ENDORPHINES
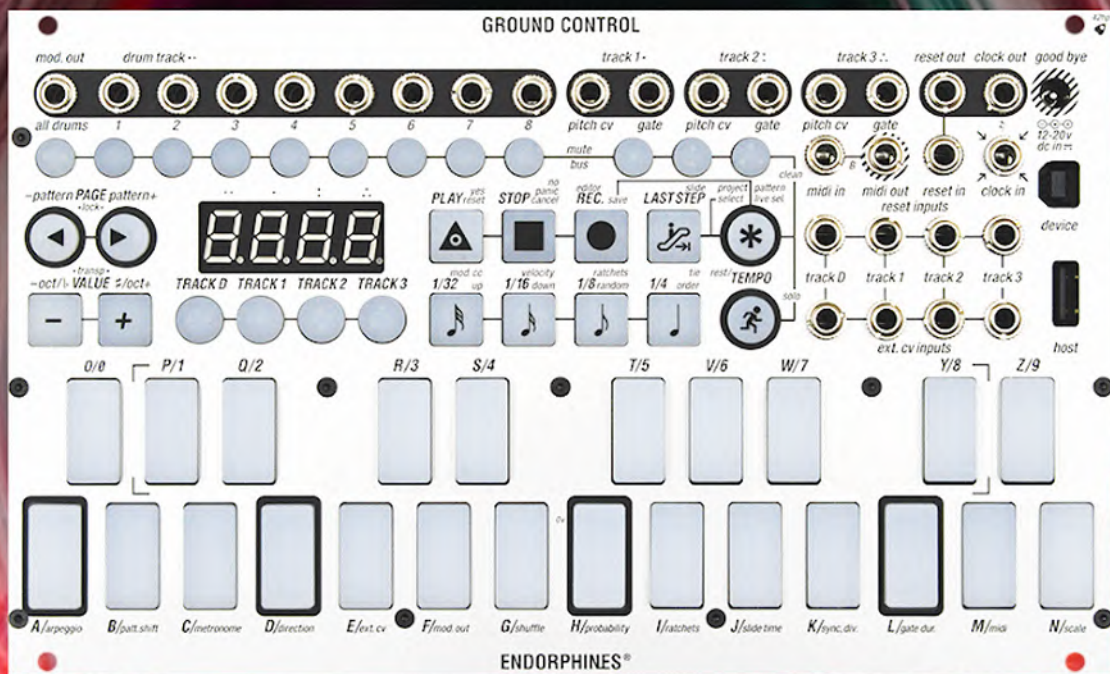
GROUND CONTROL

EURORACK & STANDALONE

FIRMWARE V.3

WARRANTY

1-year warranty is guaranteed from the product's purchase date in case of any manufacturing errors or other functional deficiencies during runtime.

The warranty does not apply in case of:

- → damage caused by misuse
- → mechanical damage arising from careless treatment (dropping, vigorous shaking, mishandling, etc.)
- → damage caused by liquids or powders penetrating the device
- → heat damage caused by overexposure to sunlight or heating
- → electric damage caused by improper connecting

The warranty covers replacement or repair, as decided by us. Please contact us via email for a return authorization before sending anything. Shipping costs of sending a module back for servicing is paid by the customer. Device complies with all EU regulations concerning RoHS lead-free manufacturing and WEEE disposal.

VISIT US:

https://endorphin.es

https://youtube.com/user/TheEndorphines

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https://www.instagram.com/endorphin.es/

https://www.modulargrid.net/e/modules/browser/vendor:167

For technical requests: **support@endorphin.es**

For dealer / marketing inquiries: info@endorphin.es

FURTH BARCELONA, S. L. (EU VAT ID: ES B66836487)

GROUND CONTROL

➜ 42hp eurorack modular polymetric and polyrhythmic performance CV/MIDI/USB-MIDI sequencer / random automatic arranger with random variations for drums and melodies

➜ 4 tracks: drum track with 8 triggers and modulation and 3 melodic CV/Gate tracks. Velocity and CC is recorded from external MIDI

➜ 2 octave keyboard (no velocity or pressure action), play sequences and grooves on the fly or use external USB/MIDI gear or DAW integration or control external MIDI gear

➜ arbitrary, up to ~~64~~ 128 (!) steps per pattern, 24 patterns per track, 24 projects - projects backup and update via USB

➜ various record modes: 101-style step input with step editing, live recording and step editor with x0x-style drum editing

➜ dedicated mute/solo bus with momentary mute or quantized to pattern-end length action

➜ works also as a power supply for your modular system (same as Shuttle Control) or can be powered by a buss board like any other module

➜ arpeggiator, roller, patterns queue, slides, ties/rests, ratchets, transpose

➜ music scales easily editable via highlighted keys: chromatic, minor, major, pentatonic etc.

➜ external CV modulation matrix: control various sequencer parameters under CV: pattern shift, semitone and octaves offset, shuffle, ratchets, slide, gate length, CV to CC values or pattern change

CONTENT

INTRO

Ground Control is a powerful performance sequencer for CV/Gate signals, drum triggers as well as MIDI and USB-MIDI devices.

It features X0X, 101, step editing and live play approaches for sequencing and recording. That empowers you to create grooves on the fly with fast polymetric input so you can concentrate on the score without menu diving. Alternatively you may generate totally new melodies randomly or variate existing ones to instantly get some fresh inspiration - those are new Firmware 3 features.

➔ Quick start guide: https://youtu.be/t0OjK-sw3zI

➔ Loopop's full tutorial: https://youtu.be/XhriE0MKjp0

➔ Turbo start: https://youtu.be/UwHBblPGvRA

➔ Essential guide: https://youtu.be/gUsYx2ekUPg

CONNECTING THE POWER

The Ground Control can be powered in two different ways. It is very important to use **only one** of the powering options:

1. **AS A EURORACK MODULE:** connect the module *directly into the power buss board with supplied 16-16* ribbon cable like any other eurorack module
2. **AS A STANDALONE DEVICE:** Power the Ground Control *from the faceplate with a 12-20V DC power adapter (or supplied adapter in case of standalone version)*. In that case the ribbon cable connector will act as a power supply. For a single sequencer connection you would need a 500mA adapter. For using the sequencer as a power supply - the higher the amperage of the DC adapter the better, minimum recommended rated as 3A or more. The DC jack accepts a universal 2.1 or 2.5mm / 5.5mm barrel. In that case the 16 pin cable can act as a power source for your bus-board – that can be any passive or flying bus-board. It will deliver identical current – up to 1A per +12V rail and up to 700mA per -12V rail. Small +5V jumper (off by default) on the left side will enable +5V source into the bus-board.

➔ *HINT: power consumption will increase, if devices are powered from USB HOST*

INITIAL PANEL DESIGN

Endorphines ®

mod. out   drum track   track 1   track 2   track 3   reset out   clock out   good bye

all drums   1   2   3   4   5   6   7   8   pitch cv   gate   pitch cv   gate   pitch cv   gate

12-20v dc in

mute bus   clean   midi in   midi out   reset in   clock in

reset inputs   to device

– pattern/page/pattern +   ·lock·   play yes/reset   stop no panic/cancel   record editor/save   last step/slide   load/project

– oct/♭   transp value   #/oct+   track D   track 1   track 2   track 3   1/32 mod.cc   1/16 velocity/down   1/8 ratchets/random   1/4 tie/order   rest/tempo

track D   track 1   track 2   track 3

ext. cv inputs   to host

0/0   P/1   0/2   R/3   S/4   T/5   V/6   W/7   Y/8   Z/9

A/arpeggio   B/nudge   C/metronome   D/direction   E/ext.cv   F/mod.out   G/shuffle   0v   H/probability   I/ratchets   J/slide time   K/sync.div   L/gate length   M/midi   N/scale

GROUND CONTROL

NEW PANEL DESIGN

GROUND CONTROL

mod. out   drum track   track 1   track 2   track 3   reset out   clock out   good bye

all drums   1   2   3   4   5   6   7   8   pitch cv   gate   pitch cv   gate   pitch cv   gate

12-20v dc in

mute bus   clean   midi in   midi out   reset in   clock in

reset inputs   device

–pattern PAGE pattern+   ·lock·   PLAY yes/reset   STOP no panic/cancel   REC. editor/save   LAST STEP slide   project select   pattern live sel.

–oct/♭   transp VALUE #/oct+   TRACK D   TRACK 1   TRACK 2   TRACK 3   1/32 mod.cc   1/16 velocity/down   1/8 ratchets/random   1/4 tie/order   rest/TEMPO   solo

track D   track 1   track 2   track 3

ext. cv inputs   host

0/0   P/1   Q/2   R/3   S/4   T/5   V/6   W/7   Y/8   Z/9

A/arpeggio   B/patt.shift   C/metronome   D/direction   E/ext.cv   F/mod.out   G/shuffle   0v   H/probability   I/ratchets   J/slide time   K/sync.div.   L/gate dur.   M/midi   N/scale

ENDORPHINES ®

INTERFACE

DC JACK INPUT
- good bye
- 12-20v dc in
- ⊖⊙⊕

GLOBAL CLOCK / RESET I/O

MIDI I/O
- midi in
- midi out
- B

USB

DEVICE / HOST CONNECTORS
- device
- host

- reset out
- clock out
- reset in
- clock in

MODULATION, DRUM TRIGGERS, PITCH CV/GATE 1-3 TRACKS OUTS
- track 3 ::
- track 2 :
- track 1 :
- gate
- pitch cv
- drum track ..
- mod. out

MUTE/SOLO BUTTONS BUS
- all drums
- 1 2 3 4 5 6 7 8
- mute bus
- clean

PATTERN/PROJ LOAD/SAVE SHIFT #2
- slide
- project
- pattern
- select
- live sel.
- LAST STEP

TEMPO / MENU SHIFT #1
- rest/TEMPO
- solo

TRACK'S RESET INPUTS
- reset inputs
- track D track 1 track 2 track 3
- ext. cv inputs

EXTERNAL CV INPUTS

TRANSPORT BAR
- PLAY yes / reset
- STOP no / panic / cancel
- editor / REC. save

TRACK SELECTION KEYS
- mod cc 1/32 up
- velocity 1/16 down
- ratchets 1/8 random
- tie 1/4 order

4 SYMBOLS DISPLAY

TRACK SELECTION KEYS
- TRACK D TRACK 1 TRACK 2 TRACK 3

PATTERN / PAGE KEYS
- pattern PAGE pattern+
- -lock-

TRANSPOSE KEYS
- -transp.-
- -oct/♭ VALUE ♯/oct+
- + -

2-OCTAVE PIANO KEYS
- 0/0 P/1 Q/2 R/3 S/4 T/5 V/6 W/7 Y/8 Z/9
- A/arpeggio B/patt.shift C/metronome D/direction E/ext.cv F/mod.out G/shuffle H/probability I/ratchets J/slide time K/sync.div. L/gate dur. M/midi N/scale

TRIGGERS / CV / GATE / OUTPUTS

Ground Control has the following tracks:

➜ **_DRUM TRACK_** that consists of 8x drum triggers. Each drum trigger also sends individual velocity values via MIDI or USB-MIDI, with velocity editing via the step editor. By default, the drum track is assigned to MIDI channel 10 (see **_MENU_** → **_M/MIDI_** → **_A_** settings). Trigger outputs are v-trigger outputs with increased 0...10V output range to drive low pass gates more efficiently

➜ **_3X MONOPHONIC MELODIC TRACKS_** with physical 1v/oct pitch CV and gate outputs. Pitch CV outputs cover 10 octaves -5v to +5v (similar as the Shuttle Control outputs. Gate outputs are 0 to 10V. By default, the TRACKS 1/2/3 are assigned to appropriate MIDI channels 1, 2 and 3 (see **_MENU_** → **_M/MIDI_** → **_A_** settings).

➜ **_MODULATION TRACK_** with physical CV output. Can be assigned to drum or melodic tracks with MIDI CC#01. Alternatively can be assigned to any track's note velocity output.

The lowest recognizable MIDI note is C of -2nd octave (MIDI note number 0) — its output voltage corresponds to exactly -5V. The highest note is C of 8th octave (MIDI note number 120) with the corresponding output voltage of +5V. C3 is the central note that returns exactly 0 volts. It is important to notice that the range of output voltages for any CV output is limited to -5V ... +5V.

TRANSPORT BAR

PLAY _yes_ _reset_   **STOP** _no_ _panic_ _cancel_   _editor_ **REC.** _save_   **LAST STEP** _slide_
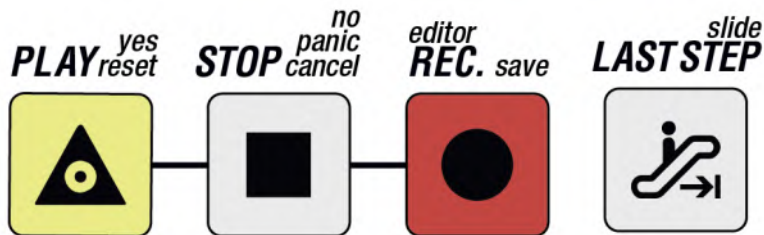
→ **PLAY:** playback start button:

- Single press starts the playback when the sequencer is stopped

- Once pressed during the playback, it resets all the tracks to their first steps

- Combination of **TRACK D/1/2/3 + PLAY** during the playback resets pressed track to the first step

- In some actions the **PLAY** button acts as **YES** confirmation of the call to action (e.g. formatting an SD card) as opposed to **NO** cancellation with the **STOP** button.

→ **STOP**: playback stop button:

- Once we are in the menus, single press acts as an exit from the menu or **NO/cancel** of call to action without stopping the playback

- Also acts as a **PANIC BUTTON** when pressed and held a few times in case some MIDI devices have hanged notes

→ **RECORD**: that button enables record or edits the notes in different combinations:

- When sequencer is not running, short **RECORD** button press starts the step record on the selected track (see **TRACK D/1/2/3** buttons)

- Long press enters the editor (**XOX** for drums or step editor for melodic tracks)

- When sequencer is running, then short press enables live recording and long hold enters the live editor, so you can preview all the changes on the fly

- Combination ✳ → **RECORD** enters the Pattern save menu

- Combination ✳ → **RECORD → RECORD** saves all the current project settings as well as all unsaved tracks

- Combination **TEMPO**+**RECORD** starts **RECORD WAIT** mode.

→ **LAST STEP**: sets the amount of steps per track but in other menus acts as alternative key (e.g. alternating project / pattern) etc.:

- Combination **LAST STEP + MUTE BUS → VALUE-/+** (or **PAGE** or numeric keys **P/0...Z/9**) sets the amount of steps per separate drum or melodic tracks. After choosing the track with **TRACK D/1/2/3** buttons, we adjust its pattern length

- In melodic tracks editor that button acts as a flag for enabled slide on the active step

- In the ✳ menu acts as alternative selection of project or pattern load/save

- **TEMPO + LAST STEP** locks the BPM value on the screen

- When arpeggiator enabled with **1/32...1/4** buttons, short press latches the arpeggiator, and long hold enables arpeggiator's super-latch mode

- In **F/MOD.OUT** settings, pressing that button enables smooth CV values vs stepped modulation values.

TRACKS D/1/2/3

TRACK D TRACK 1 TRACK 2 TRACK 3
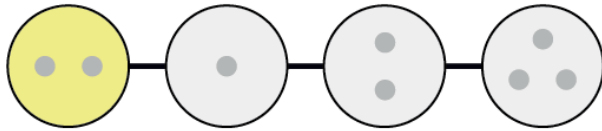
Ground Control features *1 DRUM TRACK* (consisting of *8 TRIGGERS*), *3 MONOPHONIC MELODIC TRACKS* and *1 MODULATION TRACK* assignable to any of those tracks. Once we are going to record, play, or edit one of the tracks, we activate it with appropriate *TRACK D/1/2/3* buttons.

Each track has a special dot symbol, which is written in same combination on the track names as well as also duplicated with physical bumps on the rubber keys to help navigate those main tracks with the fingers when you are on the stage:

drum track ··   *track 1 ·*   *track 2 :*   *track 3 ∴*

You can only select one of the four tracks at a time and depending on which track is active you can configure different MENU settings.

➜ In the menu settings of a specific track, *TRACK D/1/2/3* buttons enter that track's settings

➜ Combination of *TRACK 1/2/3 + TRANSPOSE +/-* buttons will shift currently selected pattern by 1 octave up or down on each combo press

➜ Combination of *TRACK D/1/2/3 + 1/32...1/4* buttons sets the time division of the track. Same combination with the long hold sets the same division but in *triplets*

➜ Combination of *TRACK D/1/2/3 + PLAY* during the playback resets pressed track to the first step.

DISPLAY

TRACK D TRACK 1 TRACK 2 TRACK 3

4-symbol display shows various information:

➜ By default or on time-out it always shows the currently selected preset on each of the tracks: each of the four letters of the alphabet shows one of the 24 (*A to Z*) patterns on each of the **TRACKS D/1/2/3**. The dots pattern above the screen corresponds to same bumps on the rubber buttons of the tracks

➜ In the menus display shows numeric values, parameters of selected menu items, hints etc.

 - a small dot near each track letter appears if that pattern is altered and is currently *unsaved*. That dot disappears if we switch to another not altered pattern. After returning back to the unsaved pattern the dot will appear again. Once we save the pattern (or **SAVE EVERYTHING** by **✱**(PROJ) → **RECORD** → **RECORD**), the dot disappears.

➜ *Once we turn off the module's power, all unsaved patterns will be lost.*

THE ALPHABET / DISPLAY TYPE-FACE FAMILY

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

*0 1 2 3 4 5 6 7 8 9 # / - * > ? + .*

PATTERNS

Every of *24 projects* named A to Z in Ground Control has **FOUR TRACKS: D, 1, 2, 3**.

Each of those four tracks consist of **24 PATTERNS** named also A to Z

Each of *24 patterns* correspond to twisted 24 [Latin alphabet](#) letters from **A** to **Z** (with the same pattern sharing V/U letter and missing X letter).

Each pattern consists of a maximum ~~64~~ **128 STEPS** from [Firmware V.3](#).

Combination of **LAST STEP + ◄PATTERN/PATTERN▶** or **TRANSPOSE +/-** sets amount of steps (length) each of those tracks with default value of 16.

Drum track consists of **8 DRUM TRIGGERS TRACKS**.

Each of those 8 drum tracks can be of any length and up to ~~64~~ **128 STEPS LONG** – i.e. fully polymetric.

Combination **LAST STEP + MUTE BUS buttons → TRANSPOSE +/-** sets the separate length of each of 8 drum tracks. After choosing the track, we adjust its amount of steps - with default value of 16 for all.
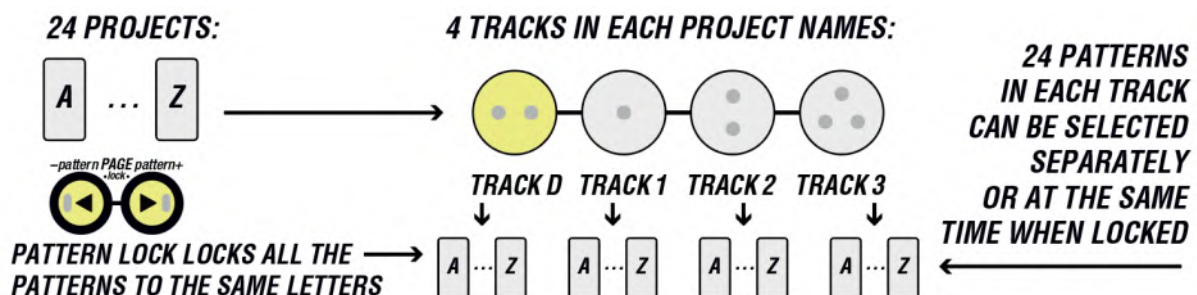
➜ **NOTE:** *there are no patterns/projects with the letters U and X.*

Selecting the patterns can be done in the following ways:

➜ Selecting active track with **TRACK D/1/2/3** buttons and then switching the pattern on that track by incrementing up or down with **◄PATTERN/PATTERN▶** buttons

➜ We can change to exact pattern on the any track by pressing **TRACK D/1/2/3 + A...Z** piano keys buttons

➜ Pressing **✳ → A...Z** piano keys buttons in the [live pattern mode](#).

Patterns are not changed instantly to the next one, but after the current one is finished. The next step after the current pattern has finished will be the first step of the new selected pattern.

PATTERNS LOCK
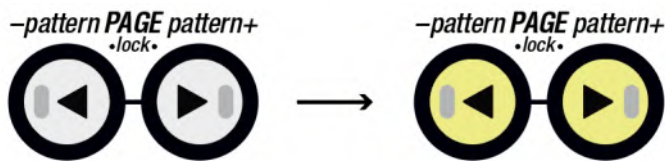
Each track can have any of *24* available patterns selected, or you can **LOCK** all 4 of them. By pressing both ◀ *PATTERN + PATTERN* ▶ buttons, we lock the patterns which means changing one pattern on one track will change to the same pattern name on the other tracks. Thus all patterns will be shown as 4 same letters on the display. Any of the pattern select ways described above are applied in that mode just switching one pattern will switch all of them.

Once the patterns are locked, both ◀ *PATTERN/PATTERN* ▶ buttons are lit and the patterns on all 4 tracks are switched in the moment *ONCE THE LONGEST PATTERN ON EITHER OF THOSE TRACKS HAS FINISHED.*

Doing live performance in **LOCKED / PATTERN LOCK** mode would probably be way convenient as it allows you to create 'drops' or 'climax' moments - i.e. sudden switching rhythm and bass/lead patterns at once. That way of sequencing - i.e. when all tracks are locked under a single pattern typically realized in Elektron™ devices.

POLYMETRY

Ground Control's power is in its freedom of workflow and pattern flexibility, where each track can run at its own speed (polyrhythms) and have independent pattern steps length - so called polymetric sequencing.

A *polymeter* is best described as the superimposition of one meter on top of another. It could also be described as the simultaneous performance of two or more independent meters.

By using the **LAST STEP** button we can set *TRACK 1* to have pattern length of 16 steps and *TRACK 2* to have pattern length of 7 steps. This will create an interesting polymetric relationship between tracks 1 and 2 as they will no longer loop at the same points in time, creating a phasing and hypnotic feel that always evolves in time. Each of 8 drum triggers can also have an independent amount of their steps. This can be extremely useful when creating complex rhythmic relationships between tracks as typically used in techno music.

You can use additional [reset inputs](#) to control and reset the tracks in case you don't want to hear constant sequence phasing with polymetric configuration.

PATTERN CHAIN

By holding **TRACK D/1/2/3** buttons + entering a sequence with the keys **A...Z** (even repeating the same letters) will add the patterns to the **PATTERN CHAIN** – i.e. they will be played sequentially and in order once the chain is entered. After we choose another pattern or its chains, we lose the previous chain. There is a single pattern chain per project. Maximum number of patterns in the chain is 24. There is no specified song mode in the Ground Control however you can chain the patterns to switch them one by one in the chain imitating that mode.

Once recorded, pattern chains can also be saved with **SAVE ALL** combination: ✳ → **RECORD** → **RECORD** and restored on the next project load or sequencer power up.

2 OCTAVE / 24 PIANO KEYS
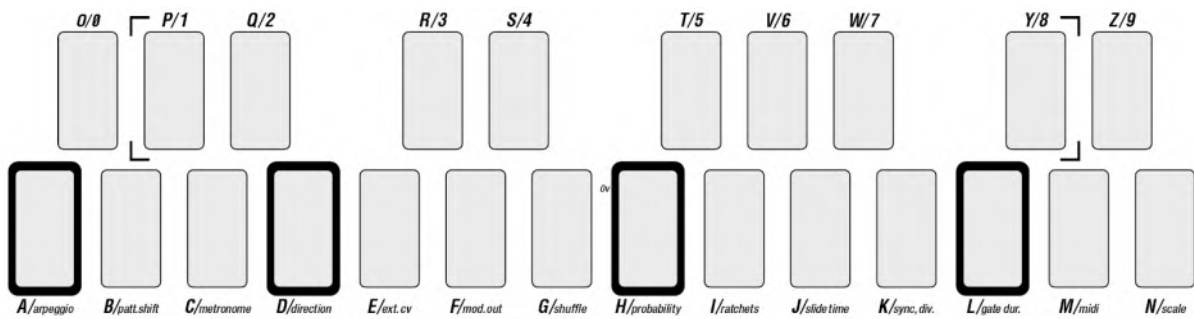
Sequencer has 2 octaves or 24 piano keys buttons – they are momentary, silicone rubber push buttons for entering melodies, drums, steps, selecting the patterns, accessing the menus, entering alphabetical and numerical values etc.

➜ *Piano keys are not velocity or pressure sensitive*

PIANO KEYS USE

➜ Play/preview melodies or trigger the drums when we are in a normal, non-recording mode:

- ▪ Once we activate one of the melody **TRACKS 1/2/3**, pressing those keys will generate the pitch CV and gate information on appropriate 3.5 mm **TRACK 1/2/3 OUTPUT JACKS** as well as generate MIDI notes information on 3.5mm TRS MIDI and both USB-MIDI host and device outputs on the channels set in the **MENU TEMPO → M/MIDI → A**. Keys cover a range of two octaves *F* to *E* and we can shift (transpose) the keyboard up and down to play the keys in higher or lower octaves. When no octaves are shifted (**TRANSPOSE +/-** buttons not lit), C-note **E/ext.cv** corresponds to **C3** note or 0v on pitch CV outputs.

- ▪ Once we activate the drum track with **TRACK D** button, we can preview/play/record drum triggers with the top row of keys marked as *P/1…Y/8*. Each of those keys has numbers from 0 to 9, and digits 1 to 8 correspond to the appropriate trigger outputs 1 to 8 marked with [   ] on the panel:
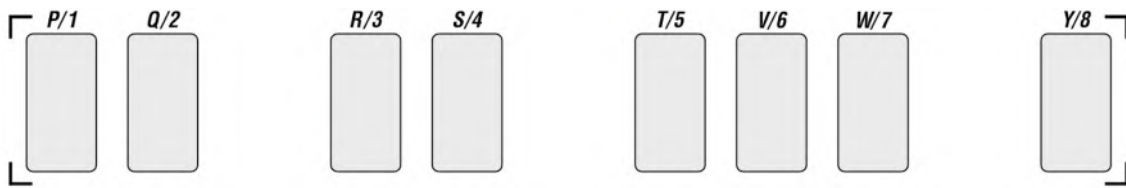
- Once we activate the arpeggiator/roller with **1/32...1/4** buttons, piano keys buttons activate the notes sequences once pressed in a chord or activate the drum rolls once we press the drum triggers

➜ Select the next pattern on active track in the combination of buttons: **✳ → A...Z** buttons. Once the new pattern is selected, it will be launched once the current one has finished playing its last step (or its full cycle in case of pendulum or random directions)

➜ Enter the menu items using the lower row of keys A to N and combination of **TEMPO + A...N** or **TEMPO → A...N**. Small hints are written near each of A...N letters and correspond to various menu item group settings, which are described in the MENU section below

➜ Numerical input **0...9** with the upper row of **O/0...Z/9** buttons to enter the exact parameter value along with the **VALUE-/+** incremental buttons

➜ Save current pattern to another pattern (via combo **✳ → RECORD → A...Z**) and also to load (open) or save one of 24 projects (via combo **✳ → LAST STEP → A...Z** to load another project and **✳ → RECORD → LAST STEP → A...Z** to save current project into another project name cell).

TRANSPOSE / VALUE CHANGE BUTTONS
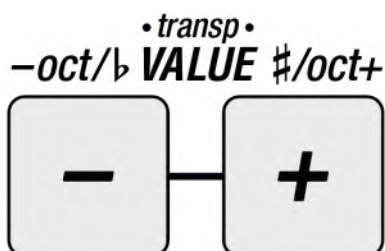
Initially **-OCT / OCT+** buttons are used to transpose the keyboard playing or recording melodic **TRACKS 1/2/3**. Ground Control range is

10 OCTAVES per each melodic track so there are 4 octave shifts down to the lower range with **-OCT** button and 4 octaves shifts up to the higher range with **OCT+** button.

Combination with **TRACK 1/2/3 + TRANSPOSE +/-** buttons will shift the currently selected pattern by **ONE** octave up or down on each combo press.

VALUE +/- buttons are also used to set values in various menu items (incrementing up or down), for example changing the track's step number via combo **LAST STEP + MUTE BUS** buttons and adjusting selected track length with **VALUE +/-** buttons. In contrary to **VALUE +/-** buttons, which adjust incremental values by -/+ 1, **◄PATTERN/PAGE/PATTERN►** buttons increment values usually by -/+ 10 or -/+16 depending on the context to speed up the values adjustment.

➜ **NOTE:** *transpose buttons don't work on the drum track.*

SEMITONE TRANSPOSE (MELODIC TRACKS)

By pressing both **-OCT + OCT+** buttons together once, we activate the semitone transpose mode. In that mode both **-OCT/OCT+** buttons will be fully lit and you will see a ░░░░ message on the display. That means after pressing **A...Z** buttons we can shift the notes on the track by the amount of semitones up or down from the root C note (marked with **E/EXT.CV**). In that mode you can press single **-OCT + OCT+** buttons to shift the keyboard to transpose to higher octave intervals up or down on the currently selected active **TRACKS 1/2/3**.

LOCK SEMITONE TRANSPOSE

In semitone transpose that mode, short press the **LAST STEP** activates the **LOCK SEMITONE TRANSPOSE** mode: you will see ░░░░ message on the display. That means that semitone transpose on the

current track, will be applied to all three melodic **TRACKS 1/2/3** at once.

You can exit transpose mode again by both **-OCT + OCT+** button press or single **STOP** button press without stopping the sequencer. Remember to save your edited patterns after you shift them by semitones up or down. Otherwise, you will lose those changes on the next module's power up.

MUTES
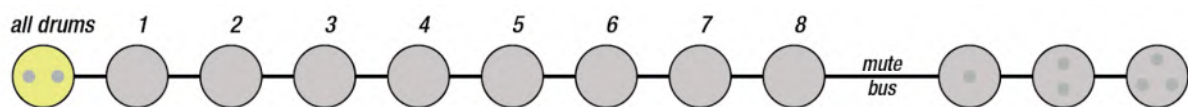
Mute *'bus'* is a row of buttons, whose main function is to mute a certain track. In addition, each of those buttons blink each time the note happens on that track which is useful to monitor activity on the tracks. **ALL DRUMS** buttons aren't blinking as we already have every drum trigger blinking with its own drum trigger.

By default, the mutes have **NON-QUANTIZED** action – i.e. they mute/unmute instantly. However if we hold the MUTE button for 1 second, it changes its mute action to **QUANTIZED***:* i.e. that track will stop or start its new cycle quantized to the track's pattern length. Use it on your musical choice – sometimes it is important to enable some tracks instantly, however sometimes it is good to queue the mute for one or multiple tracks so it will be enabled or disabled at a certain time.

ALL DRUMS button will mute/unmute immediately all the 8 drum triggers. After ALL DRUMS unmute, manually muted before tracks will be remembered. You can press any *MUTE* buttons at a time to unmute certain channels one by one. Muted tracks are remembered once you save the project (✱ → **RECORD** → **RECORD***)*.

SOLO

TEMPO+MUTE BUS buttons combo act as a momentary **SOLO** for the tracks. This action works opposite to the mutes i.e. rest tracks will be muted and only selected tracks will be enabled. When you enable SOLO without releasing the **TEMPO** button, then pressing twice on the solo'd channel will unmute all the states as before, however once you release the **TEMPO** - then you have to manually unmute all channels back.

CLEARING THE PATTERN

Combination of single **PROJECT** + any of **MUTE** buttons press will **CLEAR** the notes or triggers on the selected track but will leave the pattern length unchanged. Second consequent **PROJECT** + same **MUTE** button press will clear the steps number of that track to default 16 steps.

Single **PROJECT + ALL DRUMS** buttons press will clear all 8 drum triggers at once. Second consequent press will reset all 8 drum trigger tracks to 16 steps.

If you wish to delete a set of patterns - that means you would need to enter each pattern and press clear combo on each of them. Alternatively you may select the *EMPTY* pattern and save it into the rest pattern names destinations you wish to clear.

➡ *Maximum number of steps per track is ~~64~~ 128 with [Firmware V3](#).*

CLEARING THE PROJECT ᶠʷ ᵛ·³

Earlier, to delete a certain project you had to delete its folder with its name from the SD card. In the [Firmware V3](#) you can now delete certain projects. Projects delete option is available via [projects selection](#) menu: ✳ → **LAST STEP** (entering the project select menu) → **TEMPO + A...Z** - i.e. pressing **TEMPO** together with project name will ask for that project delete with confirmation over **PLAY/yes** or cancel with **STOP/no**.

➔**WARNING**: project delete cannot be undone, while pattern clear can be undone if you didn't save the project and simply reload it.

PATTERN / PAGE BUTTONS

The main functions of these buttons is to switch the patterns on the active track, incrementing up or down with ◄**PATTERN/PATTERN**▶ buttons.

These buttons have additional labels as ◄**PAGE**▶, i.e. in certain menus they increment values by numbers of 10 or 16 depending on the context to speed up the values adjustment in the menus.

TIME DIVISION $^{1/32...1/4}$ / ARPEGGIATOR
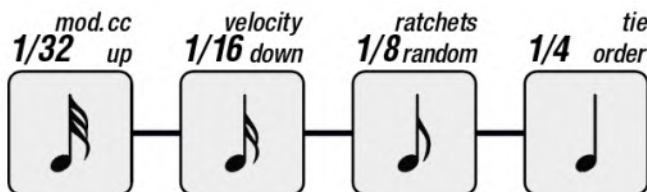
Combination with **TRACK D/1/2/3 + 1/32...1/4** buttons sets the **TIME DIVISION** of the track. Same combination with the long hold (1.5 seconds) sets the same track's division but in **TRIPLETS**.

1/16 is always the default and most used time division for any new projects therefore is marked with ° symbol at 1/16° in the old design.

Combination with **TEMPO + 1/32...1/4** buttons generate random patterns and variations on the selected track.

ARPEGGIATOR / ROLLER

Another function for *1/32…1/4* buttons is to enable/disable *ARPEGGIATOR* on melodic *TRACKS 1/2/3* and the *ROLLER* for the drum *TRACK D*.

ARPEGGIATOR

Pressing *1/32…1/4* buttons enables one of the *4 ARPEGGIATOR MODES* available: *UP / DOWN / RANDOM / ORDER* (the button selected will start to blink):
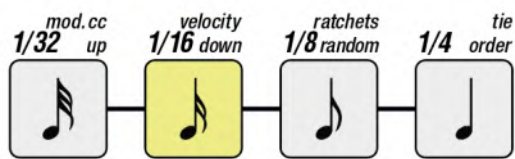
ROLLER

Pressing *1/32…1/4* buttons on the drum *TRACK D* will enable the drum *ROLLER*: each drum trigger note *P/1…Y/8* pressed will repeat itself following the selected time division *1/32…1/4*. To disable the roller press *1/32…1/4* button again.

While arpeggiator follows the track's time division, the roller on the drum track follows the pressed *1/32…1/4* time division – however only the time division initially selected for the track will be recorded if recording the roller in real-time (see section below).

When we are on the active melodic *TRACKS 1/2/3*, combination *1/32…1/4 + TRANSPOSE-/+* set the arpeggiator's *OCTAVES RANGE* (*0* by default, possible options: *-2, -1, 0, 1, 2*) – that means how many octaves the arpeggio pattern will sweep through.

➜ *Once the arpeggiator is playing the notes, you can change the modes on the fly. You can play and latch all arpeggiators and a roller on all available tracks simultaneously*

➜ *Arpeggiator and rolls can be recorded in the live recording mode, however remember the rolls will always be recorded taking into the account the current track's time division settings*

LATCH / SUPERLATCH

Pressing **LAST STEP** enables **ARPEGGIATOR'S LATCH**: it enables the arpeggiator to remember the last set of notes played on the keyboard. When *LATCH* is activated, the arpeggiating sequence will continue to play even after notes have been released. Arpeggiator's notes are cleared when playing the next chord.

To disable the arpeggiator, press **1/32...1/4 or LAST STEP** again. The arpeggiator will always have the track's time division it is played on and set by **TRACK D/1/2/3 + 1/32...1/4**.

Holding *LAST STEP* for longer than 1.5 seconds enables **ARPEGGIATOR SUPER-LATCH**:

➜ Pressing keys, will add them to the arpeggiating cycles

➜ Pressing keys that are already part of the arpeggio playing, will remove them from the current arpeggio

➜ Short press on **STEP** while super-latch is active, deactivates super-latch without clearing the note buffer to allow seamless integration of modes

➜ Maximum notes amount in arpeggiator is 24.

➜ **NOTE:** from [Firmware V.3](#) the following mode has been deactivated: when pressing both **-OCT/OCT+** buttons in earlier firmwares activated semitone transpose mode for the arpeggiator.

➜ *Pressing **STOP** button exits the semi transpose or latch states*
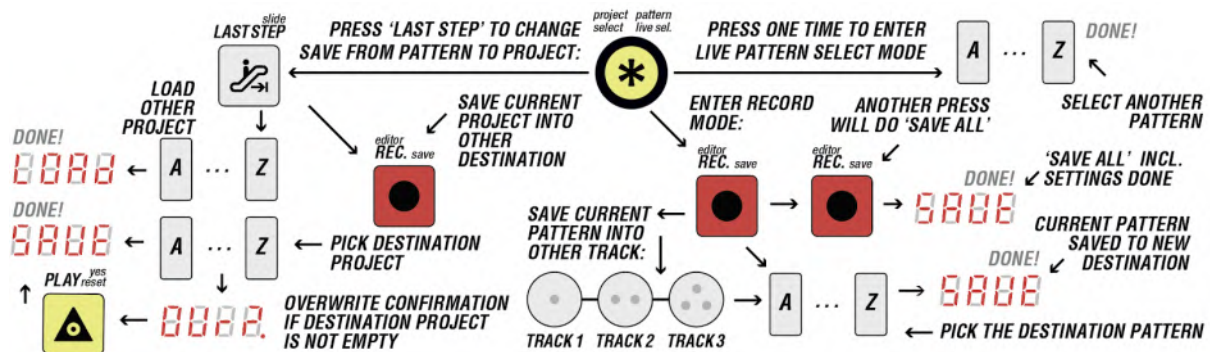

(✳)^PROJ BUTTON

project   pattern
select   live sel.

(✱)^PROJ and **TEMPO** buttons mainly work as '**SHIFT'** buttons.

(✱) or **PROJECT / PROJ**, asterisk symbol) button combinations are related to the pattern/project saving/loading/clearing functions, which usually are associated on the same level or upper the (✱) button.

PATTERNS / PROJECTS LOAD/SAVE

LIVE PATTERN MODE

Single press of the **(✱)** button will enter the **LIVE PATTERN MODE**. In that mode you can change patterns with appropriate 24 piano keys. That is an essential live performance tool when you can choose the patterns only with a single button press. When you enable **PATTERN LOCK**, then you can select the same patterns on all 4 tracks at the same time with a single key press. That's the most performative feature of the Ground Control - it is reminiscent of Ableton ^TM Live's session GRID so selecting the *locked* patterns will switch to the whole new line of clips.

Pressing **(✱)** button during live pattern mode will exit that mode.
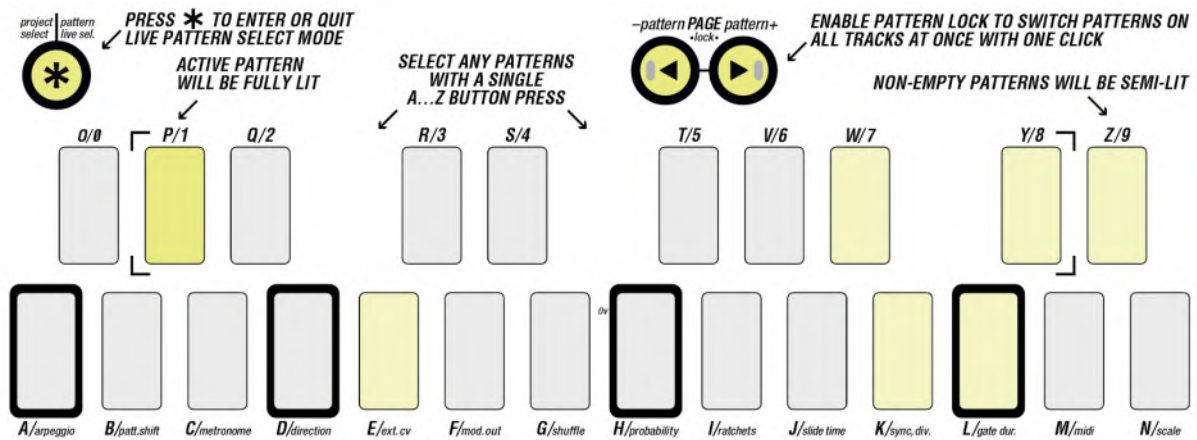
Pressing the **LAST STEP** button in live pattern mode will enter the **_PROJECT LOAD_** menu and you can load any other project with **A...Z** buttons without stopping the sequencer. Loading a new project can be done smoothly on the fly when the current project is still running without losing the sync. Once you press a new project load, after the longest pattern of the current project will be finished, all new patterns from the new project will be played on the next step.

Pressing the **TEMPO + A...Z** buttons in live pattern mode ask for a certain project CLEAR with confirmation over **PLAY/yes** or cancel with **STOP/no**.

➜ **NOTE:** *From Firmware V.3 when selecting a new project and after it will be loaded, the live pattern mode will be enabled automatically.*

SAVING THE PATTERNS AND PROJECTS

Pressing **(✱) → RECORD** or **(✱) + RECORD** buttons will enter the pattern save function.

Once you pressed **(✱) → RECORD**, you can further:

➜ press **RECORD** one more time to **SAVE ALL** settings – means all unsaved patterns on all the tracks will be saved. That also will save all the settings you've made in the menus – e.g. MIDI channels, slide amount, pattern direction, BPM etc. That is the fastest combination to save anything you have just recorded or changed

➜ press any of **24 A...Z** piano keys to save current pattern to another pattern letter

➜ press **TRACK 1/2/3 → A...Z** to save currently selected pattern on currently active track into ANOTHER track's pattern letter

➜ press **LAST STEP → A...Z** to save the current project in one of 24 project letters A…Z. Unused (clean) projects will show as unlit buttons and used projects will show as semi-lit ones. The project you are currently in will blink. To confirm the saving you will see a **SAVE** question on the screen and you can confirm overwrite (*'**OVR?**'* message) with either pressing **RECORD** or **PLAY** buttons if another project destination letter you are trying to save is not empty. To cancel the procedure and exit press **STOP** once.

After you save any pattern on a certain track (or save all fast via **(✱) → RECORD → RECORD**), those chosen patterns are restored on next modules power up. Last used project is also loaded on the next module's power up.

➜ *REMEMBER THE LOGIC: a) you can always only save the current pattern/project to itself or other destination b) everything not saved will be lost*

TEMPO BUTTON

TEMPO (**REST**/ running guy under the snow) and **(✱)**^PROJ buttons mainly work as two **SHIFT** buttons.

TEMPO button functions are mostly related to the various **MENU** settings in combination with other buttons on the same height or lower

than **TEMPO** button, while (✱) is more related to combination with other buttons or its height or higher.

The **TEMPO** button will blink according to the beats-per-minute *(BPM)* when the sequencer is running. One particular feature of the **TEMPO** button is setting the tempo value in *BPM*:

➜ when pressing **TEMPO** button 3 or more times, it will act as a **TAP TEMPO** button (for security reasons to not accidentally change - it can be disabled via **SETTINGS** menu: **TEMPO → M/MIDI → C)**

➜ when pressing the **TEMPO** button once you will see the current project tempo or tempo of the external clock if the sequencer is engaged to external MIDI/USB or jack clock. Default project's BPM value is 120. Once you see that value on the display, you can adjust it:

> ➜ with **VALUE -/+** buttons incrementing by 1 value at a press or long press to speed up the values changing
>
> ➜ with ◄**PAGE**▶ buttons incrementing tempo values by values of 10 per single press
>
> ➜ entering new BPM value with numeric **O/0...Z/9** piano keys
>
> ➜ **TEMPO + LAST STEP** combo **LATCHES THE BPM** value appearance on the display – that is useful if you need to monitor the tempo

RECORD

editor
REC. *save*

There are a few ways to record the notes on the tracks:

➜ [**STEP RECORDING**](#)*:* sequencing 101-style

➜ *[X0X-STYLE EDITOR](#)* for DRUMS: editing triggers with 16 steps per page

➜ using *[LIVE RECORDING](#)* using internal 24-piano keys or external MIDI controllers

➜ manually entering/altering the notes/velocities/modulation in the *[EDITOR](#)* or do that when the sequencer [is running](#).

STEP RECORDING

STEP RECORDING is a method of entering notes step-by-step (starting from first step) with entering *ACTIVE NOTES* and *RESTS* (pauses) into existing time-division grid. It was introduced long ago in synthesizers such as [Roland® SH-101](#) but also in *ENDORPHIN.ES – [Running Order](#)*.

Once the sequencer is stopped, the *RECORD* button is pressed once. The existing sequence/pattern on the current track is cleared and overwritten by a newly entered sequence of notes/pauses *(rests)*. Exit that mode by pressing *RECORD* or *STOP* without anything to record and the previous sequence will not be cleared. This mode currently only works when the sequencer is not running. To start paying that sequence of notes/rests, just press *PLAY*. The newly entered sequence will run through the CV/gate jacks or via MIDI.

➜ *NOTE:* Remember to always [save the result](#) when you like it.

In that record mode, the *TEMPO* button acts as a *REST* - i.e. inputting an empty step and engaging to the next one. Overlapping the keys (i.e. holding one of *A...Z* buttons and pressing another *A...Z* button) will put a *SLIDE* on that step's transition.

Pressing *1/4 ^{TIE}* or *TEMPO* buttons in record mode in conjunction with one of the *A...Z* keys will create a *TIE* - i.e. creating a note that occupies more than one step in the pattern and has a longer duration. Thus using TIEs creates longer notes. After years of trial and error, we found that this method is one of the most effective for entering patterns and grooves fast, which are melodic, occasionally unpredictable and can

have a various metric (steps length) which is useful in various electronic music styles. Pressing **LAST STEP** ^{SLIDE} in record mode in conjunction with one of the **A...Z** keys will place a note with a **[SLIDE](#)**, and pressing **1/8** ^{RATCHET} in record mode in conjunction with one of the **A...Z** keys will place a **[RATCHET](#)** on that step

EXAMPLE #1 OF STEP RECORD

Press **STOP** and switch to melodic **TRACK 1**. Select new pattern **B** by switching **PATTERN ▶** button. Press the **RECORD** button and press a notes sequence with **A...Z** keys pairing with the **TEMPO** button acting as a **REST**. Press **PLAY** to start the currently entered sequence. Alternatively, you can press another **TRACK D/1/2/3** to instantly continue entering steps on another track. That is useful to quickly fill the patterns on all the tracks.

EXAMPLE #2 OF STEP RECORD

Press **STOP** and switch to drum **TRACK D**. Select the pattern you wish to record and then press a few times one of the **1...8** piano keys. In that case, you will know exactly which drum trigger you are going to record and you can switch to different drum triggers to preview the drums. After you decide which drum you are going to record in step mode – just press **RECORD** and enter that drum sequence of triggers pressing the same **1...8** drum trigger keys and **REST** button. After you have a sequence ready, you can either: press play to start that sequence playing or press another **1...8** button to immediately start to record another drum trigger sequence. Once you press that button, the amount of steps and all the triggers/rests on the previously recorded track will be saved.

➜ *Selecting other **1...8** drum triggers on drum track or choosing other **TRACKS D/1/2/3**, will switch the step input or live recording on the next track while keeping the recording enabled. In such a way you can speed up the step input or live record of tracks one by one.*

LIVE RECORDING

Live recording is another way to record the notes into the tracks.

First of all you have to press **PLAY** so the sequencer is running. Then press the **RECORD** button and enter the notes with the keyboard or attached MIDI or USB-MIDI keyboard controller. The notes will be recorded quantized to the currently selected grid.

If you don't like what you recorded you can quickly **CLEAN** that track by pressing **(✱) +** any **MUTE** button once. That will clean only the notes on that track but will keep its length. Second **(✱) +** same **MUTE** button press will also clean the step number of that track to default 16 steps.

Remember to always save the pattern once you have entered the notes and you like it. The easiest way to do that is **(✱) → RECORD → RECORD** from anytime the sequencer is running or stopped. Last saved project or selected patterns saved are restored on the next module's power up.

ARM RECORD / WAIT FOR RECORDING

Is a special live record mode in which the sequencer is stopped and waits for the first note to be entered with the piano keys or via MIDI to immediately start playback with the live recording enabled. That feature is enabled by **TEMPO + RECORD** once the sequencer is stopped.

Once pressed you will see on the display meaning you have to enter the notes or triggers for the live record to begin. That's a nice feature if you want to record some melody or arpeggiator faster, but don't want to wait for the next pattern cycle to properly start the first notes.

RANDOM PATTERN GENERATOR ^{FW V.3}

Firmware V.3 obtained a dedicated random pattern generator. There are three pretty different random generators - which are available for both melodies and rhythm tracks and those are: *euclidean, wide* and *narrow*. Each accessible when you activate the certain track and press the following combos:

TEMPO + **1/32** for **EUCLIDEAN -** tends to equally distribute the notes over our pattern steps. Euclidean patterns reminiscent afro-style rhythms - just some instruments tend to be played slower, others faster. It shows on the screen with the following message:

TEMPO + **1/16** for **WIDE RANDOM -** has plenty of randomness and lots of random freedom. It shows on the screen with the following message:

TEMPO + **1/8** for **NARROW RANDOM** - is focused, giving a more conservative, clear result around the root note. It shows on the screen with the following message:

➜ **NOTE:** For melodic tracks pattern generators follow the music scales and most important - its root note, while 8 drum tracks all have different character (density, rhythmic pattern). There are no rules to generate interesting results on the fly except the one - **PLAY WITH IT** and explore **HAPPY ACCIDENTS**.

➜ **IMPORTANT:** when you initiate any of the random pattern generators above, the current unsaved pattern (or full drum track) will be cleared and LOST. Be careful to save your important patterns (and happy accidents) before generating more stuff.

RANDOM VARIATION ^{FW V.3}

Along with the random pattern generator, there is a dedicated random variation feature available for already generated or existing patterns.

It is available via: **TEMPO** + **1/4** and you will see the following message on the display: `8888`

Random Variation adds slight variations to the tracks - ratchets, slides, probability, octave shifts etc. - yet maintaining the melody in the key - it can dramatically change its character.

STEP EDITOR

Once you want to edit already recorded notes, you can do that via the editor.

Press and hold the **RECORD** button for more than 1.5 seconds to enter the currently selected track editor: you will see the following message on the screen: `8888`. In the editor you can change the tracks without quitting the editor by pressing **TRACK D/1/2/3** buttons.

In the editor, you can navigate thru the steps via ◄**PAGE**► buttons and current step will be shown on the display. Once there is an active note on that track you will see that key light up on the piano keys. Be aware that piano keys show only the current middle view of the keyboard so if you are sure the note is present on the current step but you don't see it, then you should navigate with the **TRANSPOSE-/+** buttons to find that note appears on another octaves. Once you reach the last step on the current track, it will be marked with two dots, i.e. if you are on the pattern A with length of 16 steps, then reaching the 16th step you will see: `88.88.`

Pressing (✷) button anywhere in the editor will add one extra step in the end of the currently edited pattern. Pressing **REST/TEMPO** anywhere in the editor will clear the current step from any notes and associated flags.

Once you navigate through the steps, you can edit the notes and their features – so called *flags*. Flag is a binary additional feature (0 or 1) which that step can have. You can turn the notes on or off in the editor and then add or disable their flags. To clean the note you can either press it again – i.e. press on the light up piano key or press the **REST** button. Each note can have the following flags: **RATCHETS**, **TIE** or **SLIDE** or **REST** (empty step). Those are ON/OFF features, meaning they are either present or not.

➔ **TIE** $^{1/4}$ button merges the current note with the next one creating a twice longer one. If that next note will also be tied with the third one, then the overall note's duration will be triple longer than the selected track's time division etc.

➔ **REST** ^{TEMPO} button light up red always cleans the current note and any modulations/velocities that are on that current step.

➔ **RATCHET** $^{1/8}$ button flag means the ratchet is enabled on the current step. The amount of ratchets can be set via the MENU: TEMPO → I/ratchets per track.

➔ **SLIDE** $^{LAST\ STEP}$ button flag means that the note will slide to another one on the last step before the destination note. Slide time can be set via **MENU: TEMPO → J**.

There are other additional features of the notes: **MODULATION** and **VELOCITY**.

While there is only one modulation track, which can be connected to any of 8 drum or 3 melodic tracks, each note or drum has a velocity transmitted via MIDI. Both can be recorded via MIDI or USB-MIDI controller, however also manually entered or adjusted per-step in the editor.

MODULATION EDITOR

To access the **MODULATION EDITOR**, switch to the track it is assigned to and long press **RECORD**. Press **MOD.CC** *1/32* button and you will get into the modulation step editor for the current pattern with the display showing **C__1:** meaning you are editing CC modulation #01 (always **CC#01**) on the drum track (default Rx/Tx MIDI channel 10).

Navigating thru the steps with the ◄ **PAGE** ▶ buttons you select the step on which you wish to adjust the modulation value and then either with **VALUE-/+** buttons or lower row of **A...N** buttons set the value from 0 to 127. Those 128 values correspond to 7-bit CC#01 message sent thru the MIDI and USB-MIDI outputs as well as converted into physical CV from 0 to +5V or -5 to +5v range at the **MOD. OUT** jack output. In the bipolar output mode to select exact *0 volts* output, just press both **G** and **H** keys together that will correspond to CC or velocity value to 64:
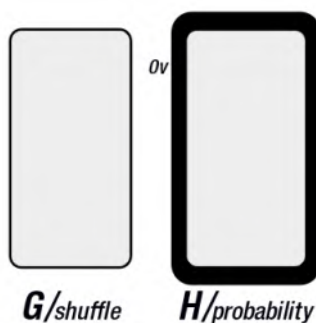
MODULATION OUT JACK ^{FW V.2}

It is possible to assign modulation or velocity of a certain track to the **MODULATION OUTPUT JACK**. If it is assigned to modulation of a certain track or drum track, it has the length of the steps of that track.

Modulation output jack settings are accessible in the menu via **TEMPO** → **F/MOD.OUT** combination: see the **MENU** section below for all the settings.

VELOCITY EDITOR

To access the **VELOCITY EDITOR**, switch to any of the **TRACK D/1/2/3** and long press **RECORD**. Press **1/16** ^{VELOCITY} button and you will get into the velocity step editor for the current pattern with the display showing **V__1:** meaning you are editing velocity value on the selected track or selected drum trigger with 1...8 buttons. Navigating thru the steps with the ◄**PAGE**► buttons you select the step, the note's velocity on which you wish to adjust and then either with **VALUE-/+** buttons or lower row of **A...N** buttons you set the value from 0 to 127. Those 128 values correspond to 7-bit note's velocity message sent thru the MIDI and USB-MIDI outputs on certain note appearance.

➜ *Velocity value 0 means that note isn't fired*

X0X-STYLE EDITOR (FOR DRUM TRACKS)

For editing the drum patterns, it is easier to use **X0X-STYLE** editing inspired by Roland® TR-606/808/909 etc. machines. That X0X editor is a part of the standard editor and exists only for the drum track.

To enter the editor, long press **RECORD** and then select **TRACK D**. In that mode a lower row of 14-piano keys together with **O/0** and **Z/9** side keys creates a 16-step grid. Press **P/1...Y/8** buttons to select the drum trigger – that selection activates its steps on imaginary 16-step grid:
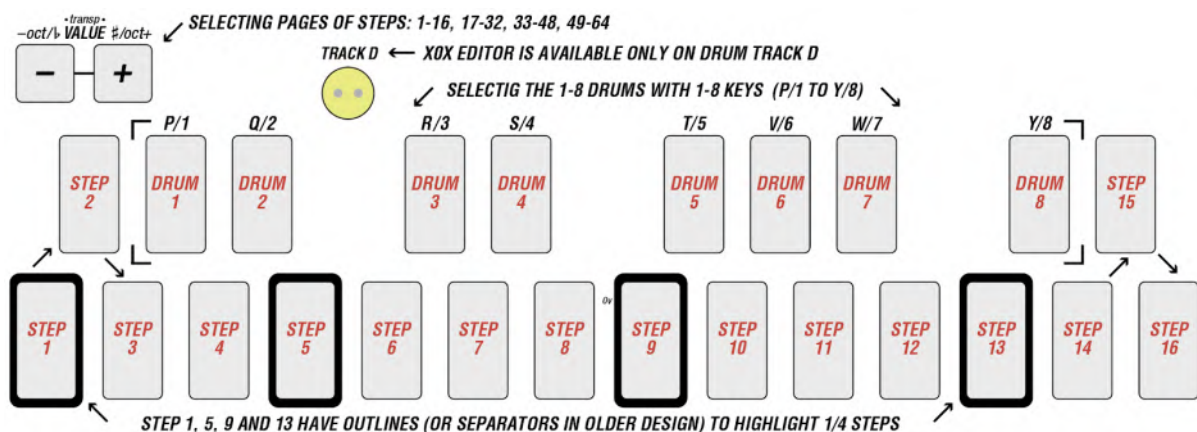
In that drum mode we see only 16 steps at once: from step 1 to 16 (page 1 is shown as 🔲🔲🔲.🔲 (**PAG.1**). Press **VALUE-/+** buttons to

navigate to **NEXT PAGES**: page 2: **17-32** steps, page 3: **33-48**, page 4: **49-64** steps and so on up to page 8 with the steps 113-128. You can access pages 2 to 8 only if a certain selected drum has more than 16 steps (selected via **LAST STEP +** any **MUTE DRUM** button + **VALUE-/+** or ◄**PAGE**►).

In the *X0X* editor you can switch between the drum notes to see each drums' grid by single press of those drums. Second press of the same drum will preview it on the drum's triggers and MIDI or USB-MIDI outputs.

➜ **HINT:** *You can access the editor when the sequencer is stopped or when it is running*

LIVE EDITOR

It is possible to adjust notes and drums step-by-step on the go – i.e. when the sequencer is running. Once the playback is running, *LONG PRESS* of the **RECORD** button will enter into the live editor mode. On the drum track you will be shown the X0X editor where you can see steps running in real-time and navigate through the pages with **VALUE-/+** buttons. On melodic **TRACKS 1/2/3** you will see the step editor and the notes will blink if they run on the current selected step.

CLOCK I/O

reset out clock out

reset in clock in
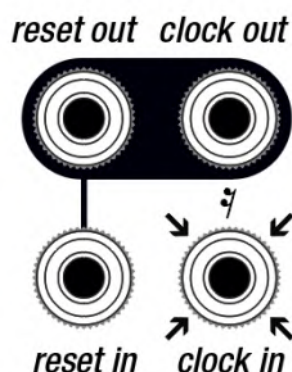
CLOCK and **RESET** are analog logic *INPUT* and *OUTPUT* signals made to synchronize Ground Control together with other Eurorack gear

(typical 1/16th notes clock and reset at the start). The trigger outputs are 0...+10V range 10 mSec length to be able to clock various music gear. Trigger inputs are typically 0...+5V (up to +10V) expected with the threshold of 0.65V.

CLOCK IN – is external, 'eurorack' clock input with 3.5mm mono/TS cable from another master sequencer or clock generator (e.g. Running Order). From Firmware V.3 its input standard is a typical clock in eurorack in sixteenth notes (PPQN/6 or 1/16th). That type of clock is reworked in Firmware V.3 to work on a step-per-pulse basis meaning it can accept variable speed from eurorack clock to infinitely stretch or squeeze the sequences on the fly yet to fit on the grid with your master sequences. Currently there are **no** input dividers applied on that type of clock as it is expected to follow the eurorack standard - it will maintain the master clock BPM while listening for its 1/16th pulses input. If there is a cable inserted into the **CLOCK IN** jack, it will automatically switch to that external 1/16th pulses clock overriding internal, MIDI or USB host/device masterclock types if they are selected as masters. You will see a message on the display when the external modular clock is activated.

CLOCK OUT – is a master clock output sent by default in sixteenth notes (corresponds to PPQN/6 or 1/16th notes), therefore is marked with ♪ symbol. Refer to **K / SYNCHRONIZATION / DIVIDERS** below of the **MENU** section on how to set the **MASTER CLOCK** and its **OUTPUT DIVIDERS**.

Ground Control sends one short trigger from its **RESET OUT** jack on playback start when you press the **PLAY** button.

Applying a trigger into the **RESET IN** jack (or manually pressing PLAY while the sequencer is running) will reset all the sequences on all 4 **TRACKS D/1/2/3** to the first step.

reset inputs

track D   track 1   track 2   track 3
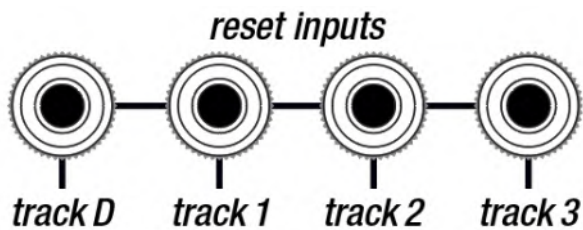
There is a row of separate track's reset inputs, meaning you can apply a trigger on a certain track to reset it independently from others to the first step. You can also manually reset certain tracks to the first step by **TRACK D/1/2/3 + PLAY** combo. Each separate track's reset is synchronized to the grid of each track's selected time division (**1/16** by default).

MIDI I/O

midi in   midi out
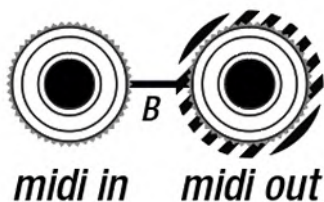
Those are 3.5 mm **TRS type B** MIDI jacks.

MIDI pinout – **TYPE B:** standard of Arturia® Beatstep Pro, 1010Music, ALM, Erica Synths, Polyend, VPME etc. (see more at minimidi.world):

➜ **DIN PIN 5 – TRS RING** (current sink)

➜ **DIN PIN 4 – TRS TIP** (current source)

➜ **DIN PIN 2 – TRS SLEEVE** (shield)

One adapter is included with the module and you can use any third party ones just ensure it is B-standard.

All the MIDI related settings can be accessed via the **MENU: TEMPO → M/MIDI** (see MIDI settings below).

USB-MIDI HOST-DEVICE I/O

device   host
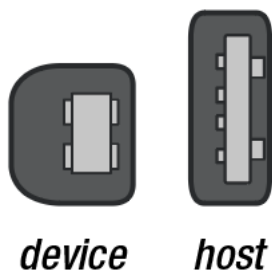
Those are similar as **CLASS COMPLIANT** USB-MIDI **TYPE A** and **TYPE B** sockets.

If you are familiar with *ENDORPHIN.ES - [SHUTTLE CONTROL](#)*, they are similar in Ground Control. Moreover, Shuttle Control may and will work as a perfect MIDI expander module for the sequencer where you can assign all the velocities, internal generators etc.

You can plug any USB class-compliant USB-MIDI devices:

➜ Usually **DEVICE** is connected to the computer or tablet. In that case Ground Control works as a USB-MIDI to CV converter or you can use Ground Control as MASTER clock for your DAW since USB-MIDI is bidirectional. In **[MASS STORAGE MODE](#)** you can backup the projects and update the firmware by placing the firmware file into the sequencer's storage

➜ usually **HOST** is connected to various MIDI controllers: from USB-MIDI keyboards, faderbanks etc.

By default, any MIDI input events are appearing into any MIDI outputs. However with the USB-MIDI sockets we can decide if we wish to pass the MIDI flow from host to device or from device to host or have a host loopback (a.k.a. **MIDI THRU**) in the **MIDI MENU** settings via **TEMPO → M/MIDI**.

Note for using the Ground Control with Arturia® Beastep Pro/Keystep Pro devices via USB. Those devices mirror any MIDI notes that enter that via USB-MIDI connection. That may cause issues and double notes press or unwanted loops using the arpeggiator. For best work set TX channels on BSP/KSP devices to unused MIDI channels (i.e. 4 or other).

USB MASS STORAGE FW V.3

After updating to Firmware V.3, you are able to use USB Mass Storage Mode to get access to the internal SD card via USB.

ENTER MASS STORAGE MODE: press and hold **(✱)** button within 5 seconds until you will see ⬛⬛⬛⬛ (**'STOR'**) message on the display. Connect the sequencer via USB device socket to the computer with the simple type B to A cable USB cable. In a moment you will see a new disk/drive will be mounted with the name of your SD CARD label. Open that disk and you will have access to all the projects which you can backup as simply copying from the drive to your computer and vice versa. Be sure to maintain the folder names rules - you can either delete projects or rename projects to rearrange them for a proper live performance sequence.

FORMATTING THE SD CARD. When you are in Mass Storage Mode you are able to format the SD card. That is needed when you want to CLEAR all the data, settings and projects entirely from your sequencer and start from a blank page. When in Mass Storage Mode, press and hold with 5 seconds **TEMPO** button press. Further format process requires confirmation with **PLAY/yes** button or cancel with **STOP/no**.

To **EXIT MASS STORAGE MODE**: press and hold **(✱)** button within 5 seconds again: you will see ⬛⬛⬛⬛ (**'EXIT'**) message on the screen and the sequencer will reboot into the normal mode.

➜ **NOTE:** that Mass Storage Mode is available only when you are on **Firmware V.3** or higher. If you are on Firmware V2.x or lower - you must update to V.3 first by ejecting the SD card, inserting it into the computer, copying the HEX update file to the SD card root folder and inserting it back into the sequencer.

EXT. CV INPUTS ^{FW V.2}

There are four, assignable**,** un-attenuated **CV INPUTS: D, 1, 2, 3**. CV input range is -5v…+5v or 0…+5V depending on the destination it is assigned.
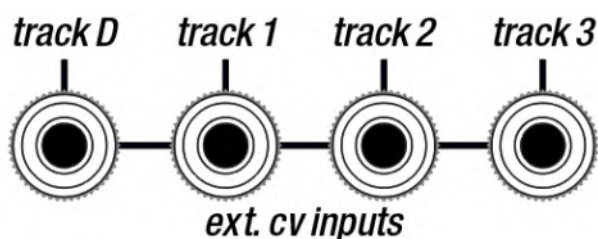
Modulation matrix is accessed via **MENU: TEMPO → E/EXT. CV** and is available from firmware version 2 of higher.

In the CV modulation matrix, you can assign each of the 4 CV inputs (D, 1, 2, 3) to various parameters from the list: see **E/EXT.CV** menu list below.

MENU
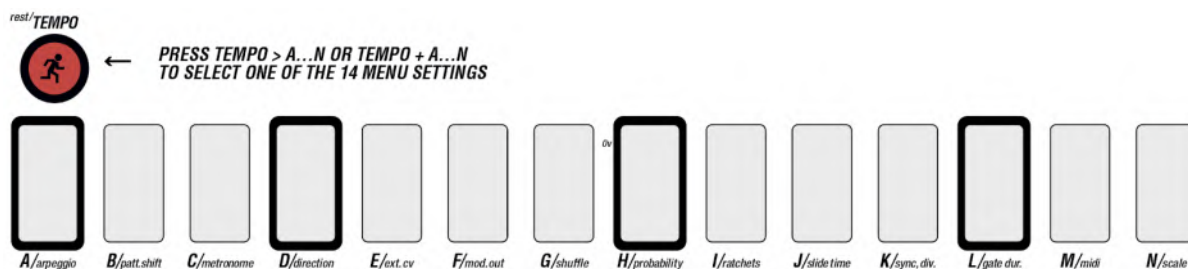
There is no obvious menu diving in the module except **TEMPO → A...N** or **TEMPO + A...N** lower row of 14 piano buttons. With those keys combinations we instantly access various sequencer settings, which are organized into *14 PAGES* - corresponding to all white **A...N** piano keys. Some of the menu items are picked with similar letters to remember their access but all other coincidences are for technical purposes only. You can change those settings whenever the sequencer is stopped or is running.

A / POLYRHYTHMIC TIME-BASE ^{FW V.2}

Polyrhythms allow you to stretch and squeeze a given number of steps within a defined pattern length, in other words as 'stretching a pulse train'.

The more technical definition of polyrhythms is as follows: polyrhythm is the simultaneous use of two or more rhythms that are not readily perceived as deriving from one another, or as simple manifestations of the same meter. The rhythmic layers may be the basis of an entire piece of music (cross-rhythm), or a momentary section.

Some examples of the polyrhythmic patterns:

(17:16) - means the pattern length is 16 steps, but instead of having typically sixteen 16th notes within the pattern, we have seventeen 16th notes, which are slightly shorter. This way we are squeezing 17 steps into 16, without changing the pattern length.

 (27:32) - means the pattern length is 32 steps, but instead of having 32 16th notes we only have 27, that still fill up all 32 steps with extended note duration. In this case we are stretching 27 steps to fit the 32 steps.

As you can see, polyrhythms allow you to play around with the length of steps in the pattern, creating more complex rhythmic structures and relationships both between steps in the sequence and between tracks. Ground Control allows you to have polyrhythmic patterns up to 32:32, which is not possible on any other sequencer currently available in either eurorack or outboard hardware formats.

To modify the polyrhythms we have to select a track first with **TRACK D/1/2/3** buttons - any of the 4 tracks can have polyrhythmic behavior. Once the track is selected, we can access the polyrhythmic setup using a combination of **TEMPO + A** buttons. The 2 numbers light up on the screen, by default it is set to 4:4, which is the most basic time signature. The first number sets the imaginary number of steps in a sequence and the second number sets over how many steps the previously selected number of steps are stretched / squeezed.

Note: 4:4 / 8:8 / 16:16 / 32:32 will all give you the same *x1* time signature as in the end the ratio is always 1:1 and no steps are being stretched or squeezed.

Once the numbers appear on the screen you can start changing them, the first nominator number can be incremented by +/-1 using the **PAGE** buttons and the second denominator number is changed using the **VALUE** buttons.

Let's set the first number to be 5 and the second to be 4, resulting in a 5:4 time signature. This means that now we can fit 5 steps into an imaginary pattern of 4 steps long, which will shrink the duration of each note in the sequence to accommodate one extra step.

The time signature numbers do not change the pattern length, as they only set the timing of steps in the sequence, so for example you can still have a 16 step sequence, but the time signature will now be 5:4 instead of 4:4. It is best to play around with this to get a better feel and understand how the time is affected. Try setting the same time signature for all tracks, create a beat on the drum *TRACK D* and a melody on the TRACK 1/2/3 and you will hear the subtle differences that polyrhythms introduce. Another interesting time signature to try out is 17:16, which almost sounds like 4:4, but has a slight shift in the step duration.

➜ *If you want to experiment even more, we recommend trying to combine Polymetric and Polyrhythmic sequences, where both the time signature and pattern length are changed.*

B / PATTERN SHIFT (NUDGE) ^{EXT. CV}

Pattern shift, nudge or pattern's rotation is the same name for **SHIFTING THE TRACK** notes on their pattern's grids forward and backward.

On entering that menu, we select the track we want to shift with **TRACK D/1/2/3** buttons. On drum **TRACK D** we can select any of the 8 drum tracks which we want to shift with **MUTE** buttons. After selecting the track we want to shift we press **TRANSPOSE +/-** buttons to adjust the

shift in steps (up to +/-64 steps range) and it is shown on the display as

⊓⊔.⊓⊔ (*NU* means *NUDGE*).

➜ *Note: that parameter can be modulated under external CV*

C / METRONOME

Ground Control has a small piezo buzzer. When enabled it acts as a physical metronome so you can start recording grooves without necessity to patch something and hear the clock first.

Metronome settings are accessible with combination *TEMPO → C*. With the *VALUE -/+* buttons we choose the following options: (*CLC* means *CLICK*):

➜ **⊏L⊏.–** (none),

➜ **⊏L⊏.0** (drum track),

➜ **⊏L⊏.0 ⊓** (certain melodic *TRACK 1/2/3*).

When you choose any value other than '**—**', the metronome is enabled and follows the selected track's time division. If you choose '**—**', then the metronome click sound is off.

➜ *Metronome is a small physical buzzer located on the rear side of the module and its volume can be perceived differently depending how close or open your case is*

D / DIRECTION OF THE PATTERN

This menu item sets the direction of the currently active selected track. With the *VALUE -/+* buttons we choose the following options:

→ **means FORWARD** – typical direction from first step 1 to the last step and then again returning to the first and so on.

→ **means REWIND** – direction from the last step to the first step 1 and then again returning to the last and so on.

→ **means PENDULUM** – is a combination of first forward and then backward movement.

→ **means RANDOM** – each next step the sequencer is selected is random of track's set steps.

→ **means RANDOM STEP** – on each step sequencer decides if it goes forward or backwards.

Whatever direction you choose, keep in mind that once you choose another pattern, it will be switched once the current pattern fully finishes its full cycle. In *FORWARD* mode that means once the pattern reaches its last step, the next step will be the first step from the new pattern. In *BACKWARD* mode the pattern should reach its first step and then will be switched to the new pattern. In *PENDULUM* mode the pattern should go forward and then backward and only then will be switched to the next pattern – i.e. will pass twice more steps before the switch. In *RANDOM* and *RANDOM STEP* modes the logic is simple – the switch to the new pattern will occur after initiated and once the pattern will pass the full number of its set steps (by default 16).

E / EXT. CV ᶠᵂ ⱽ·²

In that menu with the buttons *TRACK D/1/2/3* we select the CV jack source.

Then with ◄*PAGE*► buttons you select the following *MODULATION DESTINATIONS* with additional parameters like tracks selected via *TRANSPOSE +/-* buttons.

MODULATION DESTINATION SELECTED WITH *PAGE* ▶	EXTRA SETTINGS WITH TRANSP +/-	SHOWN ON DISPLAY	MODULATION RANGE	EXPECTED CV RANGE
PATTERN SHIFT	D.1...8, T.1...3	*SHFT*	+/-64 steps	increasing voltage on 1v, shifts on 12 steps, or 0.833V per step
SEMITONE OFFSET	T 1...3	*SEMI*	+/-5 octaves	voltage added from the jack quantized to semitones and adds to pitch CV outputs. Also those influences on the MIDI notes outputs
OCTAVES OFFSET	T 1...3	*OCTS*	+/-5 octaves	same as above, just the CV inputs applied to octaves: i.e. when CV from 0 to +1V then no change, when CV from +1 to +2v, then shifts 1 octave up etc up to 5 octaves and similar in negative range
SHUFFLE AMOUNT	D.1...8, T.1...3	*SHFL*	-50...+50	CV values -5 to +5v correspond to -50 to +50 shuffle values
PROBABILITY	D.1...8, T.1...3	*PROB*	0...100	Accepts only positive CV values: 0 to +5V which correspond to 0 (none) to 100% (max.) tracks probability / notes skipped
RATCHETS	D.1...8, T.1...3	*RATC*	0...4	5 values: 0 to 4 scaled to 0 to 5v sectors (0-1, 1-2, 2-3, 3-4, 4-5). Value of 0 ratchets doesn't output the note at all, value of 4 repeats the note on its step 4 times)
SLIDE	D all / T1...3	*SLDE*	0...100	Accepts only positive CV values: 0 to +5V which correspond to 0 (none) to 100% (max.) longest portamento slide time
GATE LENGTH	D.1...8, T.1...3	*GATE*	0...100	Defines the gate/trigger length of a certain drum drigger or melodic track. Accepts only positive values 0 to +5V which correspond from 0 to 100% (max)
CC VALUE UNIPOLAR	CC#1...127	*CC.UN*	0...127	Basically works as CV to MIDI CC# converter. Unipolar means that CV accepts only 0 to +5V range which converts from 0 to 127 defined CC# value. CV=0v corresponds to CC value 0
CC VALUE BIPOLAR	CC#1...127	*CC.BI*	0...127	Same as above, just CV accepts bipolar values -5...+5v converted

				to 0…127 CC# values, CV=0v corresponds to CC value 63. MIDI channel corresponds to the track's name which that track is assigned to. E.g. if CC assigned to CV 1, then it follows Track 1 MIDI channel: 1 by default

➜ *Once we have assigned something to one CV input – the same setting for exactly the same trigger is excluded with the list in other CV sources. I.e. once we assigned CV1 to Shuffle of Track1, we cannot assign CV2 to the Shuffle of the same Track1, but Track D, 2 and 3 only*

➜ *Once we have assigned something to some CV input – same setting for manual change in the MENU will be ignored*

➜ *External CV inputs work from the Firmware version 2 and above*

F / MODULATION OUTPUT JACK ^{FW V.2}

This menu item contains settings for what is assigned to the **MODULATION OUTPUT CV JACK**.

It is possible to assign modulation output to the modulation or velocity of a certain track. If it is assigned to modulation of a certain track or drum track, it automatically obtains the length of the steps that track or certain drum track has.

Modulation output jack settings are accessible in the menu via **TEMPO** → **F/MOD.OUT** combination and is shows on the display as:

In that menu:

ALL DRUMS buttons define whether the **MOD. OUT** jack outputs CC#01 modulation or velocity by altering **D.1.V** and **D.1.M** letters. **V** means velocity and **M** means modulation.

◀**PAGE**▶ buttons will change the polarity or the velocity or modulation output: unipolar 0 to +5V (default) or bipolar -5v…+5v with D.1.V**b** letter:

8.8.88 → 8.8.88

Finally, pressing one of the **MUTE BUS** buttons will assign that modulation output to a certain track or drum tracks.

Pressing the **LAST STEP** in that menu settings will enable **SLEW** on the modulation output meaning all the modulation output will not be stepped but interpolated and can be used as an envelope or LFO if programmed properly.

By default the **MODULATION OUTPUT JACK** is assigned to a special modulation track which together with 8 trigger outputs is a part of the drum track. Default modulation output range is 0...+5V and with the further firmware updates it will be possible to reassign that modulation output jack to other generators or CV destinations.

➜ *Assignable Modulation output jack works fully from the Firmware version 2 and above*

G / SHUFFLE ^{EXT. CV}

SHUFFLE, groove or swing (shown at display as **66.50** by default) – is settings per one of the **TRACKS D/1/2/3** inspired directly from famous AKAI® MPC vintage machines by Roger Linn. It is set in values 50 to 99, which is a ratio of time duration between the first and second 16th notes within each 8th note. At value 50% there is no swing. There is a perfect triplet swing at value 66%. Most used (and secret) value in electronic music producers used: 53-54%, which gives a light yet very musical feeling.

➜ *Note: that parameter can be modulated under external CV*

H / PROBABILITY EXT. CV

PROBABILITY or humanization means some of the notes on the track can be accidentally skipped, imitating the imperfection of human nature.

It is shown at display ⌷⌷.⌷⌷ with values from **0** to **99**.

Zero setting corresponds to zero imperfections (default values on all the tracks). The higher the values increase from 0 to 99, the more notes or triggers will be skipped.

➜ *Note: that parameter can be modulated under external CV*

I / RATCHETS EXT. CV

Ratchet means that trigger fires per **ITS OWN STEP** not once, but up to 3 times more (4 in total with the original trigger).

Ratchet amounts are assigned per track (or a certain drum track) and then in the patterns can either be enabled or disabled or modulated via external CV. They are shown on the display in the following way:

⌷⌷.⌷⌷. Value **1** means no ratchets (only original trigger), while the value of **4** gives us 4 times note repeat on the step where RATCHET FLAG was enabled.

With **0** value of ratchet the whole note will not be fired.

Additional possible settings are:

➜ **FWRD** means **FORWARD**: ratchets amount increases by 1 on every pattern cycle

➜ **RAND** means **RANDOM**: random ratchet amount is set every time the note will ratchet on a certain track.

It is very interesting to modulate the amount of ratchets per track using external CV via **MODULATION MATRIX.**

You can assign only one global ratchet per track (or certain drum track)

➜ *With 0 value ratchets you can mute notes with CV*

➜ **NOTE:** *that parameter can be modulated under external CV*

J / SLIDE TIME ^{EXT. CV}

SLIDE occurs when we record two consequent notes on melodic tracks overlapped – means the initial note key is still held while the new one is already pressed. Slide range per melodic track is 0 to 99 and its default value is 50 – which corresponds to approximately 100 mSec of slide from one note to the other. It shows on the display in the following way:

8 8.8 8 . In case of having the long notes merged with the TIEs which occupy a few steps, the slide occurs on the last step of that TIE'd long note – before the upcoming note where the pitch slides to. That type of slide is inspired by Roland® TB-303 type of sliding with fixed default slide time.

When slide value is set to 0, the slide time is instant. With a maximum value of 99 the slide time is approximately 1 second.

➜ **NOTE:** *that parameter can be modulated under external CV*

K / SYNCHRONIZATION / DIVIDERS

That menu sets the **MASTER CLOCK** synchronization source (JACK (INTERNAL/EXTERNAL), MIDI, USB HOST, USB DEVICE) and their **INPUT / OUTPUT DIVIDERS.**

MASTER CLOCK SOURCE

Selecting the master clock is made via **MENU: TEMPO → K → VALUE -/+.** The possible options are:

➜ 8 8 8 8 **('INT')** – means internal Ground Control clock generator. Works when no cable is inserted into **CLOCK IN** jack.

➜ **⦿⦿⦿⦿** (*'JACK'*) – can be activated ONLY when the patch cable is inserted into **CLOCK IN**, the sequencer automatically detects that and switches to the external clock no matter which master clock we have chosen.

➜ **⦿⦿⦿⦿** (*'USB.H'*) – means Ground Control becomes a slave to the clock that comes from the device connected into **USB HOST** socket

➜ **⦿⦿⦿⦿** (*'USB.D'*) – means Ground Control becomes a slave to the clock that comes from the device connected into **USB DEVICE** socket

➜ **⦿⦿⦿⦿** (*'MIDI'*) – means Ground Control becomes a slave to the clock that comes from **3.5 MM TRS MIDI IN JACK** (MIDI [type B](#) standard can be converted to DIN-5 jack via adapter).

➜ **NOTE:** *if you selected some master clock source, which is actually not connected, the sequencer may not start with manually pressing the PLAY button, as it will expect to receive a clock and a START command from an external clock source.*

OUTPUT CLOCK DIVIDER

Output clock divisions are selected via **MENU: TEMPO → K → ◄PAGE►**. Possible options are:

➜ *o. 1* – original 24 PPQN output clock (typically used for DIN sync)

➜ *o. 2* – 24PPQN/2 twice slower than original clock output

➜ *o. 4* – output clock in 24PPQN/4

➜ *o. /32* – output clock in 32nd notes (corresponds to 24PPQN/3)

- ➜ **_o. /16_** – output clock in 16th notes (corresponds to 24PPQN/6) **- DEFAULT CLOCK OUTPUT SET FROM CLOCK OUT JACK**

- ➜ **_o. /8_** – output clock in 8th notes (corresponds to 24PPQN/12)

- ➜ **_o. /4_** – output clock in 4th notes (corresponds to 24PPQN/24)

- ➜ **_o. /2_** – output clock in 8th notes (corresponds to 24PPQN/48)

- ➜ **_o. 1br_** – output clock in 1/1 notes (corresponds to 1 tick per 1 bar, 24PPQN/96)

- ➜ **_o. 2br_** – output clock in 2/1 notes (corresponds to 2 bars, 24PPQN/192)

- ➜ **_o. 4br_** – output clock in 4/1 notes (corresponds to 4 bars, 24PPQN/384)

- ➜ **_o. ¬2_** – twice faster than original output clock (corresponds to 24PPQN*2 = 48PPQN a.k.a. Korg® standard)

- ➜ **HINT: 'o'** *symbol in the beginning means we adjust output clock division*

INPUT CLOCK DIVIDER

It is possible to adjust the **_INPUT CLOCK DIVIDER_** to make the sequencer playing slower or faster than the incoming MIDI clock. It is done **_only when the sequencer is in the slave mode_** (i.e. USB D/H or MIDI chosen as master clock) via the following combination: **_TEMPO_** → **_VALUE-/+._**

The following options are:

- ➜ **_PQ.24_** – corresponds to the original **24 PPQN** typical MIDI clock standard. This is the default sync option when MIDI or USB-MIDI master clock option is selected. Choose this option when you synchronize (slave) Ground Control to another master MIDI device with exact 1:1 tempo.

➜ **PQ.48** – corresponds to **PPQN48** alternative a.k.a. Korg® MIDI clock standard. Choose this option when you synchronize Ground Control to another master MIDI device with a twice-faster 48PPQN clock.

➜ **PQ.12** – corresponds to **PPQN12**. Choose this option when you synchronize Ground Control to another master MIDI device with twice-slower 12PPQN clock. With PQ.28 and PQ.12 options you can adjust your Ground Control to essentially be twice faster or twice slower from your typical MIDI clock.

➜ **i. /32** – input clock in 32nd notes (corresponds to 24PPQN/3).

➜ **i. /16** – input clock in 16th notes (corresponds to 24PPQN/6) – **default value if JACK is chosen (external CLOCK IN jack) which is eurorack clock 'standard'. Use this option for example if your input clock arrives into CLOCK IN jack is in 16th notes.**

➜ **i. /8** – input clock in 8th notes (corresponds to 24PPQN/12).

➜ **i. /4** – input clock in 4th notes (corresponds to 24PPQN/24).

➜ **HINT: 'i'** *symbol in the beginning means we adjust input clock division*

➜ *Note:* if there is a cable inserted into [CLOCK IN jack](#), with the Firmware V.3 it will act as a pulse-per-step in 1/16th note as for the eurorack clock 'standard'. That clock can now also be variable but there are no dividers for it (i.e. it will maintain the BPM as for the 1/16th pulses input).

L / GATE LENGTH ^{EXT. CV}

All the sequencer's notes are hard tied to the grid. The track's grid is set by time division buttons via **TRACK D/1/2/3 + 1/32...1/4** buttons combo (and long hold to obtain triplets values of those divisions). **1/16** is always the default and most used time division for any new projects therefore is marked with ° symbol at 1/16°.

Each note on a certain melodic **TRACKS 1/2/3** has a strict fixed gate duration (the gates we receive from melodic **TRACK 1/2/3 GATE OUT JACKS**). Those values are variable from 1 to 99, measured in % of the step length. There is no 100% gate length otherwise that would mean that the current note will be TIE'd with the upcoming one. Default gate length is 50% and is always constant for all the notes in the same track.

It is shows on the display as following: `88.88` **('GL.50')**

➔ *Note: that parameter can be modulated under external CV*

M / MIDI

That menu covers all the **MIDI** and some other device specific or global settings. New settings might be added with the further firmware updates – please ensure you are running the latest firmware. Once we press **TEMPO → M/MIDI** combination, we enter the **SETTINGS** menu and see the lower row of certain keys light up. Each of those lit up keys defines the menu item we can select or adjust. By pressing on each of those keys we see corresponding menu hints on the display and the values which we can adjust with **VALUE-/+** buttons. Since some of the settings are per-track settings, we can select those with **TRACK D/1/2/3** buttons.

The settings items are the following:

➔ **A: CH.RX** – means **CHANNEL RECEIVE** – is a MIDI channel from which a selected track will RECEIVE and SEND its information. It can be 1 to 16. By default TRACKS D/1/2/3 are set to Ch.Rx. corresponding MIDI channels: 10/1/2/3. Received MIDI channel (RX) is always the same as transmitted MIDI channel (TX) and cannot be separated

➔ **B: CH.GL** – means **GLOBAL MIDI CHANNEL** - is a special MIDI channel on which every active track will receive its information - e.g. from external MIDI keyboard. By default set to *OFF*, but can be values *1 to 16* or *OFF*. Using a global MIDI channel is convenient when you write a score and switch on various tracks of Ground

Control and don't want to switch the MIDI channel on the MIDI keyboard all the time. In that case the MIDI keyboard will work on an active / selected track just to make sure its global MIDI channel corresponds to the MIDI keyboard channel sent. The channel can also be one of the used channels mapped on other tracks - in that case they both will receive information from the MIDI keyboard.

➜ *C: TAP.T* – means to enable or disable the *TEMPO* button acting as a TAP tempo button (setting the tempo after 3 or more taps). That settings is found to be useful to set to OFF so you can't accidentally change the BPM during performance

➜ *D: HS I- D* – means *USB HOST to DEVICE* data transfer. Available options are: ON/OFF. With that feature enabled all the USB-MIDI data (notes/CC from all 16 channels and MIDI clock) that appear from USB HOST will be routed to USB DEVICE. Use this feature if for example you use Beatstep Pro as a Master Clock source connected to the USB HOST and you wish that clock to appear on the USB DEVICE which is connected to the computer DAW. Default value is ON

➜ *E: DE I- H* – means *USB DEVICE to HOST* data transfer. Available options are: ON/OFF. With that feature enabled all the USB-MIDI data (notes/CC from all 16 channels and MIDI clock) that appear from USB DEVICE will be routed to USB HOST. Use this feature if for example you want to send the master clock and all the notes from your computer DAW connected to DEVICE to be sent also to Beatstep Pro as a slave source connected to the USB HOST. Default value is ON

➜ *F: H.LPB* – means *USB HOST LOOPBACK* or *MIDI THRU*. Everything that is routed into USB MIDI HOST IN will be duplicated and routed thru same USB MIDI HOST OUT. It is useful to use any USB-MIDI adapter's MIDI OUT plug as a MIDI THRU one. Default value is OFF

➜ *G: R.CLK* – means *RUNNING CLOCK*. Once the sequencer is running, it sends the MIDI clock and once it is stopped, the MIDI

clock also stops. Available options are: ON/OFF and default value is OFF

➜ **J: T.OUT** – means **MENU TIMEOUT** in seconds. Available options are: 5, 10, 15, 30 sec and **NEVR** (means 'never' but 24 hours). Sets the time after which the menu returns back to the pattern view screen, default value is 15 seconds.

➜ **K: KLED** – means **KEYS LEDS**. Available options are: ON/OFF. By default is enabled and if enabled – you will see blinking PIANO KEYS on the active track once active notes appear that correspond to those keys. Note that if the notes are located in higher or lower octaves they will not blink on the keys unless you switch the octaves with **–OCT/OCT+** transpose buttons

➜ **M: SCAL** – means what happens with the notes when they appear out of our music scale:

> ➜ **SC.UP** – means the out-of-scale note will be 'routed' to the nearest upper note
>
> ➜ **SC.DN** – means the out-of-scale note will be 'routed' to the nearest lower note
>
> ➜ **SC.IG** – means the out-of-scale note will be ignored

➜ **N: VERS** – shows current firmware version number on the display

N / SCALES / DRUM MAPPING ^{FW V.2}

Music scale is any set of musical notes ordered by a fundamental or root note. **NOTE SCALES** work like filters on melodic **TRACKS 1/2/3**: allowing which notes can be played and those notes that don't fit the scale are either ignored or tuned to the nearest ones.

Ground Control offers a set of a few predefined music scales, any of which can be edited into the custom scale. Each musical *TRACK 1/2/3* has its own scale per project. They can be set as following:

➜ ⧙⧙⧙⧙ – means chromatic music scale where all the 12 keys are active

➜ ⧙⧙⧙⧙ – major

➜ ⧙⧙⧙⧙ – minor

➜ ⧙⧙⧙⧙ – melodic minor

➜ ⧙⧙⧙⧙ – Lydian

➜ ⧙⧙⧙⧙ – pentatonic major scale.

➜ ⧙⧙⧙⧙ – any manually edited scale above becomes custom scale

Scale menu is accessed via **TEMPO → N**. It shows the current scale as keyboard LEDs: all 24 keys are either semi-lit or off: duplicating in 2 octaves. The keys which are semi lit show which keys are in the scale. The keys which are full on show the root key of the scale.

◄**PAGE**▶ buttons selects predefined scales from the list above.

TRANSPOSE +/- buttons select the **ROOT** note, which is always **FULLY ON**.

← *SELECTED C-MINOR SCALE: TWO C-KEYS (E/ext.cv and L/gate dur.) ARE FULL ON*
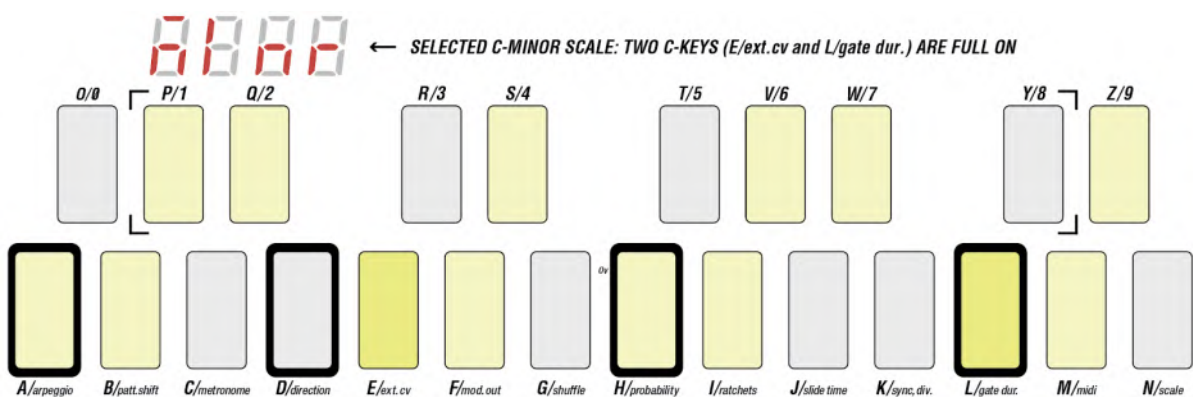
Default scale on all melodic tracks 1/2/3 is **CHROMATIC**. When we change any of the selected pre-defined scales in the list it automatically becomes **CUSTOM**.

➜ **NOTE:** you can set how the out-of-scale notes behave via **_TEMPO →_** **_M → M_** **_(SCAL)_** menu: either tied to upper or lower notes or ignored.

Scales work only on melodic *TRACKS 1/2/3*. Once in the scales menu we switch to the drum **TRACK D**, then we enter the **DRUM MAPPING** menu: meaning we can set the custom MIDI notes mapping for each of 8 drum trigger notes.

Default **DRUM MAPPING** is the following:

*P/***1** *– TRIGGER 1:* **C1**

*Q/***2** *– TRIGGER 2:* **C1#**

*R/***3** *– TRIGGER 3:* **D1**

*S/***4** *– TRIGGER 4:* **D1#**

*T/***5** *– TRIGGER 5:* **E1**

*V/***6** *– TRIGGER 6:* **F1**

*W/***7** *– TRIGGER 7:* **F1#**

*Y/***8** *– TRIGGER 8:* **G1**

With drum buttons **P/1…Y/8** we select the certain drum trigger we want to change and with ◄**PAGE**► buttons we select its assigned MIDI drum note.

➜ **NOTE:** *you can't assign the same MIDI note for two different drum triggers. For example if you assigned Trigger 1 to C1, then you can't assign Trigger 2 to C1 anymore etc.*

➜ *Remember to save any changes of scale with* ✳ → **RECORD** → **RECORD** *combination. Once you save the settings, then selected music scales for Tracks 1/2/3 and drum mapping for Track D will be saved and restored on the next modules' power up. If you will not save any of the settings by* ✳ → **RECORD** → **RECORD**, *they will be lost on the next power up.*

SD CARD / SETTINGS

Everything: from track's notes and modulations to all the settings and calibration data are saved on the SD card. That means if you have a few Ground Control sequencers – you can simply duplicate or swap SD cards between them and you will get access to all the same projects and already set settings, scales, MIDI channels etc. All the settings and recorded scores are NOT erased during firmware updates.

Most of the settings from the **TEMPO → A...N** keys are global settings and are applied to all projects at once. Other settings are related to the project only and certain channels.

Each of 24 PROJECTS stored the SD card into separate folders, which correspond to that project's name: *'A'* to *'Z'*.

The global settings are set for all the 24 projects in **GlobalSettings.txt** file (USB routing, last loaded project, buzzer, master clock source).

Additionally, extra 4x CV output calibration settings are stored in the **Calibration.txt** file if the calibration was made and saved with the editor.

Each project parameters are stored in the **ProjectSettings.txt** file (BPM, MIDI channels, slide, shuffle, probability, gate length).

PITCH / MOD. CV CALIBRATION

Sometimes pitch CV voltages may deviate a few cents from their proper values.

We recommend doing that when you change the power supply. By default Ground Control is not calibrated. For correcting the calibration values, we use the same Shuttle Control calibrator to enable Ground Control's 4x DAC correction (modulation output and pitch CV on tracks 1/2/3).

CALIBRATION PROCEDURE explained in the following video:

https://www.youtube.com/watch?v=CHWN2ur-OGk&t=714s

You will need a voltmeter to read the values from all SHUTTLE CONTROL's jacks in case you feel its output pitch CV isn't precise enough (all C notes should correspond to all whole integer voltage amount: e.g., -3V, +4V, 0V etc).

Almost any consumer voltmeter that can measure two decimals (i.e. 3.00V when putting the voltmeter in the 20V DC range) does the job.

The calibrator is accessible thru the **CARGO 4** web editor:

https://cargo4.app/calibration.php

A set of buttons is used to read, set, write and test every 4 CV outputs.

READ: When you are using the calibration for the first time, there are no certain values to be read (literally default ones: -3000, 0000, +3000). If you calibrate GC after you already calibrated it in the past, press '**READ'** and all adjusted CV values are shown in the tables below the button.

Now press **'SET ALL TO -3V/0V/+3V'** one by one, and each time measure the CV outputs value with the voltmeter and enter it into the table (each of melodic tracks into CV 1/2/3 and modulation in the drum track on CV 10 , a total of 3 x 4 measurements).

All values should be entered in millivolts (three decimals after integer but without decimal point):

➜ at -3V if the multimeter reads -2.99V, then enter '-2990'

➜ at 0V if the multimeter reads -0.01V, then enter '-0010' or if it shows 0.02V, then enter '0020'

➜ at +3V if the multimeter reads 3.01V, then enter '3010'.

Afterwards press the **'WRITE'** button to record the adjusted values and all the calibrated values will be saved.

Afterwards you may press the '**TEST CALIBRATED -3V, 0V, +3V'** buttons to see if the calibrated values show exactly what you expect (-3V, 0V, +3V) by checking them with the voltmeter.

If the desired values deviate only a bit from what you expect (e.g., +2.99V and not +3.00V), then you write a smaller value (decrease for

'0001') in the specific cell of the calibrator table, press 'Write' again, and then press **'TEXT CALIBRATED +3V'** again.

Measure it again, and it should be your exact value. When every **'TEST CALIBRATED -3V, 0V, +3V'** values match your measurements exactly, you can close the calibrator. Once the calibration is saved into the device, it is stored on the SD card **Calibration.txt** file located in the root directory. If the file is erased, then default calibration values are applied. Calibration or any other settings are NOT erased during firmware updates.

FIRMWARE UPDATE

Firmware updates are essential for any digital modules. They bring new features or bug fixes.

Feel free to write any bugs, features ideas or improvements to beta@endorphin.es

To update the firmware of your Ground Control sequencer first download the latest firmware file once available on Endorphin.es website. Then you have two options.

IF YOU ARE ON V.2.X OR EARLIER FIRMWARES

You need to take out the micro SD card from the GROUND CONTROL module and put it into your computer (or a card reader connected to your computer). We promise - with V3 that will be the last time you do that. If you are on V3 or later - read later.

1. Power OFF your modular system.
2. Eject the microSD card from the module. Insert it into the computer.
3. Unpack the downloaded archive and place the gc-*******.hex latest version file into the *ROOT* folder of the microSD card. Don't rename the file and place only one file with the latest version or the version you wish to update to.
4. Put the card back into the module and turn on the power of the Ground Control: you will see a message on the screen meaning the firmware is flashing and you will see the process of the lower row of A...N keys light up showing the upload process. After approximately 10-15 seconds the module will reboot with the new firmware and new features installed.

IF YOU ARE ON V.3.X OR LATER FIRMWARES

1. Power up the Ground Control and connect it to your computer (Mac or Windows or Linux) with simple USB Type B to type A cable (type B plugs into DEVICE socket on the GC and type A plugs into the computer).

2. Open the Finder / Windows Explorer or any other file manager and copy the latest version gc-*******.hex file into the *ROOT* folder of the mass storage of your mounted GC SD card

3. After copying the HEX file, press PROJ* button on GC for around 5 seconds: the GC will reboot into the normal mode: you will see a message on the screen meaning the firmware is flashing and you will see the lower row of A...N keys light up showing the upload process. After approximately 10-15 seconds the module will reboot with the new firmware and new features installed.

If you experience technical issues during the update - write us to support@endorphin.es

If you experience bugs or have advices for the firmware features - write us to beta@endorphin.es

➔ *NOTE:* the firmware updates doesn't alter any of your recorded patterns information. However we strongly advise you to occasionally back up your micro SD card. Different memory cards have different amounts of read/write cycles. If by any chance you wish to upgrade to the better SD card - look for 'industrial' version. Even using your sequencer every day, your SD card will serve you for years. However SD cards are considered as consumables and sometimes are good to backup.

CREDITS

ENDORPHIN.ES® – GROUND CONTROL

<u>FIRMWARE VERSION 3</u>

COLLECTION SPRING/SUMMER 2025

Module idea, hardware design, direction, photos and manual by Andreas Zhukovsky

V3 updates by A.B.

Core engine programming by BSVi

UI programming by Xavier Galai / Kouik03

SD card updater by Vitaly (a.k.a. embedder)

Rubber keys 3D design by Simone Fabbri

3D printed light frames for the rubber keys by Leonardo Cardinale

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Nicolas Bougaieff for the polyrhythms idea and inspiration

Julia Bondar for using GC as a main live sequencer in all the shows worldwide - that helped to nail many bugs and add new features

Endorphin.es are made in Barcelona province of Spain

Follow, like, post and tag us at Instagram: <u>@endorphin.es</u>

GROUND CONTROL SHORTCUTS CHEAT SHEET (24-JAN-25)

➔ **PLAY**: starts the playback on all patterns from their first steps. Acts also as confirmation yes in call to actions. During sequencer is running, pressing **PLAY** resets current patterns on all TRACKS D/1/2/3 to first step

➔ **STOP**: stops the playback. When in the menu, a single press exits the menu keeping the playback running. Next **STOP** press stops the sequencer.

➔ **STOP:** when sequencer stopped acts as a panic action in case of hanging MIDI notes. Second **STOP** press sends **ALL NOTES OFF** on all MIDI channels in case of hanging the MIDI notes on external MIDI devices

➔ **TRACK D/1/2/3**: selecting the active track

➔ **TRACK D/1/2/3 + 1/32...1/4** sets the time division of the track

➔ **TRACK D/1/2/3 + PLAY** during the playback resets certain track to the first step (quantized to each track's time division)

➔ **TRACK D/1/2/3 + ◀PATTERN/PATTERN▶, TRACK D/1/2/3 + A...Z** piano keys, **✱ → A...Z:** selecting the pattern on active track

➔ *TRACK D/1/2/3 + A...Z* sequence of letters: entering the patterns chain

➔ **TRACK 1/2/3 + TRANSPOSE +/-:** shift currently selected pattern by 1 octave up or down

➔ **RECORD** on sequencer stop: starts step record mode

➔ **RECORD** on sequencer start: starts live recording mode

➔ **RECORD** long hold: enters the editor (X0X on drum track or step editor on melodic tracks 1/2/3)

➔ **TEMPO + RECORD** starts RECORD WAIT mode

➔ **TEMPO + LAST STEP** locks the BPM value on the screen

➔ **LAST STEP + MUTE BUS + VALUE-/+** (or **◀PAGE▶** or **O/0...Z/9**) setting the amount of steps per track

➔ **LAST STEP** in arpeggiator/roller mode acts as arpeggiator's latch (long hold acts as super-latch)

➔ **LAST STEP** in the F/MOD menu enables smoothing modulation track values instead of stepped values. **- TRANSPOSE + TRANSPOSE +** both buttons press → A...Z buttons: semitone transpose current pattern from root C key

➔ **BOTH TRANSPOSE -/+ → LAST STEP** activates transpose lock and semitone shifts apply to all TRACKS 1/2/3 at once

➜ **◄ PATTERN + PATTERN ►** both press: activates the patterns **LOCK**

➜ **A...Z:** playing / entering the notes/drum triggers on active track

➜ **1/32...1/4:** activating the arpeggiator/roller on the active track

➜ **1/32...1/4 + TRANSPOSE-/+** in the arpeggiator mode sets the arpeggiator octave swing

➜ **MUTE BUS** long press: selecting quantized (one blink) or momentary (default, double blink) mute buttons action

➜ **✳ (PROJ):** **'SHIFT'** function button related primarily to saving patterns/projects

➜ **✳** single press enters or quits live pattern select mode

➜ **✳ +** any **MUTE** button: 1) first press clears the notes/triggers on the selected track but leaves the same number of steps. 2) second press clears the steps number of that track to default 16 steps

➜ **✳ → RECORD** or **✳ + RECORD** buttons will enter the pattern save function

➜ **✳ → RECORD → RECORD** saves all project's settings and all unsaved patterns

➜ **✳ → RECORD → A...Z:** saves current pattern on any of 24 patterns cells in the current track

➜ **✳ → RECORD → TRACK 1/2/3 → A...Z:** saves current pattern on any of 24 patterns cells in the other selected TRACK 1/2/3.

➜ **✳ → RECORD → LAST STEP → A...Z:** saves current project into any of 24 project cells. Keys with already non-empty projects will lit.

➜ **◄ PAGE ►** in the editor navigates thru the steps on the active track/pattern

➜ **✳ (PROJ)** in the editor adds extra empty step in the end of the pattern

➜ **TEMPO** /rest in the editor cleans current step

➜ **TIE** (1/4) in the editor TRACKS 1/2/3 merges note on current step (ties it) to the next one.

➜ **RATCHET** (1/8) in the editor enables ratchet flag on current step

➜ **SLIDE** (LAST STEP) in the editor on TRACKS 1/2/3 enables slide flag on the current step so it slides to the next note

➜ **MOD.CC** (1/32) in the editor on TRACK D enters the modulation CV output step editor

➔ **VELOCITY** *(1/16)* in the editor on TRACKS D/1/23 enters the notes velocity step editor

➔ **TEMPO***: 'SHIFT'* button function button related primarily to entering the menu settings via **TEMPO → A...N** buttons

➔ **TEMPO + A...N or TEMPO → A...N***:* selecting the menu settings items

➔ **TEMPO** *3x* or more times press acts as a tap tempo action when the sequencer acts as a master clock (if enabled via MENU → M → C)

➔ **TEMPO → VALUE-/+** or ◀**PAGE**▶ or *P/0...Z/9* – setting the tempo manually incrementing in values by 1 or by 10

➔ **TEMPO + MUTE BUS** does the solo action for the pressed track

➔ **TEMPO → A →** ◀**PAGE**▶, **VALUE-/+** active track polyrhythmic time-base (time signature) settings

➔ **TEMPO → B** pattern shift (nudge) setting nudge/pattern rotation settings

➔ **TEMPO → C** enabling the metronome click

➔ **TEMPO → D** setting the tracks direction on current pattern

➔ **TEMPO → E** settings for 4 external CV inputs (modulation matrix)

➔ **TEMPO → F** settings for the modulation CV output jack settings

➔ **TEMPO → G** setting the shuffle value on the current track

➔ **TEMPO → H** setting the notes probability on the current track

➔ **TEMPO → I** setting the ratchets amount on the current track

➔ **TEMPO → J** setting the slide time on the TRACKS 1/2/3

➔ **TEMPO → K →** ◀**PAGE**▶ sets the divider for CLOCK OUT output clock jack

➔ **TEMPO → K → VALUE-/+** sets the input divider for external master clock input

➔ **TEMPO → L** setting the gate length for the melodic TRACKS 1/2/3

➔ **TEMPO → M** entering the MIDI / global settings menu

➔ **TEMPO → N** notes scales / drum mapping settings

➔ **TEMPO → 1/32** euclidean randomizer algorithm on active / selected track

➔ **TEMPO → 1/16** wide randomizer algorithm on active / selected track

➔ **TEMPO → 1/8** narrow randomizer algorithm on active / selected track

➔ **TEMPO → 1/4** random variation algorithm on active / selected track