

# BITSYNTHZR



## BIT REDUCTION SYNTHESIZER

# **BITSYNTHZR** Operation Manual

Bit Reduction Synthesizer with Cross Modulation, OP Combiner, 3-Lane Sequencer, Glitch Processor and Lo-Fi Effects

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# 1. Introduction

Thank you for choosing **BITSYNTHZR**!

**BITSYNTHZR** is a two-oscillator synthesizer designed for low-resolution and unstable sound. Its two **Sound Generators** produce sine, ramp, pulse and noise waveforms with variable bit depth, and each can modulate the other. An **OP** section combines the two signals with arithmetic and logic operations. A three-lane step sequencer can be advanced by the clock, by incoming notes, by the **MOD** LFO, by either **Sound Generator**, or by external **CV**. A **Glitch** processor introduces controlled malfunction to the signal, and a lo-fi delay and reverb complete the chain.

*The instrument is intended to be played and re-patched rather than set once. Most sections of this manual end with a short "Try this" example. The examples are starting points; the interesting sounds are usually one step past them.*

## Conventions used in this manual

- Panel labels are shown in **bold capitals**, for example **BWR**.
  - **Cmd-click** means Ctrl-click on Windows. Cmd-clicking a knob, display or cell returns it to its default value.
  - Knob positions are given as clock positions (9 o'clock, noon) or percentages.
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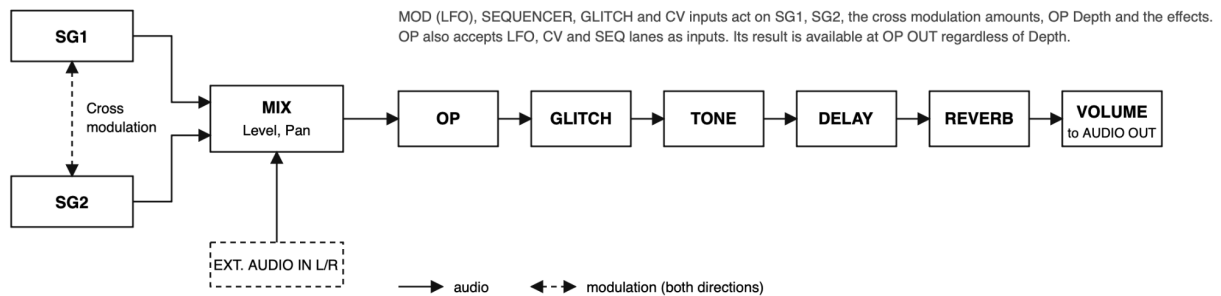
## 2. Quick Start

1. **Reset** the device (right click on panel -> Reset Device). Play a note. You hear both Sound Generators (**SG1** & **SG2**), playing a clean sine wave.
2. Turn the SG1 **BWR** knob down to noon. The bit depth is reduced and digital grit appears. Continue to the bottom of the range for a two-level square staircase.
3. Set SG2 **WAVE** to Pulse and offset its **FREQ** slightly from SG1.
4. In the orange **MOD** row, turn the inner (top) **Freq** knob. SG1 now frequency-modulates SG2. Turn the outer ring as well and the two generators cross modulate each other.
5. Set **GLITCH** to about 20%. Hold a chord and listen for a few bars.
6. Click the small arrow at the lower left of the panel to open the Modulation Programmer. Click **RUN**. Set the **SG1 / SG2** lane destination to **Freq Octave** and click a few cells in the display. Blue = outer/bottom = **SG2**, Orange = inner/top = **SG1**

Every major section of the instrument is now in use. The remainder of this manual describes each in detail.

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### 3. Signal Flow and Panel Layout



- **SG1** and **SG2** are identical and independent, but not isolated. They can modulate each other, be combined in **OP**, and be modulated by **MOD**, the **Sequencer** and **Glitch**.
- The external audio input joins the mix before **OP**, so external signals pass through **Glitch**, **Tone**, **Delay** and **Reverb**, and are available as **OP** inputs.
- **Glitch** is placed before the master **Tone** filter so that **Tone** can soften its output.

#### 3.2 Front panel

**SG1 row** (top) and **SG2 row** (below the MOD row): the two Sound Generators.

**MOD row** (orange): the four concentric cross modulation knobs and the central display.

**GLOBAL** column: **VOLUME**, **VEL**, **TONE**.

**FX** row: Delay, **GLITCH**, Reverb.

#### 3.3 Modulation Programmer

Click the small arrow button at the lower left of the front panel (or the matching button on the rear panel) to open the lower drawer. It contains the **MOD** section (LFO), the **OP** section, the **SEQ** section and the **5256 PROGRAMMER** step display.

The open or closed state is stored with the song, not with the patch, so changing patches never resizes the device.

## 3.4 Displays

All displays in the Modulation Programmer respond to the mouse:

| Action      | Result                                                                                                  |
|-------------|---------------------------------------------------------------------------------------------------------|
| Click       | Opens a menu of the available settings. Long lists are grouped into SG, Cross Mod and Effects submenus. |
| Cmd-click   | Resets to default (Off for destinations and OP inputs, RM for OP Mode).                                 |
| Hover       | Shows the standard Reason tooltip.                                                                      |
| Right-click | Opens the Reason device menu only. It never changes a value.                                            |

## 3.5 The central display

The display between the cross modulation knobs shows the activity of both generators as a field of “bubbles”. **SG1** is orange, **SG2** is blue. The vertical position of a bubble is the signal level at that instant; its size is the loudness of that peak. Bubbles fade at a fixed rate. A generator that is not sounding produces no bubbles.

When a cross modulation knob is turned by hand, a text bar appears over the display naming the control, for example **X-MOD SG1 > SG2 BITS**. Inner knobs are shown at the top of the display, outer rings at the bottom.

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## 4. Sound Generators

**SG1** and **SG2** have identical controls. The following applies to both.

### 4.1 WAVE

Selects the waveform: **Sine**, **Ramp**, **Pulse** or **Noise**.

### 4.2 BWR (Bits / Width / Resolution)

The function of **BWR** depends on the selected waveform.

| Waveform   | BWR controls                                                                                                                                                                                              |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sine, Ramp | Bit depth. Fully clockwise is clean (approximately 11 bits). Around noon the resolution is approximately 4 bits and the grit is clearly audible. Fully counter-clockwise gives a 1-bit, two-level output. |
| Pulse      | Pulse width, from 1% at the bottom through 50% (square) at noon to 99% at the top.                                                                                                                        |
| Noise      | Length of each noise ping, from a single-sample click at the bottom to a ping that rings until the next one arrives at the top.                                                                           |

***Try this:** Sine, **BWR** at 9 o'clock, short **D/R**, **S** off. This is a basic 8-bit pluck. Then assign Lane 1 of the Sequencer to **BWR** (Section 8) and let the bit depth change from step to step.*

### 4.3 The Noise waveform

Noise in BITSYNTHZR is not a continuous hiss. It is built from short sine pings, each struck at a random pitch and level and left to decay.

- **FREQ** sets how often pings occur: isolated blips at the bottom of the range, a dense wash equivalent to white noise at the top. FREQ also tilts the overall tone, darker when slow and brighter when fast.
- **BWR** sets the length of each ping.
- The random sequence is seeded by pitch, so a given note always sounds the same. The first ping of every note follows the played note when **KBD** is up, so Noise remains playable from the keyboard.

*Try this: Noise, **FREQ** at 10 o'clock, **BWR** at 2 o'clock, **KBD** at +100%. Play a low note. Add Delay.*

### 4.4 FREQ, RANGE and MODE

**RANGE** selects the frequency zone. **MODE** selects whether **FREQ** is continuous (**FREE**) or stepped (**QTZ**).

| RANGE | FREE             | QTZ                                             |
|-------|------------------|-------------------------------------------------|
| LOW   | 0.01 Hz to 40 Hz | Tempo-synced divisions, 16 bars to 1/16 T       |
| MID   | 1 Hz to 1 kHz    | Tempo-synced divisions, 1/2 to 1/4096           |
| HIGH  | 30 Hz to 10 kHz  | Semitones, plus or minus 36 around MIDI note 60 |

In **LOW** and **MID** with **QTZ** selected, the generator is locked to the song tempo and becomes a rhythmic source. A Pulse at 1/8 is a gate signal; a Pulse at 1/64 is a buzzing tone that is still in time with the song. In **HIGH** the generator follows Reason's Master Tune setting.

## 4.5 KBD (Keyboard Tracking)

Range: -100% to +100%. Default: +100%. Centre detent at zero.

At +100% the generator tracks the keyboard chromatically, with **FREQ** setting the pitch at MIDI note 60. At 0 the generator ignores the keyboard, which is the correct setting for drones, fixed-pitch noise and tempo-locked generators. Negative values invert the tracking.

## 4.6 ENVELOPE

- **A** (Attack): 0.2 ms to 2 s.
- **D/R** (Decay / Release): 10 ms to 10 s.
- **S** (Sustain): OFF gives a one-shot Attack then Decay. ON holds the note while the key is down and uses the D/R time as the release.

## 4.7 LEVEL and PAN

Output level (default -12 dB) and stereo position of the generator.

## 4.8 Polyphony

- Sine, Ramp and Pulse: 8 voices. When all voices are in use, the quietest released note is faded out to make room. A held note is only replaced when all 8 voices are held.
  - Noise: monophonic, last note priority.
- 

# 5. Cross Modulation

The four large concentric knobs in the orange **MOD** row allow each Sound Generator to modulate the other. From left to right they control **Bits**, **Freq**, **Level** and **Pan**.

Each knob has two parts:

- **Inner knob** (legend **SG1** |): SG1 modulates SG2.
- **Outer ring** (legend **SG2** ■): SG2 modulates SG1.

All eight controls are bipolar with a centre detent. Centre = off. Turning either way applies modulation; passing through zero inverts its polarity. Both parts of a knob may be active at once for two-way modulation.

| X-Mod Control | Effect                                                                                                                                                            |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bits          | The source modulate the <b>BWR</b> value of the destination.                                                                                                      |
| Freq          | The source frequency-modulates the destination. With both generators in HIGH this gives FM bells and growls; with the source in LOW it gives slow pitch movement. |
| Level         | The source modulates the destination's volume in the mixer.                                                                                                       |
| Pan           | The source modulates the destination's stereo position.                                                                                                           |

Note on behaviour:

- **Freq** modulation continues for the whole duration of the destination note, even after the source's envelope has ended.
- **Bits**, **Level** and **Pan** follow the source's envelope, so the modulation rises and falls with the source note.
- The source's **LEVEL** knob has no effect on modulation depth. A silent generator can still modulate at full strength. (Exception: a Noise source's Level and Pan modulation does follow its LEVEL knob.)

*Try this: SG1 Sine in HIGH. SG2 Sine in HIGH, tuned a fifth above, **LEVEL** fully down. Turn the outer **Freq** ring up. SG2 is inaudible but is frequency-modulating SG1, producing a bell from a single audible voice. Shorten SG2's **D/R** and the bell gains a bright attack that settles into a plain sine.*

*Try this: SG2 Pulse, **RANGE** LOW, **MODE** QTZ, division 1/8, **KBD** 0, **LEVEL** down. Turn the outer **Level** ring up. SG1 is now gated in eighth notes by a generator you cannot hear.*

## 6. MOD Section (LFO)

The **MOD** section contains a single assignable low frequency oscillator. It can reach the **Sound Generators**, all eight cross modulation amounts, the effects, **Glitch** and **OP** Depth.

## 6.1 Shape display

The display at the top of the section has three zones:

- **Waveform:** click to open the shape menu.
- **Arrows:** step to the previous or next shape.
- **Buttons:** **R** enables Retrigger (the LFO restarts on every note). **1** enables One-Shot (the shape runs once per note, then holds its final value). One-Shot requires Retrigger to be on.

## 6.2 Shapes

| Group            | Shapes                                                                                    |
|------------------|-------------------------------------------------------------------------------------------|
| Waves            | Sine, Triangle, Ramp Up, Ramp Down, Drift (smooth random)                                 |
| Pulse and random | Square, Pulse 25%, S&H (stepped random)                                                   |
| Envelopes        | Half Sine, Half Tri, Half Sq, Lin Ramp, Exp Ramp, 3x Exp Ramp, Stuttered Decay, Trapezoid |

The Envelope shapes run from 0 to +1 and end at zero. They are intended for use with One-Shot.

## 6.3 Controls

- **DESTINATION:** the parameter to modulate (see 6.4).
- **RATE:** Free (0.01 Hz to 30 Hz) or Sync (16 bars to 1/32), selected with the **SYNC** button.
- **DEPTH:** bipolar. Negative values invert the shape. On the Frequency destinations the range is tapered: small values give vibrato, full depth gives plus or minus 24 semitones.
- **POLARITY** (rear panel, BI / UNI): Bipolar swings around the destination's current setting. Unipolar adds in the positive direction only.

## 6.4 Destinations

- Off.
- **SG**: Waveform, Frequency, BWR, Level, Pan, each available for SG1, SG2 or both.
- **Cross Mod**: the eight cross modulation amounts.
- **Tone**.
- **Effects**: Delay Send, Delay Rate, Delay Feedback, Delay Mix, Reverb Send, Reverb Mix, Reverb Tone, Reverb Time.
- **Glitch**.
- **OP Depth**.

**Delay Send** and **Reverb Send** have no panel knob. They are fully open by default and are closed by negative modulation. A Square LFO at -100% on Delay Send therefore gates the signal going into the delay while the existing echoes continue.

*Try this: Shape Stuttered Decay, **R** and **1** on, **DESTINATION** SG1 BWR, **DEPTH** -60%. Each note starts with reduced bit depth and stutters toward clean. Play short notes.*

*Try this: Shape S&H, Sync 1/16, **DESTINATION** Cross Mod, Freq SG2 > SG1, **DEPTH** 50%. The FM amount changes to a new random value every sixteenth note.*

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## 7. OP Section (Combiner)

OP takes two inputs, applies a selected operation, and blends the result into the mix. The result is also available at the **OP OUT** jack on the rear panel.

### 7.1 Inputs

**Input 1** and **Input 2** are the two stacked displays at the top of the section. Both offer the same list:

Off, SG 1, SG 2, SG 1+2, External L, External R, External L+R, LFO (the MOD shape, before Depth), CV 1, CV 2, SEQ 1 Top, SEQ 1 Bot, SEQ 2, SEQ 3.

Audio inputs (SG and External) only carry signal while notes are playing. Control inputs (LFO, CV, SEQ) are always live, so OP can be used as a signal processor or logic block with no notes held.

## 7.2 DEPTH

Sets how much of the OP result enters the mix. As Depth rises, the audio inputs are replaced by the result. At 100% only the combination is heard.

## 7.3 Modes

| Mode   | Operation                                   | Character                       |
|--------|---------------------------------------------|---------------------------------|
| RM     | Ring modulation (multiply)                  | Metallic, inharmonic, bell-like |
| AM     | Amplitude modulation                        | Tremolo to gritty sidebands     |
| XOR    | Bitwise exclusive OR (8-bit)                | Harsh digital edges             |
| AND    | Bitwise AND                                 | Sputtering, broken              |
| OR     | Bitwise OR                                  | Denser and brighter than AND    |
| SHFT   | Bit shift by the other input                | Octave jumps, aliased tones     |
| MULT 8 | 8-bit multiply with wrap                    | Aggressive fold distortion      |
| MIN    | Smaller of the two inputs                   | Rough rectification             |
| MAX    | Larger of the two inputs                    | The opposite bias to MIN        |
| DIFF   | Input 1 minus Input 2                       | Cancellation, difference tones  |
| GATE   | Input 2 opens Input 1                       | Rhythmic chopping               |
| ENVF   | Input 2's envelope shapes Input 1           | Swells and ducking              |
| S&H    | Input 2 clocks a sample and hold of Input 1 | Stepped, re-clocked             |

In GATE, ENVF and S&H, Input 1 is the carrier (the audible signal) and Input 2 is the control.

The bitwise modes use sign-magnitude encoding. Silence in gives silence out, and combining a signal with silence leaves it unchanged, so the low-bit character is obtained without a DC offset.

**Try this:** Input 1 SG 1, Input 2 SG 2, Mode XOR, **DEPTH** 100%. Both generators Pulse, a fifth apart. Sweep SG2 **BWR** (pulse width). The bit pattern shifts and the timbre moves with it.

***Try this:** Input 1 SG 1+2, Input 2 SEQ 2, Mode GATE. Set Lane 2's destination to OP Source so that it controls nothing else, and draw a pattern of high and zero cells. The synthesizer is now chopped by the sequencer. Set Lane 2 **Steps** to 5 for a five-against-four rhythm.*

***Try this:** Input 1 External L, Input 2 LFO (shape S&H, fast rate), Mode S&H. Feed a drum loop into the external input. The output is a stepped, re-clocked version of the loop. Patch **OP OUT** to another device's CV input to use the result as a modulator.*

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## 8. Sequencer

The Sequencer has three lanes of up to 16 steps each, drawn on the **5256 PROGRAMMER** display. Each lane has its own speed and length, so the lanes can run polymetrically. The sequencer can be advanced by the master clock, by incoming notes, by the MOD LFO, by either Sound Generator, or by external CV.

The sequencer affects the sound, and feeds OP and the CV outputs, only while **RUN** is on and the section is powered.

### 8.1 Lanes and destinations

**Lane 1 (SG1 / SG2)** holds two values per step. The narrow orange bar in the centre of each cell is SG1; the wider blue bar behind it is SG2. Click the centre of a cell to edit SG1, the outer part to edit SG2.

Lane 1 destinations: Waveform, BWR, Frequency, Freq Semitone, Freq Octave, Attack, Decay, Level, Pan. The SG1 bars control SG1 and the SG2 bars control SG2.

**Lanes 2 and 3 (DEST. 1 / DEST. 2)** are single lanes for global destinations: **SG** (Waveform, Frequency, Freq Semitone, Freq Octave, BWR, Level, Pan, applied to both generators), **Cross Mod** (the eight amounts), **Tone**, **Effects** (as in the MOD section), **Glitch**, **MOD Rate**, **MOD Depth**, **OP Depth** and **OP Source**.

A lane set to **Off** is hidden and the remaining lanes share the display. **OP Source** keeps a lane running without controlling any parameter, so that it can be used purely as an OP input or a CV output.

Waveform, Freq Semitone and Freq Octave are stepped destinations and are drawn as a ladder: plus or minus 3 waveforms, 12 semitones, or 5 octaves.

## 8.2 Per-lane controls

The column to the right of each lane:

- **Speed:** /8 through /2, x1, x2 through x8 relative to the master clock (default x1). With the LFO, SG1 and SG2 sources, a multiplier subdivides the clock and every step plays. With the Note and CV sources, a multiplier advances that many steps per trigger.
- **Steps:** loop length, 1 to 16 (default 16).

## 8.3 Global controls

The three tiles at the right of the display:

- **RUN:** starts and stops the sequencer. RUN also follows the Reason transport (Play starts it, Stop returns it to step 1) and the Combinator's Run button.
- **TRIG:** click the label to advance the sequencer by hand. Click the source name below it to select the trigger source (see 8.4).
- **RESET:** click the label to return all lanes to step 1. The number below it is the master wrap length, 1 to 256 (default 64). After that many clock ticks every lane returns to step 1 together, so that polymeric lanes realign into a phrase. Use the arrows, drag the number, or Cmd-click for the default.
- **POLARITY** (rear panel, BI / UNI): Bipolar (cell centre is 0) or Unipolar (cell bottom is 0).
- **Power** (red button beside the SEQ label): disables the sequencer.

After RESET, or when RUN starts, the first trigger plays step 1.

## 8.4 Trigger sources

The trigger source determines what advances the sequencer. This is the most important choice in the section. The same pattern behaves very differently depending on what drives it.

| Source   | Advances                                        | Typical use                                                                                                    |
|----------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Note 1st | Once per first key down (a chord counts as one) | A pattern that moves one step each time you play. The melody is in the sequencer; the rhythm is in your hands. |
| Note All | Once on every note on                           | Arpeggio-like behaviour. Fast playing runs through the pattern quickly.                                        |

| Source    | Advances                                     | Typical use                                                                                                                                                                 |
|-----------|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LFO       | Once per MOD LFO cycle, times Speed          | A steady clock at any LFO rate, free or synced. With Retrigger on, each note restarts the timing so that the pattern locks to your playing.                                 |
| SG1 / SG2 | Once per cycle of that generator's frequency | The sequencer runs at the pitch of a Sound Generator. High notes run the pattern fast, low notes run it slowly. With the generator in LOW / QTZ it is a tempo-locked clock. |
| CV1 / CV2 | On each rising edge at the rear-panel jack   | Synchronisation to another device: a drum machine gate, a Matrix, a Thor step output.                                                                                       |

With the SG1 and SG2 sources, the clock follows everything that moves the generator's pitch: the **FREQ** knob, its CV input, Lane 1 pitch destinations, MOD, and **KBD**. With KBD up, the clock follows the most recently played note.

**Try this (play the pattern):** **TRIG** Note 1st. Lane 1 destination Freq Semitone, draw a scale over eight steps, **Steps** 8. Play a single note repeatedly. Each key press plays the next note of the melody. Change the played note and the melody transposes.

**Try this (the synthesizer clocks itself):** SG2 Pulse, **RANGE** LOW, **MODE** QTZ, division 1/16, **KBD** 0, **LEVEL** down. **TRIG** SG2. Lane 1 destination BWR with an uneven pattern on the SG1 bars. SG1 is now bit-crushed in sixteenth notes by a silent SG2. Raise SG2's **KBD** and the clock follows your left hand.

**Try this (audio-rate clock):** As above, but SG2 in **MID / FREE** at 20 to 60 Hz. The sequencer is now stepping at audio rate. Set Lane 1 to Waveform or Freq Octave and the pattern becomes the timbre.

**Try this (three lengths):** Lane 1 Freq Octave, **Steps** 6. Lane 2 Delay Rate, **Steps** 4, **Speed** x2. Lane 3 Glitch, **Steps** 7. **RESET** count 48. **TRIG** LFO, Sync 1/16. The lanes drift apart and realign every three bars.

## 8.5 Editing cells

| Action            | Result                                                          |
|-------------------|-----------------------------------------------------------------|
| Click or drag     | Set the value (drag paints across cells)                        |
| Cmd               | Reset to 0                                                      |
| Shift             | Fine adjustment; the lane expands to full height while dragging |
| Alt               | Random value (drag for a random pattern)                        |
| Cmd + Shift       | Straight line from the first cell to the cursor                 |
| Cmd + Alt         | Smooth curve                                                    |
| Shift + Cmd + Alt | Stepped ramp                                                    |

For Speed, Steps, the trigger source and the RESET count: click for a menu or drag the value. Cmd-click resets.

***Tip:** Alt-drag across a lane set to Freq Semitone or Waveform, listen, and Alt-drag again. Random patterns are the quickest way to find something you would not have drawn.*

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## 9. Glitch

**GLITCH** is a single knob, 0 to 100%. At 0% the effect is bypassed completely.

As the knob is raised, **BITSYNTHZR** begins to malfunction in a controlled way. At low settings the effect is a shifting lo-fi instability. Further up, parameters are seized and modulated, pitches jump by octaves, the signal is gated and torn, fragments are captured and reversed, and near the top the signal stutters and ratchets. Which effects occur, and when, is intentionally unpredictable. Events are sparse and slow at low settings and dense and long at high settings.

Fixed behaviour:

- Glitch runs on the song tempo and restarts with playback, so its events fall on the grid.
- All pitch jumps are whole octaves and remain in tune.
- The attack of a new note is always protected. Held notes accumulate more glitching than short ones.

- **VEL** scales how strongly velocity drives the larger events.
- Glitch is placed before the master **TONE** filter. Turn Tone toward low-pass to soften its transients.
- Glitch is a destination for the MOD section and the Sequencer. It can be pulsed, swept, or switched on for particular steps only.

***Try this:** A sustained pad with **GLITCH** 35%. Lane 3 destination Glitch, all cells at zero except steps 15 and 16 at maximum. Every phrase ends in a collapse and the next starts clean.*

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## 10. Effects

### 10.1 Delay

A lo-fi delay in the manner of early bit- and rate-reduction delay chips. It is clean at short times and becomes grainier as the delay time increases, while remaining in tune.

- **RATE:** Free (1 ms to 2 s) or Sync (3/4 to 1/32), selected with **SYNC**. Moving the time while audio is present produces a tape-style pitch glide.
- **TONE:** bipolar, in the feedback path. Counter-clockwise darkens, clockwise thins. Each repeat is filtered again.
- **F.B:** feedback. 0% gives a single echo. Near maximum the repeats continue indefinitely and, at short times, become a pitched tone.
- **P-P:** ping-pong. Counter-clockwise starts the echoes on the left, clockwise on the right, centre is mono.
- **DELAY:** wet/dry mix. 0% bypasses the delay.

### 10.2 Reverb

A Schroeder reverb (four comb filters into two allpass filters) with the character of late-1980s digital units.

- **REVERB:** wet/dry mix. 0% bypasses the reverb.
- **TONE:** below centre darkens the tail. Above centre a high-pass filter in the feedback path brightens it, so that high frequencies ring longer than low ones.
- **TIME:** decay time, from a short slap to approximately 30 seconds.

## 10.3 Delay Send and Reverb Send

Neither send has a panel knob. Both are fully open by default and are closed by negative modulation from the MOD section or a Sequencer lane. This allows the signal entering an effect to be gated while the effect's tail continues.

## 10.4 Master TONE

The **TONE** knob in the GLOBAL column is a 12 dB per octave filter on the complete mix. Centre is bypass; counter-clockwise is low-pass; clockwise is high-pass. It is placed after Glitch and before Delay and Reverb.

***Try this (resonant drone):** Delay Free at a very short time, **F.B** near maximum, generator levels low. Play short notes and the delay rings at a pitch. Control the pitch from a Sequencer lane assigned to Delay Rate.*

***Try this (gated reverb):** **REVERB** 60%, **TIME** long. MOD shape Square, Sync 1/8, **DESTINATION** Reverb Send, **DEPTH** -100%. The reverb receives only half of every eighth note.*

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## 11. Master Section

- **VOLUME:** 0 dB at noon, +6 dB fully clockwise.
  - **VEL:** amount of velocity control over level. 0% (default) is velocity-independent. Also scales the velocity sensitivity of Glitch.
  - **CPU / QUALITY** (rear panel, HIGH / ECO / LOW): HIGH runs the voices at full rate and the effects at 22.05 kHz. ECO runs the effects at 11.025 kHz with smoothing on the returns and the voices at approximately 22 kHz. LOW runs the effects at 11.025 kHz without smoothing and the voices at approximately 11 kHz. LOW is the cheapest setting and adds its own aliasing. It is worth trying as a sound in its own right.
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## 12. Rear Panel

Every CV input has a trim knob except the trigger inputs. CV inputs add to the setting of the corresponding panel control.

| Section               | Connections                                                                                                                                             |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| AUDIO OUT             | L, R                                                                                                                                                    |
| EXT. AUDIO IN         | L, R. Joins the dry mix (through Glitch, Tone, Delay and Reverb) and is available as an OP input. With one jack connected the input is treated as mono. |
| MONO SEQ CTRL         | Gate and CV note inputs, monophonic.                                                                                                                    |
| SOUND GENERATOR 1 / 2 | WAVE, BWR, FREQ, ATTACK, DECAY, LEVEL, PAN CV inputs for each generator.                                                                                |
| VOL                   | Master Volume CV input.                                                                                                                                 |
| DELAY                 | RATE, TONE, F.B, MIX CV inputs.                                                                                                                         |
| REVERB                | MIX, TONE, TIME CV inputs.                                                                                                                              |
| MOD                   | POLARITY switch, RATE and DEPTH CV inputs, and OUT. The output carries the LFO at full strength regardless of Depth, for use as a free LFO source.      |
| OP                    | DEPTH CV input and OUT. The output carries the OP result whether or not notes are playing.                                                              |
| CV IN 1 / 2           | General-purpose inputs, used as OP inputs and as Sequencer trigger sources.                                                                             |
| SEQUENCER             | POLARITY switch, ALL TRIG (advances every lane) and ALL RST (resets every lane).                                                                        |
| LANES 1 / 2 / 3       | Per lane: CV OUT (Lane 1 has two, marked   for SG1 and ■ for SG2), TRIG and RESET. Set a lane to OP Source for a CV-only lane.                          |

**Try this:** Patch Lane 3 CV OUT to another device's filter cutoff and set Lane 3 to OP Source. BITSYNTHZR now acts as a step modulator for the other device while its own sequencer continues to follow your keyboard.

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## 13. Programming Examples

These are starting points. Adjust freely.

**Buzzy 8-bit lead** SG1 Sine, MID, FREE. BWR at noon. Short Attack, Sustain on, medium D/R. Delay Sync 1/8, F.B 40%, Tone slightly dark. Glitch 12%.

**Polymetric clock bass** SG1 Pulse, QTZ, LOW, a slow division, KBD 0, Sustain off, short D/R. Lane 1 Freq Octave, Steps 6. Lane 2 Delay Rate, Steps 4. RUN. Allow it to run for a minute before judging it.

**OP texture** Both generators at slightly different QTZ divisions. OP Input 1 SG 1, Input 2 SG 2, Mode AND (or XOR), Depth up. Sweep one generator's BWR and FREQ to move the bit pattern. Patch OP OUT elsewhere if required.

**Melody played one note at a time** TRIG Note 1st. Lane 1 Freq Semitone, draw a phrase, Steps 8. Lane 2 BWR with a few reduced steps. Play one key rhythmically.

**Self-clocked stutter** SG2 Pulse, LOW, QTZ 1/16, KBD 0, LEVEL down. TRIG SG2. Lane 1 SG1 Level with an on/off pattern. Lane 3 Glitch with two high steps. SG1 becomes a gated pulse that occasionally breaks up. Raise SG2's KBD to control the clock from the keyboard.

**Sequenced glitch wash** Sustained pad on both generators, soft Attack, Sustain on. Glitch 40%. Lane 3 Glitch with a few high and low steps. TRIG LFO, Sync 1/8. Close TONE partly and add Reverb.

**Drift drone** SG1 Noise, KBD 0, Sustain on, slow Attack. MOD shape Drift, Sync at a slow division, DESTINATION SG1 Frequency, moderate Depth. SG2 Sine an octave below for weight. A small amount of Glitch.

**Bell with a short FM attack** SG1 Sine HIGH. SG2 Sine HIGH a major third above, LEVEL off. Outer Freq ring 40%. SG2 Attack 0, D/R 300 ms, Sustain off. Reverb TONE above centre, TIME long. The FM is present for the first 300 ms only, after which the sine rings alone in the reverb.

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## 14. Quick Reference

- Cmd-click (Ctrl-click on Windows) resets knobs, displays, cells and the RESET count to their defaults.
- The Modulation Programmer opens with the arrow at the lower left, front or rear.
- The Sequencer only runs while RUN is on and always starts on step 1.
- OP with control inputs (LFO, CV, SEQ) operates without notes playing.
- LOW quality is a tone colour as well as a CPU saving.