Ground Control

First things first

RTFM – be so kind and read the manual. It will provide you with the information you need to fully indulge in the module you just purchased – for which we like to thank you.

Enjoy your sound experiences, dear sonic traveller.

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

The warranty dœs 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.

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Drop us a line:

For technical requests: support@endorphin.es

For general requests: info@endorphin.es

FURTH BARCELONA, S.L.

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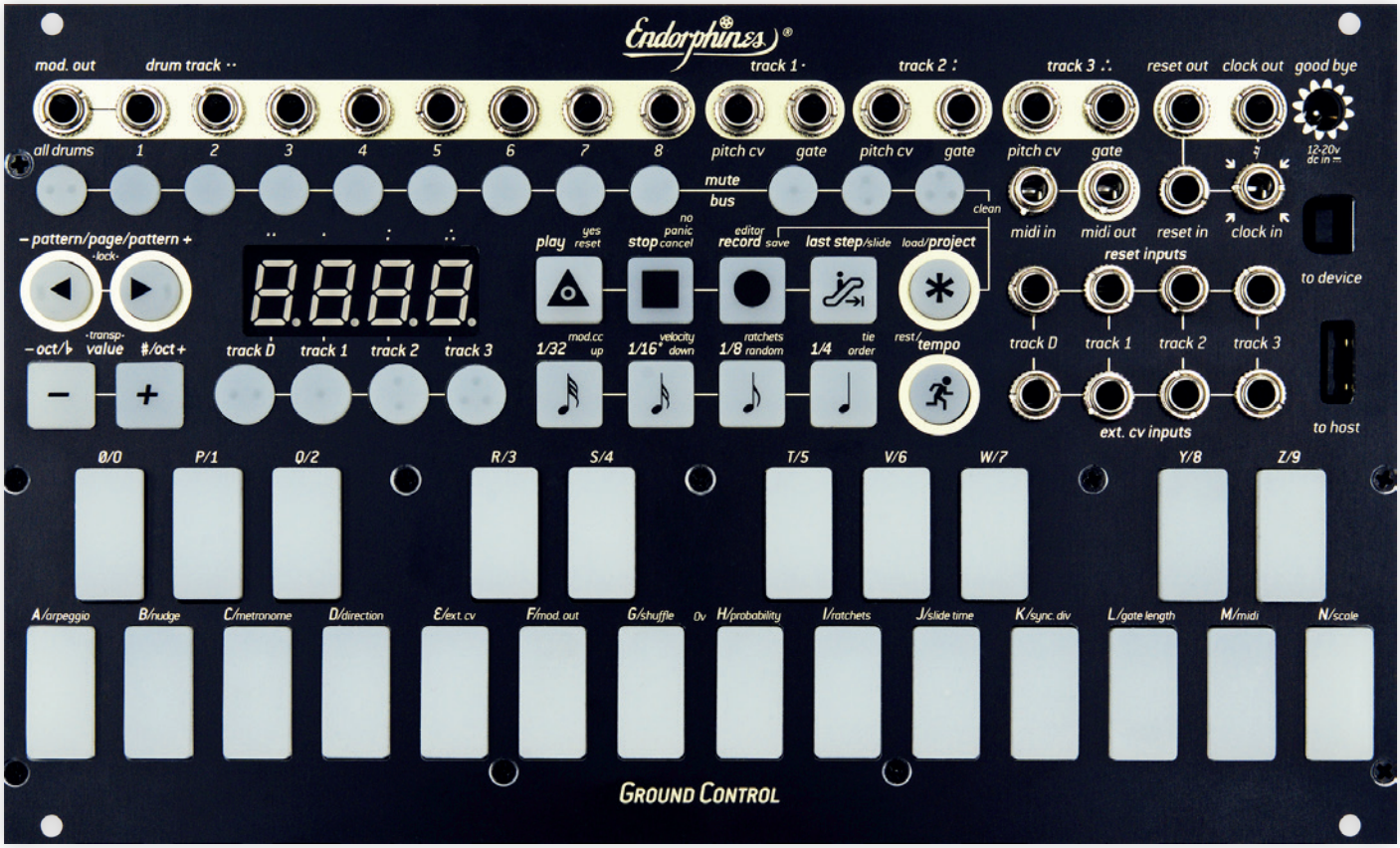
LET'S ROCK!



Hard Facts

- 42hp Eurorack modular performance CV/MIDI/USB-MIDI sequencer/workstation.
- 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 steps per pattern, 24 patterns per track, 24 projects
- Dedicated mute/solo bus quantized/momentary to pattern length.
- 4 tracks: 1 drum track with 8 triggers and modulation and 3 melodic CV/Gate tracks. Velocity and CC is recorded from external MIDI.
- Also works as a power supply for your modular system (same as Shuttle Control) or can be powered from the bus board like any other module.
- Various recording modes: 101-style step input with step editing, live recording and step editor with x0x-style drum editing.
- Arpeggiator, roller, patterns queue, slides, ties/rests, ratchets, transpose.

Check out our quick start guide: ***https://youtu.be/t00jK-sw3zI***

Or enjoy Loopop's full tutorial: ***https://youtu.be/XhriE0MKjp0***

INTRO

Ground Control is a sequencer for CV/Gate signals as well as MIDI and USB-MIDI devices. It's the best of two worlds: It takes an alternative approach by using the 101 step input for melodical sequencing. That empowers you to create melodies on the fly with easier polymetrical input so you can concentrate on the creative part with less menu diving. Programming beats is easy as it ever was—typical XOX-style!

Speed up the workflow using shortcuts: i.e. button combinations to achieve proper action. See the shortcuts combinations list in the addendum of the manual.

Shortcuts written with "+" symbol means, those buttons have to be pressed at the same time: Usually this works best pressing and holding the first button and then pressing the second button.

However, most of the user interface of the Ground Control utilizes a so called 'sticky user interface', which means that the button combinations can be pressed in a sequence using only one finger.

Shortcuts written with ">" symbol means, those buttons can be pressed in a sequence "button ***followed by*** button".

Hint: *Everything that is sticky ">" can be '+' as well, but not the other way around.*

CONNECTING THE POWER

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

1. Connect the module directly into the power bus board with supplied 16-16 ribbon cable like any other Eurorack module.

   The power consumption is:

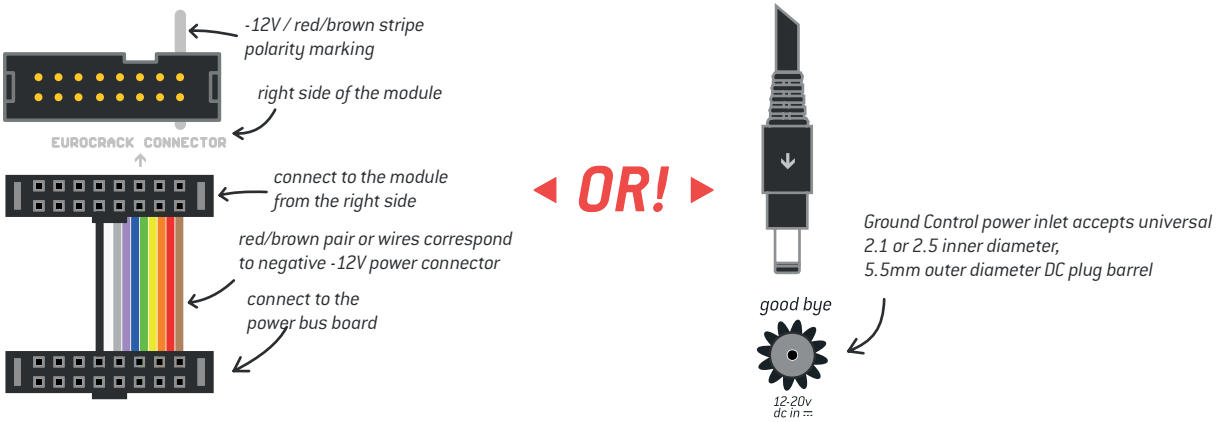
   +12V: 420mA

   -12V: 0mA

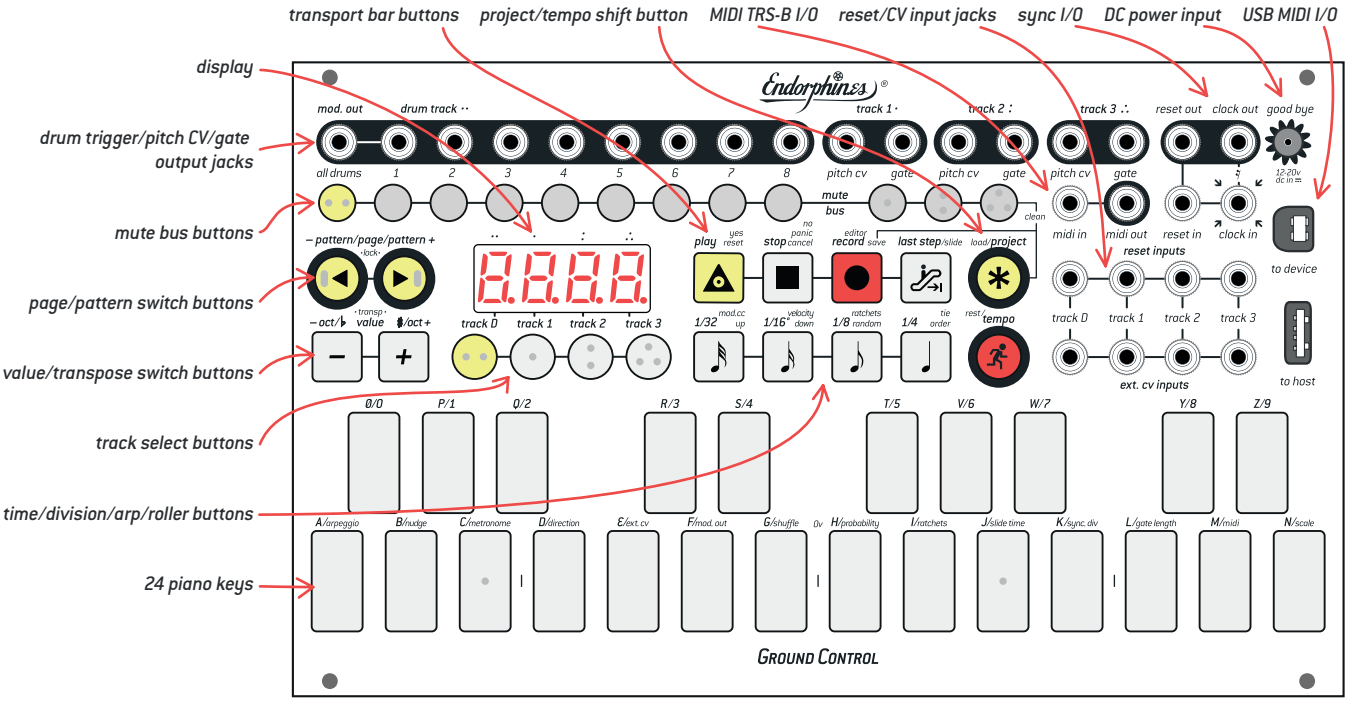
   +5V: 0mA

   Hint: *Of course the power consumption will increase, if devices are powered from USB HOST.*

2. Power the module using a 12-20V DC power adapter to the power inlet on the front panel. The higher the amperage of the DC adapter the better, minimum recommended is rated as 3A or more. The DC jack accepts 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. A small +5V jumper (off by default) on the left back side will enable routing +5V to the bus board.



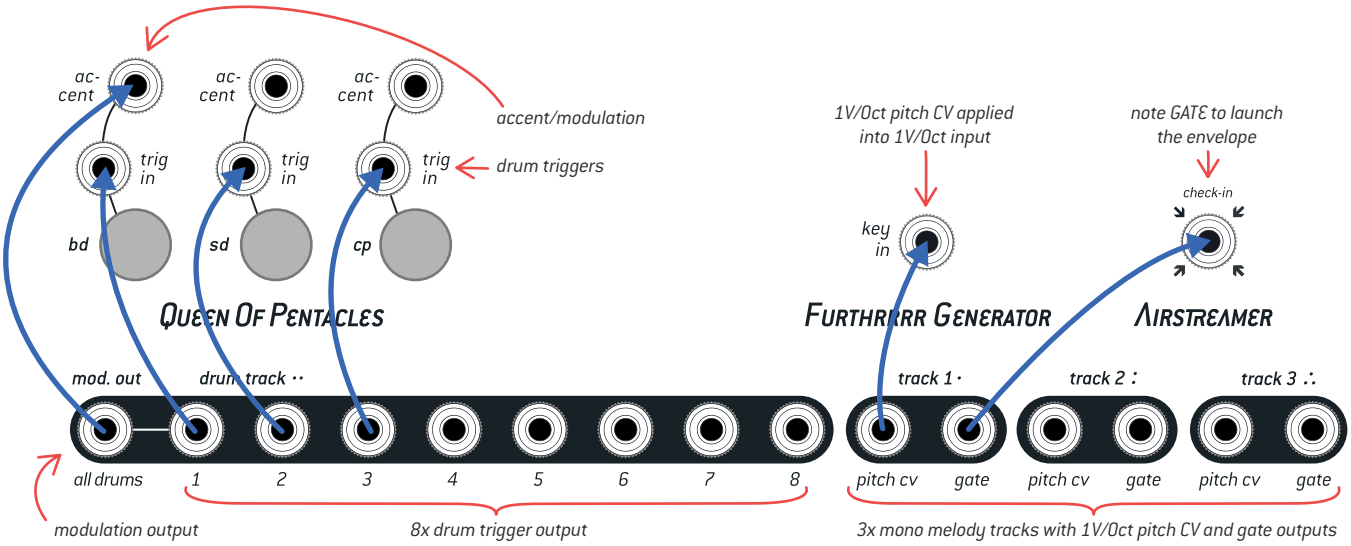
INTERFACE



TRIGGERS/CV/GATE OUTPUTS

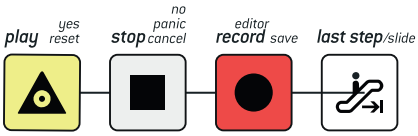
Ground Control has the following tracks:

- ***1x drum track that consists of 8x drum triggers and 1x modulation track*** (by default assigned to MIDI CC#01). Each drum trigger also sends individual velocity value via MIDI or USB-MIDI, with velocity setup available the edit page. By default, that drum track assigned to Rx/Tx (Rx: Receive Midi Channel/Tx: Transmit Midi Channel) MIDI channel 10 (see MENU: M/midi). Trigger outputs are v-trigger outputs with increased 0...10V output range to more efficiently drive LPGs etc. The default accent modulation CV output is 0...+5V.
- ***3x mono melodic tracks with physical 1V/Oct pitch CV and gate outputs.*** Pitch CV outputs cover 10 octaves -5v to +5v (similar to the Shuttle Control outputs). Gate outputs are scaled to 0...10V output.



The lowest recognizable MIDI note is C of -2nd octave (MIDI note #0) — its output voltage corresponds to -5V. The highest note is C of 8th octave (MIDI note #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 range.

TRANSPORT BAR



- ***PLAY: playback start button***

  Once pressed during the active playback, it resets all the tracks to the first step.

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

  In the menu options selection PLAY button acts as YES/confirmation of any call to action.

- ***STOP: playback stop button***

  Once in the menus, single press acts as an exit or cancel of any call to action.

  Also acts as a panic button when pressed a few times in case some MIDI devices have hanging notes.

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

  Long press enters the note editor.

  Pressed together with with PROJECT>RECORD enters the save Pattern/Project menu.

  Pressed together with TEMPO+RECORD starts RECORD WAIT mode.

- ***LAST STEP: Sets the amount of steps per melodic or separate drum tracks***
  After choosing the track with TRACK D/1/2/3 buttons, we adjust its pattern length by holding LAST STEP + one of the MUTE BUS buttons: LAST STEP + MUTE BUS + VALUE-/+ (or PAGE or 0...9)

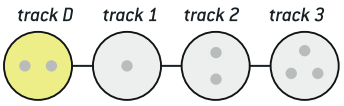
  One can only change amount of steps per track in STEP RECORD mode or with LAST STEP + MUTE BUS buttons.

  In the editor, that button acts as a flag for enabled slide on the active step.

  In the PROJECT menu the button acts as alternative selection for project or pattern load/save.

  TEMPO + LAST STEP locks the BPM value on the screen.

TRACK SELECTION



Ground Control has 1 drum track (consisting of 8 trigger tracks and 1 modulation track) and 3 melodic tracks. Once we are going to record, play, or edit one of the tracks, we activate it by pressing the appropriate TRACK D/1/2/3 button.

Each track has a special dot symbol used in the track names as well as on the associated buttons in form of palpable physical 'nipples' or 'bumps' on the rubber keys themselves to help navigate those main tracks with the fingers when performing:

drum track ⁘ track 1 ⁘ track 2 ⁘ track 3 ⁘

You can only select one of the four tracks at a time. 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.

Pressing the combination of TRACK 1/2/3 + TRANSPOSE-/+ buttons will shift currently selected pattern by 1 octave up or down on each combo press.

The combination of TRACK D/1/2/3 + 1/32...1/4 buttons set the time division of the current track. Holding that same combination for 1.5 sec. 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

The 7 digit/4 symbol display is used

- ***to show the currently selected pattern on a certain track:*** each of the 4 letters of alphabet shows one of the 24 patterns on each of the TRACKS D/1/2/3.
- ***for showing menus, values of selected menu items, hints etc.***

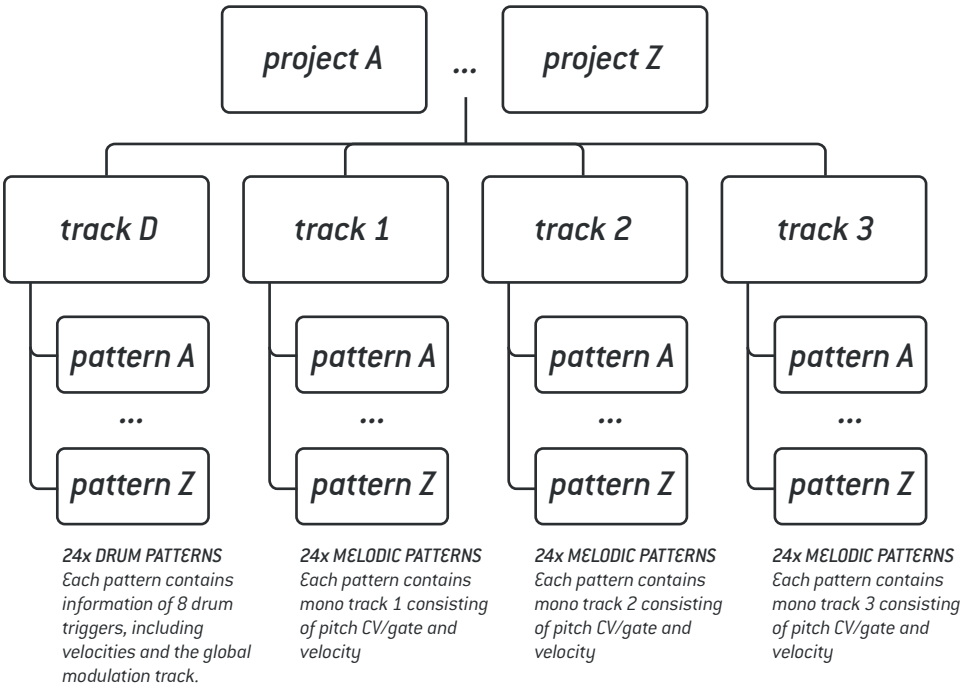
Check the dot symbols above the screen—they correspond to same palpable 'bumps' on the rubber buttons of the tracks.

The small dot near each track letter appears if that pattern is altered and is currently unsaved. That dot disappears if we switch to another pattern which was not altered. After returning to the unsaved pattern the dot will appear again. Once we save the pattern (or the SAVE ALL ___ action), the dot disappears. Once we turn off the module's power, all unsaved patterns will be lost, like tears in the rain.

PATTERNS

Each of the 24 projects that can be saved on the memory card of the Ground Control has 4x TRACKS: D/1/2/3. Each of those four tracks consist of 24 patterns, which correspond to a twisted Latin alphabet of 24 letters from A to Z:

Each pattern consist of 64 steps maximum. The number of steps contained in each of the drum trigger tracks can be any number up to a total length of 64 steps. Set the amount of steps per melodic track or drum tracks by holding LAST STEP + one of the MUTE BUS buttons. After choosing the track, we adjust its numbers of steps.



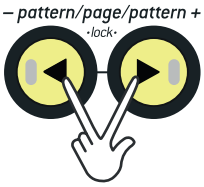
Note: *There are no patterns with the letters U and X due to the limitations of the 7 digit display.*

Each track may have any of 24 available patterns chosen, or you can lock/link them so switching the patterns on one track will switch the to the patterns with the same name on other tracks.

Change the patterns in one of the following ways:

- selecting the active track with TRACK D/1/2/3 and switching the pattern on that track incrementing up or down with <PATTERN/PATTERN> buttons.
- switch to exact pattern on the any track by pressing TRACK D/1/2/3 + A...Z piano keys buttons
- pressing PROJECT > A...Z piano keys buttons

By pressing both <PATTERN + PATTERN> buttons, we activate the ***PATTERN LOCK (link)*** which means changing one pattern on one track will change the patterns on all tracks to the pattern with the same name:

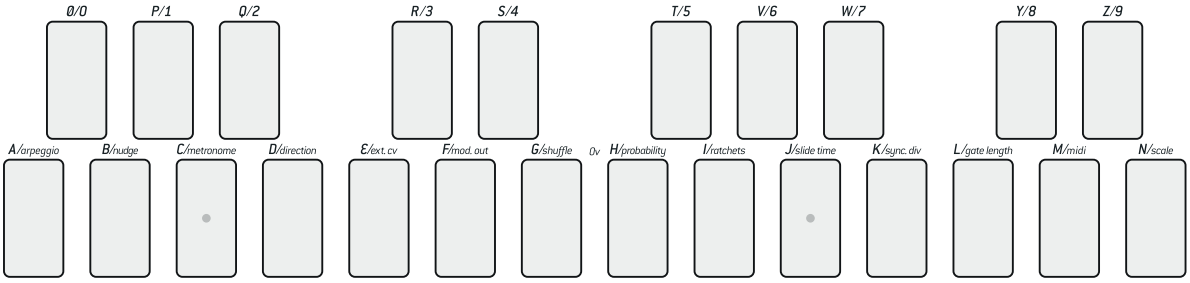


Patterns don't switch instantly to the next one selected, but after the current one was finished.

PATTERN CHAIN: By holding TRACK D/1/2/3 button + entering a sequence of the letters A...Z (even repeating the same letters) will add the patterns to the chain—i.e. they will be played sequentially and in order once the chain is entered. If we choose another pattern or its chains/create another chain, we loose the previously created chain. Maximum amount of patterns in a chain is 24.

Note: *Chains cannot be saved.*

24 PIANO KEYS



Ground Control has 24 piano key buttons—they are momentary keys for entering melodies, selecting patterns, accessing menus, entering alphabetical and numerical values etc.

The keys are not velocity or pressure sensitive.

- ***The piano keys are used to play melodies or trigger drums*** when we are in normal/non-recording mode:

  Activate one of the melody TRACKS 1/2/3, pressing those keys will generate the pitch CV and gate information on appropriate 3.5mm TRACK 1/2/3 output jacks as well as generate MIDI note information on MIDI and USB-MIDI outputs on the channels set in the MENU TEMPO > M/midi. The keyboard covers a range of two octaves (from F to E) and can be shifted (transposed) up or down to play the keys in higher or lower octaves.

  Activate the drum track by pressing the TRACK D button, to preview/play drum triggers with the top row of keys marked P/1....Y/8. Each of those keys has a number, each digit 1 to 8 corresponds to appropriate 1 to 8 trigger outputs.

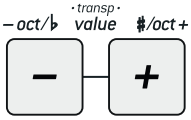
  Activate the arpeggiator/roller with 1/32...1/4 buttons. The piano key buttons—once pressed—activate the note sequence/arpeggio of i.e. a chord or a triad or activate drum rolls.

- ***The piano keys are used to select the next pattern on an active track*** by using a combination of the following buttons: PROJECT> A...Z buttons. Once the new pattern (or pattern chain) 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).

- ***The piano keys are used to enter the menu items using the lower row of keys from A...N*** and combination TEMPO + A...N or TEMPO > A...N. Next to each of the letters A...N are small labels corresponding to various menu item group settings, which are described in the ***MENU*** section below.

- ***The piano keys are used for numerical input 0...9 by using the upper row of 0...Z buttons*** to enter the exact parameter values along with the VALUE-/+ incremental buttons.
- ***The piano keys are used to save the current pattern (i.e. "A") to another pattern (i.e. "E")*** via combo PROJECT > REC>A...Z
- ***and also to load (open) or save one of the 24 projects*** via combo PROJECT>LAST STEP>A...Z to load another project and PROJECT>REC>LAST STEP>A...Z to save current project into another project (i.e. project "B" into project "F").

VALUE/TRANSPOSE BUTTONS



-OCT/VALUE/OCT+ (transpose) buttons in their basic functionality are used to transpose the keyboard output or recording melodic TRACKS 1/2/3.

Ground Control's range is 10 octaves per each melodic track so there are 4 octave shifts down to the lowest range with -OCT button and 4 octaves shifts up to the highest range with OCT+ button. The transpose buttons do not affect the drum track.

Pressing a combination of TRACK 1/2/3 + TRANSPOSE-/+ buttons will shift the currently selected pattern of the current track up or down by 1 octave on each combo press.

VALUE+/- buttons are also used to select various menu items (incrementing up or down) in any menu or for example changing the number of steps per track via the combo LAST STEP + ANY MUTE BUS button and adjusting selected track length with VALUE +/- buttons. In contrary to VALUE +/- buttons, which adjust incremental values by -/+1, the <PATTERN/ PAGE /PATTERN> buttons increment values usually by -/+ 10 or 16 depending on the context to speed up the adjustment of values.

SEMITONE TRANSPOSE (FOR MELODIC TRACKS 1/2/3 ONLY)

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 the message 'SEMI' on the display.

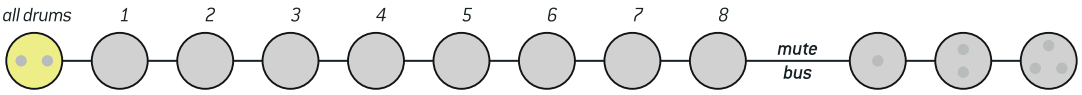
That means after pressing A...Z buttons the notes on the track can be shifted by the amount of semitones up or down from the root C note (marked with E/ext. cv on the keybard). Press both -OCT + OCT+ buttons together to shift the keyboard to transpose to higher intervals up or down on the currently selected active TRACKS 1/2/3.

In that mode, pressing the LAST STEP activates the LOCK SEMITOTE TRANSPOSE mode: you will see the message 'LOCK' on the display. That means that semitone transpose will be applied to all three melodic TRACKS 1/2/3 at once.

You can exit transpose mode again by pressing both buttons -OCT + OCT+. Remember to save your edited patterns after you shifted them up or down by some semitones. Otherwise, you will lose those changes on the module's next shut down.

In the Arpeggiator mode pressing 1/32...1/4 + TRANSPOSE-/+ combination will set the arpeggiator octave swing: default is 0 octaves, possible options: -2,-1, 0, +1, +2.

MUTE BUS



The mute bus is a row of the buttons below the trigger/CV/gate outputs on the top side of the Ground Control. The main function is to mute a certain track. In addition, each of those buttons blink each time a note happens on that track, which is useful to monitor the activity on the tracks at once. 'ALL DRUMS' button isn't blinking as every drum trigger mute button is already signaling its own pattern.

By default, the mutes have quantized action – i.e. they mute/unmute not instantly, but when the certain track will start a cycle (quantized to the track's pattern length). Long hold (1.5 seconds) any MUTE BUS button will enable its momentary mute action—i.e. the mute will be instant without waiting for the new cycle to start. It's a musical decision – sometimes it's important to enable the track instantly, sometimes it's good to queue the mute for one or multiple tracks, which frees up your hands to do other maybe more interesting and important things.

'ALL DRUMS' button will mute/unmute all 8 drum trigger tracks immediately. Tracks that have been separately muted before using 'ALL DRUMS' to mute all tracks at once, will still be muted when unmuting by pressing 'ALL DRUMS' again. You can press

any combination MUTE buttons at a time to mute certain channels at once. Muted tracks are remembered once you save the project (PROJ > REC > REC).

TEMPO + any MUTE BUS buttons 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.

Combination of pressing PROJECT + any MUTE BUS buttons will clear the notes/triggers on the selected track but will leave the same number of steps. Repeating the action (PROJECT + same MUTE BUS button) will reset the step count of that track to the default of 16 steps.

Pressing PROJECT + ALL DRUMS will clear all 8 drum triggers at once. Repeating the action will reset the step count of all 8 drum trigger tracks to the default of 16 steps.

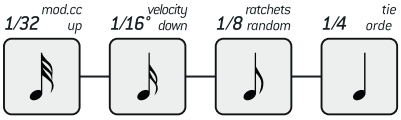
Maximum number of steps per track is 64.

<PATTERN/PAGE/PATTERN> 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 such as 'PAGE', these increment values by numbers of 10 or 16 depending on the context to speed up the values adjustment in the menus.

TIME DIVISION/ARPEGGIATOR/1/32...1/4 BUTTONS



Pressing button combinations using TRACK D/1/2/3 + 1/32...1/4 buttons set the time division of the current track. Same combination with the long hold (1.5 seconds) sets the same track's division but in triplets.

1/16 is always default and most used time division for any new project therefore it's marked with ° symbol at 1/16°.

Another function for those buttons is to enable/disable the ARPEGGIATOR on the melodic tracks 1/2/3 and the ROLLER for the drum track. Pressing 1/32...1/4 buttons enables one of the arpeggiator modes: UP/DOWN/RANDOM/ORDER (the button selected will start to blink). Pressing LAST STEP enables ARPEGGIATOR LATCH: arpeggiator notes are cleared when playing the next chord. To disable the arpeggiator, press 1/32...1/4 buttons or LAST STEP (latch) again. The arpeggiator will always have the current track's time division set by TRACK D/1/2/3 + 1/32...1/4.

Pressing 1/32...1/4 buttons on the drum track will enable the ROLLER: each drum trigger note 1...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.

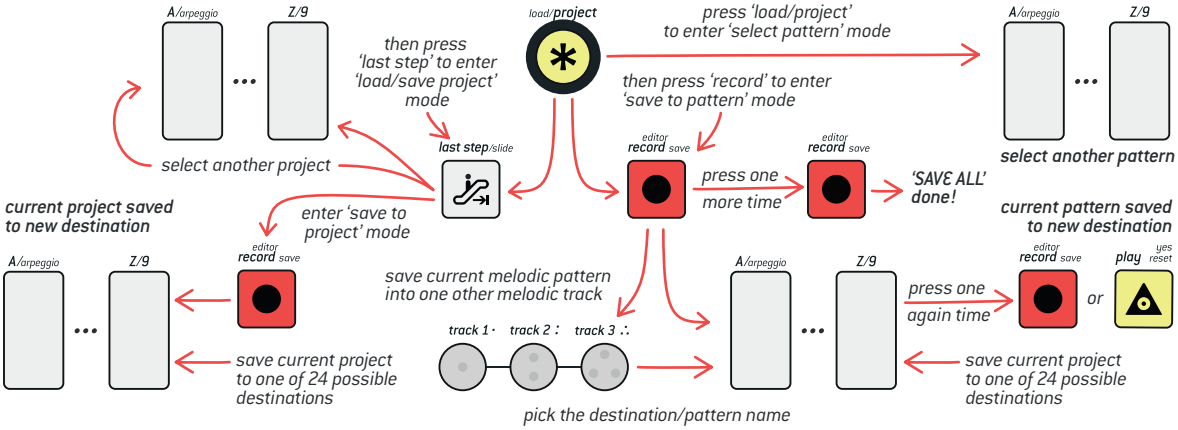
The roller on the drum track follows the pressed 1/32...1/4 time division—however only the time division initially selected for the track will be recorded if recording the roller in realtime (see section below).

Hint: *Once the arpeggiator is running the notes, you can change the modes on the fly. You can play and latch arpeggiators/rollers on all available tracks at once.*

PROJECT BUTTON: PATTERNS/PROJECTS LOAD/SAVE

PROJECT and TEMPO mainly work as SHIFT buttons.

PROJECT button functions are related to pattern/project saving/loading/clearing, which usually are associated on the same level or above the PROJECT button.



Pressing the PROJECT button will enter the LOAD menu for PATTERNS. Any of the 24 patterns can be selected by pressing the appropriate piano key. Pressing the LAST STEP button being inside that menu will change the load state from PATTERN to PROJECT. Now pressing any of 24 piano keys loads one of the 24 projects.

Pressing PROJECT > RECORD or PROJECT+RECORD buttons will enter the pattern save function.

Once you pressed PROJECT > RECORD, you can further:

- press RECORD one more time to SAVE ALL – means all unsaved patterns on all the tracks will be saved. That's the fastest combination to save anything you've just recorded.
- press any of A...Z piano keys to save current pattern to another pattern cell (A...Z)
- press TRACK 1/2/3 > A...Z to save currently selected pattern on currently active track into ANOTHER track's pattern cell (A...Z).
- press LAST STEP > A...Z to save the current project in one of the 24 project cells. Unused (clean) project cells are indicated by unlit buttons and used projects will show as semi-lit ones. The current project is blinking. To confirm saving 'SAVE' is visible in the display and can be confirmed by either pressing the RECORD or PLAY button. To cancel the procedure and exit, press STOP once.

Remember the logic: *You can always save current pattern/project only to itself or to another destination.*

After saving any pattern on a certain track (or save all fast via PROJ>REC>REC), those chosen patterns are restored when the module is powered up the next time as is the last project used.

TEMPO BUTTON

TEMPO and PROJECT mainly work as SHIFT buttons.

TEMPO button functions are related to the various MENU settings in combination with the lower row of piano keys A...N (TEMPO + A...N or TEMPO > A...N). One particular feature of the TEMPO button is setting the tempo:

- when pressing TEMPO button 3 or more times, it will act as a TAP tempo button
- when pressing TEMPO button once you will see current project tempo value in beats-per-minute (BMP). Default BPM value

is 120. Once you see that value on the display, you can adjust it:

Pressing VALUE-/+ buttons increments by 1 value at the time

Holding VALUE-/+ buttons speeds up the increase/decrease of values

Increasing/decreasing tempo by increments of 10 per press of <PAGE> buttons

Entering new BPM values numerically with 0/0...Z/9 piano keys

TEMPO + LAST STEP combo latches the BPM value appearance onto the display – that is useful if you need to monitor the tempo constantly.

RECORD

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

- ***STEP RECORDING:*** sequencing 101-style
- ***LIVE RECORDING:*** using internal 24-piano keys or MIDI gear
- ***EDITOR:*** manually entering/altering the notes/velocities/CC modulation
- ***XOX-STYLE EDITOR for DRUMS:*** editing triggers with 16 steps per page

STEP RECORDING

Step recording is a method for entering notes step-by-step (starting from first step) by entering notes and pauses (called rests) into an existing grid with a fixed time division. It was introduced long ago in synthesizers such as Roland® SH-101 and as well used in Endorphin.es® Running Order trigger sequencer.

Once 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. This mode currently only works when the sequencer is not running. To store the sequence of notes/rests, just press PLAY. The newly entered sequence is output through the CV/gate jacks or via MIDI.

In that record mode, 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 steps transition. Pressing TIE (1/4 button) in record mode in conjunction with pressing 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 fast, which are melodic, occasionally unpredictable and can have a various metric (steps length) which is useful in various electronic music styles.

EXAMPLE 1: Press STOP and switch to melodic TRACK 1. Select new pattern B by pushing PATTERN> button. Press RECORD button and program a note sequence using the A...Z keys paired with the TEMPO button creating RESTs. Press play to start the currently entered sequence. Press another TRACK D/1/2/3 button to instantly continue entering steps on another track. That is useful to quickly fill the patterns on all tracks.

EXAMPLE 2: Press STOP and switch to drum TRACK D. Select the pattern you wish to record and then try some of the 1...8 piano keys (upper row) to check, which drum trigger you are going to record. After you decided which drum you want 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 buttons, the amount of steps and all the triggers/rests on the previously recorded track will be saved.

Hint: *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 next track while keeping the recording enabled. In such 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 press PLAY to have the sequence running. Then press RECORD and enter the notes with the keyboard or attached MIDI or USB-MIDI keyboard controller. The notes will be entered and quantized to the currently selected grid.

In a future firmware update RECORD + PLAY combination will enable WAIT functionality for live recording, meaning that recording and sequencer clock will only start when you press the first note using the piano keys. To exit the live recording mode just press RECORD one more time.

If you don't like what you recorded you can quickly clear the track by pressing PROJECT + according MUTE BUS button once. That will clean only the notes on that track but will keep its length. Repeat pressing PROJECT + MUTE BUS button will also reset the step count of that track to 16 steps default.

There is no way to adjust the amount of steps of the pattern during the live recording mode. You can only do that via the step record mode, or aforehand/afterwards manually set the amount of steps via LAST STEP + MUTE BUS button that corresponds to that track and adjust the value with VALUE-/+ or <PAGE> buttons or using numerical 0/0...Z/9 keys.

Remember to always save the pattern once you have entered the notes and you like it. The easiest way to do that is pressing the sequence PROJECT>RECORD>RECORD anytime the sequencer is running or stopped. Last saved project and selected patterns saved will be recalled next time the module's powered up.

WAIT FOR RECORD

This is a special live record mode in which 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 ***REC...WAIT*** on the screen 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 start.

EDITOR

Once you want to edit already recorded notes you can do that via the editor. That's also the only way to adjust recorded notes velocity/modulation without external MIDI controllers.

Press and hold RECORD button for more than 1 second to enter the currently selected track editor.

In the editor, you can navigate thru the steps via the <PAGE> buttons—the current step will be shown on the display. Once there is an active note on that track you will see that specific piano key lights up. Be aware that piano keys only show 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 can navigate with the TRANSPOSE-/+ buttons to find that note in lower/higher octaves. Once you will reach the last step of 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: A.16. Pressing the PROJECT button anywhere in the editor will add one extra step at 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 (tie, slide, ratchets, rest).

Once navigating thru the steps, you can edit the note information stored and their features—so called flags. You can turn the notes on or off in the editor. To clear the step you can either press it again—i.e. press on the light up piano key or press the REST button. Each step can have 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 note twice as long. If that next note will also be tied with a third one, then the overall note's duration will be triple as long (in the grid of the track's time division etc.).
- ***REST (TEMPO button lights up red)*** always cleans the current note and any modulations/velocities that were stored in that current step.
- ***RATCHET (1/8 button)*** flag means the ratchet is enabled on the current step. The amount of ratchets can be set per track via the menu: TEMPO > I/ratchets
- ***SLIDE (LAST STEP button)*** flag means that the note will slide to another note with adifferent pitch. Slide time can be set via menu: TEMPO > J/slide time.

Additional features of notes are MODULATION and VELOCITY.

While modulation is currently only available on the DRUM TRACK D, each note has a velocity. It can be recorded via MIDI or USB-MIDI controller, however also manually adjusted per-step in the editor.

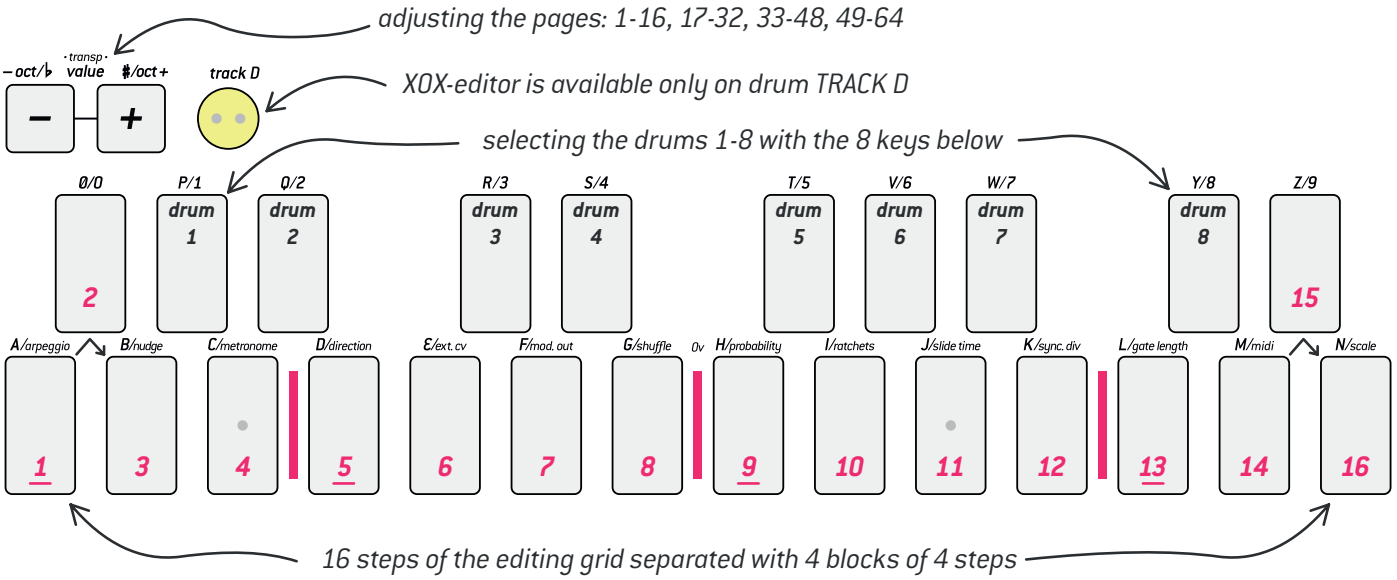
To access the ***MODULATION EDITOR,*** switch to TRACK D and press RECORD for long (1.5 sec.). Press ***MOD.CC*** button (1/32 button) and to navigate to the modulation step editor for the current pattern—the display will show C_1: meaning you are editing CC modulation #01 on the drum track (default Rx/Tx MIDI channel 10). The modulation track corresponds to the drum trigger track 1 and has the same number of steps. Navigating thru the steps with the <PAGE> buttons you select the step which modulation value you wish to adjust and then use either the VALUE-/+ buttons or the lower row of keys (A...N) to 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 being converted into physical CV from 0 to +5V range at the MOD. OUT jack output of the drum TRACK D.

To access the ***VELOCITY EDITOR,*** switch to any of the TRACK D/1/2/3 and press RECORD for long (1.5 sec). Press the VELOCITY button (1/16 button) and to enter the velocity step editor for the current pattern—the display will show V_1: meaning you are editing velocity values on the selected track or selected drum trigger track (selected by using the upper row of keys: 1...8). Navigating thru the steps with the <PAGE> buttons you select the step or note, which velocity you wish to alter. Adjust the values using either the VALUE-/+ buttons or lower row of keys (A...N) to set the value from 0 to 127. Velocity value 0 means the note isn't fired. Those 128 values correspond to the 7-bit note velocity messages sent thru the MIDI and USB-MIDI outputs as the certain note is played.

XOX-STYLE EDITOR (FOR DRUM TRACK D ONLY)

For editing the drums patterns, it's easier to use the XOX-style programming inspired by Roland® TR-808/909 etc. machines. That XOX editor exists only for the drum track.

To enter the editor press RECORD for long (1.5 sec.) when sequencer is not running and then select TRACK D. In that mode lower row of the 14-piano keys piano roll including the outer left and outer right upper row keys 0/0 and Z/9 form the 16-step grid used for XOX-style programming. We select the drum trigger with P/1...Y/8 buttons and after that program its steps on the 16-step grid:



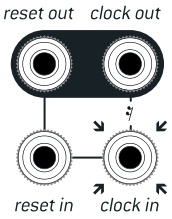
In that drum mode we see only 16 steps at once: from step 1 to 16 (page 1 or shows as P 1). Press VALUE-/+ buttons to navigate to next pages: page 2: 17-32 steps, page 3: 33-48, page 4: 49-64 steps. You can access to those next pages 2 to 4 only if a certain selected drum has more than 16 steps (selected via LAST STEP + MUTE BUS DRUM TRIGGER + VALUE-/+ or <PAGE>).

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, press the RECORD button for long (1.5 sec.) will enter the live editor mode.

On the drum track you have accessed the XOX editor where you can see steps running in realtime and navigating thru the pages with VALUE-/+ buttons. On melodic TRACKS 1/2/3 you will see the step editor and the notes will blink as they play on the currently selected step.

CLOCK/RESET I/O

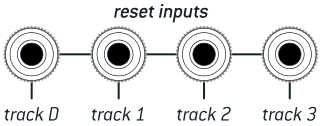


Clock and reset are analog logic INPUT and OUTPUT signals made to synchronize Ground Control together with Eurorack equipment or other music gear. The trigger outputs have a range from 0...+10V to be compatible to gear of many different maufactuerers. Trigger inputs are typically designed to receive 0...+5V with the threshold of 0.65V.

Ground Control sends one short trigger from its ***RESET OUT*** jack once the playback starts by pressing the ***PLAY*** button.

Applying a trigger to 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 steps.

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



CLOCK OUT is the master clock output by default set to sixteenth notes (corresponds to PPQN/6 or 1/16th notes): 𝅘𝅥𝅯

It is possible to adjust this clock output divisions via MENU: TEMPO > K/sync. Div > <PAGE>.

The 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. /32*** – output clock in 32th notes (corresponds to 24PPQN/3)
- ***o. 4*** – output clock in 24PPQN/4
- ***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.*

CLOCK IN is a slave clock input and accepts clock CV signals from other sequencers or clock generators (such as Running Order for instance). By default the input expects the standard sixteenth notes (PPQN/6 or 1/16th) typical for Eurorack.

Selecting the master clock is done via MENU: TEMPO > K/sync. Div > VALUE-/+. The options are:

JACK means internal Ground Control clock generator, if no cable is inserted into CLOCK IN jack. If a cable is inserted into CLOCK IN, the sequencer automatically detects the input signal and switches to external clock.

- Display shows ***'USB.H'*** means Ground Control becomes a slave to the clock received from another device connected via USB HOST socket
- Display shows ***'USB.D'*** means Ground Control becomes a slave to the clock received from the device connected into USB DEVICE socket.
- Display shows ***'MIDI'*** means Ground Control becomes a slave to the clock received from MIDI IN 3.5mm jack (MIDI type B standard via adapter).

Be aware: *If you selected a master clock source, which is not actually connected, the sequencer will not start if manually pressing the PLAY button, as it will expect to receive a START command from external clock source.*

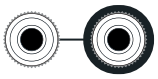
It is possible to adjust the input clock divider to make sequencer playing slower or faster than incoming clock. ***It can only be done, if the sequencer is in the slave mode*** (i.e. USB D/H or MIDI is selected as master clock or there is a cable inserted into CLOCK IN jack) via following combination: TEMPO > VALUE/-+.

The options are:

- Display shows ***'PQ.24'*** – corresponds to the original 24PPQN typical MIDI clock standard. This is default sync option when MIDI or USB-MIDI master clock option selected. Choose this option, if you sync Ground Control (slave) to other master MIDI device with exact 1:1 tempo.
- Display shows ***'PQ.48'*** – corresponds to PPQN48 alternative a.k.a. Korg® MIDI clock standard. Choose this option, if you sync Ground Control (slave) to other master MIDI device with twice faster 48PPQN clock.
- Display shows ***'PQ.12'*** – corresponds to PPQN12. Choose this option, if you sync Ground Control (slave) to other master MIDI device with a twice slower 12PPQN clock. With PQ.28 and PQ.12 options you can adjust your Ground Control to essentially be twice as fast or twice as slow as your typical MIDI clock.
- Display shows ***'i./32'*** – input clock in 32th notes (corresponds to 24PPQN/3).
- Display shows ***'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 arrived into CLOCK IN jack is sixteenth notes.
- Display shows ***'i./8'*** – input clock in 8th notes (corresponds to 24PPQN/12).
- Display shows ***'i./4'*** – input clock in 4th notes (corresponds to 24PPQN/24).

Hint: *'i.' symbol in the beginning means we adjust input clock division.*

MIDI I/O



Those are 3.5mm TRS-B MIDI jacks.

IMPORTANT: *MIDI pinout – EU type B: standard of Arturia, Elektron, Novation, Teenage Engineering etc:*

Pin 5 – Ring (Current Sink)

Pin 4 – Tip (Current Source)

Pin 2 – Sleeve (Shield)

One EU type B adapter is included with the module *and you can use any third party ones just ensure it is the 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

to device *to host*

Those are similar as class compliant USB-MIDI type A and type B sockets.

If you familiar with Endorphin.es Shuttle Control, they are similar to the Ground Control. Moreover, Shuttle Control may and will work as a perfect MIDI expander module for the sequencer to assign all the velocities, internal generators etc.

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

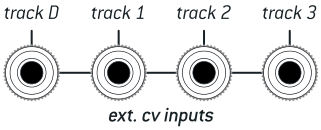
- usually TO DEVICE is connected to the computer or tablet. In that case Ground Control works as a USB-MIDI to CV converter or you can use Ground Control as MASTER clock for your DAW since USB-MIDI is bidirectional.
- usually TO DECIVE is connected to various MIDI controllers: from USB-MIDI keyboards to faderbanks etc.

By default, any MIDI input events are routed to 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.

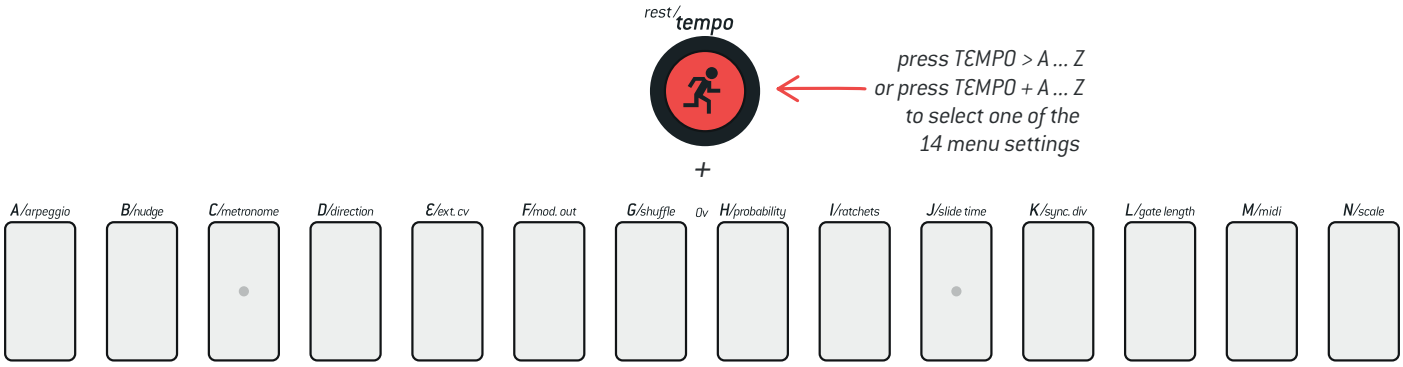
Hint: *Set Tx (Transmitting CMidi Channel) channels on Beatstep Pro/Keystep Pro device to unused MIDI channels (i.e. 4 or other) to make everything run smoothly.*

EXT. CV INPUTS



In further firmware updates the modulation matrix will be accessed via MENU: TEMPO > E/ext. cv.

MENU



There is no menu diving in the module except TEMPO > A...N or TEMPO + A...N.

By that combos we instantly access various sequencer settings, which are organized into 14 PAGES—1 page per A...N button.

Some of the menu items are related to similar initial letters (i.e. 'A' for 'Arpeggio') to remember their access—all other coincidences are for technical purpose only.

A/ARPEGGIO

This menu item is reserved for are arpeggiator/roller settings in further firmware updates.

Currently all arpeggiator settings are selected with 1/32...1/4 buttons, which correspond to arpeggiator modes: ***UP/DOWN/RANDOM/ORDER.***

When we are on the active melodic TRACKS 1/2/3 pressing combination of the 1/32...1/4 + TRANSPOSE-/+ buttons set the arpeggiator octaves swing (0 by default, possible options: -2, -1, 0, 1, 2).

Currently all drum roller settings are selected with that buttons as well and correspond to drum rolls speed: 1/32...1/4.

Arpeggiator and rolls can be recorded in the live recording mode. However remember the rolls will always be recorded having the current track's time division settings applied.

B/NUDGE

This setting is reserved for shifting the track notes on their pattern's grids back and forth in further firmware updates.

C/METRONOME

Ground Control has a small buzzer installed which, if enabled, acts as a physical metronome so you can start recording grooves without necessity to patch something to make the clock audible first.

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

- **—** (none)
- ***d*** (drum track)
- ***1/2/3*** (certain melodic tracks).

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

Info: *The metronome speaker is a small physical buzzer located on the back side of the module and its volume can be perceived differently depending on the physical structure of your case and the noise in your surrounding.*

D/DIRECTION

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

- Display shows ***'FRWD'***: means FORWARD – typical direction from first step 1 to the last step and then again returning to the first and so on.
- Display shows ***'REWD'***: mean REWIND – direction from the last step to the first step 1 and then again returning to the last and so on.
- Display shows ***'PEND'***: means PENDULUM – is a combination of forward and backward movement.
- Display shows ***'RAND'***: mean RANDOM – the steps of the sequence are played randomly.
- Display shows ***'RSTP'***: mean RANDOM STE – on each step the 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 will finish its full cycle. In FORWARD mode that means once the pattern will reach its last step, the next step will be the first step from 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 (16 by default).

E/EXT. CV

This menu item is reserved for the MODULATION MATRIX and will be available in future firmware updates.

F/MOD. OUT

This menu item is reserved to maintain settings for the MODULATION OUTPUT CV JACK and will be available in future firmware updates.

By default the MODULATION OUTPUT jack is assigned to a special modulation track, which—together with 8 trigger track outputs—form the DRUM TRACK. Default modulation output range is 0...+5V and with the further firmware updates it'll be possible to adjust and reassign that modulation output jack to other generators or CV destinations.

G/SHUFFLE

SHUFFLE or swing (shown at display as 'Gr.50' meaning 'groove') is settings per one of the TRACKS D/1/2/3 inspired directly from famous AKAI® MPC vintage machines by Roger Linn. That means delaying all the even-numbered 16th notes within the beat (2, 4, 6, 8, etc.). Is set in values 0-50-100, which is a ratio of time duration between the first and second 16th note within each 8th note. At value 50% there is no swing. At value 66% is a perfect triplet swing. Most used (and secret) value in electronic music: 53-54—this value gives a light yet musical shuffled vibe.

H/PROBABILITY

Probability or humanization means some of the notes on the track can be accidentally skipped, imitating imperfection of the human nature. It is shown at display as 'HN._0' meaning 'humanization'.

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

I/RATCHETS

Ratchet means that a trigger fires not once per current step, but up to 3 times more (4 in total including the initial trigger). Value '0' means no ratchets while value of 4 results in 4 notes/triggers on one the step, if the RATCHET FLAG was enabled.

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

J/SLIDE TIME

Slide occurs, if the recorded notes on melodic tracks overlap—that means the initial note key is still pressed while the new one is being pressed. Slide range per melodic track is 0 to 99 and its default value is 50 which corresponds to approximately 100 ms of slide from one note to the other. In case of creating longer notes by using TIEs which occupy a few steps, the slide occurs on the last step of that TIE'd long note before the upcoming note of different pitch where the pitch slides to. That type of slide is inspired by Roland® TB-303 type of sliding with fixed default slide time.

Hint: *If the slide value is set to 0, then slide time is instant. With max. value of 99 the slide time is approximately 2 seconds.*

K/SYNC. DIV

That menu sets the master clock synchronization source (JACK (INTERNAL/EXTERNAL), MIDI, USB HOST, USB DEVICE) and their dividers.

If JACK is selected and no cable is inserted into the CLOCK IN jack, the clock used is the internal clock of the Ground Control (can be taken from the CLOCK OUT jack). It is forced to switch to external analog pulses 'Eurorack' clock once a cable is inserted into CLOCK IN jack.

Info: *See clock I/O divisions settings in the CLOCK IN/CLOCK OUT section in this manual.*

Default clock settings for analog Eurorack synchronization are sixteenth notes (shown as /16 on the display) which corresponds to 24PPQN/6 in terms of internal MIDI divisions. If you use MIDI or USB-MIDI as master clock for the Ground Control, then the typical division is PQ.24 (24PPQN).

L/GATE LENGTH

Currently all 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 button combo (and long hold (1.5 sec). to obtain triplets values of those divisions). 1/16 is always default and the time division used most for any new projects—therefore it's marked with ˚ symbol at 1/16˚.

Each note on a certain melodic TRACK 1/2/3 has a strictly fixed duration of the gate (the gates we receive from melodic TRACK 1/2/3 GATE output jacks). Those values vary from: 1 to 99, measured in % of the step length. There is no 100% gate length since it means that current note will be TIED with the upcoming one. Default gate length is 50% and is the always constant for all the notes in the same track.

M/MIDI

This menu covers all the MIDI settings. New settings might be added with further firmware updates. Once we press TEMPO > M/midi combination we enter the MIDI settings menu and see the lower row of keys light up. Each of those lit up keys defines a menu item we can select or adjust. By pressing on each of those keys we see corresponding menu hint on the display and the values which we can adjust using the VALUE-/+ buttons. Since most of the settings are per-track settings, we can select these using the TRACK D/1/2/3 buttons.

The settings items are the following:

- ***A:*** Display shows ***'Ch.Rx' – means CHANNEL RECEIVE*** and is a MIDI channel from which the track will RECEIVE its information. It can be either OFF, 1 to 16 or OMNI meaning it will receive from any MIDI channel. By default TRACKS D/1/2/3 are set to Ch.Rx. correspondent MIDI channels 10/1/2/3. Setting them to OMNI will be an easy solution if you use MIDI keyboard to enter the notes so you will just switch the tracks with TRACK D/1/2/3 buttons and enter the notes with the keyboard without reassigning the MIDI channel on the MIDI keyboard every single time.
- ***B:*** Display shows ***'Ch.Tx' – means CHANNEL SENT*** and is a MIDI channel on which the track will SEND its information. It can be either OFF, 1 to 16. By default TRACKS D/1/2/3 are set to Ch.Tx. correspondent MIDI channels 10/1/2/3.
- ***D:*** Display shows ***'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 appear to USB DEVICE which connected to the computer DAW.
- ***E:*** Display shows ***'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 send also to Beatstep Pro as a slave source connected to the USB HOST.

- ***F:*** Display shows ***'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. That is useful to use any USB-MIDI adapter's MIDI OUT plug as a MIDI THRU one.
- ***G:*** Display shows ***'R.CLK' – means RUNNING CLOCK.*** Once the sequencer is running, it sends the MIDI clock and once it stopped, the MIDI clock also stops. Available options are: ON/OFF.
- ***H:*** Display shows ***'TP.RX' – means RECEIVING of TRANSPORT MIDI MESSAGES.*** If enabled – the sequencer will react to start/stop/continue MIDI messages sent from external MIDI controller or DAW – feature added soon
- ***I:*** Display shows ***'TP.TX' – means SENDING of TRANSPORT MIDI MESSAGES.*** If enabled – the sequencer will send start/stop/continue MIDI messages sent from all of its MIDI and USB-MIDI outputs to control external MIDI controller or DAW – feature added soon
- ***J:*** Display shows ***'GTED' – means GATE TRIGGER LEDS.*** Available options are: ON/OFF. By default is enabled and if enabled – you will see blinking appropriate MUTE BUS buttons once active notes appear that correspond to that tracks – feature added soon
- ***K:*** Display shows ***'KLED' – means KEYS LEDS.*** Available options are: ON/OFF. By default is enabled and if enabled – you will see blinking PIANO KEYS on active track once active notes appear that correspond to that keys. Note that if the notes are located in higher or lower octaves they will not blink unless you switch to higher/lower octaves using -OCT/OCT+ transpose buttons.
- ***M: exits the MIDI menu***

N/SCALE

Those item is reserved for note scales filter which will be available with upcoming firmware updates.

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 card between them and you will have instant access to all the projects and settings, scales, MIDI channels etc.

Hint: *NO settings and recorded scores will be erased during firmware updates.*

Lots of settings from the TEMPO > A...M keys are global settings and are automatically applied to all projects at once. Other settings are related to the project and/or certain channel only.

Each of the 24 PROJECTs are stored the SD card in separate folders, which correspond to the project name: 'A' to 'Z'.

These global settings are set for all 24 projects in ***GlobalSettings.txt*** *file:*

- LastLoadedProject – defines the last opened project to be loaded when the Ground Control is powered up the next time
- BuzzEnabled – if mechanical buzzer (metronome click is enabled)
- buzzerTrack – sets which of TRACK D/1/2/3 selected time division the metronome click follows
- masterClockSource: sets the master clock input
- midiHostLoopback – enables the host's loopback option.
- If enabled: everything that enters the USB MIDI HOST IN will be rerouted back into USB MIDI HOST OUT
- midiHostToDeviceForward – enables all MIDI routing from USB MIDI HOST into USB MIDI DEVICE
- midiDeviceToHostForward – enables all MIDI routing from USB MIDI DEVICE into USB MIDI HOST
- clockOnStop – enables running MIDI clock if the sequencer is stopped.
- keyLed – enables the PIANO KEYS to blink to indicate active notes appearing on the active track
- RXTransport – enables receipt of MIDI TRANSPORT commands (start/stop/continue) from external MIDI and USB-MIDI devices
- TXTransport – enables transmit/send of MIDI TRANSPORT commands (start/stop/continue) to external MIDI and USB-MIDI devices
- muteExternalGateLed – enables the MUTE BUS button's LEDs to blink if the active notes appeared on those tracks

*Additionally, extra 4x CV output calibration settings are stored in **Calibration.txt** file:*

- channel – calibration settings per channel. 0 corresponds to modulation output on the drum track. 1 to 3 corresponds to TRACK 1/2/3.
- low_mv/zero_mv/high_mv – calibration values for -3/0/+3 volts, entered in milivolts

*Each project's parameters are stored in the **ProjectSettings.txt** file:*

- BMP – project's tempo in beats per minute, 30 to 240
- ActivePattern – last saved patterns on each of 4 TRACKS D/1/2/3 to be restored on the next module's power up.

*Each of the 4 tracks parameters of every project are stored in **TrackSettings.txt** file:*

- channelRX – MIDI channel from which that TRACK D/1/2/3 accepts the MIDI data. Options are: 1 to 16, OFF or OMNI (any channel)
- TXCopyRX – MIDI channel which transmits is the same channel that receives MIDI data
- channelTX – MIDI channel from which that TRACK D/1/2/3 send the MIDI data. Options are: 1 to 16 or OFF.
- enableRX – enable MIDI receipt on a certain TRACK D/1/2/3 (option: ON/OFF)
- enableTX – enable MIDI transmit (send) from a certain TRACK D/1/2/3 (option: ON/OFF)
- OmniChannel – enable MIDI receive from any input MIDI channel
- Slide – slide time, default: 50 (100ms), options are 0 (instant) to 100 (1-2 seconds)
- Shuffle – shuffle time, 0 by default corresponds to zero shuffle
- humanize – probability option per drum tracks or per musical tracks. Options are 0 (100% probability) to 99 (1% of probability)
- ratchet – ratchet per individual drum tracks or per musical tracks. Options are 0 to 3.
- Gatelenght – length of the gate per step. Values are 25%, 50% ,75%.

Each of 24 patterns on each of 4 tracks stores:

- Notes with their velocities
- Flags (on off) per active steps for tied notes and slides (melody TRACKS 1/2/3) and ratchets
- Modulation value on the drum track
- Time division
- Pattern direction

CV CALIBRATION

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

For correcting them we can use the same Shuttle Control calibrator to enable Ground Control's 4x DAC correction (modulation output and pitch CV on tracks 1/2/3).

You will need a voltmeter to read the values from all Ground 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://www.endorphin.es/cargo4/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. 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 multi-meter reads -2.99V, then enter '-2990'.
- at 0V if multi-meter reads -0.01V, then enter '-0010' or if it shows 0.02V, then enter '0020'
- at +3V if multi-meter reads 3.01V, then enter '3010',

Afterwards press the 'Write' button to send the adjusted values to the Ground Control and all the calibrated values will be stored.

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 only deviate 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. The calibration 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.***

Hint: *Make a backup of your Calibration.txt (or all of the data contained on the SD card) on your computer so you have it at hand, whenever something goes wrong i.e. accidentally erasing the SD card while you have plugged into your computer.*

FIRWMARE 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.

Take the sequencer out of your rack and eject micro SD from it (located on the backside of the module). Insert that card into your computer using SD adapter or card reader (sold separately). Unzip ***gc-firmware_XXX.hex*** file from downloaded archive and place it into the ROOT directory of your SD card.

Eject the micro SD card from the computer and insert it back into the Ground Control. Turn on the power of the Ground Control: you will see 'BURN' message on the screen meaning the firmware is flashed and you will see the process of 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.

Note: *the firmware updates doesn't alter any of your recorded patterns information. However we strongly advice to occasionally back up your micro SD card. Different memory cards have different amount of read/write cycles. Don't worry, even using your sequencer every day, your SD card will serve you for years. However SD cards they are considered as consumables and sometimes are good to backup.*

CREDITS

ENDORPHIN.ES® – GROUND CONTROL

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

Rubber keys 3D design by Simone Fabbri

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

Core engine programming by BSVi

UI and all the rest programming by Xavier Galai/Kouik03

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

Video review and valuable feedback by Ziv Eliraz (Loopop)

Endorphin.es are made in Barcelona, Spain

Follow, like, post and tag us at Instagram: @endorphin.es

GROUND CONTROL SHORTCUTS CHEAT SHEET (22-MAR-21)

- ***PLAY:*** starts the playback. 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 steps
- ***STOP:*** stops the playback. When we are in menu, single press exits the menu keeping the playback running.

  Next STOP press stops the sequencer.

  Another long hold STOP press acts as a panic action in case of hanging MIDI notes.

  And one more long 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*** buttons 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)
- ***RECORD while sequencer is not running:*** starts step record mode
- ***RECORD when sequencer is running:*** starts live recording mode
- ***RECORD long hold (1.5 se.) while sequencer is not running:*** enters the editor
- ***TEMPO + RECORD*** starts RECORD WAIT mode
- ***LAST STEP + MUTE BUS + VALUE-/+ (or PAGE or 0...9)*** setting the number of steps per track
- ***LAST STEP in arpeggiator/roller mode*** acts as arpeggiator's latch.
- ***TEMPO + LAST STEP*** locks the BPM value on the screen
- ***TRACK 1/2/3 + TRANSPOSE-/+:*** shift currently selected pattern by 1 octave up or down
- ***Both TRANSPOSE-/+ buttons pressed together > A...Z buttons:*** semitone transpose current pattern from foot C key
- ***Both TRANSPOSE-/+ buttons pressed together > LAST STEP*** activates transpose lock and semitone shifts apply to all TRACKS 1/2/3 at once
- ***TRACK D/1/2/3 + <PATTERN/PATTERN>, TRACK D/1/2/3 + A...Z piano keys, PROJECT > A...Z:*** selecting the pattern on active track
- ***<PATTERN + PATTERN> both buttons pressed together*** activates the patterns LOCK –to switch patterns of all tracks simultaneously
- ***TRACK D/1/2/3 button + entering a sequence of the letters A...Z:*** entering a pattern chain
- ***24 PIANO KEYS:*** playing/entering the notes/drum triggers on active track
- ***1/32...1/4:*** activating the arpeggiator/roller on the active track
- ***TEMPO + A...N or TEMPO > A...N:*** selecting the menu setting items
- ***1/32...1/4 + TRANSPOSE-/+ in arpeggiator mode*** sets the arpeggiator octave swing.
- ***MUTE BUS long press (1.5 sec.)*** selecting quantized (one blink) and momentary (double blink) mute buttons action
- ***PROJECT:*** 'shift' function button related primarily to saving patterns/projects
- ***PROJECT+ MUTE BUS:***

  1) first press clears the notes/triggers on the selected track but leaves the same number of steps.

  2) second press resets the step count of that track to 16 steps default.
- ***PROJECT > RECORD or PROJECT + RECORD*** buttons will enter the pattern save function
- ***PROJECT > RECORD > RECORD*** saves ALL unsaved patterns/settings in the current project
- ***PROJECT > RECORD > A...Z:*** saves current pattern on any of 24 patterns cells in the current track
- ***PROJECT > RECORD > TRACK 1/2/3 > A...Z:*** saves current pattern on any of 24 patterns cells in the other selected TRACK 1/2/3.
- ***PROJECT > RECORD > LAST STEP > A...Z:*** saves current project into any of 24 project cells. Occupied keys (containing a project already) will be lit.

- ***TEMPO:*** 'shift' function button related primarily to entering the menu settings via TEMPO > A...N buttons
- ***TEMPO pressed 3x or more times*** acts as a tap tempo action when the sequencer acts as a master clock
- ***TEMPO > VALUE-/+ or <PAGE> or 0..9*** – setting the tempo manually incrementing by 1, by 10 or in digits
- ***TEMPO + MUTE BUS*** does solo the tracks selected by pressing
- ***<PAGE>*** in the editor navigates thru the steps on the active track/pattern
- ***PROJECT pressed while in the editor*** adds an extra step at the end of the pattern
- ***TEMPO/rest pressed while in the editor*** clears the current step
- ***TIE (1/4)pressed while in the editor TRACKS 1/2/3 merges (ties)*** note stored on the current step to the next one
- ***RATCHET (1/8) pressed while in the editor*** enables ratchet flag on current step
- ***SLIDE (LAST STEP) pressed while 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) pressed while in the editor*** on TRACK D enters the modulation CV output step editor
- ***Velocity (1/16) pressed while in the editor***on TRACKS D/1/23 enters the notes velocity step editor
- ***TEMPO > K/sync. div > <PAGE>*** sets the divider for CLOCK OUT output clock
- ***TEMPO > K/sync. div > VALUE-/+*** sets the input divider for external master clock input
- ***TEMPO > A*** *reserved for arpeggiator settings in future updates*
- ***TEMPO > B*** *reserved for nudge/pattern rotation settings in future updates*
- ***TEMPO > C > VALUE-/+*** enabling/disabling the metronome click
- ***TEMPO > D*** setting the tracks direction on current pattern
- ***TEMPO > E*** *reserved for external CV (modulation matrix) settings in future updates*
- ***TEMPO > F*** *reserved for adjusting the modulation CV output jack settings in future updates*
- ***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*** setting the master clock source
- ***TEMPO > L*** setting the gate length for the melodic TRACKS 1/2/3
- ***TEMPO > M*** entering the MIDI settings
- ***TEMPO > N*** *reserved for notes scales settings in future updates*