

Anyware Instruments

MOODULATOR

User's Manual



www.anyware-instruments.de

Introduction

Congratulations and thank you for purchasing the MOODULATOR compact classic synthesizer!

The concept behind this new synthesizer is to have the classic Moog® sound in a compact and affordable unit. Don't be fooled by its size though, it's fully packed with features, like 2 Moog® VCOs, 2 suboscillators, ring modulator, noise generator, hardsync, a Moog® clone VCF, filter FM, one LFO, 3 envelope generators, CV and Gate inputs, a builtin MIDI to CV converter, balanced outs, plenty of modulation options, etc.

Beyond the features, most important is sound quality, and we think we just nailed the perfect sound.

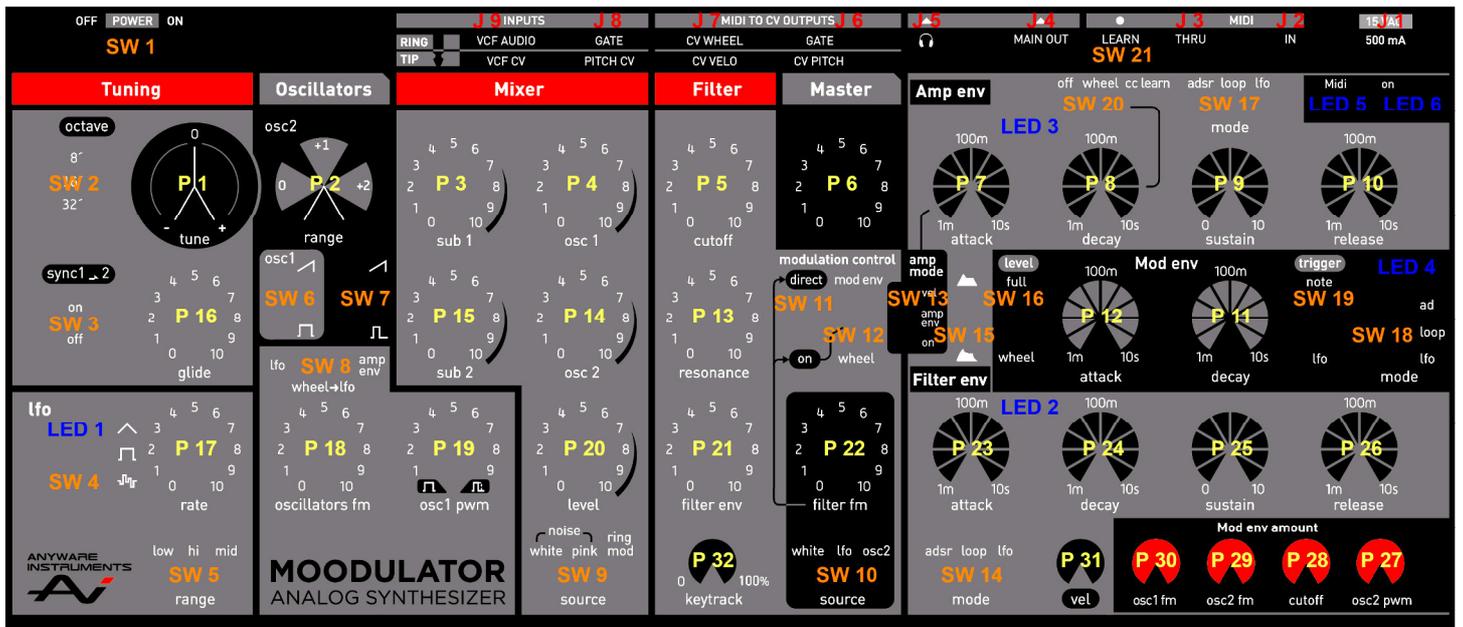
All those features make possible the creation of not only perfect basses and round leads, but also strange effects and weird noises.

We hope you enjoy this analogue synthesizer as much as we do and find it inspiring for making better music.

Feature set

- **2 Voltage Controlled Oscillators, with Sawtooth and Pulse waves including PWM**
- **2 SubOscillators**
- **1 pre filter Mixer with saturation**
- **1 Noise Generator with White and Pink noise colours**
- **1 Classic Moog® lowpass VCF -24dB Filter, Resonance up to self-oscillation**
- **1 LFO with Tri, Square and Sample & Hold**
- **1 Ring Modulator**
- **1 AD Modulation Envelope with one-shot, loop & LFO mode**
- **1 Amplifier Envelope with one-shot, loop & LFO mode**
- **1 Filter Envelope with one-shot, loop & LFO mode**
- **2 internal Modulation VCA's**
- **MIDI IN & THRU**
- **booster circuit for original vintage analog sound**
- **sync, ringmod, Osc. FM and PWM**
- **White & Pink Noise generators**
- **Mod-Wheel and Velocity can modulate a lot of parameters**
- **CV inputs for Pitch, Gate and Filter Cutoff**
- **CV outputs for MIDI Note, Gate, Mod Wheel & Velocity**
- **works as a external 12 Bit MIDI to CV converter**
- **Audio input going through the filter**
- **Studio, Balanced Audio Output with extra Headphone Amp**
- **Front with 32 Knobs & 21 Switches**
- **a solid high class metal case, UV Print Alu material**
- **external 15V AC/AC Powersupply**
- **Size (WxDxH): 310 x 160 x 80 mm**
- **Weight: 1,4 kg**

MOODULATOR FRONT PANEL



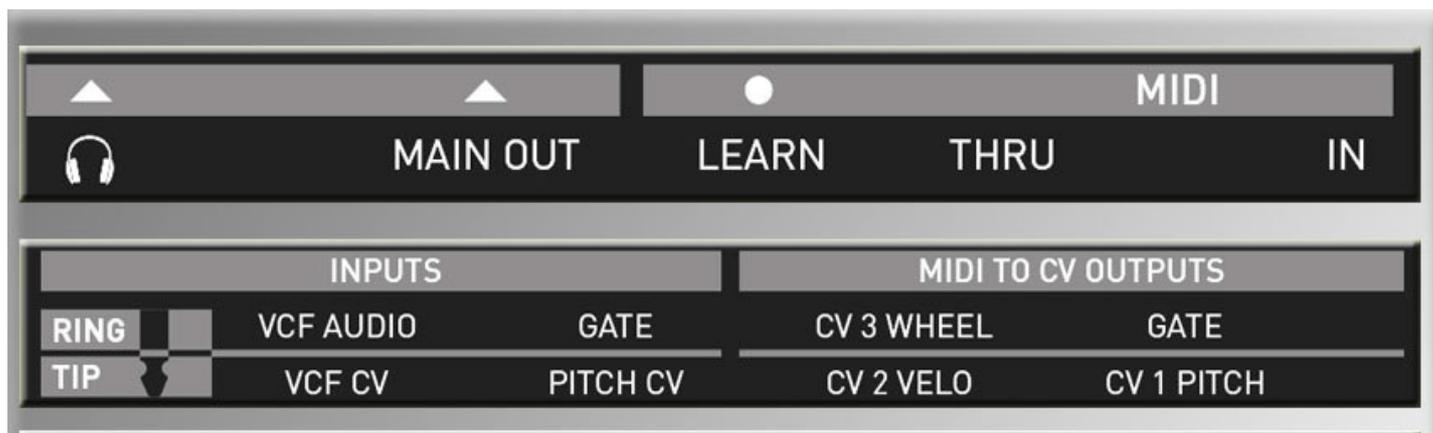
- P 1 TUNE OSC. 1+2
- P 2 RANGE OSC. 2
- P 3 SUB1 VOLUME
- P 4 OSC. 1 VOLUME
- P 5 CUTOFF
- P 6 MASTER VOLUME
- P 7 AMP ENV ATTACK
- P 8 AMP ENV DECAY
- P 9 AMP ENV SUSTAIN
- P 10 AMP ENV RELEASE
- P 11 MOD ENV DECAY
- P 12 MOD ENV ATTACK
- P 13 RESONACE
- P 14 OSC. 2 VOLUME
- P 15 SUB2 VOLUME
- P 16 GLIDE
- P 17 RATE LFO SPEED
- P 18 OSC. 1+2 FM
- P 19 OSC. 1 PWM
- P 20 NOISE / RING VOLUME
- P 21 FILTER ENV AMOUNT
- P 22 FILTER FM AMOUNT
- P 23 FILTER ENV ATTACK
- P 24 FILTER ENV DECAY
- P 25 FILTER ENV SUSTAIN
- P 26 FILTER ENV RELEASE
- P 27 MOD ENV - OSC. 2 PWM
- P 28 MOD ENV - CUTOFF
- P 29 MOD ENV - OSC. 2 FM
- P 30 MOD ENV - OSC. 1 FM
- P 31 VELOCITY -FILTER ENV AMOUNT
- P 32 FILTER KEYTRACKING

- SW 1 OFF / ON
- SW 2 OCTAVE OSC. 1+2
- SW 3 SYNC- OSC.1 → OSC.2
- SW 4 LFO WAVEFORM
- SW 5 LFO SPEED SELECT
- SW 6 OSC. 1 WAVEFORM
- SW 7 OSC. 2 WAVEFORM
- SW 8 OSC. 1+2 FM SOURCE
- SW 9 NOISE/RING SELECT
- SW 10 FILTER FM SELECT
- SW 12 FILTER FM SOURCE
- SW 13 AMP MODE SELECT
- SW 14 FILTER ENV MODE
- SW 15 ENV - LIN - EXPO SELECT
- SW 16 MOD ENV MODE SELECT
- SW 17 AMP ENV MODE
- SW 18 MOD ENV MODE
- SW 19 MOD ENV TRIGGER
- SW 20 AMP ENV DECAY MOD
- SW 21 MIDI LEARN

- LED 1 LFO SPEED
- LED 2 FILTER ENV AMOUNT
- LED 3 AMP ENV AMOUNT
- LED 4 MOD ENV AMOUNT
- LED 5 MIDI ACTIONS
- LED 6 POWER OFF/ON

- J 1 AC INPUT
- J 2 MIDI IN
- J 3 MIDI THRU
- J 4 MAIN OUT
- J 5 HEADPHONE
- J 6 GATE / CV PITCH OUT
- J 7 CV WHEEL / CV VELOCITY OUT
- J 8 CV PITCH/ EXT. GATE INPUT
- J 9 EXT. FILTER CV / AUDIO INPUT

CONNECTIONS



- **Power input connector: 15v AC 500mA**
- **MIDI in**
- **MIDI Thru**
- **MIDI learn button: (see MIDI section)**
- **Headphones out**
- **Audio OUT:** **Balanced audio out.**
- **VCF Audio IN:** **Audio input for processing through the VCF/VCA.**
- **Pitch CV IN:** **External CV input for the oscillator's pitch and vcf cutoff.**
- **VCF CV IN:** **External CV input for the VCF's cutoff frequency.**
- **Gate IN:** **External Gate input to trigger the envelopes.**
- **CV 1 Pitch OUT:** **CV output 1, assigned to midi note number.**
- **Gate OUT:** **Gate output to trigger external analogue synths. +5 Volt**
- **CV2 Velo OUT:** **CV output 2, assigned to midi note velocity.**
- **CV3 Wheel OUT:** **CV output 3, assigned to modulation wheel.**



OSCILLATOR Section

Oscillators are the primary sound source of a synthesizer; they provide the basic pitch and tone colour to the final sound. In the case of the MODULATOR, they generate two different basic waveforms, Sawtooth and Pulse (each has a different tone colour).

A lot more timbre variation is possible by doing PWM, hard sync, ring modulating them, etc.

TUNE (knob)

Master Tune lets you set the general tune of both oscillators with a range of more than 5 octaves.

OCTAVE (switch)

The Octave switch lets you select between 3 octave ranges for both oscillators.

GLIDE (knob)

Also controls both oscillators. Glide, also known as portamento, is a voltage processor. It's basically a lowpass filter for control signals; what it does is round any sudden voltage change, like the ones that happen from note to note when controlled from a keyboard, making a smooth transition between notes. The time it takes to go from one voltage level to the next is determined by the Glide Knob.

OSCILLATOR 1 WAVE SELECT (switch)

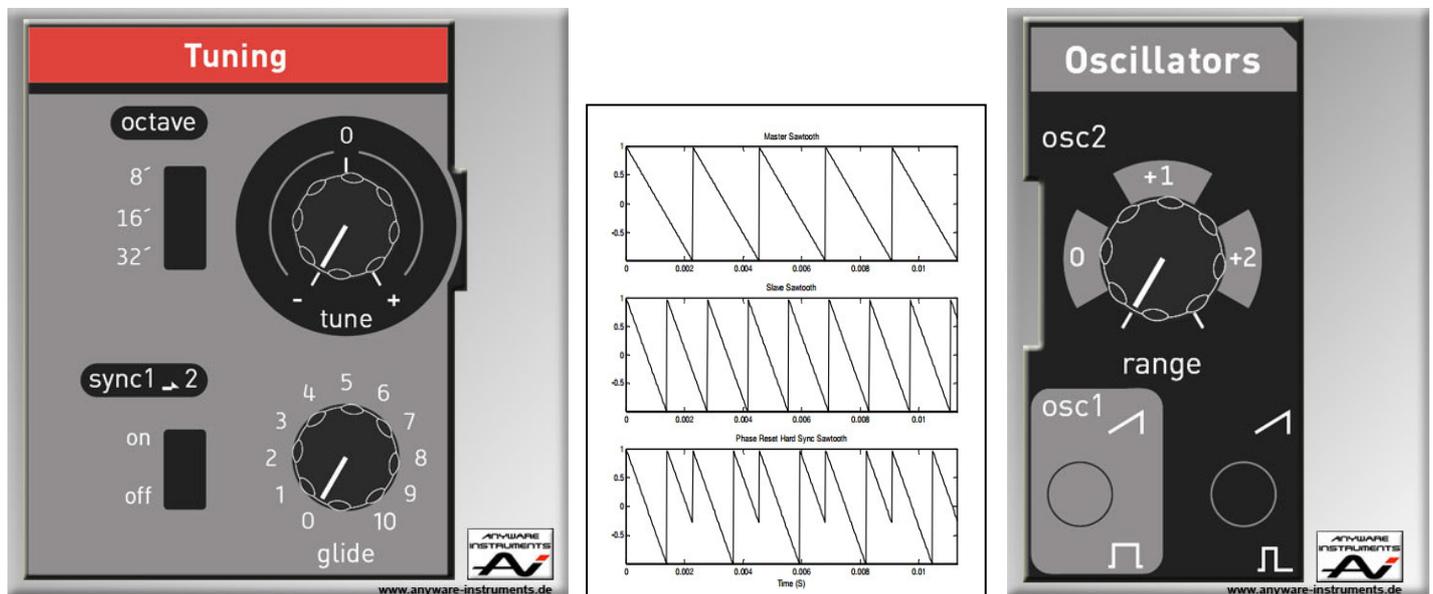
You can choose between SAW and SQUARE. The Pulse Width of the SQUARE wave can be modulated by LFO. For more info, go to LFO section.

OSCILLATOR 2 RANGE (knob)

This knob allows you to detune Oscillator 2 from Oscillator 1. At 9:00 o'clock position it's unison... at 12:00 it's an octave higher apart, and finally at 3:00 position pitch is two octaves higher.

OSCILLATOR 2 WAVE SELECT (switch)

You can choose between SAW and PULSE. The Pulse Width of the PULSE wave is fixed.



SYNC (OSC1→2) (switch)

Hard Sync was originally conceived as a way to tune analogue (i.e., unstable) oscillators in perfect unison or Octaves without any beating problems. Then it turned out to be a fantastic way to create new waveforms by applying different tunings and pitch sweeps to the slave oscillator.

Hard Sync works as follows: Two oscillators are synchronized by internally taking the Sync output of the "Master" oscillator (OSC1) and connecting it to the Sync input of the "Slave" oscillator (OSC2). Each time the Master oscillator completes its cycle, the slave oscillator restarts as well;

no matter where in its phase it is at that particular moment.

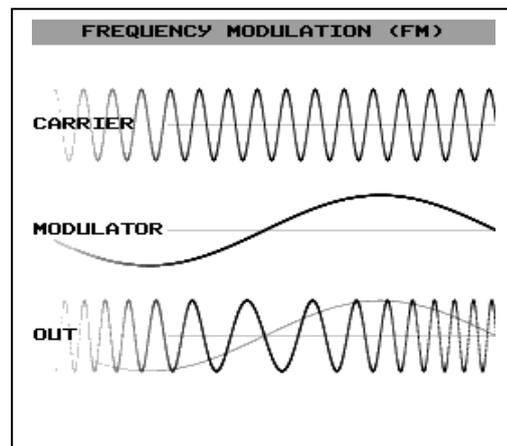
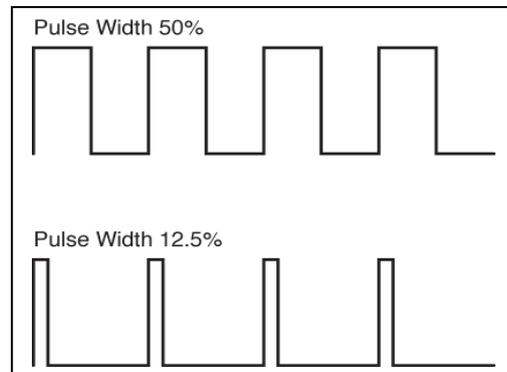
If both oscillators are tuned in unison, then they'll be perfectly in tune and there won't be any beating. The same will happen if the slave is tuned to any position within the harmonic scale, (that is x2, x3, x4, x5, etc). Octaves will be x2, x4, x8, etc.

For classic hard sync sounds, the slave oscillator has to be modulated by an envelope or an lfo. On the MOODULATOR, the best way is by modulating OSC2 with the Mod Env, either as an envelope or in lfo mode. On the "Mod env amount" section on the panel, use "osc2 fm" knob to define the depth of the modulation.

The two way switch works as follows:

OFF: Turns off hard sync.

ON: Turns on hard sync, now both oscillators are synchronized.



OSCILLATOR FM SOURCE SELECT (switch)

This is a three way switch which selects the modulation source for oscillator's pitch. The modulation depth is defined by the OSCILLATORS FM knob.

LFO: LFO modulates both oscillator's pitch, defined by the OSCILLATORS FM knob.

WHEEL → LFO : Pitch of both oscillators are modulated by the LFO. Depth is defined by a combination of the OSCILLATORS FM knob and the modulation wheel.

AMP ENV : Pitch of both oscillators are modulated by the amplitude envelope. Depth define by the OSCILLATORS FM knob.

OSCILLATORS FM (knob)

This knob defines the modulation depth for the oscillators. The modulation source is selected with the OSCILLATOR FM SOURCE SELECT switch.

OSC 1 PWM (PULSE WIDTH MODULATION) (knob)

This knob defines the modulation depth of oscillator's 1 pulse width by LFO. Oscillator 1 has to be set to Square wave to hear the effect.

MIXER Section

This 6 input mixer is very handy, as it's here where you'll mix all the sound sources to be filtered, like Oscillator, Noise generator, SubOscillators and external audio signals. High signal levels will make the mixer/filter distort. This is a desired effect sometimes (it was designed that way intentionally), but if you want to avoid it just lower the input signals. If only one oscillator is used, it'll begin distorting at level 7.

The sound sources include SubOscillators. A SubOscillator is a frequency divider: its inputs are connected to each Oscillator, and they generate a square wave one octaves below them. To generate its waveform (Square, one octave below), the SubOscillator generates half a cycle for every cycle of the Oscillator. A SubOscillator waveform will be in phase with, and will respond to, any pitch modulation of Oscillator 2. Use it to reinforce bass sounds, or as an additional sound source.

One of the mixer's inputs is a shared between Noise and Ring Modulator.

A Ring Modulator is a really cool audio effect commonly used for processing external audio or for belllike tones. It consists of a special type of VCA, which modulates one of its two inputs with the other, generating new harmonics based on the sum and difference of each of the input's frequencies.

In the case of the MOODULATOR, the output of each OSC's pulse waves are ring modulated.

The only real difference between a Ring Modulator and a normal VCA is that the former allows bipolar signals on its modulation input. This generates a phase inversion on the main input every time the modulator goes below 0V. The output sends the result of the multiplication, not any of the original sources.

Our last internal sound source is the Noise Generator, which is a circuit dedicated to generating random electrical variations that can be very useful as an audio source or control. There are two so called noise "colours" on the MOODULATOR, white and pink, and may be used for different purposes.

White noise has equal energy across the frequency spectrum. It is used as an audio source for sound effects, percussion sounds, etc. It can also be used as a modulation source (modulating the VCF frequency for a grittier sound, for example).

Pink Noise is a filtered version of white noise, which has a lower, more bassy sound. Its amplitude distribution across the spectrum is different; it's inversely proportional to frequency.

Pink Noise is not as widely used as white noise, but may be used in cases when lower, darker noise is needed. Noise Generators don't have any control parameter.

OSC 1 (knob): This defines the level of oscillator 1.

SUB 1 (knob): This defines the level of Suboscillator 1.

OSC 2 (knob): This defines the level of oscillator 2.

SUB 2 (knob): This defines the level of Suboscillator 2.

NOISE / RING MOD (knob): This defines the level of Noise or Ring Modulation.

SOURCE (switch): Select the sound source for the NOISE/RING MOD knob.

The options are:

White Noise

Pink Noise

Ring Modulator



FILTER SECTION

This voltage controlled filter is a flexible lowpass, great sounding filter based on the classic Moog design. MOODULATOR's filter has a slope of 24dB/octave.

This means that any signal at the double of the cutoff frequency will be lowered by 24 dB.

CUTOFF (knob)

Perhaps the most important parameter of a filter, Cutoff sets the frequency at which the filter begins to work.

RESONANCE (knob)

This is a feedback loop within the filter that emphasizes the signal at the cutoff frequency proportional to the knob position. 0 Resonance means there'll be no feedback, while 10 means total feedback to the point of selfoscillation.

Selfoscillation means the filter generates a sine wave at the cutoff frequency, which can be used as a sound source.

The audible result of Resonance is the typical electronic synth sound, but it's also very useful to simulate acoustic characteristics like formants.

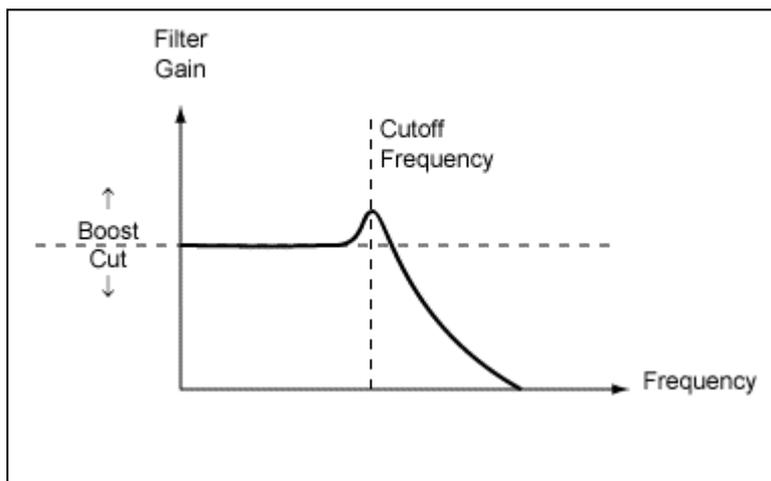
FILTER ENV AMOUNT (knob)

This knob determines the modulation amount of the FILTER ENV to the cutoff frequency of the filter.

KEYTRACK (mini knob)

Keytracking is nothing but using the keyboard as a modulation source. That means that the higher the note, the higher the cutoff frequency, depending on the modulation amount.

At around 5 o'clock you have 100% keytracking, which means that if you turn down all sound sources and make the filter selfoscillate you can play melodically with it.

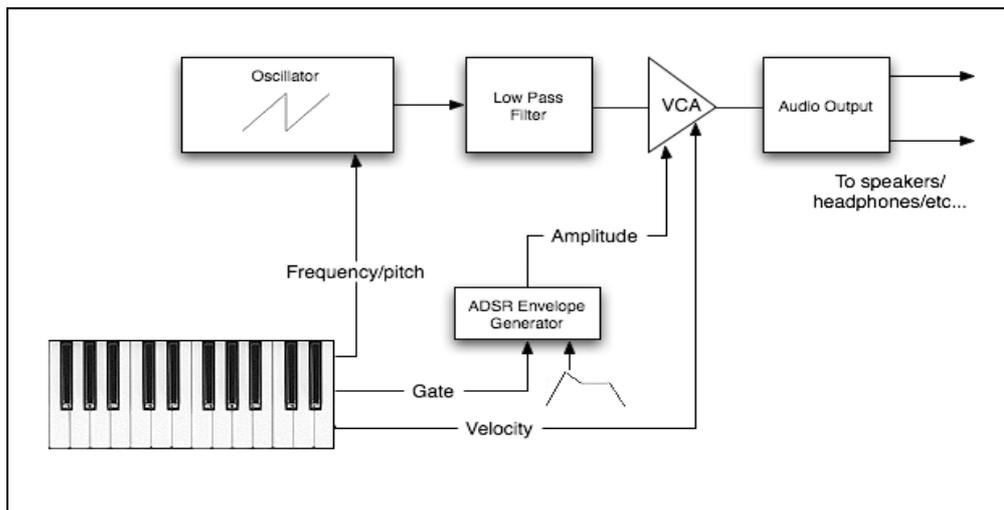


AMPLIFIER SECTION

A voltage controlled Amplifier (VCA) is a circuit that has two inputs and one output, and basically multiplies one input with the other. Consider it a voltage controlled attenuator, in which one input signal level is controlled by the other, and the result of such modulation goes to the output.

An amplifier module is an essential part of a synthesizer. The most basic use is to control the final volume of a patch, normally at the end of the audio chain, by an envelope generator. In that case the output of the filter (or whatever the source is) goes to the “VCA IN”, the envelope signal goes to the “VCA CV” input, and the shaped sound goes to the “VCA OUT”.

All this is preconnected inside the synth, so you don't have to worry about it.



MASTER (knob)

Sets the main volume of the final sound. It's the last stage of the sound within the synth.

AMP MODE (switch)

This switch determines how the VCA will be modulated.

VEL: The **AMPLIFIER ENV** controls the VCA, but its depth is controlled by MIDI Velocity.

AMP ENV: The **AMPLIFIER ENV** controls the VCA.

ON: The amplifier is not controlled by the envelope, it's always on.

ENVELOPE GENERATORS

An envelope generator is a module that generates an evolving voltage at the moment it receives a gate signal at its input. The shape of that evolving voltage depends on the parameters attack, decay, sustain and release. Its used as a way to control parameters in a predictable way across the evolution of a note.

To trigger an Envelope Generator you have to play a note on a MIDI keyboard (which is converted internally to a gate signal), or connect some gate source on the GATE input. Once the envelope is triggered, it will evolve through its various stages as long as the gate signal is still "ON".

If, at any point the incoming Gate signal goes "OFF", the envelope will jump to its Release stage. Now let's take a look at the parameters themselves.

Attack: Is the TIME it takes to go from 0 (when the Envelope Generator begins) to maximum level.

Decay: After the Attack stage ends, the decay stage begins, which in fact is the TIME it takes to go from the Attack to Sustain stages.

Sustain: This is the next stage, and is the LEVEL at which the sound stays, after the decay, as long as the key is still held. If sustain level is 10, then decay stage is cancelled.

Release: This last stage defines the TIME it takes the Envelope Generator to go from whatever stage it is in at the moment we release a key to zero.

This Envelope Generator type is called ADSR for obvious reasons. There's a blue LED indicating when the envelopes are being triggered.

There are 3 envelope generators within MOODULATOR. They have a special feature which is looping, which means once they end, they begin again. You can use them as LFOs with strange shapes.

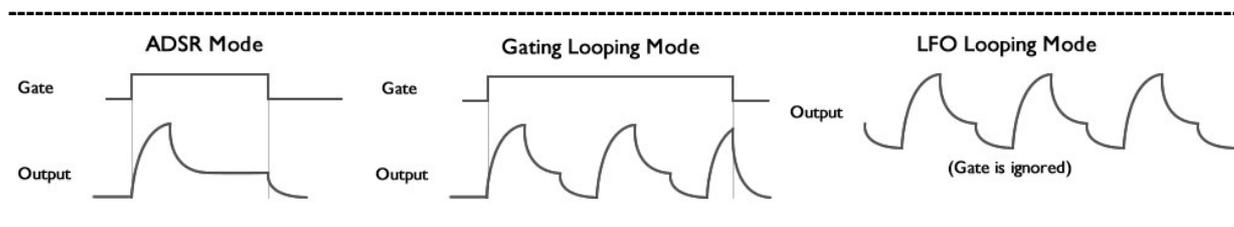
LFO frequencies to 300Hz

Since the segment times can be as short as 1ms, it is possible to produce LFO waveforms up to around 300Hz. This is above Middle C!

All Envelope's lets you choose between an Exponential or Linear mode.

Exponential and Linear Envelopes

The chip can produce classic exponential ADSR curves suitable for volume control with a linear VCA, or can produce linear envelopes typical of early digital synths. These can be more suitable For use with exponential VCAs.



AMP ENV & FILTER ENV

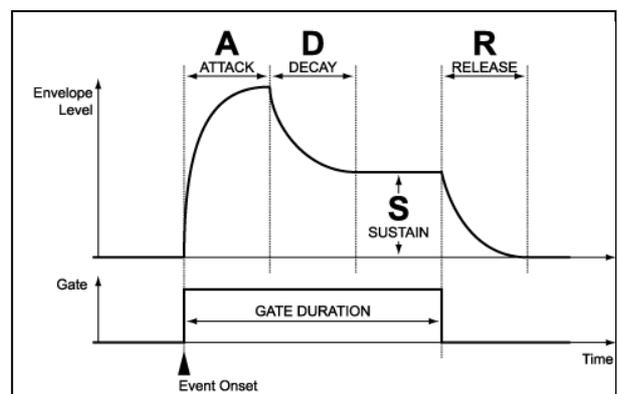
These Envelope Generators are used controlling the amplitude and timbre of the sound. They can also be used to control the OSCs pitch.

ATTACK : Defines the Attack time, from 1ms to 10 secs.

DECAY : Defines the Decay time, from 1 ms to 10 secs.

SUSTAIN : Defines the Sustain level, from 0 to 5 volts.

RELEASE : Defines the release time, from 1 ms to 10 secs.



MODE

ADSR: Normal mode, no looping.

LOOP: A gated loop mode, which means it'll loop as long as a gate is ON.

LFO: It's always looping, no matter the gate state.

The Amp Envelope

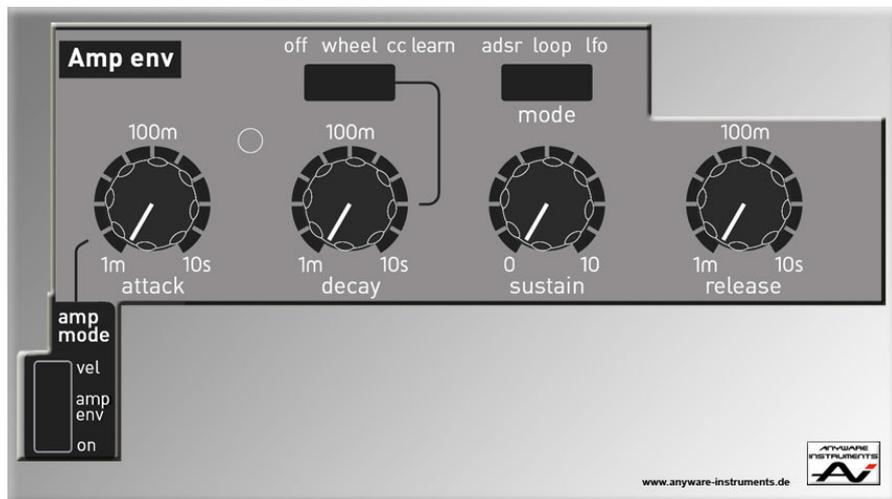
DECAY modulation source selector (switch)

This switch allows you to choose a mod source for the decay

OFF: No modulation

WHEEL: Decay time is modulated by the mod wheel (CC1) midi message.

CC Learn: this allows you to choose a any other CC for decay modulation, by pressing the LEARN button and sending the desired CC.



The Filter Envelope

VEL (mini knob)

At the bottom right of the the panel you can find this mini knob that controls the level of modulation between the FILTER ENV and the cutoff frequency of the filter.



The MOD Envelope

Mod env (Modulation Envelope) is a multi function envelope, and it's the main element of the Modulation Control section (see below). It's an AD envelope, with looping capabilities, and it's level can also be modulated.

ATTACK : Defines the Attack time, from 1ms to 10 secs.

DECAY : Defines the Decay time, from 1 ms to 10 secs.

LEVEL (switch)

FULL: it works as normal, with it's full level all the time.

Wheel: it's level is controlled by the mod wheel (CC1).

If you're using the Mod env for, ie, hard sync, you can control the hard sync depth with the mod wheel.

TRIGGER (switch)

Note: this the normal mode, the env is trigger by a note on event, or a gate signal at the Gate input.

LFO: Mod env is triggered by the LFO.

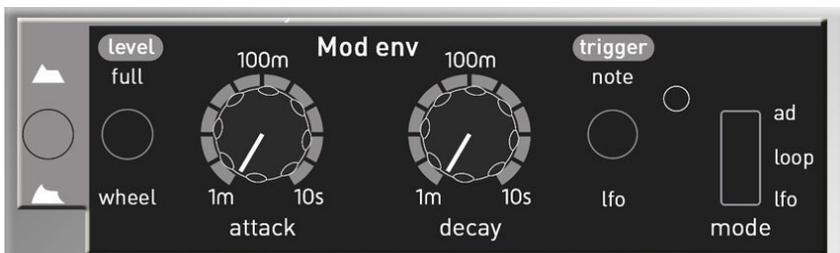
MODE

AD: Normal mode, no looping.

LOOP: A gated loop mode, which means it'll loop as long as a gate is ON.

LFO: It's always looping, no matter the gate state.

EXPO / LIN (switch): set the Exponential or Linear mode of all 3 envelope's.



MOD ENV AMOUNT Section

OSC1 fm: controls the amount of frequency modulation to the oscillator 1.

OSC2 fm: controls the amount of frequency modulation to the oscillator 1.

Cutoff: controls the amount of cutoff modulation to the VCF.

(tip: if you combine this with the Filter env, you can get nice complex envelope shapes)

OSC2 PWM: controls the amount of pulse width of oscillator 2.



LOW FREQUENCY OSCILLATOR (LFO)

An LFO is basically an oscillator whose frequency range is usually below the audible spectrum. It's used as a modulation source because it produces cyclic voltage fluctuations.

By applying an LFO to an audio oscillator's FM input you get something like a sweep, siren type of sound if the LFO's speed is very slow and the FM amount is relatively strong; a vibrato if modulation depth is moderate and the speed is medium, and timbre change if speed is faster than 10/20 Hz.

Some of the basic audio oscillator functions apply here, like waveform, speed, etc.

RATE (knob)

Sets the speed or frequency of the LFO. That rate depends on the rate range set on the RANGE switch.

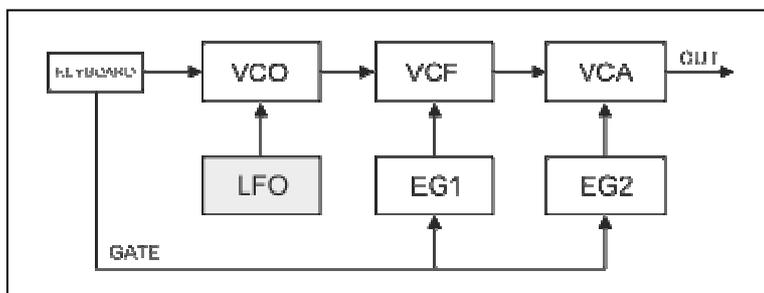
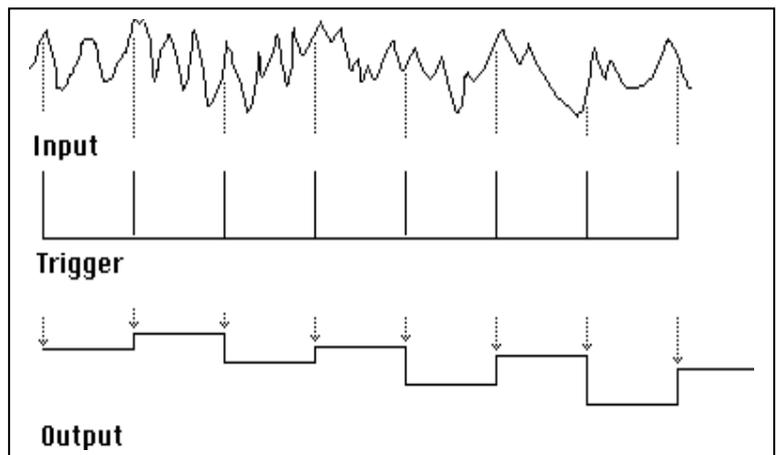
RANGE (switch)

This switch selects between three rate ranges: LOW, MID and HI.

SHAPE (switch)

Here you can choose the shape (waveform) of the LFO. The options are Triangle (with a linear ascending and descending shape),

Square with a sudden change from minimum to maximum, and SAMPLE + HOLD, which generate a new random level with every LFO cycle.



MODULATION CONTROL

Modulation Control is a very useful feature of the MOODULATOR that allows you to make sounds way more complex than what most monophonic synths can.

The idea is this: the filter might be modulated by one of 3 sources (White noise, LFO or OSC2), but at the same time, the depth can be modulated by the Filter FM knob and either the Mod env or the Mod wheel. Considering that the level of the Mod env itself can be modulated by the Mod wheel, this system allows a lot of flexibility.

The signal flow on this case goes from bottom to top, beginning with the source and going up.

SOURCE (switch)

One of the following sources can be selected: White, LFO, and OSC2.

FILTER FM (knob)

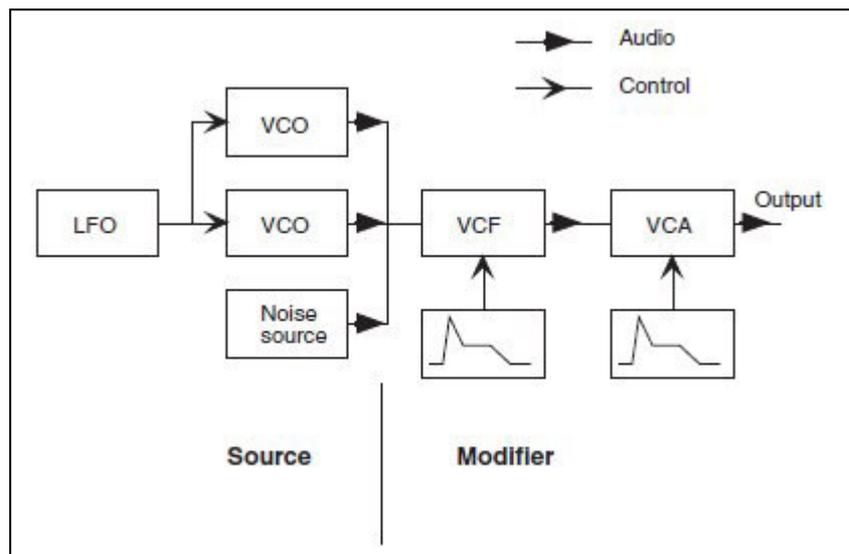
This knob controls the amount of modulation that goes from the source to the filter. If the switch above it is set to "on", the signal goes to the Modulation Control section for further processing. If it's set to "direct", this knob controls the modulation source directly to the VCF cutoff.

ON/DIRECT (switch)

This switch defines if the signal from the sources and Filter FM knob goes to the Modulation Control section (ON) or it goes directly to the VCF cutoff (Direct).

MOD ENV / WHEEL (switch)

Here you select the "modulator of the modulation". You can choose between the Mod env or the Mod wheel.



MIDI/CV GATE

The Moodulator's midi specs are simple, but useful.

Note on

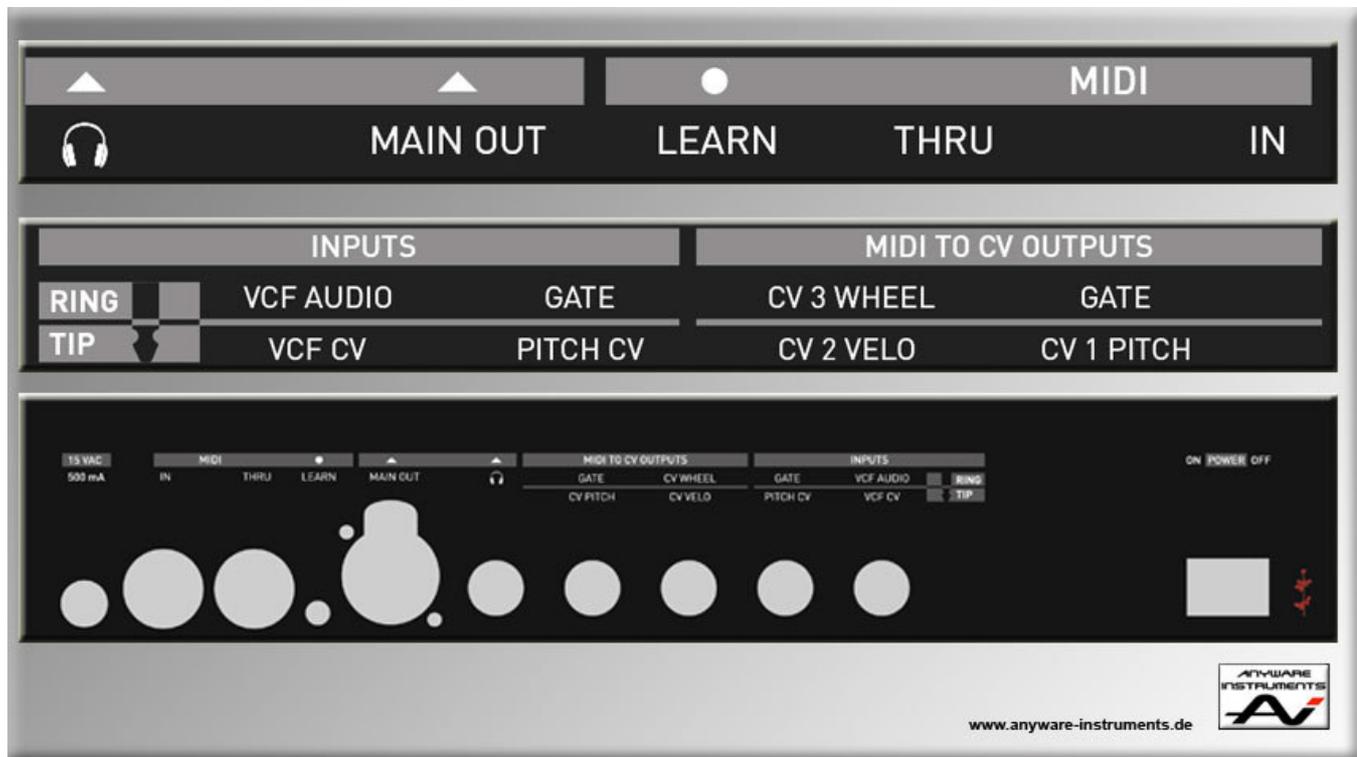
Note off

Velocity (routed to Amp env and Filter env)

Mod Wheel (CC1) (routed to Vibrato, Modulation Control, Mod env level and Amp env decay time)
Volume (CC7)

Midi Learn: Any controller will be routed to Amp env decay, by pressing the Learn button and sending the chosen controller to the MOODULATOR.

In addition to MIDI, the MOODULATOR can be controlled with analog CV and Gate signals.



Gate In signals trigger the envelopes.

Pitch CV In controls the oscillator's pitch, and also the keytracking of the filter.

Use **VCF CV In** if you want to modulate the filter's cutoff with external CV.

There's a 12 bit MIDI to CV converter included on the MOODULATOR, which allows you to control other analog synths.

Gate: Note on and note off events will be converted to Gate signals.

CV 1 Pitch: Midi note number will be converted voltage according to the 1v/Oct standard.

CV 2 Velo: Note on velocity will be converted to voltage on this output.

CV 3 Wheel: Midi controller 1 will be converted to voltage on this output.

Credits:

Thomas Welsch, Synth Design and Engineering

Estela Welsch, PCB Production

Javier Zubizareta, Synthesizer Specialist, User Manual

Enrique Martinez, Graphic Design

Carsten Moll, Midi Interface

Tom Wiltshire, Envelope Design + Programming

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Safety Instructions

Please follow the instructions for use of the instrument carefully because this will guarantee proper operation of the instrument. Due to the fact that these instructions touch on Product Liability, it is absolutely imperative that they be read carefully. Any claim for defect will be rejected if one or more of the items has not been observed. Disregard of the instructions can void the two years covered by warranty.

Transport the instrument carefully, never let it drop or fall over. Make sure that during transport and in use the instrument is supported properly and cannot drop, slip or fall over because people might get injured. Never use the instrument in the immediate proximity of electronic devices (e.g. monitors, power supplies, computers) as these interferences could cause malfunctions within MOODULATOR and corrupt memory data.

The instrument may only be operated at the voltage stated on the power input on the rear panel. Before opening the case, disconnect both power plug and power adaptor.

No liquids or conducting substances must get into the instrument. Should this be the case, the instrument is to be disconnected from mains power immediately and examined, cleaned and possibly repaired by a qualified technician.

The instrument may only be used for the purpose described in this operating manual. Due to safety reasons, the instrument must never be used for other purposes.

Never expose the instrument to temperatures above +50° C or below -10° C. Before operation, the instrument should have a temperature of at least 10°C. Do not expose the instrument to direct sunlight. Do not install the instrument near heat sources like heaters, open fire places, central heating etc. Keep the top of the instrument clear in order to allow proper ventilation, otherwise the instrument could eventually overheat.

Never place heavy objects on the instrument.

All eventual modifications are to be performed by a qualified person only in accordance with valid safety instructions. With the introduction of a third person, the warranty will be void. In case of a destroyed warranty seal, any warranty claim will be rejected.

The instrument must never be operated outdoors but solely in dry rooms. Never use the instrument in a humid or wet environment, nor near flammable goods.