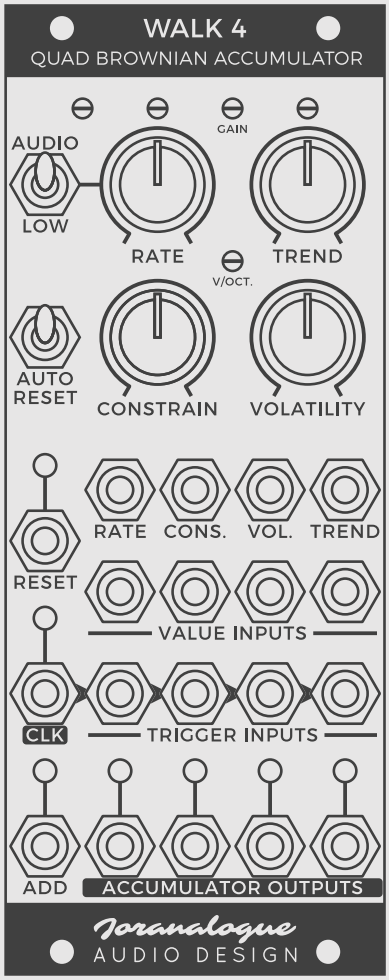
WALK 4

USER MANUAL



Joranalogue
AUDIO DESIGN

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INTRODUCTION

A ‘battery for CV’, an analogue accumulator is a circuit which stores a voltage, and then charges or discharges it in discrete steps according to a trigger signal. Walk 4 combines four such accumulators with a clock generator, four white noise sources and an auto reset system to create a 10 HP voltage stepping juggernaut.

The accumulators are principally used to create staircase waveforms. At each trigger, the stored voltage changes by a certain amount. This value can be set directly through an input, by the module’s shared parameters trend, volatility and constrain, or any combination thereof.

Trend provides a fixed value input to all accumulators, while constrain prevents them from straying too far away from the baseline. Volatility brings the noise generators into play, adding an element of chance at every trigger. This elevates Walk 4 from not just a quad arpeggiator or subharmonics generator, but also a fourfold random walk CV or coloured noise source.

With full voltage control and independent value and trigger inputs for each accumulator, there’s always more stochastic patching to explore ahead. And if you need a reliable master clock source with a huge range, 1 volt per octave tracking and external reset—that’s covered, too.

Like a sample-and-hold with a master’s degree, Walk 4 brings a welcome touch of vintage analogue computing to any Eurorack system.

CONTENTS

In the Walk 4 box, you'll find:

- → Product card, stating serial number and production batch.
- → Fold-out signal flow and front panel diagram.
- → 16-to-10-pin Eurorack power cable.
- → Mounting hardware: four black M3 x 6 mm hex screws, four black nylon washers and a hex key.
- → The Walk 4 module itself, in a protective, reusable cotton bag.

If any of these items are missing, please contact your dealer or support@joranalogue.com.

INSTALLATION

Before installation, make sure your Eurorack system has been powered down for at least 10 minutes and is placed horizontally on a stable surface.

Locate a free spot in your system in which to mount your module. First plug the included power cable between the module and a free output header on the power distribution board or cable.

Keep an eye on the polarity: the red stripe on the cable, denoting the –12 V power voltage, should always point towards the bottom of the module: 'red stripe down'. All our modules are equipped with keyed headers, which makes it impossible to plug them in the wrong way around.

Also pay attention to the polarity of the cable on the power distribution side. Contact the manufacturer of your rack in case you are uncertain.

Even if the polarity ends up reversed, this will not damage your module. However, this may not be true for modules of other brands.

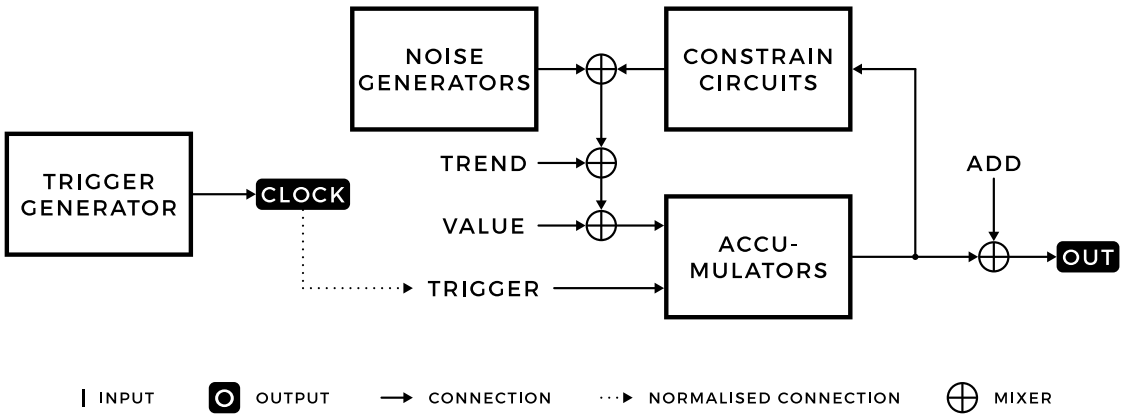
Next, it's time to screw your module in place. Included with your module, you'll find a set of M3 screws and nylon washers.

Place the nylon washers onto the screw threads, and using the supplied 2.5 mm hex key, fasten the screw/washer combo onto the rack rails, through the module's front panel. If your case uses sliding nuts, you'll need to position them first. Repeat until all screws are in place; always use all the supplied screws to install a module.

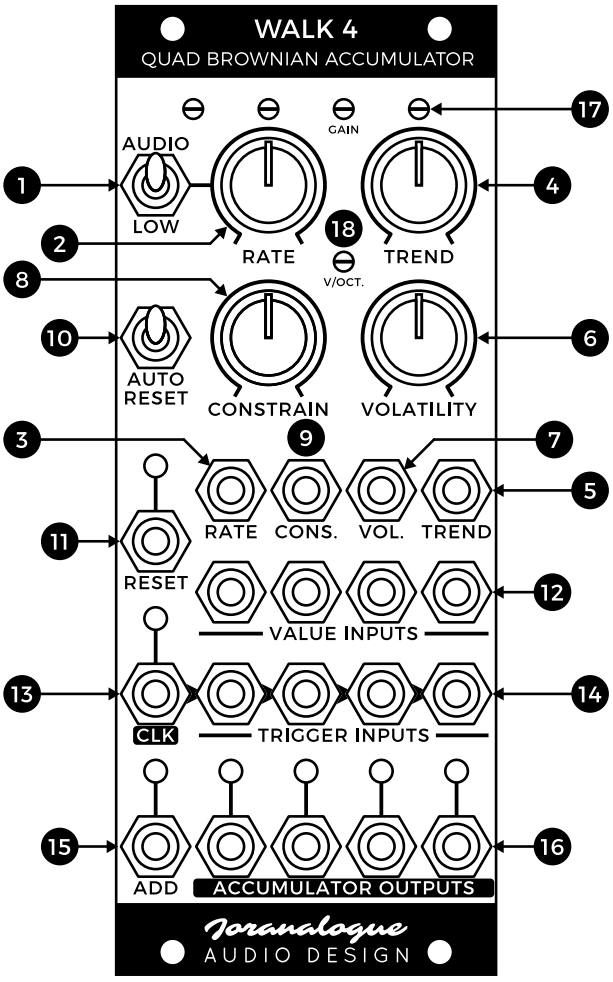
Note that some racks might use a different thread than the supplied M3 screws, or the rails might be recessed too deep for the supplied screws to fit. In this case, you'll need to source third-party screws matching your rack.

Now you can power up your rack and enjoy your new module!

SIGNAL FLOW



CONTROLS & CONNECTIONS



1 LOW/AUDIO SWITCH

Walk 4's internal clock generator is a special kind of voltage controlled oscillator, generating a stable 'clock' trigger signal. This switch determines over which frequency range it will operate: low frequency (VCLFO) or audio frequency (VCO).

2 RATE KNOB

The rate knob is used to set the frequency of the internal clock generator. The range is 22 Hz to 22 kHz in audio mode. In low mode, the range becomes 5.5 mHz (a period of 3 minutes) to 180 Hz, with 1 Hz when the knob is centred.

3 RATE CV INPUT

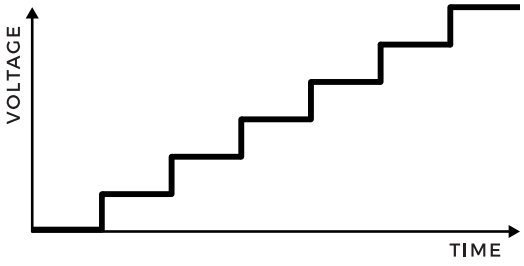
This input is used to modulate the clock frequency in an exponential fashion using external CV (control voltage).

In the audio range, it is calibrated to 1 volt per octave. In low mode, the sensitivity is increased to approximately 0.6 volt per octave.

4 TREND KNOB

The trend knob is used to add a static offset to the accumulator inputs, adjustable from 0 V to +5 V.

This makes it easy to generate staircase signals, as shown in the following diagram. Turn up the trend parameter to increase the size of each stairstep.



5 TREND CV INPUT

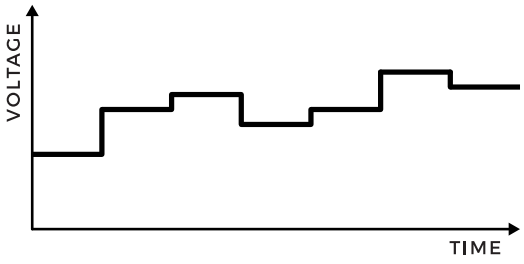
Use this CV input to modulate the trend parameter. Negative voltages can be used to make the accumulators trend downwards, rather than upwards.

6 VOLATILITY KNOB

The volatility knob adds an element of chance to Walk 4. It enables the module to create random walks with stochastically assigned voltage step sizes.

Four integrated, fully independent white noise generators are sampled on each trigger, one for each accumulator. The level of white noise is adjustable, from fully disabled to maximum, according to the volatility parameter.

A typical random walk on one accumulator's output when the volatility knob is turned up has been plotted below.



As these white noise generators are based on semiconductor physics, some variation between channels is to be expected due to manufacturing tolerances.

7 VOLATILITY CV INPUT

The volatility parameter may be modulated using this CV input. With the volatility knob at 0, the nominally maximum level is reached at +5 V. However, is possible to achieve even higher levels of volatility, using a higher control voltage.

8 CONSTRAIN KNOB

To avoid the accumulators reaching saturation too quickly, it is possible to 'constrain' them.

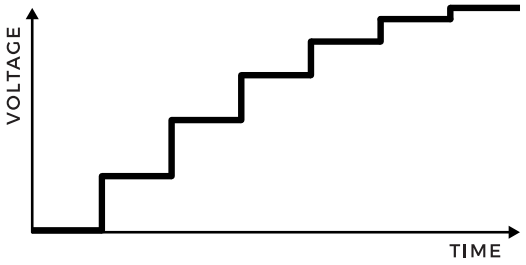
The constrain circuit is a controllable negative feedback loop from the accumulator output to the input. The parameter controls both a minimum voltage threshold, as well as the level of feedback, for all accumulators in parallel.

As the constrain parameter is increased, the threshold rises and the feedback strength decreases. As the accumulator is then triggered, the constrain circuit then acts to restrict the output voltage within a controlled band around 0 V.

Note that the edges of the band are not hard—instead, the constraining action functions like a spring, gradually becoming stronger as the accumulator voltage strays further from the 0 V baseline.

Also keep in mind that, when constrain is turned down, subsequent triggers may reduce the accumulator voltage without any additional inputs applied. Conversely, when turned up all the way, the constriction effect will only come into effect at accumulator voltages beyond 10 V (positive or negative).

The following diagram visualises moderate constrain applied to a generated staircase with a nominally fixed step size.



9 CONSTRAIN CV INPUT

A CV applied to this input socket will modulate the constrain parameter.

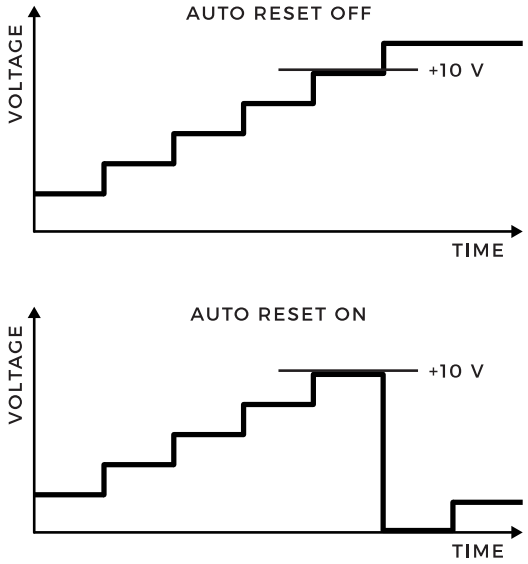
The constrain knob has been tuned for a range most useful for typical use. However, further constrain range is available through external modulation, beyond both ends of the knob range.

10 AUTO RESET SWITCH

This switch determines the accumulators' behaviour as they near saturation.

When auto reset is disabled, the accumulators are allowed to saturate at nearly ±12 V and will require either an input in the opposite direction, or an external reset trigger, to move out of saturation.

Enabling the auto reset mode causes each accumulator to be instantly reset to 0 V, as soon as its stored value exceeds 10 V (positive or negative).



11 RESET INPUT AND LED

Walk 4's accumulators and oscillator can all be instantly reset to 0 V by a rising edge on this external input.

The adjacent LED will light up briefly for every external reset event.

12 VALUE INPUTS

Each accumulator has its own dedicated value input. At each trigger, the current accumulator voltage is incremented by the summed voltage of four sources: the trend voltage, a random volatility voltage, the counteracting constrain voltage (which depends on the current voltage level in the accumulator), and any additional voltage applied to the value input.

To extinguish the trend, volatility and constrain components, simply turn the first two knobs fully anti-clockwise, and the constrain knob fully clockwise. In this case, only the value sockets will be used to update the accumulators, allowing for precision accumulation of external voltages.

The incoming voltage sum may be negative. This will cause the accumulator output voltage to decrease and, if crossing 0 V, turn negative itself.

13 CLOCK OUTPUT AND LED

This is the output of the internal clock generator, taking the form of +5 V trigger pulses.

By default, the pulsewidth is 1 ms. However, as soon as the clock frequency exceeds 500 Hz, the pulsewidth will narrow as the waveform transitions to a square wave signal.

The adjacent LED will light up briefly for every clock pulse.

14 TRIGGER INPUTS

By default, the accumulation action for the leftmost accumulator is triggered by the internal clock generator. Each successive accumulator is triggered by the same trigger signal as its left-hand neighbour.

However, any of these normalisations can be overruled by patching cables into the trigger inputs.

As soon as a rising edge is received by a trigger input, the corresponding accumulator will be updated.

The trigger and reset inputs are uniquely designed to be driven reliably even from weak, slow, bipolar signals. They feature Schmitt action, with a +2 V low and +3 V high logic threshold.

Note that when triggered at audio rates, either externally or though the built-in clock generator, accumulators may appear to continually rise in voltage, even when trend and volatility are turned down and nothing is plugged into the value input. This voltage may either positive or negative. This is caused by tiny, unavoidable input offset voltages being accumulated many times per second, and is to be considered normal behaviour.

15 ADD INPUT AND LED

Any voltage applied to the add input is continuously added to the accumulator outputs, independent of the triggering and auto reset systems. A straightforward application is using Walk 4 to generate four related variations on an existing pitch sequence.

The adjacent LED shows the real-time input voltage, lighting up red for positive and blue for negative.

16 ACCUMULATOR OUTPUTS AND LEDS

These are the output sockets for the accumulators.

The adjacent LEDs show the real-time output voltages, lighting up red for positive and blue for negative.

17 GAIN TRIMMERS

The gain trim potentiometers are used to calibrate each accumulator's voltage gain, compensating for individual component tolerances, enabling precision voltage accumulation.

Since they are accessible from the front panel, calibration can be easily performed without removing the module from the system. Each module is individually calibrated during production; do not adjust any trimmers if not needed.

Should you find any of your Walk 4's accumulators to be out of calibration, apply a +3 V precision voltage to the accumulator's value input, set the constrain knob to its maximum setting, and trend and volatility to minimum. Switch the clock generator to the low frequency range, set the rate knob to approximately 1 o'clock and enable auto reset.

The accumulator's voltage will now rise by approximately 3 V twice per second, in a 0—3—6—9 V pattern.

Use a precision multimeter, connected to the accumulator's output, to verify that the final step in this pattern is exactly 9.000 V. If not, adjust the accumulator's gain trimpot as required.

18 VOLT PER OCTAVE TRIMMER

This trim potentiometer is used to calibrate the pitch tracking of the trigger oscillator.

Should you find your Walk 4's oscillator to be out of tune, set the rate knob to about 20 % of its range (9 o'clock).

Make sure Walk 4 has been powered for at least 20 minutes at a stable ambient temperature. Now connect the clock output to a calibrated digital tuner.

During the tuning process, the volt per octave input should be continually switched between 0 V and a precision +5 V source, toggled automatically or by hand. Leave all other inputs unpatched.

Using a dedicated trimming tool or standard 2.5 mm flat screwdriver, adjust the V/oct. trimmer until the interval between both states is exactly 5 octaves. For example, if 0 V corresponds to a pitch of C1 + 23 cents, +5 V should yield C6 + 23 cents.

PATCH IDEAS

SUBHARMONIC GENERATOR

By enabling auto reset and turning up the trend parameter, it's easy to generate staircase signals using Walk 4. As each accumulator will only reset once it reaches +10 V, the size of the steps determines the final frequency. This frequency will always be a subharmonic of the clock.

For example, with the trend knob turned up, the step size is 5 V. This results in a 0—5—10 V pattern, at a frequency three times lower than the clock rate. As the trend parameter is decreased and the steps become smaller, the output frequency 'snaps' at integer subharmonics: ÷4, ÷5, ÷6…

Make the most out of Walk 4's four accumulators using the separate value and trigger inputs: apply different fixed voltages to the value inputs to program multiple simultaneous subharmonic divisions, or use the trigger inputs to subdivide up to four different frequencies.

Since these are integer subdivisions, mixing multiple outputs results in chords that are in just intonation—a 'purer' sound than encountered in the equal temperament tuning system which dominates modern music.

This subdivision concept works at audio frequencies as well as low rates, potentially turning Walk 4 into a quad programmable clock divider.

ARPEGGIATED SEQUENCES

Using Walk 4, you can build a sequence out of stacked intervals instead of fixed pitches. Program a set of voltages in a step sequencer. Attenuate these, if necessary, to limit the range of each step between 0 and 1 V.

Advance the sequencer using Walk 4's clock output and apply its CV output to any value input. Set constrain to maximum, and trend and volatility to minimum. Patch the sequencer's 'sync', 'reset' or 'first step' output to Walk 4's reset input. Use the corresponding accumulator output to control a VCO or voice.

As the sequencer advances, the accumulator stacks each interval on top of the previous ones. The loop length will be equal to the sequencer's length.

By removing the reset connection and relying on Walk 4's auto reset instead, the sequence can be made to reset automatically once a 10-octave range is reached. In this variation, the same arpeggio will be repeated multiple times over the entire pitch range, with a loop length depending solely on the programmed intervals.

In another variation, a sequential switch is used instead, selecting between a limited set of precisely generated voltages corresponding to 12-tone intervals. This allows the final sequence to be in equal temperament tuning, without needing additional quantisation.

SPECIFICATIONS

MODULE FORMAT

Doepfer A-100 'Eurorack' compatible
3 U, 10 HP, 30 mm deep (including power cable)
Milled 2 mm aluminium front panel with non-erasable graphics

MAXIMUM CURRENT DRAW

+12 V: 105 mA
–12 V: 85 mA

POWER PROTECTION

Reverse polarity (MOSFET)

I/O IMPEDANCE

All inputs: 100 kΩ
Clock output: 1 kΩ
Accumulator outputs: 0 Ω (impedance compensated)

OUTER DIMENSIONS

128.5 x 50.5 x 43 mm (H x W x D)

MASS

Module: 150 g
Inc. packaging and accessories: 225 g

SUPPORT

As all Joranalogue Audio Design products, Walk 4 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. Please mention your serial number, which can be found on the product card or on the module's rear side.

ACKNOWLEDGEMENTS

With compliments to the following fine people,
who helped to make Walk 4 a reality!

Ben ‘DivKid’ Wilson
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Lieven Stockx
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Simon Hubert
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Yves De Mey

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info@joranalogue.com
https://joranalogue.com/

LAB-GRADE
SYNTHESIS.

EST. 2016
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