6 Steps To Releasing Your Music with Complete Confidence

by Ian Shepherd

Thanks for downloading this guide! As a professional mastering engineer myself, I know the goal of every musician in the home studio is to make your music sound the best it can possibly be – on any platform, online and everywhere else.

You probably have some strategies for home mastering already, that can get it sounding great on your own system. But maybe they don't work so well when you listen to your music out in the world – in your car, on earbuds, other people's monitors or online. Or maybe you're just baffled by all the conflicting advice about standards and requirements for all the different formats. I'm going to help you with that.

In this brief guide I'll going to walk you through the 6 steps that *every* master must go through in order to sound its best.

We all want our music to sound fantastic, so that people connect directly with the emotion and the passion behind it.

My promise to you is that after reading this guide, you'll know exactly what it takes to release your music with complete confidence, and what you can to get the best possible results, listening online – or anywhere else.

Ready to get started? Let's dive in

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Overview

There are six crucial steps to mastering.

Everyone thinks about the fun stuff when they think of mastering. Expensive EQ, compression, limiting and more, but the truth is that processing is just one of the six steps. And without the other five, you'll never get the best possible results.

The good news is that each step is simple to understand, with clearly defined goals. Mastering isn't easy, but it is simple.

The 6 steps are:

1. Calibrate – Optimise your monitoring and listening environment
2. Compare – Identify your goals using reference material at matched loudness
3. Adjust – Level, EQ, compression, limiting and more
4. Repair – Spot and correct common technical faults
5. Preview – Hear your music through your listener's ears – the ultimate real-world test!
6. Deliver – Export your files in the correct format

Understanding what these steps are and how they fit together will help you get better home mastering results.

STEP 1: Calibrate

To make the best decisions for how your music will sound, you need to hear it clearly. That means your monitoring and listening environment have to be up to scratch, and this is one of the hardest challenges to deal with for home mastering.

Professional mastering studios have been finely tuned over many years to be as neutral and accurate as possible. Often they're purpose-built, with insanely expensive speakers and amps. But most of us don't have the luxury of doing this at home !

The good news though is that you don't have to. Mastering monitoring doesn't need to be insanely great to get good results (although it helps!) but it does need to be good enough.

That means it needs to be capable of reproducing a wide enough frequency range, and many affordable modern monitors **are** up to the job.

In a minute I'm going to suggest four guidelines, or "Monitoring Maxims", that'll help you get better results with any monitoring setup. First we need to tackle an important topic, though - and understand why it matters.

The Loudness Deception

Our ears are more sensitive to bass and treble for louder sounds. No-one knows quite why – it might be the result of evolution, perhaps. It's more valuable to pay attention to the sabre-tooth tiger breathing down our neck than the one over there watching that herd of gazelles, for example, so our brain pays more attention to louder sounds.

Whatever the reason, the practical effect is that most people think that louder sounds better. Bigger, wider, richer, deeper.

I call this the "loudness deception". If you do nothing else but turn something up, it sounds better – this is the root cause of the "loudness war". To hear the loudness deception in action, watch this video.

The effect for mastering is critical, because in order to get the music to sound right, you need to get the loudness right first. If you add EQ and compression to something but then change the loudness afterwards, you'll change the way it sounds and have to adjust the EQ again.

All of which leads to the first monitoring maxim:

Monitoring Maxim #1 - Choose ONE fixed mastering monitoring level

Since loudness affects how we hear things, and we want to listen accurately, our monitoring level needs to be right. If your monitors are too quiet, you'll always end up making things too loud. If you monitors are too loud, you won't make things loud enough - or you'll damage your ears.

The goal is to find an ideal monitoring level where things sound good and loud when they need to be, but not too loud. Finding this will take some trial and error, but once you find it, **mark the level on your amp or monitoring controller, and don't chang**e it.

This one simple step makes a huge difference to success in mastering. Over time you'll learn exactly how things should sound, and how loud they are. You'll hear EQ and compression differences more clearly, and make better decisions for the music you're mastering. It's amazing !

(Of course, the perfect monitoring level depends on how loud you make your masters. How loud should they be ? We'll dig into this in Step 3)

Monitoring Maxim #2 - Make it as accurate and neutral as possible

If your monitoring has too much bass, your masters won't have enough. If it has too little, they'll have too much. If they're too toppy, your masters will sound too dull everywhere else… and so on.

Put another way, you want you monitors to be as flat and neutral as possible, when mastering. "Balanced", if you like. That way, when someone plays your masters on earbuds, they'll sound tinny and harsh – just as they expect. In a car with massive bass bins, the low end will sound massive - just as they expect. The less your monitoring changes the sound of what you're listening to, the better your masters can be.

Whatever you do, don't fall for the idea that because people are listening on earbuds and phones, we should too. By all means double-check on phone speakers and earbuds, but **don't** use them for final decisions. To find out why not, read this. Mastering monitoring should be as accurate, and as neutral, as possible.

Monitoring Maxim #3 - Use acoustic treatment

This is probably the single most important step there is when you're getting your monitoring to sound as good as possible, and also the one most people don't bother with.

Don't be that person. Your room is lying to you, colouring the sound - all rooms do, even professional designed studios. Adding decent acoustic treatment to your room is the best way to solve this problem – the best monitoring upgrade you can buy, and easily the most cost-effective.

DON'T use acoustic foam - and don't just put it where you *think* it needs to go. There are simple straightforward guidelines to get great results, which work in almost any room.

All rooms need acoustic treatment, and almost any treatment will help the room sound better, and make it easier to get good results. Yes, you can cope without - but it's **really** hard, especially in mastering.

To see how I added acoustic treatment to my own "home mastering studio" (and how I almost got it wrong) take a look at this video:

Building a home mastering studio - Part 3: Acoustic treatment

The treatment I describe in this video literally changed my home room from unusable to sounding **great**.

Monitoring Maxim #4 - <mark>Learn how your monitoring sounds</mark>

This one is simple, easy and **free**. You don't even have to try !

<mark>Just listen to a ton of music in your studio</mark>. That's it !

It's such a simple idea, but so few people do it. We only work on our own music in the studio, so we have no idea what the other music that we like sounds like.

So just listen, all the time, whenever you're not actually working on music. When you're backing up files, or mending cables, or reading PDFs, whatever – over time, you'll learn how the music you like should sound, and unconsciously start to make yours sound more like it, too.

And this idea leads us naturally to…

STEP 2: Compare

One of the most important goals of mastering is to help the music **translate** - to make it sound great everywhere, not just on our own monitoring.

But how do we know that ? Our monitoring is all we have !

The answer is to find songs that *already* translate well - that sound great to you wherever you listen to them, and work to make your music sound more like them.

Since these reference tracks sound great to you everywhere else already, if you can make your music sound great compared to *them*, it should also sound great out in the real world, too. There are some rules you need to follow to get this to work really well, though.

Comparison Concept #1 – You Need To Be Brave

I'm going to be honest with you - comparing your mixes and masters to reference tracks is going to **hurt**.

Because the chances are, your favourite songs were performed, recorded, mixed and mastered by legends, at the top of their game. That's why you love them so much in the first place.

You're comparing yourself to the best of the best, which is the toughest comparison you can make.

So be brave - it'll be worth it, because you'll learn a ton. But it's going to hurt. The next two Comparison Concepts will help, though !

Comparison Concept #2 – You Need To Choose Wisely

True story: someone once sent me a metal album to master. Hardcore aggressive metal - but their references included Steely Dan, Simon & Garfunkel and Fleetwood Mac.

!!!

Don't get me wrong, those are some great-sounding references, and they told me a lot about the breadth of taste of the artists - but they told me **nothing** about how the album should sound, because they sounded nothing like it.

In terms of their goals for the sound, it would be much better if they had chosen reference material in the same genre, at least.

You should do the same. Look for reference material that fits well with you music - so that you might be included together in a playlist, for example. That way the comparisons you make will be more relevant.

Comparison Concept #3 – ALWAYS Loudness Match when comparing

Now you know about the Loudness Deception, it should be obvious why this is important.

If one of the reference files is even a dB louder than yours, there's a chance it'll sound better to you **just because it's louder.**

That's not a fair comparison, and it's not realistic, either.

In 2022, over 85% of all music industry revenue in the US came from **non-physical formats**.

That's code for streaming and downloads, and almost all streaming services these days use **loudness normalisation**. They turn down the loudest songs, to stop you being blasted by sudden changes in loudness, because it's the biggest source of user complaints.

This applies by default to all the main streaming services – YouTube, Spotify, TIDAL, Amazon Music, Pandora and Deezer. And only 17% of users bother to turn it off. On YouTube and Pandora you **can't** turn it off ! iTunes has a similar feature but is the only platform where it's off to begin with.

What that means is that online, **most people won't hear the file at its original loudness**.

And even on physical formats like CD, the first thing people do is adjust the volume to their own preference.

So when we're making comparisons with reference tracks to try and make our music sound better, there's no point in trying to match their loudness. In fact we learn far more by taking loudness out of the equation.

A quick note - I'm **not** telling you not to master your music loud, if you want to ! That's a personal and creative choice, and we'll talk about it more in Step 3. Just don't get hung up on loudness. You don't need to compete, any more. Master your music so it sounds the best it can be, so it sounds great when the loudness is matched, and decide exactly how loud that should actually be as a separate issue.

How to Loudness Match

Loudness matching by ear is a tricky skill that can take years to learn, but luckily there's a short-cut.

We just measure, using Loudness Units (Full Scale) or **LUFS** for short.

The LUFS method isn't perfect - sometimes your ears will tell you something different than the numbers, but it's really pretty good on most material.

And importantly, it's an international standard, which is already used by TV & radio stations, plus YouTube, Spotify, TIDAL, Apple Music and Amazon.

So the loudness of your music in LUFS determines how many people will hear it for the first time, making it an important step in the comparison process.

There are a ton of LUFS meters available, ranging from expensive pro hardware options to affordable and free plugins – in fact there may already be an LUFS meter in your DAW.

They all give the same results, so just pick one that suits you and your budget.

The process is then simple:

1. Play your song and reference tracks all the way through, and look for the "integrated" or "program" loudness value. This is an overall value that can be measured for any piece of audio – if you watch it in realtime you'll see it changing quite a bit to begin with, and finally settling on a single value. Play each song from start to end and make a note of the value for each one.

2. Adjust your song and all the reference tracks to all have the same integrated LUFS loudness - use the lowest value for now to avoid clipping distortion.

That's it - you're now listening to the songs at the same overall loudness in LUFS. Any differences you hear now when you compare **will** be the way people hear them on many streaming platforms.

How to Compare Masters

Comparing is easy. Listen, and decide what you do (or don't) like about each song. Try and figure out **why** you do or don't like it, and make some notes.

The trick is to make sure you compare as many different aspects of the music as possible, to make sure you're listening like a mastering engineer.

Here are the four main things I listen to, and questions I ask myself about when I'm comparing songs in mastering:

EQ Balance

What is the overall EQ of each song ? Is one brighter or darker than the other, does one have tight, punchy bass and the other has deep, booming subs ? Does one have a harsh or cutting mid-range, does another have open, spacious top end ?

We're going to look more deeply into EQ and how to figure out what you're hearing in Step 3, so for the time being just listen and pay as much attention as possible to the differences you hear.

Dynamics

How does loudness change in each song ? Are some varied, open and lively, while others are dense, controlled and intense ? Do some have big contrasts between the louder and quieter sections, but others all sound a similar level throughout ?

Does the sound you hear match the style and emotional intensity of the song ? Are the verses louder than the chorus, does the drop really hit you ? Do the songs maintain energy throughout, or do some sections lose presence and impact ? Listen especially to the drums - how much snap and clarity do they have, and which do you prefer ?

Distortion

There are many different types of distortion. Some are beautiful creative decisions, others are a side-effect of extreme dynamics processing. Some sound soft and mulchy, some sound harsh and aggressive.

How does the degree of distortion relate to the dynamics and intensity of the music in your song and the reference tracks ? Think about how distorted each song is, and whether it suits the style and the emotional impact of the music.

Stereo image

There are two aspects to stereo image for me - width, and depth.

Width simply describes the spread of the elements in the mix or master - how widely are they panned, how much contrast is there, does the image sound very tightly focused in the centre, or much more spacious ?

Depth is more about the "3D" nature of the audio. Does everything sound like it's coming from a simple left-right line between the speakers ? Or is there a sense of space in the sound ? Do some elements sound as if they're set further back behind the speakers, and others are more up-front ? Sometimes sounds can even sound almost as if they've come from outside the speakers, or behind you.

Again, think about whether the choices suit the music and the emotion. Is the wide stereo image cool, or distracting ? Does the space add to your enjoyment ? Or does the sound seem clustered and muddled ? Reverb and delays can have an important impact on the way we hear stereo.

Time For Action

Before we move on to Step 3, I'd like to ask you to apply some of the ideas from these first two steps to your own music. So before you go any further, take these steps:

1. **Choose 3 reference tracks**

   These need to be in a similar genre to the song you want to master, and they need to sound fantastic to you, wherever you listen to them.

2. **Loudness-match them by measuring their integrated LUFS values**

   Any LUFS meter will do - just measure the three reference songs and your own, and turn them up or down to match.

   So for example, if your mix measures -18 LUFS, and the first reference song measures -12 LUFS, you need to turn it down by 6 dB before you compare

3. **Adjust your monitoring level so they all sound good and loud**

   This isn't your fixed mastering level yet, we'll be deciding that in Step 3 - we just want to listen at a good healthy level so we can hear what's going on clearly

4. **Compare the songs, and make notes**

   Think about all the categories I listed above, and decide which songs sound best to you, and why. If you want to try and improve you own mix, think about what you might need to change in the mastering.

   And remember - be brave ! Your mix isn't mastered yet, so there's plenty of scope to improve it. If it doesn't sound great yet, that's OK. We're going to improve it - this stage is all about learning to listen objectively, *before* we start adding mastering processing.

That's it – you're done. Great work !

Hopefully you now have some helpful notes about the way your songs sound in comparison to the reference tracks, and how you might like to try and improve them.

For example, perhaps the reference songs have more solid, defined bass. Or a more open, airy top end. Or maybe you don't like them as much as you thought you did, now you've heard them loudness-matched !

Loudness can distract us all kinds of problems, overwhelming subtle differences with its sheer brute force. But most people nowadays are hearing things first online, with matched loudness, and this can reveal distortion and other aspects of the sound that we didn't notice before.

I often hear people claim that the streaming services have ruined the sound of their masters, and it is true that the quality can suffer, especially on mobile devices at low data-rates. But many times when I listen, I find that what's actually happening is that the loudness-matching of the streaming services is **revealing** things people don't like about the sound, that were there already but they hadn't noticed.

Most likely, it's a mix of all these things - there are probably things you prefer about the reference songs, and things you like about your mix, too. Either way, in Steps 3 & 4 we're going to look at the ways you can adjust the sound in mastering, and repair common problems.

Before we get to that though, we need to deal with the (loud) elephant in the room.

How Loud Should You Master ?

It's the most common question I get asked.

Loudness is fundamental, and affects every other decision we make in mastering. So how loud should you go ? How loud is loud enough, and how loud is too loud ? What's the best loudness online ? And so on.

In a nutshell, you have two options:

1. Match the loudness of a reference track

2. Choose a specific loudness to master at

Option 1 is easy to understand - just choose a song or artist you think sounds great and aim for a similar loudness. This works, but it can be **hard**.

A lot of mainstream music is mastered super-loud at the moment, and this can be difficult to achieve with good results. It's quite possible, but the question is, is the effort worthwhile ? If people hear it online, they won't know how loud it was originally, and research shows that <u>music fans actually don't care about overall loudness</u>, even when normalisation isn't being used.

Option 2 on the other hand allows you to choose exactly how loud you want to master, without competing with every other release out there – but it still doesn't answer the question of "how loud" that should be.

My recommendation for loudness

<mark>Make the loudest sections no louder than -10 LUFS, and balance everything else musically</mark>

If that idea seems simple – that's because it is ! But it's based on over 25 years of professional mastering experience, and it still serves me well. This strategy will get you right in the "loudness sweet spot" – it sounds great, with excellent dynamics, and it will

work well on both CD, vinyl and online.

We'll talk more about this again in Step 6, but if you're interested in more detail about this strategy, and why it works, take a look at this:

How loud ? The simple solution to optimizing loudness online – and everywhere else

Before we move on, a few comments:

- This guideline is based on using **short-term** LUFS, not the overall "integrated" value. You can find out more about this at the link above.
- I also recommend peak levels no higher than -1 dB (True Peak)
  Again, there's more detail at the link above, and we'll look at True Peak levels again in Step 5
- This is **not** super-loud, by current mainstream standards
  But it **will** enable you to achieve a great sound, in almost any genre, and work really well online
- You may even find it's too loud for your tastes - in which case choose a lower value !
  There are no rules on this, no standards - it's all about finding your own "loudness sweet spot"

Which leads us to another important point:

There are no "targets" - we DON'T want to make everything equally loud

It doesn't make musical sense for everything to be the same loudness – an acoustic ballad shouldn't be as loud as a heavy rock song, for example. So even when we've decided how loud we want to master, there should still be plenty of variety from song to song. They'll work musically next to each other, which is a crucial goal of mastering.

It also doesn't make sense to aim for the reference levels used by online streaming services, either. I often see people saying "aim for -14 LUFS", since that's a common reference level used by YouTube, Spotify, TIDAL and others. But we don't **need** to aim for that value, or any other one.

The streaming services adjust to their preferred Distribution Loudness **for us**, so all we need to do is make the music sound as good as it can. It's a good idea to Preview what they'll do, so we can make sure we're happy with the end result - but if it gets turned down by 2-3 dB, provided it sounds great, that's fine. We'll look at this in more detail in Step 6.

And don't worry – the variety I'm suggesting still works with normalisation, too. Individual songs may get turned down in playlists or shuffle mode, but Spotify, TIDAL and iTunes all have an "album mode" to make sure quieter songs aren't boosted when we listen to albums.

Setting your mastering monitoring level

Once you've decided how loud to master your music, you can choose your final mastering monitoring level, as I suggested back in Step 1.

It doesn't matter whether you're matching a particular song, album or artist – simply adjust your monitoring level until the music is comfortably loud at the loudest moments, and stick to that level.

Step 3: Adjust

So, you've chosen your reference tracks, and matched them all to your preferred mastering loudness. That means either:

- As loud as your chosen reference track(s)
- Following my "no louder than -10 LUFS" recommendation, or
- Your own particular preferred level

You've set your mastering monitoring level so that these songs sound good and loud at the loudest moments, and you've invested in some acoustic treatment for your studio to get it sounding as accurate as possible. (You *have* done this, right ?! DIY acoustic treatment is very affordable…)

You're ready to start making mastering adjustments to your music, to help make them sound as good as they can possibly be !

First though, ask yourself an important question:

Would it be better to go back and make changes to the mix ?

This is a luxury you'll only have if you're the artist or engineer, but even if you're mastering things for other people it's an option to ask about.

Often there isn't time, or money, or energy (!) but it's always worth considering. Usually the results you get by improving the mix are even more effective and successful than trying to achieve the same thing at the mastering stage.

Assuming you've done all you can with the mix though (and further tweaks aren't an option), it's time to get started. First of all, let's talk about the kind of processing I use when I'm mastering.

My Mastering Chain

I see so many posts online about different mastering processing chains. They're all different, and often rely on one or more "magical" pieces of gear or plugins.

The one thing that most of them have in common is that they're often really complicated – 7, 8 or more processors in a row, often with multiple EQs, compressors, maximisers and more.

My chain is different, in two important ways.

First, it's simple. It has only 4 stages.

Here they are:

- EQ
- Compression
- Limiting
- Metering

That's it !

Of course I sometimes vary the order, and I sometimes add extra elements to achieve specific tasks – stereo width processing, for example. But probably as much as 80% of everything I master is done using *only* these 4 processing stages. And the meters don't even do anything to the sound !

And **second**, I don't really care what I use at each stage.

Actually that's not strictly true - I *do* have favourite plugins and bits of gear, just like anyone else. And some of them I'd miss if I couldn't use them.

But I *could* use almost anything and get great results, if I had to. I often go to colleges and do a workshop where I use **only** stock EQ and a limiter to make dramatic improvements to a collection of songs provided by the students. And actually back when I was first trained, many albums were mastered in exactly this way – compression was still quite rare in the mastering studio back then.

So, let's look at each of those stages in detail. I'm going to start at the end of the chain and work backwards.

Mastering Metering

Your monitoring is the *real* final stage in your mastering chain, which is why it's so crucial to get right. And of course your ears are the best possible judge of what sounds best.

There are many useful meters that can help us while we're learning though - LUFS loudness meters, as we've seen, but also frequency analysers for example, that help give an idea of the overall EQ balance.

When I'm mastering, I tend to use:

- An LUFS loudness meter
- A True Peak meter (to make sure there's no clipping) - see Step 5
- A frequency analyser - for example Voxengo SPAN is a great free option - I'll talk more about it in a minute
- A correlation meter - these help give an idea about the stereo width of the signal. Again I'll talk more about this in a minute

My other favourite meter is a plugin emulation of an analogue needle-style VU meter. My favourite is the Klanghelm VUMT, which has a great name and is extremely affordable.

I was trained using a VU meter to judge loudness, and although they're a bit quirky in comparison to LUFS meters, they have the huge advantage of being most sensitive in the middle of the range. You only have to go a dB or two too loud and the needle "pegs", and if the level is too low it will rarely reach zero, which is easy to notice.

So when I'm mastering, I use a VU meter calibrated to -11, and aim to have the needle hovering around zero in the loud sections, pushing 1 or 2 dB into the red occasionally. This gives results that completely fit with my "no more than -10 LUFS" recommendation. Try it, you might like it !

You can see more about VU meters and how they relate to LUFS loudness in this video:

LUFS, dBFS, RMS… WTF ?!? How to read the new loudness meters

Limiting and Compression

These are two separate stages in the processing chain really, but I use them together to get the best results. In fact, strictly speaking a limiter is just a compressor with a very high ratio, and very fast attack and release times.

My goal with compression and limiting in mastering is to be **invisible**. In mixing, compression can be an important creative tool, changing the sounds dramatically, but in mastering I want people to just think the music sounds amazing without knowing why, not think *"wow, that's some great mastering compression"*.

Limiters are best at handling transients cleanly, and compressors are better at handling the "body" of the sound. If a limiter is working so hard it's cutting into the vocal, or bass guitar for example, it's almost certainly going to sound poor.

So my recommendation for mastering is:

- Always have a high-quality mastering limiter at the end of the chain
- Start by adjusting the input gain **before the EQ** so your song is at about the right loudness - more on this later
- Remember the EQ comes before the compressor so it should already balanced - I'll talk more about this in a minute, too
- If it sounds great already, you're done ! No compression needed
- If it needs more "glue" or dynamic control, try adding some compression
- Start with moderate settings, for example 2:1 ratio, and 100ms attack/release times
- Avoid compressing too heavily, and adjust the threshold so that the compressor releases back to zero gain reduction several times a bar

Using these guidelines will enable you to get great results on a really wide range of material.

By adjusting the loudness using a simple gain change first, you minimise the amount of tweaking of threshold and make-up gain that will be needed, and hear less level change when you bypass the compressor to see if you like how it's working, reducing the risk of being fooled by the loudness deception.

Avoiding very fast attack and release times in the compressor will allow the transients to come through much more cleanly - and the limiter can deal with those, which is what it's good at. But the compressor will control the body of the sound more gently, and help ease the load on the limiter, which also helps it do its job better.

Making sure the compressor releases back to zero gain reduction regularly helps avoid over-doing things. I've written more about this topic, and why you might sometimes want to break the rule, here:

When over-compression sounds great

Finally, I often like to use multi-band compression when I'm mastering, to get even more invisibility. There isn't space to go into it fully here, but you can find out more about how I use it in this post:

Multiband compression – the mastering engineer's secret weapon?

Remember I mentioned above that it's important to have balanced EQ going into the compressor, which is why I usually apply EQ first. In the next section we'll look into this in more detail.

EQ in Mastering

EQ is probably the most important element of mastering. So often I see people throwing more and more processing at their audio, without getting the EQ right first.

A tiny change of only 1 dB or more can help a snare seem to open out, or tame a harsh vocal, or really help add thump to a kick drum. Whereas other times very large changes are worthwhile – for example if a song was mixed on very small speakers and has way too much bass as a result.

Of course there's a limit to what EQ in mastering can influence, but I'm still amazed at how effective it can be, even after all this time. We can't really choose to only EQ once element of a mix, but quite often we can make it *seem* as if we can !

As I mentioned above, it's important to get the EQ balanced before compression – here's why:

Imagine a mix with a very thumpy kick drum – too much 50 Hz energy, say. If we compress that without EQ first, the chances are it'll cause pumping – the compressor will react the the kick and pull the overall gain back, affecting the whole mix. If we then add EQ after the compression to take the excess 50 Hz out, the EQ will sound balanced but the pumping will still be there. In fact, it could be **more** noticeable because now the heavy 50 Hz that caused it has been removed.

But now imagine the same situation where we apply the EQ to reduce the 50 Hz boom *before* the compressor instead. Now the overall EQ is still balanced, but with less (or no) compressor pumping. The compression is less noticeable, more invisible – mission accomplished !

So the goal of mastering EQ is balance - but what **is** balanced EQ ?

In a nutshell, you want to avoid large lumps or dips at any point in the frequency spectrum – **IF** you have a full arrangement. So a full band should probably have fairly even frequency response across the whole range, whereas an acoustic guitar & vocal ballad is unlikely to have pounding bass or sizzling high frequencies.

The best way to train your ears to this is to start watching a frequency analyser. Many DAWs and EQ plugins have them built in, or you can get something like **Voxengo SPAN** for free. If you decide to try it, I recommend switching it to Master Mode - this will give you a much less detailed, slower overall display, which makes it easier to pick out the overall EQ shape without being distracted by too much detail. Look for big gaps or build-ups, and experiment with tweaking them.

And finally, remember to adjust the loudness of your music **before** you start to add EQ. If you EQ when the level is low and then turn it up later, you'll hear more bass and treble (the loudness deception) and have to re-adjust it. Many EQs allow you to change the gain internally, but I recommend you do it as a separate process beforehand, to minimise the change in loudness when you bypass the EQ to hear it's effect clearly.

Stereo Processing

I mentioned that I do add extra stages to this chain sometimes, and one of the most common goals is to tweak the overall stereo image. There isn't enough room to go into this in detail here, but if you're interested you can see some of the options I use in this video:

Stereo width in mastering – how to measure, monitor and modify it

Summary

So that's it ! You should now understand the entire mastering processing chain. Let's recap, from start to end:

- Adjust the gain to achieve your desired loudness
- Balance the EQ
- Add compression if necessary
- Check the loudness again (in case the EQ and compression have affected it)
- Compare to your reference track
- Repeat if necessary

Here's another video where I walk through the whole process from beginning to end:

The simple secret of real mastering – subtlety and simplicity

And remember – you need to do this separately for each and every song. Mastering is **NOT** just adding a bit of global limiting and EQ. Every song needs to be considered and optimised individually.

This may sound really obvious, but it's a point that lots of people miss. In fact (guess what !) I wrote a blog post about it:

The heart and soul of mastering

I gave it quite a 'big' title, because I think it deserves it !

Step 4: Repair

In an ideal world, your mixes will sound perfect, with pristine quality.

In reality, that's unlikely.

Here's a list of just some of the faults that may crop up in the recording and mixing process.

- **Hum** – Amp noise, earthing problems, a nearby road, air conditioning…

- **Crackle** – A dodgy cable, poor connection, dirty EQ pots, rustling clothes…

- **Buzz** – Guitar pickups, bright stage lights, amp noise (again !)…

- **Clicks** – Mouth noises, a creaky chair, dodgy edits, faulty gear…

- **Distortion** – Overloading inputs, impedance mismatch, too many guitar pedals (!)…

You name it, you'll hear it, one way or another. And of course ideally we'd go back to the mix to fix it, but that's not always possible.

Either way, mastering is the final stage in the quality control chain, and if you notice a fault, it's up to you to make the client or artist aware and possibly try and fix it.

You may wonder why I didn't mention this earlier on, and it's certainly true that problems like this are best fixed as early as possible. But often the mastering problem will enhance or reveal a fault in all it's glory, that hadn't really bothered you before. Or, it can just be the process of putting the music under the microscope that makes it bother you. So ideally, if you notice it during mastering, go back to the source and try and fix it there, if you can. But it's almost always at the mastering stage that you'll notice.

I'll talk about some of the ways we can help improve problems like these in a minute, but before I do you may have noticed there's one fault I didn't mention - **hiss**. And it's actually one of the most common "faults" we come across, and something that many people obsess about.

It's always been here – some of our favourite classic recordings are bathed in hiss ! Tape noise, amp noise (again !), poor gain-staging, air conditioning units… you name it.

But here's the thing - hiss is our friend.

OK, not always - not if it's seriously distracting. But a bit of white noise never hurt anyone, and our ears quickly tune it out. Added to which, even the most sophisticated modern processing adds annoying artefacts when removing hiss. It's **so** easy to over-do it, and end up with something worse than the original problem.

So de-hiss if you must, but maybe just try rolling out a little top end in the quiet sections instead - it can often sound more natural.

Removing faults

A detailed discussion of repairing all the problems we've been talking about (and more) could make a small book in itself.

Instead, I'm going to give you some (hopefully) helpful pointers to help you get better results.

1. **Get IZotope RX**

   Many plugins and DAWs offer tools to report and remove faults, and some of them are pretty good. By all means give them a try, but the best value I've discovered so far is the amazing iZotope RX.

   Clicks, thumps, pops, buzz, hum, crackle, mouth noises, lost sheep – yes, even hiss. There's almost nothing RX can't at least help with.

   On the downside it's a deep, complex application, and takes a lot of work to master. But if you're serious about trying to repair faults in mastering, you *need* RX. And especially, learn how to use the Spectral Editor.

2. **Be creative – experiment**

   Even with a heavyweight tool like RX, it can take time to figure out the best way to repair certain faults.

   For example, I mentioned the buzz caused by powerful stage lights that you sometimes get into a live recording. The interesting thing about this particular type of fault is that although it sounds like a buzz, it's actually often made up of tiny clicks, at a very high rate. So the best way to remove it isn't necessarily a de-buzz process, but actually a de-click pass. And so on.

3. **Don't give up**

   This follows on directly – keep trying. It can be discouraging if a processor that you think should be perfect for the task completely fails to get a result you're happy with, but that doesn't mean you'll never succeed. Keep trying ! Especially if you're trying to repair That Perfect Take.

4. **Always go back to the source, if possible**

   I know I've already said this, but working on the master can be the worst place to repair faults.

   I shudder to think of the number of times I've spent an hour or more removing annoying mouth noises in a song, only to have the artists decide they want a mix tweak and send me a new version, so I have to do it all over again !

   And if you really *must* de-hiss something, it's far better to work only on the problem

channel within the mix, rather than applying the processing to the whole mix. Wherever possible, repair it as soon in the processing as you possibly can.

Time For Action (Again)

So there you go ! By this point you've learned to optimise your mastering monitoring, chosen the loudness you want to master at, compared you mixes to suitable reference material (at matched loudness), adjusted the EQ, compression and limiting to get the best possible result, and repaired all the faults.

All you need to do is give all these ideas a try, and see how you get on.

So once you've finished adjusting your songs and they're sounding great - what's left ?

Quite a bit, actually ! First, you have to make sure you're happy with the result of your hard work. And next, you have to get it safely onto its destination format or platform.

Neither of these steps are very difficult, but neither of them are entirely simple, either.

Let's dig in !

Step 5: Preview

Surely we already "previewed" our work by listening to it during Step 3 ?

Yes, but now we need to test it out more thoroughly, in three different ways:

1. Out in the real world
2. After encoding
3. Online

Let's look at each of these in turn.

Previewing masters in the real world

"In the real world" could mean almost anywhere, but ideally it should be places you often listen to music, so you have an instinct for how it should sound.

So for example, this could include 2-3 of any of these options:

- On earbuds or a great pair of headphones
- In the car
- On a smart speaker
- In your living room stereo
- Through your TV
- On a laptop
- At a friend's house

…and so on.

Don't bother listening in places or on systems you don't know well, though. One of my favourite sayings is *"A man with a watch may know what the time is, but a man with two can never be sure".* This applies absolutely to audio, but with knobs on !

In other words, there's a real risk of getting **utterly** confused.

To avoid this, I suggest you use this process:

- Listen in the Real World
- If you notice something, make a note
- Listen again back in the studio
- If you hear something – boomy bass or harsh mids, say – adjust it
- Repeat as necessary

If you **don't** hear the same thing in the studio, listen again somewhere else. If you never hear that problem again, it was probably just a quirk of the particular playback system you were listening on.

But if you notice it in other places too, there's a chance you've noticed something that you're not hearing in your studio, and you need to be careful.

A boomy bass note would be a classic example - the room acoustics in your studio might prevent you from hearing a particular frequency accurately, so you end up adding too much of it. You'll then hear this frequency booming out in plenty of other places. Time to experiment with speaker placement or more acoustic treatment, perhaps !

In the same way, if you keep hearing something on your favourite real world listening system, but no-where else, you've probably identified a quirk of that system, and can safely ignore it if you hear it in future.

As you can probably tell, this is a continual learning process ! The good news though is that every time you go through the process, you learn more about mastering, more about what makes your music sound great, and more about your mastering monitoring.

Previewing masters after encoding

The reality is, your music **will** be ripped, meaning: be encoded to some form of lossy codec. MP3, AAC, Ogg Vorbis, whatever.

And all these formats change the sound. Not always massively, but in important ways. There's not a huge amount we can do about this, but we *can* follow a few simple guidelines to minimise the damage.

The first of these is to test, by listening to encoded versions of our files. Either by encoding them ourselves, or more conveniently by using one of the pieces of "codec preview" software that are available.

These allow you to listen to encoded versions of our audio in real-time, in a variety of formats. Some even allow you to listen to the "null" signal, or the information that has been thrown away during the encoding process – mulchy distortion, most of the time.

Whatever the result, there's not usually much you can do about it, but with one exception.

PAY ATTENTION TO THE PEAKS

Almost all encoded files have higher peak levels than the original. This is because the encoding process involves very aggressive processing. Very loosely speaking, the audio gets filtered into 30 or more separate bands, up to 90% of the information is thrown away and the bands are then rebuilt into something (that sounds surprisingly like the original) in the decoder.

When you think of it like this, it's not that surprising that the peak levels change !

The problem is, often these peaks are above 0 dBFS, and many of the mainstream decoders slice them straight back off again immediately after decoding, which can cause extra distortion.

The solution is to reduce the peak levels slightly before encoding, so that the decoded peaks don't go above zero, which is one of the reasons I suggest keeping peak levels to -1 when you're mastering.

In fact, I recommend -1 dBTP. The TP stands for "True Peak", which is basically an oversampled version of the normal peak level, to try and predict when problems like this might occur.

The other thing that helps is to not master too loud. The higher the LUFS loudness, the more likely the decoded peaks are to go above zero. I've seen examples as high as +4 !

If you're following my suggestion of "no higher than -10 LUFS", with True Peaks no higher than -1, you should be pretty safe. If you're mastering louder than this though, you need to pay attention to this. Spotify even recommend you keep peaks below -2 dBTP if you're mastering louder than -14 LUFS.

Of course in theory you could supply masters for encoding at slightly lower levels, but in my experience even people who still buy CDs also rip them, so I think it's better to simply keep to peaks no higher than -1 dBTP, on any format.

To hear an example of this in action, take a look at this video:

Is Billie Eilish too loud ? (Here come the Loudness Police)

Previewing masters online

You've probably realised by now that I pay a lot of attention to what happens to the music I master online. That's because it's where most people listen, these days !

And the two factors that affect the quality online are lossy encoding, as we've just seen, and loudness normalisation.

Overall I think normalisation is a Good Thing - it gives us a better user experience, and it means people don't have to "compete" with loudness in the way that they used to on CD. But it's still quite a new technology. It's doesn't always work the way we expect it to, or would like, and all the online platforms do things a little differently. Which is why I worked with **MeterPlugs** to develop the Loudness Penalty website.

In a nutshell, the site tells you how the loudness of your music will be changed, on all the most popular streaming sites. For free, and without uploading !

More importantly though, it allows you to listen to a realtime Preview of the loudness change, so you can directly compare the results for your music on YouTube (say) against a suitable reference track playing directly from the platform in another browser tab.

You'll notice I keep stressing the importance of using Preview to **hear** the effect. One downside of the site is that people are getting very hung up on the numbers. Remember, **they aren't targets**.

Personally if I find something I've mastered is being pulled down more than 3 dB on YouTube, I can't help wondering if I mastered it a bit hot, and experimenting with a more dynamic master. But that's just me – if you love the sound of your master compared to other reference tracks even though it's been turned down by 6 dB or more, great ! The important thing is to Preview and check.

Knowledge is power.

Step 6: Export

OK, we're there ! You mastered your music, you checked it out in the real world, listened through some lossy encoders and on the Loudness Penalty site, and you **love** it. You're good to go!

All you need now is to export it in the correct file format to make sure all your hard work actually translates as you've intended. And luckily, this is simple. In terms of the sound, you've already achieved your goals by following the steps so far.

And as far as the file format is concerned, the basic requirement is simply to provide a **lossless** audio file. No MP3, AAC or whatever - use a lossless format like WAV or AIFF.

As far as the specification of the file is concerned though, you need to make a choice about the sample rate and bit-depth, which I'll get to in a minute. First though let's start with a really clear example:

CD Masters

CD is a stereo 16-bit, 44.1 kHz format, so that's how you need to supply the audio. If you supply individual files though, you need to be careful because all kinds of things can go wrong. For CD masters you're far better off supplying a DDP Image master.

DDP images include all the audio in a single package, built-in error-checking to help ensure the file doesn't get corrupted, and can contain some limited meta-data, like song titles and ISRC codes.

Several DAWs support DDP export - if not there are several standalone applications, for example made by HOFA and Sonoris.

If you're using a company like Distrokid, CD Baby or similar to distribute your music, including making CDs, you **can** send files - but personally I always prefer to use DDP.

Online Masters

(I'm including online distributors like DistroKid in this category, since they'll upload your music to all the major streaming platforms for you. It also applies if you upload the files yourself, though.)

First of all, **never** supply encoded files like MP3 or AAC. If you're lucky the online services will use the files as-is, but there's always the risk of double encoding (which will sound ugly) and you would never want a CD made from MP3. Ugh.

And another safe recommendation is to supply 16-bit, 44.1 kHz stereo lossless files, as you do for CD. This used to be the standard and will sound excellent anywhere.

But this is where it gets a little more complicated though, since in recent years many streaming services have started offering higher sample-rate, higher bit-rate audio

The advantage of this is the ability to offer higher-spec audio for users who would like it. The potential downside is when this audio is played back by a system that doesn't support the higher specifications, it needs to be reduced down to 16-bit, or 44.1 kHz. The question is whether we can rely on streaming services to make these changes in the best possible way. They should, but we can't guarantee it !

The situation is improving all the time though, so I think at this point it's safe to suggest we do supply files at their original sample rate, and in 24-bits. In particular since this makes or audio future-proof, rather than needing to re-submit higher-spec files in future.

Vinyl Masters

The good news is that if you follow the guidelines in this guide, your masters will be in great shape for vinyl. And for this format we certainly want to submit 24-bit files though, and at the original sample rate, to ensure we get the best possible quality at the cut.

I also quite often remove the final limiter. It's very hard for the cutting head to reproduce heavily limited material accurately, and in fact they can burn out if the loudness is too high, so if you submit a super-loud master for vinyl the cutting engineer will just turn it down anyway.

Finally, you may be asked to supply two files – Side A and Side B – with timings, by some manufacturers.

I've also written more about mastering for vinyl here:

Why custom mastering for vinyl isn't necessary

Always remember - use a manufacturer that offers a dedicated cutting engineer to review your masters and discuss any possible issues with you, and always ask for a test pressing to make sure you'll be happy with the final result.

Don't dither about dither

One last thing – when you're exporting your final file, always use dither.

Dither is very low-level noise, added when you reduce the bit-depth to prevent truncation distortion. *(See ? I told you you didn't want to know.)*

Seriously though, if you're saving to 16 or 24-bit, make sure you apply dither. And if you're

really a glutton for punishment, here are a couple of blog posts on the subject:

Dither or distort ? You decide

When in doubt, dither

Time For Action

That's it, you made it !

You now understand all 6 steps to releasing your music with complete confidence – so go for it !

Don't be tempted to spend all your time on Step 3, though – messing around with mastering processing is fun, but without the other steps you'll never get the results you'd like.

Put the time into improving your monitoring, learning your room (and how to loudness-match) and pick some great reference tunes.

Compare them carefully with the songs you want to master.

Adjust the sound to make it sound as good as it can be, repairing any faults you might hear.

Preview it, both in the real world and online.

And finally, export it with care and confidence.

This is the "home" mastering guide, but actually you've probably guessed, this is how I master **everything**, not just at home. Because the ideas, methods and strategies in this guide **work,** and now you can use them, too.

I want to say thanks again for downloading this guide, and for reading it ! If you ever get stuck with mastering your music, I might be able to help. There are hundreds of articles and videos about mastering on my website and channel, and you might like to try listening to my Mastering Show podcast as well.

Come and say "Hello" on social media, too ! I can't guarantee to answer every question, but I'd love to hear from you, and if enough people ask me the same thing there's a good chance I'll write a post or record a video about it sometime soon.

Now, stop reading this and build yourself some acoustic treatment panels !

Make your music sound the best it can be.

Cheers,

Ian (Production Advice)