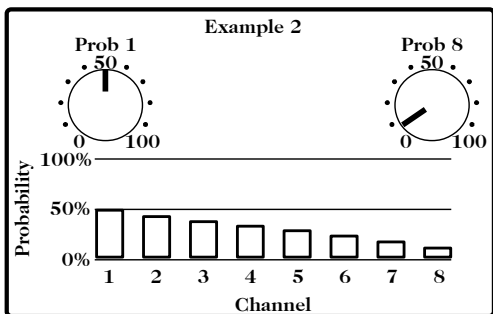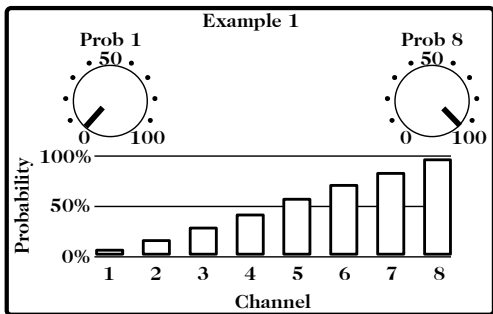# Iron Ether Pithoprakta Owner's manual

The Iron Ether Pithoprakta is a 16HP Eurorack module, which generates new rhythms in real time, based on probabilities. These semi-random rhythms can then be looped, and the loops morphed over time using probabilistic processes, resulting in sequences that appear to "improvise" on their own.

It also includes a bonus CV output, derived directly from the states of the gate outputs. This CV sequence will loop and evolve along with the gate outputs.

At its core, Pithoprakta is 8 channels of random gate or trigger generation, all clocked by a common clock input. On every clock pulse, each output will flip a virtual coin to determine whether or not it will fire. Each channel has its own probability value, from 0% to 100% likely to fire on the next clock.

The probability values for channels 1 and

8 can be defined directly, with the Prob 1 and Prob 8 knobs respectively, as well as their associated CV inputs, P1CV and P8CV, each with its own attenuator. The values for channels 2 through 7 are interpolated between these, as shown below:



Example 1



Example 2

The P1CV input is normalled to P8CV, so you can modulate the values with a single CV source. To modulate P1CV only, simply turn the P8CV attenuator down all the way. P1CV is disconnected from P8CV when a cable is plugged into P8CV.

This unique CV control scheme allows you to create a spread of probabilities, and modulate them all to different values with only 2 external modulation signals.

## Div Mode

When the Div toggle switch is set to the right, Divider mode is engaged. All of the above remains true in this mode, except that each output is now clocked by a different division/offset of the input clock. From left to right, the columns of outputs are divided-by-two, divided-by-four, divided-by-eight, and divided-by-sixteen. The upper four channels receive odd-numbered clocks, while the lower outputs receive even-numbered clocks.

Musically, you can think of these as being downbeats and upbeats, respectively. In

terms of logic functions, you can think of each pair of upper and lower outputs as the two outputs (Q and Q') of a flip-flop - they alternate firing, assuming all probabilities are at 100%.

## Looping

At all times, the module is recording the states of all 8 outputs, with a memory of 64 steps. Looping can be engaged at any time by pressing the Loop button or by sending a gate-high signal to the Loop Gate input. Based on the loop Length knob or CV input, the preceding 2, 4, 8, 16, 32, or 64 steps can be looped. The loop Length can be freely modulated while a loop is repeating. The dot on the panel between 16 and 64 indicates 32 steps.

Note that when Div mode is active and looping is engaged, the module will wait until the beginning of the division count to begin looping. This keeps rhythmic loops in time without requiring the user to engage looping at the exact right time.

When looping is engaged, the Prob 1 and

Prob 8 knobs and CV inputs change from setting the probability of the outputs being on or off, to now setting the probability that a given step of the loop will be over-written on the next step. In other words, they become "probability of change" controls. With both controls at 0, the loop will repeat without changing. At 100%, a given channel's saved on/off value will be over-written with a new coin flip every time. At settings in between, there is a chance that the saved step will be over-written or stay as it was. Low settings will repeat the loop with small changes each time, eventually becoming something entirely different.

NOTE: Upon entering the looping mode, the Prob 1 and Prob 8 knobs are ignored until they are turned down to 0 and then back up. This keeps your loop from immediately being over-written by high "probability of change" values.

<u>Reset</u>

The Reset button and trigger input have two concurrent functions: when looping is

active, Reset will reset the loop to its beginning, and when Div mode is active, Reset will reset the division count to its beginning.

### Trig/Gate switch

This sets whether the outputs will be triggers or gates, with their lengths set independently in System Mode - see below.

### CV Out

This signal is derived by combining the gate/trigger outputs, each with a different "weight." With gates selected, the CV output will generate stairstep-like random voltage sequences in the range 0V to 5V, which loop and change along with the gates. This is useful when sent through a quantizer module and connected to a VCO for pitch CVs, or for random modulation of filter cutoff, etc.

Since the CV is derived from the gates, the sequence will stay locked in time with the

rhythmic events coming from the main outputs, will reset in tandem, and will loop or change according to the Probability controls. Thus, the Pithoprakta can serve as the center of a full generative composition.

When triggers are selected on the Trig/Gate switch, the CV output will be a sequence of triggers of different levels. This can be useful for triggering modules that will change their sound depending on the level of trigger they receive - for example, some drum modules - or dynamically "pinging" filters, lowpass gates, or any vactrol-based modulation input.

Keep in mind that the CV output comes directly from the state of the gate outputs, and therefore when gate lengths of less than the full step length are chosen in the system mode, the CV output's voltage will drop to 0 when the gate outputs are all low. When using this signal as a pitch source for oscillators, use a quantizer with a trigger input, or a sample-and-hold module, to keep the pitch steady for the

entire step length. Using one of the gate outputs of the Pithoprakta to trigger the quantizer/S+H will create more complex sequences, and several different-but-related melodic/bass lines can be made simultaneously by sending the CV output to several S+H units and triggering them with different gate outputs of the Pithoprakta.

In Div mode, the CV output has a more limited range, because the upper and lower channels receive alternating clocks, and therefore no more than 4 channels can be active at a time in this mode. If you add extra syncopated hits by looping and switching out of Div mode, the CV output will become more active. The CV out is a free bonus feature, not a primary function of the Pithoprakta, and is therefore more limited than dedicated CV sequencers.

<u>System Mode</u>

This special settings mode allows you to set up some under-the-hood details, to integrate better with your system and preferences. The settings that can be

changed are gate length, trigger length, and reset behavior.

To enter System Mode, start with the modular rack powered down, and with nothing connected to the CV and gate inputs. Set both Probability knobs to 100% and hold the Reset button while powering up the rack. Connect a clock source to the Clock input, and you should see outputs 1 and 8 flashing on each clock.

In System Mode, Output 1 sends gates. Set the gate length using the Probability 1 knob. Gate lengths are expressed as a ratio of the total step length (amount of time between input clocks) and the available settings are 1/8th through 8/8ths (on for the full step length).

Output 8 sends triggers. Set the trigger length using the Probability 8 knob. The available settings are 1 millisecond, through 8 milliseconds.

Since these 2 outputs fire on each clock in

System Mode, you can connect them to whatever you're triggering while adjusting the lengths, to hear the result while fine-tuning the values.

The last system setting defines the behavior of the Reset button and gate input. Normal operation resets to the beginning of the loop and/or division count. When integrating with other sequencers, it may be necessary to instead reset to the last step. Set the Div switch to the left for normal (first step) Reset, or to the right for last step Reset.

When you have set the controls to your desired settings, press the Reset button to save them and exit System Mode.

## Special behaviors

The following are some details which would not be obvious from looking at the panel. They are special behaviors which make sense within the context of using the module for making music.

When you have a loop repeating, you can switch from Div mode to regular mode without disrupting the loop you have going. This can be useful for setting up a straightforward drumkit-like rhythm using Div mode, but then switching over to the undivided mode and adding in little bits of syncopation by momentarily turning up the Probability knobs, to overwrite parts of the regimented rhythm with some randomness. Switching in the other direction, from the undivided mode to Divider mode, will overwrite the loop you've created, so this can be used to instantly get back to a simple, straightforward beat after taking the chaos as far as you can.

In Divider mode, when you engage looping using either the pushbutton switch or gate input, the module will wait until the end of the divider count to begin looping. This keeps loops which are based on regular divided rhythms in time without the user having to enter looping at the exact right time, and it keeps the Reset pointer at the beginning of the beat so you can perform stuttering/"beat repeat" effects by pressing

Reset or lowering the loop length to 2. However, when Div mode is off (Div switch to the left) and looping is engaged, looping will begin immediately on the next clock without waiting.

## Patching hints

The Pithoprakta can be clocked up to about 1kHz, or 1000 clock pulses per second. At these clock frequencies, the outputs will generate audio-rate pitched digital noise. In Div mode the divided outputs will be in four different octaves. Engaging looping will lock the noise into repeating waveforms. A V/oct oscillator's audio output sent to the clock input will allow it to play in-tune melodies, and the loop Length CV can be used as an octave-shift CV input. Unlike standard VCOs, the waveform itself will be different at different Length (octave) settings, as it gets truncated with shorter loop lengths.

At audio rates the CV output becomes a sort of "random wavetable oscillator", with waveforms of up to 64 points. Randomize the waveform by experimenting with the

probability controls, then lock the waveform by engaging the loop, and introduce random waveform mutation over time by setting the probability controls to around 5 to 10 percent. This mutation can create a wavering, detuned sound.

Try connecting one of the gate outputs to the Pithoprakta's Reset input. When using the Pithoprakta to create rhythmic loops, the loops will change time signature in a probabilistic way, as any time this particular output fires off, the loop will reset. In Div mode, connecting the lower gate outputs to the Reset input allows you to create time signatures other than those based on powers of two. Connecting output 2 to Reset yields three-based rhythms, outputs 4 and 6 yield five-based rhythms, and output 8 yields nine-based rhythms (different time signatures are possible depending on the Reset behavior you've saved in System Mode). Taking one of these outputs and sending it to a basic clock divider before going to the Reset input will allow for longer measures like 18 or 36 steps, so considerable rhythmic

complexity can come from experimenting here.

At audio rates, connecting these lower outputs to Reset will create various subharmonic intervals in relation to the input oscillator.

<u>Specifications</u>

<u>Digital inputs</u>: The Reset, Clock, and Loop Gate inputs will trigger from a rising edge at a threshold level of ~1.5V. They are conditioned so that even slowly-moving signals with no sharp edges should trigger fairly reliably.

<u>CV inputs</u>: The CV inputs respond natively to the range 0V to 5V, but using the offset knobs (Prob 1, Prob 8, loop Length) and their respective attenuators, any normal Eurorack signal can be put into the correct range for modulating these parameters fully.

<u>Gate outputs</u>: The gate/trigger outputs are 0V when low and 5V when high.

**CV output**: The CV output is in the range 0V to 5V.

**Power**

The Pithoprakta can be powered by any standard Eurorack power supply. Connect the power cable (2 x 8 connector) with its red stripe oriented towards the "-12V" label on both the module and your power bus board/cable.

It is delivered set up to derive its 5V power from the 12V rail, as in most digital Eurorack modules. If your case's power supply has a 5V power rail, you can move the jumper on the back (towards the top right of the back of the module) from the INT[ernal] to the EXT[ernal] setting. In this configuration, the module will draw no power from the 12V rail.

**Power consumption**: With 5v power jumper at INT[ernal] setting:
**+12V: 25mA**
**-12V: 1mA**

With 5v power jumper at EXT[ernal] setting:
+12V: 0mA
+5V: 25mA
-12V: 1mA

<u>Warranty</u>

The Pithoprakta is warranted for one year after date of purchase, for any defects in manufacturing. The warranty covers replacement or repair, at the option of Iron Ether. The warranty does not cover damage caused by misuse or abuse of the device, including wrong power supply voltages, backwards power cable connection, or excessive voltage levels. The cost of returning items for repair will be paid by the customer.

Concept/hardware design by Taylor Livingston
Firmware by Michael Barton

IronEther.com