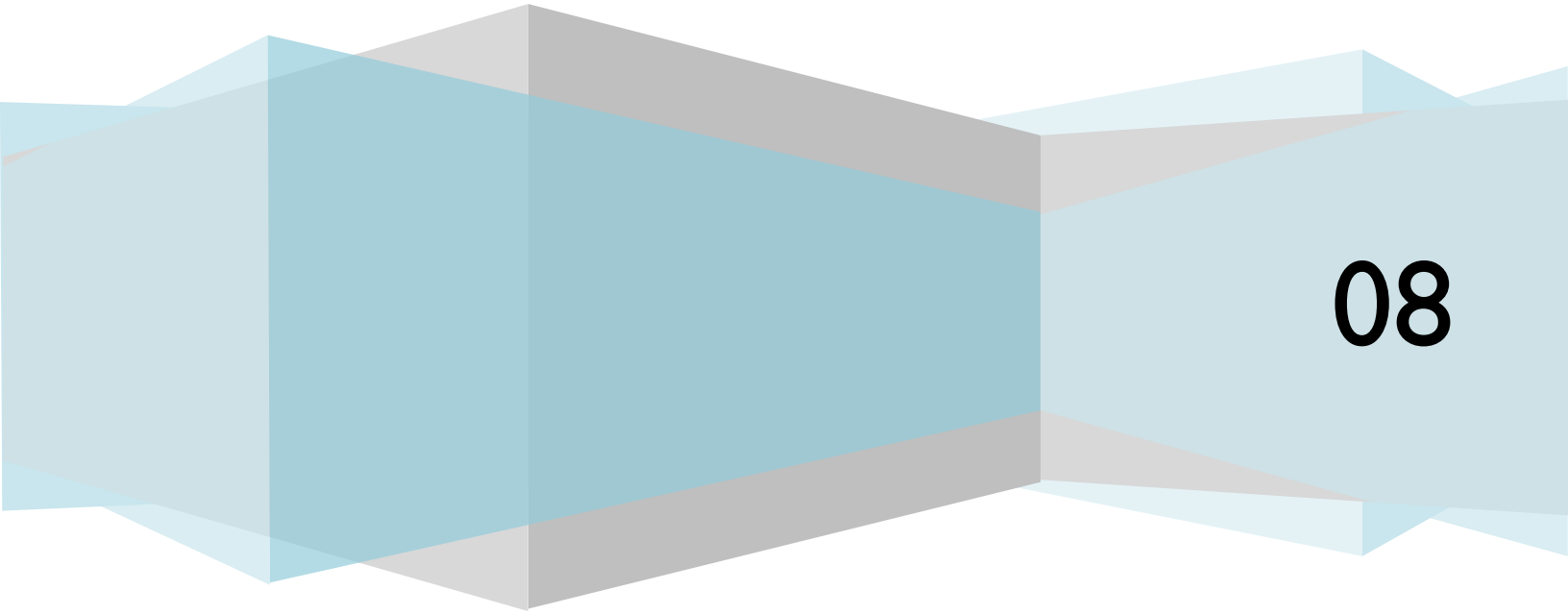
I'm Not Larry ® Music

Understanding and Configuring Your G-System

Solving Problems and Getting the Best Sound for Your Rig

Laird Williams



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FORWARD

The G-System is a complex piece of equipment. When I first acquired mine, the product was fairly new and I spent weeks muddling around trying to make things work well. There were no user forums hosted by TC Electronic as there are now, and for a long time little was said about the G-System on independent forums like TGP (The Gear Pages) and others. I was pretty-much on my own for a while.

I am an engineer though. My "day job" is as a Software Engineer and I also build amplifiers with an RF Engineer friend of mine here in Raleigh, NC. I am all about problem solving. I did my Master's Thesis on formalizing and automating models of fault diagnosis. I also designed and built the live sound environment for our church, and do the sound recording and engineering for some local high school bands. Most importantly, I have played electric guitar for the better part of 15 years, and guitar in general for over 35 years. One would expect that, having such a broad background in music and technology, one could figure out the G-System to some degree on one's own. Equipped with the very-incomplete G-System manual and my own enormous ego to feed, this is what I have endeavored to do.

I have managed to make the G work very well in both setups that I use – a studio/rack setup that features the G mated with a VHT Valvulator GP3 and a "live rig" that mates the G with a Hughes and Kettner Switchblade 212 Combo. Over time, the emphasis of my activities has shifted from making my own system work well to helping others get the G to work well.

This paper is a summary of what I have learned so far about configuring the G-System for different environments. It collects and digests not just my own direct experiences, but those of numerous other users who have made their trials and triumphs public so we can all learn from them. In many cases, I have been able to provide help over the phone, through e-mail, or in on-line forums. In others, folks have worked things out on their own. In a few cases, folks gave up and "eBayed" their units. We can learn a lot about the G from all of these people's experiences if we maintain a balanced, rational outlook and reasonable expectations.

This paper is NOT a "how to program the different effects" in the G-system paper. It is not about any bugs that may be present in the spill-over algorithms or FX code that the DSPs run. It is more about how to keep as much of your playing dynamics as possible and maintain a good-to-excellent signal-to-noise ratio in the G-System. It also touches on MIDI and channel switching. In some cases, I try to provide background so you can understand the underlying concepts and why things happen and why certain solutions tend to work and others do not. In short – this paper is about integrating your gear – getting it all to work together well, using the G-System as the integration point.

You'll also be able to see why some of the "diagnoses" given by some folks on-line are complete nonsense. Note that I am not asserting that their ears are bad and they are imagining

a problem. I am saying they hear a real problem, but they can't diagnose their way out of a paper bag. Be glad these folks are not your family doctor. You'd be dead. At times I get a little "preachy," especially about engineering principals. Please forgive me in advance. I have tried to make clear distinctions between fact and opinion so you can judge for yourself. Frankly - if you don't like my style that's too bad. It's not as though I am getting any tangible benefit from doing this.

Good luck and remember: Your guitar, G-System, Amp – they are not life-support systems. If they don't work instantly the way you need them to work, nobody dies. Relax, be patient, and most importantly have fun. This really is pretty cool stuff.

Laird Williams

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BREAKING THINGS DOWN

The one thing I can say with very high confidence is that if you purchase a G-System, connect it like the manual says, and start playing – you are probably going to be *very* unhappy with the results. This is a shame, because the G-System is a very well-built and conceived system. It is just a complex one, and it is nowhere near to "plug and play." This is not to say that the G-System is perfect. There are some significant issues – but many can be mitigated with minimal investment. Others can be solved in firmware releases. And some issues are common in any complex audio environment and not necessarily confined to the G-System.

REDUCTIONIST THINKING

Trying to understand and configure a complex system all at once is a nightmare. Fortunately, successful scientists and technologists have used a method for centuries (even millennia) that makes working with certain types of complex systems easier. It is called "reductionism". You break the system down into its pieces, understand those, and then how the pieces interact, and you achieve a pretty good understanding of the system. Reductionism does not work very well for gestalt systems (where the whole is greater than the sum of its parts), like understanding a work of art or human consciousness – but it works *great* for technology. You may be an artist, and you may not like the reductionist world view, but all of your gear is technology and thinking like a reductionist when addressing your gear will make things much easier on you. This is called "applying the right mental tool" to the job at hand. You can apply your other, more pleasant mental tools to other jobs – like making the refrain in that new song you are writing more compelling.

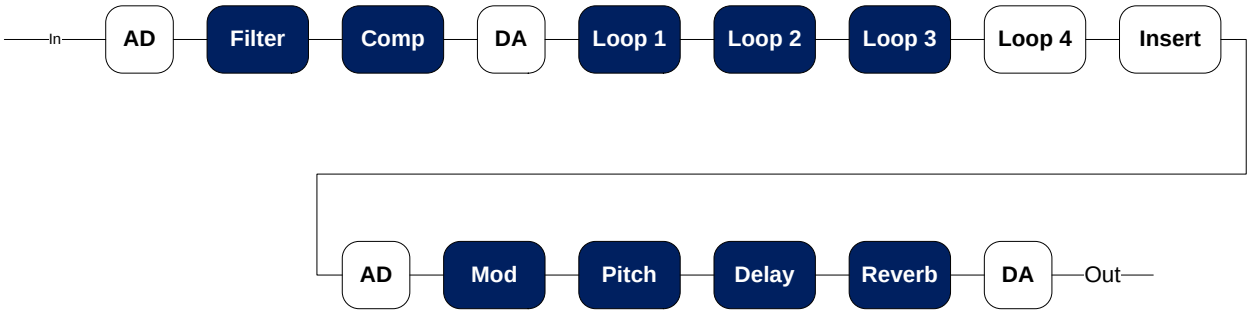
Part of being a reductionist is being disciplined about "isolating variables." What this means in terms of the G-System is that we try to isolate individual components and configure them without involving any of the other components. This is an ideal, and in some cases components that are irrelevant to the task have to be included. In such cases, these "ancillary" components should be put in a known, reliable configuration and not varied during adjustments and experiments. In other cases, two components interact so heavily that we have to vary both. In such cases, when things don't sound or behave properly, we can't know whether it is the first or second component (or both) that are the cause of the issue. This is when things get frustrating, so we try to avoid it as much as possible.

The other part of being a reductionist is that you have to either discover or know what the components are so you can isolate them. Fortunately, TC Electronic has given us a fairly good

start at understanding the G-System. The only issue is that this information is scattered all over the place in the manual. Here's what you get when you finally put it all together.

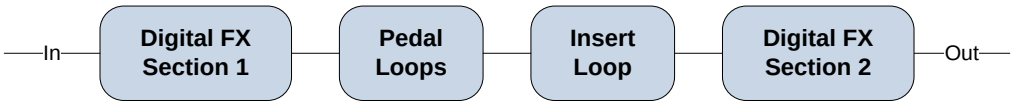
A CONFIGURATION-ORIENTED REDUCTIONIST VIEW OF THE G-SYSTEM

We've all seen this block diagram. It is plastered on the front of the GFX-01 and also in the documentation. It is a nicely-reductionist view of the signal path in the G.



This view (and its related variations for FX routing options) is great for understanding the effects in the system and how they will interact. When you are trying to program effects to get a certain sound, it is the right way to think about things. But this is a lousy diagram for understanding signal flow from the standpoint of integrating your G-System, guitar, and amp. In some respects it shows too much detail, and in others it is missing some critical information. In short – it simply shows the wrong information for setting up the G.

Here is a good start at breaking the G down into manageable pieces. It needs information added, as we will see in a minute. But for integrating with your amp, this is the way you need to start thinking about the G-System:



You will note the following. First, there are two digital sections, one for pre-gain digital effects and one for post-gain digital effects. All of the other pieces are analog. The pedal loops are analog. The insert loop is analog. There are no digital-to-analog or analog-to-digital conversions in these areas – period. This also explains why the pedal loop routing is so inflexible. It is wired, not programmed on a DSP. Hence, it is a lot harder to change the order of these components.

If the G lived entirely in the digital domain all the time, and did DA-AD conversions every time something went off-board, then it would be easy to change the order here – but that's not how the G works. The loops are analog, true-bypass, physically-switched, wired (Ok – Printed-Circuit-Board-traced) loops.

This also means that, if you have a pedal in a loop and you don't like the sound, it is not because of the (non-existent) digital conversion on the loops. Blaming loop-related issues on loop DA in the G is a bit akin to blaming the crackers in your bed on the (also non-existent) trolls that live under it. A pedal may sound bad in a loop on the G for one of a small number of legitimate reasons:

1) The signal coming from a preceding section (an earlier pedal or the first Digital FX Section) is feeding the pedal a signal that the pedal does not like very much.
2) The analog interface between the pedal and the G has a problem – probably signal-level, RF, or impedance related. (More on this later)

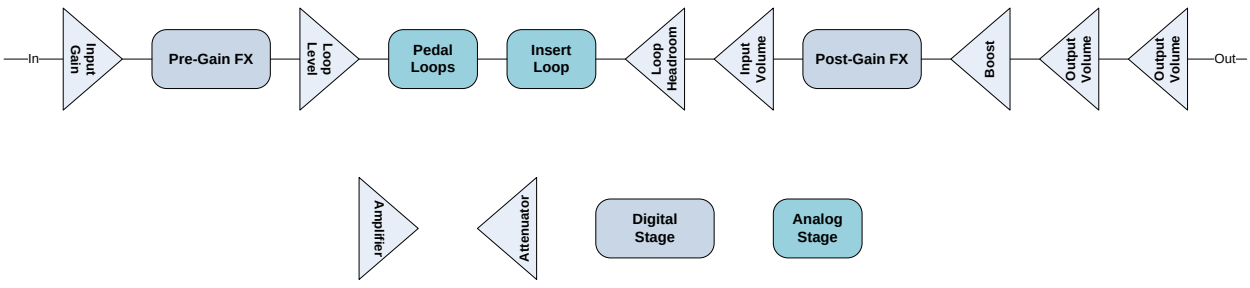
The other thing to note is that, in "four-cable" configuration as recommended in the manual, the "Insert Loop" effectively becomes the preamp section of your amp. This means that Digital FX Section 1 and the pedal loops (Loops 1-4) are PRE-gain (between the guitar and the amp input) and the second digital FX section is POST-gain (probably in you amp's FX Loop). This is a great configuration since most (not all) people agree that compression, OD and Distortion boxes, and many vintage pedals sound best pre-gain, and modulation, delay, and reverb generally sound better post-gain.

SIGNAL LEVEL CONTROL POINTS IN THE G-SYSTEM

The problem with the both pictures above is what they do not show – the places where signal levels can be manipulated within the G-System. Understanding the following is vital to understanding the G.

1) Where signal levels can be controlled.
2) In what manner (amplification, attenuation) they can be controlled.

The following diagram expands the picture from the prior section to include critical control points on the G-System:



You'd probably be surprised to notice that there are only two spots on the G-System that have any kind of amplifier, just before and after the pre-gain FX. All the other signal level adjustments are about if and how much you attenuate the signal (make it quieter). They have no mechanism for amplifying the signal. This will become very important later.

THE BOOST CHIMERA

This diagram generates a lot of questions. The most common would be "hey – I thought the boost made things louder – but you have it as an attenuation stage and not an amplification stage." You're right, I do. The "boost" on the G is a "politician". You know politicians – when they are reducing a planned 25% increase in your taxes to a 20% increase – they call this a "Tax Cut". Never mind that your taxes are still going to go ***up*** by 20%. This is the inverse of what the boost on the G does. When you set the boost headroom on the G, it *attenuates* the signal by that amount. Then, when you hit the boost button to engage the boost, it gives what it took away back to you – and no more.

The G-System boost can be very useful for making it easy for you to make your playing louder and softer on a song – but it hardly qualifies as a "boost". And its location in the signal path means that engaging the boost will only make things sound "louder". It won't impact gain at all. The point? Firstly, the G-System boost is no replacement for a good boost pedal or a switchable boost feature on a good amp. Secondly, it has a detrimental effect on signal-to-noise ratio in the connection from the G-System to the power amp. Thirdly, it complicates configuring the G.

If you have a good boost pedal or boost mode on your amp, or a switchable secondary master volume, or pretty much anything along those lines, you probably don't need the G's boost at all. *And you certainly do not need it while configuring the G-System*. Turn off the boost and lock it off (more on that later) while you do configuration and set signal levels. You can turn it back on later if you want to.

SIGNAL-TO-NOISE PRINCIPALS

The other issue is signal-to-noise ratio. When you have a very quiet signal, it does not take much noise to make it sound – well – noisy. If you have a nice loud signal a little noise gets washed out. This is why audio equipment specs always talk about signal-to-noise ratio. The higher the signal is relative to the noise, the better things will sound. You can certainly raise your signal-to-noise (s/n) ratio by keeping noise down to a minimum – and you should. (We'll talk about ways to do that later). But remember grade-school arithmetic. There are *two* ways to increase the value of a fraction (a ratio). The first is to reduce the size of the denominator – and that is what you are doing when you keep noise under control. The second is to increase

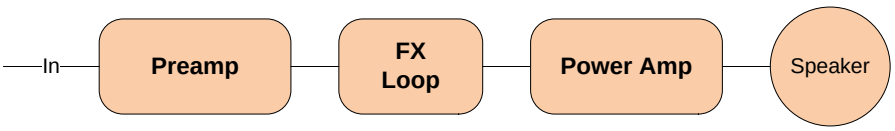
the size of the numerator. This means keeping your actual signal levels as high as you can (without clipping – which adds really ugly noise). Freely-translated, in most installations you should be able to set the input volume and output volume to 0db – their loudest setting (representing "no attenuation"). You can then use a volume pedal to control these for swells and such later on. This is a general principal, and we will break it under certain circumstances…but keeping the G's attenuation levels at or near 0db will maximize s/n ratio. Coupled with a disabled boost, minimized loop headroom, and properly-set input gain, you can get a very high s/n ratio out of the G-System.

A CONFIGURATION-ORIENTED REDUCTIONIST VIEW OF YOUR AMP

The relationship between the G-System and your amplifier is very important and, generally, very complex. It is a bit like a marriage. Some amps work very well with the G-System right off the bat and never have a problem. Some combinations need help in the form of buffers, line isolators, level shifters, balanced cables, and other auxiliary items. You have the role of family counselor. For you to know what help is needed, you need to understand both parties in the relationship. The G-System is one party. Your amp is the other party – and it is sometimes just as much to blame (or more so) for problems as the G-System is.

KEY COMPONENTS OF YOUR AMP

Whether you have a combo amplifier, an amp head, or a rack system, the fundamental components are exactly the same. One thing that can differ significantly from model-to-model is the FX loop topology. The FX loop topology of an amp is very important to the integration of the G-System, so we will make the loop an explicit component of the configuration. This is reflected in the diagram below.



The preamp is often actually several preamps in a switchable configuration. It is responsible for much of the tone and character of an amp. It is here that most (but not quite all) of the amp's effects on tone are generated. The power amp is responsible for taking the signal from the preamp and boosting/transforming it to a level suitable to drive the speaker, which of course produces the sound. On fundamental level, the FX loop simply gives us a way to put things between the preamp and the power amp.

In a "combo amp", all 4 of these components are housed in a single enclosure. In a "head", the first three components are in the head and the speaker is in its own cabinet, connected by a speaker cable. In a rack setup, the FX loop is "virtual" and the preamp and power amp are

physically separate, as is the speaker. The only salient difference between these topologies is that in a rack system, the existence of two grounded components and external cables connecting them dramatically increases the probability of different types of Radio Frequency Interference (RFI). Introduction of any complex multi-FX unit in the loop of the amp also increases the probability of RFI, so once the G is added, there really is no difference between these topologies for our purposes – so we won't address it again – except on one more topic.

FX LOOPS AND THE G-SYSTEM

RACK SYSTEMS AND FX LOOPS

You may have a rack-based system where the components really are physically separate. That is fine. From our standpoint, however, a rack system is identical to a head, except that the external connection between the preamp and the power amp, which is a cable and can therefore be interrupted, is effectively the same as a serial loop.

Some rack preamps also include an FX loop. The functions of such a loop vary a bit – but most preamps that have a loop have one to enable parallel loop topology – which we will discuss shortly. As you will soon see, from the standpoint of integrating with the G-System, a serial loop is vital to getting good sound – so we will ignore the built-in loop of a preamp for our purposes. There are some occasions (studio applications, front-of-house/back-of-house splits) that might give you reason to use one – but these occasions are rare. Go the TC Forums and ask around if this is how you want to use your preamp. This paper focuses on more common usage – and in most cases the built-in loop of a stand-alone preamp is useless or even detrimental. Believe it or not, one preamp manufacturer even comes out and says so. Check out this quote taken directly from Mesa's manual for their Recto Recording Amp:

"Though the Recto Pre s' EFFECTS LOOP is the best type for a guitar product to preserve the inherent attack characteristic and overall sound quality and no expense was spared in its development, our tests have resulted in some interesting findings. We have had the best sonic and tactile results by actually bypassing the EFFECTS LOOP altogether and patching outboard gear directly between the pre-amp and the power amp with short, good quality cables.

Though this may seem in many ways contradictory to the very concept of - and reason behind - a parallel effects loop...in repeated test situations we found the sound to be more three dimensional and full of punch, body and life than that of the same processing used in the EFFECTS LOOP with equivalent cable lengths. Theoretically (and electronically) this does not make good sense - and in fact should actually cause greater degradation of tone due to the more sensitive impedances present at the MAIN outputs. Nonetheless, being the tone-first-theory-later design team we have come to be, this patching scheme has worked much to our favor. We have long felt this to be true and in fact included this tip in some of our other products' owner's manuals. To verify our findings we recently took a census of TriAxis (Programmable Pre-amp) users among our phone-in customers and touring artists and found that most used their processing between pre-amp and power amp, saving their effects loops for more specific switchable applications. When asked why, in almost every case they said they liked the sound better between the pre-amp and the power amp. So try both ways for your specific application and choose the

one that fits your ears and patching requirements best. There is no right or wrong way to interface processing to your Recto Pre so experiment at will."

[Ed. The Mesa folks demonstrate here, in spades, just how good a group of engineers they really are. Any time you swallow your pride and advise folks to not use a feature that you worked hard to put into a product - because you've decided that there is a better way – is the apex of engineering credibility. And they did not *hide* this advice in a search feature of an FAQ section either – they plunked it right into the relevant section of their manual so any intelligent person who buys, or even investigates their product will see the advice. That's excellent, proactive customer service.]

WHY PARALLEL LOOPS AND DIGITAL FX GENERALLY DO NOT MIX WELL

The one aspect of amp topology that is very important is that there are a couple of different types of FX loops – serial and parallel. A serial loop completely interrupts the signal from the preamp to the power amp. All of the signals passing into the power amp come directly from the FX – none come directly from the preamp.

In a parallel loop, there are two paths from the preamp to the power amp, one directly connecting the two components (the "dry" signal) and one that passes through the FX (the "wet" signal). There is usually a way to blend the wet and dry signals to taste before sending them to the power amp.

Parallel loops are great for certain applications. By letting some of the preamp tone pass directly through to the power amp, more of the character of the amp and guitar can be preserved in cases where the wet side is damaging or masking that tone for some reason. This can be true if the wet side of the loop itself is poorly-designed (more on this later). This is especially true when using vintage pedals originally designed for "before the input" applications in a loop. Such pedals color the sound that passes through them substantially, and can sound awful in an FX loop. By mixing the output of these pedals with a dry signal, you can get the effect you want without the tone-coloration side-effects by restoring the original preamp tone with the dry mix. But such a loop can only work well under the assumption that the wet and dry signals are perfectly in-phase, and thus mixing them will not produce any odd artifacts. It also is only worth the trouble if there are tone coloration issues with your FX. Digital FX usually break ***both*** of these assumptions.

Unfortunately, putting digital FX on the wet side of a parallel loop makes for some ugly problems. If you have ever heard a vintage guitar nut complain that this-or-that digital delay sounds "too hi-fi", it is probably because he or she expected it to have the same tone-color issues as a vintage delay pedal and put it in a parallel loop to compensate. This is not terribly competent electronics, but guitarists are not engineers so it is a very understandable mistake. They use a parallel loop to make the over-all sound more hi-fi, but the digital delay most likely already ***is*** hi-fi – so why bother with the parallel loop? In fact – as you will see – using the parallel loop makes things a ton worse.

The other, much bigger problem is that digital FX necessarily delay the signal passing through them. You will not hear this delay directly. It is only on the order of a few milliseconds and the human brain is outstanding and realigning slightly-mismatched temporal stimuli. (In fact, we would not even be able to distinguish between different timbres were this not the case.) If there is a bit of delay between when you pick the strings and when you hear the results, you won't notice. Your brain corrects the issue without you even noticing. Ok – so what's the problem then?

The problem comes when mixing that ever-so-slightly delayed signal with a signal that was not delayed – like the dry signal in a parallel loop. In this case the peaks and troughs of the waves don't line up exactly. If your digital FX introduce a miniscule 20ms (20 one-thousandths of a second) of delay, then it will arrive at the power amp 20ms later than the dry signal. This is a sonic nightmare. When the signals are re-summed, you get all kinds of artifacts including phase-shifter-like effects and even frequencies that were not present in the original signal (aliasing). It all adds up to lousy tone.

If 20ms sounds like a discrepancy too miniscule to hear, please note that recording engineers spend hours realigning signals that are out of phase by only a millisecond or two. A single millisecond of phase delay produces artifacts that are at fairly high pitches, but well within the human hearing range. These artifacts can completely suck the high-order harmonics out of your guitar tone – making it flat and lifeless. I record a lot of acoustic guitar with one mic about 2'3" farther from the guitar than the other. The net is that signals arrive at the second mic almost exactly 2ms after they arrive at the closest mic. If I don't realign the signals (by deleting the first 2ms of the track for the farther mic) my recording sounds ok, but it loses a lot of life. And that's 2ms, not 20ms.

There are fancy ways for digital FX to compensate for this problem. Since they are handed the dry signal to begin with, they can add its inverse when the signal leaves the FX (with a little time shift) and this will effectively cancel the dry signal when the wet and dry signals are summed. (Wet minus dry plus dry equals wet only, just like 2-1+1=2.) This is sometimes called a "kill dry" feature and it is pretty neat (although I have oversimplified it a little bit). But the G-system does not have this feature and it is a hacked compensation for a loop topology that should not be used with digital anyway.

The net is that the G-System only works well in serial loops. In some parallel loops, where the mix can truly be set to 100% wet (making the parallel loop "effectively serial"), things will work fine. But on many amplifiers, there is substantial "leakage" of the dry signal to the power amp even when the mix is set to "100% Wet". If this is the case with your amp, then your amp and the G-System are a bad match. You can modify your amp – or you can go to vintage pedals or a digital unit that has a kill-dry feature – or you can compromise and live with the side-effects. Those are your only choices.

It may come as a surprise to you that even some "serial" loop designs have small levels of signal bleed that are high enough to cause audible sonic artifacts. Similar sonic artifacts can result from other issues as well. Here is a thought: If you hook up your G to your amp straight away and experience these sonic artifacts, how do you know what component is causing the problem? You don't – and please do not pretend that you do.

You may be tempted to say "well, the artifacts were not there before I hooked up the G-System and the artifacts are there now – so it must be the G-System." Not true. Was there anything digital in your loop prior to hooking up the G-System? If not, there is near-zero probability that signal leakage inside the amp across the loop would have caused any audible artifacts. If you had nothing in the loop prior to that – then guess what: there is ZERO probability that signal leakage across the loop would have caused any sonic artifacts. If you had a digital device with a kill-dry feature you would not have heard any issue. You see the point: the fact that adding the G-System to your system exhibited a problem tells you very little about *where* the problem originates. How about this: We'll test just how "serial" your loop is without involving the G-System at all. If your amp fails this test – it is a problem with your amp – not with the unconnected-and-therefore-irrelevant G-System.

HOW TO: TEST YOUR AMP'S LOOP

Grab a muting guitar tuner pedal. Be sure that it really mutes. If you don't have one, borrow one from a friend. These things are far too common for you to need to purchase one special just for this test.

1) Set the amp up the way you like to use it with just the amp and your guitar. Get a nice, high-gain sound going.
2) Put the amp on standby
3) Use a short patch cable to connect the amp's insert send to the input on the tuner pedal
    a. Note: if your amp has two loops, serial and parallel, use the serial loop
4) Use another short patch cable to connect the output of the tuner pedal to the amp's insert return.
5) If you have a multi-mode loop on your amp, put it in "serial mode"
6) If you have a parallel loop on your amp, set it to 100% wet.
7) Take the amp off standby
8) Play with the tuner *unmuted* and adjust levels so they sound right.
9) Turn the amp main volume up fairly loud (normal playing level is fine). Don't kill your ears or infuriate your family/neighbors/etc.
10) Now mute the tuner and play. Is anything coming from your speaker? Even faintly?

If so – think about this: How could there be? It is 100% wet or serial right? The tuner has already been shown to fully mute, right? So the signal can't be coming from the insert return,

right? So….it HAS to be coming from inside the amp somewhere. Congratulations, your amp has a faulty loop design or a manufacturing defect that permits some preamp signal to leak across to the power amp even when the loop is serial or 100% wet. You don't have a fully-serial loop – even if the amp manual says it is serial. You can work with the manufacturer to deal with it, or get a good amp tech to make the necessary repairs/mods, or you can live with the artifacts if they are not too bad for you, or you can replace the amp, or you can dump the G-System. But don't blame the G-System.

LOOP IMPEDANCE AND THE G-SYSTEM

Another aspect of FX loop design that can have a major impact on effects performance is impedance. We tend to think of the output of one device producing the same signal no matter what is plugged into it. We think of the signal cascading from the beginning of the signal chain to the end, with the downstream components having no impact on what the upstream components do. This is not true for electronics.

It is a little counter-intuitive, but the behavior of the input circuit at one end of an audio connection *actually alters* what comes out of output circuit at the other end. This is the result of circuit loading on the pickup (and the rest of the guitar electronics) imposed by the relationship between the output impedance of the "sending" circuit and the input impedance of the "receiving" circuit. This relationship is frequency-dependant, and the impedance tends to become a real issue at higher frequencies. This is why we hear a lot of high-frequency roll-off and signal "flattening" when there is a bad impedance match between output and input.

While this is a gross oversimplification, you can think of impedance for an amp's FX loop in simple terms. The output impedance of the FX loop send should be much lower than the input impedance of the device receiving the signal. By "much lower" I mean 25-100 ***times*** lower. If the difference in the impedances is not this great (or larger), there will be significant sonic artifacts. Frequency response will disintegrate with high frequencies rolling off audibly and low frequencies will lose their "punch". A typical guitar amp, for example, will have a 1000K-Ohm (1 MegaOhm) input impedance so it can handle the 10K-15K output impedance on a typical guitar pickup without significantly attenuating any audible frequencies. The input on the G-System also has 1-MegaOhm impedance – so you can rest assured that the G-System input is not loading your pickups (although your cable might do so…).

The problem is that with many guitar amp designs, loops were an after-thought by the designers. (In some cases, it would be a stretch to even give these designers credit for "thinking" at all, a situation that makes even the word "afterthought" absurdly comical.) To be fair, early designers did not know better, and had to learn that some common loop designs are just plain lousy. But we've had years for folks to learn these lessons now – and there are still amp designers out there putting the same old loops in their otherwise-thoroughly-modern amp designs. If you can put 3-4 channels of MIDI-switched preamp and maybe dual master volumes

in your amp, you should be able to include a competent loop. Some amp designers and companies do exactly this. But some surprisingly-popular amp makers do not.

Early loops were simple. They were literally "mods" to existing amps that did not have loops. The wire leading from the tone stack or coupling capacitor of the last preamp stage to the power amp was cut. Each segment was routed to a 1/4" jack. The "send" jack was the other end of the wire coming from the preamp. The "return" jack was on the wire leading to the power amp. Easy, right?

The problem is that this kind of loop sounds awful with all but the most specialized FX pedals. The output impedance of the send is very high since it is tied to the output side of a tone stack or plate (anode) coupling capacitor, or "cap" (or worse, off a tone stack that itself comes off a plate coupling cap rather than a cathode-follower). This high output impedance means that the input impedance on a connected FX unit has to be very high. Most FX systems, including most vintage pedals, just don't have so high an input impedance. Hence, when used, these loops result in substantial tone loss with all but a few pedals. This, by the way, is another reason that parallel loops were created. These guys never thought to bring the output impedance of the FX send down to remove the coloration from the serial loop that they had. Instead they "fixed" the problem by creating a parallel loop that would let some of the preamp signal bypass their sorry loop design.

The pedal loop returns on the G-System are 91k-ohm - high, but not that high. The insert loop return on the G-System is 47k-ohms. This barely qualifies as high – and it means that if the output impedance of your send is not "low" (2k-ohm at absolute max, 600-ohm or less optimal) you are not going to be happy. This also explains one of the reasons people hear tone loss with the G-system wired in 4-cable configuration, but not so much (or even at all) when the G-system is completely contained within the amps FX loop. The 1 MegaOhm input impedance on the G-System instrument input allows for much higher output impedance on the amp FX send without degrading frequency response.

Fortunately, if your amp has a high-enough output impedance that you can hear it, there are off-the-shelf circuits called "buffers" that will mitigate this issue. They let you put into your amp's FX loop what should have been put there by the loop designer.

LOOP SIGNAL LEVELS AND THE G-SYSTEM

Another common issue with amp FX loops is the signal level. Guitar equipment typically operates at one of two different signal levels – "instrument" level and "line" level. Instrument level is about -10db, or about 320 millivolts, or 0.32 volts nominal voltage. Line level is about +4db or about 1.2 volts nominal voltage. The G-System works fine with both of these signal levels (more on this later) – but the assumption is that an amp FX loop will operate at or between these two levels.

As it turns out, many amps have FX sends that are way hotter than nominal line-level. These sends can be anywhere from 1.5-3.0 volts – far in excess of what the G-System insert return can handle. Often, these sends have to be attenuated significantly in order to keep the G-System from clipping. But sometimes attenuation alone comes with its own set of problems – not the least of which is the lost signal going back into the return. Remember that the G has no way to re-amplify the signal it gets from the Insert Return. If we attenuate the signal coming into the G so that it is 1volt or less, it works great with the G, and then goes out of the G at 1volt or less.

But remember, the amp's FX send was hotter than this. This means that the amp's FX return is probably built under the assumption that the signal coming in is about the same level as the send. If we attenuate the signal coming from the amp's FX send, we need to restore the signal to about its original levels before it goes into the amp's FX return. Otherwise, we will hear a significant drop in over-all system volume and, in many cases, experience a significant loss of tone in the process. We lose the tone because the components in the power amp stage are no longer being driven as hard, and so they behave differently.

For example, phase-inverter (part of many power amp stages) distortion is a significant part of some people's sound. You need a strong signal to drive a phase inverter to distort. If you weaken the signal coming into the phase inverter, guess what happens to your phase inverter distortion: It is reduced or even nearly-eliminated, and you lose the tone you love.

Fortunately, relatively-inexpensive solutions exist for this problem. EbTech has a 2-channel, passive, bi-directional product called the "Line Level Shifter." This little $70(US) unit can be used to BOTH knock the FX-send of an amp down before entering the insert return on the G-System and raise the voltage that comes out of the G-System back up to "hotter" levels before returning the signal to the amp's FX return. It does this using transformers in a totally-passive (no power necessary) box. If you have a hot loop that has limited-to-no signal adjustments built-into the amp, using this box or something similar is likely to help. Also, a high-quality clean boost placed after the G-System output can be used to provide even more gain make-up if you need it.

SUMMARY ON AMP FX LOOPS AND THE G-SYSTEM

Well-designed modern loops have constructs to deal with all of the aforementioned issues. They have adjustable send levels, -10/+4db switches, and even a "gain makeup" stage right after the FX return so you can really tune the signal levels in the loop without damaging your sound. They also tend to be buffered (as described in the prior section), so impedance mismatches and the consequential signal degradations are not an issue. Many of these loops are serial, or can be switched between parallel and true serial operation. Such loops work extremely well with the G-System. Examples include the loop on the VHT series of amplifiers and the Switchblade series from Hughes and Kettner, and nearly any rack-based or pedal-based preamp.

If your amp's FX loop is not like this: If it has a very high, out-of-norm signal level or if it has a high-impedance send you are probably going to need additional hardware to make the G-System and your amp get along well. If your amp has only a parallel-only loop that has dry signal leakage when set to 100% wet, then you are going to have to either modify the amp loop so that it is true serial, live with the sonic artifacts, or find a solution other than the G-System.

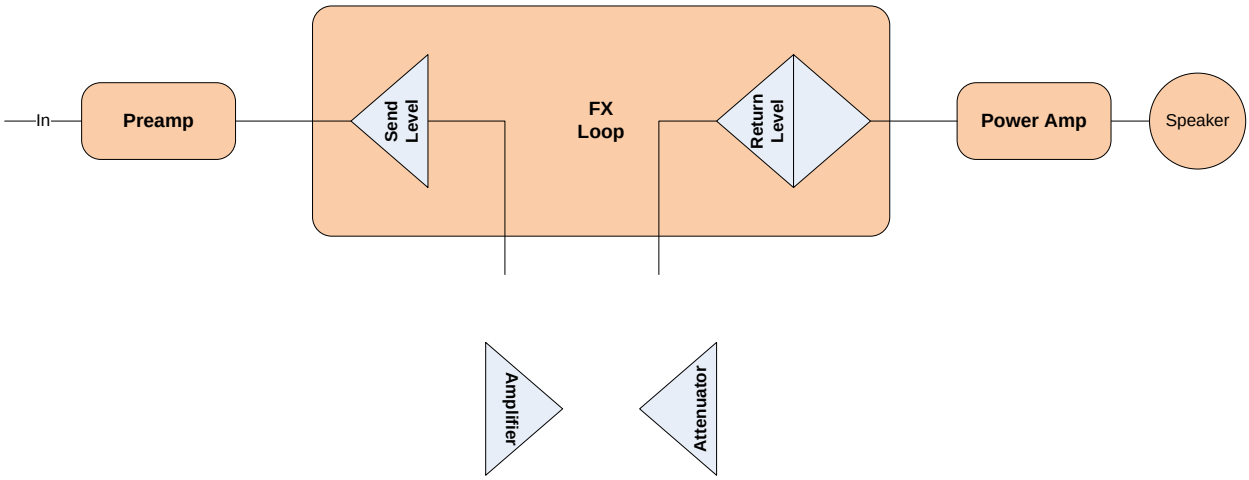
KEY SIGNAL-LEVEL CONTROL POINTS IN YOUR AMP

Most of the gain-level and volume controls on your amp are about two things: controlling the gain-level in the preamp and controlling the overall volume of the power amp. The latter has little-to-no relation to configuring the amp and G-system – so we will ignore it. Further, the gain settings in the individual channels do have some impact on G-System configuration since they can impact the send level of the loop. The preamp gain controls, however, are mostly about tone production and not so much about overall volume – so we will mostly ignore those too.

Many amps have "channel master" volume controls that are used to help make the volume levels comparable between two or more preamp channels so you can voice the preamp the way you want and then control the overall preamp volume so one channel is not way louder than another. In an amp with a send-level control, the channel volume is not all that important and can be ignored. In an amp without a send-level control, the channel volume can be used, to some degree, to control the FX send level. For our purposes, we can "pretend" that a channel master is an FX send in cases where an amp has no additional FX send control.

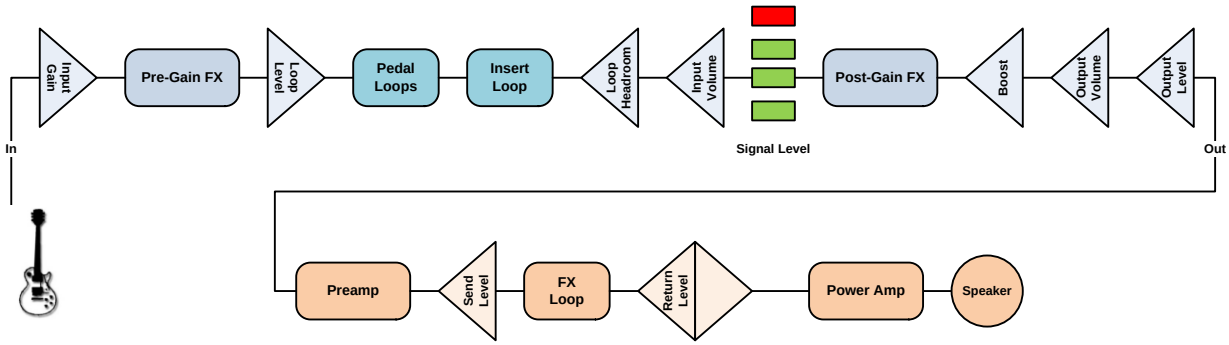
Finally, a +4/-10 switch is really just a fixed-level form of send and/or return level control – so we can safely ignore this too.

Given these simplifications, the over-all topology of the amp looks (approximately) like this:



CONFIGURATION OPTIONS, OR "HOW MANY CABLES?"

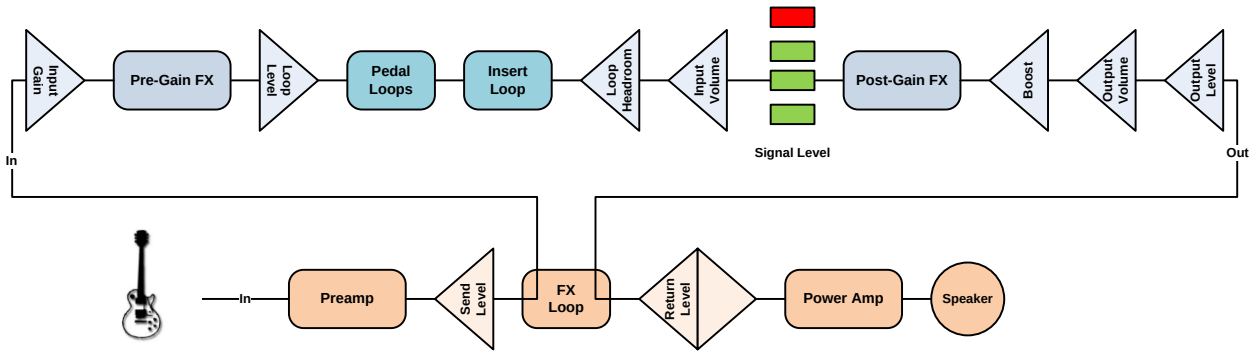
PUTTING THE WHOLE G-SYSTEM BEFORE THE AMP: 2-CABLE CONFIGURATION



As you can see in the diagram above, the G-System can be placed between the guitar and amp such that all of the G-System features (loops, FX) are places before the amp input. If you have an old combo amp or head that does not have a loop, this is your only option.

The key issue with this setup is that it puts FX that are designed to be post-gain before the preamp. This can result in some very odd time-based sonic artifacts, including unintended phase issues and unintended tremolo. If you want more info on why this is, go read on-line at www.amptone.com about effects order.

PUTTING THE WHOLE G-SYSTEM IN THE AMP'S FX LOOP: 3-CABLE CONFIGURATION



In this configuration, all of the G-System features are completely contained in the amp's FX loop. This configuration has the advantage of simplicity. In some cases, if your amp's loop is high impedance or has signal-level issues, then using this configuration may help, since the G-System Input handles such oddities more gracefully than its insert return. While this setup may help with these particular loop-related issues, it will not help a parallel loop. In fact, it will make things much worse, since the delay introduced by the G-System front end will be added to the

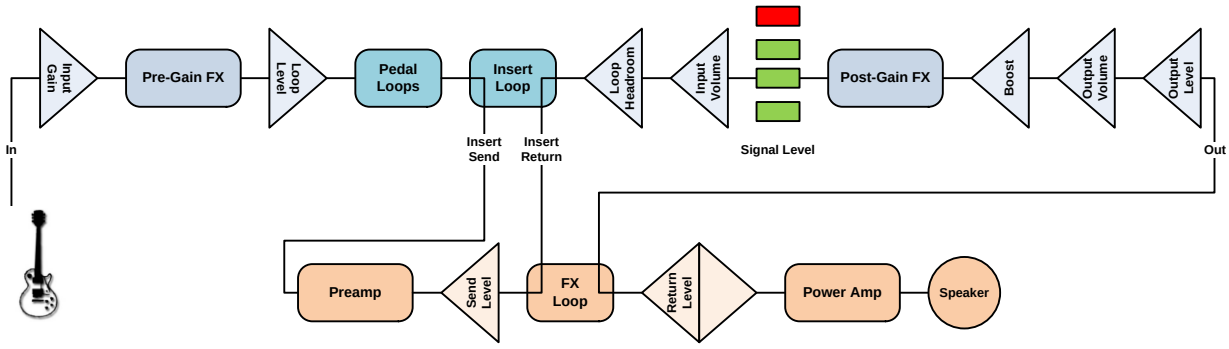
delay introduced by the back end in the loop – taking what might have been a subtle-but-acceptable set of artifacts and making them unbearable.

The problem with this setup is that FX that most people agree sound better pre-gain come after the preamp. It also puts the pedal loops inside the amp FX loop, so pedals (which are usually pre-gain optimized) become post-gain as well – with consequential impacts on sound quality.

That said – you may well prefer hooking up the G-System this way under the following circumstances:

1) As stated – if you have signal-level or impedance issues in your loop and you don't want to use supplementary hardware to mitigate the issue.
2) If you plan on running pedals that are optimized for post-gain usage anyway and would like the G-system to control those pedals.
3) If you don't plan on using the FX in the first DSP block much or at all.

SPLITTING THE G IN HALF: THE "FOUR-CABLE" METHOD



In most cases, this is the optimal way to hook up the G-System to your amp. This is what the G-System engineers really intended. In this configuration, pre-gain FX and the pedal loops come before the preamp, post-gain FX and pedals go in the loop. Component locations are "optimized" according to what most people see as the best way to connect amp and FX.

Having said this – this is not the "right" way (or the "wrong" way) to hook up. The "right" way is the way that results in sound and function that *you* and your listeners like.

CONFIGURING THE G-SYSTEM SIGNAL PATH

Configuring the G-System that is either completely contained in an amp's FX loop, or entirely kept before the amplifier input is pretty trivial. You can simply adjust the input gain and output levels to taste and go with the factory defaults for almost everything else. But this can result in timbre ("tone") quality issues as described in the previous section. For optimal timbre from your system, you generally need to use the 4-cable hookup method, since this positions both G-System internal FX and pedals in their "optimal" locations before or after the amp's preamp.

Unfortunately, this configuration non-trivial for several reasons:

1. The number of connections between the amp and the G-System increases. This proportionally increases the probability of RFI causing sound-quality issues in your rig. Such issues may require hardware mitigation (use of balanced cables, incorporation of ground isolation devices, etc.)
2. The G-System becomes much more sensitive to properties of the amp's FX loop implementation (impedance and signal level specifically). These issues may also require mitigation, in the form of signal level shifters and buffers.
3. The G-System levels/signal path require more tuning to minimize noise and maximize signal levels.

The direct consequence of these complications is that setting up the G-System in 4-cable configuration can be terribly frustrating. Most users simply hook up the G-System as described in the manual and start using it. When they encounter problems, they generally get frustrated. The smart ones go on-line and get help. The rest either figure it out, or replace the unit with something else.

Fortunately, you only need to get through this process once or perhaps twice (for two amps). Once you have things working well, they stay working well and you can focus the fun part – programming FX and playing your instrument. The following process will help you to get through the configuration of the G-System in such a way that you can set configuration parameters intelligently and so that you can isolate and diagnose problems more easily.

BEFORE YOU CONNECT THE G-SYSTEM TO YOUR AMP

There are some common critical success factors that have dominated discussion of configuring the G-System. You should start with these:

1) A serial FX loop, or a parallel FX loop that truly goes to 100% wet. This is easy to test, as you will see below. If your loop has any dry signal bleed-through you will encounter some level of signal degradation and you will have to decide whether to live with it (some can and do) or have a tech modify the amp's loop.
2) High quality, well shielded, low-impedance cables for all connections between the G-System and the amp. Cable quality is very important, and the cheap bulk cables from your local music store will not cut it. That said – you don't necessarily need Mogami or George-L's either. There are good, less expensive solutions out there.
3) A *balanced* cable for use between the G-system insert send and the amp input, as well as one between the amp send and the insert return. Even though your amp input and send are not balanced (unless it is a very unusual amp), the G-System does some "fancy" things when you use balanced cables in these locations. It is not like other devices in this regard. Many G-System users have noticed a significant improvement in signal quality when they switched to balanced cables at these locations. The G-System manual is explicit about this. Here is a quote from page 20 of the release 2.04 manual:

   > ***Insert***
   >
   > *This loop is intended for a pre-amp. If cables longer than 3 feet are used, they should be balanced, even if the connectors on the pre-amp are unbalanced. When balanced cables are used, a special pseudo balanced circuit will reduce the noise which would occur when using unbalanced cables.*

   You will also note that many users have experienced significant signal improvements when the lead from the insert send to the amp input is balanced, even when the cable length is less than three feet. Further, the G-system outputs are also balanced – so if you use a balanced cable here then you are one small step from having a true balanced connection if you end up needing it. (More on how to determine this later)

I recommend that you do yourself a favor and grab a small TRS-TRS recording snake and use it for hooking the G-System to your amp. You won't regret it. All of your leads from the floor to the back line will be bundled neatly, managed easily, and can be balanced if need be. As you will see in the section on switching – if you are using the G's relay switching capabilities to switch amp channels and features, then one or two of the snake's leads can be dedicated to those functions also. That has you using 5-6 leads on an 8-channel snake, with 2-3 left over for other gear or for spares if a lead gets cut or something happens to a plug. Such a snake will cost much less than the sum of the individual cables you would need otherwise.

PREPARING YOUR G-SYSTEM FOR CONFIGURATION

Before trying to configure any complex system, it is best to put it in a "known" state. G-System comes from the factory configured for 2-cable or 3-cable usage. If you have been trying to do things yourself, you may have things in a really odd state. This section will walk you through preparing your G-System for configuration in a 4-cable configuration.

Go ahead and plug the G-System into the wall – but do not make any connections between the amp and the G-System. In fact, don't connect the G-System to anything.

- No Guitar
- No Pedals
- No Amp
- No Amp Switching
- No MIDI
- *Nothing but power*

HOW TO: TURN OFF THE BOOST

The boost in the G-System is a little odd, as stated earlier. It can be useful – but it can actually confuses matters if it is enabled during configuration. It is best to "turn it off" while configuring. To do so, do the following:

1) Navigate to the Utility Menu
    a. Press the Edit Button
    b. Press the Menu Button
    c. Rotate the Loop3/Parameter "A" button/knob until the display says "Utility"
    d. Press Enter|Return (from now on – just "Enter")
    e. Note: from here on out we will shorthand this type of sequence as "Edit>Menu>[Utility]>Enter"
2) [Boost Lock] = ***OFF***
3) [Boost Max] = ***0db***
4) Press Edit
5) Press the Boost button 2-3 times until the light around the button is off (Boost *OFF*).
6) Edit>Menu>[Utility]>Enter>[Boost Lock] = ***ON***
7) Press Edit

We set the boost lock above – so the boost level for all patches will remain at 0db no matter what a patch we switch to says its boost level should be. There will be more on locks in the next section.

HOW TO: TURN ON THE INSERT LOOP

In 4-cable configuration, it is the G-System insert loop that transfers the signal between the G-System and the amplifier's preamp. By default, this loop is off, which causes a lot of confusion when people don't turn it on and then wonder why they get a weak, no-distortion signal from their high-gain amp. Well of course not. With the insert loop turned off, the gain on your high-gain amp is being bypassed.

Even more confusion is created since, by default, the insert loop is a patch parameter, so even if you turn it on, the next time you switch to a patch that has it off, it will turn off again. ALL of the factory patches have the insert loop off (they have to). So unless you do something about it, every time you switch to a factory patch you will bypass your preamp. Not good.

Fortunately, the G-System has several parameters with "locks". Locking a feature tells the G-System "hey dude, when I change patches I want you to leave this parameter where it is and ignore what the patch says about it." This is why we turned on the boost lock in the previous section. We want the G-System, while we are setting things up and testing, to ignore what any patch has to say about boost levels and status – so we lock the boost off. Similar reasoning applies to locking the insert on – which is arguably even more important. I can't tell you how many users I help out swear to me that their insert loop is on – only to find upon inspection that it is off.

The Insert Lock is vital to your sanity. Unless you sometimes want to bypass your preamp, you should set this lock on and keep it there permanently. If you intend to do something fancy and switch between amps later, ok. But set this lock on while doing configuration anyway. You can always unlock it later.

Turn on the Insert loop and lock it as follows:

1) Navigate to the Utility Menu (Edit>Menu>[Utility]>Enter)
2) [Insert Lock] = ***OFF***
3) Press Edit
4) Press Edit
5) [Loops]>Enter>[Insert] = ***ON***
6) Press Edit
7) Edit>Menu>[Utility]>Enter
8) [Insert Lock] = ***ON***
9) Press Edit

HOW TO: BYPASS ALL OF THE G-SYSTEM FX

While you are configuring the G-System, having any digital effects or pedals in the signal path can confuse issues substantially. It is best to bypass everything (except the insert loop, which we

locked above). The best way to do this is to select the "All Bypassed" patch on the G-System as follows:

1) Press the Bank UP button until the display reads "***B9***". (It will probably be flashing)
2) Press the Patch 5 button.
3) The display should read "B9-5 All-Bypassed" or something similar.

Just to repeat a point. Selecting the "All-Bypassed" patch does not bypass (turn off) the insert loop because earlier we locked the insert loop in the on state – and the lock says "ignore what the patch says." So the G-System will ignore the command from the All-Bypassed patch that tells the G to turn off the Insert loop. Do you see why understanding and using locks is so important?

HOW TO: SET INITIAL SIGNAL LEVELS

G-System level setting is extremely important. Improperly-set levels can result in bad clipping, lost gain and tone, and bad volume and/or noise levels. We will be progressively adjusting levels as we go through this process – but for the process to work, the G-System has to start in a known state. Set levels initially as follows:

1) Edit>Menu>[Levels]>Enter
2) [Input Gain] = ***12db***
3) [Loop Level] = ***0db***
4) [Loop Headroom] = ***2db***
5) [Volume] = ***0db***
6) [Volume Position] = ***Output***
7) [Output Level] = ***0db***
8) Press Enter

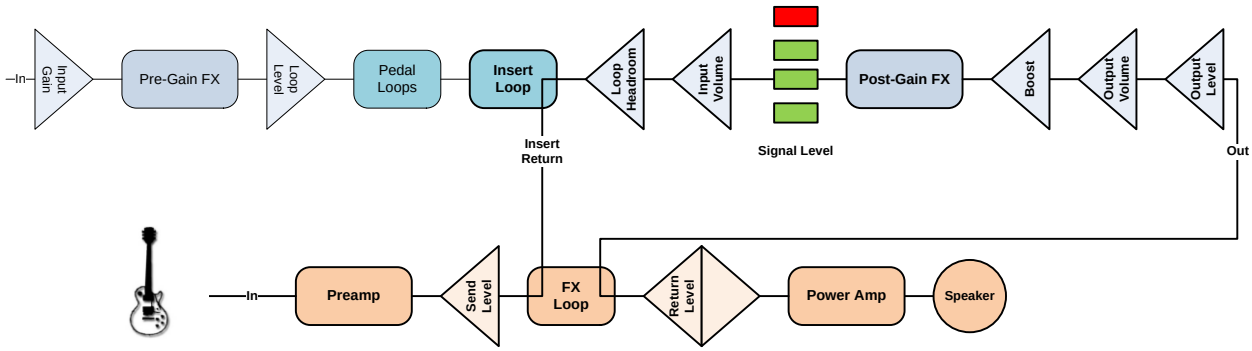
CONFIGURING THE G-SYSTEM "BACK END"

Because most of the problems that arise in configuring the G-System involve its integration point with the amplifier's FX loop, it is best to start here for configuration. We will bypass the front end of the G-System (the input, the first DSP block, and the pedal loops) and jack the guitar directly into the amplifier (wait on this though…please).

The goals for this section of the configuration task are as follows:

1) Adjust the amp's FX loop for optimal usage with the G-System
2) Adjust the G-System Loop Headroom for optimal usage with the amp.
3) Detect and correct any RFI/noise issues that are introduced by the corresponding connections.

WIRING



The diagram above shows the signal path of the G-System when we bypass the front end and put just the back end in the amp's FX loop. Notice that nothing from the G-System input to the insert send is in the signal path – so any issues we encounter in this configuration can't originate in these components. Also, if we are clever and patient about when we hook up the three cables involved, we can quickly isolate and (often) solve problems introduced at each connection point.

One way we can do this is to actually connect things "backwards" in the signal chain. For example, we will start by connecting the output of the G-System to the FX return on the amp. We will not get any guitar signal this way – but if there is a ground loop or RF noise on that connection, we should hear it right away and we can probably fix it.

HOW TO: PREPARE YOUR SYSTEM FOR HOOKUP

We need to get things ready first.

1) If you have not already done so, then run through the section above titled "Preparing Your G-System for Configuration" and make sure you have the G-System in a good starting state.
2) Plug in a guitar, power up your amp and put it on settings that you like to use. Set the volume pretty loud, but not deafening.
3) If your amp has a ***loop on/off switch***, turn the loop ***on***.
4) If your amp has a switch to ***serial/parallel switch***, set it to ***serial***.
5) If your amp has a ***+4/-10db switch***, set it to ***-10db***.
6) If your amp has only a ***parallel loop***, set it to ***100% wet***.
7) If your amp has a ***send level*** control, set it about ***half-way*** for now.
8) Put the amp on standby.
9) Unplug the guitar cable from the amp input.
10) Take the amp off standby and wait about 30 seconds.

11) Listen and make a mental note about the amount of sound coming out of your speaker now. Try to remember this noise level.
12) Put the amp back on standby.

HOW TO: CONNECT THE G-SYSTEM TO THE AMP'S FX LOOP

We're going to start by simply connecting the output of the G and see if there are any RF problems. You won't be getting any instrument signal, but if you hear a noticeable increase in hum or buzz, then there are RF issues that need to be mitigated before we continue. Do the following:

1) Connect a cable from the G-System *Left/Mono output to the FX loop return* on your amp.
    - Note: if you have both a serial and a parallel loop on the amp (some amps have two loops) then plug into the return for the serial loop.
2) Take the amp off standby and wait about 30 seconds.
3) Listen again.
    - Do you hear additional hum and buzz? If not, great – we can continue to the next connection.
    - If you do hear more hum and buzz than before, you probably have either a cabling issue or a ground loop. On this connection, the solution is the same either way – you will need to purchase an additional piece of hardware. The selection of which piece, however, is a partly a function of the next connections, so we have to wait to decide what to go get. For now – remember that the "Output Connection is Noisy" and we'll continue.
4) Put the amp back on standby.
5) Connect the G-System *Insert Return to the FX loop send* on your amp.
    - Note: if you have both a serial and a parallel loop on the amp (some amps have two loops) then plug into the send for the serial loop.
6) Take the amp off standby and wait about 30 seconds.
7) Listen again.
    - Does it sound about the same noise-wise as it did when you had just the output connected to the amp? Or do you hear additional hum and buzz? If not, great – we can continue to the next connection.
    - If you do hear more hum and buzz than before, you may or may not have a problem. Remember – you now have the preamp back in the signal chain. If it generates any noise, you will hear it now where you would not have heard it before. How does the noise level compare to when you listened during "Prepare Your System for Hookup?" If that is about the same, then you can continue on, as the new connection did not introduce any new noise – it only restored noise that was already present in the preamp.

- Otherwise - you probably have either a cabling issue or a ground loop. If you did not use a balanced cable on this connection, go get one and try it. If that quiets things down, you can continue.
- If you have a balanced cable on this connection and you still have hum, then you will need additional hardware. For now – remember that the "Insert Return connection" is noisy and continue onward.

8) Put the amp on standby.
9) Plug the guitar into the amp.
10) Take the amp off standby and wait about 30 seconds.
11) Don't play the guitar yet – just listen – with the volume all the way up on the guitar.
    - If you get additional hum or buzz at this point – it is your guitar or its cable. If the noise level is acceptable, then fine. If not, you can:
        i. Try another cable.
        ii. Move the guitar away from any florescent lights, or electronics – including the amp and especially computers of any kind.
        iii. Install a string ground.
        iv. Shield the pickup cavity of the guitar.
        v. Have the electronics in the guitar checked for faults – especially ground faults.
        vi. Get a guitar with humbucking pickups if you currently use single-coils.
        vii. Get a hum filter pedal for the guitar like the Morley HumDebugger.
        viii. Live with it and later use the noise gate on the G-System to take care of it.

HOW TO: SET AND DIAGNOSE THE LOOP LEVELS

We are now ready to check the loop level and attempt to adjust the levels to maximize signal-to-noise ratio (s/n ratio) and minimize clipping. We may discover while doing this that the loop on your amp is too "hot". If this turns out to be the case, we can deal with it.

Do the following:

1) Switch the amp to a clean channel.
2) Play your guitar and listen.
3) Is there any clipping – unwanted distortion that you can hear in the signal?
    a. If not, then you probably do not have any signal-level issues with your amp loop. Take note of this.
        i. If and you have an amp send control – then try turning the amp send up until you do get unwanted clipping.
            1. If you turn the amp send all the way up and you still don't clip – great!

2. If you reach a point where you can hear the clipping, back off about "1 hour" on the knob. (So if the knob is at 4:00 when the clipping starts, dial it back to about 2:00.)
3. As you adjust the loop send level, you may need to adjust the amp master volume to compensate.

ii. If you don't have an amp send control and if you think the signal is a little weak, try turning the channel volume on your clean channel up if you have one. Follow the same approximate procedure for this as you would for adjusting the send level.

b. If you do have clipping right off the bat, it is a little more complicated.

i. Try increasing the value of the G-System Loop Headroom

1. Edit>Menu>[Levels]>Enter>[Loop Headroom]
2. Adjust this until things sound ok – but don't go past about 8db.
    a. If you get to 8db and you can't get rid of the clipping, then you have a signal-level problem on your loop. Put the loop headroom value back at 2db and move on.
    b. If you manage to get rid of the clipping before you reach 8db, then keep that setting.
3. You may need to turn the return level or volume on your amp up as you increase the loop headroom.
4. Press Enter

ii. Try turning down the send level or channel master. Again, compensate for lost volume using the amp's volume control if you can. You can also try compensating by changing the +4db/-10db switch if you have one. Don't go too far with this. You'll hear when the tone quality suffers. Don't get that far. If you can't turn things down without ruining the quality of the sound, you have a signal-level issue with your loop and there are better ways to deal with it.

4) If you don't have signal-level issues so far, then continue here.
5) Change to your loudest amp channel.
6) Play loudly…do you hear any clipping?
    a. If so – adjust your loop headroom or the amp's send level as described above in step 3b. If you can't dial out the clipping without a loss of tone, then you have a signal-level issue in your amp.

HOW TO: SOLVE SIGNAL-LEVEL PROBLEMS IN YOUR LOOP

If you have signal-level issues with your loop, you will need to get a line-level shifter. EbTech makes a good 2-channel unit that is perfect for the job. Once hooked up, this unit will also

address RF noise issues if you have them. It will also help prevent RF noise problems as you move from environment to environment.

1) Acquire a 2-channel line-level shifter.
2) Put your amp on standby.
3) Connect the *amp's send to the channel 1 +4db jack on the line-level shifter* using a short, high-quality instrument cable or patch cable.
4) Connect the *line-level shifter's channel 1 -10db jack to the G-System insert return* using a balanced cable.
5) Connect the *G-System Output to the channel 2 -10db jack on the line-level shifter* using a balanced cable.
6) Connect the line-*level shifter's channel 2 +4db jack to the FX loop return on the amp* using a short, high-quality instrument cable or patch cable.
7) Take the amp off standby and **repeat** the level-setting procedure describe above.

HOW TO: SOLVE RF NOISE PROBLEMS IN YOUR LOOP

If you have no issues with loop signal level, but you had a noisy output or insert return connection, then you have an RF noise problem. In this case, you will not need a line-level shifter. Instead, you will need an isolation transformer that converts balanced and unbalanced signals. EbTech makes both 2-channel and 8-channel HumEliminators that serve the purpose. There are other vendors who make similar products.

If your output connection is noisy, do the following:

1) Put the amp on standby.
2) Connect the *G-System output to the input on one HumEliminator channel* using a balanced cable.
3) Connect the *HumEliminator output (same channel) to the FX Loop Return on the amp* using a short, high-quality instrument cable or patch cable.
4) Take the amp off standby.

If your insert send connection is noisy, do the following:

1) Put the amp on standby.
2) Connect the *Amp FX loop send to the input on one HumEliminator channel* using a short, high-quality instrument cable or patch cable.
3) Connect the *HumEliminator output (same channel) to the Insert Return on the G-System* using a balanced cable.
4) Take the amp off standby.

You should have a nice quiet rig now, with only guitar and preamp noise present. The RF hum and buzz introduced by either of these connections should be gone. There should be no noticeable change in volume or tone.

HOW TO: ADDRESS A SIGNIFICANT LOSS OF TIMBRE

In some cases, especially on hand-modified amps where loops were added outside of the factory, there may be impedance issues at the amp FX loop send. This will manifest itself as a noticeable loss in brightness or sparkle in the tone – even with the levels set fairly high.

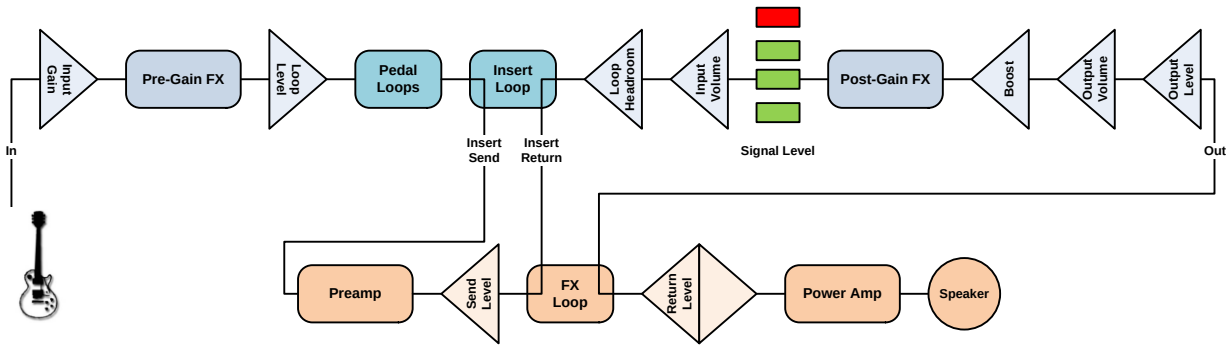
If this is happening to you, you probably have an impedance issue between the amp send and the G-System insert return. A good buffer or impedance-matching device will often solve this problem. The VHT Valvulator I and the Radial Dragster are examples of devices that may help resolve this issue. Try inserting one between the FX loop send of the amp and the insert return on the G-System.

CONFIGURING THE G-SYSTEM "FRONT END"

The front end of the G-System contains all of the pre-gain components, including the input, the first DSP block, and the pedal loops. Generally, the goal of configuring this section is to set things up so that the signal sent to the amp from the G-System is as similar as possible to the signal that would be sent to the amp directly from the guitar. Achieving an exact copy of the guitar's signal is a theoretical ideal that is not attainable with any piece of equipment except perhaps a bare cable or a true bypass pedal *when* it is bypassed. (When it is not bypassed, the pedal will be incapable of producing a perfect copy of the guitar signal too.) So we try to come as close as we can.

WIRING

The diagram below shows the signal flow of the G-System that we will use to set up the front end. This is actually the final wiring configuration for a four-cable hookup. The neat thing is that we "know" the amp's loop and G-System back end are working well together since we just get them working in the last section, so we can (should) leave those parts alone. Do not change the loop headroom, volume, volume position, output level, boost max, boost lock, or insert lock at ***any*** time during the remainder of the process. These will not help you – and changing them will only confuse things when you finally put everything together.



HOW TO: CONNECT THE G-SYSTEM FRONT END

This section describes a detailed process that can be used to connect and configure the front end of the G-System.

1) Put the amp on standby.
2) Select the "All-Bypassed" patch on your G-System
3) Bypass the FX loop of your amp.
    a. If you have a loop enable/bypass switch on your amp, you can put this switch in the bypass position.
    b. If you do not have a loop bypass switch, then remove the plugs from BOTH the FX loop send jack and the FX loop return jack on the amp. You can safely leave everything else plugged in as it was.
4) Unplug the guitar cable from the amp input jack.
5) Connect the *G-System Insert Send to the input on the amp* using a balanced cable.
6) Take the amp off standby and wait about 30 seconds.
7) Listen to the amp. Do you have an added hum or hiss?
    a. If not – then you should be fine without any additional hardware.
    b. If so, then you may have a ground loop here – which is surprisingly common. If you have an isolator with a channel free, then do the following steps. (Do not use a free channel on a signal shifter if you have one open).
        i. Put the amp on standby.
        ii. Connect the G-System insert send to the input jack of the free channel on the HumEliminator using a balanced cable.
        iii. Connect the corresponding *HumEliminator output jack to the input on the amp* using a short, high-quality instrument cable.
        iv. Take the amp off standby and listen. The additional hum should be mostly gone.
8) Connect the Guitar *output to the G-System input* with a high-quality instrument cable.
9) Put the amp on standby.

10) Remove the plug from the amp input and put it aside.
11) Plug the guitar directly into the amp input.
12) Take the amp off standby and wait about 30 seconds.
13) Switch the amp to a high-gain (distorted) channel.
14) Play the guitar and take note of the volume level (remember).
15) Put the amp on standby.
16) Plug the guitar into the G-System input.
17) Restore the plug you removed from the amp input in step 2.
18) Take the amp off standby and wait about 30 seconds.
19) Navigate to the input gain on the menu:
    a. Press Edit
    b. Turn the "Filter" knob, this will take you to the [Input Gain] Setting
20) Turn the [Input Gain] up and play until the volume and gain levels match what you heard in step vi. This will probably put you somewhere near 10db – 14db.