

## INTRODUCTION

Moving from mono to stereo sound: a logical progression for any synthesist looking to expand their sonic palette. Making use of two audio channels, rather than just one, quite literally adds another dimension to the capabilities of a synthesiser.

Unfortunately, controlling stereo signals can be a challenge within a modular system. This realisation led to the development of Enhance 2: a convenient yet high-fidelity tool for stereo enhancement. It can be used to adjust balance, width and spectral content, while also opening up a world of mid/side processing; all under voltage control and in just 8 HP.

The primary stereo parameters are balance (moving the sound left or right) and width (making it narrower or wider). The balance circuit uses a true constant-power gain law, while the width stage allows for seamless transitions from pure mono to extra-wide stereo.

In addition, tone control is provided by a pair of unique, wide-ranging mid/side voltage controlled tilt filters with selectable corner frequency. These make 'cleaning up' a muddy-sounding mix straightforward, but also provide unique binaural effects when modulated.

Mid/side processing encodes the stereo signals into one containing only the mono material (mid), and another containing the differences between both channels (side). Apart from the internal tilt filters, mid/side outputs also enable external signal processing such as compression or reverberation. An integrated mid/side decoder returns the results back to standard stereo. And at all times, a LED bar phase meter ensures that phase correlation can be easily maintained.

Stereo field modulation, mid/side equalisation and beyond; Enhance 2 brings true analogue stereo control to the Eurorack world.

## CONTENTS

In the Enhance 2 box, you'll find:

- Product card, stating serial number and production batch.
- 16-to-10-pin Eurorack power cable.
- Mounting hardware: two black M3 x 6 mm hex screws, two black nylon washers and a hex key.
- The Enhance 2 module itself, in a protective cotton bag.

If any of these items are missing, please contact your dealer or [support@joranalogue.com](mailto:support@joranalogue.com).

## CONTROLS & CONNECTIONS

### 1 PHASE CORRELATION METER

The phase correlation meter is used to gauge the similarity of the left and right stereo output channels. The correlation figure can range from +1 (fully correlated, so no stereo content, only mono), through 0 (no inter-channel correlation) to -1 (the two channels are completely in anti-phase).

A good stereo image is achieved with a correlation factor between 0 and +1. Negative correlation however, indicates a phase issue and is to be avoided. In this case, sound would be lost if the stereo channels were to be mixed into mono (for example, loss of bass during playback on a mono speaker or a subwoofer-equipped sound system).

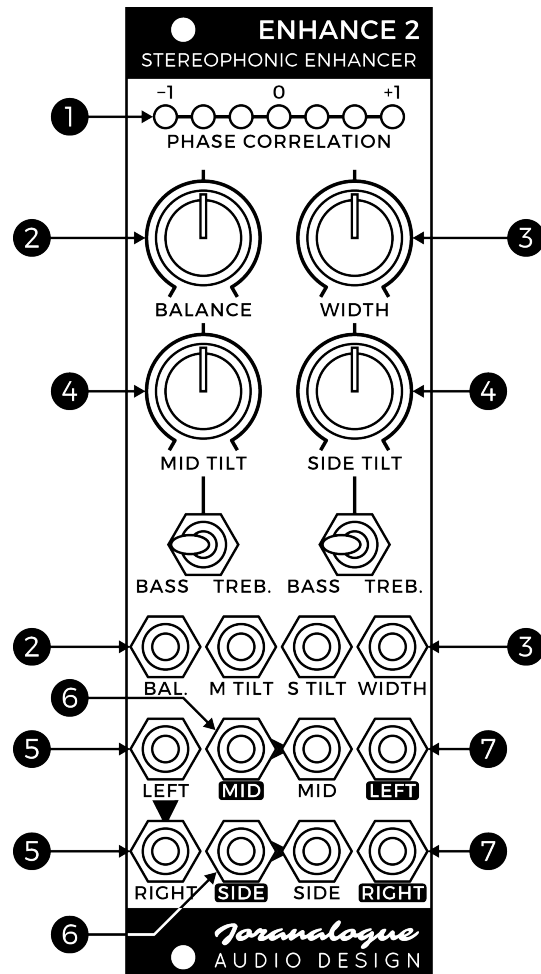
Note that at least 100 mV<sub>pp</sub> of signal is required on both channels to ensure correct phase readings.

### 2 BALANCE KNOB AND CV INPUT

Use the balance control to shift the stereo image left or right.

The gains of both channels are controlled according to a carefully tailored balance law. The opposing channel will be maximally attenuated (approximately -40 dB) when set to either extreme position, while the selected channel will be boosted by +3 dB to maintain constant loudness. Set to the centre position, both channels remain at unity gain.

This parameter can be voltage modulated using the corresponding CV input. With the balance knob centred, the stereo image will shift fully left for a CV of -5 V, or fully right at +5 V.



### **3 WIDTH KNOB AND CV INPUT**

The width knob adjusts the overall 'stereeness', from 0 % (mono mix), through 100 % when set centrally (no change to the stereo image), and beyond up to 200 %.

The width CV input is used to modulate this parameter at 20 %/V. You can achieve extremely wide stereo sound this way, but keep an eye on the phase correlation!

### **4 MID/SIDE TILT KNOBS, SWITCHES AND CV INPUTS**

Enhance 2 uses mid/side processing, a powerful technique for sculpting stereo material. Two new channels are derived from the stereo pair: the mid channel contains only the centred material that is common to left and right, while the side channel isolates the stereo content which differs between both sides. This makes for very intuitive processing.

The tone of each of these channels can be easily adjusted using the tilt filters. They smoothly morph from a +6 dB bass boost and full treble cut when set fully counter-clockwise, to a full bass cut and +6 dB treble boost when set fully clockwise. The centre positions are flat (unity gain).

The corner frequency for each filter can be toggled between bass (250 Hz) and treble (1 kHz) using the range switches.

Modulate the tilt filters using the CV inputs. Moving from flat to either extreme tilt requires a 5 V change in CV.

### **5 STEREO INPUTS**

Connect your pair of stereo source signals here. The entire signal path is DC-coupled.

Mono signals can be processed using just the left input socket, as there is normalisation to the right. Keep in mind that in this case, due to the lack of stereo content, only the balance and mid tilt features will be functional.

### **6 MID/SIDE OUTPUTS**

These are the mid/side outputs of the stereo processor. You can use these for further mid/side processing using external modules.

Keep in mind that for most stereo signals, the mid signal will be much stronger, as there is typically more mono than pure stereo material; or in other words, a high phase correlation.

Both outputs are inverted with respect to the input signals.

### **7 MID/SIDE INPUTS AND STEREO OUTPUTS**

This mid/side decoder allows you to convert a mid/side pair back to stereo. It is fully independent from the stereo processor, except for the normalisation from the processor's outputs to the decoder inputs.

This means that if you do not wish to perform any additional mid/side processing, you can simply use the module's stereo inputs and outputs directly. Otherwise, you can plug your processed mid/side pair into this decoder and get standard stereo outputs. External processing of only the mid or the side channel is possible as well.

Note that the phase correlation meter uses the decoder's stereo outputs as its source pair. This means that the meter will also take in account any external mid/side processing that may influence the phase correlation.

Also be aware that while Enhance 2's entire signal path is DC coupled, the meter will only respond to audio frequencies. To complement the module's inverting mid/side outputs, this decoder is inverting as well, restoring the proper phase relationship of your stereo signals.

## **PATCH IDEAS**

### **STEREO MIX WIDENER**

The most obvious application for Enhance 2 is that of stereo mix widening. However, a full mix cannot simply be made wider without risking phase correlation issues. It is also important to keep psychoacoustics in mind: higher audio frequencies are perceived as being much more directional than low ones, limiting the benefits of widening bass frequency content.

The tilt filters allow you to adjust the spectral stereo field accordingly. Plug your stereo pair into the input sockets. Centre the balance and width controls, and toggle both frequency switches to the bass setting. Next, set the mid tilt knob to 9 o'clock, and the side one to 3 o'clock. This will boost the mid channel bass frequencies and simultaneously attenuate the treble.

Meanwhile, the side channel undergoes the opposite operation, ensuring that nearly all bass content in the final mix is mono. Now you can widen the stereo field by adjusting the width control beyond its centre position. Experiment with different filter settings to achieve anything from subtle, natural-sounding widening to drastic stereo effects.

### **LINEAR VCA WITH TONE CONTROL**

Enhance 2 can be used as a simple linear VCA in patches where no stereo processing is required. Centre all knobs and connect your input signal to the right stereo input. The width knob and CV input will then affect the output amplitude on the right stereo output, with +5 V corresponding to unity gain if the knob is set to its minimum setting. Without any CV, unity gain is reached when the knob is centred.

Additionally, the side filter can be used to add spectral control to the VCA. The balance parameter also allows for amplitude control. However, the response will be non-linear, as a result of the constant-power balance control law.

### **STEREO TILT FILTERS**

While by default the tilt filters are configured in a mid/side pair, stereo tilt filtering is possible as well, adjusting the tone of the left and right channels directly.

To achieve this, centre all knobs and patch your stereo input signals into the module's mid/side input sockets. Next, connect the stereo outputs to the stereo inputs. The mid/side outputs are used as the true stereo output pair.

By exchanging the mid/side encoders and decoders this way, the module's signal path is effectively 'swapped around'. The mid tilt filter now only affects the left channel, while its side counterpart affects the right.

Note that the balance control will influence the stereo width instead, while the width knob can be used to attenuate or amplify the right channel and thus change the balance. The correlation meter essentially becomes meaningless.

### **PHASE METER**

Apart from measuring the correlation between the two channels of a stereo signal, Enhance 2's phase correlation meter can also be used to measure the phase shift between two otherwise identical signals.

Simply centre all knobs and plug both signals into the left and right input sockets. 30° of phase difference is represented between adjacent LEDs. This means that if, for example, the two signals are 90° out of phase, the '0' LED will light up. Both signals are passed through unaltered to the stereo output sockets on the bottom right of the module.

## **SPECIFICATIONS**

### **Module format**

Doepfer A-100 'Eurorack' compatible module  
3 U, 8 HP, 30 mm deep (inc. power cable)  
Milled 2 mm aluminium front panel with non-erasable graphics

### **Maximum current draw**

+12 V: 70 mA  
-12 V: 70 mA

### **Power protection**

Reverse polarity (MOSFET)

### **I/O impedance**

All inputs: 100 k $\Omega$   
All outputs: 0  $\Omega$  (impedance compensated)

### **Outer dimensions (H x W x D)**

128.5 x 40.3 x 43 mm

### **Mass**

Module: 115 g  
Including packaging and accessories: 200 g

## **SUPPORT**

As all Joranalogue Audio Design products, Enhance 2 is designed, manufactured and tested with the highest standards, to provide the performance and reliability music professionals expect.

In case your module isn't functioning as it should, make sure to check your Eurorack power supply and all connections first.

If the problem persists, contact your dealer or send an email to [support@joranalogue.com](mailto:support@joranalogue.com). Please mention your serial number, which can be found on the product card or on the module's rear side.

With compliments to the following fine people,  
who helped to make Enhance 2 a reality!

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***Joranalogue***  
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