LINEAR ACOUSTIC

UPMAX2251:neo

5.1-Channel Surround-Field Processor

User Guide

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Table of Contents

List of Figures

Chapter 1: Introduction

The Linear Acoustic UPMAX 2251 produces a 5.1 channel audio signal that is perfect for eventual transmission via Dolby Digital (also known as AC-3) to all consumers. The unit accepts a 2-channel input and "upmixes" it to fill as many of the 5.1 output channels as the user selects. Any input signal from mono to LtRt (Left Total/Right Total) surround encoded audio can be applied to the Main Input and an output will be produced that maintains consistency with other 5.1 channel programming.

Further, external discrete sources of audio such as announcer or stereo crowd can be applied to the unit via its Mix Inputs and can be selectively mixed with the audio produced by the upmixing process. A subwoofer, or LFE channel can also be selectively created from the Main Input audio or via the discrete LFE Mix Input.

The UPMAX 2251 provides the following features:

- Advanced upmixing algorithm for stable, convincing surround experience.

- Optionally selectable DTS neo:6 algorithm for further upmixing flexibility.

- The only processor fully downmix compatible with Dolby Digital (AC-3).

- Upmixed surround field is infinitely adjustable in width and depth.

- External inputs allow mixing of discrete audio signals with internal upmix.

- Relay bypassed digital inputs for "mission critical" broadcast applications.

- Built-in adjustable delays to compensate for video path processing.

1.1 Principles of Operation

The UPMAX 2251contains two paths for audio signals. The first path contains an upmixer, a bass extension filter to create the LFE (Low Frequency Effects) or subwoofer channel, and a simple but powerful set of mix controls to vary each element of the surroundfield. The second path provides discrete inputs for the Center, LFE, Ls (Left Surround), Rs (Right Surround), Lf (Left Front) and Rf (Right Front) channels. The upmixed and discrete outputs are selectively combined to allow for the addition of specific audio elements to the upmix-derived elements.

Please refer to Figure 1-1. It should be noted that this diagram is a general representation of signal flow. Please consult the appropriate section of this manual for an accurate description of actual functionality.
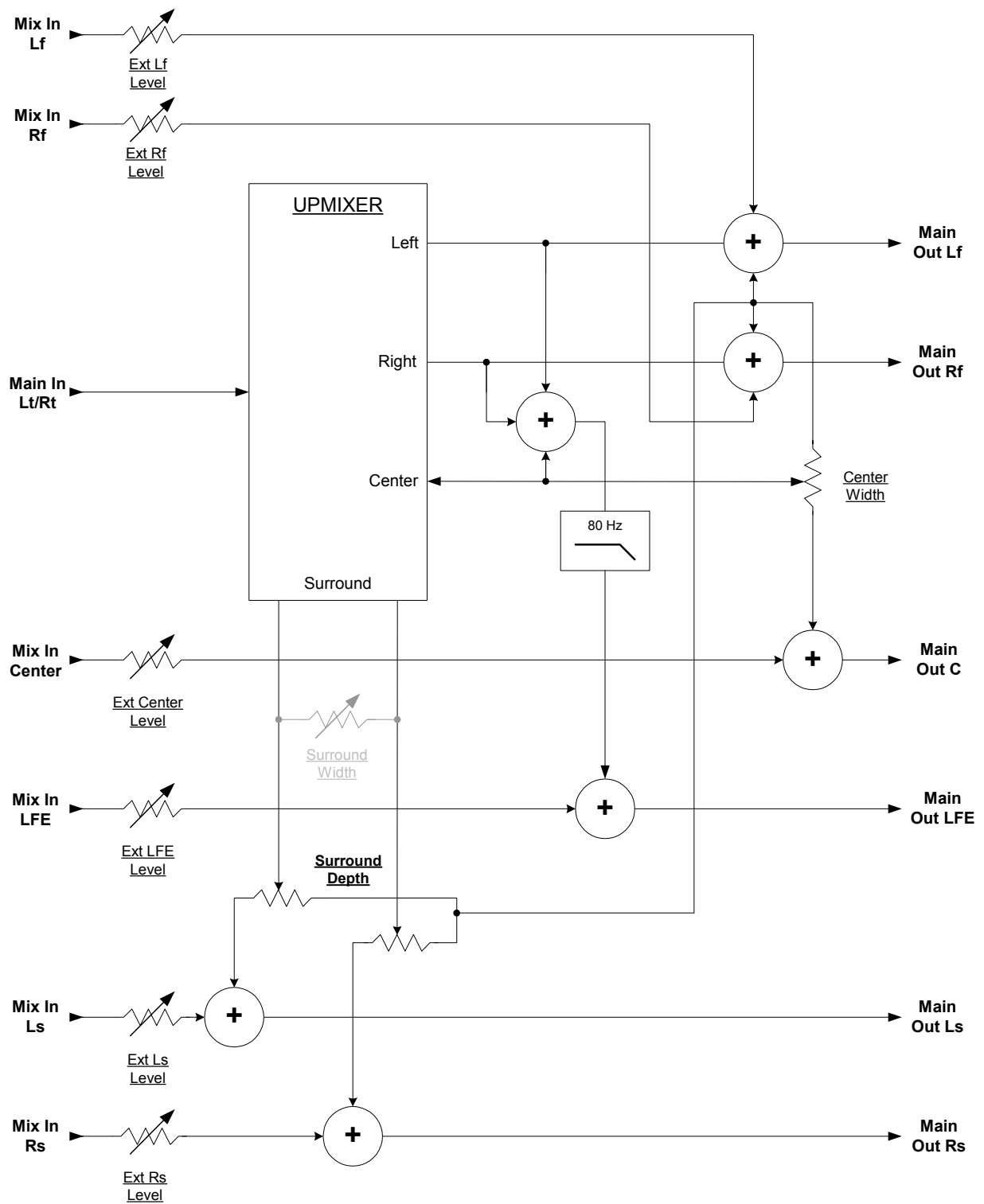
Figure 1-1 Audio Block Diagram

Two-channel audio is applied via the Lt/Rt Main Input. The audio is upmixed to produce Left, Right, Center, and Surround signals. The Left and Right outputs of the upmixer are passed unmodified to the Left and Right Main Output.

The Center channel output of the upmixer is passed through the **Center Width** control which varies the amount of center channel audio present at the Center Main Output versus how much is summed back into the Left and Right Main Output. A setting of 100% indicates that all of the upmixed Center audio is being fed to the Center Main Output, while 0% indicates that all of the upmixed Center audio is being fed back into the Left and Right Main Output. The 0% setting is the same as "Phantom Center" mode common on some decoders.

The Left, Right, and Center outputs of the upmixer are combined then 80Hz low pass filtered and when selected via the **LCR Sum To LFE** switch are passed via the LCR Sum Level control to the LFE Main Output.

The Surround output of the upmixer is passed through the **Surround Depth** control which varies the amount of surround information present at the Ls/Rs Main Output versus how much is summed back into the Left and Right Main Output. A setting of 100% indicates that all of the upmixed Surround audio is being fed to the Ls/Rs Main Output, while 0% indicates that all of the upmixed Surround audio is being mixed back into the Left and Right Main Output.

All outputs of the upmixer can also be selectively combined with signals applies to the Mix Inputs. The Mix Inputs are available for all channels and have **Mix Level** controls that vary from off to +6dB. Note that the +6dB range is provided for convenience, but a full-scale signal applied to these inputs can be increased to clipping, so settings above 0dB should be used carefully and sparingly.

1.2   Signals and Levels

The Linear Acoustic UPMAX 2251 is calibrated for -20dBFS environments, but will work fine with other reference levels with the minor caveat that the analog LtRt utility output (on the LtRt/Aux DB-25 connector) is fixed at -20dBFS=+4dBu.

The sample rate of the UPMAX 2251 is nominally 48kHz, but the unit will run at other sample rates as determined by the signal applied to the AES REF input. Please note that currently this causes the test tones to change slightly in frequency, but has no effect on the program audio.

Below is a list of the inputs and outputs of the UPMAX 2251:

- Lt/Rt Main Input - Main input to upmixer

- Mix Inputs (C/LFE, Ls/Rs, Lf/Rf) - Direct mix into the main output channels

- Main Outputs (Lf/Rf, C/LFE, Ls/Rs) - Main outputs, SMPTE 320M format

- LtRt Main Output - A utility two-channel downmix of the 5.1 channel program (this output is also available as an analog signal on the LtRt/Aux connector)

1.3   Downmix Compatibility

Downmixing is the process where the individual channels of a Dolby Digital signal are combined in order to be reproduced from a given number of channels. For example, a 5.1 channel program must be downmixed to be reproduced from a stereo speaker system and so the left and right channels are combined with the left and right surround signals and an attenuated version of the center channel before being output as a stereo signal. This type of signal is called LoRo (for Left only/Right only).

Downmixing may also produce an LtRt compatible signal by performing a pseudo-surround encode. A 90-degree phase shift is applied to the surround signals in the Dolby Digital encoder prior to the actual encoding stage so that after downmixing from 5.1 to 2-channels in the consumer decoder the signal can be heard in surround by the many consumers that only have a matrix surround decoder.

An extremely important design goal of the Linear Acoustic upMAX 2251 was that the output be downmix compatible. Not only stereo and surround, but also mono- and it had to sound good in 5.1! A tall order that has been satisfied.

One important thing to remember is that to ensure widest compatibility, the Dolby Digital encoder must be set to apply a 90-degree phase shift. Luckily, this is the default position for most of the presets, however please consult the encoders user manual to find the menu location where this setting can be checked.

Please note that the key to ensuring that audio is downmix compatible is to monitor through a device that can simulate all of the downmix modes. A recommended product is the Dolby DP570 Multichannel Audio Tool which provides these simulations in addition to flexible monitoring capabilities.

Chapter 2: Connections and Setup

This chapter covers all required connections for the Linear Acoustic upMAX 2251.

2.1   Unpacking and Inspection

Before unpacking the unit, inspect the outer carton for shipping damage. If the carton shows damage, inspect the unit in those areas. Please save the carefully designed shipping carton and packing materials. In the unlikely event that the unit needs to be returned to the factory, alternate cartons or packing materials may not be adequate and can cause damage not covered by warranty.

The following essential items are provided with the unit:

- Warranty information: Fill out and return the warranty card to Linear Acoustic to ensure your software and documentation are kept up to date.

- A front-panel USB extension cable for software updates (PLEASE SAVE THIS!)

- Bag containing one power cord (style matches country unit is shipped to), a handy "sharpie" with our name and logo conspicuously emblazoned on it, a quick start sheet that is worth reading, and this manual.

2.2   Installation

upMAX 225 installation requires:

- three standard rack space units with ADEQUATE VENTILATION; the unit vents from the front sides and exhausts out the back through the power supply;

- standard 75Ω BNC cables for digital signal connections;

  To connect to digital equipment with 110 Ω XLR connectors, use impedance-matching transformers (available from Canare and other manufacturers).

- an AES reference supplied to the **AES REF** input *PRIOR* to powering unit on.

- a suitable 5.1 channel monitoring system.

2.3   Rear Panel

The rear panel of the ᴜᴘMAX 2251 contains its electrical I/O. The power supply has an autoranging input, and accepts from 100 to 240 VAC at either 50Hz or 60Hz.

2.3.1   Connection Ports

All ᴜᴘMAX 2251 connections are on the rear panel and are described in detail below. See Chapter 5: *Specifications* for specific pinouts.
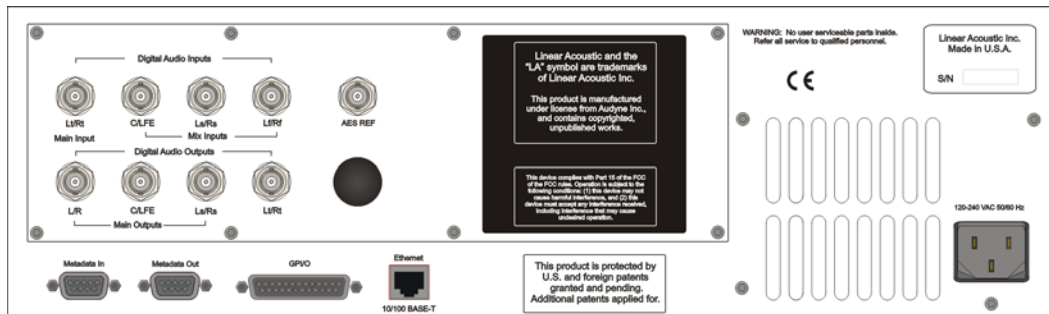
Figure 2-1 ᴜᴘMAX 2251 rear Panel

- **Main Audio Input**: Connect the PCM signal which will be upmixed to create a 5.1 channel signals to this input.

- **Mix Inputs:** PCM signals connected to these inputs can be selectively mixed with the output of the upmixing algorithm. These are useful for adding announcer via the **C** (center) input, or stereo "natural," "crowd," or "ambience" audio via the **Ls/Rs** (Left surround/Right surround) inputs. **Lf/Rf** (Left front/Right front) inputs are for placing audio in the L/R main outputs with no additional processing.

- **Main Audio Outputs:** Main processed digital audio outputs with the SMPTE 320M standard channel configuration: **Left/Right, Center/LFE, Left Surround/Right Surround**. An Lt/Rt compatible downmix of the 5.1 channel output is always available on the **Lt/Rt** output connector and is useful for monitoring or feeding systems which support only two audio channels.

NOTE: *The main audio inputs are hard-bypassed to the Main Audio Outputs during boot and bypass (power off) for mission-critical applications. Under these circumstances, each input connector bypasses to the output connector directly below it, passively maintaining audio continuity.*

- **AES REF:** Connect an AES plant reference signal to this connector (*not a video or word clock reference*). The signal may be an AES Black or AES signal containing audio.

NOTE: *A valid AES signal is required on the AES REF connector for the system to operate (not video or word clock).*

- **GPI/O:** Connect to the GPI/O outputs of your automation system or routing or master control switcher to control special processor functions and recall presets. Note that GPI A and B require a held contact closure to ground for the duration of the function. However, GPI 1-6 require only a momentary contact closure to ground; if held, other numerical GPIs cannot be selected.

- **ETHERNET:** Automatically senses 10 or 100BASE-T Ethernet connectivity. The upMAX 2251 will appear on the network as: upMAX followed by the units serial number (i.e. upMAX-04301 (your number will be different)). The units workgroup is defaulted to WORKGROUP with no password.

- **Metadata In:** Connect to the Professional Audio Metadata output of a VANC de-embedder or Dolby E decoder to input external metadata.

- **Metadata Out:** NOT CURRENTLY USED (passive loop-through of Metadata In).

2.4   Front Panel

The front panel of the upMAX 2251 contains a 5-inch color TFT display, four navigation buttons (described in chapter 4, but reasonably simple to understand), a big knob for changing various parameters, and a secret door disguised as our logo on the left hand side.

2.4.1   What's Behind Door #1?

Using a soft object (such as your finger), you can open the logo door from its left side, and it will swing out revealing two very important features: a USB connection and a red reset button.

The USB connector on the left is used for software upgrades. We will provide instructions and the memory card required for such a situation, but please **do not** connect any other device to this connector without first contacting us.

The red reset switch on the right is included in case the unit experiences power disturbances or incorrect shutdown (i.e. pulling the plug) and enters protection mode. This mode causes the unit to stay in bypass and remain unpowered until someone opens the door and *briefly* pushes the reset switch. This prevents brown- or black-outs from causing audio interruptions and/or permanently damaging the unit. To date, this feature has saved several units from complete destruction during bad weather storms.

Chapter 3: Applications

The UPMAX 2251 is intended to be used either in the production or distribution stages of 5.1 channel programming, and also selectively in transmission environments. Cable and satellite facilities may find it useful as the distribution and transmission sections are usually very close together. For terrestrial emission (transmission) applications such as at DTV stations, the Linear Acoustic AEROMAX 5.1 may be a more appropriate choice as it contains requisite dynamic range processing and additional useful features such as voice-over.

The Linear Acoustic UPMAX 2251 is *not* a substitute for a good, discrete multichannel mix (if one is available), rather it is a useful tool to create one!.

That being said, the UPMAX 2251 *is* an excellent tool useful in either creating a 5.1 channel version of a program when few or no other elements exist, and also for creating a solid foundation for a true discrete multichannel mix.

This chapter discusses several applications of the UPMAX 2251:

- Integrating 2-channel commercials into a 5.1 channel program

- Creating a 5.1 channel sports program from stereo plus natural sources

- Use for music programming

- Discussion of presets stored in the unit

3.1   Typical Scenarios

Below are some application examples to give users some guidance in real-world situations. However, before continuing, it is absolutely imperative that a proper multichannel monitoring environment be set up and *calibrated* before **every** mix. If the mix cannot be heard properly, then it cannot be created properly. Users are advised to obtain copies of the *Dolby Surround Mixing Manual* and the *Dolby Digital Professional Encoding Manual*, both available form the Dolby Laboratories web site (*www.dolby.com*) for detailed, accurate information on both the monitoring and mixing processes.

The Linear Acoustic UPMAX 2251 is useful almost anywhere a multichannel mix must be created. From hands-on adjust-as-you-go environments like a music awards program to set-and-forget applications like helping two-channel commercials fit into 5.1-channel programming, the UPMAX 2251 is the answer.

3.1.1   Two-Channel Commercials and Interstitial Programming

One of the largest complaints viewers of digital and high definition television programming is the annoying fact that stereo commercials don't seem to "fit" into the 5.1-channel program. This is because in many cases, the commercials are simply transmitted on the Left and Right channels of a 5.1-channel program. The net result is that during the program, dialogue comes from the center speaker, but at commercial or station breaks, all of the dialogue comes from the left and right speakers. It can be a jarring experience.

The first application is one where the UPMAX 2251 processes the stereo material allowing it to fit nicely within a 5.1 channel program. Figure 3-1 shows this scenario.
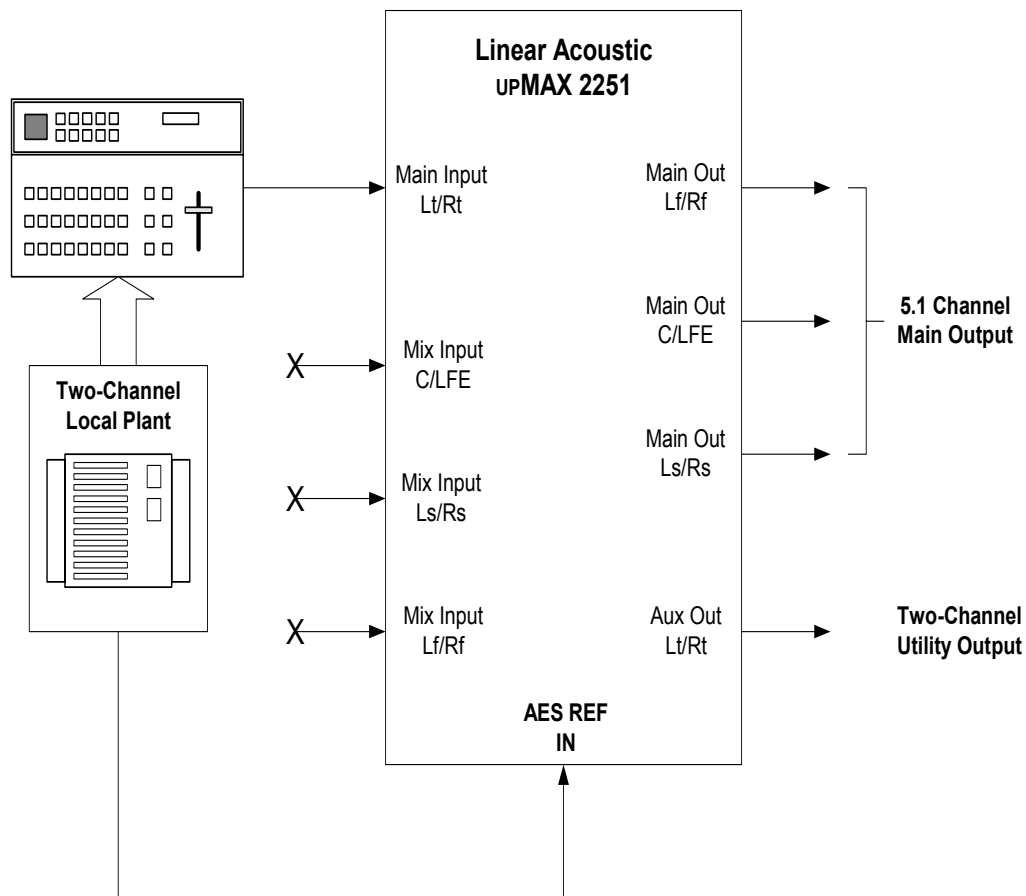
Figure 3-1 UPMAX 2251 in a commercial upmixing application

Note that the two channel material is simply input to the UPMAX 2251 and a 5.1 channel signal is available at the output. Either of the **Commercial** or **Music** presets can be chosen, and are explained in detail at the end of this chapter.

A similar situation can arise when the Dolby E system is in use, and can actually help to automate the process of turning the upmixing process on and off with no user intervention. The Status Port of a DP572 Dolby E Decoder provides a control signal that is logic

high (1) when the DP572 is decoding Dolby E material, and is logic low (0) when two channel PCM audio is being passed through. By connecting the DP572 Status Port to the upMAX 2251 GPI input (A or B), the upmixing process will automatically be turned on and off, and audio will be silently crossfaded between the two modes. Figure 3-2 shows how this can be easily accomplished.
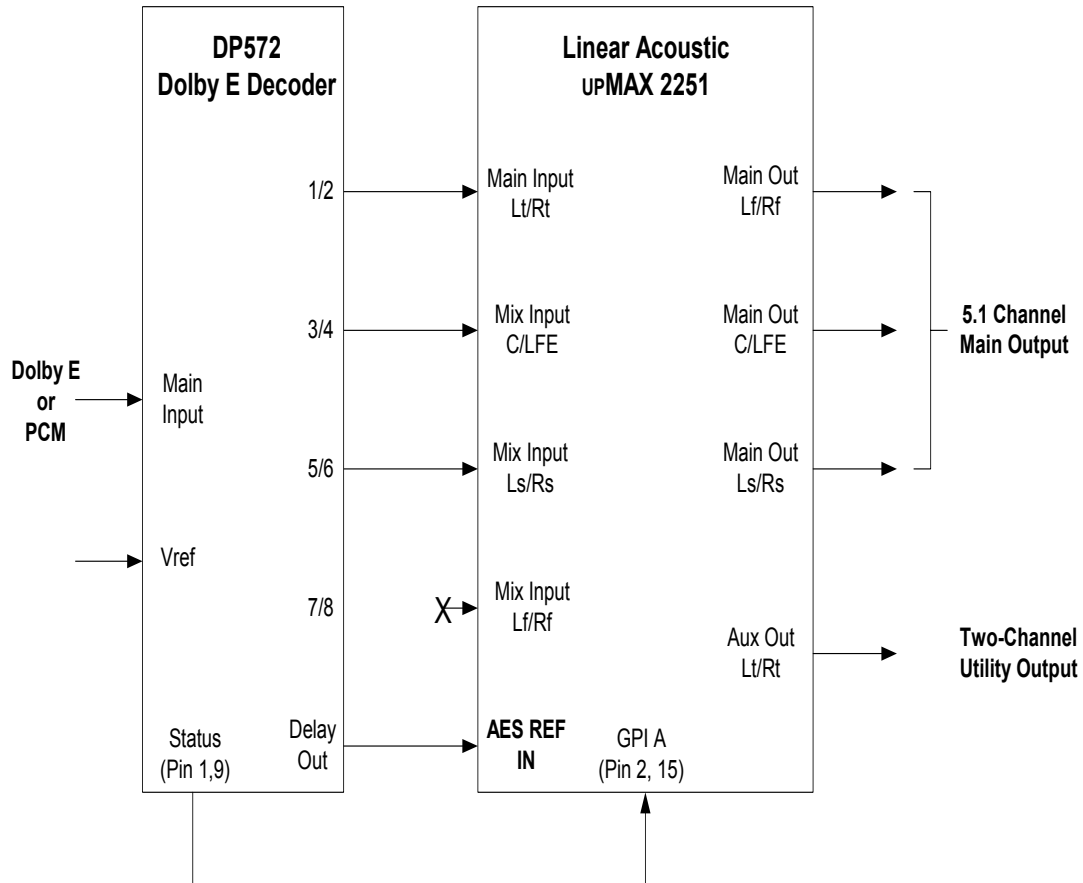
Figure 3-2 UPMAX 2251 with Dolby DP572 Dolby E Decoder

The result is a clean, consistent 5.1 channel program that is discrete when Dolby E is present and is upmixed when PCM is present, but with no audible change apparent to listeners or viewers. Note that while the upMAX 2251 AES Reference input is driven from the PCM Delay Output of the DP572 for the sake of clarity in Figure 3-2, this is a perfectly acceptable approach to use in practice.

3.1.2   Sporting Events

Figure 3-3 shows how a sporting event with a stereo mix, a stereo "natural" or ambience mix, and an optional dry announcer mix can be easily combined into a very convincing 5.1-channel program.
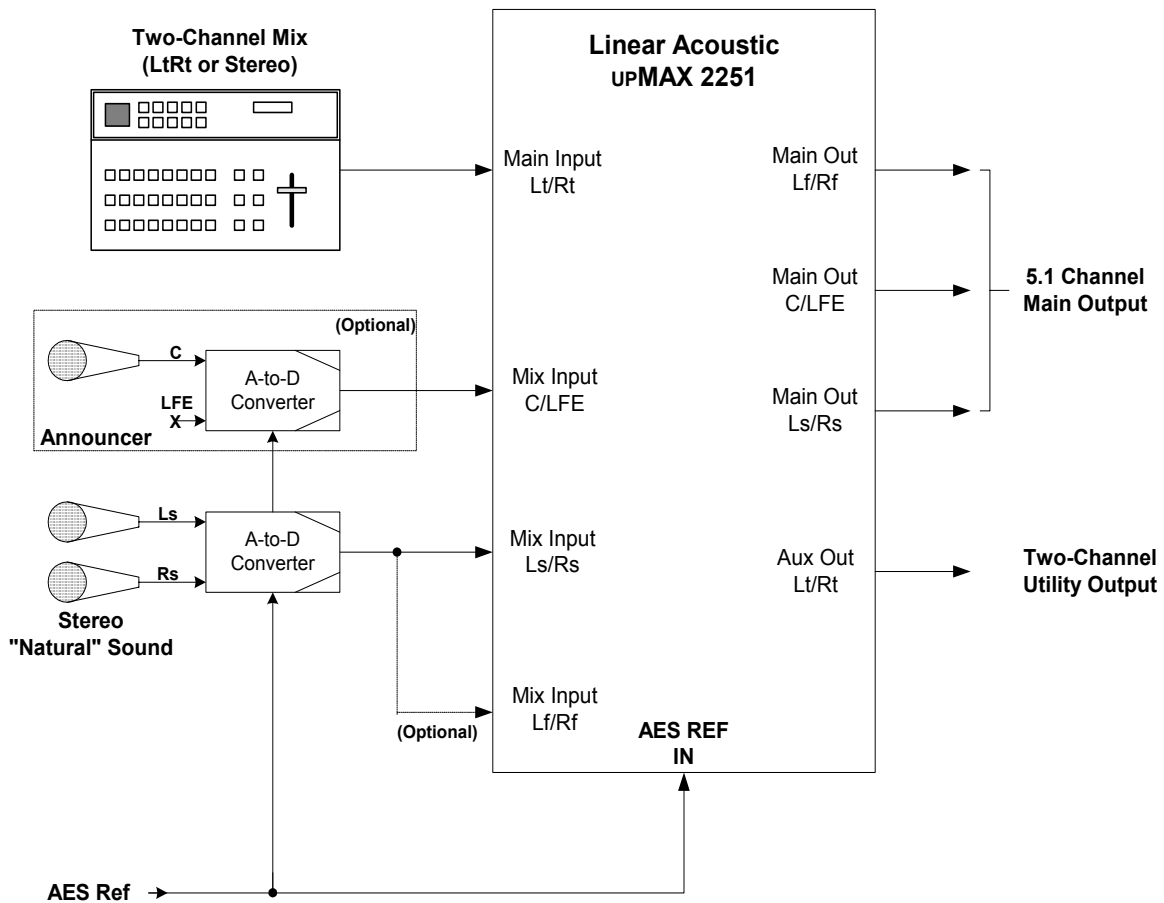
Figure 3-3 UPMAX 2251 in a live sports application

Note that if the announcer is already present in the main stereo mix (applied to the LtRt Main Input), then no additional announcer input is required as it will automatically be up-mixed into the Center channel output.

3.1.3   Music Awards-Type Events

Figure 3-4 shows how a music awards-type program can be greatly simplified by the use of an UPMAX 2251. The main stereo or surround mix of the program is applied to the LtRt Main Inputs, while crowd noise, reverb, ambience, and selective music cues are selectively applied to the Ls/Rs and Lf/Rf Mix inputs. All announce microphones can be either part of the main mix or applied as a separate feed to the Center Mix Input.
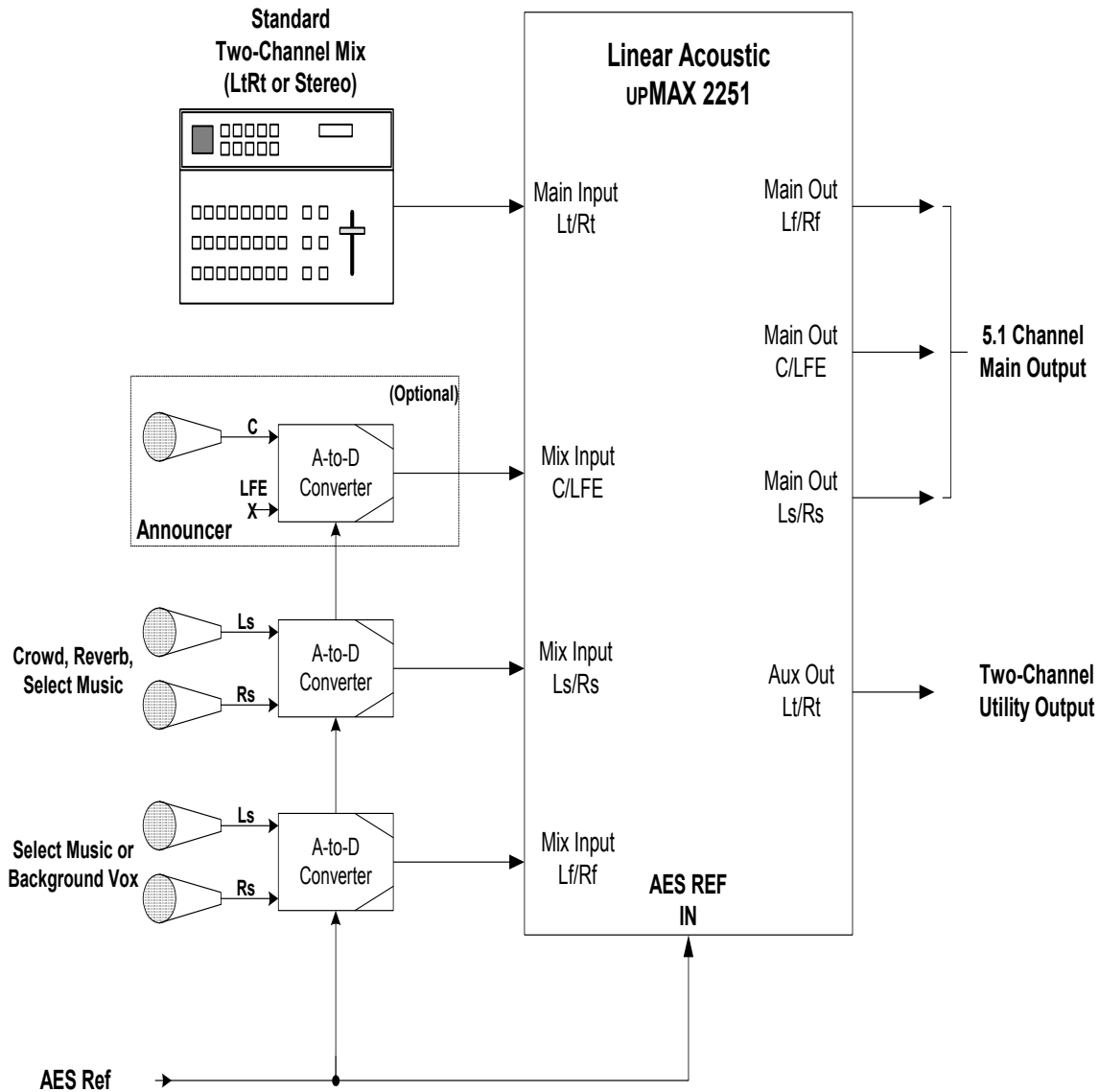
Figure 3-4 UPMAX 2251 in a music awards-type program

3.2   Factory Presets

To get users up and running as quickly as possible, a few basic presets have been created for different situations. The name of the game with this unit is "play". There is no possible way that presets appropriate for every situation could be generated, so we have included a few to get you started. By all means, make adjustments, listen, store your new preset with a name of your choice when you get it just right (we even have some Swedish characters in there).

The upMAX 2251 ships with the following factory presets:

- **Reference Settings** - Stock settings, a good place to start from scratch as all settings are in a reasonable "detent" position. Start here if you are unsure.

- **Music Cntr Spread** - Straight two-channel to 5.1 channel upmixing, with the center channel spread across the Left, Center, and Right outputs. This is very useful for programming that either contains dialogue with music or is just mono dialogue as it nicely fills the front three channels, and feeds the surrounds when appropriate.

- **MUSIC FULLCENTER** - Again, straight two-channel to 5.1 channel upmixing, but with the Center channel kept discrete. Useful for film mixes and certain music mixes. Two-channel mono programs will be reproduced from the Center channel only.

- **LIVE 4-CH to 5.1CH** - Couples a straight two-channel to 5.1 channel upmix with external surround information applied to the Ls/Rs Mix Inputs. Useful for a sports mix where a two-channel main program and a 2-channel natural or ambience mix are available.

- **LIVE 4-CH and ANNOUNCE** - Again, couples a straight two-channel to 5.1 channel upmix with external surround information applied to the Ls/Rs Mix Inputs, but also allows an announcer to be mixed into the Center channel via the Center Mix Input.

- **COMMERCIAL SHALLOW** - Straight two-channel to 5.1 channel upmix with the Surround audio positioned closer to the front channels. The Center channel is spread by the standard 33%.

- **COMMERCIAL DEEP** - Straight two-channel to 5.1 channel upmix with the Surround audio positioned all the way to the back and the Center channel spread by the standard 33%

- **3 CHANNEL** - Two-channel upmix to Front Left, Front Right, and Center channels only, no center channel spread.

- **UPMIX NO EXT** - Used specifically when upMAX unit is used in situations where external inputs 3/4 and 5/6 must be muted when upmixing is enabled, such as when the unit is connected to a Dolby E decoder. When selected, this preset allows the external inputs to pass through when the unit is not upmixing, and mutes them when it is upmixing.

"AUTOMATIC" UPMIXING MODES - Useful for applications where it is impossible to command upmixing on and off (the preferred method). Content that is supplied as L/R, C/LFE, Ls/Rs should be applied to the Lt/Rt, C/LFE, and Ls/Rs inputs accordingly (connect nothing to the fourth Lf/Rf input):

- **AUTO FULL** - Full Center (no spread) and full Ls/Rs Depth upmix of L/R input, while C/LFE and Ls/Rs inputs are passed untouched. Useful for precisely matching imaging to original 5.1 channel content.

- **AUTO FULL BASS ENH** - Same as AUTO FULL, but with LCR filtered and fed to the LFE output for Bass Enhancement. Useful for matching imaging of 5.1 channel content while providing some low frequency information for consumer subwoofers.

- **AUTO GEN** - Upmixes L/R with a 33% spread of Center, and Ls/Rs Depth set to 75%, while C/LFE, Ls/Rs inputs are passed untouched. Useful for better matching two channel mono, stereo, and 5.1 channel content as Center channel audio is pushed back into Lf/Rf, and surround channels are not as deep.

- **AUTO GEN BASS ENH** - Same as AUTO GEN, but with LCR filtered and fed to the LFE output for Bass Enhancement.

Chapter 4: Menus

This chapter discusses how to use the front panel LCD interface to access the menus. Most of it is rather obvious, and a bit of experimentation will quickly make you comfortable navigating through the submenus. If in doubt, use the Left Arrow to back out towards the Main menu. The menus and submenus are structured to access more complex functionality as you go deeper into the hierarchy. Almost every important adjustment can be made from the first three menu levels.

4.1   Main Menu

Figure 4-1 shows the main screen. The top eight meters show input activity for the Main Input (Lt/Rt) and the Mix Inputs (C/LFE, Ls/Rs, Lf/Rf). The bottom eight meters show the output activity for the Main AES Outputs (Lf/Rf, C/LFE, Ls/Rs, Lt/Rt). The sub-menus to the right of the meters are used to access the processor's functions, which are described in this chapter.
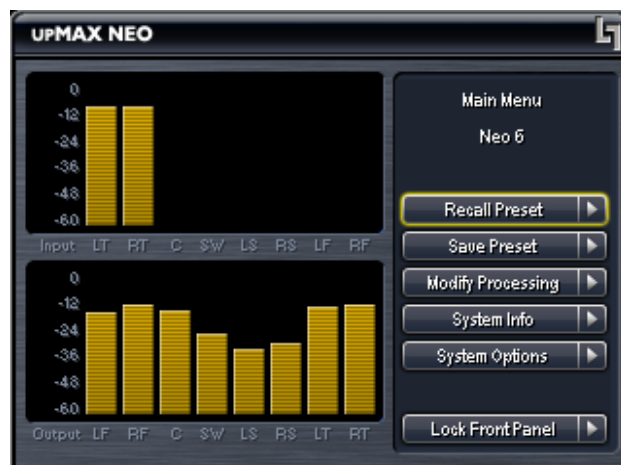
Figure 4-1 Main Screen showing level meters to the left and menus to the right.

4.1.1   Recall and Save Preset

All configuration begins with a factory preset but these can be modified, stored, and re-called. Saving a preset is a simple procedure. Adjusting any parameter in the **Modify Processing** menu appends an *M* to the name of the original preset to indicate that it has been modified but not yet saved yet. Figure 4-2 shows the **Save Preset** menu.
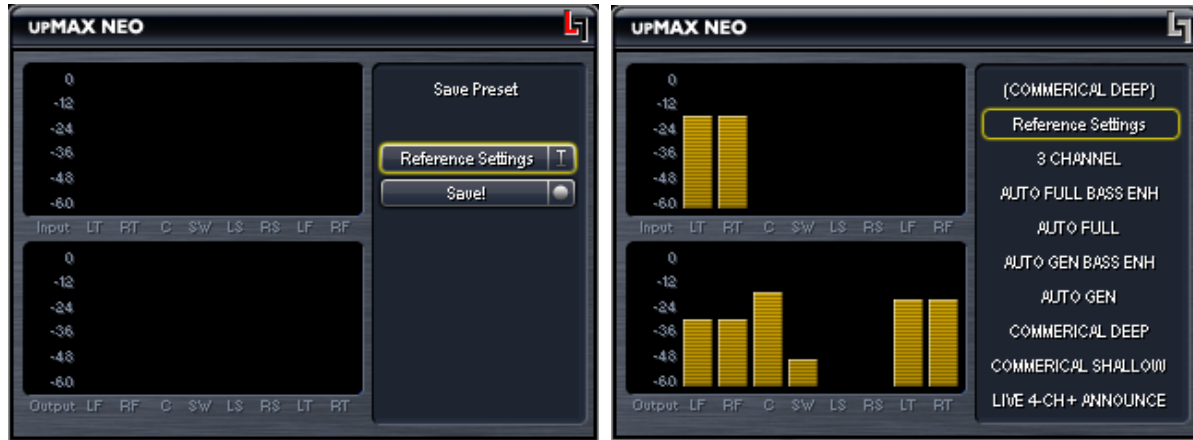
Figure 4-2 Save Preset (left) and Recall Preset (right) Menus

The **Save Preset** screen allows you to keep the existing name or rename and save using the arrow keys and the rotary encoder. If you remove the *M* and attempt to write over the previously saved preset name, you will be prompted to confirm that you wish to overwrite a stored preset.

CAUTION:The system allows overwriting the factory stored presets, please rename!

4.1.2   Modify Processing Menu

The **Modify Processing** menu controls all of the audio functions provided by the upMAX 2251. As all of the settings do not fit onto one screen, it is necessary to scroll to the bottom (using the Down Arrow). Figure 4-2 shows the selections available in the Modify Processing menu:

Figure 4-3 Modify Processing menu (left); scroll down for more choices (right).

After enable/disable and algorithm selection, the **Modify Processing** menu is broken into four major sections, Center channel controls, Low Frequency Effects (LFE) channel controls, Surround co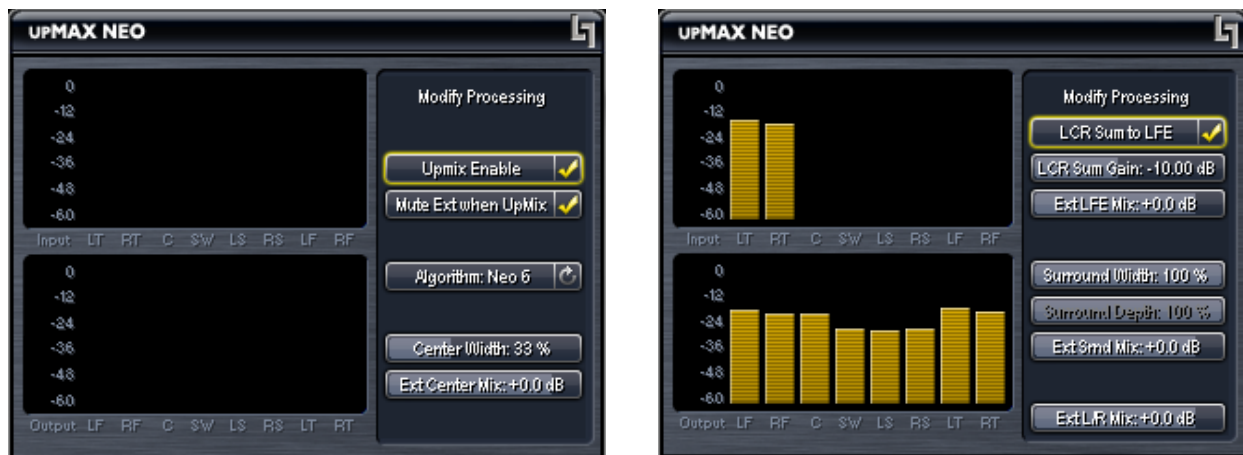ntrols, and Left Front/Right Front (Lf/Rf) controls. Each section has specific controls for both the upmixer output signals (where appropriate) and for the external Mix Inputs. Note that the upmixer controls have no effect on the external Mix Inputs, these input are kept fully discrete from input to output. Below, each of the controls is presented with the default setting in **bold**:

- **Upmix Enable** – Yes (checked)/No (un-checked) - Allows manual enabling of upmixing, or if GPI is active acts as an indicator showing that upmixing is enabled. Note this control/indicator is in parallel with the one in the **System Options/IO Options** menu described below.

- **Mute Ext when UpMix** – Yes (Checked)/No (un-checked) - If enabled, this option will automatically mute the externally applied inputs when upmixing is manually enabled or enabled via GPI. This is especially useful when upmixing two channels of audio and needing to mute channels 3/4 and 5/6 (such as with a Dolby E decoder in PCM Bypass mode where all outputs get a duplicate of the PCM input).

- **Algorithm**:

    - upMAX – Standard upmixing algorithm optimized to produce a satisfying 5.1 channel surround field while maintaining 100% compatible downmixing. Supports downmixing to both LoRo and LtRt in the most compatible manner. Also withstands multiple downmix/re-upmix operations.

    - **neo:6** – An alternate upmixing algorithm developed by DTS. Provides additional surround effects that may be useful in upconverting certain content. This option should be selected only if you are using appropriate equipment to monitor the effects on downmix compatibility.

- **Center:**

    - **Center Width** – controls how much of center channel output of the upmixer is spread back into the Left and Right channel Main Outputs of the unit; Default **33%**

    - **Ext Center Mix** – controls how much attenuation is applied to the discrete external Center channel Mix Input is mixed into the Center channel Main Output; Default **0dB**

- **LFE:**

    - **LCR Sum to LFE** – On/Off selection; Default **On** (highlighted)

    - **LCR Sum Level** – controls how much of a 120Hz low pass filtered sum of

the Left, Center, and Right outputs of the upmixer is fed to the LFE channel Main Output; Default **-10dB**

- **Ext LFE Mix** – controls how much attenuation is applied to the discrete external LFE channel Mix Input is mixed into the Center channel Main Output; Default **0dB**

- **Surround**:

  - **Surround Width** – controls how much separation is produced between the Left Surround (Ls) and Right Surround (Rs) outputs of the upmixer, where 100% means maximum separation and 0% means minimum separation (i.e. mono); Default: **0%. NOTE: This setting is disabled when algorithm = upMAX, and is enabled when Algorithm = neo:6.**

  - **Surround Depth** – controls back-to-front panning of the Surround output of the upmixer, where 100% equals full signal from the Left Surround and Right Surround Main Outputs and 0% equals surround fully mixed back into the LCR outputs; Default: **100%. NOTE: This setting is disabled (fixed at 100%) when algorithm = neo:6, and is enabled when Algorithm = upMAX.**

  - **Ext Surround Mix** – controls how much attenuation is applied to the discrete external Left and Right Surround channel Mix Inputs are mixed into the Left and Right Surround channel Main Outputs; Default **0dB**

- **L/R**:

  - **Ext L/R** – controls how much attenuation is applied to the discrete external Left Front and Right Front channel Mix Inputs are mixed into the Left and Right channel Main Outputs; Default **0dB**

4.1.3   System Options Menu

The **System Options** menu shows the current preset that the upMAX 2251 is running and allows access to both recall other presets or store a modified preset:

Figure 4-4 System Options menu

The **Setup** menu also allows for I/O setup (upmix on/off, delays, and channel mutes) and for configuration of the GPI Inputs, selection of Test Tones for setup, as well as changing a password (if one has been set). Below are detailed descriptions of these submenus:

- **I/O Options** – gives access to enable the upmixing process, add additional delay to the outputs, muting individual channels, and for setting the digital audio clock source:

NOTE: *Note that GPI control will override upmix on/off and certain channel mutes. If you are unable to make an adjustment, GPI is very likely active and is preventing any manual changes; disable GPI as described below if necessary.*

- **Master Bypass** – Relay bypass of Digital Inputs to Digital Outputs

- **Upmix Enable** – Enables upmixing function and gives indication of upmix status for cases where upmixing is enabled by GPI.

- **Mute Ext when UpMix** – Yes (Checked)/No (un-checked) - If enabled, this option will automatically mute the externally applied inputs when upmixing is manually enabled or enabled via GPI. This is especially useful when upmixing two channels of audio and needing to mute channels 3/4 and 5/6 (such as with a Dolby E decoder in PCM Bypass mode where all outputs get a duplicate of the PCM input).

- **Additional Delay (Ch 1-6)** – Up to 500 msec of delay can be added to the main 5.1 channel output (in addition to the minimum system delay of 33 msec).

- **Additional Delay (Ch 7-8)** – Up to 500 msec of delay can be added to the LtRt output (in addition to the minimum system delay of 33 msec).

- **Mute Mix: All, Center, LFE, Front, Surround** – Mutes external inputs and/ or indicates that these inputs are muted. Note that GPI can override these.

- **Clock Source** – Select between the following (must be 48kHz):

    - External Reference

    - AES Input 1 or AES Input 4

    - Internal 48kHz

- **Apply Clock Change** – After making a clock source selection, you must apply it by highlighting the Apply Clock Change menu and pressing the right arrow.

NOTE: You **MUST** Apply Clock Change (highlight, then press right key) for the change to take place. Note that this will produce a small audible pop on all outputs.
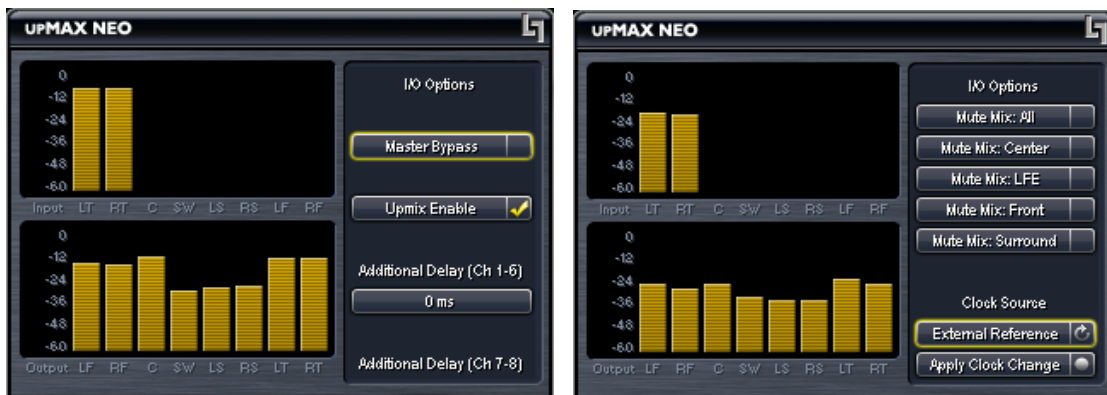
- **Test Tones** – Multiple setup tones are available to calibrate the upMAX 2251 and other downstream equipment. The **Level** control is self-explanatory, but is set at the standard –20 dBFS reference level and adjusts the overall level of the test signals. The available test signals are:

    - Sine – 1 kHz sine wave

    - Voice – Voice ID of all selected channels

- • Pink Noise – Equal energy-per-octave noise

- • White Noise – Equal level-per-octave noise

- • Brown Noise – Low-pass-filtered noise

- • Brown Nose – Try it (can't be serious all the time- we'd crack)

- The last selection determines which channels will reproduce the selected test signals. It can be adjusted by cycling through all channels, all channels of just the main program (default), and individual channels.

- **GPI Setup** – This menu allows configuration of the GPI A, B, and Metadata (GPI C) inputs. GPI A and GPI B require held contact closures, and produce a function while held in a state. With no closure applied, the function is not active, and with a contact closure, the function activates. GPI C is controlled by the audio coding mode of Program One of the externally connected serial metadata.

  Each GPI can be set to provide a specific function that will be active while either of the GPI pin (A or B) is held in a low state, or when the metadata input is active (GPI C). Note that each GPI (A,B,C) must have a different function, meaning that if GPI A is set to Upmix LfRf, then none of the other GPIs can be set for any of the Upmix LfRf functions.

  When GPI is enabled (the **Enable GPI** menu item is highlighted), the unit waits for an external command via the GPI/O port and nothing else can be changed. To make a change, disable GPI by de-selecting the menu item.

  The available functions include the following:

  - • **Disable**

  - • **Upmix Off/On** - Holding GPI low causes the upmixer to be activated. This mode is useful when GPI A or B of the upMAX 2251 is being sourced from the Status Port of a DP572 Dolby E Decoder as it will provide a constant 5.1 channel signal regardless of whether the incoming signal is 5.1 channel Dolby E or PCM. See Section 3.1.1 for more information.

  - • **Upmix On/Off** - Inverted operation of above; Holding GPI low causes the upmixer to be de-activated

  - • **Mute All Ext Inputs** - GPI low causes the Ext Center, LFE, Ls/Rs, and Lf/Rf inputs to be muted.

  - • **Mute Ext Center** - GPI low causes the External Center input to be muted

- **Mute Ext LFE** - Holding GPI low causes the External LFE input to be muted

- **Mute Ext Surround** - Holding GPI low causes the External Surround inputs to be muted.

- **Mute Ext LfRf** - Holding GPI low causes the External Left front and Right front inputs to be muted.

Metadata->GPI C State – A Dolby Metadata compliant signal applied to the Metadata In connector on the rear panel of the unit can also be used to drive the above functions. Metadata control of the unit is implemented as GPI C. Normally, metadata is examined to determine if the main program is two channels, and if it is then it can trigger upmixing. There is also a setting to tell the unit what to do in case of metadata failure. The adjustments are as follows:

- 2 Channel = GPI C On (Off); Default is On

  If two channel mode is detected for program one of the incoming metadata stream, then GPI C is activated (GPI C function can be set as described above). If two channel mode is not detected, then GPI C is de-activated.

- Metadata Fail = GPI C (On) Off; Default is Off

  Determines what to do should the incoming metadata stream fail. Default is for GPI C to be de-activated. If the incoming metadata stream is valid, then no change to GPI C is made (i.e. normal GPI C functions continue to operate as controlled by metadata). For example, this will allow the unit to stop upmixing if the metadata fails, thereby passing all audio channels straight through.

WARNING: Setting the Metadata Fail to activate upmixing is dangerous! If a 5.1 channel program is present and metadata fails, the dialog will be muted. It is suggested to instead use an Auto Upmix mode or choose to "Deactivate GPI C" on failure.

- **Metadata Status** – Shows current state of incoming metadata. Value will be either the mode of Program 1 or "Metadata Fail."

- **Preferences:**

  - **Change Password** – The password is either entered here for the first time or changed. Use the rotary knob and the right arrow key to enter your password, then select **Save.** You will be prompted several times, and then you will be reminded not to lose the password. *Please heed the warning!* If you do happen to lose it, please call us to assist recovery without losing presets. If you wish to remove the password, simply enter the old password, then enter nothing for the new one and select **Save**. You will be prompted a few times, and then it will be removed.

  - **LCD Shutoff** – Select the time-out for the LCD backlight. The backlight turns on once any control is pressed. The unit ships with a 15 minute setting to prolong the life of the backlight tube. Although the unit is rated for long life, it will not last forever and the entire costly LCD display must be replaced if it fails.

- **Reinitialize** – Fast reset of the system application.

- **Save Settings Now**- In an effort to minimize any slight audio clicks, the unit will save changes over a period of time, usually several minutes. Pressing Save Setting Immediately will bypass this feature and write the changes immediately and usually without any audible side effects. It may still take up to a minute for the buffers to completely flush.

- **Power Cycle –** Slow reset of the entire system. Select this to perform a full system reboot and re-initialize; you are returned to the main menu. This is a very useful way to guarantee all current settings are saved immediately and the unit is re-booted, re-synchronized, and started fresh. Note that this operation may take up to 3 minutes.

4.1.4   System Info

The **System Info** menu provides the following statistics:

- **Firmware Version** –

- **Host** – Unit name (normally upmax04XXX, where XXX is the serial number)

- **IP Address** – Dynamically allocated, this will change IF connected to network

- **Active Decoder** – Upmixing algorithm currently in use, normally upMAX.

- **CPU Usage** – Normally around 40%

- **Buffer Size** – 480 samples

- **Average SR –** Average Sample Rate, nominally 48kHz

4.1.5   Lock Front Panel

Select this menu to lock the front panel (funny enough). If no password has been selected, you will be prompted to create one. If you wish to change the password, you must enter the old password first. Please make careful note of this password as you must contact the factory if you lock yourself out of the unit- there are no hidden "back doors" to allow password reset.

Chapter 5: Specifications

Table 5-1 Electrical Specifications

Sampling Rate	48 kHz (±0.1%), 44.1 kHz (±0.1%)
Output Delay	Main (1-6):33 msec (min.), adjustable up to 500 msec LtRt (7-8): 33 msec (min.), independently adj. up to 500 msec
Upmixing Algorithms	Standard Linear Acoustic UPMAX and DTS neo:6, selectable
Audio Word Length	Up to 24 bits, process dependent
Digital Audio In	Five BNC female connectors, AES-3ID-1995/SMPTE 276M
Digital Audio Out	Four BNC female connectors, AES-3ID-1995/SMPTE 276M
Metadata Input	RS-485, 9-pin female D-connector on rear panel
GPIO Port	TTL level, 25-pin female D-connector
Ethernet Port	RJ-45 female jack connector
Digital I/O	
Digital Audio Inputs	Four unbalanced female BNC connectors compatible with AES-3ID-1995/SMPTE 276M specifications.
Digital Audio Outputs	Four unbalanced female BNC connectors compatible with AES-3ID-1995/SMPTE 276M specifications.
REF Input	One unbalanced female BNC connectors compatible with AES-3ID-1995/SMPTE 276M specifications.

Table 5-2 Mechanical Specifications

Dimensions	5.25 × 19 × 24 in (13.3 × 48.3 × 61 cm)
Net Weight	25 lb (12.6 kg) approx.
Shipping Weight	32 lb (15.75 kg) approx.
Power Requirements	115/220 VAC, switchable, 50–60 Hz
Power Consumption	40 W maximum

Table 5-3 Environmental Specifications

Operating Temperature	0^oC to 50^oC, fan cooled
Non Operating Temperature (Storage)	-20^oC to $+70^oC$
Humidity	Up to 98% relative humidity, non-condensing
EMC Radiation Limits	FCC Part 15 Class A, ICES-003

Metadata Input Port

9-pin female D-connector with full-duplex RS-485 protocol running at 115 kbps. Pinout is compatible with SMPTE 207M.

Table 5-4 Metadata Input Port Pinout

Pin	Connection
1	Shield
2	TX A asynchronous data out −
3	RX B asynchronous data in +
4	Ground
5	NC
6	Ground
7	TX B asynchronous data out +
8	RX A asynchronous data in −
9	Shield

Metadata Output Port

9-pin female, RS-485, full-duplex, 115 kbps. Pinout is compatible with SMPTE 207M.

Table 5-5 Metadata Output Port Pinout

Pin	Connection
1	Shield
2	RX A asynchronous data in −
3	TX B asynchronous data out +
4	Ground
5	NC
6	Ground
7	RX B asynchronous data in +
8	TX A asynchronous data out −
9	Shield

Ethernet Port

The Ethernet port is a standard RJ-45 female connector that supports 10 or 100BASE-T and is auto-selecting.

GPI/O Parallel Control Port

TTL level controls, active Low. GPI A and B are held low to activate their assigned function, while GPI 1-6 require momentary contact to ground to activate their functions. The 5-V output for external GPO indicators is limited by a self-resetting fuse.

Table 5-6 GPI/O Parallel Control Port Pinout

Pin	Function	Pin	Function
1	+ 5 V (150 mA)	14	+ 5 V (150 mA)
2	GPI A (Hold Low = On)	15	Ground
3	GPI B (Hold Low = On)	16	Ground
4	GPI 1 (Momentary)	17	Ground
5	GPI 2 (Momentary)	18	Ground
6	GPI 3 (Momentary)	19	Ground
7	GPI 4 (Momentary)	20	Ground
8	GPI 5 (Momentary)	21	Ground
9	GPI 6 (Momentary)	22	Ground
10	No Connection	23	Ground
11	No Connection	24	GPO 1
12	GPO 2	25	Ground
13	Ground		