

Bypassing Myths - Fact or Fiction

Most guitar players who ask me about the various bypassing methods that are used today have their own personal reasons as to why they are even interested in knowing about this technical area and may have heard of the various claims that have been attributed to the various bypassing methods in use in today's electronic effects. When then questioned about their favourite guitar player solo they will refer to a specific cut or track from a vinyl album or CD. Very few will refer to a live performance as someone who was also there can only share the experience of relating their joy of hearing their guitar hero live. This may seem obvious but it is highly relevant as almost all reference material available to guitarists is heard through their own sound system at various volume levels in a wide range of surroundings. It is therefore unreasonable to assume that the sound they struggle to emulate can be easily obtained e.g. in their bedroom with a couple of pedals and an amp without any basic understanding of the signal path and knowledge of sound recording techniques. Listen to a CD player plugged into your Hi Fi sound system and then into a guitar amp and you will find a huge difference in sound quality. That is the first basic step in understanding how your favourite guitar tone was produced. It may have been produced by a combination of effects and a guitar amp or recorded direct using modern digital technology and then gone on through a complicated mastering process and the final end product be it vinyl or CD produced by a plastic injection moulding machine. This is then played on an electronic system designed to reproduce all sorts of music. So where do you start and how is it possible to succeed you may ask. As with almost all problems it helps to start at the beginning with a keen understanding of basics and a firm objective of what you wish to finally achieve. There are no simple answers or any rules that can't be broken but success can only be achieved by following a logical plan that has been designed to aid further understanding. Jimi Hendrix and I broke a lot of new ground and created revolutionary sounds when we recorded but I can assure you that we both certainly knew our objectives and were committed to follow a path that would lead to ultimate success and the results achieved were not down to luck and I hope that the following hints will help you to achieve your sound.

Bypassing an effect by definition should in the perfect world have absolutely no effect on the signal whatsoever. But as is the case with most things this is not as simple as it is made out to be. Your road to success in finding your ultimate tone can be reached by taking a careful and measured approach in obtaining the best from your equipment and learning to understand what's going on with the signal path.

Pickup and Guitar Control Basics: Magnetic coil type of pickups converts the change of magnetism caused by the string vibrating into an electrical signal. They are made in varying configurations e.g. Single Coil and Humbucking and have varying tone qualities. These types of pickups all suffer a loss of high frequency detail by cable or internal capacitance. The optimal output signal can only be heard by connecting the guitar into a high impedance low capacitance type of input e.g. a typical guitar amp front end. A typical guitar volume control value is 250K or 500K and the tone control circuit of most guitars actually connects a capacitor across the pickup to produce a bass tone. Once high frequency detail has been lost to capacitance it cannot be restored by subsequent equalisation.

Guitar Lead and Connector Basics: The optimal guitar lead has no capacitance and zero resistance whilst providing total screening from all electrical signals and freedom from any form of handling or vibration induced noise. In the real world capacitance, resistance, screening and handling noise are all directly proportional to length so the shorter the better. You can easily hear the difference between a lead 10 feet long and one 30 feet. The connectors should all be spotlessly clean as the magnitude of signal current is very small indeed and any dirt especially nicotine coatings can cause problems and even radio

pick up. Use a cotton bud soaked in cleaning fluid to clean jack sockets on your guitar, amp and effects to remove dirt.

Connecting Effects into the Signal Path: The guitar should connect to the first effect by the shortest lead that gives the freedom of movement on stage. This will ensure optimal tone quality up to the input of the first effect. Now in the case of say just one effect an additional cable connection must be made to the amplifier that may be some distance away. There are various effect bypass techniques in use and a knowledge of how to identify tone sucking problems that may occur and an understanding of these is important.

Hard Wire Bypass: Often hailed as the magical simple answer but it has several drawback which include increasing the total system cable length as now the guitar cable and effect / amplifier cable are effectively as one. This means less high frequency detail and the possibility of picking up cable and electrical interference due to the fact that the amplifier cable acts like an antenna with a pickup coil at the end. Also the high output impedance of the guitar is carried through to the next device in line. Not all high gain distortion effects are happy with pickup coils connected directly to their inputs as due to the high impedance and the reactive nature of the coil, problems can occur which include high/low frequency oscillation and various radio pickup problems. Switching clicks and pops are always a problem when coils are passively switched and are impossible to eliminate due to the energy stored in the coil itself and this problem occurs in passive switchers e.g. AB boxes. Hard wire bypass was the preferred and virtually only method used in old style pedals due to cost considerations as low noise transistors were expensive and hard to find and some designs relied on the fact that the pickup was loaded when the pedal was in circuit.

Tone Sucking: This is best described as a loss of tone quality when in bypass and can be caused by several factors. One type occurs when the input of the effect is always connected to the guitar even in bypass mode but this will only cause a problem if the input impedance of the effect is not high enough to eliminate loading problems or if capacitance has been added across the signal path. This form of tone sucking achieved notoriety with the early Wah designs, which only used a Single Pole Double Throw switch or SPDT, and the adoption of a high impedance buffer in front of the wah was pioneered by me in 1967 and is used as the solution nowadays in the standard Cry Baby pedals and described as a Hendrix modification. The other type of tone loss or sucking can occur when FET/electronic switching is used as opposed to a stomp box switch. Great care must be exercised in these types of design to ensure that the signal path and buffering used is of the highest audio quality and careful checks should always be made to compare bypass performance.

Using High Impedance/Low Output Impedance Buffers. These are used in many modern pedals that are designed for the multi task set-ups that are found in studios, home recording and live stage performance scenarios. Their origin and universal use as a standard building block in audio recording systems and questions of audio quality should be brought into the correct perspective by the fact that any recording you have heard will have had your favourite guitar tone passing through them many times over. They have many uses and advantages for audio engineering and were not widely used in the early retro guitar effects due to cost considerations, as low noise transistors were both expensive and hard to find. When I worked on recording studio console design for Olympic Studios where Jimi Hendrix recorded, the recording chain contained many such buffers so there should be no doubts as to overall performance. The audio performance of a well designed buffer will not contribute any discernible coloration or add noise to the guitar and transforms the pickup output impedance to a much lower value that will enable long leads to be driven with no audio high frequency loss. The buffer also allows the splitting of the signal for multi-path processing, connecting to a tuner, and direct connection to medium impedance inputs of recording consoles and machines. The use of a buffered output to an amplifier is to be preferred, as you effectively create a zero lead length and low noise connection that is impervious to electrical interference. Switching a low impedance audio source to various devices then becomes easy and click free.

Bypass Performance Check. Always remember to check the bypass performance and or tone sucking problems of each individual effect separately. Connect each one in turn to the amp with the shortest lead possible thus keeping cable length losses to a minimum. Then commence building your chain and verifying each addition in the same way. This will show up any interface problems and should enable you to isolate them.

Recording Tips. The simultaneous direct recording of guitar signals is very helpful in obtaining the final tone as it gives full control of the many possibilities of adding echo or other effects to a clean direct signal. The guitar should be connected to a direct box or a buffered spitting device and then to the console and effects chain. The use of a buffered DI box or splitter will also enable the player to record from the control room and to feed the effects chain and amp set-ups in the studio area. The effects chain should end with a final buffered output connected to the amp or if two amps are used via a splitting device which preferably has an isolated output to eliminate ground loop problems. A multi- path recording chain was used for Jimi's studio recordings to give flexibility of using several different amplifier types as well a direct signal to the console. The final tone you hear on the record uses a blend of direct and microphone signals with additional limiting and or compression plus EQ and multi- path techniques to produce the final sound design required.

So as you can appreciate all effects have to be connected into a system with cables and a piece of hard wire does not magically lead to the holy grail as the overall picture is far more interesting than that. Retro sounds and the methods used then in the recording of them was not as simple as equipment marketing and advertising people would lead you to believe and each bypassing technique has it's own place and merits. But the overall golden rule to remember is try to preserve the guitar tone in its original and pure form up to the point in the signal path that you decide to change it as once detail is lost, it is gone forever and cannot be restored.

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