

THE BEGINNER'S GUIDE TO

Dynamics Processing

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What are “Dynamics” and why do they need to be processed?

Dictionary Definition:

Main Entry: **dy·nam·ics**

Pronunciation: dI- 'na-miks

Function: *noun plural but singular or plural in construction*

1 : a branch of mechanics that deals with forces and their relation primarily to the motion but sometimes also to the equilibrium of bodies

2 : a pattern or process of change, growth, or activity <population *dynamics*>

3 : variation and contrast in force or intensity (as in music)

The more Dynamic music is, the more differences exist between loud and soft passages.

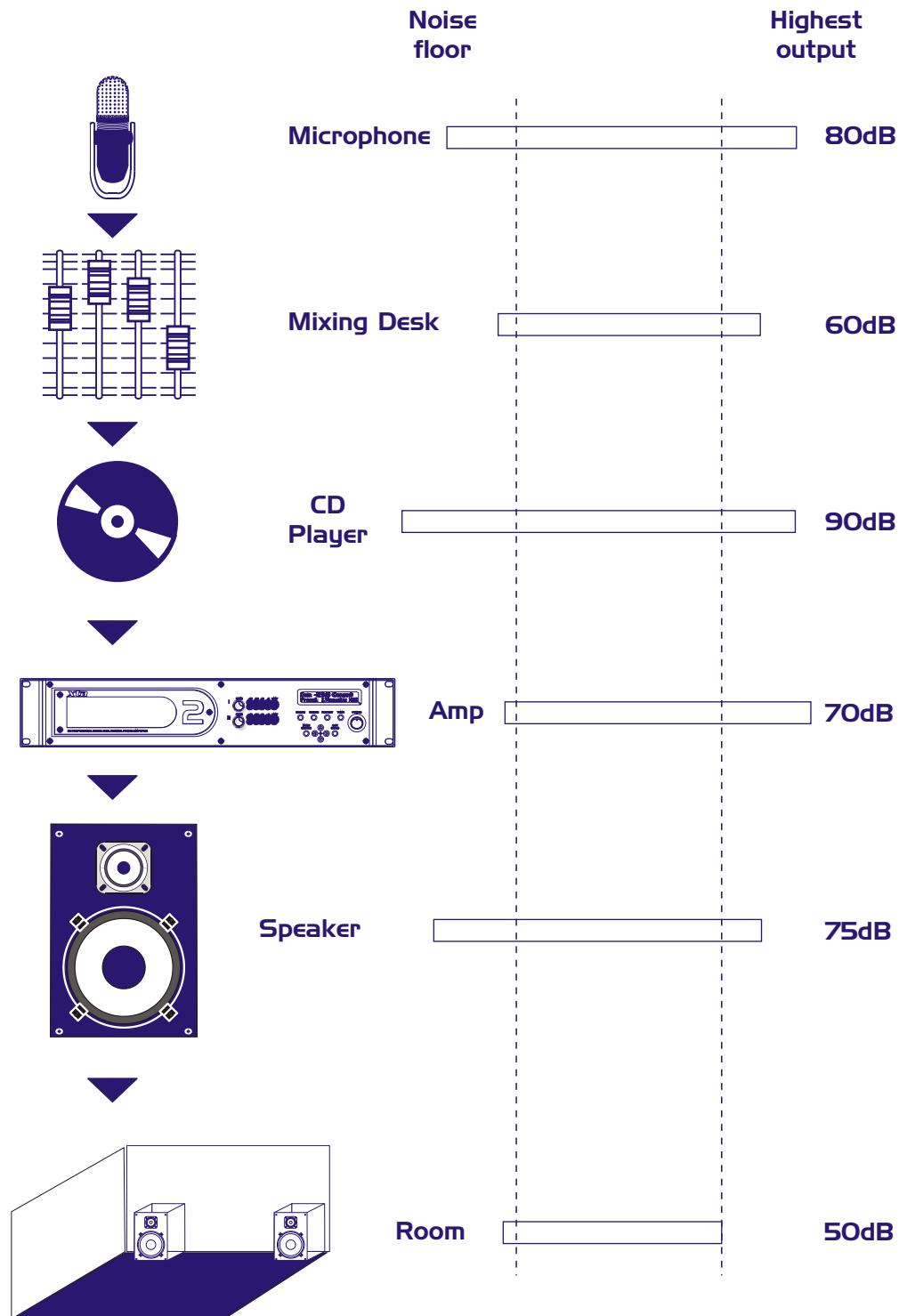
The less Dynamic music is, the more uniform its overall level is with less dramatic changes in volume.

Often the difference between the loud and soft passages in the music will make it difficult to keep under control, and hard work to listen to.

To counteract this we can alter the dynamics of the sound and in doing so make it more controllable, and better to listen to.

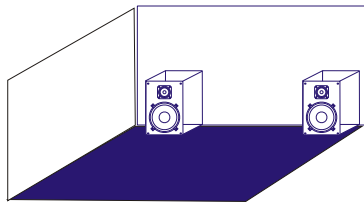
What is Dynamic Range?

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The difference between quietest sound that can be resolved and loudest sound that can be reproduced without distortion is the DYNAMIC RANGE of a device.

An Example...



Room



50dB

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Consider the room's dynamic range:

The lowest level sound that can be resolved is set by the background noise of the room (people talking, air conditioning etc.).

The highest level is set by the environmental health officer or your next door neighbours...

Very quiet sounds may be lost in the background noise of the room, unless we can boost them above this.

Very loud sounds may cause someone to pull the plug on the sound system or call the police, so these must be kept below this threshold.

So how is this achieved?

Compressing or Limiting the Dynamic Range...

D.I.Y. Control...

You already know how to control the dynamic range of an audio signal...consider a commercial TV show:



Programme comes to a break - average level is 80dBA SPL.

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Programme comes to a break - average level of adverts is 86dBA SPL. (a LOT louder).



Turn down the volume...



Programme comes back on - average level of programme is back down to 80dBA SPL.



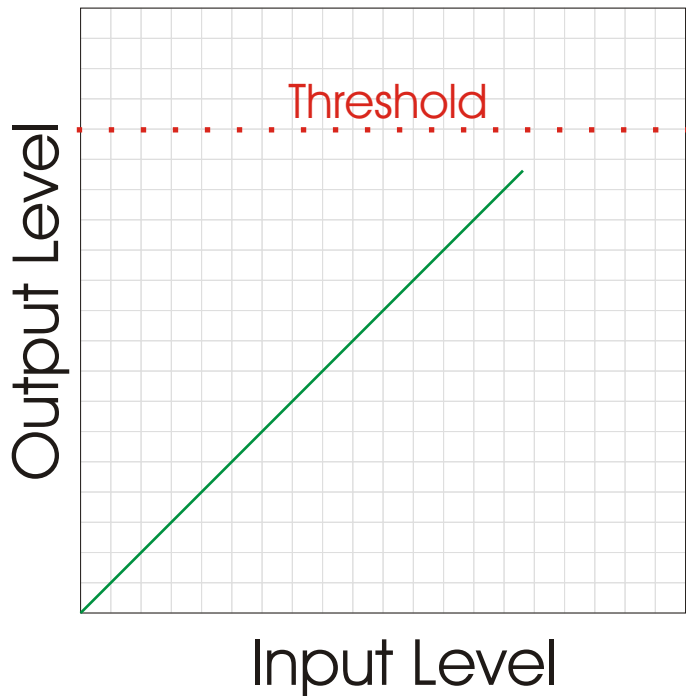
Turn volume back up...



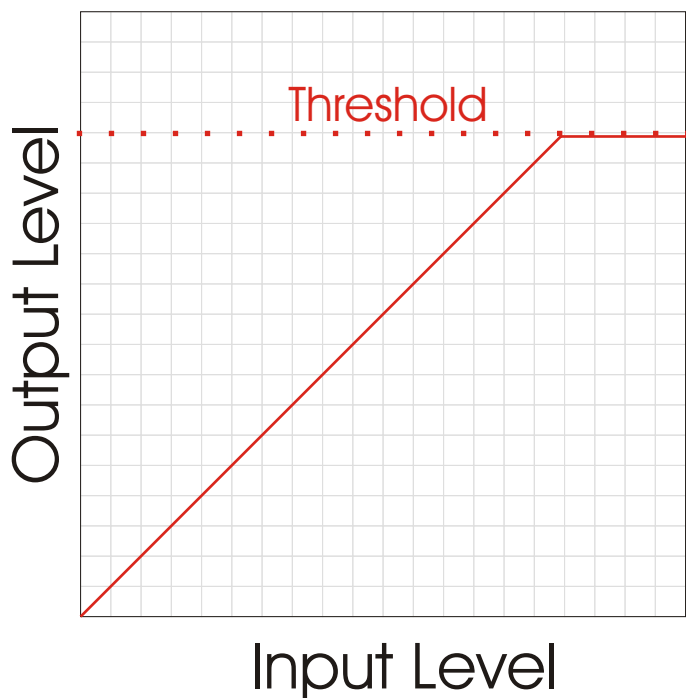
This is the principle of dynamics processing: keeping control of the level of the signal so it sits in the window we require.

Limiting and Limiters

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Set a threshold that the signal mustn't exceed.



If it does begin to turn it down so it stays under the **threshold**.

When it drops below the **threshold** again, turn it back up.

Limiting and Limiters - what are they used for?

In a DP226 or DP428 the limiters are used to protect the speakers from too high a signal that could damage them.

Limiters are also used by radio stations (in a slightly different guise) known as Levellers to make sure that the output of the station stays as loud as possible - Radio 1 use a sophisticated leveller to ensure that when you flick through stations, Radio 1 appears to be the loudest so you will be inclined to stop at it...

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Radio

The airwaves are crowded.
The competition is after your listeners.
Can your signal cope with the challenge?



Radio

Could you use more punch? More sizzle? More overall loudness to grab and hold dial surfers?
A cleaner, purer signal for a discriminating classical audience?
Or just extended geographic reach?

Limiters need careful setup if they are not to sound obvious (i.e. terrible) when they are working or they will be as useless as not being there.

So what are “Attack” and “Release”?



There are two more parameters normally associated with setting a limiter. These are the Attack and Release times.

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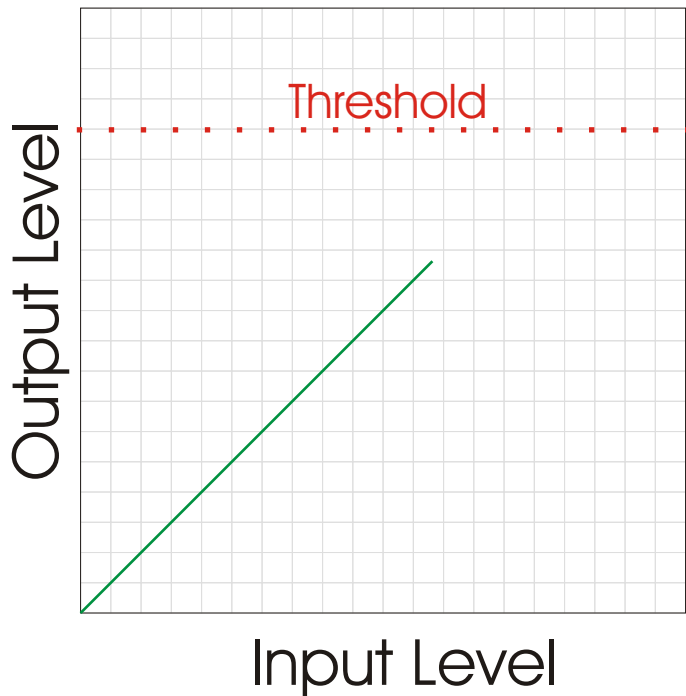
The **Attack** time is a measure of how fast the signal is turned down when it exceeds the threshold (how quick you get to the TV remote).

The **Release** time is a measure of how fast the signal is allowed to return to its former level when it has dropped below the threshold again (how quick you turn the volume back up).

Too fast attack and release times introduce distortion as the volume adjustment tries too hard to follow changes in level, making things worse than having no limiting.

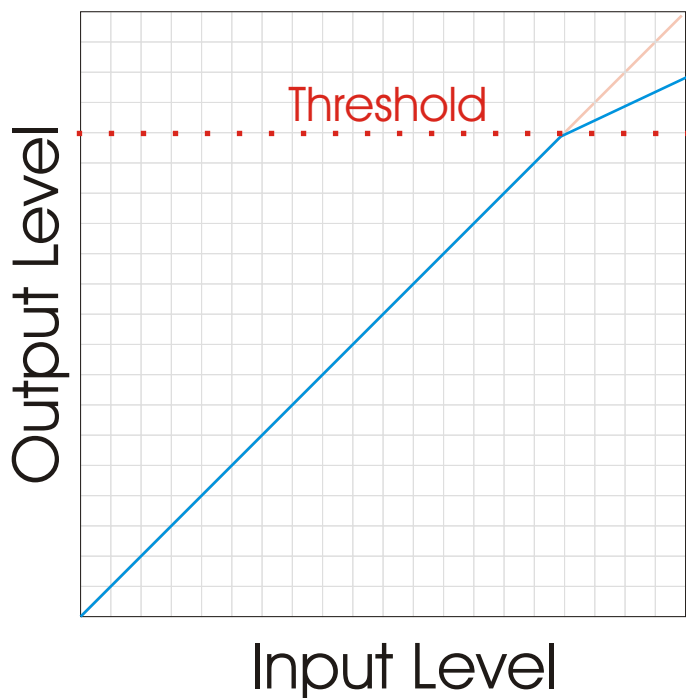
Too slow attack times allow too much signal to get through over the threshold so the limiter doesn't protect properly. Too slow release times mean things stay quieter longer than is really necessary.

Compressor - Limiter's gentler cousin.



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Set a threshold below which the signal will not be affected.



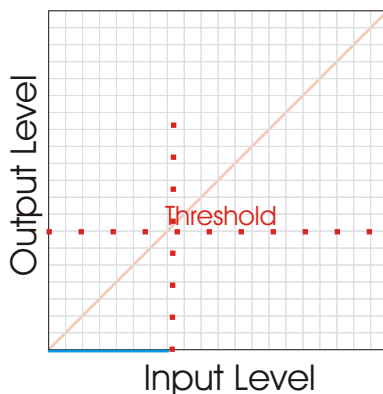
Above this **threshold** begin to turn it down so it exceeds this **more gradually**. How gradually is set by the Ratio parameter.

When it drops below the **threshold** again, let the volume return to its previous setting.

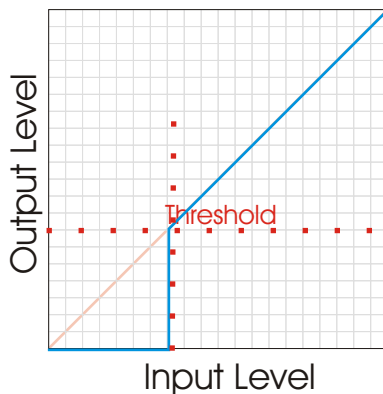
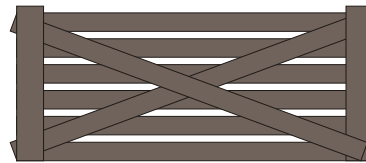
Gating - Limiting the other way round.

Whilst Limiters (and Compressors) take care of signals getting too loud, Noise Gates (and Expanders) take care of signals when they are quiet.

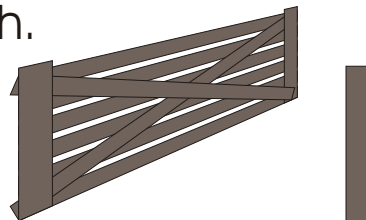
A Noise Gate is so called as it acts exactly like a gate, in that it opens and shuts, so allowing signal to pass or not.



While signal is lower than then threshold the gate stays shut (so no output).



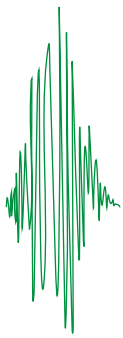
Signal reaches threshold:
Gate opens and lets it through.



When the gate opens is dependant on the Threshold - the higher the threshold the louder the signal will have to be to open the gate. Once open, the signal passes just as if the gate wasn't there - it has no effect on the signal when open.

What's a Gate Used For?

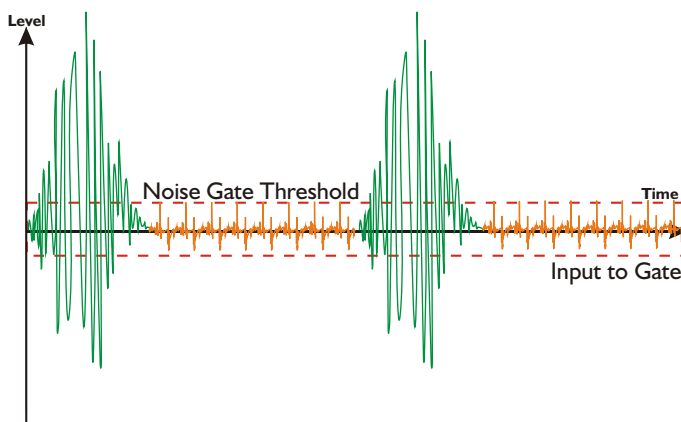
Reducing the effects of background noise.



Drum beat



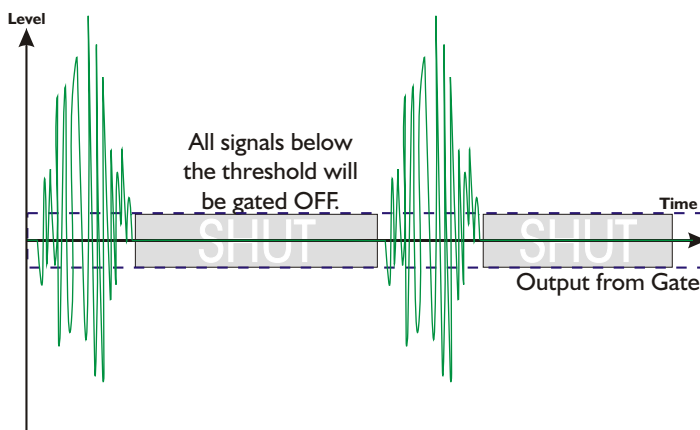
Noise



Noise will be audible between beats...

Set threshold of gate to just above the level of the noise so -

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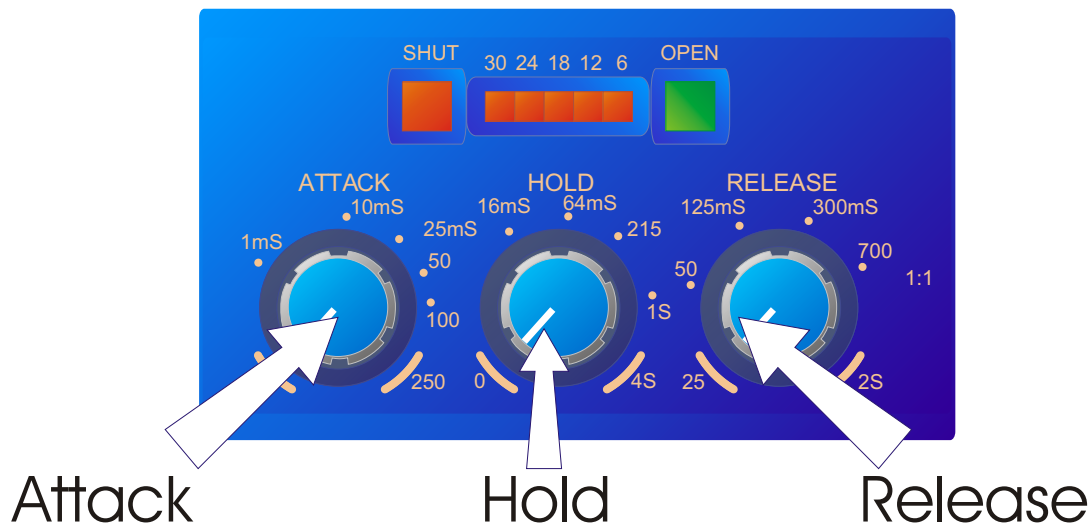
Noise will be hidden between beats...

Signal will be loud enough to cover noise anyway with the result that:

Noise appears reduced!

Note that the noise is still present when the gate is open but won't be noticed as much due to the relatively loud level of the drum in comparison to the noise level.

Attack HOLD and Release Times?



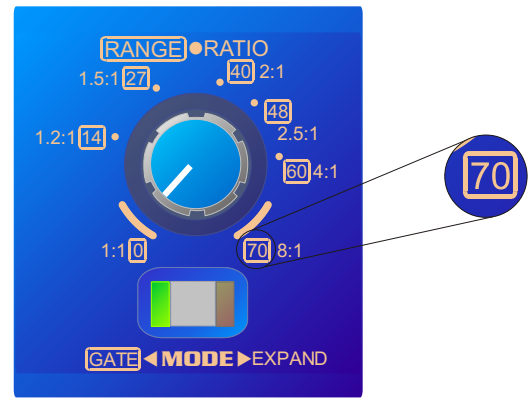
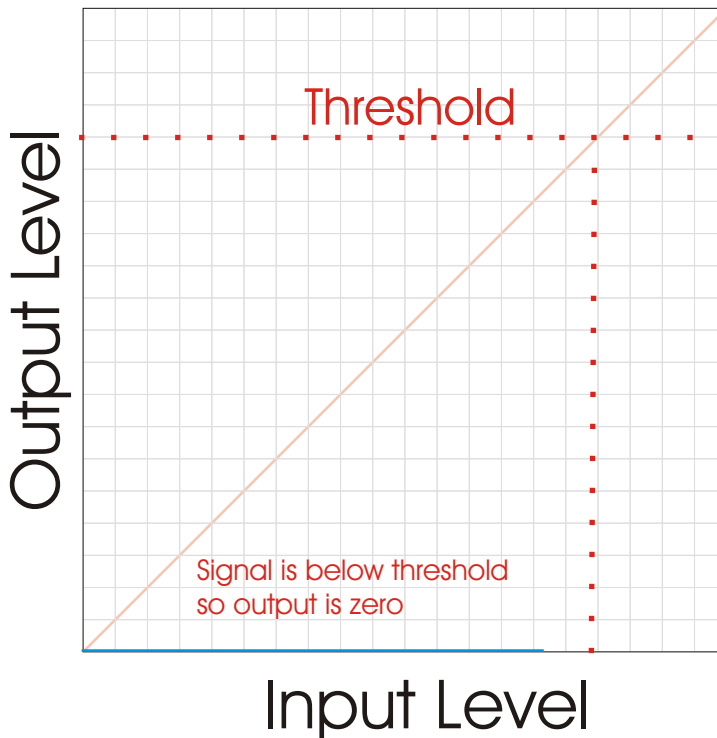
These parameters affect how the gate behaves as the signal crosses the threshold - setting them correctly makes all the difference between the gate working inobtrusively or not. As its primary purpose is to hide noise in most cases , making its action noticeable would be the last thing we would want...

Attack time decides how fast the gate opens - too fast and a click will be heard, especially on sounds which start gradually - like the human voice.

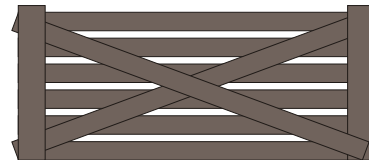
Hold time allows the gate to stay open after the signal drops below the threshold when it would otherwise close. This is useful when the signal hangs about at the threshold and doesn't clear it cleanly. It would cause the gate to "stutter" (i.e. open and close quickly repeatedly) if there was no hold time.

Release time decides how quickly the gate closes when the signal drops below the threshold again - too slow and unwanted noise can be heard; too fast and the sound will appear "cut off".

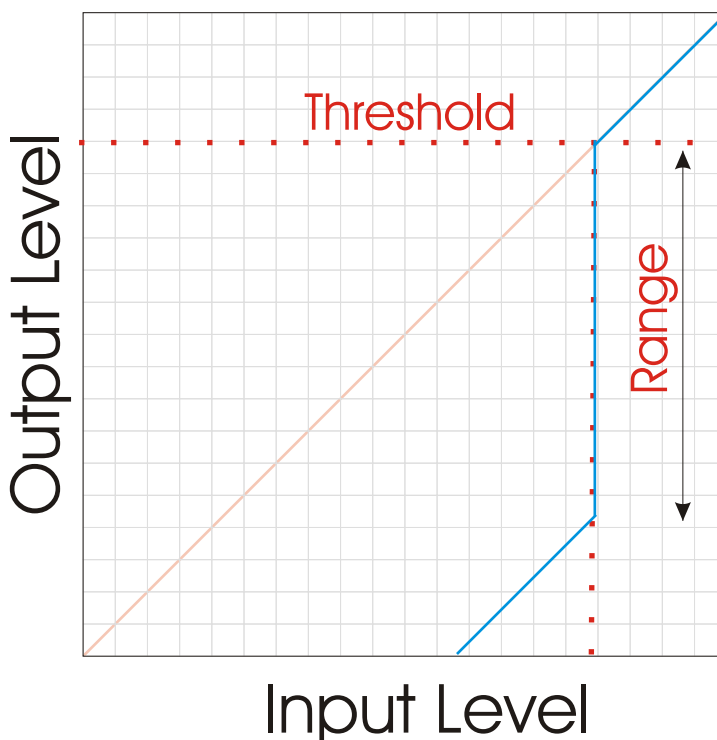
What is the RANGE control for?



While signal is lower than then threshold the gate stays shut (so no output).



However...this isn't the whole story - the gate doesn't have to completely shut. The amount of attenuation when the signal drops below the threshold is set by the RANGE control.



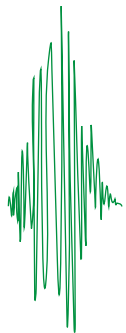
When the gate shuts, it applies a fixed amount of attenuation to the input.

This is just like turning down the volume control a certain amount.

As the range is reduced you will hear the more of the signal even when the gate is shut.

Why would you want the Gate to stay "slightly open"?

Most of the time this control is set to maximum so as little as possible of the signal gets through when the gate is shut. However...

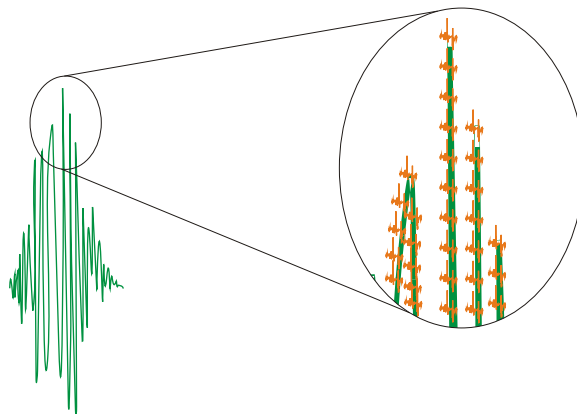


Drum beat



Noise

Going back to the main use of the gate again - reduction of background noise - if we examine the signal more closely we see it actually looks like this:



Noise

Drum beat PLUS noise

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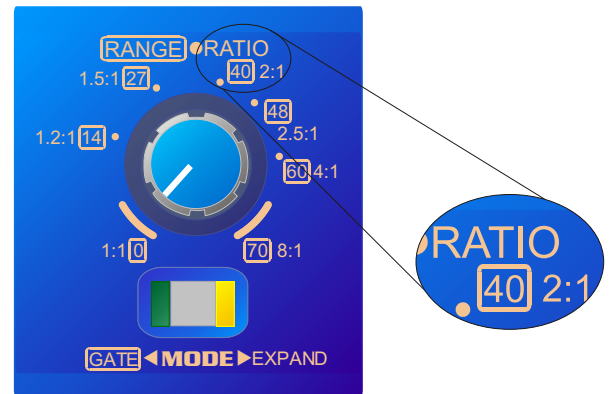
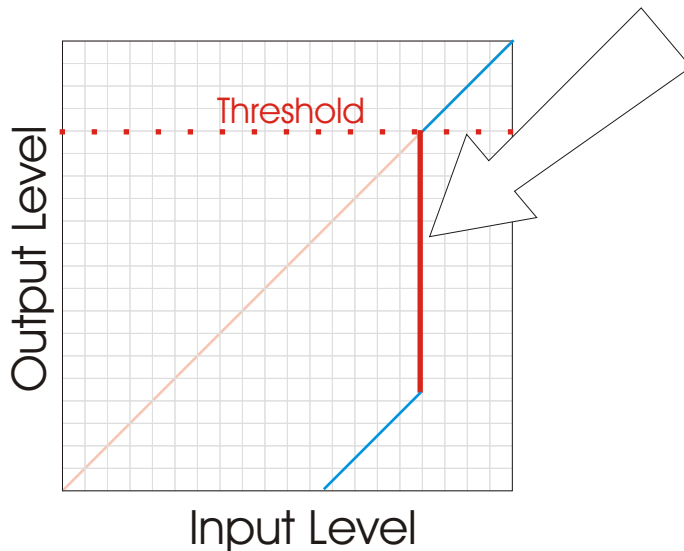
Drum beat masks the noise as long as it's not too loud in comparison. If the noise is quite loud, cutting it off completely when the gate closes only highlights it when the gate opens again.

The solution - turn the RANGE up so that you can hear a little of the noise when the gate is closed - making things sound more natural.

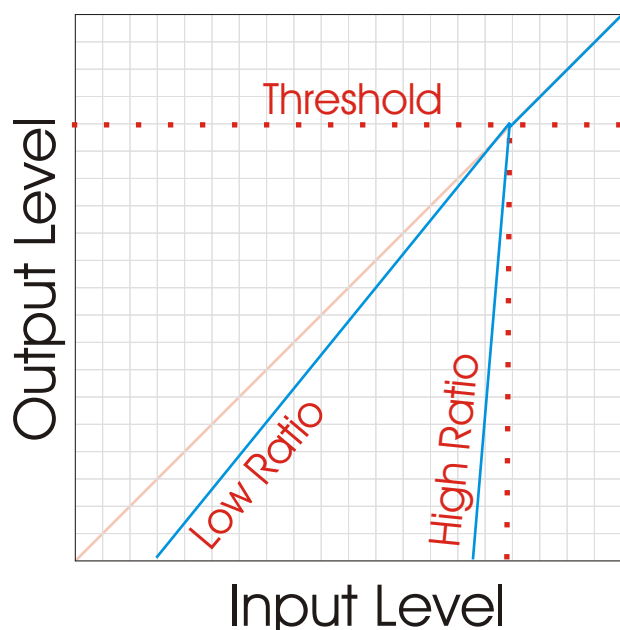
Expander - Gate's gentler cousin.

In the same way as the Compressor is the gentler version of the Limiter, the Expander is the same for the Gate.

No matter what the threshold, when the signal drops below it, the signal will suddenly also drop in level when the Gate closes.



Swapping the Range control for a Ratio control allows the abruptness of the attenuation to be controlled. A HIGH ratio makes the Expander so und like a Gate again as for every dB the signal drops under, it will be attenuated by a LARGE amount.



A LOW ratio means a SMALL drop in level as the signal goes below the threshold

So, compressing all this into a summary...

Limiters are used to set a *limit on the maximum allowable level* to protect speakers and keep signals under control.

Compressors are used to *compress the dynamic range* of a signal - that is - stop the loud parts getting too loud in a bid to prevent sudden unwanted jumps in level.

Gates are used to *turn off a signal* once it becomes too quiet to be useful - keeping unwanted noises out and cleaning up the sound.

Expanders are used to *expand the dynamic range* of a signal - making quiet signals quieter, but in a less abrupt way than a gate..