The GS-10's stereo properties

Version 1.0.2.

Contents

1 Introduction

The GS-10's stereo properties are quite complicated: some of its physical inputs and outputs are mono, some are stereo, and the effects exhibit a wide variety in behavior. This document discusses these properties and their consequences for effect chains.

2 Physical inputs

The Input Select parameter in each patch selects the physical input used for the effect section. Some of these inputs are mono, some are stereo:

Mono:
- Guitar
- Bass
- Microphone

Stereo:
- USB (Gtr/Mic)
- USB (Bass)
- AUX

USB is digital, all the others are analog.

3 Physical outputs

The GS-10 has several physical outputs, which are always available simultaneously (although all of them can be *switched off* by various means). Most of these outputs support stereo:

Mono:
- Guitar Amp Out

Stereo:
- Speakers
- Phones
- Output
- USB
- Digital Out

USB and Digital Out are digital outputs, and receive their signals from the USB tap in the effect chain. All the other outputs are analog, and receive their signals from the very end of the chain.

The signal sent from the USB tap can be customized by means of the global USB Output Mode parameter. This parameter has two settings:

1. Stereo (L/R):
   This simply passes on the signals from the effect section as they are at the point where the USB tap is placed in the chain. If you want to record in stereo, this is what you need.

2. Effect/Direct:
   In this case the following happens:

a. The completely dry input signal (i.e. without any effects applied) is sent to the USB tap's right channel. So in case the dry input signal is in stereo, the USB tap first converts it to mono.
b. The effect section's signal (at the USB tap point) is sent to the USB tap's left channel. Again, the tap merges any stereo signal into mono, which of course may be undesired if the effect section's signal has become stereo before the tap point (e.g. by means of a stereo chorus).

Note that the USB Output Mode parameter does *not* affect any effects appearing after USB in the effect chain: it strictly applies to the USB and Digital Out outputs themselves.

4 Effects

4.1 Mono input

If an effect receives a mono input signal, the output is usually mono too. Only the following effects create a *stereo* output signal from a mono input:

	Effect	Setting
FX-2	Flanger	
	Harmonist	Voice = 2-Stereo
	Pitch Shifter	Voice = 2-Stereo
	2×2 Chorus	
	Pan	
	Rotary	
	Delay	Type = Pan/Stereo
	Chorus	Mode = Stereo1/Stereo2
	Reverb	

Note that no FX-1 effects occur in this list. This makes kind of sense, since in FX-1's most common position, i.e. *before* Preamp/Speaker Simulator, any stereo would be undone by Preamp/Speaker Simulator anyway.

Flanger's Separation parameter determines how much its left and right processors work out of phase. So for a mono input Separation determines the degree to which the output becomes stereo: if Separation is 0, you get mono output, at 100 maximum stereo. The more the left and right inputs differ (i.e. the more truly stereophonic the inputs already are), the less it is possible for Separation to further increase their difference. Thus, Separation is indeed most effective on mono input signals.

4.2 Stereo input

If we apply a stereo input signal to the individual GS-10's effects, their output types can be categorized as follows:

4.2.1 Parallel effect

These effects process a stereo input signal by means of separate processors for the left and right channels. Thus, these effects maintain their input's stereo quality. They are listed below:

	Effect	Setting
FX-1	Advanced Compressor	Type = Stereo Comp
	Limiter	Type = Stereo LM
	Tremolo	
	Feedbacker	Mode = Natural
FX-2	Pan	
	Slicer	
	Stereo Equalizer	
	Noise Suppressor	
	Foot Volume	

Note that there is a difference between being able to *pass* a stereo signal and being able to *create* one. Most effects in this category cannot *create* a stereo signal, even though they can *pass* one; only Pan can also create stereo from a mono signal.

4.2.2 Pass-thru stereo plus effect

These effects mix two types of output signal:

a. They pass on the input stereo signal 'as is'. Often they have a Direct Level parameter, which determines the level of this output signal.

b. They *add* their own effect signal, either centered ('mono') or stereo.

The effects in this category are listed below:

	Effect	Setting	Position of added effect signal
FX-2	Flanger		Stereo
	Harmonist	Voice = 1-Voice/2-Mono	Center
		Voice = 2-Stereo	Stereo (Voice 1 left; Voice 2 right)
	Pitch Shifter	Voice = 1-Voice/2-Mono	Center
		Voice = 2-Stereo	Stereo (Voice 1 left; Voice 2 right)
	Pedal Bend		Center
	2×2 Chorus		Stereo
	Short Delay		Center
	Auto Riff		Center
	Delay	Type = Single	Center
		Type = Pan	Stereo (1st echo left; 2nd right; etc.)
	Chorus	Mode = Mono	Center
		Mode = Stereo1	Stereo
	Reverb		Stereo

4.2.3 Mono effect based on merged inputs

These effects do *not* maintain an incoming stereo signal at all: the first thing they do is convert any stereo signal they receive to mono, and then use that mono signal to create a mono output signal. They are listed below:

	Effect	Setting
FX-1	Pedal Wah	
	Auto Wah	
	Tone Modify	
	Advanced Compressor	Type = BOSS Comp/D-Comp
	Limiter	Type = Rack 160D/Vtg Rack U
	Enhancer	
	Slow Gear	
	Defretter	
	Ring Modulator	
	Feedbacker	Mode = Oscillator
FX-2	Compressor	
	Overdrive/Distortion	
	Preamp/Speaker Simulator	
	Equalizer	
	Phaser	
	Octave	
	Vibrato	
	Uni-V	
	Humanizer	
	Bass Simulator	

4.2.4 Stereo effect based on merged inputs

Only the Rotary effect falls into this category. Like the effects in the previous category, Rotary merges an incoming stereo signal to mono, but it then uses that mono signal to create a *stereo* output signal. So Rotary is a bit tricky: even though the output is stereo again, the stereo image of the input signal is completely lost.

4.2.5 Hybrid stereo

This category contains two effects:

Effect	Setting
Delay	Type = Stereo
Chorus	Mode = Stereo2

These effects are rather treacherous: the left output consists solely of the left input 'as is', and the right output is the effect sound, based on the merged left and right inputs. So, whereas the *left* input affects *both* outputs, the *right* input only affects the *right* output; thus, the original stereo image is, in a sense, not *completely* lost.

Note that if you set Effect Level to 0, only the left input is output (namely at the left); the right input is killed completely, and the right output remains silent. See section 5 for a curious application of this setting.

4.2.6 Guitar Synth

Guitar Synth only produces mono output, but there are some very peculiar details to its behavior:

a. The effect sound is output at the center; its output level is determined by the Synth Level parameter.

   However, the effect sound is based on the *merged* left and right inputs to the *effect chain*, i.e. the signal at the very start of the whole chain! So it is *not* based on Guitar Synth's 'immediate' input, i.e. the output from the previous effect in the chain.

b. The normal, 'immediate' *left* input (i.e. the output from the previous effect) is also output at the center; its output level is determined by the Direct Level parameter.

c. The normal, 'immediate' *right* input isn't passed or processed in any way, and is thus lost. I have no idea why this is so – it may even be a kind of bug.

See section 5 for discussion of Guitar Synth's position in the effect chain.

5 Effect chains

The behavior of the whole effect chain can be understood on the basis of the input-output properties of the individual effects. In particular, if we want to create effect chains that are 'proper' in terms of stereo, we should be aware of the following facts:

1. Most importantly: if we put any stereo-destroying effect after a stereo signal, we are left with a mono signal.

   For a simple demonstration of this phenomenon, put the Equalizer effect after an effect producing stereo (e.g. Chorus or Reverb), keep all Equalizer's EQ parameters at 0 dB (so that Equalizer does 'nothing'), then switch Equalizer on and off while playing: it functions like a simple switch between mono and stereo!

   Of course this phenomenon applies to *any* stereo signal, including stereo signals from the USB and AUX inputs. This puts severe limitations on the reprocessing of previously recorded stereo signals: we can't apply *any* mono effect to these signals; the most notable 'casualty' (or culprit, if you like) is of course Preamp/Speaker Simulator. The only solution would be to reprocess the individual stereo channels during *separate* runs. But of course this whole problem can be avoided by simply recording all the mono effects first, and then the stereo effects.

2. A more specific point: as discussed in section 4.2.6, Guitar Synth's main output (the synth sound) is based on the *overall effect chain's* input. This has several consequences:
   a. It is not possible to improve Guitar Synth's note-on/off triggering by 'cleaning up' the input signal by other effects (e.g. Compressor) in front of Guitar Synth.

b. Similarly, it is not possible to silence the synth sound by e.g. Foot Volume in front of it.
c. With respect to the synth sound, it absolutely doesn't matter where we put Guitar Synth in the chain. However, if we want to mix in Guitar Synth's 'immediate' input (i.e. the previous effect's output), then point 1 above applies again, since Guitar Synth's immediate input will come out as mono. In practice, Guitar Synth is probably best put at the very start of the chain. (However, see below for a completely weird use of Guitar Synth.)

Split chains

As described in sections 4.2.5 and 4.2.6, Stereo Delay, Stereo2 Chorus and Guitar Synth exhibit anomalous pass-thru behavior. We can use this to create chains involving two independent sub-chains, where one consists of only Stereo Delay or Stereo2 Chorus.

Consider the following chain:

... (mono signal) ➜ DD ➜ USB ➜ CE ➜ EQ ➜ ... (FL/2CE/RV etc.)

Delay's Type parameter is set to Stereo, so that the left input signal is output to the left, and the echoes to the right.

The USB tap follows immediately after Delay, so Delay's output is sent to the USB and Digital Out outputs.

Delay's output is also passed on to Chorus, in Stereo2 mode. In general, if we set Chorus' Effect Level to 0 in Stereo2 mode, Chorus *kills* its right input channel, and no effect sound is produced: the unprocessed left channel is all that comes out of Chorus! In the chain above this means that Delay's echoes (at the right channel) become completely inaudible after Chorus, and the original mono signal is output from Chorus' left channel.

Equalizer, set to its 'flat' setting, then moves the original mono signal from the left to the center. Thus, the original mono input is completely restored, and can be processed normally by the following effect(s), as if the Delay, Chorus and Equalizer effects weren't there at all.

So basically in this setup the input signal is processed in two *independent* ways: USB and Digital Out receive *only* Delay, and the analog outputs receive *only* FL/2CE/RV etc. Thus, there are two different, simultaneous effect chains, although one 'chain' only consists of Delay.

Since the input/output behavior of Stereo Delay and Stereo2 Chorus is identical, we can swap these two effects in the above setup, with a similar result:

... (mono signal) ➜ CE ➜ USB ➜ DD ➜ EQ ➜ ... (FL/2CE/RV etc.)

Since Chorus and Delay have changed roles, their settings for Effect Level should be reversed as well: Delay's Effect Level should now be 0, and Chorus' Effect Level should *not* be 0 (but e.g. 100).

Alternatively we can use Guitar Synth in the same way as the Chorus ➜ Equalizer or Delay ➜ Equalizer combinations in the above setups:

... (mono signal) ➜ DD ➜ USB ➜ SYN ➜ ... (CE/RV etc.)
... (mono signal) ➜ CE ➜ USB ➜ SYN ➜ ... (DD/RV etc.)

We keep Synth Level at 0 and Direct Level at 100, so that Guitar Synth simply throws away its immediate right input and centers its immediate left input. Compared to the earlier setups, this frees up Equalizer and either Chorus or Delay, but makes the other FX-2 effects unavailable.