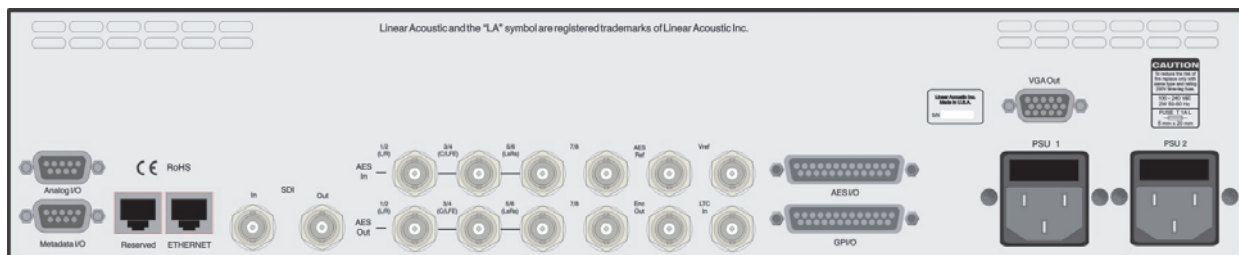




# AERO.2000 Audio/Loudness Manager

## User Guide

Release Date: April, 2013  
Software Version: 0.12.05 and later



### Linear Acoustic Inc.

Phone: 717-735-3611  
FAX: 717-735-3612  
Web: [www.LinearAcoustic.com](http://www.LinearAcoustic.com)



108 Foxshire Drive | Lancaster, PA 17601 USA | T: +1.717.735.3611 | F: +1.717.735.3612 | [TelosAlliance.com](http://TelosAlliance.com)

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**DISCLAIMER OF WARRANTIES:** Products manufactured by Linear Acoustic are warranted against defects in material and workmanship under the standard Telos Alliance 5-year warranty from the date of purchase. **THERE ARE NO OTHER IMPLIED OR EXPRESS WARRANTIES AND NO WARRANTY FOR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

During the warranty period Linear Acoustic Inc. will repair, or at our discretion replace, components which prove to be defective, provided the unit is returned, shipped pre-paid to us directly with a return authorization (RA) number clearly marked on the packaging. **Please note, this RA number must be present or package will be refused and returned to sender.**

All requests for repairs MUST include the unit serial number to ensure quick and accurate service.

**DEFECTS CAUSED BY UNAUTHORIZED MODIFICATIONS, MISUSE OR ACCIDENTS, UNAUTHORIZED CUSTOMER REPAIRS, OR ANY FURTHER DAMAGE CAUSED BY INADEQUATE PACKAGING FOR SERVICE RETURN ARE NOT COVERED BY THIS WARRANTY.**

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This product contains Audyne dynamic range processing and is manufactured under license.

This product optionally contains Dolby Digital (AC-3) encoding and/or decoding and is manufactured under license from Dolby Laboratories, Inc. The encoder contains confidential unpublished works and is protected by US and foreign patents and is copyright 2007 Dolby Laboratories, Inc.

This product optionally contains Nielsen Watermarking technology and is manufactured under license.

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# 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

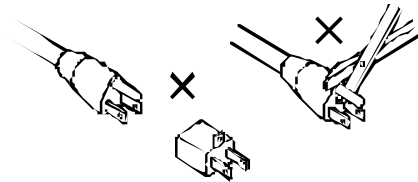


***WARNING: Troubleshooting must be performed by a trained technician. Do not attempt to service this equipment unless you are qualified to do so.***

***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  $\perp$  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.
-

## EU

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

### IMPORTANT SAFETY NOTICE

This 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 coffee 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 observed:

- o Ensure that your mains supply is in the correct range for the input power requirement of the unit. (GB)
- o Ensure **fuses** fitted are the **correct rating and type** as marked on the unit.
- o The unit **must be earthed** by connecting to a correctly wired and **earthed** power outlet.
- o The **power cord** supplied with this unit must be wired as follows:

Live—Brown Neutral—Blue Earth—Green/Yellow

### IMPORTANT – NOTE DE SECURITE

Ce 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 liquide, tels que des tasses de café, sur l'appareil. Pour vous assurer d'un fonctionnement sans danger et de prévenir tout choc électrique ou tout risque d'incendie, veuillez à observer les recommandations suivantes.

- o Le selecteur de tension doit être placé sur la valeur correspondant à votre alimentation réseau. (F)
- o Les fusibles doivent correspondre à la valeur indiquée sur le matériel.
- o Le matériel doit être correctement relié à la terre.
- o Le cordon secteur livré avec le matériel doit être câblé de la manière suivante:

Phase—Brun Neutre—Bleu Terre—Vert/Jaune

### WICHTIGER SICHERHEITSHINWEIS

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

- o Der Spannungswähler muß auf Ihre Netzspannung eingestellt sein. (D)
- o Die Sicherungen müssen in Typ und Stromwert mit den Angaben auf dem Gerät übereinstimmen.
- o Die Erdung des Gerätes muß über eine geerdete Steckdose gewährleistet sein.
- o Das mitgelieferte Netzkabel muß wie folgt verdrahtet werden:

Phase—braun Nulleiter—blau Erde—grün/gelb

### NORME DI SICUREZZA – IMPORTANTE

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

- o Assicurarsi che il selettore di cambio tensione sia posizionato sul valore corretto.
- o Assicurarsi che la portata ed il tipo di fusibili siano quelli prescritti dalla casa costruttrice. (I)
- o L'apparecchiatura deve avere un collegamento di messa a terra ben eseguito; anche la connessione rete deve avere un collegamento a terra.
- o Il cavo di alimentazione a corredo dell'apparecchiatura deve essere collegato come segue:

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

### AVISO IMPORTANTE DE SEGURIDAD

Esta 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 recipientes con líquidos, como tazas de café. Para asegurarse un funcionamiento seguro y prevenir cualquier posible peligro de descarga o riesgo de incendio, se han de observar las siguientes precauciones:

- o Asegúrese que el selector de tensión esté ajustado a la tensión correcta para su alimentación. (E)
- o Asegúrese que los fusibles colocados son del tipo y valor correctos, tal como se marca en la unidad.
- o La unidad debe ser puesta a tierra, conectándola a un conector de red correctamente cableado y puesto a tierra.
- o El cable de red suministrado con esta unidad, debe ser cableado como sigue:

Vivo—Marrón Neutro—Azul Tierra—Verde/Amarillo

### VIKTIGA SÄKERHETSÅTGÄRDER!

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

- o Kontrollera att spänningsväljaren är inställd på korrekt nätspänning. (S)
- o Kontrollera att säkringarna är av rätt typ och för rätt strömstyrka så som anvisningarna på enheten föreskriver.
- o Enheten måste vara jordad genom anslutning till ett korrekt kopplat och jordat el-uttag.
- o El-sladden som medföljer denna enhet måste kopplas enligt följande:

Fas—Brun Neutral—Blå Jord—Grön/Gul

### BELANGRIJK VEILIGHEIDS-VOORSCHRIFT:

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

- o Controleer of de spanningscarroussel op het juiste Voltage staat. (NL)
- o Gebruik alleen zekeringen van de aangegeven typen en waarden.
- o Aansluiting van de unit alleen aan een geaarde wandcontactdoos.
- o De netkabel die met de unit wordt geleverd, moet als volgt worden aangesloten:

Fase—Bruin Nul—Blauw Aarde—Groen/Geel

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## Fusing Information



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

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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:

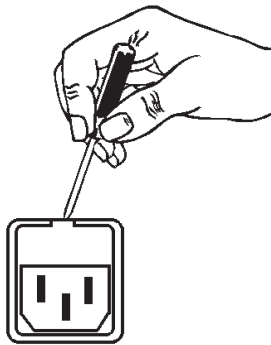
T 1A L (1 Amp, 250 V, 20 mm, time-lag, low breaking capacity) for all operating voltages.



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**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.

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# Chapter 1: Introduction to AERO.2000

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The Linear Acoustic AERO.2000 Audio/Loudness Manager is a state-of-the-art, adaptive, multiband, broadcast audio/loudness processor. The AERO.2000 can apply loudness control and upmixing to ten input channels. It outputs 5.1 processed channels, an LtRt version of the main audio channels, and two separate two-channel programs (stereo or mono).

Professional audio metadata can be applied to AERO.2000 to minimize processing and control functions, such as upmixing. AERO.2000 protects itself against loss of incoming metadata with reversion modes that apply plant reference loudness values. The resulting audio is clean, consistent, and appropriately dynamic - perfect for consumer transmission via Dolby® Digital (AC-3) or any other format.

The AERO.2000 includes the following features:

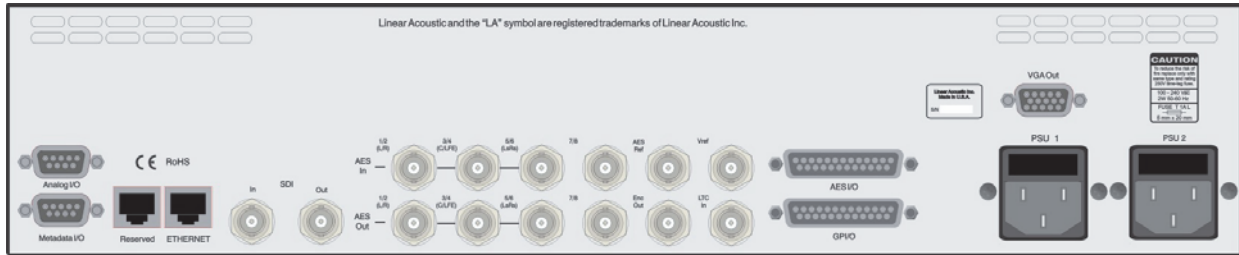
- Program configurations: 5.1+2+Local + 2+2+Local support 16 audio channels
- AEROMAX® multiband loudness processing provides ATSC, ITU and EBU compliance  
Includes Input AGC, parametric EQ, multiband AGC and limiting, look-ahead peak limiting, and selectable multiband source noise reduction
- ITU-R BS.1770-3 meter for each output program simplifies loudness target calibration
- Selectable dual upmixers utilizing industry-standard UPMAX® II algorithm
- Full-time LtRt or LoRo downmix of main 5.1 channel program
- HD/SD-SDI I/O for embedded audio and VANC metadata
- Dual, redundant, auto-ranging power supplies
- Decoding options: Dolby Digital and/or Dolby E
- Encoding option: Dolby Digital (AC-3)
- GPI and Ethernet control
- Nielsen® Watermark Encoding option

This rest of this chapter includes:

- a description of back panel connectors;
- system block diagrams
- an introduction to AERO.2000's displays, menus, and navigation
- a summary of important setup parameters.

See *Connector Pinouts* on page 41 for AES and analog connector, Metadata, and GPI pinout tables.

## 1.1 Back Panel



**Figure 1-1** AERO.2000 back panel

Figure 1-1 shows the AERO.2000 back panel. Its connector functions are described below from left to right:

- **Analog I/O** (DB9) – Stereo +4 dBu I/O (not currently used)
- **Metadata I/O** (DB9) – RS-485 metadata (no crossover cable required)
- **Reserved** (RJ45) – Reserved for future use (not connected internally)
- **ETHERNET** (RJ45) – Auto-sense 100/1000 BASE-T, *connect to stable network*
- **SDI I/O** (dual BNC) – Auto-sensing SD/HD, supports 16 audio channels, VANC metadata, and has internal compensating video delay
- **Main AES I/O** (BNC) – 16 I/O channels
- **AES Ref** (BNC) – Apply 48 kHz DARS (Digital Audio Ref Signal), or any AES signal, but not video. Use only if SDI embedding is disabled.
- **ENC Out** (BNC) – Encoder output, fed in parallel with AES 15/16
- **Vref** (BNC) – Video reference input (not currently supported)
- **LTC In** (BNC) – LTC timecode input (not currently supported)
- **AES I/O** (DB25) – AES channels 9-16, unbalanced (pinout below)
- **GPI/O** (DB25) – Eight parallel inputs, 5-V TTL levels, active low
- **VGA Out** (HD-DB15) – VGA (640 x 480) video output
- **PSU1/PSU2** – AC power inlets

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**NOTE:** All BNC inputs are 75- $\Omega$  internally terminated.

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Figure 1-3 shows a detailed view of Instance 2 (2+2+Local).

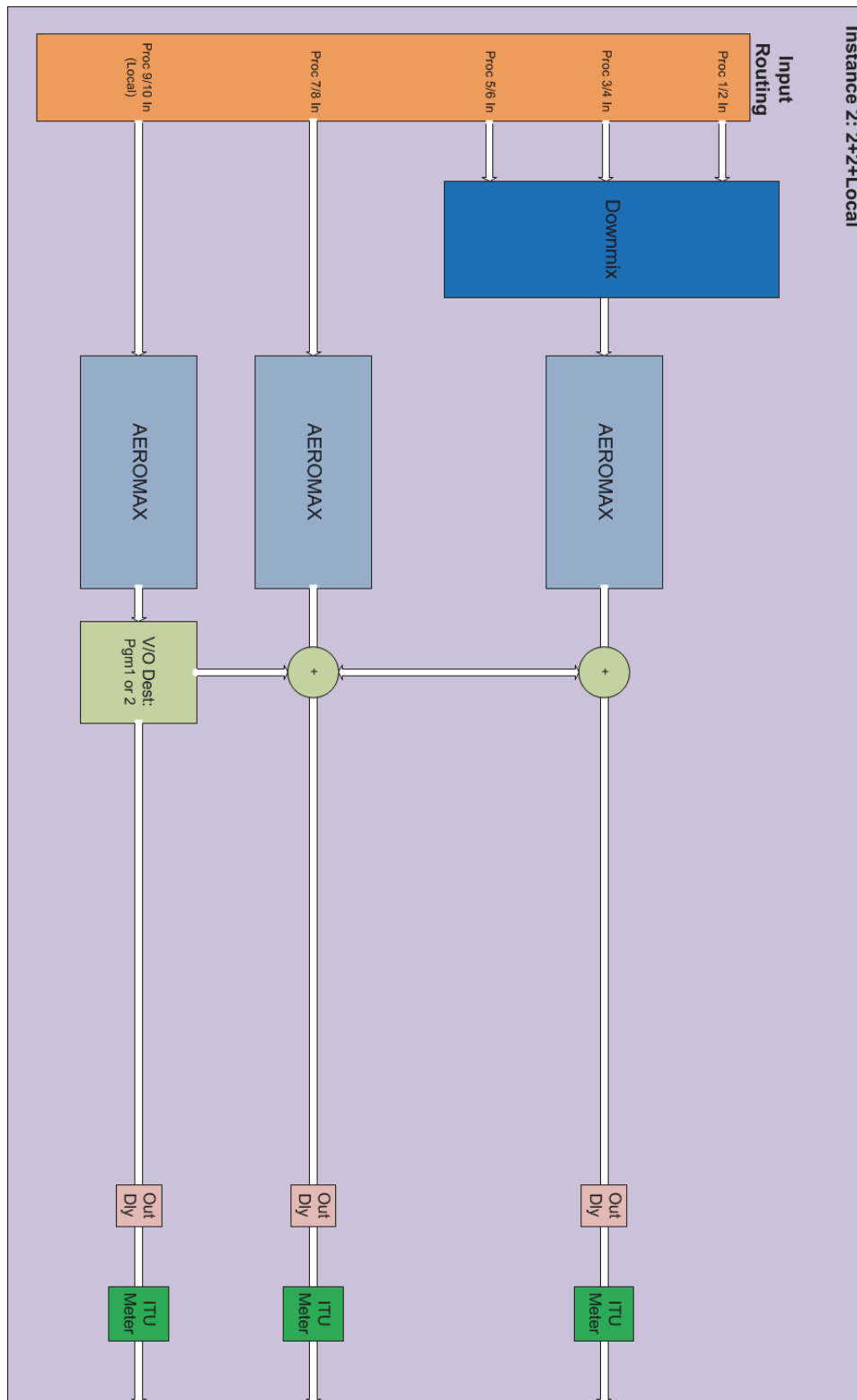


Figure 1-3 Instance 2 (2+2+Local)

## 1.3 Power

The AERO.2000 is equipped with two power supplies (dual PSUs). Always connect BOTH power inlets to clean AC power sources, ideally from separate feeds. Remember, this is primarily to protect you against unreliable *power sources*, and not from problems with AERO.2000's power supplies.

We strongly recommend using an uninterruptible power supply (UPS) on at least one of the AC power feeds; separate units should be used for each inlet.

Apply AC power to power on the AERO.2000; there is no power switch. The blue light behind the Linear Acoustic logo illuminates, the LCD screen shows the Linear Acoustic logo, and fans turn on. When the menu appears on the LCD screen, startup is complete and the unit is ready to use. This process may take up to two minutes.

To power off, just remove both AC power cords from the unit.

## 1.4 Navigation

The right, left, up, and down arrow keys navigate AERO.2000's menu system:



**Figure 1-4** Menu navigation keys

- **▶ Next** Takes you into the selected menu; same as **Enter**
- **◀ Prev.** Takes you back the same path; same as **Back** or **Esc**
- **▲▼** Scrolls through screen parameters

The central rotary knob adjusts the selected parameter.

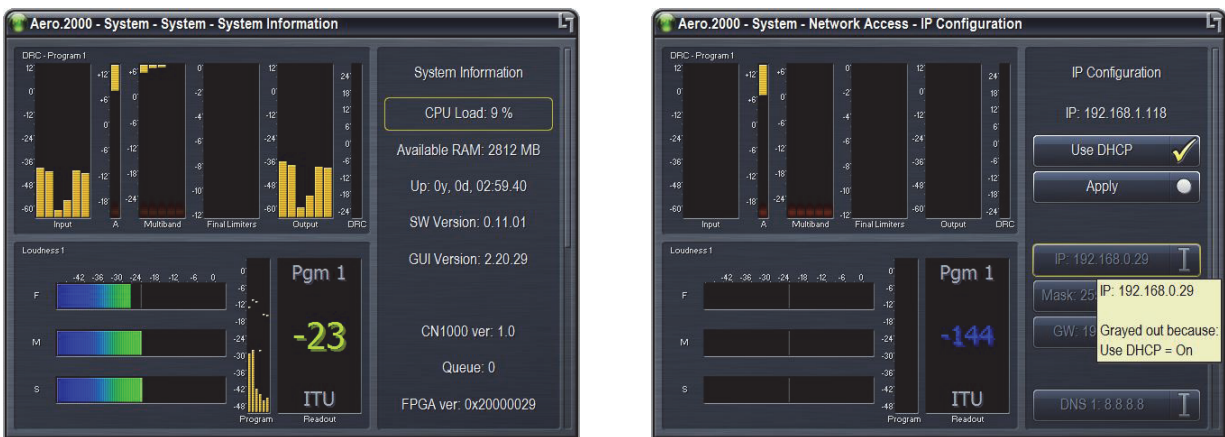
# 1.5 Menus

AERO.2000’s menus are hierarchical, and follow logical signal processing flows.

A parameter changed from its stored value is displayed in yellow. When stored, it returns to white.

AERO.2000 employs the “breadcrumbs” tactic so you’ll always know where you are in the menu hierarchy. The top of the each menu displays your current position. For example, Figure 1-5 shows the menu position as **AERO.2000 \* System \* System \* System Information**.

The menu displays tips and hints in yellow to explain a function or why it is inactive. For example, Figure 1-5 (right) shows why the IP Address field is grayed out and inactive.



**Figure 1-5** Left: menu path at top; Right: yellow popup hint



## 1.6 Display Setup

The front panel display can be fully customized, and can contain up to six meters of the same or different types. The display can also be set to “Meters Only” mode so the menus are temporarily hidden. Of course, display resolution may limit the number of active front panel meters, but all six will work fine using the AERO.2000 VGA output.

The left side of Figure 1-6 shows Display 1 set to DRC, Program 1 and Display 2 set to Loudness (for Pgm 1), and Displays 3–6 off.

The right side of Figure 1-6 shows the same metering configuration set to full screen.



**Figure 1-6** Display and meter setup options

## 1.7 Important Setup Parameters

### 1.7.1 Reference

The AERO.2000 can be referenced to:

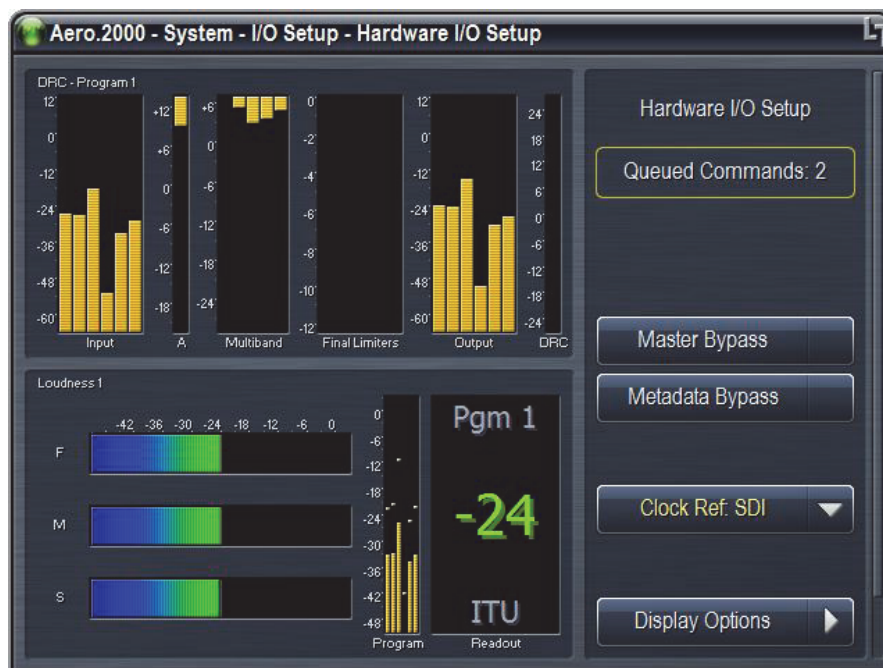
- AES DARS (or any AES signal applied to the Ref In connector);
- AES In 1
- SDI
- Internal 48 kHz (standalone use only).

---

**NOTE:** *If SDI embedding is enabled, clock reference will be forced to SDI automatically. Otherwise, proper reference MUST be selected for glitch-free operation!*

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Figure 1-7 shows the clock reference set to SDI. The menu's yellow lettering indicates that it has been changed from the saved value. Saving again turns it white. Note again the menu path displayed at the top.



**Figure 1-7** Clock Reference set to SDI

### 1.7.2 Audio Input Select

Since a single physical input can feed multiple instances, each instance has a built-in router to select audio on a pair-by-pair basis.



Figure 1-8 Left: inputs for a given instance; Right: available choices for AES or SDI pair

### 1.7.3 Audio Output Routing

Since one physical Output can come from just one source, a single output router configures each of the 16 AES and 16 SDI outputs.



Figure 1-9 Left: main AES outputs (BNC and DB25) and SDI outputs; Right: SDI output setup

Note that any one Instance or Encoder output can go to all physical outputs if desired. Any AES or SDI input signal pair can be routed to any AES or SDI output pair with no processing.

### 1.7.4 Ethernet

The Ethernet connection, like the reference signal, must be stable and always present. Audio glitches may be heard on air if Ethernet is interrupted. Although initially configured for DHCP (auto-IP address), static IP addresses can also be entered explicitly.



Figure 1-10 Left: IP address, remote port, and MAC address; Right: reconfiguring IP settings

### 1.7.5 Video Compensation Delay

Included video compensation delay can help re-time audio and video/ancillary data signals from SDI In to SDI Out to match processing delay. Exact processing delay will depend on the presence of Dolby encoding/decoding and Nielsen Watermark options, and normal practice is to set the video delay to the next whole video frame value (different for NTSC and PAL of course). Rough timing is via the delay control (milliseconds) and the Fine control can adjust to the microsecond. Once video delay is set, A/V lip-sync can be accomplished in the I/O Menu using the Utility Audio Delays



Figure 1-11 Left: SDI video delay settings; Right: Output Delay settings available for each instance

### 1.7.6 Preset Selection

The factory default is TV 5B Gen, but several others are included and can be selected for each instance. Note that Factory presets, which cannot be overwritten, are white. User presets, which can be added and modified, are yellow.



**Figure 1-12** Left: current preset for Instance 1, Program 1; Right: partial list of available presets

## 1.8 Dolby

Dolby E and Dolby Digital decoding are available on a per-technology/per-instance basis. The decoder shows bitstream status and two settings:

- Decode 7/8 (Dolby E) – Selects whether 7/8 audio comes from the input or the Dolby E decoder. This has no function when decoding Dolby Digital.
- Bypass routing – Determines where PCM audio goes when the decoder detects the input is not Dolby E or Dolby Digital



Figure 1-13 Left: Decoder settings; Right: bitstream status information

The Dolby Digital Encoder has a few settings; the most important are data rate and dialnorm. Although these parameters are located in different menus, the menu path at the top shows where you are.



Figure 1-14 Left: Data rate setting; Right: Reference Level (dialnorm) setting

## 1.9 Nielsen

If the Nielsen Watermark option is present, MAKE SURE to configure network settings, and select a valid, operational NTP server. Then enter the Site ID (SID) and Check Digits supplied by Nielsen.

**NOTE:** *Linear Acoustic CANNOT assign these settings. They are supplied and monitored by Nielsen.*

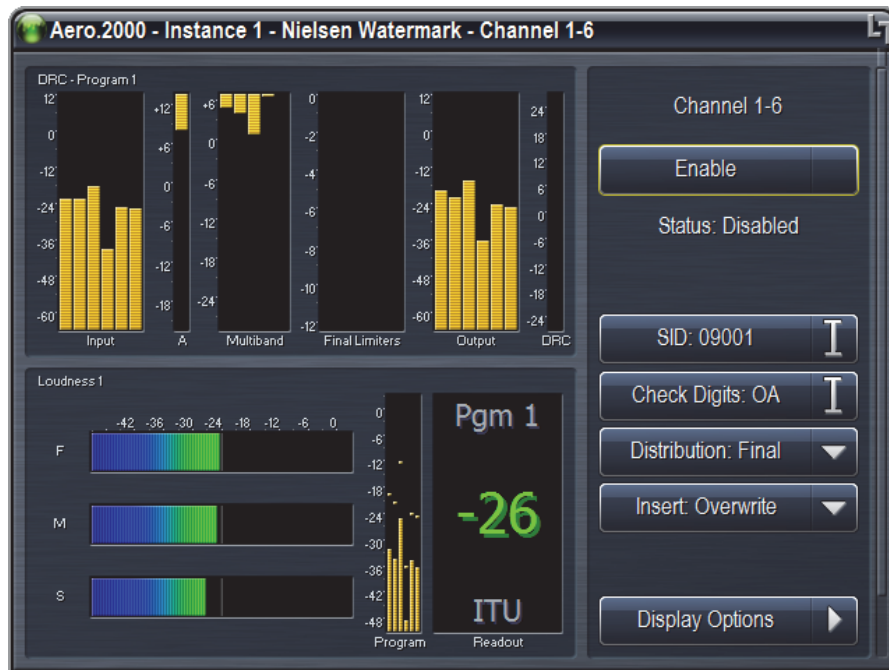


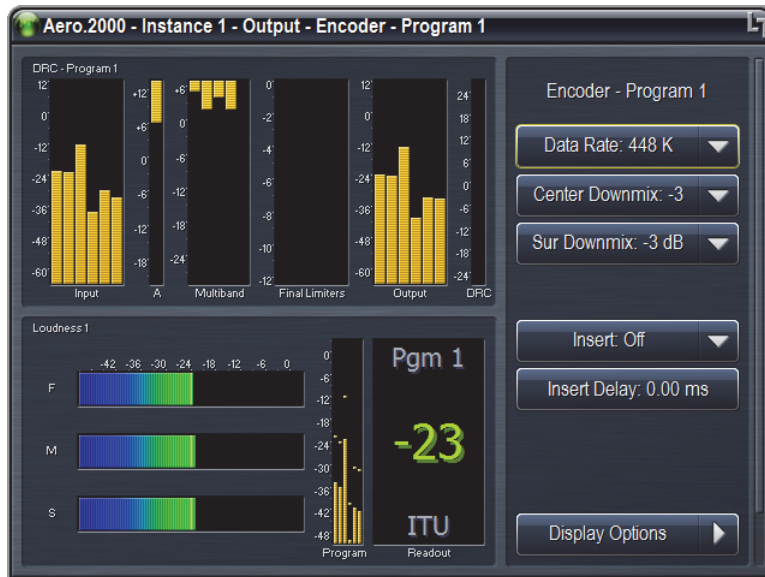
Figure 1-15 Nielsen setup

## 1.10 Compliance

Simply setting up the AERO.2000 in-line and assigning a factory preset (other than Protection Limit, which is essentially Bypass) will result in smooth, viewer-pleasing audio and compliance.

The next step is to make sure that the average audio loudness matches the target loudness value set in the final encoder. Using the built-in metering makes this process simple. Choose ONE of these processes to match loudness targets:

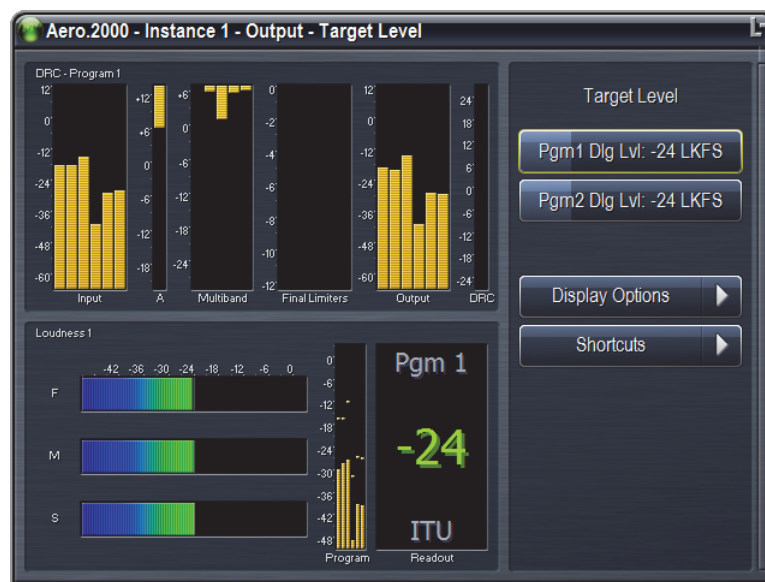
Adjust the program's Output Level until the meter matches the target (see below).



**Figure 1-16** Adjusting Output Level so the meter matches the target

- OR -

Adjust the Target Level (dialnorm) until it matches the meter (see below).



**Figure 1-17** Adjusting the target level (dialnorm) to match the meter



# Chapter 2: Remote Interface

The Remote Interface software is a separate client application that can be downloaded and installed on most recent desktop, laptop, or tablet PCs running Windows XP, Vista, or 7. Touchscreen support is provided for touch-sensitive devices.

All AERO.2000 front panel parameter adjustments can be made via the remote client. The remote has the additional capability of streaming audio back over the local network to the host computer.

## 2.1 Setup

The following process enters the IP address of the remote computer into the “white list” on AE-RO.2000, and establishes a front-panel password.



Figure 2-1 Left: HTTP server Whitelist setup; Right: password setup

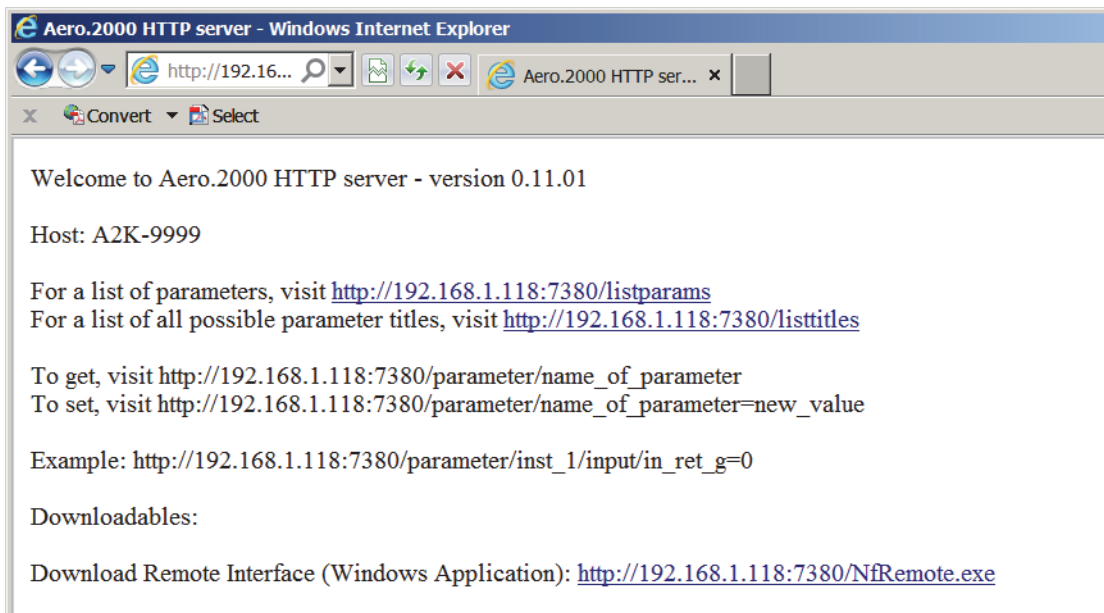
1. To connect to the HTTP server in your AERO.2000, enter the following address on any web browser running on a Windows computer on the same network:

`http://<IP Address of AERO.2000>:7380`

The AERO.2000 IP address can be found at the following screen:

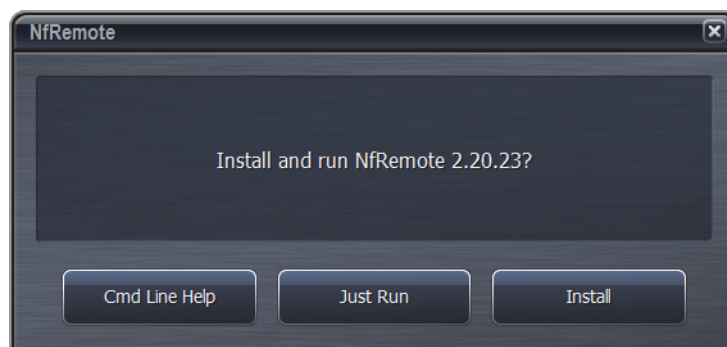
### **AERO.2000 – System – System – System Information**

When connected, a “Welcome to AERO.2000” screen appears with a link from which to download the most recent version of the remote software.



**Figure 2-2** Browser display when connected to AERO.2000 HTTP server

2. Download the Remote Interface software installer by clicking the link to its right.
3. Launch the installer and select from the three options: **Cmd Line Help**, **Just Run**, or **Install**. Normally, just choose **Install**, which installs the Remote software as a Windows program.



**Figure 2-3** Remote software installer

4. Launch the NFRemote software (New Framework Remote), and enter the IP address, password (if required) to connect to the desired unit, and Station info.



**Figure 2-4** Left: Remote control setup screen; Right: AERO.2000 negotiates connection with remote

5. Press **Add** to add this unit and its information to the list.  
Multiple units can be added and will appear in a list at the bottom of the remote.
6. To connect to the desired unit, select it from the list, and click **Connect**.

## 2.2 Overview

After successful connection, the remote starts at the Home Screen. The remote interface screen is fully re-sizeable and can be adjusted in the same manner as any such window, that is, via handles at each corner. The displays and windows will dynamically adjust themselves to make the best use of available screen real estate as you resize the window.



**Figure 2-5** Home screen, Non-Expert mode (default)

Windows that indicate the AERO.2000’s CPU load, client volume (streaming audio), headphone volume, and the host PC’s CPU load are displayed at the top of the screen (see Figure 2-6). In some cases, when the display is made smaller, these controls combine and a drop-down arrow appears allowing you to activate individual controls.

Click the **Menu** button to display meters only (no controls visible), lock the window’s onscreen position, maximize the window, enter full screen mode, or close the window. You can also choose between **Expert** and **Non-Expert** display modes.

To the right of the **Menu** button are six Display Presets that quickly recall saved screen configurations.

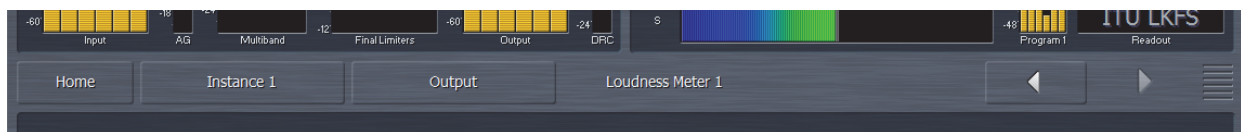


**Figure 2-6** Top of remote interface

## 2.3 Expert and Non-expert Modes

“Expert” and “non-expert” refer ONLY to how information and controls are displayed on the screen, and not to the number of controls available or their precision.

The default non-expert mode (shown in Figure 2-6) devotes the top of the screen to display windows, while the bottom is reserved for menus and controls. An informational area between these two sections serve as a “breadcrumbs” display indicating where you are in the menu hierarchy. The left and right arrow buttons allow you to navigate between the most recently visited controls.



**Figure 2-7** “Breadcrumbs” trail, left/right nav, and top/bottom re-size (looks like venetian blinds)

In the expert mode, all menus and all controls are displayed on the screen simultaneously (see Figure 2-8). Since this mode inherently makes menus, controls, and their labels smaller, it works best when the remote software window can be large enough to spread things out. Everything is visible at once in expert mode, so you have direct access to all menus and controls without having to step through the menu structure in sequence.



**Figure 2-8** Home screen in Expert mode

Both modes allow you to resize the sections that take up room on the screen. In both modes, small horizontal lines separate the sections. Non-expert mode has top and bottom sections, while Expert mode has top, center, and bottom sections. Click and drag on these lines to resize each section to divide the screen as needed.

## 2.4 Display Presets

Six display presets are offered. The AERO.2000 remote software first appears with display preset 1 active. Any changes made to the screen (i.e., selecting between expert/non-expert modes, resizing window sections, or choosing the number and/or type of display windows visible) are automatically saved in real time. Switching back to this preset from any other automatically recalls your saved settings.

## 2.5 Display Windows

Although up to eight windows can be shown on the remote screen at once, each additional display takes away screen space from the others. Depending on your monitor size, you may find it more practical to limit the number of windows, and use display presets to switch among different windows.

Clicking the mouse within a window causes a yellow box to appear around the active display window. The bottom of the active display window also turns into a Display Settings menu.



Figure 2-9 Display Settings menu in lower section

From this menu, you can

- turn displays on and off;
- select the information to display in each: processing meters for DRC 1, 2, and local engines; AC-3 confidence decoding information; I/O meters for each processing instance; I/O meters for the hardware.

AERO.2000 offers the following signal analysis tools:

- Over-sampled digital oscilloscope
- RTA (real time analyzer)
- FFT spectrum analyzer

These valuable monitoring and diagnostic tools can measure and display signals from myriad patch points within AERO.2000. Extensive setup controls are provided for these meter types.



**Figure 2-10** Settings for the selected RTA

## 2.6 Loudness Metering

ITU-BS.1770-3 loudness meters for each instance are provided as well. Note that because the loudness meter is tied to the program and the settings are likely to be program-specific, loudness meter setup is located within the program settings.



**Figure 2-11** Settings for the program-specific ITU meter

The precise patch points available for these tools differ depending on which section of the audio and/or signal path is selected for display. The list is detailed and comprehensive.



## 2.7 General Notes

- Multiple computers can connect to the same AERO.2000 unit simultaneously.
- One computer can connect to multiple AERO.2000 units with a single installation of the Remote Interface software,

This is a handy feature for monitoring or adjusting main and backup units at the same facility, or addressing units assigned to additional channels or even different stations.

- Each instance of a remote connection requires some horsepower from AERO.2000's CPU.

Tasks that require significant CPU resources are using multiple instances of the oscilloscope and streaming client audio back from the AERO.2000 to the remote computer. Although it is highly unlikely that your CPU would run out of resources even in a fully configured unit addressed from several remote computers, it is an important issue to monitor. Fortunately, the CPU percentage meter will warn you when resources begin to run low.

- The available bandwidth on the local network determines how robust the remote connection will be.

The remote software measures available network resources during the initial handshake with AERO.2000. If bandwidth is marginal, some patch points may be unavailable for monitoring on the oscilloscope and spectrum analyzer. Additionally, the quality of the client audio streamed to the remote computer will be adjusted to best match current network resources.



## Chapter 3: Factory Presets

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This section lists each preset in alphabetical order, as they appear in the AERO.2000 and the remote interface. Each preset's adjustable processing parameters are described. Some presets do not use every parameter. For example, TV 4B Gen does not use the 5th band.

All presets are adjusted so that with the input content averaging around -24 LKFS, the output is optimized to produce -24 LKFS,  $\pm 1-2$  dB per ATSC A/85.

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**NOTE:** *This calibrated measurement is made with a Linear Acoustic LQ-1000 or LQ-1, with 10 second integration. Longer integration times produce measurements with less variation.*

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### Fine Arts 5B Gen

Fine Arts 5-Band General offers medium processing appropriate for artistic programming that may have large dynamic range variations. It produces consistent loudness and spectral balance.

### ITU 5B Loudness Lim

ITU 5-Band Loudness Limit utilizes a specially tuned Multiband AGC Limiter and the Final Limiter to slowly adjust the average program loudness to a specific loudness value as measured over time. The Multiband Limiters and Final Limiters act until the very slowly responding wideband AGC catches up. The multiband AGC is bypassed (1:1) so spectral balance is unaffected. This preset can be appropriate for ingest, live, or network transmission applications where content is pre-normalized.

### Music 5B Hvy

Music 5-Band Heavy is an aggressive preset for TV music channels that effectively delivers music programming to small televisions and portable receivers.

### MVPD 5B Gen

MVPD 5B Gen is intended for Multiple Video Program Distributors who may not have full control of all programs, interstitials or commercials present in a given network stream. It applies medium-light multiband processing, sets Gate and Freeze to prevent background noise pull-up, and is tuned for all genres.

### Net 5B Limit

Net 5B Limit applies a final polish to an already consistent network program prior to distribution. A combination of TV 5B Light and ITU 5B Loudness Limit, this preset has a very slow input AGC, and a lighter multiband AGC. It preserves microdynamics and pulls the low-level information up slightly while protecting against long-term loudness shifts.

## Protection Limit

Protection Limit sets all processing to unity gain and leaves only look-ahead peak limiters in the signal path. The master output level is set to 0 dB, so applied signals get a unity gain path through the processor.

## Reference Settings

This preset offers standard processing test settings that match TV 5B Gen.

## Sports 5B Gen

Sports 5-Band General provides medium processing that features quick response with minimal background pumping. It keeps dialogue present and audible, even in rich surround mixes.

## TV 4B Gen

Television 4-Band General is essentially the same as TV 5B Gen (below) with four audio bands. This keeps all other settings the same, lessens the density and impact on dialogue, and results in more open sounding audio, albeit with less short-term dynamic loudness control.

## TV 5B Gen (Default)

Television 5-Band General is the factory default preset and also the most commonly used. It provides moderate dynamic range processing, and is appropriate for all content types.

## TV 5B Hvy

Although Television 5-Band Heavy is similar to TV 5B Gen, its multiband compression ratio is higher, which creates a denser but less dynamic sound useful for systems with smaller speakers.

## TV 5B Light

Although Television 5-Band Light is similar to TV 5B Gen, its multiband compression ratio is lower (2:1) for more subtle action. This is an excellent preset for content known to be consistent that needs just a bit of spectral polish. Note that this preset allows more variations without correction, but for already consistent content, this is not an issue.

## TV 5B Loud

Television 5-Band Loud is similar to TV 5B Hvy, but louder and punchier.

## Chapter 4: Troubleshooting

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AERO.2000 is reliable and easy to install. Most problems turn out to be wiring mistakes that apply incorrect input signals. However, it is a powerful processor with many user-adjustable parameters, some of which interact. If you cannot find the source of a problem, simplify the signal path. Hard-bypass is one of AERO.2000's best troubleshooting features. To instantly remove AERO.2000 from the signal path, remove AC power from both inlets.

### The unit does not power on

1. Check whether the front panel logo is back-illuminated blue and that the fan is turning when AC power is applied.

The boot process may take up to two minutes. If the unit boots, you are done.

If the fan spins but the unit still does not boot, continue.

2. Remove the AC cords and wait two minutes.
3. Plug both AC cords back in to power the unit on.

AERO.2000 will automatically power back on.

### Dialogue causes surrounds to pump

The current preset may be too aggressive, fast, or the Gate and Freeze settings are inappropriate for the content. Since all processing channels in a program are linked, they all receive the same gain reduction and expansion. The loudest channel initiates the gain control, so it can seem that the surrounds are ducked by dialogue. Choose a moderate preset, and then carefully adjust Gate and Freeze so crowd noise does not increase when dialogue stops.

### Output audio clicks and pops

The AES Reference may be missing or at the wrong sample rate; the unit expects to lock to 48 kHz. AERO.2000 defaults to an internal 48 kHz reference if the external reference is removed or missing. This allows audio to continue, but with asynchronous inputs and outputs (due to the sample rate converters on each input pair). Make sure to connect a valid reference signal to avoid this issue.

An improper reference signal in equipment located up- or downstream from AERO.2000 can also cause output noise. Use master bypass to verify that AERO.2000 is not the problem.

## Input audio has dropouts

The Dolby Digital AC-3 encoder is probably not properly referenced with respect to the DTV video encoder/multiplexer. Normally, all gear is referenced to the local plant.

In some cases (i.e., some Tandberg devices), the multiplexer generates a special reference signal that must be routed back to the Dolby Digital (AC-3) encoder and used as its reference. Consult your DTV encoder reference manual for more details.

## Audio sounds strange

Reverberant audio that sounds like a tunnel indicates timing differentials between the channel pairs. Stereo viewers are usually the first to notice such problems. The delay settings in AERO.2000 should all be equal, or set explicitly. Offsets of just a few milliseconds can be audible under the right conditions.

For those using a Dolby DP564 AC-3 decoder, one of monitoring modes uses the analog and digital outputs. This can inject up to 10 ms of delay into the surround channels, which usually elicits complaints. Either bypass the unit or set the monitoring mode to Digital.

## Audio issues disappear in bypass

Since AERO.2000 can apply significant gain to incoming signals, previously inaudible sounds may get pulled out of the background. We recommend listening carefully to the station audio for hums, buzzes, clicks, pops, phase issues, frequency response problems, and bass build-up. When amplified, these artifacts can ruin otherwise excellent programming. Moral of the story: make sure the input audio is immaculately clean or it will sound worse in surround!

## Audio fixed by re-boot

Re-booting sometimes fixes audio problems by interrupting the AES signals, thereby causing equipment downstream to re-lock to the incoming signals. Selecting a preset with minimal processing (i.e., Protection Limit) may shed further light on the problem.

## Audio has artifacts

Sometimes described as “squirrels in the surrounds,” this is almost always caused by low bit-rate source content. Some program delivery services or server systems use MPEG 1, Layer 2 audio data reduction to save bandwidth. At 256 kbps or higher per stereo pair, there are no issues. However, at or below 128 kbps coding artifacts in the original stereo signal are unmasked by upmixing. This inferior content has similar results without upmixing if consumers matrix-decode the signal, which is the default mode for most home A/V receivers. We recommend contacting the program provider or server manufacturer. Bandwidth is so inexpensive that there is no good reason to run lower than 256 kbps.

# Chapter 5: Specifications

Table 5-1 Electrical

Processing	
<b>Structure</b>	<p><b>Instance Style 1:</b> 5.1+2+2 (local/voiceover input) with downmix output and dual-path upmixing</p> <p><b>Instance Style 2:</b> 2+2+2 (local/voiceover input) with Auto SAP/DVS</p>
<b>Algorithms</b>	<p><b>AEROMAX®:</b> ITU-R compliant loudness control via adjustable wideband and multiband processing</p> <p><b>UPMAX® II:</b> 5.1-channel upmixing, automatic bypass of discrete content</p>
<b>Options</b>	<p><b>Option 02:</b> Dolby Digital (AC-3) Encoder Outputs a Dolby Digital (AC-3) bitstream Encoder is 5.1 (3/2L) for Instance Style 1, and 2.0 for Instance Style 2</p> <p><b>Option 06:</b> Dolby E/Dolby Digital Decoder Auto-senses Dolby E, Dolby Digital, or PCM</p> <p><b>Option 08:</b> Nielsen Watermark Encoder</p>
Headphone Output	
<b>Frequency Response</b>	20 Hz–20 kHz, ±1 dB (Protection Limit preset)
<b>Level</b>	+12 dBu maximum
<b>Connector</b>	1/4-in (6.35-mm) front panel jack with volume control
Digital I/O	
<b>Digital Audio I/O</b>	<p>All inputs are unbalanced, 75-Ω with internal termination</p> <p>1-2, 3-4, 5-6, 7-8, AES Ref use BNC (F) connectors.</p> <p>Eight channels of auxiliary digital I/O on F-DB25 connector</p> <p>Signal levels per SMPTE 276M/ AES-3ID-2001</p> <p>All I/O can be assigned as needed</p>
<b>Remote</b>	<p>TCP/IP remote control and audio monitoring via Remote Interface software, a Windows®-compatible application (included)</p> <p>HTTP server allows get/set control from any OS</p>
<b>Ethernet</b>	100 to 1000 BASE-T via RJ-45 connector
<b>GPI/O Parallel Control Port</b>	F-DB25 connector, 0–5 V TTL levels
<b>Metadata Input</b>	<p>DB9-F connector, 115 kbps, pinout per SMPTE 207M (RS-422/485)</p> <p>Interfaces directly with Dolby Metadata (SMPTE RDD6)</p>
<b>Reference</b>	48 kHz via AES DARS reference input or SDI input
<b>HD/SD-SDI Auto-Sensing I/O</b>	<p>De-embed up to 16 audio channels from SDI, process and/or encode, and re-embed up to 16 channels</p> <p>Signal levels per SMPTE 292M /259M</p> <p>Supports SMPTE 2020 A and B VANC metadata</p> <p>Supports up to 1080p/60/59.94/50 Hz</p>

Table 5-2 Physical

<b>Dimensions</b>	<b>2RU</b> <b>H</b> = 3.50 in (90 mm) <b>W</b> = 19 in (483 mm) <b>D</b> = 13.25 in (337 mm)
<b>Net Weight</b>	12.5 lb (6 kg) approximate
<b>Environmental</b>	<b>Operating:</b> 0 – 50°C <b>Non-operating:</b> -20 – 70°C Fan cooled
<b>Power Requirements</b>	Dual redundant auto-sensing power supplies, each rated at 100–240 VAC, 50–60 Hz, 175 W maximum

## Latency

Zero timing is achieved via included Compensating Video Delay and instance audio delays. The table below shows the fixed latency for each type of processing function and the corresponding audio delay necessary for NTSC and PAL integer frames.

Table 5-3 Fixed latency for different modes and functions

Mode	Function	Latency	Audio delay to add for integer NTSC frame	Audio delay to add for integer PAL frame
<b>5.1+2+2</b>	Channels 1–6 to channels 1–6	126.4 ms	5.6 ms = 4 Frames	33.6 ms = 4 Frames
	Channels 7-8/9-10 to channels 7-8/9-10	107.8 ms	24.2 ms = 4 Frames	12.2 ms = 3 Frames
	Downmix Out	150.4 ms	14.6 ms = 5 Frames	9.6 ms = 4 Frames
<b>5.1+2+Local</b>	Channels 9-10 to channels 1–6 or 7-8	126.4 ms	5.6 ms = 4 Frames	33.6 ms = 4 Frames
<b>2+2+2</b>	Channels 1–6 to channels 1-2	134.2 ms	1 ms = 5 Frames	25.8 ms = 4 Frames
	Channels 7-8 to channels 7-8	107.6 ms	24.4 ms = 4 Frames	12.4 ms = 3 Frames
	Channels 9-10 to channels 9-10	131.5 ms	0.5 ms = 4 Frames	28.5 ms = 4 Frames
<b>2+2+Local</b>	Channels 9-10 to channels 1-2 or 7-8	134.2 ms	31 = 5 Frames	25.8 ms = 4 Frames
	SRC Bypass	-3.0 ms	N/A	N/A
	Dolby Digital (AC-3) Encode	58 ms	8 ms = 2 Frames	22 ms = 2 Frames
	Nielsen	21 ms	12 ms = 1 Frame	19 ms = 1 Frame



## Connector Pinouts

**Table 5-4** Analog I/O (F-DB9)

Pin	Function
1	Shield
2	Tx A Asynchronous Data Out -
3	Rx B Asynchronous Data In +
4	Ground
5	No Connection
6	Ground
7	Tx B Asynchronous Data Out +
8	Rx A Asynchronous Data In -
9	Shield

**Table 5-5** 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

F-DB9 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 5-6** AES I/O (F-DB25)

<b>Pin</b>	<b>Function</b>
1	AES 9/10 In +
2	AES 11/12 In +
3	AES 13/14 In +
4	AES 15/16 In +
5	AES 9/10 Out +
6	AES 11/12 Out +
7	AES 13/14 Out +
8	AES 15/16 Out +
9	No Connection
10	Ground
11	No Connection
12	Ground
13	Ground
14	AES 9/10 In Ground
15	AES 11/12 In Ground
16	AES 13/14 In Ground
17	AES 15/16 In Ground
18	AES 9/10 Out Ground
19	AES 11/12 Out Ground
20	AES 13/14 Out Ground
21	AES 15/16 Out Ground
22	Ground
23	Ground
24	Ground
25	Ground

**Table 5-7 GP I/O Parallel Control Port (F-DB25)**

Pin	Function
1	+5 V, 150 mA
2	GPI A (Active Low)
3	GPI B (Active Low)
4	GPI C (Active Low)
5	GPI D (Active Low)
6	GPI E (Active Low)
7	GPI F (Active Low)
8	GPI G (Active Low)
9	GPI H (Active Low)
10	No Connection
11	Status OK
12	No Connection
13	Ground
14	+5 V, 150 mA
15	GPO A (currently unused)
16	GPO B (currently unused)
17	GPO C (currently unused)
18	GPO D (currently unused)
19	GPO E (currently unused)
20	GPO F (currently unused)
21	GPO G (currently unused)
22	GPO H (currently unused)
23	Ground
24	No Connection
25	Ground

## 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.

