unit has a keyed power connector that prevents the unit from the power connector being plugged in wrong. However when using a 3rd party power cable or non-keyed power busses, please make sure that the -12 V line is physically connected to pins 1-2 (below), marked with the **ЯED STЯIPE** label.

THE THEORY OF OPERATION

The AWS stands for Alisa Wave Shaper, which means that this module is a modular equivalent to the harmonics section of the Soviet synthesizer, Alisa-1377. This waveshaper is designed for use with sources of continuous waveforms, especially harmonically poor waveforms, such as triangle or sine wave. Technically, AWS is a non-linear function processor consisting of wave folding VCA stage followed by two special non-linear stages connected in series. Those stages alter certain portions of input waveform the way, that they change their phase and direction.

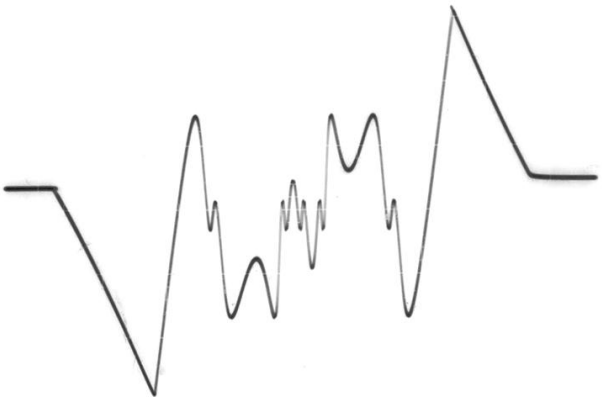
Wave folding VCA

The difference between a normal VCA and a wave folding VCA is that a normal amplifier implements a simple linear gain function, $Y=KX$ where X is the input and K is the gain CV amount. Any electronic linear amplifier stage has a maximum level, which limits the output signal, causing distortion. The wave folding VCA has a threshold level too but when output exceeds this level, it changes its phase proportionally to the overload amount. This means that the portion of the signal that should have been above that level softly reverses its direction and aim to the opposite threshold level. This process is traditionally called

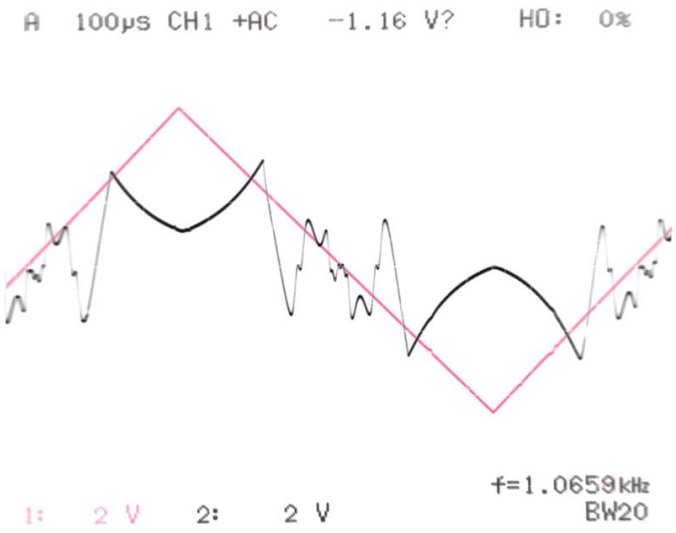
wave folding. The simplest wave folding function example is ***Y=K(sin (AX+S))*** where ***X*** is the input, ***A*** is the gain, ***S*** is the symmetry offset and ***K*** is the post-amplification. But if the sine function is continuous, the real wave folding amplifier still have a limit after a certain number of folding cycles. The characteristic curve of the VCA is symmetric and has a relatively narrow linear region at the center. So when the input signal is well-balanced, the positive and the negative half-periods are folded almost equally. With the symmetry control, you can shift the signal from the balanced region to process each half-period differently.

Non-linear circuit

This circuit has a linear dynamic response over almost whole voltage range except for a small region near the zero-crossing, inside which the response curve is exponential. The difference between the normal and non-linearized signals is being inverted, amplified and added to the post-amp signal. This causes intense harmonic enrichment with the character directly dependable from the gain and symmetry. In fact, this circuit works as a high-gain amplifier for any signal at the zero-crossing. Originally, this waveshaper was designed to work with an oscillator, which is always turned on, so it's not designed to process silence. Because of that, if there's no significant input signal and the symmetry is set to a very precise ideal balanced position, the ground noise and hum will be amplified by the non-linear circuit and will become noticeable. Because of the same reason, turning the symmetry knob with silence at the input will give a noticeable rustle at the output.



AWS Characteristic curve



Waveshaping

FRONT PANEL CONTROLS

The controls of AWS are very straightforward.

1. The VCA gain amount is controlled by initial setting adjusted with the **DRIVE** knob, mixed with the voltage at **DRV** input attenuated by the **DRIVE CV** knob. The leftmost position of the **DRIVE** knob sets the VCA to zero gain and the rightmost position sets it to intense wave folding.

2. The symmetry of the VCA is controlled in the same manner with the **SYMM** input, **SYMM** offset knob and **SYMM CV** attenuator. The balance for modes 2 and 3 is achieved when this knob is set to the center position. For mode 1, the well-balanced setting is at 10 o'clock.

3. With the **COLOR** switch you change the behavior of the non-linearizing circuit. The default position is **2**, in which AWS gives the bright, metallic character of the Alisa-1377 waveshaper. Position **3** is almost the same as 2 but with filtered top-end. Switching to position **1** enables the feedback loop between two stages, which gives a different character having narrower spectrum and more emphasized 2nd harmonic.

4. The **MIX** knob sets the balance between dry and shaped signals for the **MIX** output. The wet signal is always presented at the **WET** output.

DC-COUPLED CONNECTIONS CONSIDERATIONS

AWS intentionally has DC-coupled input and outputs, which also gives you ability to process low-frequency oscillators, envelope generators or even sequencers. When the symmetry is not in center position, there is DC offset presented at the outputs. In the most situations it's not important because usually, subsequent mixing stages, VCAs, filters and effect processors have AC-coupled inputs, which eliminate any DC component from the signal and helps to improve the headroom, but putting a decent DC offset can cause distortion at subsequent audio input stages if they have a DC-coupled inputs. If it happens, you need to put an additional AC-coupled module or a decoupling element (transformer, capacitor) between them, or attenuate the signal to keep it within the input range of the module, next in the chain.

Please keep these considerations in mind when planning your patch.

Technical specifications

- Recommended input audio signal amplitude: **±5V**
- Recommended CV amplitude: **±5V**
- Audio signal and CV frequency: **DC–20kHz**
- Module width: **10hp**
- Module depth: **33mm**
- Dimensions: **50×129×55mm**
- Weight of the assembled module (inc. power cable and screws): **143g**
- Current draw (+12v): **15mA**
- Current draw (-12v): **15mA**