

Two families: metadata moves the volume knob; processing changes the signal.

Mechanism by destination

MECHANISM	FAMILY	REFERENCE / RULE
Dialnorm (AC-3 / E-AC-3 / AC-4)	metadata	attenuation = dialnorm - 31 dB
ReplayGain 2.0 (music files)	metadata	ref -18 LUFS; track + album gain
Opus output gain (RFC 7845)	metadata	ref -23 LUFS (not -18!)
Apple Sound Check	metadata	playback gain toward -16 LUFS
Spotify normalization	processing	real-time, -14 LUFS (3 modes)
YouTube normalization	processing	turn-down-only, -14 LUFS
FFmpeg loudnorm	processing	re-render to a target level

The math

dialnorm field = 27 -> $27 - 31 = -4$ dB -> decoder turns programme down 4 dB

Range 1..31 maps to -30..0 dB. Value 31 = no attenuation. Measure dialogue; never default.

ReplayGain dB = reference - measured. $-18 - (-12) = -6$ dB (track at -12 LUFS turned down 6 dB)

Opus uses -23 LUFS: a -18 tagger sets Opus gains 5 dB wrong.

Test before delivery (FFmpeg loudnorm)

Pass 1 (measure only):

```
ffmpeg -i master.wav -af loudnorm=I=-14:TP=-1:LRA=11:print_format=json -f null -
```

Pass 2 (re-render, one linear gain):

```
ffmpeg -i master.wav -af loudnorm=I=-23:TP=-1:LRA=11:measured_I=.:linear=true out.wav
```

Remember

- Metadata moves the player's volume; processing changes the signal.
- A wrong dialnorm is fixed by re-mixing metadata - never re-encode the audio.
- You cannot out-loud a normalizer: mastering hot only sacrifices dynamic range.
- Turn-down-only platforms never boost - master to target, not below it.
- Measure first with loudnorm, then choose the family. Re-render only if required.