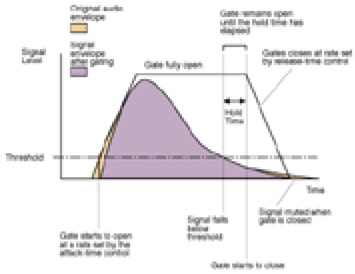
technique advanced gating

advanced gating techniques

Part 1: **Paul White** explains that there's much more to gating than you might think.



At its most basic, a gate is a device which mutes a signal whenever its level falls below a threshold set by the user. Its most common use is for combating noise problems by automatically closing down the audio path during periods of very low signal level, when only noise is present. Clearly a gate can do nothing about noise that's present at the same time as the wanted audio signal, because then the gate will be open. However this isn't usually a problem, because low-level noise will normally be masked by your audio signal.

If this was all there was to gating then gates would not need anything more than a threshold control, yet a glance at a few different units will turn up all sorts of other controls, the action of which may not be immediately obvious. So, in the first part of this short series, I'll be explaining what all these controls do, and why you might need each of them to achieve the gating effect you require.

Attack & Release Times

If a gate could only be on or off, with no transition in between, decaying sounds would be cut off abruptly as soon as they fell below the threshold level. Because of this, most gates have the facility to make the opening and closing of the gate more gradual. Some gates have attack-time and release-time controls which specify, respectively, how quickly the gate opens and shuts. Alternatively, there are other gates which can automatically adapt these times to the audio being gated. A more progressive gating action allows decaying low-level sounds to fade more naturally rather than being cut off abruptly.

The release time is certainly the most important parameter which needs setting after the gating threshold. Many natural sounds start fairly abruptly and the majority have a well-defined decay characteristic, so matching the release time of the gate to that of the sound being processed is extremely important if you wish the fade into silence to be made to sound smooth and natural.

Not that all sounds oblige us by starting abruptly, and it is here that the attack-time control comes into its own. If a gate is set to open very quickly and the signal being processed has a slow attack, the abrupt opening of the gate, when the input signal exceeds the threshold level, can cause an audible click. In such cases, you can gradually extend the attack time until the clicking disappears.

On the other hand, percussive sounds need a gate with a very fast attack time, otherwise some of the percussive leading edge of the sound will be cut off. At its fastest, an attack time of just a few tens of microseconds is typical, whereas sounds with a slower attack may respond better to gating with an attack time of 10mS or more.

Hold Time & Hysteresis

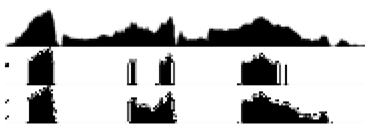
If a gate is set with a fast attack time and a fast release time, any signal level which hovers around the threshold can end up causing a problem known as 'chattering', where the gate opens and closes rapidly several times in succession. One way in which manufacturers have addressed this problem is by adding a hold-time control. This allows the user to specify the minimum time for which the gate will remain open once the signal level has exceeded the threshold. When the signal falls below the threshold, the gate is held open for the duration of the hold time before starting to close.

Note that even though a particular gate may not have a hold-time control, the designers have probably built a fixed hold time into the system, usually about 20 to 30mS. This ensures that the gate doesn't try to trigger on individual cycles of very low frequency bass sounds when fast attack and release settings are used.

The second method used to avoid chattering is called hysteresis. Essentially, a hysteresis control raises the threshold for opening the gate and lowers that for closing it, such that they then differ by a few dBs. This means that, whatever the threshold level which opens the gate, the signal must fall a few dBs before the gate will be allowed to close again. As long as you also set the release and hold times properly, hysteresis can help make gates behave much more smoothly and predictably. Once again, many manufacturers build hysteresis into their gates, though some high-end models and software plug-ins allow the user to vary it.

The Range Control

Up to this point we have only considered a gating action where the signal is completely muted below threshold. However, there are gates that don't shut down completely, but rather attenuate the signal level by a user-defined amount. Such gates require a range control, which specifies the number of decibels by which the signal level is reduced when the gate is fully 'closed'. Naturally, if you wish to use such a gate in the more simple on/off manner, then this range control needs to be set to its maximum value.

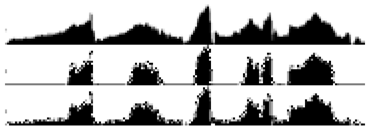


The main advantage of reducing the range setting is that this can produce a more natural effect where the degree of unwanted background sound (such as spill from other instruments) is such that its complete disappearance would be very noticeable during pauses in the wanted signal. By setting the gate's range control to attenuate by a only few dBs the ambience can be allowed through during pauses, but at a reduced level.

However, another lesser-known benefit of limited-range gating is that this can help the gate to open faster than it would if it were set to attenuate to silence — something that can be handy if you need a faster response than your attack-time control allows at its lowest setting. Attack and release times actually indicate the *rate* at which the gain changes, so the amount of gain to be covered alters how fast the gate appears to act. If the gate's gain has to go from -90dB to 0dB, the delay between the audio signal exceeding the threshold and the gate becoming fully open will be larger than if the gain had to go from -20dB — the gate will seem to open more rapidly, as it only has to change gain by 20dB.

Side Chain Filtering

Gates are based around a gain-control device, the gain of which is made dependent upon the audio signal level. Whether this gain control element is a FET, a VCA, a valve, an optical device, or a digital implementation of any of these, it helps in understanding how a gate works if you can make a mental distinction between the audio signal path and the control signal path (also called the side-chain). The audio path passes the audio signal through the gain-control element, allowing the signal level to be altered by it, while the side-chain carries a control signal to which the gain-control element responds. This distinction may not seem particularly relevant to what has been discussed so far, because both signal paths have been carrying the same signal, but it really comes into its own when the two signals are different.



But why would you want to have different signals in the audio path and side-chain? One of the most common reasons is when you need to alter the frequency content of the side-chain in order to get the gate responding exactly how you want it to. For example, let's say that you are attempting to gate a snare drum track to reduce spill from the rest of the drum kit, but find that the kick drum is also opening the gate even when you've set the threshold so that everything else is excluded. By EQ'ing the side-chain signal to roll off the low frequencies, the gate is less likely to respond to the kick drum and is therefore more likely to open only for the snare. Similarly, if hi-hat spill is causing false triggering on your snare track, you can take some top end out of the side-chain to reduce the problem. What is important to realise in both these cases, though, is that the EQ only affects the side-chain signal, not the timbre of the gated sound.

While serious equalisation of the side-chain signal can be necessary for clean triggering, it's worth bearing in mind that it might not a good idea to filter off more top end than necessary if the sound being triggered has a fast attack. This is because high-cut filtering works by slowing the rate at which a signal's voltage can change, and this will therefore slow down the attack of the side-chain signal, delaying the opening of the gate slightly.

While some gates provide facilities for patching an external equaliser into their side-chains, many commercial gates come with side-chain equalisation built in — usually in the form of high-pass and/or low-pass filtering. This is often combined with a facility for passing the side-chain signal directly to the audio outputs of the gate, allowing the user to tune the filtering such that the desired frequencies are most effectively isolated.

Side-chain Linking & Using Key Inputs

When gating stereo sound sources, it is necessary to have individual gain-control elements for each channel, and these need to have their actions synchronised to prevent one channel being processed differently to the other — the stereo image shifting that occurs if both channels operate independently is normally undesirable. In order to achieve this synchronisation, both side-chain signals have to be identical and must be derived by mixing the signals passing through the two audio channels. Normally such stereo linking is a built-in feature of two-channel gates, and can be engaged simply by operating a front-panel switch.

However, there are cases when it is useful to feed the side-chain from a completely different source than that which feeds the audio path. Some gates provide an external side-chain input, called a 'key' input, for just this purpose and this allows for a host of useful operations. For example, several gates can be made to operate identically by sending the same signal to all

Sound Of Silence

While compressors are often said to have a specific sound, gates tend to be designed so as to be as transparent as possible. In other words, when they are open, the of their key inputs — useful where you have a group of backing vocalists on separate tracks who aren't performing tightly. By gating every vocal channel and feeding all key inputs from the channel with the best timing, you can often make a real improvement to the perceived quality of the performance.

This technique is also popularly used to tighten up bass guitar tracks by gating them and feeding their key inputs with the kick drum — you can at least prevent the bass note from starting before the kick drum. Just make sure you set the hold and release controls to suit the type of sound you want.

sound should be unchanged and when they are closed, they should provide only attenuation. How close gates come to this ideal depends on the type and quality of the gain control element used. For example, VCAs can now be built to a very high specification indeed, meaning that the sound remains extremely transparent. FETs introduce more distortion than modern VCAs, and valves even more, though in both these cases the effect is relatively benign. However, the main consideration with gates is actually how well the controls work, rather than how they change the sound.

Coming Soon...

Gates often have more controls than you might think they require but, as we've seen, each gating parameter is important to be able to get good results. Next month, I'll be looking at how to get the best from all this functionality in practice, as well as showing you how to exploit the creative potential of gates and their nearest cousins.

Glossary

http://www.sospubs.co.uk/sos/regular_htm/glossary.htm

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