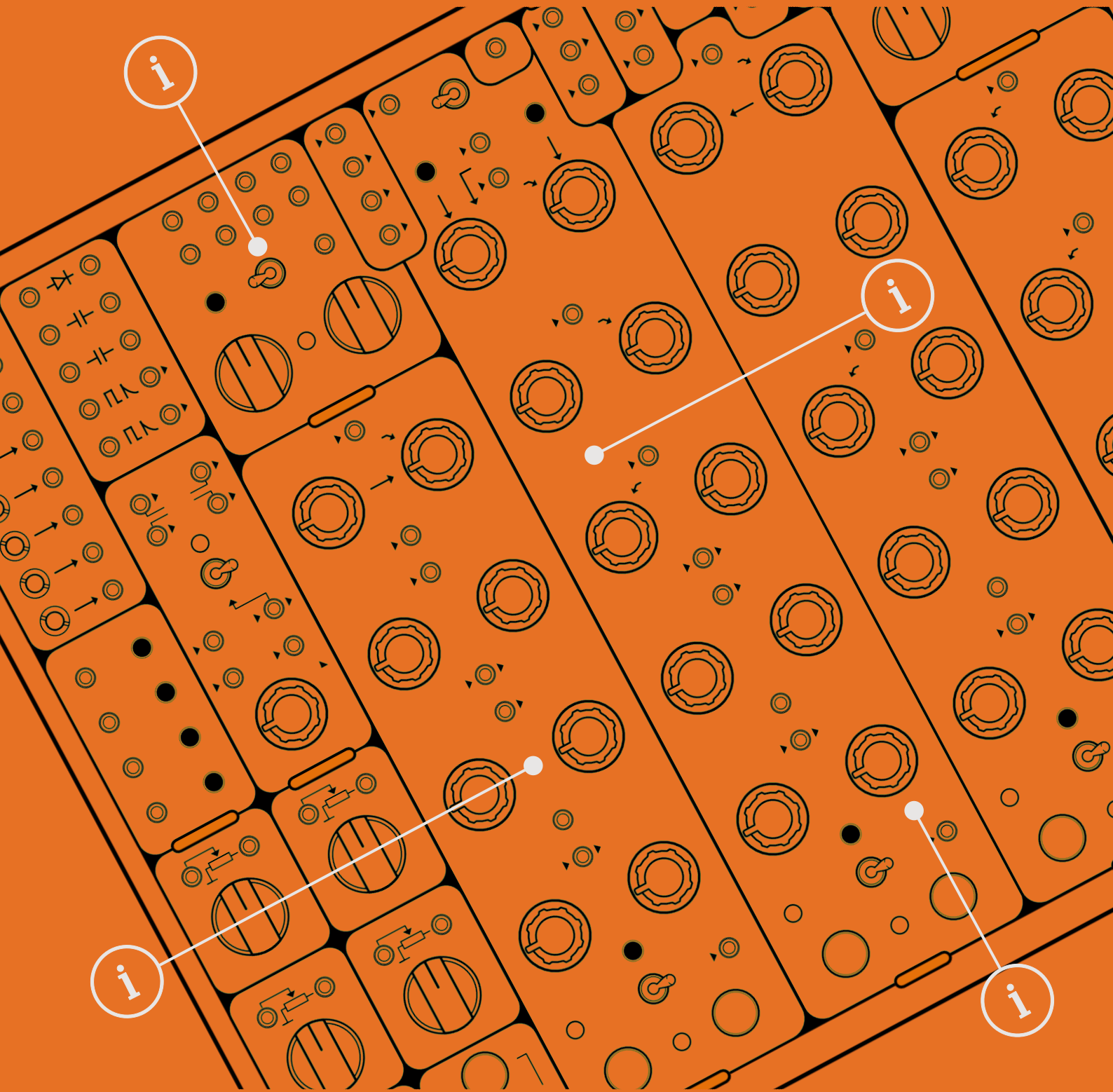
PULSAR·23

A Guidebook
A Notebook
A Reference Book



SYNTHDAWG
PRODUCER GUIDES

Ver 1.0

Contents

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Overview

Pulsar-23 is described by SOMA as an organismic drum machine and it truly lives up to this description. Unlike a typical drum machine, Pulsar-23 aims towards experimental sound design and creative exploration. Organic patch routings use natural or clock oriented modulation rather than fixed grid based sequencing. There are four sound generation voices which can of course operate inline with the principles of more traditional drum synths. However the real power and beauty of Pulsar-23 is in the things that make it different from a routine drum synth. While Pulsar-23 brings lots of new, creative and innovative features it does not step away from synthesis traditions. In fact the opposite. A fully analog signal path for audio adds a unique character along with classic warm sounds and a touch of digital control to support the user 'hands on' experience. In terms of architecture, Pulsar-23 follows the principles of modular synthesis with defined elements that can be used discretely or together as per their default wired routing. Each module can also be patched together with others using alligator clip cables or human touch. Pulsar-23 also includes incoming MIDI control and the ability to interface to modular systems and other gear. A dedicated master effect section with reverb, delay plus a distortion option is also featured. There is an almost 'anything goes' principle when working with this drum synth and be sure to expect the unexpected. It is therefore strongly advised to approach Pulsar-23 with an open mind and embrace the innovation, unusual features and it's almost endless options that can be applied for sound design, modulation and patching. This producer guide is aimed to get the best from Pulsar-23 for new and experienced users. Think of it as an extension to the manual, bringing a user perspective alongside the SOMA expertise along with space for your own notes too. The Pulsar-23 organismic drum machine does not play by the rules and this is what makes it special and unique.

1 Overview

1.1 How to Use This Guidebook

NOTES

This book sits alongside the existing SOMA quick start and official manual for Pulsar-23. It brings a different perspective to user experience and goes a little deeper on some of the unique functionality.

The design means it acts as a reference, a guidebook and also a notebook with ‘designed in’ space to capture your own notes and comments. Making it personal in order to build a comprehensive producer guide for new and existing users alike.

Diagrams used in this book are for illustrative purposes to help inform on how Pulsar-23 works in a practical and functioning environment. They are not intended to represent exact electronic schematic or circuit diagrams. For example the filters have a very complex parallel circuit but are illustrated here as functions in the series.

Book Conventions

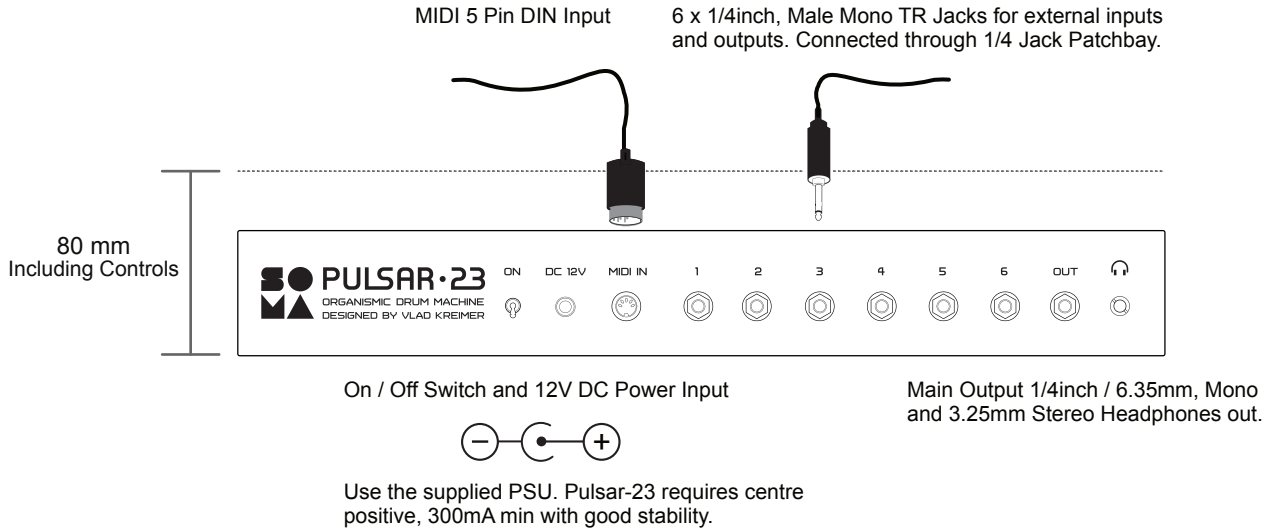
The book uses a style to make it easy to understand the functions of Pulsar-23 and follow the guidance simply.

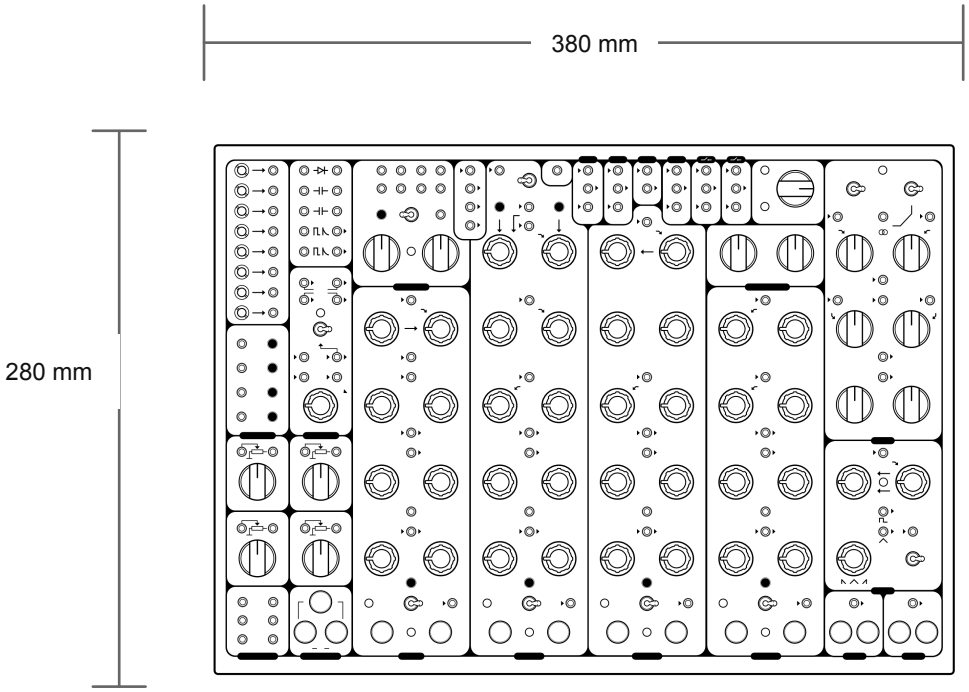
LRN	Any dedicated front panel labelled function will be described with capital letters e.g. LRN.
(AMT)	Rounded brackets / parenthesis represent parameters that are adjustable using one of the 55 front panel control knobs.
[BANK]	Square brackets / parenthesis represent one of the 15 capacitive sensor buttons. These may be preceded by the module name.
{REC}	Curly brackets / parenthesis represent the position of one of the front panel switches e.g. Record / Play Switch {REC PLAY}.
‘MOD’	Patch points will be described by it’s purpose and context and will carry quotation marks to indicate the specific patch point.
	Elements that are labelled only by a symbol will be described in context of the topic in the text e.g. Diode, Capacitor, Gate to Trigger.

Your Notes can be written here .....

1.2 Hardware Overview

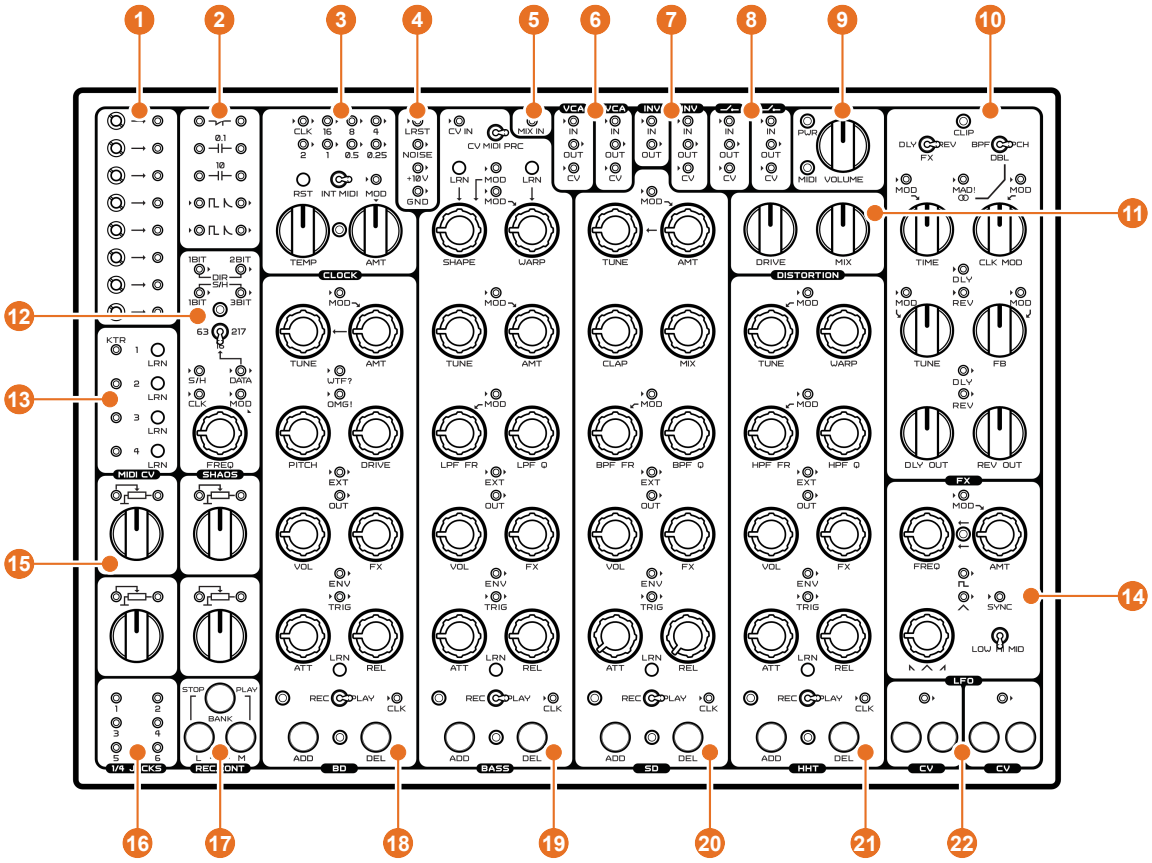
Pulsar-23 is supplied, as well as the unit, with the 12V Power Supply Unit , 20 x 65mm alligator clip patch cables, 10 x 30mm alligator clip patch cables, soft travel case and packaging.





1 Overview

1.3 Overview of Functions



1. **Eurorack to Pins Patch Bay**
   Converts 3.5mm to a pin connector.
2. **Circuit Bending**
   Adds components and converts sustained gates to triggers.
3. **Clock Section**
   Clock pulses and dividers.
4. **Looper Reset**
   Synchronise and restarts the looper. Section also has Noise, +10V & GND
5. **Mix In**
   Additional external audio input.
6. **Voltage Controlled Amplifiers**
   2 VCA's controlled by CV.
7. **Inverters**
   2 Inverters, one is CV controlled.
8. **Switches**
   2, CV Controlled audio / CV switches.
9. **Main Output Volume Control**
   Level control, power / MIDI indicators.
10. **FX Section**
    Master delay and reverb effects.
11. **Distortion**
    Master distortion effect.
12. **SHAOS**
    Chaotic sample & hold generator.
13. **MIDI CV**
    Incoming MIDI learnt to pin points.
14. **Low Frequency Oscillator**
    Single LFO modulation source.
15. **Attenuators**
    4 Audio or CV controllers.
16. **1/4 Jack Connections**
    Patchbay to/from rear connectors.
17. **Recorder Control**
    Multi functional buttons.
18. **BD Bass Drum**
    Bass drum audio generator voice.
19. **BASS**
    Bass channel audio generator voice.
20. **SD Snare Drum**
    Snare drum audio generator voice.
21. **HHT Drum**
    Hi Hat audio generator voice.
22. **Dynamic Sensors**
    2 CV Controls. CV generated by touch.

NOTES

1.4 What Makes Pulsar-23 Different?

Pulsar-23 is not a conventional drum synthesizer and while it does hold onto some classic analog features, it aims to build further on these and also take a different path to most drum machines. A summary of some of the key differences from the norm will help to get to know Pulsar-23 and set the expectations for the onward journey. The available features don't necessarily make an instrument better nor make it worse, they just make it different and each will fit based on individual preferences and needs.

Traditional / Typical Drum Synthesizers.	Pulsar-23 Organismic Drum Synthesizer
Audio is usually sample based, analog or digital. Multiple channels.	Four analog audio channels for character and warmth. Some digital control of advanced features.
Linear audio channels with rigid sequential functions.	Non-linear structure with patchable functions. Everything can interact with everything.
Generally fixed control functions and signal path.	Modular approach for patchable CV and/or Audio to reconfigure and change circuit defaults.
Sometimes CV or Audio patching with 3.5mm or 6.35mm plugs and cables.	Alligator clip cables and also human touch patching options. Raised patch point pins for easy access. Patching between CV and / or Audio possible.
Variable grid based time signature step sequencing and recording.	Clock based sequencing and per channel loop recording options. Multiple clock divider values and patch points.
Pads offer manual trigger control.	Organic controls to trigger the sound sources but also to provide a natural modulation source.
Defined MIDI Input mapping and control.	Learn function to assign MIDI controls to patchable inputs.
Circuit bending would require intrusive adaption of the physical circuitry.	Circuit bending options built in. Electronic components can be patched in.
LFO shapes and envelope modulation with control signals and parameters.	Modulation sources includes the LFO and across audio and / or CV elements as well as human touch. Also the crazy SHAOS sample and hold style generator.
On board effects.	Reverb and Delay are provided in the in the analog audio path from FX sends. Also a master Distortion.
Typical drum synths output the audio generated. Some may have audio input options for example to use its effects.	6 two way audio input/output points, converted to/from Pulsar-23 patch points. External audio also can be patched in.

1.5 Glossary of Terms

While you may think this should be hidden at the back of this book, understanding the terminology associated with these topics and especially the Pulsar-23 will help unlock it's power and performance. It makes sense to become familiar early with the essential terms to help embed into your workflow.

Attenuator: A function which can control a signal by turning it down thereby attenuates the signal. Think of a volume control as an attenuator. Pulsar-23 can attenuate both CV and Audio signals.

Bank: The organisation of looper recordings, structured in banks, accessible with the REC.CONT Recording control. There are 4 banks, each of which consists of 4 loops.

Capacitor: An electronic component that stores energy when charged and releases energy to the circuit when required. Adds character within the circuit bending options of Pulsar-23 and changes a signals shape.

Clock: The element that manages the timing of the Pulsar-23 controls, and affects loop lengths. The CLK - Clock signals can be patched to create and control loops and sequences.

CV: Control voltage is commonly found in modular systems and allows patching and interconnection between functions using voltage ranges to control parameter settings and create modulation. Pulsar-23 has +10V patching options and uniquely on board CV and Audio can also be patched to interact creatively together.

Diode: An electronic component that passes current only in one direction and operates with a non-linear resistance. Adds character and cool features within the circuit bending options.

Envelope: An ENV - Envelope is used to modulate and shape parameters and audio over time. Pulsar-23 has an ATT - Attack and REL - Release envelope assigned to each of it's four voices.

External. External controls and audio can be connected from another separate device to Pulsar-23. The MIX IN and EXT patch points allow audio patching while MIDI and CV patching offers control interfacing.

Feedback: This is a technique often found within effects and electronic instruments where the output from a sound (or part of) is fed back into the input. Delays for example use FB - Feedback to develop an echo effect.

Filter: A filter is a function that cuts (attenuates) or boosts FREQ - frequencies at selected points in the audio spectrum to help shape the sound. The key elements represented in Pulsar-23 are FR - Frequency cutoff point and Q - Resonance, which boosts the level at the frequency cutoff point.

FX: A number of master effects are provided including REV - Reverb or DLY - Delay as configurable effects as well as a distortion effect.

Gate: Similar to a trigger but more typically a more sustained 'on' pulse that initiates an event until the gate is 'off'. Pulsar can transform gates to triggers within the circuit bend section.

Inverter: A function which takes an input and inverts and changes it on its output. For example a signal range of 0-10 on the input would become 10-0 at its output.

LED: Light Emitting Diode. An illuminated light that provides a visual indication of a state.

LFO: Low frequency oscillator which is normally used to modulate parameters for sound design and movement but in Pulsar-23, can be used to generate sound.

Loop Recording: The process of replaying audio or a pattern continuously in a defined cycle e.g. start to end then start to end. Sounds can be triggered to REC - Record in loop mode. The on-board functions, REC.CONT - Recording control and also the LRST - Looper restart support loop control. Loop recorder is sometimes called LR.

MIDI: MIDI stands for Musical Instrument Digital Interface and is a standard protocol used for communicating between audio equipment. MIDI Input is applied using 5 Pin MIDI DIN connection. Pulsar-23 also has a LRN - Learn function to map incoming MIDI CC to it's controls and functions.

Modulation: Modulation is the ability to control and manipulate one parameter from another. This provides creative soundscapes. This is applied by patching across functions and especially MOD - Modulation points.

OMG!: A unique Pulsar-23 creative modulation feature operating on the BD VCO that really needs hands on experimentation to make it what you want it to be.

Parameter: The individual value of a specific function or control element. A parameter can be adjusted for example setting an AMT - Amount to affect a sound or to control a function or VOL - Volume to adjust level.

Patch: A term used to refer to the connection between two or more elements in a circuit or in a configuration. Pulsar-23 uses fixed patch pins and removable alligator clip cables to patch between on board as well as external modules.

Percussion: Percussion refers to instruments played by striking with an object or by hand such as drums or chimes. Pulsar-23 is a drum machine and can be played by hand or by controls as a PRC - percussion instrument but also can offer bass and drone sounds too.

Power: Pulsar-23 is supplied with PWR - Power using the dedicated power supply. On board points for GND - Ground and +10V - DC 10V are used for patching.

Pulsar-23: Pulsar-23 is an organismic drum machine. This brings analog drum synthesis together with experimental and organic modulation and control.

SHAOS: This is a cyclic pattern generator building on classic S/H - Sample and Hold and RNG - Random Note Generator shift registers.

Sound Generators: Pulsar-23 has 4 dedicated sound generators; BD - Bass Drum, BASS, SD - Drum and HHT - Hi Hat. Sound can also be generated by other Pulsar-23 functions.

Switch: A function that fully opens / turns on or closes / turns off the signal flow between elements.

Synchronisation: This is the alignment of functions, generally through timing of various elements. For example to manage multiple clock signals or to synch the looper recorder or LFO.

Trigger: Similar to a gate but a shorter decaying pulse that initiates an event. For example a manual TRIG - Trigger can initiate a drum synth to play or record a beat. Trigger can be manually initiated for recording by tapping ADD - Add. To remove the recorded beat press DEL - Delete.

Velocity: Velocity is a feature which allows a response based on how hard a trigger is activated. This would be typically how hard a keyboard key is pressed or drum pad is hit. Pulsar-23 records a full velocity range from an external MIDI controller. Internal controls can only be triggered at three velocity levels; L - Low, M Medium / Middle and H - High (L+M).

Voice: In synthesis language, a voice is an audio channel with dedicated features that control and manage an independent audio pathway. For example a mono synth has one voice allowing only one note at a time. Poly synths will allow chords by using multiple voices. Pulsar-23 has 4 voices, one for each sound generator.

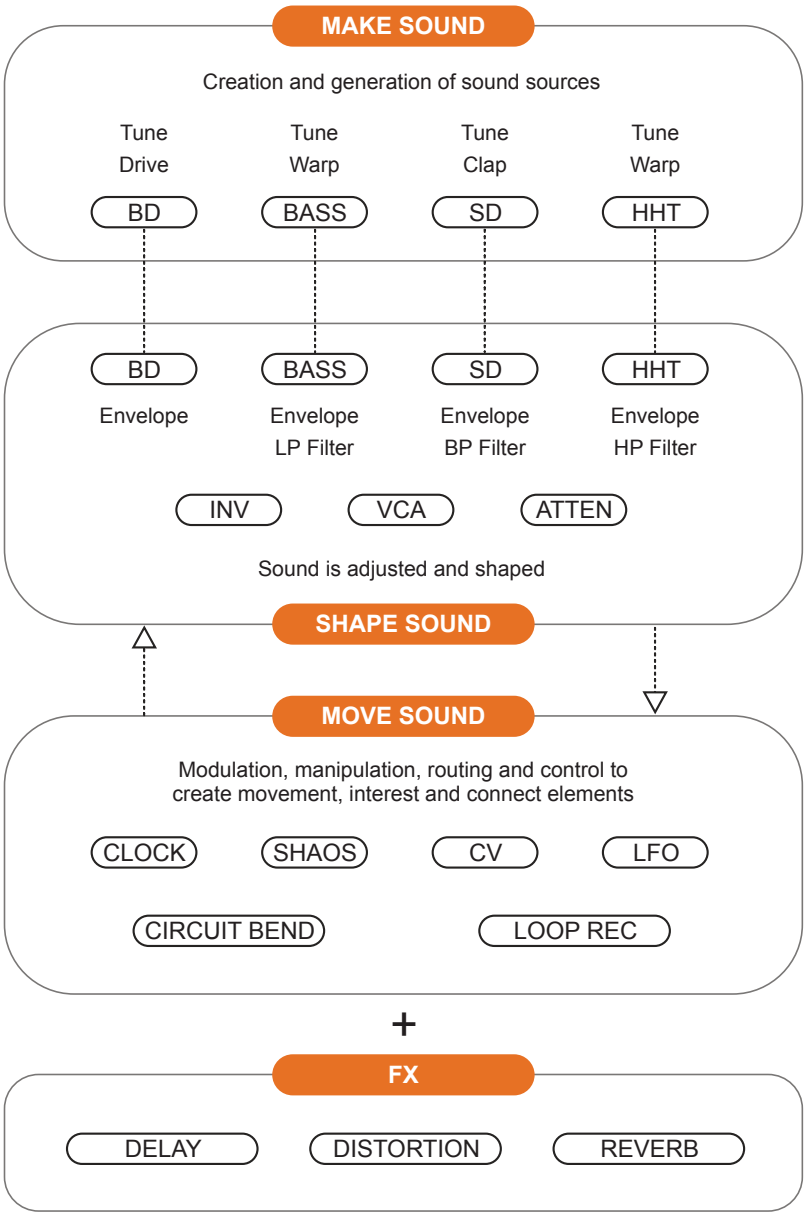
WTF?: A unique Pulsar-23 creative modulation feature operating on the BD Pitch envelope that really needs hands on experimentation to make it what you want it to be.

1.6 Structure of Pulsar-23

NOTES

While Pulsar-23 is very different to the traditional drum machine it follows some core principles of synthesis especially with respect to the sound sources. In addition the workflow and operation heavily relates to the principles of modular synthesis; make sound - shape sound - move sound.

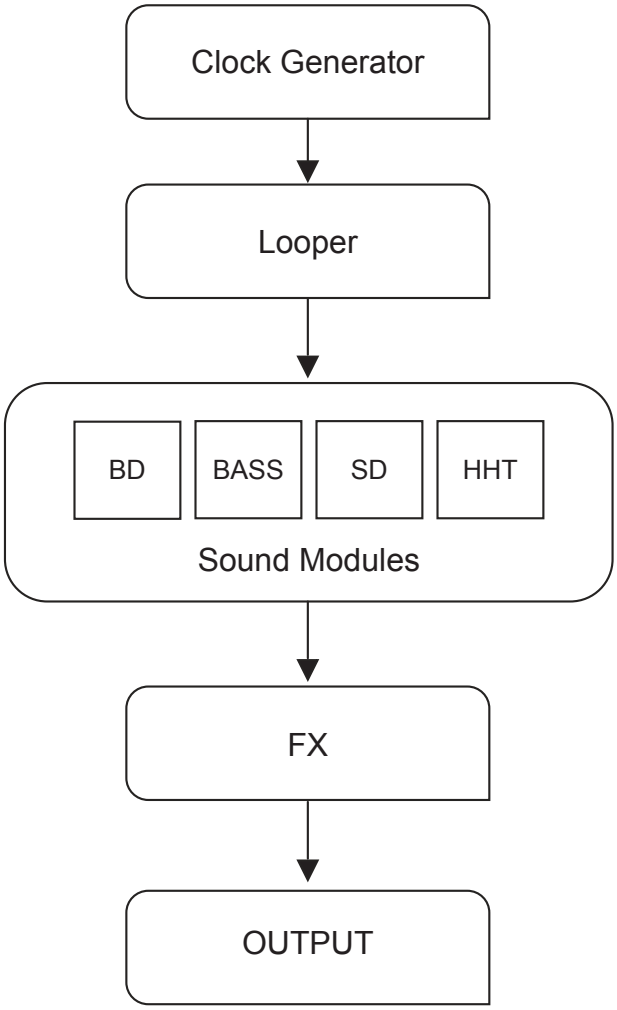
Remember Pulsar-23 does not follow a linear signal flow and these elements can be connected and combined in many ways. Experimentation and just trying things is the way to go.



NOTES

While Pulsar-23 has a series of modules with an almost endless set of patching configurations. This encourages wild and crazy experimentation. However, there is still a core underlying structure when unpatched. This allows building around the default ‘in the box’ wired routings.

Unpatched - Hard Wired Routing



2

Sound Generators

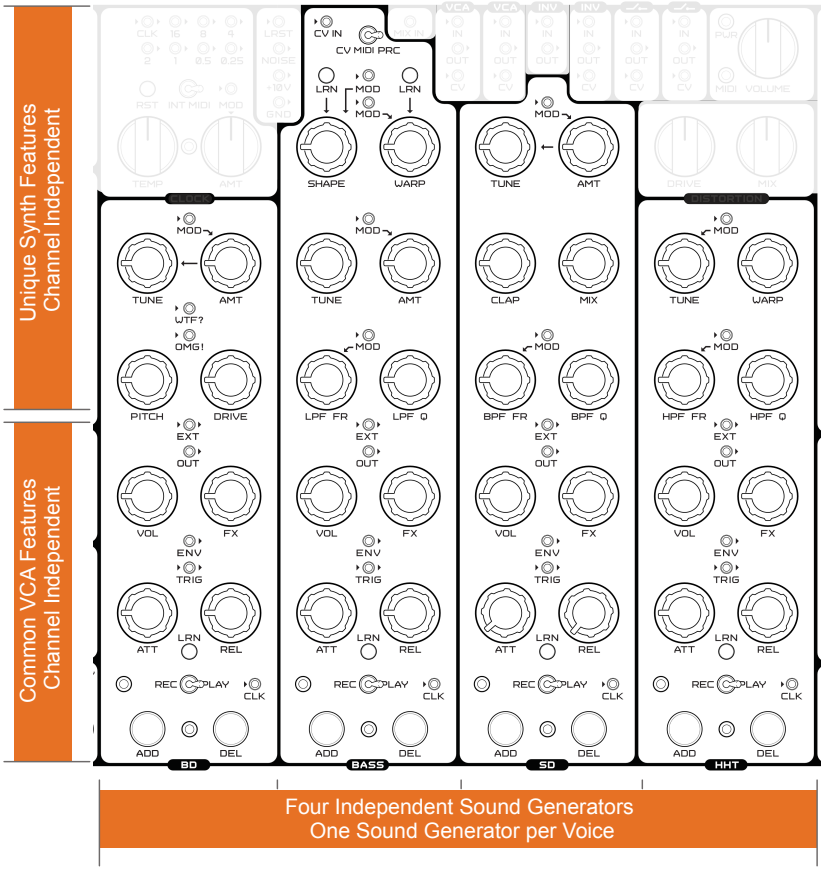
Pulsar-23 has four primary sound generators for each of the four synth voices. These are designed to suit the characteristics of bass drum, melodic bass, snare drum and high hat. The configuration and settings can however go beyond just the percussive replication of these sounds for example to create drone engines. While these are the main sound sources it is important to recognise that other functions can be manipulated and patched to generate sound too. For example the LFO which traditionally is used below sonic levels can be used as an audio oscillator. There is also a noise feature located within the looper reset section. Remember that the Pulsar-23 has no hard rules between CV control and Audio patching. Freedom to create and experiment in the discovery of sound source elements, even where they may appear less obvious is encouraged. Remember a core principle of Pulsar-23 is that control functions can generate sound and audio functions can be used as controls, all when patched with the right setup. Each of the primary generator modules has its own set of parameters and controls to make the sound and to shape it to personal taste. The synthesis features differ significantly between modules, where each is unique. There are some common features, that operate in the same way. These include volume, envelope attack and release and loop recorder. The modules can be triggered manually using the module ADD buttons or by using clock patching. They can also be recorded and controlled using the looper recorder. Multiple patch points allow for an expansive range of modulation and routing options. This section concentrates on the four primary sound sources, their features and controls as well as some basic patching topics.

2 Sound Generators

2.1 Sound Module Overview

NOTES

Pulsar-23 has 4 specific audio generation modules, each with a unique sound engine and a feature set for sound design and shaping. Others can of course generate audio but these 4 audio modules are covered here as the primary audio sources.



BD — Designed to emulate the character and timbre of bass drums and is based on a triangular waveform at its core. Drones and soundscapes can also be generated. PITCH and DRIVE are unique parameters.

BASS — Aimed to add a melodic bass instrument with a digitally controlled oscillator at its core. Percussion mode also helps generate percussive sounds too. A low pass filter aids sound design as well as the dedicated SHAPE and WARP parameters.

SD — Designed with a noise generator at its core to emulate the snap and timbre of snare drums and also introduce an additional clap sound. Drones and soundscapes can also be generated. A band pass filter is included for SD. CLAP and MIX also offer more percussive sound design options.

HHT — Designed to emulate the shrill and tone of hi hats, shakers and cymbals. Drones and soundscapes can also be generated. A high pass filter is included as well as WARP parameter to aid sound design.

NOTES

2.2 Triggering Sounds

Sounds can be triggered by multiple options individually or at the same time. Triggering does not initiate the direct sound creation but actually triggers the modules envelope. Trigger sources include:-

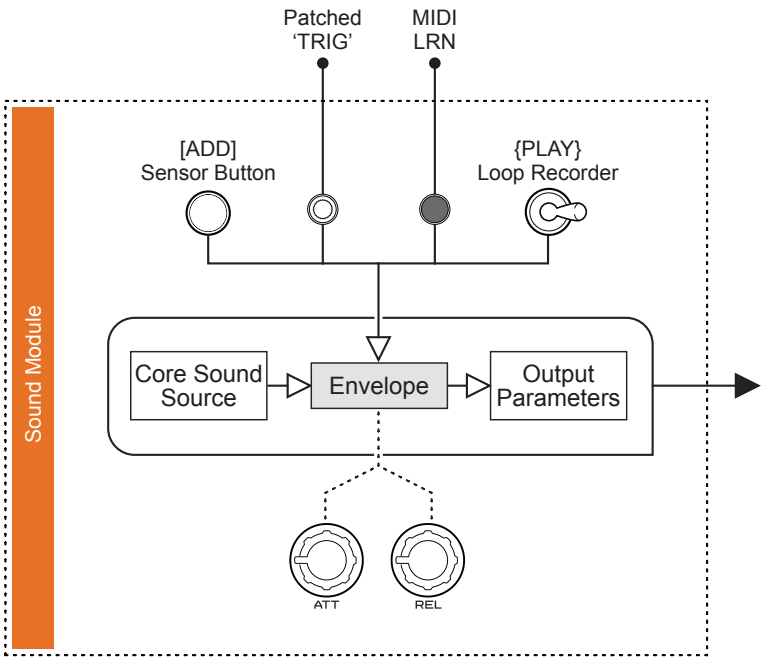
1. Manually triggered by hand by tapping / holding the ADD sensor buttons for each module.

2. Patching a trigger signal from the clock or input from a modulation trigger source. Patching with cables or by human physical patching. Note that the TRIG pin carries the envelope trigger input and also the loop recorder channel output.

3. Each module can be triggered by it's loop recorder which can record and then playback the triggering of sounds.

4. Incoming MIDI signals from external gear can also trigger the sound generators. MIDI LRN button will map the input to the sound module.

All of the trigger inputs can be applied individually or simultaneously.
The strongest signal (highest voltage) will determine which trigger takes precedence

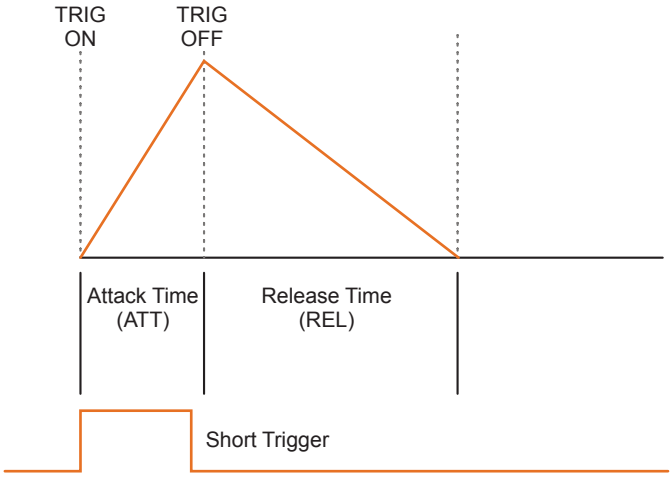


The length of the sound is determined by duration that the trigger is present

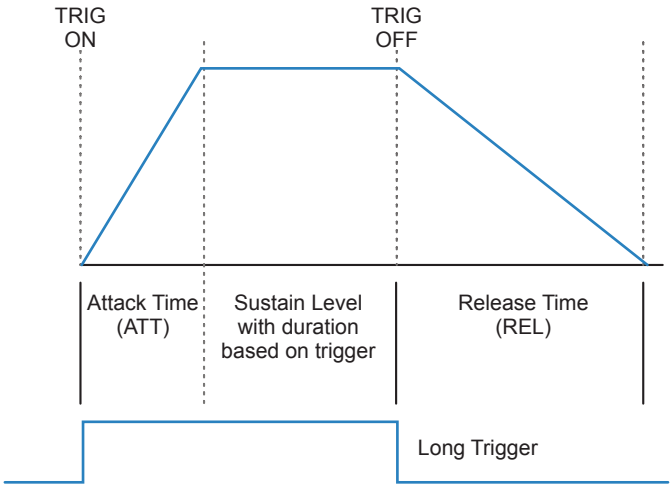
NOTES

Envelope Generators

Each sound module has its own envelope generator which is integrally configured to control volume. An envelope is triggered to control the activation and shape of the sound as it develops over time. This is also based on the duration of the trigger state. An AR - Attack / Release envelope type is used in Pulsar-23, a model often used for drum sounds.



A short trigger will initiate the ATT - Attack phase ramping up the sound level and when the trigger is off the REL - Release time will control the audio ramp down. This is typical for percussive hits and the envelope adjusted to suit.

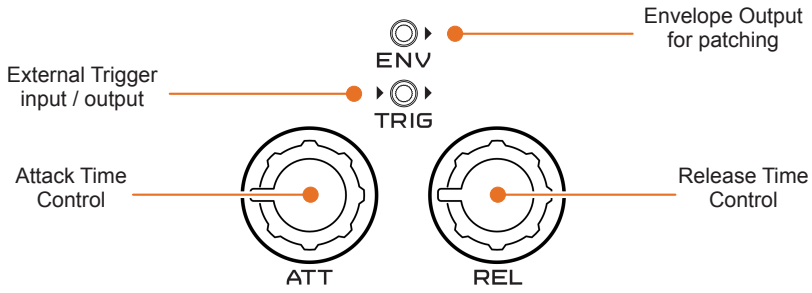


A long trigger will initiate the ATT - Attack phase ramping up the sound level and then will be sustained for the duration. When the trigger is off the REL - Release will control the audio ramp down time. This is typical for drones and pads and the envelope can also be adjusted to suit.

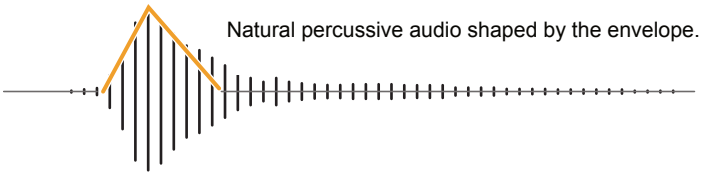
NOTES

The envelopes are adjusted manually using the (ATT) - Attack and the (REL) - Release rotary knobs. A set of envelope controls and patch points exists within each sound generator.

The envelope generator also has an output which can be used separately from the sound module for modulation control and complex patching to any other function. This is patched from the ‘ENV’ Pin.



The typical behaviour and dynamics of percussive sounds would aim for short attacks for punch / impact at the start followed by a tail that is then controlled by release time. While a sound may have a natural envelope, the AR functions can offer more precise sound design options and also to help move beyond just percussive sound design.



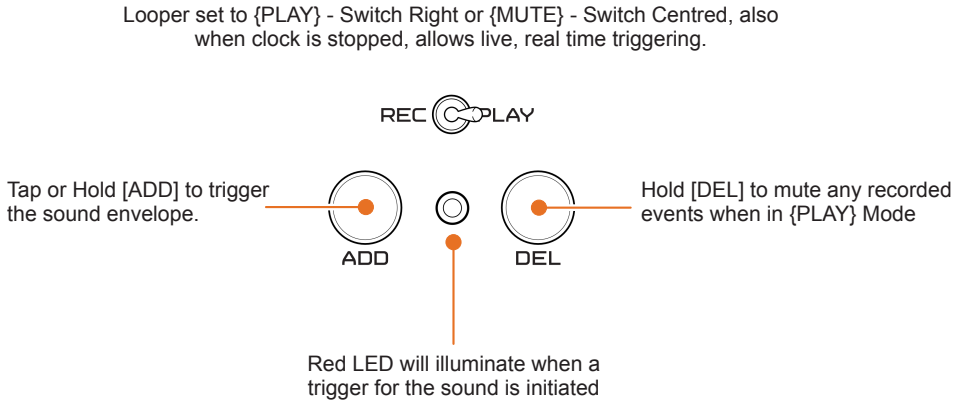
MANUALLY SETTING UP THE ENVELOPE

1. Ensure the sound module looper switch is in {Play} mode.
2. Set the (ATT) and (REL) Knobs down - fully counter clockwise.
3. Tap [ADD] to trigger the sound to adjust. It is advised to always tune the envelope settings to your desired objectives by ear.
4. Start by increasing the (ATT) in small amounts followed by increasing the (REL) knob. The effect will be heard when triggering.
5. This is an incremental and iterative process so tweak and adjust until a desired state is found. This may be revised during further sound design and development adjustments of other parameters.

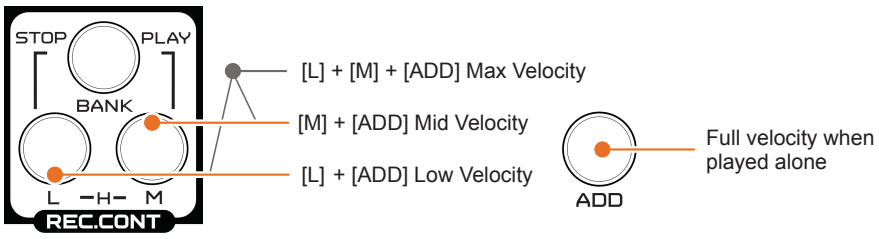
NOTES

Manual Trigger Buttons

Each sound module has two sensor buttons which operate by the capacitive nature of a human touch. These are multifunctional and can operate various functions. They can be used to manually trigger the sound generator envelopes and hence initiate the sound.



Velocity is the behaviour recognised by an instrument of how hard a note is triggered or a drum pad is pressed, technically defined as speed of an object with a direction. For example light or hard touch on a piano key will often correspond to its loudness. Pulsar-23 can recognise velocity, but is only controllable from an external MIDI controller. Internally, Pulsar-23 can trigger the sound generators at 3 manually selectable velocity levels.



NOTES

When triggering using the sound module sensor buttons, the touch should be done organically for example by human hand to be effective. These use capacitive technology which senses conductive contact with anything that has different electrical characteristics to those of air. The sensors are very sensitive and offer quick response. One or more sound modules can be triggered simultaneously as each has it's own voice.

MANUALLY PLAYING DRUM SOUNDS

1. Ensure the sound module looper's PLAY REC switch is set to the {PLAY} mode - right side. Also if it is in {MUTE} mode - switch centred or the clock is stopped this process will function for manual, real time triggering.

2. Ensure the triggered module can be heard with the levels and parameter settings correctly applied. Some settings may mute audio.

3. Tap the [ADD] sensor buttons for the desired sound modules to trigger. A short tap is typically required for drum sounds.

4. Tap and hold the [ADD] sensor buttons to generate elongated drone sounds. The release of the envelope will be activated when hold is removed.

5. Hold the REC.COND, [L] button + Tap the [ADD] sensor button to generate a drum trigger at the low velocity setting. This will initiate a quieter sound than normal.

6. Hold the REC.COND, [M] button + Tap the [ADD] sensor button to generate a drum trigger at the medium velocity setting. This will initiate a mid level sound.

7. Hold both the REC.COND, [L] + [M] buttons + Tap the [ADD] sensor button to generate a drum trigger at the maximum velocity setting. This will initiate the highest level sound.

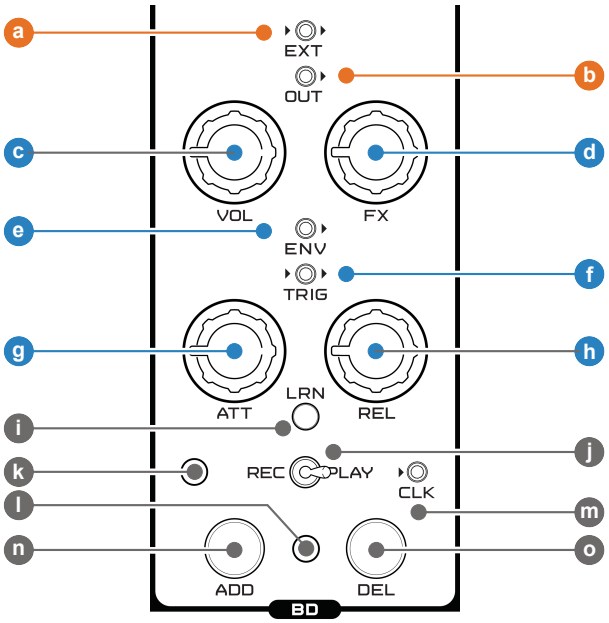
8. If loop recording, maximum velocity level is also applied and recorded when only using the [ADD] button. Velocity can be changed by overdub recording in the loop recorder.

2.3 Common Module Functions

NOTES

Each module has its own set of common functions. These functions, whilst independent per module, are replicated across all four modules. These are described together here and are the same for each module. These features typically are found at the bottom part of each module. Any differences are highlighted in the module description.

BD Bass Drum
Example



Sound source and generator. Each module will have some audio and modulation features specifically aimed at developing the Pulsar-23 character sound, timbre and tone associated with it's unique synthesis function.

The VCA audio and envelope parameters. These functions such as the volume level, FX send, envelope parameters are replicated discretely per module.

Looper recorder and module control functions. These functions such as the MIDI Learn, external clock and the manual add / del sensor buttons are replicated discretely per module.

Many of the potentiometer rotary controls can adjust a range of levels. These are specific to each parameter and some can be affected by a CV 'MOD' input. For example 0 fully left - 100% clockwise on the (VOL) level.

The actual control on some of the potentiometer rotary controls may not be immediately obvious. For example the BD (DRIVE) changes the wave-shape when adjusted. It is advised to tweak and tune by ear and don't worry too much about the technical background functions.

Common Parameters and Functions

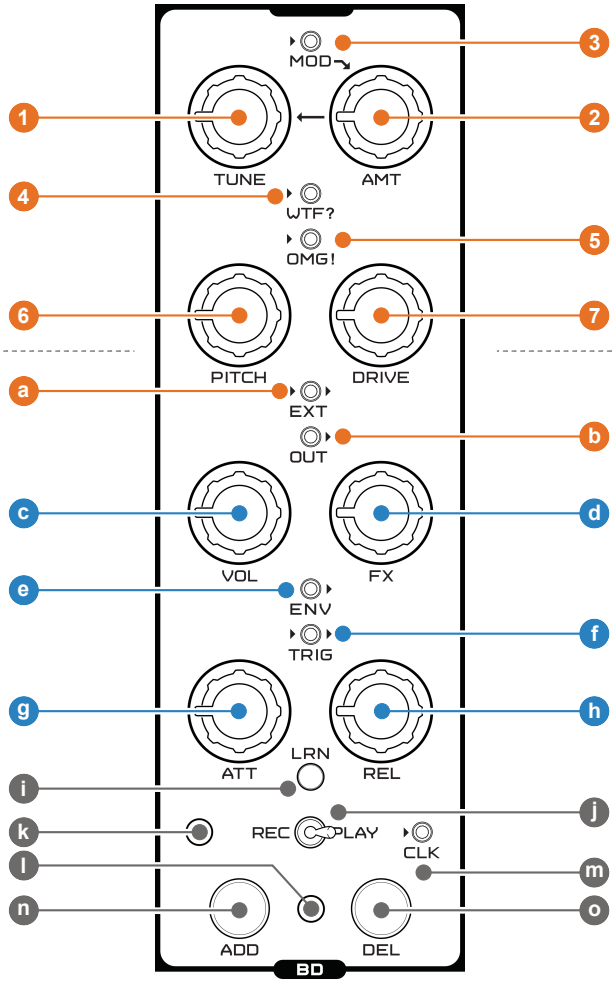
Item	Function	Label	Control	Description
a	External Signal	EXT	Pin	Input of external signal which is processed in the module synthesis function.
b	Module Output	OUT	Pin	Output of the module audio signal which is output before the volume control when the module is triggered.
c	Volume	VOL	Knob	Controls the main volume of the Module audio level. The 'EXT' pin and (FX) Send are both output before this control is applied.
d	FX Send	FX	Knob	Controls the amount of signal that is sent to the FX section. Output is pre-fader, i.e. before the volume control is applied.
e	Envelope Output	ENV	Pin	Output from the module's envelope generator, which is available as and additional modulation source.
f	Trigger input / output	TRIG	Pin	Trigger in to start the modules envelope generator and also the output for the loop recorder channel.
g	Envelope attack	ATT	Knob	Adjusts the attack time period for the modules envelope generator
h	Envelope Release	REL	Knob	Adjusts the release time period for the modules envelope generator
i	MIDI Learn	LRN	Button	Learn function to activate mapping of incoming MIDI to module.
j	Rec Play Mode	REC PLAY	Switch	Loop recorder mode selector. Used to record drum loops or playback loops or manual real time playback
k	Loop Mode Indicator		LED	Mode indicator - amber means loop recording active.
l	Drum trigger indicator		LED	Drum trigger indicator - red.
m	Discrete clock point	CLK	Pin	Input for externally clocking the loop recorder channel. This will replace the internal clock.
n	ADD Button	ADD	Sensor	Manual trigger for playing or recording drum hits.
o	DEL Button	DEL	Sensor	Manual trigger for deleting / muting recorded drum hits.

2.4 BD - Bass Drum Module

NOTES

The first module in the four is the bass drum, labelled BD and is driven by a triangular wave oscillator. While this function is based on classic analog bass drums, there are many more avenues and options to explore and experiment with than just the traditional features.

BD Bass Drum



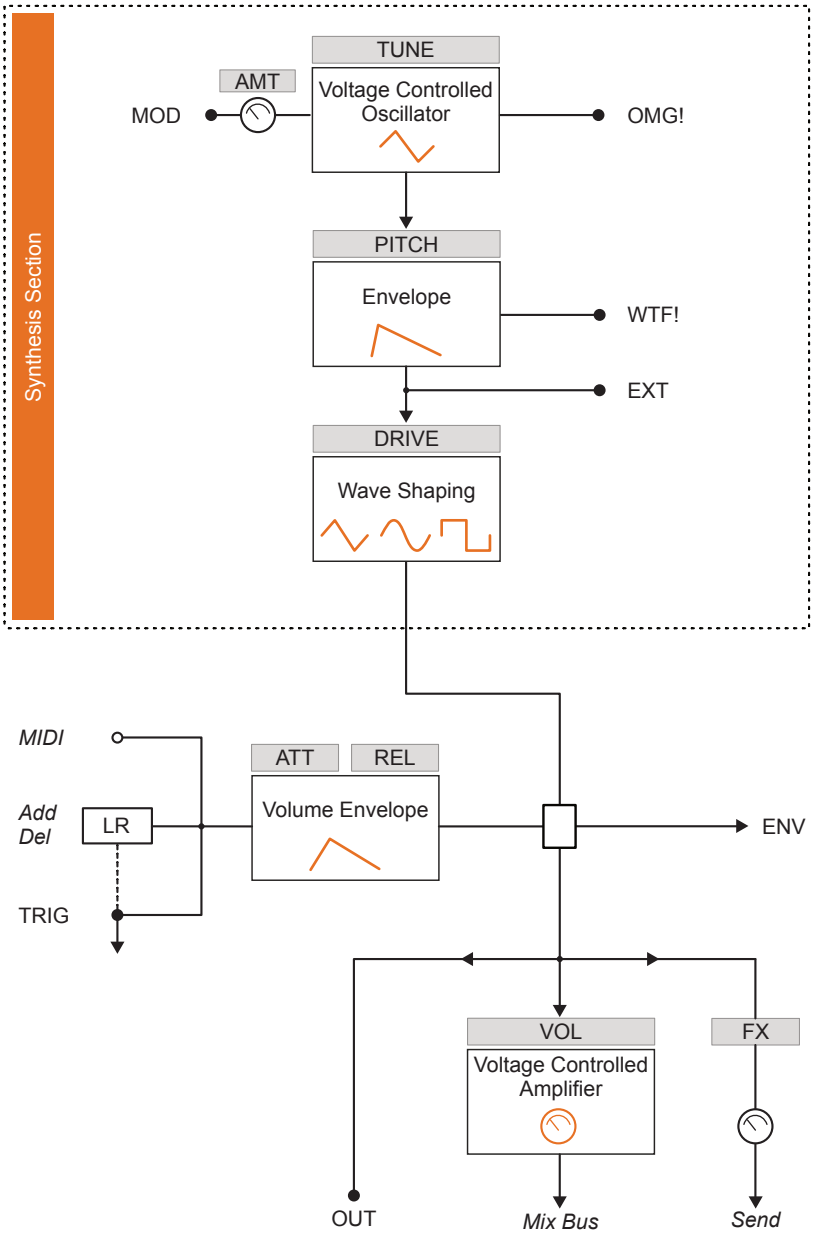
BD - Bass Drum

Item	Function	Label	Control	Description
1	Tune	TUNE	Knob	Pitch control for the specific BD module audio.
2	Amount of Modulation	AMT	Knob	Controls the amount of CV that is applied on the pitch of the signal. The CV is applied at the 'MOD' connection pin.
3	Pitch Modulation Input	MOD	Pin	Connection point for incoming modulation to control pitch. A linear V / Hertz relationship is applied from the incoming voltage.
4	Go Figure!	WTF?	Pin	Connection point for incoming modulation to apply circuit bending behaviour to pitch.
5	Go Figure!	OMG!	Pin	Connection point for incoming modulation to apply circuit bending behaviour to the triangular waveform oscillator source.
6	Pitch	PITCH	Knob	Controls the decay rate and depth of modulation. Gives the characteristic pitch transient at the BD sound start.
7	Drive	DRIVE	Knob	Waveform control of BD. Clockwise will move from triangle, through sine to square.
a	External Signal	EXT	Pin	External signal in, processed before the BD waveform generator.
b	BD Output	OUT	Pin	Output of the BD synth signal - pre volume control when the module is triggered.
c	Volume	VOL	Knob	Controls the main volume of the BD Module audio level. The 'EXT' pin and (FX) Send outputs are before the volume control.
d	FX Send	FX	Knob	Controls the amount of BD signal that is sent to the FX section. Output is pre-fader, i.e. before the volume control is applied.
e	Envelope Output	ENV	Pin	Output from the module's envelope generator.
f	Trigger input / output	TRIG	Pin	A Trigger in will start the modules envelope generator or loop rec
g	Envelope attack	ATT	Knob	Adjusts the attack time period for the modules envelope.
h	Envelope Release	REL	Knob	Adjusts the release time period for the modules envelope.
i	MIDI Learn	LRN	Button	Learn function to activate mapping of incoming MIDI to module.
j	Rec Play Mode	REC PLAY	Switch	Loop recorder mode selector.
k	Loop Mode Indicator		LED	Mode indicator - amber means loop recording active.
l	Drum trigger indicator		LED	Drum trigger indicator - red.
m	Discrete clock point	CLK	Pin	Input for alternative, external clocking for loop recorder.
n	ADD Button	ADD	Sensor	Manual trigger for playing or recording drum hits.
o	DEL Button	DEL	Sensor	Manual trigger for deleting / muting recorded drum hits.

NOTES

BD Synthesis.

The BD module is based on a voltage controlled oscillator in the synthesis section. This can be manipulated with the wave-shaping function where the default triangle shape can be changed to sine and square using the 'DRIVE' parameter knob. Two circuit bending options called WTF! operates on the pitch envelope and OMG! affecting the VCO triangle.

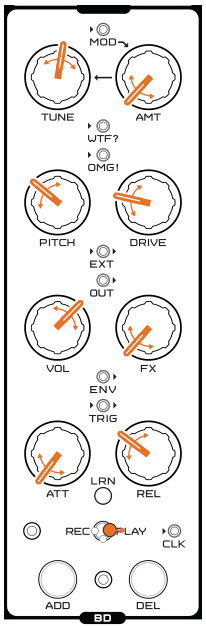


KNOB Function with control *Italics* Internal Functions CAPITALS Pin In / Out (Arrow)

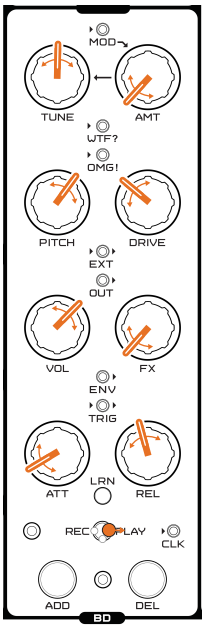
NOTES

BD Sound Design Examples.

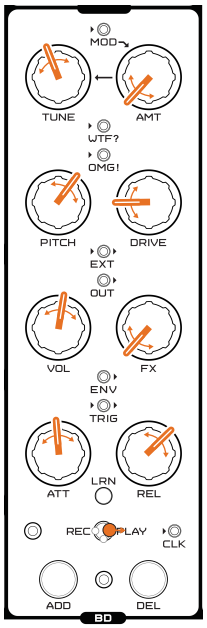
Hard Kick



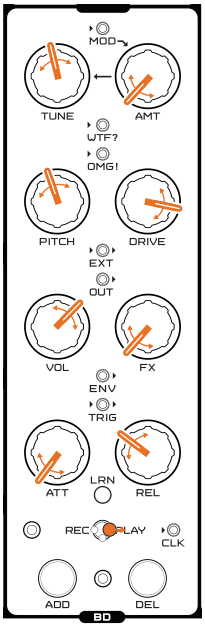
Electronic Kick



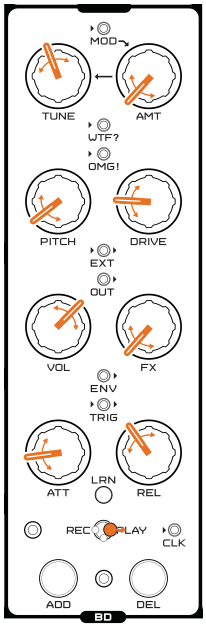
Ambient Bass Drum



Aggressive BD



Sub Bass

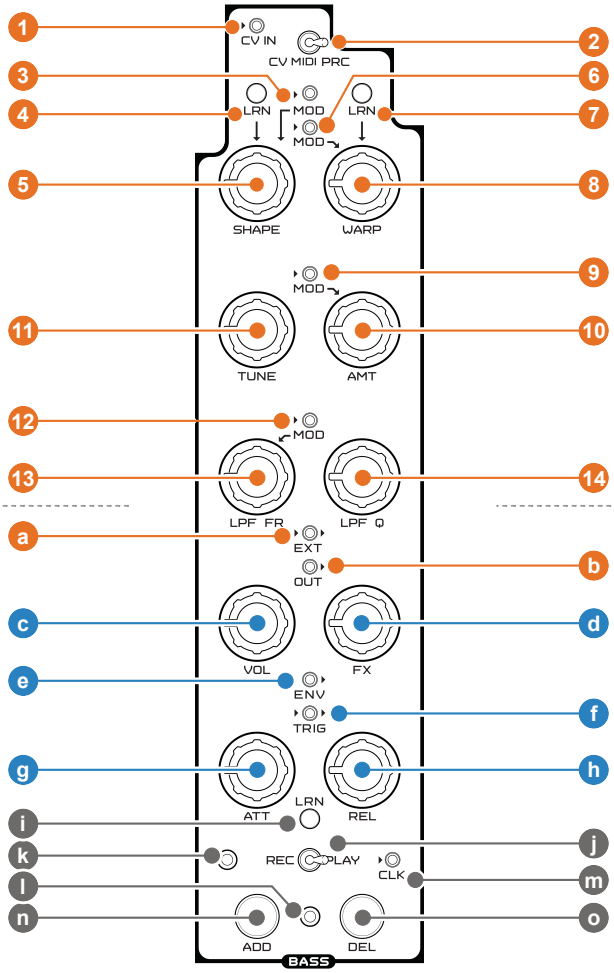


2.5 Bass Module

NOTES

The next module is bass, which is essentially a monophonic synthesizer with the ability to operate also as a percussion synth. This synth is built on a DCO - Digitally Controlled Oscillator which then passes through an analog signal chain including a LPF - Low Pass Filter. The mode switch selects pitch control from CV or MIDI or the percussion PRC mode.

Bass Synth



Bass - Bass Mono Synth

Item	Function	Label	Control	Description
1	Pitch Control	CV IN	Pin	Pitch control for the specific Bass module audio. Control is logarithmic, Volt / Octave with a range of 4 octaves over 4 Volts.
2	DCO Mode	CV MIDI PRC	Switch	Selects CV - Control Voltage, MIDI control for the oscillator. Also PRC - Percussive mode for drum sounds.
3	Shape Modulation Input	MOD	Pin	Connection point for incoming CV for modulation of shape.
4	MIDI Learn - Shape	LRN	Button	Learn function to assign mapping of incoming MIDI CC.
5	Shape	SHAPE	Knob	Control of the DCO waveform shape in pitch mode. For PRC, the resonance is controlled with harmonic changes.
6	Warp Modulation Input	MOD	Pin	Connection point for incoming CV for modulation of warp.
7	MIDI Learn - Warp	LRN	Button	Learn function to activate mapping of incoming MIDI to warp.
8	Warp	WARP	Knob	Controls the amount of post oscillator wave-shaper loading. In PRC mode adds drive and cross modulation.
9	Phase Modulation Input	MOD	Pin	Connection point for incoming CV for modulation of DCO Phase. Acts as sidechain input in PRC Mode.
10	Amount of Modulation	AMT	Knob	Controls the amount of CV that is applied on the phase of the DCO. The CV is applied at the 'MOD' connection pin.
11	Oscillator Pitch Tuning	TUNE	Knob	Controls the oscillator pitch over 5 octaves or +/- 1 Semitone when operating in MIDI mode.
12	LPF Modulation	MOD	Pin	Connection point for incoming CV for modulation the frequency cutoff of the low pass filter.
13	Low Pass Filter Freq	LPF FR	Knob	Controls the cutoff frequency of the low pass resonant filter
14	Low Pass Filter Res	Q	Knob	Controls the resonance level of the low pass resonant filter
a	External Signal	EXT	Pin	Input of external signal which is processed in the Bass synthesis function. Incoming signal applied before LPF.
b	BD Output	OUT	Pin	Output of the Bass synth signal, sent before the volume control.A trigger for the envelope will also trigger the 'OUT'
c	Volume	VOL	Knob	Controls the main volume of the Bass Module audio level. The 'EXT' pin and (FX) Send is output before this control is applied.
d	FX Send	FX	Knob	Controls the amount of Bass signal that is sent to the FX section. Output is pre-fader, i.e. before the volume control is applied.
e	Envelope Output	ENV	Pin	Output from the module's envelope generator.
f	Trigger Input / Out	TRIG	Pin	Trigger in to start the modules envelope generator or loop rec
g	Envelope attack	ATT	Knob	Adjusts the attack time period for the modules envelope
h	Envelope Release	REL	Knob	Adjusts the release time period for the modules envelope
i	MIDI Learn	LRN	Button	Learn function to activate mapping of incoming MIDI to module.
j	Rec Play Mode	REC PLAY	Switch	Loop recorder mode selector.
k	Loop Mode Indicator		LED	Mode indicator - amber means loop recording active.
l	Drum trigger indicator		LED	Drum trigger indicator - red.
m	Discrete clock point	CLK	Pin	Input for alternative, external clocking for loop recorder.
n	ADD Button	ADD	Sensor	Manual trigger for playing or recording drum hits.
o	DEL Button	DEL	Sensor	Manual trigger for deleting / muting recorded drum hits.

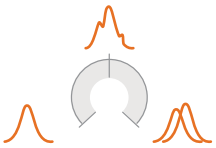
NOTES

BASS Module Modes

BASS is a complex monophonic synthesizer based on a Digitally Controlled Oscillator and with the ability to operate as a pitch or percussion orientated module. This synth is built on a DCO - Digitally Controlled Oscillator which then passes through an analog signal chain including a LPF - Low Pass Filter. The two modes (with 3 options) are:-

- Mode switch {CV} or {MIDI}. The digital controlled oscillator has adjustment for the waveform shape, a wave-shaper and phase control. This mode is aimed at pitch based operation.
- Mode switch {PRC} as a percussion synth. A resonator drives the audio source also with control over the frequency tones and tuning.

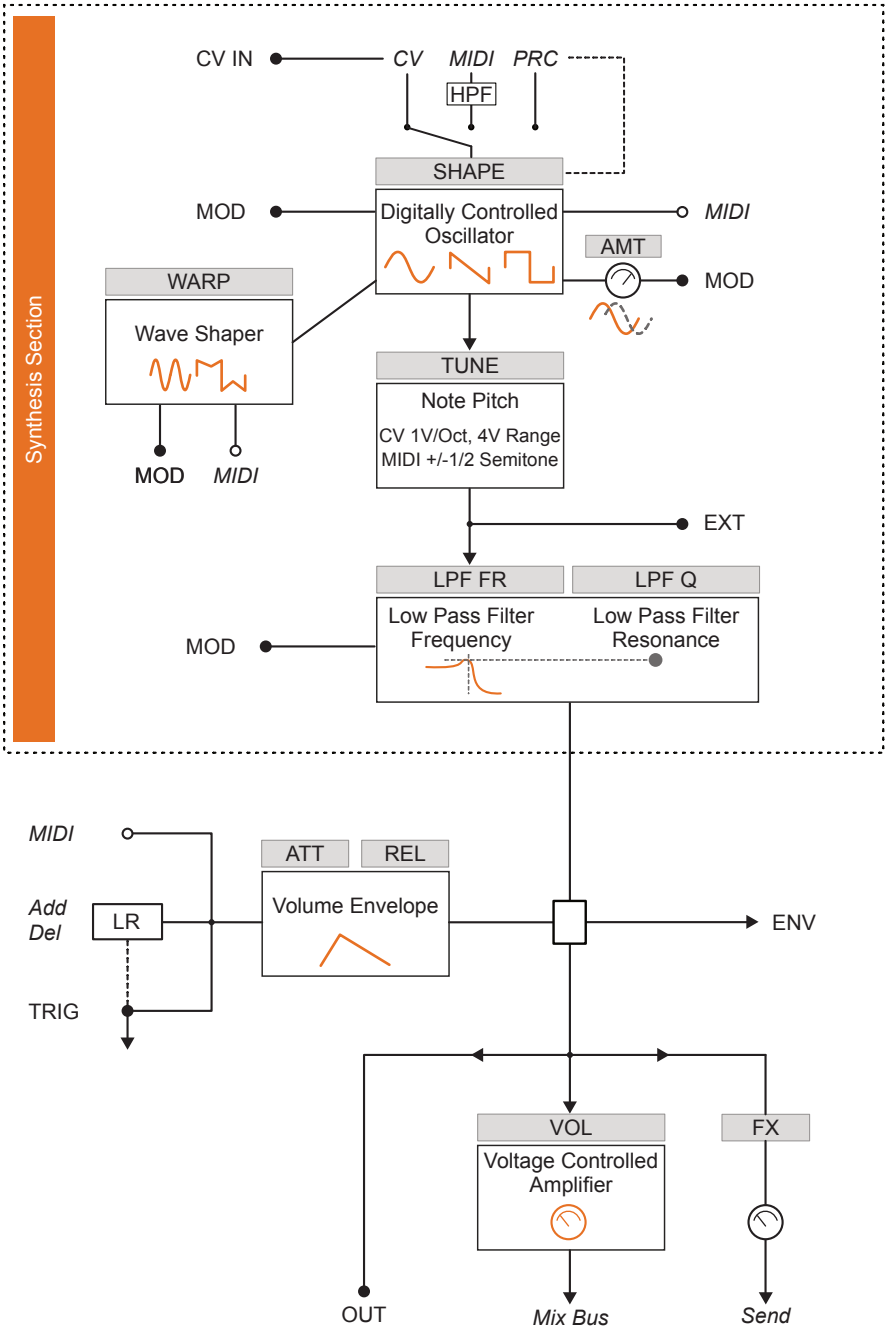
The VCA and Filter section is identical in all modes.

CV or MIDI		PRC
	SHAPE	
		
‘SHAPE’ knob controls smooth transition of the waveform from; Sine (Anti-clockwise), Saw (Centre) and Square (Clockwise).		‘SHAPE’ knob controls smooth transition of the resonance tone from; Clean Tones (Anti-clockwise), Single frequency resonance + noise (Centre), Detune resonators (Clockwise).
	WARP	
‘WARP’ : Wave shaping of oscillator to affect tone and timbre.		‘WARP’ : Drive and cross modulation of resonators. Harsh and dense sound.
	MOD	
‘MOD’ : Phase modulation of the DCO from a CV input plus control over the modulation amount.		‘MOD’ : Sidechain trigger input. Controlled ‘ducking’ inversion of DCO based on the input shape e.g. envelope.
		

NOTES

BASS Pitch Mode Synthesis.

BASS is a complex monophonic synthesizer based on a Digitally Controlled Oscillator and operating in 2 modes for melodic pitch and percussion. Selecting CV or MIDI selects the pitch orientated synthesis engine.

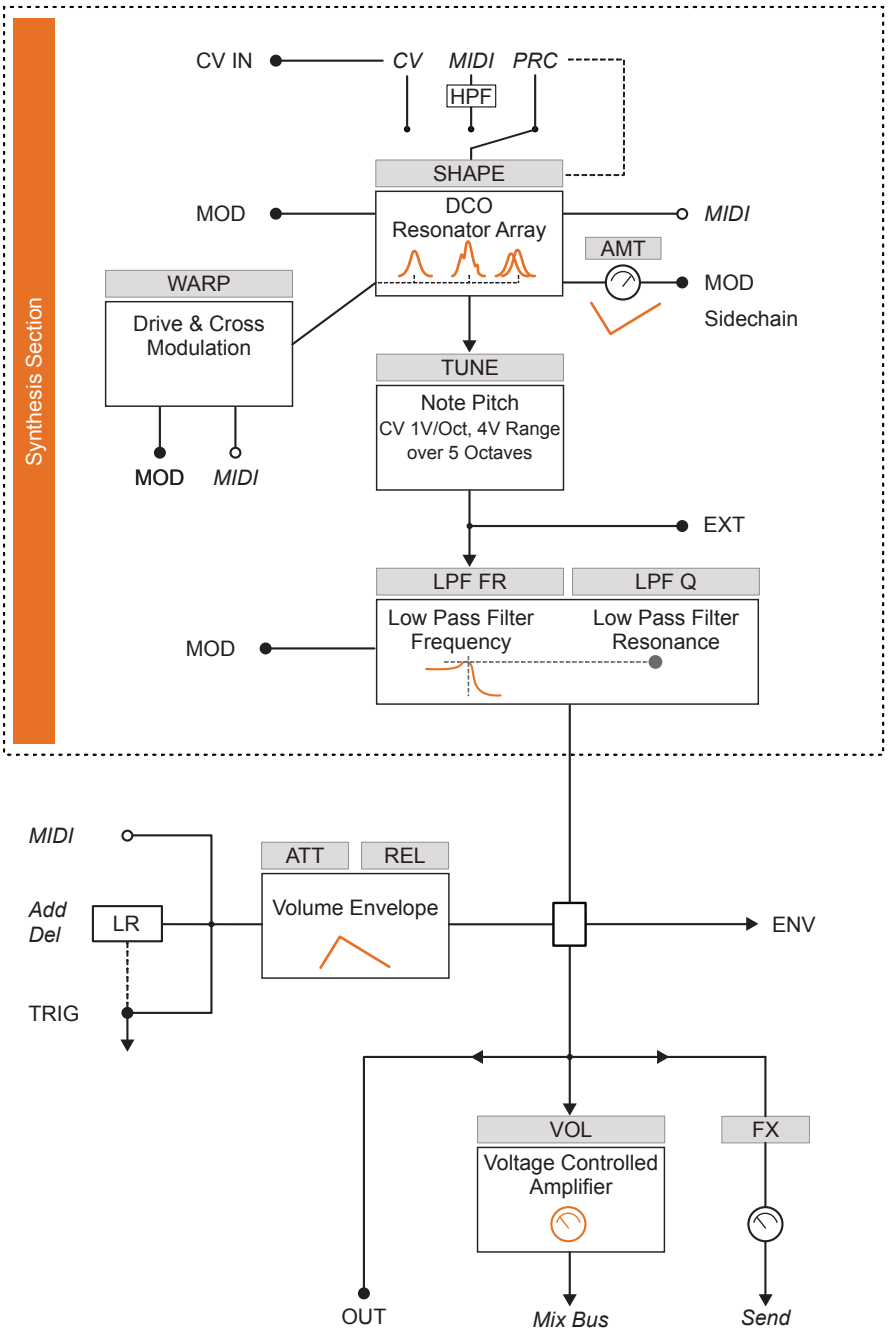


KNOB Function with control *Italics* Internal Functions CAPITALS Pin In / Out (Arrow)

NOTES

BASS PRC Mode Synthesis.

BASS has a percussion mode selected by the PRC option. This offers a percussive orientated environment for the BASS module.

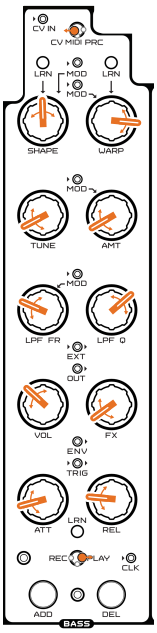


KNOB Function with control *Italics* Internal Functions CAPITALS Pin In / Out (Arrow)

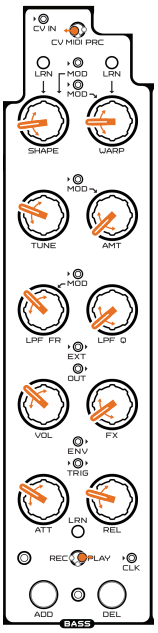
NOTES

BASS Sound Design Examples.

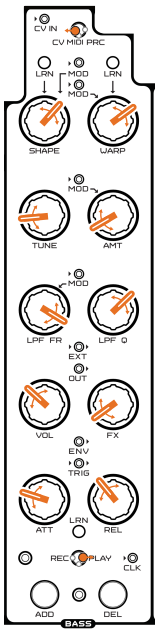
Moody Bass



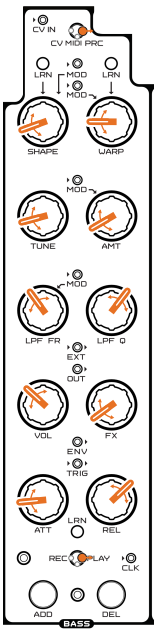
Smooth Bass



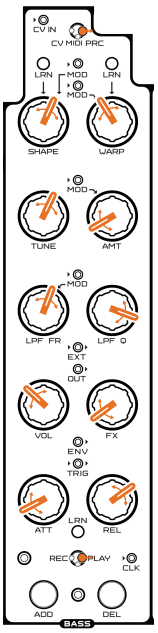
Gnarly Bass



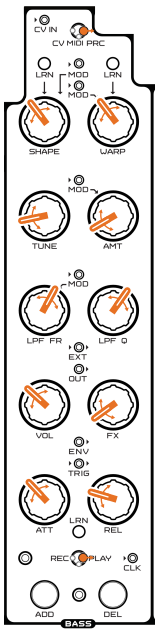
Boomy Bass Drum



Screetch



Steam Train

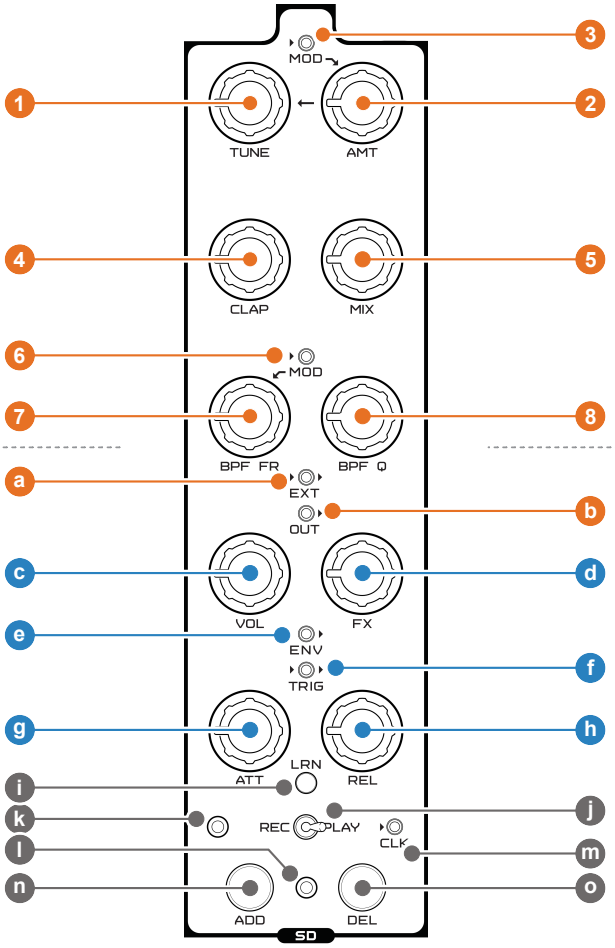


2.6 SD Snare Module

NOTES

The SD module represents the snare drum as well as integrated clap synthesis. This synth is built on a unique spectrum controlled noise generator which is the sound source. The analog signal path includes a BPF - Band Pass Filter.

SD Snare Drum



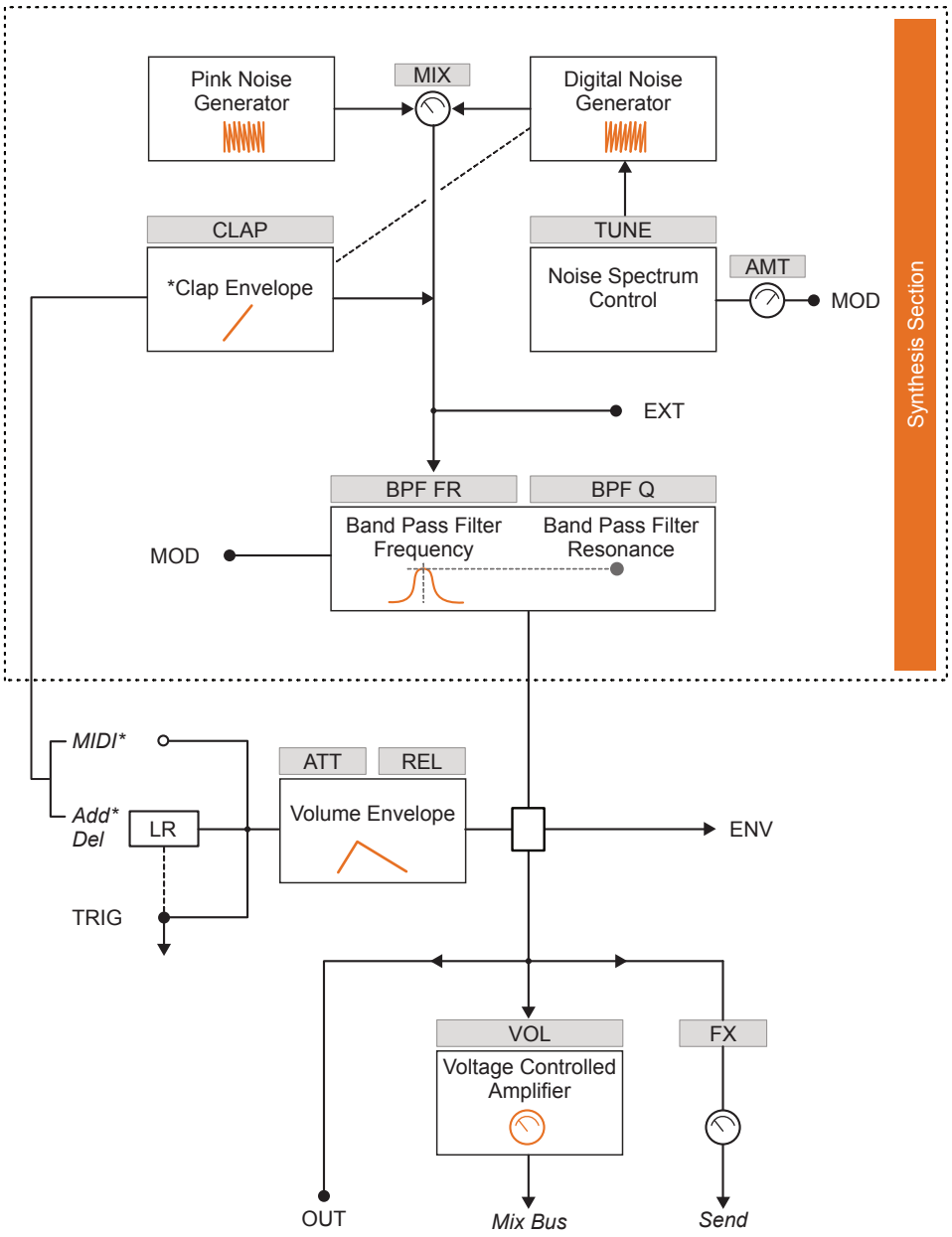
SD - Snare Drum

Item	Function	Label	Control	Description
1	Tune	TUNE	Knob	Controls the spectrum of the noise generator for the SD module.
2	Amount of Modulation	AMT	Knob	Controls the amount of CV that is applied on the tune parameter. The CV is applied at the 'MOD' connection pin.
3	Tune Modulation Input	MOD	Pin	Connection point for incoming modulation to control tune. A linear V / Hertz relationship is applied from the incoming voltage.
4	Clap	CLAP	Knob	Controls the clap element by splitting the sounds attack. Does not activate from the 'TRIG' pin.
5	Mix	MIX	Knob	Adjust the balance of pink noise (counter clockwise 0%) to spectral noise (clockwise 100%).
6	BPF Modulation	MOD	Pin	Connection point for incoming CV for modulation the frequency cutoff of the band pass filter.
7	Band Pass Filter Freq	BPF FR	Knob	Controls the cutoff frequency of the band pass resonant filter
8	Band Pass Filter Res	Q	Knob	Controls the resonance level of the band pass resonant filter
a	External Signal	EXT	Pin	Input of external signal which is processed in the SD synthesis function. Incoming signal applied before the band pass filter.
b	SD Output	OUT	Pin	Output of the SD synth signal which is output before the volume control and when the module is triggered.
c	Volume	VOL	Knob	Controls the main volume of the SD Module audio level. The 'EXT' pin and (FX) Send is output before this control is applied.
d	FX Send	FX	Knob	Controls the amount of SD signal that is sent to the FX section. Output is pre-fader, i.e. before the volume control is applied.
e	Envelope Output	ENV	Pin	Output from the module's envelope generator, which is available for modulation.
f	Trigger input / output	TRIG	Pin	Trigger in to start the modules envelope generator and also the output for the loop recorder channel.
g	Envelope attack	ATT	Knob	Adjusts the attack time period for the modules envelope.
h	Envelope Release	REL	Knob	Adjusts the release time period for the modules envelope.
i	MIDI Learn	LRN	Button	Learn function to activate mapping of incoming MIDI to module.
j	Rec Play Mode	REC PLAY	Switch	Loop recorder mode selector.
k	Loop Mode Indicator		LED	Mode indicator - amber means loop recording active.
l	Drum trigger indicator		LED	Drum trigger indicator - red.
m	Discrete clock point	CLK	Pin	Input for alternative, external clocking for loop recorder.
n	ADD Button	ADD	Sensor	Manual trigger for playing or recording drum hits.
o	DEL Button	DEL	Sensor	Manual trigger for deleting / muting recorded drum hits.

NOTES

SD Synthesis.

The SD module is based on a noise generator as the oscillator which generates as two sources / modes. The MIX function combines firstly the analog pink noise generator and secondly, the digital spectrum generator.



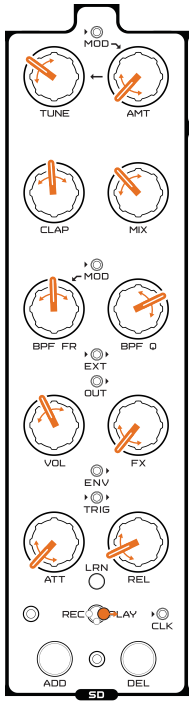
* Clap only operates with 'ADD' and MIDI, not the 'TRIG' Pin.

KNOB Function with control *Italics* Internal Functions CAPITALS Pin In / Out (Arrow)

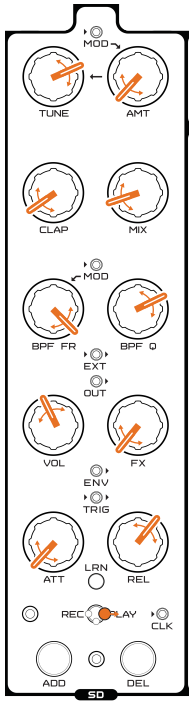
NOTES

SD Sound Design Examples. (Clap does not activate from the ‘TRIG’ pin)

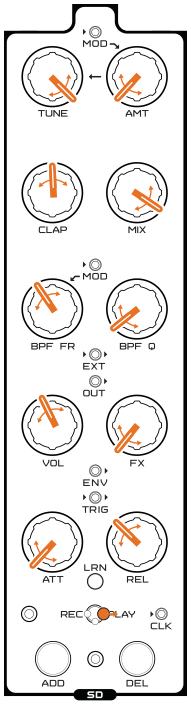
Single Clap



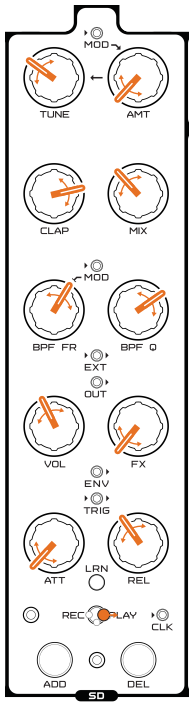
Flam Snare



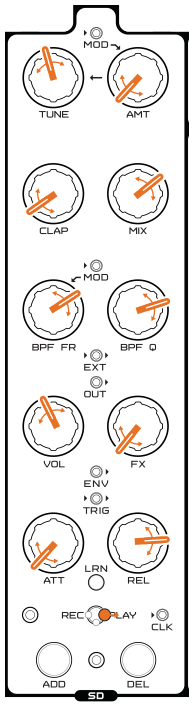
Classic Snare



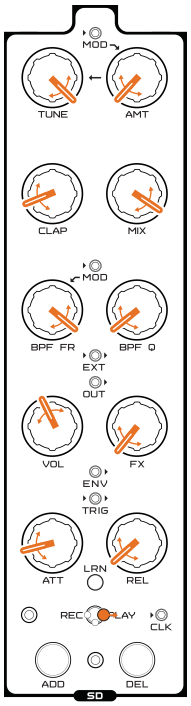
Echo Clap



Noisy Snare



Rim Snare

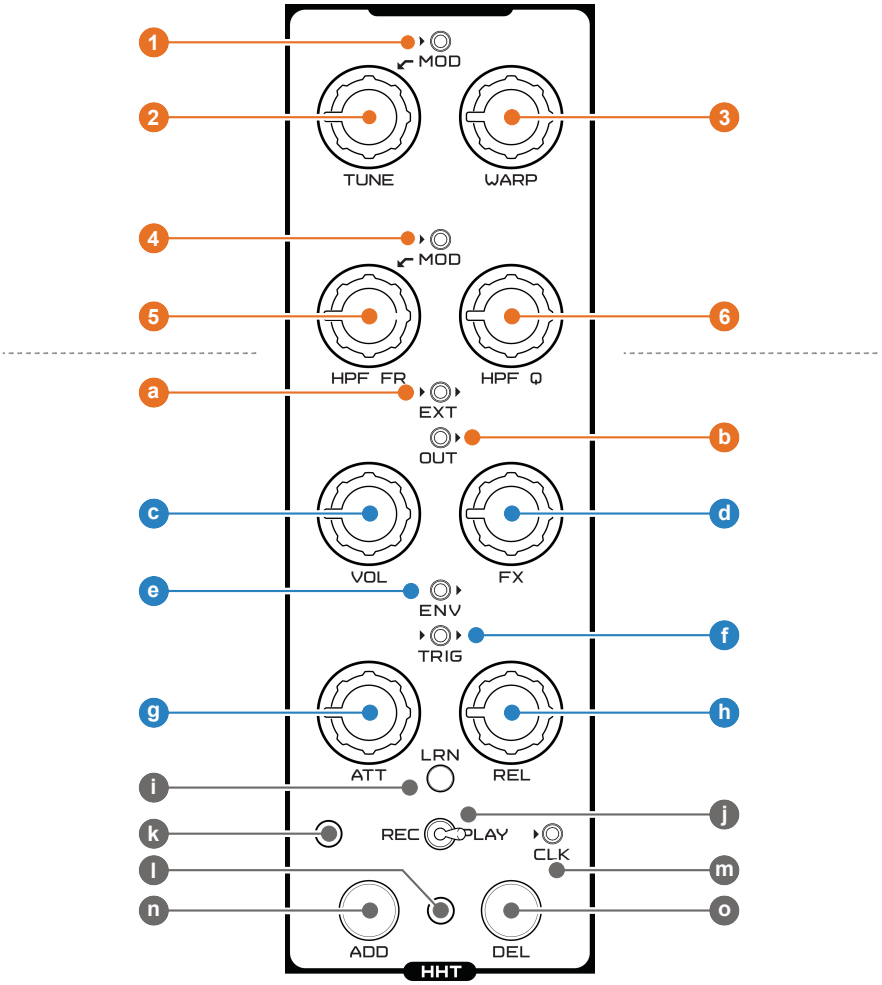


2.7 HHT Hi Hat Module

NOTES

The final sound generator is the HHT Synthesis module which represents Hi Hat, Shaker and Cymbal sounds again using a noise generator. The analog signal chain includes a HPF - High Pass Filter.

HHT Hi Hat



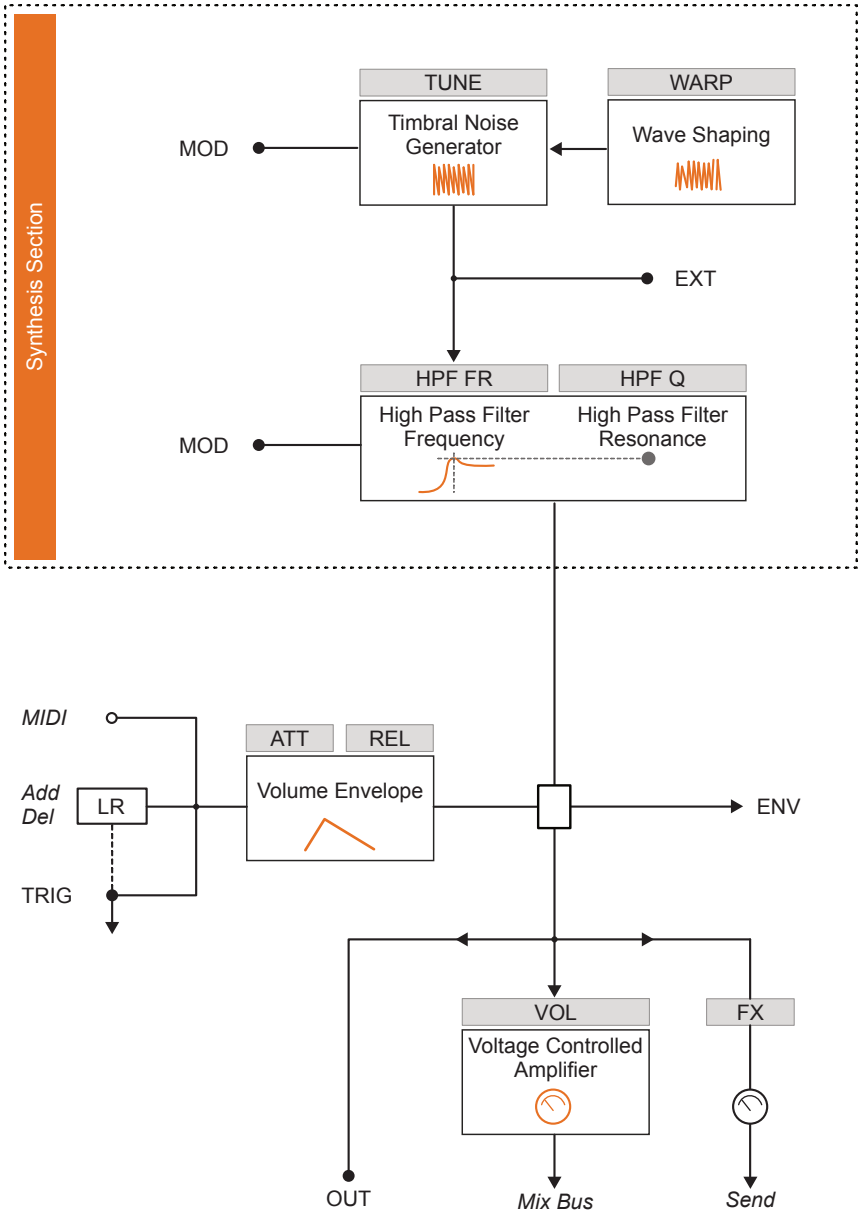
HHT - Hi Hat Drum Synth

Item	Function	Label	Control	Description
1	Tune Modulation Input	MOD	Pin	Connection point for incoming modulation to control tune which is the spectrum of the noise generator.
2	Tune	TUNE	Knob	Controls the spectrum of the noise generator for the HHT module.
3	Warp	WARP	Knob	Adjusts the wave-shaper that controls the noise spectrum
4	HPF Modulation	MOD	Pin	Connection point for incoming CV for modulation the frequency cutoff of the high pass filter.
5	High Pass Filter Freq	HPF FR	Knob	Controls the cutoff frequency of the high pass resonant filter
6	High Pass Filter Res	Q	Knob	Controls the resonance level of the high pass resonant filter
a	External Signal	EXT	Pin	Input of external signal which is processed in the HHT synthesis function. Incoming signal applied before the high pass filter.
b	HHT Output	OUT	Pin	Output of the HHT synth signal which is output before the volume control and when the module is triggered.
c	Volume	VOL	Knob	Controls the main volume of the HHT Module audio level. The 'EXT' pin and (FX) Send is output before this control is applied.
d	FX Send	FX	Knob	Controls the amount of HHT signal that is sent to the FX section. Output is pre-fader, i.e. before the volume control is applied.
e	Envelope Output	ENV	Pin	Output from the module's envelope generator, which is available for modulation.
f	Trigger input / output	TRIG	Pin	Trigger in to start the modules envelope generator and also the output for the loop recorder channel.
g	Envelope attack	ATT	Knob	Adjusts the attack time period for the modules envelope generator
h	Envelope Release	REL	Knob	Adjusts the release time period for the modules envelope generator
i	MIDI Learn	LRN	Button	Learn function to activate mapping of incoming MIDI to module.
j	Rec Play Mode	REC PLAY	Switch	Loop recorder mode selector. Used to record drum loops or playback loops or manual real time playback
k	Loop Mode Indicator		LED	Mode indicator - amber means loop recording active.
l	Drum trigger indicator		LED	Drum trigger indicator - red.
m	Discrete clock point	CLK	Pin	Input for externally clocking the loop recorder channel. This will replace the internal clock.
n	ADD Button	ADD	Sensor	Manual trigger for playing or recording drum hits.
o	DEL Button	DEL	Sensor	Manual trigger for deleting / muting recorded drum hits.

NOTES

HHT Synthesis.

The HHT module is centred around a timbral noise generator as the primary audio oscillator within the synthesis section. The noise spectrum can change the timbral nature of the sound by adjusting the ‘TUNE’ parameter, which can also be modulated. Also by changing the spectrum by wave-shaping using the ‘WARP’ parameter for shaker like sounds.

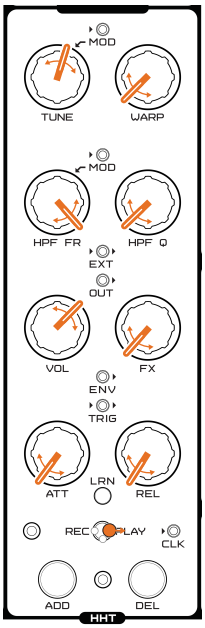


KNOB Function with control *Italics* Internal Functions CAPITALS Pin In / Out (Arrow)

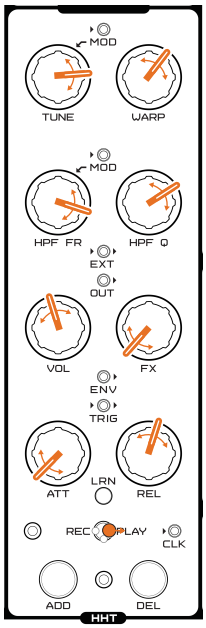
NOTES

HHT Sound Design Examples.

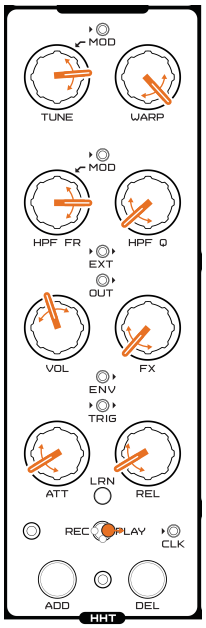
Hat



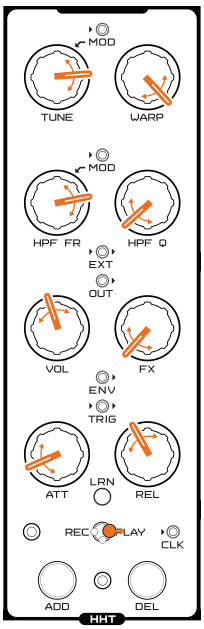
Shaker



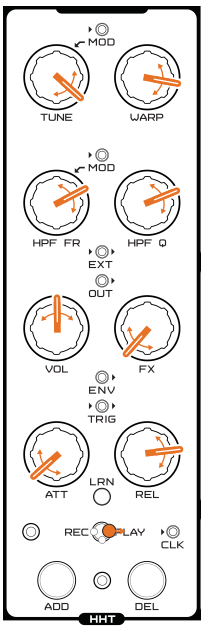
Closed Hat



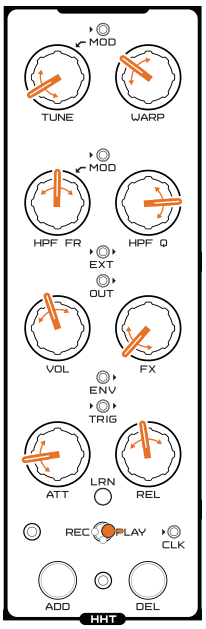
Open Hat



Crash



Rattle



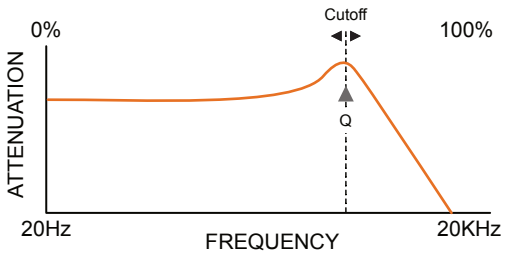
2.8 Filters

NOTES

Three of the four sound generators host a filter, each of which is a different type. A filter is commonly found in subtractive synthesis as it generally subtracts i.e. cuts, frequencies from the audio spectrum of the sound. Human hearing operates in the 20Hz to 20KHz range and therefore this is the typical range of a filter.

Pulsar-23 also uses filtering as part of the sound shaping and construction of sounds for the Bass synth, Snare Drum and Hi Hat Drum. These help to polarise the focus of the sound in the spectrum and avoids frequency clashes with others in the mix. Pulsar-23 has resonant filters which when 'Q' is set high can generate audio through self oscillation.

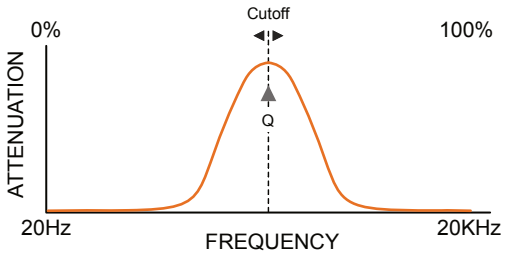
Bass Synth



LOW PASS FILTER

Rolls off frequencies at the cutoff point. Frequencies below the cutoff pass through unaffected. A boost in Q - Resonance can be applied. Ideal for bass by reducing higher frequencies.

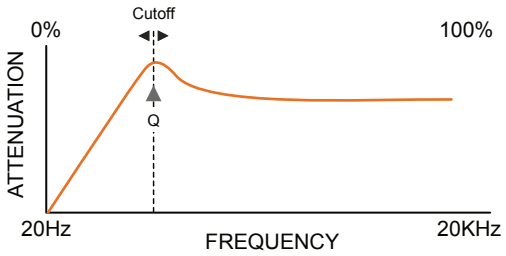
SD Snare Drum



BAND PASS FILTER

Rolls off frequencies at either side of the cutoff point. Frequencies within the band pass through unaffected. A boost in Q - Resonance can be applied. Ideal for polarising tone to defined frequencies.

HHT Hi Hats



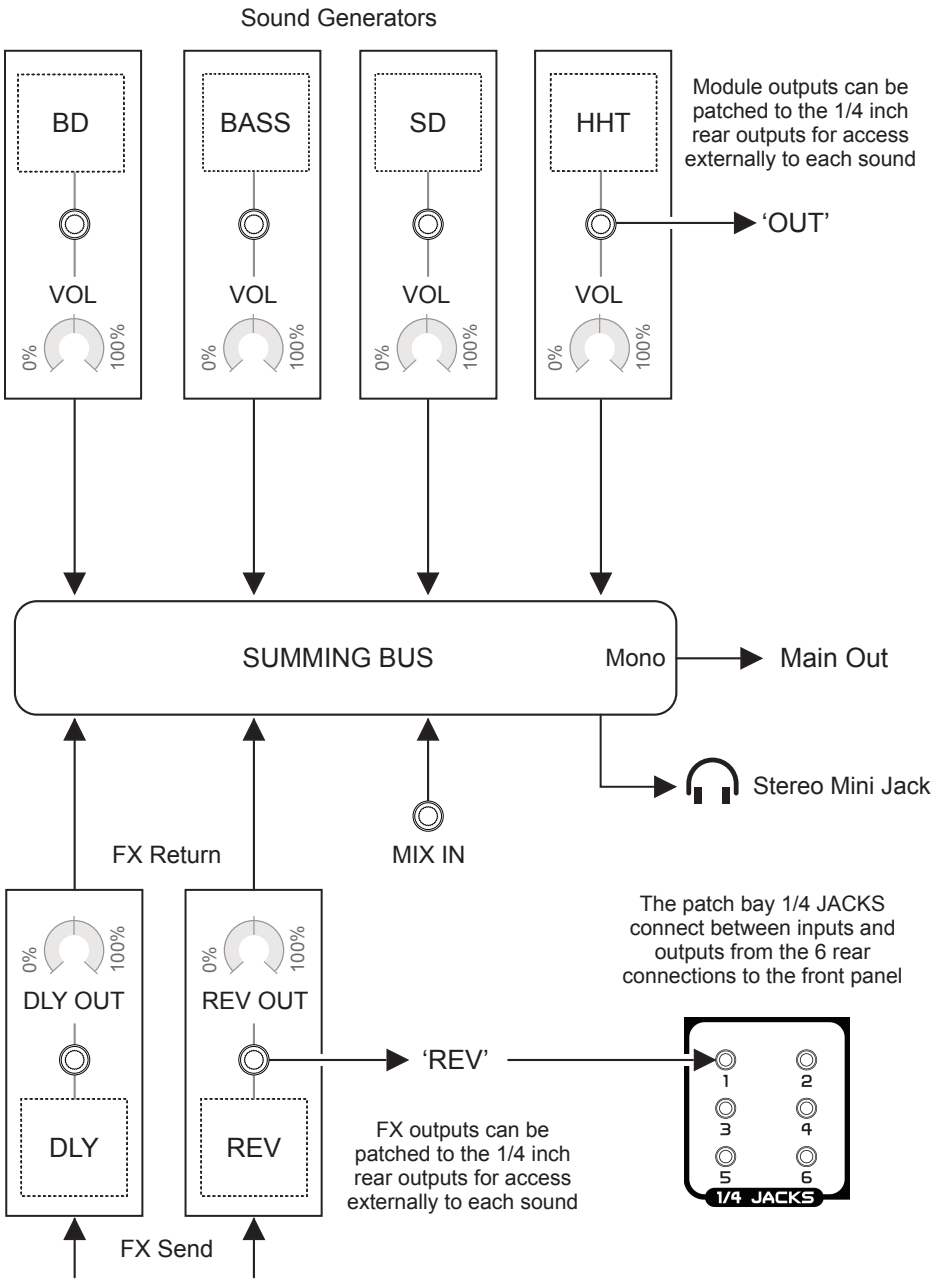
HIGH PASS FILTER

Rolls off frequencies at the cutoff point. Frequencies above the cutoff pass through unaffected. A boost in Q - Resonance can be applied. Ideal for focussing on shrill sound like cymbals and hats by reducing lower bass frequencies.

NOTES

2.9 Mono Summing Mix

Each of the four sound generators operates in mono with the audio summed at the main output, also in mono. The patching options does allow for individual outputs which then can be used externally in various ways including positioning in a stereo field for example using an external mixer.

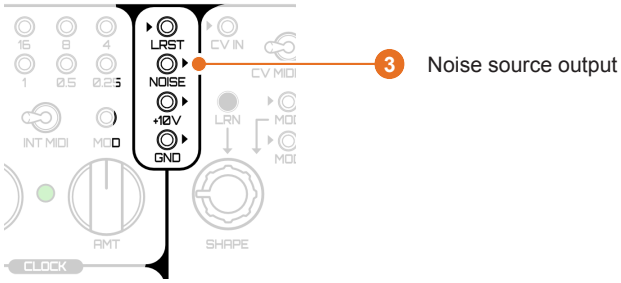


The diagram shows a simplified illustration of the output summing principles. Other elements that are not show here such as distortion also is included in the audio master out.

2.10 Noise

NOTES

Pulsar-23 has four dedicated sound modules which operate for BD, Bass, SD and HHT. In addition a dedicated noise source is provided which operates independently from the four sound modules. This is a patchable output pin and is located along with the power and looper reset functions.



The noise generated is pink noise, which is a more musical and pleasing sound than using white noise, especially for percussive sounds.

About Noise

Some general notes on the principles of noise, especially around white and pink noise which are common in sound design. Noise basically contains ALL frequencies. White Noise has a constant energy level across the frequency range. This sounds high pitched and can be described as a sounding like a wind rush. This can be a harsh sound but is still useful in music making. Pink noise decreases in intensity per octave and sounds deeper and more bass orientated than white noise. Pink noise has less emphasis on higher frequencies. Pink noise is more pleasant and generally is a good fit to percussive sound design and development.

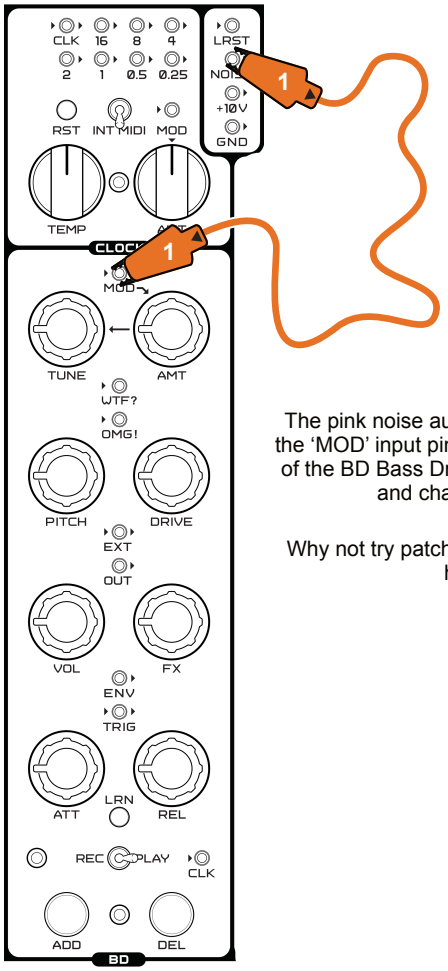
NOTES

2.11 Sound as a Control Source

Pulsar-23 is an extremely versatile device. The ability to use audio as a modulation source is possible. It is worth trying various patch combinations and discovering some of the secrets it holds.

Bass Drum Grunge Modulation

A simple example of modulating a control function using audio can be seen by patching the noise audio generator to the BD Pitch and increasing the TUNE parameter ‘AMT’.



The pink noise audio output pin can be patched to the ‘MOD’ input pin for controlling the tuning amount of the BD Bass Drum sound module creating crazy and chaotic pitch modulations.

Why not try patching noise to ‘WTF?’ or ‘OMG!’ to hear the results.

2.12 Control as a Sound Source

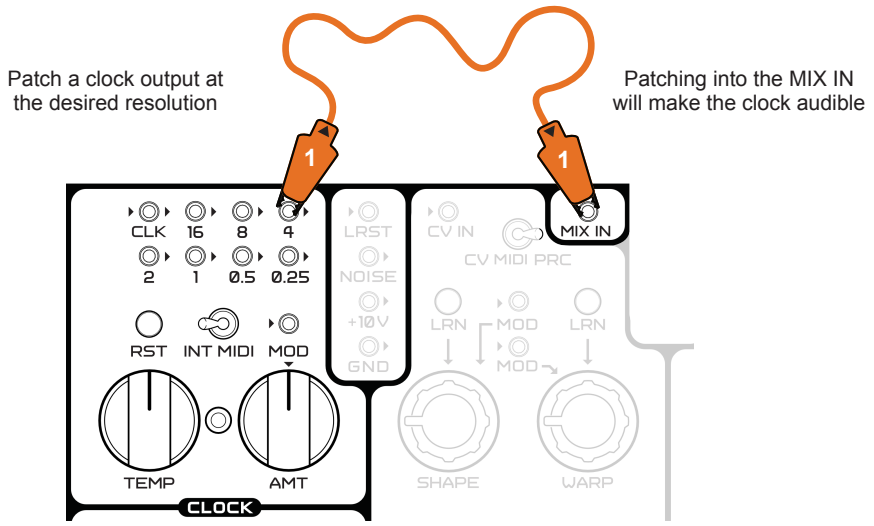
NOTES

Its been said that a unique feature of Pulsar-23 is the ability to use audio as a modulation source but also how control can also be used to generate sound. In the true spirit of Pulsar-23, experimentation and exploration by trying things is a journey worth taking. Some basic examples are shown here, which also gives the first introduction to patching and gets things started on these concepts.

Metronome

While there is no defined metronome function, this can easily be created by patching the clock output into the audio path mix. This is a very basic, but practical example of control as an audio source. The metronome, i.e. 'MIX IN' will trigger on the rising and also the falling cycle of the clock pulse. As such a division of 2, not 4, will give a metronome tick each quarter note.

Also consider using one hand to temporarily patch the metronome when needed instead of the fixed patch cable.



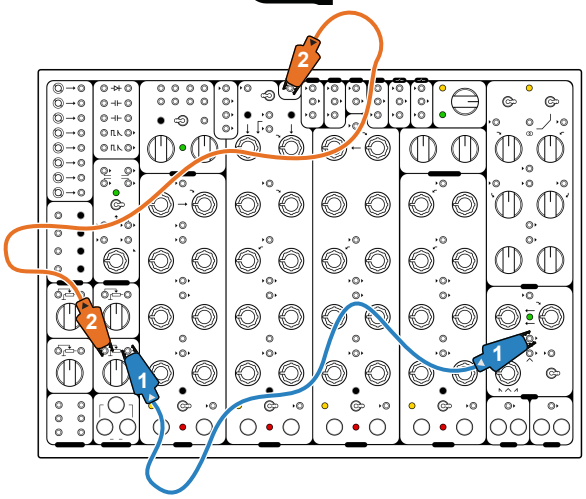
Adjusting clock speed will of course control the master clock, but also in this patch will make a clock cycle audible just like a metronome. Using an attenuator patched in between will allow the volume level to be adjusted and shut off completely if needed.

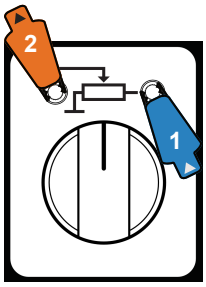
NOTES

LFO as an Audio Oscillator

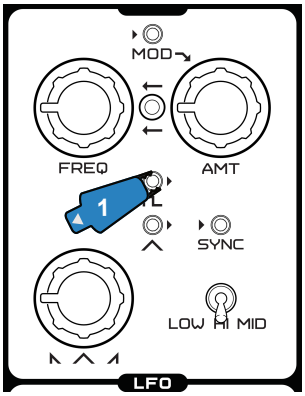
A Low Frequency Oscillator is typically designed to operate at low speeds so that it can be used to affect control and modulation. The frequencies are normally too low to operate in the audible frequency range 20Hz and above. However the Pulsar-23 LFO can operate at higher audio frequencies and can be patched as a traditional oscillator sound source.

The 'MIX IN' pin allows audio to be mixed into the main audio mix.





The attenuator is optional and acts as a level control. Output - left pin is patched to the audio 'MIX IN'.



The Pulsar-23 LFO can operate at higher frequencies than traditional LFO's. Set the switch to HI. Use either of the square or triangle outputs to patch optionally through the attenuator - right pin to allow control of the oscillator level.

Consider a hard synchronisation of the LFO by patching a 'TRIG' output from a sound module or a clock divider output to the 'SYNC' input of the LFO

3

Looper & Clock

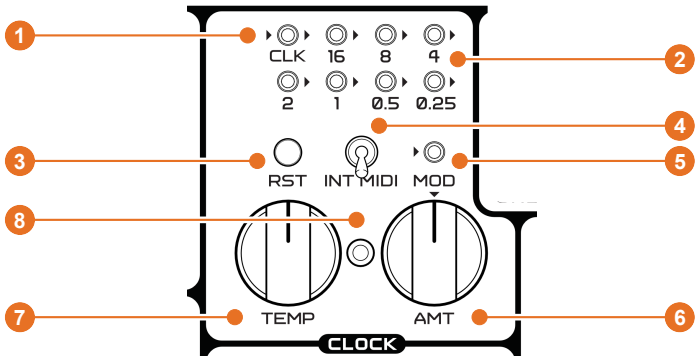
Sequencing in Pulsar-23 does not follow the normal step sequencing convention. While sequences can be created using multiple methods, this section concentrates on two core elements to sequence patterns in Pulsar-23. Firstly the master clock generator allows, amongst other things, the ability to create triggered patterns. The clock is extremely precise and has multiple timing options plus it also controls the master tempo. Secondly the looper recorder is a unique feature for creating pattern loops. Unlike most drum machines which relies on step sequencing, the looper recorder operates more like a classic tape recorder, capturing and overdubbing drum patterns as played. Just like the sound and control features in Pulsar-23 the looper recorder aims towards more organic drum sequencing. The clock and looper recorder work together in harmony and each has a role to play in developing drum patterns. The clock actually determines the looper recorder length. MIDI control from an external sequencer and other external and internal modulation sources can be used to create rhythmic patterns too but these elements are not covered in this section. It has been said many times that Pulsar-23, as an organismic drum machine which operates differently to other drum machines. The sequencing options are somewhat unconventional, but that is what makes this instrument unique and intriguing. The looper recorder and clock are core features in Pulsar-23 and at the heart of creating full songs and sequenced patterns. The use and application of these functions, just like other modules, encourages pushing the boundaries and testing the infinite options in Pulsar-23.

3 Looper & Clock

3.1 Master Clock Module Overview

NOTES

The master clock module is central to Pulsar-23's timing and tempo. The role of a clock is important in modular based systems to ensure all functions operate in time together. Timing pulses are sent to enable this synchronisation across functions and can also be used to trigger drum hits and events. Multiple divider points are available for patching the clock. The clock is also tightly linked to operation of the loop recorder.



Item	Function	Label	Control	Description
1	Clock	CLK	Pin	Operates as clock generator output when switch is in INT or MIDI position. When switch is centred, clock recognises this pin as an external input to the clock which controls the clock dividers and looper recorder.
2	Dividers	Various	Pin	Output pins for the binary clock dividers. Ideal for driving drum triggers and creating patterns and controls. The 8 labels indicate note duration from; 16, 8, 4, 2, 1, 0.5, 0.25. Array represents looper length.
3	Reset	RST	Button	Resets the clock divider array and therefore the looper recorder is reset to the start and is synchronised to the clock. Press before loop recording to ensure synchronisation between looper and clock dividers.
4	Clock Source	INT MIDI	Switch	Selection of clock source between internal clock generator - left, external MIDI source - right and when set to centre, internal clock is disabled / stopped and CLK acts as an input for an external pulse.
5	Clock frequency	MOD	Pin	Connection for external control and modulation of the clock frequency.
6	Amount of modulation	AMT	Knob	Amount of modulation CV applied to the MOD Pin input for frequency control.
7	Tempo	TEMP	Knob	Sets the clock generator frequency between 1-200Hz. This effectively determines tempo and looper length.
8	Tempo indicator		LED	LED indicator which flashes in time with tempo frequency, once per quarter plus bright flash at the loop start. LED is green.

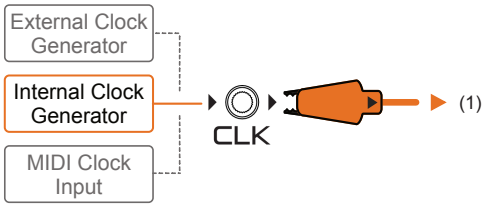
NOTES

3.2 Master Clock Source

The master clock module has an internal clock generator which, by default is used in Pulsar-23. There are also options to use an externally connected MIDI clock or patch an external clock pulse input to the ‘CLK’ Pin. This is selectable on the ‘INT MIDI’ 3-way switch. Pulsar-23 is intelligent enough to establish the role of input and outputs when connected to the clock.

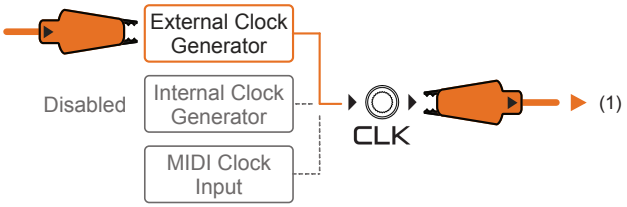
Internal Clock
Switch Left

INT MIDI Switch is set to the left, {INT}. This will use the internal clock generator as the master clock. The looper and clock dividers will be based on this internal master clock.



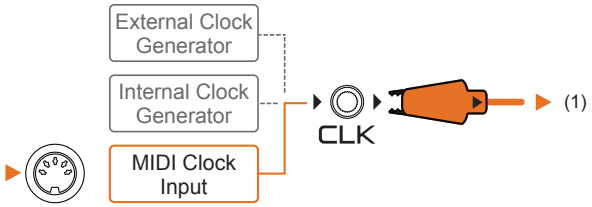
External Clock
Switch Centre

INT MIDI Switch is set to the centre {EXT}. This will disable and stop the internal clock. However an external clock >3V connected to ‘CLK’ pin will be interpreted as the master clock input and operate to this control. The looper and clock dividers will be based on this external input as the master clock.



MIDI Clock
Switch Right

INT MIDI Switch is set to the right, {MIDI}. This will use the clock received through the MIDI connection from an external device. The external device will need to be set to send clock. The looper and clock dividers will be based on the MIDI clock.



(1) The clock output is the default ‘hard wired’ function but can optionally be patched.

3.3 Clock Pulses and Divisions

NOTES

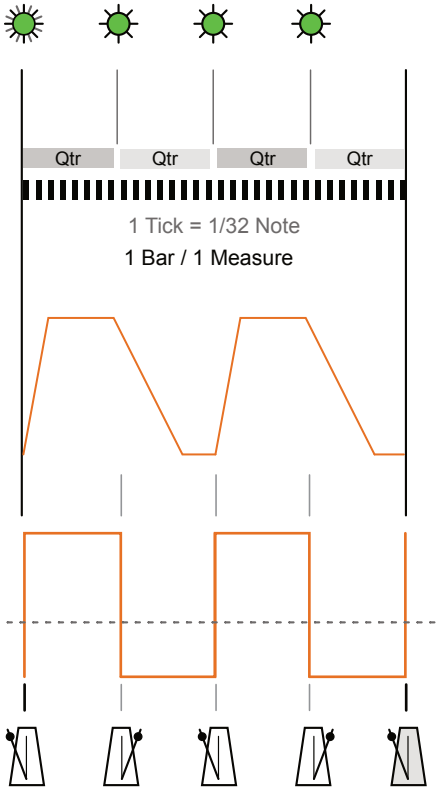
Pulsar-23 tempo is controlled by frequency and measured in Hz. Hertz or Hz represents cycles per second while tempo is normally measured in BPM - Beats Per Minute. Some considerations should be noted:-

- The division label in the clock module indicates the number of clock cycles per bar or measure.
- The green tempo LED located in the clock module will flash to match the quarter note intervals. A bright pulse flash will indicate the loop start / first pulse in the overall 4 bar / measure length.
- An audible metronome can be patched by connecting a clock divider to the attenuator input and the output to ‘MIX IN’. The attenuator is optional and will control the volume level of the ‘click’.
- The cycles in Pulsar-23 will have a rising edge and a falling edge in each cycle. When patching a clock divider to the ‘MIX IN’ to operate as a metronome, 2 triggers will be output per cycle. The rising and falling edge of the pulse triggers the ‘MIX IN’ Tick.
- When patching a drum module, the rising edge of the clock will trigger the drum module. The drum module envelope will sustain for the duration of a high trigger and release on the falling edge.
- Turn the (TEMP) knob to adjust the tempo. This is only when the internal clock generator is used. This is very precise and has a wide range from extremely slow to very fast tempo. The clock LED or patched metronome will help guide in setting the timing needed. This will determine the overall time of the loop in seconds / minutes.
- The internal clock operates at 128 ticks across the full duration of the looper length, 4 bars or 4 measures. This can be patched as an output from the clock module ‘CLK’ pin. This should be noted when patching an external or MIDI clock as an input to the clock module ‘CLK’ Pin.
- Bar and measure are interchangeable musical terms. They refer to the length of a musical passage. A bar and a measure are the same length. The length is in musical divisions and in Pulsar-23 this can be adjusted to an actual time based duration with the tempo control.
- An external clock does not necessarily have to be an external device. Internal modules such as SHAOS or the LFO can be used to trigger the ‘CLK’ external inputs.

NOTES

Clock Triggers and Divisions

Example: Division = 2



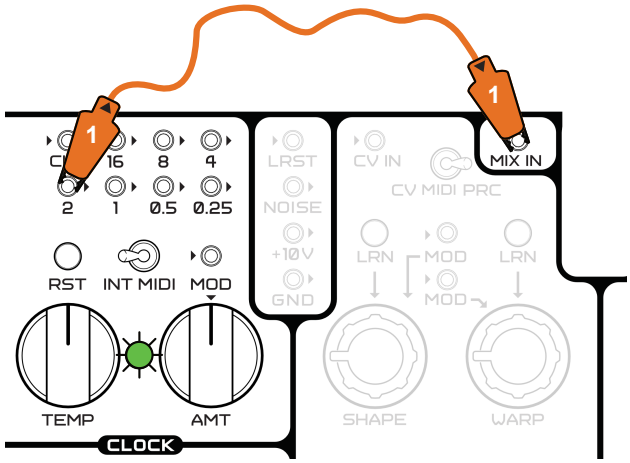
LED Tempo indicator flashes each quarter note.

Looper length is 4 bars / 4 Measures with 128 ticks. Diagram shows only 1 bar for illustration purposes.

Drum module envelope attack is triggered on the rising pulse and then released on the falling pulse.

A Division of 2 will output 2 clock cycles per bar or measure

The ‘CLK’ Pin will recognise external inputs above a 3V threshold as the master clock pulses



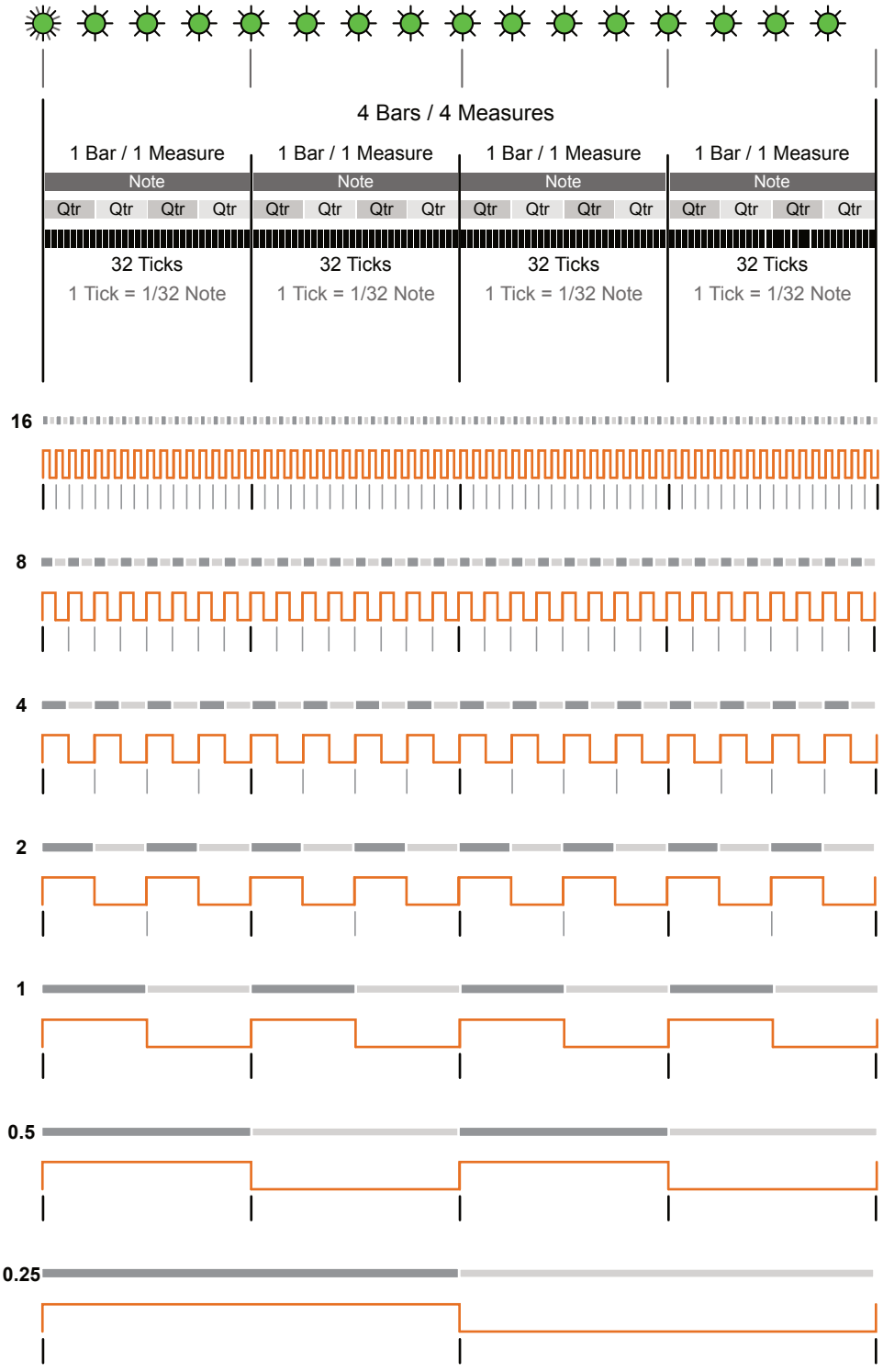
If patched to ‘MIX IN’ as a metronome, the ‘click’ will be triggered on the rising and also on the falling pulse of the clock cycle. The metronome would ‘click’ at 2x the division value. Therefore set the division to half the required frequency i.e. set to 2 for a metronome at every quarter note interval.

NOTES

Clock Divisions & Length

Clock Tempo - LED Pulse

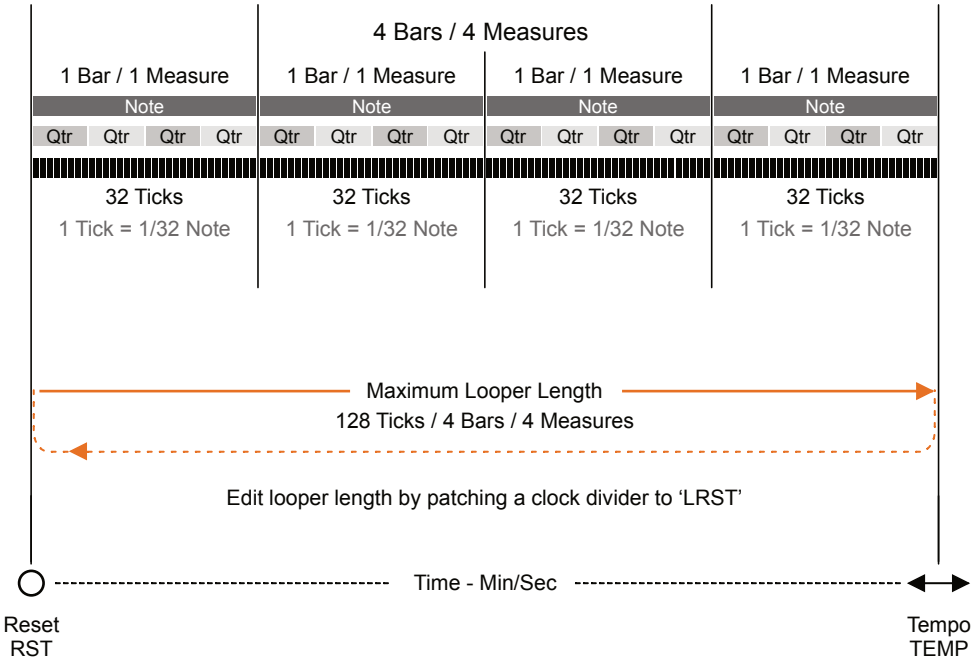
Bright at the start of the length and dimmer on the quarter note.



NOTES

3.4 Clock Timing & Looper Length

The master clock module is very accurate and operates to trigger events in Pulsar-23 or for other external equipment. The clock also determines the looper recorder length. Note that there is no numerical indicator of tempo in BPM, the clock LED is the visual indicator of timing. Looper length is a maximum of 4 bars and is determined as a duration in seconds or minutes by the tempo.



The RST Reset button manually resets and synchronises the looper / clock to the start. A reset can automatically be provided by patching the '0.25' division pin to the 'LRST' Looper reset pin. The '0.25' division has only one high trigger over the 4 bars / 4 measures and is therefore full length. It is good practice to use 'LRST' patched to a clock divider and to press RST before beginning loop recording.

Note that other clock divisions patched to the 'LRST' looper reset will change the loop length. This is useful, for example to create a 1 bar loop, use a division of 1 or try other divisions for loop length.

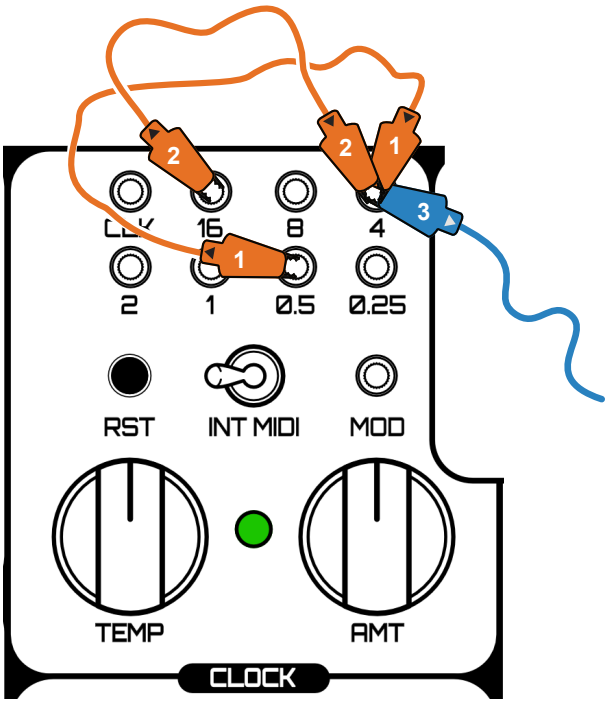
3.5 Clock Patching Techniques

NOTES

A number of useful patches will help to get an understanding of the clock module and real world applications.

Summing Clock Pulses

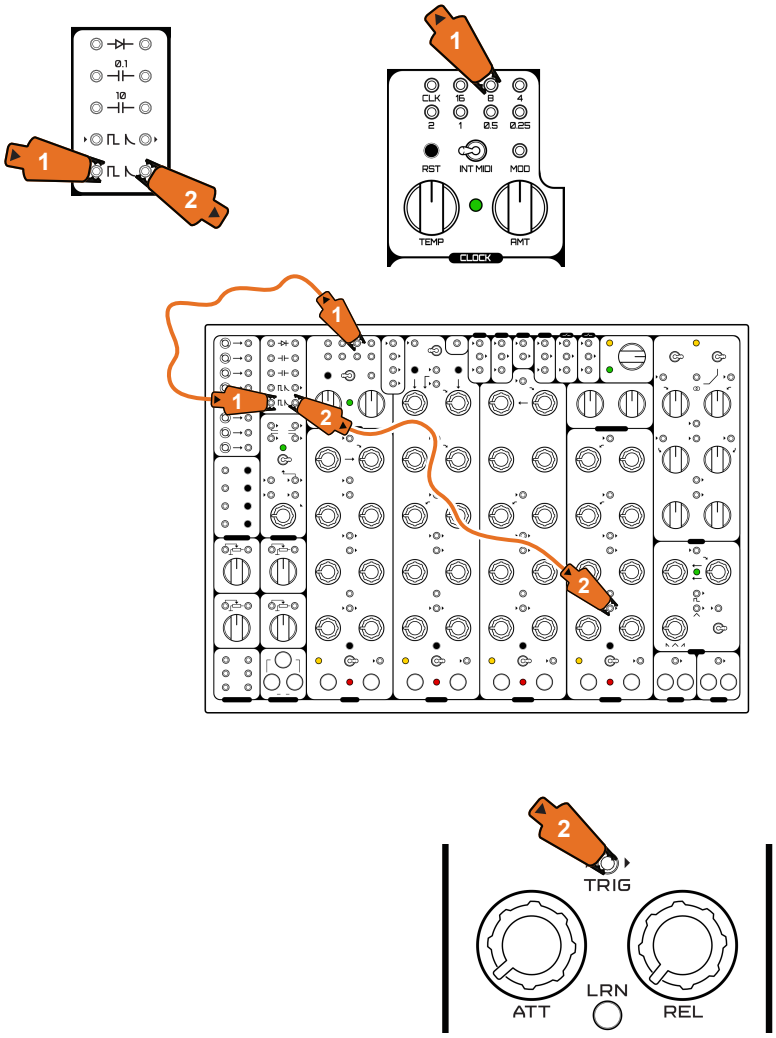
Multiple clock pulse outputs can be connected together. The resulting clock will generate a more interesting and complex pattern, ideal for triggering a drum module or as a modulation source.



NOTES

Straight Hi Hat Rhythm

Clock is patched through the pulse transformer to convert the longer rectangular pulse to a short trigger. Connect multiple clock dividers together to give a shuffle or skip to the hi hat instead of a straight rhythm.

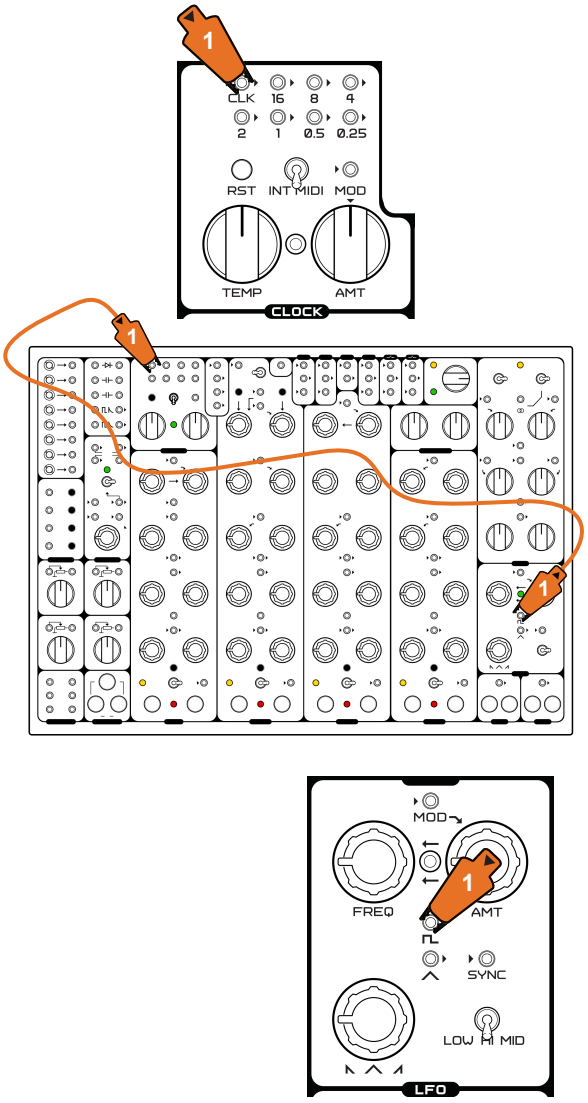


HHT Module triggered by the clock. Short attack and release time to give short hat ticks. The frequency governed by the tempo and clock divider. Try using the clocks ‘16’ output divider and patch to the HHAT without the pulse transformer. The shorter pulses should be ideal for hi hats.

NOTES

Alternative Source as a Master Clock

The master clock can be controlled externally from a separate device or it can even be controlled by using another Pulsar-23 function such as the SHAOS or LFO module. The clock has intelligence to recognise the incoming pulses when patched to the ‘CLK’ input, even when patching from its own modules as a source.

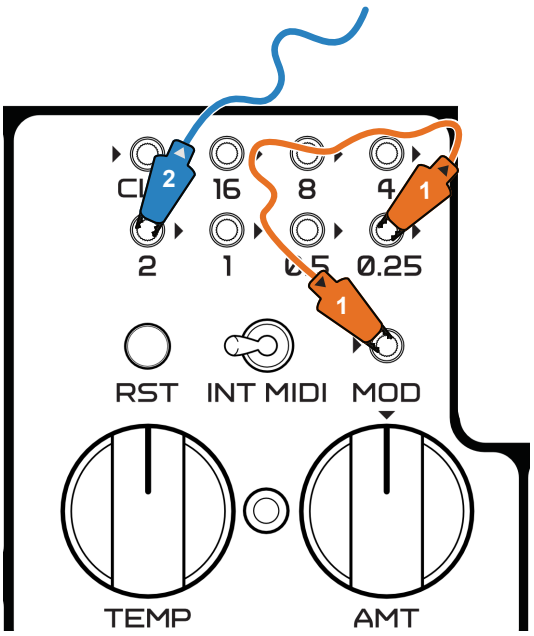


Ensure the clock switch is set for external clock, central position in order to recognise the incoming clock pulses from another device or function. The pulse timing of the ‘CLK’ input is set to expect 128 pulses for the full 4 bar length while the at the source i.e. LFO may be different. This can add interesting combinations but also be careful to align if accurate synchronisation of timing is needed.

NOTES

Modulating the Clock

The clock has a modulation input function. This can be used with internal or external modulation source. One example is to use the clock to modulate itself to create interesting patterns.

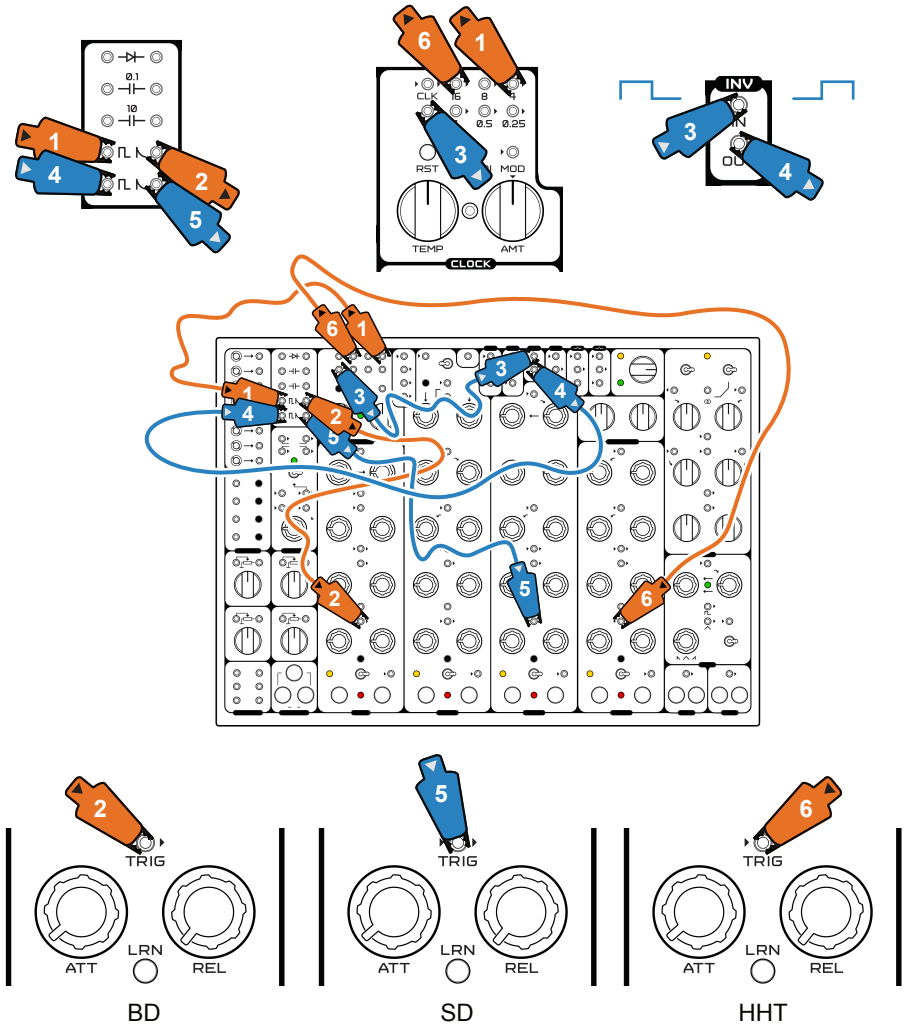


The amount of adjustment can be made and other dividers individually or patched together with other dividers to generate interesting patterns. The ‘AMT’ knob will control the amount of modulation applied.

NOTES

Three track - triggered pattern

The clock can be a powerful sequencer and control all 4 modules. This example illustrates the 3 drum modules controlled to generate a repeated rhythm using a variety of clock outputs to establish timing of each drum module beat. This is an interesting use of the clock with drum modules and adding the bass can give a complete track pattern.

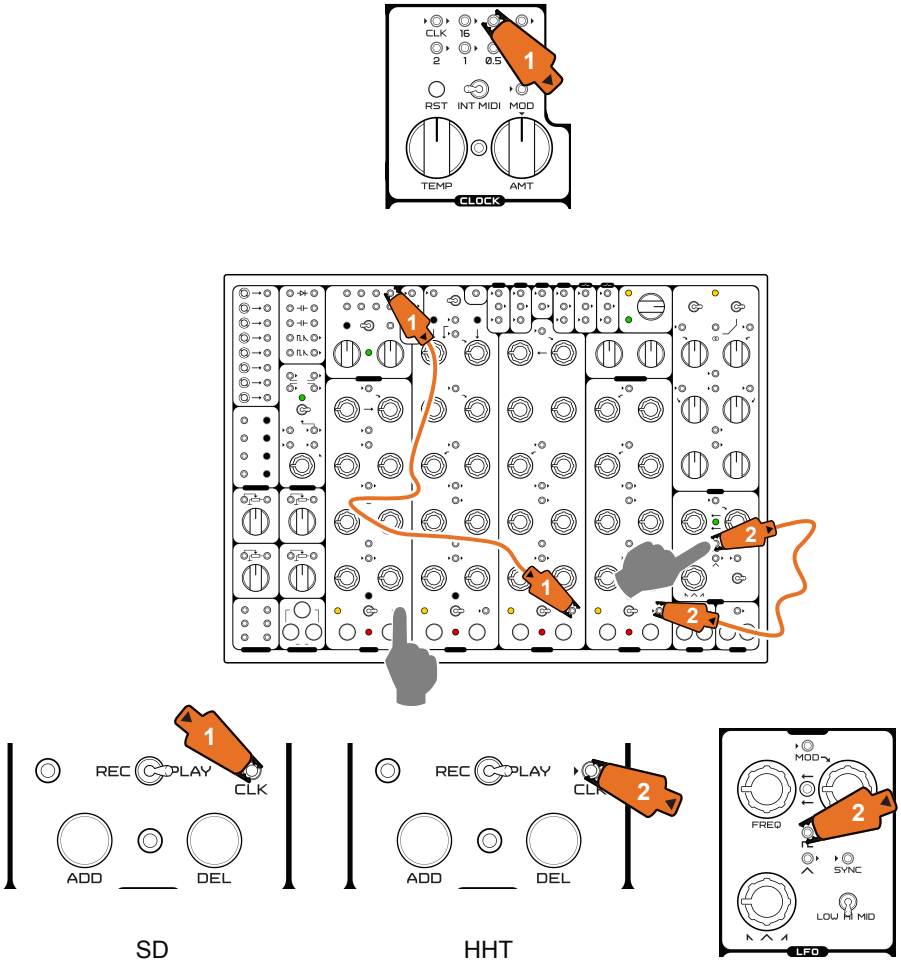


BD will trigger on beat and the SD delayed to trigger on the off beat. 16th note hats will be straight. Tempo will adjust the overall speed / timing. Try using the looper recorder to lay a bass line over the beat.

NOTES

Three track - multi clocked pattern

Rather than triggering modules from the clock, each drum module has a separate clock input. Setting different clock rates to each module can be a more elegant and simpler solution for multiple timing. The drums would still require triggering and it can be assumed in this example they are recorded into a loop for 3 drum modules. This is a chaotic use of the clock with drum modules but adding other clock techniques can develop the patch even more.

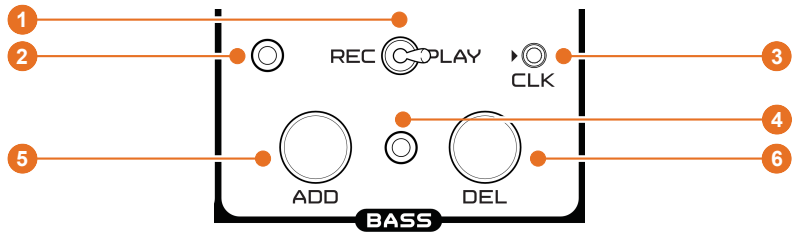


Use different clock sources to trigger or alter the modules clocks. Try using a “roaming” patch cable or by a manual single hand patch to trigger from the ‘GND” pin to affect clocks in an ad hoc way. This can throw them out of synchronisation and create interesting and experimental patterns. Press the RST Reset button to reset the Master Clock synchronisation.

3.6 Looper Recorder Overview

NOTES

Each of the 4 sound generator modules has its own looper recorder channel. Rather than step recording with grid quantised programming, Pulsar-23 operates more like a tape based loop recorder using the [ADD] and [DEL] buttons. Each looper recorder operates independently and by default is controlled and 'hard wired' from the master clock. Each module also has a dedicated 'CLK' input patch pin and can therefore also be individually controlled.



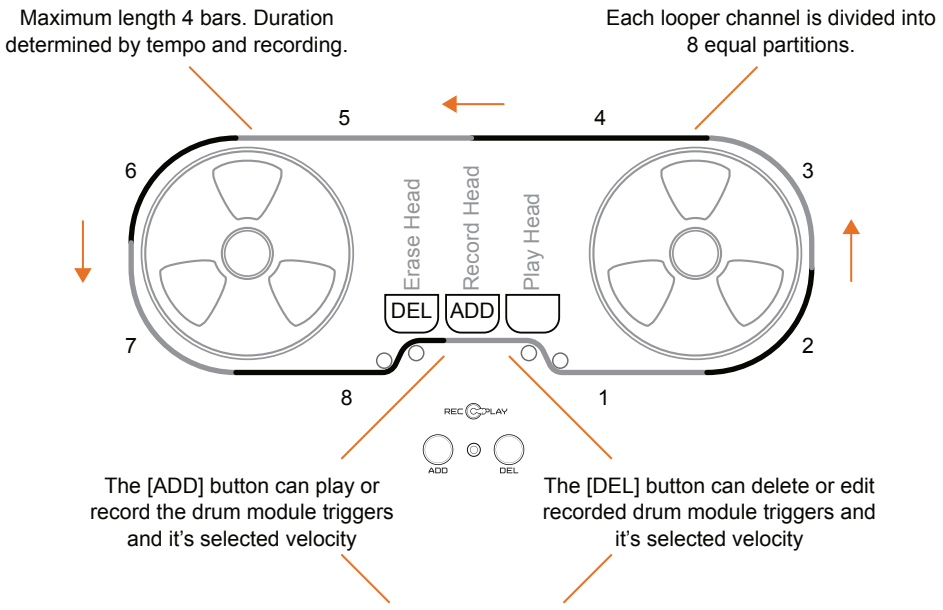
Item	Function	Label	Control	Description
1	Looper Mode	REC PLAY	Switch	Selects loop recorder for recording and overdubbing played beats. Mute, central position, mutes recordings. Playback mode, plays recorded loops and allows manual accompaniments.
2	Bank		LED	Current bank selection indicator. Each module also represents selection of a loop bank.
3	Alternate Clock	CLK	Pin	Control the clock of each drum module independently with an alternate patched pulse.
4	Trigger Indicator		LED	Illuminates each time the modules envelope is triggered.
5	Multifunction - Add	ADD	Button	Plays the module manually or adds beats to a recording. Selects bank. Used in conjunction with the looper control for velocity levels. Function dependant on looper mode.
6	Multifunction - Edit	DEL	Button	Deletes or mutes recorded beats. Selects bank. Function dependant on looper mode.

The looper recorder does not record from the 'TRIG' inputs.

NOTES

Think of the looper recorder in the same way a classic tape recorder works but by recording to a tape loop. The looper records start of note events, length and velocity. In reality this is managed by the Pulsar-23 memory, but it is useful to illustrate this in the same way as a continuous tape loop with real time recording and overdubbing. Each sound generator module hosts one of the 4 looper channels. A Bank contains 4 channels and Pulsar-23 has 4 bank slots, also represented by the modules.

Example: BD Looper Channel (repeated per sound generator module)



REC

Tap [ADD] button to overdub while playing.

REC PLAY

Hold [DEL] button to erase from the loop while playing.

Hold [DEL] + Tap [ADD] button to punch-in, erase and record.

PLAY

Tap [ADD] button to accompany but not record.

REC PLAY

Hold [DEL] button to mute while playing, but will not erase.

MUTE

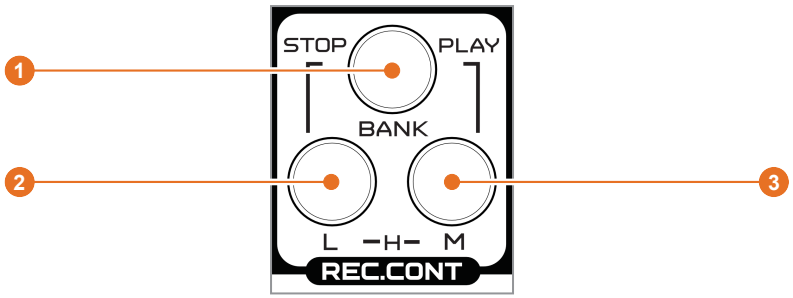
REC PLAY

Tap [ADD] button to manually play the drum module while the loop position continues silently controlled by the clock.

3.7 Recorder Control Overview

NOTES

The Recorder Control module, labelled REC CONT, is a multifunctional module that represents, bank selection, sound generator play options and general control over the Recorder Looper. REC CONT consists of 3 buttons which are used individually or together with other function and whose function may also depend on the looper mode selected.



Item	Function	Label	Control	Description
1	Multifunction	BANK	Button	Hold to select a Bank using the sound generator channel ADD or DEL. Can paste banks by holding BANK + ADD + DEL. Hold with L to stop looper and with M to play the loop.
2	Multifunction	L	Button	Hold with the ADD button or when loop is playing will trigger a low velocity drum event. Also held together with M, will trigger a maximum velocity event. Velocity can be recorded.
3	Multifunction	M	Button	Hold with the ADD button or when loop is playing will trigger a medium velocity drum event. Also held together with L, will trigger a maximum velocity event. Velocity can be recorded.
1,2,3	Quantize		Button	Holding all three buttons simultaneously + ADD or DEL of a selected channel will quantize recorded events. The looper will stop and need restarting with BANK + M + ADD / DEL of BD to continue.

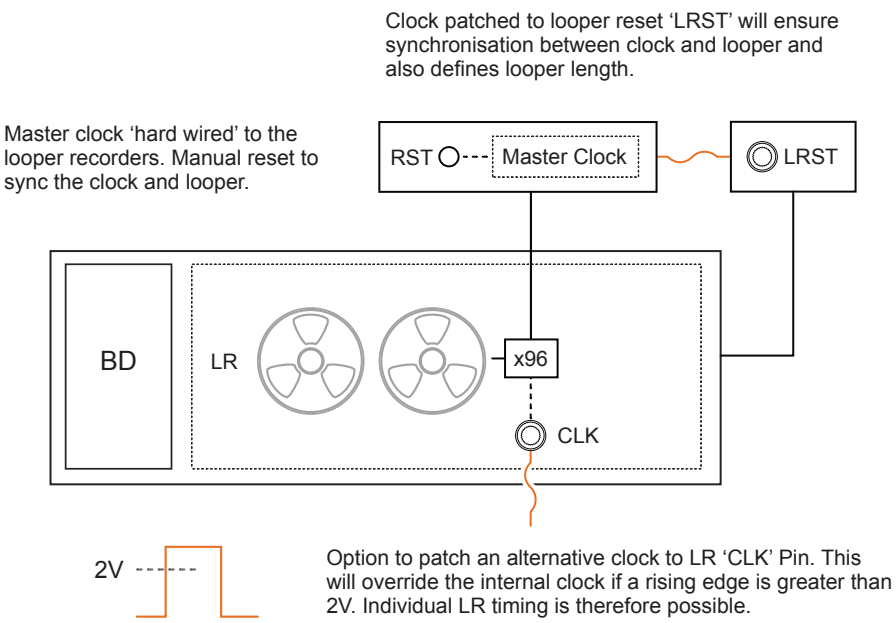
REC CONT & Looper Recorder Quick Reference

Function	REC PLAY	REC CONT			Sound Module		Description
	Mode	BANK	L	M	ADD	DEL	
Play Notes	Play				Tap		Play notes manually over an existing, recorded loop at maximum velocity. Does not alter the recording.
Play Notes	Mute				Tap		Play notes manually. Looper is muted but continues in clock sync.
Play Max Velocity	Play		Hold	Hold	Tap		Play notes manually over an existing, recorded loop at maximum velocity. Does not alter the recording.
Play Low Velocity	Play		Hold		Tap		Play notes manually over an existing, recorded loop at low velocity. Does not alter the recording.
Play `Mid Velocity	Play			Hold	Tap		Play notes manually over an existing, recorded loop at medium velocity. Does not alter the recording.
Mute Notes	Play					Hold	Mutes recorded notes temporarily. Does not alter the recording.
Adjust Playback Velocity - low	Play		Hold				Adjusts, while holding L, the velocity to low for recorded notes while they play. Does not alter the recording.
Adjust Playback Velocity - med	Play			Hold			Adjusts, while holding M, the velocity to Mid for recorded notes while they play. Does not alter the recording.
Select Bank	Any	Hold			Tap	Tap	Either ADD or DEL of a module, selected when holding BANK will select one of the 4 loop banks.
Paste Bank	Rec	HOLD			HOLD	HOLD	Hold BANK + ADD + DEL to paste from the previous selected bank channels in rec mode.
Stop looper	Any	Hold	Tap				Stops the looper. Bank LED on the module will flash yellow when stopped, solid when active.
Restart Looper	Any	Hold		Hold	Tap	Tap	Restarts the looper from one of 8 loop partitions. Use BD ADD to start the looper from the first partition.
Overdub Record	Rec				Tap		Will record event start, length and velocity throughout the loop length. Will record new notes while retaining existing note events.
Punch In Recording	Rec				Tap	Hold	Will erase any existing note events while recording any new ADD events
Delete Recording	Rec					Hold	Will erase any existing note events while holding DEL as the loop plays.
Quantize 1/16th notes		Hold	Hold	Hold	Tap	Tap	Will quantize to 1/16th intervals, the notes recorded for the selected ADD or DEL Channel.

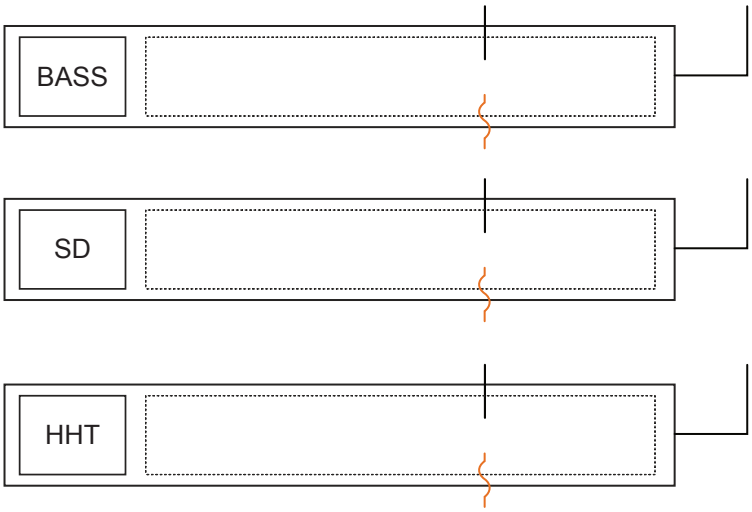
3.8 Looper Reset and Clock

NOTES

The master clock and the 4 Looper Recorder channels have a very close relationship and generally synchronise together, even though they are independent functions. The master clock operates at 128 ticks (each 1/32nd note) but to ensure high recording precision the looper recorder control upscales the incoming clock by 96 times of its frequency.

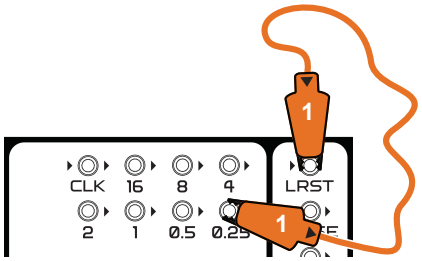


Function is the same for all four Looper Recorders.

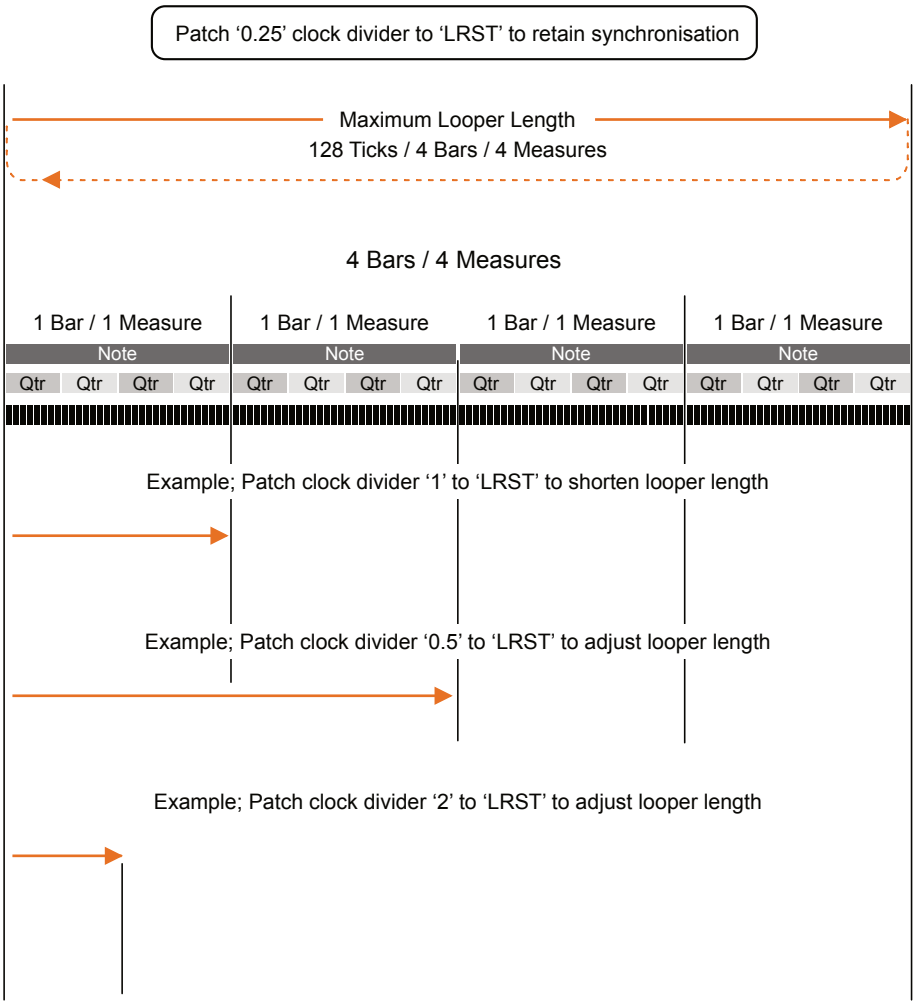


NOTES

To ensure good synchronisation is it is advised to press RST, the onboard clock module reset button before looper recording. In addition it is good practice to patch a clock divider to the ‘LRST’ Pin. This will reset the clock and the looper start position. Using the 0.25 divider will reset each full 4 bar length of the looper but other dividers can be used to shorten the length.



Patch ‘0.25’ to ‘LRST’ as good practice for the full loop length. Try other divisions to change loop length.

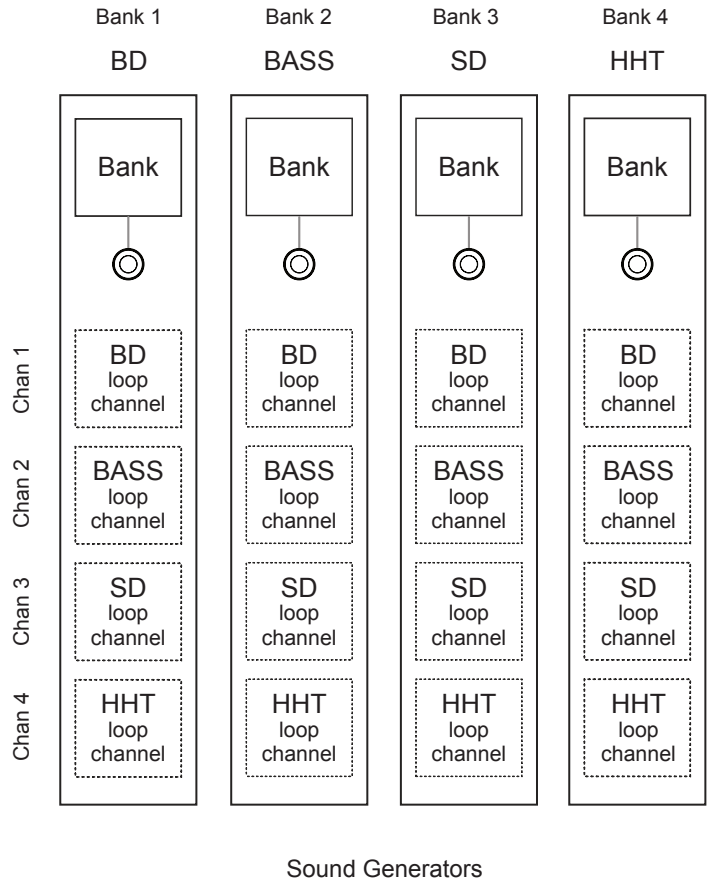


3.9 Looper Banks

NOTES

Pulsar-23 can store the the 4 recorded looper channels for each module, into a bank. Pulsar-23 has 4 banks, each of which can be also be selected by using the 4 drum module controls. The memory for the looper is volatile, meaning that once power to Pulsar-23 is removed, the memory is cleared and all loops are lost. There is no ability to store permanently or transfer loops to another device.

Hold [BANK] + [ADD] or [DEL] to select a Bank.



Each of the drum modules hosts one bank

Bank LED is illuminated solid yellow when selected. Flashing means looper is stopped.

Each bank has four independent looper channels. Each channel represents a drum module looper.

NOTES

SELECTING LOOPER RECORDER BANKS

1. Hold [BANK] + Tap [ADD] or [DEL] button for the bank to select. The BANK button is located in the ‘REC CONT’ section and the ADD/DEL are located in each sound generator module.
    - BD - Bank 1
    - BASS - Bank 2
    - SD - Bank 3
    - HHT - Bank 4
2. The module LED located in the looper section to the left of the REC PLAY switch will illuminate yellow when the bank is selected.
3. The bank selected will contain 4 looper channels, one for each sound generator drum module.

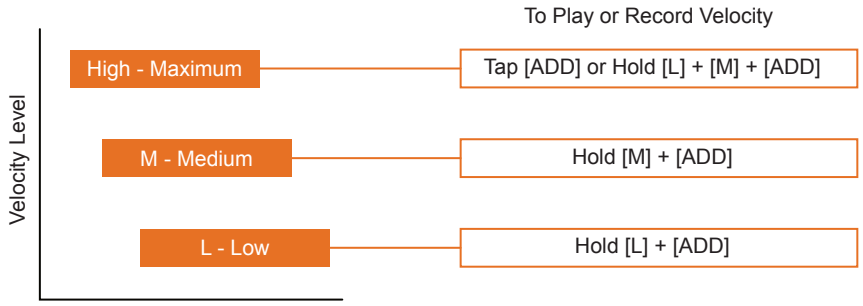
COPYING / PASTING LOOPER RECORDER BANKS

1. Select {REC} mode, toggle left, on the REC PLAY switch for the looper channels to copy. Only channels set to ‘REC’ will be copied.
2. Hold [BANK] + Tap [ADD] or [DEL] button for the bank to select. This bank can be played or edited and will be copied.
3. The module LED located in the looper section to the left of the REC PLAY switch will illuminate yellow when the bank is selected and by default, will be held in memory and is therefore the copy source.
4. Hold [BANK] + [ADD] + [DEL] on the destination bank, represented by the sound generator module selected. Keep the buttons held for the duration of the loop to paste the copied bank into the new location.
5. To copy only part of the loop, Hold [BANK] + [ADD] + [DEL] on the destination bank, represented by the sound generator module selected. Keep the buttons held for the length required to paste part of the copied bank into the new location.

3.10 Velocity Playback, Recording and Quantize

NOTES

Velocity represents how hard a note is played. Often this reflects in how loud the drum event will sound. Pulsar-23 has three internal velocity settings when playing or recording note events. The REC CONT buttons act as modifiers for velocity. In addition Pulsar-23 recognises the full range of note velocity from a connected external MIDI controller.



RECORDING OR PLAYING WITH VELOCITY

1. Velocity will operate in any of the {REC}, {PLAY} or {MUTE} modes, when set on the REC PLAY switch.
2. Tap [ADD] to play or record at maximum velocity. The same velocity level is applied by, Holding [L] + [M] + Tap [ADD]
3. Hold [L] + Tap [ADD] to play or record at low velocity level. The audio should distinguish between higher and lower velocity levels.
4. Hold [M] + Tap [ADD] to play or record at medium velocity level. The audio should distinguish between the velocity levels.
5. With the REC PLAY Switch in {PLAY} mode i.e. to the right, holding the [L] or [M] buttons will temporarily change the velocity playback for the recorded note events. These will return to maximum or their recorded velocity level when the button is released.

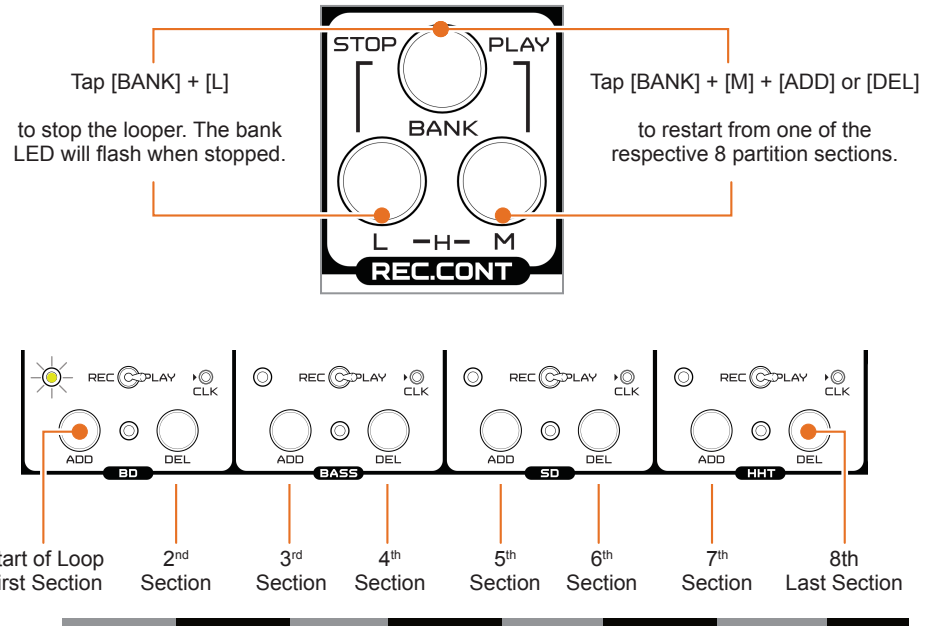
QUANTIZE A RECORDED LOOP

1. Hold [BANK] + [L] + [M] + Tap the [ADD] or [DEL] button for the desired looper channel to quantize to 1/16th Notes. The looper will stop.
2. Hold [BANK] + [M] + Tap [ADD] or [DEL] of the section from where to start. Tap [ADD] for BD to start at the looper section 1 beginning.

NOTES

3.11 Stopping & Restarting the Looper

The looper is controlled by the master clock and when the clock is stopped the looper will also stop. The RST button will also restart the clock to ensure the looper and clock are synchronised. Also the looper can be stopped and started from the 'REC CONT' Module.



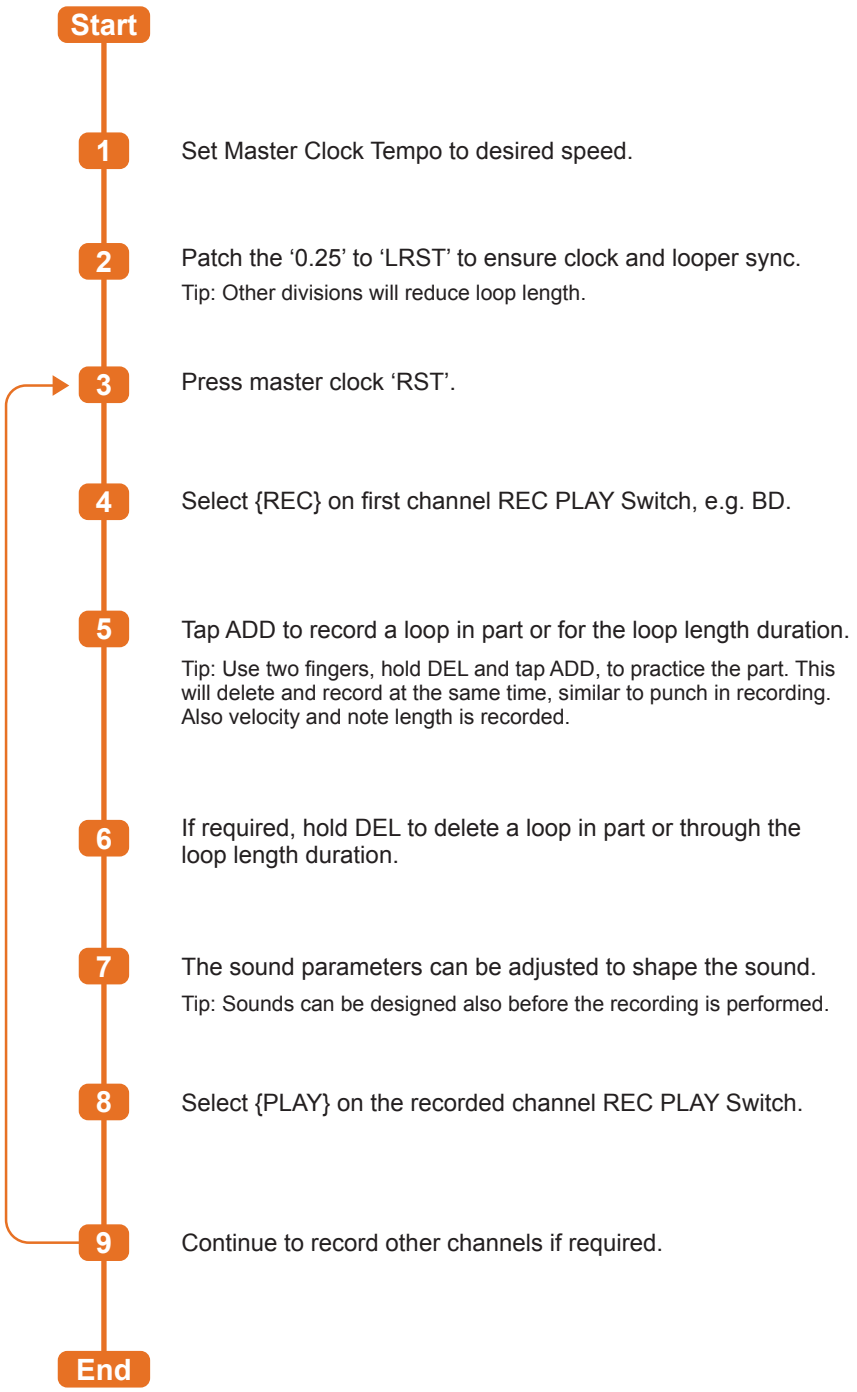
MANUALLY STOPPING / STARTING THE LOOPER

1. Tap [BANK] + [L] to stop the looper. The looper will stay synchronised to the clock.
2. The selected looper bank LED will flash yellow when stopped.
3. To restart the looper, Hold [BANK] + [M] + [ADD] for the BD Sound generator module. This represents the first section of the looper.
4. To restart the looper from one of the other 8 partition sections, Hold [BANK] + [M] + [ADD] or [DEL] for the Sound generator module that represents the section 1-8, left to right. This is useful for mashups and ad libs mixing loop sections on the fly.
5. Stopping the master clock or grounding the module 'CLK' will also stop the looper. To ground the clock, patch by cable 'GND' to the specific sound generator module 'CLK'.

3.12 Loop Recording Workflow

NOTES

Of course individual producers and musicians will develop their own work flow when working with Pulsar-23. A basic example workflow to get started may help identify some key steps.



NOTES

3.13 Looper Recorder Tips and Tricks

The basic process for working with the looper recorder is essential to understand how it works and to get the best from it. In addition there are many creative options than may on first glance appear less obvious.

- Erasing recorded loops requires holding [DEL] when in record mode for the duration of the loop or part of the loop to erase. This is a real time process and can take some time. Adjust the (TEMP) knob to temporarily increase speed while deleting a full loop to quicken this process up. Restore to the desired tempo afterwards.

- The LR ‘CLK’ Pin allows individual clocks patched per channel. This will enable interesting intervals. The master clock does not always need to be the source, try the SHAOS function or an LFO trigger.

- Use the 8 looper recorder partition segments to mash up and remix a beat. Stop the looper with [BANK] + [L] and [BANK] + [M] + one of the channel ADD and DEL buttons to start the section.

- Use a roving patch cable from the ‘GND’ to touch on the channel clocks. This can throw the synchronisation off and introduce creative ad libs and sections. Press ‘RST’ to re-synchronise the master clock and looper.

- Try modulating the master clock to develop more interesting and less predictable patterns.

- Creating variations recorded into banks allows on the fly bank changing. Copy and pasting banks also helps develop a set while easily reverting to the starting point. This can bring improvisation and variations into a live performance.

- The sound module ‘TRIG’ Pin is an input for patching a trigger into the module. It is also an output. Any manual trigger from the [ADD] button or the looper recorder will also output on the ‘TRIG’ Pin. This means loops recorded on one module can trigger another. Try the circuit bending capacitors in-between patching the ‘TRIG’ Pins.

4

Patching

Pulsar-23 is a semi-modular drum machine. A fully modular setup has a number of discrete and interchangeable devices which can be connected. Pulsar-23 also has a number of modules but these are fixed and located together into the single housing. These can be connected between each other in a variety of ways which can change the default ‘wired in’ configuration. Connecting between modules uses individual patch cables. The actual process of patching in Pulsar-23 is somewhat unconventional. Patching can be through the use of supplied patch cables. These are alligator clip cables that connect to pins on the front panel as opposed to the standard and traditional 3.5mm mono jack plugs and sockets. Take care when using patch cables as they can easily get caught under knobs and around pins. Also patching can be made by use of human touch or use of conductive organic materials. While this brings more interest it does also carry some technical benefits. As with most modular or semi-modular gear, each patch will be different and once the patch has been deconstructed and removed it will be lost forever or at least it would need to be rebuilt from scratch. There is no electronic memory or method to store the patches as they are based almost entirely on physical connections. This encourages experimentation and exploration. In summary a ‘patch’ is the re-wiring and interconnection of modules and their settings to create a new sound or audio function. These principles are at the heart of Pulsar-23 and are at the core of how this drum machine is designed where connecting anything to anything can be tried. Patching new sounds is fundamental in unlocking the full potential of Pulsar-23 and is a normal and expected part of the workflow and the onward creative journey.

4 Patching

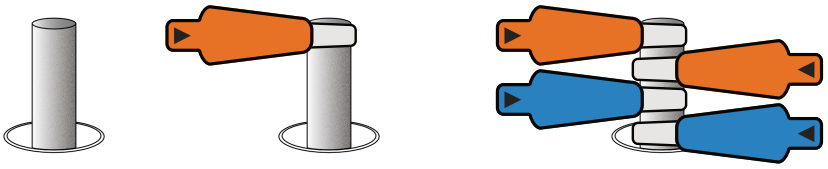
4.1 Principles of Patching

NOTES

Patching in Pulsar-23 is somewhat unconventional. However the use of alligator clip cables to patch pins does add a lot of advantages. Multiple connections can be made to the same patch point.

Patch Pins

Each Pulsar-23 patch point uses a metal pin which extrudes above the top panel face plate. These can be used to clip the alligator cable or to connect by touch to another patch point. There are 119 patch pins on the top panel.

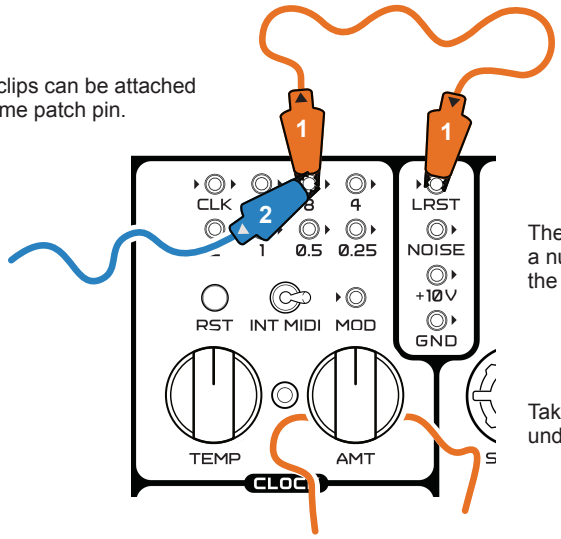


The patch pins can connect the inputs and outputs to / from functions using the alligator clip patch cables. Single or multiple clips can be used on one pin.

Alligator Patch Cables

The patch point pins are connected using alligator clip based patch cables. These are supplied with Pulsar-23 but can also be easily purchased separately.

Multiple clips can be attached to the same patch pin.



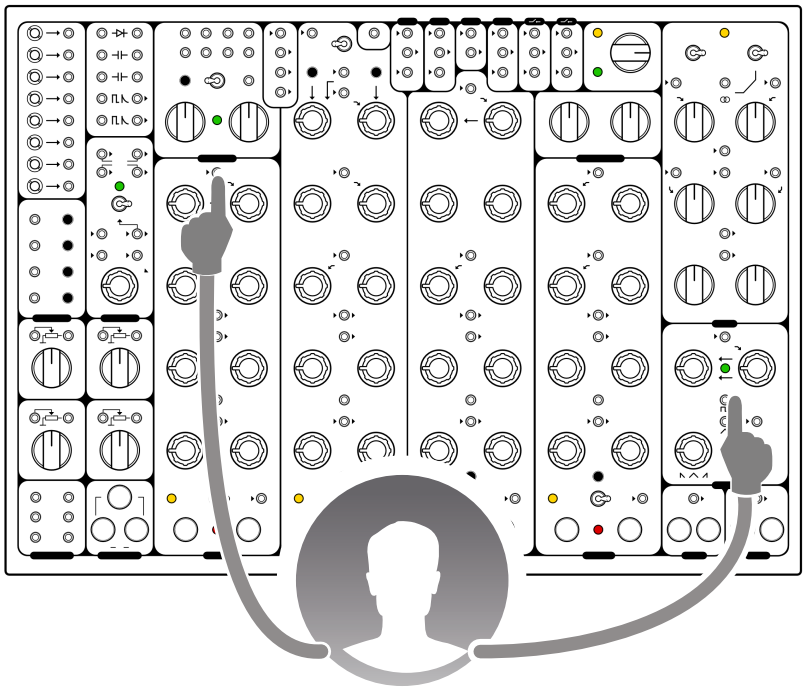
The diagrams in the book shows a number to indicate the ends of the same patched cable.

Take care to avoid cables trapped under control knobs.

NOTES

Human Touch

Patch points can be connected using hands as a human touch. The human body will conduct the necessary signals. This is useful for temporarily patching points in live situations. Try patching the sound generator modules by touching ‘OUT’ to ‘EXT’ to create a feedback loop. Also try the ‘OUT’ Output to the ‘WTF?’ or ‘OMG!’ Pins on the BD module.



Advantages of Patch Pins

Using patch pins as opposed to the typical 3.5mm jack plus has many advantages. Generally this offers multiple connections to the same point and makes the patching accessible to touch. In addition the cost and size of the Pulsar-23 is improved especially due to the number of patch points provided. Finally the reliability of patch pins is higher than with TS jack sockets. A patch bay is also provided to interface between more conventional 3.5mm jacks and patch pins.

4.2 Patch Inputs and Outputs

NOTES

Patch pins can represent an input to a function, output from a function or both. In Pulsar-23 audio and control can be cross patched. This is great for creative sound design.

The Pulsar-23 front panel is labelled to indicate the input / output function using an arrow tag left or right of the pin.

Input Patch Point

Output Patch Point

Input & Output Patch Point

Arrows on the patch pin label indicate if the pin carries an input - left arrow, output - right arrow or both input and output - left and right arrows.

This book will indicate patch cables with numbers that represent the clips on the same cable and also input / output tags on the clip illustration to designate routing.

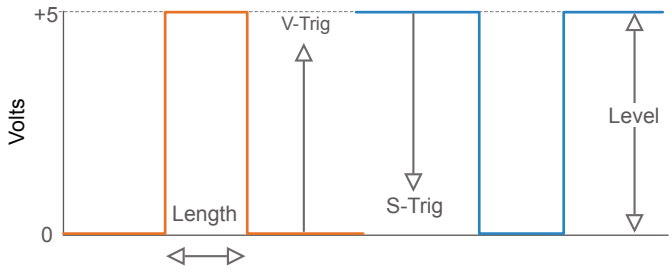
NOTES

4.3 Control Trigger

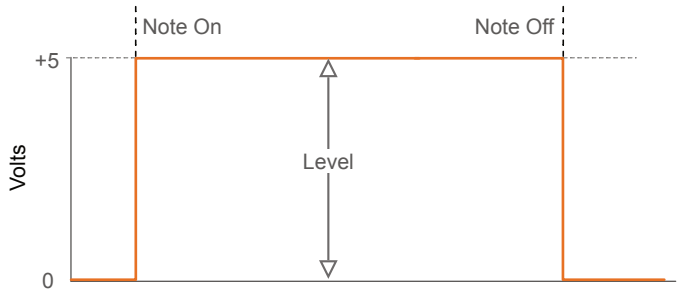
The term trigger also called trig and often interchangeable with the term gate is a common control element for connecting in and across modular and other systems. There are differences between gates and triggers. A trigger would activate an event, for example initiate a drum sound and is typically a short pulse. While these examples are generic, there can be differences in how they are applied across systems.

Common / Generic Trigger Examples

Trigger
A trigger is typically a short voltage pulse that will activate an event. For example a trigger may activate a note on. In drum machines this would normally be a drum hit and therefore the short trigger duration seems logical. Typical trigger levels are from 0V to +5V sometimes referred to as V-Trig - Voltage Trigger, and also +5V to 0V referred to as S-Trig - Shorting Trigger, switch to ground. Clocks are often a series of time synchronised triggers.



Gate
Gate and Triggers are very similar functions, where a gate follows the principles of a trigger very closely. The main difference is that typically a gate has a longer duration than a trigger and the gate may even be held high or held low rather than transmitted as a single pulse. This is more common in melodic synthesizers where notes and chord envelopes are sustained.



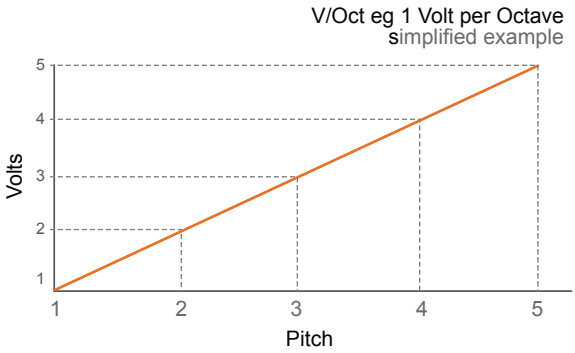
4.4 Control Voltage

NOTES

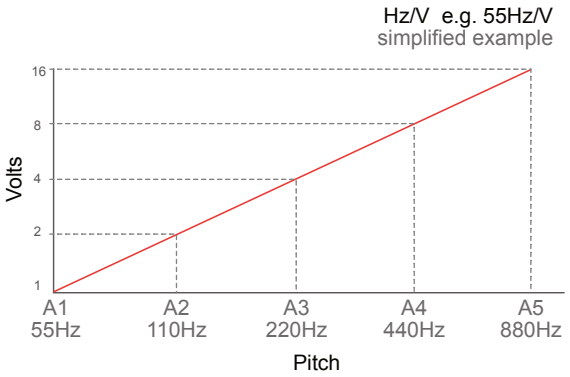
Control Voltage, commonly called CV is the method used for transmitting and receiving signals between functions. This is the primary control method used in modular systems and of course Pulsar-23. Remember that uniquely in Pulsar-23, control and audio can be patched together to explore new sound and control possibilities. Various voltage levels can be found in different modular setups and it is useful to understand these and their differences.

Common / Generic Control Voltage Applications

Volts per Octave
The most common model in the control of pitch is often handled using the V/Oct principle. In essence every volt in the control will alter pitch by 1 octave.



Volts per Octave
Another alternative control voltage method is the Pitch Frequency (Hz) per Volt model. This is a less common standard but is used by Korg and Yamaha.



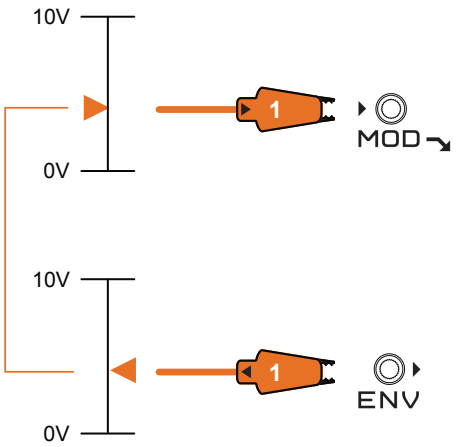
Our perception of pitch is based on frequency and is actually logarithmic. These diagrams are there therefore for illustrative purposes only

NOTES

4.5 Pulsar-23 Control Voltage & Trigger

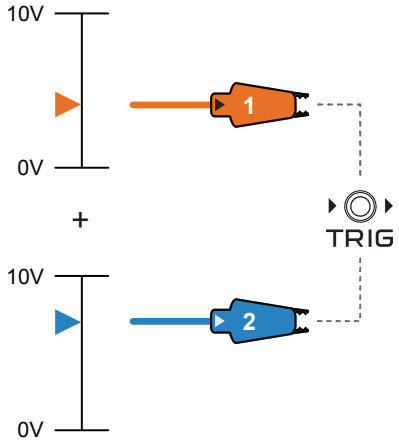
While the audio world is full of different voltage control standards, the common-5V to +5V and 0 to 5V ranges to the less common 0 to 8V.

In Pulsar-23 case both audio and the controls operate across a 0 to 10V range to allow for cross connections. The real consideration is the match up between devices and functions and of course the voltage ranges. Most equipment can tolerate voltage ranges above their own, but the function will respond based on its calibrated range. Pulsar-23 can accept +/-20V but the operating range is 0-10V.



Inputs destinations can receive modulation from the voltage variation and/or level. Destination points will receive a CV or Trig.

Output sources can send modulation from the voltage variation and/or level. Destination points will receive a CV or Trig.



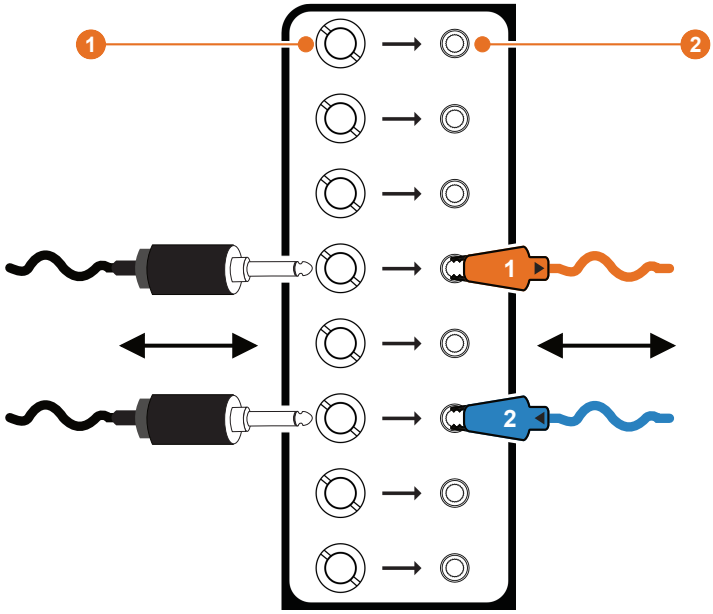
Where multiple inputs are connected the control is mixed, but Pulsar-23 will determine the Trigger and CV input / output needs automatically.

Pulsar-23 has overload protection to ensure good integration with Eurorack modular systems and compatible desktop synths and audio gear.

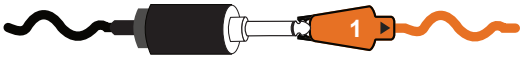
4.6 Patch Bay - Eurorack to Patch Pin

NOTES

Pulsar-23 recognises the importance of interfacing to Eurorack systems as well as other CV and Trigger based gear. As such an 8 channel, 3.5mm Jack to Patch pin patch bay is provided. This does not in itself offer any control or audio features but simply allows the conversation from the jack plug format to allow connection to patch pins.



Item	Function	Label	Control	Description
1	Mini Jack		Socket	3.5mm TS Mono Jack Socket. Audio or Control Input and Output. Signal works both ways,
2	Patch Pin		Pin	Pulsar-23 Patch Pin. Audio or Control Input and Output. Signal works both ways,



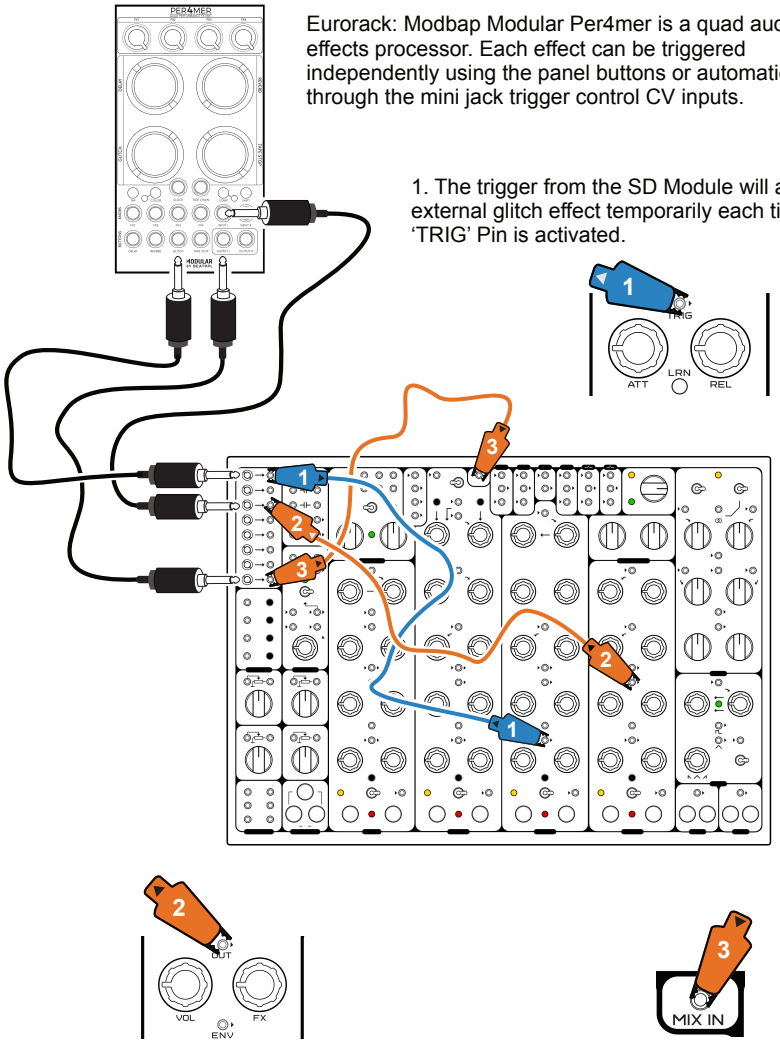
Connecting the alligator clip to the TS Mini Jack TIP also makes the connection

Note: The patch bay also acts as the ground connection between Eurorack and Pulsar-23. Ensure at least one signal is connected through the patch bay when connecting between Eurorack and Pulsar-23 devices.

NOTES

External Eurorack Example

The example shows a Eurorack processor, Modbap Modular Per4mer triggered from Pulsar-23 SD. This will affect the routed HHT drum module audio which is processed by Per4mer before returning it into Pulsar-23.The Patch bay converts from mini jack to the patch pin format in Pulsar-23.



Eurorack: Modbap Modular Per4mer is a quad audio effects processor. Each effect can be triggered independently using the panel buttons or automatically through the mini jack trigger control CV inputs.

1. The trigger from the SD Module will activate the external glitch effect temporarily each time the SD 'TRIG' Pin is activated.

2. Audio out 'OUT' from the HHT module is routed to the Per4mer effect module audio input. This is the audio that will be processed by the Eurorack module.

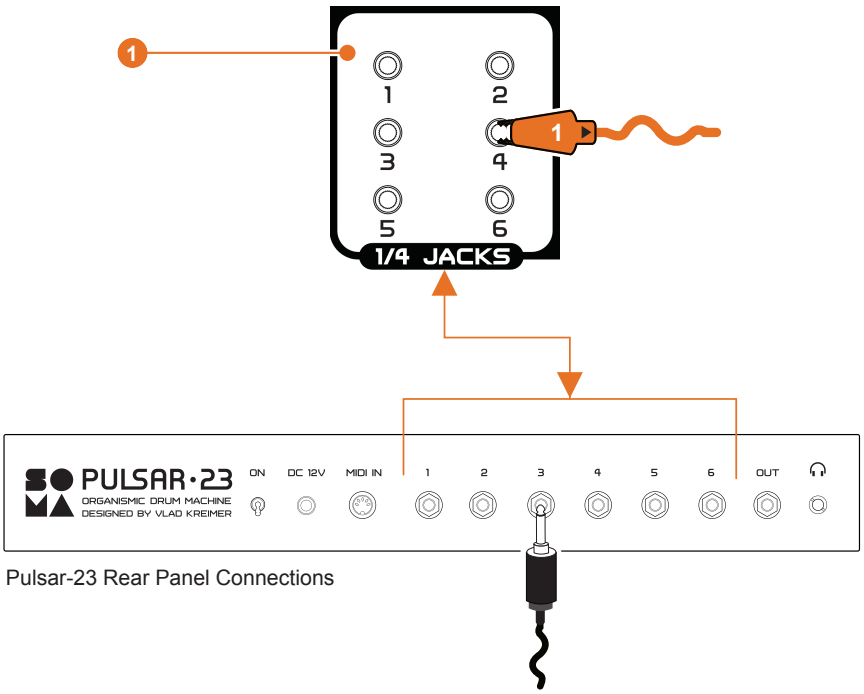
3. The processed HHT audio from Per4mer is returned to Pulsar-23 and routed to the audio 'MIX IN' input.

It is also possible to patch the audio in through a module using the 'EXT Pin. This will allow some control such as envelope over the sound. Although the module's discrete sound should also be considered.

4.7 Patch Bay - 1/4 Jacks

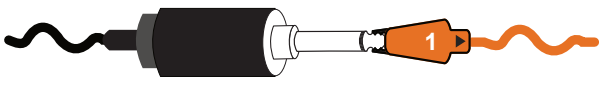
NOTES

Pulsar-23 also accommodates interfacing to other external devices and systems. As such 6 industry standard 1/4inch / 6.35mm Jacks are available for both inputs and outputs at the rear. These connect to the '1/4 JACKS' Patch bay located on the top panel.



Pulsar-23 Rear Panel Connections

Item	Function	Label	Control	Description
1	Patch Pin	1-6	Pin	Connects Pulsar-23 Patch Pins to the 6 rear panel 6.35mm / 1/4inch TR Mono Jack Sockets. Audio or Control Input and Output. Signal works both ways. Numbers on patch bay correspond to rear panel.



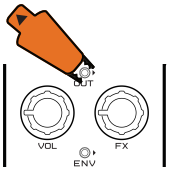
Connecting the alligator clip to the TS Jack TIP also makes the connection

Note: The patch bay also acts as the ground connection between external gear and Pulsar-23. Ensure at least one signal is connected through the patch bay when connecting between external devices and Pulsar-23.

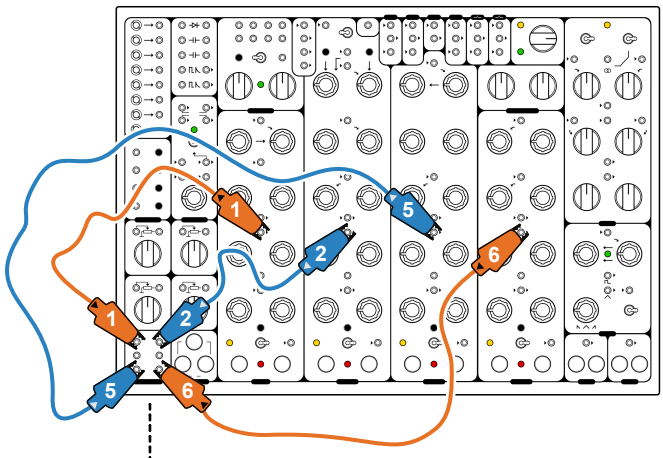
NOTES

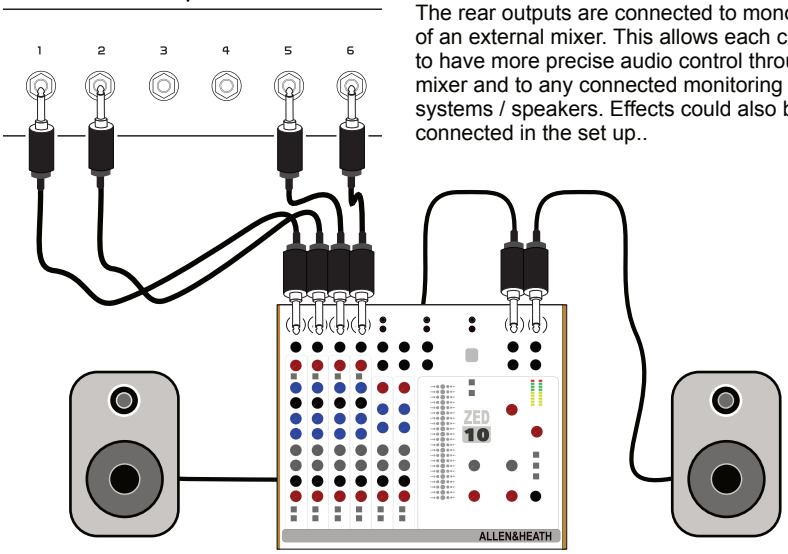
Example: External Mixing

The example shows how each of the drum modules can individually be sent as audio outputs to an external mixer.



All modules audio out ‘OUT’ Pins are connected to the ‘1/4 JACKS’ patch points.



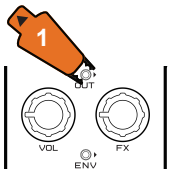


The rear outputs are connected to mono inputs of an external mixer. This allows each channel to have more precise audio control through the mixer and to any connected monitoring systems / speakers. Effects could also be connected in the set up..

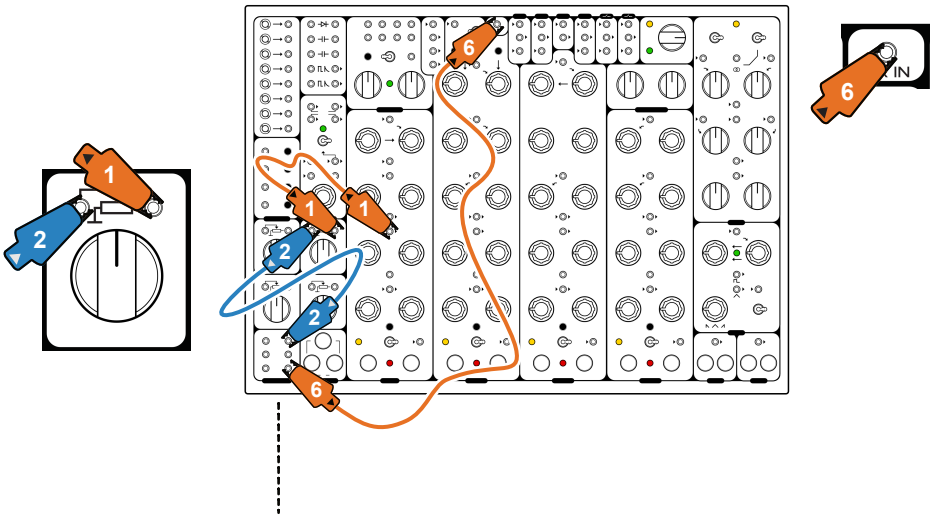
NOTES

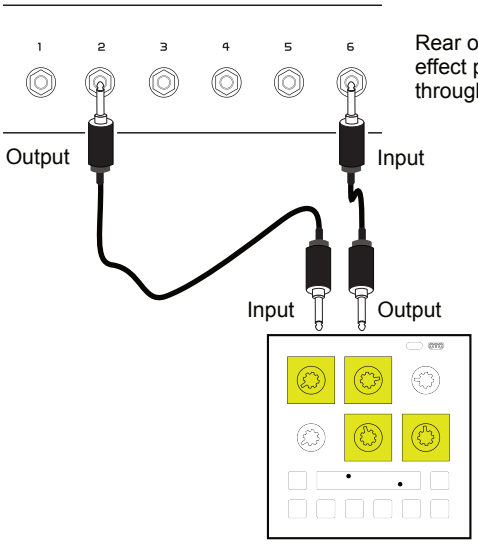
Example: External Send Effects

The example shows an external send effect. The BD drum module can individually be sent as audio output to an external effect e.g. reverb and returned to Pulsar-23. The amount of send can be controlled with an attenuator.



Module audio out 'OUT' Pin are connected through an attenuator to control the amount of audio send to the '1/4 JACKS' patch points.





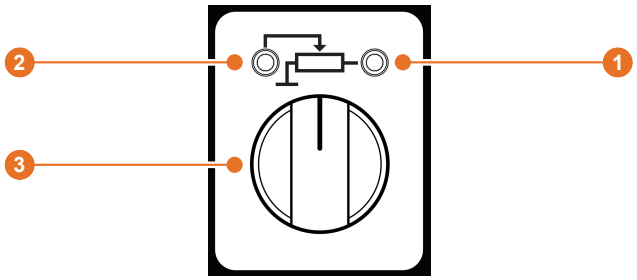
Rear outputs connected to mono output to the effect processor and then the return back in through the rear connectors.

OTO BAM Reverb used as a send effect for the BD Module. Amount adjusted with Pulsar-23 attenuator or on BAM.

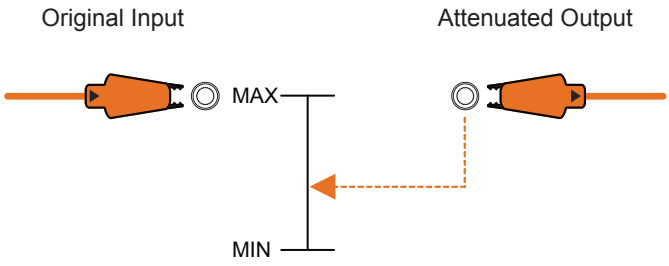
NOTES

4.8 Attenuators

Pulsar-23 has 4 attenuators which can be patched to various functions. The role of an attenuator is to control the level of an audio or control signal. Control is performed manually using the potentiometer rotary control knob. These are passive functions so cannot amplify or boost the signal but can reduce the signal patched in.



Item	Function	Label	Control	Description
1	Input		Pin	Connection pin for audio or control input signal
2	Output		Pin	Connection pin for the audio or control output signal. This is the level affected output.
3	Level		Knob	Level of attenuation applied on the input signal and delivered to the the output.

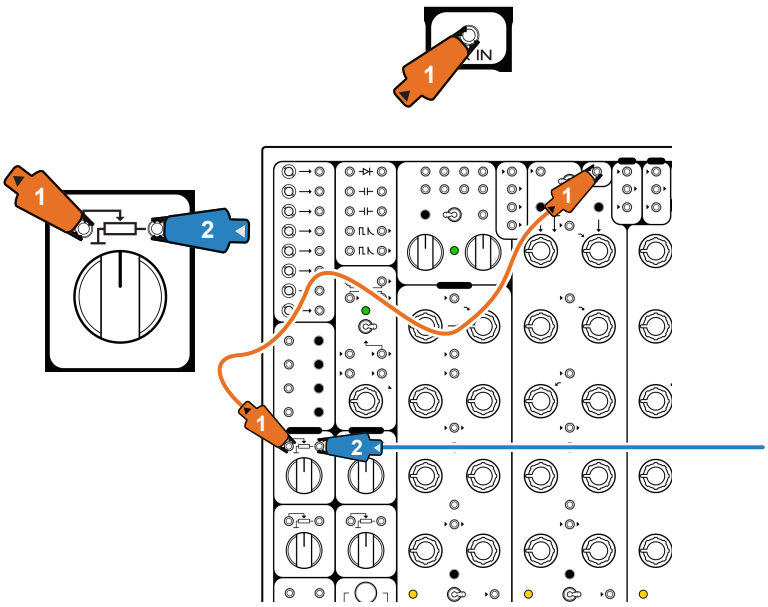


4.9 Mix In

NOTES

The ability to add external or direct internal audio is also provided using the ‘MIX IN’ function. Multiple audio sources are combined in the main mix bus including the ‘MIX IN’ audio. It is recommended to use an attenuator patched in before the ‘MIX IN’ pin if control over the audio is required.

Item	Function	Label	Control	Description
1	Audio Input	MIX IN	Pin	Connection pin for audio master mix input

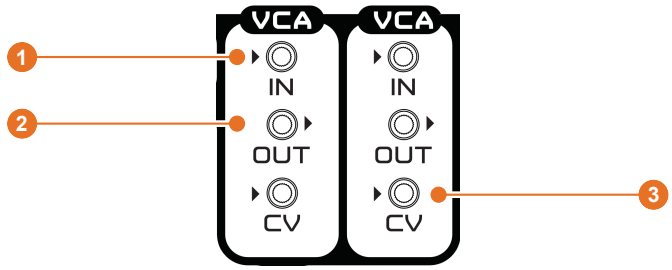


Although not essential, it is good practice to patch the ‘MIX IN’ via a Attenuator to allow good control over the signal level sent to the main mix.

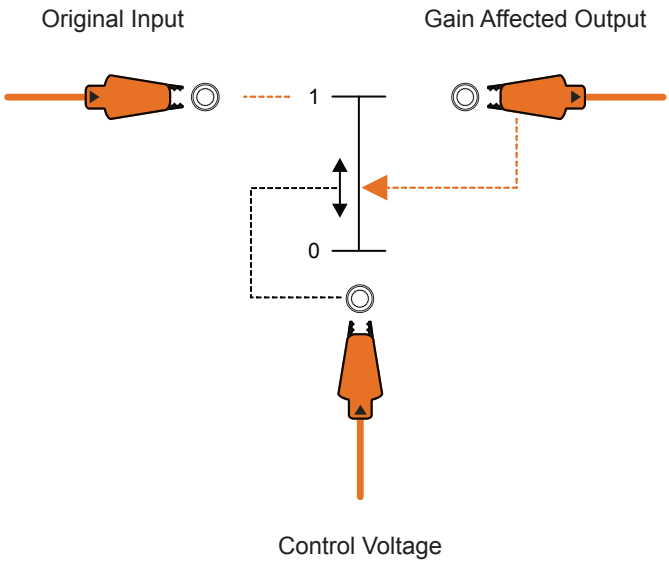
NOTES

4.10 VCA

A Voltage Controlled Amplifier, also called VCA, is a function that adjusts the gain of a signal automatically using a control voltage. Pulsar-23 has two independent VCA's and they can control either audio or control signals.



Item	Function	Label	Control	Description
1	Input	IN	Pin	Connection pin for audio or control input signal
2	Output	OUT	Pin	Connection pin for the audio or control output signal. This is the gain affected output.
3	Control Voltage	CV	Pin	Control signal that adjusts the gain level. This is a voltage input that will control gain from 0 - No output, to 1 - Max gain level, as per original signal level.

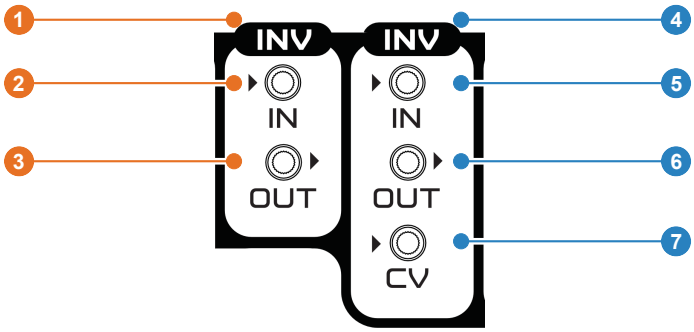


Typical control sources include envelopes, function generators, LFO's.

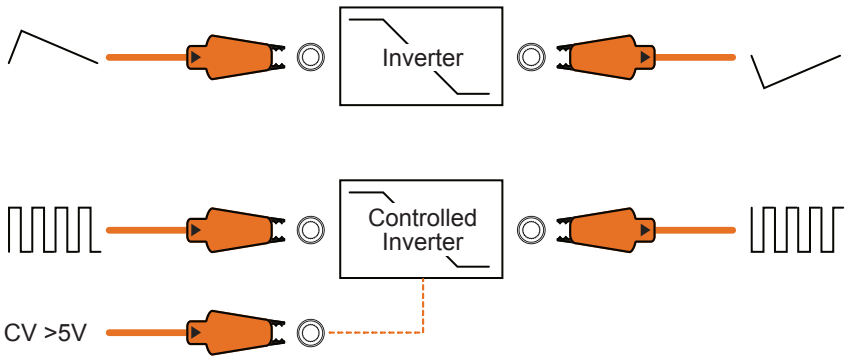
4.11 Inverter

NOTES

An inverter basically takes the input and inverts it at the output. There are two inverters available in Pulsar-23, one is controllable by CV to invert trigger signals and the other is fixed, non-controllable for audio and control signal inversion.



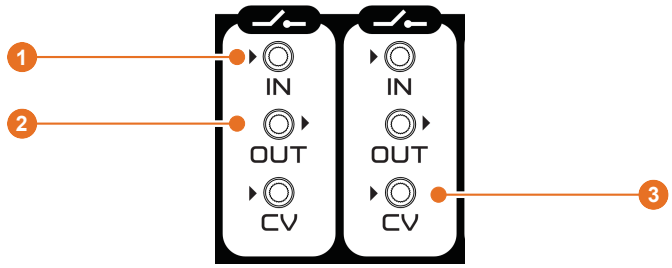
Item	Function	Label	Control	Description
1	Inverter Fixed	INV		Non-controllable inverter module. Inverts relative to a +5V reference.
2	Input	IN	Pin	Audio or control signal input
3	Output	OUT	Pin	Inverted audio or control signal
4	Inverter Controllable	INV		CV Controllable inverter module. Can only be used to invert trigger signals.
5	Input	IN	Pin	Audio or control signal input
6	Output	Out	Pin	Inverted audio or control signal
7	Control Voltage	CV	Pin	CV greater than +5V will invert incoming trigger signal at the output. Positive and negative edge of the CV change will trigger the inversion.



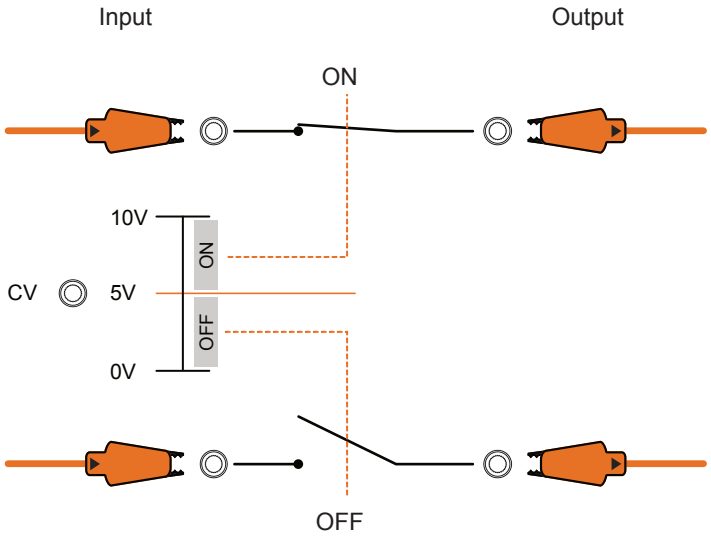
NOTES

4.12 Switches

Two identical voltage controlled switches are provided in Pulsar-23 that can switch audio and control signals. Voltages greater than +5V will turn the switch on and below will turn it off.



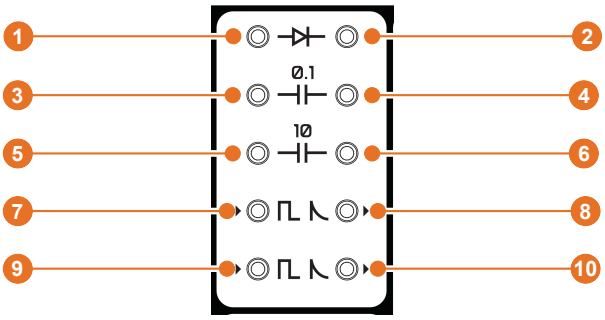
Item	Function	Label	Control	Description
1	Input	IN	Pin	Connection pin for audio or control input signal
2	Output	OUT	Pin	Connection pin for the audio or control output signal. This is the switched output.
3	Control Voltage	CV	Pin	Control signal that triggers the switch. This is a voltage input that will control switch on when >5V and will turn it off <5V.



4.13 Circuit Bending

NOTES

Circuit bending is the technical art of physically modifying circuitry to alter the sound or a function. This may seem daunting unless you're an engineer or an electronics technician. Pulsar-23 provides the ability for circuit bending by the patching of on board components such as resistors, capacitors and diodes. The human body when organically patched can also act as a component for example it will offer resistance based on touch pressure. A dedicated circuit bending patch bay makes this easier by providing a set of predetermined but patchable electronic components.



Item	Function	Label	Control	Description
1	Diode Anode		Pin	Connection to the diode component. Typically this is a positive input.
2	Diode Cathode		Pin	Connection to the diode component. Typically this is the negative output.
3	Capacitor		Pin	Non-polarised capacitor connection. This capacitor value is 0.1mf.
4	Capacitor		Pin	Non-polarised capacitor connection. This capacitor value is 0.1mf.
5	Capacitor		Pin	Non-polarised capacitor connection. This capacitor value is 10mf.
6	Capacitor		Pin	Non-polarised capacitor connection. This capacitor value is 10mf.
7	Pulse converter In		Pin	Converts longer rectangular, gate pulses into shorter trigger pulses. Input gate connection.
8	Pulse converter Out		Pin	Converts longer rectangular, gate pulses into shorter trigger pulses. Output trigger connection.
9	Pulse converter In		Pin	Converts longer rectangular, gate pulses into shorter trigger pulses. Input gate connection.
10	Pulse converter Out		Pin	Converts longer rectangular, gate pulses into shorter trigger pulses. Output trigger connection.

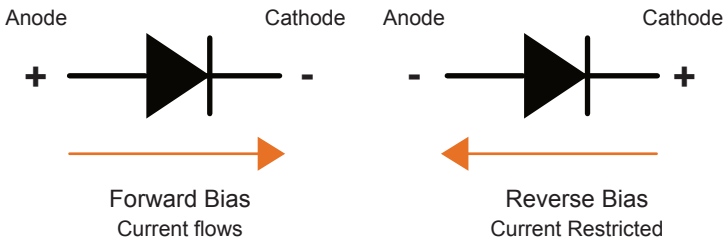
NOTES

These components are designed to be used in any way you like. Experimenting and just trying things out, ideally in modulation patches is the best way to get to know how circuit bending works. However, there are some conventions and core principles for these components. Knowing what they technically do may help get a basic understanding of the electronic theory applied.

It is important to note that circuit bending does not rely only on the component design theory, but in fact is just as useful exploring use cases that exploit the design flaws and specification errors inherent in the components. Using them in unintended ways is just as interesting.

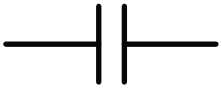
What is a diode and what is a typical use?

A diode is designed to allow current in one direction and restrict it in the other direction. Diodes are commonly used in electronics as a switch, to rectify AC to DC current, voltage protection and power control. A LED is a light emitting diode, emitting light when current flows.



What is a capacitor and what is a typical use?

A capacitor is an electronic device which stores electrical energy. You can think of this as a fast battery which is charged to store energy and later releases it very quickly. Most capacitors are non-polarised as per the Pulsar-23 although some are. Often capacitors are found in power circuitry to help maintain, regulate and smooth voltage levels, to retain memory and to remove electrical noise. The rating in mf - micro farad, indicates the amount of storage potential. An everyday example is the discharge of a capacitor to trigger a traditional camera's flash bulb.



Capacitor
Non-polarised

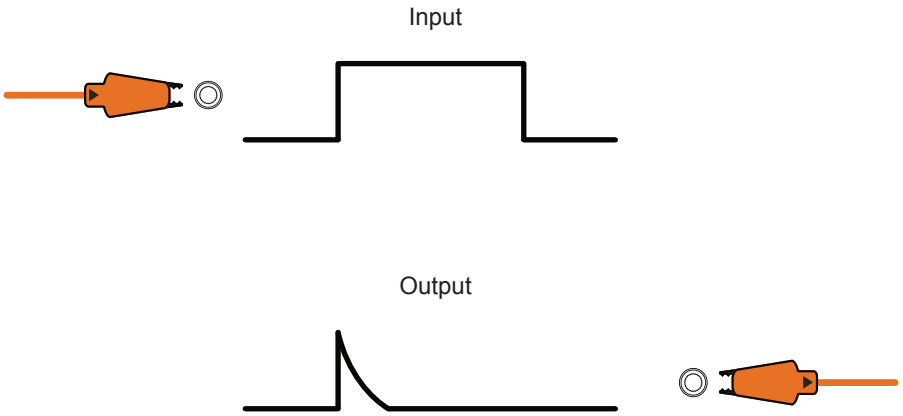
NOTES

It could be argued that the pulse transformers are not technically circuit bending components, but they are contained in this section too.

Pulse Transformers

The simple role of the pulse transformer is to convert longer gated signals into shorter trigger pulses. This is especially useful for a semi-modular drum machine where short pulse triggers are applied to drum hits. Typically the gate will trigger each drum module's envelope. In Pulsar-23 a common application is to use this with the clock divider.

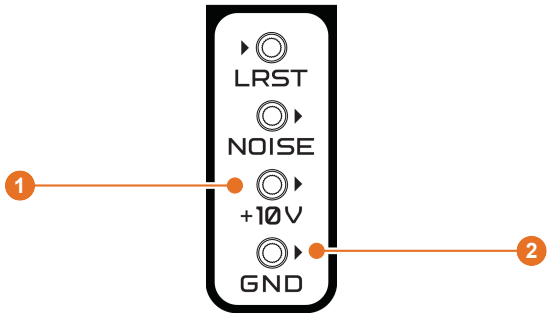
The output will follow the initial transient of the input pulse then automatically decay at the output, even if the input is still high. There are no adjustable controls for the trigger output.



NOTES

4.14 Voltage Patch Points

Two individual power signal points are available as patch pins. The '+10V' DC output and the 'GND' Ground connection. These are located along with the looper reset 'LRST' and 'NOISE' pins. These are particularly useful for manual patching by hand for immediate but temporary triggers.



Item	Function	Label	Control	Description
1	+10V Out	+10V	Pin	+10V control voltage output. Overload protected.
2	Ground	GND	Pin	Ground connection for Pulsar-23

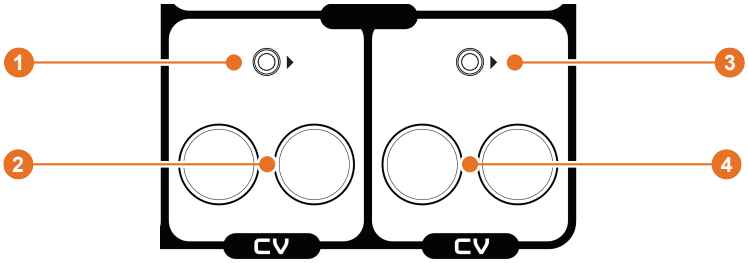
Note that when patching between external Eurorack or desktop devices at least one connection should be made between the devices using the Pulsar-23 Eurorack 3.5mm Patch Bay or the 1/4 Jack Patch bay. Essentially to avoid unwanted electrical noise especially in the audio signal it is technically good practice to ensure all devices are connected to a common ground.

4.15 Dynamic Touch Sensors

NOTES

Pulsar-23 uses less conventional technology in its human interface. There is no better example of this than the dynamic touch sensors which are used to generate a manual modulation voltage. These are paired sensors which when both are touched by hand generate a voltage between 0-10V. The voltage level will depend on how both sensors are touched, how much pressure, skin humidity and the nature of the body.

There are two sets of dynamic sensors each with a CV output pin from where to patch various destinations.



Item	Function	Label	Control	Description
1	CV Out		Pin	0-10V CV output, generated from sensor pair 1 touch and used as a modulation source.
2	Touch Sensors		Buttons	Touch sensor pair 1. When finger pressure is applied to both a voltage between 0-10V is generated at the CV pin.
3	CV Out		Pin	0-10V CV output, generated from sensor pair 2 touch and used as a modulation source.
4	Touch Sensors		Buttons	Touch sensor pair 2. When finger pressure is applied to both a voltage between 0-10V is generated at the CV pin.

NOTES

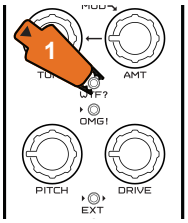
Each of the resistive sensor pairs should be touched by hand or a conductive object. Both sensors in the pair must be touched together to generate a voltage at the CV pin.

USING THE DYNAMIC TOUCH SENSORS

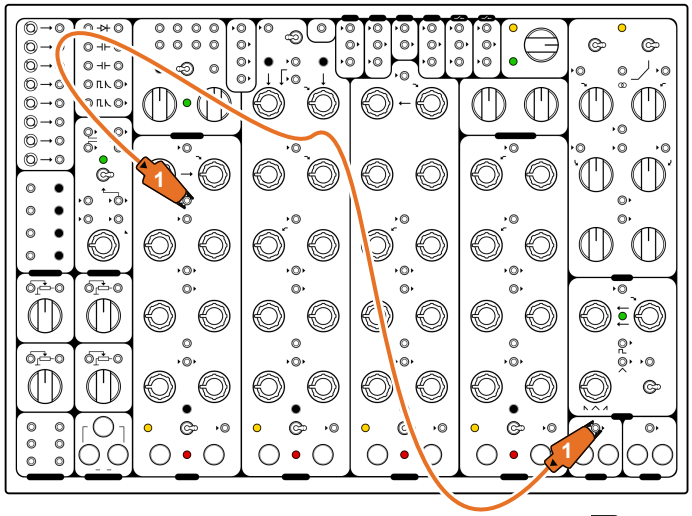
1. Patch the CV output from one of the two dynamic sensor modules to a destination source. For example patch to the BD ‘WTF?’ from the sensor module 1.

2. Tap or press both of the two sensors in the module. This will generate a voltage at the CV output pin. This voltage will depend on the amount of resistance and conductivity of the touch. Essentially this is an organic modulation source.

3. Release the touch from the sensors to stop the CV modulation change.



Various modulation sources can be tried for the dynamic sensor output voltage.



Dynamic sensor manipulated by touch and generates a voltage at the CV output pin.

5

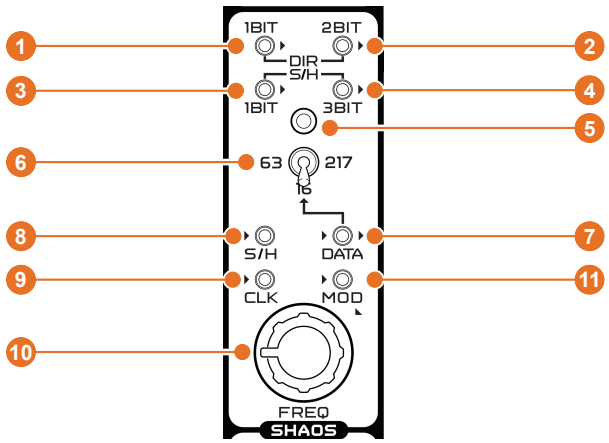
SHAOS & LFO

Modulation is a catch all term used in the music production community to represent the control over a parameter. This can add creative movement and musical effects into audio designs. In modular and semi-modular systems, modulation usually takes place by patching one parameter to control another. Almost all of Pulsar-23's features are open as a modulation source or destination. Patching has already been covered but this section focuses on two key modulation functions. Firstly the SHAOS module which is a less conventional sample and hold plus shift register sequencer (all will become clear later). Secondly the LFO or Low Frequency Oscillator which traditionally is designed to operate at frequencies below audio levels to only act as a modulation source. Pulsar-23 moves away from the traditional expectations and the LFO has a wider range than can be used in audio applications and in itself can also be modulated. Pulsar-23 takes a "try patching anything to anything" approach including audio as a modulator for a control and a control as audio. This opens up a whole new range of sound design options and modulation is at the core of this semi-modular organismic drum machine. The LFO and SHAOS units are integral in the array of options available for modulation either used alone or patched to other modules. They can assist in shaping sounds, sequencing crazy patterns or just to create subtle movements in sound design.

5.1 SHAOS Overview

NOTES

SHAOS is derived from S&H SHift register function with added chAOS. It is an hybrid modulation source with its own internal clock, bringing a classic shift register to drive pseudo-random sequencing coupled with a sample and hold function for more chaotic modulation and pattern generation.

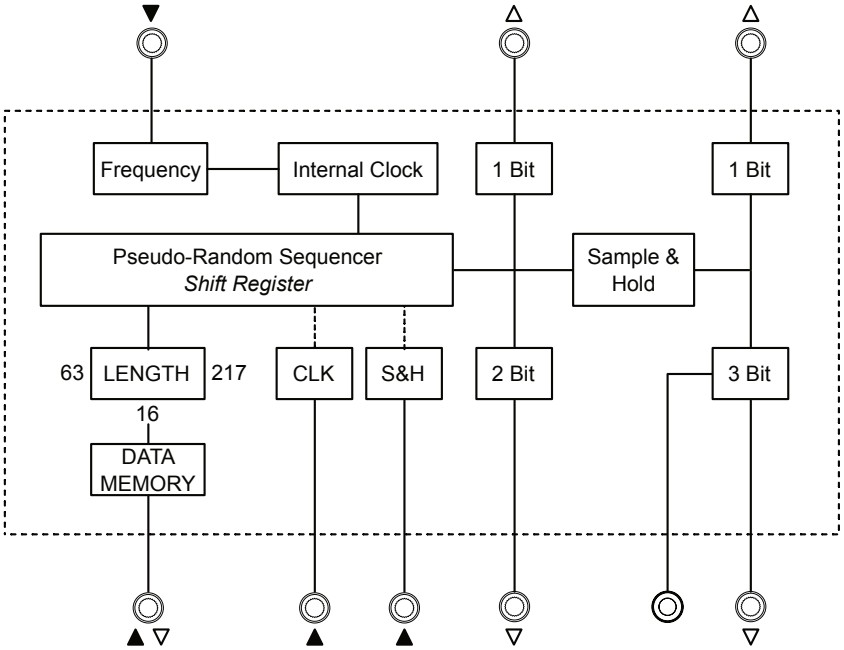


Item	Function	Label	Control	Description
1	Direct Out	1 BIT DIR	Pin	Shift register direct output. Not affected by the sample and hold function. 1 bit - 2 output levels.
2	Direct Out	2 BIT DIR	Pin	Shift register direct output. Not affected by the sample and hold function. 2 bit - 4 output levels.
3	S&H Out	1 BIT S/H	Pin	Shift register, plus the sample and hold output. 1 bit - 2 output levels.
4	S&H Out	3 BIT S/H	Pin	Shift register plus the sample and hold output. 3 bit - 8 output levels.
5	3 Bit LED		LED	Indicates activity on the 3 Bit output.
6	Seq length	63 16 217	Switch	Determines length or the pseudo random sequencer and selects the 16 step memory.
7	Memory I/O	DATA	Pin	Shift register memory for capturing sequences or from the seq length and outputting the sequence
8	S&H Clock	S/H	Pin	External clock used for the sample and hold function. Internal clock is used if disconnected.
9	Ext Clock	CLK	Pin	External clock which replaces the internal SHAOS clock if connected.
10	Frequency control	FREQ	Knob	Manual control over the SHAOS internal clock frequency.
11	Freq Modulation	MOD	Pin	CV input for frequency modulation control.

Note that while SHAOS is essentially a modulation source it can also operate at audio range and as such be used as a sound generator.

NOTES

SHAOS is a complex module drawing on several functions in order to generate crazy, complex patterns. The sequences are generated continuously, described as pseudo-random. This means that patterns are mathematically generated but generally appear to be random, although some defined pattern exists from the algorithm itself. The onboard memory function allows capturing snapshots of repeatable patterns.



Clocks

The default of the SHAOS module is to operate from it's own internal clock, the frequency of which can be manually controlled and also controlled with CV on the 'MOD' pin.

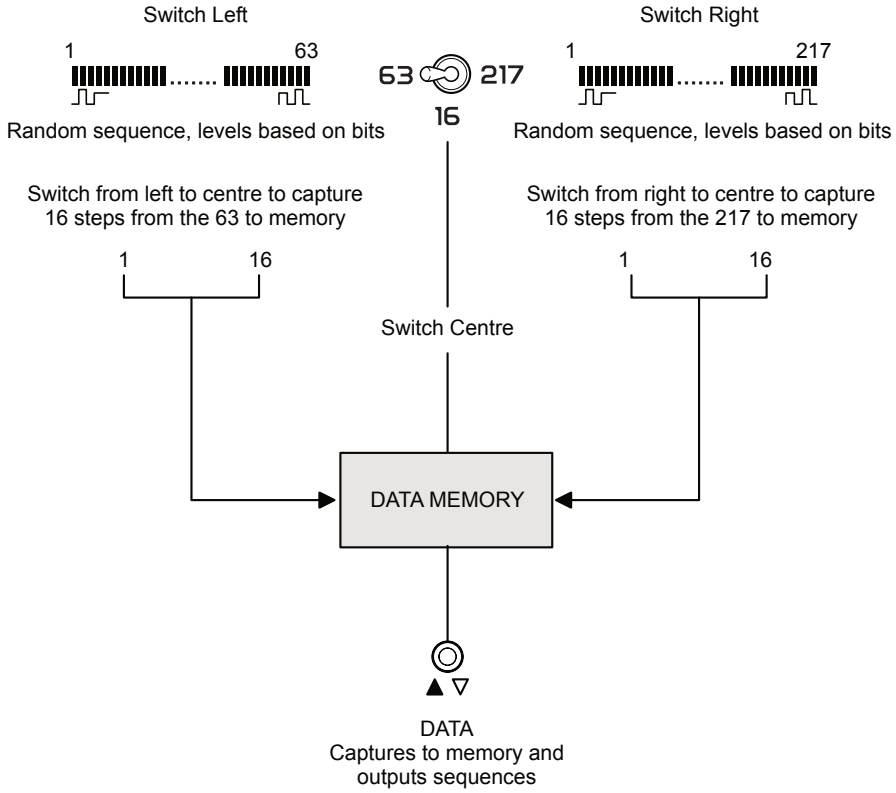
When an external clock is connected to the 'CLK' pin the externally connected clock will take precedence and replace the internal clock. The master clock and its divisions can be used as the external clock or try being more creative with other functions such as the LFO.

The 'S/H' pin is an alternate input for the sample and hold clock which will synchronise the sample and hold function and will replace the internal clock. The internal clock will perform this function normally by default if no input is connected to 'S/H". Each pulse will trigger the sampling and holding of the pseudo-random sequencer. The 1 BIT and 3 BIT S/H outputs are synchronised to any S/H input.

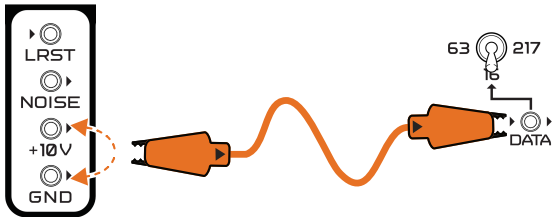
5.2 SHAOS Sequence Memory & Length

NOTES

The pseudo-random sequencer has 3 lengths available, each of which is selected from the 63-16-217, 3-way switch. While the {63} and {217} settings are fixed lengths, the {16} option has a 16 step length but also selects and controls the SHAOS internal memory. The 16 step memory can capture patterns from the either one of the other two lengths or from a signal modulating the 'DATA' input pin.



By switching the switch to the {63} or {217} sequence position will play the pseudo-random sequence. Switching back to the {16} step central position will capture a 16 step snapshot of the sequence into the memory, which is output at the 'DATA' pin. Throwing this switch left / right to centre randomises the pattern



Manual recording of pulses into memory can be done through the 'DATA' input switched in {16} Mode. Tapping to patch alternatively between the '+10V' and 'GND' to 'DATA' will record pulses into the 16 step memory. This will record, evolve and drive the output patterns.

NOTES

5.3 Sample & Hold and Direct Outputs

SHAOS has 4 outputs each with its own unique characteristics for the pseudo-random sequence. The internal clock will synchronise sampling and holding but the 'S/H' input can take over when an alternate pulse source is connected. Sample and Hold grabs the state of the pseudo-random sequencer and holds it for a period. This creates glitchy, unpredictable patterns. Two outputs are positioned before the sample and hold function, outputting the pseudo-random sequence unaffected by S/H. Two outputs are also positioned after the sample and hold function and are therefore affected also by S/H activity. The 'BIT' value attributed to each output refers to the number of states generated across the sequence. These states are effectively CV levels and are useful for melodic patterns such as controlling the pitch of tuneable functions.

Level	Bits						
8	1	0	0	0			
7	0	1	1	1			
6	0	1	0	1			
5	0	1	0	0			
4	0	0	1	1			
3	0	0	1	0			
2	0	0	0	1	1 Bit 2 Levels	2 Bit 4 Levels	3 Bit 8 Levels
1	0	0	0	0			

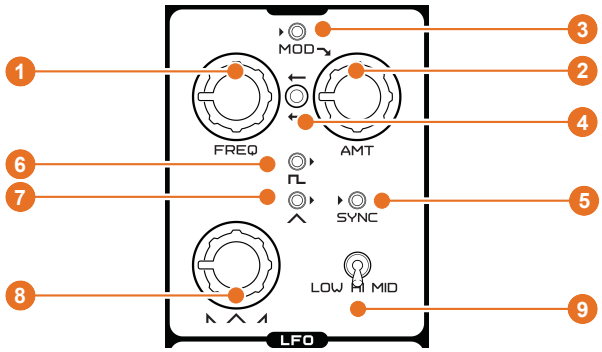
The shift register will 'move' data through the function incrementally based on the clock synchronisation. Pulsar-23 generates pseudo-random sequences additionally affected by the sample and hold function. The CV levels or states when patched to a tune parameter can generate melodic patterns.

In general the sequence consists of the steps which can drive triggers based on the clock and the randomisation plus the sample and hold on the two S&H outputs. Also the state, based on the bits, will determine a level which can control CV as a source.

5.4 LFO Overview

NOTES

Typically an LFO or Low Frequency Oscillator operates below audio ranges and traditionally is used purely as a modulation source. The singular LFO also is designed as a modulation source with enhanced features including the ability to operate at audio levels. The LFO can therefore perform as an additional sound generator.



Item	Function	Label	Control	Description
1	LFO Frequency	FREQ	Knob	Manually sets the LFO speed.
2	Mod amount	AMT	Knob	Adjusts the amount of CV applied from the MOD pin for external modulation control.
3	Frequency modulation CV	MOD	Pin	Connects an external modulation CV to control the frequency.
4	LFO Rate indication		LED	Flashes at the LFO frequency rate.
5	Input for synchronisation		Pin	Resets the start of the LFO. This will synchronise the LFO to the pulse such as drum trigger or clock divider.
6	LFO Square shape output		Pin	LFO output. Square wave shape out.
7	LFO Triangle shape output		Pin	LFO output. Triangular wave shape out.
8	Triangle Shape		Knob	Triangle wave shape from falling saw when fully left / counter clockwise to rising saw fully right / clockwise. Center is triangle.
9	LFO Rate range.	LOW HI MID	Switch	Frequency range. Low is in fractions of Hertz, High is in Kilo Hertz.

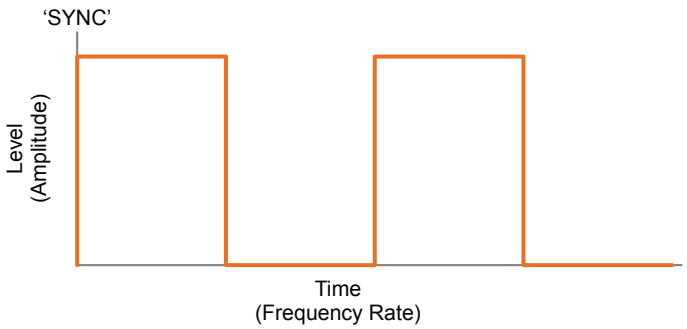
Higher frequencies will generate a waveform in the audio range that can be used as an audio oscillator and an additional sound generator. Whether the triangle or square wave output is used in the audio range the LFO (*TRIANGLE*) shape and (AMT) will affect the audio as well as the (FREQ) control setting.

NOTES

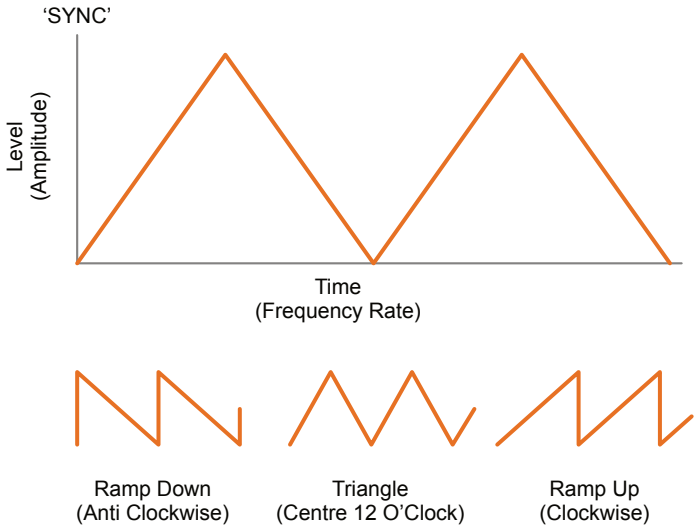
5.5 LFO Wave shapes

The LFO contains two wave shapes. Square wave and triangle. The triangle wave can be adjusted between a ramp down and up saw wave.

Square Wave



Triangle Wave



The triangular wave can morph from a ramp down saw to ramp up saw gradually through the rotation of the triangle knob. The central position of the knob will output a pure triangle wave shape.

The LFO can also be used as an additional variable clock and can offer some interesting patch options when used for example to trigger or independently clock sound modules or drive the SHAOS S/H clock.

6

Master Out & Effects

Pulsar-23 operates in mono with a single output volume control for the mono output and headphones, which are dual mono. Audio can be prepared for stereo output by patching to the external 1/4 inch jacks and then by using an external mixer to control the stereo field. In addition Pulsar-23 has a parallel distortion. The distortion effect operates in the master output with a dry / wet mix control. A dual channel effects processor is also incorporated which has multiple configuration that can be set to suit the specific application. The effects processor operates as a send effect where each sound generator can send audio using the 'FX' control knob to send to the effects processor and the affected FX audio output is returned into the master output. Only one of the effects can be selected at a time in the default state, but both can be used if patched to the effects. Delay and reverb as send effects in an audio set up is a common arrangement.

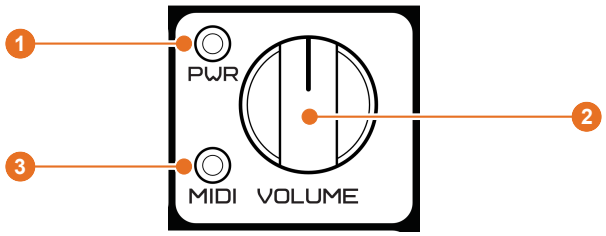
A delay is based on delayed output fed back into the input. This creates an echo like effect. Reverb is an emulation of a room and space dynamics, where sound is reflected and has different time characteristics based on how the sound behaves in the room. A large hall will sound different to a small kitchen. Sound typically bounces around and is absorbed by furniture or walls. Both are great effects in the master chain as they fill space and generate thicker more complex sound structures. The Pulsar-23 effects are very comprehensive but in usual SOMA fashion are applied in a less conventional way than traditional delay and reverb. As always exploring, testing and trying anything is recommended, especially with the multiple operating modes and settings available in the effects.

6 Master Out & Effects

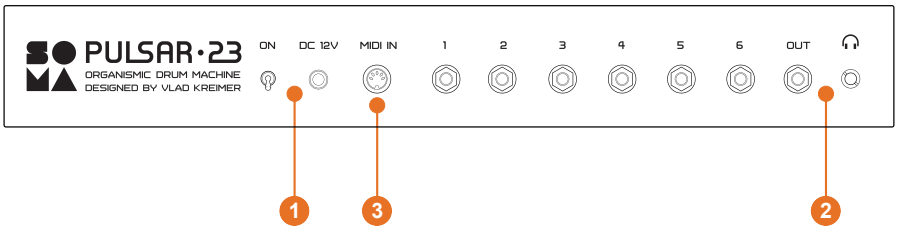
6.1 Main Output

NOTES

The main output control is the simplest of functions containing just an output volume control and two LED indicators. There are no patchable options in the master module but functions like VCA's can be used earlier in the signal chain. It is good practice to always start with the volume level low to avoid unexpectedly loud output.



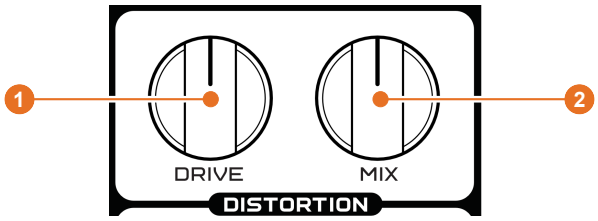
Item	Function	Label	Control	Description
1	Power on	PWR	LED	Illuminates yellow when powered on. Power switch up at the rear to power on.
2	Volume control	VOLUME	Knob	Adjusts the volume level of the main output and headphones output.
3	MIDI Input	MIDI	LED	Indicates MIDI input activity. Green LED indicates incoming MIDI data which is assigned to a control. Red LED indicates incoming MIDI but is unassigned.



NOTES

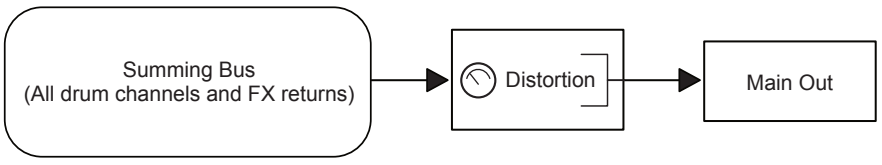
6.2 Distortion

The distortion module is a parallel effect which is located in the master output chain. The effect consists of a drive control and a mix control which sets the balance between full distortion and pure dry signal at the output. No CV control is available for the distortion module.



Item	Function	Label	Control	Description
1	Drive amount	DRIVE	Knob	Adjusts the amount of drive in the distortion. Generates a more gritty, aggressive sound.
2	Dry / Wet Mix	MIX	Knob	Main output mix balance of dry, unaffected sound and the wet, distortion.

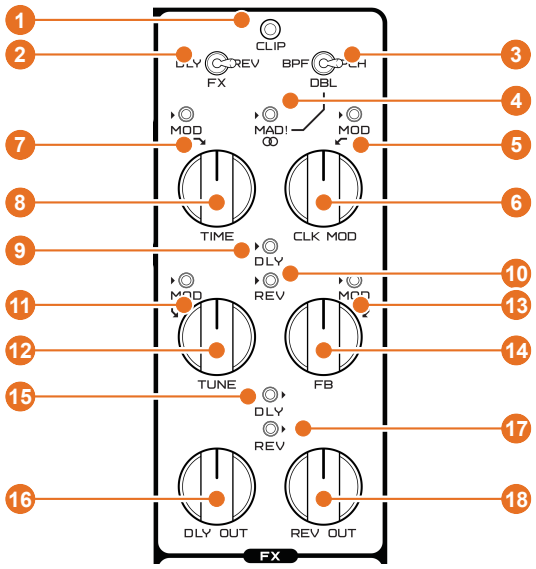
The distortion affect is located in the main output chain and therefore will apply to the full signal. Outputs can also be patched to the ¼ inch outputs and bypass the main output. This will allow better control for example with an external mixer if required.

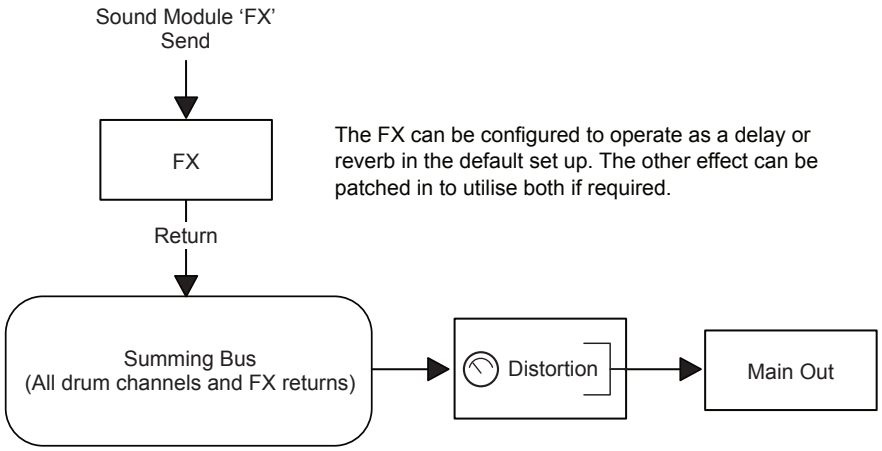


6.3 FX Overview

NOTES

Pulsar-23 has an FX section containing two effects each with multiple configurations. The configurations, known as operating modes determines how the effect operates and also the role of the controls.





The FX can be configured to operate as a delay or reverb in the default set up. The other effect can be patched in to utilise both if required.

NOTES

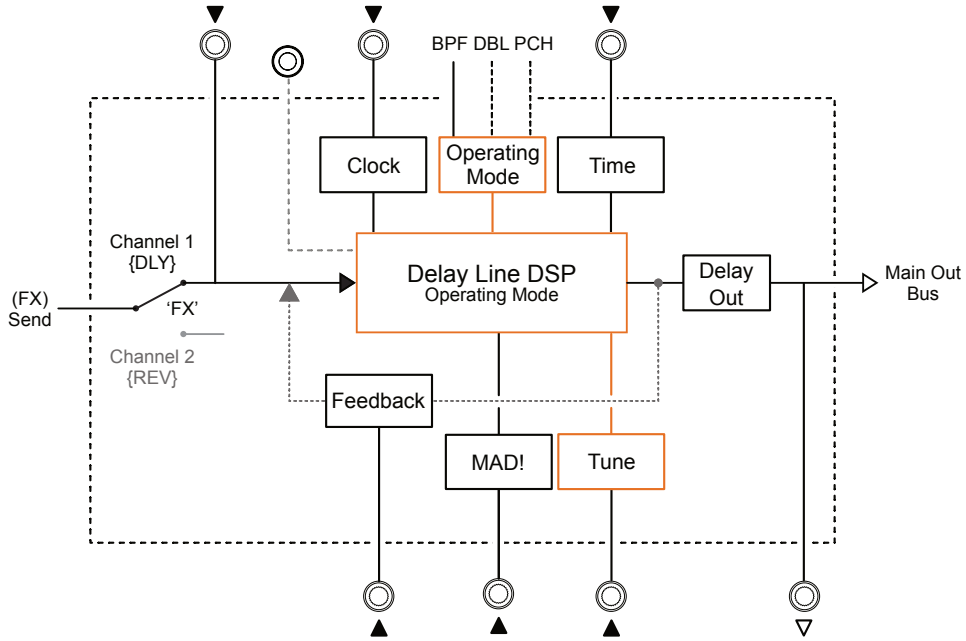
Item	Function	Label	Control	Description
1	Clipping	CLIP	LED	Clipping indicator for overload of A/D converter input in the DSP processor.
2	Delay or Reverb Selection	FX	Switch	2 Position switch selecting either reverb or delay as the effect that the module FX is sent.
3	Operating mode	BPF DBL PCH	Switch	3 Position selection of operating mode between BPF band-pass filter, DBL Double, PCH Pitch
4	MAD / Stereo	MAD!	Pin	Introduces craziness in BPF band-pass filter and PCH Pitch mode. Stereo when in DBL Double mode. Connect the +10V for a permanent patch.
5	Modulation Input - clock	MOD	Pin	CV Modulation input for controlling the clock modulation
6	Depth of Clock modulation	CLK MOD	Knob	CV Modulation input amount applied to the FX DSP clock.
7	Modulation Input - delay	MOD	Pin	CV Modulation input for controlling the delay time
8	Delay amount	TIME	Knob	Delay time setting.
9	Delay Input	DLY	Pin	Auxiliary delay input for processing external audio through the delay FX.
10	Reverb Input	REV	Pin	Auxiliary reverb input for processing external audio through the reverb FX.
11	Modulation Input - tune	MOD	Pin	CV Modulation input for controlling the tuning. Tune is multifunctional depending on the operating mode set.
12	Multi function control	TUNE	Knob	Tune is multifunctional depending on the operating mode set; BPF - Filter cutoff, DBL - 2nd delay line time, PCH - Pitch interval
13	Modulation Input - feedback	MOD	Pin	CV Modulation input for controlling the feedback
14	Feedback	FB	Knob	Feedback depth of delay and reverb decay time of the reflections
15	Delay Output	DLY	Pin	Output of the delay audio. Ideal for external mixing.
16	Delay Output	DLY OUT	Knob	Level of delay returned to the main mix.
17	Reverb Output	REV	Pin	Output of the reverb audio. Ideal for external mixing.
18	Reverb Output	REV OUT	Knob	Level of reverb returned to the main mix.

6.4 Delay

NOTES

Delay is a classic time based effect that delays an input at the output and when this is fed back into the input can create long echo style effects. Pulsar-23 applies classic principles plus a unique set of operational modes and configurations within channel 1 of the FX module.

Both effects will continuously operate but the two-way ‘DLY REV’ FX switch must be set to {DLY} to ensure that the delay, channel 1 is the effect in operation.



WORKING WITH DELAY

1. Set the position of the FX switch to the left. This will select the {DLY} function, channel 1 as the primary effect.

2. Select the operating mode using the ‘BPF DBL PCH’ 3-way switch. The option will depend on the application but experimentation with all options is encouraged.

3. Adjust the (FX) control on each of the sound generation modules from which to send audio to the effect. The effect section operates as a send - from the sound modules and return - mixed audio returns to the master bus.

4. Adjust the effect parameters to taste. Ensure (DLY OUT) is audible.

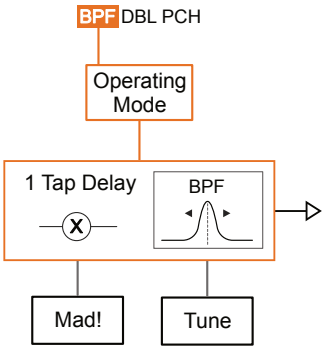
NOTES

Delay - Channel 1, Operating Modes

The 2-way FX switch should be set to {DLY} and the 3-way BPF DBL PCH switch set to the desired operating mode for the delay.

BPF - Band Pass Filter

Switch is set to the left position



The 3-Way switch is set to {BPF}.

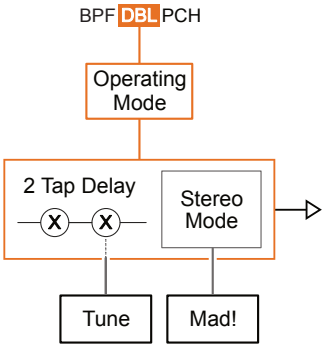
The delay operates as a single tap delay with a band pass filter.

The cutoff frequency of the band pass filter is adjusted by using the 'TUNE' knob when in BPF operating mode.

Voltage on the 'MAD!' Pin causes DSP madness. +10V for permanent chaos.

DBL - Double

Switch is set to the centre position



The 3-Way switch is set to {DBL}.

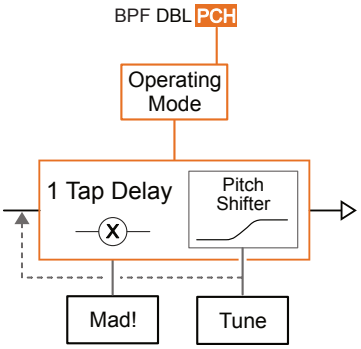
The delay operates as a 2 tap delay.

The delay time of the second delay is adjusted using the 'TUNE' knob when in DBL operating mode.

Voltage on the 'MAD!' Pin activates stereo mode. +10V for permanent stereo.

PCH - Pitch

Switch is set to the right position



The 3-Way switch is set to {PCH}.

The delay operates as a single tap delay with an adjustable feedback pitch shifter.

The pitch interval in the feedback is adjusted by using the 'TUNE' knob when in PCH operating mode.

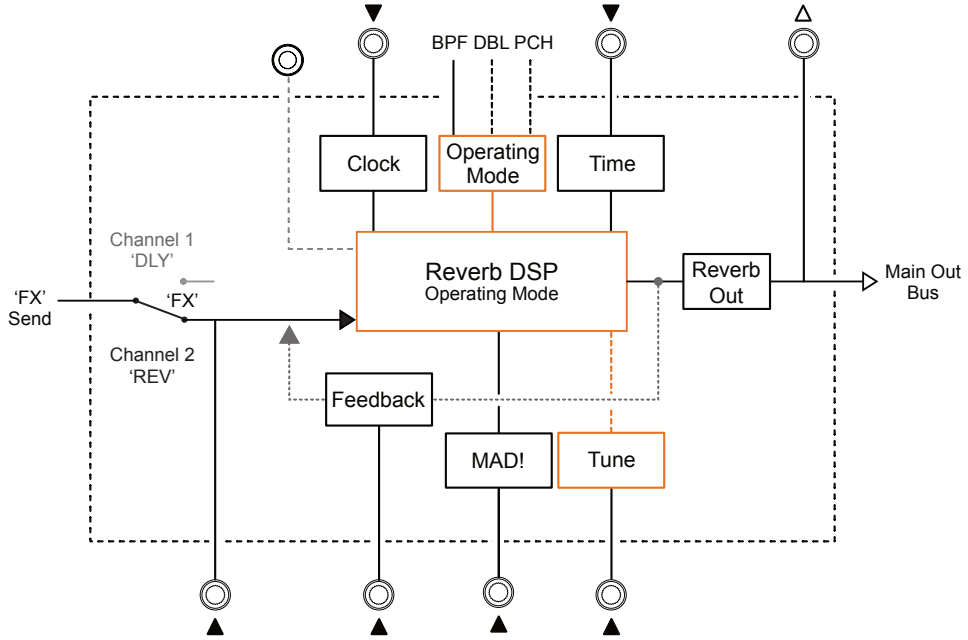
Voltage on the 'MAD!' Pin causes DSP madness. +10V for permanent chaos.

6.5 Reverb

NOTES

Reverb is also a classic time based effect that represents the space or room dynamics where audio waves would reflect and bounce from walls and objects generating extended sound characteristics. Pulsar-23 applies the classic principles but with a unique set of operational modes and configurations in channel 2 of the FX module.

Both effects will continuously operate but the two-way FX switch must be set to {REV} to ensure that the reverb, channel 2 is the effect in operation.



WORKING WITH REVERB

1. Set the position of the FX switch to the left. This will select the {REV} function, channel 2 as the primary effect.

2. Select the operating mode using the 'BPF DBL PCH' 3-way switch. The option will depend on the application but experimentation with all options is encouraged.

3. Adjust the (FX) control on each of the sound generation modules from which to send audio to the effect. The effect section operates as a send - from the sound modules and return - mixed audio returns to the master bus.

4. Adjust the effect parameters to taste. Ensure (REV OUT) is audible.

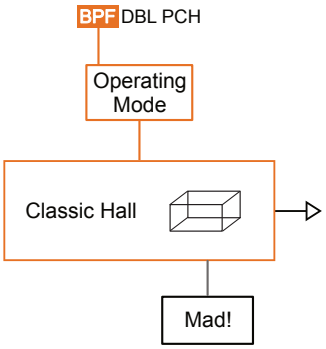
NOTES

Reverb - Channel 2 Operating Modes

The 2-way FX switch should be set to {REV} and the 3-way ‘BPF DBL PCH’ switch set to the desired operating mode for the delay.

BPF - Band Pass Filter

Switch is set to the left position



The 3-Way switch is set to {BPF}.

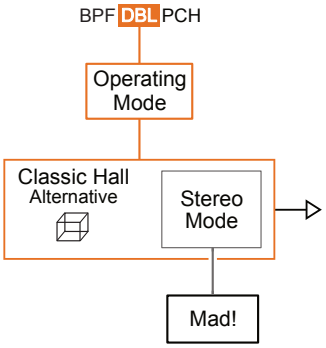
The reverb operates with the characteristics of a classic hall reverb.

The ‘TUNE’ knob when in BPF operating mode has no effect for the reverb.

Voltage on the ‘MAD!’ Pin causes DSP madness. +10V for permanent chaos.

DBL - Double

Switch is set to the centre position



The 3-Way switch is set to {DBL}.

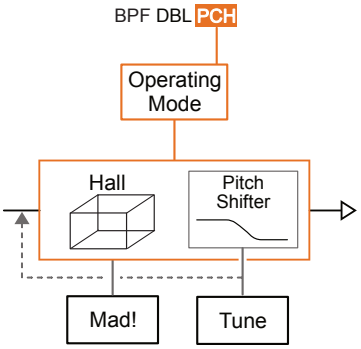
The reverb operates with the characteristics of a classic hall alternative.

The ‘TUNE’ knob when in DBL operating mode has no effect for the reverb.

Voltage on the ‘MAD!’ Pin activates stereo mode. +10V for permanent stereo.

PCH - Pitch

Switch is set to the right position



The 3-Way switch is set to {PCH}.

The reverb operates with characteristics of a hall space.

The pitch interval in the feedback is adjusted by using the ‘TUNE’ knob when in PCH operating mode.

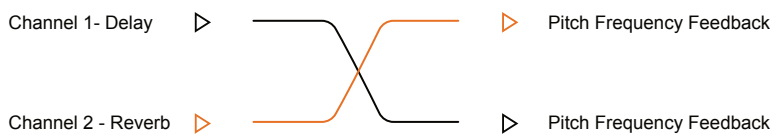
Voltage on the ‘MAD!’ Pin causes DSP madness. +10V for permanent chaos.

6.6 Delay and Reverb Notes

NOTES

While only one effect is directly ‘patched in’ the other can be manually patched with cables. Each channel of the FX module refers to each effect. Channel 1 is delay and Channel 2 is reverb. There are some consistencies and interactions in the operating modes that should be noted

- In ‘PCH’ Mode the pitch shifters for each channel are adjustable across +/- 1 Octave range.
- In ‘PCH’ Mode the pitch shifters for each channel operate in the opposite directions. So when the frequency for channel 1, delay increases, the frequency for channel 2, reverb decreases. This is a creative choice for interest and uniqueness.



- The clock of the entire DSP processor and A/D - D/A Converters can be modulated. The speed of processing can change by up to x7 times. This is a creative choice for a unique additional feature in sound design. The ‘CLK MOD’ amount for a modulation source connected at it’s ‘MOD” pin will control the speed.
- FX outputs for both channels are in mono by default. Stereo mode is active in ‘DBL’ operating mode when the ‘MAD!’ pin is set high, for example patched to the ‘+10V’ Pin. In fact a voltage greater than +5V will activate. The delay and reverb output pins then become the left and right stereo outs respectively.
- The ‘CLIP’ LED will illuminate if the input of the A/D Converters of the DSP processor are overloaded.
- Both the delay and reverb are fed into the DSP effect processor. By default only one is selected with the ‘FX’ switch but the input pin can be used to connect the other. For example set FX to {DLY} and adjust the sound module (FX) knob to send from each sound generator. Also use the sound output patched to ‘REV’ Input to simultaneously use the reverb effect.

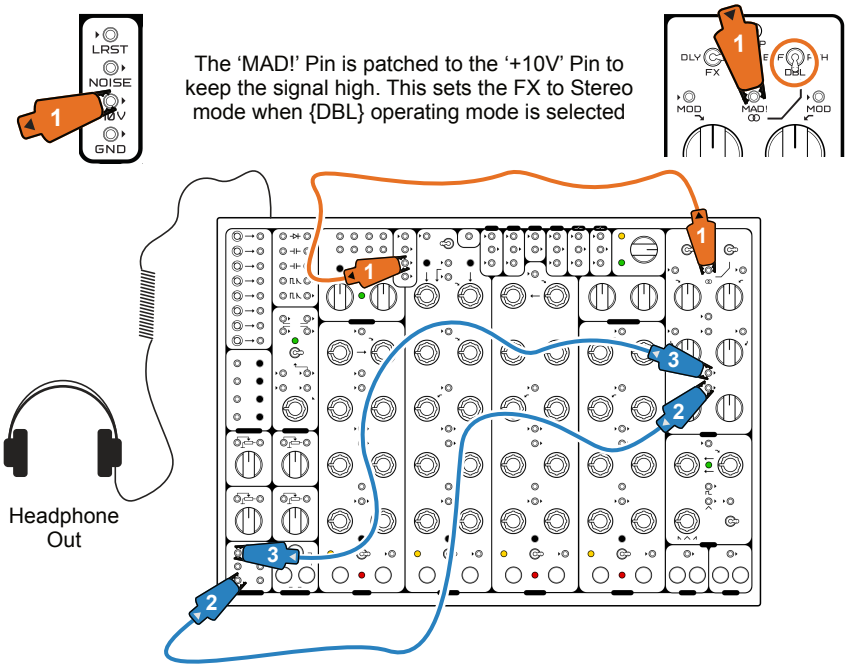
NOTES

6.7 Stereo Output

The option to set a stereo output instead of the default mono outputs is possible. This will generate a stereo left / right output on the output of the FX module. The DLY and REV output pins also represents both delay and reverb stereo out. The two main criteria required for this option are:-

1. The operating mode ‘BPF DBL PCH’ switch is set central, to {DBL}. The delay will be the 2-tap option and the reverb the alternate classic hall.

2. The ‘MAD!’ Pin is patched with a voltage greater than +5V. The ‘+10V’ pin can be used to patch this permanently if required.



7

External Control

There are many options for interfacing Pulsar-23 to other gear with built in patch bays to make the process simple. There are two main methods of connecting external devices. The first option is to connect using modular principles, typically Eurorack standard. A patch bay allows interfacing between 3.5mm Eurorack standard jacks to / from the Pulsar-23 Alligator clip standard. It is important to highlight that Pulsar-23 uses a 10V range for CV while most Eurorack gear uses a lower 5V range. Common Eurorack applications use 1-5V, -5V to +5V or 0-5V. Alignment between devices may be needed which in some cases would need additional hardware. The most common interfacing method for audio gear is MIDI or Musical Instrument Digital Interface. MIDI is a long standing protocol for musical equipment and has a set of defined standards, although the implementation may vary between devices. MIDI connects with 5-Pin DIN style connectors and this is the interface applied in Pulsar-23 where a MIDI input is available on the rear of the unit. Many devices also use MIDI via USB but Pulsar-23 is limited only to incoming MIDI control from another device using the MIDI 5-Pin DIN Input. MIDI Control output from Pulsar-23 to another device is not possible. A series of MIDI 'Learn' buttons allow control to be easily assigned to functions as well as a MIDI to CV converter patch bay. It is also important to note that Pulsar-23's clock can also be controlled externally and this is switch selectable in the master clock section. In summary, Pulsar-23 can connect with external MIDI and CV devices as well as patching within itself. All these options can operate side by side to create simple or complex networks and interconnection of audio gear.

7 External Control

7.1 MIDI Definitions

NOTES

To clarify some of the terminology and technology around MIDI with respect to Pulsar-23 a summary of key definitions is provided. Pulsar-23 uses a direct MIDI input. MIDI over USB is not possible.

5 PIN MIDI

MIDI DIN 24

This is often found for MIDI Out and Thru and enables syncing of classic devices. This uses 0v & 5v messages as sync signals at 24 pulses per quarter note (PPQN). Pulsar-23 uses 192 PPQN Internally.

MIDI DIN 48

This is often found for MIDI Out and Thru and enables syncing of classic devices. This uses 0v & 5v messages as sync signals at 48 pulses per quarter note (PPQN). Pulsar-23 uses 192 PPQN Internally.

MIDI

Musical Instrument Digital Interface. A protocol for communicating between electronic musical gear. Never connect MIDI gear to incompatible DIN signals. Pulsar-23 uses only a 5 Pin DIN In connection.

MIDI CC

MIDI Control and Note change messages are used to communicate messages across MIDI with values of 0-127. Control Changes (CC) affect parameter values while note data triggers notes. Pulsar-23 can learn CC's.

MSB & LSB

Most Significant Byte and Least Significant Byte. MSB provides the 128 data resolution which is ok for most MIDI applications. More advanced devices use MSB and LSB values increasing resolution to 16,384 steps.

MIDI STANDARDS

While there are MIDI standards defined, many synth developers interpret this in slightly different ways. Its always worth reviewing the documentation with each to fully understand each device level implementation.

NRPN

Non-Registered Parameter Number is part of the MIDI standard. CC and NRPN are technically very similar but NRPN is less well defined in the standards. NRPN uses more data and can give better control.

SYSEX

System Exclusive. This is an expansion of the normal MIDI communications set up and is typically used for transferring data such as back ups, patches, firmware updates to and from devices. These are not used in Pulsar-23

SDS

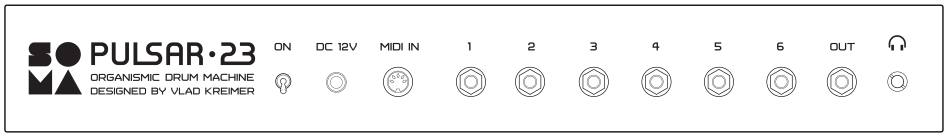
Sample Dump Standard. This is an older transfer protocol used for transferring data to and from devices. This is rarely seen nowadays.

The term 'primary lead' will refer, in this guide to a device that has the main control responsibility. For example controls the clock and transport and is the central lead. A device which will be controlled by, and follow the primary lead device and which will be subservient by responding to the main control messages will be called a 'secondary follower'.

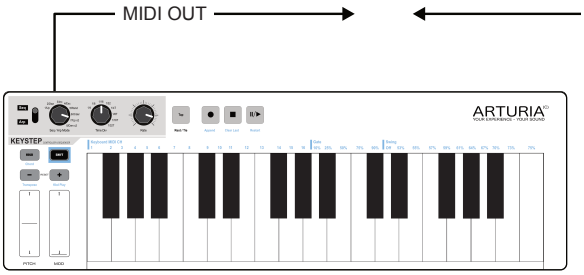
NOTES

7.2 MIDI Connections

The 5 Pin MIDI Input connection is located on the rear of Pulsar-23. This uses a standard MIDI DIN cable and easily connected between other gear. Connect Pulsar-23 from the MIDI Out or MIDI Thru of an external device. This controls the sound modules but does not record into the looper.

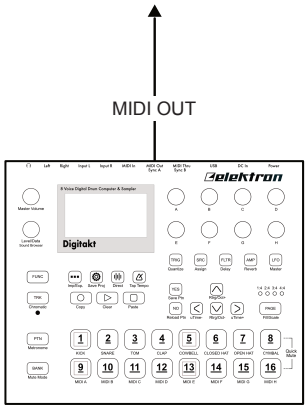


Pulsar-23's MIDI Learn functions can map the external control to it's designated function.

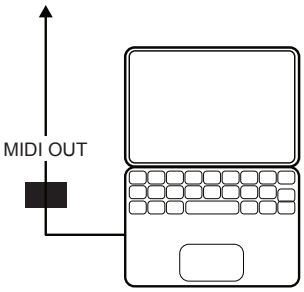


A keyboard or pad controller can be used. Velocity will be transmitted and interpreted by Pulsar-23.

A MIDI controller used for control change (CC) messages.



A synth or drum machine sequencer can control Pulsar-23 sequencing.



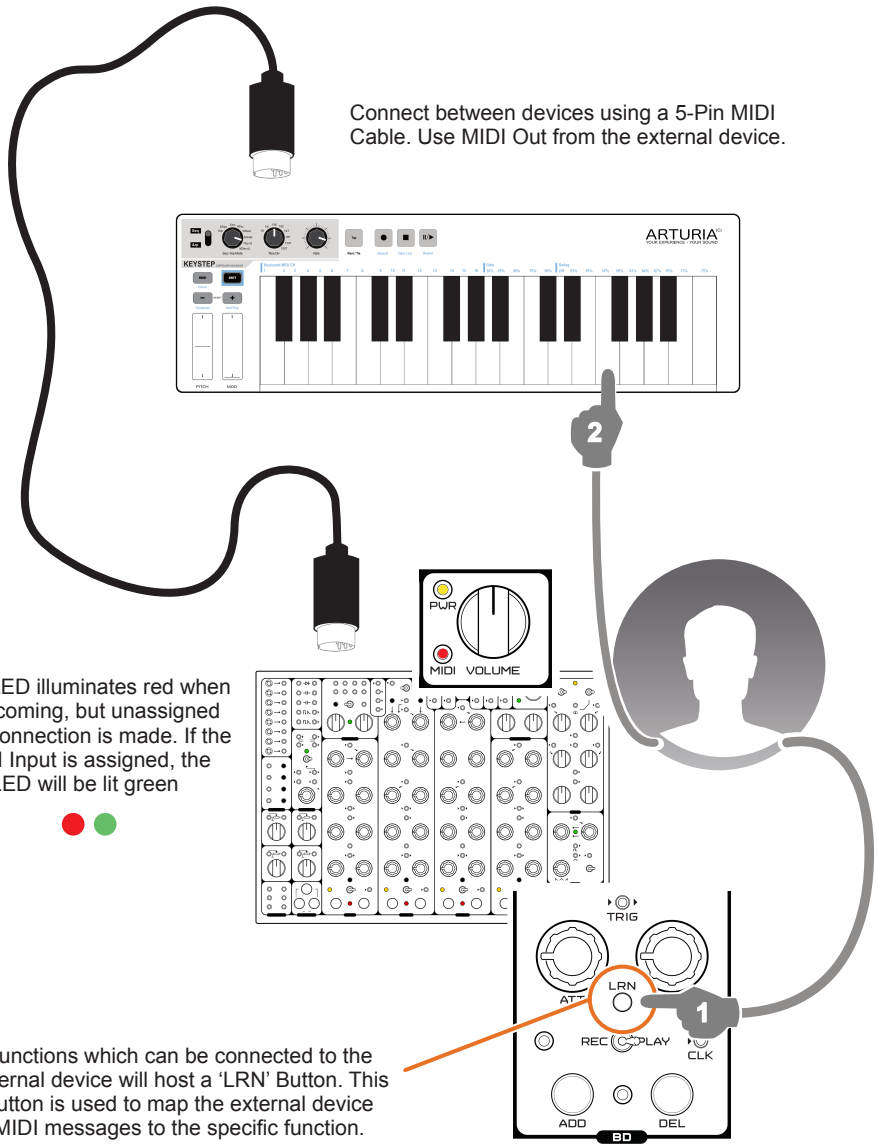
With a MIDI interface a PC or Mac can be used used with digital audio workstation software.

7.3 MIDI Learn

NOTES

The implementation of MIDI is based on control from an external device to the Pulsar-23 using MIDI in. Note and CC based data can be learnt within Pulsar-23, which essentially assigns the learnt function to the external controller input.

Note based data such as playing an external keyboard will trigger the sound modules and recognises velocity. Control Change - CC data will communicate a value for a specific parameter setting.

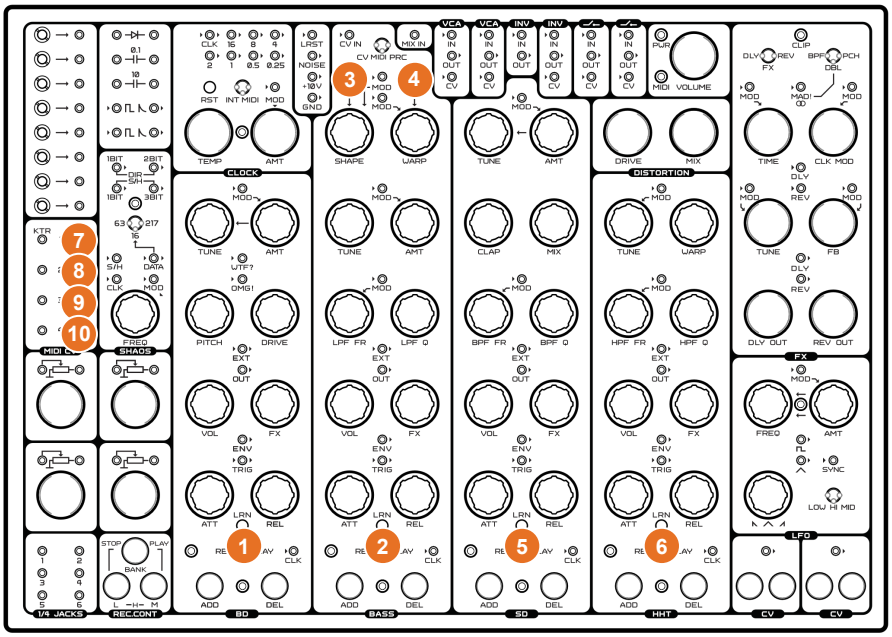


Sound modules can be played by external controllers and also will apply a fully velocity range. The notes and CC cannot however be recorded in the looper recorder channels.

NOTES

12 Assignable MIDI Parameters

10 LRN Functions plus 2 Pre-defined BASS CC's



Item	LRN Function	Description
1	BD Sound Generator	Maps the external device to the BD Sound module. Used for triggering the drum using a keyboard or drum pads.
2	BASS Sound Generator	Maps the external device to the Bass Sound module. Used for triggering bass using a keyboard or drum pads.
3	BASS Shape	Maps the external CC, Control Change to the Bass Sound to control the shape function value.
4	BASS Warp	Maps the external CC, Control Change to the Bass Sound to control the warp function value.
5	SD Sound Generator	Maps the external device to the SD Sound module. Used for triggering the drum using a keyboard or drum pads.
6	HHT Sound Generator	Maps the external device to the HHT Sound module. Used for triggering the drum using a keyboard or drum pads.
7	CV Ch 1, Key tracking	Maps the external MIDI device to the specific 'KTR' Pin 1.
8	CV Channel 2	Maps the external MIDI device to CV pin 2.
9	CV Channel 3	Maps the external MIDI device to CV pin 3.
10	CV Channel 4	Maps the external MIDI device to CV pin 4.
11	N/A	Portamento of BASS Module. Pre-defined MIDI CC.
12	N/A	Pitch Bend of BASS Module. Pre-defined MIDI CC.

7 External Control

NOTES

GENERAL MIDI LEARN PROCESS

1. Use a 5-Pin MIDI Cable to connect the MIDI Out, or MIDI Thru to the Pulsar-23 MIDI In socket.

2. Ensure the external device settings allow transmission of MIDI. This will differ between devices so follow the manufacturers instruction for MIDI configuration of the device. Initially the MIDI LED may be lit red signifying the incoming MIDI is unassigned.

3. Press and hold the LRN button on one of the Pulsar-23 sound generator or one of the MIDI to CV functions e.g. BD LRN to map it to a controller.

4. While holding LRN, initiate a command on the external device to send a MIDI message. This could be changing a CC control or playing a keyboard note or triggering a drum pad. The external device could also be a PC or Mac based DAW.

5. Pulsar-23 will recognise the MIDI Channel and message and assign this to the function represented by the LRN option pressed. The external controller can now control the Pulsar-23 function. The MIDI LED will be lit green when the incoming MIDI message is assigned to a function. Any additional unassigned messages may still show the LED red.

6. When powering Pulsar-23 off, any assignments will be retained and will be available when power is restored.

CLEARING MIDI LEARN ASSIGNMENTS

1. Press the LRN buttons for all of the Pulsar-23 sound generators simultaneously. For example, hold LRN for the four BD, BASS, SD and HHT all at the same time.

2. All MIDI assignments are cleared. This will clear not only sound module assignments but any other MIDI assignment in Pulsar-23.

MIDI PANIC - STOP ALL MESSAGES

1. Press the LRN buttons for both of the Pulsar-23 BASS sound generator shape and warp simultaneously. For example, hold LRN buttons for both the WARP and SHAPE at the same time.

2. All MIDI triggers in Pulsar-23 will be halted. This is useful if MIDI inputs hang or the MIDI system freezes.

NOTES

7.4 MIDI Clock In

An external clock can be used from a connected MIDI input. The external device which is the clock primary lead must be set to send the clock messages across the MIDI connection.

USING AN EXTERNAL MIDI CLOCK

1. Use a 5-Pin MIDI Cable to connect the MIDI Out, or MIDI Thru to the Pulsar-23 MIDI In socket.

2. Ensure the external device settings allow transmission of MIDI and is set as the primary lead to send its clock. This will differ between devices so follow the manufacturers instruction for configuration of the device.

3. Set the ‘INT MIDI’ Switch located in the master clock module to the left, {MIDI} position. This sets Pulsar-23 to use the clock received from the MIDI in device.

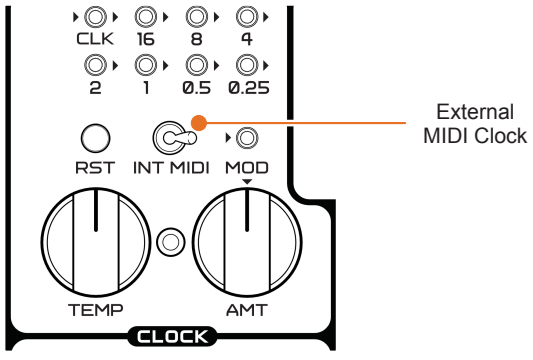
4. Remember several points of note when using an external MIDI clock:-

    - The looper recorder and clock dividers will reference the incoming MIDI clock instead of the internal clock.

    - The looper recorder has an upsampled clock speed and as such needs settling time after the clock starts. The time between an incoming start and stop of the sequencer should be longer than 5 seconds to allow for stabilisation between clock and looper recorder.

    - To avoid settling time issues with the looper recorder, patch the ‘LRST’ Pin to the ‘0.25’ Pin of the clock dividers. This will retain a good synchronisation with the looper recorder.

    - The ‘CLK’ pin in the master clock module can be used to patch a clock from the internal or external clock signals. Patched to an external module like Pam’s New Workout will give a visual BPM display of the clock tempo.



7.5 MIDI Control of Drum Modules

NOTES

The three BD, SD and HHT drum modules can be triggered from an external device. Also bear in mind that as the triggers can be held, creating drone style sounds is possible. An external continuous CC as well as a note message can be used for precise envelope style sound shaping. BASS has some unique MIDI options but these will therefore be covered in a separate section in the notebook.

MIDI LEARN FOR A DRUM MODULE

1. Use a 5-Pin MIDI Cable to connect from the MIDI Out, or MIDI Thru from the external device and connect to the Pulsar-23 MIDI In socket.

2. Ensure the external device settings allow transmission of MIDI. This will differ between devices so follow the manufacturers instruction for MIDI configuration of the device.

3. Press and hold the LRN button at the bottom of a Pulsar-23, drum module to ensure it is ready to map from the connected incoming controller MIDI.

4. While holding LRN, Initiate a command from the external device.

    - Press a keyboard key to issue a note trigger from the controller.

    - The Pulsar-23 module's envelope will be triggered and the sound is activated.

    - The note value will be mapped to the module. Playing only this mapped note, once the device is mapped, will trigger the sound generator. Other notes are not mapped or recognised.

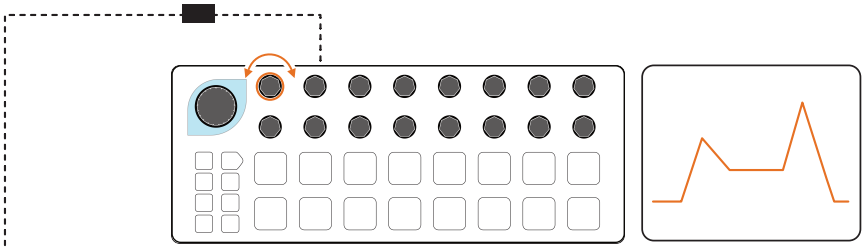
6. Alternatively, while holding LRN, Turn a rotary / slider control on the external controller.

    - The CC, control change message will be recorded which will play the module in drone mode. The level controllable from the CC In.

    - Also using a PC or Mac DAW's automation option with 'drawn in' control for MIDI CC out is possible. This will will generate the audio shape based on the incoming continuous CC message.

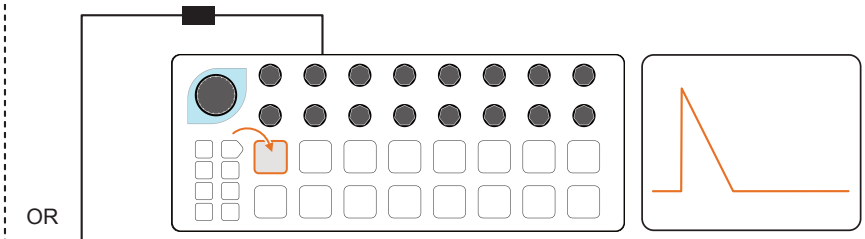
NOTES

External Controllers learnt by the BD, SD or HHT Module.

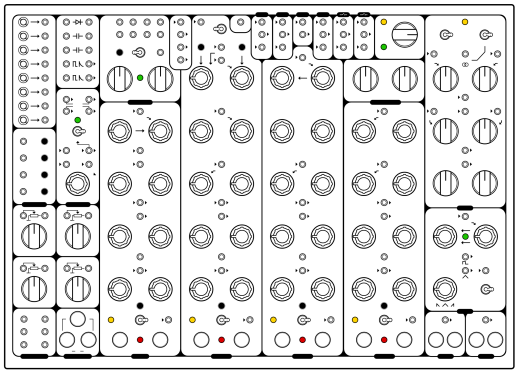


Continuous CC controller message, will be received by Pulsar-23 for the note envelope once the CC is mapped using the LRN button. In this example the rotary control would generate the CC messages.

OR



Note On / Off messages plus velocity, will be received by Pulsar-23 for the note envelope once the note is mapped using the LRN button. In this example the pad would generate a note on / off message for triggering the drum module envelope only for the individual pad.

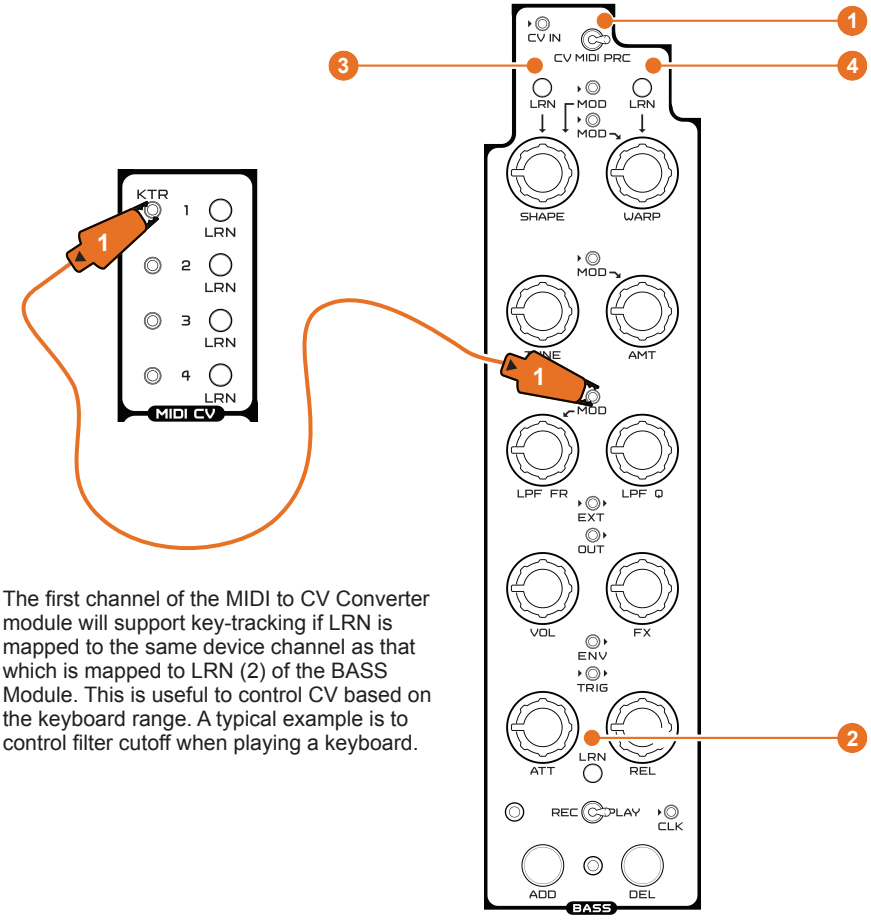


Hold LRN then initiate a message from the controller or DAW by turning a control, pressing a key or DAW mapping automation for MIDI output.

7.6 MIDI Control of BASS Module

NOTES

The BASS modules can be triggered from an external device and has some unique features beyond those of the BD, SD and HHT drum modules. While the same principles of using the LRN assignment generally apply to BASS, there are some extra features which are useful for BASS being a pitch based sound generator including the dedicated MIDI mode.

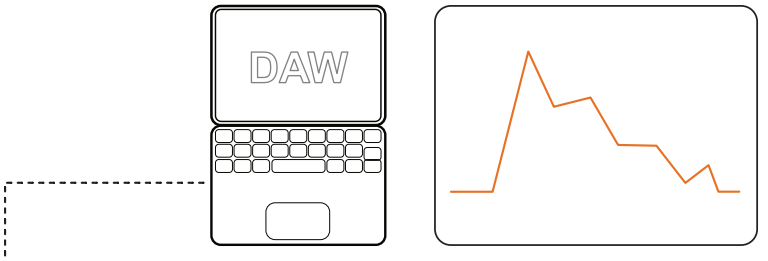


The first channel of the MIDI to CV Converter module will support key-tracking if LRN is mapped to the same device channel as that which is mapped to LRN (2) of the BASS Module. This is useful to control CV based on the keyboard range. A typical example is to control filter cutoff when playing a keyboard.

Item	Function	Label	Control	Description
1	Module Mode	CV MIDI PRC	Switch	Select MIDI, Centre position for mapping the pitch based MIDI control.
2	Module Learn	LRN	Button	Hold and trigger an external MIDI input to map to the module sound i.e. keyboard.
3	Shape Learn	LRN	Button	Hold and adjust an external MIDI CC input to map to the module SHAPE control.
4	Warp Learn	LRN	Button	Hold and trigger an external MIDI input to map to the module WARP control.

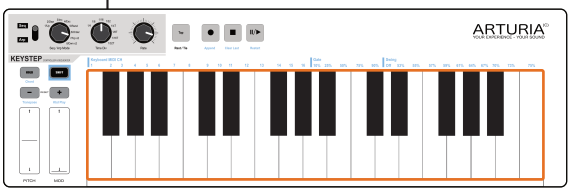
NOTES

External Controllers learnt by the BASS Module.

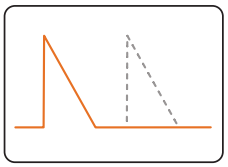


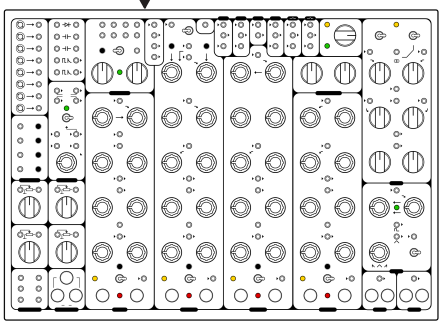
Continuous CC controller message, will be received by Pulsar-23 for Pitch Bend and also CC05 for Portamento. Dedicated LRN buttons can map CC to the SHAPE and WARP controls on the BASS Module.

OR



Note On / Off messages plus velocity, will be received by Pulsar-23 for the note envelope. All notes can be played once the device is mapped and learnt for the BASS module.





Hold LRN then initiate a message from the controller or DAW by turning a control, pressing a key or DAW mapping automation for MIDI output.

Note: If using an external synth to control CC and Notes, consider setting it to ‘Local Off’ to avoid triggering synth functions when controlling external gear.

NOTES

MIDI Notes and Default Controls

MIDI LEARN NOTES FOR A BASS MODULE

1. Use a 5-Pin MIDI Cable to connect from the MIDI Out, or MIDI Thru from the external device and connect to the Pulsar-23 MIDI In socket.

2. Ensure the external device settings allow transmission of MIDI. This will differ between devices so follow the manufacturers instruction for MIDI configuration of the device.

3. Set the ‘CV MIDI PRC’ Switch to the central, {MIDI} position. This will map the keyboard chromatically. Using position {CV} or {PRC} will map only a single note just like the other sound modules. {PRC} mode also maps chromatically but doesn't clash with other sound generator MIDI channels.

4. Press and hold the LRN button in the lower part of a Pulsar-23 BASS module to ensure it is ready to map from the connected incoming controller MIDI.

5. While holding LRN, Initiate a command from the external device.

    - Press a keyboard key to issue a note trigger from the controller.

    - The Pulsar-23 module’s envelope will be triggered and the sound is activated.

    - The note and controller will be mapped to the module. Playing any of these notes, once the device is mapped, will pitch trigger the sound generator. Other notes are also mapped in {MIDI} Mode.

6. When mapping the controller to Pulsar-23, two control change messages are also automatically mapped.

    - Pitch bend is mapped to BASS. This is a typical control found on many MIDI controllers and synths. This will operate with the BASS module with a +/- 12 Semitone range.

    - Portamento - pitch glide, is also mapped. An external controller would need to transmit over CC05 to adjust the Pulsar-23 portamento. This can only be changed by using MIDI.

NOTES

MIDI CC for BASS

A number of control change CC functions exist in Pulsar-23 BASS module. The Pitch Bend and Portamento would be based on a single MIDI controller mapping. This also applies if using key-tracking KTR with the MIDI to CV indirect function. The WARP and SHAPE controls can be mapped separately to CC inputs.

MIDI LEARN FOR THE SHAPE FUNCTION

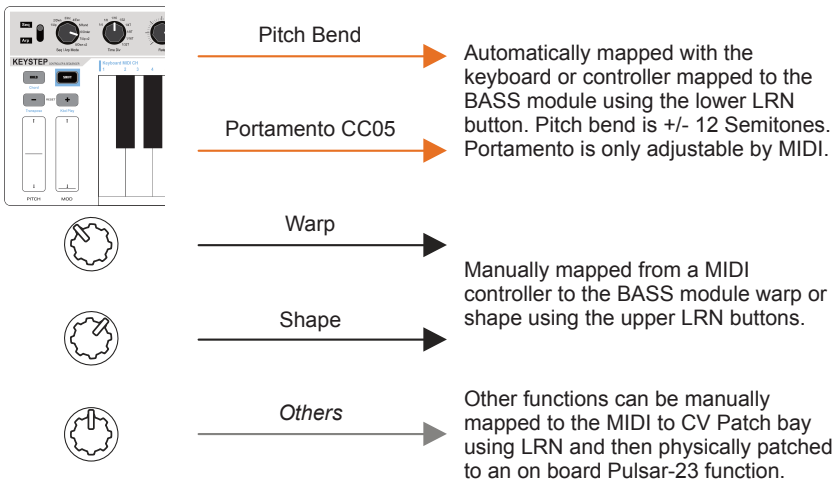
1. Press and hold the LRN button in the upper left part of the Pulsar-23 BASS module. This is for the SHAPE function to ensure it is ready to map from the connected incoming controller MIDI.

2. While holding LRN, adjust the external controller. The control is mapped and as such values for the control are mapped from the device to Pulsar-23.

MIDI LEARN FOR THE WARP FUNCTION

1. Press and hold the LRN button in the upper right part of the Pulsar-23 BASS module. This is for WARP function to ensure it is ready to map from the connected incoming controller MIDI.

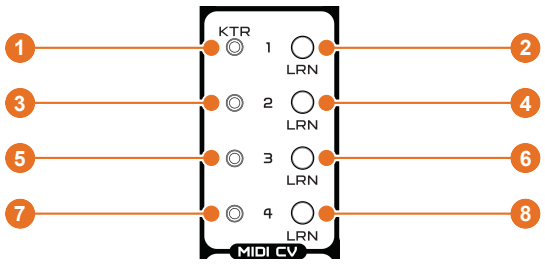
2. While holding LRN, adjust the external controller. The control is mapped and as such values for the control are mapped from the device to Pulsar-23.



7.7 MIDI to CV Conversion

NOTES

While there are a limited number of predefined mappings for MIDI to Pulsar-23, this can be extended by using the MIDI to CV Converter patch bay. This allows up to four MIDI inputs to be learnt on a patch pin and then physically patched with alligator cables to a function in Pulsar-23. The converter can take MIDI Notes, captured as a velocity value or external parameter controls as CC Values.The first channel is proportional to a keyboard assigned to the BASS module and therefore can be used for key tracking control.



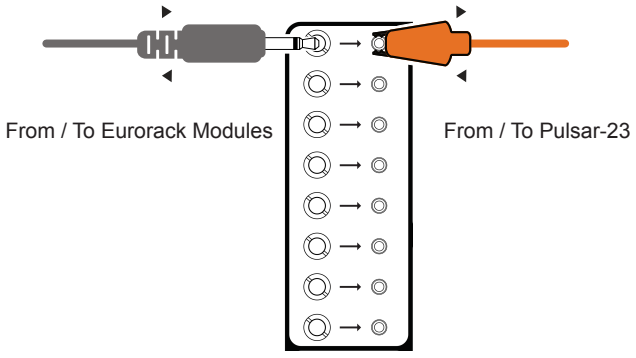
Item	Function	Label	Control	Description
1	Channel 1 KTR	KTR	Pin	CV output from mapped MIDI control. Used for key-tracking for the same device mapped to the BASS module.
2	Channel 1 Learn	LRN	Button	Hold the learn button while activating a connected MIDI value to map to the pin.
3	Channel 2 Out		Pin	CV output 2 from mapped MIDI control.
4	Channel 2 Learn	LRN	Button	Hold the learn button while activating a connected MIDI value to map to the pin 2.
5	Channel 3 Out		Pin	CV output 2 from mapped MIDI control.
6	Channel 3 Learn	LRN	Button	Hold the learn button while activating a connected MIDI value to map to the pin 3.
7	Channel 4 Out		Pin	CV output 2 from mapped MIDI control.
8	Channel 4 Learn	LRN	Button	Hold the learn button while activating a connected MIDI value to map to the pin 4.

NOTES

7.8 Eurorack Interconnections

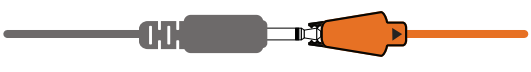
The most common modular synthesis format is Eurorack. This uses 3.5mm mini jack patch connections and generally operates in the 0-5V, -5V to +5V and 1-5V ranges for control. Other voltages ranges may also be found in some modules. The three core topics to consider when interfacing Pulsar-23 with Eurorack are:-

- The physical connection between mini jacks and alligator clips. The converter patch bay can handle this in both directions for up to 8 inputs and outputs. This is the preferred option and connects ground signals between the systems.
- The voltage range of 0-10V to / from Pulsar-23 to the range specific for the connected Eurorack module. This should be generally OK for triggers but outcomes may be less predictable for CV control. However, experimentation may find some interesting sweet spots.
- Selecting which device will be the primary lead for the master clock and which will be the secondary followers. Pulsar-23 could be set to follow an external clock from another module as the primary control. Alternatively Pulsar-23 could be the primary lead. Remember that Pulsar-23 uses 128 ticks for the full array of the dividers and the looper recorder length.



The bi-directional patch bay can interface between the 3.5mm TS Mini Jack and the Pulsar-23 Alligator clip patch cables.

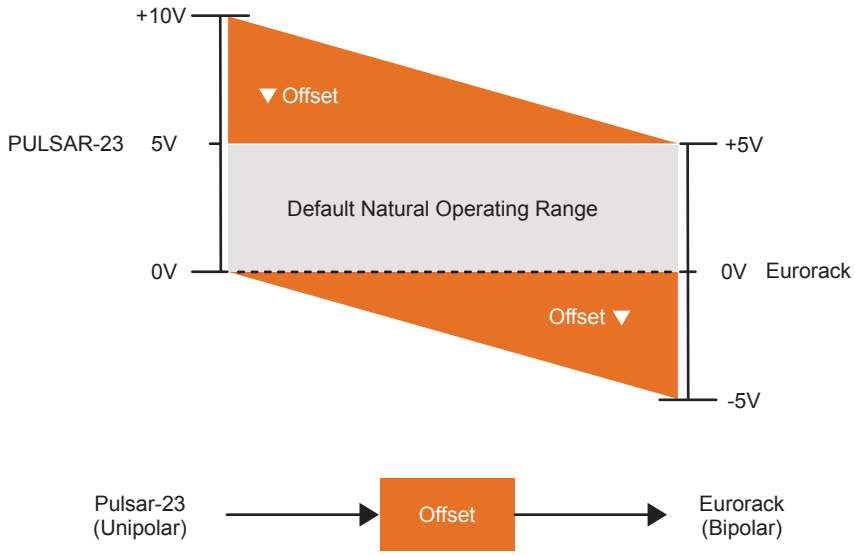
Connecting the mini jack tip to the alligator clip technically fulfils the signal connection. However it is strongly advised to use the patch bay as this ensures the grounding is also handled correctly.



7.9 Eurorack Voltage Conversion

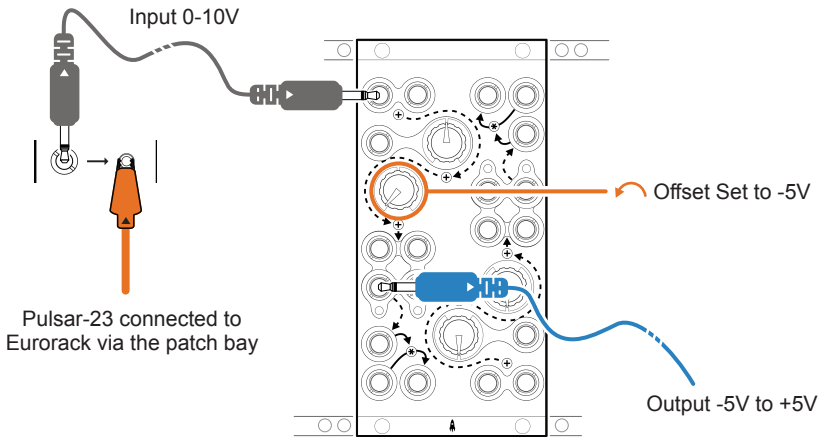
NOTES

As stated, Pulsar-23 uses 0-10V control signal ranges. This is not a Eurorack standard but in many cases will provide some level of control. If a more precise range is required there are options to convert, or at least re-range to a Eurorack standard. The example shows conversion from 0-10V to +/-5V but these principles can be adapted for other ranges.



A device can be used to adjust the range for Eurorack compatibility. This could be as simple as just applying an offset to the incoming signal so that -5V is applied to offset the 0V level. Some attenuators also have this functionality built in. Take a look at Pulp Logic's Attenuators, TINRS Ardabil, Intellijel Triatt which are elegant Eurorack solutions.

Example: Eurorack Module
This Is Not Rocket Science - Ardabil

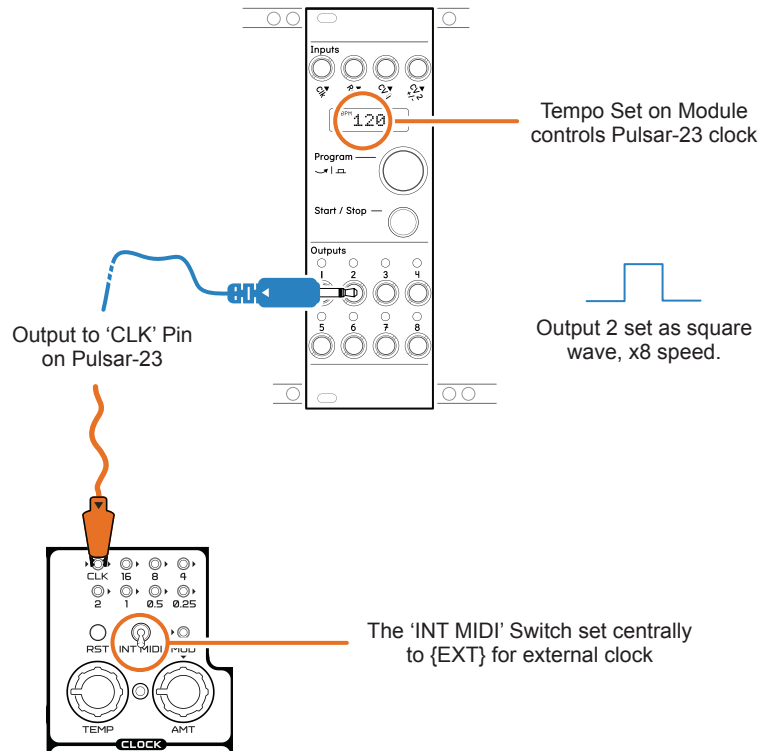


NOTES

7.10 Clock as a Lead or Follower

Pulsar-23 normally uses its own internal clock for internal control but also this can control external gear as a primary lead. In addition the Pulsar-23 clock can be set as a secondary follower, controlled by an external device. It is also possible to connect a device by MIDI which can act as the primary lead for the clock. This example assumes patching via the jack to alligator patch bay, which for illustration purposes isn't shown.

Example: Eurorack Module as Primary Lead
ALM Busy Circuits - Pam's New Workout



The primary lead clock, in this example Pam's, would need to account for Pulsar-23's 128 Tick resolution in order to match Pulsar-23's tempo as secondary follower. In this example the square wave output is set to a x8 modifier to ensure the tempo match.

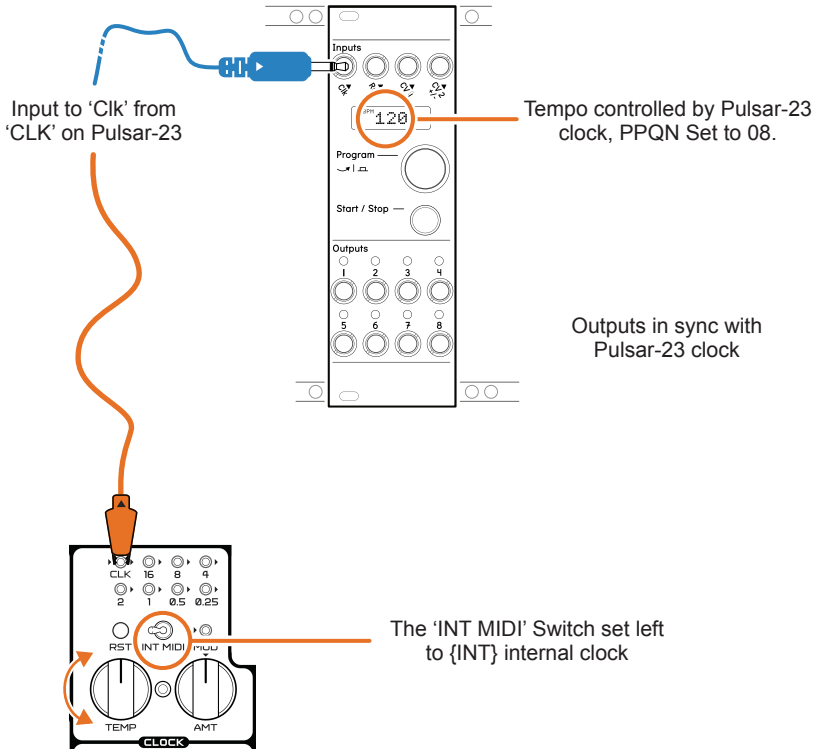
As a tip, in this example other outputs from Pam's could be connected to trigger the sound generator modules, using the external module also as a sequencer. Setting various speeds can create interesting synchronised patterns.

7 External Control

NOTES

Pulsar-23 can be the central piece in a gear setup using MIDI and CV controls to interface to a variety of gear simultaneously. It would be typical to use the central device as the main clock primary lead. The examples show assume patching via the jack to alligator patch bay, which for illustration purposes isn't shown.

Example: Eurorack Module as Secondary Follower
ALM Busy Circuits - Pam's New Workout



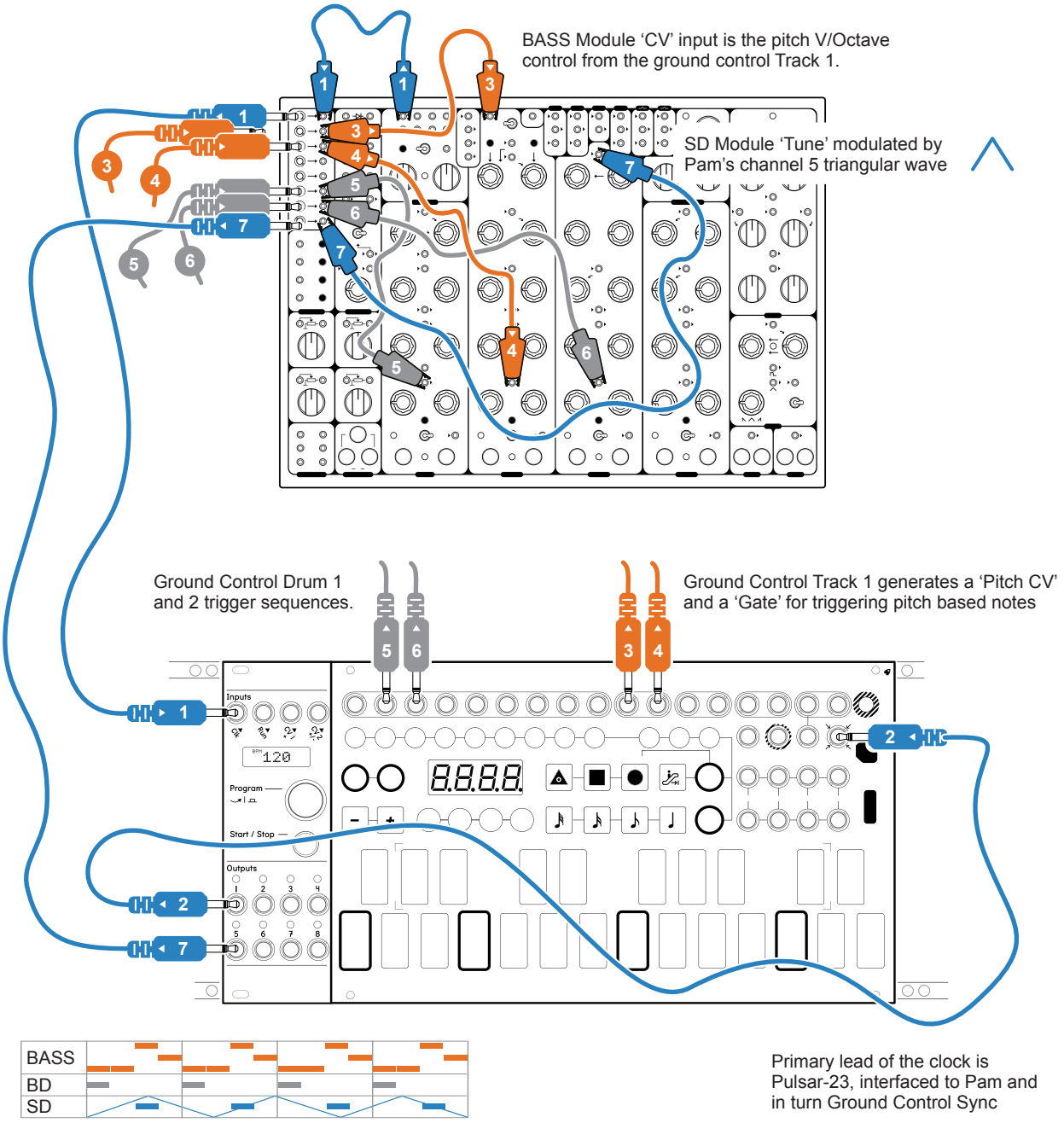
The primary lead clock, in this example Pulsar-23 will generate a clock based on its 128 Tick resolution. In order to match Pulsar-23's tempo as secondary follower, Pam's clock needs to know ticks per quarter note, called PPQN (Pulses Per Quarter Note). In this example hold Pam's 'program' button to set PPQN to 08 and therefore ensure that the tempo is matched from Pulsar-23. For many devices Pulsar-23's clock may have a higher range than the receiving device.

As a tip, in this example modulating other inputs on Pam's for example from Pulsar-23 LFO or SHAOS generator to CV 1 will give some crazy patterns on any connected modules to Pam's outputs. Especially good if all Pam's outputs are assigned from the modulation of CV 1 input. Pam's CV inputs can also be used to apply offsets on signals.

7.11 Eurorack Sequencing Pulsar-23

Interfacing between Eurorack gear can be as simple as patching between devices. Using the patch bay to convert between mini jack from / to alligator clips is advised as this also grounds the connection between Pulsar-23 and the rack. A typical example is to use a Eurorack sequencer for controlling the Pulsar-23 and offer a more traditional grid based pattern generation. Pulsar-23 is the primarily lead clock for this example but it makes sense for Ground Control to lead the clock.

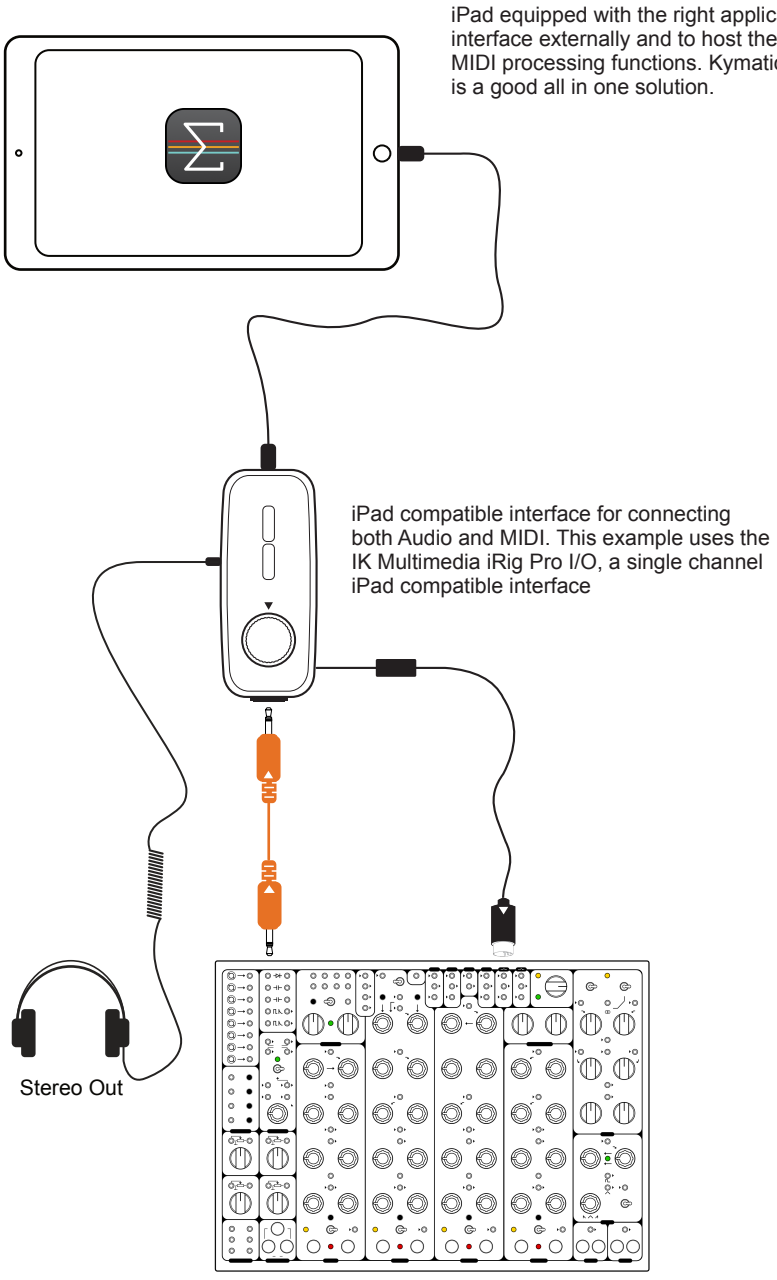
Example: Eurorack Module as Sequencer
Endorphines - Ground Control + ALM Busy Circuits - Pam's New Workout



7.12 iPad and Pulsar-23

NOTES

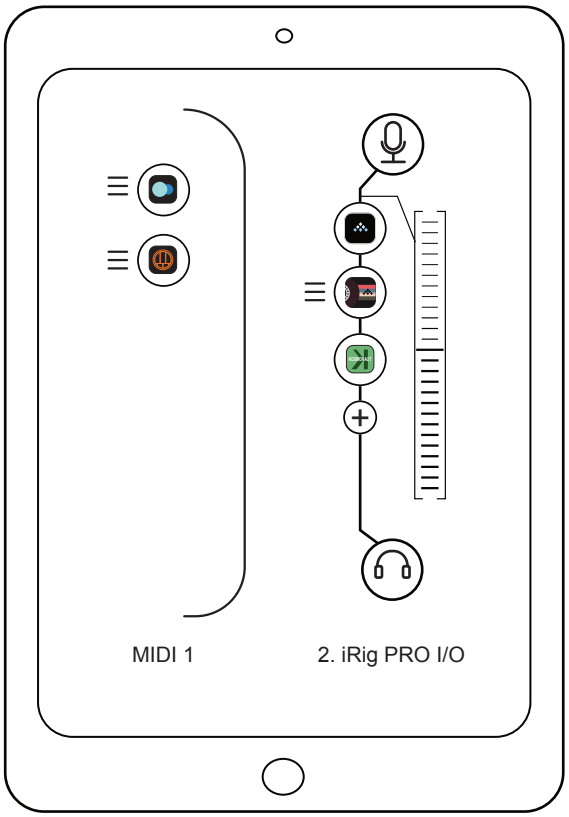
The development of iPad based music apps has improved significantly in the past few years. So much so that an iPad now can be considered an serious option in a multi device setup. Pulsar-23 benefits greatly from this when interfacing an iPad over MIDI and also by routing audio.



Hold LRN then initiate a message from the iPad application by adjusting a control, pressing a key or starting a sequencer on an iPad application

NOTES

Example: iPad Configured with AUM
AUM manages the interfacing and chaining of AUv3 iPad compatible plug-ins.



MIDI chain would control Pulsar-23 through it's MIDI input. The messages from iPad are assigned in Pulsar-23 using 'LRN'. This could be as simple as iPad keyboard or sequencing using an arpeggiator.

In this example Audiomodern's Riffer app is used as a MIDI Pattern generator and connected to Pulsar-23's BASS module. This is set to MIDI mode to play melodic notes.

Also Kai Aras, Keyboard Suite KB-1 is set on the MIDI chain for manual keyboard and pad control plus CC controls mappable to Pulsar-23 controls.

Audio chain would route Pulsar-23 audio output, through the plug-in chain in AUM. This will allow additional processing and effects to be added before channeling the audio out to the iRig headphones

Three effect apps are shown in the audio chain. The MSXII Sound Design's Lo-Fly Dirt adds grit and distortion, while Fly-Tape II offers 'on the fly' effects such as slow down, reverse and lo-fi. Finally Bram Bos' Kosmonaut echo effect to add ambience.

8

Technique

Reading the manual or a producer guide, watching videos and talking with others are all part of the learning process for audio gear. But these alone, whilst helping on the journey, wont accomplish mastering the art of the device. Pulsar-23 is a complex semi-modular, organismic, drum machine that crosses many borders and blurs the edges of what's expected of an analog synth. Hands on experimentation, learning by doing and trial and error are also part of the journey and helps you, as a Pulsar-23 musician or producer, take a step nearer to your personal destination. Succeeding and failing is part of this adventure. This book alone wont teach how to succeed with everything about Pulsar-23. It will however be another step along the way. It will help set the direction and speed up the learning and internalisation of knowledge. It's a reference and the built in space for notes is designed to make the book personal with the option to add your own notes and learning points. Some blank Pulsar-23 patch templates are also included to help you record your own patch creations. This final section is designed to show some example patches and configurations, either for the full unit or for parts and functions. It is designed to leave with some real life patch examples that are useful not only to learn but also to embed into your own sound designs and form part of your library of patches. These are starting points in patch creation where you can build and extend your journey further. As always with Pulsar-23, expect the unexpected, try things that seem unusual, explore and test and most importantly enjoy the journey and not just the destination.

8.1 FM Synthesis

NOTES

Patch Name: Planets Calling Earth

FM Synthesis is created when one waveforms frequency controls the frequency of another. In its purest form the controller is a ‘modulator’ and destination is called a ‘carrier’. FM can create unique metal-like sounds. Pulsar-23 has the ability to emulate the principles of FM synthesis, in this case using the LFO as a Modulator. This patch can be expanded and is a starting point to develop an FM orientated design. Try tweaking the parameters to develop a sound.

1. The ‘10V’ Pin is used to trigger the BASS module and to create a drone in order to sustain the sound which will help when tweaking and developing the sound.

2. The LFO with a triangle wave is used as the modulator. Set the LFO switch to {Hi} for a high frequency in the audio range.

3. To offer even more modulation the LFO frequency itself is modulated by the SHAOS module, in this example using a 3-Bit Pin.

NOTES

8.2 Everything as a Sound Source

Patch Name: EaaSS

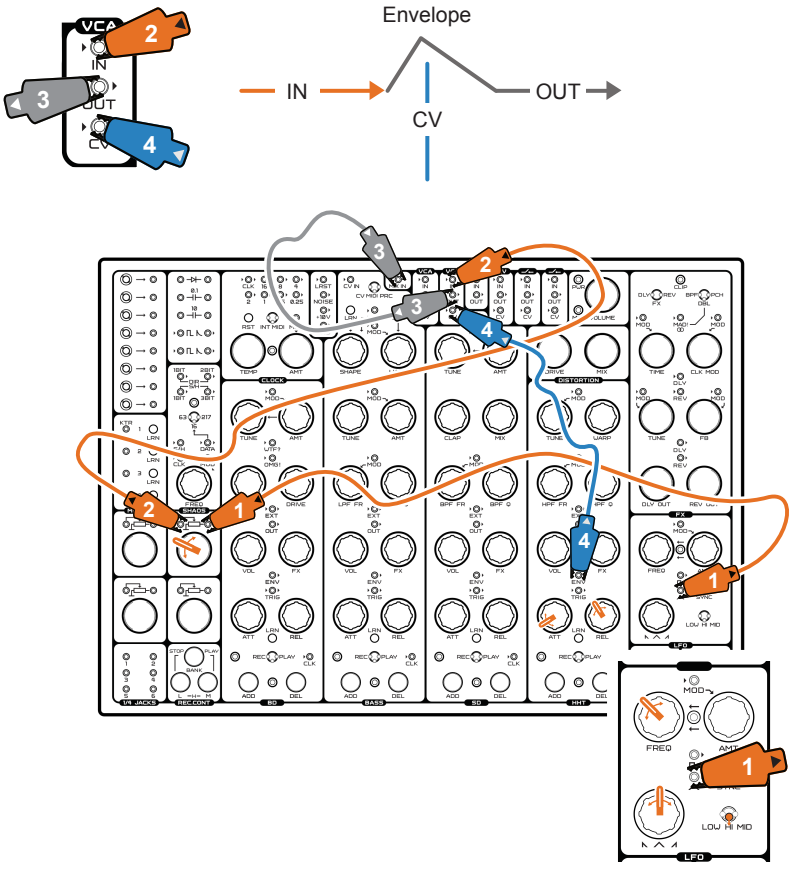
Almost everything can be used as a sound source. This example is slightly more elaborate than the example earlier and demonstrates use of the VCA. This shows how to use the LFO as a sound generator. This is a simple patch with the triangle wave LFO running at high (or medium) speed.

1. The LFO triangle output is patched through an attenuator to control the level before entering a voltage controlled amplifier.

2. The attenuator controls the input to the VCA.

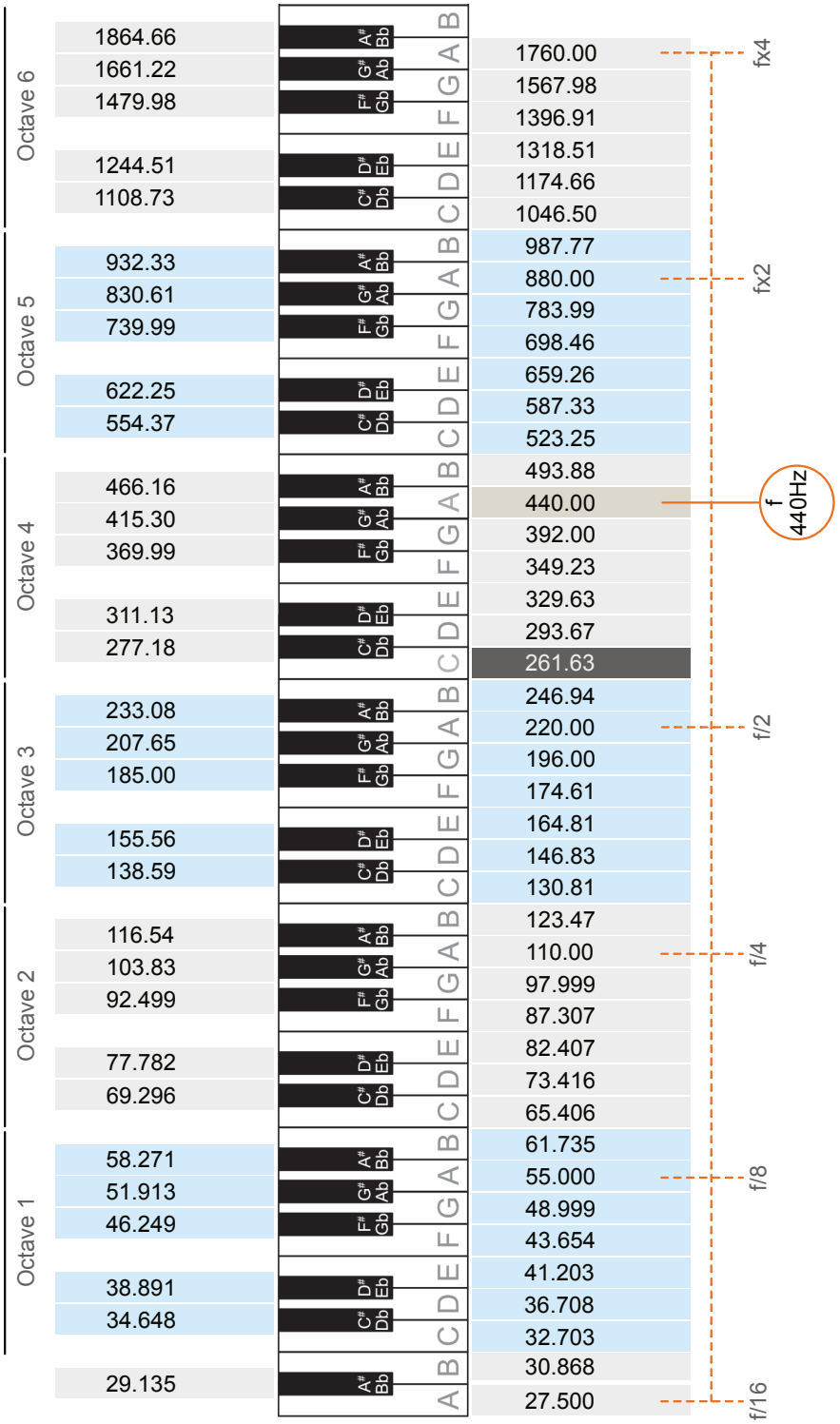
3. The VCA output is shaped by the incoming CV and the audio is sent to the ‘MIX IN’ Pin which will mix with the audio mix bus. The ‘EXT’ Pins on the sound modules also allow audio processing through the module function.

4. The VCA CV input uses an envelope. In this example the triggering the HHT envelope output is used to shape and activate the sound using it’s ‘ATT’ - Attack and ‘REL’ - Release.



NOTES

It is useful to use a tuning meter to calibrate a frequency based sound to a musical note. It may also be helpful to refer to the following table as a guide to the frequency specific to notes across an octave.



NOTES

8.3 Sidechain

Patch Name: What the Duck!

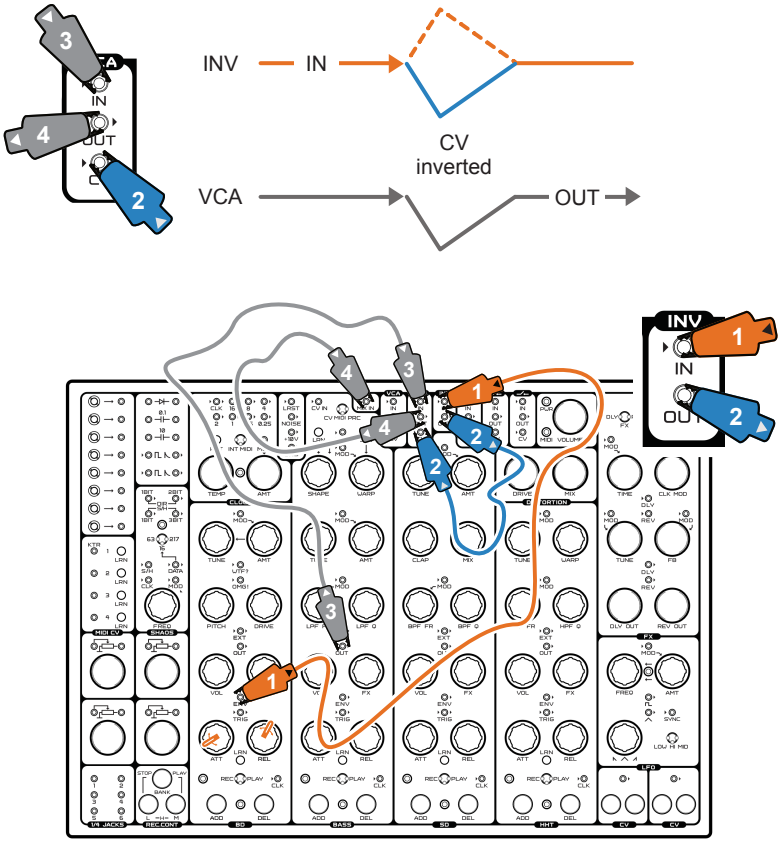
Side-chaining enables the control of a function from another. A typical example would be a compressor controlled by a kick drum which in turn reduces the gain of say a pad sound at the point the kick hits. This is also called ducking and can be emulated using an inverter and VCA in Pulsar-23.

1. Using BD as the sidechain trigger, patch the BD ‘ENV’ envelope out to the Inverter INV, Input. Use the inverter module without the CV option.

2. The Inverter output should be connected to the VCA CV Input. This signal will be inverted creating a replicated, but inverted, envelope control of the VCA.

3. Create a drone sound on the BASS module. This can be any sound but to illustrate the ducking effect a drone or pad works best. Patch the BASS ‘OUT’ output to the VCA input.

4. Patch the VCA output to the ‘MIX IN’ audio input. Each time the BD triggers, the BASS drone sound will duck, creating space for the BD sound. Tune the BD ‘ATT’ - Attack and ‘REL’ - Release to ensure the ducking is appropriate.



Although not shown, it is advised to use an attenuator between the BASS ‘OUT’ and the VCA Input. This allows volume control.

8.4 Pitch Drop

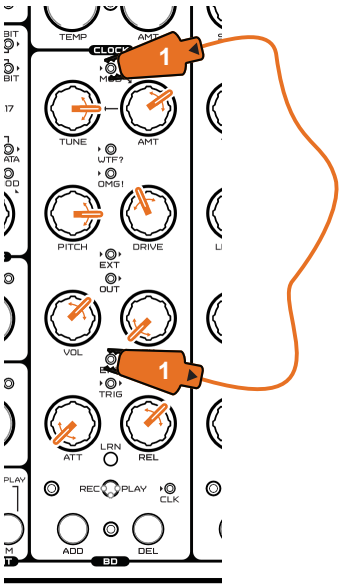
NOTES

Patch Name: Synptom

Reminiscent of the classic syntom electronic drums of the 80's this patch generates a pitch drop when the BD drum module is triggered. Ensure tweaking and adjusting the BD parameters to taste.

1. Connect the BD (or any other module) 'ENV' Output to the Tune 'MOD' Pin. The 'ATT' - Attack and 'REL' - Release can be tuned to suit the drop style.

2. The settings are important and the PITCH specifically affects the sound.



NOTES

8.5 Ambient Water Drips

Patch Name: Droplets

Its easy to see Pulsar-23 as an aggressive analog drum machine, but there can be some ambient and subtle sound designs with the right patch focus and parameter settings. The real key to this patch is the modulation used on the clock, FX and the HHT module especially when pinging the filter. This patch creates an ambient water droplet soundscape.

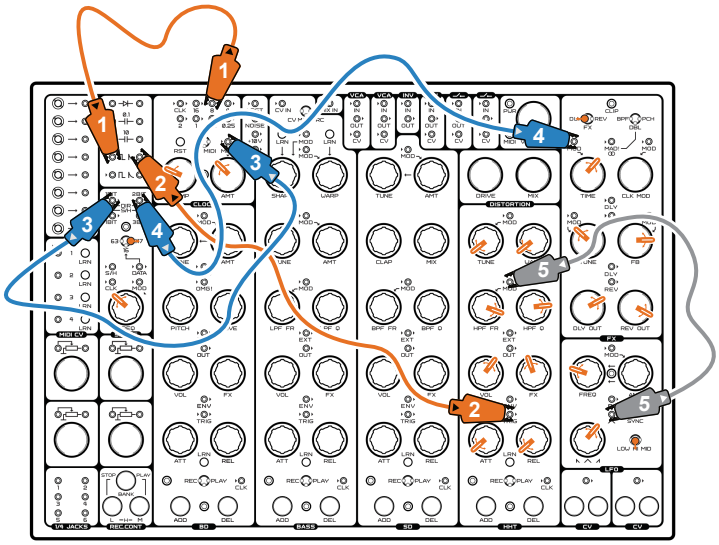
1. Use the clock to trigger the pulses of the HHT module. Connect from the clock divider ‘8’ via the pulse converter, to generate short triggers

2. Connect from the pulse converter to the HHT ‘TRIG’ input. HHT parameter settings are important to achieve the right results.

3. Modulate the clock by patching from the SHAOS module the 1-Bit output to the clock ‘MOD’. Adjust the clock modulation ‘AMT’ - Amount, which should be set around 10 O’Clock. The Tempo at around 9 O’Clock, approx 110BPM.

4. Also from SHAOS, patch the 2-Bit output to the FX module ‘MOD” Pin associated with the TIME parameter, which should be set at around 1 O’Clock. The delay in particular is important and the HHT Send FX adjusted to about 11 O’Clock - 40%. FX set to delay.

5. Patch from the LFO Triangle Pin output to the HHT Module, ‘MOD’ Pin associated with the ‘HPF FR’ - Frequency. Pinging this filter is key to this sound and the HPF Resonance - ‘Q’ set high, 3 O’Clock. Set the LFO switch to ‘HI’.



8.6 FX Clock Chaos

NOTES

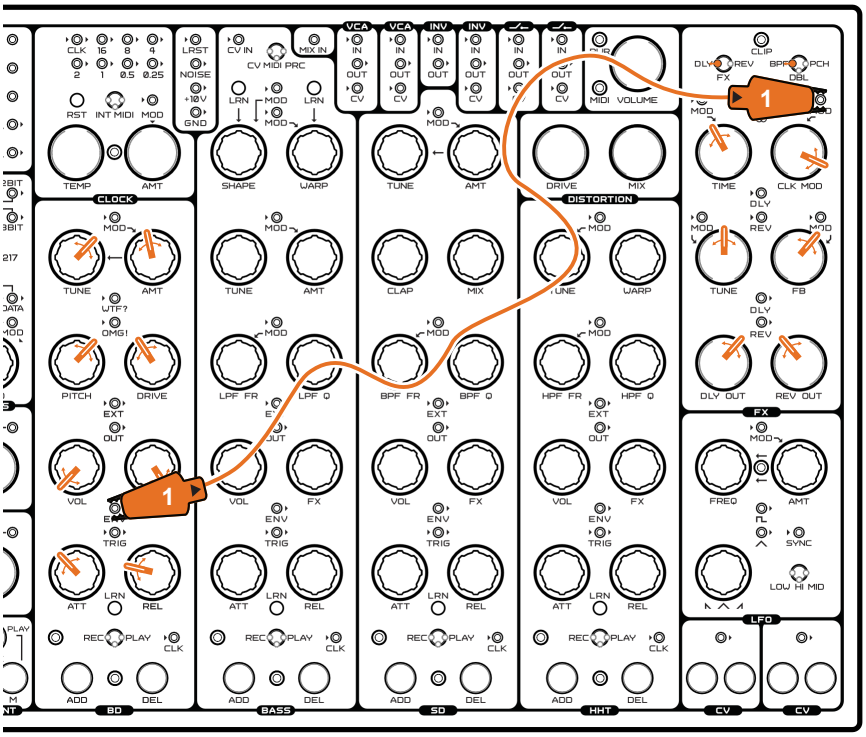
Patch Name: Start Your Engines

Modulation of the FX clock CLK MOD can generate some crazy sounds and movement. The envelope output from BD is used here to adjust the clock in a pattern following the envelope shape and have an after effect through the release phase of the envelope.

1. Connect the BD (or any other module) ‘ENV’ Output to the FX CLOCK MOD, ‘MOD’ Pin. Set the amount of modulation from the ‘CLOCK MOD to 4 O’Clock.

2. Set parameters as illustrated. Trigger the BD module.

3. Optionally, try the same patch with the SD module envelope.



NOTES

8.7 Bright Pings

Patch Name: Sparkles

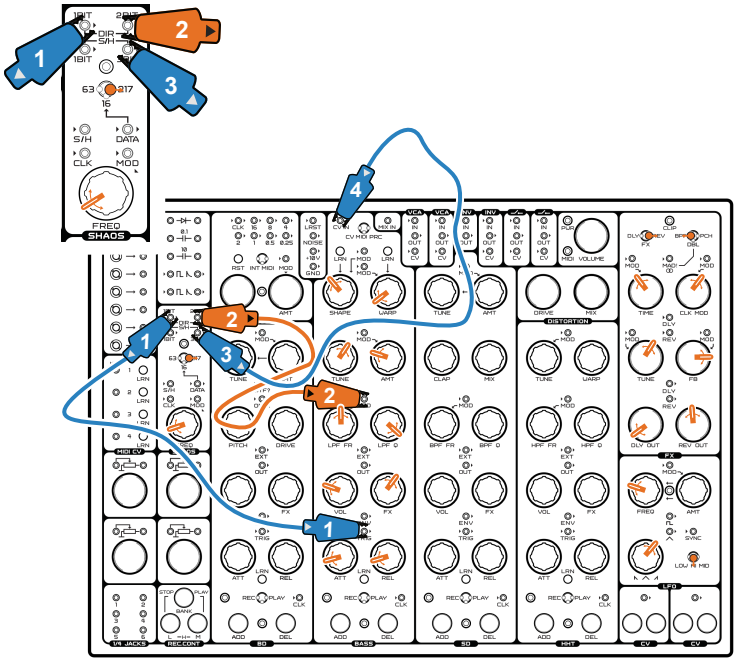
Evolving percussive soundscapes is possible in Pulsar-23. This patch creates a wash of sparkly pings and shows off the generative nature of SHAOS. Reverb fills close out the space with an ambient texture.

1. Set SHAOS Freq low, switch to {217} and connect 1BIT Pin to the BD Module ‘TRIG’. Ensure BASS settings match the illustration. The SHAOS switch can be toggled to generate new patterns.

2. Connect from the BASS Filter ‘MOD’ Pin to the 2-Bit SHAOS Module. This will ping the filter as resonance is set high.

3. Connect the BASS ‘CV’ Pin to SHAOS 3Bit pin. Also ensure BASS is set to {CV} on the mode switch. This will generate the pitch changes.

4. Set FX switch to {REV{, Mode to {BPF} and settings as per illustration.



8.8 Shifting Hi Hats

NOTES

Patch Name: Ticker

Clock driven Hi Hats can be shifted using the inverter module. The controlled inverter will allow a shift in the timing, for example from quarter notes to eighth notes when using the CV input. The falling edge is also recognised using the inverter control.

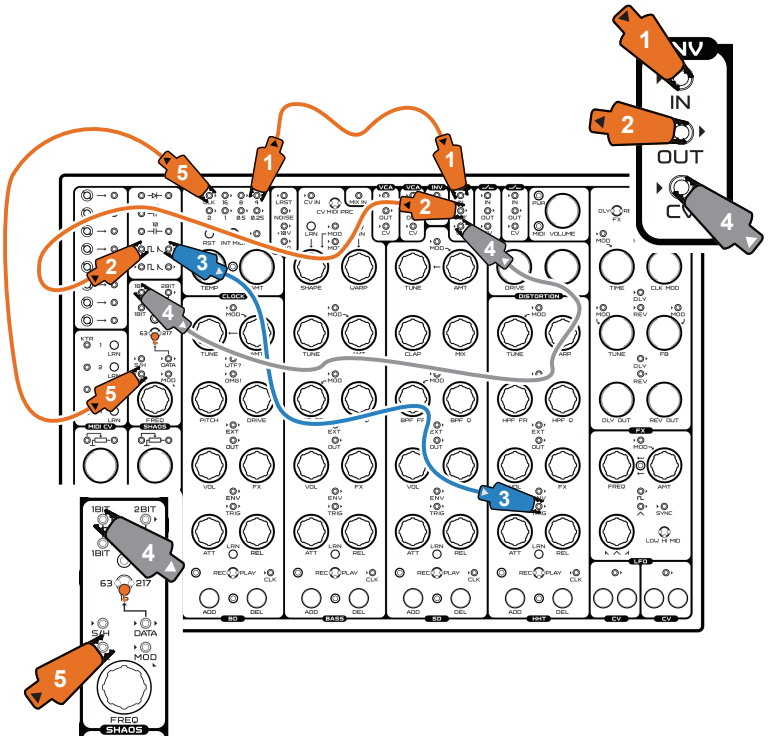
1. Rather than directly trigger the HHT module, the clock ‘4’ divider output is used as an input to the inverter.

2. The inverter output is passed through the pulse transformer to generate short triggers from the longer gate input.

3. The pulse transformer output is patched to the ‘TRIG’ input on the HHT module. This will drive the hat based on the clock, but is inverted, when control is active, rather than directly patched.

4. The CV input to the inverter will be the main connection which controls the inversion. This could be set high by tapping a patch cable to the ‘10V’ pin, or even patched to the resistance CV pads. However in this example, the SHAOS 1-Bit output is used to control the inverter and the hat pattern. Switching between 217, 63 and then back to 16 will define the pattern.

5. For synchronisation the clock ‘CLK’ is connected to the SHAOS ‘CLK’.



NOTES

8.9 Strings from Noise

Patch Name: BowWow

There are many sound sources in Pulsar-23. Almost everything can be an oscillator. Noise shouldn't be overlooked as an interesting source especially when controlled and coupled with FX module.

1. The clock, ‘CLK’ is connected to the SHAOS module ‘CLK’ to synchronise between the two modules.

2. The SHAOS 1-Bit output is connected to the LFO ‘SYNC’ to synchronise between the two modules.

3. Noise is the main source for this patch. Noise is purely a generator with no dedicated on board controls. Noise will need to be controlled through a VCA in order to shape its sound. Noise is connected to the VCA input.

4. The output of the VCA is connected to the FX module delay ‘DLY’ input. This is the shaped and volume controlled noise. The FX parameter settings are very important to generate the sound. Set these as precise as possible shown on the illustration.

5. The CV input on the VCA is controlled from the LFO via the Attenuator for better control over the sound shape.

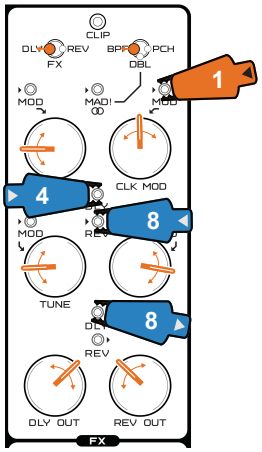
6. The triangle output of the LFO is set to a slow speed. This will emulate a ‘bow’ like characteristic for the strings. This is connected to the attenuator input.

7. As an option, modulation from the SHAOS ‘DATA’ output to the CLK MOD’s ‘MOD’ pin will offer a pattern to the bowing. This is not a necessity but by switching between ‘217’ or ‘63’ and the ‘16’ memory out may generate some interesting patterns and string sequences.

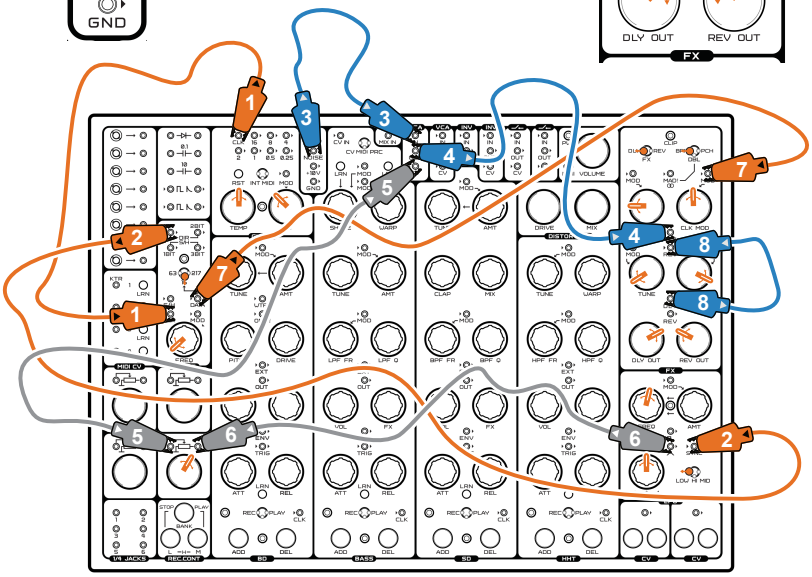
8. For an additional effect chain the delay output ‘DLY’ to the ‘REV’ input to use both effects in series. This gives a more realistic character to the sound.

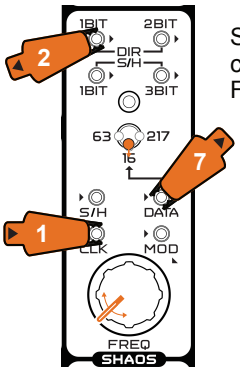
NOTES

Settings of the FX module parameters are important in order to generate the correct sound. The CLK MOD option patched to SHAOS is optional and will add the ability to generate patterns for the sound.



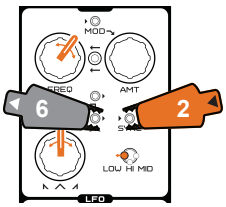
Noise as the core sound source





Synchronisation of the Master internal clock, LFO and generate modulation for the FX clock are centralised through SHAOS.

LFO operates at a slow speed to control the 'bowing' of the strings.



NOTES

8.10 Alternating Hats

Patch Name: Open / Close

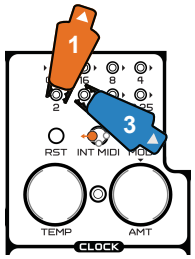
The classic open and closed hat with the choke behaviour inspired this patch. Effectively the principle is to alternate the sound of the hat to add interest in a melodic and predictable way.

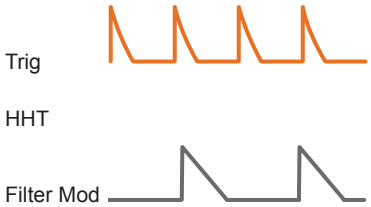
1. Use the clock to trigger the pulses of the HHT module. Connect the clock divider '2' pin via the pulse converter, to generate short triggers

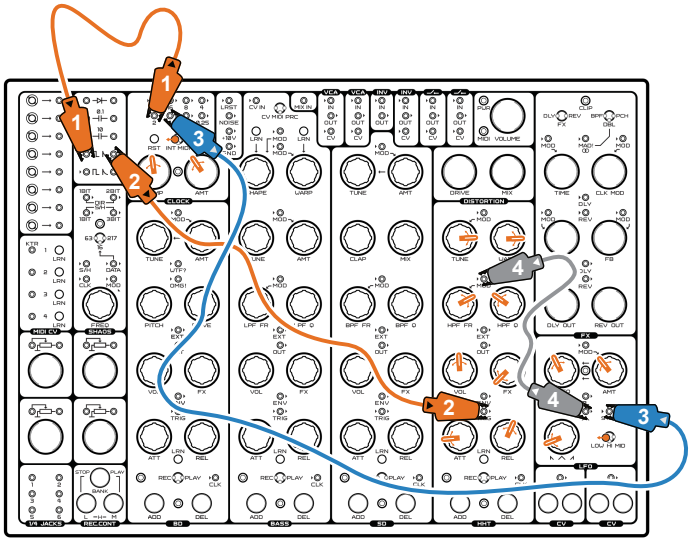
2. Connect from the pulse converter to the HHT 'TRIG' input. HHT parameter settings are adjusted to taste to achieve the desired results.

3. The LFO clock is set low and is synchronised by connecting the clock divider '1' pin to the 'SYNC' pin of the LFO. This is modulate the HHT to provide the alternate sound. The LFO speed can be tweaked to get the alternate state correct.

4. The LFO triangle setting is adjusted to around 7 O'Clock to get the fast attack, slower release phase of the saw shape. The LFO triangle pin is connected to the HPF FR - Filter frequency 'MOD' Pin. This modules the filter at alternate intervals to the main trigger.







8.11 Generative Soundscapes

NOTES

Patch Name: Originator

SHAOS brings unpredictable patterns and sequences into use. They can be used in more subtle ways for modulation. The LFO is used as an audio trigger for the FX Delay with SHAOS modulating the feedback. Take care with this patch and start with the master output low as this can generate loud and long feedback loops.

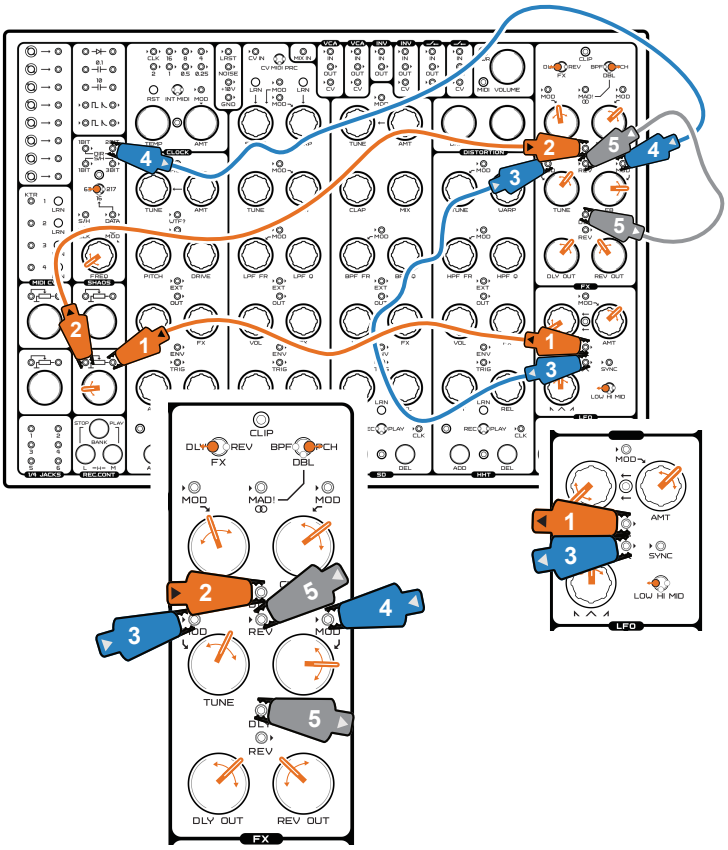
1. The LFO Square wave output is used to trigger the delay. The LFO square is connected via an attenuator to ensure good control. This patch can get crazy without having points of control in the chain.

2. The output of the attenuator is connected to the FX section ‘DLY’ input. The FX module is set to delay mode. Start with attenuator low.

3. The first modulation patch is the LFO triangle connected to the FX section TUNE ‘MOD’ Pin. The FX switches should be set to {DLY} and to {PCH}. The LFO is set to operate as a standard triangle shape but can be adjusted to experiment, as can the frequency of the LFO.

4. The second modulation is from SHAOS 2-Bit output connected to the FX FB “MOD’. This can also get crazy so pay attention to the control of FB. SHAOS is set to ‘16’ sequence steps.

5. Chain the output of the delay ‘DLY’ to the reverb input ‘REV’ creating a series of effects delay > reverb. Tweaking parameters across the FX and LFO modules and also the SHAOS module allows experimentation to evolve the soundscape.



NOTES

8.12 Subtle Bass

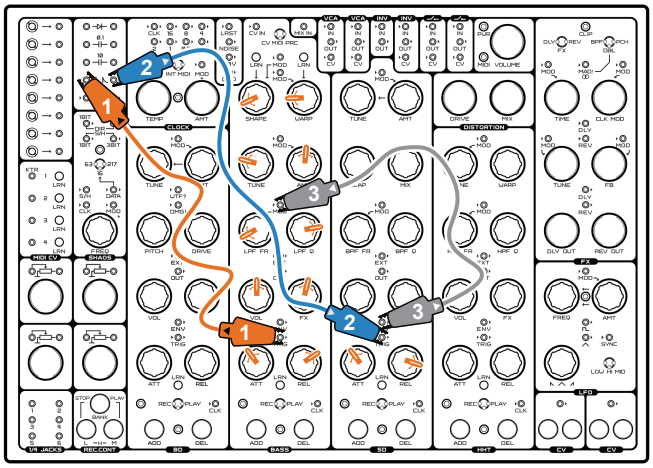
Patch Name: Plucky

The sound modules have dedicated envelopes that operate on the sound volume. To shape the sound in a more elaborate way an envelope can be used from another module. This patch adds a subtle shape to the BASS filter. A BASS pattern is recorded in or sequenced from MIDI. Tune the bass sound with the parameters to taste. A plucky deep bass usually works best, as per the parameters illustrated.

1. Use the BASS ‘TRIG’ output to trigger the pulse converter input. This will ensure a short trigger from the bass even if drone or notes are longer from BASS itself.

2. The output of the pulse converter is patched to the trigger of SD. This can be a ‘TRIG’ on any of the other three sound modules to BASS. This would be a freely available sound module as the envelope is the function used.

3. Modulate the Filter frequency of the BASS module using the envelope from the SD module. Connect the ‘ENV’ output from SD to the LPF FR “MOD’ pin.



8.13 Patch Templates

NOTES

The following pages are purely for your own notes. These can be duplicated to create your own patch books or general notes added here based on your own sound designs and creations.

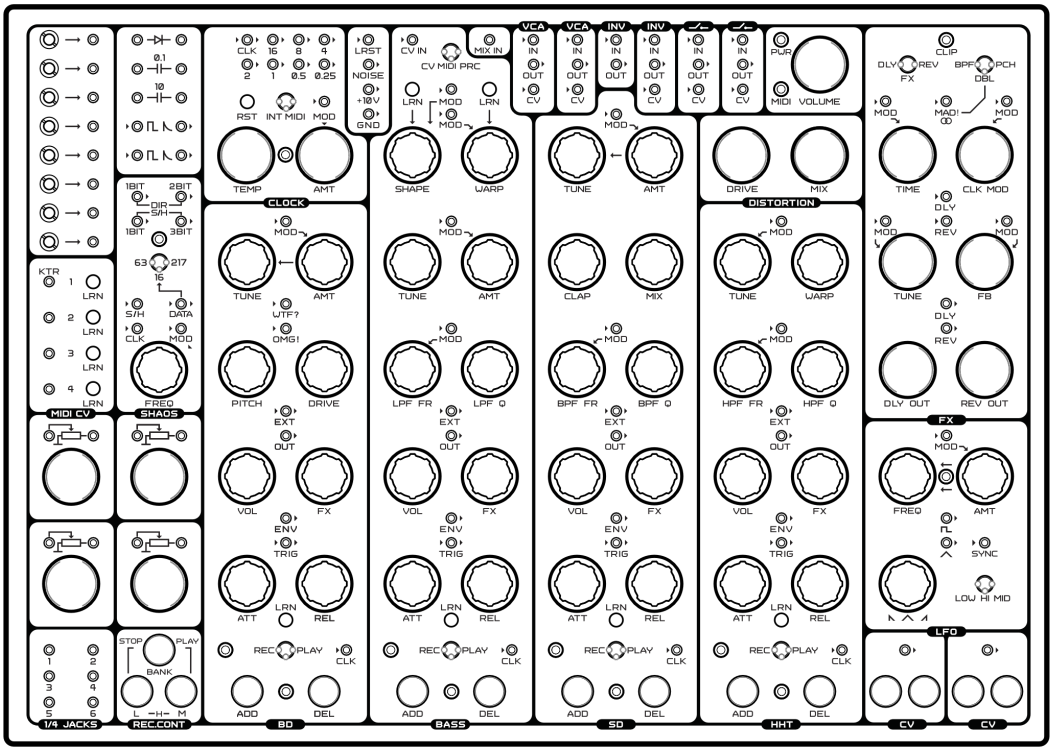
The templates provided have blank control positions, but all the functions and labels are included in the diagrams.

The official SOMA manuals and documents get you started on the Pulsar-23 journey. This guide helps bridge the user experience. Synthdawg producer guides intentionally have built in space for capturing personal notes and documenting your own experiences. It makes the Pulsar-23 more personal to you and helps to expand the content on topics of relevance to the specific user. Hopefully this will set up well to continue the Pulsar-23 journey and build expertise and knowledge even more.

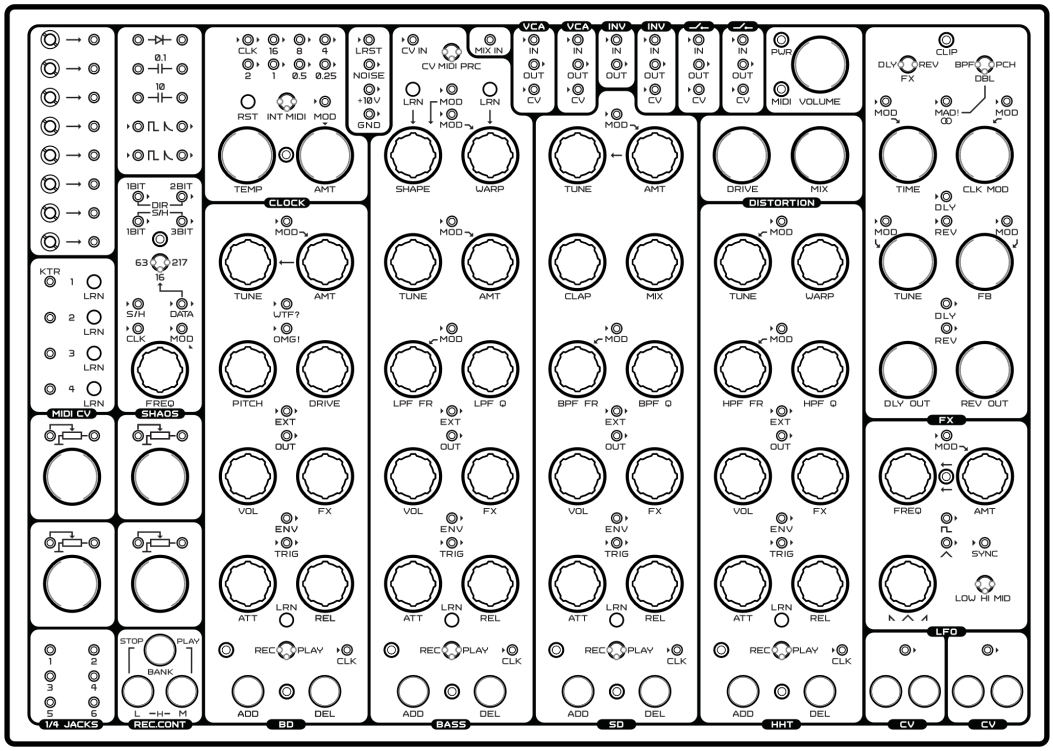
Pulsar-23 Notes

8 Technique

Patch Name: _____

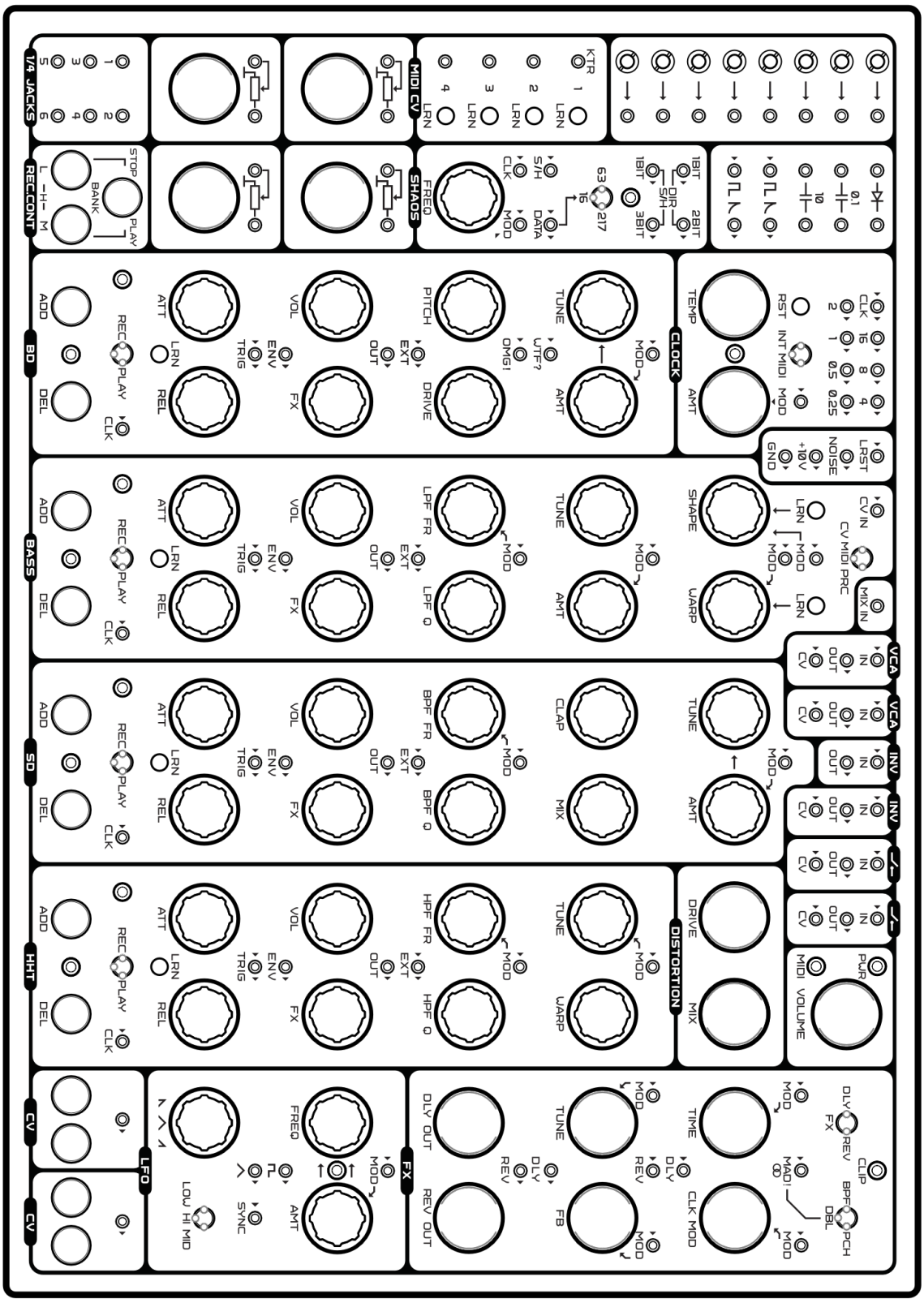


Patch Name: _____

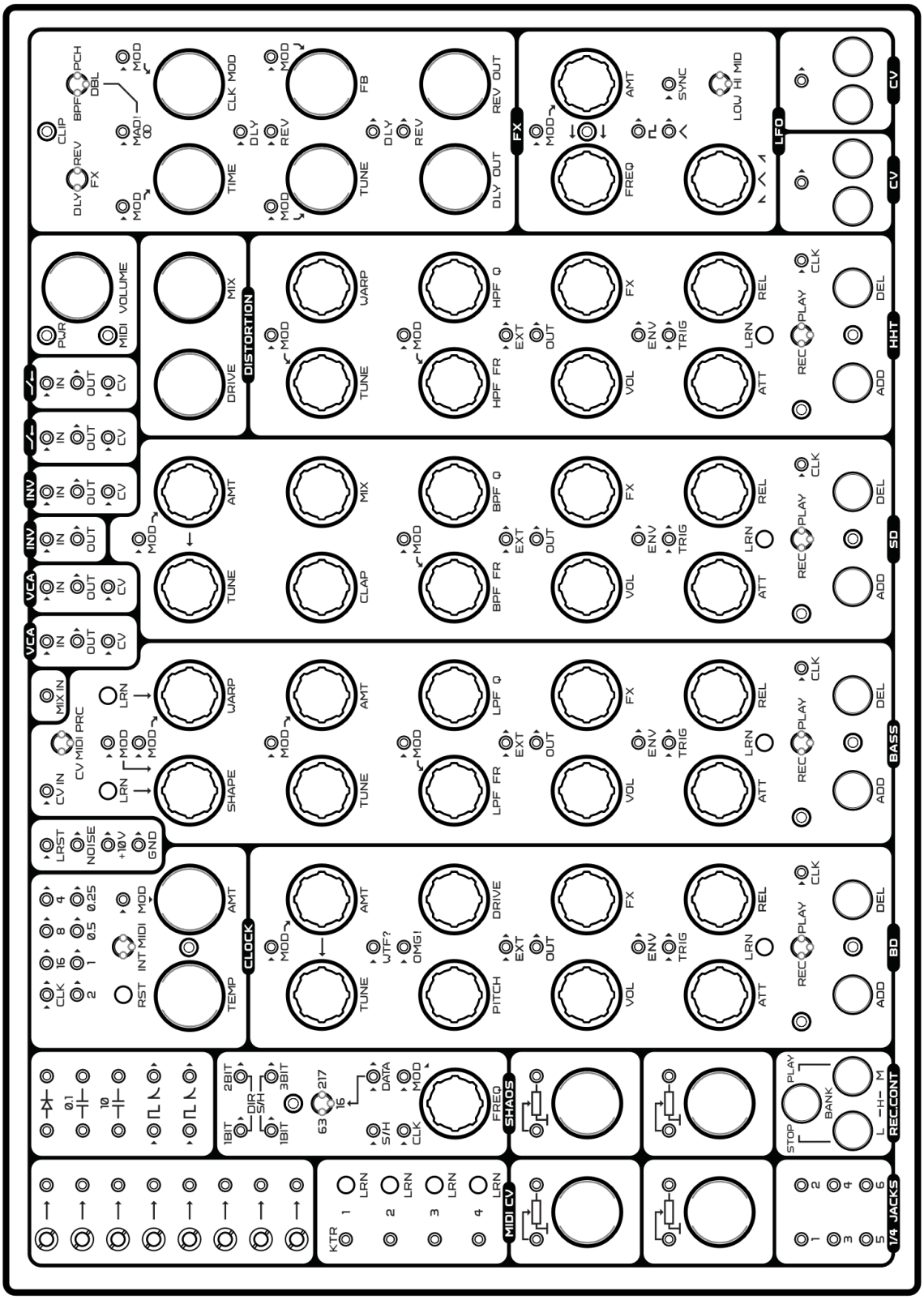

CLOCK
CLK
16
8
4
2
1
0.5
0.25
RST
INT MIDI
MOD
TEMP
AMT
LRST
NOISE
+10V
GND
CV IN
MIX IN
CV MIDI PRC
LRN
MOD
SHAPE
WARP
VCA
IN
OUT
CV
INV
PUR
MIDI
VOLUME
CLIP
DLY
REV
FX
BPF
PCH
DBL
TIME
CLK MOD
MAD!
DLY
FB
DLY OUT
REV OUT
FX
DISTORTION
DRIVE
MIX
TUNE
AMT
WTF?
OMG!
PITCH
DRIVE
CLAP
MIX
WARP
LPF FR
LPF Q
BPF FR
BPF Q
HPF FR
HPF Q
EXT
OUT
VOL
FX
ENV
TRIG
ATT
LRN
REL
REC
PLAY
CLK
ADD
DEL
BD
BASS
SD
HHT
MIDI CV
KTR
1
2
3
4
LRN
SHAPES
1BIT
2BIT
DIR
S/H
3BIT
63
217
16
DATA
FREQ
LFO
SYNC
LOW HI MID
1/4 JACKS
REC.CONT
STOP
PLAY
BANK
L
H
M
CV

8 Technique

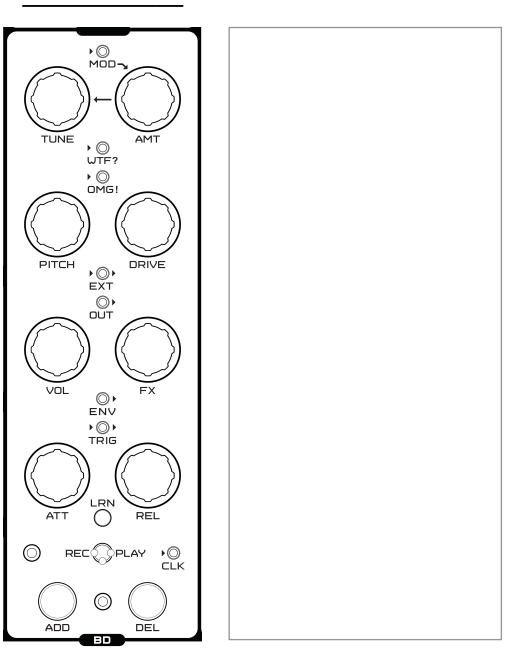
Patch Name: _____

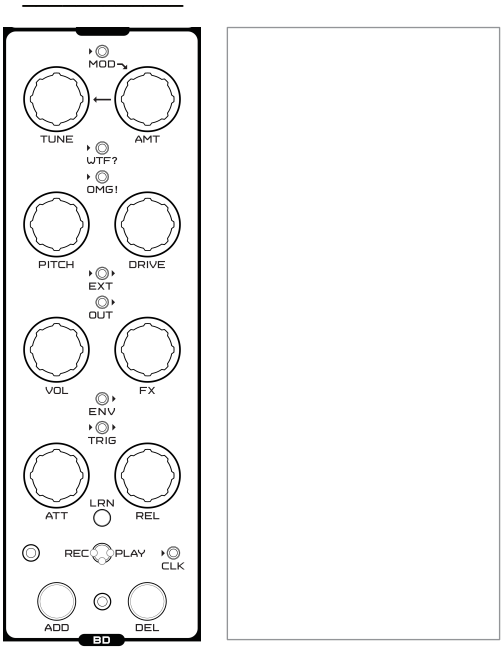


Patch Name: _____

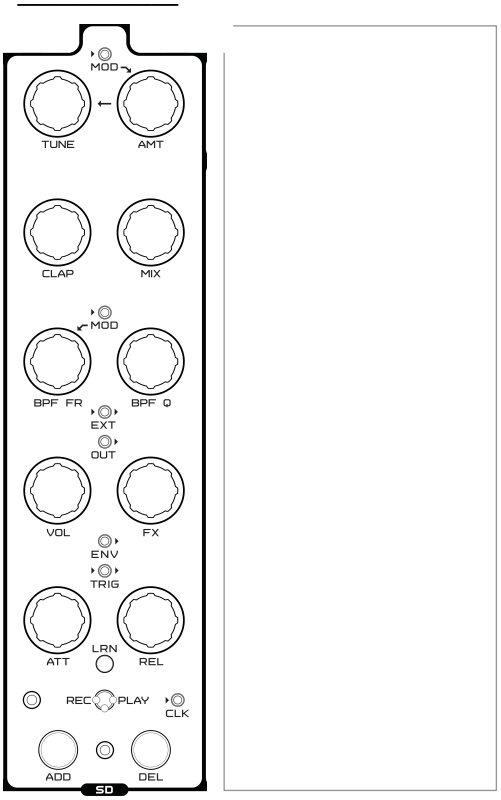

1/4 JACKS
RECCONT
MIDI CV
SHAOS
FREQ
CLOCK
TEMP
SHAPE
BASS
TUNE
PITCH
LPF FR
LPF Q
BD
VOL
ATT
REL
ADD
DEL
SD
BPF FR
BPF Q
CLAP
MIX
HHT
HPF FR
HPF Q
WARP
DISTORTION
DRIVE
FX
TIME
FB
DLY OUT
REV OUT
LFO
FREQ
AMT
SYNC
VCA
INV
CV
MIDI VOLUME
PWR
CV IN
LRST
NOISE
GND
REC
PLAY
STOP
BANK

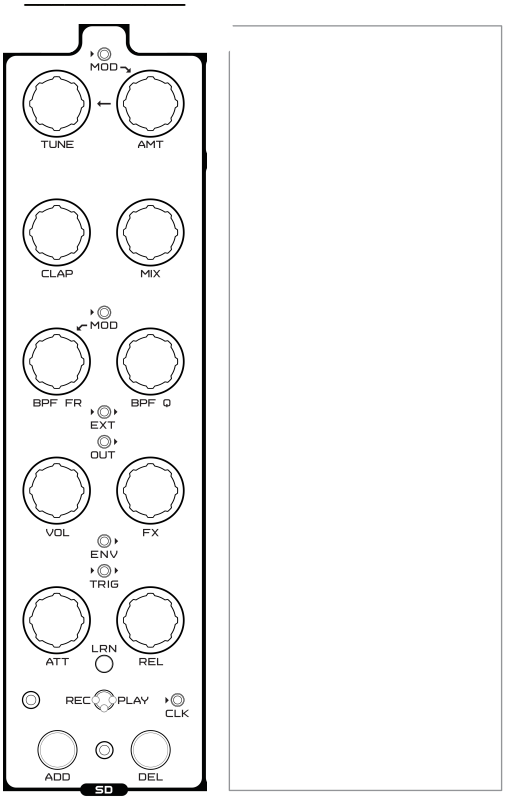
BD Bass Drum Sounds



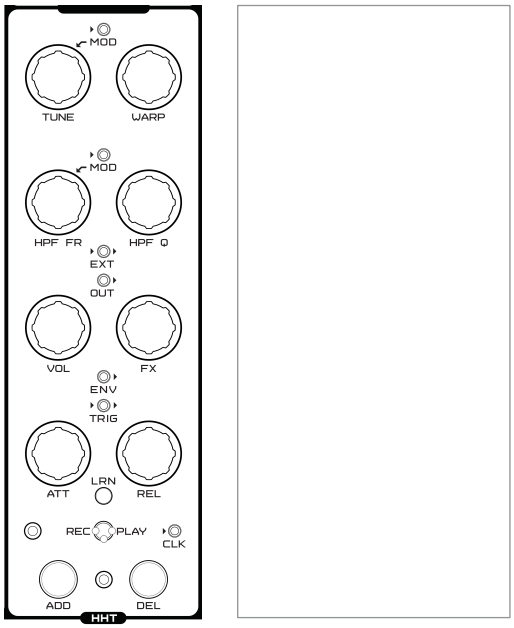


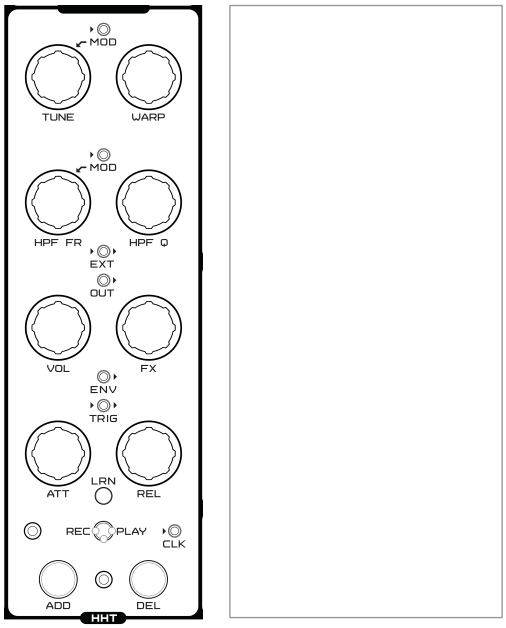
SD Snare Drum Sounds



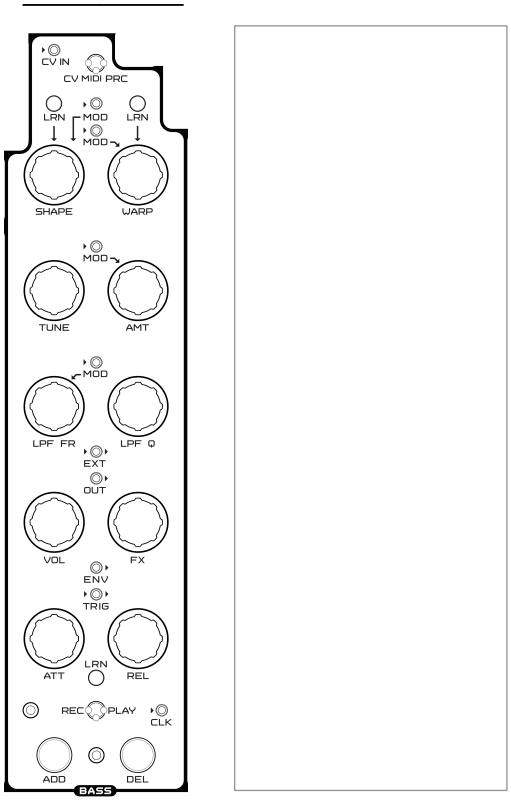


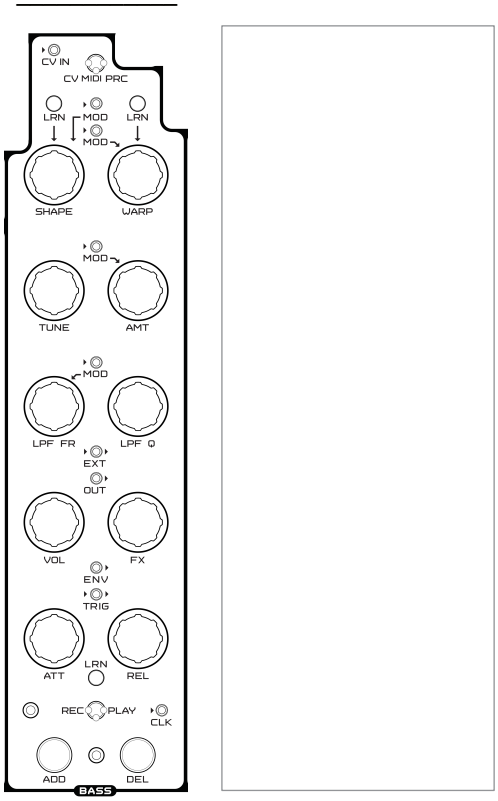
HHT Hi Hat Drum Sounds





BASS Sounds





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Produced in the United Kingdom

Version 1.0 July 2022 - SOMA Pulsar-23

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