



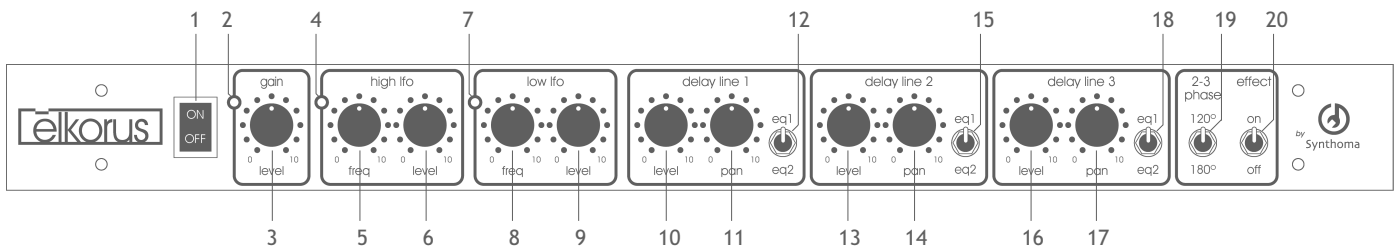
# User Guide

Version 3

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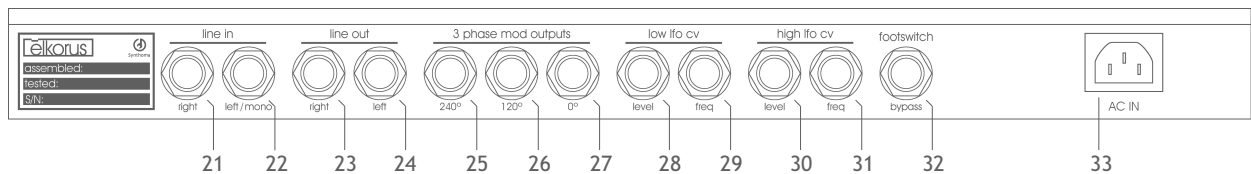
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## Front and rear view



### Front panel

- 1- Power switch
- 2- Led (red) peak detector
- 3- Gain level knob
- 4- Led (white) shows the high LFO frequency
- 5- High LFO speed knob
- 6- High LFO level knob
- 7- Led (white) shows the low LFO frequency
- 8- Low LFO speed knob
- 9- Low LFO level knob
- 10- Delay 1 audio level knob
- 11- Delay 1 pan position knob
- 12- Delay 1 EQ switch
- 13- Delay 2 audio level knob
- 14- Delay 2 pan position knob
- 15- Delay 2 EQ switch
- 16- Delay 3 audio level knob
- 17- Delay 3 pan position knob
- 18- Delay 3 EQ switch
- 19- Phase 2-3 switch
- 20- Front panel bypass switch



### Rear panel

- 21- Right audio input
- 22- Left or mono audio input
- 23- Right audio output
- 24- Left audio output
- 25- CV output (\*) phase 240° or 300° (by switch 19)
- 26- CV output phase 120°
- 27- CV output phase 0°
- 28- Low LFO CV level input
- 29- Low LFO CV frequency input
- 30- High LFO CV level input
- 31- High LFO CV frequency input
- 32- Footswitch Bypass pedal input
- 33- IEC power connector

(\*) Control voltage

## About the string ensemble sound

When we think in the élkorus we thought in a very particular sound typical from the decade of the 70's and even took part in the 80's. It's the sound of String-machines. Without going much it is worth mentioning that they were an alternative to real string sections or, perhaps most conveniently, an alternative to the Mellotron and similar instruments that could bring string section textures. Really the result their sound was quite different in sound and especially at dynamics of the sound that made the first models were too rigid to define release and attack times Even in last models add polyphonic envelopes as maximum level of expressiveness.

Its operation was based on the generation of a transistor organ. Total polyphony, each key was a separate sound generator and could sound simultaneously as many keys have the model in question. It all starts in a wave master oscillator which is divided into each of the keys instrument, only one simple filter which gave color to the basic waveform and an amplifier.

The magic of the sound of these machines lay in the ingenious use of a circuit consisting of analog delay units better known as BBD ("Bucket Brigade Device") the operation of which will be detailed later.

This ensemble circuit transform the static, thin and basic waveforms into lush and rich sound. It really was a very efficient idea.

As often happens in the world of music, defects can become advantages and original characteristics.

Musicians saved their shortcomings using volume pedals, using effects processors to grant infinities of nuances and movements... All this coupled with its peculiar sound and ease of use and transport at the time earned him an important place in the musical production of the 70's and 80's and removed the image of real strings unsatisfactory imitator making it an instrument with relevant personality.

In this way the history repeats the same of the tube organs and after the transistor, which each instrument has a value and unique personality beyond its limitations and even become representative of styles, artists and periods.



## Why an élkorus?

As lovers of those periods of music and sounds we make us a question back in 2005. Why after all the revival of analog sound, being cloning and expanding analog synthesizers (even Mellotrons!) nobody wanted to revive again the sound of the lovely string machines?.

We started to investigate on these instruments and with the apparent variety found several points that were common and could help deliver a product that could bring us those feelings.

We assume that the main thing was the ensemble - chorus circuit because these days the polyphony in inexpensive and any affordable synthesizer was able to generate basic tones like the old machines strings (sawtooth and pulses with more or less harmonics)

So we look in detail how different were the ensemble circuits that were manufactured. Once found the similarities we decided to use a configuration versatile enough to offer the most characteristics of the different circuits that were manufactured.

Found that setting we ask us what we could do to improve this design and is why we think the ability to manipulate the most important elements of the chorus circuit, changing speeds, cell levels, modulation depths... and especially bring a stereo sound.

Then we decided to add stereo input (previously mono-to stereo output) and provide as extras the voltage modulations output and control voltage inputs of frequencies and levels of the LFO's.

These features don't make the unit more expensive and we saw the useful face modular system users or experimenters voltage signals.

We want that lovers of this "string ensemble" sound, old and charming, can recreate it again with a device much smaller and lighter. Anybody can have in their studio occupying minimum space or to take their gigs without carrying lot of kilos. The user will lose the fear of frequent breakdowns and transport problems caused on the old instruments.

We love the ability to process different types of waves and making different kinds of "chorus" New string ensemble sounds! And more interesting still seems the idea of processing different instruments like guitars, vocals, percussion... do not want the origin of this sound make the élkorus only serves to make sounds of string ensembles, we want this effect can process any type of instrument and create new sounds and sensations.

## Description

The élkorus is a chorus unit that emulates the classical “ensemble” sound of those string machines from seventies. That emulation is not achieved by any DSP technology or software. The élkorus sounds analog because is really analog.

Its chorus engine has three audio delay lines and two low frequency oscillators (LFO) whose senoidal waves properly summed and dephased modulates those delay lines.

Each delay line has an analog delay chip manufactured at earlies seventies, the TCA350, who was used as main component on the very earlies string machine’s chorus units.

The frequency of both LFO’s are fully adjustable in a wide range: 1,13 to 23Hz for the high LFO and 0,3 to 6,4 Hz for the low one, as well as their amplitudes.

The outputs of the three audio delay lines has their related level, EQ and panpot controls. Those panpot allows the user to route each delay line on its own stereo position, producing a very custom stereo chorus.

Since the renaissance of the modular synths and the using of control voltage (CV), we thought to make the élkorus compatible with this kind of control.

The élkorus version 3 has their LFO’s parameters fully CV controlable via 4 CV inputs. Their frequencies and amplitudes can be controlled by voltages applied on those CV inputs.

In addition, the three phases that modulates each audio delay line are present as modulation outputs.

This kind of control can be applied, for example, to a three VCO’s bank modulating their frequencies and producing a “generation” chorus effect instead a “procesing” one.

At the élkorus version 3 we work to improve the signal noise ratio and make it easier to integrate in more situations when the different sources levels needs to be adapted at the process. This is the reason to delete the “clip” feature of the high LFO, present at the V1 and V2, and incorporate a pre-amp circuit of variable gain with clipping led indicator. With this feature when can obtain a better signal-noise ratio between source and élkorus and we add a protection to these valuable TCA350 from to high voltages at the input.

Using the TCA350 have a little noise of this BBD, but with all the improvements we keep the noise as down as possible, making the élkorus v3 more suitable for the today demands , but with the wonderful and vintage TCA tone and colour.

## Precautions

The élkorus is a sound processor with dedicated protections. However, you should observe the same reasonable precautions that apply to any piece of audio equipment

Always use the correct line voltage. Refer to page 8 at the power requeriments.

Don’t install the élkorus v3 in an unventilated rack, or directly above heat-producing equipment such as power amplifiers.

Never attach audio power amplifier outputs directly to any of the élkorus v3 connectors.

To prevent fire or shock hazard, do not expose the élkorus v3 to rain or moisture

# Internal Block Diagram

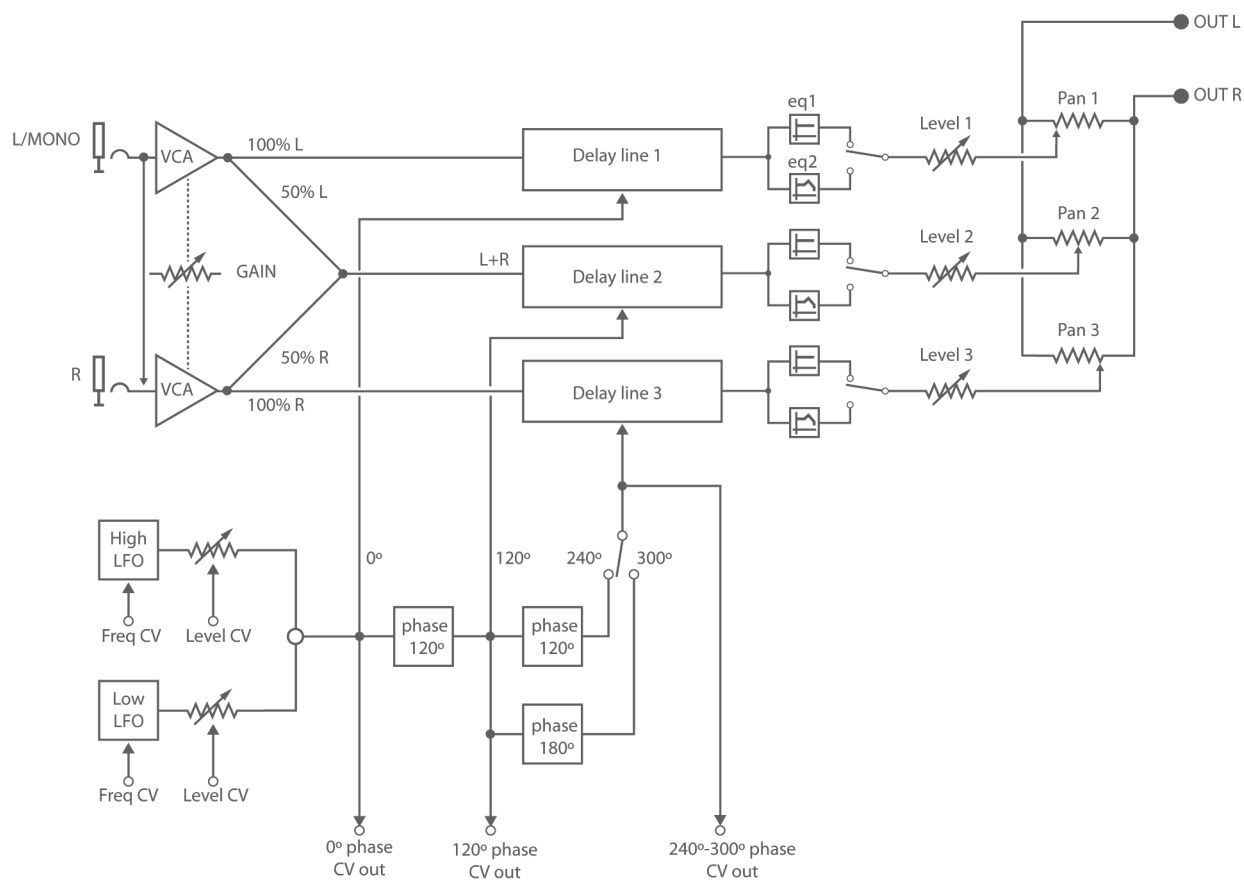


Figure 1

## Connecting the unit

The élkorus v3 measures 19" wide x 1,73" high x 7" deep (483 x 44 x 179 mm). It uses one rack space and can be mounted on any level surface or in a standard 19 inch rack. Do not mount the élkorus v3 directly above heat producing equipment. Be sure to provide adequate ventilation inside the rack.

### Power requirements

The élkorus v3 is equipped with a 3-pin IEC power connector to work with detachable cord. Plug the female end of the power cord into the élkorus v3 and the male end into the wall outlet.

The élkorus v3 operates at either 100/120 VAC or 220/240 VAC depending on the setting of an internal voltage selector. You can see this at the following picture:

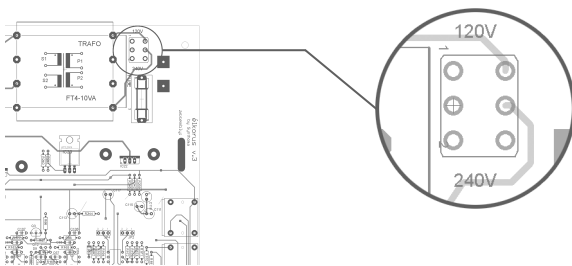


Figure 2

If you want to change the factory voltage selection we must recommend to mark with a label rear the unit. An incorrect AC configuration can damage the unit so be sure the line specifications of your installation and the settings of your élkorus before plug it.

### Audio Connectors

The audio connector 21, 22, 23 and 24 are 1/4" TS phone plugs. If you connect a TRS connector you must know that the ring will be in open state. The level will be determined by the Gain value of the pre-amp.

The élkorus v3 can work with mono or stereo sources. If you want to connect a mono source you must connect it at the connector 22, left audio input.

If you connect the unit in a patch-bay system you must know that connecting the phone plug at the right input it breaks the mono setting. If you want to use in mono with a patch-bay you must duplicate the signal in another cable and then connect the same signal in both inputs.

The left input feeds the delay line 1 input at 100%. A 50/50 mixing of both inputs feeds the delay line 2 and the right input feeds the delay line 3 at 100%. If their respective output panpots are panned properly a stereo audio input will be reflected on the output.

### Control Voltage connectors

The connectors 25, 26 y 27 are the voltage outputs of each phase stage of the LFO's with a 5 vpp of level.

The connectors 28,29,30 and 31 are the control voltage inputs of the frequency and level parameters of heach LFO. The signal level can be adjusted by the internal jumpers. The factory level is 0-5v and can be adjusted to 10 vpp.

Applying negative voltages to the CV INs will not affect the parameters at all, and will not cause any damage to the CV circuitry. It will be simply ignored.

## Bypass connector

The connector 32 works like the Bypass front switch. When a plug is inserted on that jack (labeled as bypass pedal) the bypass/effect front panel switch is ignored and that feature only can be selected via an external footswitch (closed = effect, open = bypass).

## Description of the élkorus v3 blocks

### Pre-amp stage (Gain)

The pre-amp of the élkours does some very important task that can help a lot to obtain the best performance.

The gain level is determined by the control 3. The minimum level is mute of the signal input and at the maximum the gain is about +6dB.

The pre-amp circuit adds a protection to the BBD's. Any signal that reach the level that can stress the BBD chip will be limited with clipping and the peak led will be activated.

If the user still adding more gain it will hear the distortion of the clipping signal but the BBD's will be in safe margins.

### Modulation LFO's

The élkorus modulation is basically the summing of two sine wave LFOs, and usually one of them would have a frequency 5 or 10 times faster than other one. That's why they are marked as high and low LFO respectively.

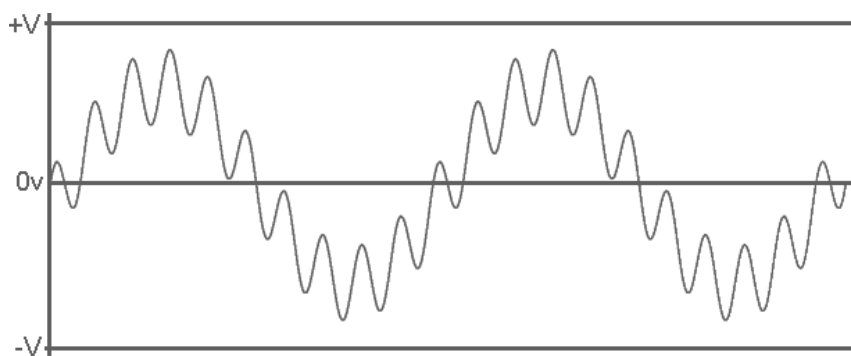


Figure 3

The high LFO range is approx. 1,13 to 23 Hz and the low one is approx. 0.3 to 6,4 Hz.

Those LFO's has a wide level range, but we can note that each LFO has a function at the process structure. The high lfo has less depth than the Low LFO.

To make a typical ensemble chorus the high LFO must be setted between 5 or 10 times faster than the Low LFO. For example, 4Hz for High LFO and 0,6Hz for Low LFO will be fine. The High LFO will produce the "vibrato" effect of the chorus, and the Low LFO will give the "breath" effect.

We make this design to offer the freedom to set the depth of the LFO at any value, even at maximum that the circuit can work.

### Audio Delay Lines

The resultant wave shape from the both LFO's summing just modulates the first Delay Line. We can call this first modulation as 0° (zero degrees). If that shape would be the only modulation source for the

three delay lines we couldn't have a chorus effect, but only a vibrato effect. You can hear this vibrato effect leaving only one delay line level up.

This vibrato gives some "character" to one of the 3 delay lines. To give different characters to the other 2 delay lines we de-phase that original shape  $120^\circ$  twice, producing a  $120^\circ$  and  $240^\circ$  degrees shapes. The  $120^\circ$  de-phased one will modulate the delay line 2, and the  $240^\circ$  will do at delay line 3.

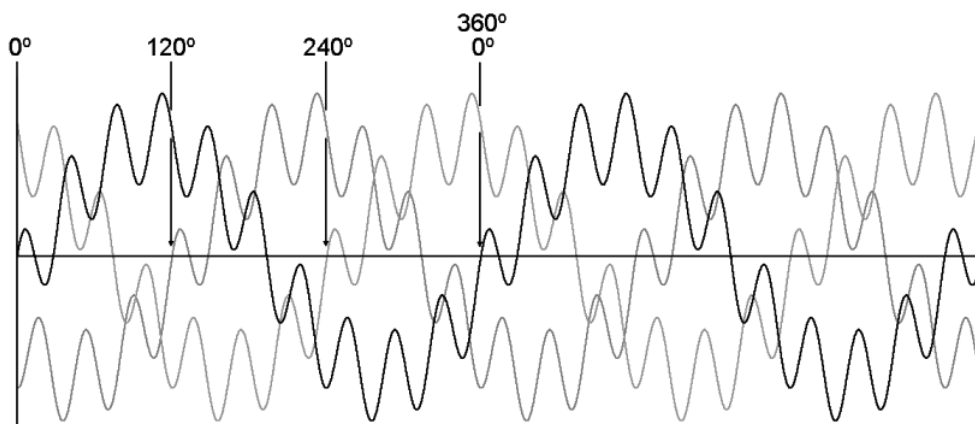


Figure 4

Those de-phasings modulations applied to the 3 delay lines "kills" the vibrato effect, compensating each to other, producing the well-named chorus effect.

In a sense the effect produced by those 3 delay lines together gives to the audio signal something equivalent to put a video image out of focus.

Those 3 delay lines have their respective "level", "panpot" and "eq" controls. With the panpot controls you can place the 3 outputs in a true stereo position.

The eq1 allows the whole spectrum of the delay line output audio, whilst the eq2 cuts them approx. at 4 KHz, producing a more nasal sound.

To recreate the behavior of a 2 delay line chorus, like the Elka Rhapsody one, you need to use only the delay line 2 & 3. Since those chorus had their delay line modulations de-phased  $180^\circ$  between them, we have applied the "phase" control, that selects the de-phasing between lines 2 & 3 on  $120^\circ$  or  $180^\circ$  degrees.

If you want to use this control with the 3 delay lines levels raised, then you would have two choices of accumulated modulations: " $0^\circ - 120^\circ - 240^\circ$ " or " $0^\circ - 120^\circ - 300^\circ$ ".

To recreate the Elka Rhapsody chorus, is not enough to adjust the chorus controls properly. It is needed to emulate the same audio waveform as produced by the internal audio generator of that specific string machine. Whilst most of string ensembles uses a normal sawtooth audio waveform (sometimes created by a summatory of square waves harmonics, something like a staggered saw) the Elka Rhapsody produce a sort of pulse wave, or a rectangular wave with a 10% PW duty cycle.

That kind of wave is not the most usual to emulate strings, and it is undoubtedly one of the tricks of the Rhapsody's trademark sound (the other is, of course, its chorus).

Each delay line contains a chip from ITT called TCA350, same chip used in the Solina and the Elka Rhapsody's chorus units. It has a very specific character since it was manufactured in the early seventies. Its distortion, noise and frequency spectrum gave to those string machines that typical rough sound.

## Control Voltage inputs

The frequencies and levels of both LFOs can be controlled from an external signal, mainly variable DC or very low frequency. When a 1/4" jack is inserted in one of those CV INs the related parameter is turned down (unless a CV voltage is applied on it) and the related front panel knob controls the amount of that incoming CV. If the related control is adjusted at 0 (zero) there will be no CV control at all. If adjusted at maximum, the whole CV IN will control that specific parameter.

Those CV INs accept two possible voltage ranges: “0 to +5v” and “0 to +10v”. Those two ranges are internally selectable by PC-style jumpers. There are one jumper per CV IN (that is 4 jumpers). The élkorus units leave the factory with the jumpers on the “0 to +5v” position.

Applying negative voltages to the CV INs will not affect the parameters at all, and will not cause any damage to the CV circuitry. It will be simply ignored.

## Modulation Outputs

The 3 modulation outs allow to use the 3 internal modulation phases (0° - 120° - 240°) as external modulation sources. For example you could use them to modulate the frequency of three VCO's of a modular system. Modulating each VCO frequency with each one of those de-phased outs can produce a generating chorus-like instead a processing one.

Of course, if you select the 180 degrees de-phasing between delay line 2 and 3, that will affect the third modulation output as well (despite the jack serigraphy states only 240°).

The modulation outputs have a maximum amplitude of +/-5 volts, reachable when the two LFO's levels are adjusted at maximum.

## Bypass Footswitch

Plugging a footswitch in this input the Bypass front switch will be disabled. The footswitch must be push/pull type, the momentary switch are not recommended.

The true-bypass circuit is working with a switching relay. When the unit is off the relay will be in Bypass mode.

## Patch sheets

Here is the recommend position of the knobs to set the élkorus v3 in a Eminent or Solina type of chorus. As the élkorus is full analog device the set can be adjusted to your taste by ear if you find that the velocity or the depth is sightly different. Take note that the original ensemble-chorus sound was mono, but you can open the pan image a bit just with the delay pan 1 and delay pan 3 to expand the stereo image.

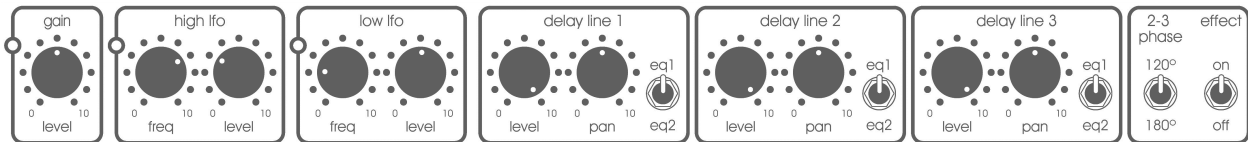


Figure 5: Eminent/Solina settings

This set is a way to emulate the 2 delays ensemble-chorus like the Elka Rhapsody. You need to mute the delay 1 and set the 2-3 phase in 180° position. You can also add the EQ2 at the delay stage to make darker and older sound.

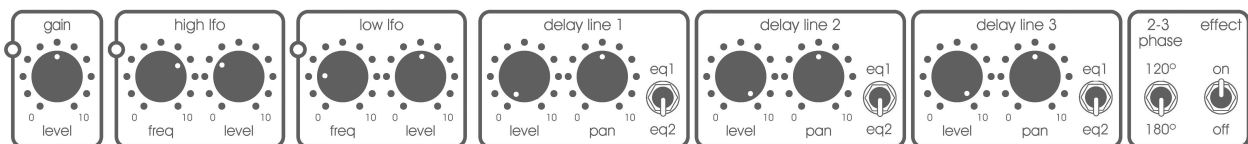


Figure 6: Elka settings

This set is more a flanger sound than a chorus. You can use the delay lines that you want but only using 2 lines. Playing with the different delay lines and the 2-3 phase switch you can hear different flanger colours. Remember to use slow Low LFO speeds and subtle levels of the same LFO. The High LFO level must be at 0. Also you can use only one delay line and mix with the original “dry” signal.

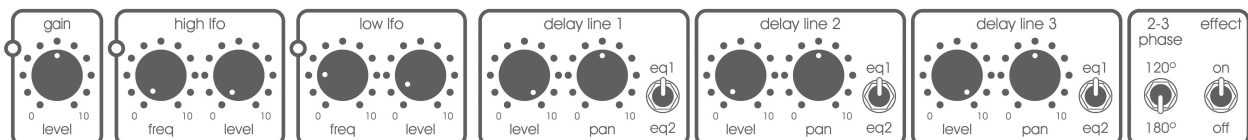


Figure 7: Flanger settings

This setting is for vibrato or for slow detune. Adjust the LFO used for modulation at your taste. Remember to use only one LFO and only one delay line.

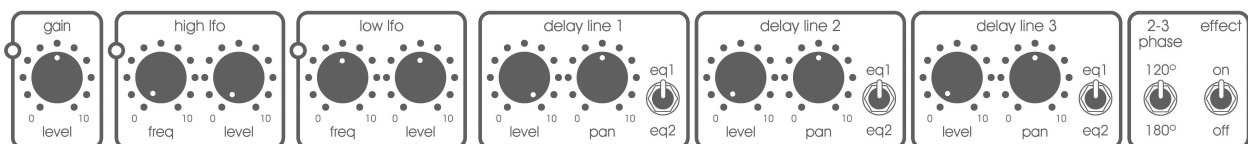


Figure 8: Vibrato settings



## Tips & tricks

Try to make a good adjustment at the inputs to obtain the best sound quality of your élkorus v3. A too low adjustment that after the process must be amplified can make that the typical noise of the TCA's will be amplified too. We recommend that you spend a little time with this stage, the results will worth it.

It may be possible that with some sounds the élkorus can produce a kind of distortion even with the clipping led not flashing. This is because the sum of mid range frequencies at the BBD+filters stage can do this. The TCA audio response is not lineal, their sound and character specially at the mid ranges can do this kind of distortion when the 3 delays are summed. An example of this is the very nasal and narrow sounds, poor in Low and High frequencies, but mid range frequencies at high level.

Too high filter resonance levels, near auto-oscillation can do the same effect.

Any kind of this distortion is not dangerous for the BBD's or the filters. If you want to eliminate this, just reduce the signal input level.

Even the élkorus is designed like an insertion effect, you can use like a send effect and then you can mix the “dry” signal with the processed. With this configuration even more sounds can be obtained and the chorus will have 4 voices (3 delays + original voice)

It's recommended when using clean guitars or mic sources, that aren't dynamic processed, try to use a compressor before the input, to improve the signal noise ratio without distortion of the preamp.

## Troubleshooting

| TROUBLE   | SOLUTION  |
|---|---|
| The unit is connected no light is flashing.   | Check if the power source is working well.  |
| There are current and connected OK, but the leds don't flash.   | The LFO's levels are too low, increase the Lfo level and you will see that the white leds start to flash.   |
| The leds are ok but I can't hear anything at the output.  | You have all the delay volumes (10,13,16) at minimum. Turn right the volume pots to hear the delay lines.   |
| Still no hearing sound  | You have the Gain level too low. Adjust the Gain level.   |
| I hear sound but without processing, I tweak knobs and the sound doesn't change.  | You have a Bypass applied by front switch (20) or by footswitch (32). Remove any phone plug from the rear connector and put the front switch in "effect on" position.               |
| I don't hear nothing when effect is on, but when I apply the bypass I hear the original sound. The volume and gain controls are OK. | You have connected backwards the audio connectors, inputs at the outputs and outputs at the inputs. Connect your cables in a right way.   |
| I'm using the unit the unit in mono input mode but I don't hear anything in the delay line 1.                                       | You have connected the phone plug at the right connector (21). To work with mono input you must connect to the connector (22) Left/mono.  |
| I'm using the unit with a patch-bay and only one channel is heard, and I'm using the (22) Left/mono input.                          | If you are using patch-bay and you want to use mono sound sources, you must duplicate the signal to enter the same signal at the right input (21). This is explained at the page 8. |