INSTRUō | SPECIALIST SYNTHESIZERS

Pocket SCÍON

Biofeedback Instrument

User Manual

Contents

Description

Pocket SCÍON is a portable device that captures biofeedback data sourced from contact with living organisms. This data is used by the onboard sound engine to generate evolving soundscapes, and a range of MIDI messages. The data is also accessible as OSC messages, broadcast from the accompanying desktop application.

Anyone can create, shape and enjoy music with Pocket SCÍON, regardless of existing musical experience. Despite its stand-alone, plug-and-play interface, experienced or adventurous users can use the MIDI and OSC output capabilities to integrate Pocket SCÍON into their studios, installations and audio-visual projects.

Pocket SCÍON includes instruments created exclusively for the device, made in collaboration with Tarun Nayar (Modern Biology), an ecologist, musician and prolific user of our Eurorack format SCÍON module.
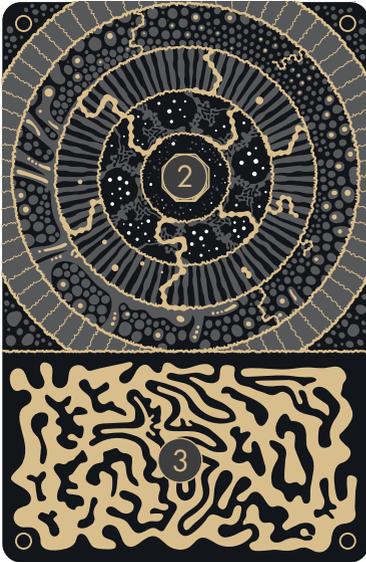
Features

- Four custom instruments
- Sound generation via the capacitive touch pad or sensor clips
- Five note polyphony
- Raw signal output
- TRS-MIDI and USB-MIDI output with single- or multi-channel MIDI voice allocation
- Open Sound Control (OSC) data over USB via the desktop application

Operation ▬

1. Pocket SCÍON can be powered either by 3x AAA batteries or via a suitable USB power source (computer/laptop, powerbank etc). For battery operation, ensure the power switch is in the downward ON position

2. Connect Pocket SCÍON's **Stereo Line Level/Headphone Output** to headphones or a monitoring system.

3. Connect the included 3.5mm sensor cable to Pocket SCÍON's **Sensor Input** and attach the sensor clips to an organism of your choice.

SCÍON | ˈsʌːən | **noun** (biology) young shoot or stem useful for sprouting or forming new roots, descendant of a noble family

Front

Back

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POCKET SCÍON

AUDIO

SENSOR

VOLUME [♯/♭]

[VOICES] SENSITIVITY

MIDI

USB

INSTRUMENT [SHIFT]

OFF
ON

MODERN BIOLOGY

Key

1. On/Off Switch
2. Sensitivity Display Graphic
3. Capacitive Touch Pad
4. Sensor Input
5. [Voices] Sensitivity Buttons
6. Instrument [Shift] Button

7. Audio Output
8. Volume [♯/♭] Buttons
9. TRS MIDI Output
10. Micro USB Port
11. Battery Compartment

How Pocket SCÍON works ━━

Pocket SCÍON uses an analogue pulse oscillator to monitor and track changes in resistance measured at the **Sensor Input** or **Capacitive Touch Pad**.

The circuit is completed when the sensors are attached to an organism or when the **Capacitive Touch Pad** is touched. A capacitor charges until the voltage surpasses a threshold, at which point the oscillator toggles its output HIGH. The capacitor then discharges, and the oscillator toggles its output LOW, starting the cycle again and creating an oscillating pulse waveform. The resistance of the plant/soil path measured between the sensor clips controls the frequency of this charge/discharge cycle.

The oscillator allows for accurate measurement of resistance changes by analysing the frequency of the pulse waveform. Every time the oscillator output rises, a timestamp is created (in microseconds). A window of ten measurements is used to determine how resistance fluctuates over time. It calculates the minimum value, maximum value, mean, delta, standard variance, and standard deviation of each set of measurements. A new note event is triggered when the deviation relative to the delta measurement exceeds a threshold set by the **Sensitivity Buttons**.

Capacitor
Voltage

Output
Voltage
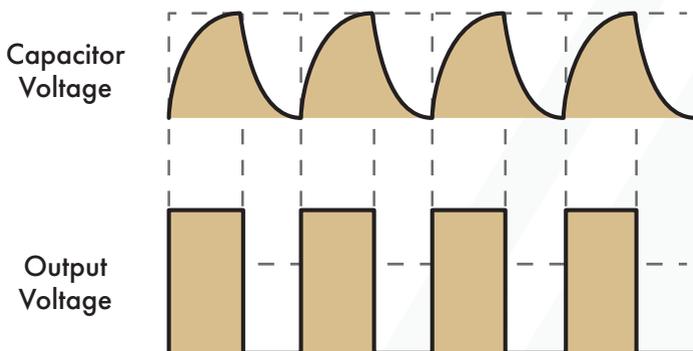
Stimulation

Pocket Scion's biofeedback sensor can be stimulated in multiple ways:

By touching the **Capacitive Touch Pad**.

- Touching the **Capacitive Touch Panel** allows the user to complete the circuit that affects the internal biofeedback sensor.

By connecting the sensor cable to a biofeedback source via the **Sensor Input**.

- A sensor cable connecting the **Sensor Input** to a biofeedback source will stimulate the internal biofeedback sensor. Biofeedback sources such as plants, fungi, and human skin generate biofeedback data that can be used to play Pocket SCÍON's instruments and generate MIDI and OSC information for data sonification. Factors such as moisture, sunlight, and contact surface area determine the responsiveness of the biofeedback source. Every biofeedback source will have a different level of responsiveness.
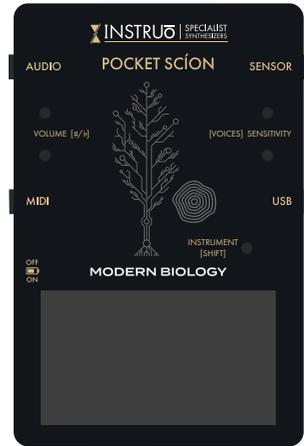
By connecting any audio or control voltage signal via the **Sensor Input**.

- Connecting audio or control voltage signals to the **Sensor Input** will stimulate the internal biofeedback sensor. Although rising-edge signals tend to work best, white noise will continually stimulate the internal biofeedback sensor.
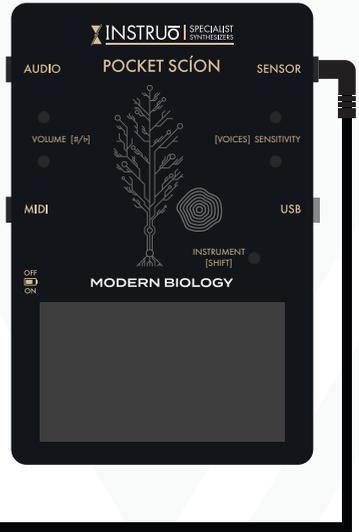
By connecting a standard 3.5 mm TS patch dummy cable to the **Sensor Input**.

- When a 3.5 mm TS patch cable is connected to the **Sensor Input**, and both the tip and sleeve of the unpatched end of the cable are touched by a fingertip, the circuit is completed that affects the internal biofeedback sensor.
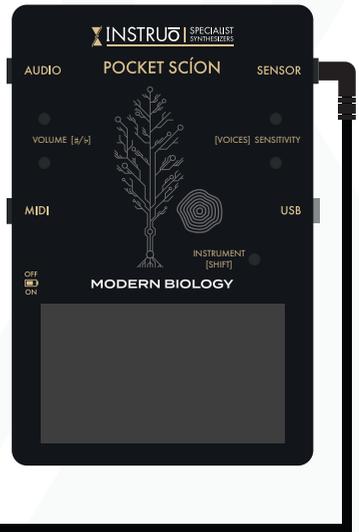
Sensitivity

The sensitivity of Pocket SCÍON can be adjusted via the primary function of the **[Voices] Sensitivity Buttons** on the device. This sets the amount of electrical activity from the biofeedback source needed for changes to occur.

- Short presses of the **[Voices] Sensitivity Buttons** allow for sensitivity adjustments in coarse increments.
- Long presses of the **[Voices] Sensitivity Buttons** allow for sensitivity adjustments in fine increments.
- Changes in sensitivity are indicated by green LED segments present across the five rings of the **Sensitivity Display Graphic**.
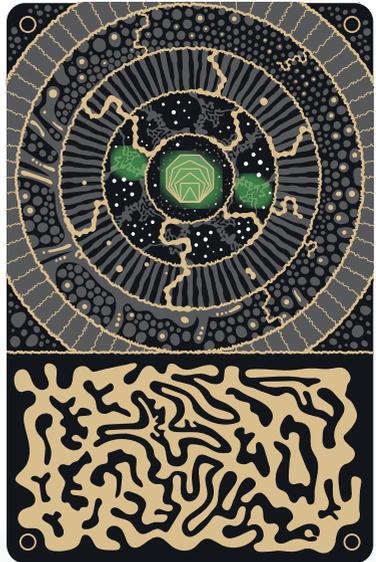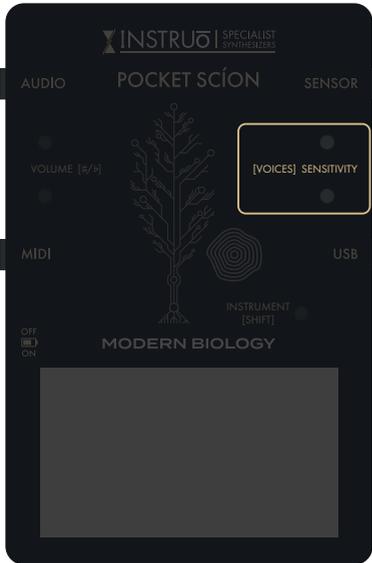
Instruments ▬

Pocket SCÍON has four instruments that can be played via the **Capacitive Touch Pad** and the **Sensor Input**.

Instrument selection can be cycled via the primary function of the **Instrument [Shift] Button**.

Secret Garden
When stimulated, this instrument is indicated by red LED animations.

Fungal Waves
When stimulated, this instrument is indicated by blue LED animations.

Treebeard's Koto
When stimulated, this instrument is indicated by green LED animations

Soil Circuits
When stimulated, this instrument is indicated by purple LED animations.

Voice Count

Users can define how many simultaneous notes can be played by an instrument via the secondary functions of the **Instrument [Shift] Button** and the **[Voices] Sensitivity Buttons**.
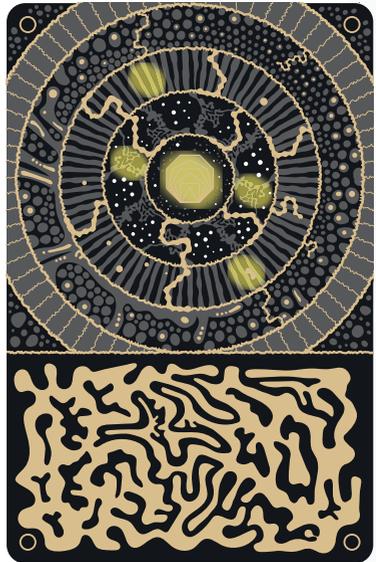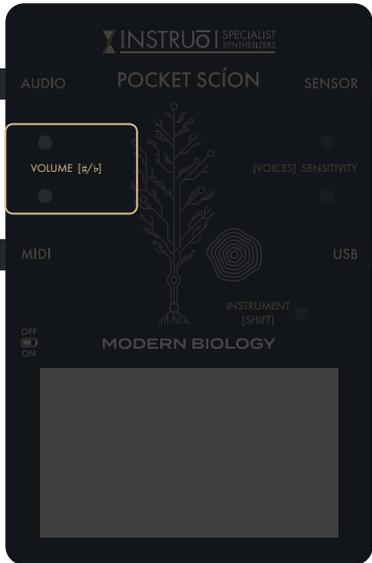
- Press and hold the **Instrument [Shift] Button** and then press the upper or lower **[Voices] Sensitivity Buttons** to adjust the number of active voices.
- Changes in the number of active voices are indicated by blue LED segments present across the five rings of the display.
- The minimum number of voices is one; the maximum number of voices is five.
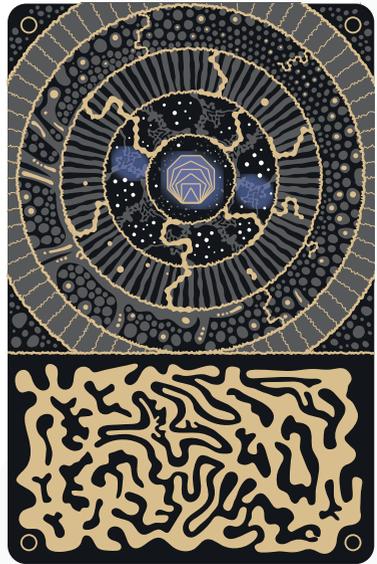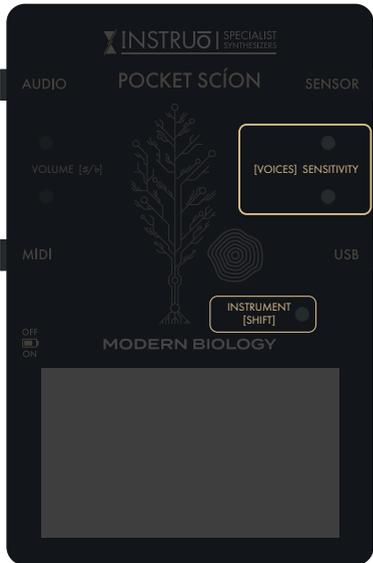
Volume ━━━

The volume of the **Audio Output** can be adjusted via the primary function of the **Volume [♯/♭] Buttons**.

- Changes to volume level are indicated by yellow LED segments present across the five rings of the display.
- Pressing the upper **Volume [♯/♭] Button** increases the volume.
- Pressing the lower **Volume [♯/♭] Button** decreases the volume.

Global Pitch Shift ▬

Users can apply a global semitone pitch shift to notes played by all of the instruments via the secondary functions of the **Instrument [Shift] Button** and the **Volume [♯/♭] Buttons**.

- Press and hold the **Shift Button** and then press the upper or lower **Volume [♯/♭] Buttons** to increase or decrease the shift in semitones. Pitch can be shifted by up to +/- 12 semitones.
- Changes in global semitone pitch shift are indicated by red LED segments present across the five rings of the display.
- Exclusive yellow LED behaviour indicates a shift of -12 semitones.

Red and white LED behaviour indicates a shift of +12 semitones
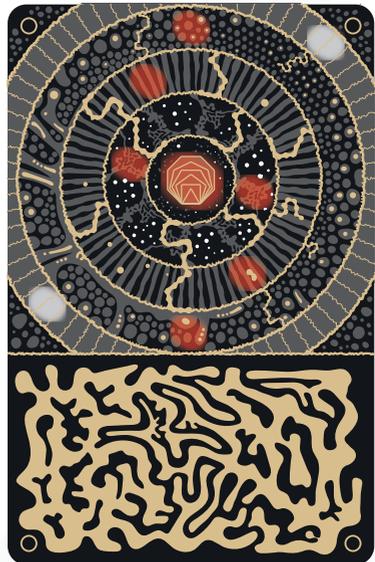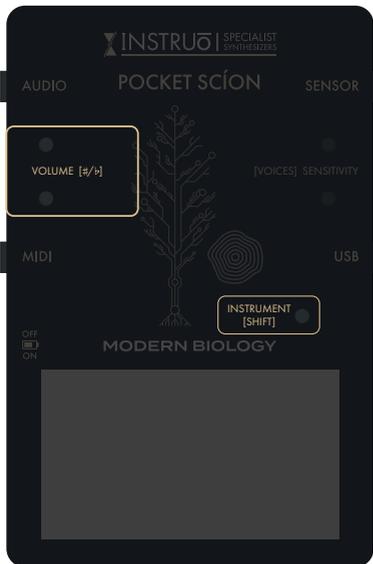
Raw Outptut Mode

As an alternative to outputting an instrument's audio, Pocket SCÍON also provides the chaotic raw pulse waveform from the analogue circuit used to generate the data at the internal biofeedback sensor.

- Press and hold both **[Voices] Sensitivity Buttons** for 3 seconds to enable/disable Raw Output Mode.
- When stimulated, raw data is indicated by white LED animations.
- The more stimulation Pocket SCÍON receives, the higher the frequency produced.

Tip: Raw Output Mode makes for a great gestural harsh noise synth.
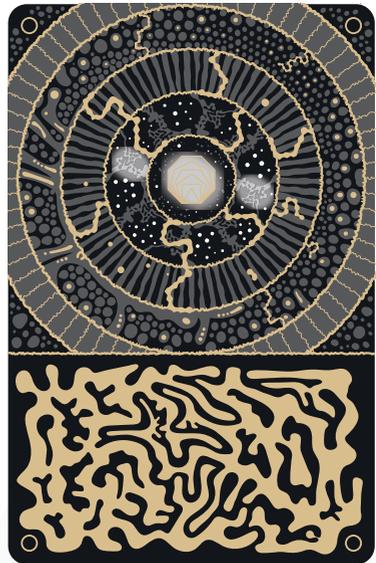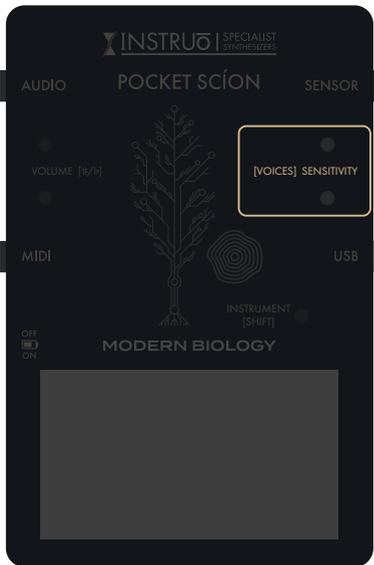
MIDI Output

Pocket SCION can send up to five simultaneous MIDI notes, each with velocity and an assignable varying CC, via the TRS-MIDI Output or USB port. Multi-channel MIDI mode allows these messages to be split across five channels for routing either to separate MIDI tracks in a DAW or to external hardware devices.

MIDI DEVICE
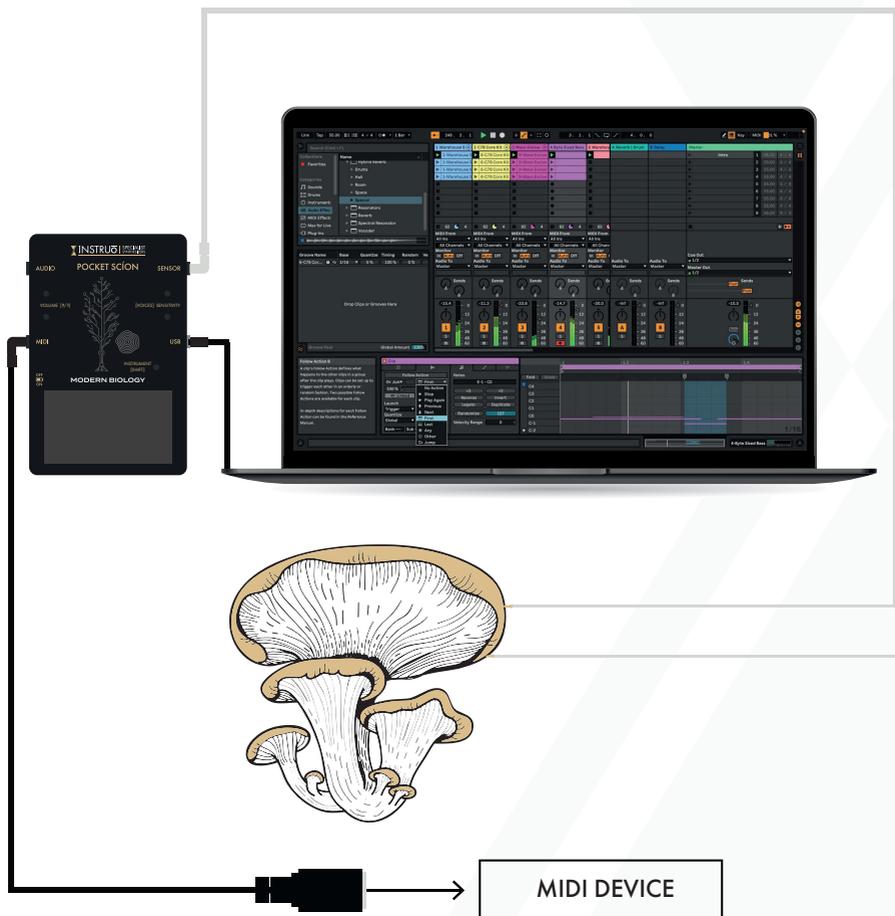
MIDI Modes ━━━

Pocket SCÍON has two MIDI modes

- Press and hold both **Volume [♯/♭] Button** for 3 seconds to switch between MIDI modes.

- Single-Channel MIDI Mode is indicated by a momentary green LED animation.

  - When Single-Channel MIDI Mode is enabled, Pocket SCÍON can send up to 5x: note-on messages, note number, velocity, and MIDI CC messages to a single MIDI track in a DAW or to an external device.

- Multi-Channel MIDI Mode is indicated by a momentary red LED animation.

  - When Multi-Channel MIDI Mode is enabled, Pocket SCÍON can send up to 5x note-on, 5x Gate, 5x velocity and 5xCC messages, to up to 5x individual MIDI tracks in a DAW or external devices.

- MIDI messages can be configured further via the Pocket SCÍON application.

- Please note that when in Raw Output Mode, Pocket SCÍON won't transmit MIDI data.

Tip: Try using Pocket SCÍON in conjunction with additional MIDI effects in your DAW.

Connecting to the Pocket SCÍON Application

When Pocket SCÍON is connected to a computer over USB, users can open the dedicated desktop application to customise the behaviour of instruments, voices, MIDI and broadcast Open Sound Control (OSC) Messages.
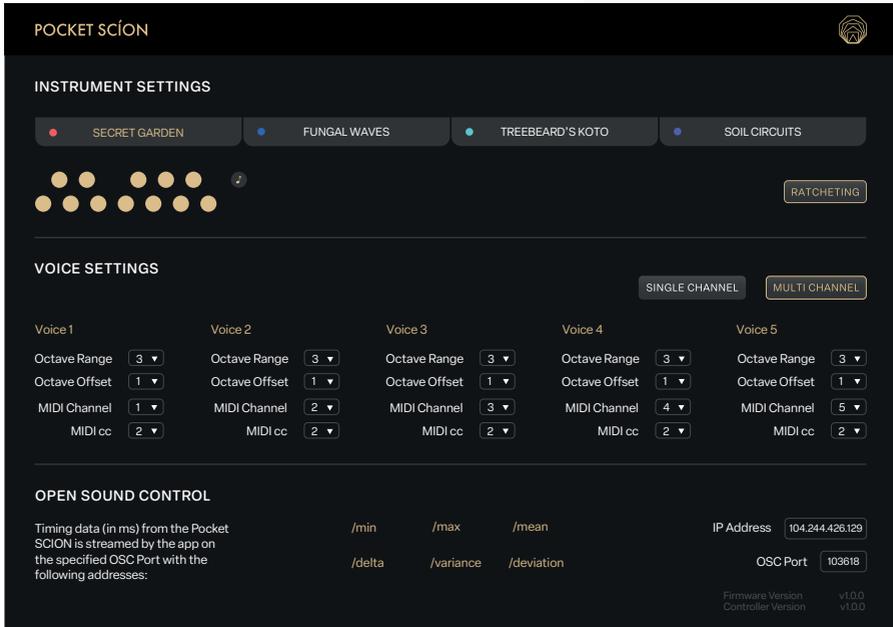
Instrument Settings

Scale: The Scale Buttons are used to enable and disable chromatic notes that quantise the selected instrument and associated MIDI notes.

Ratcheting: With Ratcheting enabled, notes played by the selected instrument and associated midi notes will repeat at stochastic subdivisions of the note duration.

Voice Settings

Octave range: Selects the total span of octaves for the selected voice
Octave offset: Selects a +/- 2 octave offset that can be applied to the selected voice.

MIDI Channel: Selects the MIDI channel of the selected voice.

MIDI CC: Selects the MIDI CC address for outgoing CC messages of the selected voice.

SINGLE Channel: When enabled, note-on messages, note number, velocity, and MIDI CC messages are sent to a single MIDI channel (Defaults to Channel 1)

MULTI Channel: When enabled, note-on messages, note number, velocity, and MIDI CC messages are sent to a multiple MIDI channels (Defaults to Channel 1 - 5)

Open Sound Control (OSC) ▬

Simultaneous to audio and MIDI, when used alongside the desktop application, Pocket SCÍON can also broadcast OSC messages from the selected OSC port, based on the stimulation of the internal biofeedback sensor.

This feature allows Pocket SCÍON to become a portable means for data sonification and visualisation with a variety of audio and visual based software, such as: Max/MSP, Pure Data, Touch Designer, Unreal Engine, and more.

When connected to the desktop application, the following six values (in ms) are broadcast as OSC messages:

- **/min**: The minimum time between stimulation events.
- **/max**: The maximum time between stimulation events.
- **/mean**: The average time between stimulation events.
- **/delta**: The range between minimum and maximum time between stimulation events.
- **/variance**: The average of difference from the mean value.
- **/deviation**: The standard deviation of values (variance^2).

Autosave

To retain its state between power cycles, Pocket SCÍON automatically saves the most recent settings. A 5-second timer begins whenever a change to any parameter is detected. If no additional changes occur within those 5 seconds, a save is executed.

If another parameter is changed during this time, the timer resets. Saving only occurs after 5 continuous seconds without any changes.

When connected to the app, the save status is indicated by the Pocket SCÍON logo. A pending save is shown by the logo appearing as grey in the top right corner. Once the save is complete, the logo turns gold.

Firmware Update

Power down the device. Press and hold the small bootloader button on the inside panel at the top corner whilst connecting the device to a computer via USB. Once powered up, Pocket Scion will appear as a removable storage device on the connected computer. Drag and drop the pocket_scion.uf2 firmware file onto Pocket Scion storage device. After transfer is complete the device will automatically unmount and begin operation. The update procedure is complete.

Factory Reset ━━

A factory reset can be performed to initialise the settings of Pocket SCÍON.

To perform a factory reset, press and hold all 5 buttons for 5 seconds.

- A factory reset will initialise the following parameters.
- Clear any pitch shifting that was previously applied
- Restore the number of active voices to 5
- Restore sensitivity its mid point
- Restore volume to its mid point
- Revert to MIDI channel 1, Single Channel MIDI mode, CC's numbers 1-5
- Disable Raw Output Mode

Glossary ━━

SCÍON - |'sʌːən| noun (biology) young shoot or stem useful for sprouting or forming new roots, a descendant of a noble family

Generative (art) - A creative practice where a system is built for the purpose of generating works partially or completely autonomously. E.g. Recording an EP made entirely by connecting a Pocket Scion, a lion's mane mushroom and your favourite hardware/ software synth.

MIDI - "Musical Instrument Digital Interface", a communication protocol designed to primarily pass musical data from one device to another. E.g. A Pocket SCÍON transferring pitch information to a hardware/ software synthesiser via TRS/USB MIDI.

OSC - "Open Sound Control", similar to MIDI, is another communication protocol used for sending data to and from devices. Its applications are flexible and not necessarily related to music production. E.g. A pocket SCÍON providing data to generate graphics in Touch-Designer.

TS Cable - "Tip Sleeve," a 3.5 mm mono audio cable with one black ring on the plug. Commonly known as a "patch cable" in the world of modular synthesisers, it's used to connect audio and control voltage signals between modules in a modular synthesiser system.

TRS Cable - "Tip Ring Sleeve", a 3.5 mm stereo audio cable with two black rings on the plug. It can be used to connect stereo audio between devices or transfer MIDI data between devices. It's used as one end of a TRS-MIDI adapter.

Modular Synthesiser - A type of hardware synthesiser where individual "modules" are arranged into a system. Unlike typical keyboard/desktop synthesisers connections are not hardwired and can change with the user's needs.

Eurorack - A specific format of modular synthesiser that was developed by Doepfer. For a modular synthesiser to be Eurorack format, it must adhere to a specific height, width, power supply and other specifications.

Data Sonification - A creative practice that translates data into sound.

Data Visulisation - A creative practice that translates data into images, graphics, and video.

DAW "Digital Audio Workstation" - Software designed for playing, recording and arranging audio. E.g. Ableton Live, Logic Pro, Xfiverr, Pro Tools, FL Studio, Bitwig Studio, Reaper, or Cubase/Nuendo.

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Manual Design: Dominic D'Sylva