

# GRAND TERMINAL



Safety instructions for firmware 1.6/26.02.17

## ***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 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

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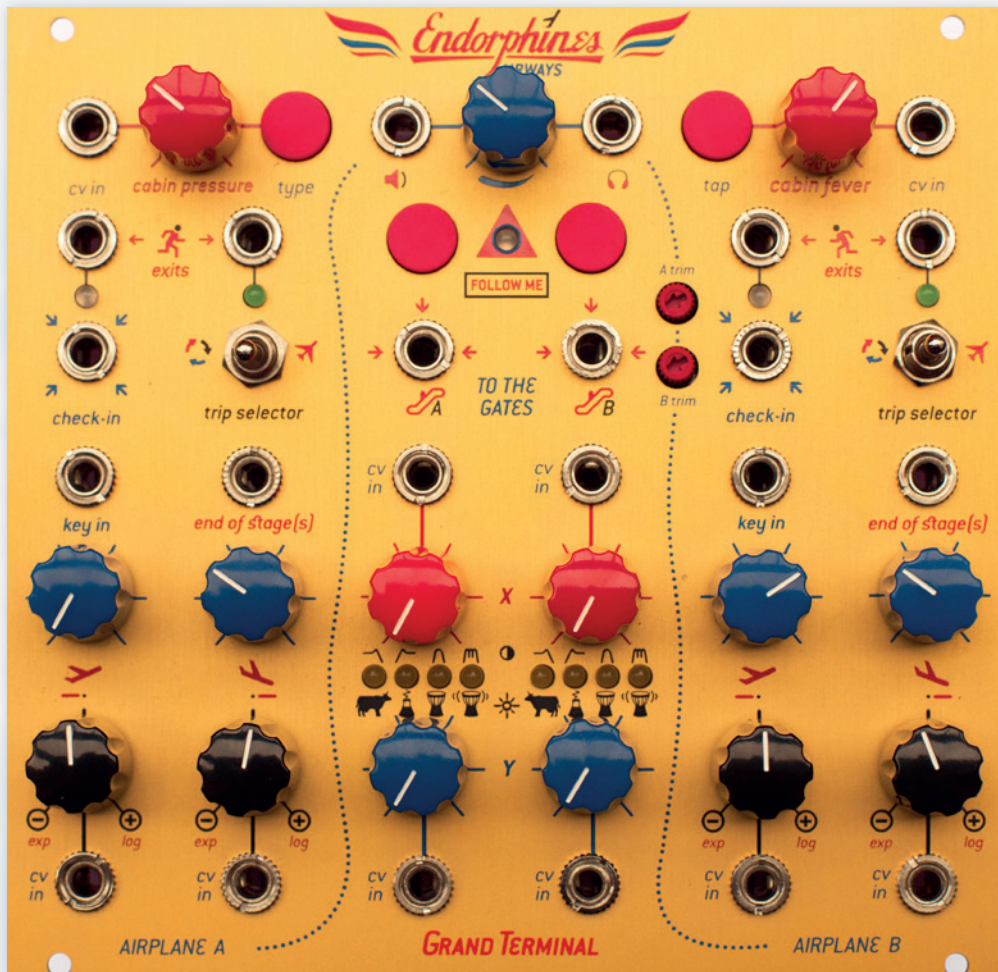
[info@endorphin.es](mailto:info@endorphin.es)

***FURTH BARCELONA, S.L.***

VAT ID:ES B66836487



## GRAND TERMINAL OPERATED BY ENDORPHIN.ES AIRWAYS



### LIFE IS A TRIP

- 26 HP, 1" in depth – super slim and Shuttle friendly
- Dual multi-mode filter (ladder, diode, vactrol, state-variable lp/hp/bp and comb) in dual, stereo and serial modes
- Dual looping/AD/ASR envelope generator that acts as band-limited oscillator when cycling at linear slopes
- Stereo “Cabin Pressure” processor with different ambient effects: from shimmered halls and reverberations to a spring simulation over tape/ping-pong delays to a chorus
- Separate mono modular level output and stereo line level output for direct line recording or driving the headphones.
- Easy firmware update via USB
- And of course fully compatible with Gateway<sup>TXP</sup>
- I/O: 48 kHz 16 bit audio

# WELCOME TO THE NEW ENDORPHIN.ES – GRAND TERMINAL!

It is a complex all-in-one module that together with any oscillator (e.g. Furthrrrr Generator) or even on its own represents a full modular synthesizer voice.

On one hand, the module is simple – just two envelopes and two filters which are very handy for beginners, having a block of modules that in some approximation usually could be found in every keyboard synthesizer like Moog, Nord, Prophet, or whatever. Such a set of blocks is extremely handy for live performances having everything in a yet compact but accessible way.

On the other hand, everything is modular and CV controlled. By pressing a few button combinations, surprisingly advanced possibilities open up without deep menu diving.

## BEFORE TAKE-OFF

GENERAL INFO: As more and more modules are using stereo and mono jacks simultaneously it is important to state the following: Use 3.5mm MONO cables for all CV inputs of the GRAND TERMINAL (X/Y CV, Airplanes CV inputs, Cabin Pressure CV and Cabin Fever CV)!

*We also recommend you to download and update the latest firmware on your Grand Terminal to ensure all of the features that are described in the manual work in your module. Manual update instructions are in the end of the manual.*

## FINAL OUT

The blue knob in the top middle of the modules adjusts the volume (amplitude) of the final stereo and mono outputs. The Stereo output is a true stereo line-output with enough current to drive headphones or record into sound-card directly (approx. 1Vpp or 0dBu at normal level and approx. up to 3Vpp or +4dBu at maximal volume level) and the mono output is a modular level (approx. +/-5V) output where left and right channels are mixed together.



With every Grand Terminal we supply a stereo to two separate Left and Right mono channels adapter so you may use conveniently route its output into other modular gear:





## THE AIRPLANES

If you're already familiar with the **Airplanes (envelopes)** in Endorphin.es TERMINAL module – you will find the same envelopes in GRAND TERMINAL as well. Tested for years, with its unique no-time stretch algorithm when adjusting the shapes of the slopes, they provide all necessary functions that an envelope may have in a modular setup.

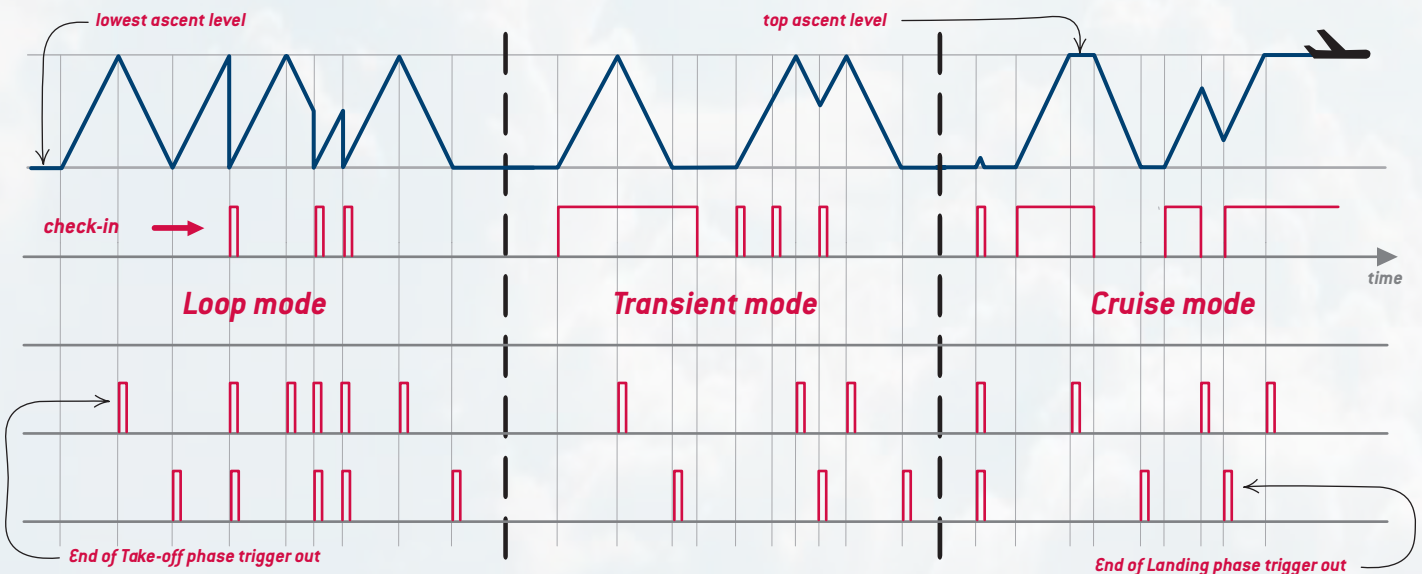
**Airplanes** are transient function generators that generate control voltages after an incoming trigger/pulse. Each Airplane has two phases: **take off** [a.k.a. attack, ascent, climb, rise, upward, up] and **landing** [a.k.a. release/decay, descent, dive, sink, fall, downward, down], and features separate bi-polar [-5 ... +5 volts] and uni-polar [0 ... +8 volts] outputs (**exits**) as well as **end of current**, Airplane's **stage** trigger outputs (zero or +6 volts). The relative brightness of LEDs under each exit shows the current amplitude and help to monitor the output voltage polarity: red when the voltage goes below 0 volts and green when the output goes higher than 0 volts. At calm both Airplanes stay on hold waiting for an upcoming launch signal (at the **check-in** jack). There are 3 different modes in which the Airplanes can fly:

**Cruise mode** [a.k.a. sustained, AR/ASR, on hold, long-haul flight] mode (trip selector in far right position) the Airplane takes off to the highest level after receiving a triggergate (higher than approximately 0.65 volts constant signal) and stays in cruising mode as long as the gate signal remains high. At any moment the gate signal drops, the Airplane performs the landing. During landing the Airplane will immediately gain altitude (so called going-around or aborted landing) when a triggergate arrives.

**Transient mode** [a.k.a. AD, shorthaul flight] mode (trip selector in the middle position, the Airplane performs a take off after an incoming trigger signal (may be short trigger or constant gate higher than 0.65 volts). Reaching the top of the ascent level, the Airplane immediately performs a landing. Same as in Cruise mode, during a landing the Airplane will immediately gain altitude after receiving a trigger or a gate signal.

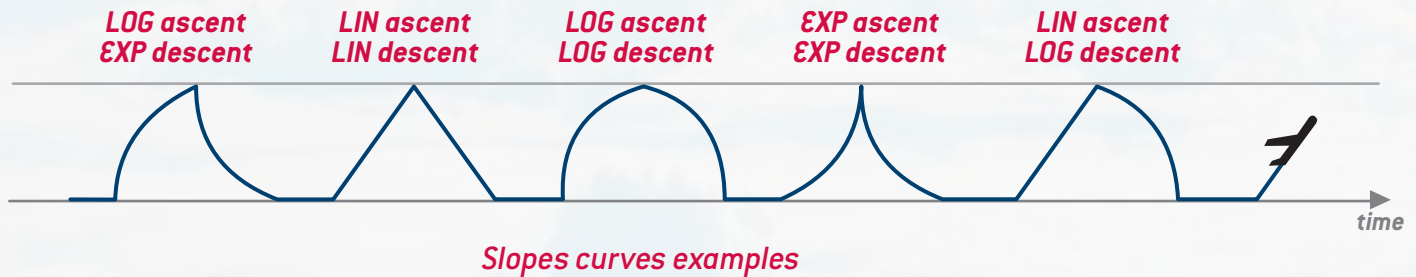
**Loop mode** [a.k.a. cycling, nonstop flight, LFO] (trip selector in far left position) enables the Airplane to take off. Reaching the top of the ascent level, the Airplane performs a landing. At the lowest descent stage the take off immediately begins and gains altitude again and so on up to infinite. In this mode it will function as an LFO.

The **End Of Stage** outputs return short 1 ms triggers after take off or landing stages have been either fully ended or went into cruising or in holding mode or were interrupted by the next stage after a trigger signal (the mode end of stage trigger is selectable via jumpers for each stage and each Airplane separately on the backside of the **Terminal** – see the **Jumperization Chart later in this manual**).



## AT TAKE OFF & LANDING

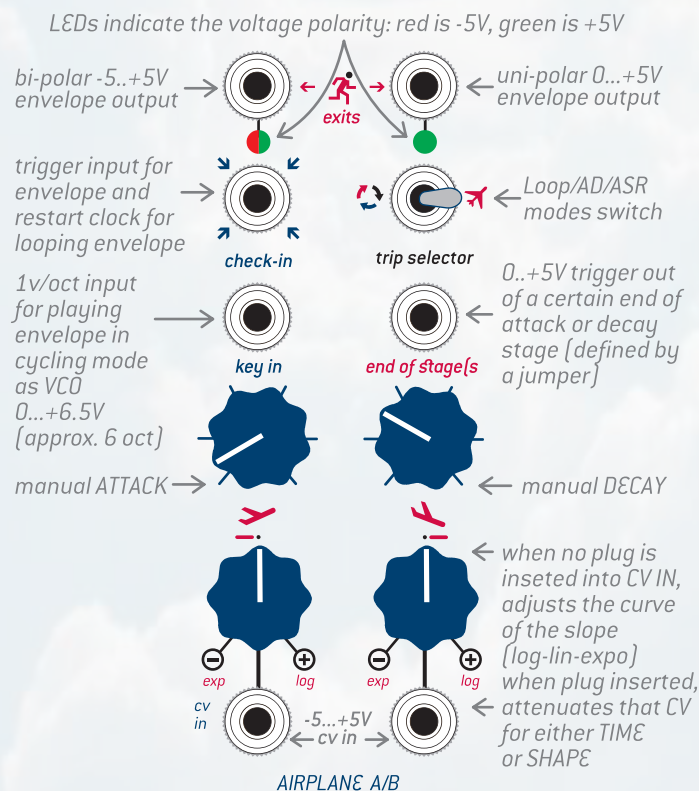
The duration of take off and Landing stages are separately voltage controllable and may be controlled manually with the according knob or via incoming control voltage [the amount of CV is defined by using the knob as an attenuverter]. When nothing is plugged into the CV and key inputs, take off and Landing knobs vary the duration time of corresponding stage from 1 millisecond to 10 seconds. When no control voltage plug is inserted into the appropriate **CV IN** jack, each attenuverting knob defines bending of the according curve of the certain slope: either to **exponential** shape [knob is in far counterclockwise position], to **linear** [knob is in centered position], or to **logarithmic** [knob position is far clockwise]. These knobs have **exponential** characteristic for turning them in both sides from the centerposition – i.e., the control changes slightly when the knob is close to the middle position and more dramatically when the knob comes closer to its far left and right positions. Adjusting the linearity **doesn't change the duration time of the according stage**, as it's usually expected in analog envelope generators [when feedback signal from the envelope's output was routed into CV IN of a certain stage and at the same time playing with the polarity and amplitude of that signal changed the shape but affected the duration of the stage]. Altering the shape of the stage may obtain continuously variable responses that require precise shape, as for example 'vactrol' ones.



The CV Input for each Airplane's stage requires **3.5 mm mono plug (not stereo)** to function properly. The range of acceptable voltage is  $\pm 5$  volts [10 Vpp]. It's also possible to control the shape of the slope [from exp-to-lin-to-log] instead of the time. By installing appropriate jumper settings [see the **Jumperization Chart**] the control of the input voltage is changed from 'control over parameter time' to 'control over parameter shape'.

There is however one tiny change in how CV applies for the time duration of each slope. Each black polarizer knob – when turned from the middle into CW (+) direction – enlarges the duration of the appropriate stage [attack/decay] and – when turned into CCW (-) direction – shortens the duration of that stage.

After different approaches, we consider that way of functionality to be more performance oriented, so musicians can always be aware of what to expect from envelopes modulated by CV.





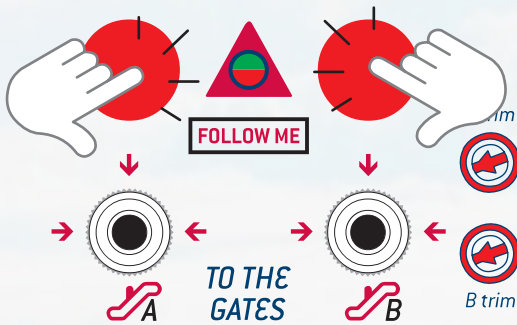
## FILTER TYPES

Filters play an important role in shaping the tone of the timbre. This goes as far as sometimes a filter itself may define the whole style of music. Filtering frequencies of waveforms gives one of the most drastic changes in sound one may obtain from synthesizers, making the timbre either bright, dull, wooden or harsh.

It is always interesting to have a few different filters in the modular systems to gain a wider sound palette: Using them in the way a sculptor would use different knives while creating a statue or a photographer changing his lenses to get a special picture

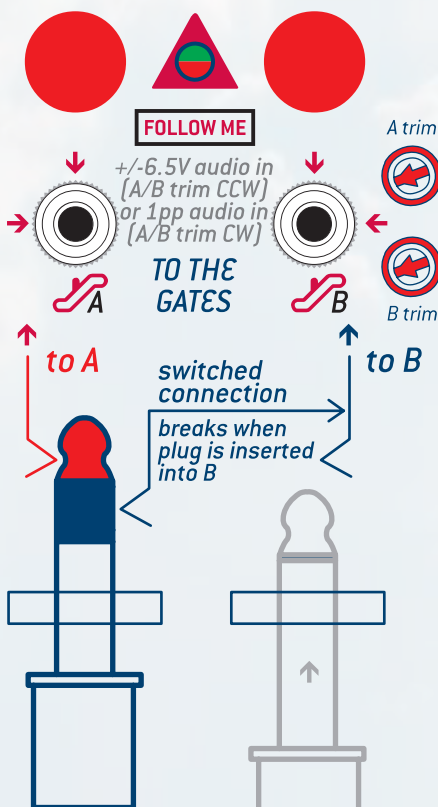
Having a bunch of analogue filters always requires more space in the rack and more costs are the result. GRAND TERMINAL has a powerful ARM M4 DSP inside that runs dual filters and a stereo effect processor at 16 bits and 48 kHz sampling rate.

## FILTER CONTROLS



The audio input of filter A and filter B marked with 'TO THE GATES' – are AC coupled audio inputs. The two 'FOLLOW ME' - MODE A and B buttons define the type of filter applied. Pressing the buttons shortly cycles thru all 8 filter types. Small A trim and B trim knobs define the input level of the appropriate multi-filter/gate/channel. When one of the trimmer knobs is fully CCW, the input of that filter accepts modular level of the signal – i.e. +/-5V [approx. +15dBu] with some reserve for extra gain. Signals that exceed the range of approx. +/-6.9V [approx. +19dBu] will be soft clipped [saturated] to avoid clipping distortion. When one of the trimmer knobs is fully CW, the input gain of the signal corresponds to an approximately 10 times higher source – i.e. a normal 1Vpp [+0.5V] line-level signal with some reserve for the headroom.

Keep in mind you can always decrease [attenuate] the incoming signal level for accepting up to 0 or +4dBu adjusting the appropriate knobs when connecting professional audio electronics. You may also connect portable electronics directly [approx. -10dBV level] that has a 3.5mm jack output (i.e. mp3-player or something similar) without the necessity to adjust the gain of your mp3-player to a modular level.



Moreover, input A is a STEREO input: If you insert a stereo 3.5mm plug there, the right channel [ring of the plug] can pass thru the switched connection of the jack B into the filter B [this also works with TRRS plugs]. If you are using mono cables only, then each input of filters work independently without any pre-routed connections.

A row of 4 LEDs between the X and Y knobs show the currently selected filter type. If a LED is fully lit, it corresponds to the lower row of icons [filter types 1-4] and if the LED is semi lit [or dimmed], it corresponds to the upper row of icons [filter types 5-8].

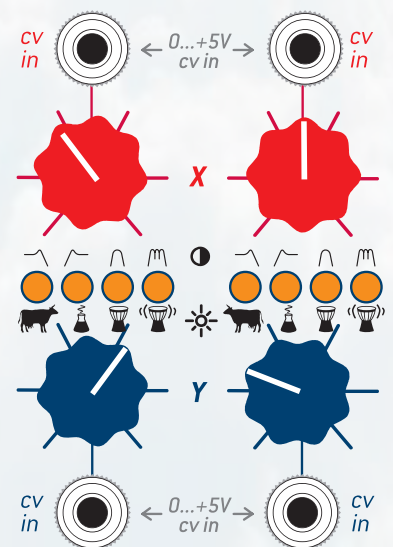
The X and Y knobs and the corresponding DC-coupled CV inputs define X and Y parameter changes of the filter chosen – only two parameters may be changed per each filter.

X usually adjusts the cut-off frequency and Y adjusts the resonance. Sometimes Y is assigned to alternative functions like length of the decay [#3 Vactrol filter] or bandwidth [#7 Bandpass filter].

The CV IN jacks accept UNIPOLAR 0 ... +5V CV input. Everything that is higher than +5V is being saturated. Those inputs are made to be fully compatible with the SHUTTLE CONTROL CV outputs (unipolar type). Keep that in mind when applying other envelopes to the CV inputs, you may need to attenuate them [using an external attenuator module or the attenuators of the

GATEWAY<sup>XP</sup>]. When no jack is inserted in the appropriate CV input, define the change of that parameter by turning the corresponding knobs [X/Y]. However when CV is applied, the corresponding knob defines the amount of CV that is applied to that parameter.

*Hint: If you urgently need a manual offset and CV attenuator/polarizer both simultaneously, we advise you to use one part of the GATEWAY<sup>XP</sup> (as dual 1+1 mixer) – the red knob 'Offset' will give you an offset from 0 to 6.5V and the bi-polar attenuator will accept any bi- or uni-polar voltage to a desired scale.*



## FILTER TYPES



There are two multi-filters/gates/channels marked 'TO THE GATES': A and B. Each filter has 8 different modes – so each can be one of the 8 filter types. This is a set of digital modelled filters with some added non-linearities to recreate the approximate behaviour of some well-known and often used analogue voltage controlled filters.

*Mention: Your choice of the filter type depends on the type of music you like to perform and – of course – what fits best to your taste and needs.*

- 1. TRANSISTOR LADDER FILTER** 🐮 is a 24 db/oct low-pass filter, modelled after the famous Minimoog filter. It has a rich slope and deep bass sound. It self-oscillates at full resonance with the recognizable chickens peep timbre when being modulated. Suits well for every kind of sound. Frequency response up to 16 kHz.
- 2. DIODE LADDER FILTER** ⚡ is a 18 db/oct low-pass filter, inspired by the Roland TB-303 and EMS Synthi A filters. It gives a distinct 'acid' feel and suits very well for all that techno arpeggios, bass sounds etc. Frequency response up to 18 kHz.
- 3. VACTROL LO-PASS GATE** 🥁 is a 12 db/oct modelled after Buchla's LPG and was used in it's traditional way (with an analogue Vactrol) in the Endorphin.es TERMINAL a few years earlier. That filter type simulates non-resonant vactrol filter models, however instead of the resonance, we can control the DECAY time (closing resistance) of the vactrol. We all know, there are different types of vactrols – ones are fast, other are slow. Slow ones – when 'pinging' them with a short pulse of CV – give that distinct 'Buchla Bongo' sound (passing a small 1ms trigger immediately opens the gate but the gate itself will be closed much slower giving a so called musical natural response). Adjusting the Y control of that filter, adjusts the decay – from short decays around 120 ms (full CCW) to long ones with up to 4 seconds duration (far CW). Frequency response up to 17 kHz. *Trivia: The Vactrol Lo-Pass Gate simulates the behaviour of an opto-coupler (called 'Vactrol') in a Sallen-Key filter topology. Applied CV (or manual offset) lights up the LED and the LED with its light affects the coupled photo-resistor. The photo-resistor changes its resistance and as a result, the filter cuts more or less frequencies.*
- 4. RESONANT VACTROL LO-PASS GATE** 🥁 is a variation of the previously describes vactrol filter model, however instead of adjusting the decay time, we now control the resonance. The decay is fixed in this filter type and is set to approximately the response of the mostly used standard (fast) vactrols. So we don't lose dynamic, but still have a distinct lo-pass sound. The resonance of the sound is ringing, just as it may be expected from a normal lo-pass gate. Frequency response up to 17 kHz.
- 5. STATE VARIABLE LOW-PASS FILTER** ~ is a 12 db/oct filter. Unlike ladder or diode filter types, its sound is probably less harmonically rich, however is provides a cleaner sound because of a flatter cut-off slope. That type of filter was used first in Oberheim SEM, Korg MS-10/20 and many more other synthesizers. That filter also features a resonance loudness compensation, because usually with more resonance the amplitude decreases. Frequency response up to 16 kHz.
- 6. STATE VARIABLE HIGH-PASS FILTER** ^ – same as the previous state-variable filter, but this one passes the high frequencies and filters the lower ones. *Be aware: At minimal resonance (Y) and full open cut-off (X) it cuts the low frequencies up to a full silence.*
- 7. STATE VARIABLE BAND-PASS FILTER** ^ – same as the other state-variable filters (5 & 6), but passes only a defined band of frequencies. X defines the band's centre point and Y defines the width of the band. It doesn't have a resonance control since the band is always on one level. *Keep in mind: The amplitude of the resulting waveform changes within altering the band width.*
- 8. COMB FILTER** 🎹 recreates a series of harmonically related amounts of notch filters. On the audio spectrum this looks like a comb, where the name was derived. In static state, it sounds similar to a phaser, but with modulation applied to the frequency (X) it comes closer to a flanger. With cranked up resonance (Y) it creates ringing and resonating timbres but it is also useful for mellow Roland Juno alike leads and pads. Frequency response up to 21 kHz.



## MODES/SECONDARY FUNCTIONS

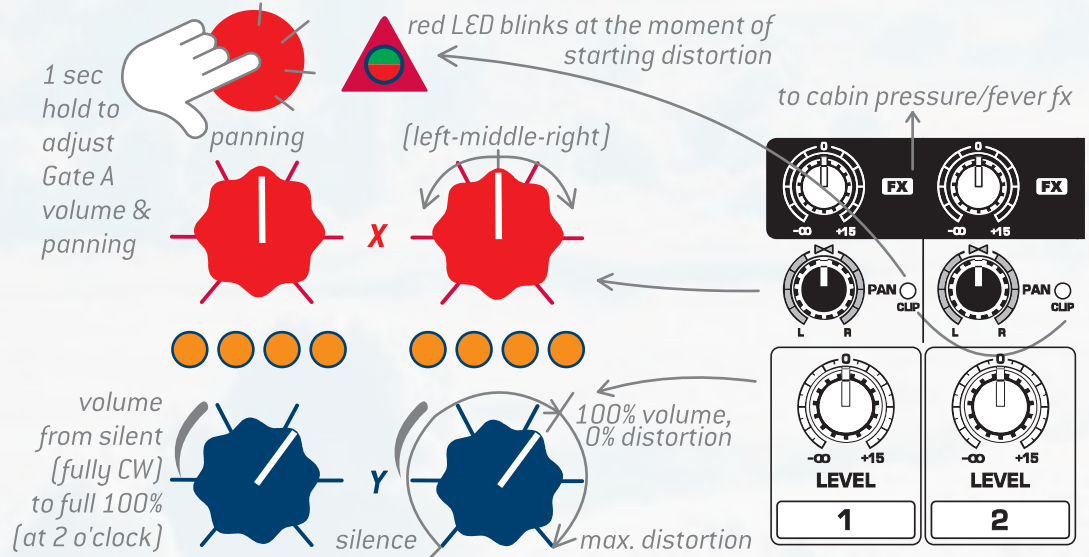
To change the mode of the GRAND TERMINAL or to alter settings of a parameter, which is set up as a secondary function of a knob or CV input, there are a few button combinations to press. While pressing these button combinations you will see the 'Follow me' LED will blink red when enabling and green when disabling that secondary function. When you change to another mode the LED constantly shows another colour (off/green/red).

### FILTER VOLUME/PANNING ADJUSTMENT

After holding the MODE ('Follow me') button of a multi-filter/channel/gate for a longer than 1 second, you get access to the secondary functions for that multi-filter/channel/gate.

In this case think of the secondary function layout as a mixer, where the lower row of knobs defines the volume and the next upper row defines the panning.

The X parameter defines a pan – this means – how the multi-filter/gate/channel is positioned in the stereo panorama. Adjusting the X knob to 12 o'clock, will spread equal power of the multi-filter/gate output (amplitude) into the left and right



channel of the final output of the GRAND TERMINAL. Keep in mind, that when you use the MONO (modular level) output – adjusting the panning will not be audible, since both L/R outputs are always with the same power. You will see the LEDs under the appropriate channel moving left and right when adjusting the panning and after 2 seconds, the LEDs return back to work as a VU-meter showing the volume level of the channel.

The Y knob defines a volume of the multi-filter's/channel's/gate's output. If you crank it more than approximately 70% of the knobs range (after approximately 2 o'clock), you will experience an extra increase in gain up to a certain level of distortion at the input of the filter. This is useful when you want to play distorted acid lines without using a distortion module or a guitar pedal in addition to your modular setup. Attention: Adding extra distortion considerably adds aliasing and therefore some gain into the output of your filter.

Hint: After the Y knob crosses the level from normal volume to the approx. 2 o'clock position, the further rotation will cause distortion of that channel's volume. At the moment of crossing over 100% of the normal volume level, you will see the FOLLOW ME LED blinking shortly in RED. When you decrease the level of distortion to a normal 100% volume level, you may notice the LED blinking shortly in GREEN ('back to normal' and channel is not overdriven/clipped anymore).

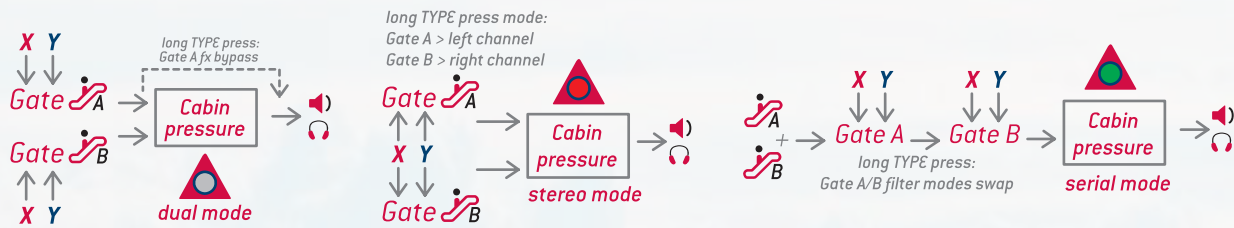
You may visually monitor the level of the signal by watching the 4 LEDs of each multi-filter/gate/channel that work as a VU-meter in that mode.

### KNOB SNAP

Important: After you adjusted the filter's cut-off manually or attenuate incoming CV for a certain parameter, you may want to access the secondary option for that channel. Holding a MODE button for a while (over one second) gives you the access to the volume and panning via manual X and Y knobs. However while accessing into that mode, the amounts of manual offset or CV attenuation (set by the knobs) are stored while the CV continues to modulate a certain parameter of the filter. When you return to the primary mode (by pressing the same MODE button again for more than a second), the values of X/Y are still as stored before, at the time you decided to go alter the secondary function. BUT the position of the knob will – in most cases – NOT represent the actual value stored! Now when you change to a new value by moving the knob, there will be no instant jump, but a mixture of a jump, a snap and relative behaviour (you may know these options from other synthesizers which have more than one function assigned to one knob). Same applies to the Cabin pressure section as well.

## FILTER ROUTING

There are three different modes how the filters/gates/channels may be routed to the final stereo out. By pressing the two MODE buttons simultaneously for approx. 1 second, it will change the filter's routing.



- 1. PARAL.LEL** (standard: **dual mode**): Filters A and B are independent and both are summed together at the output with FX applied to the mix. In that mode the 'Follow me' LED is off. *Press the TYPE button for a moment to bypass the Cabin Pressure processor for Gate A, so you may use Gate B with effects applied while Gate A will always be fully dry (Basslines often seem muddy with reverb).*
- 2. STEREO** mode: Filter A and B are linked together. The X/Y knobs and the MODE button of filter B are inactive and the X/Y knobs of filter A control filter A and B at the same time. Both filters share the same filter type and by default are put in spread pan (filter A far left and filter B far right – altering the panning under secondary function from L to R shifts the panning vice-versa for both channels). In that mode the 'Follow me' LED shines RED. *Pressing the TYPE button for a moment in that mode immediately spreads Gate A to the far left and Gate B to far right in the panorama no matter which panning was set before.*
- 3. SERIAL** mode: The audio inputs of Gate A and B are summed together and pass into filter A first, and then into filter B. *Pressing the TYPE button for a moment in that mode swaps the filter types selected for A and B with one another (you will notice that by watching the LEDs).*

## CABIN PRESSURE EFFECT PROCESSOR

There are 8 effect types which recreate different ambient spaces and they are more or less arranged in a size-wise order – going from bigger spaces (like halls) to smaller ones, finishing with a chorus (very short ambiances). Again as with the filter types, the choice of the effect is entirely based on your musical taste. The effects we picked suit a wide pallet of musician's needs: from small rooms for Techno up to infinite spaces of experimental Avant-garde drones, but who says one cannot use a hall in Techno.

The effect selection is done by pressing the TYPE button in the cabin pressure area on upper left corner of the GRAND TERMINAL. The effects are cycled one by one. Some effects work in true stereo or widen the stereo spread that may be merely audible to hear from the mono output.

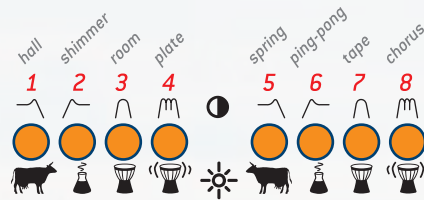


The current effect type chosen is shown at the row of LEDs between the X and Y knobs by shortly blinking of the LED. Only one effect may be chosen at a time. The 8 LEDs correspond to the 8 effect preset cells. The Cabin pressure knob always defines the DRY/WET parameter of the effect: When the knob is fully CCW, then there is no effect at all (dry output only). When the knob is fully CW, then the the signal will be totally processed with the effect (100% wet). Adjusting that knob is a balance of how the sound is processed: Think of it as you open the window to get some fresh air – you may open it only a bit for a small ventilation or fully open it to get lots of fresh air. The corresponding CV IN jack is a CV control for the dry/wet parameter. It accepts BI-POLAR -5v ... +5v voltage and when the plug with CV is inserted (3.5mm MONO jack), the CABIN CRESSURE knob acts as an attenuator for that incoming CV.

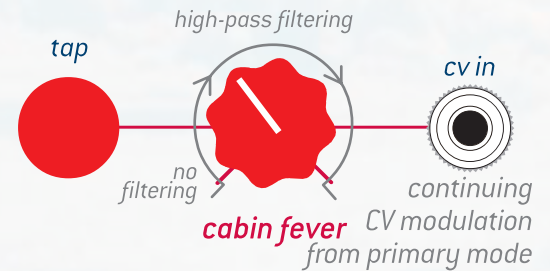
Each effect has a few additional parameters. These parameters are defined by the CABIN FEVER knob (to be found in the CABIN FEVER area on the upper right side of the GRAND TERMINAL), corresponding to the CV IN jack and a TAP button. Depending on the effect, these controls are assigned to different parameters as described below. Pressing and holding the TAP button longer than 1 second activates the secondary mode for the CABIN FEVER knob. The 'Follow me' LED will blink RED once, so you will notice you are in secondary mode. You can also check if the corresponding effect slot's LED (between X and Y) will strobe TWICE instead of once per a few seconds, to see in which mode you are (blinking twice > secondary parameter, blinking once > primary parameter). Press and hold the TAP again for around 1 second and you will notice the 'Follow me' LED will blink GREEN once and the corresponding effect slot's LED will strobe ONCE instead of twice per a few seconds meaning you are back in primary mode.



**There are the following effects:**

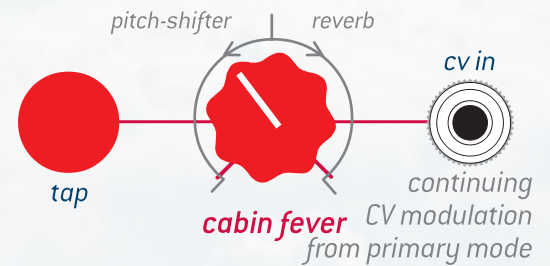


**1. HALL REVERB** ●●●●●●●● is a very clean space effect that may create an extremely huge up to almost infinite ambience. The CABIN FEVER knob defines the decay of the reverb, or speaking in another words, can be considered as the hall size. At full CW position the sound will sustain up to the infinite and while at fully CCW only a subtly effect will be heard. Don't forget to adjust CABIN PRESSURE simultaneously to have a proper balance for your timbre. *Holding the TAP button for longer than 1 second enables the secondary function for the CABIN FEVER knob.* The amount of decay (primary parameter of the CABIN FEVER knob) will be stored and the CABIN FEVER knob will adjust the amount of fixed HIGH PASS filter at the input of the reverb (only manual control without voltage control – see illustration to the right). The high pass filter is an essential tool within almost any reverb to cut off low frequencies and have more 'air' in the final output without the 'boomy' low frequencies.

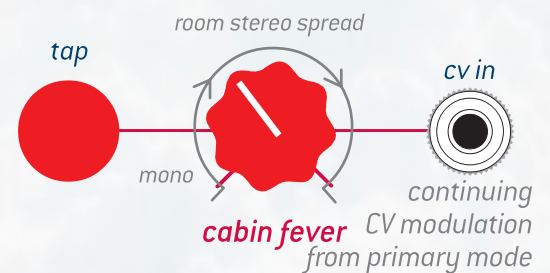


*Hint: By default, or after resetting the module, this hi-pass filter cuts only a bit of low frequencies until you adjust it manually with the secondary CABIN FEVER function.*

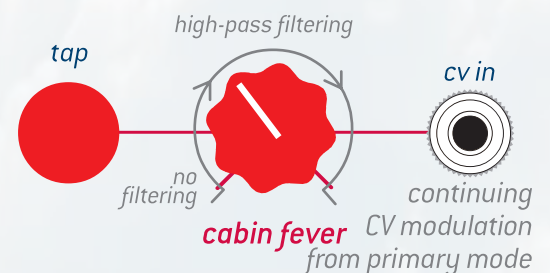
**2. SHIMMER REVERB** ●●●●●●●● is a variation of the hall reverb, with a pitch shifter in the reverb feedback loop, creating weird, choir alike, huge and unrealistic spaces. The primary CABIN FEVER function defines the decay of the reverb and the secondary function (see illustration to the right) defines the amount of pitch-shifter mixed into original reverb – this means: no pitch-shifter at the fully CCW position of the CABIN FEVER knob, half and half in the middle and and pitch-shifted mix only at fully CW position. By default, or after resetting the module this secondary parameter is set with an approximate ratio 40%/60% of shimmer/reverb until you adjust it manually with the secondary CABIN FEVER function.



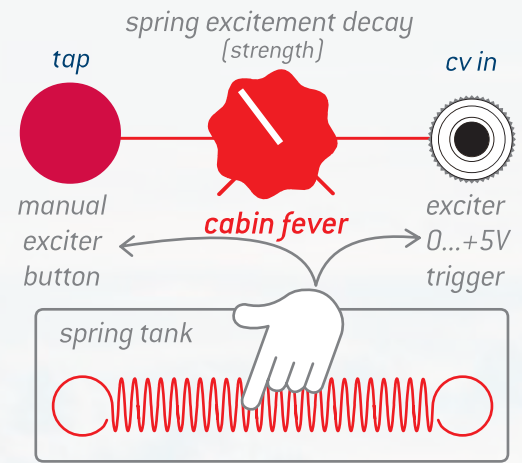
**3. STEREO ROOM REVERB** ●●●●●●●● uses four all-pass filters in series and eight parallel Schroeder-Moorer filtered-feedback comb-filters for each audio channel to recreate a sort of stereo ambience. The CABIN FEVER defines the DECAY of the reverb, or, as was said before, adjusts the room size. The secondary function (see illustration to the right) defines the STEREO SPREAD of the reverb. From mono (fully CCW) up to a huge stereo excitement (by default, or after resetting the module this spread is cranked up fully until you adjust it with secondary CABIN FEVER function). That change is best audible when you use the stereo output from the Grand Terminal connected, e.g. to your headphones or speaker-phones.



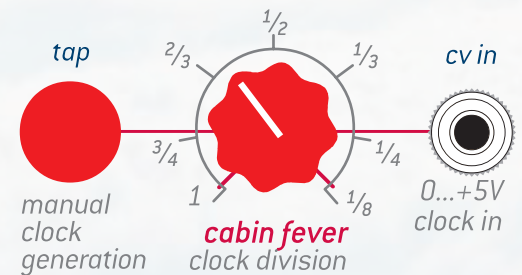
**4. PLATE REVERB** ●●●●●●●● has a distinct sound that recreates picked up vibrations of a big metal sheet driven by an electromechanical transducer – and was one of the first reverbs approached to be simulated digitally. However it suites various music genres, vocals and drums from a subtle effect up to an infinite sustained ambience. The CABIN FEVER defines the decay of the reverb (in the analogue version the distance from the pickups to the metal plate defined how long tail of the reverb was present) and the secondary parameter (see illustration to the right) defines the amount of fixed high-pass filter to cut unnecessary 'boomy' low frequencies from the input of the effect. By default, or after resetting the module that hi-pass filter cuts only a bit of low frequencies until you adjust it manually with the secondary CABIN FEVER function.



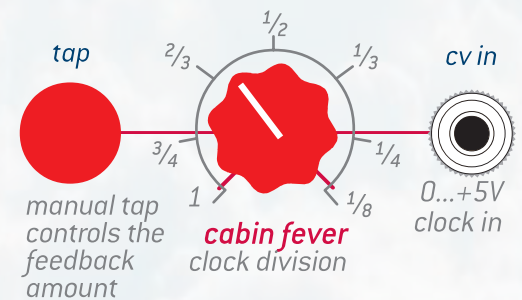
**5. SPRING REVERB** ●●●●●●●●●● has its unique sound because of the diffusion in the metal spring. Higher frequencies 'travel' through the spring slower than lower ones. The CABIN FEVER knob as usual defines the decay of the reverb. There is also a unique feature implemented – with the TAP button you may simulate a sound as if you pluck the real spring with your finger. That gives the distinct exciting spring reverb sound we all love so much. The secondary function (see illustration to the right) of the CABIN FEVER is tied to the afore mentioned TAP button's 'pluck the spring' feature and defines the DECAY of how fast the spring will calm down after manually plucking it. The spring plucking may be done manually by using the TAP button or by applying a trigger into the CABIN FEVER CV input while being in secondary function. By adjusting the decay to the maximum value, the spring sounds long up to infinite with a small self-oscillation. Keep that in mind when you select that effect.



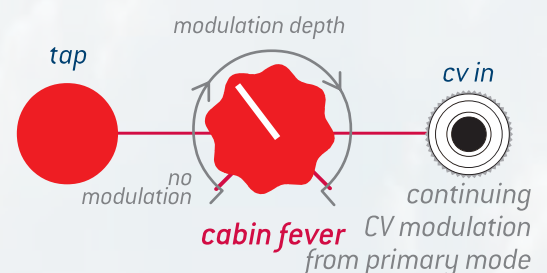
**6. PING-PONG DELAY** ●●●●●●●●●● is a recreation of a stereo delay with the rate of repeats controlled by a manual tap or a clock. A 'tap' is usually three or more short clicks in a row on the TAP button, and after that the repeats of the delay follow the tempo you've tapped. (Double internal down-sampling allows the delay to obtain up to 2 seconds of maximum delay time. The primary CABIN FEVER parameter defines the feedback of the delay – i.e. how much sound goes into the feedback loop to be repeated. At full CW knob position, almost no new incoming sound comes to the feedback loop and the sound regenerates itself infinitely. The secondary CABIN PRESSURE parameter defines the clock division of the incoming tap/clock. These taps/clock come either from the manual TAP button or from the CV IN jack (the CV IN jack becomes a 0 ... +5V trigger input in that mode). In the secondary function (see illustration to the right) the CABIN PRESSURE knob range is divided into 6 sectors. They respond to divisions: 1, 3/4, 2/3, 1/2, 1/3, 1/4, 1/8. Clock division change is possible during new taps and is saved after you switch to the primary mode. Some pitch-shifting artefacts may arise during changing the divisions, however you just need to wait a few seconds until the delay buffer will be fully emptied/renewed and you will have a proper tempo calibration. If the total tap applied (after division) is longer than the maximal time delay can handle, then the maximal tap tempo is set. Since it's a stereo delay, all taps affect the left and right channel.



**7. TAPE ECHO** ●●●●●●●●●● is a recreation of Variable Tape Speed Echo machines with 3 fixed playback heads – inspired by the Roland RE-201 Space Echo with a warm saturation emulation. With the double internal down-sampling, the total delay time is around 1.4 seconds from the initial echo input until the output of the third delay. (The overall time is spread over all three tape heads/delays. That's why total 1.4 seconds may be audible as 480ms delay.) In primary mode the CABIN FEVER knob defines the delay repeat rate (speed of the tape). Bipolar +/-5V CV input applied (i.e. an LFO) to the CABIN FEVER CV input using the knob as attenuator may create interesting detuned audio effects. The tap button works in a limited frequency range of manual tapping, defines the INTENSITY (number or repeats, or feedback) of the delays. The faster tapping – the longer decay (delay tail) you may obtain. The secondary CABIN FEVER function (see illustration to the right) works as a divider for the incoming clock (into CV IN jack) or by using manual taps with the same dividers as in Ping-Pong delay described above.



**8. CHORUS** ●●●●●●●●●● is also an ambient effect to thicken the sound, however with varying parameters, unrealistic sound spaces may as well be obtained. The chorus has subtle effect inspired from the vintage Roland Juno-6/60/106 series and recreates a stereo chorus without a feedback loop. In the primary mode the CABIN FEVER knob defines the modulation frequency (at a pretty limited but musically picked LFO range). Although it is possible to adjust the LFO rate to a faster frequency as the knob range includes some headroom for more intense modulations, however that may increase small clicks. and the secondary function (see illustration to the right) defines the modulation's depth (when turned to fully CCW, then no chorus effect is audible).

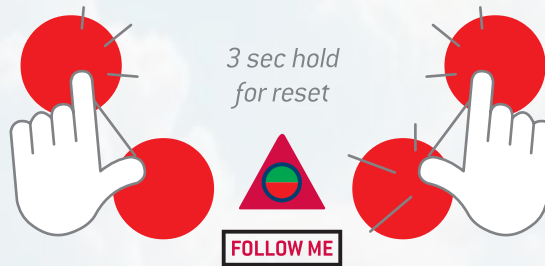




| <b>Effect</b>          | <b>LED blinking</b> | <b>Primary 'Cabin fever' function/parameter</b> | <b>Secondary 'Cabin fever' function/parameter</b>                        |
|------------------------|---------------------|---|--|
| <b>Hall reverb</b>     | ●●●●●●●●            | Decay of the reverb                             | Hi-pass filter at reverb input   |
| <b>Shimmer</b>         | ●●●●●●●●            | Decay of the reverb                             | Pitch-shifter vs reverb mix  |
| <b>Room</b>            | ●●●●●●●●            | Decay of the reverb                             | Room stereo spread   |
| <b>Plate</b>           | ●●●●●●●●            | Decay of the reverb                             | Hi-pass filter at reverb input   |
| <b>Spring</b>          | ●●●●●●●●            | Decay of the reverb                             | Decay of spring excitement from TAP button or incoming by CV IN clock    |
| <b>Ping-pong delay</b> | ●●●●●●●●            | Delay's feedback amount                         | Divider for delay's frequency from TAP button or incoming by CV IN clock |
| <b>Tape echo</b>       | ●●●●●●●●            | Tape speed                                      | Divider for delay's feedback from TAP button or incoming by CV IN clock  |
| <b>Chorus</b>          | ●●●●●●●●            | LFO speed                                       | Modulation depth   |

Remember: When selecting an effect, the primary function/parameter of the CABIN FEVER is active. Holding the TAP button for longer than 1 second enables the secondary function for the CABIN FEVER knob. You return to the primary function/parameter by pressing the TAP button for longer than 1 second again.

### WHEN EVERYTHING GOES WEIRD



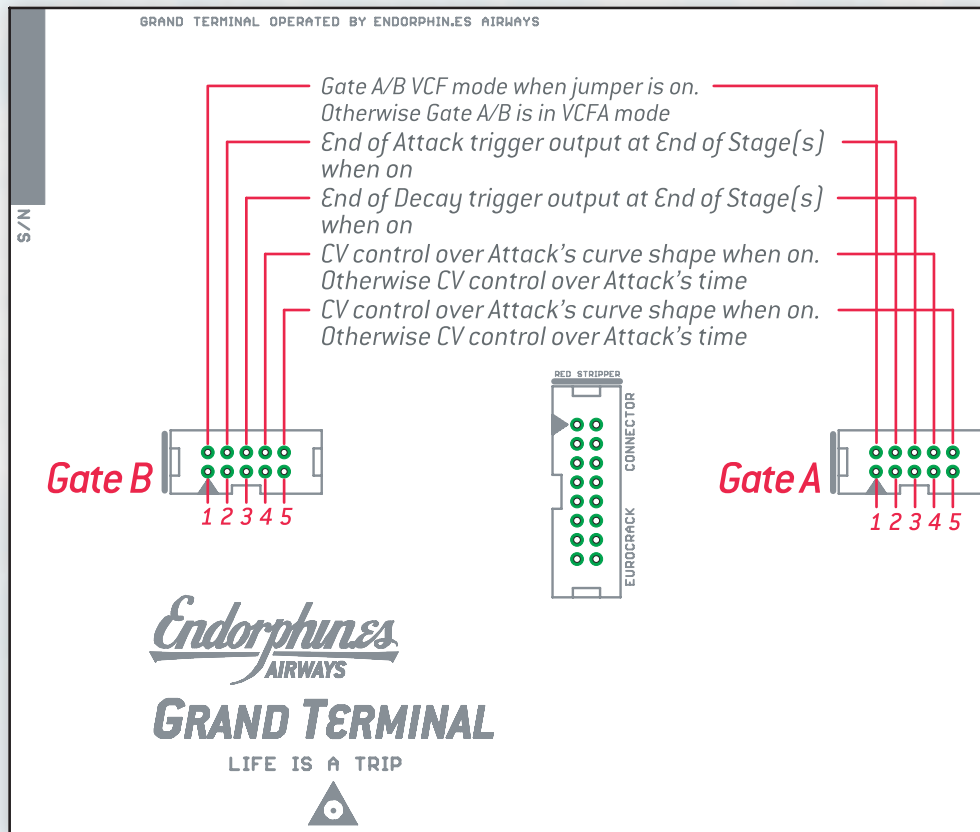
In case you tweaked everything so hard, you finally don't hear any more output from the GRAND TERMINAL, or only things you don't want to hear, there is a soft reset that adjusts all parameters to their default values, so you may start tweaking from the beginning. Reset also adjusts both filter's volume levels to normal 100% amount right before their levels start to distort, reset the panning of the multi-filters/gates/channels to center and clears all filter/effect memories. Press all four buttons simultaneously and hold for more than 3 seconds. You may hear a short blip and then you will see both gates will be at first ladder filter setting and the effect will be set to the first cell.

## JUMPERIZATION ADDENDUM CHART

The GRAND TERMINAL is a small yet complex module which every user can customise it to his own needs.

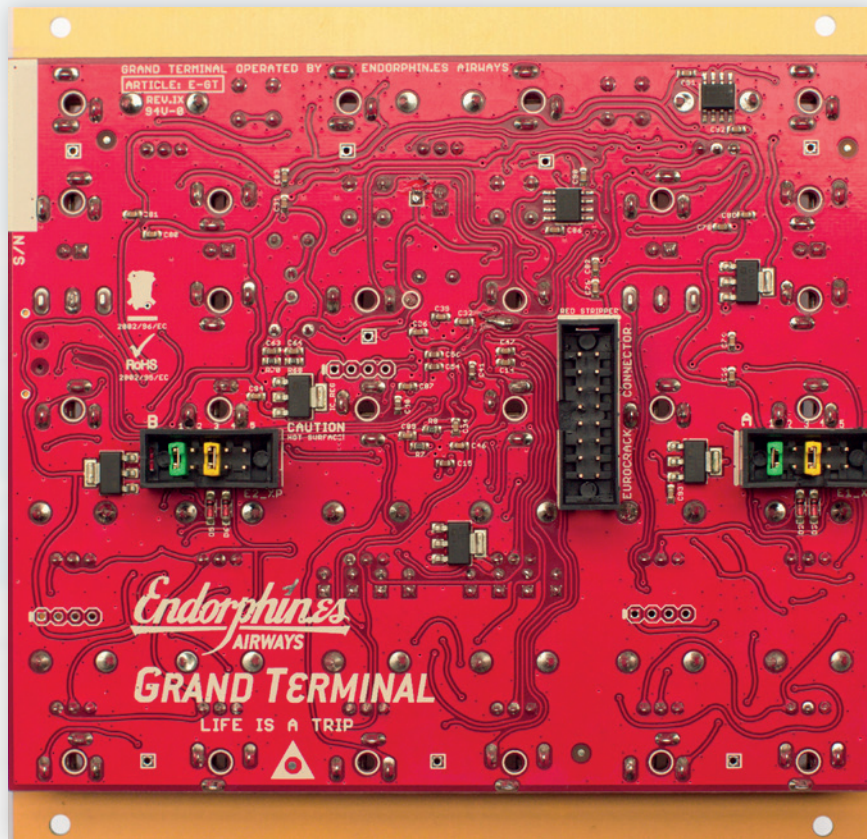
**Doepfer A-100 bus IDC-connector.** We advise that you use the supplied 16-pin ribbon cable! Please ensure that the **red stripe** of the cable [the side with the top pair of pins/wires] is connected to the **negative** -12V rail when plugging the cable into your power distribution board. If the ribbon cable is connected backwards, you could damage the module. Please check twice before you make the connection and turn on your modular since failure/malfunction due to a wrongly connected module ("**magic smoke**") is not covered by our warranty.

Each Airplane has a 10-pin expansion slot where jumpers are installed: All of the pins are able to either carry jumpers or to connect an expansion module. The expansion module will help you to conveniently use both Airplanes as VCOs as well as all the switched functions described below. The jumpers must be installed vertically, separately for each pair of **1-5 pins** to customize the functions below:



- when jumper **(1)** (most left one, marked with a bold white line nearby) is installed it will enable full **12db/oct VCF** mode on the according A or B gate. When enabling the VCF mode on the gate A, it is possible for example, to use this gate for CV processing as a voltage controlled slew limiter (portamento) for controlling the pitch of a VCO.
- when jumper **(2)** is installed, the Airplane will output a short 1ms trigger after the end of each take off (attack) stage.
- when jumper **(3)** is installed, the Airplane will output a short 1ms trigger after end of each landing (decay/release) stage at the end of stage outputs. Jumpers **(2)** and **(3)** **can be installed simultaneously** giving you a trigger when a stage has ended at the **end of stage** outputs. **When Combining the end of stage triggers, one may obtain additional functions such as 2x or 1/2 clock multiplying or even more when chaining both Airplanes together.**
- when jumper **(4)** is installed, the control voltage at **CV input** of **take off** stage **will control the shape of the slope instead of its time**. The attenuverter will polarize the accepted incoming voltages of maximum  $\pm 5$  volts into positive (knob in far clock-wise position) or negative (inverted, knob at far counter-clockwise position) amount of the control voltage applied. For example, when a current of +5 volts is applied into the **CV input** when the **attenuverting knob** is far clockwise, this will result in a LOG (logarithmic) curve and turns into an EXP (exponential) when the attenuverting knob will be in the far counter-clockwise position.
- when jumper **(5)** is installed, the control voltage at the **CV input** of the **landing** stage **will control the shape of the slope instead of its time**. Thus when using **(4)** and **(5)** jumpers you won't be able to control the time of the slope via CV separately anymore but can only manually change it with the according knobs or via the **key in** 1v/oct input when controlling both stages at the same time.





As it was noticed above, all the A/B XPansion jumpers (row of 5 pairs of pins on the left and right side of the module's backside) correspond to the same functions as in the Endorphin.es Terminal.

Jumper pairs #2 and #3 (when installed, yellow by default) define the end of attack and end of decay triggers are enabled. Jumper pairs #4 and #5 enable CV control over the shape of envelope's attack and decay instead of the time stretch. Jumper pair #1 (green by default) defines the VCF/VCFA mode. Same as in the Endorphin.es TERMINAL, when this jumper is installed, then the appropriate Gate works in pure VCF mode. However when you remove the jumper (or switch down the appropriate VCF Mode toggle at the Gateway<sup>XP</sup>), then each filter will have the alternative (experimental) VCFA mode – while cutting the frequencies, the amplitude of the signal will decrease as well.

That's a tribute to the original Buchla Lo-Pass Gate (LPG) functionality (VCFA/both modes) spread on other filter types, however may be not always suitable, as there may be stronger volume drops at cut-off modulation.

*TIPP: At the same time, in that VCFA mode, such filters as bandpass or comb close fully when the cut-off knob is set full CCW, so you may use them in a creative way.*

## FILTER/FX SCANNING ADDENDUM

You may wonder, however all the time you tweak the knobs of every filter or effect, all last changed values and knob positions are stored in the memory.

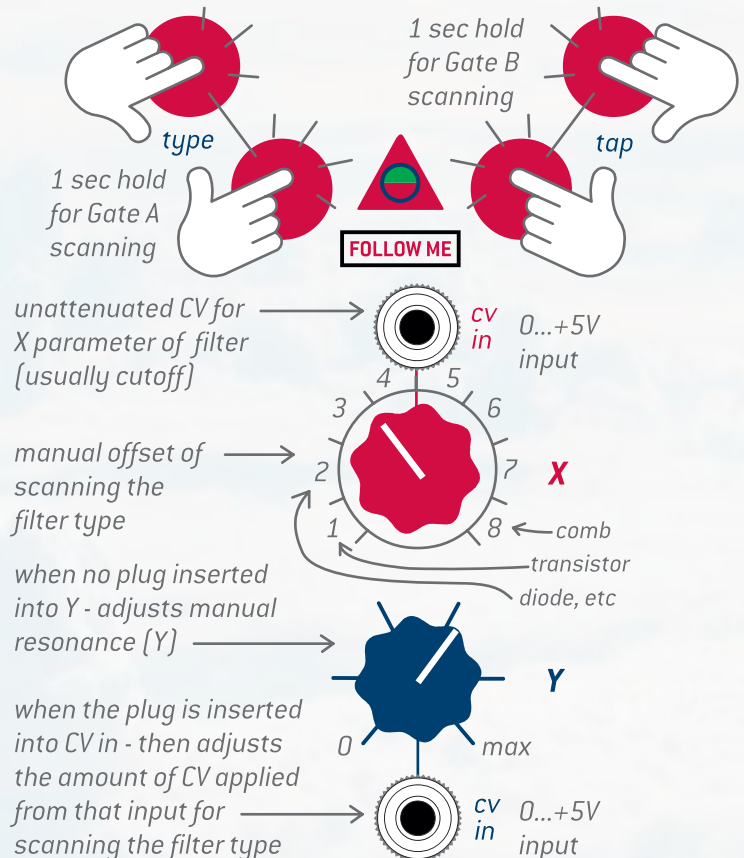
### FILTER SCANNING MODE

By pressing the **TYPE + MODE A** or **TAP + MODE B** buttons **simultaneously for longer than 1 second**, you will enable switching/scanning through the filter types under incoming CV—is called the **FILTER SCANNING MODE**. This works for filter A or B separately, so the values set for each filter are stored and then immediately recalled under upcoming CV for a certain filter type. The idea is, that by the scanning the filters you obtain glitchy, Aphex-Twin alike sound sequences.

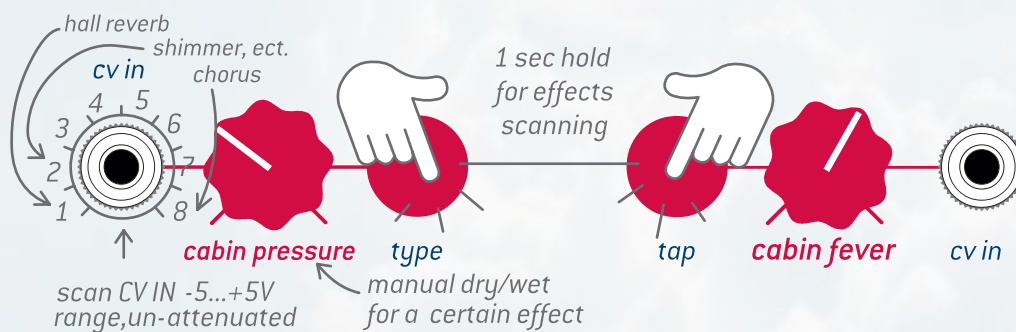
In that mode, the behaviour of the X and Y parameters is different.

The range of 0...+5V is divided into 8 zones (with adjusted hysteresis to eliminate spontaneous switch at small voltage fluctuation) with approx. 0.625V increase per step. So far, if the incoming CV is from 0V to approximately 0.625V, then the first filter type is chosen. If the CV is in the range from 0.625 to 1.25V, then the second filter is chosen and so on—up to the 8<sup>th</sup> filter. **That's true when the offset knob(X) is set to zero (fully CCW).** By adjusting the offset and attenuation of incoming scanning CV with the Y knob/jack, you may scan a certain range of filters.

**IMPORTANT:** Because the DSP in the module can only handle to load two filters and one effect at once, fast audio-rate scanning of the filters and effects may cause clicks. There are small crossfades in volume between the transitions and we tried to adjust fade regions as possible to minimize them, still they cannot be fully eliminated.



### CABIN PRESSURE SCAN



By pressing and holding the **TYPE + TAP** buttons **simultaneously for longer than 1 second**, it enables to switch inbetween the effect types under incoming CV. It is very similar to the filter scanning, however with some differences.

Every effect type has a memory, so the values of every parameter are stored and then immediately recalled under incoming CV for a certain effect type. The CV input for Cabin Pressure accepts bi-polar -5...+5V CV signal and changes the type of effect under incoming CV. The range of -5...+5V is divided into 8 zones (with adjusted hysteresis range) with approx. 1.25V per step. So far, if the incoming CV is from -5V to -3.75V, then the first effect type is chosen. If the CV is in the range from -3.75 to -2.5V, then the second effect is chosen and so on, up to the 8th effect. **In that mode, the CABIN PRESSURE parameter is no longer CV controlled and only works as a manual DRY/WET control. The CABIN FEVER knob/buton/jack are functioning as they were before.**



## FIRMWARE UPDATE ADDENDUM

Endorphin.es continuously works on new features and improvements as well as on bug fixes. It is recommended to use the latest firmware installed to experience the latest features. It is also possible to downgrade to any earlier or custom firmwares in case you like them better.

**Warning – during update procedure you will lose your filters/effects tweakings stored in the memory.**

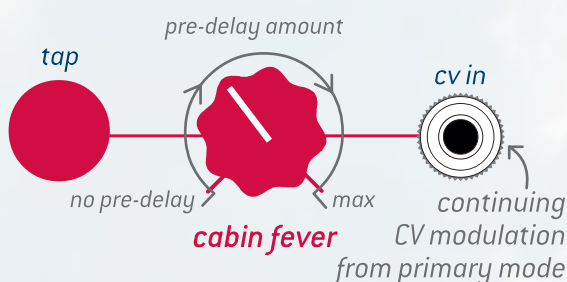
### FIRMWARE HISTORY:

#### Grand Terminal v. 1.6—major update [latest edits 26.02.2017]:

[http://firmware.endorphin.es/Grand\\_Terminal\\_v1.6\\_MAC\\_OSX\\_update.zip](http://firmware.endorphin.es/Grand_Terminal_v1.6_MAC_OSX_update.zip)

#### What's new in v.1.6

- CV sampling frequency for X and Y jacks increased twice.
- Filter #1 (transistor ladder)—improved resonance volume drop.
- Filter #3 (vactrol)—shorted the shortest vactrol's decay time.
- Filter #4 (vactrol with resonance)—improved resonance behaviour.
- Filter #6 (svf high pass)—removed bleed when resonance is applied on (bleed may still occur at high distortion gain).
- Exponential curve of Cabin pressure knob.
- All updates after current version 1.6 may also be done via audio file playback into Gate A input (QPSK modulation):
  - a) Pressing TAP during power-up enables audio firmware update into Gate A audio input (re-power to boot in normal mode again). Mono file, 1.5 minutes, line level (adjusted with Gate A input trimmer).
  - b) Pressing TYPE during power up—the module will be loaded as before in normal DFU mode (update via USB).
- Effect #4 (plate reverb) – high pass filter is fixed to a moderate level to prevent boomy lo-frequencies. Secondary Cabin fever parameter now controls pre-delay amount (before pre-delay was set to zero, now it can enhance the room size).



**HINT:** See next page for further news in update 1.6!

power OFF you modular system:



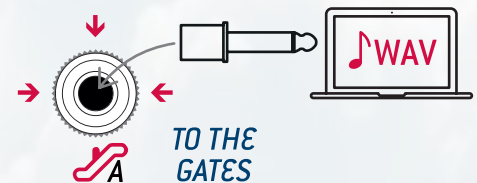
hold TAP while powering your system again:



you will see all 8 LEDs will light up for 1 sec and then off. 'FOLLOW ME' LED will blink green



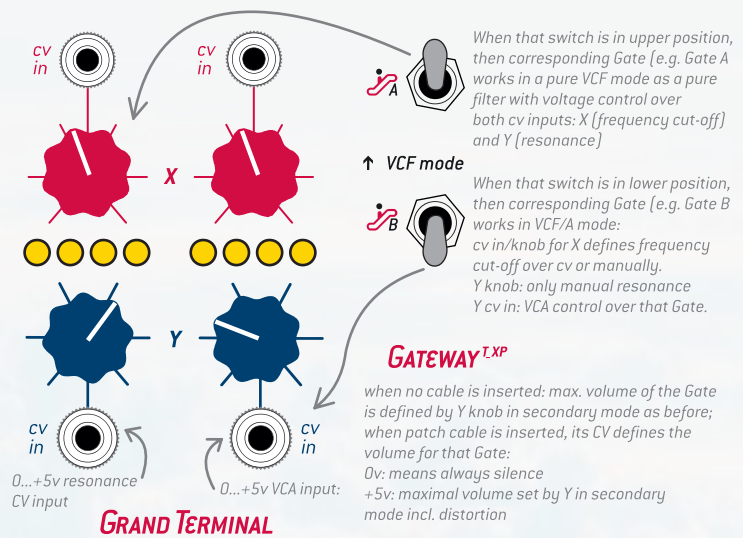
with simple mono or stereo 3.5mm cable connect audio output from your computer headphones output to Grand Terminal's Gate A input



Press PLAY on WAV file player and wait 1.5 minutes. Your GT will reboot automatically after new firmware will be installed

- VCF/VCFA mode revised:

- when the 1st green jumper on the XP pins on the backside of each Gate is ON (VCF mode switch on Gateway is UP), then the certain Gate works as pure VCF.
- when NO 1st jumper is installed (VCF mode switch on Gateway is DOWN), then:
  - Y knob (usually resonance) is no more CV controlled (only manual change).
  - instead, Y jack in that mode becomes a CV control over a VCA at certain Gate. Maximal range of CV control over VCA is defined by Y knob in secondary gate mode (including extra gain for distortion!). That mode is useful when having CV control over gain to create accents.



### Grand Terminal v.1.5 – 291216 – minor bug fixes

[http://firmware.endorphin.es/Grand\\_Terminal\\_v1.5\\_MAC\\_OSX\\_update.zip](http://firmware.endorphin.es/Grand_Terminal_v1.5_MAC_OSX_update.zip)

- #1, #5, #6 filter's ranges adjusted, filters close fully
- State Variable Filters #5–#7 glitches in low/high ranges removed
- improved filter volumes at VCFA mode (1st jumper – green by default – NOT installed for certain Gate – see Jumperization Addendum) and tuned to each filter without volume drop. Now #7 Bandpass and #8 Comb Filter close to full silence in VCFA mode.
- improved resonance amount, glitches removed in #4 Resonant Vactrol Lo-Pass Gate (sometimes caused module's full mute)
- effect #7 (Tape Echo) Cabin Fever control inverted (faster tape speed > longer delay time)
- logarithmic feeling for all resonance (Y) parameters as well as cabin fever knob behavior in effect #5 (Spring Reverb)
- improved logarithmic view of VU meter in secondary filter modes for more dynamic signal monitoring
- Silent Reset of the module (press all 4 buttons at once for more than 3 seconds)
- Serial Mode improved: Gate A and B inputs are summing inputs into the filter A and then into filter B. Long hold on the 'type' button swaps filter A and B types with one another.
- Stereo Mode improved: long hold on the 'type' button immediately spreads Gate A left and Gate B right in the panning, no matter what panning was set for each gate earlier.

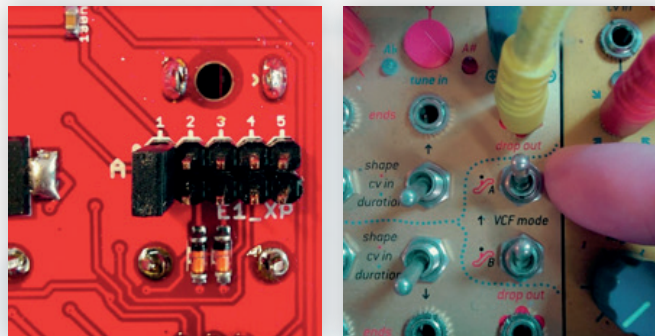
### Grand Terminal v.1.4 – 251116 – release candidate

[http://firmware.endorphin.es/Grand\\_Terminal\\_v1.4\\_MAC\\_OSX\\_update.zip](http://firmware.endorphin.es/Grand_Terminal_v1.4_MAC_OSX_update.zip)

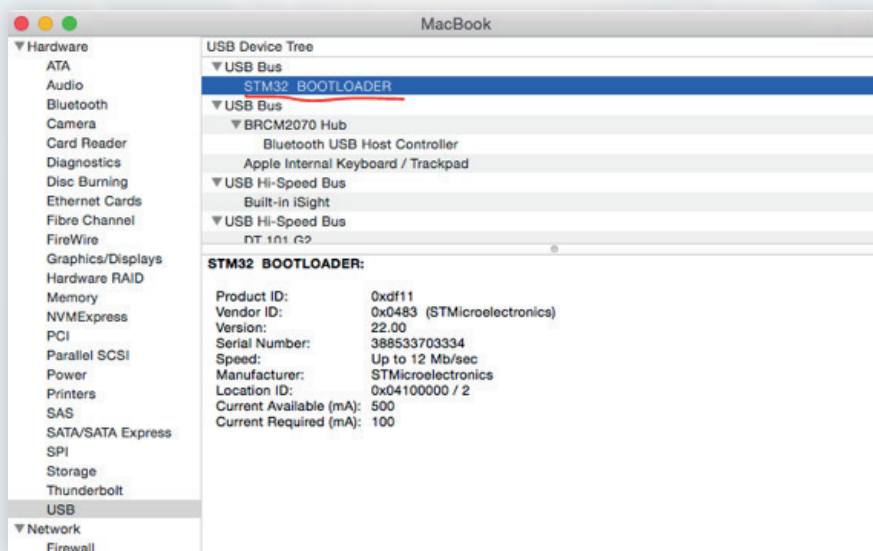


**UPDATE PROCEDURE UNDER MAC OS X. (You find the update under windows a few pages further)**

1. Download and unpack and following archive into one folder:  
[http://firmware.endorphin.es/Grand\\_Terminal\\_v1.5\\_MAC\\_OSX\\_update.zip](http://firmware.endorphin.es/Grand_Terminal_v1.5_MAC_OSX_update.zip)
2. Turn off your Grand Terminal (or even better the entire modular rack). Connect your GRAND TERMINAL module to your MAC with a micro USB cable by plugging it into the micro USB connector located on the right side of the GT PCB. The micro USB cable is not included with the package so you have to find one on your own – e.g. from your Android phone charger. The easiest way to connect the module for the update procedure is to not unmount the module of your rack – but to remove some modules from your case right to the GT. Like this you have an easy access to the micro USB connector. Otherwise, when the GT is not mounted in the rack, it is recommended to stand it up – e.g. you may put a small screwdriver in one of its lower mounting holes as a stand and put it upright on the table.
3. Check that first pair of jumpers at XP\_A is installed (full VCF mode for Gate A enabled) or toggle appropriate switch on the GATEWAY<sup>XP</sup> up (in case the GW is connected to GT:



4. Power-up the your GRAND TERMINAL (or modular system in which it is mounted) **while holding the TYPE button** (the one right from the Cabin Pressure knob) on the GT module. Hold the button up to 5-7 seconds after you turned the power on and then release it. Grand Terminal should now be set into the **DFU** (Direct Firmware Update) mode – none of 8 LEDs showing the filter/effect type chosen should light up, however MAC OS X should detect new plug-n-play generic USB device, which will appear in your Hardware > USB list as **STM32 BOOTLOADER**: Applications > Utilities > System Information:



5. After you ensured the **STM32 BOOTLOADER** is present in your hardware list, navigate to the 'Grand\_Terminal\_MAC\_OSX\_update' folder you unpacked before.
6. To load the new firmware on your Grand Terminal – simply double click on the following command file:  
**Grand\_Terminal\_MAC\_OSX\_update\update\_GT\_v1.2.cmd.command**

If after clicking the command you receive the message that you are not allowed to launch third party apps on your MAC, simply follow these instructions to bypass this behavior: [CLICK HERE](#)

Then launch the command again and confirm.

7. The OSX's Terminal window will open showing the update process:

```
julia — update_shuttle_v1.cmd.command — dfu-util — 80x24

Copyright 2005–2008 Weston Schmidt, Harald Welte and OpenMoko Inc.
Copyright 2010–2012 Tormod Volden and Stefan Schmidt
This program is Free Software and has ABSOLUTELY NO WARRANTY
Please report bugs to dfu-util@lists.gnumonks.org

Filter on vendor = 0x0000 product = 0xdf11
Opening DFU capable USB device... ID 0483:df11
Run-time device DFU version 011a
Found DFU: [0483:df11] devnum=0, cfg=1, intf=0, alt=0, name="@Internal Flash /0
x08000000/04*016Kg,01*064Kg,07*128Kg"
Claiming USB DFU Interface...
Setting Alternate Setting #0 ...
Determining device status: state = dfuERROR, status = 10
dfuERROR, clearing status
Determining device status: state = dfuIDLE, status = 0
dfuIDLE, continuing
DFU mode device DFU version 011a
Device returned transfer size 2048
No valid DFU suffix signature
Warning: File has no DFU suffix
DfuSe interface name: "Internal Flash "
Downloading to address = 0x08000000, size = 123222
.....
```

8. After roundabout 10 seconds, the process will be finished. Don't interrupt it – just take a few deep breaths.

```
julia — update_shuttle_v1.cmd.command — 80x24

Opening DFU capable USB device... ID 0483:df11
Run-time device DFU version 011a
Found DFU: [0483:df11] devnum=0, cfg=1, intf=0, alt=0, name="@Internal Flash /0
x08000000/04*016Kg,01*064Kg,07*128Kg"
Claiming USB DFU Interface...
Setting Alternate Setting #0 ...
Determining device status: state = dfuERROR, status = 10
dfuERROR, clearing status
Determining device status: state = dfuIDLE, status = 0
dfuIDLE, continuing
DFU mode device DFU version 011a
Device returned transfer size 2048
No valid DFU suffix signature
Warning: File has no DFU suffix
DfuSe interface name: "Internal Flash "
Downloading to address = 0x08000000, size = 123222
.....
File downloaded successfully
Transitioning to dfuMANIFEST state
Error during download get_status
logout

[Process completed]
```

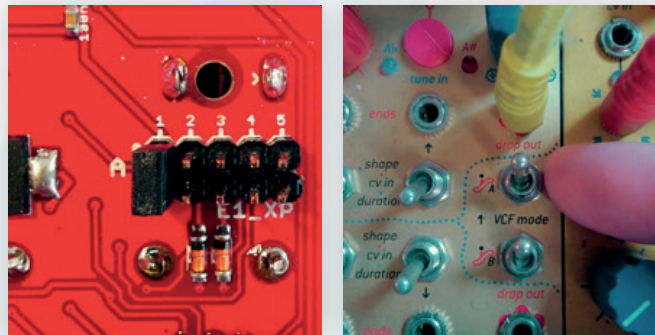
9. Once the process is completed, the Grand Terminal will reboot with the new firmware and you will see the row of 8 LEDs will light up with 1st and 4th LEDs up (first filter type chosen at every Gate with the first LEDs strobing. If not – simply remove the micro-USB cable, turn the modular system power off and on again.

*Note: You may have 'Error during download get\_status' message at the end of the upgrade procedure. This is normal. Just close the OSX Terminal.APP window when you're done.*

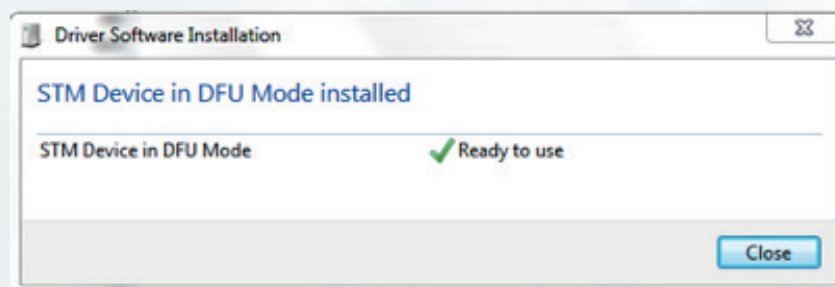


## UPDATE PROCEDURE UNDER WINDOWS via USB for firmware v1.6 or earlier

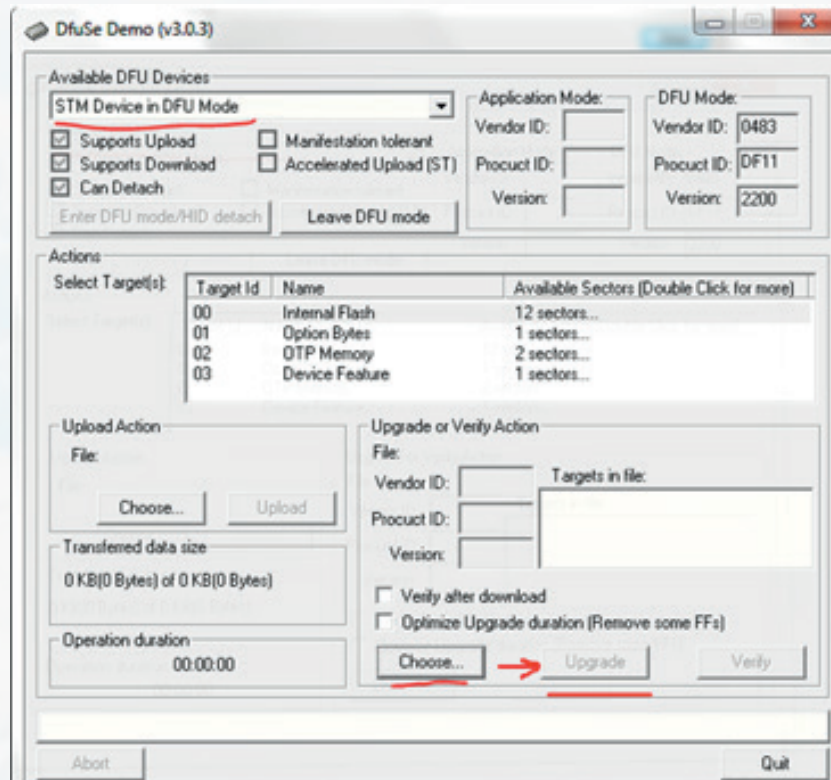
1. Download and install free DfuSe USB device firmware upgrade STMicroelectronics extension (STSW-STM32080) from the official STMicroelectronics web-site:  
<http://www.st.com/web/en/catalog/tools/FM147/CL1794/SC961/SS1533/PF257916>  
The current version is 3.0.3 (3.0.5). No SMS or registration is required to download the installer. It is recommended to have Windows XP/7/8.1 or a later version of operating system.
2. Download the latest Grand Terminal firmware update DFU file:  
[http://firmware.endorphin.es/Grand\\_Terminal\\_v1.6\\_MAC\\_OSX\\_update.zip](http://firmware.endorphin.es/Grand_Terminal_v1.6_MAC_OSX_update.zip)
3. Turn off your Grand Terminal (or better entire modular rack from which GT is powered). Connect your Grand Terminal module to your PC with micro USB cable and micro USB connector located on the right side of the GT. Micro USB cable is not included with the package so you have to find one on your own – e.g. from your Android phone charger. The easiest way to do that do not plugging the module out of your rack – is to remove some modules from your case that stand right from the GT to have an easy access to micro USB connector. Otherwise, when GT is not in the rack, it is recommended to stand it up – e.g. you may put the screwdriver in one of its lower mounting holes and put it on the table.
4. Check that **first pair of jumpers at XP\_A is installed** (full VCF mode for Gate A enabled) or toggle appropriate switch on the GatewayT\_XP up (in case GW is connected to GT):



5. Power-up again your Grand Terminal (or modular system where it is powered) while holding TYPE button on the GT module (the one right from the Cabin Pressure knob). Hold the button up to 2 seconds after you turned on the power on and then release it. Grand Terminal should be loaded into DFU (Direct Firmware Update) mode – no one of 8 LEDs showing the filter/effect type chosen shouldn't light up, however Windows should detect new plug-n-play generic USB device which will appear in your Windows Devices list (**STM32 Device in DFU Mode / STM32 BOOTLOADER**). Wait for a while until Windows installs driver for it – the usual procedure just like you insert ordinary USB-flash drive first time in your computer. Don't be afraid to see Grand Terminal being in DFU mode – any time you can exit it by turning its power off and on again.

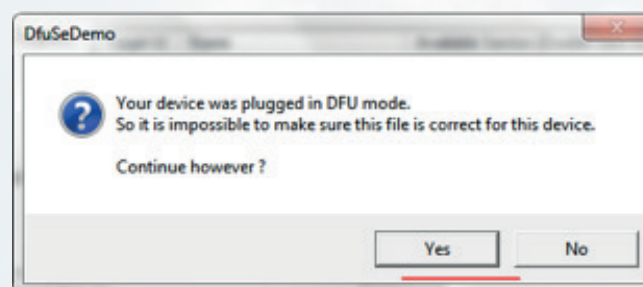


6. After Windows successfully installs drivers for new devices (they should be installed automatically after you installed DfuSe software) you may go to: **Start > All Programs > STMicroelectronics > DfuSe > DfuSe Demonstration**. You will see **STM Device in DFU Mode** in the available DFU Devices list:

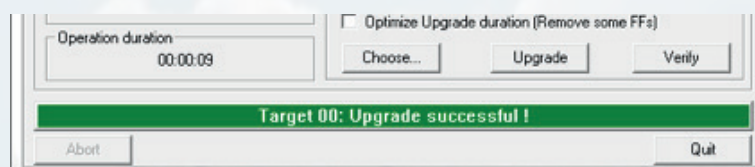


If your Grand Terminal still does not appear in the available DFU devices list, go to Control panel > Device Manager and find there STM32BOOTLOADER device marked with '!' sign. That means drivers were not automatically installed for it. **Simply double click on that device and press Update driver > Choose manually and choose the folder where you have installed DfuSe before** (usually it is located at C:\Program Files (x86)\STMicroelectronics\Software\DfuSe v3.0.5\). Afterwards the driver will be installed and you may repeat that step 5) again.

7. After your Grand Terminal appeared in available DFU devices list, press **Choose...** from **Upgrade or Verify Action** part of the window and after the new window will open – choose new firmware file (DFU) you've downloaded (see the links with firmware above).
8. Afterwards press **Upgrade** and wait until the operation will be finished (usually up to 10 seconds). Before updating you have to confirm that firmware file is correct for that device. **Don't disconnect or turn off the Grand Terminal during that procedure!**



9. After upgrade operation is finished you will see successful green upgrade message in the bottom of DfuSe window: You may now quit DfuSe Demo and turn your Grand Terminal power off and on again. If it's powered with own PSU – just turn the switch off and on.



10. **Enjoy new the features.**