# Upmix

## Applicability

This description applies to the Surround (up to 5.1) and Immersive (up to 7.1.4) versions of the Auto Upmix module.

The terms Upmix and Auto Upmix are used interchangably.

## Overview

Upmix is a module for deriving a higher-channel output format from a lower-channel or partially populated input format. It is used to create surround or immersive program paths from available source signals.

The module can also include source fail-over and surround detection behavior, depending on the Processor in which it is used.

## Processing Principle

Upmix analyzes the selected source format and generates the configured target format. It can distribute center, surround, side surround, LFE, and height-related components according to the selected upmix mode and related balance settings.

Additional detection and fail-over parameters control how the module reacts to missing or unsuitable input signals.

# Parameters

## Format and Mode

| Parameter - Format and Mode | Description |
|---|---|
| Source Format | Selects the source channel format used for upmixing. |
| Target Format | Selects the target channel format generated by the module. |
| Upmix Mode | Selects the upmix processing mode. |
| Surround Output Select | Selects which surround output components are generated or used. |

# Upmix Balance

| Parameter - Upmix Balance | Description |
|---|---|
| Center Gain | Adjusts the generated or routed center channel level. |
| Upmix Center Divergence | Controls how center content is distributed during upmixing. |
| Surround Gain | Adjusts the generated surround channel level. |
| Side Surround Gain (only version 7.1 and 7.1.4) | Adjusts the generated side surround channel level. |
| Vertical Balance (only version 5.1.4 and 7.1.4) | Controls the balance between lower-layer and upper-layer components in immersive upmixing. |
| Top Layer Crossover Frequency (only version 5.1.4 and 7.1.4) | Sets the crossover frequency used for top-layer processing. |
| Top Layer Crossover Direct Mix (only version 5.1.4 and 7.1.4) | Controls direct signal mixing into the top-layer crossover path. |

# LFE and Center Replacement

| Parameter - LFE and Center Replacement | Description |
|---|---|
| Upmix LFE Enable | Enables or disables generated LFE processing. |
| Upmix LFE Gain | Adjusts the generated LFE level. |
| Upmix LFE Cutoff | Sets the cutoff frequency for generated LFE content. |
| Upmix LFE Effect Gate Threshold | Sets the threshold used for LFE effect gating. |
| Center Replacement | Enables or configures center replacement behavior. |
| Center Replacement Center Divergence | Controls how replacement center content is distributed. |

# Detection and Fail-over

| Parameter - Detection and Fail-over | Description |
|---|---|
| Surround Detection Channels | Selects the channels used for surround detection. |
| Surround Detection Threshold | Sets the threshold for detecting surround content. |
| Surround Detection Wait | Sets the wait time before surround detection changes state. |
| Fail-over Side-chain Filter | Selects or enables filtering for fail-over detection. |
| Fail-over Fail Threshold | Sets the signal threshold used to detect a failure condition. |
| Fail-over Fail Wait | Sets how long the fail condition must persist before switching. |

| Parameter - Detection and Fail-over | Description |
| --- | --- |
| Fail-over Fail Return | Controls how the module returns after a failed source becomes valid again. |

# Related Processors

- Automixer - 5.1
- Program + Spectral Processing Channel Strip - 5.1
- Program Processing Channel Strip - 7.1.4 (+Upmix)

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Revision #1
Created 2026-09-04 12:58:17 UTC by FK
Updated 2026-09-04 12:58:17 UTC by FK