

## **TT DR Offline Meter Software** (Windows)

## **TT DYNAMIC RANGE METER VST Plugin** (Windows)

### **Manual Version 1.1**

24 February 2009

**Dear User,**

Congratulations on committing yourself to more dynamic music!

Simply allowing for peak headroom during CD mastering will lead to a significant improvement of sound quality with "normal" consumer playback devices, MP3 data compression formats, and with radio broadcasts.

Measurement and display of the Dynamic Range – as well as splitting the dynamics into whole number values – is not without complexity, as we have discovered through the research and development stages of finding this solution.

Please read this manual carefully so that the aim of obtaining better sound can be reached. We are happy to share our knowledge with you.

### **Installation**

To install, simply click on the "TT-DR-Install.exe" file. In the "Programs" folder, a folder called "TT Dynamic Range" will be created within the "Algorithmix" sub-folder. You can start the TT DR Offline Meter with alias which is created automatically on your desktop.

Now open the folder C:\Programs\Algorithmix\TT Dynamic Range) and drop the "DR-Meter" folder in your preferred VST folder (for example: C:\Programs\Steinberg\VST). Now the plugin is ready to be used the next time you start your host application. **IMPORTANT:** Please copy the entire "DR-Meter" folder into your VST folder, and not just the dll file!

### **Logos**

The DR logos (DR\_logo.zip) can be found with the specifications (DR\_Logo\_Guide.pdf) in the folder entitled "TT Dynamic Range" (C:\Programs\Algorithmix\TT Dynamic Range).

### **General use and limitations of plugins**

Plugin formats – regardless of whether they are VST, RTAS, or AU – are not fully suited for graphic representation and are built on a series of compromises. Each DAW and each plugin interface puts audio calculation on a higher-level priority than graphic representation, which is understandable. This is why truly professional meters are either hardware devices, native-running software which uses the CPU resources directly, or host-integrated solutions. These all allow for access to graphic and measurement information in a way which also makes it possible to control a meter's so-called ballistics.

In addition, plugins cannot save values and create histograms, which we need for obtaining our objectives.

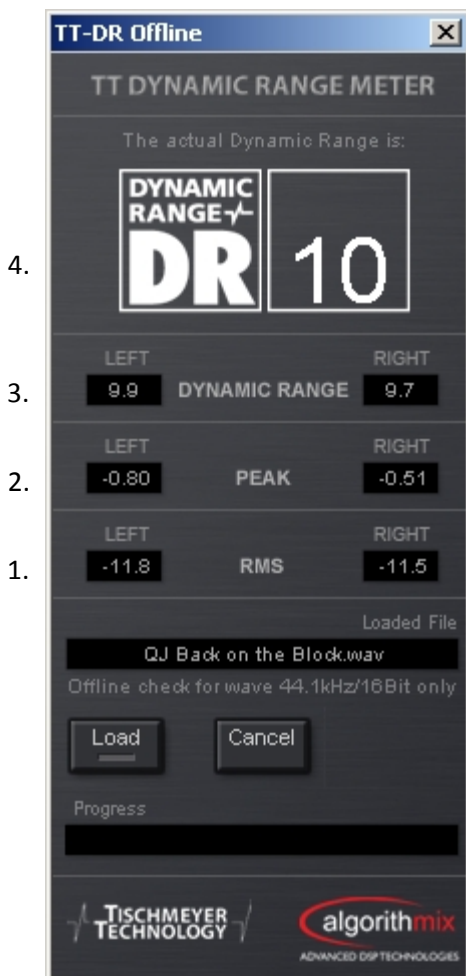
This is why the **TT DR Offline Meter** serves to measure the **"official" DR values** with the advantage of being able to measure an album within a few seconds. The real-time plugin **TT Dynamic Range Meter** however, provides accurate numerical values as a **TRUE PEAK** meter and serves as a guide for the available dynamic range and the approximate DR-Value that you should expect. For this, the plugin can be used to loud passages of songs. The timing of the metering can vary, depending system latency and the mode of operation of the host application.

**We have tested and optimized the meter plugin on a number of different host applications. Despite system-dependent limitations, we have obtained very good graphic results in most cases.**

### Our goal

Our clearly-defined goal is to discover and categorize over compression and to prevent overs with good true peak metering. In order to achieve this goal, we have conducted extensive experimentation and have decided to obtain the "official" DR Value from the TT DR Offline Meter. A real-time measurement would have certainly taxed the patience of users in determining the official and correct DR value.

### Measuring with the TT DR Offline Meter



In order to determine the official DR value, a song or entire album (16 bit, 44.1 kHz wave format) is scanned. A histogram (loudness distribution diagram) is created with a resolution of 0.01 dB. The RMS – an established loudness measurement standard – is determined by gathering approximately 10,000 pieces of loudness information within a time span of 3 seconds (dB/RMS). From this result, only the loudest 20% is used for determining the average loudness of the loud passages.

At the same time, the loudest peak is determined.

The DR Value is the difference between the peak and the top 20 average RMS measurements (top 20 RMS minus Peak = DR).

The top 20 RMS value is not displayed separately. It can be easily calculated in the head by adding the displayed stereo (plus decimal place) DYNAMIC RANGE value with the peak headroom.

To make this clear, the following is an example of the measurement process.

In the above illustration, you can see the song "Back on the Block" by Quincy Jones.

- 1) The RMS value is the standard average value in dBFS measured over the entire song. "FS" stands for full scale.
- 2) The PEAK value is the highest measured peak value in dBFS. Because this is a true peak measurement, values above 0dBFS are shown as "overs." We strongly recommend keeping a headroom of 0.3dB and avoiding releases with "over" peak values. According to the latest technical information available, such recordings could be labelled defective. The precise basis of measurement and the explanation will be described under " True Peak Display" and "Why 0.3 dB headroom?" below.
- 3) The DYNAMIC RANGE stereo value (including decimal places) shows the top 20 RMS value, minus peak headroom (the top 20 RMS value is DR+Peak).
- 4) The official DR value is a rounded off whole number value of both stereo channels. Please only use this value as the official DR Value!

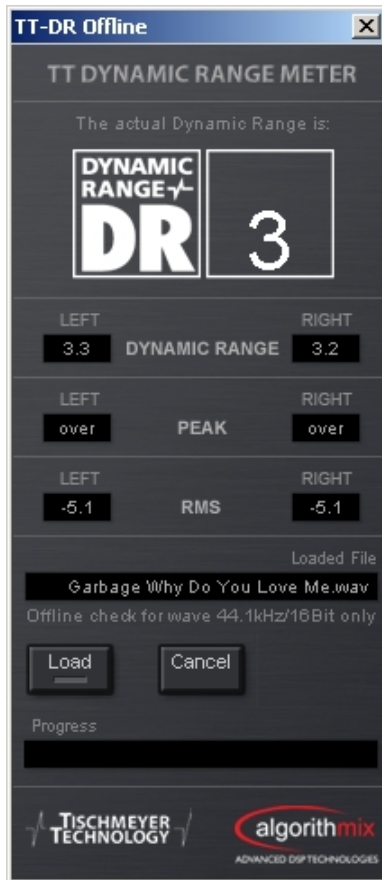
### **Correct measurement and labeling of recordings**

A fundamental part of the concept is being able to reproduce the measurement. Here there are two factors to observe:

- 1) Please measure the entire recording (when the peak headroom of the individual songs doesn't vary more than plus/minus 0,3dB. Read more about this under "exceptions"). Results may vary or not be 100% reproducible when you measure each song separately and then calculate a value on your own. If you do not have a complete wave file of the entire recording, you will find tips for creating your own files, making it easy to perform a measurement.
- 2) The real-time plugin is only meant to be used as orientation, NOT for determining the official DR Value. For determining official DR Values, use only the TT DR Offline Meter pictured above.

We strongly recommend keeping within a peak headroom of 0.3 dB! For an explanation why, please read the section "True Peak Display" and "Why 0.3 dB headroom?".

## DR Value calculation examples using the TT DR Offline Meter

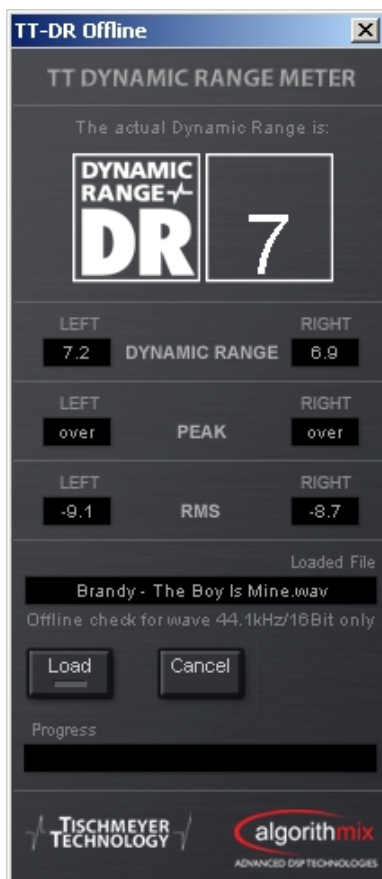


The song "Why Do You Love Me" from the Garbage album "Bleed Like Me" (2005) has an average RMS loudness of -5.1 dB on both stereo channels.

Standard peak meters show a peak headroom of 0 dB. By using "True Peak" technology, overs can clearly be recognized, making a release strongly inadvisable.

The top 20 loudness measurements are very easy to calculate, since there is no headroom:  $3.3 + 0 = 3.3$  for the left channel and  $3.2 + 0 = 3.2$  for the right channel. The rounded off value results in an official DR value of 3.

For this, we will give it the label "unfit for consumption." Too bad!



Here we have measured the song "The Boy is Mine" from Brandy (Never Say Never 1998).

The average RMS value of the whole song is -9.1 for the left channel and -8.7 for the right channel.

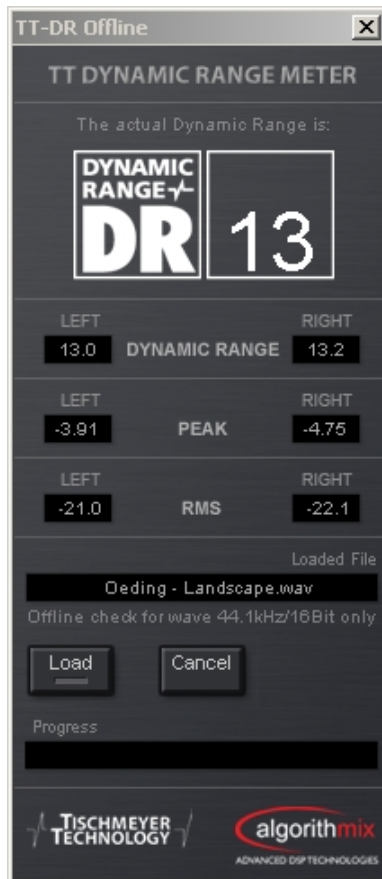
The peak values can be clearly seen as overs. Distortion is guaranteed here:



A Release of such a master is strongly inadvisable, according to what we know today.

Because of the lack of headroom, the DR value is the same as the top 20 value.

The recording has a DR of 7 (DR7).



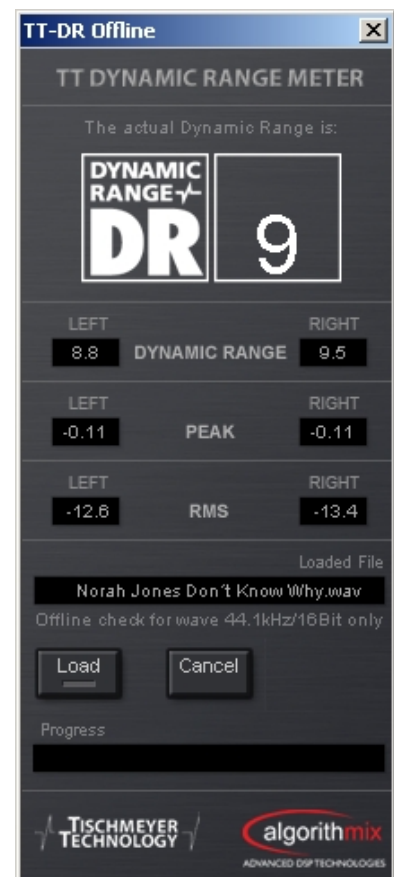
The song "Landscape" by jazz guitarist Christoph Oeding is a natural-sounding song with hardly any compression, made with acoustic instruments.

You can see here that the top 20 RMS value here is -16.91 dB for the left channel and -17.95 for the right one.

Once we subtract the peak headroom, we obtain a DR Value of 13. If this song had been normalized to -0.3 dB headroom, the DR Value would be the same.

The illustration on the right is the measurement of Norah Jones' hit "Don't Know Why" from the year 2002.

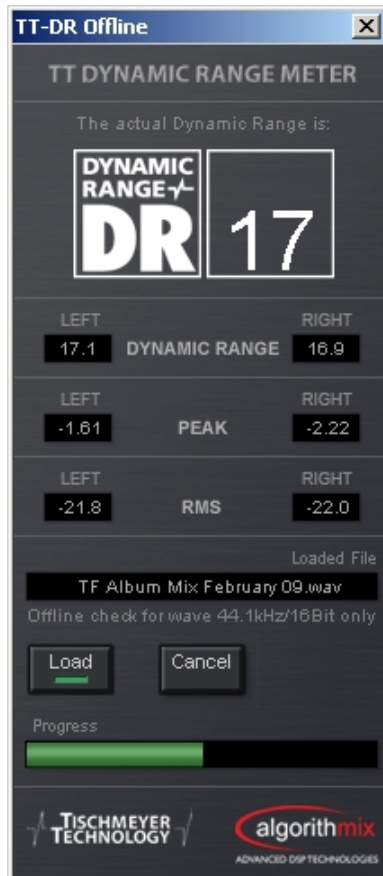
Most advanced users know that vocals are particularly thick, and therefore loud. If you look at a waveform in your mastering application from a loud, short passage where the vocals are very intensive, values of up to -6 dB/RMS can occur, whereas the whole song might have a value of -13 dB/RMS. Because the refrain – as opposed to most popular styles – does not have a homogenous loudness upswing, the real-time plugin does not always display the same values. In this case, the TT Dynamic Range Meter plugin shows varying values that may be briefly too high or too low. Beware of differences between the plugin and the offline meter with vocals, acoustic instruments, and similar music styles.



DR9 is however a representative value. The producers have found a market-oriented compromise between loudness, peak headroom, and compression. For a post DR release, values between DR12 and DR14 are however more desirable.

DR9 shows that a song with DR9 does not sound quieter on the radio than a title having DR3 to DR8. Or did you miss this song on the radio?

### Measuring DR Values of recordings



With the LOAD button, a window opens for selecting the wave file to be measured.

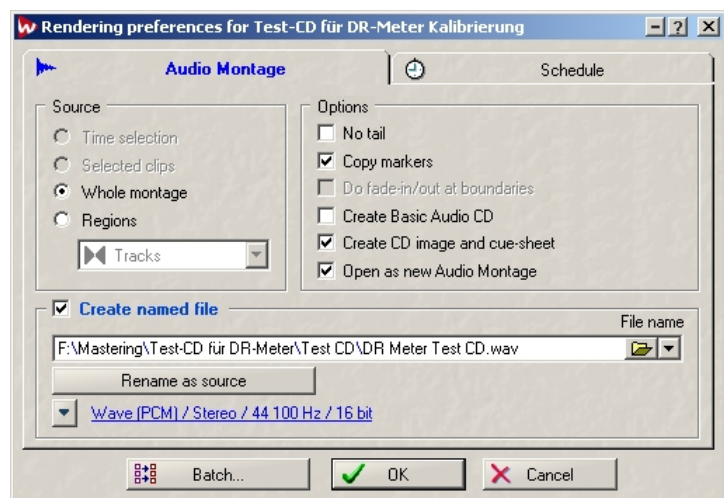
After double-clicking, the actual measurement process begins, shown by the green progress bar.

The CANCEL button stops the process, in case the incorrect file had been chosen, for example.

If you work with Steinberg's WaveLab, it is easiest to choose the file from the final 16 bit Montage. This wave file contains the entire album.

If you are used to writing the master directly from the Montage (consisting of single songs), then it is a good idea to create a single, continuous wave file for the entire album. You can do this by rendering your final Montage directly from the master dialog and automatically creating a 16 bit montage. This only lasts a few minutes and includes all single tracks into one single file.

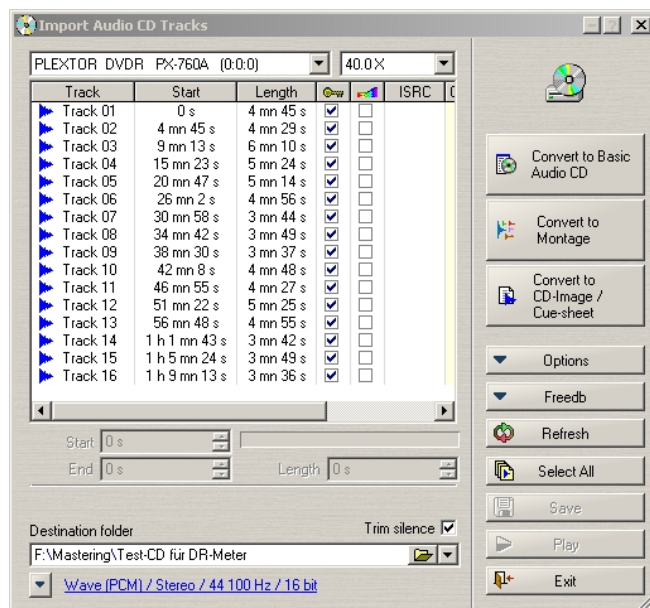
Pictured here is the Render dialog box in WaveLab with the necessary settings for making a continuous wave file from single tracks in the Montage.



Nearly every mastering application has the ability to make a so-called image or to read from a CD. For legal licensing reasons, the TT DR Offline Meter does not have the driver support for reading a CD from a CD drive, but this feature is useful for measuring CDs that have already been burned or duplicated.

Using WaveLab as an example:

- Place a CD you wish to measure into the CD drive of your computer.
- Open the "Import-Dialog" in WaveLab (Command-I).



The function "Convert to CD-Image"/Cue-sheet" creates a continuous wave file with the appropriate CD markers. Make sure that the process is set for the 16bit/44.1kHz format.

Use this continuous wave file for calculating the official DR Value.

### **Why are the top 20 RMS values used for determining the DR Value?**

A mastering engineer compares loud passages of a song and, along with spectral adjustments and various sonic enhancements, ensures that there is an even loudness over the entire recording. This only works when the loud passages are used as a basis for comparison. A song having a quiet, long introduction and a final refrain compressed down to DR2 might have a RMS value of DR10 or DR12. The DR Value would therefore not reflect the amount of loudness in the passages where loudness is critical.

**The DR Value therefore represents the amount of density/thickness (loudness) more than the dynamic range of the entire song!**

## **Is there music which is not suitable for the DR system? [Exceptions!]**

Yes and no. Generally, the DR measurement indicates the degree of density (in sense of compression) for every music style.

Since the measurement does not take psycho-acoustic elements into consideration, very dynamic music (such as classical music) is less suitable for DR scaling. The large dynamic range of a classical music album – which has little or no compression – is (with perhaps DR14) not represented in a psycho-acoustic perceived relation to a DR10 pop music song, for example.

This equivalence would only be possible if psycho-acoustic parameters were incorporated which would necessitate long and costly research and development.

We see this situation on a pragmatic level: The problem that we will solve with DR metering is exorbitant over compression of current middle-of-the-road, pop and rock music releases. The goal is to indicate density (in other words, the loss of dynamics) in whole number values. This is why we have optimized the measurement of this "problem group." Labeling and categorizing classical music is not the primary objective of this initiative. Depending on the means available to us, we will however expand our research activities in order to further optimize the process.

## **Measurement differences between releases with titles with different peak headroom [Exceptions!]**

For technical reasons, in the current version 1.1, the highest peak value of the entire recording is determined and then subtracted from the top 20 RMS values in order to calculate the DR value.

Today's albums in the MOR/Pop/Rock styles usually have a low peak headroom that remains constant. This is not a significant factor. However, if some of the songs on the album have a higher peak headroom and at least one of the songs a very low peak headroom, then the low value will be used in the calculation involving the subtraction of the top 20 RMS values from peak headroom. This can occur in the case of compilations and lead to too high DR Values.

***Only in this case the DR Value is to be calculated on a song-by-song basis and not over the whole album in order to have a fair and meaningful DR label.***

Proceed as follows:

1.) Measure each song individually with the TT DR Offline meter and note the DR Values for Left and Right in a list:

Dynamic Range	Left	Right
Song 1:	11.2	12.3
Song 2:	12.6	12.8
Song 3:	10.9	11.2
Song 4:	8.1	7.9
etc.		

2.) Add L and R for each song

Song 1:	$11.2 + 12.3 = 23.5$
Song 2:	$12.6 + 12.8 = 25.4$
Song 3:	$10.9 + 11.2 = 22.1$
Song 4:	$8.1 + 7.9 = 16$
etc.	

3.) Add all results

$$23.5 + 25.4 + 22.1 + 16 = 87$$

4.) Divide the results by two and by the number of songs (4)

$$87/2 = 43.5 \quad 43.5/4 = 10.875$$

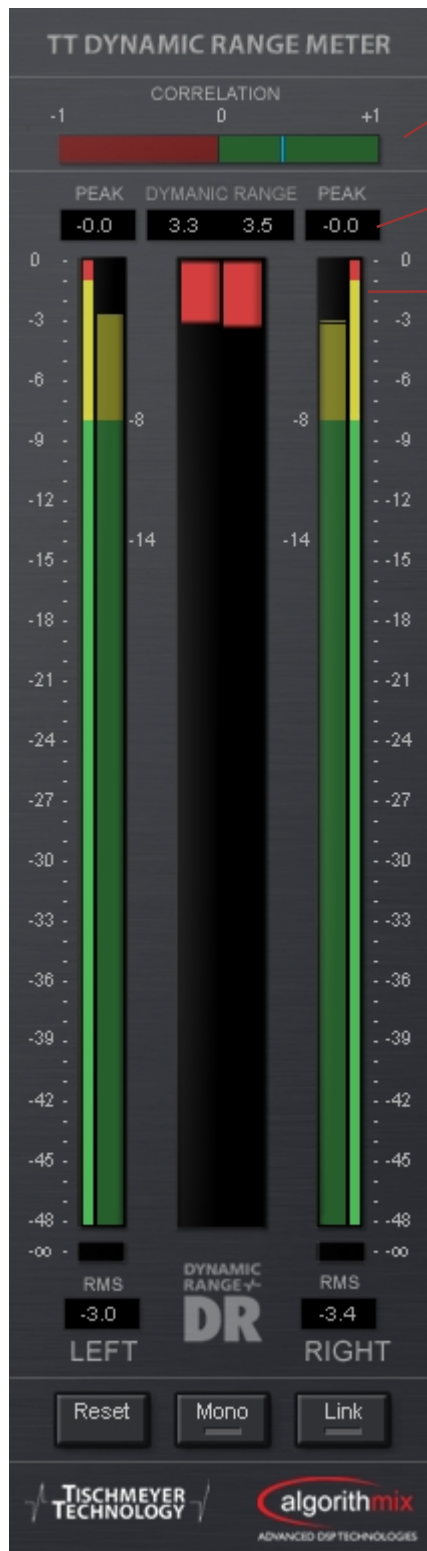
5.) Round off the results (Values of .500 or more: round up; values up to .499 round down)

Your DR Value is DR11

## TT Dynamic Range Meter Plugin (VST)

Open the plugin in your host application in the last slot of the master bus, after the output fader. This varies from DAW to DAW. If you are not sure, please check in the manual of the software or set the output faders to 0 dB.

Here you can see the shocking results when "Garbage" is played. This is NOT how things should look.



1.) **Stereo correlation meter:** Display of the phase differences between the left and right stereo channels. For information on interpreting this, please refer to technical literature.

2.) **True Peak Display** with one decimal point and the corresponding peak level bar on the outer side. In the area close to full scale, peak measurement is particularly complex and critical. First of all, fixed point resolution can only show values up to full scale, since on the digital level, no overs are possible. However, contiguous full-scale words create audible overs and so-called interleaved sample overs\*. Secondly, floating point calculation makes it possible to represent values well over 0dB. The measurement and display of peak values in 4x over sampling\*\* leads to a display of overs so frequently that we have found a middle-of-the-road solution. The peak values are measured "normally" and provided numerically. In the case that two contiguous bit words show full scale (all 16 bits at 1 without any oversampling) and at the same time a value of over 0 dB is detected via oversampling metering (run as a parallel process), then the peak display shows "OVER."

**Peak Bar:** The display area ranges from -48 to 0dB.

A peak-hold function with a slow release time (ballistics) makes it easy to read and follow the values visually.

(\* 4x over sampling = Quadrupling of the sampling rate).

(\*\* Interleaved Sample Overs (also: inter-sample peaks) are overs which can be detected only after multiplying the sampling rate (over sampling by a factor of 2 to 4). The values are not detected on the digital level because values only up to 0dB can be represented (fixpoint). An interleaved sample over can also occur when the peak headroom is 0.1 dB or more and creates distortion only after leaving the digital domain.

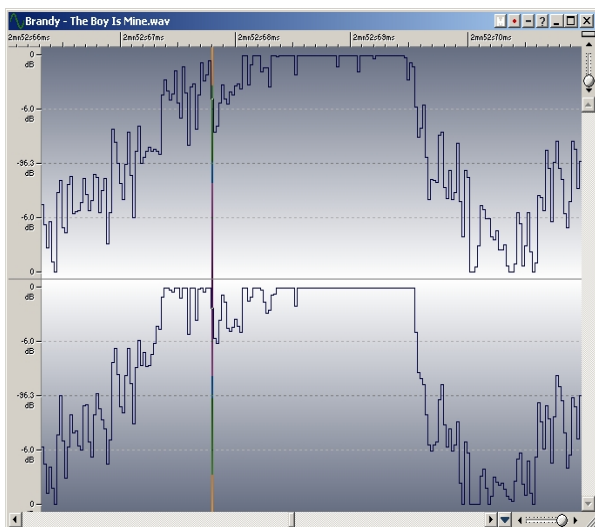
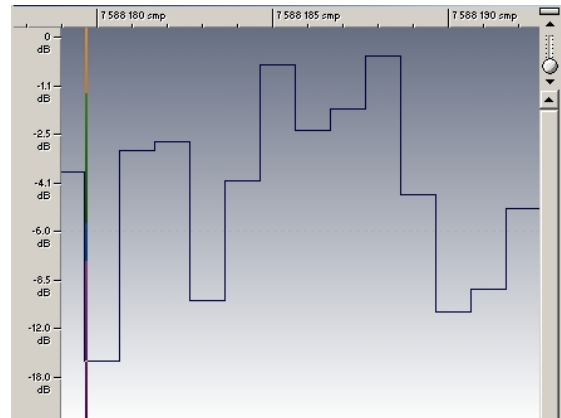
Stopping and restarting playback also results in an resetting of the numerical peak display, in the same way that clicking the RESET button does.

The numerical display shows the highest value reached since the last reset.

At the right you can see a "good" digital signal which will not create distortion when going through a D/A converter:

There is only one sample which approaches full scale and the highest peak value does not exceed -0.3 dB.

Distortion on a digital level is not possible.



On the left, several dozen samples in a row are full scale. The D/A converter, having the job of turning the digital steps into round analog waveforms, needs about 6dB headroom, in order to allow the waveform to swing upwards in its full, normal range. But this headroom is not available. The result is undesirable distortion. With data compression (MP3, etc.), another 6 dB can be added to the peaks as a result of energy redistribution, depending on the resolution used. The results are not acceptable.

### Despite headroom — use a brickwall limiter

Please always use a professional brickwall limiter for mastering. There are many good brickwall limiters on the market, but also many less-good ones, which don't deliver what they promise. Be wary and verify your brickwall limiter.

A brickwall limiter's job is to make sure that no interleaved sample overs are produced, using the over sampling process described above. A brickwall limiter should process the sound in such a way that the actual level reduction is inaudible.

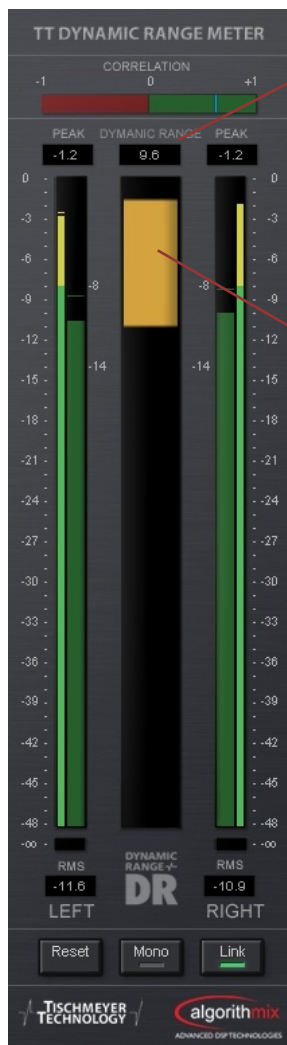
### Why 0,3 dB Headroom?

In order to prevent any discussions among experts: Yes, this headroom value of 0,3 dB is somewhat arbitrary. It could just as well be 0.253 dB, 0.378 dB, or 0.5 dB headroom.

Despite using a good brickwall limiter, there are two reasons for leaving some headroom:

1. Modern D/A converters use linear-phase FIR reconstruction filters which are not always designed to process full scale signals without distortion. This is particularly true of steep-sloping signals which are often produced by hard limiting or over compressed music. Extra headroom significantly reduces this risk while making any loss of loudness to be practically imperceptible (see Gibbs phenomenon).
2. Additional headroom reduces artifacts used by all data compression formats which use the masking effect. The lower the data rate of the target format, the more headroom is necessary. For highly compressed music, 0.3 dB headroom is not sufficient in order to avoid distortion. In this case, a headroom of 5 dB would be theoretically necessary. Recordings which have the DR logo are fortunately not so strongly compressed; a headroom of 0.3 dB prevents unwanted artifacts in most cases!

### Further description of the TT Dynamic Range Meter:



#### 3.) Numerical DYNAMIC RANGE Display:

In link mode, the left-right DR Value is shown to one decimal place. Using the meter on the loudest passages produces values which are very close to those of the Offline Meter. If the "Link" button is deactivated, then two separate DR bars are shown with corresponding numerical displays above the bars (see the first illustration of the TT Dynamic Range Meter Plugin). This mode is appropriate for the mixing process in order to have separate, detailed information concerning the inner dynamics of the two stereo channels.

#### 4.) DR Display Bar: Color-coded display of the dynamic range which is used.

Values of less than DR8 are displayed with the color red. Values of DR14 or more are green. Values between the two are displayed in various shades of yellow.

The DR bar shows the average difference between peak and RMS and corresponds to the so-called crest factor.

Since the bars do not display any static information in order to indicate the top 20 RMS values, in specific situations the indications do not always completely reflect the official values given by the Offline Meter. Keep in mind that the objective is to standardize the "thickness" of a recording and not to measure the overall dynamics.

The variation between the two measurement devices increases as the dynamic range of the material measured is increased. The bars serve to visualize the crest factor.

If you work with more headroom during mixing, a decreasing bar that moves downwards will warn you of too much compression, because the display of the crest factor is independent on the peak room which is used.



### 5.) Digital 0 Display

The "minus-infinity" display lights up as so as there is digital 0 at the input.

6.) **Numerical RMS Display:** The display shows the current average loudness very slowly, making it very practical for having an idea of the amount of current loudness.

### RMS Display Bars: (wide interior bars)

We decided to use the standard calculation of loudness in RMS (root mean square) because it proved to be superior to most other measuring methods with complex frequency weighting models when put through comparative testing. Those methods which were better required a great deal of CPU resources and are very controversial among specialists. The idea behind the DR Meter is a simplified way of determining thickness and NOT a psycho-acoustically perfect loudness measurement tool. The RMS value is corrected by +3 dB so that sine waves have the same peak and RMS value. This is the case with most meters.

7.) **Mono Switch:** This switches the stereo signal to mono for checking the signal and turns red when activated. This switch can be used as a mono switch for checking stereo compatibility when the DR Meter inserted into the stereo section of your DAW. The mono switch is a practical tool, since many DAWs no longer have one.

8.) **Reset Switch:** Resets the numerical peak headroom display.

### Support for other formats and platforms

We have already begun work on an RTAS version of the plugin for Mac OS and PC as well as an AU version for Mac OS. A Mac OS version of the TT DR Offline Meter is also planned — thank you for your patience! On the Website [www.PleasurizeMusic.com](http://www.PleasurizeMusic.com) you can learn about the latest releases.

## Updates

**Please always use the latest version of the software.**

**Future optimization of the measurement procedure could lead to slightly different results.**

In future versions, the following additional features are planned:

### Plugin:

- numeric peak display with interpolated value indication in the zone above 0 dB. Interpolation can uncover potential overs occurring in later D/A conversion in playback devices resulting in peak values which are too high (interleaved sample overs). The implementation involves significant research and development efforts.
- implementation of Bob Katz' K-System. Particularly the K-12 and K-14 are very well suited for achieving more dynamic mixes.
- surround version

### Software:

- Direct reading in from DVD/CD drives
- This requires obtaining licenses and the payment of license fees for drivers from third-party manufacturers.

## Donation

Under the heading Donation/Spende you can help support our work. The Pleasurize Music Foundation is a non-profit organization aimed at establishing a dynamic sound standard and a surround sound quality label, in order to generally raise the quality of recorded music and thereby to help revitalize the music industry.

## Credits

- DR idea and overall concept and realization: Friedemann Tischmeyer
- Technical concept and project management: Dr. Christoph Musialik from Algorithmix
- Programming: Dr. Ulrich Hatje from Algorithmix

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