Dynamics Processing

NST AUDIO

DESIGNED AND MANUFACTURED IN YORKSHIRE, UK

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)

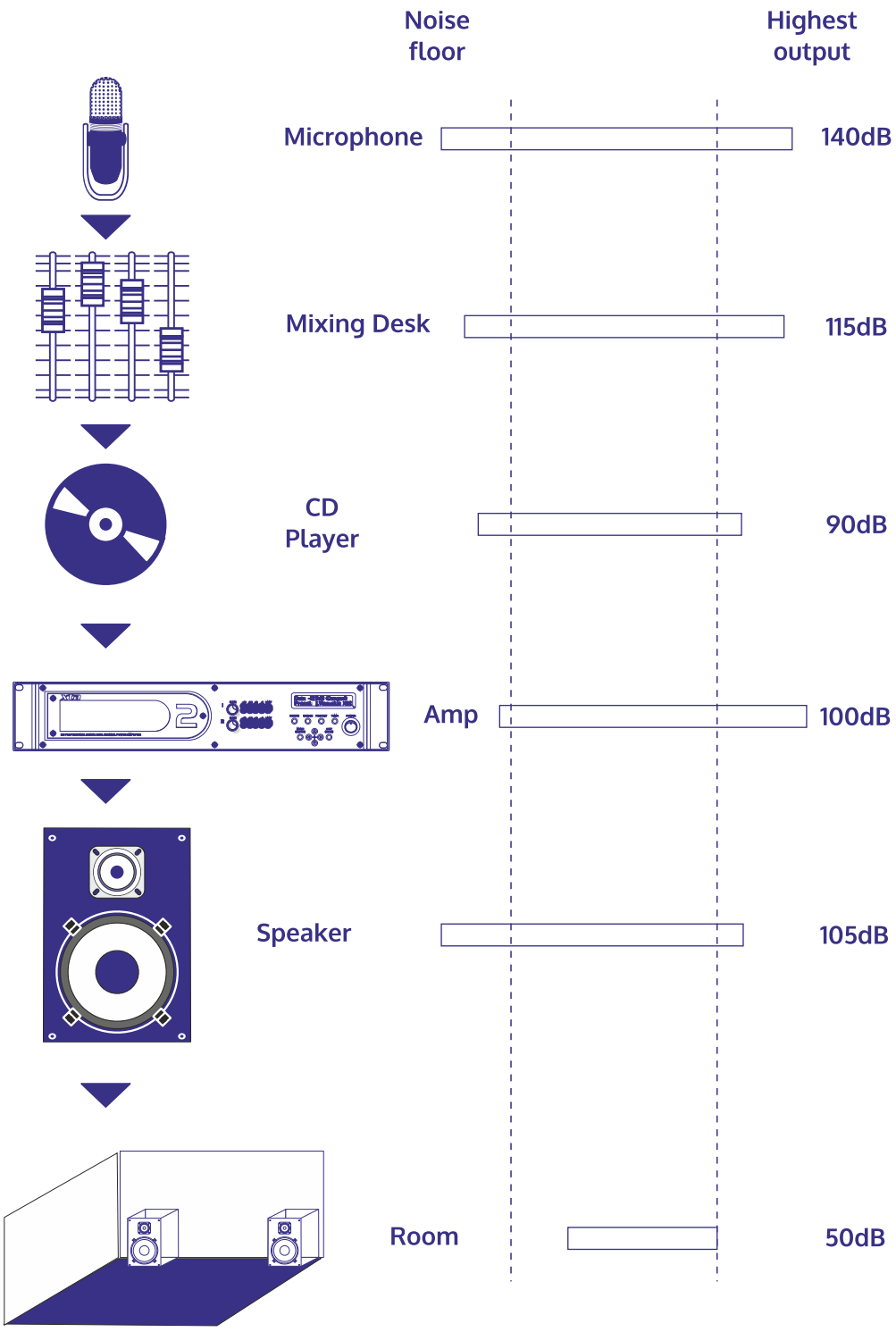
The more Dynamic music is, the more differences exist between loud and soft passages.

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?



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.

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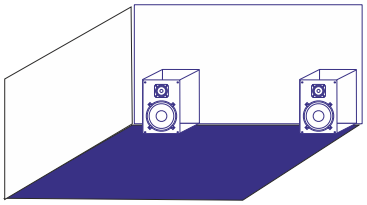
An Example...



Room

50dB

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...

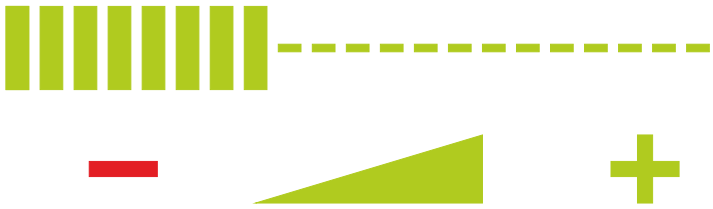
DIY Control...

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.

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.

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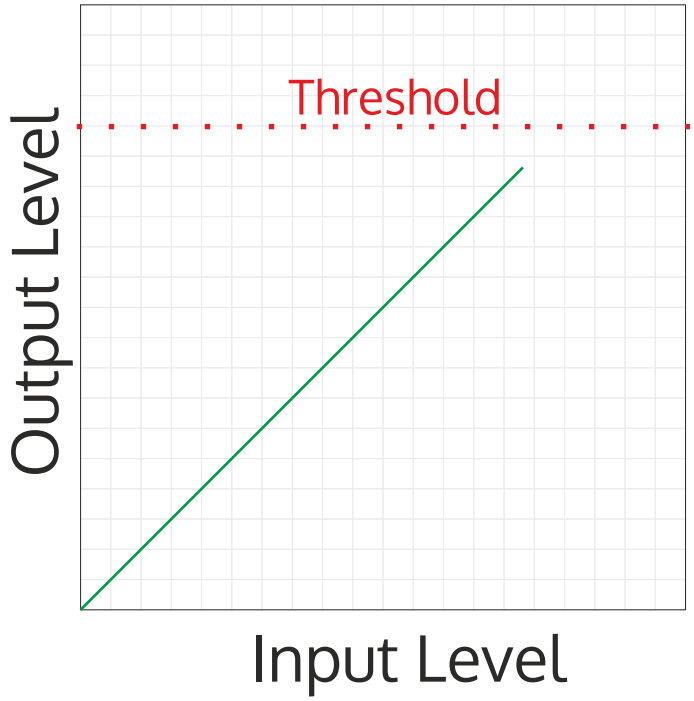
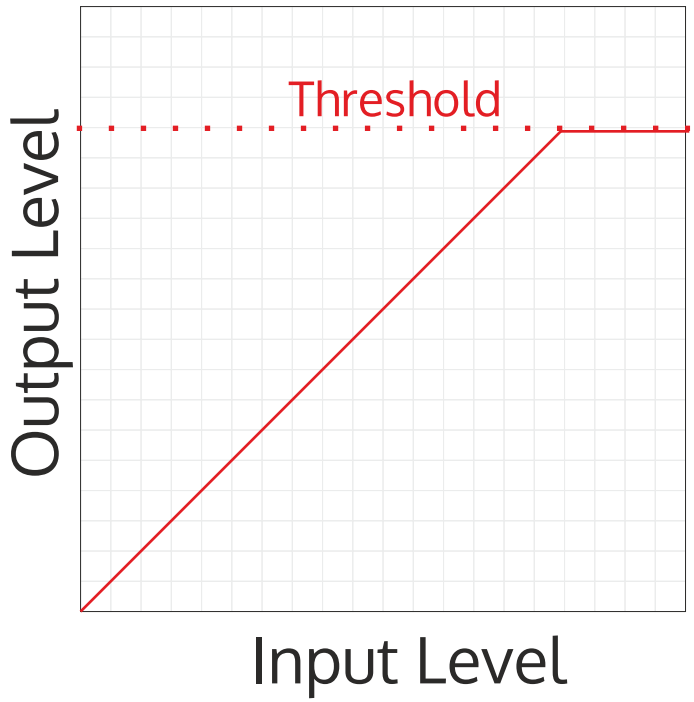
Limiting and Limiters



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.

Limiters - what are they used for?

In all NST processors, the limiters are used to protect the speakers from too high a signal that could damage them.

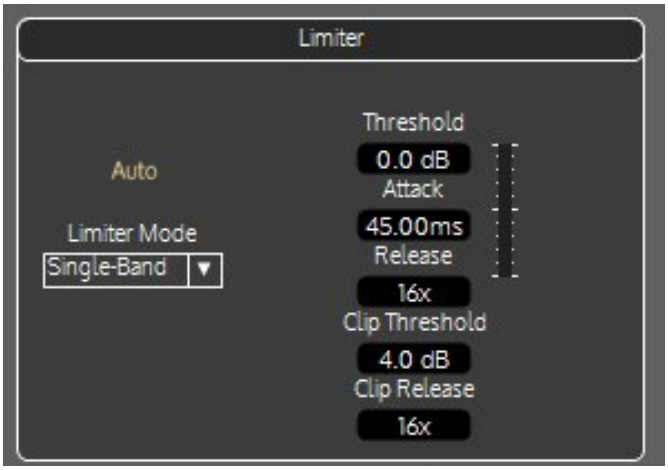
Limiters are also used by radio stations (in a slightly different guise) known as Levellers to make sure that the output of the station stays as loud as possible - commercial radio use a sophisticated levellers to ensure that when you flick through stations, their station appears to be the loudest so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

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.

How do we make sure limiters work well?



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

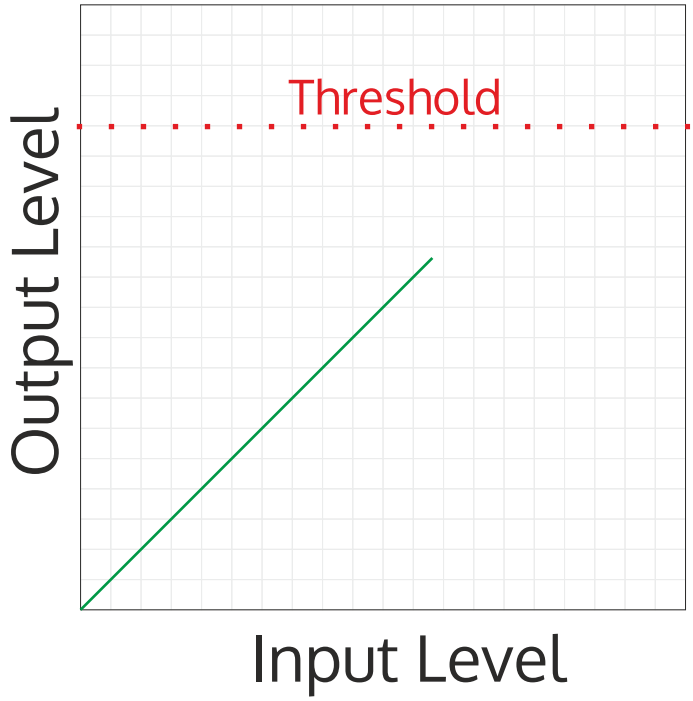
The **Attack** time is a measure of how fast the signal is turned down when it exceed the threshold (how quick you get to the TV remote).

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).

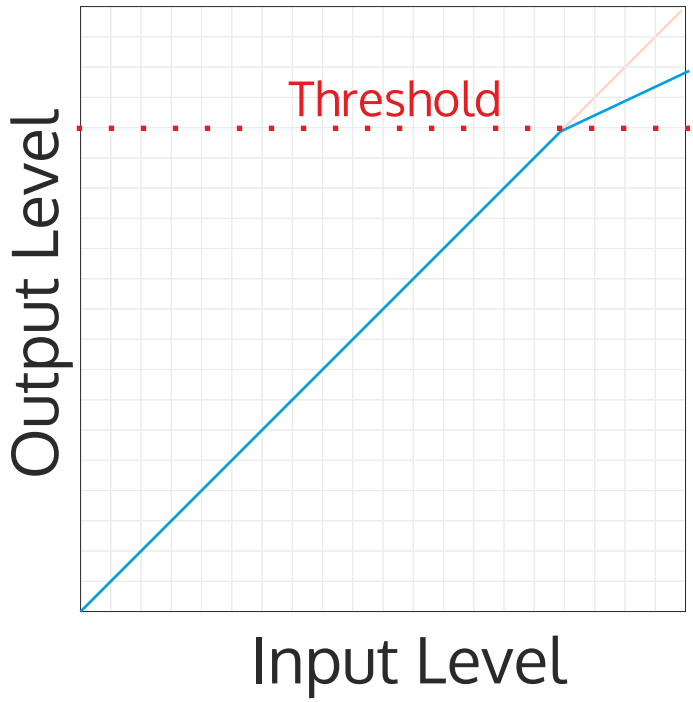
Too fast attack and release times introduce distortion as the volume adjustment tries too hard to follow changes in level, making things worse than having no limiting.

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.



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.

TRIGGER WARNING!

The following page contains scenes of extreme cruelty to speakers.

This may upset some viewers and readers!

Limiters in practice - speaker protectors.

This is what we are trying to avoid...
https://www.youtube.com/shorts/KDjguMnIaik

Limiters in practice - speaker protectors.

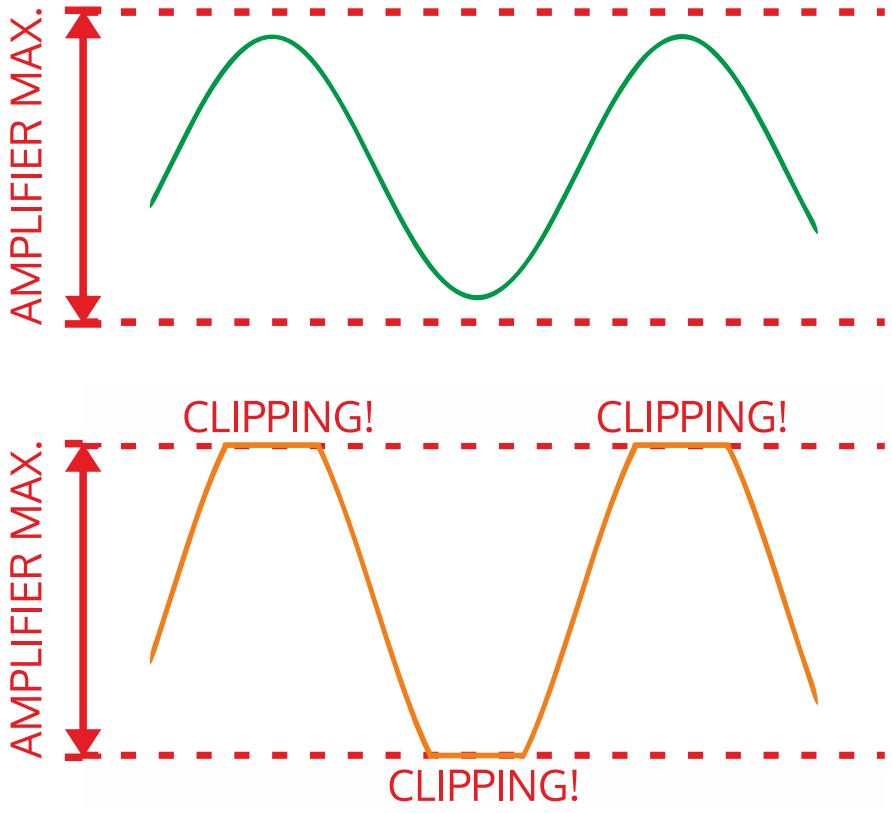
There are two key situations that damage or destroy speakers.

ONE: Amplifiers that are too small.

Counterintuitively, if an amplifier **isn't powerful enough** for a given speaker, it will probably end up being driven beyond its limits.

This results in a phenomena known as "Clipping".

A normally smooth waveform "hits the electrical end-stops" of what this underpowered amplifier can output resulting in a waveform being "clipped" as there is just no more voltage available...

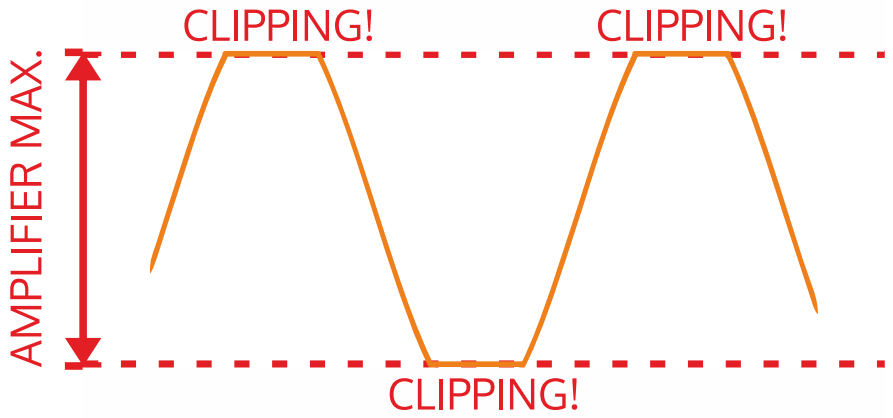


Why clipping is bad...

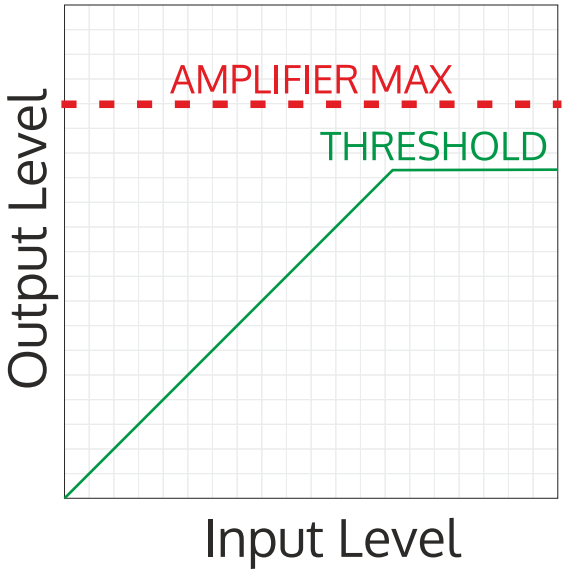
The distorted waveform sounds terrible!

It also contains lots more DC content than normal unclipped audio and this DC results in the speaker overheating and burning out.

Clipping is more damaging, even for very short periods, on smaller speakers such as high frequency drivers as they can't get rid of heat as easily and also can handle less power in general.



Limiters can help here.



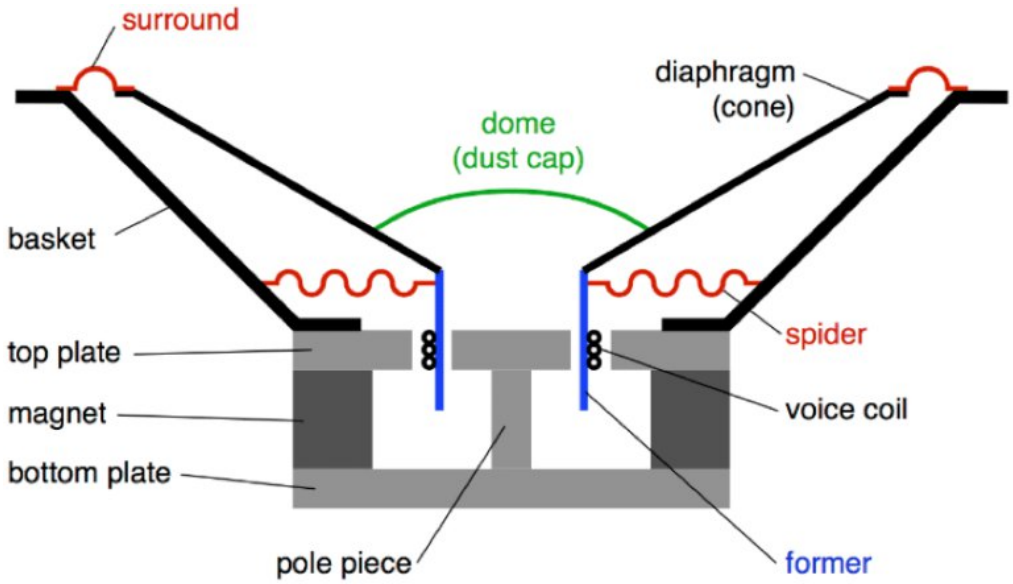
This type of limiter is normally built into the amplifier itself to try and prevent clipping.

Our processors limiters aren't really used for this type of protection...

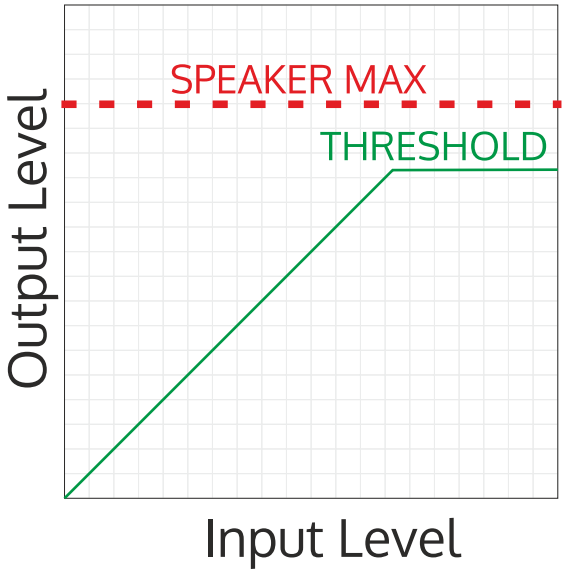
TWO: DJs that are too loud!

Assuming the amplifier is big enough for the job, and can power the speaker as loud as it can go, how do we stop someone sending **too much power** to the speaker?

Aside from overheating, speakers can also be destroyed by mechanical damage. Bigger speakers (low frequency - woofers) are prone to this sort of damage. This is usually caused by a driver being forced to move beyond its physical end-stops.



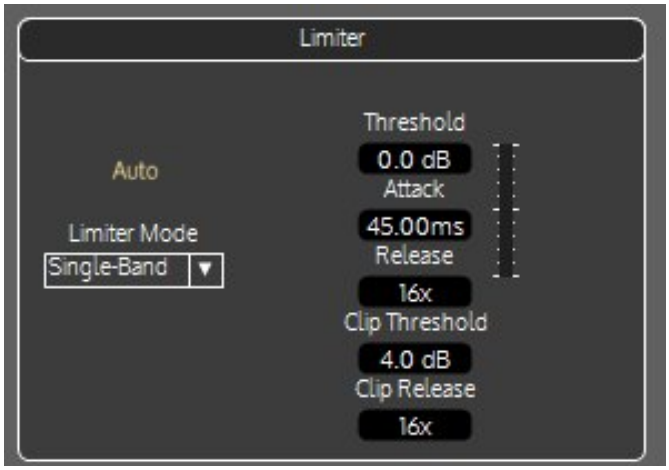
Limiters can help here too.



The threshold for the limiter is determined by how much power the speaker can handle.

Keeping the power safely below this level will protect the speaker.

Limiters Protect Speakers and Ears!



Limiters help prevent the audio level from either getting so high that it will damage the speakers.

They are also used to prevent the level being so high it could cause hearing damage, and for environmental reasons to reduce noise pollution.

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.

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