advanced SID chip emulation / MBSID v2 based sound engine / 6x LFO / 8x MOD / 2x ENV / 4x WAVESEQ / 3x ARP / 24x14 trigger matrix / phybus instrument clusters / UI cooperation / 12x poly chain option / MIDI option

zetaSID

expandable modular SID synthesizer voice

USER MANUAL

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Table of contents

Table of contents **1**
1. Welcome to zetaSID! **5**
2. Specifications **6**
3. Features **6**
4. Quickstart **7**
5. Connections **8**
5.1 Eurorack power 8
5.2 phybus 8
6. Front panel features and ports **9**
7. Interacting with zetaSID **10**
7.1 Sound structure overview 10
7.2 Menus and editing 10
7.3 Play a lead, bassline or drum engine voice 10
7.4 Modulation, splicing and subscription 11
8. Splicing and subscription over phybus **11**
8.1 Definitions 12
8.1.1 Virtual and physical connections 12
8.1.2 Stream and port types 12
8.1.3 LEDome indication 12
8.2 Splicing 13
8.3 Input sockets 14
8.3.1 Select input socket 14
8.3.2 Input socket activity indicator 14
8.3.3 Connect port or service to input socket 15
8.3.4 Configure input socket 15
8.4 Output sockets 17
8.4.1 Select output socket 17
8.4.2 Output socket activity indicator 17
8.4.3 Connect output socket to port 18
8.4.4 Configure output socket 18
9. Session **19**
10. Patch **20**
10.1.1 Patch select 20
10.1.2 Link mode 21
10.1.3 Instrument ID 21
10.1.4 Polyphony mode 21
10.1.5 Unison detune 21
10.1.6 Legato mode 22
10.1.7 Glide mode 22

10.1.8 Init patch 22
10.1.9 Edit patch name 22
10.1.10 Save patch 22
10.1.11 ASID mode 23
11. Lead engine 23
11.1 Oscillators (OSC) 23
11.1.1 Select oscillators 23
11.1.2 Waveform selection 23
11.1.3 Transpose 24
11.1.4 Finetune 24
11.1.5 Oscillator sync 24
11.1.6 Ring modulation 24
11.1.7 Delay/attack/decay/sustain/release (DADSR) 24
11.1.8 Pitchbend range 24
11.1.9 Portamento rate 24
11.1.10 Portamento type 25
11.1.11 Pulsewidth 25
11.1.12 Gate hold 25
11.1.13 Detune 25
11.2 Filter 25
11.2.1 Oscillator channel routing to filter 25
11.2.2 Filter cutoff frequency 25
11.2.3 Filter resonance 26
11.2.4 Filter mode 26
11.2.5 Filter key tracking 26
11.2.6 OSC 3 out 26
11.2.7 Filter interpolation 26
11.3 Arpeggiators (ARP) 26
11.3.1 ARP routing 26
11.3.2 ARP enable 27
11.3.3 ARP direction 27
11.3.4 ARP clock divider 27
11.3.5 ARP gate length 27
11.3.6 ARP octave range 27
11.3.7 ARP sorted 27
11.3.8 ARP latch 27
11.3.9 ARP clock sync 27
11.3.10 ARP constant cycle 28
11.3.11 ARP easy chord 28
11.4 LFO 28
11.4.1 LFO selection 28
11.4.2 LFO enable 28

11.4.3 LFO depth 28
11.4.4 LFO rate 29
11.4.5 LFO delay 29
11.4.6 LFO phase 29
11.4.7 LFO waveform 29
11.4.8 Clock sync 30
11.4.9 LFO oneshot 30
11.5 Envelopes (ENV) 30
11.5.1 ENV select 31
11.5.2 ENV depth 31
11.5.3 ENV delay 31
11.5.4 ENV attack/decay/sustain/release 31
11.5.5 ENV attack/decay/release curve response 31
11.6 Modulators (MOD) 32
11.6.1 MOD select 32
11.6.2 MOD source 1/2 32
11.6.3 MOD operator 32
11.6.4 MOD depth 33
11.6.5 MOD targets 34
11.6.6 MOD invert target 1/2 34
11.7 Trigger matrix 34
11.7.1 Select event source 35
11.7.2 Select target 35
11.8 Wave sequencer (WS) 36
11.8.1 Select wave sequence 36
11.8.2 Clock divider 36
11.8.3 Stereo channel assignments 36
11.8.4 WS target 37
11.8.5 WS start/end/loop position 38
11.8.6 MOD to WS position 38
11.8.7 Note to WS position 39
11.8.8 WS oneshot 39
11.8.9 WS editor 39
11.8.10 Special WS targets 39
12. Bassline engine 42
12.1 Oscillator page 43
12.1.1 OSC1 (master oscillator) 43
12.1.2 OSC2 and OSC3 (sub-oscillators) 44
12.2 Sequencer page 44
12.2.1 Sequencer controls 44
12.2.2 The Step Grid 46
12.3 LFO page 46

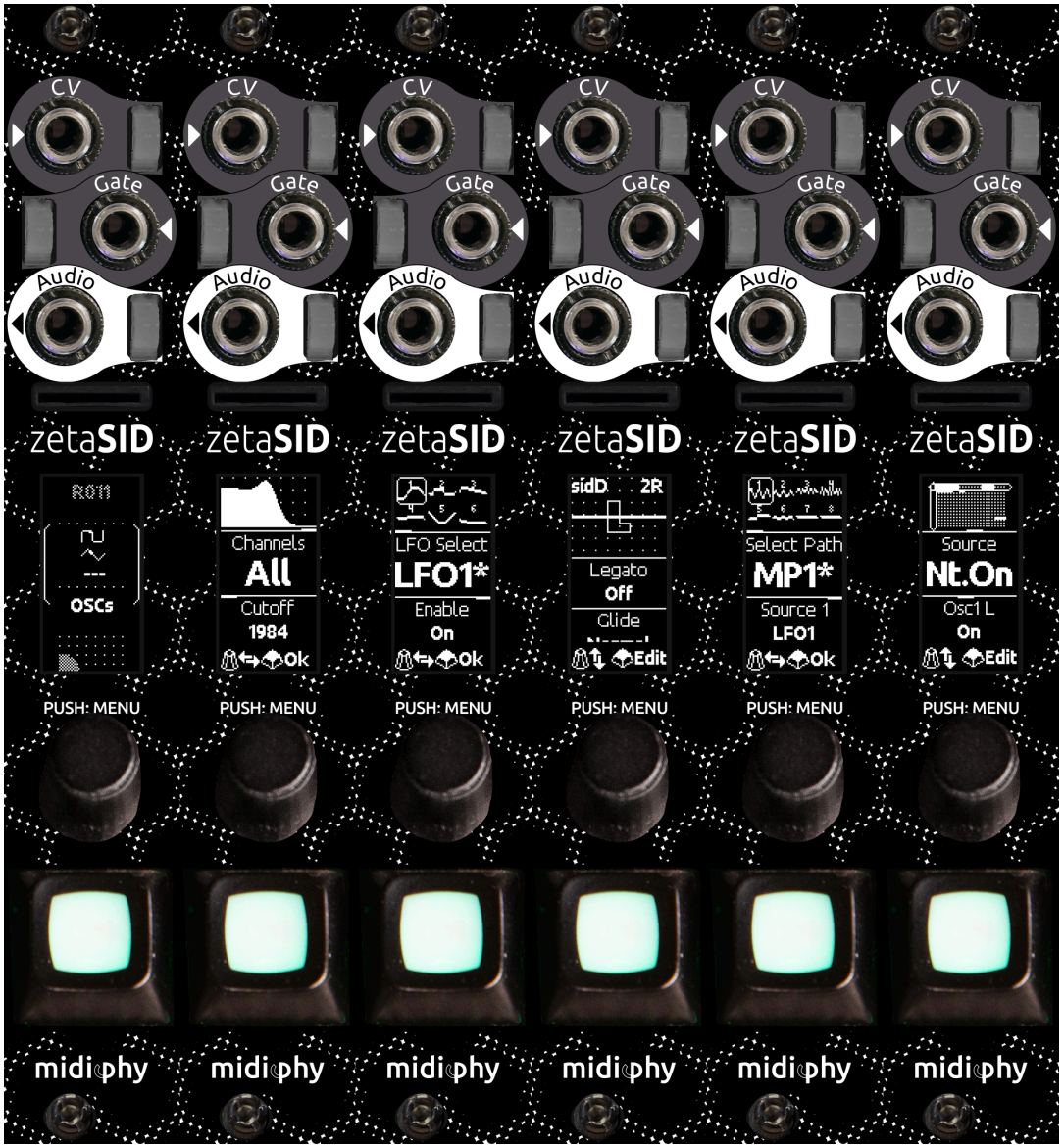
12.4 Envelope page 47
12.5 Eurorack clock and CV integration 48
12.5.1 SEQ STEP 48
12.5.2 SEQ RESET 48
12.5.3 SEQ PATTERN 48
13. Drum engine 49
13.1 Drums 49
13.1.1 Select drum 49
13.1.2 Assign voice 49
13.1.3 Select model 50
13.1.4 Attack/decay/sustain/release 50
13.1.5 Tune 50
13.1.6 Drum gate length 50
13.1.7 Speed 50
13.1.8 Extra parameter 51
13.1.9 Attenuate 51
13.1.10 Velocity target 51
14. Setup 51
15. What's New/Changelog 53
APPENDIX A: ROM Patchbank 54
APPENDIX B: Using the zetaSID web editor 55
APPENDIX C: Firmware updates 57
APPENDIX D: Acknowledgements 58

1. Welcome to zeta**SID**!

zetaSID is a small but powerful 4HP synthesizer voice that goes above and beyond classic SID sounds. Choose from an extensive selection of built-in patches or edit a voice with subtle to wild parameterisation and modulation.

If mono voices aren't enough, extend zetaSID with phybus: a behind-the-scenes digital network that links and controls multiple modules. Up to twelve zetaSIDs can comprise a phybus instrument cluster for six stereo voices of polyphony.

Interact with zetaSID using a CV/gate interface, a high-contrast OLED display along with other high-quality hardware elements. Go beyond standard CV/gate control of zetaSID by connecting nexusMIDI or other expanders (available separately) into a phybus network. zetaSID also supports ASID compatible SID-file playback over MIDI.



2. Specifications

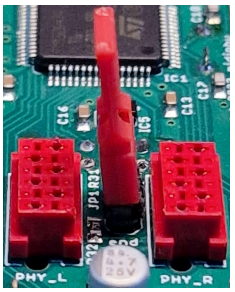
- Width: 4HP
- Case depth required: 30mm (with cable)
- High-quality milled aluminium frontpanel (no PCB material)
- Power connector: standard eurorack +/–12V 10-pin IDC
- Power requirements:
    - +12V: 120mA
    - –12V: 15mA
    - 5V: 0mA/not required
- Storage (optional): µSD card 10/A1 or faster; FAT32 format
- Maximum instrument cluster size: 12 zetaSID units (6 stereo voices)
- Physical inputs (for classic patching):
    - CV input: –5V to +5V or 0 to 10V (configurable)
    - Gate/trigger input: nominal +5V gate/trigger standard
- Physical outputs (for classic patching):
    - Audio output (eurorack level audio)
- Phybus input sockets (for virtual patching):
    - MIDI: MIDI In 1, 2
    - Gate: Note Gate
    - Trigger: Drum Trigger 1, 2, 3, 4, SEQ step, SEQ rst
    - CV: Note Pitch, LFO1 depth, Filter cutoff, SEQ pat
- Phybus output sockets (for virtual patching):
    - MIDI: MIDI Out
- Maximum phybus network size: 16 modules
- Maximum total phybus cable length: 150 centimeters

3. Features

- Advanced SID lead engine: sculpt three oscillators with a plethora of filter options, LFOs, modulators, envelopes, an extensive trigger matrix and more
- Sequenced bassline engine: SID acid for the win! :-)
- Access up to 16 lo-fi SID drum sounds in a single drum engine patch
- Noise-free SID sound chip emulation
- Stereo sound engine design: chain two zetaSIDs linked via phybus for true stereo voicing supported by all engines
- Stereo voice polychaining: link up to twelve zetaSID modules in a phybus network for up to six lead engine stereo voices
- Unison mode: link and detune multiple zetaSIDs to create fat sounds
- Screen-per-function editing with OLED display and signature midiphy hardware
- User interface collaboration: delegate specific editing tasks to dedicated units
- ROM bank with more than 100 hand-selected and optimized preset patches
- Advanced features and expansion:
    - Independent arpeggiator per oscillator

- Integrated wave sequencer: progressive animation of sound parameters
- MIDI input and output through nexusMIDI expanders (available separately)
- phybus network connectivity: reassign ports and route control signals
- Save and load sessions and patches to micro SD card (available separately) with total recall capability

4. Quickstart



1. Make the appropriate connections and screw into a rack
   a. Add phybus cables between modules (skip if there is only one module)
   b. Place exactly two bus termination jumpers: one on the first and one on the last module of a chain
   c. Plug in IDC Eurorack power cables
2. Usage example: attach cables to ports
   a. 1V/oct CV source to CV In
   b. Gate source to Gate In
   c. Audio out to a mixer or output module

3. Power up and play or sequence in notes with CV/gate
4. Turn the encoder knob to scroll through the ROM bank, exploring preset patches
5. Select patch "R010 Acid Blob"
6. Enter the menu by pressing the encoder knob
7. Navigate to the filter page by turning the encoder knob
8. Press the key to enter the filter menu
9. Scroll to the "Cutoff" submenu
10. Press the key and modify cutoff value by turning the encoder knob
11. After setting the cutoff frequency, press the key again to jump back to the filter submenu
12. Press the encoder knob to jump back to the main menu
13. Navigate to the ARP screen
14. Scroll through the settings and set Arpeggio to on
15. Set Octaves to 3
16. Play or sequence in notes with CV/gate to hear the arpeggiated sound
17. Push the encoder to navigate back to the menu system and explore the other sections.

18. Insert a microSD card to automatically save your current session, allowing you to continue your work when you next power up your modular system. (Note: patches need to be saved manually on the SD card after they were edited)

Enjoy your zeta**SID**!

5. Connections

5.1 Eurorack power

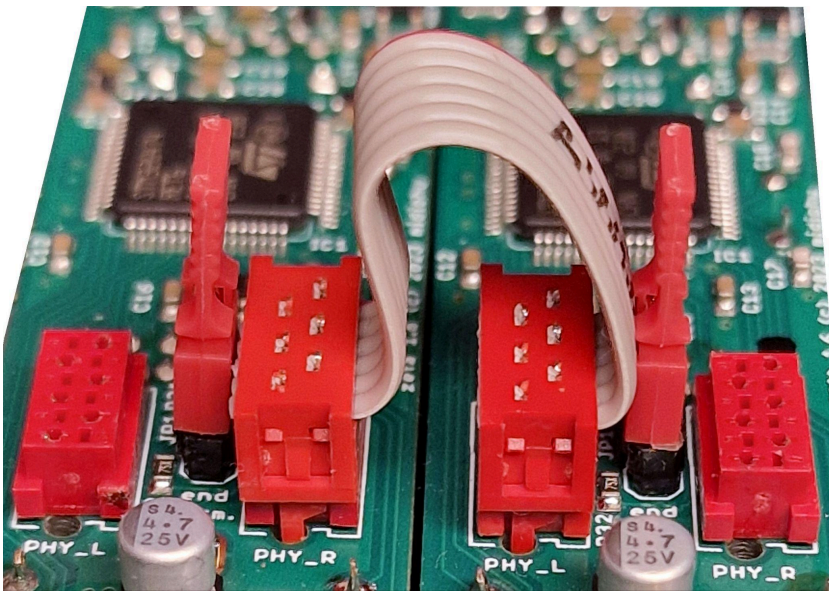
- Standard 10-pin header with –12V indicated using the red stripe
- The module is protected from reverse polarity, but it is still recommended to make all connections with the rack power switched off
- 5V bus power is not required

5.2 phybus

The midiphy phybus system is a high-speed, expandable data protocol for low-latency routing of data streams, MIDI and CV/gate conversion: connected modules can interact to share user interface control elements and virtual services.

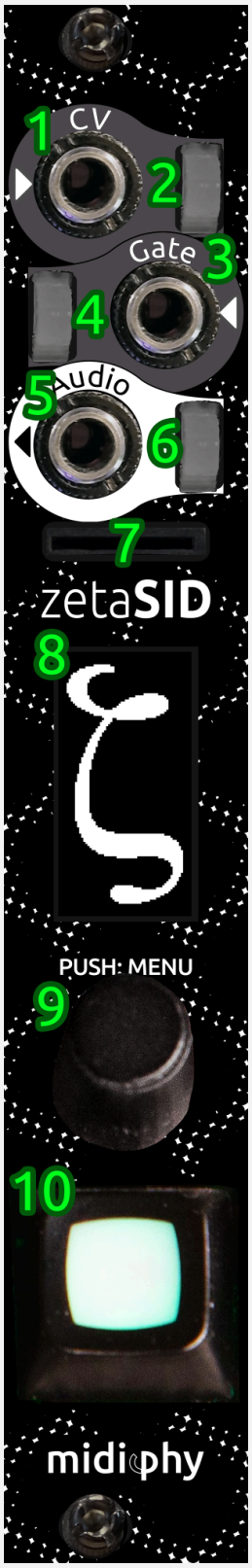
Connect as follows:

- Daisy-chain adjacent modules using a six-conductor phybus ribbon cable from PHY_L to PHY_R
    - Consider making all phybus connections before connecting to power and screwing the modules into the rack
- Leave the outer PHY_L and PHY_R connectors empty
- Place a total of two termination jumpers on the two-pin “end term.” headers
    - Only the outer (two) modules of a network should be terminated
    - Don’t place the jumper for internal modules
    - If additional modules are added, remove all jumpers except for those located on the two modules at the ends of the chain
- Don’t use the phybus headers for any other purpose



(empty) — terminator — phybus cable — terminator — (empty)

6. Front panel features and ports



1. CV in local port
   - Range: –5V to +5V or 0 to 10V
     (configure via the setup screen)
   - Default: 1V/oct scaling
     (configure scaling, quantization, offsets via the input socket screen)
2. CV in LEDome
   - Press to splice this physical input port to a compatible input socket on your phybus network
   - Default: spliced to the **Note Pitch** input socket
3. Gate in local port
   - Accepts nominal +5V gate signals
   - Default: spliced to the **Note Gate** input socket
4. Gate in LEDome
   - Press to splice this physical input port to another compatible input socket on your phybus network
5. Audio out local port
   - zetaSID audio output
   - outputs eurorack level audio, **do not directly attach headphones to the 3.5mm audio output port**
6. Audio out configuration LEDome
   - Press to configure the audio output
7. MicroSD card slot
   - Use FAT32 formatted cards
8. OLED
   - Shows the local user interface - expand with more zetaSIDs via phybus to grow the available user interface
9. Encoder with pressable knob
   - Press to enter the menu
   - Turn to change parameters
   - Push-and-hold while turning to accelerate parameter inputs, i.e. to perform a faster filter sweep
10. Illuminated mechanical key, referred to as “key”
    - Press to enter the currently selected menu item or to edit the currently selected parameter or setting

7. Interacting with zeta**SID**

7.1 Sound structure overview

- A session (see chapter 9) holds all performance state like CV routing, MIDI configuration and phybus splices, as well as links to the active patch
- A patch (see chapter 10) is using one of the engines (Lead, Bassline or Drum)
- The engines (see chapters 11-13) have different individual features and capabilities to make best use of the emulated SID chip characteristics for the engine usecase

7.2 Menus and editing

- When in the menu or in a screen, turn the encoder to navigate between screens and to select parameters
- Press the key to enter the selected screen or to start editing the selected parameter
    - Active editing is indicated by a larger font size and animated lines
    - Turn the encoder knob to adjust the active parameter
    - Push and turn the encoder knob to accelerate inputs while editing a parameter
    - Press the key to confirm the change and stop editing the active parameter
- Return to the main menu by pressing the encoder knob
    - Nested screens require two presses to return to the main menu

7.3 Play a lead, bassline or drum engine voice

- Lead engine
    - Use CV/gate local ports
        - Note pitch/CV for tuning: 1V/oct (0V = C3)
        - Note gate to fire the SID output amplifier envelope
    - Use MIDI
        - Requires additional phybus MIDI capable module, e.g. nexusMIDI, splice by pushing the MIDI IN LEDome button and assign to the virtual MIDI In 1 or 2 input.
- Bassline engine
    - Use CV/gate local ports
        - Splice a phybus gate input port by pressing the nearby LEDome button and assign it to the SEQ step input socket to be able to progress bassline sequence steps with an external eurorack clock
        - Optional: splice a phybus gate input port by pressing the nearby LEDome button and assign it to the SEQ rst input socket to be able to externally reset the sequence progression to step 0

        - Optional: splice a phybus CV input port by pressing the nearby LEDome and assign it to the SEQ pat input socket to be able to select the local bassline pattern number with an external control voltage
    - Use phybus based MIDI notes C3–G3 and C4-G4 to launch left- and right-channel bassline sequence patterns
        - Requires additional phybus MIDI capable module, e.g. nexusMIDI: splice by pushing the MIDI IN LEDome button and assign to the virtual MIDI IN 1 or 2 input socket. Note: the zetaSID MIDI input sockets can sync to an external MIDI clock master to be able to synchronize the bassline sequence progression to it - or set their own tempo - in absence of an upstream MIDI master clock
- Drum engine
    - Use CV/gate local ports (see above)
    - Use virtual trigger 1–4 input sockets
        - Splice one or more phybus gate input ports by pressing their nearby LEDome buttons and assign them to the Drum trig 1-4 input sockets
    - Use phybus based MIDI notes C3–D#4 to trigger drums 1–16
        - Requires additional nexusMIDI module, splice by pushing the MIDI IN LEDome button and assign to the virtual MIDI In 1 or 2 input

7.4 Modulation, splicing and subscription

- Use internal modulators, i.e. LFOs and the MOD matrix to achieve complex internal modulation without requiring any external modules (see dedicated chapters)
- External modulation (also see next chapter): repurpose any spare ports on phybus connected modules (press port LEDome buttons and assign)
    - Splice CV ports from other modules (using LEDome buttons)
    - Splice MIDI ports (using LEDome buttons)
    - Subscribe to broadcasted phybus data streams from other modules (via the inputs menu)

8. Splicing and subscription over phybus

All phybus-equipped modules may interact, sharing ports and datastreams to create a powerful inter-connected network.

A virtual connection between a physical port and any module on the network is established by creating a splice between them. Voltage or data received at the port is then used to control the remote modules without using physical patch cables. Likewise, data produced by a module may be spliced to an output port and used elsewhere within the modular system.

Some modules may also offer logical services (not based on a physical input or output port) that other modules may subscribe to.

8.1 Definitions

8.1.1 Virtual and physical connections

Term	Description
Local	Module on the phybus network that is the current point of focus
Remote	Module on the phybus network that is distal from the local module
Stream	Network data broadcasted/subscribed to or flowing to/from a port
Port	Physical connector e.g., DIN, 3.5mm
Socket	Virtual location that transmits or receives a stream
Splice	Connection or action that interfaces a socket with a port
Service	Provides data that other modules may subscribe to
Subscription	Action that interfaces a service with an input socket

8.1.2 Stream and port types

Symbol	Type	Description
∿	CV	CV or high-resolution service
⎍	Gate	Active with an indefinite duration
⊥	Trigger	Active with a fixed duration
♫	MIDI	Notes, clock, controllers, modulators, sysex

8.1.3 LEDome indication

Colour	Indicates
Warm white	Port is unused and available for splicing, flashes with port activity
Cool white	Splice process started with this port (blinks momentarily)
Off	Port is spliced and in use, but is idle or voltage is near 0V
Green	Voltage 0 to +10V, brightness scales with positive voltage

Colour	Indicates
Red	Voltage –10 to 0V, brightness scales with negative voltage
Orange	Gate
Cyan	Trigger
Blue	Audio +/– up to 10V p–p, brightness scales with output level

8.2 Splicing

1. Port type (**MIDI**)
2. Associated source global stream name (**in 03**)
3. Associated module name and enumeration (**midiA** = first nexusMIDI)
4. Connection established indicator
5. Local socket if connected, or clear/cancel commands
6. Encoder knob and key action legend

- To start splicing, press an LEDome adjacent to a local or remote physical port
- All OLEDs on the phybus network display the splice screen
- Turn the encoder knob on the selected module to associate the port with a compatible socket
- Press the key to confirm connection of the splice
    - The LEDome next to the physical port flashes white to indicate that it is selected
- Continue to create splices as required
    - One port may be spliced to multiple sockets
- Choose the cancel option to abort the operation and return to the previous screen
- Choose the clear option to disconnect a port
- Query an actively spliced port by pressing the corresponding LEDome
    - All modules that associate with that port display the established connections
    - Clear splices if desired

8.3 Input sockets

View and configure the input sockets that receive voltage or data signals from local or remote ports on a phybus network, or subscribe to services offered by modules.

1. Current session number
2. Currently selected input socket and connected source port type, stream name and source module name
3. Next input socket

8.3.1 Select input socket

- Scroll through the available input sockets by turning the encoder knob
- Configure an input socket by pressing the key
  - Press the encoder knob to exit the input socket configuration screen
  - Press again to exit to the main menu

8.3.2 Input socket activity indicator

1. Input socket name
2. Socket activity (varies by socket)
3. Stream type and direction indicator (from/to)
4. Source stream name
5. Source module name

Input socket	Stream type	Activity indicators
MIDI In 1, 2	♫	• Note • Clock • CC • Pitchbend • SysEx
Note Gate	⎍	• Gate (triggers lead engine playback)
Trig 1–4	⊥	• Drum trigger status

Input socket	Stream type	Activity indicators
SEQ step	⊥	• Pattern step progression status
SEQ rst	⊥	• Pattern step reset status
Note Pitch	∿	• Graphical • Voltage • Nearest quantised note
LFO1 depth	∿	• Graphical • Voltage • Applied depth setting
Filter cutoff	∿	• Graphical • Voltage • Applied filter cutoff setting
SEQ pat	∿	• Graphical • Voltage • Selected bassline pattern 1-8

8.3.3 Connect port or service to input socket

- Scroll through the available ports or services by turning the encoder knob
  - For ports: the LEDome associated with the port illuminates
  - For services: the broadcasting module provides a notification
  - Clear an input socket by selecting "---"
- Confirm by pressing the key

Note: pressing the LEDome associated with a port creates an equivalent splice to a socket.

8.3.4 Configure input socket

Input socket	Configuration options

MIDI In 1, 2	• MIDI channel
	  ○ Omni
	  ○ 1–16
	• Velocity
	  ○ On: scales output DCA
	  ○ Off (default): notes played at full velocity
	• Program Changes Received
	  ○ On: receives MIDI program changes (and CC#32 bank select: 0: bank R (ROM patches), 1-7: bank A-H)
	  ○ Off (PC messages ignored on this socket)
	• Clock
	  ○ Auto (default): incoming clock overrides internal clock

Input socket	Configuration options
	○ Agent: waits for incoming clock ■ Never uses internal clock ○ Chief: ignores incoming clock ■ Always uses internal clock ○ Chief BPM (auto/chief clock; default 120) ■ Choose BPM
Note Gate	• Invert (default off)
Trig 1–4	• Target (drum 1-16)
SEQ step	• Reset After: timeout, before the pattern step position is reset to "0" (default: 3 seconds) - if no clock pulse arrives within this time, the clock is assumed to have been stopped, restarting at pattern step position 1 when the next clock pulse arrives
SEQ rst	• None (always resets the pattern step position to 1, when a trigger pulse is detected)
Note Pitch	• Scale ○ Range (default 100%): –200% to +200% ■ Negative values invert the signal • Octave ○ Range (default 0V = C3): 1V steps • Transpose ○ Range (default 0V): 1/12V steps (semitones) • Finetune ○ Range (default 0): –100 to +100 cent • Quantise to semitone
LFO1 Depth	• Scale ○ Range (default 100%): –200% to +200% ■ Negative values invert the signal • Offset ○ Range (default 0V): 1V steps • Trim ○ Range (default 0V): 1/12V steps
Filter Cutoff	• Scale ○ Range (default 100%): –200% to +200% ■ Negative values invert the signal • Offset ○ Range (default 0V): 1V steps • Trim ○ Range (default 0V): 1/12V steps
SEQ pat	• Scale ○ Range (default 100%): –200% to +200%

Input socket	Configuration options
	■ Negative values invert the signal • Offset ○ Range (default 0V): 1V steps • Trim ○ Range (default 0V): 1/12V steps

8.4 Output sockets

View and configure the output sockets that send voltage or data signals to local or remote ports on a phybus network.

1. Current session number
2. Currently selected output socket
3. Next output socket

8.4.1 Select output socket

- Scroll through the available output sockets by turning the encoder knob
- Configure an output socket by pressing the key
  - Press the encoder knob to exit the output socket configuration screen
  - Press again to exit to the main menu

8.4.2 Output socket activity indicator

1. Output socket
2. Socket activity (varies by socket)
3. Currently selected socket option: audio output gain adjustment

Output socket	Stream type	Activity indicators
MIDI Out	♫	• Note (for arpeggio forwarding)

		• SysEx - truncated (for use with a remote SysEx controller)
Audio	None	• Output Audio Scope • Automatic audio limiter level (avoids clipping)

8.4.3 Connect output socket to port

- Scroll through the available ports by turning the encoder knob
  - The LEDome associated with the port flashes white
  - Clear an output socket by selecting "---"
- Confirm with the key

Note: pressing the LEDome associated with a port creates an equivalent splice from a socket.

8.4.4 Configure output socket

Output socket	Configuration options
MIDI Out	• MIDI channel (1-16) • Send ARP (forward arpeggio notes to MIDI output) • Reset to defaults
Audio	• Base Gain (default "Low"): 0 to +24 dB output gain, affected by automatic audio limiter to avoid clipping • Reset to defaults

9. Session

A session represents the complete state of zetaSID: it links to the currently active patch and holds all performance and routing state around it, plus module-wide settings such as MIDI and CV configuration/splicing.

zetaSID stores up to 100 sessions on a microSD card (available separately). If configured, it can broadcast a session switch operation to other modules on the phybus network. As loading a session recalls a previous state, this allows for instant reconfiguration of patches and splices on all phybus modules.

1. Session selector
2. Active session

To initialize a session:

- Turn the encoder knob so that the selected and active session numbers show the same value
- Press the key to initialize the session - this will reset the session to its
    - default patch settings
        - Link mode
        - Polyphony mode
        - Instrument ID
    - default input and output socket options

To switch a session:

- Turn the encoder knob to select another session number
- Press the key to save the active session and switch to the selected session
    - Sessions are also saved continuously in the background
- Alternatively, insert another microSD card to load the most recent session on that card

Note: if you are using multiple zetaSIDs to increase voice polyphony and if you are happy with the default input and output socket options for each module, it is sufficient to use only a single microSD card: configure one module as a **Chief** (see next section) and store all patch data on the microSD card of that node. All other nodes will by default become **Agents** after startup, when no local SD card is present and when a **Chief** is detected.

10. Patch

Inside the session sits the active patch: one sound, using one of three engines (described in the following chapters).

The patch screen allows manipulation of patches and is shown after startup, with the "patch select" command activated.

1. phybus name of this module (sidD)
2. Polyphony
   - number (2)
   - stereo channel (R) of this module
3. Oscilloscope view of the current audio output
4. SID patch engine type
   - L (lead)
   - B (bassline)
   - D (drum)
5. Active command
6. Patch name
7. Editing indicator: animated when modifying a parameter or command
8. Encoder knob and key action legend

zetaSID automatically creates a PATCHES folder within the root directory of a fresh microSD card. Saved patches take the following form:

A123 - Patch Name.syx

- The first letter (A-H) corresponds to user patch bank 1-8
- Three digits designate the patch number within the bank (up to 127)
- The patch name is spelled out in plain text
- The .syx extension

On an external device, transfer downloaded patches into the PATCHES folder on the microSD card, ensuring that they follow the naming convention above.

Backup patch data regularly!

10.1.1 Patch select

- Load new patches from user banks A–H or ROM bank R

- If configured as chief (see link mode), this zetaSID transmits patch changes to all connected link mode agents
- The active patch is stored in the current session

10.1.2 Link mode

- Off: standalone operation
- Chief: facilitates storing, loading, polyphony mode, name and initialisation of the shared patch
    - In chief mode, the number of peer agents is listed
    - Only one chief can be configured per instrument cluster
- Agent: follows the chief regarding patches, polyphony modes, etc.
    - In agent mode, the name of the chief module is listed
- The selected link mode is stored in the current session

Note: chiefs and agents must be configured with the same instrument ID to link up to a polyphonic instrument cluster (see Section 10.1.3).

10.1.3 Instrument ID

- Range: 0–15
- Agents with the same instrument ID load the same patch and expand the polyphony
    - Modules configured with different IDs (or with link mode switched off) can load a different patch
- IDs are stored in the current session
    - Configure and switch sessions to instantly re-partition an instrument cluster into different voicing or engine types

10.1.4 Polyphony mode

- Indicates the current polyphony, limited by the total number of zetaSID modules within an instrument cluster and the voice mode
    - The maximum polyphony count is six for both stereo and mono operation
        - Stereo operation assigns two zetaSID modules per voice
    - Define an instrument cluster by assigning one chief and the desired number of agents
- The following voice modes are available
    - Unison
    - Stereo
    - Mono
- The selected polyphony mode is stored in the current session

10.1.5 Unison detune

- Spreads the pitch of multiple zetaSIDs operating in unison voice mode
- The selected unison detune value is stored in the current session

10.1.6 Legato mode

- On: sends a gate-off only when all notes are released (typically only relevant for MIDI notes or ORed gate sources)
- Off: sends a gate off when a note is released regardless of any held notes
- The selected legato mode value is stored in the patch

10.1.7 Glide mode

- Normal: active if configured within oscillator portamento rate
- SusKey: active only if the second note is played before the previous note is released
- The selected glide mode value is stored in the patch

10.1.8 Init patch

- Hold the key for two seconds to reset parameters to a generic starting point
- Tap the key to exit
- Turn the encoder knob to choose the SID engine type
  - L: lead engine
  - B: bassline engine
  - D: drum engine
- Initialising a patch deletes the current patch
  - Save the current patch if required (see section 10.1.10)

10.1.9 Edit patch name

- Turn the encoder knob to select a different letter
- Press and turn the encoder knob to adjust the cursor position
  - Acceleration is not active for this action
- Press the key to apply the current patch name and exit to the previous screen
- Save the patch to apply any changes

10.1.10 Save patch

- Ensure that a FAT32 formatted microSD card is inserted
- Turn the encoder knob to choose a save location
  - Banks A–H each with 128 slots are available
  - Bank R is ROM memory
- Choose an empty slot to save a new patch, or overwrite an existing one
- Hold the key for two seconds to save the patch
- Tap the key to exit without saving

10.1.11 ASID mode

- Engaged: zetaSID responds to the ASID protocol over MIDI, i.e. provided via a nexusMIDI expander (try https://deepsid.chordian.net/ for ASID files that can be streamed from your browser to a USB MIDI device which should then be connected to nexusMIDI)
- If using multiple zetaSIDs: turn the encoder to perform fat unison detuning per zetaSID (see displayed **UniDet:** value)
- Push the key to engage or disengage ASID mode

11. Lead engine

The Lead engine is zetaSID at its most expressive: a polyphonic-expandable and stereo-capable synth voice with the richest synthesis, modulation, and performance toolkit on the module.

The following sections describe all Lead engine parameters and are often applicable for other engine types as well.

11.1 Oscillators (OSC)

In lead engine mode, configure three oscillators of the emulated SID sound chip.

❶ Output DCA (digitally controlled amplifier) DADSR envelope per oscillator; selected oscillators are highlighted

❷ Active menu item: select oscillators for editing

11.1.1 Select oscillators

- Turn the encoder knob to select one or more oscillators to edit
  - By default, parameter changes propagate to
    - both left and right channels, which can be disabled from Setup > Patch Stereo Edit
    - all modules with the same instrument ID

11.1.2 Waveform selection

- Select any combination of waveforms for each oscillator
  - Triangle
  - Sawtooth

- Pulse
- Noise

11.1.3 Transpose

- Adjusts the coarse tuning in semitone steps (range: –64 to +63)

11.1.4 Finetune

- Adjusts the fine tuning

11.1.5 Oscillator sync

- Activates hard sync

Follower	Leader
OSC1	OSC3
OSC2	OSC1
OSC3	OSC2

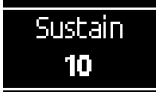
11.1.6 Ring modulation

- Only applicable for triangle waveforms

Oscillator	Modulated by
OSC1	OSC3
OSC2	OSC1
OSC3	OSC2

11.1.7 Delay/attack/decay/sustain/release (DADSR)

- Output DCA envelope curve
  - Visualised graphically in the OSC screen



11.1.8 Pitchbend range

- Specifies the maximum MIDI pitch bend range in semitones

11.1.9 Portamento rate

- Range: 0–255
  - A value of 0 disables portamento
- See also: 10.2.7 Glide Mode, especially "SusKey"

11.1.10 Portamento type

- Normal: rate of pitch change depends on the direction of the slide
  - Sliding up to higher notes “accelerates” as pitch increases
  - Sliding down to lower notes “decelerates” as pitch decreases
- Glide: pitch changes at a constant rate
- Glissando: plays each semitone step

11.1.11 Pulsewidth

- Range: 0000–4095
  - At least one pulse waveform must be active
  - Set a value of 2048 for a symmetrical square waveform

11.1.12 Gate hold

- Output DCA is held constant at the sustain level
  - Gates or note off messages have no effect

11.1.13 Detune

- Range: 0–127
- Applies an offset value to Finetune for all oscillators

11.2 Filter

Control the 12dB/octave multimode filter, including oscillator routing.

1. Graphical filter response curve
2. Active menu item: filter channel routing

11.2.1 Oscillator channel routing to filter

- Routes any combination of oscillators O1/O2/O3 into the filter
- Unrouted oscillators bypass the filter

11.2.2 Filter cutoff frequency

- Range 0–4095

11.2.3 Filter resonance

- Range: 0–15

11.2.4 Filter mode

Set any combination of:

- LP (Lowpass)
- BP (Bandpass)
- HP (Highpass)

Note: This implementation of the SID filter emulates the behavior of the original chip; the audio output can be routed to an external module for different sounds if desired. Some distortion is audible if all filters are active.

11.2.5 Filter key tracking

- Range Off, 1–255

11.2.6 OSC 3 out

- Determines whether OSC3 will be routed to the filter or muted
    - Optionally mute OSC3 if it is used for sync or ring modulation

11.2.7 Filter interpolation

- Smoothes out filter cutoff changes when modulated

11.3 Arpeggiators (ARP)

Each arpeggiator controls one oscillator.

❶ Arpeggiator overview: shows the generated arpeggio notes as they are played.

❷ Active menu item: arpeggio routing.

11.3.1 ARP routing

- Edit any combination of arpeggiators 1/2/3, each of which is coupled to the respective oscillator

11.3.2 ARP enable

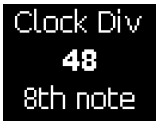
- Enables or disables arpeggio(s)

11.3.3 ARP direction

Considering a chord of notes A, B, C and D, the direction setting determines the note order:

- Up: ABCDABCD
- Down: DCBADCBA
- U&D (Up&Down): ABCDCBABCDC
- D&U (Down&Up): DCBABCDCBAB
- UD2 (Up&Down #2): ABCDDCBAABCDDC
- DU2 (Down&Up #2): DCBAABCDDCBAAB
- Random: random note order

11.3.4 ARP clock divider



- Range: 1–64
- Divider relative to the MIDI or chief clock
- The equivalent note step length is displayed for rational divisions

11.3.5 ARP gate length

- Range: 1–64
- Sets the duration of a gate triggered by an arpeggio event

11.3.6 ARP octave range

- Range: 1–8
- Octave alteration is added on top of the ARP direction effect

11.3.7 ARP sorted

- On: notes play in chromatic order
- Off: notes play according to the order in which they were entered

11.3.8 ARP latch

- On: latches and continues to play the arpeggio when keys are released
    - Entering a new note clears the latched arpeggio and starts another

11.3.9 ARP clock sync

- On: arpeggiated notes are synchronised to the clock

- Off: arpeggiated notes play as they are entered

11.3.10 ARP constant cycle

- On: notes play within a fixed clock period
  - The more notes in the arpeggio, the shorter the duration of each note
- Off: notes play sequentially according to the divider setting

11.3.11 ARP easy chord

- On: upon releasing notes, arpeggios continue to play through the release segment of the output DCA envelope
  - Entering a new note clears the arpeggio and starts another
  - When this feature is enabled and if using ARP forwarding to an external MIDI port, MIDI notes will continue to play even after note release.
- Off: upon releasing notes, the last note of the arpeggio rings out through the release segment of the output DCA envelope

11.4 LFO

In lead engine mode, configure up to six LFOs with optional sync and one-shot triggering.

❶ Graphical LFO overview; the currently selected LFO is highlighted.

❷ Active menu item: LFO selection

Note: LFOs are shared for both channels of a stereo instrument but may be separately assigned to L/R targets.

11.4.1 LFO selection

- Select LFO1–6

11.4.2 LFO enable

- Enables or disables the selected LFO

11.4.3 LFO depth

- Range: –128 to +127

- Negative values invert the waveform

11.4.4 LFO rate

- Range: 0–255
  - Value 0: LFO holds at the current level (stopped)
  - Corresponds to ca. 0.008–45 Hz
- If clock sync is active, rates > 244 correspond to the following bar or note lengths
  - 245: 64 bars
  - 246: 32 bars
  - 247: 16 bars
  - 248: 8 bars
  - 249: 4 bars
  - 250: 2 bars
  - 251: 1 bar
  - 252: 1/2 note
  - 253: 1/4 note
  - 254: 1/8 note
  - 255: 1/16 note

11.4.5 LFO delay

- Range: 0–255
  - A value of 0 disables the delay
- Effect of cycle mode on transition behavior
  - One-shot: transitions from zero to the starting phase
  - Retriggering: current phase held, then transitions to the starting phase
  - Free running: delay has no effect

11.4.6 LFO phase

- Range: 0–255
  - A value of 128 applies a 180° phase shift
- Applicable only if one-shot or retriggering is configured

11.4.7 LFO waveform

The following bipolar and unipolar waveforms are available:

- Sine
- Triangle
- Pulse
- Ramp (sawtooth)
- Random (sample and hold)

11.4.8 Clock sync

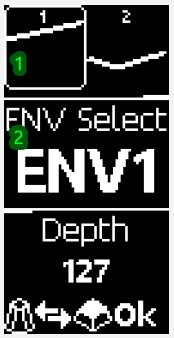
- On: LFO syncs to a multiple or division of the clock according to the LFO rate setting

11.4.9 LFO oneshot

- On: runs through one waveform period upon receiving a trigger
  - Configurethe trigger source from Trigger Matrix > LFO1–6 restart
  - Off: LFO is free-running

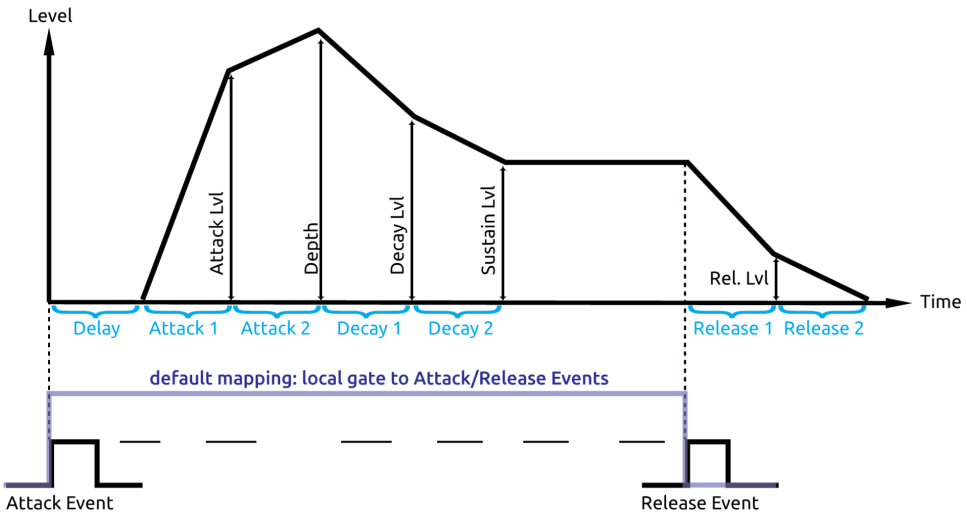
11.5 Envelopes (ENV)

In lead engine mode, configure two $DA^2D^2SR^2$ envelopes with variable slopes (linear, exponential or log).



1. Graphical overview of each envelope state. The selected envelope is highlighted.
2. Active menu item: envelope selection

Note: envelopes are identical for both channels of a stereo pair but may be separately assigned to L/R targets, or a single envelope can be inverted for the second channel.



11.5.1 ENV select

- Select ENV1 or 2

11.5.2 ENV depth

- Range: –128 to +127
    - Negative values invert the envelope

11.5.3 ENV delay

- Range: 0–255

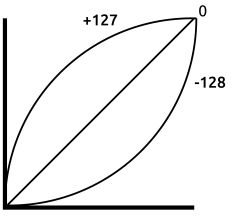
11.5.4 ENV attack/decay/sustain/release

- Range: 0–255

Segment time	Ramps to
Delay	(Minimum)
A1	Attack level
A2	Depth
D1	Decay level
D2	Sustain level
R1	Release level
R2	Minimum

11.5.5 ENV attack/decay/release curve response

- Value 0: linear curve
- Range –128 to –1: exponential curve
- Range 1 to 127: log curve



Note: increasing the magnitude of curve response increases the respective segment time.

11.6 Modulators (MOD)

Modulators 1–8 each combine two sources using an operator and are distributed to one or several targets at a selected depth.

1. Graphical MOD overview; the currently selected modulator is highlighted.

2. Active menu item: modulator selection.

Note: modulators are identical for both channels of a stereo pair but may be separately assigned to L/R targets, or a single modulator can be inverted for the second channel.

11.6.1 MOD select

- Select MOD1–8

11.6.2 MOD source 1/2

The following sources are available:

- ---: disable source
- ENV1, ENV2
- LFO1–6
- MOD1–8
- ModW (modwheel)
- Note
- CC11–16
- Vel (velocity)
- PB (pitch bend)
- AT (aftertouch)
- WS1–4 (wave sequence)
- 0–127 (constant offset)

Note: MIDI sources are only available if a MIDI splice is present.

11.6.3 MOD operator

The following operators are available:

Operator	Output	
---	Disabled	
Source1	Source 1 only	
Source2	Source 2 only	
Add	Source 1 + source 2	Arithmetic (decimal values)
Sub	Source 1 – source 2	
Mul	Source 1 * source 2	
XOR	Source 1 and Source 2 are treated as binary numbers and bitwise operations are performed. See table below for examples.	
OR		
AND		
Min	Minimum(source 1, source 2)	
Max	Maximum(source 1, source 2)	
<	Maximum depth if source 1 < source 2	
>	Maximum depth if Source 1 > source 2	
=	Maximum depth if source 1 = source 2	
S&H	Source 1 sampled when source 2 transitions from negative to positive	

XOR, OR and AND operator examples:

	Operator		
	XOR	**OR**	**AND**
Source 1 (= 45 decimal)	101101	101101	101101
Source 2 (= 56 decimal)	111000	111000	111000
Output (binary)	010101	111101	101000
Output (decimal)	21	61	40

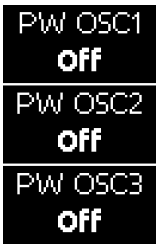
11.6.4 MOD depth

- Range: –128 to +127
  - A value of 0 disables the modulator

- Negative values invert the modulator

11.6.5 MOD targets

- Pitch Oscillator 1–3
  - Route to L/R channel or both
- Pulsewidth (PW) Oscillator 1–3
  - Route to L/R channel or both
- Filter Cutoff
  - Route to L/R channel or both
- Volume
  - Route to L/R channel or both
- Target 1/2; assign to the following destinations:
  - Pitch
    - Left channels: OSC1–3
    - Right channels: OSC1–3
  - PW (pulsewidth)
    - Left channels: OSC1–3
    - Right channels: OSC1–3
  - CutL/R (filter cutoff frequency)
  - VolL/R (volume)
  - LFO1–6 depth
  - LFO1–6 rate
  - WS1–4 (wave sequencer position)

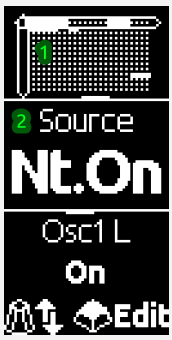


11.6.6 MOD invert target 1/2

- Inverts a modulator before distributing to target 1/2
  - Useful for stereo effects stemming from a single modulator

11.7 Trigger matrix

Configure a set of 14 events to trigger 24 targets.



1. Graphical trigger matrix overview, with events arranged by row and targets by column. Active row and column are highlighted, with connections indicated in bold white.

2. Active menu item: select source event (matrix row).

Note: the trigger matrix is identical for both channels of a stereo pair but events may be separately assigned to L/R targets.
Note: default patches use the Note On event to trigger the OSC1/2/3 output DCA envelopes, ENV1/2 and WS1–4.

11.7.1 Select event source

The following sources are available:

Event	Occurs when
Note on	Note on or gate in event received
Note off	Note off or gate off event received
ENV1/2 sus.	ENV sustain segment reached
LFO1–6 cyc.	LFO completes one period
Clock	Clock pulse received
Clock:6	6th clock pulse received
Clock:24	24th clock pulse received
Clock start	MIDI clock start event received

11.7.2 Select target

Target	Result
OSC1–3 L/R	Triggers output DCA envelope • Special: a received note off event triggers the release segment
ENV1/2 att.	Triggers ENV attack segment
ENV1/2 rel.	Triggers ENV release segment
LFO1–6 reset	Resets LFO
WS1–4 reset	Resets wave sequencer
WS1–4 step	Increments wave sequencer

11.8 Wave sequencer (WS)

In lead engine mode, configure four tracker-like sequences that step through almost any zetaSID parameter.

Note: the original SID term was “wavetable”, which zetaSID renames as “wave sequencer” to avoid confusion with “wavetable synthesis”.

1. The currently selected wave sequence is highlighted
2. Position
3. Output value
4. Active menu item: selected wave sequence for editing

Note: wave sequences are identical for both channels of a stereo pair but may be selectively applied to a L/R channel or controlled from the modulator setting.

11.8.1 Select wave sequence

- Select WS1–4

11.8.2 Clock divider

- Range: 1–64
- Divider relative to the MIDI or chief clock
- The equivalent note step length is displayed for rational divisions

11.8.3 Stereo channel assignments

- WS applied to either L/R channel, both or none

11.8.4 WS target

- Select from the table of targets
  - e.g., T96–103: MOD1–8 depth
- Certain targets control all elements of a group
  - e.g., T40: finetune OSC1+2+3

Group	Parameter	Group element								
		All	1	2	3	4	5	6	7	8
Volume	Volume	1								
Filter	Cutoff	4								
	Resonance	5								
	Routing	6								
	Mode	7								
OSC	Detune	3								
	Waveform	32	33	34	35					
	Transposition	36	37	38	39					
	Finetune	40	41	42	43					
	Portamento rate	44	45	46	47					
	Pulsewidth	48	49	50	51					
	Pitch bend	80	81	83	84					
DADSR	Delay	52	53	54	55					
	Attack	56	57	58	59					
	Decay	60	61	62	63					
	Sustain	64	65	66	67					
	Release	68	69	70	71					
ARP	Clock divider	72	73	74	75					
	Gatelength	76	77	78	79					
MOD	Depth		96	97	98	99	100	101	102	103
LFO	Waveform		128	129	130	131	132	133		
	Depth		136	137	138	139	140	141		
	Rate		144	145	146	147	148	149		
	Delay		152	153	154	155	156	157		

Group	Parameter	Group element								
		All	1	2	3	4	5	6	7	8
	Phase		160	161	162	163	164	165		
ENV	Depth		193	209						
	Delay		194	210						
	Attack 1		195	211						
	Attack level		196	212						
	Attack 2		197	213						
	Decay 1		198	214						
	Decay level		199	215						
	Decay 2		200	216						
	Sustain		201	217						
	Release 1		202	218						
	Release level		203	219						
	Release 2		204	220						
	Attack curve		205	221						
	Decay curve		206	222						
	Release curve		207	223						
WS	Clock divider		224	225	226	227				
	Start		228	229	230	231				
	End		232	233	234	235				
	Loop		236	237	238	239				
	Position		240	241	242	243				
Direct OSC	Play note	252	253	254	255					

Note: Direct OSC note support for oscillators 2 and 3 (targets 254/255) is currently not supported.

11.8.5 WS start/end/loop position

- Range: 0–128
  - Default: Start 1, End 32, Loop 1
  - WS1–4 may use overlapping positions

11.8.6 MOD to WS position

- Position controlled by modulator value

    - Limited by WS start and end position range
    - Assign WS1–4 as targets within MOD configuration
    - Lower priority than note to position
    - Clock divider and loop position ignored

11.8.7 Note to WS position

- Position controlled by note value
    - Limited by start and end position range
    - Higher priority than MOD to position
    - Clock divider and loop position ignored

11.8.8 WS oneshot

- On: runs through one cycle upon receiving a trigger
    - Ignores loop position
    - Trigger source derived from Trigger Matrix > WS1–4 Reset
- Off: WS is free-running

11.8.9 WS editor

- Position number: 0–127 steps
    - WS1–4 share the same table
        - Limited by WS1–4 start and end positions
    - Active position highlighted
- Output value in hexadecimal
    - Set relative change from the previous value (“rel” in decimal):
        - Decrement: 0x00–0x39 (–64 to –1)
        - Static: 0x40
        - Increment: 0x41–0x79 (+1 to +63)
    - Set absolute value (“abs” in decimal):
        - 0x80 to 0xFF (0 to +127)
- Values are scaled to match the full range of the target
    - Certain targets decode values to perform special functions

11.8.10 Special WS targets

The following subsections list targets and hexadecimal values or ranges that correspond with particular settings.

11.8.10.1 Filter routing and mode (targets 6 and 7)

Hexadecimal range	Filter routing	Filter mode
0x80–0x87	None	Mute

0x88–0x8F	OSC1	LP
0x90–0x97	OSC2	BP
0x98–0x9F	OSC3	LP+BP
0xA0–0xA7	OSC1+2	HP
0xA7–0xAF	OSC2+3	LP+HP
0xB0–0xB8	OSC1+3	BP+LP
0xB9–0xBF	OSC1+2+3	LP+BP+HP

11.8.10.2 OSC waveform (targets 32–35)

Hexadecimal	OSC Waveform
0x80	Off
0x81	Triangle
0x82	Saw
0x83	Triangle + Saw
0x84	Pulse
0x85	Triangle + Pulse
0x86	Saw + Pulse
0x87	Triangle + Saw + Pulse
0x88	Noise (others disabled)

The following “hexadecades” set additional OSC parameters:

Hexadecade	Disabled	Sync	Ringmod
0x9x	✓		
0xAx		✓	
0xBx	✓	✓	
0xCx			✓
0xDx	✓		✓

0xEx		✓	✓
0xFx	✓	✓	✓

11.8.10.3 LFO waveform (targets 128–133)

Hexadecimal range	LFO Waveform
0x80–0x87	Sine bipolar
0x88–0x8F	Triangle bipolar
0x90–0x97	Saw bipolar
0x98–0x9F	Pulse bipolar
0xA0–0xA7	Random bipolar
0xA7–0xAF	Sine unipolar
0xB0–0xB8	Triangle unipolar
0xB9–0xBF	Saw unipolar
0xC0–0xC8	Pulse unipolar

11.8.10.4 Direct OSC (targets 252–255)

Hexadecimal (range)	Function
0x80	Note off
0x81	Hold note
0x82–0xFB	Play MIDI note number 2–123
0xFC–0xFF	Play notes in the order (1–4) in which they were received (build your own arpeggiator!)

12. Bassline engine

The bassline engine turns zetaSID into a TB-303-style step-sequenced bass voice. It inherits the concept from MIDIbox SID V2 and extends it with eurorack clock and pattern CV inputs.

Each bassline patch supports a double-sequenced/stereo setup of two independent channels, L and R. The two channels share eight sequence patterns but are otherwise programmable separately, with their own oscillator settings, LFOs and envelopes.

When multiple zetaSIDs are polychained via phybus to a single instrument id, the Chief drives every Agent's sequencer, keeping them perfectly in sync. No additional splicing or configuration is required on the Agent side, regardless of how the Chief itself is clocked (external MIDI clock, internal MIDI clock, or eurorack clock; see 12.5.1).

Pattern switches can be optionally synchronised to the measure, so that a new pattern starts only after the previous one has finished playing.

Each channel can run in one of two modes: with the sequencer turned on, the channel plays one of eight stored patterns and every step carries its own configurable note, octave, gate, slide, accent, and one freely assignable patch parameter (see 12.2.1). When the bassline sequencer is turned off, the channel plays live notes from MIDI or CV/gate.

The bassline engine offers an asymmetric oscillator section (OSC1 master plus OSC2 and OSC3 sub-oscillators), a bassline-specific envelope with per-segment curvature, a 16-step sequencer with eight patterns per channel, and three eurorack sockets (SEQ STEP, SEQ RST, SEQ PAT) that drive the sequencer externally (see 12.5). The next sections will describe all bassline-specific parameters - for information about common parameters or screens, have a look in the Lead engine chapter.

If you own a nexus**MIDI** expander module, also have a look at the web editor, it can help a lot when editing complex multi-pattern sequences (see Appendix B).

12.1 Oscillator page

The bassline oscillator page controls the master oscillator OSC1 and two sub-oscillators OSC2 and OSC3. Each bassline channel (L/R) has independent bassline oscillator settings. Subtle oscillator differences between the L and R channels in a stereo zetaSID bassline setup can lead to impressive results.

1. Configured OSC1-OSC3 waveforms (combinations per oscillator are possible) and configured ADSR SID DCA envelope

2. Active menu item: Waveforms selection for OSC1

12.1.1 OSC1 (master oscillator)

Waveform selects the SID waveform combination: None, Tri, Saw, Tri+Saw, Pulse, Tri+Pul, Saw+Pul, T+S+P, or Noise.

Pulsewidth sets the pulse duty cycle and has an effect only when a pulse waveform is active.

Transpose and **Finetune** offset pitch in semitones and cents.

Sync and **Ringmod** enable the SID's hard-sync and ring-modulation behaviors.

Delay postpones the oscillator's amplitude envelope after the gate fires.

Attack, **Decay**, **Sustain**, and **Release** shape that envelope at the SID register level, with A, D and R being time parameters and S being a level parameter.

Pitchrange sets the maximum pitch-modulation deviation in semitones when the sequencer is off and the bassline engine is played via MIDI and receives Pitchbend events.

Porta Rate sets the portamento speed; it reads "Off" when the rate is zero.

Porta Type selects portamento behavior: Normal (smooth glide), Glide (constant-time glide), or Glissando (glide quantised to semitone steps).

Gate Hold keeps the gate open across consecutive sequence steps when On; when Off, the gate releases at the end of each step and retriggers on the next.

12.1.2 OSC2 and OSC3 (sub-oscillators)

Detune offsets the pitch of sub-oscillators OSC2 and OSC3, creating hollow or beating sounds when the sub-oscillators play in the same octave range.

Each sub-oscillator is shown with its own two-line header and carries a subset of OSC1's controls: Waveform, Pulsewidth, Transpose, Finetune, and Delay behave as on OSC1.

Note defaults to "Follow", which is the normal behavior: OSC2 and OSC3 follow the OSC1 master oscillator and act as true sub-oscillators. Setting any other value pins the sub-oscillator to that fixed pitch instead, independent of the note played.

OSC2 and OSC3 do not carry Sync, Ringmod, Porta, or Gate Hold; those remain OSC1 controls.

12.2 Sequencer page

The sequencer page is the heart of a bassline channel and is automatically mapped either to the L(eft) or R(ight) channel, depending on the stereo position of your zetaSID. Each patch holds eight 16-step patterns and each sequencer (L or R) can play back one of these patterns.

1. Left or Right sequencer engine (L/R) and active pattern (1-8)
2. Current playback step (1-16)
3. Oscilloscope view of bassline notes recently played
4. Active menu item: select pattern for playback and editing

12.2.1 Sequencer controls

Pattern selects the active pattern. It has nine positions: "-" (the channel's sequencer is idle and plays no steps) and patterns 1 through 8. All pattern changes respect **Sync To Measure** (see below). Next to this user-interface selector, active patterns can also be selected via

- MIDI: incoming MIDI notes C, C#, D, D#, E, F, F#, G on octaves 3 and 4 launch respective sequences 1 to 8 for the left and right channels, all notes > G (i.e. G# or A) set the respective sequencer to "-" (standby)
- CV: assign/splice a CV input to the **SEQ pat** socket (see section 12.5.3)

The **Operations** submenu performs one of these commands on the currently selected pattern:

- **Copy** transfers the current pattern to a temporary memory buffer (useful to save a copy of the current pattern before performing note or operation modifications)
- **Paste** clones a previously copied pattern from the memory buffer to the currently selected pattern.
- **Clear** resets the pattern steps back to their defaults
- **Rnd** rolls a freshly randomized pattern from scratch
- **Rnd +10%** nudges the existing pattern slightly, useful for finding small variations of a pattern you like
- **Done** closes the submenu

Sequencer is the master On/Off switch for the channel's sequencer. When Off, the channel plays live MIDI or CV/gate notes instead of a pattern.

Clock Div is only relevant when the sequencer is driven from a MIDI clock, whether internal or external. It sets how many MIDI clock ticks advance the sequencer by one step. Each channel has its own divider, so Bassline L and Bassline R can run at different rates from the same clock. It has no effect when the SEQ STEP input socket is successfully spliced to a local or remote port, since in that case each step trigger advances the sequencer by exactly one step.

Sync To Measure is an On/Off toggle. When On, any pattern change requested from the UI, from MIDI note-select, or from the SEQ PATTERN CV input (see 12.5) is queued and applied when the sequencer next wraps to step 0, so the new pattern is played only after the old pattern has finished playing. When Off, pattern changes take effect immediately.

Steps defines the pattern length, from 1 to 16 (default 16). Shorter patterns loop sooner. As with every sequencer parameter, the left and right sequencers can play back different pattern lengths, allowing to play polymeter basslines.

Par Assign binds the per-step parameter column to a synth engine parameter. Parameters are applied live, so it is advisable to stop playback of the pattern before sweeping this list to avoid modifying unwanted patch parameters.

Edit selects which column of the step grid is currently editable: Note, Oct, Gate, Slide, Accent, or Par, moving the cursor horizontally between columns.

Shortcut alternative: push and turn the knob in the Step Grid to switch columns.

12.2.2 The Step Grid

The step grid shows each step of the active pattern and also indicates the current sequence playback position via vertical bars at the side of the screen. In the right-hand demo we're editing the note of step 05 - see inverted cursor.

Push the matias button to start and stop editing the highlighted cell, i.e. to choose a different note via the knob or to toggle a switch (i.e. Gate On/Off).

When not editing, you can scroll your cursor by

- turning the knob to scroll vertically
- pushing and turning the knob to scroll horizontally (or using the **Edit** selector)

Edit the pattern using these columns:

- **Note** contains the per-step semitone: C, C#, D, D#, E, F, F#, G, G#, A, A# or B
- **Octave(Oct)** can be set to -2, -1, 0 or 1
- **Gate(G)** can be On (*) or Off ( )
- **Slide(S)** automatically indicates the slide direction when active (/ - \)
- **Accent(A)** boosts the filter envelope depth when on (o)
- **Par** sets the per-step parameter value (0-127)

12.3 LFO page

Each bassline channel has two LFOs with fixed routing. Every LFO drives the pitch, pulsewidth, and filter cutoff targets all at once, each with an individual depth.

❶ Active LFO marker (rectangle) and oscilloscope view of the respective LFO output routed to Pitch, Pulsewidth and Filter

❷ Active menu item: select LFO for editing

LFO Select switches between LFO 1 and LFO 2. The top of the screen indicates which LFO is selected: the selection rectangle also contains the modulation outputs the LFO creates for its three targets (as mini-scopes).

Waveform selects the LFO shape. The first five values (Sin, Tri, Saw, Pulse, Rnd) are bipolar, centered on zero. The five "+" variants (+Sin, +Tri, +Saw,

+Pul, +Rnd) are unipolar and only add to the target parameter, which is useful when modulation should never pull a parameter below its programmed value.

Rate sets the LFO speed.

Depth P, **Depth PW**, and **Depth F** are the modulation depths for pitch, pulsewidth, and filter cutoff respectively. Each can be set positive or negative; negative values invert the modulation direction.

Key Sync resets the LFO phase on each new note when On.

Clk Sync locks the LFO rate to the master clock when On (only when driven by an internal or external MIDI clock).

Oneshot runs a single LFO cycle per note trigger rather than free-running, which can be useful for treating the LFO as a slow auxiliary envelope.

Delay postpones the start of the LFO after the gate fires (relevant if Oneshot or Key Sync are activated, as otherwise the LFO is free-running)

Phase sets the LFO's starting phase (relevant if Oneshot or Key Sync are activated, as otherwise the LFO is free-running).

12.4 Envelope page

Each bassline channel (L or R) has one envelope, which is in parallel routed to pitch, pulsewidth, and filter cutoff with configurable depths/weights. This "soft-envelope" is separate from the SID-based chip envelope on the oscillator page (see 12.1).

1. Active Envelope oscilloscope view visualizing the envelope output routed to Pitch, Pulsewidth and Filter

2. Active menu item: adjust envelope depth amount routed to Pitch

Depth P, **Depth PW**, and **Depth F** are the three modulation depths for the routed targets. Each can be set positive or negative; negative values invert the direction of modulation: the effect can be observed at the top of the screen in the mini-scopes, one for each of the targets (labeled P, PW and F).

Attack, **Decay**, **Sustain**, and **Release** set the four stages of the envelope, where Attack, Decay and Release are time-based parameters and Sustain is a level parameter.

Curve sets the curvature applied to the envelope segments. It can be set positive or negative, and the two signs bend segments in opposite directions.

Curve Att, **Curve Dcy**, and **Curve Rel** are three On/Off toggles that decide whether the Curve value is applied to the attack, decay, and release segments respectively. When all three are turned "Off", then the envelope is linear regardless of the Curve setting.

Accent is the boost that accented steps add to the filter depth (accent affects filter only).

Acc Decay is the decay time of that accent boost: on accented steps, Acc Decay replaces the normal Envelope Decay value for that cycle.

12.5 Eurorack clock and CV integration

The bassline engine adds three eurorack sockets dedicated to sequencer control: SEQ STEP, SEQ RESET, and SEQ PATTERN. They are used to control the bassline engine via common eurorack signals and are listed with the other input sockets in Chapter 8.

12.5.1 SEQ STEP

SEQ STEP is a trigger input. Each pulse on the socket advances the active sequencer by one step.

While SEQ STEP is spliced to a port, the channel's MIDI-clock-driven stepping is bypassed entirely. Clock Div has no effect in this state (see 12.2.1), and the sequencer runs only as fast as the incoming triggers arrive.

12.5.2 SEQ RESET

SEQ RESET is a trigger input. Each pulse jumps the sequencer to step 0 of the current pattern. Pattern selection is not changed; only the step position is reset.

SEQ RESET is typically driven from a pattern cycle or song-position reset pulse, so that all spliced bassline modules will stay aligned with each other and with the rest of your externally sequenced modules.

12.5.3 SEQ PATTERN

SEQ PATTERN is a 0 to 5V CV input that selects the idle pattern ("-") or one of the eight stored patterns based on input voltage - each pattern number is separated by 0.55V to be

able to squeeze the voltage range into nine equal bins. Pattern changes observe the channel's **Sync To Measure** setting (see 12.2.1).

13. Drum engine

The zetaSID drum engine offers access to a kit of 16 percussion models covering a range of arcade-ish fx to old-school to low-fi 8-bit drums.

Each MIDI note triggers one drum, with two octaves' worth of notes mapped across the kit. Up to six drums can sound at once, spread across the module's two SID chips, and the two SID filters are shared across all sounding drums.

Every drum has its own synthesis model, ADSR envelope, tune, gate length, speed, and voice assignment: left/right pair, left only, right only, or pinned to a specific voice.

Only the pages that differ from the Lead engine are documented in this chapter.

13.1 Drums

In drum engine mode, configure a kit of 16 different SID percussion models.

1. Drum Kit overview: the currently selected drum is highlighted. Drum playback within the kit is animated with a playback indicator.

2. Active menu item: select drum for editing

13.1.1 Select drum

- Turn the encoder knob to select drum 1–16 for editing

13.1.2 Assign voice

- LR (Left/Right): oscillators are assigned to the next free oscillator in a round-robin fashion
    - Assign the next drum to be played to the next free oscillator Drums will be played on both the left and right channels of a stereo pair
- L– (Left): the drum is only played on the left audio channel
    - Plays up to three drum voices
    - Use this setting if only one zetaSID is available
- –R (Right): the drum is only played on the right audio channel
    - Plays up to three drum voices

- O1–O6: assigns an individual oscillator for the drum
    - Oscillators O1–O3 are played on the left **zeta**SID audio channel
        - Use O1–O3 if only one zetaSID is available
    - Oscillators O4–O6 are played on the right **zeta**SID audio channel
    - Directly assigning oscillators in this way increases the priority for selected drums but reduces the polyphony of L/R assignment modes

13.1.3 Select model

Type	Model	Type	Model
Bass drums	BD1	Clap	CLAP
	BD2	Effects	FX1
	BD3		FX2
Snare drums	SD1		FX3
	SD2		FX4
	SD3		FX5
High hats	HH1		FX6
	HH2		FX7
Toms	TOM1		FX8
	TOM2		FX9

13.1.4 Attack/decay/sustain/release

- Output DCA envelope curve

13.1.5 Tune

- Range: –2 to +2 octaves in 256 steps

13.1.6 Drum gate length

- The duration of a drum sound

13.1.7 Speed

- Adjusts the playback speed of the associated drum model wave sequence

13.1.8 Extra parameter

- Adjusts a specific setting for each drum model
- Range: –127 to +128

13.1.9 Attenuate

- Reduces the output volume for each drum model
- Useful to tune your kit drums to identical volumes
- Range: 0dB (default) to +30dB

13.1.10 Velocity target

- Volume
- Filter cutoff
- Filter resonance
- Attack
- Decay
- Sustain
- Release
- Drum tune
- Gate length
- Drum speed
- Extra parameter

14. Setup

Configure permanent settings that persist across sessions

1. Setup screen
2. Active menu item: choose screensaver type
3. Next menu item

Parameter	Setting
Screensaver type	• Blank • Animated starscape
Screensaver timeout	• Minutes after which the screensaver activates

CV in port range	• –5V to +5V (default) • 0–10V
Transmit session changes	• On: sends out a “change session to” command to other nodes when loading a session on this zetaSID (default) • Off: session changes are not transmitted
Receive session changes	• On: modules that receive a “change session to” command switch to the appropriate session (default) • Off: “change session to” commands are ignored for this module
Patch stereo edit	• On: parameter changes propagate to both L/R channels of an instrument cluster • Off: patch changes originating from the left channel propagate only to other left channels of an instrument cluster; right channels behave in the same way
LED Brightness	• Static: low brightness; static port activity • Low: low brightness; dynamic port activity (default) • High: high brightness; dynamic port activity
Scope Speed	• Time axis compression of the scope (1:1 ... 1:16)
SD Save Interval	• 5 sec … 30 sec - define the time after which changes to the session are saved on the microSD card. Note: the SD card should not be removed and the system should not be powered down, when saving is in effect. Higher values reduce the risk of filesystem corruption (in case of sd card ejection/power down) and also reduce the write load on the SD card. • **A tiny "SD" icon is shown on top of the screen during SD card accesses - do not eject the card or power down your modular system when this icon is shown.** • **Remember to back up your SD cards on your main computer from time to time.**
Wrap Patch Selection	• On: wrap when scrolling beyond the limits of the patch list, i.e. to quickly move from patch R001 to patch F052 (if that is your last user patch) • Off (default): stop scrolling at the limits of the patch list

15. What's New/Changelog

In case you have been using zetaSID for a while and wonder what changes were introduced in newer software revisions, have a look here:

V1.5a (released on 2026/05/15)

- Bassline engine support (thanks, Inty, for debugging help!)
- Drum engine drums can now be individually attenuated (thanks, Paulee!)
- Display rotation support (thanks, Christoph!)
- MIDI Program Change support (thanks, Inty!)

V1.4b-d (matches software released on 2026/02/26)

- Improvements of wave sequencer and patch wrap-around (thanks, Inty!)

V1.4a (matches software released on 2026/02/20)

- Initial release of zetaSID

APPENDIX A: ROM Patchbank

Lead

R001 - Poly Sunrise H
R002 - The Loader
R003 - Relax in Space
R004 - Cannon Y
R005 - Rinkeby Centrum
R006 - Curveball
R007 - Popcorn
R008 - Techno 5th
R009 - Oldschool
R010 - Acid Blob
R011 - Stereo Asteroids
R012 - Analog Dream4
R013 - Gotland
R014 - Den of Saws
R015 - TV Piraterna
R016 - Monty Lead3
R017 - Lead Stacco1
R018 - League
R019 - Mustache On
R020 - Techno PWM
R021 - Vib Synth
R022 - Tensta Marknad
R023 - Accomp1
R024 - Bubble Grapes
R025 - Nice Lead

Bass

R026 - Deep Bass 9
R027 - Pulsator
R028 - Driving Bass
R029 - Bad Basshead
R030 - C64 Bass
R031 - Auto Zone
R032 - Warm Bass
R033 - Razor Blade][
R034 - NT Bass
R035 - Leaky Capacitor
R036 - Autobahn
R037 - Radar Bass H
R038 - Slussen
R039 - Seq Bass4
R040 - Seq Bass5
R041 - Monty Bass
R042 - Chipmelter
R043 - PWM Bass1
R044 - PWM Bass2
R045 - PWM Bass3
R046 - PWM Bass4
R047 - Organic Bass
R048 - Twister
R049 - Skate or Cry!
R050 - Zak Bass

ARP

R051 - Power Glove ARP
R052 - Interlace ARP
R053 - Laserdome Lover
R054 - Auto ARP
R055 - The Future ARP
R056 - 8-bit Starpig
R057 - Pac Pill ARP
R058 - wARP Drive
R059 - Transistor ARP
R060 - Soothing ARP

Wave

R061 - SEQ Vintage B
R062 - SEQ Runner
R063 - SEQ Falling
R064 - Alien Groove
R065 - Step by Step
R066 - ARPSEQ One C
R067 - ARPSEQ Two A
R068 - ARPSEQ Four
R069 - SEQ Trance Bass
R070 - SEQ Powerbass

Kit

R071 - 8-Bit Mono
R072 - 8-Bit Kit
R073 - Hawkeye Mono
R074 - Hawkeye Kit
R075 - Frogger Mono
R076 - Frogger Kit
R077 - Chip Mono
R078 - Chip Kit
R079 - Smithy Mono
R080 - Smithy Kit

Drum

R081 - Bassdrum A
R082 - Bassdrum B
R083 - Kick
R084 - Snare
R085 - Cymbal A
R086 - Cymbal B
R087 - Cymbal C
R088 - Hat
R089 - Klick
R090 - Lo-Fi Perc

FX

R091 - A Stormy Day
R092 - RampUp
R093 - Shamus Case
R094 - Classic Zelda
R095 - Nonlinear Time
R096 - Arcade Lover
R097 - Lords of Chaos
R098 - Sopbil by Night
R099 - Abducted
R100 - Rebirth H

Bass!

R101 - Bassline 2 TK
R102 - Bassline 3 TK
R103 - Bassline 4 TK
R104 - Bassline 5 TK
R105 - Bassline 8 TK
R106 - Bassline 22 TK
R107 - Bassline 24_2
R108 - Melb. Bounce
R109 - Smithy BL1
R110 - Hawkeye 303

APPENDIX B: Using the zetaSID web editor

If you are using a nexusMIDI expander, it is possible to directly edit all of zetaSIDs patch parameters with the midiphy zetaSID web editor found here:
https://www.midiphy.com/en/zetasid-webedit/

Setup

- Connect USB MIDI interface cables: USB MIDI OUT to nexusMIDI IN2, USB MIDI IN to nexusMIDI OUT2
- Press the LEDome key next to nexusMIDI IN2 and create splices to the "MIDI IN2" sockets of all zetaSIDs
- Press the LEDome key next to nexusMIDI OUT2 and create splices to the "MIDI OUT" sockets of all zetaSIDs
- (If you're using microSD cards in the zetaSIDs, splices will be saved automatically)

Usage

- Use "LOAD .SYX" and "SAVE .SYX" for file operations - loading existing patches or saving your patches to disk
- Set the Instrument Id to match the Instrument # on your Chief zetaSID
- "Connect" the USB MIDI device
- You can now receive and transmit patches, as well as randomize and rename them

- If you have no other MIDI or CV/Gate inputs connected, you can use the virtual keyboard to play notes for testing the patch

Link options

- Use "Link Stereo" to link a single oscillator with its stereo counterpart on a neighboring zetaSID when the Chief has Polyphony mode set to "Stereo"
- Use "Link OSCs" to link all three oscillators on one stereo side of the patch

Sections and panel use

- Click any section name to scroll directly to that section, e.g. Filter
- Use the randomize and initialize buttons next to section names to randomize/initialize only that section
- Use the randomize and initialize buttons on each panel (e.g. OSC1 LEFT) to randomize/initialize only that part of the patch

Tips

- Save early, save often - you can always download nice-sounding patches as .syx files, especially before making major changes
- When experimenting with randomization, enable "Transmit after RND/INI" to automatically send the patch SysEx to hardware after each randomization operation
- Remember that you can randomize individual panels - e.g. drum voices - by clicking the RND buttons in the individual panels, allowing you to build a custom drum kit by randomizing individual drum sounds until you find ones you like:

APPENDIX C: Firmware updates

You can either update a single module or automatically update all modules on your phybus network from your zetaSID!

For both cases, prepare an SD card and enter bootloader mode first:

- Either format a microSD card as FAT32 filesystem or delete the previous firmware folder.
- Download the newest modular firmware zip bundle from www.midiphy.com**.**
- Unpack the firmware bundle zip file into the root directory of the microSD card
  The **/firmware** directory now contains the latest firmware version for all modules
- Insert the microSD card into the card slot of the zeta module.
- Power up the module with the key held down

In bootloader, to update a single module with a specific firmware:

- Choose **Flash App**.
- Select the appropriate firmware file.
- Press the key to start the update procedure.

In bootloader, to automatically update all modules on a phybus network:

- Choose **Update All**.
  Now you can browse the complete list of modules, including the current firmware versions and (if applicable) to which version each module will be updated.
- Choose **Proceed** to start the automatic mass update process.
  Each module will be updated and rebooted in turn.
  The local module will be updated last (if applicable).
  Larger phybus networks may require around five minutes to update.

Red LEDomes indicate that the flash process is in progress, all modules will reboot automatically after flashing.

During an ongoing flash process, do not remove the power supply, the microSD card or any cables before the process completes.

APPENDIX D: Acknowledgements

Many thanks to:

- Thorsten, who created MIDIbox and the original MBSID sound engine
- Hermit, who created the SID emulation engine
- All MBSID v2 patch contributors: TK., Chiptraxxx, Pingosimon, Smithy.
- All current and future users of zetaSID, who made this device possible and ensure continuous development. You know who you are!