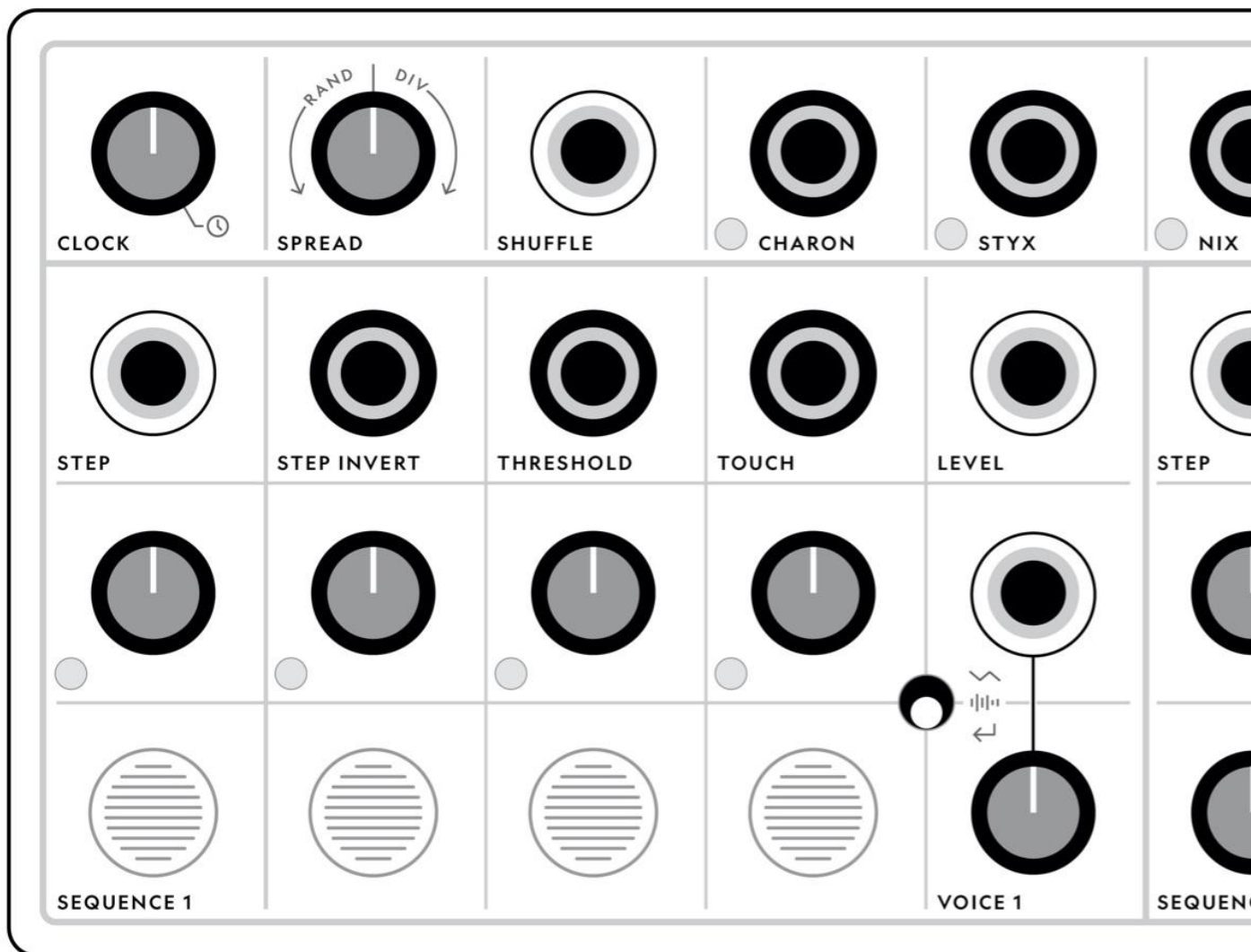


Pluto Manual



Pluto Manual
Hardware 1.5.02
Firmware 1.5.3
October 2023



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Introduction

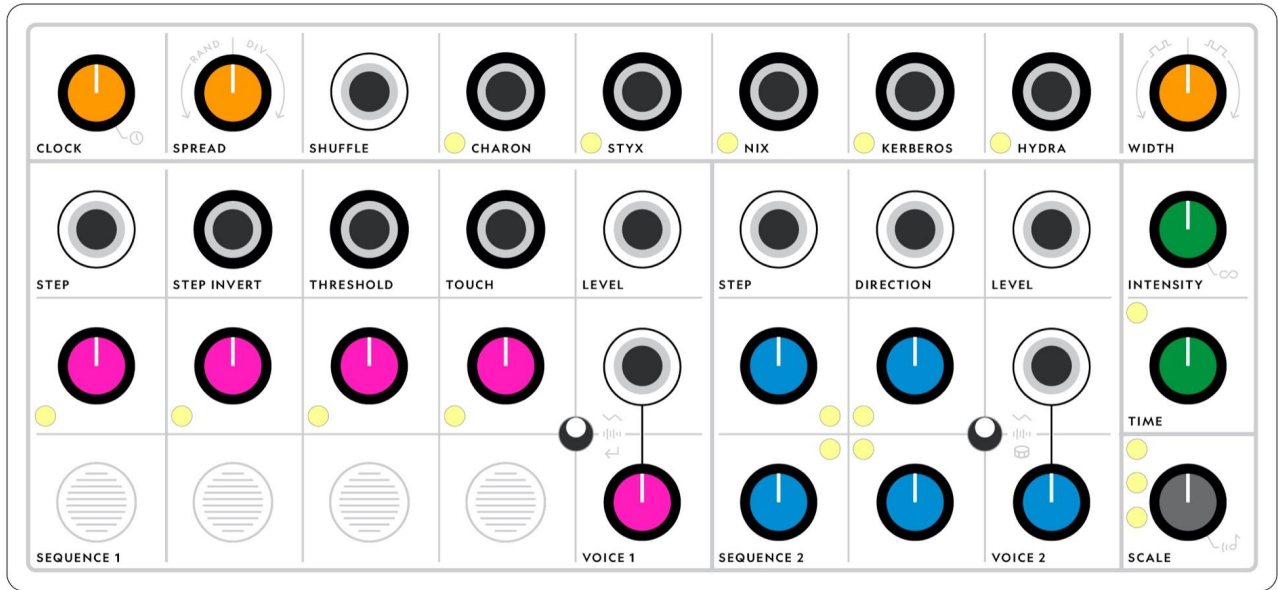
Pluto is a compact, portable synthesizer with abilities that belie its small size. Five channels of modulation (named for the five moons of Pluto), two voices, two sequencers, a mini-keyboard, and built-in effects make Pluto its own complete sound environment, but it can happily play with other devices.

The design of Pluto draws from a legacy of portable electronic instruments, from the Buchla Music Easel to 80s Casio synthesizers. With an intuitive patch cable interface and no menus to dive through, Pluto is easy to learn, but deep enough for musicians searching for uncommon sounds and rhythms.

Features

- Portable 2-voice, 2-sequencer patchable synthesizer
- Easily create complex, randomized sequences
- Low-aliasing digital oscillators, wavetable oscillators
- Mini touch keyboard
- Built-in delay and reverb effects
- Quantize to preset scales, MIDI input, or even audio input
- Clock range from 1 bpm to audio rates
- Audio input for audio processing (line level)
- Audio output (headphone, line out)
- Sync In & Out
- MIDI In & Out (TRS Type A, USB)
- 2 channels CV Out (0-5v, 1v/oct)
- Power via USB-C cable (included)
- Rechargeable 2500mAh battery

Overview



Moons

(Orange knobs) The moons of Pluto the planet were an inspiration for the main modulation sources on Pluto the instrument.

Sequence 1 + Voice 1

(Magenta knobs) The first Sequencer-Voice combination can be played with the four touch keypads or controlled with pulse signals. The sequencer is tied to Voice 1, which has 3 distinct modes.

Sequence 2 + Voice 2

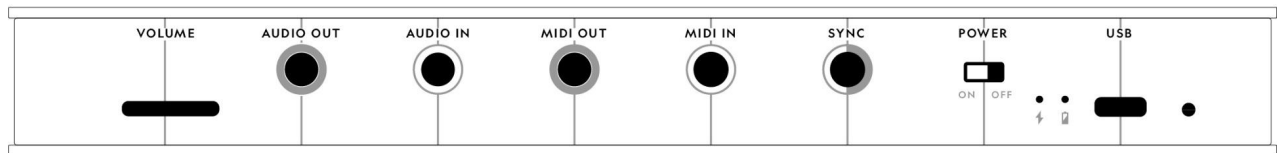
(Cyan knobs) The second Sequencer-Voice combo is controlled with pulse signals. The sequencer is tied to Voice 2.

Effects

(Green knobs) Both voices run through the effects section which produces analog-style delay, glitchy delays, looping delay and reverb.

Scale

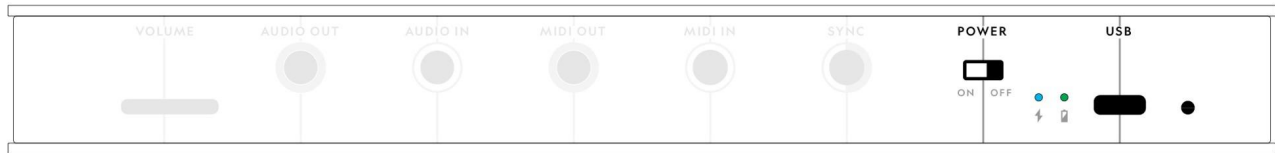
(Gray knob) The SCALE knob controls which notes are played by the sequencers. Select from unquantized, a series of built-in scales, or control the quantization with MIDI or audio.



Back panel

VOLUME	Sets the output volume
AUDIO OUT	Connect to headphones or speaker
AUDIO IN	Audio input
MIDI OUT	TRS MIDI output (Type A)
MIDI IN	TRS MIDI input (Type A)
SYNC	Sync input/output
POWER	Power on/off switch
USB	Power supply, USB MIDI
Program	Initiate firmware updates

Power



Basics

Turn Pluto on by sliding the POWER switch to the ON position.

Use the provided USB cable to connect Pluto to a power source. This will power Pluto and charge the internal battery. Use only a USB-C cable to power Pluto.

Battery

Pluto has an internal rechargeable battery. LEDs on the back panel will indicate the status of the battery.

Charging – A **blue** light above the CHARGE icon indicates that Pluto is plugged in and the battery is charging.

Low battery – A **red** light will blink above the BATTERY icon when the battery is low. If the battery is VERY low, the red light will be solid.

Fully charged – A **green** light appears above the BATTERY icon when the battery is fully charged.

Charged – No LEDs will display when Pluto is unplugged AND the battery is charged above ~20% capacity.

Getting started

Patching basics

To use Pluto's patch interface, connect a 3.5mm patch cable from any output jack (filled circle) to any input jack (outlined circle.)

Pluto's interface uses pulse signals. This means the signals are either on or off (high or low.) These on/off signals are used to control the timing of the sequencers and modulate the sound of Pluto's voices.



OUTPUT



INPUT



OUTPUT

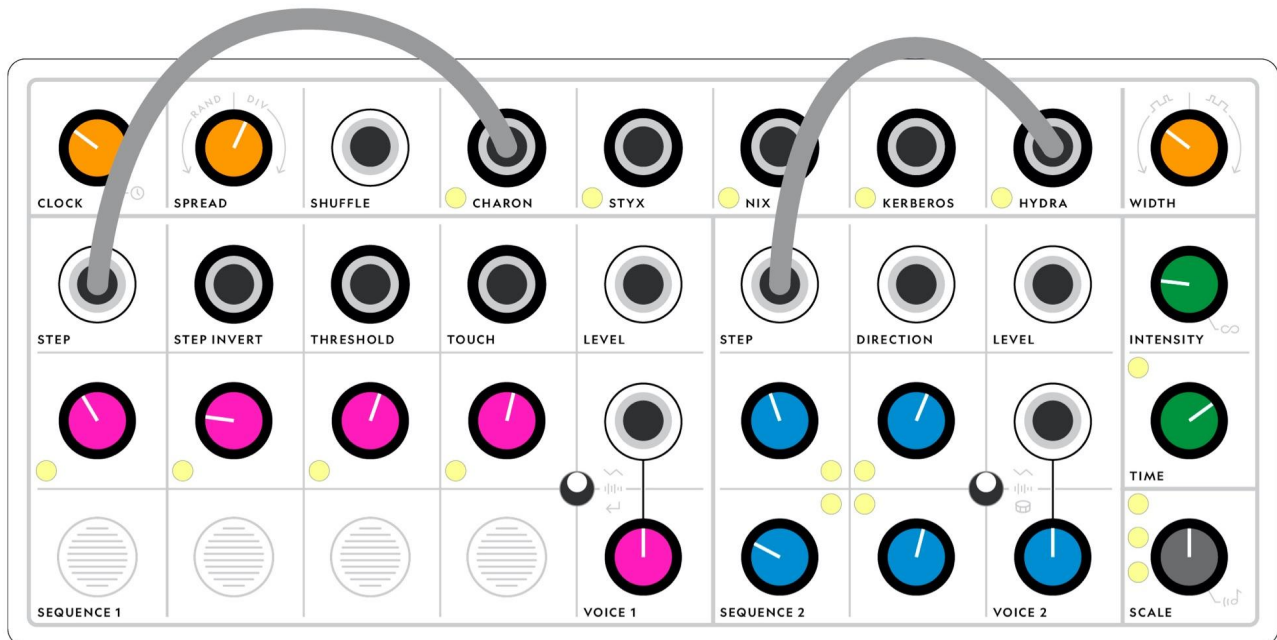


INPUT

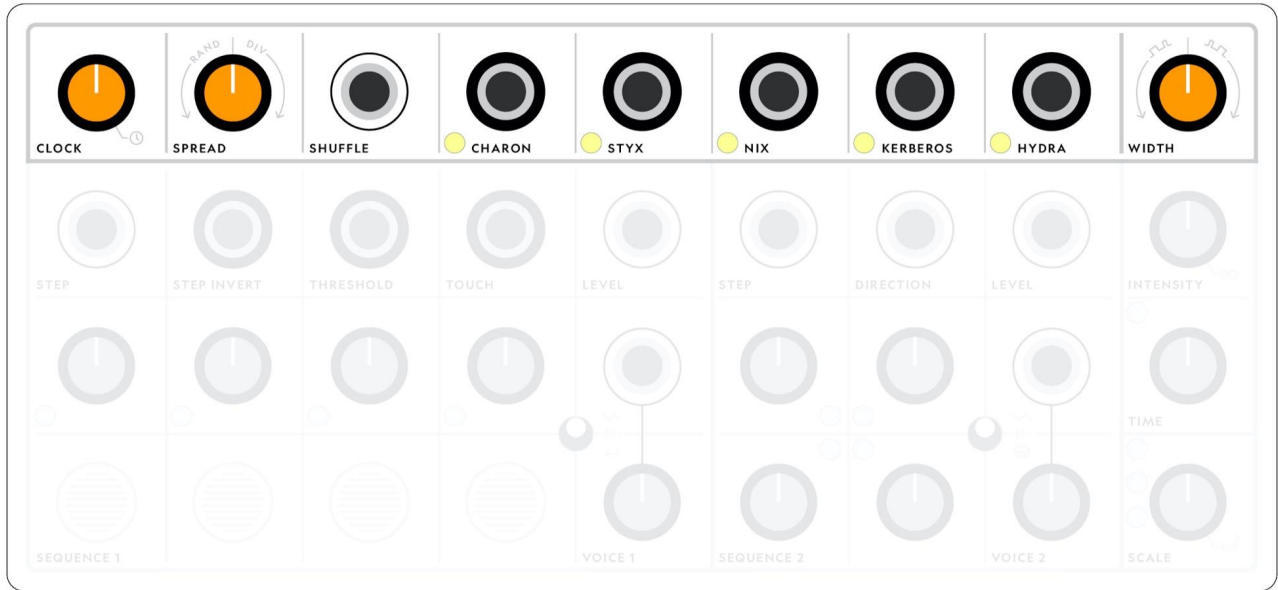
First patch

Here's a good place to start. Use two patch cables to make connections as shown below. This will get both sequencers and voices going.

From here, just listen and explore. Turn some knobs. Patch more cables. Have fun.



Moons



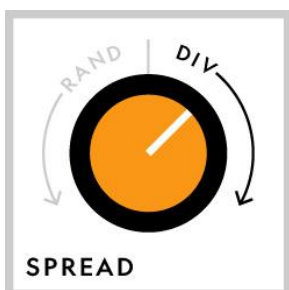
Named for the five moons of Pluto (the planet), the five outputs along the top are the main modulation sources of Pluto (the synth.) The outputs can generate a range of clock divisions, polyrhythms, and randomly evolving patterns.

CLOCK

The CLOCK knob sets the base tempo of the five "moons" outputs.

SPREAD

The SPREAD knob determines the timing relationship of the "moons" outputs.



As the SPREAD knob turns clockwise from noon, the "moons" will output greater and greater clock divisions of the main CLOCK tempo.



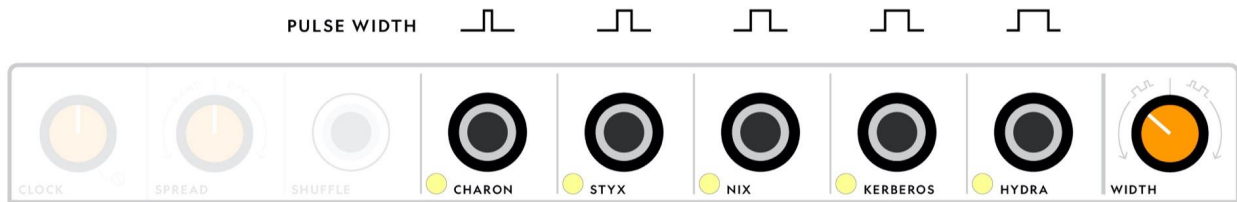
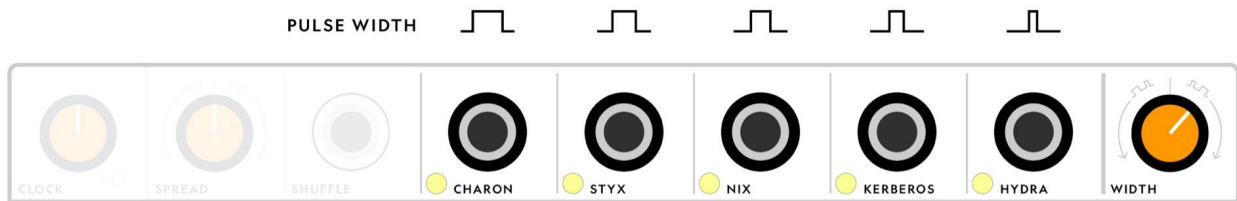
Turning SPREAD counter-clockwise from noon causes the "moons" to generate random patterns. The further counter-clockwise, the more quickly these patterns evolve. Turn SPREAD back to the noon position to lock the randomly-generated pattern.

WIDTH

The WIDTH knob adjusts the pulse width of the "moons" signals.

At the noon position, the pulse width of all output signals is very narrow. Turning WIDTH clockwise (to the right) from noon will increase the pulse width of the five moons signals from left to right.

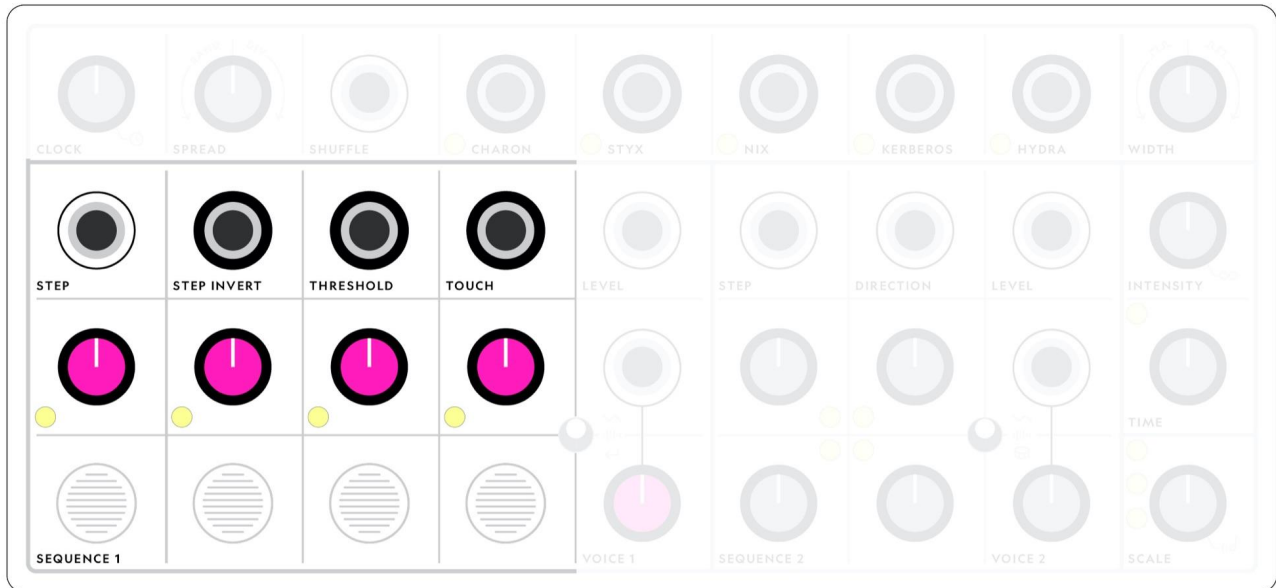
Turning WIDTH counter-clockwise (to the left) from noon will increase the pulse width of the five moons signals from right to left.



SHUFFLE

When the SHUFFLE input receives a high signal, the output signals shift from left to right. CHARON's output moves to STYX, STYX to NIX, etc. And HYDRA's output moves to CHARON.

Sequencers



Sequence 1

SEQUENCE 1 determines what frequency is played by VOICE 1.

The four steps of SEQUENCE 1 can be played manually with the four keypads or by patching a signal to the STEP input.

This sequencer has three different modes, depending on how STEP and the Voice 1 LEVEL input are patched.

1. If LEVEL and STEP are unpatched

- Keypads can be played like a mini keyboard
- Voice 1 frequency is set to the active step

2. If LEVEL is patched but STEP is unpatched

- Touch a keypad to make it the active step
- LEVEL is modulated by its input signal
- Voice 1 frequency is set to the active step

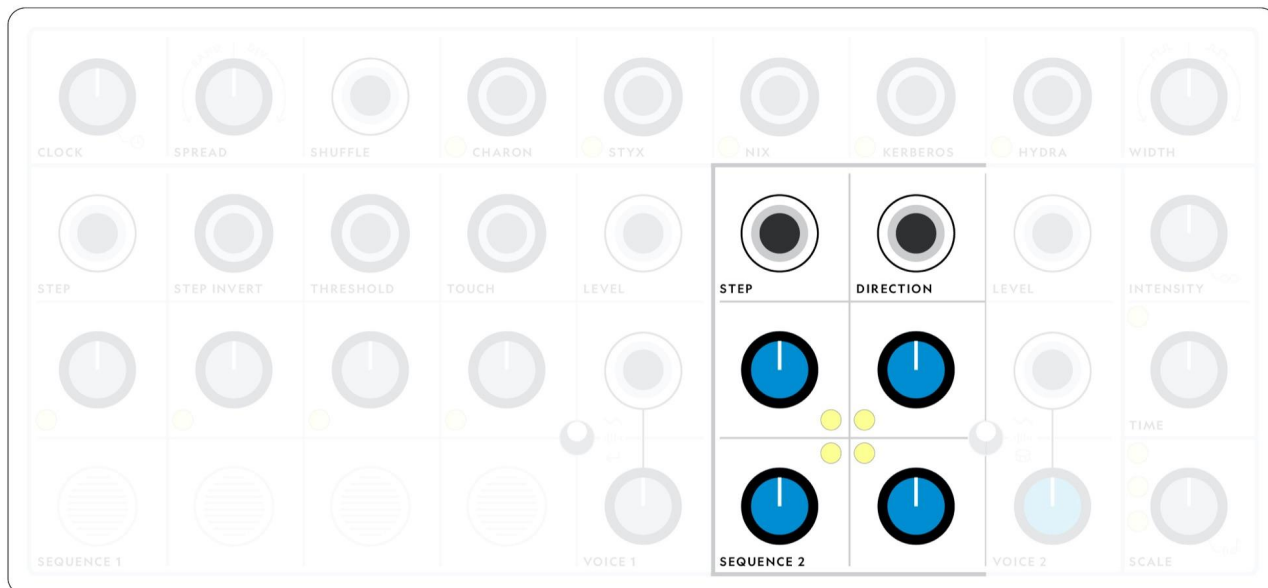
3. If STEP is patched

- A rising edge in STEP input signal advances to the next step in the sequence
- Touch a keypad to toggle a direction change at that step
- When sequence reaches a selected step (50% LED brightness), the sequence reverses after playing that step
- If LEVEL is unpatched
 - LEVEL input is normalled to STEP input
- If LEVEL is patched
 - LEVEL is modulated according to its input signal
- Voice 1 frequency is set to the active step

STEP INVERT outputs an inverted STEP signal. If STEP is high, STEP INVERT is low and vice versa. If nothing is patched to STEP input, STEP INVERT outputs a high signal.

THRESHOLD outputs a high signal when the knob position for the active step is past the noon position. When the Audio input voice mode is selected, THRESHOLD becomes an envelope follower output.

TOUCH outputs a high signal when any keypad is touched.



Sequence 2

SEQUENCE 2 determines what frequency is played by VOICE 2.

The four steps of SEQUENCE 2 are played by patching a signal to the STEP input.

The STEP input is normalled to Voice 2 LEVEL input.

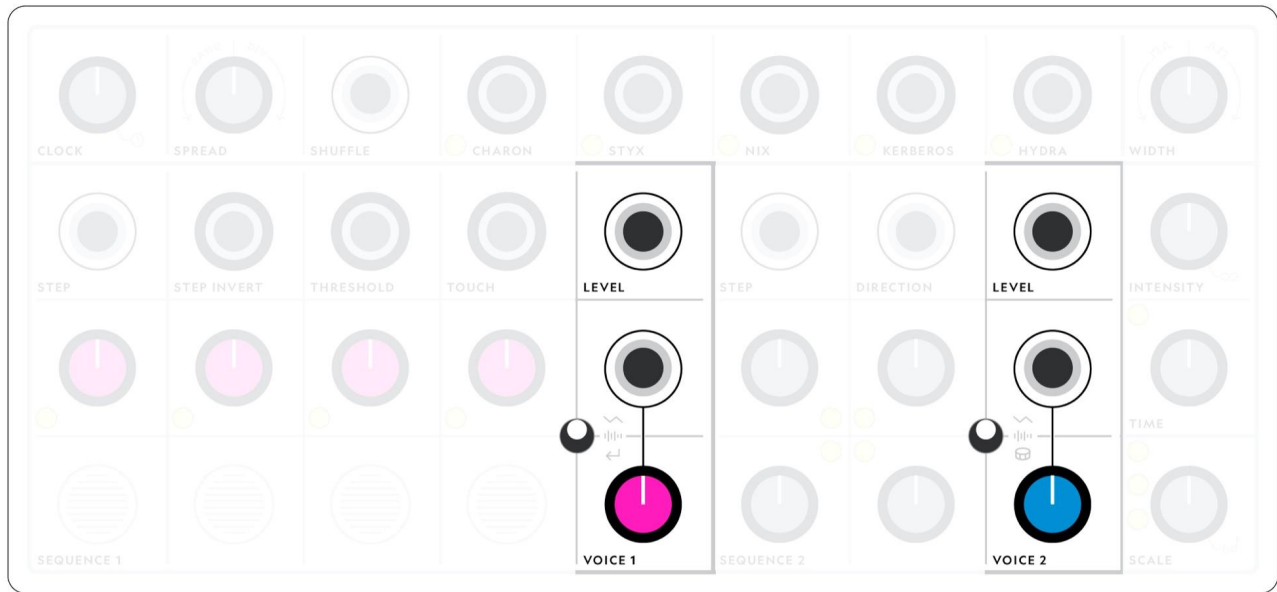
If STEP is patched and the DIRECTION input receives a high signal, SEQUENCE 2 will move in the reverse direction.

If STEP is unpatched and the DIRECTION input receives a high signal, SEQUENCE 2 will move to a random step.

Randomization

When any individual sequence knob is turned full CW, the sequencer outputs a random note at that step.

Voices



Pluto has two multi-mode voices whose amplitude and timbre may be modulated.

LEVEL input

Each Voice has a LEVEL input for modulating the amplitude (volume) of the voice when a control signal is patched. The envelope of the amplitude is automatically determined by the rate and pulse width of the input signal.

The LEVEL input is normalled to the STEP input of the corresponding sequencer.

Voice mode switch

Both of Pluto's voices have three different modes. Use the toggle switch to select a mode.

Voice 1

1. **Classic** – Blends from Sine to Triangle to Saw waveforms
2. **Wavetable** – Morphs between 32 different wavetables
3. **Audio input** – Uses the AUDIO IN signal instead of an oscillator. When this mode is selected, THRESHOLD output becomes an envelope follower output. Try with drum machine audio for converting audio to triggers.

Voice 2

1. **Classic** – Blends from Sine to Triangle to Saw waveforms
2. **Wavetable** – Morphs between 32 different wavetables
3. **Percussive** – A blend of wavetable and FM oscillators. Designed to produce a range of percussive sounds. This voice has faster attacks, some pitch envelopes, FM modulation, and noise. Gets some growly FM sounds with longer envelopes.

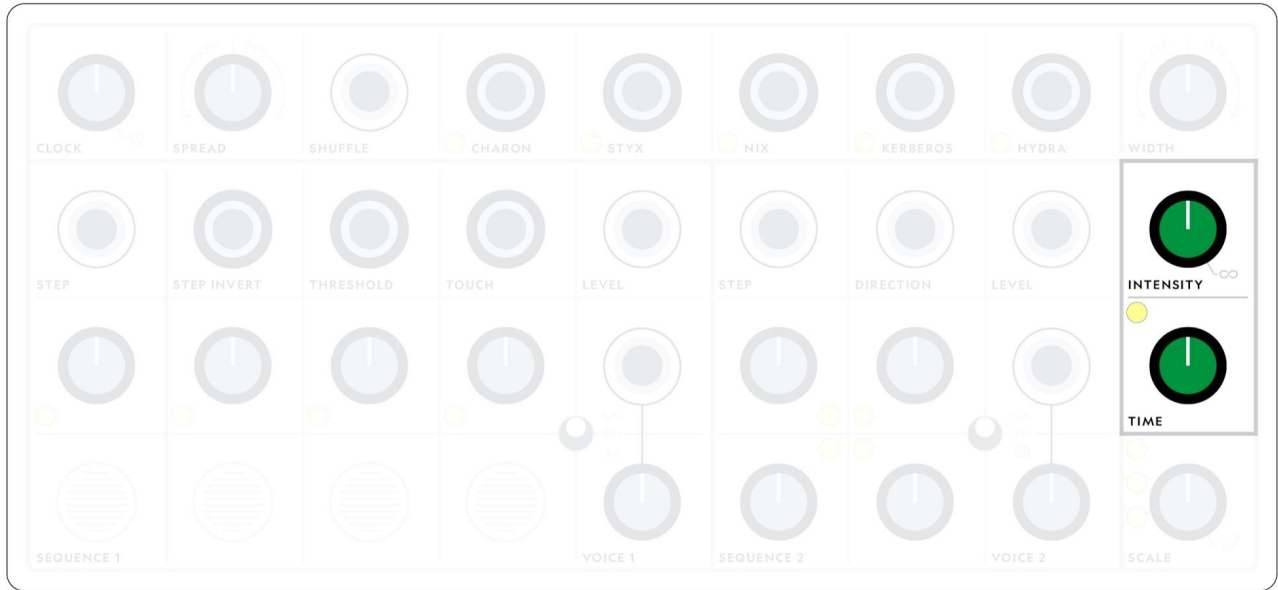
VOICE knob

Turning the VOICE knob changes the timbre of the voice.

Modulation input

Patching a signal to the modulation input will modulate the timbre and sometimes the frequency of the voice. Each voice mode handles modulation a little differently. Like the LEVEL input, the envelope of the modulation signal is automatically determined by the rate and pulse width of the input signal.

Effects



Pluto has built-in delay and reverb effects that are applied to both Voice 1 and Voice 2. The effects range from analog-style delays to glitchy delay effects to shimmering reverb.

INTENSITY

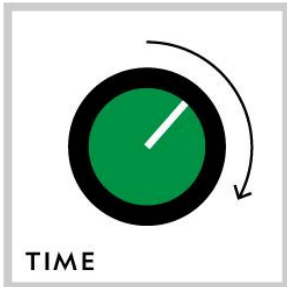
The INTENSITY knob controls both the level of effect signal and other variables like the amount of delay feedback or reverb shimmer.

When the INTENSITY knob is turned to the full CW position, delayed signals will begin to loop. No incoming audio is added to the loop. The loop duration is set by the TIME knob.

TIME

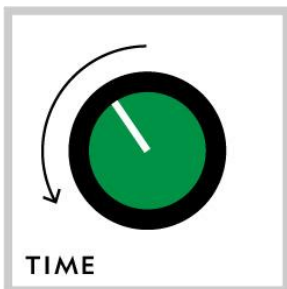
The TIME knob adjusts the delay time and blends between different delay and reverb effects modes.

Analog-style delay



From noon to the full CW position, the TIME knob adjusts the delay time like a traditional analog-style delay effect. The farther CW the knob is turned, the longer the delay time.

Glitch delay and reverb

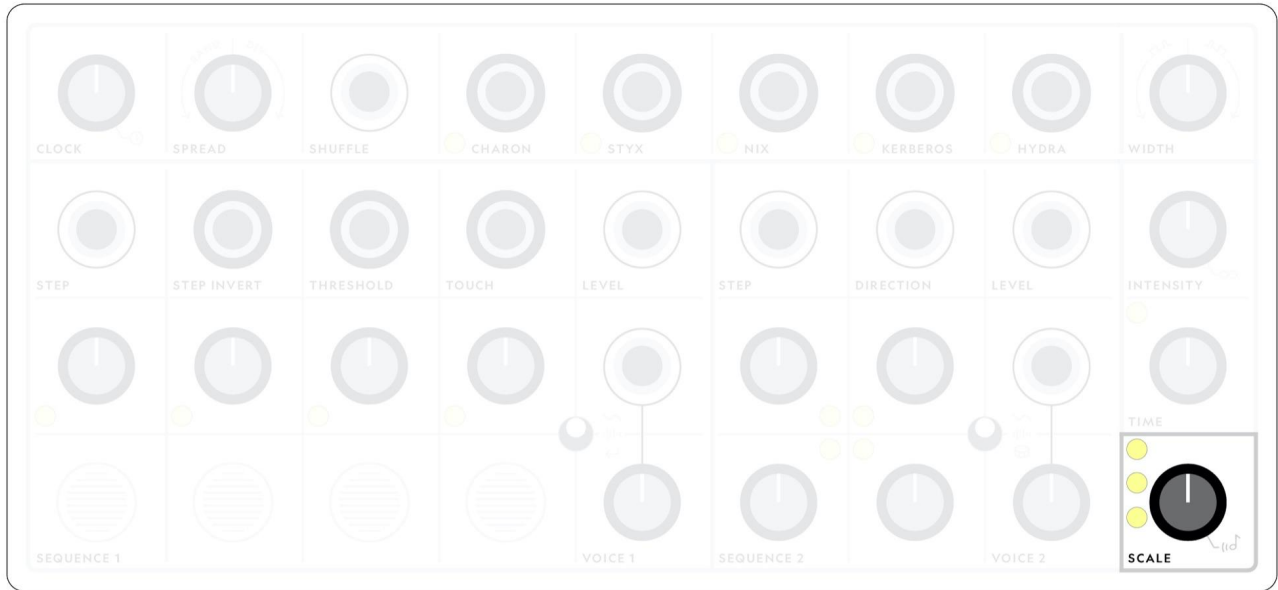


The glitch delay and reverb modes are accessible when the TIME knob is turned CCW from the noon position.

Clock-based delay – When the TIME knob is between about 10 and 12 o'clock, the delay time is derived from divisions of the clock rate as well as the knob position of the active steps of both sequencers.

Shimmer reverb – As the TIME moves from about 10 o'clock to the full CCW position, the delay effect blends into reverb. Use the INTENSITY knob to dial in the reverb level and amount of shimmer (pitched-shifted reverb.)

Scales



SCALE knob

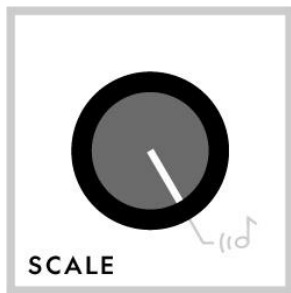
The frequencies played by each voice are determined by the SCALE knob. The quantized scales are in the key of C.

The preset scales listed from CCW knob position to CW position:

Scale	Notes
Unquantized	-
Pentatonic	C, D, E, G, A
Major full	C, D, E, F, G, A, B
Major	C, E, G, B
Minor full	C, D, D#, F, G, G#, B \flat
Minor	C, D#, G, B \flat
Triad I	C, E, G
Triad V	D, G, B

Triad vi	C, E, A
Triad ii	D, F, A
Triad iii	E, G, B
Triad IV	C, F, A
Listen mode	Notes based on MIDI or audio input

Listen mode



When the SCALE knob is turned to the full CW position, Pluto will quantize notes based on an external source, either to MIDI note input or to notes detected in the audio input signal.

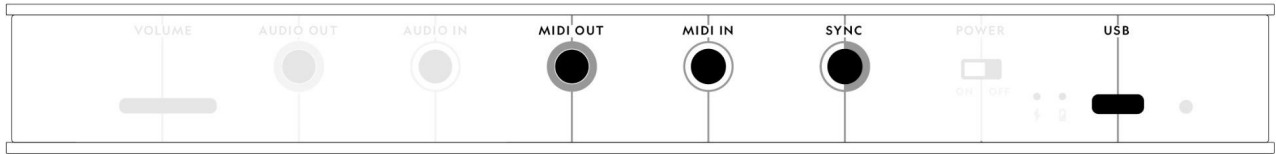
When quantizing based on the audio input, Pluto will try to detect notes in the audio input signal. It stores the last three unique notes it detects and will quantize both voices to that three note scale.

When quantizing to MIDI, Pluto will quantize to the notes received via MIDI. Hold down a chord and Pluto will use those notes as a scale, quantizing both voices to those notes.

Note: When a STEP input of a sequencer is unpatched, incoming MIDI notes are played directly by the corresponding voice.

Note: Listen mode is independent from Voice 1 Audio Input mode.

MIDI



Pluto sends and receives MIDI data via the 3.5mm TRS MIDI jack and USB. To connect a MIDI device to the MIDI jack, use a TRS/stereo 3.5mm cable or TRS-to-MIDI DIN adapter. The MIDI jack is “Type A,” the official MIDI 2.0 spec.

MIDI in

Pluto receives notes on MIDI channel 1. When neither STEP input is patched, the notes are played by both voices. If a sequencer’s STEP input is patched, then the MIDI input will not be used for that sequencer’s respective voice.

MIDI input may also be used to set the scale/quantization for both voices. See **Scales**.

MIDI out

Pluto sends MIDI notes from both Sequencers independently. Sequencer 1 sends MIDI notes on channel 1. Sequencer 2 sends MIDI notes on channel 2.

When Sequencer 1 STEP is unpatched, the keypads will send notes on MIDI channel 1.

Changing MIDI channels

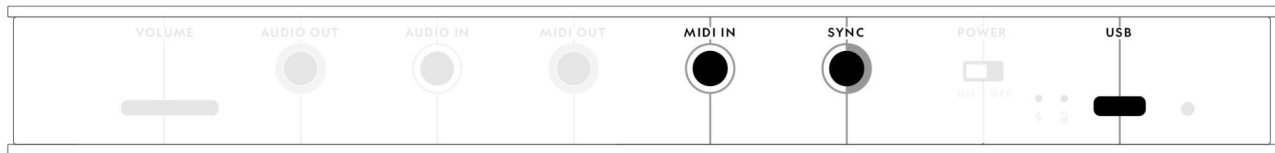
See **Configurations** for instructions on how to change the default MIDI input and output channels.

MIDI control change

Pluto sends MIDI CC messages for all knobs and toggle switches. The MIDI CC mapping is as follows:

CONTROL	MIDI CC
CLOCK	102
SPREAD	103
WIDTH	104
SEQ 1 STEP 1	105
SEQ 1 STEP 2	106
SEQ 1 STEP 3	107
SEQ 1 STEP 4	108
VOICE 1	109
VOICE 1 SWITCH	118
SEQ 2 STEP 1	110
SEQ 2 STEP 2	111
SEQ 2 STEP 3	112
SEQ 2 STEP 4	113
VOICE 2	114
VOICE 2 SWITCH	119
INTENSITY	115
TIME	116
SCALE	117

Sync Pluto to other devices



Set CLOCK to external sync



Pluto can be synced to an incoming sync signal or MIDI clock. To initiate sync to an external clock source, turn the CLOCK knob to the full CW position.

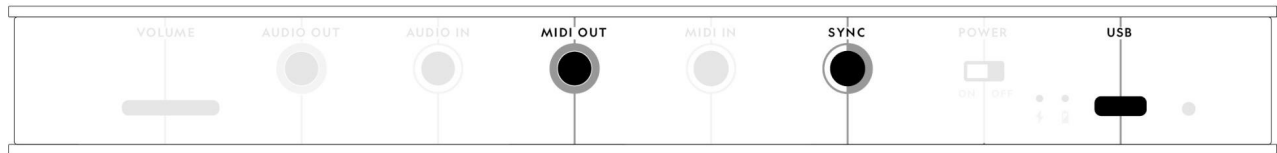
MIDI clock in

Pluto receives MIDI clock data via the MIDI IN jack and USB MIDI. The incoming MIDI clock is received at 12 PPQN.

SYNC in

To receive a sync signal with the SYNC jack, make sure the CLOCK knob is in full CW position and connect a clock source to the SYNC jack.

Sync other devices to Pluto



MIDI clock out

Pluto outputs MIDI clock data via the MIDI OUT jack and USB MIDI.

Note: MIDI clock data is per device and not channel dependent.

SYNC out

A sync signal is automatically output from the SYNC jack unless the CLOCK knob is set to full CW position. Pluto will output a 5v sync signal in time with the CLOCK.

Configuration mode

Configuration mode is used to change MIDI channels, audio output mode, and calibrate Pluto's touch keypad.

Access configuration mode

- Power off Pluto
- Turn all knobs counterclockwise (to the left)
- Power on Pluto (without touching the touch pads)
- After the LED startup sequence, Pluto will be in CONFIG MODE

Save or cancel changes

- Turn CLOCK knob to exit config mode and save any changed settings
- To cancel any changes, POWER off Pluto

Touch keypad calibration

- Use VOICE 1 knob to manually adjust touchpad sensitivity (CCW = more sensitive, CW = less sensitive)
- Test the keypads. LEDs should light up when their respective keypads are touched.

MIDI channels




Pluto accepts MIDI input on one channel and outputs MIDI from Sequence 1 and 2 to two channels

- Switch TOGGLE 1 to set MIDI IN channel: 1, 9, 14
- Switch TOGGLE 2 to set MIDI OUT channels: 1+2, 9+10, 14+15

Note: if toggle switches are not operated during CONFIG MODE, no changes will take place

Audio output mode

Turn the WIDTH knob to set the audio output mode. The LEDs along the top of Pluto will indicate the mode:

-  Dual mono
-  Voice 1 and 2 are panned 50% left/right
-  Voice 1 and 2 are panned 100% left/right

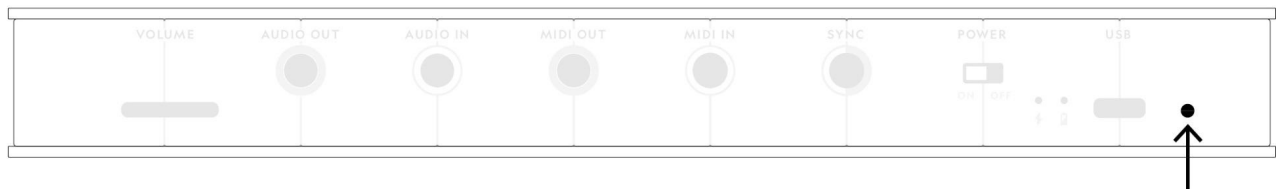
Firmware

Updating firmware

From time to time, firmware updates will be available with new features and fixes.

The instructions to update the firmware are as follows:

1. Download the latest firmware:
<https://www.modernsounds.co/pluto>
2. Download the Teensy Loader app here:
<https://www.pjrc.com/teensy/loader.html>
3. Plug in Pluto to your computer with the USB cable. Power on Pluto.
4. Unzip the firmware and open the .hex file with Teensy Loader.
5. Choose "Automatic Mode" from Teensy Loader's Operation menu.
6. Insert a toothpick or paper clip inside the hole to the right of the USB jack on the back panel. Gently press the button inside. The firmware will load in a few seconds and Pluto will automatically reboot. The update is complete.



Troubleshooting

If Pluto does not reboot, make sure you have "Automatic Mode" selected and try again. If you're still having trouble, email us at info@modernsounds.co

Patch notes

