Tech Note: Using Traction Sound DSP Presets

Introduction

Traction Sound maintains and issues a library of Output Channel Presets for use with Traction Engine DSP Amplifiers, available from the Resources section on our website: www.tractionsound.com. Our DSP Presets contain locked parameter settings for Infinite Impulse Response and Finite Impulse Response filters, RMS and Peak Dynamics Processors, and pre-delay values designed to achieve unified magnitude and phase response between all Traction Sound loudspeakers.

All Traction Sound loudspeakers are designed to be used with DSP Presets, and most must not be deployed without them, though some products have been engineered to have an acceptable response without DSP which greatly reduces the cost of a complete system.

All our DSP Presets are designed such that the phase response of all loudspeakers is matched to within +/-30 degrees (relative to operating band of each product) when the front edges of any two Traction Sound loudspeakers are aligned. This ensures up to +6dB summation across overlapping operating ranges where magnitude is the same for both devices and further ensures that crossovers to subwoofers work as intended. Allowing a +/-30 degree margin means that no further delay calculation is necessary when mounting a speaker on a pole connected to a subwoofer, or when splaying multiple speakers on a stack of subwoofers.

Note: For deployments where speakers are not aligned or mounted as described above, the physical distance offset should be measured and accounted for with extra user-applied delay. The value of this can be calculated using the following formula:

$$\frac{\Delta D}{343} = T$$

where D is the distance offset in meters, 343 is the speed of sound in m/s (change this based on local temperature, air pressure and humidity) and T is the delay value in seconds to be applied to the nearest source.

Traction DSP presets do not guarantee the desired response every time, rather they provide a starting point that is based on a pre-defined target response in controlled test conditions. They do not account for application specific variables such as room reflections, modal interference, system layout or other user-specific requirements.

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DSP Preset Structure

We supply DSP Presets falling into the following three main categories:

"S" Presets: To be applied to a full-range loudspeaker when partnering it with a subwoofer. These presets define a low frequency roll off that integrates with the unified phase response of Traction Sound subwoofers. Aside from assisting integration with a subwoofer, "S" presets also enable higher maximum output from the selected loudspeaker due to the reduction in cone excursion and power input for a given broadband output level.

"FR" Presets: To be applied to a full-range loudspeaker when using it on its own, without a partnering subwoofer. These presets are carefully designed to strike a balance between low frequency extension and maximum SPL without exceeding safe operating margins for the transducers.

"Sub" Presets: These are the presets used for Traction Sound subwoofers, and they ensure that both phase and magnitude response are kept to within a certain margin of a pre-defined target response, relative to the subwoofers intended operating band. For example, the SW10 will not produce output that extends as low as the SW218, but across their respective operating bands the response will be comparable. This means they could be used together constructively if desired, but it also contributes towards maintaining a standard voicing between products and between systems.

There are further variations for each of these preset types, including "Infra" and "Cardioid" sub presets, and versions of presets for use when combining multiple array-able products such as the Raptor APS212.

Multi-channel presets are also used for bi-amped loudspeakers. These ensure the crossover between the two ways is kept constant and cannot be accidentally edited or applied incorrectly by the user.

The type and intended use of each preset is defined in its file name, using the following naming convention:

Product - Preset Type - Variation - Version Number

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For example "Osprey FC20-X S Bi-Amp v1.3" is the two channel-preset for the Osprey FC20-X for use with a subwoofer.

Please note that the variation notation is specific to the use of that preset and is not used if no specific use case is defined. Subwoofer preset names do not specify "sub" preset type as this is inferred from the product name.

Cardioid presets:

Please see the separate document titled "Tech Note: Cardioid Bass" for details on how and when to use cardioid presets for Traction Sound subwoofers.

Loading DSP Presets

Presets can be loaded to traction Engine DSP amplifiers using either AudioCore or Globcon control software packages, both of which are available from www.tractionsound.com. Video and PDF guides are also available on the website showing the specific procedures for each.

Before loading a DSP preset to any device, ensure that no audio is passing through the amplifier and that all speakers are disconnected from the SpeakOn sockets on the rear of the amplifier. Once all desired presets are loaded, un-mute the high frequency (or full-range) channels before any sub channels to ensure the connections and channel allocations have been made correctly without risking damage to sensitive high frequency devices.

When loading a single channel preset to an output channel, simply right click on the desired channel and follow the steps outlined in the guides mentioned above.

When loading a multi-channel preset, the process is the same however care must be taken to ensure that there are enough outputs available after the selected output for the preset to load all required channels. For example, you cannot load a two-way DSP preset to output 4 of a 4-channel amplifier as the second channel of the preset will have nowhere to go and will not be loaded. It is recommended that 2-way presets be loaded to either outputs 1 or 3, keeping pairs of output channels in line with the physical pairing of channels withing NL4 cables.

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Modifying System Response

As stated above, Traction DSP presets do not guarantee the desired response every time, rather they provide a starting point that is based on a pre-defined target response in controlled test conditions. They do not account for application specific variables such as room reflections, modal interference, system layout or other user-specific requirements.

To completely optimise a system, response should always be measured using a two channel Transfer Function measurement system and adjusted the parametric equalisers built into Traction Engine DSP amplifiers, which can be modified and managed in groups using both AudioCore and Globcon.

When adjusting system response, group EQs and input EQs are preferred as they will inevitably inflict a phase shift on the signal, and doing so globally maintains the relative phase relationships between sources defined by the DSP presets as much as possible. They are also easier to manage as there are fewer points for user-error to go unmissed, particularly in large deployments with high channel count and distributed zones that may not always be audible from the same control position.

It is recommended that a high shelf filter be active on the input channels, which can be used to quickly account for temperature and audience changes throughout the course of an event, as well as to somewhat manage variation in the timbre of the input material.

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Using Limiters

All Traction Engine and Traction Control DSP presets have limiter settings embedded. These are always locked.

Limiters are dynamic processors that modify the amplitude envelope of a signal, with control over the threshold level at which they start doing so, and how fast or slow they start and stop doing so. They act to manage the long-term power input to a loudspeaker, and to protect it from sudden transient bursts that would otherwise damage components.

Limiters are not perfect, and they are not a guarantee against damaging a system or its components.

All Traction DSP system use two-stage limiters. The first stage is a slow-acting RMS limiter, that lets dynamic transients through untouched but begins to compress the average level of the signal to keep the long-term power input to the system below a pre-defined threshold.

The second stage is a fast-acting peak limiter, that acts as a hard cutoff for the signal above a certain threshold. Whilst the peak limiter is the last line of defence to protect a loudspeaker from high amplitude peaks, it will cause the audio to distort significantly and running into it too often can still cause a loudspeaker to fail.

Both stages of limiter are there to manage over-signal conditions. No system should ever be used with either stage of the limiter constantly active. If any part of the limiter is active, it should serve as a warning that you are approaching the maximum level your system can achieve and **action should be taken to not exceed this**.

If a limiter is constantly operating with high level of gain reduction, it can reduce the dynamic range of a signal so much that the transducers have no time in-between peaks to cool down and will eventually fail from premature over-heating. Long before this point however, the audio will have been very audibly compressed to the point of sounding very unpleasant and with high harmonic distortion content.

The operator has the final responsibility to prevent system components from failing due to over-temperature and over-excursion, and the 2-stage limiters are a tool to help manage this.