

Fine Tuning Loudness Control

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Background

While there are many controls available in the AERO® processors, to fine tune loudness control, there are just a few adjustments that provide most of the control that general television programming requires. The purpose of this application note is to provide some basic information about the most often used controls in the AERO processor. Included here is what these controls do, some suggestions for their use and where to find them. A list of the parameters and settings for factory presets is provided for comparison purposes.

Linear Acoustic is known for, and our customers demand, very high audio quality no matter what the source program material is. In order to deliver this we provide very fine adjustments of the many parameters required to create our loudness management. This fine control allows AERO Loudness Managers to be used for channels that specialize in everything from live sports to live church services, news, talk, Hollywood movies, old television programs and for broadcasts that carry many different program types every day.

We recommend that you have a working AERO processor in front of you while reading this application note. Looking at the settings on the front panel, or using NfRemote, will help in finding where in the menus the adjustments are made. It is also highly recommend that any adjustments be made while listening to the AERO output. This is easily accomplished using the headphone output or by monitoring using Client Audio in the NfRemote application and good quality sound card, speakers and headphones.

The Why of Loudness Management

If the audio level of 100% of your content was all the same then loudness control would be easy! The reality is that broadcasters have to contend with a wide range of content. The content is recorded, produced, created, ingested and received in real time. The content is not all at the same level. The dialog levels, let alone the average program levels, may vary over a wide loudness range. Loudness control is important to viewers. Viewer complaints continue to drive the creation of television broadcast loudness regulations all over the globe.

Loudness shifts occur within a program, from one program to another program, and from channel to channel. The shift from analog to digital broadcasting makes the differences in loudness levels more apparent than it ever was in analog. The worldwide shift to digital broadcasting has made loudness management a critical part of broadcasting all over the world.

Many of the countries that have changed over to digital broadcasting already have audio loudness regulations. Digital television broadcasting and loudness regulations continue to spread. AEROMAX® processing is in use all over the world helping broadcasters to comply with audio loudness regulations. However, compliance is not the only reason to use AERO Loudness Managers. In fact, loudness regulations did not even exist when the first AERO loudness Manager was released. In the beginning it was all about audio quality.

The Viewer at Home

A viewer's home is not the same listening environment as a movie theater or audio mix room, mixing theater, video edit room or audio control room. This fact has some important consequences. When we think about delivering audio into a viewer's home we must consider the typical home playback system and how loud the system is played at home. We must consider the viewer's preferences.

Home viewers listen at lower levels than audio professionals do. Recording, mixing and reviewing content in a professional environment is done at louder listening levels, and on better equipment, than is found in the viewer's home. This means that viewers at home will perceive both high and low frequencies as being softer than midrange frequencies compared to almost any professional environment. The reduced perception of high and low frequencies at low volumes is not a small effect. This problem has long been known. In 1933 researchers Fletcher and Munson published a paper about this. Fletcher and Munson published curves of equal loudness contours showing how human perception of sound changes with listening volume. Since that time hi-fi equipment for the home has included a loudness control to compensate for the ear's reduced frequency response when listening at low levels.

When audio is mixed at a listening level of 80 dB SPL sounds around 100 Hz are perceived to be about the same loudness as sounds around 1000 Hz when both are played back at the same level. However, at home, listening at a level around 65 dB SPL, 100 Hz is perceived 10 dB lower in level than 1000 Hz. This is simply the way that humans perceive sound. Low frequencies sound, to the home viewer, 1/2 as loud as the mixer intended them to. The effect is worse as the frequency is reduced and also as the listening volume is lowered. In addition, home viewers are likely to be listening on the small, low power, rear or down facing speakers, found in the typical thin panel TV. This adds another level of loss to the perception of both high and low frequencies in the audio program compared to what the audio creator heard and intended. The very low power and limited output capability of the typical thin panel television speaker system means that dynamic range in the home is also very limited.

AEROMAX Processing

The proper (and judicious) use of noise reduction, AGC, equalization, multiband compression and limiting and look ahead final limiting, can all be used to recreate, at home, the audio experience that the program creator had in mind. Further, AERO processing can balance the need to correct audio for the typical thin panel television with creating a dynamic, wide bandwidth, great sounding surround sound output for those using high quality multi-channel playback systems at home. The AERO Loudness Manager was developed to provide viewers at home a great audio experience. Before loudness regulations AERO Loudness Managers were used by broadcasters who sought to deliver the best audio experience to their viewers. This was 9 years before any loudness regulations existed. Our 14 years of experience has demonstrated that audio which sounds good to the viewer at home is **naturally compliant**.

AERO processing is a tremendous aid in translating everything from a news commentary to a Hollywood production mix to audio that sounds great in the home. The AERO can also improve the audio quality of older content. The popularity of broadcasting television shows from the 1950s and 1960s has made AERO loudness managers invaluable to broadcasters. The dynamic response of AERO's multiband AGC and limiting is one of the features that both improves program to program consistency and subtly improves the apparent frequency response and dynamic range of the typical home television.

The AERO has also found a home on channels broadcasting music videos and live events featuring music. It used by news channels, program distributors and networks for local, regional and international distribution. The ability of AERO Loudness Managers to control audio in a flexible, high quality and reliable fashion has made Linear Acoustic the choice of broadcaster's all over the world for over 14 years.

Loudness Control Presets

The heart of the AERO.2000 is found in the DRC settings. DRC stands for Dynamic Range Control and is the loudness control portion of the AERO processor. This is where program loudness control and audio processing takes place. We recommend starting with a factory preset and modifying it, if necessary, to suit your particular needs. Which preset you choose, and what changes you make, depends on your source material and what your goals are for the audio you broadcast.

Note that LKFS and LUFS are identical loudness measurement units referring to the ITU-R B.S. 1770 loudness standard. Anywhere in this application note that LKFS appears it can be replaced

by LUFS.

Choosing a Preset

The first thing to do is to get an idea of the LKFS levels of the source material. We recommend looking at a range of integration times between 1 and 30 seconds, as well as measuring the integrated LKFS level of program segments, to determine what the short term and longer term level variations are. A meter such as the Linear Acoustic LQ-1000 can display LKFS levels of 4 different integration times simultaneously as well as a graphical histogram of levels. It is an invaluable tool for configuring a loudness manager.

How wide a range of loudness measurements are there? If the integrated LKFS audio levels of your network feed, program segments, commercials, and promos are close to your target level before playout (+/- 6dB) then start with the TV 5B Light preset. If the integrated LKFS program segment levels are not very well controlled (+/- 10dB) start with TV 5B Gen. Adjust the preset's final output control so that the output is at your target LKFS level.

Read the brief descriptions of the factory presets, below, and chose a few additional presets that appear to fit your needs. Call up each preset and listen to a range of different content using each one. Again, make sure to adjust each preset's final output control so that the output is at your target LKFS level. Remember, for reasons already explained, a louder program will always sound better than a softer program, all other things being equal. Make sure that the final output levels are set correctly. This will match the loudness control to your LKFS target level. Setting each preset to the same LKFS target will also help to ensure that you can properly evaluate the sound of each preset and any changes that you make. Remember that louder audio means increased perception of both low and high frequencies. Louder will often sound "better" but perhaps not for the right reasons! See Figure 1-1, below, for a look at the tabbed menu structure in the NfRemote application. Final Output adjustment is made in the Final menu tab.

There is a Bypass tab in the menu. Here you can bypass loudness control processing and also set the gain of the bypass signal. To compare the source audio to the audio after loudness processing set the bypass gain so that the source audio is as loud as the processed audio. This will help ensure a proper comparison.

After selecting a factory preset remember to listen to a range of content before making changes. If you start with TV 5B Gen and you immediately hear and see that the audio levels never change then perhaps this preset is applying more control then is required. Change the preset to TV 5B Light or Sports. Listening off-line before putting the unit in the air path

provides an opportunity to A/B presets and find something close to what you want. The Load Preset tab has a quick compare feature that allows two presets to be swapped for comparison.

Making Changes

AEROMAX processing is used by broadcasters that specialize in one kind of programming and also by those that broadcast a wide range of program types. The large number of available parameters allows the AERO.2000 to be highly tuned to these programming needs. It is not practical to make specific processing recommendations to solve particular audio problems in this text. Audio issues need to be heard to be understood. Any solution must fit into the overall requirements for all content that will pass through the AERO Loudness Manager preset.

However, there are a few particular parameters which control most of what creates the control and the sound of a preset. Once the decision is made to make changes to improve the sound of a preset these are the parameters to adjust first.

Refer to Figure 1-1, below. The adjustments referred to here are found in each DRC in an Instance. The path to each parameter is given. In the examples below the path is:
Instance 1 > DRC Program 1 > Input AGC (or other tab).

The parameters that can be adjusted in the Input AGC are seen in the section at the bottom of the NfRemote screen.



Figure 1 DRC Menu Input AGC Parameters

Controls are interactive and every change will have an effect. A change that helps audio in one particular program may not sound good on other programs. We recommend that changes are made one parameter at a time and the effect of changes is evaluated with a range or source material.

- Parameters that are changed will appear yellow in color.
- The starting point is marked on the parameter “pull bar” to allow a quick return to the original value.
- You can save an unlimited number of presets and we recommend you save often and use descriptive names.
- The yellow parameters all disappear when a preset is saved.
- There is a Diff button in the Recall Preset menu. Pressing this will highlight all of the parameters that are different between the Current Preset and the Backup Preset.

Input AGC

Instance 1 > DRC Program 1 > Input AGC

Ratio:

- Reduce the Ratio to allow the average output level to vary over a wider range.
- Increase the Ratio to decrease the average output range.
- Reducing the Input AGC Ratio may reduce the average program level making it necessary to increase the Final Output level to maintain the target LKFS level.
- Increasing the Input AGC Ratio may increase the average program level making it necessary to decrease the Final Output level to maintain the target LKFS level.

Note: If an adjustment has no units then the control is program dependent and/or it effects several parameters at the same time. This means that characteristics of the input program have some control over how the parameter effects the audio.

Attack.

- Reduce to slow the reaction time of the AGC and allow the output level to change more when the input changes rapidly.
- A slower attack allows impulsive sounds, like gunshots, or breaking glass, to pass through the AGC.
- Increase the attack to speed up the AGC reaction time and reduce the change in output level when the input level changes quickly.
- A very fast attack time can catch the instant level increase of a gunshot reducing its volume.
- Too fast an attack can make audio sound unnatural. Too slow an attack can defeat the ability of an AGC to gently control input level changes.

- One of the functions of the AGC is to provide a more consistent input level to the processing sections that come after it.

Release.

- Controls how fast the AGC will return to unity gain after reducing the output level.
- Reduce to make gain recovery slower.
- Slowing the Release reduces overall output level and dynamics.
- Increase to make AGC gain recover more quickly.
- Fast attack and fast release can make audio pumping audible.

Gate Threshold.

- When the input audio level is above the Gate Threshold the Release setting equals the AGC Release time setting.
- When the input audio level is between the Gate Threshold and Freeze Threshold the AGC Release time is reduced to 1/2 of the set Release value.
- Raising the Gate above the normal dialog level helps dialog sound more natural. The AGC release is slowed and the dialog sounds natural. This is especially true when high Ratios and fast Attack and Release times are used.
- Lowering the Gate Threshold below normal dialog level keeps dialog level more consistent but breathing of the audio (increase of gain at the Release value and decrease of gain from the Ratio and Attack settings) may be heard.
- Using low AGC ratios allows lower Gate settings to be used to maintain a more consistent dialog output level without audio pumping and breathing.

Freeze Threshold.

- When audio input level falls below The Freeze Threshold the AGC will not release (Increase the output level toward unity gain) until the input levels exceed the Freeze Threshold. This prevents the increase of noise during quiet (level below the Freeze Threshold) passages.
- Adjusting Freeze Threshold to a level just below the lowest dialog level allows the AGC to increase low dialog levels but prevents unnecessary increases in levels during quiet scenes.
- Adjusting Freeze Threshold so it falls above quiet dialog may prevent dialog levels from being raised back to an acceptable level after a loud event occurs just before low level dialog.

Note: Watch the DRC Program Meter, Loudness Program Meter and Graph Program meters, of the DRC being adjusted, when making adjustments. These meters show the input levels and

action of the AGCs, limiters, short term output levels and long term output level changes.

Multiband Setup

Instance 1 > DRC Program 1 > Multiband Setup.

Multiband Gate Threshold

- This works the same way as the AGC Gate Threshold.
- The Multiband Gate and AGC Gate settings are usually set to the same level.
- If there is too much audible gain change during dialog raise the Multiband Gate Threshold above normal dialog levels to reduce the speed of multiband gain increase in the dialog region. This will make gain changes less noticeable.

Multiband Freeze Threshold

- This works the same way as the AGC Freeze Threshold.
- The Multiband Freeze Threshold setting and the AGC Freeze Threshold setting are locked together at the same value. Changing either one changes the other.

Multiband AGC > MB AGC Main > Ratio.

- The Multiband AGC is a very powerful gain control element and low ratios are normally sufficient to produce the control required.
- Multiband AGC helps to maintain consistent dialog levels in the presence of loud high and low frequency sounds.
- The ratio can be set to 1:1 to disable the multiband AGC/Limiter. This is done to create wideband control.
- When creating a wideband loudness controller WB AGC 1 and WB AGC 2 should be used to better control the output level. An example of a wideband configuration is shown in Table 4 at the end of this document.
- Low ratios produce consistency in level across the audible frequency spectrum. This effect is good for output level consistency and also improves the perceived quality at home.

Please note that changing to wideband AGC significantly compromises the ability to control average LKFS levels while also maintaining good dialog level. It also limits the ability of the loudness manager to improve the quality and consistency of marginal content and present a

consistently excellent sound for the home viewer.

- Increasing multiband ratios may become audible with some program material. Some users may like and use this effect. It will tend to make all source material sound more consistent and alike in character.

Instance 1 > DRC 1 > Multiband AGC > Ratio O/R

- When AGC Ratio Override is Off the AGC ratio shown for each band is used at all input levels.
- When a band's Ratio Override is On the output in that band will not exceed the target level.
- If the loudness of your source material is well controlled the AGC Ratio Override can be switched Off. This will increase maximum True Peak levels.
- Content that has average LKFS levels much higher than the desired target level may require the Override to be On to provide adequate loudness control.
- Find factory presets with the Ratio Override on and off and compare the sound of these to get a better feeling for the use of this control.

Instance 1 > DRC 1 > MB Thresholds > Limiter Threshold (coupled).

- Use the (coupled) control to increase the limiting threshold for all bands at once. This will allow higher peak levels in each band before the multiband limiters begin to work.
- It is possible to allow the audio peaks in the source to pass with little or no limiting up to the recommended limit of -2 dBFS ATSC (-1 dBTP EBU R-128)
- Allowing high TP levels does not typically change the average LKFS loudness level of the output.
- Observe TruePeak measurements and Limiter action on a range of material to ensure that excessive limiting or levels above -2 TP are not occurring.
- The Multiband display in the DRC meter shows compression in yellow and limiting in red. See Figure 2.

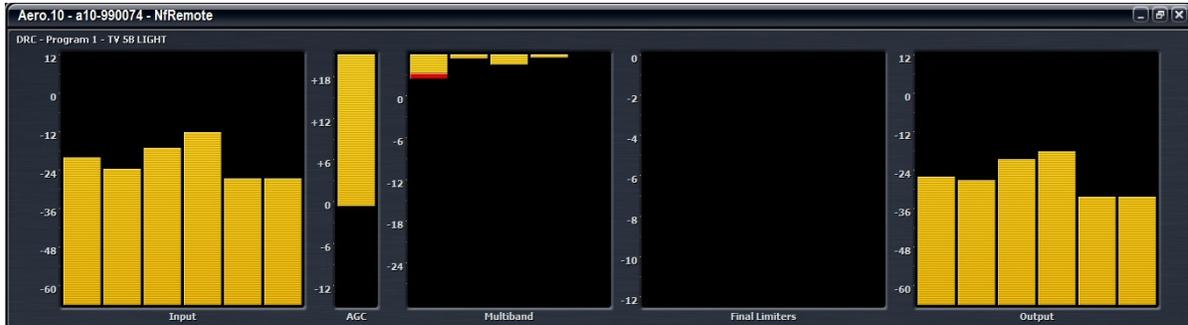


Figure 2 Program 1 DRC Multiband Meter

- Home playback equipment may sound less than optimal when constantly driven by levels which exceed its maximum output. High peak levels will not be reproduced in most homes!

Final

Final > Output Level.

- Adjust Output Level to make the average output, as seen on DRC Loudness Meter, match the desired target level.
- The target value is usually -24 dB LKFS for ATSC A/85 compliance and is fixed at -23 dB LUFS for EBU R182 compliance.
- Lower AGC and Multiband ratios will reduce the average LKFS level of content. This will require an increase in Final Output level to maintain a given output target.
- Higher AGC and Multiband ratios will increase the average LKFS level of content. This will require a decrease in final output level to maintain a given output target.
- Final Output Level may need to be adjusted several times while fine tuning a preset in order to maintain average LKFS level at the target level.

If assistance is required to achieve a particular goal please contact your Linear Acoustic dealer for assistance.

Factory Presets

This section has a brief description of each factory preset. Following the preset descriptions is a table with the parameter settings of each factory preset.

All presets are factory adjusted so that, with the input content averaging around -24 LKFS, the output is optimized to produce -24 LKFS, ± 2 dB per ATSC A/85.

Note: This calibrated measurement is made with a Linear Acoustic LQ-1000 or LQ-1, with 10 second integration. Longer integration times produce measurements with less variation

Compliance with loudness regulations that permit only very small loudness variations can be achieved by using the new advanced ITU (AI) limiter (software V0.13.55 and later). Settings for the ITU limiter are found in the **Instance 1 > DRC1 > Final** adjustments.

Fine Arts 5B Gen

Fine Arts 5-Band General offers medium processing appropriate for artistic programming that may have large dynamic range variations. It produces consistent loudness and spectral balance.

The Gen in the factory presets is short for general and is a good starting point for TV stations broadcasting a wide range of program types that have widely varying average LKFS audio levels.

ITU 5B Loudness Lim

ITU 5-Band Loudness Limit utilizes a specially tuned Multiband AGC Limiter and the Final Limiter to slowly adjust the average program loudness to a specific loudness value as measured over time. The Multiband Limiters and Final Limiters act until the very slowly responding wideband AGC catches up. The multiband AGC is bypassed (1:1) so spectral balance is unaffected. This preset can be appropriate for ingest, live, or network transmission applications where content is pre-normalized.

Music 5B Hvy

Music 5-Band Heavy is an aggressive preset for TV music channels that effectively delivers music programming to small televisions and portable receivers.

MVPD 5B Gen

MVPD 5B Gen is intended for Multiple Video Program Distributors who may not have full control of all programs, interstitials or commercials present in a given network stream. It applies medium-light multiband processing, sets Gate and Freeze to prevent background noise pull-up, and is tuned for all genres.

Net 5B Limit

Net 5B Limit applies a final polish to an already consistent network program prior to distribution. A combination of TV 5B Light and ITU 5B Loudness Limit, this preset has a very

slow input AGC, and a lighter multiband AGC. It preserves micro-dynamics and pulls the low-level information up slightly while protecting against long-term loudness shifts.

Protection Limit

Protection Limit sets all processing to unity gain and leaves only look-ahead peak limiters in the signal path. The master output level is set to 0 dB, so applied signals get a unity gain path through the processor.

Reference Settings

This preset offers standard processing test settings that match TV 5B Gen.

Sports 5B Gen

Sports 5-Band General provides medium processing that features quick response with minimal background pumping. It keeps dialogue present and audible, even in rich surround mixes.

TV 4B Gen

Television 4-Band General is essentially the same as TV 5B Gen (below) with four audio bands. This keeps all other settings the same, lessens the density and impact on dialogue, and results in more open sounding audio, albeit with less short-term dynamic loudness control.

TV 5B Gen (Default)

Television 5-Band General is the factory default preset and also the most commonly used. It provides moderate dynamic range processing, and is appropriate for the broadcast of a wide range of content types.

TV 5B Hvy

Although Television 5-Band Heavy is similar to TV 5B Gen, its multiband compression ratio is higher, which creates a denser but less dynamic sound useful for systems with smaller speakers.

TV 5B Light

Although Television 5-Band Light is similar to TV 5B Gen, its multiband compression ratio is lower (2:1) for more subtle action. This is an excellent preset for content known to be consistent that needs just a bit of spectral polish. Note that this preset allows more variations without correction, but for already consistent content, this is not an issue.

TV 5B Loud

Television 5-Band Loud is similar to TV 5B Heavy, but louder and punchier.

Factory Preset Parameters

Below is a table with the parameter settings for the factory presets.

Downward Expanders, Wide Band AGCs 1, 2 and 3, and parametric EQ (PEQ) are not used in the factory presets. The WB AGCs are set to Off and the PEQ and Downward Expanders are set to 0 gain.

Listening to the presets and studying the settings may assist in understanding the use of the controls.

Multiband AGC > Multiband AGC Levels > AGC Target are the same controls as Multiband Thresholds > AGC Target MB Thresholds > AGC Target. The later are not shown in the charts.

The parameters in the Band Mix tab are the same as those in the: Multiband AGC > Multiband AGC Levels tab. Band Mix is not shown in the charts.

For reference, the 5 band multiband crossover frequencies are:

- Band 1 (Low Bass): 20 Hz - 60 Hz
- Band 2 (Mid Bass): 30 Hz - 200 Hz
- Band 3 (Low Mid): 170 Hz - 1.15 kHz
- Band 4 (High Mid): 950 Hz - 6.1 kHz
- Band 5 (Brilliance): 5.2 kHz - 24 kHz

Linear Acoustic Application Note

Aero.10/100/1000/2000 Presets	Preset	FineArts 5B Gen	ITU 5B Loudness Limit	Music 5B Heavy	MVPD 5B Gen	
Parameter	Parameter					
Downward Expanders		Off	Off	Off	Off	
Input AGC > Main	Ratio	6.3:1	5.9:1	12.5:1	2:01	
	Max Gain	24	15	34	18	
	Attack	21	35	21	21	
	Release	47	16	47	45	
	Target	-15	-12	-18	-14	
	Gate Threshold	-40	-18	-40	-30	
	Freeze Threshold	-60	-31	-60	-40	
Multiband Setup	Bands	5	5	5	5	
	Gate Threshold	-40	-18	-40	-30	
	Freeze Threshold	-60	-31	-60	-40	
	Gate Delay	190ms	190ms	190ms	190ms	
Multiband AGC > Main	Max Gain	24	18	24	18	
	Ratio	2.0:1	1:01	3.6:1	1.5:1	
	Progressive Release	50	35	50	50	
Multiband AGC > Levels	AGC Target B1	0	0	0	0	
	AGC Target B2	0	0	0	0	
	AGC Target B3	0	0	0	0	
	AGC Target B4	0	0	0	0	
	AGC Target B5	0	0	0	0	
	Band Mix B1	0	0	3	0	
	Band Mix B2	0	0	2.5	0	
	Band Mix B3	0	0	0	0	
	Band Mix B4	0	0	1	0	
	Band Mix B5	0	0	1.5	0	
Multiband AGC > Speed	AGC Attack B1	42	38	69	38	
	AGC Attack B2	80	63	78	63	
	AGC Attack B3	80	63	78	63	
	AGC Attack B4	75	63	78	63	
	AGC Attack B5	78	74	82	74	
	AGC Release B1	33	57	44	36	
	AGC Release B2	50	66	54	48	
	AGC Release B3	75	74	80	59	
	AGC Release B4	63	82	82	65	
	AGC Release B5	57	84	86	70	

Table 1-A

Linear Acoustic Application Note

Presets Continued	Preset	FineArts 5B Gen	ITU 5B Loudness Limit	Music 5B Heavy	MVPD 5B Gen		
Parameter	Parameter						
Multiband AGC > Ratio O/R	B1	On inf:1	Off	On inf:1	Off		
	B2	On Inf:1	Off	On Inf:1	On inf:1		
	B3	Off	Off	Off	On inf:1		
	B4	Off	Off	Off	On inf:1		
	B5	Off	Off	Off	Off		
Multiband Thresholds	AGC Target (same as in Levels)		-	-	-		
		Limiter Threshold B1	4.25	5.5	4.25	4.25	
		Limiter Threshold B2	4.25	6.5	4.25	6	
		Limiter Threshold B3	8.5	6	2.75	7.5	
		Limiter Threshold B4	12	6.75	4	9.25	
		Limiter Threshold B5	9	8.25	4.75	10.5	
Band Mix	Same as Multiband AGC > Levels > Bandmix shown above.				-		
Final	Bass Clipper	On	On	On	On		
	Bass Clipper Slope	1	1	1	1		
	Bass Clippr Threshold	-1.5	-1.5	-1.5	-1.5		
	Final Limiter Drive	2.25	0	2.25	-1.5		
	Output Level	-11	-6	-13	-6		
	Loudness Limiter	Off	Off	Off	Off		
	Integration Time	na	na	na	na		
	Threshold	na	na	na	na		

Table 1-B

Linear Acoustic Application Note

Aero.10/100/1000/2000 Presets	Preset	Net 5B Limit	Protection limit	Reference Settings	Sports 5B Gen	
Parameter	Parameter					
Downward Expanders		Off	Off	Off	Off	
Input AGC > Main	Ratio	2:01	1:01	3:01	12.5	
	Max Gain	12	25	20	21	
	Attack	14	21	10	21	
	Release	8	45	10	47	
	Target	-15	-14	-13.5	-12	
	Gate Threshold	-31	-30	-21	-40	
	Freeze Threshold	-60	-40	-30	-55	
Multiband Setup	Bands	5	5	5	5	
	Gate Threshold	-31	-30	-21	-40	
	Freeze Threshold	-60	-40	-30	-55	
	Gate Delay	190ms	190ms	190ms	190ms	
Multiband AGC > Main	Max Gain	9	18.5	14	12	
	Ratio	1:01	1:01	2:01	2.4:1	
	Progressive Release	20	50	40	65	
Multiband AGC > Levels	AGC Target B1	0	0	0	3	
	AGC Target B2	0	0	0	3	
	AGC Target B3	0	0	0	3	
	AGC Target B4	0	0	0	3	
	AGC Target B5	0	0	0	3	
	Band Mix B1	0	0	0	-2.5	
	Band Mix B2	0	0	0	-1	
	Band Mix B3	0	0	0	0	
	Band Mix B4	0	0	0	0	
	Band Mix B5	0	0	0	-1	
Multiband AGC > Speed	AGC Attack B1	38	38	43	32	
	AGC Attack B2	51	63	63	40	
	AGC Attack B3	51	63	60	42	
	AGC Attack B4	55	63	62	54	
	AGC Attack B5	69	74	63	54	
	AGC Release B1	47	46	65	24	
	AGC Release B2	56	58	66	30	
	AGC Release B3	64	69	74	42	
	AGC Release B4	72	70	82	42	
	AGC Release B5	74	76	84	44	

Table 2-A

Linear Acoustic Application Note

Presets Continued	Preset	Net 5B Limit	Protection limit	Reference Settings	Sports 5B Gen	
Parameter	Parameter					
Multiband AGC > Ratio O/R	B1	Off	Off	Off	Off	
	B2	On inf:1	Off	On inf:1	On inf:1	
	B3	On inf:1	Off	On inf:1	On inf:1	
	B4	On inf:1	Off	On inf:1	Off	
	B5	Off	Off	Off	Off	
Multiband Thresholds	AGC Target (same as in	-	-	-	-	
	Limiter Threshold B1	3	18	18	3.75	
	Limiter Threshold B2	4	18	9.5	4.25	
	Limiter Threshold B3	3.5	18	7.5	6.5	
	Limiter Threshold B4	4.25	18	7.25	9	
	Limiter Threshold B5	5.75	18	14	9	
Band Mix	Same as Multiband AGC > Levels > Bandmix shown above.					
Final	Bass Clipper	Off	On	On	On	
	Bass Clipper Slope	na	1	1	1	
	Bass Clippr Threshold	na	-1.5	-1.5	-1.5	
	Final Limiter Drive	4	0	0	-2	
	Output Level	-7.5	0	-11	-10	
	Loudness Limiter	Of	Off	Off	Off	
	Integration Time	na	na	na	na	
	Threshold	na	na	na	na	

Table 2-B

Linear Acoustic Application Note

Aero.10/100/1000/2000 Presets	Preset	TV 4B Gen	TV 5B Gen	TV 5B Heavy	TV 5B Light	TV 5B Loud
Parameter	Parameter					
Downward Expanders		Off	Off	Off	Off	Off
Input AGC > Main	Ratio	3:01	11.1:1	11.1:1	5.9:1	11.1:1
	Max Gain	20	25	25	25	25
	Attack	21	21	21	21	21
	Release	45	45	45	45	45
	Target	-13.25	-14	-14	-14	-16
	Gate Threshold	-21	-21	-30	-30	-30
	Freeze Threshold	-30	-31	-40	-40	-42
Multiband Setup	Bands	4	5	5	5	5
	Gate Threshold	-21	-21	-30	-30	-30
	Freeze Threshold	-30	-31	-40	-40	-42
	Gate Delay	190ms	190ms	190ms	190ms	190ms
Multiband AGC > Main	Max Gain	14	18	22.5	18	14
	Ratio	2:01	2.9:1	5.9:1	1.5:1	14.3:1
	Progressive Release	40	50	50	50	40
Multiband AGC > Levels	AGC Target B1	0	0	0	0	0
	AGC Target B2	0	0	0	0	0
	AGC Target B3	0	0	0	0	0
	AGC Target B4	0	0	0	0	0
	AGC Target B5	na	0	0	0	0
	Band Mix B1	0	0	0	0	0
	Band Mix B2	0	0	0	0	0
	Band Mix B3	0	0	0	0	0
	Band Mix B4	0	0	0	0	0
	Band Mix B5	na	0	0	0	0
Multiband AGC > Speed	AGC Attack B1	43	38	38	38	36
	AGC Attack B2	63	63	63	63	40
	AGC Attack B3	60	63	63	63	44
	AGC Attack B4	62	63	63	63	44
	AGC Attack B5	na	74	74	74	44
	AGC Release B1	65	55	46	46	50
	AGC Release B2	66	66	58	58	60
	AGC Release B3	74	74	69	69	60
	AGC Release B4	82	82	70	70	60
	AGC Release B5	na	84	76	76	65

Table 3-A

Linear Acoustic Application Note

Presets Continued	Preset	TV 4B Gen	TV 5B Gen	TV 5B Heavy	TV 5B Light	TV 5B Loud
Parameter	Parameter					
Multiband AGC > Ratio O/R	B1	Off	Off	Off	Off	Off
	B2	On inf:1	On inf:1	On inf:1	On inf:1	On inf:1
	B3	On inf:1	On inf:1	On inf:1	On inf:1	On inf:1
	B4	On inf:1	On inf:1	On inf:1	On inf:1	On inf:1
	B5	Off	Off	Off	Off	Off
Multiband Thresholds	AGC Target (same as in	-	-	-	-	
	Limiter Threshold B1	18	4.25	4.25	4.25	18
	Limiter Threshold B2	9.5	6	6	6	9.5
	Limiter Threshold B3	7.5	7.5	7.5	7.5	7.5
	Limiter Threshold B4	7.25	9.25	9.25	9.25	7.25
	Limiter Threshold B5	na	10.5	10.5	10.5	7.25
Band Mix	Same as Multiband AGC > Levels > Bandmix shown above.					
Final	Bass Clipper	On	On	On	On	On
	Bass Clipper Slope	1	1	1	1	1
	Bass Clippr Threshold	-1.5	-1.5	-1.5	-1.5	-1.5
	Final Limiter Drive	0	-3	-3	-3	0
	Output Level	-10	-9	-10	-6	-14.5
	Loudness Limiter	Off	Off	Off	Off	Off
	Integration Time	na	na	na	na	na
	Threshold	na	na	na	na	na

Table 3-B

Additional Presets

Below are examples of 2 custom presets for your reference. Table 4 A, B and C

Aero.10/100/1000/2000 Presets	Preset	Wideband	Music Video				
Parameter	Parameter						
Downward Expanders	Max Gain Reduction	Off	5				
	Threshold B1		-50				
	Threshold B2		-50				
	Threshold B3		-50				
	Threshold B4		-50				
	Threshold B5		-50				
Expander Speed	Attack B1		30				
	Attack B2		30				
	Attack B3		30				
	Attack B4		30				
	Attack B5		30				
		Release B1		50			
		Release B2		50			
		Release B3		50			
		Release B4		50			
		Release B5		50			
Input AGC > Main	Ratio	3.2:1	3:01				
	Max Gain	25	25				
	Attack	24	21				
	Release	42	45				
	Target	-13	-14				
	Gate Threshold	-21	-30				
	Freeze Threshold	-31	-40				
Input AGC > Sidechain PEQ	PEQ 1 Freq		57				
	PEQ 1 BW		1.5 octave				
	PEQ 1 Gain	0	-6				
	PEQ 2 Freq		2891				
	PEQ 2 BW		2 octave				
	PEQ 2 Gain	0	-0.5				
	PEQ 3 Freq						
	PEQ 3 BW						
	PEQ 3 Gain	0	0				
WB AGC 1 > Main	Enable	On	Off				
	Max Gain	6					
	Max Gain Reduction	24					
	Ratio	2:01					
	Attack	50					
	Release	50					
	Progressive Release	25					
	Target	-3.75					
	Gate Threshold	-21					
	Freeze Threshold	-31					

Table 4-A

Linear Acoustic Application Note

Presets continued	Preset	Wideband	Music Video			
WB AGC 1 > Sidechain PEQ	PEQ 1 Freq	57 Hz				
	PEQ 1 BW	3 octaves				
	PEQ 1 Gain	-7	0			
	PEQ 2 Freq	1338 Hz				
	PEQ 2 BW	2 octaves				
	PEQ 2 Gain	-5	0			
	PEQ 3 Freq					
	PEQ 3 BW					
	PEQ 3 Gain	0	0			
Multiband Setup	Bands	5	5			
	Gate Threshold	-21	-30			
	Freeze Threshold	-31	-40			
	Gate Delay	190ms	190ms			
Multiband AGC > Main	Max Gain	14	18			
	Ratio	1:01	1.5:1			
	Progressive Release	50	50			
Multiband AGC > Levels	AGC Target B1	0	0			
	AGC Target B2	0	0			
	AGC Target B3	0	0			
	AGC Target B4	0	0			
	AGC Target B5	0	0			
	Band Mix B1	0	0			
	Band Mix B2	0	0			
	Band Mix B3	0	0			
	Band Mix B4	0	0			
	Band Mix B5	0	0			
	Multiband AGC > Speed	AGC Attack B1	22	38		
AGC Attack B2		32	63			
AGC Attack B3		42	63			
AGC Attack B4		50	63			
AGC Attack B5		66	74			
AGC Release B1		56	46			
AGC Release B2		67	58			
AGC Release B3		68	69			
AGC Release B4		74	70			
AGC Release B5		84	76			

Table 4-B

Linear Acoustic Application Note

Presets continued	Preset	Wideband	Music Video			
Parameter	Parameter					
Multiband AGC > Ratio O/R	B1	Off	Off			
	B2	Off	Off			
	B3	Off	Off			
	B4	Off	Off			
	B5	Off	Off			
Multiband Thresholds	AGC Target (same as in Multiband GC > MB AGC Levels above)					
	Limiter Threshold B1	0	4.25			
	Limiter Threshold B2	0	6			
	Limiter Threshold B3	0	7.5			
	Limiter Threshold B4	0	9.25			
	Limiter Threshold B5	0	10.5			
Band Mix	Same as Multiband AGC > Levels > Bandmix shown above.					
WB AGC 2 > Main	WB AGC 2:	Post MB	Off			
	Max Gain	6				
	Max Gain Reduction	6				
	Ratio	1.5:1				
	Attack	50				
	Release	50				
	Progressive Release	50				
	Target	-8				
	Gate Threshold	-30				
	Freeze threshold	-40				
WB AGC 2 - PEQ	none used					
Band Mix	Same as MB AGC > MB AGC Levels > Band Mix (shown above)					
Final	Bass Clipper	Off	On			
	Bass Clipper Slope	na	1			
	Bass Clippr Threshold	na	-1.5			
	Final Limiter Drive	0	-3			
	Output Level	-11	-6			
	Loudness Limiter	Off	Off			
	Integration Time	na	na			
	Threshold	na	na			

Table 4-C