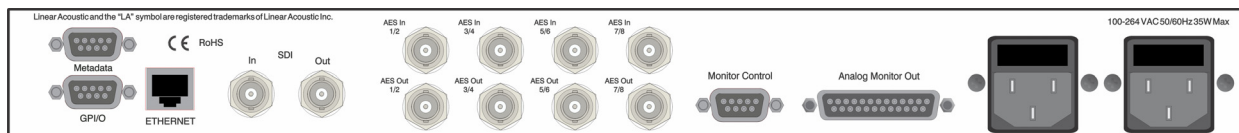# LINEAR ACOUSTIC®

## THE TELOS ALLIANCE®

# UPMAX v4 Surroundfield Controller

## User Guide

**Release Date:** January 2019
**Software Version:** 0.0.20 and later



**Linear Acoustic Inc.**
Phone:    717-735-3611
FAX:       717-735-3612
Web:      TelosAlliance.com/Linear

# *Warranty Information*

For the latest Telos Alliance warranty, visit: telosalliance.com/warranty

# Regulatory Notices and Fusing Information

## FCC

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

## Canada

This Class A digital apparatus complies with Canadian ICES-003.

## UL

⚠️ *WARNING: Troubleshooting must be performed by a trained technician. Do not attempt to service this equipment unless you are qualified to do so.*

*Check that the correct fuses have been installed. To reduce the risk of fire, replace only with fuses of the same type and rating.*

Exposed portions of the power supply assembly are electrically "hot". In order to reduce the risk of electrical shock, the power cord MUST be disconnected when the power supply assembly is removed.

The ground terminal of the power plug is connected directly to the chassis of the unit. For continued protection against electric shock, a correctly wired and grounded (earthed) three-pin power outlet must be used. Do not use a ground-lifting adapter and never cut the ground pin on the three-prong plug.
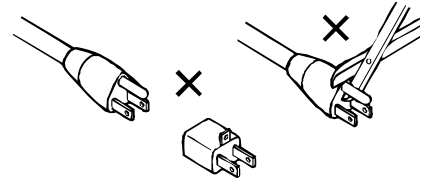
## UK

As the colours of the cores in the mains lead may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

- The core that is coloured green and yellow must be connected to the terminal in the plug identified by the letter E or by the earth symbol ⏚ or coloured green or green and yellow.
- The core that is coloured blue must be connected to the terminal that is marked with the letter N or coloured black.
- The core that is coloured brown must be connected to the terminal that is marked with the letter L or coloured red.
- This apparatus must be earthed.

**J**

s equipment complies with the EMC requirements of EN55103-1 and EN55103-2 when operated in an E2 environment ccordance with this manual.

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### IMPORTANT SAFETY NOTICE

unit complies with the safety standard EN60065. The unit shall not be exposed to dripping or splashing and no objects filled with liquids, such as
e cups, shall be placed on the equipment. To ensure safe operation and to guard against potential shock hazard or risk of fire, the following **must** be
rved:

Ensure that your mains supply is in the correct range for the input power requirement of the unit.

Ensure **fuses** fitted are the **correct rating and type** as marked on the unit.

The unit **must be earthed** by connecting to a correctly wired and **earthed** power outlet.

The **power cord** supplied with this unit must be wired as follows:

(GB)

        Live—Brown    Neutral—Blue    Earth—Green/Yellow

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### IMPORTANT – NOTE DE SECURITE

materiel est conforme à la norme EN60065. Ne pas exposer cet appareil aux éclaboussures ou aux gouttes de liquide. Ne pas poser d'objets remplis de
de, tels que des tasses de café, sur l'appareil. Pour vous assurer d'un fonctionnement sans danger et de prévenir

choc électrique ou tout risque d'incendie, veillez à observer les recommandations suivantes.

Le selecteur de tension doit être placé sur la valeur correspondante à votre alimentation réseau.

Les fusibles doivent correspondre à la valeur indiquée sur le materiel.

Le materiel doit être correctement relié à la terre.

Le cordon secteur livré avec le materiel doit être câblé de la manière suivante:

(F)

        Phase—Brun    Neutre—Bleu    Terre—Vert/Jaune

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### WICHTIGER SICHERHEITSHINWEIS

es Gerät entspricht der Sicherheitsnorm EN60065. Das Gerät darf nicht mit Flüssigkeiten (Spritzwasser usw.) in Berührung kommen; stellen Sie
e Gefäße, z.B. Kaffeetassen, auf das Gerät. Für das sichere Funktionieren des Gerätes und zur Unfallverhütung (elektrischer Schlag, Feuer) sind die
enden Regeln unbedingt einzuhalten:

Der Spannungswähler muß auf Ihre Netzspannung eingestellt sein.

Die Sicherungen müssen in Typ und Stromwert mit den Angaben auf dem Gerät übereinstimmen.

Die Erdung des Gerätes muß über eine geerdete Steckdose gewährleistet sein.

Das mitgelieferte Netzkabel muß wie folgt verdrahtet werden:

(D)

        Phase—braun    Nulleiter—blau    Erde—grün/gelb

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### NORME DI SICUREZZA – IMPORTANTE

sta apparecchiatura è stata costruita in accordo alle norme di sicurezza EN60065. Il prodotto non deve essere sottoposto a schizzi, spruzzi e
ciolamenti, e nessun tipo di oggetto riempito con liquidi, come ad esempio tazze di caffè, deve essere appoggiato sul dispositivo. Per una perfetta
rezza ed al fine di evitare eventuali rischi di scossa êlettrica o d'incendio vanno osservate le seguenti misure di sicurezza:

Assicurarsi che il selettore di cambio tensione sia posizionato sul valore corretto.

Assicurarsi che la portata ed il tipo di fusibili siano quelli prescritti dalla casa costruttrice.

L'apparecchiatura deve avere un collegamento di messa a terra ben eseguito; anche la connessione rete deve
avere un collegamento a terra.

Il cavo di alimentazione a corredo dell'apparecchiatura deve essere collegato come segue:

(I)

        Filo tensione—Marrone    Neutro—Blu    Massa—Verde/Giallo

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### AVISO IMPORTANTE DE SEGURIDAD

unidad cumple con la norma de seguridad EN60065. La unidad no debe ser expuesta a goteos o salpicaduras y no deben colocarse sobre el equipo
ipientes con liquidos, como tazas de cafe. Para asegurarse un funcionamiento seguro y prevenir cualquier posible peligro de descarga o riesgo de
ndio, se han de observar las siguientes precauciones:

Asegúrese que el selector de tensión esté ajustado a la tensión correcta para su alimentación.

Asegúrese que los fusibles colocados son del tipo y valor correctos, tal como se marca en la unidad.

La unidad debe ser puesta a tierra, conectándola a un conector de red correctamente cableado y puesto a tierra.

El cable de red suministrado con esta unidad, debe ser cableado como sigue:

(E)

        Vivo—Marrón    Neutro—Azul    Tierra—Verde/Amarillo

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### VIKTIGA SÄKERHETSÅTGÄRDER!

na enhet uppfyller säkerhetsstandard EN60065. Enheten får ej utsättas för yttre åverkan samt föremål innehållande vätska, såsom kaffemuggar, får ej
eras på utrustningen." För att garantera säkerheten och gardera mot eventuell elchock eller brandrisk, måste följande observeras:

Kontrollera att spänningsväljaren är inställd på korrekt nätspänning.

Kontrollera att säkringarna är av rätt typ och för rätt strömstyrka så som anvisningarna på enheten föreskriver.

Enheten måste vara jordad genom anslutning till ett korrekt kopplat och jordat el-uttag.

El-sladden som medföljer denna enhet måste kopplas enligt foljande:

(S)

        Fas—Brun    Neutral—Blå    Jord—Grön/Gul

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### BELANGRIJK VEILIGHEIDS-VOORSCHRIFT:

e unit voldoet aan de EN60065 veiligheids-standaards. Dit apparaat mag niet worden blootgesteld aan vocht. Vanwege het risico dat er druppels in
apparaat vallen, dient u er geen vloeistoffen in bekers op te plaatsen. Voor een veilig gebruik en om het gevaar van electrische schokken en het risico
brand te vermijden, dienen de volgende regels in acht te worden genomen:

Controleer of de spanningscaroussel op het juiste Voltage staat.

Gebruik alleen zekeringen van de aangegeven typen en waarden.

Aansluiting van de unit alleen aan een geaarde wandcontactdoos.

De netkabel die met de unit wordt geleverd, moet als volgt worden aangesloten:

(NL)

        Fase—Bruin    Nul—Blauw    Aarde—Groen/Geel

## Fusing Information

⚠️ *WARNING:* **To reduce the risk of fire, replace fuses only with the same type and rating.**

Both units use a universal switching power supply that handles the full range of nominal mains voltages between 90 and 264 VAC and any frequency between 50 Hz and 60 Hz.

### Check Main Fuse

The Main fuse rating is:

> T 1A L (1 Amp, 250 V, 20 mm, time-lag, low breaking capacity) for all operating voltages.

⚠️ *WARNING:* **The power to the unit must be off when the following steps are performed. Ensure that the main power cable to the unit is not connected to a power source.**

1. Open the fuse compartment door in the AC power input housing with a small flat-blade screwdriver (Figure 1). Carefully pull out the fuse carrier.

2. Check that the replacement fuse has the correct rating. The fuse carrier must be inserted into the compartment carefully. *Do not force the carrier into the compartment or both could be damaged.*

3. Snap the fuse compartment door closed.
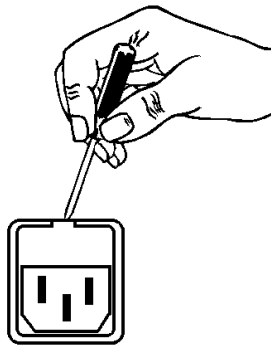
**Figure 1** Checking the Main Fuse

### Internal Fuse

The switching power supply contains a separate fuse. Most fault conditions should be protected by the main fuse.

If you find it necessary to replace the internal fuse, be certain to replace it with a fuse of the same type and rating as printed on the switching power supply board.

# Table of Contents

# List of Figures

# Chapter 1: Introduction

The Linear Acoustic UPMAX v4 produces a 5.1 channel audio signal that is perfect for eventual transmission 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 stereo to LtRt (Left Total/Right Total) surround encoded audio and even three channel (M&E plus Dialog) can be applied to the Main Inputs and an output will be produced that maintains consistency with other 5.1 channel programming.

The UPMAX v4 provides the following features:

• Advanced upmixing algorithm for stable, convincing surround experience.

• Fully downmix compatible

• Upmixed surroundfield is infinitely adjustable

• External inputs allow crossfaded bypassing of upmixing to enable discrete 5.1 channel audio to pass untouched, or mixing of external and upmixed content

• Built-in independent LoRo/LtRt encoder

• Relay bypassed I/O for "mission critical" broadcast applications.

• HD/SD-SDI I/O for audio and metadata

## 1.1    Principles of Operation

The UPMAX v4 contains 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 can be crossfaded between to allow smooth transitions between upmixed and discrete audio.

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.
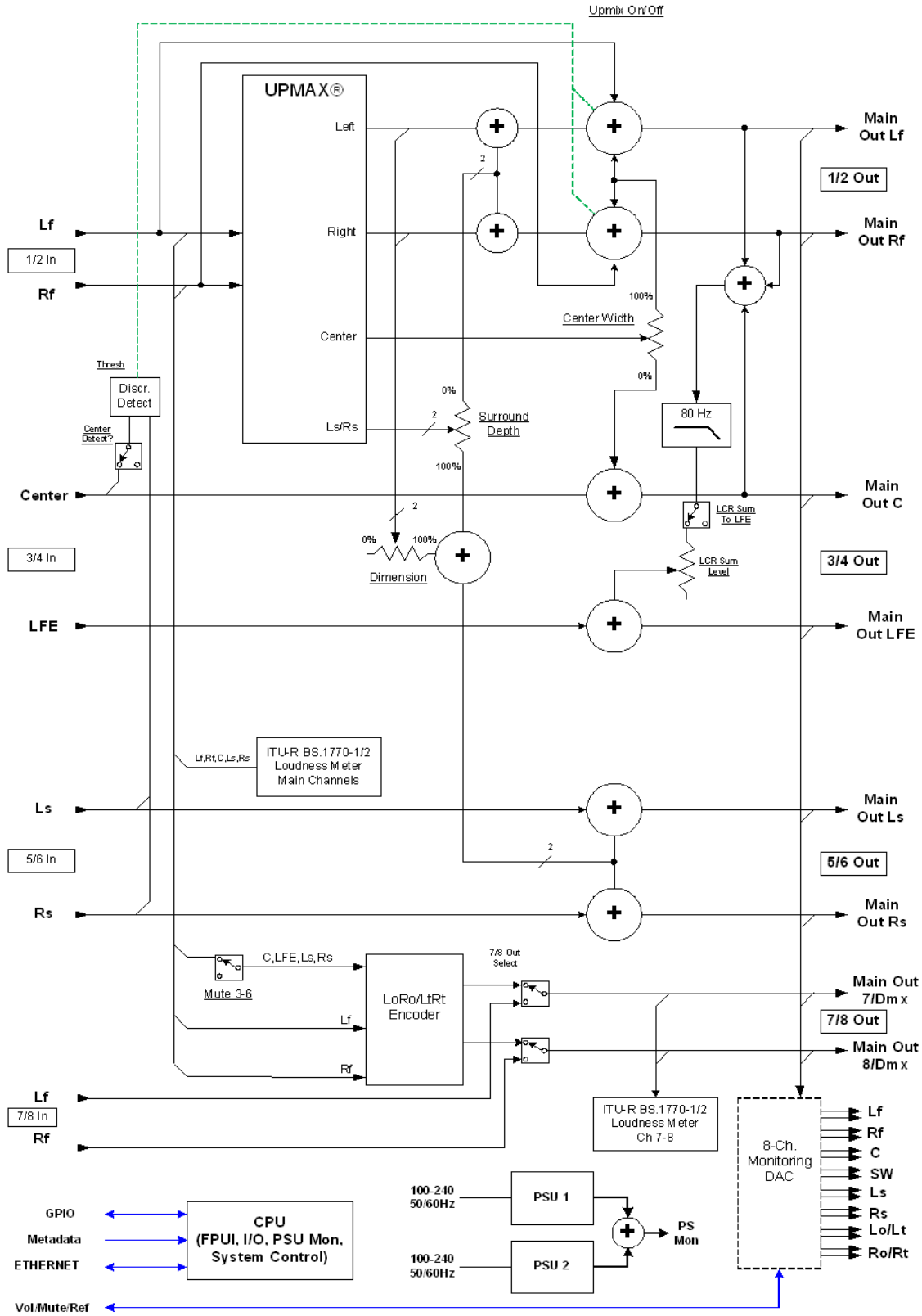
**Figure 1-1** Audio Block Diagram

## 1.2     Warranty

For the latest Telos Alliance warranty, visit: telosalliance.com/warranty

# Chapter 2: Connections and Quick Setup

This chapter covers all required connections for the UPMAX v4.

## 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:

- Bag containing:

    - Quick-start sheet to get you up and running

    - Two IEC power cords (style matches country of order);

    - USB stick with this manual

    - Spare fuses and a handy black pen.

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

## 2.2    Installation

UPMAX v4 installation requires:

- One standard rack space unit with ADEQUATE VENTILATION (the unit relies on convection cooling from side-panel vents);

- standard 75-Ohm BNC cables for digital signal connections;

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

- Proper reference. The unit will default to internal 48kHz with no signals applied, but AES 1/2 or SDI can be used as the reference. For proper plant timing, proper reference selection in imperative. Note that if SDI embedding is active, clock source will automatically be forced to SDI.

## 2.3      Rear Panel

The rear panel of the UPMAX v4 contains its electrical I/O.

### 2.3.1      Connection Ports

All of the UPMAX v4's connections are on the rear panel and are described in detail below. See Chapter 5: *Specifications* for specific pinouts.
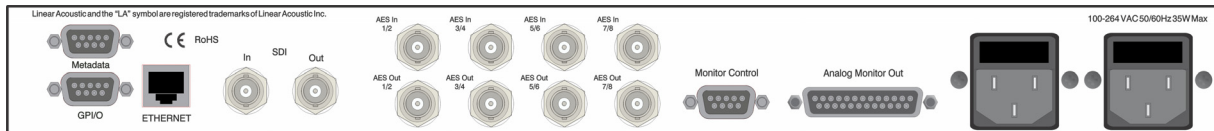


**Figure 2-1** Rear Panel

- **Metadata I/O:** RS-485 connection accepts the metadata output of any SMPTE RDD6 (i.e. Dolby) compliant metadata source. Can be used to control upmixing and recall of presets.

- **SDI Input/SDI Output:** Allows access to all 16 audio channels for embedding and de-embedding. VANC metadata per SMPTE 2020 can also be extracted.

- **GPI/O:** Connect dry contact closures here to control upmixing on/off. Note that GPI functions require held closures for the duration of the desired function. Status of GPI will be reflected on the corresponding GPO pin.

- **ETHERNET:** Used for software upgrades and SNMP monitoring.

- **Main Audio Input**: Connect the 48kHz PCM signals to these inputs. The input channels are arranged as follows: 1/2 = Left front/Right front, 3/4 = Center/LFE, 5/6 = Left surround/Right surround, and 7/8 = Stereo Aux input.

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*NOTE:   Appropriate reference should be applied AND selected for proper operation.*

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- **Main Audio Outputs:** Main 48kHz processed digital audio outputs. 1/2 = Left Front/Right Front, 3/4 = Center/LFE, 5/6 = Left Surround/Right Surround.

- **7/8 (LoRo/LtRt) Output:** A two channel downmixed version of the audio applied to Inputs 1-6, or a time-aligned passthrough of the 7/8 input.

- **Monitor Control:** Remote control of analog volume, mute, and return to reference using a standard rotary encoder, switches, and LEDs (with series resistors). A suitable high-quality remote control is available from Linear Acoustic.

- **Analog Monitor Outputs:** A +4dBu balanced analog version of outputs 1-8. Volume can be controlled from the front panel joystick encoder or via the Remote port.

## 2.4     Quick Setup Notes

The Linear Acoustic UPMAX v4 is configured at the factory and is ready to go on the air after making the proper input and output connections and determining if upmixing is desired.

- Apply a two-channel (stereo or LtRt) signal to Main Input 1/2

- The main menu will default to showing output meters, and you should see activity on some or all of the first six meters.

- Upmixed audio will be output from the Main Out 1-6 AES outputs in the following format: 1/2 = Left Front/Right Front, 3/4 = Center/LFE, 5/6 = Left Surround/ Right Surround

- You will also have audio on the analog outputs in the same format as above.

The best way to learn the processor is to explore the different settings with audio applied and monitored. There are several factory presets to support many different tastes. Some presets may not sound much different at first, but will perform very depending on program content. When in doubt, try turning the upmixing process off or as a last resort use the Master Bypass feature which will remove the UPMAX v4 completely from the signal path.

# Chapter 3: Applications

The UPMAX v4 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 AERO series of processors may be a more appropriate choice as they contain requisite loudness control, dynamic range processing and additional useful features such as Dolby encoding and decoding.

The Linear Acoustic UPMAX v4 is *not* a substitute for a good, discrete multichannel mix (if one is available), however it is a useful tool for creating one.

That being said, the UPMAX v4 *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 v4:

- General application notes

- 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.

The Linear Acoustic  UPMAX v4 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 v4 is the answer.

### 3.1.1 General Notes

The latency of the UPMAX v4 has been kept as low as possible. To take best advantage of this, make sure it is installed in a synchronous system (i.e. as a send and return to a console) and set the Sample Rate Converter Bypass to ON (i.e. SRCs are off). This will keep the latency at around 4msec. Make sure to take care not to bring up both the send and return audio else even this very low 4msec might cause comb filtering.

In general, an upmixer responds to level to control Left to Center to Right positioning, and phase to control front to back positioning. UPMAX v4 operates across multiple bands to minimize low frequency content causing center channel build-up. However, dialog can do the same thing, especially announce dialog. It was discovered some years ago that simply separating a mix into two parts: Main Stereo (no announce) and a separate Announce channel then upmixing only the Main Stereo and combining with a time aligned version of the Announce audio produces a very wide and stable result free of odd sounding artifacts.

### 3.1.2 Two-Channel Interstitial Programming

One of the largest complaints viewers 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 v4 processes the stereo material allowing it to fit nicely within a 5.1 channel program. Figure 3-1 shows this scenario. Note that the two channel material is simply input to the UPMAX v4 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.

### 3.1.3 Sports Production

Sports production could be as simple as creating an excellent and wide stereo mix with dialog on a separate bus. Using the UPMAX v4, the stereo mix can be turned into 5.1 and the announce audio passed around the upmixer.

A Center Detect control was added to the Auto mode to facilitate handling this type of 3-channel audio. It ignores the presence of audio on channel 3 (i.e. the announce audio), time aligning it and summing it with the upmixed version of the audio from input channels 1-2.

This mode is also useful if the audio might be of several different flavors. With Center Detect set to off, Stereo, 3-channel, and 5.1 channel input audio can be automatically handled with no operator intervention. A tip would be to adjust the crossfade timing to be as fast as practical.

### 3.1.4    Music Applications

Upmixing stereo music stems is an excellent application of the UPMAX v4. In general, either of the music presets can be chosen, with the only difference being that Music Full spreads some of the upmixed center channel audio back into Left front and Right front. The default Center Width of 33% was determined mathematically and verified by professional audio mixers who adjusted the width until they could just tell that audio was also coming from Left front and Right front, then backed it down a notch. Good old science proven out by practical experience!

If you desire a music mix that uses only some of the Center channel, a common practice, try flipping the Center Width percentage: i.e. set it for 67%. This can leave a nice spot for lead vocals or announce if they are available as isolated outputs.

Another control that is useful to try with music is the Dimension control which determines how much of the upmixed Left front/Right Front audio to leak into Left surround and Right surround. This has the effect of filling in the hole that can sometimes exist between the front and rear channels - the audible result is similar to pushing the sides out a bit. Note that it really does not take much to produce a decent effect, around 10% is good. Too much can become problematic during certain downmixes so use with care.

## 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.

The UPMAX v4 ships with the following factory presets:

- **Music Full**- Straight two-channel to 5.1 channel upmixing, with the Center Width at 33%. 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 Narrow** - Straight two-channel to 5.1 channel upmixing, but with the Center channel kept discrete. Useful for film mixes and certain music mixes.

- **Music Wide** - Straight two-channel to 5.1 channel upmixing, but with the Center Width spreading audio 67% to the Left front and Right front outputs and Center Channel Detect set to Off. It appropriately fills the front three channels, and feeds the surrounds when appropriate. Importantly, it upmixed content lower in the Center channel leaving a "hole" with some music, perfect for announce audio or even an isolated bus with lead vocals.

- **Commercial Deep** - Useful for "blind" upmixing (i.e. no skilled operator present). Conservative two-channel to 5.1 channel upmix with the Surround audio positioned 100% to the back and Center Width at the standard 33%. Dimension is set to 0% to protect against oddly mixed content

- **Sports 3 Chan** - Upmixes audio present on input channels 1-2 with Center Width at 33%, time aligns and mixes audio on channel 3 with the resulting upmixed audio. Center Detect is set to Off so that 3-channel audio will not trigger automatic upmixing. Note that any discrete LFE information applied to channel 4 will also pass.

- **Sprts 3 Ch Wide**- Upmixes audio present on input channels 1-2 with Center Width at 67%, and time aligns and mixes audio on channel 3 with the resulting upmixed audio. Center Detect is set to Off so that 3-channel audio will not trigger automatic upmixing. Note that any discrete LFE information applied to channel 4 will also pass.

# Chapter 4: Detailed Operation

This chapter discusses in detail the structure of the Linear Acoustic UPMAX v4, how to use the front panel interface to access the menus, accessing and saving factory and user processing presets, and GPI and Metadata setup.

## 4.1     User Interface

With the exception of headphone output volume control, all adjustments are made using the joystick on the front panel.

Joystick Operations

*   Pressing the joystick to the left acts as an escape key and backs you out towards the main menu.

*   Pressing the joystick to the right navigates through the menu or submenu categories. It also acts as an Enter control when adjusting parameters

*   Pressing the joystick up or down navigates through a particular menu or submenu category.

*   Turning the joystick allows adjustment of parameters and control settings.

*   Pressing the joystick in cycles through the upmix modes.

## 4.2     Menu Navigation

Most of it is rather obvious, and a bit of experimentation will quickly make you comfortable navigating through the submenus. If in doubt, press the joystick repeatedly to the left 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. See the last page of this section for a detailed menu tree.

## 4.3     Statistics

Pressing the joystick down, the firmware revision, any installed firmware options, and information regarding the DSPs and application are displayed.

# 4.4     UPMAX Setup

This menu is the main entrance to all setup parameters for the unit, which are accessed via the submenus described below:

## 4.4.1     Presets Down To View

Press the Down arrow to view and modify presets- the default is the currently active preset.

## 4.4.2     User Preset

Six factory presets (See Chapter 3) plus user Preset_7 - Preset_16, or a named preset. Displays and recalls a preset to be used by the UPMAX v4 or edited by the user.

## 4.4.3     Preset Params

The parameters stored in a preset may be adjusted in the following menus.

- **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. 100% width equals all Center channel information summed back into the Left and Right outputs, while 0% equals Center channel information sent to the Center Channel output; Default is **33%**

- **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%.**

- **Auto Threshold:** Controls the level at which upmixing will start or stop when in Auto mode. NOTE: Set above noise floor and below average audio levels to present false triggering. Around -75 is a good starting point, adjust higher for noisier sources.

- **Auto Speed:** Controls the rate of transition between upmixed output and discrete multichannel passthrough when in Auto mode.

- **Center Detect:** Selects whether audio present on the Center channel input is used to determine if the content is discrete. For applications using 3.0 channel mode (mix+dialog), this should be set to off.

- **Dimension:** Controls how much of the LfRf signals from the upmixer are added into the surround outputs. This helps audibly widen the image and a little goes a long way, and a decent maximum would be around 10%.

- **LCR Sum to LFE:** Enable or disable the Low Frequency Effects (bass enhancement) output of the upmixer. Note this does not affect the discrete LFE input.

- **LCR Sum Level:** Controls how much of an 80Hz low pass filtered sum of the Left, Center, and Right outputs of the upmixer is fed to the LFE channel Main Output; Default should be around **12%**

## 4.5 I/O Menu

Provides for general input and output configuration via the following menus:

### 4.5.1 Master Bypass

Activates the hard relay bypass of each AES input signal to the BNC connector directly below it. Note that this is a "crash" switch and will likely produce disturbances to downstream equipment. It will activate automatically in case of unit failure and manual control is included to aid in troubleshooting.

### 4.5.2 GPI Control Enable

Enables or disables the GPI control for the UPMAX v4.

### 4.5.3 GPI Function (1 - 4)

These select the function to be controlled by GPI 1 - 4. Available options are:

- None

- Preset (Recall Preset)

- Reset LKFS (Reset Loudness Measurement)

- Upmix Off/On

- Upmix On/Off

- Upmix Off/Auto

- Upmix Auto/Off

- Upmix Auto/On

- Downmix to 7/8 Off/On

- Downmix to 7/8 On/Off

- MonMode Ful/Dmx (Monitor Mode Full/Downmix)

### 4.5.4    GPI Preset (1 - 4)

Selects the preset to be recalled via GPI controls 1 through 4.

### 4.5.5    Monitor Mode

determines whether outputs 1 - 6 are multichannel output or the output from the downmix stage. Note: This is a global adjustment and affects, the Analog outputs, AES outputs, and HD-SDI output.

### 4.5.6    Upmix LfRf When

Controls how upmixing is engaged. Selections include:

- Set On Now (Local Control)

- Set off now (Local Control)

### 4.5.7    When Upmixing, (Mute Ch 3 - 6 / Do Not Mute)

Because Input 2 (C/LFE) and 3 (Ls/Rs) are also inputs to the Downmix encoder, it is necessary to mute these inputs when using the upmixer and downmixer together. The upmixer will always mute these inputs, and this setting allows the same thing to happen for the downmixer. When using the downmixer for a separate program not related to the audio applied to the upmixer, set this to Do Not Mute.

### 4.5.8    Downmix Type

Set for LoRo ITU style stereo downmix or LtRt surround downmix compatible with Dolby Pro Logic and Pro Logic II. Note that the LtRt setting introduces an additional 5 msec of delay on the 7/8 output due to additional filtering requirements of this mode.

### 4.5.9    Downmix --> 7/8

Routes the downmix to output 7/8.

### 4.5.10    Downmix Center Level

Controls the level which the Center channel is attenuated and included in the downmix

### 4.5.11    Downmix Surround Level

Controls the level which the Surround channels are attenuated and included in the downmix.

### 4.5.12    Downmix LFE Level

Controls the level which the LFE channel is attenuated and included in the downmix. This parameter allows the downmix to contain LFE information for a little extra "punch" when desired.

---

*NOTE:   When emulation of a consumer device is desired, this parameter should be set to "OFF"*

---

### 4.5.13    7/8 in Channel Mode

Selects the audio mode for inputs 7/8. Selections include: Stereo, Mono, Mono Ch1, Mono Ch2

### 4.5.14    SRC Bypass

Selects whether input audio is passed through Sample Rate Converters before processing. Input audio can be either a different sample rate (44.1 kHz) or more typically is a different clock reference than the output audio. Unless the input and output audio are known to synchronous, SRC Bypass should be set to "OFF" (SRCs in the path)

### 4.5.15    Headphone Boost

Enables or disables a 10 dB boost at the headphone output.

### 4.5.16    Clock Source Type

Selects whether the reference clock source a stable source or a changing source

### 4.5.17    Clock Source

Selects the output reference source for the unit. Selections include: Internal 48kHz (default), AES 1, and SDI.

---

*NOTE:   All inputs pass through audio frame synchronization (SRCs) whose output is determined by the clock setting. Inputs of many different sample rates can be accommodated, but reference must be from a 48kHz source. Good clocking practices are strongly encouraged!*

---

### 4.5.18    Audio Input Sources (Channels 1-8)

Selects between applied AES audio or audio de-embedded from SDI. Each of the input pairs 1/2, 3/4, 5/6, and 7/8 can be sourced from its corresponding AES input pair or any

SDI pair. Default is AES.

### 4.5.19   SDI Embed

Selects whether to enable audio re-embedding or pass the SDI signal through the UPMAX v4 untouched. Note this does not affect de-embedding which is active at all times.

### 4.5.20   SDI Out Destination (Channels 1-16)

Selects source of audio for re-embedding into an applied SDI signal. Choices are Mute, AES (corresponding pair), and any of the SDI pairs. This menu can be used as a router or pair shuffler within SDI.

### 4.5.21   Metadata Setup

The UPMAX v4 has been designed to take best advantage of metadata. The incoming or Dolby-compatible metadata stream is parsed on a program-by-program basis and the dialogue loudness and audio coding mode (channel count) parameters are used to scale processing and control upmixing respectively. Setup of metadata can be accomplished in the UPMAX v4 -> I/O menu.

UPMAX v4 Metadata Setup Procedure:

- **Metadata Source:** Selects between the RS-485 serial metadata input and metadata extracted from the Vertical Ancillary (VANC) of an applied HD-SDI signal. For VANC metadata there are several other settings:

- **VANC MD is Async:** Disabled for standard VANC metadata, Enabled for CBS-style VANC metadata. Default is Disabled.

- **VANC DID:** Selects the Data ID of the metadata signal in hex. SMPTE RP2020 recommends this value be set to 0x45 and this is the default.

- **VANC SDID:** Selects the Secondary DID of the VANC metadata signal in hex. SMPTE RP2020 recommends this value be set to 0x01 and this is the default.

- **VANC MD Line:** Selects the video line to extract VANC metadata from. SMPTE RP2020 recommends that metadata be inserted on Line 9, but we have seen a great deal of variation, thus the default is Auto.

- **MD Pgm Select:** Allows selection of any program present in an applied metadata signal to control upmixing. This control is based on the acmod parameter of the selected program. Default is Pgm 1

- **MD=2/0 Function:** Determines the behavior of the UPMAX v4 when the acmod field in the metadata is set for 2/0. The selections are: None and Upmix LfRf.

### 4.5.22    Loudness Measurement

Configures the Loudness Measurement/Estimation engine, using the following parameters:

- **LKFS Integration:** Determines the integration time constant for the Loudness Measurement. The selections are: 3 sec, 10 sec, 30 sec, and Infinite.

- **LKFS Type:** This selects whether the Loudness Measurement follows ITU BS.1770-1 (-70 LKFS safety gate) or BS.1770-2 (-70 LKFS safety gate plus relative gate).

### 4.5.23    GPO Alert When (1-4)

Determines the function for GPO 1-4, and determines what will cause the GPO to activate and pull low. Each GPO has its own control. The selections are: Never (off), Follow GPI, LKFS Over Threshold, LKFS Under Threshold, Silence Detection, and Loss of Reference.

### 4.5.24    GPO Threshold (1-4)

Adjusts the threshold for GPO functions such as LKFS Over Threshold, and LKFS Under Threshold.

### 4.5.25    GPO On Delay (1-4)

Sets a delay on triggering the GPO. The GPO condition must be active for the amount of the delay before the GPO is pulled low. This can be used to allow the GPO condition to momentarily occur without triggering the output. An example of this is allowing the loudness measurement to momentarily cross the threshold.

### 4.5.26    GPO Off Delay (1-4)

Sets a delay on releasing the GPO once the condition has ceased. This control and GPO On Delay allow hysteresis to be added to the GPO functions in order to prevent many annoying "false" triggers.

## 4.6    Test Tone Control

The UPMAX v4 includes test tone generation for troubleshooting, calibration of operating levels, and calibration of the listening room environment.

### 4.6.1    Test Tone

Enables and disables the tone generator.

### 4.6.2    Test Tone Type

Selects either a Sine wave tone or Pink Noise.

### 4.6.3    Test Tone Frequency

Adjusts the frequency of the test tone. Range is from 20 Hz to 20 kHz. From 20 Hz to 1 kHz, the generator is adjustable in 10 Hz increments. From 1 kHz to 20 kHz, the increments are 100 Hz.

### 4.6.4    Test Amplitude

Adjusts the level for the tone/noise generator.

## 4.7    Analog Control

- **Analog Headroom Adjusment:** Allows up to 10 dB of attenuation to be applied to all channels at the analog output.

- **Analog Trim (Left through RoRt):** Allows up to 10dB of attenuation to be applied in 0.5dB steps individually to each analog output channel. These values are stored for recall during power-up. These channel trims are used to calibrate a listening environment *after* first adjusting power amplifiers or powered speakers (see below).

- **Analog Mute (Left through RoRt):** Allows individual muting of output channels. This is useful for troubleshooting and channel ID use. Note that these values are *not* saved and will return to their normal un-muted state when the unit is power cycled.

## 4.8    Communication

Setup of TCP/IP parameters can be done in this menu group

## 4.9    System

Selective reset to factory defaults can be performed in this menu group.

## 4.10    Monitor Calibration (Analog Outputs)

The Linear Acoustic UPMAX v4 is supplied with a monitoring grade digital-to-analog converter that provides balanced outputs of all eight audio channels. The level of these outputs can be controlled by the front panel rotary encoder or from an external volume control (a high quality "big knob" remote is available from Linear Acoustic).

The individual channels can be calibrated over a 10-dB range to allow matching the unit to

power amplifiers or powered speakers. To maintain the lowest noise and widest dynamic range, it is important to manage analog gain stages properly and in order.

It is strongly recommended that gains be adjusted in the following order:

- Gains of power amplifiers or powered speakers

- UPMAX v4 channel trims

- UPMAX v4 volume control

With an input level of -20dBFS, the analog outputs will be at +4dBu. While appropriate for most every power amplifier/speaker combination, many powered loudspeakers will produce excessive output SPL when driven at this level and thus will usually contain continuously adjustable input gain controls for trimming. In some cases, these might not have enough range or the gain controls may just be coarse adjustments. In this case, it will be necessary to use an external attenuator to match the reference levels of the UPMAX v4 and the powered speaker or amplifier. Contact the factory for more information.

### 4.10.1    Main Channel SPL Adjustment

Monitor calibration is the single most important part of calibrating an UPMAX v4 and a proper mix environment. Take the time to get this right and check it regularly.

With the UPMAX v4 properly referenced, set to NOT upmix (pass through), and volume and channel trims at 0dB, apply pink noise at plant reference (such as -20dBFS) to one channel at a time starting with the Center channel. This is best accomplished via a console where the pink noise can be "eyeball averaged" at 0VU and routed to one channel at a time. If the pink noise can only be supplied as a two-channel signal, this will also work by either disconnecting the speaker that is not being adjusted, or setting its Output Trim setting to "Mute".

Using a sound pressure level (SPL) meter set to "C-weighted" and "Slow Response" adjust the Center channel power amplifier to the desired SPL. Typical industry levels range from 78-79dB/C/Slow for near field television mixing to 85dB/C/Slow for far-field film mixing. It is important to note that while an overall reference level is very important, it is more important to ensure that all main channels are set to the *same SPL*.

If the power amplifier or powered speaker is adjusted as low as possible and the desired target SPL cannot be reached, use the Center channel output trim on the UPMAX v4 to adjust to the desired SPL.

Repeat this procedure for all of the main audio channels, again making sure that the UPMAX v4 volume control remains at 0dB. This allows the "return to reference" function to support any desired volume setting while mixing, and a simple return to the calibrated SPL during final mixing or mastering.

## 4.10.2    Subwoofer SPL Adjustment

For 5.1 channel mixing, the subwoofer is required to apply 10dB of gain to the signal applied to it. This means that if the reference SPL of the main channels is set to 79dBSPL/C/Slow, then the subwoofer is set to 89dBSPL/C/Slow. This is based on the long-standing practice in film to allow an extra 10dB of headroom in the Low Frequency Effects (LFE) channel and was originally required by optical and magnetic tracks that could not pass high-level low frequency information without severe overload. Modern 5.1 systems no longer have a headroom issue, but for compatibility with industry practice and legacy material, the increased reproduction level of the subwoofer is maintained.

It is strongly recommended that this adjustment be made with a real-time analyzer (RTA) due to constraints of frequency response of typical SPL meters. The procedure is simple: after calibrating the main channels, apply pink noise to the Center channel and note the average level. Next, apply pink noise though the LFE channel to the subwoofer and adjust its level so that it has 10dB of additional mid-band level as compared to the Center channel.

The desired relationship between Center and Subwoofer is shown below
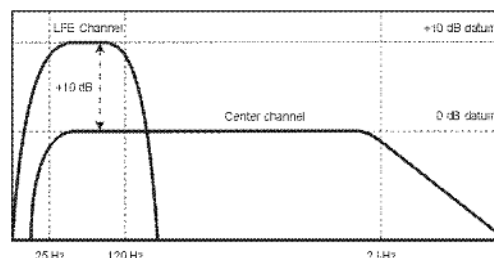


Note that this is a real-time analyzer display of the response of a typical film mixing stage. Due to the large distance from the speakers to the mixer, there is a natural roll off above 2 kHz (described in SMPTE 202M, and sometimes called the "X-curve.") In small mixing and control rooms this response would be flat.

Once the alignment of all channels is complete, play some content through the system and *listen* to make sure things sound normal. Never underestimate the effectiveness of taking a listen to known content to make sure that things are really what they seem.

# Chapter 5: Troubleshooting

The Linear Acoustic UPMAX v4 is a very stable and reliable unit, and most problems can be traced back to mis-wiring causing incorrect signals to be applied to the unit, or more than likely mis-configuration. In an effort to speed troubleshooting, some common problems and solutions are described below.

## 5.1 Problems and Possible Causes

One of the best troubleshooting features of the UPMAX v4 is the hard-bypass of the audio signals. This is useful because it allows instant removal of the unit from the signal path. Hard-bypass can be accomplished two ways, the simplest being to remove AC power from the unit. A less dramatic way to accomplish the same result is to access the System Options menu and enable Master Bypass. If you are unsure of what is happening in a particular system, simplifying the signal path is a good start and will help isolate problems quickly.

### 5.1.1 Unit won't power on

Check to make sure that the unit is connected to a live outlet (it happens...). If proper AC voltage is being applied to the unit, remove power and check the fuse (the IEC inlet module has a fuse compartment that can be carefully opened with a small screwdriver). If the fuse is blown there is a spare in the holder. Install the replacement fuse, re-insert the fuse carrier, and re-apply power.

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*NOTE:   Replace fuses only with the same size and rating: 5mmx20mm T1AL (250V)*

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### 5.1.2 Output Audio Clicks and Pops

This could indicate that the AES Reference is missing or at the wrong sample rate (the unit expects to be locked to 48kHz). The unit is designed to default to an internal 48kHz reference in case the external reference is removed. This allows audio to continue, but the outputs may be asynchronous with the rest of the plant. The solution is to make sure that the reference is connected.

It could also mean that audio applied to the unit is not properly referenced, or that the equipment that the unit is feeding is not properly referenced. Using the master bypass function of the unit is a helpful way to troubleshoot this issue.

### 5.1.3    Unit is Not Upmixing

From the main output screen, make sure that Upmix=On is shown. If not, press the joystick knob to alternate between upmix on/off.

Next, make sure that Center Width is between 0% and 33% and Surround Depth is 100%. Adjusting these controls can set the surroundfield back to stereo. If Center Width is set to 100% (Center from Lf/Rf) and Surround Depth is set to 0% (Surround from LfRf), the output signal will be stereo! Normally, these adjustments are Center = 0% and Surround = 100%.

Lastly, if upmix is on but the unit is still is not upmixing, make sure that the unit is not in Master Bypass (relay bypass) under the I/O menu.

### 5.1.4    Cannot Manually Control Upmixing

The unit may be set to respond to GPI or metadata commands. Access the I/O menu and turn GPI control off.

### 5.1.5    Analog Outputs Have Noise

Ensure that the system has been set with proper gain structure. This means adjusting the power amplifiers or powered speakers first, UPMAX v4 channel trims second, and volume control last. Not following this will cause unnecessary increase of the noise floor and will impact overall dynamic range. If the Master Volume is set to -40 for normal listening, the system is not adjusted properly! Consult Chapter 4 for more detailed alignment instructions.

# Chapter 6: Specifications

**Figure 6-1** Electrical

| Processing | |
|---|---|
| **Structure** | 5.1 channel main path plus LoRo/LtRt downmix |
| **Algorithm** | **UPMAX®:** 5.1-channel upmixing, automatic bypass of discrete content |
| **Options** | **Option 01**: Remote Volume Control |
| **Headphone Output** | |
| **Frequency Response** | 20 Hz–20 kHz, ±1 dB (upmix=Off) |
| **Level** | +12 dBu maximum |
| **Connector** | 1/4-in (6.35-mm) front panel jack with volume control |
| **Analog Monitor Output** | |
| **Frequency Response** | 20 Hz–20 kHz, ±1 dB, Upmixing Off |
| **Level** | 4dBu @-20dBFS, +24dBu into 600 Ohms @0dBFS |
| **Dynamic Range** | Greater than 85dB |
| **Connector** | DB25-F, pinout below |
| **Digital I/O** | |
| **Digital Audio I/O** | All inputs are unbalanced, 75-Ω with internal termination<br>1-2, 3-4, 5-6, 7-8 use BNC-F connectors<br>Signal levels per SMPTE 276M/ AES-3ID-2001 |
| **Ethernet** | 100 BASE-T via RJ-45 connector |
| **GPI/O Parallel Control Port** | DB9-F connector, 0–5 V TTL levels |
| **Metadata Input** | DB9-F connector, 115 kbps, pinout per SMPTE 207M (RS-422/485)<br>Interfaces directly with Dolby Metadata (SMPTE RDD6) |
| **Reference** | 48 kHz via AES 1 or SDI input |
| **HD/SD-SDI Auto-Sensing I/O** | De-embed up to 16 audio channels from SDI, process and re-embed up to 16 channels<br>Signal levels per SMPTE 292M /259M<br>Supports SMPTE 2020 A and B VANC metadata<br>Supports up to 1080i/60/59.94/50 Hz |

**Table 6-1**  Physical

| | |
|---|---|
| **Dimensions** | **1RU**<br>**H** = 1.75 in (45 mm) **W** = 19 in (483 mm) **D** = 11.5 in (293 mm) |
| **Net Weight** | 6 lb (2.72 kg) approximate |
| **Environmental** | **Operating**:        0 – 50ºC<br>**Non-operating**:  -20 – 70ºC |
| **Power Requirements** | Dual redundant auto-sensing power supplies, each rated at<br>100–240 VAC, 50–60 Hz, 35 W maximum |

## Latency

Latency is fixed regardless of surroundfield settings.

**Table 6-2**  Fixed latency for different signal paths

| Function | Latency |
|---|---|
| Main Out | 7 msec, SRC Byp Off<br>4.6msec, SRC Byp On |
| Downmix Out LoRo | 5 msec |
| Downmix Out LtRt | 11 msec |

## Connector Pinouts

**Table 6-3** Analog I/O (DB25-F)

| Pin | Function | Pin | Function |
|-----|----------|-----|----------|
| 1 | Ch 8 Ro/Rt + Out | 14 | Ch 8 Ro/Rt - Out |
| 2 | Ch 8 Ro/Rt Gnd | 15 | Ch 7 Lo/Lt + Out |
| 3 | Ch 7 Lo/Lt - Out | 16 | Ch 7 Lo/Lt Gnd |
| 4 | Ch 6 Rs + Out | 17 | Ch 6 RS - Out |
| 5 | Ch 6 Rs Gnd | 18 | Ch 5 Ls + Out |
| 6 | Ch 5 Ls - Out | 19 | Ch 5 Ls Gnd |
| 7 | Ch 4 Subwoofer + Out | 20 | Ch 4 Subwoofer - Out |
| 8 | Ch 4 Subwoofer Gnd | 21 | Ch 3 Center + Out |
| 9 | Ch 3 Center - Out | 22 | Ch 3 Center Gnd |
| 10 | Ch 2 Right + Out | 23 | Ch 2 Right - Out |
| 11 | Ch 2 Right Gnd | 24 | Ch 1 Left + Out |
| 12 | Ch 1 Left - Out | 25 | Ch 1 Left Gnd |
| 13 | NC | | |

DB-25 Female connector with an electrical pinout that matches the Tascam DA-88 format. Signals are +4dBu nominal with a digital input signal of -20dBFS, and have a maximum balanced output of +24dBu into 600 ohms.

**Table 6-4**  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 |

DB9-F connector with full-duplex RS-485 protocol running at 115 kbps. Pinout is compatible with SMPTE 207M. Pin-for-pin compatible with Dolby Metadata (SMPTE RDD6)

**Table 6-5**  Remote Volume Control Port (DB9-F)

| Pin | Connection |
|-----|-----------|
| 1 | Mute (GPI A) |
| 2 | Return to Ref (GPI B) |
| 3 | GPO A (High when Muted) |
| 4 | GPO B (High when at Ref) |
| 5 | Ground |
| 6 | Encoder Phase A Input |
| 7 | NC |
| 8 | Encoder Phase B Input |
| 9 | +5V, 200 mA Max |

Female DB-9 connector accepts TTL level controls, active Low. GPIs require a momentary contact closure to activate their assigned function. The 5-V output for external GPO indicators is limited by a self-resetting fuse.

**Table 6-6** GP I/O Parallel Control Port (DB9-F)

| Pin | Function |
|:---:|---|
| 1 | GPI 1 (Active Low) |
| 2 | GPI 2 (Active Low) |
| 3 | GPI 3 (Active Low) |
| 4 | GPI 4 (Active Low) |
| 5 | Ground |
| 6 | GPO 1 (+5V TTL) |
| 7 | GPO 2 (+5V TTL) |
| 8 | GPO 3 (+5V TTL) |
| 9 | GPO 4 (+5V TTL) |

Female DB-9 connector accepts TTL level controls, active Low.

## Regulatory

**North America**: Designed to comply with the limits for a class A digital device pursuant to Part 15 of the FCC rules (CFR). Designed for U.S. and Canadian listing with UL.

**Europe**: Designed to comply with the requirements of Low Voltage Directive 73/23/EEC and EMC Directive 89/336/EEC. Designed for RoHS and WEEE compliance.