User's Guide

LFO Modulation

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 1)

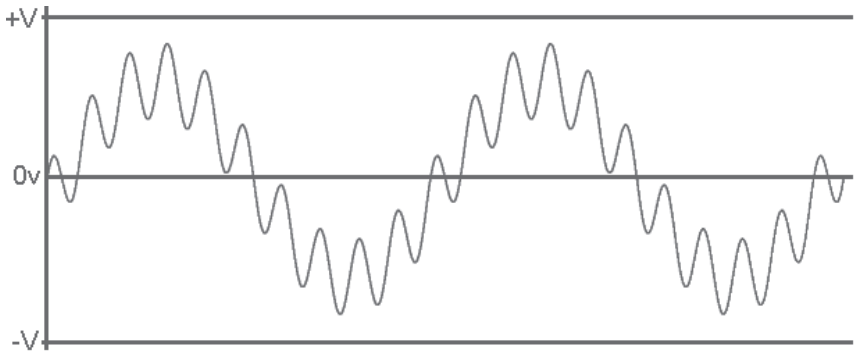

Figure 1

The high LFO range is approx. 0.5 to 60 Hz and the low one is approx. 0.2 to 40Hz, those LFO's has a wide level range, going from 0 (no signal at all) to a maximum, considering "maximum" the largest amplitude before natural clipping (usually +/-14 volts), since its electronics are driven by +/-15 volts. Each LFO can reach that maximum independently, and since their outputs are 100% mixed if you raise their both levels too high it could produce a very clipped summatory, making audible "clicks" at the audio output, even without audio signal processing (Figure 2)

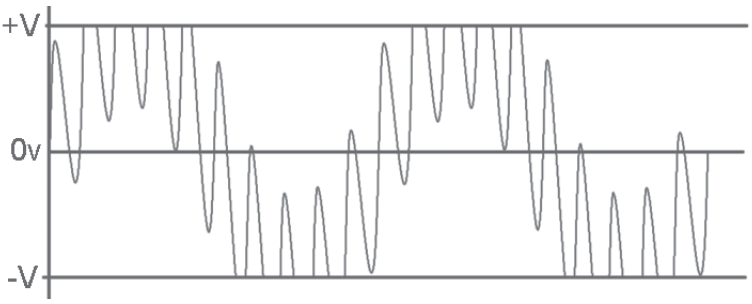

Figure 2

If a normal chorus effect would be recreated, the usual positions of those 4 controls (frequencies and levels) would be placed between 3 and 5, trying to produce a High LFO frequency 5-10 times faster than the Low LFO one. 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.
Depending on the frequency of them and the low frequencies equalization of the monitoring system some low frequency "pops" could be heard at the audio output. They could be reduced by slightly turning down the LFO's levels or even its frequencies, or maybe just one of them.
On the High LFO there are an extra control named "clip". This control saturates the sine wave shaping it gradually into a trapezoidal wave (Figure 3). It is important to say that saturation occurs before the level control (contrary to their relative places on the front panel). That means you can raise and decrease the level of High LFO without modifying the clip level, and therefore its shape. For example, you could produce a trapezoidal wave with a 10% level or lower. The clipping amount doesn't depends of the level control itself.

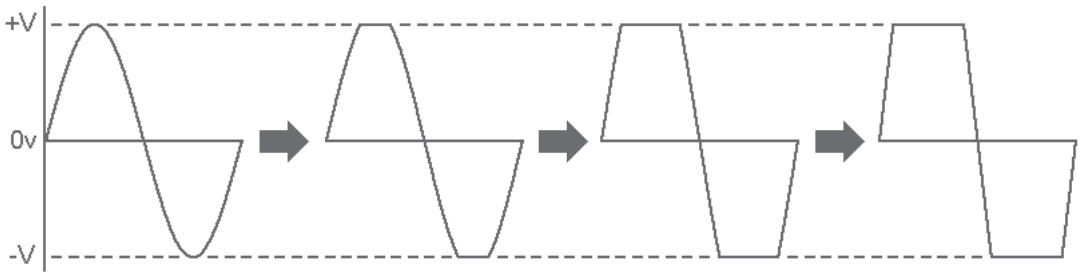

Figure 3

That clipping produce a more “rough” sound, quasi-distorted chorus effect. Like the other LFO controls, the clip control has a very wide range, and depending the frequencies and levels of both LFO’s it could be add a non-desirable effect. It could be necessary to decrease some other control (frequency or level) to avoid “clicks” on the audio output (even without any audio signal processing).
As you can see, all the LFO’s controls interacts each one into the others. We could have avoided that on our design just reducing the control ranges, but we prefer to offer all the possible ranges and leave their usings to the owner discretion.

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 0º (cero 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 120º twice, producing a 120 and 240 degrees shapes. The 120º de-phased one will modulate the delay line 2, and the 240º will do at delay line 3 (Figure 4).

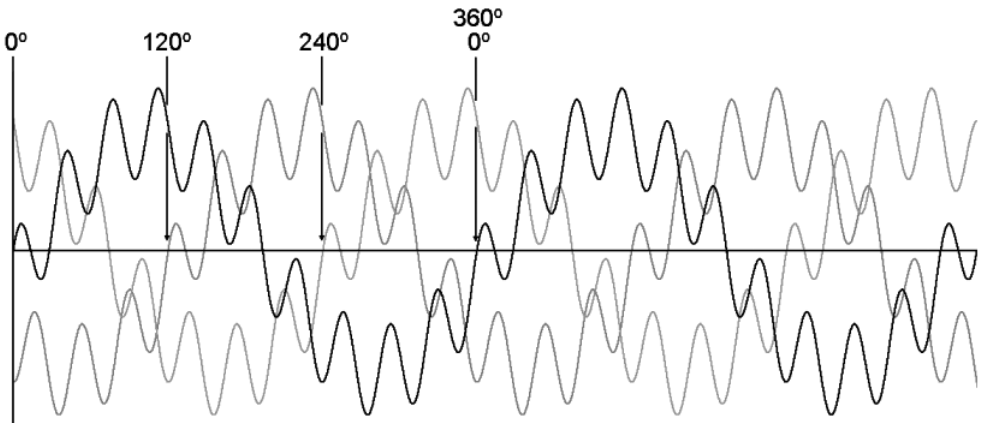

Figure 4

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 togheter gives to the audio signal something equivalent to put an image out of focus.
Those 3 delay lines has 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 degrees between them, we have applied the “phase” control, that selects the de-phasing between lines 2 & 3 on 120 or 180 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° - 120° -240°” or “0° - 120° - 300°”.
To recreate the Elka Rhapsody chorus, is not enough to adjust the élkorus controls properly. It is nedeed 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 undoubtly 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 on the earlies seventies. Its distortion, noise and frequency spectrum gave to those string machines that typical rough sound.
The élkorus LFO’s ranges (specially their frequency limits) exceeds the normal performance which those chips was designed for. Due to that it would be possible to make very undesirable sounds with the LFOs ranges reaches their maximum levels (or accumulate ranges). The user will be use them at his own discretion.
Electronically speaking there are no problem to “burn” the TCA350 with the LFO’s controls at maximum, (it would be very difficult to explain the reasons on this text) but the audio resultant will give to the user their own limits.

CV 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 not CV control at all. If adjusted at maximum, the whole CV IN will control that specific parameter.
Those CV INs accepts 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 leaves the factory with the jumpers on the “0 to +10v” 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 affects the third modulation output as well (despite the jack serigraphy states only 240°).
The modulation outputs has a maximum amplitude of +/-5 volts, reachable when the two LFO’s levels are adjusted at maximum.

Audio Inputs and Outputs

The élkorus audio inputs and outputs are placed “as viewed from its front panel”. So, the right one will be on the right side viewing the unit from its front. As most of multieffect units, the Left input acts as Mono one when no plug is inserted on the right one. If another plug is inserted on the right input the Left input will be routed on the left channel only. This is usually marked as L/Mono, but in the élkorus we forgotten to specify that on the rear panel serigraphy. They are only marked as Left and Right.
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.

Bypass Footswitch

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).

Notes & suggestions

If you produce a very complex sound on your synth, specially with several phase cancellations (2 or more VCO’s detuned, another chorus, etc) the resultant can be pretty confusing. The élkorus (and almost all chorus units) bases its behavior on 3 de-phasing outputs (equivalent to 3 detuned oscillators), so if the audio source has another de-phasing based structure its summing effect could have too much phase cancellations at the élkorus output. That’s the reason why delay lines of a chorus are placed in parallel structure and not in serial one.

Another synth parameter which needs some discretion is the resonance of the VCF (specially 24db/octave ones). An auto-oscillating resonance (or near of that state) produce very high frequency sines with very high levels, and it will produce some aliasing incoherencies inside the TCA350 due to its restricted frequency response, even with the attenuation of high frequencies that has each delay line input.

If you want to send all the rear panel inputs/outputs via an external patchbay, the 4 CV INs needs a comment. The 4 CV INs jacks has an internal switch that allows the front panel controls reach its full ranges. The unplugged jacks emulates the presence of +10v voltage on that inputs. When a plug is inserted that switch cuts the +10v voltage and the CV IN waits an external voltage as control. If that plug doesn't carries any control voltage (like a plug connected only to a patchbay) the related front panel control will not work because the lack of that +10v on that input. That parameter only will be controlled via an external CV connected on the patchbay, but not from the front panel controls. If you want to use a patchbay we suggest to leave the CV INs jacks unplugged, at least until you want to control one of those 4 parameters via an external CV.

Try to assure a good earth (ground) connection in the line voltage connector, not interrupting it across several multi-outlet connections. There are a line voltage filter before the power transformer that filters any harmonics or noises present on the 230 volts line, producing a pure sine wave.This filter has 3 stages, and one of them derives those harmonics (if any) to the earth leg. The enclosure (and the mechanical parts associated with it: potentiometers and switches) are connected to the same earth leg. If that legs don’t carries a ground reference, the enclosure will be a sort of “expansion” of that stage of the filter, receiving all the harmonics and noises from it, and could be interfere with the audio signal itself.
If you will use the élkorus with no earth connection permanently, then you will need to cut the cable between the enclosure and the connector’s third leg (earth). That action will avoid the line voltage

noises dispersed on the metal enclosure. Please, contact us for any doubts about this action. Figures 5 and 6 shows the internal structure and its front and rear panels layout.

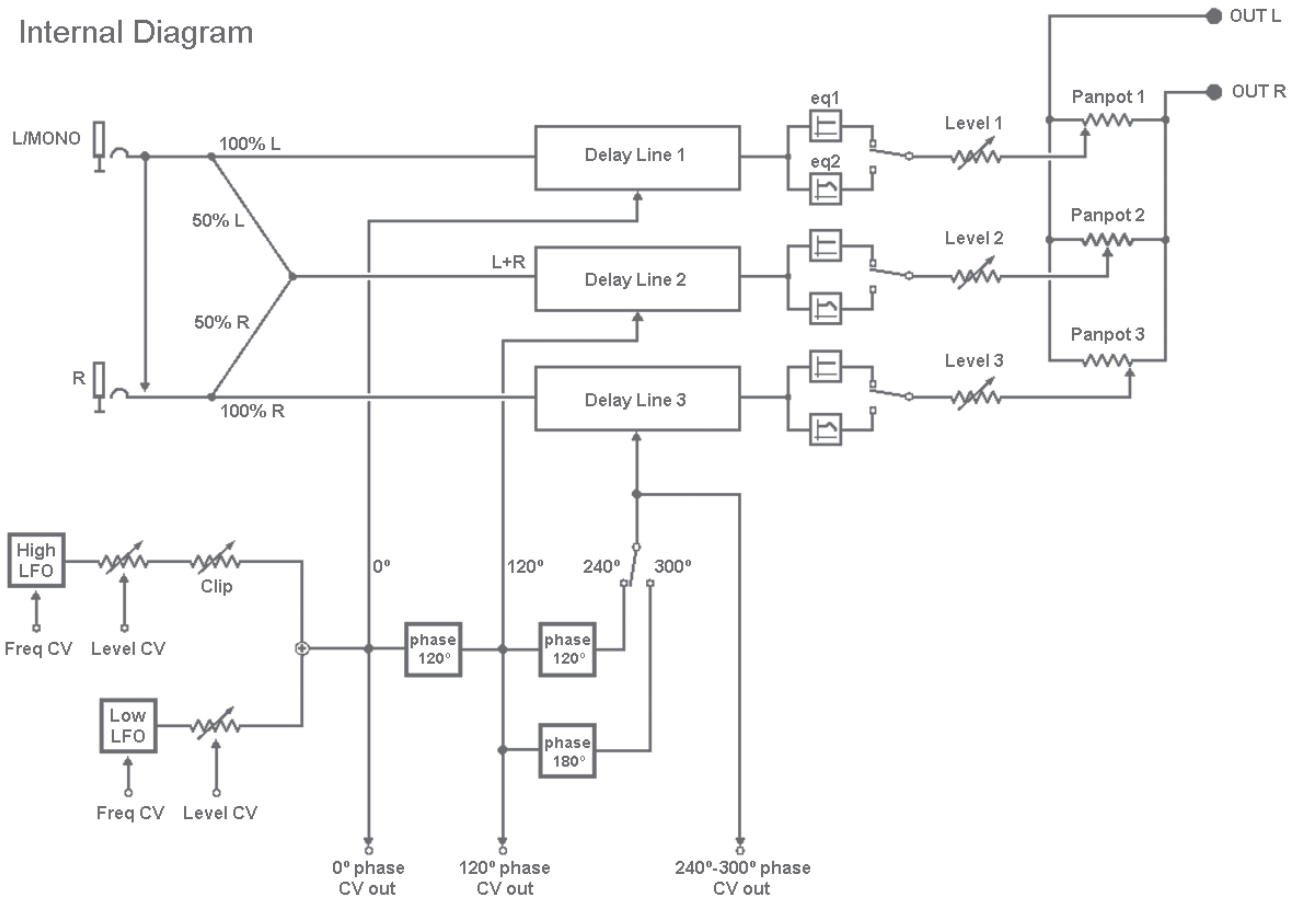

Figure 5

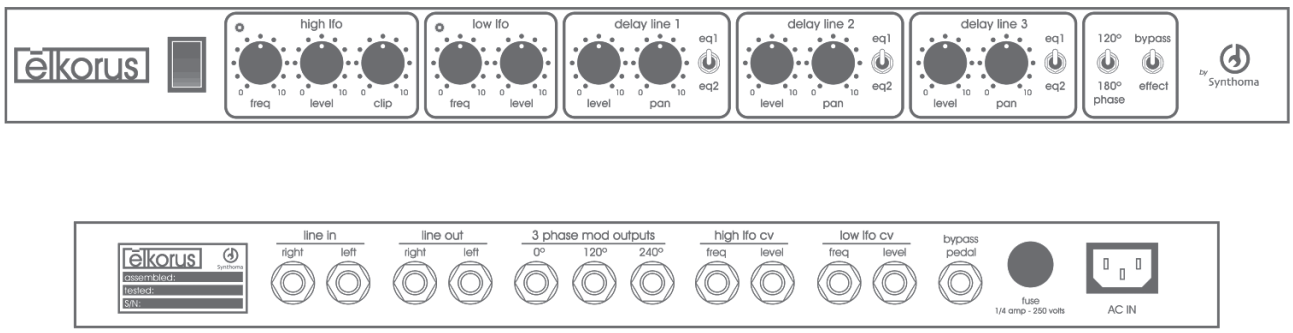

Figure 6