

Mix FX and Plugins Explained

Studio One Pro Mix FX

The **Mix Engine FX** or **Mix FX** provide a unprecedented, convenient and efficient protocol for a single plug-in to tap directly into Studio One's mixing engine. A *single* Mix FX plug-in inserted into a bus channel independently processes ALL associated channels *individually* at the source. In addition, the bus signal itself can be processed as well. This for example eliminates the need of inserting third party discrete plug-ins on each and every channel and each bus to emulate a classic hardware console.

In (Figure 1) below the green boxes represent the processing points of two Mix FXs within Studio One's mix engine. The controls listed to the right represent where in the mix engine the control changes the signal. In this case it shows the example of the Console Shaper (in black) and CTC-1 controls (in blue). Additional plugins will be available in the future with further controls within Studio One's Mix Engine.

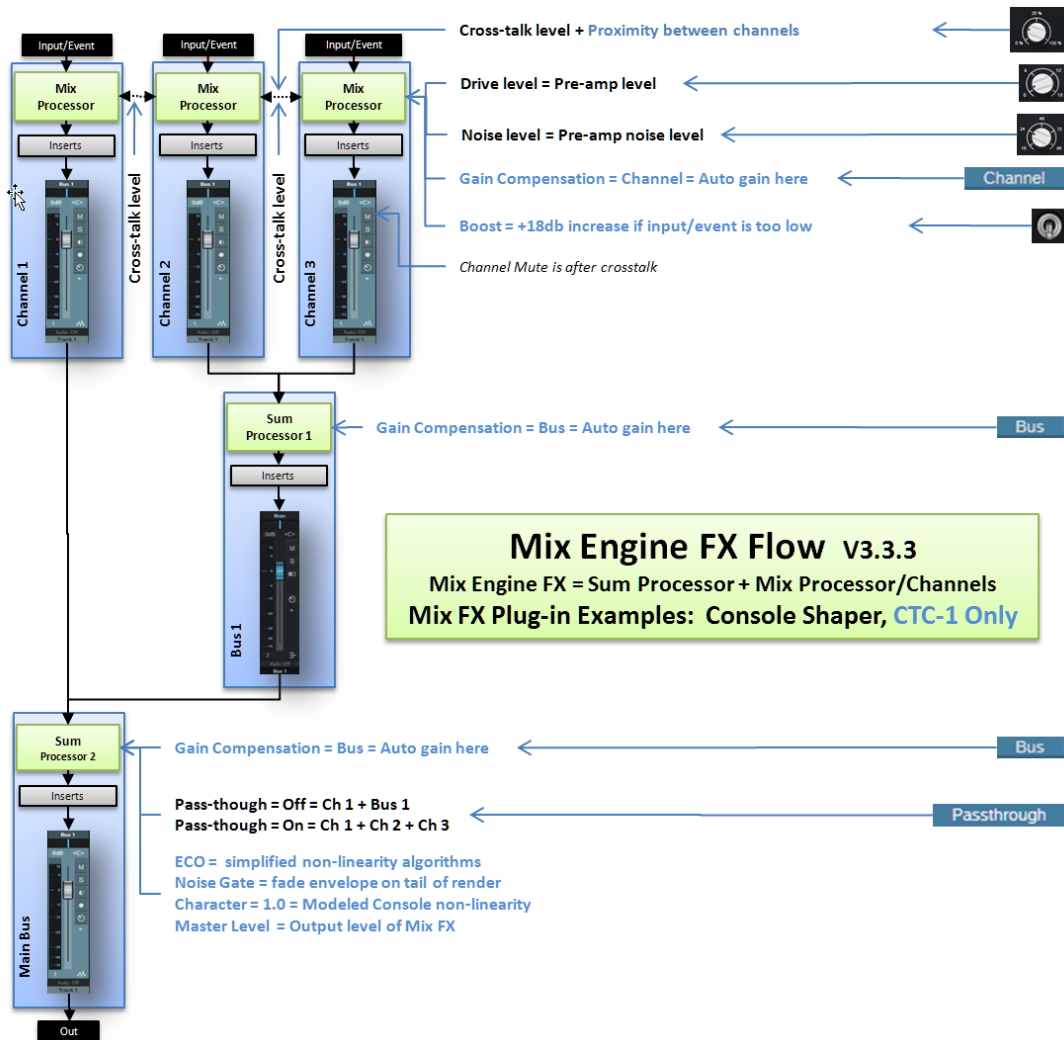


Figure 1: Mix FX Signal Flow

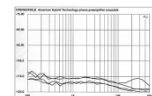
Example One: Console Shaper Flow

Presonus Console Shaper plug-in is the first Mix FX plug-in (included with Pro) which include a "Mix Processor" per channel associated with the bus and a "Sum Processor" with central controls packaged inside a single plug-in. Both Processors include a "State Space" model of analogue Pre-Amp and Auto Leveling circuits as well as control over noise and cross-talk artifacts associated with the circuitry. Drive, Noise and Crosstalk artifacts have the ability to be switched in or out of the emulation allowing for maximum flexibility, however other subtle console characteristics are always present if the Console Shaper is applied to the bus.



Figure 2: Console Shaper Plug-in Controls

- In general the flow starts with an input sources channel or an event on the track associated to the channel.
- It then enters a modeled analogue pre-amp that is control via the central Drive knob described below.
- Just the presence of the Console Shaper causes some coloration of the sound.
- The Console Shaper controls should always be used in moderation with an ear to the mix in addition each control can be turned on/off with a *bypass switch*.
- Drive: When it is switched on and increased the channel pre-amplification of all associated source signals. As drive is increased a *non-linear amplification* occurs which causes harmonic distortion of the signal adding *character and vibe*. Think of the Drive control as a ganged preamp control for all associated channels of a classic console.
- Noise: When it is on and brought up, the noise associated with analogue components can be mixed with the source signal. This type of per-channel noise can have a "gluing" affect on your mix, and add a sense of depth to some sources.
- Crosstalk: When it is on and increased the crosstalk associated with analogue components can be mixed with the source signal. Note: This is before the channels mute. If you want to exclude the crosstalk temporarily just turn off the CS crosstalk. If you want to permanently exclude specific channels you can always mute the events on the track.
- Pass-through: Because the Mix FX is summing the signal of associated channels to the bus and multiple buses can be cascaded, where one bus feeds another, a pass-through option is available to determine the routing of source drive, noise and crosstalk. With the option "On" the Mix FX plug-ins on a downstream bus (like Main Out) will process all upstream channels, even if a bus is inserted in between. With it "Off" the downstream bus processes the upstream buses or channels directly routed to it. (See Figure 1)



Example Two: CTC-1 Plug-in Controls

In addition to the CTC-1 plugins modeling two classic consoles and one custom summing engine it also has additional controls allowing more control and flexibility of gain, noise, auto-gain behavior and CPU consumption. This is the second Presonus plug-ins offered using the Mix FX protocol.



Figure 3: Example of the additional or enhanced controls on the CTC-1

- **Drive:** The character and sonic quality of this parameter varies significantly between each model.
- **Boost:** With both *Drive and Boost engaged*, 18dB of gain is added to all signal routed into CTC-1. **This helps to compensate for low recording levels.**
- **Noise Gate:** Activating the "Noise Gate" automatically creates a smooth fade to the end of the audio file when rendering. This is useful because noise adds enhancing glue to mixed signals but might stand out in silence. Unless the song ends with a sharp cut, this option should always be enabled when rendering mixes or stems.
- **Crosstalk:** In addition to the controls describes in the Console Shaper, the signal is *proximity based* so the adjacent channels receive more of the crosstalk signal than channels further away. Crosstalk adds to the effect of a mix being "glued together". Note it may affect your stereo field so keep that in mind.
- **Character:** Each analog console or summing mixer has a *unique sonic signature*. Even without any equalization or compression applied to the signal, the console has its own character which represents an *acoustic fingerprint* and makes it recognizable in the mix. The CTC-1 control allows an increase in this "Character" by a variable amount. With the character setting at 1.0 (minimum) you get an *authentic 1:1 ratio of the pure console models*. If you like the basic character of a console model - then this character knob can enhance the console character even further. **Increasing the Character can be compared to running the signal through the same console multiple times.** For typical full mixes you should be careful with this knob, or keep it on the authentic level of 1, however for "sound design", it can be useful for unique sound colors.
- **Master Level Control:** With multiple gain stages and variable routing (See Figure 1) it may be required to adjust the overall signal level before leaving the plug-in. This is particularly important if further dynamics processing (compressors, limiters, noise gates etc.) are applied to the signal after CTC-1 plug-in. In this case, the Master level should be adjusted so no actual gain change is applied if you want to avoid overdriving down inserts.
- **Gain Compensation:** Adding high amounts of Drive to the signal can result in extreme gain offsets inside the console which in turn could have a negative impact on subsequent plug-ins by offsetting dynamics threshold levels or creating distortion. CTC-1 is equipped with special gain compensation algorithms to avoid this effect. Two settings are available: (See Figure 1)
 - **Bus:** Auto gain compensation is applied inside the bus that the CTC-1 is inserted to, before any bus insert effects. The result of this mode, is that existing mixes will sound different because all channel inserts are getting a louder input signal. E.g. compressors will process the signal harder. This matches the real-world effect of turning all the associated channel pre-amps up which drives the channel inserts harder.

- **Channel:** Individual gain compensation is applied in each channel routed into its associated CTC-1. "Channel" is the default setting and in most cases the preferred one. It helps to avoid unwanted gain offsets on the channels inserts. In this case the Drive knob makes your channels 'non-linearly louder' with the overdriven effect, but the signal level will be compensated before any insert FX in the console. Note: Although this channel pre-amp overdrive effect without the effect of increasing your channel inserts signal allows for an easy or after the fact gain staging workflow it, it differs from a typical console set up.
- **ECO Mode:** Since the CTC-1 processing is applied to its bus and all associated channels, the CPU load can get excessive, particularly with some heavy non-linear "State Space" modeling is applied. When working on a large project with many channels, ECO mode will reduce the processing by using simplified algorithms with less attention to the non-linearity in the signals, thus reducing CPU cycles. It may sound slightly different in the drive stage, but it will enable you to use the CTC-1 in very large projects or when working with small computers and laptops. (See Figure 1)

How to use the CTC-1

1. Since the CTC-1 is a console or summing box emulations, typically it is best to apply the Mix FX at the beginning of your workflow. This would normally be as soon as possible but generally before you mix the song since it represents the console hardware. In most cases it is a good idea to add it to your Song Template so that it is there from the beginning. Note: It can also be used after the fact for "sound design" reasons, however that is not covered in this manual.
2. Because the harmonic distortion effect is very subtle at signal level lower than -18db you may need to boost input levels with the CTC-Boost, or an alternative way of doing the same thing is to increase your Track Event signals to above -18db to begin to notice the console warming/gluing effect. When your input levels are very low, the overdrive threshold will never be reached and there is no distortion, however as a reminder the console character is always there.
3. Use the Drive knob to increase input gain thus the warming effect of analogue harmonic distortion across all associated channels feeding the bus. The character and sonic quality of this effect varies significantly between each model. The harmonic distortion character gives your tracks (character/vibe) before any other insert effects. Note: With all Mix FX controls use them sparingly and always use your ear to make the mix judgment.
4. The Noise knob lets you add analog-style noise to the associated channels of the CTC-1. This type of per-channel noise can have a "gluing" affect on your mix, and add a sense of depth to some sources. With all Mix FX controls, use it sparingly and always use your ear to make the final mix judgment. You can decide if the noise is in fact helping the mix or not and turn it on or off if needed.
5. The master Crosstalk knob adds to the effect of a mix being "glued together". Because this gluing effect can change your stereo image it is a good idea to set it before final stereo image adjustments. The crosstalk generated in CTC-1 spills over naturally into adjacent channels with decreasing amounts the further a channel is away from the source. This is unique to Studio One's CTC-1.

Reference: CTC-1 Console Types (from the CTC-1 manual)



Classic: this emulation of a classic 70's British console is known for its unique character which shaped the sound of many legendary albums by chart-topping artists around the world. The Drive stage adds the much sought-after "rock and roll rawness", particularly when pushed. The crisp and clean character originates from a multistage preamplifier design with selected transistors.



Tube: this model is based on a legendary British tube console built in the late 50's by engineers of one of the most famous recording studios in the world (only three were ever made). It's unique dynamic texture adds depth and balance to the sound like no other console does. The negative -feedback tube circuit using three tubes in two stages had originally been designed for low noise and linear frequency response. This model sounds great at any setting.



Custom: instead of emulating a real console, this model is based on ideas and concepts by our DSP engineers and product specialists. It's best described as "modern high-end" circuit with a few twists, based on insights from mastering workflows and psychoacoustics. The developers aimed for a balance between single-channel and bus processing. While unmistakably showing tube-like Drive characteristics, the character control offers various different flavors across the entire control range.