ALC Solutions Overview

**ALC with Linear Acoustic Aeromax Processing**
- Advanced loudness control, using proven Linear Acoustic AEROMAX multiband audio processing
- Highly flexible processing, with excellent performance with vocal tracks
- Up to 8 channels of loudness processing per sub-module
- Audio processing for up to 2 programs per sub-module (mono, stereo, 5.1 audio)
- Optional 2.0 to 5.1 upmixing using Linear Acoustic technology

**ALC with Grass Valley Wideband Audio Processing**
- Lower cost, high performance wideband audio processing
- Designed for easy configuration and control
- Up to 16 channels of on-board loudness processing
- Audio processing for up to 8 programs (mono, stereo, 5.1 or 7.1 audio)
- Firmware based solution leaves the sub-module sockets on the host card free for other advanced processing functions
- Now supporting loudness measurements and true-peak limiter according to ITU-R BS.1770-3
Automatic Loudness Control (ALC) Advanced Loudness Control Solutions Which Prevent Excessive Audio Jumps

Automatic Loudness Control Using Linear Acoustic AEROMAX

Advanced loudness control is offered by ALC with Linear Acoustic AEROMAX audio processing. It uses a third generation audio processor to provide a simple and cost-effective solution for guarding against loudness shifts.

Multiband Architecture

The AEROMAX algorithms use a multiband approach to loudness control. These algorithms can apply multiband, multistage loudness control to the audio, resulting in audio free from abrupt loudness or image shifts, while preserving more of the original content than previously possible.

This version of ALC can be packaged with, or without, the Linear Acoustic upMAX upmixer on the same submodule for optimal integration.

Typical program configurations using AEROMAX

2-channel ALC with optional upmix

<table>
<thead>
<tr>
<th>2.0 ALC</th>
<th>UPMIX (-DUP)</th>
</tr>
</thead>
</table>

6-channel ALC with optional upmix

<table>
<thead>
<tr>
<th>5.1 or 2.0 ALC</th>
<th>UPMIX (-DUP)</th>
</tr>
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</table>

8-channel ALC with optional upmix

<table>
<thead>
<tr>
<th>5.1 or 2.0 ALC</th>
<th>UPMIX (-DUP)</th>
</tr>
</thead>
</table>

Upmixing is only available with the –DUP ordering codes.

Other channel configurations are also supported. Please visit www.grassvalley.com for more information.

SPECIFICATIONS

- Architecture: 8 channel multiband (5) processing
- Number of programs: 1 or 2
- Program configuration: 2 and/or 6 audio channels
- Loudness measurement: ITU-R BS.1770
- Sampling: Up to 24 bits at 48 kHz
- Processing profiles: 6
- Limiter set range: -6 to 0 dBFS or ±6 dB
- AGC pulling range: ±36 dB

ORDERING

- MOD-LA-ALC-2 2-channel ALC licensed by Linear Acoustic
- MOD-LA-ALC-6 6-channel ALC licensed by Linear Acoustic
- MOD-LA-ALC-8 8-channel ALC licensed by Linear Acoustic
- MOD-LA-ALC-2-DUP 2-channel ALC and up mix licensed by Linear Acoustic
- MOD-LA-ALC-6-DUP 6-channel ALC and up mix licensed by Linear Acoustic
- MOD-LA-ALC-8-DUP 8-channel ALC and up mix licensed by Linear Acoustic

Please visit www.grassvalley.com for more information.
Automatic Loudness Control (ALC) Advanced Loudness Control Solutions Which Prevent Excessive Audio Jumps

ALC with Grass Valley Wideband Audio Processing

Lower cost, high performance loudness control is provided by ALC using Grass Valley’s proprietary wideband audio processing algorithms. This variant of ALC offers versatile, easily configured loudness processing, which does not adversely affect the program content.

Wideband Architecture

This ALC option uses a firmware upgrade to the hosting card. Up to eight different programs and up to 16 channels can be processed simultaneously, with independent controls and loudness meters on each program. This ALC variant leaves the sub-module sockets on the host card free for other advanced processing functions.

![Diagram of ALC architecture](attachment:ALC_diagram.jpg)

Typical configurations

<table>
<thead>
<tr>
<th>2-channel ALC</th>
<th>8-channel ALC</th>
<th>8-channel ALC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 ALC</td>
<td>5.1 ALC</td>
<td>7.1 ALC</td>
</tr>
<tr>
<td>6-channel ALC</td>
<td>2.0 ALC</td>
<td>Other channel configurations are also supported. Please visit <a href="http://www.grassvalley.com">www.grassvalley.com</a> for more information.</td>
</tr>
<tr>
<td>5.1 ALC</td>
<td>5.1 ALC</td>
<td></td>
</tr>
</tbody>
</table>

### SPECIFICATIONS

- **Architecture**: 16 channel wideband processing
- **Number of programs**: Up to 8
- **Program configuration**: 1, 2, 3, 4, 6 or 8 audio channels
- **Loudness measurement**: ITU-R BS.1770-3
- **Sampling**: Up to 24 bits at 48 kHz
- **Processing profiles**: 3/5
- **Target loudness range**: -31 to -10 LKFS
- **Limiter set range**: -20 to dBFS true-peak
- **AGC pulling range**: -31 to +18 dB
- **Pre-gain stage range**: -20 to 20 dB

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Automatic Loudness Control (ALC) Advanced Loudness Control Solutions Which Prevent Excessive Audio Jumps

Segment-to-Segment: Active Loudness Control

Grass Valley’s ALC solutions can be operated in a ‘set-and-forget’ mode, with the setting of an output Target Loudness per program. This mode can achieve excellent results, and the performance can be optimized by selecting a loudness processing profile that best matches the content of the facility.

An alternative approach to loudness processing involves using playout automation to actively control the loudness processing profile, according to the type of content. This can yield improved results when the facility uses a significant amount of programming with a controlled loudness level or a reliable Dialnorm value.

In the example below, a facility controls three different profiles by playout automation to create an optimal loudness processing result, with minimal impact to the original program dynamics. The three different profiles provide aggressive loudness control for commercials, light processing for a movie with an uncontrolled loudness level, and a complete bypass of the ALC processing for a program with the correct loudness level or a reliable Dialnorm value. Traditionally, the most problematic content from a loudness control perspective has been commercial and promo insertions.

<table>
<thead>
<tr>
<th>Program</th>
<th>Promo</th>
<th>Movie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program with correct loudness level or reliable Dialnorm value</td>
<td>Loud promo</td>
<td>Movie with uncontrolled loudness level</td>
</tr>
<tr>
<td>ALC is bypassed</td>
<td>ALC is engaged with an aggressive profile</td>
<td>ALC is engaged with a light profile</td>
</tr>
<tr>
<td>Audio remains intact with its original dynamics while the program meets station’s target loudness</td>
<td>Audio level matches target loudness but compression will likely affect original dynamics</td>
<td>Audio level matches target loudness with a slight impact on the original film audio dynamics</td>
</tr>
</tbody>
</table>

Active Control of ALC by Playout Automation

Headend Uses Decoding, ALC Audio Processing, and Re-encoding

Can fix both channel-to-channel and segment-to-segment loudness problems.

Note: This configuration is possible if the audio compression algorithm and the bit rate in use allow for an extra generation of encoding without creating audible artifacts when decoded at final destination.

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Automatic Loudness Control (ALC) Advanced Loudness Control Solutions Which Prevent Excessive Audio Jumps

**Playout using ‘set and forget’ mode with ALC**

- Output target loudness is maintained by ALC
- Loudness control can be optimized by choosing an ALC profile that best matches the facility's content

**Playout using active control of ALC by automation system**

- Automation triggers different ALC profiles according to the program content, driven by content tagging performed by the traffic team
- By adapting the ALC profiles to the content, there is minimal impact to original program dynamics

**Dolby Decode/ALC at ingest**

All ingested content matches the station's Target Loudness level
Channel-to-Channel Loudness Control: ALC at Head-ends

Channel-to-channel loudness inconsistencies are another key issue, especially for cable and IPTV service providers. It’s common for viewers to experience different loudness levels as they switch between channels, and this is because the channels will have different average loudness and inconsistent dialnorm values.

Often, the cause of this channel-to-channel loudness variation is the broadcaster’s use of a default -27 dB DialNorm value for the Dolby Digital encoder when there is significant variation in the average loudness of the program segments.

Fortunately, Grass Valley’s automatic loudness control solutions can be used to address the problem by decoding and processing the audio with ALC, and then re-encoding. The Densité signal processor card can re-stamp a consistent Dialnorm value to match the target loudness value used by the ALC processor.

Typical loudness scenario in IPTV / cable system with a mix of loudness levels across channels