



Setting up Level Magic™ Audio Adjustment with FLEX™

Application Note

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1.0 AUDIO LEVELING OVERVIEW

Digital audio provides over 100 dB of dynamic range in sharp contrast to the less than 40 dB offered by analog audio. Combined with the lack of industry standards, this has led to widely divergent operational choices and consumer frustration with those choices. MVPD operators wish to lower that frustration.

The ATSC has documented audio level issues and solutions in ATSC Recommended Practice A/85 “Techniques for Establishing and Maintaining Audio Loudness for Digital Television,” published in November 2009.

ATSC A/85 summarizes:

Despite the conclusion of the DTV transition, many broadcasters and the production community have been slow to effectively adapt to the changes required to transition from analog NTSC audio techniques to contemporary digital audio practices. With digital television’s expanded aural dynamic range (over 100 dB) comes the opportunity for excessive variation in content when DTV loudness is not managed properly.

Consumers do not expect large changes in audio loudness from program to interstitials and from channel to channel. Inappropriate use of the available wide dynamic range has led to complaints from consumers and the need to keep their remote controls at hand to adjust the volume for their own listening comfort.

Among other recommendations, A/85 relies upon the ITU-R BS.1770 loudness measurement method. BS.1770 measurements result in readings in “LKFS”, which is an acronym for “loudness, K-weighted, relative to full scale.” A unit of LKFS is equivalent to a decibel.

2.0 FLEX™ AUDIO OVERVIEW

The FLEX™ decoder module provides operators with an integrated decoder/re-encoder system that offers easy redundancy capabilities without requiring much external infrastructure or cabling. While FLEX is not an IRD, it does provide the basic IRD functionality in a very cost-effective package. One feature which FLEX does provide, and is not found in traditional IRDs, is audio leveling. Two types of leveling are provided: static or dynamic.

The static leveling applies a fixed audio gain adjustment value to the decoded audio. That gain adjustment can scale the audio level either up or down (up being towards 0 dBFS or “louder” when heard). If the audio is scaled upwards, there are no checks for clipping.

The dynamic leveling uses the same technology found in Jünger Audio’s Level Magic™ hardware-based processors, which are widely deployed worldwide.

Dynamic audio leveling with FLEX is done via Jünger Audio’s Level Magic algorithms. Harmonic has licensed this technique from Jünger Audio Studioteknik for the benefit of our FLEX users.

Level Magic follows the recommendations of A/85. Beyond that, Level Magic provides automatic adjustment of program levels to the system operator’s chosen operating point. Level Magic is simple to use and aurally transparent.

3.0 AUDIO DECODING WITH FLEX

While FLEX is not a general-purpose IRD, it does provide much of the same functionality that a traditional IRD does. One such functionality is the choice of pre-compressed audio pass-through or decode and re-encode. FLEX pass-through capabilities permit the user to perform pass-through on audio types for which the standards to carry it in AES3 have not been defined, such as MPEG-1 Layer II or HE AAC.

Audio leveling only works on PCM audio, so the user must decode, level, and then re-encode in order to use it. The user must select an audio format for decoding, and thus the user needs to know which compression format is being used by their program provider.

FLEX's audio controls are found on the Audio Decoding tab of the NMX™ GUI (see Figure 1 below).

The Audio Decoding GUI page has the following controls:

- **Format.** Selects the audio format for decoding.
- **Decoding Mode.** Channel configuration for the decoding process. Choices are Stereo or Multichannel. If the input signal is stereo and multichannel is chosen, the center and surround channels will contain silence.
- **Delay (ms).** Audio delay in milliseconds. The default value is 0 ms. Typical use of this value is to compensate for an audio source that is not "lip-synced" with the video.
- **Static Level Adjustment.** See Section 4.1 below.
- **Dynamic Level Adjustment.** See Section 4.2 below.
- **Compression Mode.** Selects an AC-3 DRC profile for AC-3 decoding. Two modes are available: Line and RF. Line mode is the default. (Use of RF mode may result in audible artifacts). Please consult ATSC A/85 Section 9.1.1 and Annex F for additional information on this topic.
- **Re-embedded Group.** The selected group for the audio embedding on the monitor output of FLEX. The default group is 1.
- **Re-embedded Pair.** The selected pair for the audio embedding on the monitor output of FLEX. The default pair is 1.

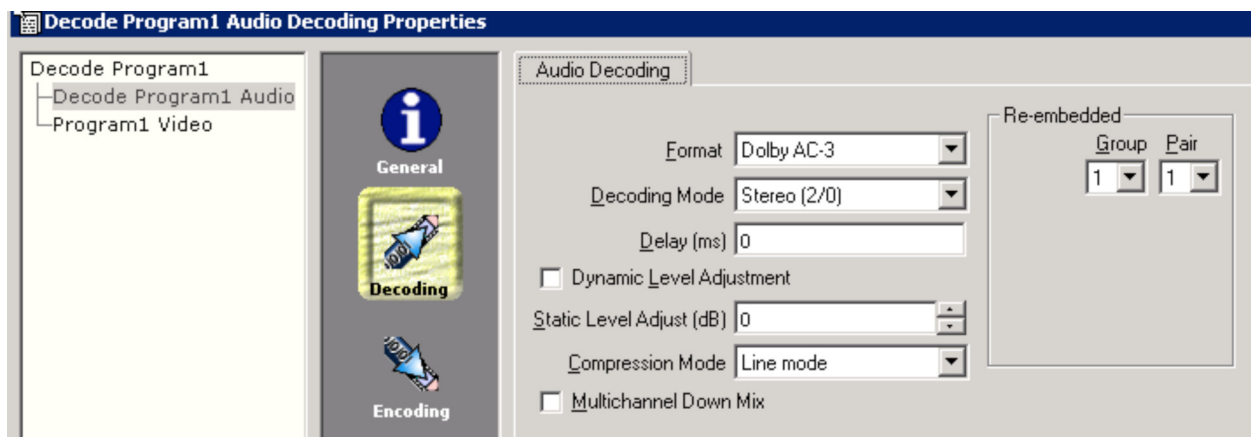


Figure 1

4.0 CONFIGURING AUDIO GAIN ADJUSTMENT (FLEX)

4.1 CONFIGURING STATIC AUDIO LEVEL ADJUSTMENT

The static audio Level Adjustment is a simple gain adjustment applied to the decoded audio and is purely “static” (or fixed) as the name indicates.

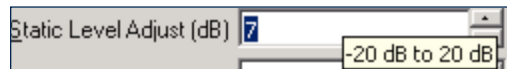


Figure 2

Select a static gain adjustment in decibels in the range of -20 dB to +20 dB. This gain applies to all channels of that audio stream. Adjustment range is ± 20 dB. Care must be taken if gain is added to avoid audible clipping.

4.2 CONFIGURING DYNAMIC LEVEL ADJUSTMENT

Select this checkbox to access the Dynamic Level Adjustment parameters (see below).

1. Select the Dynamic Level Adjustment checkbox.
2. The Dynamic Level Adjust tab and parameters appears (Figure 3).
3. Navigate inside the new tab and enter an input gain value in decibels if a fixed gain adjustment is desired. This gain applies to all channels within that audio stream (Figure 4).

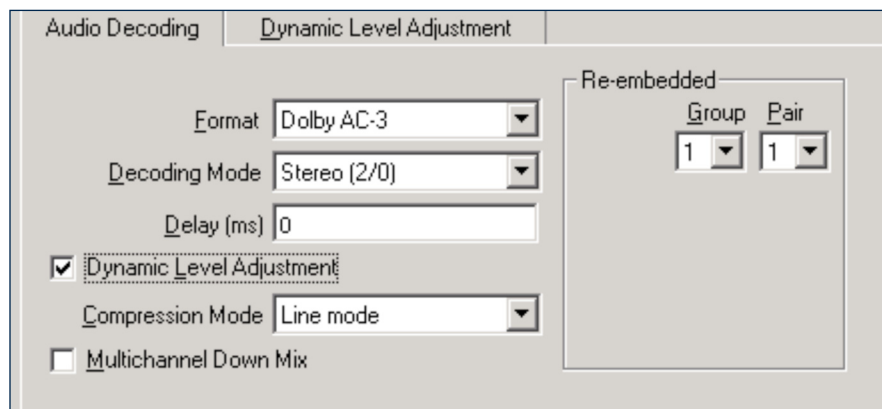


Figure 3

4. Select a Loudness Target value in LKFS.
5. Select a Max Peak Level value in dBFS. This is the necessary true-peak headroom level for your system.
6. Click OK.

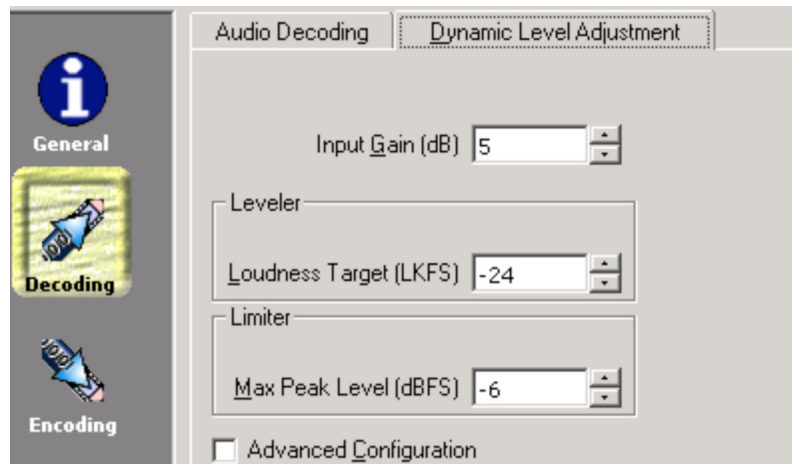


Figure 4

4.3 DYNAMIC LEVEL ADJUSTMENT ADVANCED SETTINGS

At the bottom of the Dynamic Level Adjust is a control which permits access to advanced controls. Most users will not require these settings.

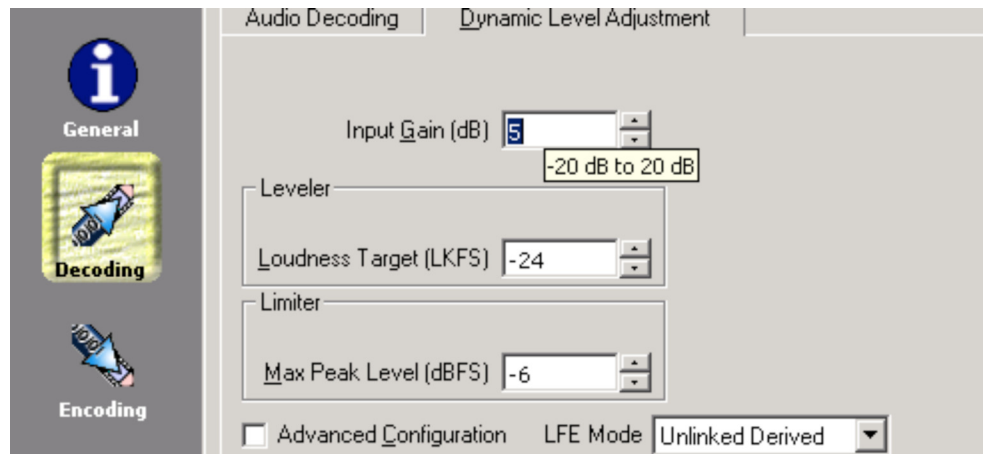


Figure 5

Selecting the Advanced Configuration checkbox provides access to the Advanced Configuration controls (Figure 6 below). Use of these is not recommended and users who choose to access them must do so with care.

For 5.1 multichannel audio services only, there is an “LFE Mode” control. LFE is an acronym for “low frequency effects” and is a band-limited channel associated with a multi-channel service. This control is available when the global option is selected and the Decoding Mode is configured as Multiple Channel. The default mode is Unlinked Derived. When LFE is configured as Unlinked Adjustable, additional LFE controls become available to modify. These are the same as for the other channels in the program (designated as “3/2” on the screen).

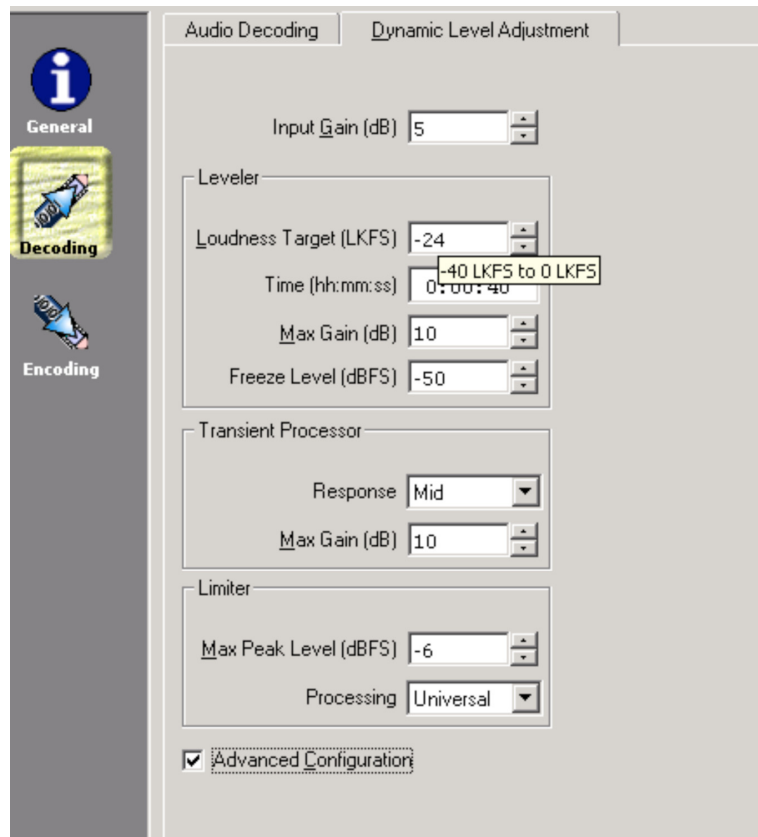


Figure 6

Input Gain (dB) permits the user to apply a fixed input gain adjustment (in dB) if desired. This gain applies to all channels.

“Leveler” controls provide the overall program dynamic gain adjustments:

- “Loudness Target” is specified in LKFS. The default loudness target is -24 dB as recommended by ATSC A/85.
- “Time” controls amount of time the leveling operation takes to scale incoming audio when loudness levels are not at target. The time range is from 1 second to 1000 seconds. The default value is 30 seconds. Most users will select shorter times; however, care must be taken not to introduce audible artifacts.
- “Max Gain” specifies maximum gain range from 0 dB to 20 dB. The default value is 10 dB.
- “Freeze Level” specifies the level below which gain will not be adjusted. The default value is -50 LKFS.

“Transient Processor” provides control over this aspect of Level Magic.

- “Response” specifies the attack time for the processing of peak transients. Three values are available: soft, mid (default) and hard.
- “Max Gain” specifies the range of transient adjustment from 0 dB to 20 dB. The default value is 10 dB .

“Limiter” provides control over the peak limiting function of Level Magic.

- “Max Peak Level” specifies the maximum peak level.
- “Processing” controls the processing modes: Live, Speech, Universal (default) and Classic.