GEAR TALK

An introduction into guitar gear and usage (Version 1.5, Mar 2019)
by DutchGuitarist

Content

Introduction

This document contains my thoughts about guitar gear such as amplifiers, speaker cabinets and effects. This guide is not intended to be a complete tutorial on gear, I just want to provide some basic thoughts on building a guitar rig and especially how and what issues I encountered during this journey. Furthermore: I have no endorsement nor am I affiliated with any of the brands I mention in this document.

Surely there are other solutions out there and I do not claim to have all the right answers, but this worked for me and maybe it works for you to...

A final word: Watch out for the **Gear Acquisition Syndrome** (GAS). This has been defined by Wikipedia as the desire to expand your collection of gear (necessary or not)

Getting started: Terminology explained

I have noticed in talks with other musicians that there is some terminology confusion going on. So before we dive into the gear talk I guess it is beneficial to explain the meaning and differences of various terms used in this document ...and if you already know this.. just skip this chapter.

Vibrato versus Tremolo versus Univibe

Starting with the most known effects: **vibrato** and **tremolo** are two related yet difference things. Basically it is quite easy to remember the difference:

Vibrato is a change in pitch while **tremolo** stand for a change in volume. The **Univibe** gets a similar pitch shifting effect as the vibrato but it achieves it by altering the phase of the signal.

Curiously Fender incorrectly labelled the tremolo effect as vibrato on their amps.

Gain versus Volume

This may be a confusing topic but I'll try to make it easy to understand. I have seen guitarists that try to use the **gain** knob on their amp to make it louder. I have got news for you: it doesn't, is only raises the amount of distortion/overdrive. If you need to be louder you will have to use the **volume** control.

So **gain** knob sets the incoming signal and as such controls the overdrive/distortion of the amp circuit while the **volume** knob controls the output level of the amp.

NOTE: gain is also referred to as drive and volume is often referred to as master or level.

This rule works for amps and pedals with a volume and gain knob.

Latched versus Momentary versus Mesh footswitch

A **latched** footswitch is basically an on-off switch as where a **momentary** switch activates a device only as long as the switch is pressed. The momentary switches are also known as **non-latched** switches. The third mode, the **mesh** footswitch is basically a type of momentary switch where you can assign parameters to the switch that influence the (effect) behaviour. This technology is **pressure sensitive** so the harder you press, the more intense the behaviour will be.

Most effect pedal and amp switching footswitches are latched switches. However, especially in the effect pedal arena, there are some useful examples of momentary and mesh footswitches.

For example: The TC electronics shaker vibrato pedal can operate in momentary mode. That mean you can kick-in the vibrato effect at any time you press(and hold down) the footswitch. Other effect pedals with momentary footswitches include the Electro Harmonix Freeze Sound Retainer and the Digitech Ricochet (You can find video clips of these on Youtube). These type of pedals (sometimes) have a on/off toggleswitch that you can set to either momentary or latched mode.

In most cases, stepping on a switch engages (or disengages) the device. As far as I know TC Electronic is the only company that has some pedals with footswitches that (de)activates a device on **releasing** the switch. In this case you need to remove your foot after pressing the witch first before the switch reacts.

Analog versus Digital

There is no right answer as to what is better. Some people swear by **analog** devices for the warmth, while others favor the precision of **digital** devices. A digital device converts your guitar signal into zeros and ones, then processes this converted signal and finally converts is back to audio.

The quality of digital devices depends on the sampling rate. The higher the sampling rate, the higher the quality and the price of the device and you should be ware that high end digital devices are often more expensive and require more DC power to operate.

Last remark: Digital effects need to 'translate' the audio signal into a digital signal before processing and turn it back into an audio signal at the end. Now with a multi-effect unit this conversion is done once, with multiple single digital effects the conversion is done for every effect and as such tone quality may decrease.

Phaser versus Flanger versus Chorus

These three effect belong to the same family of modulation effects. However there are slight but distinguish differences:

- A **flanger** doubles the signal and delays one signal by around 20ms. This provides the swells and a certain emphasised and cut frequencies.
- A **phaser** doubles the signal and switches the phase of one signal. By moving the phase point you get swells and cancelled out frequencies over the zero point.
- A **chorus** also doubles the signal. With a chorus there is a longer delay than with a flanger. This gives a subtle effect, it adds a certain level of depth to the tone.

Reverb versus Echo versus Delay

Reverb, echo and reverb belong to the same group of effects. It refers to the effect of sound reflected off solid objects, such as walls or ceilings in a theatre. Here are some differences:

- **Reverb** is a blended repetition of a sound occurring within 30ms after the sound is made. This is the sound that immediately bounces off any nearby surfaces before it gets back to your ears.
- **Echo** is a distinct repetition of a sound occurring after 30 milliseconds. This is when you can unquestionably hear the repeat sound coming back to you.
- **Delay** is similar to echo and in effect units we tend to talk about delay rather than echo.

Reverb and delay are related. If you would be in a large room and make a sound such as a handclap the very first sound you hear reflected off the walls is an echo(delay) and the echo turns into reverb as the sound is reflected off a second, third, and fourth surface. With each repeat the sound alters and gets weaker.

Overdrive versus Distortion versus Fuzz versus Booster

Again, overdrive, distortion and fuzz belong to the same family, but have specific characteristics

- **Overdrive** seeks to replicate the sound of an overdriven tube amp. They create the musical-sounding harmonics and overtones that these amps generate when they're overdriven
- **Distortion** will create a distorted sound irrespective of the amp. In other words, it'll clip on its own. They generate much more gain and crunch than overdrives. They often have multiple gain stages with the stages producing the greatest gain delivering extreme breakup effects and huge amounts of sustain.
- **Fuzz** is a special type of distortion, it heavily saturates the signal. A fuzz clips the signal harder, to the point that it practically becomes a square wave. In addition, a frequency multiplier introduces complex harmonics, giving the signal a harsher, fuzzier tone.
- **Boosters** raise the volume of the guitar signal so that the tubes in the pre-amp stage are overdriven. Basically it is a clean boost, and this boost option can often be found in other pedals as well. There are boosters that emphases specific frequency ranges only.

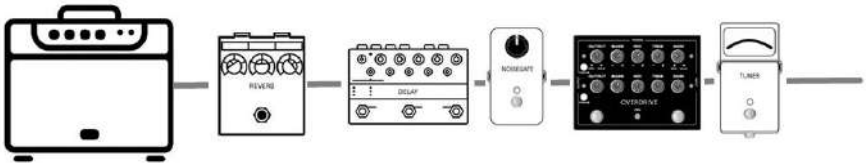
Octaver versus pitch shifter versus harmonizer

These three effect have one thing in common: they all add an additional signal to the original signal.

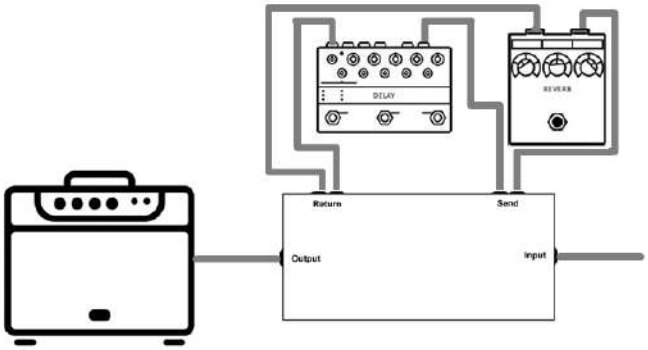
- An **Octaver** combines the original signal with a duplicated one that is an octave higher and/or lower.
- A **Pitch Shifter** also adds additional signals only now you can also alter the pitch so you are not limited to just an octave, but usually set in cents.
- A **Harmonizer** adds harmonic signals to the originals based on the chosen algorithm.(Usually scales such as Dorian, Lydian, Phrygian etc)

Parallel versus series

In general a signal chain runs in a **series** fashion, the signal goes from component ‘A’ to component ‘B’ to component ‘C’ and so on. In other words all component in the chain are processed one by one.



In **parallel** mode this there can be multiple components active at the same time. For instance the signal from component ‘A’ is split, feeds ‘C’ and ‘D’ simultaneously and then the signal is merged again. Obviously if you want to do this you will need a splitter/merger component such as the **Black Loop** from **One Control**.



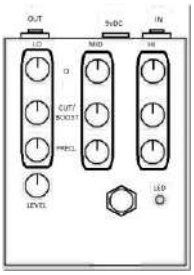
Parametric versus Graphical EQ

Both types of EQ’s serve the same purpose: to enhance the sound by making frequencies softer or louder.

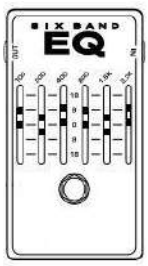
A **graphical** EQ has a fixed number of set frequency bands with a fixed bandwidth that you can either decrease or increase in volume. While a **parametric** EQ allows you to choose the frequency that you want to affect as well as the width of that band. This band parameter is referred to as the Q.

In general the graphical EQ is less difficult to use and the parametric EQ gives you more control.

3 band Parametric EQ

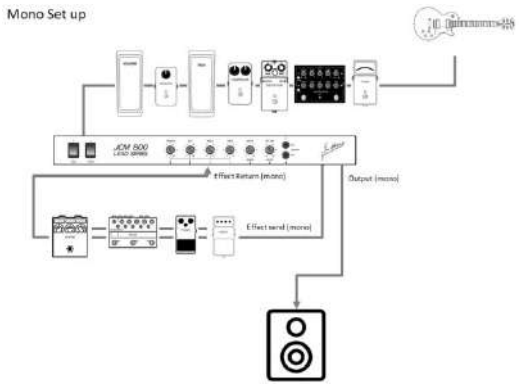


6 band Graphical EQ

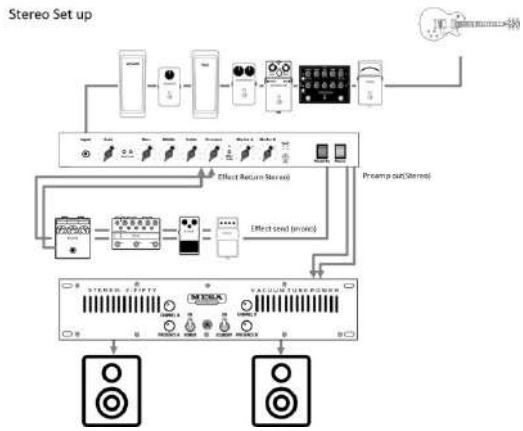


Mono versus Stereo versus Wet-Dry-Wet

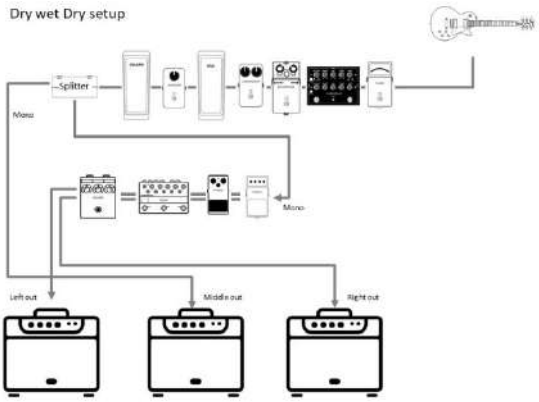
This may seem a totally unimportant topic but it has a huge impact on your sound, especially in a studio environment.



A mono set up is the most used one and the most simple signal chain: Guitar, Tone shaping pedals, Amplifier, time and modulation based effect in the effect loop(or before the preamp), Poweramp en finally the speaker cabinet.



In a stereo setup the signal chain is about the same as a mono set up, the modulation and time based effects are now in stereo and as a consequence the effect loop must be mono out and stereo in, the power amp needs to be a stereo amp(or two mono amps) and you will need two speaker cabinets.



The wet-dry-wet setup is the most complex setup (and the most expensive)
Signal chain: Guitar, Tone shaping effects, Signal Splitter, One output goes directly to the middle amp, the other signal goes to the modulation and time based effects, the stereo outputs go to the left and right amps

In this setup the original guitar signal (after tone shaping) is also present in the final output.

The amp

All tube, solid state, hybrid or modellers?

Here is where it all begins: what type of amp do you want or need? This issue can end up in an endless discussion between fanatics from all origin.

Mind you: the starting point for buying an amp (or anything for that matter) always is the available budget! I would not recommend getting a loan to buy stuff.

As for me, I have used all types : solid state amps from Session (SG2100 mosfet technology), Marlboro (1500B) and a LAB Series(LAB L5). Modelling amps from Behringer (V-amp PRO) and Line 6 (POD HD PRO) and tube amps from Davoli (Jolly), Marshall (JMP-1), Fender (Twin Reverb), Peavey (Tubefex), the hybrid way was with tube pre-amp (Marshall JMP-1) combined with a solid state power-amp (Marshall Valvestate 8004) and today my main amp is a all tube Mesa/Boogie (Formula PRE) pre amp.

Through the years I have been switching from tubes to solid state, back to tubes, forward to modelling and now again back to tubes. In my opinion it very much depends what you are going to do with the amp. For example, I choose for modelling amps at the time when I was playing acoustic guitars alongside my electric ones.

With this modelling technology I was able to make specific patches for specific (acoustic) instruments without having to invest in extra technology such as a special acoustic amp.

Pre-Amp and/or Power-Amp

Most amps have two sections: a pre-amp and a power-amp. The question here is do you need it?. Let's see.

First, Do you need a power-amp? Well not necessarily. There are some considerations to be made:

You could decide to skip the power-amp all together by plugging directly from the preamp into a mixing desk for recording or into the mixer of a PA system. Or alternatively use powered monitors. This last option is often seen by guitarists that use digital modelling amps.

Do you need a pre-amp? Again, not necessarily either. If you intent to sculpture you tone completely with the use of pedals you do not need a traditional Pre-amp and plug the output of you pedal board directly into the power-amp. However, if you want to use the overdrive/distortion from the pre-amp rather than from pedals you obviously need a decent pre-amp.

Tube misconceptions

A short word on tubes. One of the often acclaimed disadvantages is that you need to change you tubes regularly (about once a year).

Mind you this is NOT true for the pre-amp tubes these will last 20 years or more. Only the Power tubes may need replacement.

When:

- if you notice a significant change in tone or hum from your amp
- if you notice a significant drop in volume
- if it won't power on at all

If a power tube needs replacement, you should replace all of them so they will have the same age again. This will help provide a more even tone.

Furthermore, a set of back up tubes is always a good idea (especially when you are gigging often)

Unlike preamp tubes that you can replace yourself, changing power tubes is a different story.

WARNING: Tube amps work with voltages which can be fatal to humans, even when they are unplugged.

Just like the may need to adjust how your car runs idle after a major change done to the engine, new power tubes need their idle (the "bias") adjusted to make sure the amp sounds as good as possible. Some amps do this automatically, but many do not - particularly in the world of guitar amps (source: The tubestore)

So Power tubes need to be 'baised'. Tube bias is not only important to functionality of the amplifier but it also has prominent effects on tone and tube life. By setting the bias to optimal, you should be getting the longest life out of your tubes as well as the best tone from your amplifier. Now, the life of the tube can be proven but tone is subjective so "best tone" is in your ears. (source: Proguitarshop)

First you need to know how the bias is implemented. Basically there are three types:

- Non-Adjustable Fixed Bias
- Adjustable Fixed Bias
- Cathode Bias (self-biasing)

So if you need to replacement of the Power tubes, go see a specialist, this will guarantee that your power amp keeps in good shape.

Stack, Combo, Rack or Floor

Now that we have chosen our amp type it is time to think about the appearance of the amp: Stack, Combo, rack mount or a floor unit.

Each options has it specific pro's and con's. For me, I have chosen for rack mount gear years ago, because I believe it offers the greatest flexibly: I now can replace one component(such as pre-amp, power-amp and/or multi effect unit without touching the gear I want to keep. And for me this works, I have had the speaker cabinets and power-amp I bought years ago, but I changed the pre-amp multiple times.

Secondly, another thing to consider (especially with modelling amps) is this: Most modelling amps come in two versions rack mount and as a floor unit. Realise that the floor units are less expensive but, on stage, you need to go on your knees if you want to change parameters and we all know minor changes will have to be made during performances. The same argument goes for floor amps such as this one:

This amp, the Taurus Stomphead 4.SL is a compact floor amplifier, designed to be set on the pedal board, along with effects.

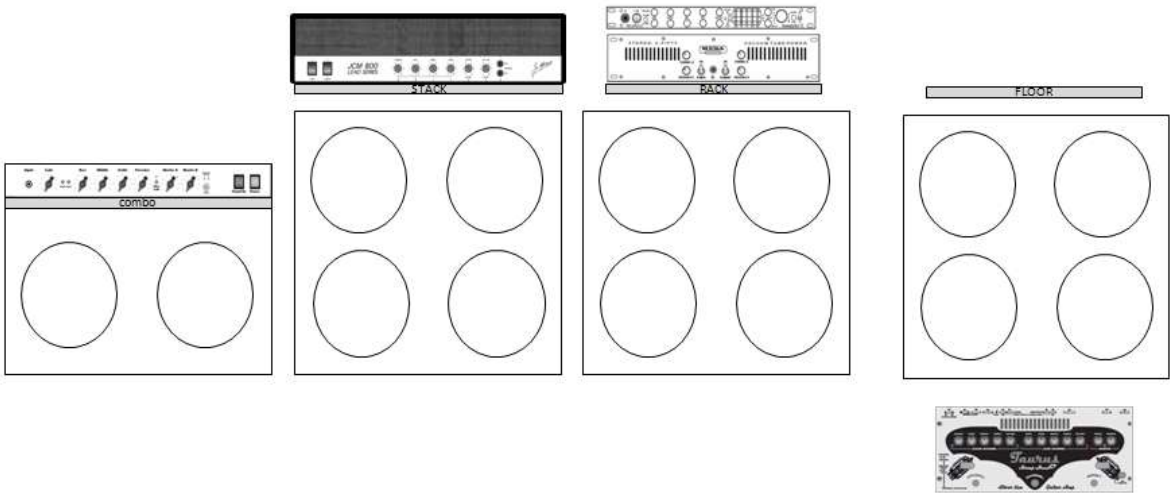
It has an integrated 70 Watts Poweramp.

Thirdly, if one component in my rack is malfunctioning and is in need of repair I do not need to return my complete set, but just the defect one.

If you choose for a combo or floor style you must realise that this is an all-in-one product, the advantages are that you can be assured that the different components in the combo will work as expected.

If you go for the stack option you have the ability to exchange speaker cabinets, but the head itself is still one piece of equipment.

Schematic differences:



The FX-loop

You will almost always need one or more effect loops in you amp in order to incorporate effects. In case of a modelling amp, you may not need an effect loop because most modelling amps have onboard effects.

What might be important is determine wheatear the FX-Loop is parallel and/or series and at what point in the signal chain it is located. Furthermore you need to determine wheatear it is a stereo loop or not (if that is an issue.)

Research at Mesa Engineering has learned that they had the best sonic and tactile results by actually bypassing the XF-loop altogether and patching rack gear directly between the pre-amp and the power amp. (provided this is possible and with a rack mount or modelling amp it mostly is.) Mesa verified their findings with customers and found that most used their processing between pre-amp and power amp, saving their FX-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.

I have tried this myself and I also bypass the FX-loop and put external devices between preamp and power amp, but mind you I could do this because I use a separate pre and power amp.

The power amp: How many watts do you need

When it comes to determining the number of watts you need there are some consideration to take into account:

- Portability: the bigger the power amp the heavier it will be and a big stack may look cool but transportation is another issue.
- Unless you're doing huge outdoor concerts 100 watts is probably the maximum you will need.
- Most (tube) amps sound best when they are cranked up(overdriven), this is much easier to accomplish with a 30 watts or less power amp than with a 100 watts.
- If you are using a PA system, you definitely do not need a big power amp

If you where aiming at a combo, floor or stack amp you will notice that most brands offer their amp in multiple wattages.
With rack gear you have to make a decision yourself. Not only the wattage, but also the type of power amp; tubes or solid state and mono or stereo.

If you can make you desired tone completely with the pre amp, you could decide for a solid state amp, as it only need to make the sound louder. Advantages are that a solid state power amp is far less fragile as it does not get as hot as a tube amp, is not sensitive to temperature changes, does not require tube changes and, not unimportant, is much cheaper.

Tube power amps tend to be louder than the stated wattage compared to solid-sate amps with the same specs. A 50-watt tube amp will be significant louder than a 50-watt solid-state amp. If you go for a solid state solution you might need a higher wattage.

Finding the tube amp's sweet spot

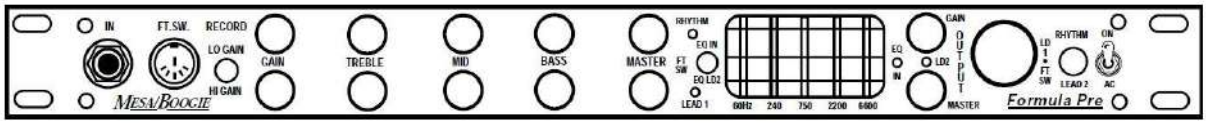
The sweet spot of a tube amp are the tone knob (Bass, Mid and Treble) settings. It are those settings that make the amp sound really good, but mind you it is all about nuances. What I consider to be a sweet spot might not be the same for you.

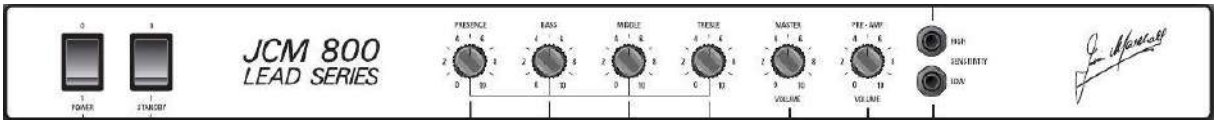
However as a rule of thumb the following is a more or less useful way to find this sweet spot on your amp:

Set all the tone controls to minimum value. Plug in your guitar and play something (anything will do) Slowly raise the treble control and identify in what range the most significant change in characteristic occurs: this is where the sweet spot for this tone control lives. In general this range will be rather short (e.g. between 5 and 6). Do the same for each tone control and you have found the basic sweet spot of your amp.

Saving amp settings

Once you have found you favourite amp tones, you should save these. With modelling amps or midi controllable amps you will probably be able to store these tones on the devices. If not, consider the use of templates such as one of these:





Just write down your favourite setting and you are done. The reason for doing this is that there is always the possibility of accidently moving buttons and by just drawing you settings on such a template you can always revert to the original settings. For amps and effect there is also a solution called a **knobguard**. Below is an example from Victory Amps and basically it is a grille that can be used to protect certain knobs and allows you to only change a limited number of parameters.

See the chapter on 'saving effect setting' for more (permanent) options

Speaker Cabinets

First: Wattage

The first thing to consider when choosing your speaker is the wattage of your amp. If you are running a 100W amp into a 2x12" cabinet, your speakers need to handle at least 50W each or you will risk damaging them.

There are a few different options to consider when determining the right balance between your amp's wattage, your cabinet's wattage and your tone. It's always a safe bet to use a speaker cabinet with double the wattage rating of your amps highest wattage output. For example, if you have a 100 watt amp, a 200 watt speaker cabinet will ensure a safe, clean operation.

Second: Impendence

Impendence is measured in Ohm. Why is this important?

(1) If you connect your amplifier to the wrong speaker impedance, you risk damaging the amp. In tube amps, too high a load impedance (or a disconnected load) can result in damage to the output tubes or output transformer, while in solid state amps, if the speaker impedance is too low, the amplifier will tend to overheat and more power is used up in the amplifier than is delivered to the speaker. Too many speakers on a solid state amp can burn up the power output section.
(2) The amplifier will deliver maximum power (volume) to the speaker when the speaker impedance matches (is equal to) the internal impedance (called the OUTPUT IMPEDANCE) of the amplifier. Too low impedance will result in weak output and poor tone. If the speaker impedance is higher than that of the amplifier, its power output will again be less than it is capable of. (source: Preston Electronics)

The safest and simplest way is to always match the output impedance of your amp to the total impedance marked on your cabinet. Most amps provide an impedance switch at the back to allow them to be connected to different cabinet types. If you are using two identical cabs (for example two 16 ohm Marshall 1960 cabs) then you will need to halve the output impedance of your head (to 8 ohms in this case).

Third: Speakers, Size matters

Different size speakers produce different sounds. Smaller speakers can produce higher frequencies than larger speakers, which is why a tweeter is small and a woofer is large. So in the real world, a 10" speaker will generally produce a better "top end" than a 15" speaker. So it very much depends on your needs. And by all means try combinations of speaker sizes...

Fourth: Cabinet, Open or Closed

There are open-back cabinets and closed-cabinet designs.

In general open back cabs have a room filling quality that sounds open and natural. Without a complete back panel that compresses the speaker's 'voice', open back cabinets might be considered a more organic representation of a guitar sound. High frequencies particularly benefit from this - they have lots of presence. The low end will tend to feel looser. (source: Celestion)

Unlike the open back cabinet, closed back cabs can really only project the sound forwards, meaning no back spill or side leakage from the cabinet. This tends to accentuate and harden midrange and bass sounds, giving them a greater amount of low end punch. (source: Celestion)

An open-back cabinet with 4 x 10" speakers will sound different than a 4 x 10" closed cabinet.

Many blues players swear by those old open-back 4 x 10" Speaker cabinets, as they can produce a range of tones from smooth to searing. If you want a big rock sound, you'll likely want to plug your guitar into a 100-watt head with one, or two, 4 x 12" cabinets.

Most(if not all) combo amps come with open-back speaker cabinets. If you have chosen for another type of amp (stack,rack or floor), you have the opportunity to choose the type of speaker cabinet yourself.

Open back speaker cabinet:

Closed Back speaker cabinet

Effects: Individual Pedals or Multi-effect

Why you might want to use pedals

The reason to choose for individual pedals is similar to the choice of amps earlier in this document. It is all about flexibility but at a price...

If you would choose a rack mount or a floorboard multi effect processor (and once I had the Yamaha XF900 Rack mount) you would have all your effects in one place. This effect processor would be in the XF loop of your amp or in case you have a separate pre-amp after the pre-amp as describes earlier in this document.

With a multi-effect processor you have no extra patch cables, the effects will work seamlessly with one another, so at first sight the perfect solution (I thought so myself)

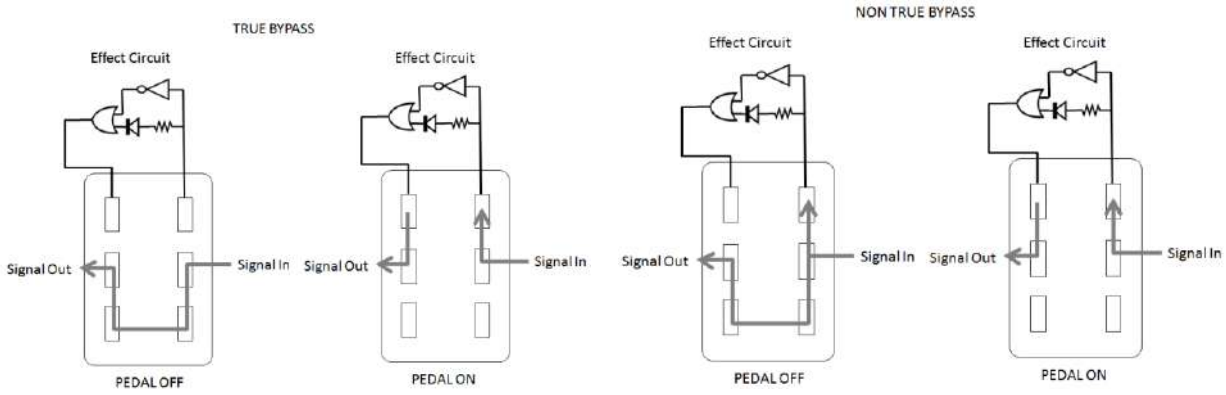
But wait a minute: Effects have a specific purpose in your signal chain and putting them at the same location (in the FX-loop or before the pre-amp section) the results may not what you expect and this has to do with the effect order and placement in the signal chain. In the next chapters we will see it is a little bit more complicated to build the ultimate signal chain...

True bypass and why it matters

The basic idea of true bypass is really simple; a true bypass circuit allows you to completely remove the guitar effect pedal from the guitar signal when the pedal is OFF. Thus when the pedal is off nothing sucks away your tone. Tone sucking occurs when the input impedance of a pedal is too low.

If the pedal is off and you remove the power, the pedal is true bypass if you can still hear your guitar.

Schematic differences:



Note that in case of a true bypass situation the signal goes directly from input to output when the pedal is OFF, where as in the case of non true bypass, the signal input signal still fuels the effect circuitry.

A true bypass pedal prevents tone loss but it turns your signal chain into one long continuous cable and this might introduce noise or other undesired artefacts such as a loss of signal. If this happens you might need a signal buffer.

More knobs: more control

This is a topic not to be overlooked as it greatly determines the influence you have on the sound from the pedal, but at the other hand it will take more time (and patience) to set the pedal the way you want it.

Some examples:

- if we look at **compressors** there are those with only one knob such as the MXR M195 Noise Clamp, that controls the threshold. At the other end of the compressor spectrum you find pedals such as the Wampler Ego Compressor with controls for volume, sustain, attack, tone and blend.

- Simple **overdrive** pedals have controls for output, drive and tone (such as the Behringer TO100 Tube-Sound Overdrive). The more complex ones(such as pedals from J.Rockett) come with additional controls for EQ (graphical of parametric) resonance, blend options and so on. Sometimes these pricy pedals are in fact dual overdrives containing even more options(pedals from T-Rex) such as stacking overdrives. (more on this in a separate chapter)

- In the **chorus** arena we see the simple ones such as the Joyo JF05 Classic Chorus that come with controls for depth and width while the top pedals (such as the MCR M143 stereo chorus) come with controls for level, tone, speed (rate) and blend (mix)

So it will be important to understand to what your candidate pedals can be manipulated so they can be tuned the way you want it to sound.

Effects and Amp's

You may have experienced this: You have seen a video of a fantastic sounding overdrive pedal and you decided to buy it, but connected to your own amp the sound is nothing compared to the video, in fact is sounds like shit!

There are two thing you need to be aware of. First of all: you don't know what type of post processing was done to the audio in the video you saw. Secondly, and even more important, what amp was used in the demo, how was it set up and what is your amp and how did you set it up. This really makes a huge difference.

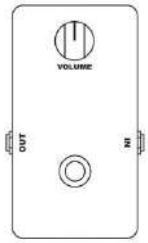
Some things to consider:

- If you are using a mediate of heavily overdriven amp you are already compressing the sound and as a result there is less headroom left. If you feed an overdriven signal in such as channel it will just compress more.
- If you setup you amps channel so it is on the edge of starting to overdrive, you will have more headroom and as such an overdriven signal will sound much better.
- Remember that also the guitar, the strings and your playing style contribute to the final result.

Effect order

Effect order is a very subjective thing and clearly **there is no right answer**. However if you follow a number of simple logical rules you cannot go wrong, but my all means experiment… In this chapter I only includes the common effects. I understand there are many more such as pitch shifters, envelope followers, tremolo, vibrato etc. But If categorize effects into groups it becomes somewhat easier (I dedicated a separate document on effects, available from my website)

The effect order is normally organised from right to left and the reason for this is that the input of almost every pedal is on the right hand side.



The reason for having the input at the right hand side is probably (yes, I am guessing) that most guitarists are right handed and a such the cable from the guitar can get straight to the pedal without any crossing. This would also mean that left-handed guitar players have a disadvantage.

When I talk about effects here note that EQ will be discussed on other chapters as this is a special one. The basic effects (mind you: these are merely guidelines and do read the notes I added):

BEFORE the preamp the typical (tone shaping) mono effects:

- Tuner as the first component (debatable if is this an effect, but it's part of the signal chain)
- Compressor before Overdrive (or Overdrive before Compressor)
- Overdrive before Distortion
- Wah-wah after Distortion
- Noise gate/ after Distortion
- Volume as the last pedal

Notes:

If you would set the Volume/Wah earlier in the chain (e.g. before the overdrive) it would affect the overdrive and/or distortion. Some guitarist like it that way. Jimi Hendrix placed the wah before distortion, Guthrie Govan prefers these pedals in the suggested position (near the end of the chain). If you place the Wah after distortion the frequency sweep is cleaner.

If you place the compressor after the overdrive you will smooth out the tone (more sustain) and lower the noise floor, whereas you place the overdrive after the compressor you can push the overdrive a little bit more.

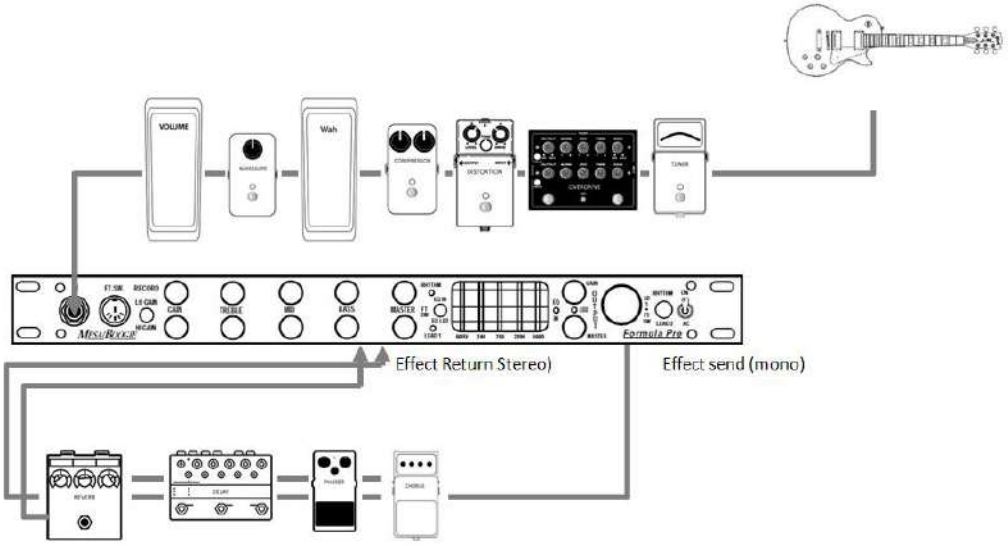
The position of the noise gate depends on where the noise is created. A noise gate looks at (or listens to) the incoming signal. So putting it at the end of the chain will suppress the cumulated noise created by the pedals earlier in the signal chain. However if you use a volume pedal you may be better off to put the noise gate before the volume pedal because the threshold of the noise gate may be triggered unintentionally.

If you are using mono modulation effects, these come after distortion and before the noise gate except for delay & reverb these could come after the noise gate. If not you might encounter cut off sounds as the gate close on decay of these effects. Stereo modulation pedals come preferably in the effect loop of the amp.

AFTER the preamp (the typical time based stereo effects):

- Modulation(Chorus/Flanger/Phaser etc) before Delay
- Noise gate before delay/reverb (NOTE: you will probably need stereo noise gate here. See separate chapter on (noise) gates
- Delay before or parallel to Reverb

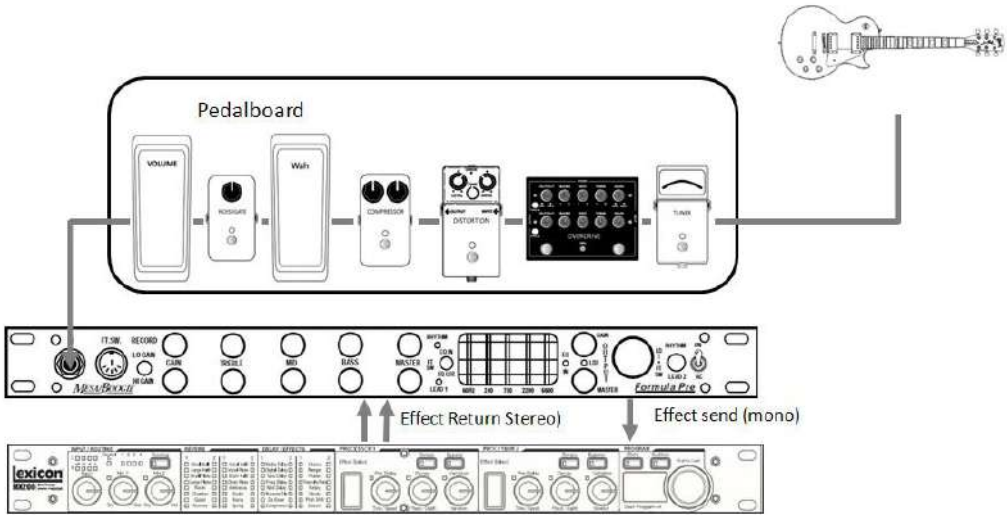
In a simplified pedal based diagram this will look something like this:



Note that with this setup there are multiple (four) cables between pedal board and pre-amp:

1. From distortion to preamp input
2. From Effect send to pedal board (in this case chorus)
3. From Reverb left out to pedal board
4. From Reverb right out to pedal board

If you don't want that many cables you could go for a multi cable solution or go for a hybrid system with mono pedals and a multi-effect rack mount components for stereo modulation effects, delay & reverb. Effectively a hybrid system could look like this:



In this case there is only one cable from the pedal board to the amp's input. Note that this is not exactly the setup I use my self. I do not use the FX-loop, but feed the pre-amps output into the multi

effect processor. The example above is a generic diagram that should work for any amp with an FX-loop.

Now there is a drawback with this option: If you use pedals and one is broken the others are still functional, but is you use a multi-effect processor it is likely that none of the effects from this unit will work anymore and you will need to exchange the whole unit (or send to a repair shop). With pedals you can simply replace the defect pedal.

The wonderful world of pedal volume

If I talk about pedal volume, I mean the option to determine the output level of a pedal. This knob is referred to as volume, level, output, master or loudness. It will allow you to set the output level in the way you want it. This can be a (slight) volume boost for soloing or a means of making sure the overall volume remains the same whether the pedal is engaged or not (also referred to as unity gain)

You must however take the following in consideration: If you have multiple pedals in a signal chain, **the volume is determined by the last pedal.** The volume level in pedal prior to the last one can be used to overdrive the next pedal by feeding it with a higher signal or to tame it (sending less volume) by setting the level lower.

So if you want to boost your signal for a solo, make sure the pedal that should raise the volume is the last in the chain. This is the reason clean boost pedals are often used at the end of a signal chain. Given this you can send a higher signal to an overdrive/distortion pedal in order to push this pedal somewhat more. In this case the input signal is hotter and will change the tone of the pedal a little.

Last words:

If you buy a pedal, look for the volume knob as it is such a handy feature. If the pedal comes without the option to set the output volume check to what extend the volume changes when you (dis)engage the pedal.

Gain staging: basic principles and uses

If you (pre)amp has one of more overdrive or lead channels you may have noticed that cranking up the gain not only distorts the sound but it can also introduce hiss or other undesired noises. To overcome this you can lower the gain on the amp to a point where the noise becomes acceptable and put an overdrive or distortion pedal before the amp to create the desired amount of distortion without the mentioned noise.

If you only have an almost clean channel on your amp(such as a Fender amp) you can consider gain staging with two of more pedals. If I talk about **gain staging** with pedals I mean using multiple overdrives or distortion pedals in a signal chain where the first pedal is feeding the second one with one simple purpose: to get the desired lead tone.

In this case you better try this with pedals of different brands as they all have the specific characteristics, especially frequency curves and with the right combination you can create useful and beautiful tones.

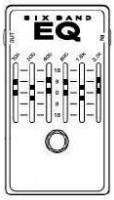
Also the type of pedals and the order of the pedals makes a significant difference. The order and type of pedals is almost becoming an obsession for some people: Do you go from high gain into low gain or the other way around(low to high), or is it better to use low into low?
There is one simple solution: what you think sounds best for you. So experiment.

There are however some rules of thumb to consider:

- The second pedal must be able to handle the incoming overdriven sound so either use a second pedal with enough headroom or don't 'overdrive' the second pedal too much. If this headroom is reached it will just compress more.
- Compression in an overdriven sound starts with the lower frequencies and as such you may want to cut those frequencies in the first pedal (either by a low-cut filter or an EQ in front.
- Experiment with the two pedals in parallel mode rather than in series (Of course this will mean you need to split the signal and feed the two pedal simultaneously and merge the output from the two pedals)
- If you feed the overdriven signal into a clean amp you hear more of the sound of the pedal, whereas sending the signal into an already overdriven amp will cause the sound of the pedal be less prominent and the amp's sound will prevail.
- Don't worry, you will not damage your amp or other pedal in your signal chain as the volume will not be significantly louder, but the sound will be more saturated instead.

Having said that, there is one more thing to realize: **Headroom**. This is the amount of signal a device(amp or pedal) can handle and this is determined by the voltage that powers the device. In general the higher the voltage the more headroom you have. Many pedals today run at 9 volts, but some of these can also run of 12 or 18 volts. This will raise the headroom and thus the signal quality.

Graphic Equaliser: The special one



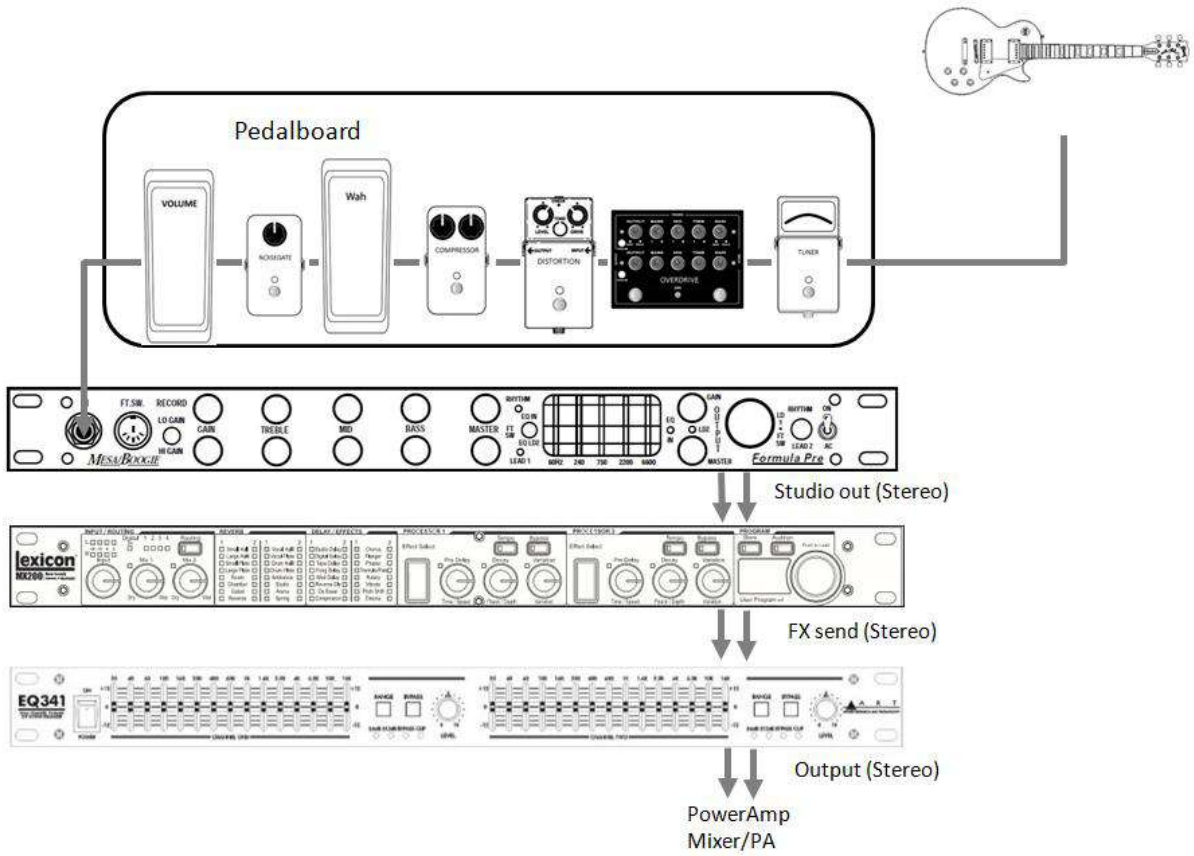
In the previous chapter I mentioned EQ would be discussed in a separate chapter so here we go. The equaliser is in a special type of effect (pedal) and first I am talking about EQ ***before*** the pre-amp.

Typical uses of EQ before the amp:

- Overall Volume boost or cut. If you use EQ as a volume boost for soloing keep in mind to roll off the bottom end because these are the first to get compressed.
- Master EQ by cutting or boosting specific frequencies in order to make the guitar sound cut through the mix
- Specific EQ to feed overdrive/distortion pedals, this way you can change/shape the overdrive territory frequency range, as boosted frequencies will compress earlier.
- EQ to increase/decrease specific frequencies after overdrive/distortion

The actual beneficial use of EQ ***after*** the pre-amp is that you adjust the EQ setting for a specific environment (Studio, Venue(in and out doors)) or even with another power amp and/or speaker cabinet) without having to change your amp setting.

For this you could use a rack mount 2 x 15 band EQ unit (if it needs to be stereo):



Pedal wise you can use an EQ **before** or **after** an overdrive/distortion pedal. If used **after**, it will change the tone of the overdriven/distorted sound. When used **before**, it will allow to change which part of the spectrum is affected first by the pedal.

Using a transparent overdrive

As explained in the getting started section of this document an overdrive emulates an overdriven amp. So an overdrive pedal should add gain and compression, but should not change the colour of your sound too much.

Therefore an overdrive(or distortion for that matter) pedal should ideally come with bass, mid and treble controls in order to minimize that colouring effect.

How to dial in an overdrive:

With the drive control set to the minimum value, you should be able to set the tone controls in such a way there is no difference in tone when you listen to the engaged or disengaged pedal. If you cannot get this right the pedal will always colour you sound when engaged. The last a step is to set the drive (or gain) at the desired level and adjust the volume as needed.

Eliminating Noise: the Gate

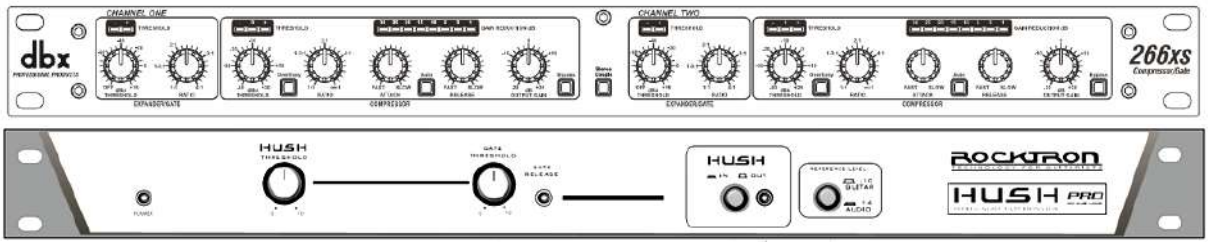
To eliminate noises a hum or hiss from the signal you will need a (noise) gate.

Noise gates have roughly the following controls (source: Wikipedia):

- Noise gates have a ***Threshold*** control to set the level at which the gate will open.
- The ***Release*** control is used to define the length of time the gate takes to change from open to fully closed. It is the fade-out duration. A fast release abruptly cuts off the sound, whereas a slower release smoothly attenuates the signal from open to closed, resulting in a slow fade-out. If the release time is too short a click can be heard when the gate re-opens. Release is the second most common control to find on a gate, after Threshold.
- The ***Attack*** control is used to define the length of time the gate takes to change from closed to fully open.
- The ***Hold*** control is used to define the length of time the gate will stay fully open after the signal falls below the threshold, and before the Release period is commenced. The hold control is often set to ensure the gate does not close during short pauses between words or sentences in a speech signal
- The ***Range*** control is used to set the amount of attenuation to be applied to the signal when the gate is closed. Often there will be complete attenuation, that is no signal will pass when the gate is closed. In some circumstances complete attenuation is not desired and the range can be changed.

Noise can occur at many points in a signal chain. That's why some noise gates, includes both a main input/output section to plug into in front of an amp and an insert for connecting your noisy effects into a separate loop for reduction at multiple points in your signal chain. Most common position for noise gates is before the amp as the last pedal. The reason for this is that a noise gate handles the incoming signal. So if you would put the noise gate at the beginning it would only suppress noise coming from your guitar and not the noise that is created after the noise gate.

If you want or need a noise gate in the signal chain, you might consider a stereo noise gate such as the DBX 266XS or the Rocktron Hush:



As a rule of thumb never put the (noise) gate after delay/reverb, as you may experience weird sounds such as the possibility of repeats being cut off.

Power Conditioner

The more rack mount gear you have more urgent will be the power provisioning. I use a SAMSON PB10 power conditioner. This is a power distribution and lighting system. 10 outlets accommodate AC. Today there are multiple devices that use an external power supply and, unless you unplug these, they are always on. I have chosen to use one of the AC outlets and connect all of these devices to this outlet (using a multiple socket before the AC outlet) This way you can turn off all devices with one switch.

The advantages are obvious:

- Only one AC outlet comes from the rack
- Central power switch
- The power is stable
- There is a rack light included

The pedal board

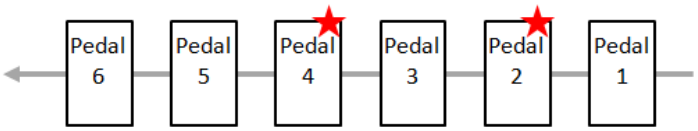
Flexibility: FX switch boards

With a FX switch board you can have the highest level of flexibility. Rather than building one a chain of effects and practice tap dancing in order to be able to switch rapidly, with a FX switch board you can actually program different presets and assign what pedals are to be used in that preset.

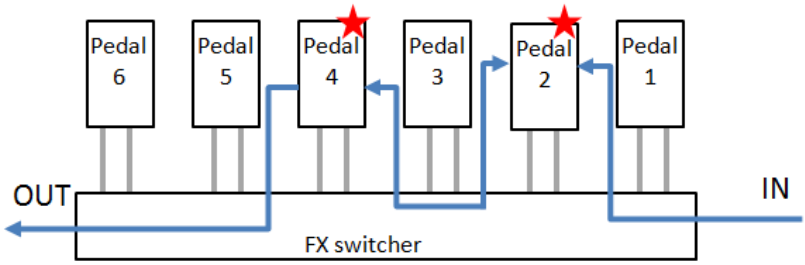
But there is a maybe more important advantage in using a switch board: on a traditional pedal board your pedals are connected in a sequential way, from pedal A to B to C etc. This implies that if one connection has a failure there will be no sound at all and you will need to trace what cable or device is causing the problem. Secondly, the more pedals you have the longer the chain becomes and as such this might introduce unwanted noise.

Consider the following:

Suppose we have six pedals connected in a standard (series) way and only pedal 2 and 4 are engaged, the other pedals will still be part of the signal chain:



With the use of the FX switching system the signal chain is only routed through the engaged pedals:



With an FX switchboard, all your individual pedals are connected directly to the switchboard, thus in parallel. This keeps the signal chain shorter and in case of a cable defect only one pedal will not function. Also keep in mind that you might also want to include the option of sending MIDI message to control other devices. Schematic view:

Keep in mind that the cheaper switchboards cannot set the pedal order only what pedal should be active . None of the switching boards can control the pedal settings (to my knowledge). Furthermore there is a price tag. Some examples:

Boss ES-5 Effects Switching board €450 (aug 2016)

Harley Benton FXL8 Pro €180 (aug 2016)

Carl Martin Octa-Switch MK3 €350 (aug 2016)

TheGigRig G2 €985 (sep 2016)

NOTE: The Harley Benton is actually a rebranded Joyo PXL-8 8 FX PRO. Harley Benton is a brand from Thomann (Germany).

If the switching requirement is not complicated you might be able us use a A/B splitter as a cost effective alternative:

MXR M 196 A/B Box €80 (aug 2016)

Cables

To connect pedals use short high quality cables with preferably angled plugs, as these will take less space on your pedal board. Here some options:

This type of connectors are available in many lengths, with different plugs (angled/straight) and different quality.

Make sure you do not go for the really cheap ones, if you do you are heading for trouble.

Alternatively there are connectors without a cable in between such as the one on the picture here.
If you intend to go for this type of connector realise that you pedals are probably from different brands and therefore of different dimensions and the location of the input/output plug is probably not at the same location.

There are some asymmetric connectors available like the one here and I advise to check these out if you are planning to go this “cable less” way. Be aware that in this case the pedals need to places on a sturdy solid surface, not a carpet as then the pedals can move and undesired friction will occur.

Fairly new are these flat patch cables from Warwick

You could also decide to construct your patch cables yourself with a **cable kit**. This way you can tailor the length of your cables to your specific requirements. But there is a price tag, a cable kit from Planetwaves for five patchcables (total length 12 meters (40 feet)) costs about €114 (june 2017), that’s €22.80 per cable! There are cheaper construction kits but remember: quality first.

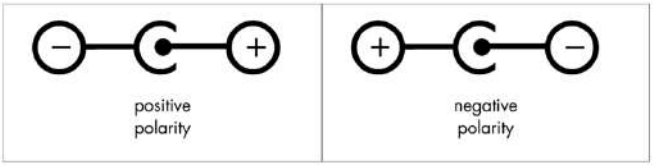
Furthermore: once your pedalboard is ready, secure the cables with tie-rips to the pedal board so they cannot move and get damaged.

Pedal power

Unless all of your pedals run on batteries, and you like changing them at the most inconvenient circumstances, you'll need some sort of power supply. The first thing to determine is what sort of power each of your pedals requires: the voltage, whether that voltage is DC or AC, and how much current (milli amperes) the pedal draws (most analogue pedals draw between 3mA and 60mA, though digital pedals may draw 150mA or more)

So you need to know the total power consumption of your effects in mille ampere (mA). Also look at future expansions you may want to have and make sure the power supply is capable of handling this amount. In general, as a rule of thumb take the total power consumption of your pedals and multiply this by 2.

Also you will need a regulated power supply. This means that no matter if your effect pedals draw 10, 50 or 200mA from the power supply, the voltage stays 9V DC.



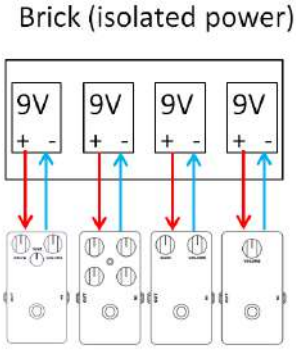
The next thing to look at is pedal polarity. Most modern pedals are, illogically, centre negative. This means that the outer ring of the plug is where the power comes in.

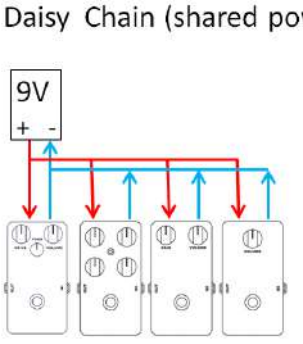
This is often visualised on the pedal itself.

Also remember that you need to look at the required voltage as well. Most effects run on 9V DC, but more complex ones might need a higher voltage and your power supply needs to accommodate this.

Last but not least: many pedals are designed to operate at 12V DC, but do accept 9V DC voltage. In this case however you might find the pedal a little bit more noisy as it run on a lower voltage.

Basically, there are two ways to power your pedals: Shared with Daisy chain of isolated with Brick:





There are pedals that don't operate well in a **shared power** environment. When this occurs you will hear a kind of oscillating hiss even with all pedals switched off. In that case you need to locate the pedal that caused the noise and give this pedal **isolated power**. This means it needs a dedicated power supply, that is not shared with other pedals. As a rule of thumb it is better to use isolated power as it will lower the noise from the pedal board. If you are using digital pedals it is almost always necessary to use isolated power for these as they tend to cause noise issues.

Mounting pedals on the board

For mounting pedals on the pedal board are various options. If you want to go for Velcro use 3M Dual Lock which is about the best in this area. According to 3M, with Dual Lock recloseable fasteners, you get the permanency and strength of a screw with the ease and aesthetics of a hidden fastener.

Another option is simply tie-rips, they are cheap and largely available. Just keep in mind that you must still be able to turn the knows and/or manipulate other switches and pushbuttons
In any way try to avoid gaffer or duct tape as this may becomes a mess when getting wet.

Personally I use Velcro and I never had any issues other than some pedal came with rubber support bumpers that needed to be removed in order get a firm connection between the effect and the floorboard.

Some advice: If you have a tuner on you pedal board, don't position it too close to other effects. Most tuners, if not all, mute the signal when engaged. It happened to me once on stage, that I accidently pushed the tuner button, since then I repositioned the tuner on the pedal board.

You will have to be careful with positioning your pedals anyway: if they are too close to one another you might (dis-)engage multiple pedals rather than one. So check your foot size ☺

Marking the connections

Using a label printer is an excellent way to document how pedals are connected to the FX switcher.

To do this I use a Brother H107 label printer, but any label printer will do.

For each loop (of one or more pedals) I describe what is connected (f.i. Overdrive(OD) & Noise Gate (NG)

At the same time for each pedal I describe to what loop it is connected (f.i. The boost Pedal(Boost) to loop-1)

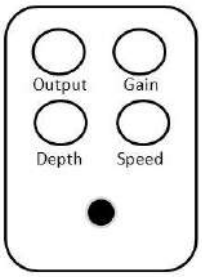
The last thing to label this way could be the presets (f.i. Preset 1 is clean, preset 2 is overdrive, etc)

By doing this I rapidly know a couple of things:

- To what loop a pedal is connected
- What pedals are connected to what loop
- What preset engages what loop

Saving pedal settings

If you are satisfied with you pedal setting you might want to save these. Most pedals do not allow you to save the settings. So as I described in the amp chapter you could consider the use of templates such as this one:



Just notate the settings for a particular effect and store it.

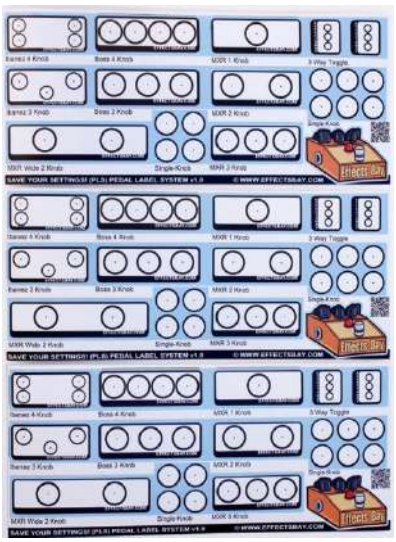
Alternatively you could use small stickers to indicate the knob/switch position directly on the device.(I saw Guthrie Govan use these also for his amp settings) or if the pedals have a not too dark colour use a permanent marker to draw the positions of the knobs and switches like Gary Moore did.

General use of markers

Gary Moore's Tubescreamer

There are specific markers for this purpose:

Alternatively you could also use special stickers:



Fairly new on the market are the these so called stompshields . The StompShield is an accessory whose function is to protect pedal knobs from accidental -unintentional manipulations, while allowing the user to adjust and monitor their settings on the fly, as they normally would. Thanks to its unobtrusive design, the StompShield can be installed on almost any pedal. The street price (sep 2017) is around €30 (four shields and four knobs)

You can also do this much cheaper like Guthrie Govan, he uses small round stickers to indicate positions for his amp and pedal settings

If you would take a look at Paul Gilbert's pedalboard you would see he actually uses adhesive tape to lock the knob positions