



ADX-2400D

AUDIO
DISTRIBUTION AND DELAY
SYSTEM

(AES Digital I/O)

Installation and Operation Manual

Software Version 5.1

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WARRANTY STATEMENT

This equipment is warranted to be free of defects in materials and workmanship for a period of two years from date of delivery. Any necessary repairs resulting from defects in materials or in manufacture will be made free of charge provided that the equipment has not been subjected to mechanical or electrical abuse, or modification, as determined by Lance Design, and also that the equipment is returned to Lance Design with prior authorization.

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CAUTION! HAZARDOUS VOLTAGES ARE EXPOSED WHEN THE TOP COVER OF THE RACK FRAME IS REMOVED. DO NOT APPLY POWER WITH THE UNIT DISASSEMBLED.

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Front Panel View



Rear Panel View

****Please note that in all following descriptions the 'Physical Input' and 'Physical Output' channel designations refer to audio channels, NOT to the BNC connector numbers on the rear panel. Channels 1 and 2 are on BNC connector 1, Channels 3 and 4 are on BNC connector 2, etc.***

SELECTING OPERATING MODE

With firmware versions 5.1 and later the ADX-2400D can operate in two distinct modes:

The **NORMAL** mode is used for general-purpose transmission and distribution applications. In this mode the units offer 24 channels of transmission in both directions, using standard-latency Cobranet format transmission. The ADX-2400D in this mode transmits three bundles of eight channels each, and receives three bundles of eight channels each.

Bundle numbers are set manually from the front panel menus.

The DSPs in the unit are used for level control, source selection, and delay.

Transmission latency is approximately 7 milliseconds in each direction (standard mode - see next page for low-latency information).

To select NORMAL mode, turn section 3 of the options dipswitch on the sub-panel (OFF and press the Reset button.

The **ANNOUNCE BOOTH** mode is selected when the ADX-2400 is used to provide the 'head end' or truck end of an ethernet-based announce booth system, using either ADX-120 Announce Units, or ADX-140 XLR Interface Frames (or both) to provide a fully self-contained announce booth system using copper or fiber ethernet as the transmission medium.

In this mode, the ADX-2400 can support up to four ADX-120s or ADX-140s, in any combination. The ADX-2400 transmits and receives four bundles of six channels each. The transmission utilizes the Cobranet 'low-latency' mode, and results in a path latency of 2.2 milliseconds, analog to analog.

The DSPs are reconfigured to provide routing matrices for IFB source selection, PGM source selection, Talkback output configuration, and 4-wire port assignments for the PL channels.

Bundle numbers are set automatically depending on the assigned system ID numbers for the remote devices (ADX-120, ADX-140).

To select ANNOUNCE BOOTH mode, turn section 3 of the options dipswitch on the sub-panel (ON and press the Reset button.



Options Dipsw ^ ^ System ID Switch ^ Reset Button

LOW-LATENCY OPERATION IN NORMAL MODE

Starting with Version 5.1 firmware, it is possible to operate the ADX-2400D in normal mode, but with low-latency transmission. Low-latency transmission reduces the path delay from one ADX-2400D to another ADX-2400D from approximately 7 milliseconds (standard mode) to approximately 2.8 milliseconds (low-latency mode).

This mode is useful if using ADX-2400's for IFB returns or some other delay-critical application.

Note that the ADX-2400s on both ends must operate in the same mode (either low-latency or standard) for audio transmission to occur.

Low-latency operation requires that the ADX-2400D be equipped with a revision J or later Cobranet interface module. If an earlier version module is installed, and fault message will be displayed, and low-latency operation is not possible.

Also, note that low-latency operation puts more demands on the network performance. Ethernet switches which operate comfortably with standard-latency operation may not be satisfactory with low-latency operation. Gigabit ethernet switches are recommended to insure satisfactory operation.

To configure the ADX-2400D for low-latency operation, turn on Options Dipswitch #4, and press Reset.

An '**LL**' indicator will be present in the upper right corner of the display, indicating low-latency operation is selected.

Note that low-latency operation is automatically selected when in Announce Booth mode, and switch 4 will have no effect.

QUICK OPERATION GUIDE - NORMAL MODE

- **To Select Output Channel (or Channels) to Adjust**
Press 'OUTPUT SELECT' button, and turn knob until desired channel is selected. Repeated presses of the 'OUTPUT SELECT' button will advance the selection to the first channel of the next group of eight individual channels, or to the next group selection. The order of the channel selection is as follows:

Local (AES) Output 1 through 24 (Individual Outputs)

Local Outputs 1-8 (Group)

Local Outputs 9-16 (Group)

Local Outputs 17-24 (Group)

All Local Outputs (Group)

Net (Transmitted to Ethernet) **Output 1 through 24** (Individual Outputs)

Net Outputs 1-8 (Group)

Net Outputs 9-16 (Group)

Net Outputs 17-24 (Group)

All Net Outputs (Group)

Note that if a group of outputs is selected, any setup adjustments (source, level, delay) will be applied to all output channels within that group.

The VU Meter and Headphone Jack will follow the output selection. If a group is selected, there will be no VU display or headphone output.

- **To Select Source** (for current output or group of outputs)
Press 'SOURCE' button. It will light, and the currently-selected source for the selected output will be displayed. The sources available for each output are as follows, and can be selected by turning the knob.

SILENCE	The output will be muted
LOCAL INPUT	The output will be fed by the corresponding local AES input
NET INPUT	The output will be fed by the corresponding network receiver
888HZ TONE	The output will be fed by the internal 888 Hz tone generator
560 HZ TONE	The output will be fed by the internal 560 Hz tone generator

You may enable a 'stereo summing' mode by selecting any of the following choices, which follow the above sources in the menu list. In these modes, the selected source will be combined with the selected source for the other channel in the even/odd pair; e.g., channels 1 and 2, channels 3 and 4, etc. When a 'something + mix' source is selected, the mixed signal is reduced by 6 dB.

SILENCE + MIX	The output will be silence and the other channel mixed
LOCAL + MIX	The local AES input mixed with the other channel of the pair
NET INPUT + MIX	The network receiver mixed with the other channel of the pair
888HZ TONE + MIX	888Hz tone mixed with the other channel of the pair
560 HZ TONE +MIX	560Hz tone mixed with the other channel of the pair

- **To Adjust Level** (for current output or group of outputs)
The output level can be adjusted in 0.25 dB increments. Maximum gain is +12 dB. To adjust, press the 'LEVEL' button, and turn the knob.
- **To Adjust Delay** (for current output or group of outputs)
The delay of each output can be independently adjusted from zero delay through 680 milliseconds, which corresponds to more than 20 frames at 30 frames/sec. The delay is adjusted by first pressing the 'DELAY' button, then turning the knob to adjust. Note that the displayed units (milliseconds or frames) is selected in the menu.
- **To Adjust Headphone Volume**
Press the 'HP VOLUME' button, and turn the knob. The bar graph display will show the knob 'position'.
- **To Configure Menu Items**
The system has several configuration items which may be set by using the menu function. Press the 'MENU SELECT' button to enable the menu function. Turn the knob to select the desired menu item, then press the 'MENU SET' button. Turning the knob will now change the parameter for this item. When the desired selection is made, you can exit the MENU SET mode by pressing any other button. (See section on menu items below).

MENU ITEMS - NORMAL MODE

Item 01 – RX 1-8 Bundle (000-999)

Packet assignment for network receiver 1, which corresponds to audio channels (net inputs) 1-8. This number should be set to match the bundle number of the transmitter in another unit which is sending audio to this receiver. Note that bundle 000 is inactive (off). Bundles 001-255 are broadcast bundles, and should only be used if one transmitter is sending to more than one receiver. Bundles 256-999 are unicast bundles, and should be used for normal point-to-point, one transmitter/one receiver operation.

Item 02 – RX 9-16 Bundle (000-999)

Packet assignment for network receiver 2, which corresponds to audio channels (net inputs) 9-16.

Item 03 – RX 17-24 Bundle (000-999)

Packet assignment for network receiver 3, which corresponds to audio channels (net inputs) 17-24.

Item 04 – TX 1-8 Bundle (000-999)

Packet assignment for network transmitter 1, which corresponds to audio outputs NET 01 – NET 08.

Item 05 – TX 9-16 Bundle (000-999)

Packet assignment for network transmitter 2, which corresponds to audio outputs NET 09-NET 16.

Item 06 – TX 17-24 Bundle (000-999)

Packet assignment for network transmitter 3, which corresponds to audio outputs NET 17 – NET 24.

Item 07 – Conductor Priority (Low – Normal – High)

This item determines the priority of this unit to operate as the 'sync generator' for the Ethernet audio network. It should normally be set to 'Normal' unless you specifically want this unit to be the conductor, in which case it could be set to high. If set to high, this unit will be the conductor unless another is also set high. In the case where more than one unit has equal priority, the first unit active will assume the conductor role. This selection isn't too important, since the network will quickly re-negotiate a new conductor if the current conductor were to fail or be turned off.

Item 08 – Delay Units (Milliseconds – Frames (30) – Frames (25))

This item selects the units used to display the delay values. It only affects the display, and if set to Frames, saves the user having to do the arithmetic in his head. It assumes 33 milliseconds for 30 Frames/sec, and 40 milliseconds for 25 Frames/sec.

Item 09 - GPI Mode = (Off, Master)

For future or special application use. Should be set to 'Off' normally.

Item 10 - GPI 1/3 Device ID = (00-99)

Item 11 - GPI 2/4 Device ID = (00-99)

For future or special application use. Should be set to '00' normally.

- Item 12 - Save To User Config 1**
- Item 13 - Save To User Config 2**
- Item 14 - Save To User Config 3**

There are three user setup files, and these three menu items allow the current configuration to be saved to these user config files. To save configuration settings, select the appropriate item number and press 'MENU SET'. The configuration will be saved to the selected file.

Note that 20 seconds after any configuration change, the current settings are automatically saved to a default configuration, which will be automatically loaded at power-up. This is separate from the User Configuration files above.

- Item 12 - Recall User Config 1**
- Item 13 - Recall User Config 2**
- Item 14 - Recall User Config 3**

Selecting one of these three items and pressing 'MENU SET' will cause the settings previously saved in the selected User Config file to be recalled.

Item 15 - Recall Standard Config

Pressing the 'MENU SET' button will recall a 'standard configuration'. All levels will be set to unity, all delays will be set to zero, all local outputs will have their sources set to NET, and all network outputs will have their sources set to LOCAL. All bundle numbers will be set to 000.

The following items are STATUS items, and are only to display status information. They may not be directly changed by the user.

Status Item 01 – NET RX 1 Status (Active or Idle)

Displays ACTIVE status if data is being received by network receiver 1. This receiver corresponds to net inputs 1-8. Note that the data could be silence; an active receiver doesn't necessarily mean that there is audio present.

Status Item 02 – NET RX 2 Status (Active or Idle)

Same for receiver 2, which corresponds to net inputs 9-16.

Status Item 03 – NET RX 3 Status (Active or Idle)

Same for receiver 3, which corresponds to net inputs 17-24.

Status Item 04 – NET TX 1 Status (Idle or Number of Receivers)

If this transmitter is turned off (bundle = 000), or if it is set to a unicast bundle (bundle = 256-999) with no corresponding receiver present, this status item will indicate IDLE status. The transmitter is not putting any data on the network.

Otherwise, it will indicate the number of receivers listening to this transmitter. The network only counts receivers up to four, so if there are more than three receivers present, the status item will report ">3 Rcvrs".

Note that unless the status is IDLE, the transmitter is putting data on the network. If assigned as a broadcast bundle (001-255), the status could be " 0 Rcvrs ", if no receivers were listening to this bundle number. The data is still present on the network.

Net TX 1 corresponds to net outputs 1-8.

Status Item 05 – NET TX 2 Status (Idle or Number of Receivers)

Same as above for net outputs 9-16.

Status Item 06 – NET TX 3 Status (Idle or Number of Receivers)

Same as above for net outputs 17-24.

Status Item 07 – Conductor Status (Another Unit or This Unit)

Indicates if the network conductor ('sync generator') is this unit or not.

Status Item 08 – PCB Temperature (degrees Celsius)

Indicates temperature of sensors on main PCB. Normal temperature is in the 40-48 degree range. A high temperature indication might indicate a fan failure, and will cause a fault message to be displayed if the temperature exceeds 55 degrees C.

(continued)

Status Item 09 – System ID (00-99)

Displays two-digit system (frame) ID, as determined by the rotary switches on the front edge of the pcb, behind the front panel. These two digits are used as the last octet of the network IP address (192.168.100.xx), and the last part of the Cobranet system name (Lance ADX2400D-xx). This IP address and system name appear when using the Cobranet 'Discovery' application to report network node status.

Status Item 10 – Firmware Version

Displays the version and date of the installed firmware.

System Configuration In Normal Mode

The ADX-2400 is designed to provide delay, level control and distribution for effects or commentary audio. The system can be used for stand-alone delay of 24 audio channels, or can be used to transmit and receive audio signals via a standard Ethernet data network (24 transmit and 24 receive channels simultaneously), or the combination of both functions.

The system is 'output oriented'. It can be thought of as having 48 outputs: 24 'local' outputs on the rear panel, and 24 'network' outputs which are sent to the Ethernet network. Each of these 48 outputs can be set up as follows:

SELECT SOURCE:

SILENCE, LOCAL INPUT, NETWORK INPUT, TONE1 (888HZ), or TONE2 (560Hz), (or the one of the above sources mixed with the source from the other channel of the even-odd pair, for stereo summing)

ADJUST LEVEL:

OFF to +12DB in 0.25DB steps

ADJUST DELAY:

0 milliseconds to 680 milliseconds (20 frames in 30fps), in 1 millisecond steps

The configuration of each output is independent, although you can select groups or all to save setup time if you are setting them all to be the same.

The unit should also be thought of as having 48 inputs: 24 AES inputs on the back panel, and 24 inputs from the network receivers.

Application Examples:

For stand-alone delay, all outputs would be set to 'local input', and level and delay adjusted as desired. The network tx/rx would not be used.

For transmitting effects to another truck, and inserting delay in the path: The network outputs would be set to 'local inputs', routing the analog audio inputs to the network transmitters. Delay and level adjustment could be done as desired. The local outputs could also be set to 'local inputs', providing an independent local delay. Alternatively, the local outputs could be set to 'network inputs', and these used as network receivers for audio coming back from the other truck.

Distribution of effects or other audio to multiple trucks could be accomplished by transmitting the audio using broadcast bundles, and receiving at each point of use. Delay and levels could all be adjusted independently at the receivers, or globally at the network transmitters.

Saving and Recalling Configurations

The menu settings and the source, level, and delay settings are stored automatically after 20 seconds of panel inactivity in a 'default' flash memory. This is the memory which is restored automatically when the unit is first powered up.

You may also save configurations in three user memories. Select the desired memory by selecting Menu Item 09-11. When the 'MENU SET' button is pressed, the current configuration will be saved to the selected user memory.

To recall one of these user memories, select the desired memory by choosing menu item 12-14. When the 'MENU SET' button is pressed, all config data saved in that user memory will be recalled and immediately applied to the audio hardware.

Factory default or 'standard' configuration may be recalled by selecting menu item 15 and pressing 'MENU SET'. It may also be recalled on power up or reset by turning on options dipswitch section 1.

The factory default sets all levels to unity, all delays to zero, local output sources to net inputs, and net outputs to local inputs. All bundle numbers are set to zero.

Dipswitch functions (Ver 5.1 firmware)

There is an Options Dipswitch located behind the front panel, accessible by removing the thumbscrews on either side of the front panel.

Section 1 - Causes factory defaults to be loaded at power-up. Normally OFF.

Section 2 - Unused

Section 3 - Puts ADX2400D into 'Announce Booth Mode' when ON.

Section 4 - Selects Low-Latency operation in Normal Mode when ON.

Section 5 - Selects older remote control protocol for use with early ADX120/140s.

Section 6 - Locks USER CONFIG 3 (inhibits saves to this config memory)

Section 7 - Locks Channel Setups (level, source, delay) when ON.

Section 8 - Locks Menu Selections when ON.



Options Dipsw ^

^ System ID Switch

^ Reset Button

QUICK OPERATION GUIDE - ANNOUNCE BOOTH MODE

- **Selecting Output Channels and Assigning Sources**

Press 'OUTPUT SELECT' button, and turn knob until desired channel is selected. Repeated presses of the 'OUTPUT SELECT' button will advance the selection to the first channel of the next group of eight individual channels. The order of the channel selection is as follows:

Local Outputs 1 to 8 - Microphone Outputs (A1, A2, B1, B2, etc.)

Local Outputs 9 to 16 - Talkback Outputs*

Local Outputs 17 to 24 - 4-Wire PL Port Outputs

Net Outputs 1 to 8 - Selected IFB Feeds to Remote Units**

Net Outputs 9 to 16 - Selected PGM Feeds to Remote Units***

Net Outputs 17 to 24 - Assigned PLs to Remote Units****

* Any of the 8 talkback outputs may be fed by any individual talkback buttons on the remote devices (or inputs 3 and 4 of the ADX-140), or various mixed combinations. Silence or tones may also be selected. These selections are made by selecting the desired output and pressing the 'SOURCE' button, then selecting the source with the knob.

** The IFB feeds going out on the network to the remote units may be fed from any of the 8 physical IFB inputs. The selections are made using the 'SOURCE' button, as above. Any physical input may feed more than one IFB.

*** The PGM (Non-Interrupt) feeds going out on the network to the remote units may be fed from any of the 8 physical PGM inputs. The selections are made using the 'SOURCE' button, as above. Any physical input may feed more than one PGM.

**** Any of the PL channels at the remote devices may be assigned to any of the 4-wire ports on the back panel of the ADX-2400 by selecting Net Outputs 17 to 24, then pressing 'SOURCE'. The assignments will be made automatically for both 4-wire directions. (That's why there is no source assignment available for local outputs 17-24). The internal 4-wire matrix takes care of all necessary mix-minus generation for the PLs automatically, so any remote device PLs assigned to the same 4-wire port will be able to talk to each other. This is similar to the 'party-line' function in the Telex Adam system, but it happens automatically.

The VU Meter and Headphone Jack will follow the output selection.

- **To Adjust Level** (for current output)

The output level can be adjusted in 0.25 dB increments. Maximum gain is +12 dB. To adjust, press the 'LEVEL' button, and turn the knob.

We suggest that output levels only be adjusted in special circumstances. In most cases the levels should all be left in the Unity (0.00dB) settings.

There is no DELAY available in the Announce Booth mode.

- **To Adjust Headphone Volume**
Press the 'HP VOLUME' button, and turn the knob. The bar graph display will show the knob 'position'.
- **To Configure Menu Items**
The system has several configuration items which may be set by using the menu function. Press the 'MENU SELECT' button to enable the menu function. Turn the knob to select the desired menu item, then press the 'MENU SET' button. Turning the knob will now change the parameter for this item. When the desired selection is made, you can exit the MENU SET mode by pressing any other button. (See section on menu items below).

MENU ITEMS - ANNOUNCE BOOTH MODE

Item 01 – ANNOUNCE UNIT A ID = (00-99)

This item selects which physical remote device will appear as Unit A in the ADX-2400. The mic outputs of the selected device will appear as Mic A1 and A2, the IFBs will appear as IFB A1 and IFB A2, etc.

The number selected corresponds to the System ID set on the rotary switches of the remote device. 01 through 99 are valid IDs. 00 is off, and selects no remote device for Unit A.

Item 02 – ANNOUNCE UNIT B ID = (00-99)

Item 03 – ANNOUNCE UNIT C ID = (00-99)

Item 04 – ANNOUNCE UNIT D ID = (00-99)

Same as above for Units B, C, and D. Note that each remote device on the network must have a unique ID number, and that a given remote device should only be assigned once; in other words don't assign the same unit to be both Unit A and Unit B.

Item 05 - GPI Mode = (Off, Master)

For future or special application use. Should be set to 'Off' normally.

Item 06 - GPI 1/3 Device ID = (00-99)

Item 07 - GPI 2/4 Device ID = (00-99)

For future or special application use. Should be set to '00' normally.

- Item 08 - Save To User Config 1**
- Item 09 - Save To User Config 2**
- Item 10 - Save To User Config 3**

There are three user setup files, and these three menu items allow the current configuration to be saved to these user config files. To save configuration settings, select the appropriate item number and press 'MENU SET'. The configuration will be saved to the selected file. Menu settings and Source assignments are saved.

Note that 20 seconds after any configuration change, the current settings are automatically saved to a default configuration, which will be automatically loaded at power-up. This is separate from the User Configuration files above.

- Item 11 - Recall User Config 1**
- Item 12 - Recall User Config 2**
- Item 13 - Recall User Config 3**

Selecting one of these three items and pressing 'MENU SET' will cause the settings previously saved in the selected User Config file to be recalled.

Item 14 - Recall Standard Config

Pressing the 'MENU SET' button will recall a 'standard configuration'. This configuration is as follows:

Unit A ID = 01
Unit B ID = 02
Unit C ID = 03
Unit D ID = 04

Talkback Output 1 [Physical Out 9] = Unit A TB 1
Talkback Output 2 [Physical Out 10] = Unit A TB 2
Talkback Output 3 [Physical Out 11] = Unit B TB 1
Talkback Output 4 [Physical Out 12] = Unit B TB 2
Talkback Output 5 [Physical Out 13] = Unit C TB 1
Talkback Output 6 [Physical Out 14] = Unit C TB 2
Talkback Output 7 [Physical Out 15] = Unit D TB 1
Talkback Output 8 [Physical Out 16] = Unit D TB 2

IFB A1 = Physical Input 1 [IFB In 1]
IFB A2 = Physical Input 2 [IFB In 2]
IFB B1 = Physical Input 3 [IFB In 3]
IFB B2 = Physical Input 4 [IFB In 4]
IFB C1 = Physical Input 5 [IFB In 5]
IFB C2 = Physical Input 6 [IFB In 6]
IFB D1 = Physical Input 7 [IFB In 7]
IFB D2 = Physical Input 8 [IFB In 8]

(continued)

PGM A1 = Physical Input 9 [PGM In 1]
PGM A2 = Physical Input 10 [PGM In 2]
PGM B1 = Physical Input 11 [PGM In 3]
PGM B2 = Physical Input 12 [PGM In 4]
PGM C1 = Physical Input 13 [PGM In 5]
PGM C2 = Physical Input 14 [PGM In 6]
PGM D1 = Physical Input 15 [PGM In 7]
PGM D2 = Physical Input 16 [PGM In 8]

PL A1 = 4-Wire Port 1 [Physical Input/Output 17]
PL A2 = 4-Wire Port 2 [Physical Input/Output 18]
PL B1 = 4-Wire Port 3 [Physical Input/Output 19]
PL B2 = 4-Wire Port 4 [Physical Input/Output 20]
PL C1 = 4-Wire Port 5 [Physical Input/Output 21]
PL C2 = 4-Wire Port 6 [Physical Input/Output 22]
PL D1 = 4-Wire Port 7 [Physical Input/Output 23]
PL D2 = 4-Wire Port 8 [Physical Input/Output 24]

All Levels set to Unity [0.00 dB]

Please see the detailed Configuration section of this manual for more information.

The following items are STATUS items, and are only to display status information. They may not be directly changed by the user.

Status Item 01 – Unit A RX Status (Active or Idle)

Displays ACTIVE status if data is being received by network receiver 1. This receiver is used for audio signals coming from the remote device assigned as Unit A.

Status Item 02 – Unit B RX Status (Active or Idle)

Same for receiver 2, audio signals coming from the Unit B remote device.

Status Item 03 – Unit C RX Status (Active or Idle)

Same for receiver 3, audio signals coming from the Unit C remote device.

Status Item 04 – Unit D RX Status (Active or Idle)

Same for receiver 4, audio signals coming from the Unit D remote device.

Status Item 05 – Output Reference (Int or Ext)

Indicates the timing reference for the AES outputs. If a valid reference signal (AES silence or other AES signal) is applied to the rear panel 'AES Ref In' connector, the unit will automatically switch to the Ext mode, and AES outputs will be synchronous with the applied reference signal.

(continued)

Status Item 06 – PCB Temperature (degrees Celsius)

Indicates temperature of sensors on main PCB. Normal temperature is in the 40-48 degree range. A high temperature indication might indicate a fan failure, and will cause a fault message to be displayed if the temperature exceeds 55 degrees C.

Status Item 07 – System ID (00-99)

Displays two-digit system ID for this ADX-2400, as set by rotary switches on the sub-panel.

Status Item 08 – Firmware Version

Displays the version and date of the installed firmware.

System Configuraton In Announce Booth Mode

Configuration of the system takes place both in the ADX-2400 and in the remote devices (ADX-120/140) themselves. This configuration is all done from the ADX-2400 front panel.

There are three catagories of configuration:

1. The ADX-2400 Menu Configuration

This is where the remote devices are assigned to be Units A, B, C, and D. There are no other config items except for gpis, saving and recalling the configurations to/ from user memory files, and some status displays.

2. The ADX-2400 Channel Setup

This is where 'truck-end' routing assignments are made for the talkback outputs, IFB and Program paths, and PL ports. These assignments are made using the OUTPUT SELECT and SOURCE buttons on the ADX-2400. The LEVEL button also is available to control output levels to both the rear-panel outputs and the outputs sent to the network and thus to the remote devices. The DELAY function is not available in announce booth mode.

3. The Remote Device menus

Each remote device (ADX-120/140) has an internal menu which may be accessed remotely via the ADX-2400.

These menus configure the hardware of the remote device itself, and are specific to the particular model, i.e. the ADX-120 has different options from the ADX-140 because of differences in their hardware capabilities.

These menus configure such things as preamp gain, phantom power, IFB output configurations, headset impedance (level), button color, etc.

These remote menu settings are saved in the remote devices themselves, and will remain associated with a particular device, even if it is moved or has its system ID reassigned. These settings are not stored in the ADX-2400 at the truck.

Status of many of the remote configuration items is displayed by LEDs on the remote devices (rear panel on the ADX-120s, front panel on the ADX-140s).

Setting System ID Switches

The System ID switches on each unit allow the system to distinguish one unit from another. Cobranet bundle numbers and Ethernet IP addresses are automatically determined based on the System ID Switches.

The System ID switches are two-digit rotary switches on the rear panel of the ADX-120 and on the front panel of the ADX-140. The ADX-2400 also has System ID switches, which are behind the removeable front panel, on the PCB sub-panel.

The range for the switches is from 01 through 99 (00 is not a valid ID). No two devices may have the same ID number.

Compatibility: ADX-2400Ds with version 5.1 or later firmware may be used with earlier ADX-120s or ADX-140s by turning on Dipswitch section 5 on the 2400, and using IDs for all devices with the first (tens) digit = 0. This is provided as an emergency or interim operating mode. All devices should be upgraded to version 5.x as soon as practical.

The System ID settings for the ADX-120/140 units become the reference for the physical unit, and will be used in assigning those units to be A, B, C, and D designations in the ADX-2400 menus (see next page).

Assigning the ADX120 / ADX140 to be Units A, B, C, or D

The announce units must first be assigned to be devices A, B, C, or D in the ADX2400 menu. To do this, press the **MENU** button once, and select config items 1, 2, 3, and 4 respectively using the knob. When the desired item is selected, press the **MENU SET** button and select the appropriate System ID number for the ADX120 or ADX140 you want to assign. Pressing either SET or MENU will take you back to the item select mode.

Accessing Remote Menus from the ADX-2400

The configuration items for the ADX-120 and ADX-140 units are accessible from the front panel of the ADX-2400. To access these remote unit menus, double-click the **MENU** button on the ADX2400. The display will say: SELECT REMOTE DEVICE. The **MENU** button will be flashing to indicate that a remote device is being accessed.

The menu display will look similar to this:

```
Select Remote Device
Unit A [01] ADX120-01
```

The number in the brackets is the System ID assigned in the ADX-2400 for Unit A (in this example). If the selected device is present on the network, its model number and System ID number will be displayed (ADX120-01 in this example).

Scroll to the desired assigned device (either A, B, C or D).

Press **MENU** again. This will access the menu of the remote device, and the menu might look like this (depending on the type of device and the selected item):

```
ADX120-01 Config Item 01
Mic 1 Gain=45dB HR>30dB
```

The configuration and status items may be selected using the knob. Once the desired item is selected, press the **MENU SET** button to allow changing that item's settings. Settings are saved automatically after about 10 seconds of inactivity.

Press either **MENU SET** or **MENU** to go back to the item select mode.

When you're done, the easiest way out of any of the menu modes is to just press the **OUTPUT SELECT** button. This will cancel all menu modes, and you won't have to step backwards out of them.

ETHERNET NETWORK INFORMATION

The Ethernet transmission uses the Cirrus Audio 'Cobranet' protocol, which is an industry standard. It is a professional, highly-reliable system which packs audio data into 'bundles' of 8 (or fewer) channels. The bundles are given numbers from 1 to 999. The first 255 are 'broadcast' bundles which can be received by any number of receivers, so long as the receiver is set to the same bundle number. The rest are 'unicast' bundles, which will only be received by one receiver at a time. More Cobranet info at: <http://www.cobranet.info/en/support/cobranet/>

There are two Audio Network ports on the rear panel of the ADX-2400. These are redundant network connections, and either may be used. If desired, a redundant network connection may be established by using the second port. If both are used, the left-hand connector will be the primary, and the right the backup. If both links are established, and one is lost, audio will continue uninterrupted.

The simplest network is simply connecting two ADX-series devices together. Note that this type of connection requires a Crossover Cable, as the ports are not auto-sensing.

Most networks are established by using standard Ethernet switch(es). The switches must support Layer 2 traffic. Each ADX unit must be connected to the switch on its own port. If multiple switches are used, it is desirable for the switches to connect to each other using gigabit Ethernet. A gigabit Ethernet link allows 700 or more audio channels to be sent in each direction. A 100base/T full duplex link allows 72 channels to be sent in each direction.

Switches with built-in fiber connectivity (SFP/GBIC) are readily available and provide a powerful, inexpensive solution to fiber transmission requirements.

It is recommended that simple hubs not be used, although they will work if total network traffic is limited to 48 channels (6 bundles total)

The **indicators** on the audio network ports provide an indication of port status, as described below:

Yellow Indicator: Steadily-lit if connector is active. (Does not indicate a link or audio transmission). Flashing indicates that this unit is the 'conductor' or sync generator for the entire audio network.

Green Indicator: Steadily-lit indicates an Ethernet link. Flashing indicates packet transmission/reception.

When audio is being transmitted, the normal condition is either:

Yellow On, Green Flashing (this unit not conductor)

or

Yellow Flashing, Green Flashing (this unit is conductor)

Setting Bundle Numbers (Does not apply in Announce Booth Mode)

The 24 transmit and 24 receive audio channels in the ADX are divided into 8-channel groups. These groups are assigned to network channels or 'bundles'. There are six bundles per ADX unit, three for receive and three for transmit. Each of these bundles can be assigned a three-digit number from 000 – 999. (Note that the Cobranet system allows numbers as high as 65000, but they are limited in the ADX-2400 to 999).

- A bundle assignment of 000 is defined as inactive, and will disable this network transmitter or receiver. Audio outputs from disabled receivers will be silence.
- A bundle assignment in the range 001-255 is a Broadcast Bundle. These numbers should be used when it is desired that one transmitter be received by multiple receivers. Note that broadcast bundle data will appear on all network segments (all switch ports) and can cause network congestion if used when not required. Use broadcast bundles only when required to avoid unnecessary traffic on the network.
- A bundle assignment in the range 256-999 is a Unicast Bundle. These numbers are used for normal transmission from one transmitter to one receiver (point to point). A switch will route this traffic only to the required port and reduce unnecessary traffic on the network.

The audio transmission will usually follow the bundle assignment almost instantly, however on occasion there will be a delay of a second or two as the Cobranet hardware negotiates the connection.

Designing the Network (Please read this section!)

The Cobranet technology is very powerful, and allows for very flexible system design. It is not without limits, however. It is important to have a full understanding of how the system operates to avoid network problems, and therefore to avoid audio problems.

Here are some important things to know:

- There are limits to the number of audio channels which may be present on any given network. The network connection on the rear panel of the ADX-2400 is a 100 Mbit/sec Ethernet connection. As transmitted by the ADX, each audio channel requires approximately 1 Mbit/sec of bandwidth, so each bundle (8 Channels) requires 8 Mbit/sec.
- Because of the additional control and timing data, each 100 Mbit/sec network segment can handle a maximum of 9 bundles.

- Exceeding this bandwidth limit will cause dropouts in the audio, and in severe cases may cause other problems such as sync and control problems.
- An Ethernet switch or switches, which generally form the network, can partition the traffic so that bundles only go to the receivers which are listening to them. Since each ADX frame only has three receivers, this can eliminate network traffic problems if each bundle is a unicast bundle (one transmitter to one receiver). The switch will route the traffic only to the required receiver.
- Broadcast bundles (bundle numbers 001-255) can NOT be isolated by the Ethernet switch. They will appear on ALL network segments, regardless of receivers. You should use broadcast bundles only when required, and be aware that they add to the traffic on all segments of the network.
- The bottleneck for network will usually be the receive side of the network segments connecting the ADX frames. The network segment connecting to an ADX frame will see all unicast bundles being received by that frame, plus ALL broadcast bundles on the network. This total number of bundles can not exceed 10 (9 is better). (This number does not include bundles being transmitted by this frame).

The broadcast bundles are a very powerful feature, in that they allow very convenient and inexpensive distribution of lots of audio signals. Using broadcast bundles can really clog up the network, however, so be aware of the tradeoffs, and use them only when required.

If the network traffic becomes too heavy, and audio packets are being dropped, the ADX front panel buttons will flash, and a "NETWORK ERRORS" warning message will be displayed.

Some other things to know about the network operation:

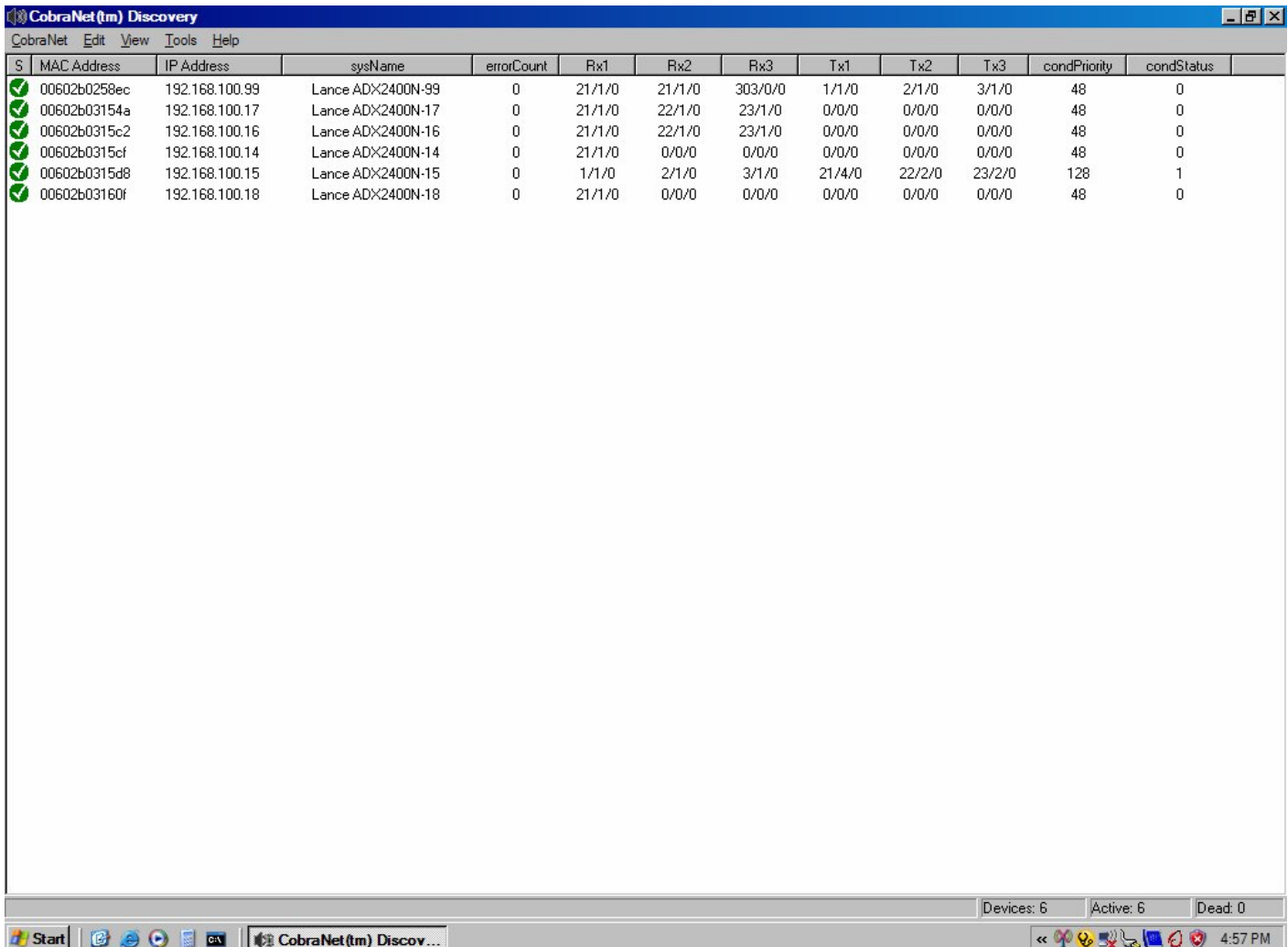
- Because of the way Ethernet works, the ADX frames can not see their own transmissions. This means that if you dial a transmitter and receiver (in the same ADX unit) up to the same bundle number, the transmitted audio will NOT appear on the receiver outputs. Select 'local' as the source instead.
- Only one ADX receiver can listen to a given unicast bundle. If you assign two receivers to the same unicast bundle, only the first will output audio. Broadcast bundles can be repeated on multiple receivers, either in separate frames or in the same frame (for multiple copies of the same audio).
- All audio on the network is 20-bit uncompressed. It takes a fixed amount of bandwidth, regardless of the audio content.

Cobranet 'Discovery' PC Application

Cirrus Logic, the developers of Cobranet, make available on their website a nice PC application called 'Cobranet Discovery', or 'Disco'. It can be downloaded and installed on any PC running Windows XP. It allows the computer to be attached to the audio network and provides a variety of information about the attached network devices. Documentation is available on their website: www.cobranet.info, or at www.lancedesign.com.

The PC TCP/IP network properties must be set for a fixed IP address (not DHCP), and a subnet mask. The firmware in the ADX-2400s sets their IP addresses to 192.168.100.xx, where xx is the System ID, set by the rotary switches on the PCB behind the front panel.

I recommend setting the PC IP Address to 192.168.100.200, although any number 001 to 254 is fine for the last octet provided the address doesn't conflict with the addresses of any ADX-2400s on the network. The subnet mask should be set to 255.255.255.0.



The screenshot shows the CobraNet(tm) Discovery application window. The window title is "CobraNet(tm) Discovery" and it has a menu bar with "CobraNet", "Edit", "View", "Tools", and "Help". The main area contains a table with the following columns: S, MAC Address, IP Address, sysName, errorCount, Rx1, Rx2, Rx3, Tx1, Tx2, Tx3, condPriority, and condStatus. There are six rows of data, each with a green checkmark in the 'S' column. The status bar at the bottom right shows "Devices: 6", "Active: 6", and "Dead: 0". The Windows taskbar at the bottom shows the Start button, several icons, and the system clock at 4:57 PM.

S	MAC Address	IP Address	sysName	errorCount	Rx1	Rx2	Rx3	Tx1	Tx2	Tx3	condPriority	condStatus
✓	00602b0258ec	192.168.100.99	Lance ADX2400N-99	0	21/1/0	21/1/0	303/0/0	1/1/0	2/1/0	3/1/0	48	0
✓	00602b03154a	192.168.100.17	Lance ADX2400N-17	0	21/1/0	22/1/0	23/1/0	0/0/0	0/0/0	0/0/0	48	0
✓	00602b0315c2	192.168.100.16	Lance ADX2400N-16	0	21/1/0	22/1/0	23/1/0	0/0/0	0/0/0	0/0/0	48	0
✓	00602b0315cf	192.168.100.14	Lance ADX2400N-14	0	21/1/0	0/0/0	0/0/0	0/0/0	0/0/0	0/0/0	48	0
✓	00602b0315d8	192.168.100.15	Lance ADX2400N-15	0	1/1/0	2/1/0	3/1/0	21/4/0	22/2/0	23/2/0	128	1
✓	00602b03160f	192.168.100.18	Lance ADX2400N-18	0	21/1/0	0/0/0	0/0/0	0/0/0	0/0/0	0/0/0	48	0

Installation

The ADX-2400D is designed to be installed in a standard 19" equipment rack. There is a cooling fan on the rear panel which draws air in through the sides of the cabinet and exhausts hot air through the rear panel. The unit should not be installed in such a way as to block the vents on the side panels, or air flow from the rear panel fan.

The unit is designed to operate on 95-250 volts AC, 50 or 60 Hz. The power supply is an wide-range switching supply, so no voltage selection needs to be made.

Power consumption is approximately 15 watts.

The AES audio input and output connections are made through BNC connectors on the rear panel. Each BNC connector corresponds to an AES pair, i.e. Input 1 is the connector for channels 1 and 2, Input 2 is the connector for channels 3 and 4, etc.

The input connectors are AC-terminated in 75 ohms (you won't see this termination with a DC meter), and require a nominal 1 volt p-p AES signal. The outputs provide a 1 volt p-p signal into 75 ohms. Inputs and outputs correspond to the AES specs for unbalanced (BNC) transmission.

The AES Reference Input is also a 75-ohm terminated input, requiring nominally 1 volt p-p. The applied signal should be AES Silence, Tone, or other AES signal. The input is not designed to accept 48-Khz word clock. The 12 outputs will be frequency and phased locked to this reference regardless of input or network timing.

There are no restrictions on the timing or locking of any of the 12 input signals. They will be synchronized in the unit to the network clock.

All AES audio into the ADX-2400D should have emphasis turned off, as emphasis is not supported internally. The output channel status bits will indicate NO EMPHASIS.

The coax cables should be supported in such a way as to prevent weight being applied to the rear of the ADX-2400. The rack mounting flanges are sufficient to support the unit itself, but not additional loading of the heavy I/O cables.

The Ethernet 'Audio Network' ports (one or both) should be connected to the network with standard CAT5 RJ-45 cables, following normal IT practice. The ports are 100/baseT Ethernet. The connectors on the ADX-2400 are wired with the same pinout as normal PC ports, and are not auto direction sensing. If connecting two units together without a switch, a crossover cable must be used.

It is not possible to 'daisy-chain' units together. The two ports do not function as 'loop-through'. Each unit should be connected to a separate switch port.

The maximum length for 100/baseT Ethernet on copper is 100 meters. For longer runs there must be a repeater (switch) or media converter (fiber) in the path. See the Cobranet website (www.cobranet.info) for more information.

Reliability Considerations

Since on-air audio is often handled by the ADX systems, reliability is of primary concern. The ADX-series products are designed with highest-quality components and conservative ratings so as to be as reliable as possible.

In addition, after manufacture, the ADX products undergo an extensive burn-in process which includes power and thermal cycling to attempt to precipitate out any early-life failures.

Even with these precautions failures are not impossible, and in addition there are other components to the system such as Ethernet switches which must also be considered in evaluating the overall reliability question.

Here are some thoughts on insuring a reliable on-air system:

- Provide a spare announce box and headset. This practice has been going on for decades with analog systems, and it's still a good idea. It protects against failure of the ADX-120 and the headset.
- Use the ADX-8000 Switch with redundant power supplies for both the switch and the ADX-120s and ADX-140s. The ADX-8000 also supports fiber trunking for redundant links.
- Insure a reliable AC power source in the remote location for the ADX units and for the Ethernet switch. If there is any question about the reliability of the AC supply you might consider using a small UPS power supply to provide battery backup. A small 500 watt unit intended for personal computer use will provide a half-hour of typical operation in the event of power failure.
- Use reliable Ethernet hardware such as switches, fiber GBICs, etc. Burn in new switches for a few days before putting them on the air. Keep all Ethernet cables and fiber in good condition.
- Many switches have two or more fiber ports available. If the switches support 'trunking' or 'port aggregation' and most do, two fiber runs could be connected between switches, thus protecting against fiber and GBIC failure.
- Consider using standard IT methods for providing a fault-tolerant network, if practical and warranted. Redundant switches and parallel networks may be used. ADX-120s and ADX-140s with version 5.0 or later firmware include a sophisticated method of selecting the active ethernet connection based on both link status and the presence of audio packets. Contact Lance Design for more information.

Physical Inputs and Outputs in Announce Booth Mode*

(*Channel numbers, not BNC connector numbers)

Outputs:

Out 1	Mic A1 Out	(ADX120 Hdst Mic; ADX140 Input 1)
Out 2	Mic A2 Out	(ADX120 Rear Panel; ADX140 Input 2)
Out 3	Mic B1 Out	
Out 4	Mic B2 Out	
Out 5	Mic C1 Out	
Out 6	Mic C2 Out	
Out 7	Mic D1 Out	
Out 8	Mic D2 Out	
Out 9	Talkback Output 1	(Each physical Talkback output may be fed by any of the Talkback paths from the ADX-120s, Inputs 3 and 4 from the ADX-140s, or various mixes)
Out 10	Talkback Output 2	
Out 11	Talkback Output 3	
Out 12	Talkback Output 4	
Out 13	Talkback Output 5	
Out 14	Talkback Output 6	
Out 15	Talkback Output 7	
Out 16	Talkback Output 8	
Out 17	4-Wire PL Port 1 Out	(Each PL channel at the ADX-120/140s may be assigned to any of the 4-wire ports.)
Out 18	4-Wire PL Port 2 Out	
Out 19	4-Wire PL Port 3 Out	
Out 20	4-Wire PL Port 4 Out	
Out 21	4-Wire PL Port 5 Out	
Out 22	4-Wire PL Port 6 Out	
Out 23	4-Wire PL Port 7 Out	
Out 24	4-Wire PL Port 8 Out	

Inputs:

Input 1	IFB In 1	(Each IFB output at the ADX120/140s may be fed from any if the eight physical IFB inputs)
Input 2	IFB In 2	
Input 3	IFB In 3	
Input 4	IFB In 4	
Input 5	IFB In 5	
Input 6	IFB In 6	
Input 7	IFB In 7	
Input 8	IFB In 8	
Input 9	PGM In 1	(Each PGM output at the ADX120/140s may be fed from any of the eight physical PGM inputs)
Input 10	PGM In 2	
Input 11	PGM In 3	
Input 12	PGM In 4	
Input 13	PGM In 5	
Input 14	PGM In 6	
Input 15	PGM In 7	
Input 16	PGM In 8	
Input 17	4-Wire PL Port 1 In	(Input side of 4W PL Interface. See above)
Input 18	4-Wire PL Port 2 In	
Input 19	4-Wire PL Port 3 In	
Input 20	4-Wire PL Port 4 In	
Input 21	4-Wire PL Port 5 In	
Input 22	4-Wire PL Port 6 In	
Input 23	4-Wire PL Port 7 In	
Input 24	4-Wire PL Port 8 In	

Remote Control Connector Pinout

Connector is RJ-45 Female

Pin #	Function
1	GPI 1
2	GPI 2
3	+5 Volts
4	Ground
5	RS232 Data In (RX)
6	RS232 Data Out (TX)
7	GPI 3
8	GPI 4

GPIs used as inputs are TTL-compatible, pulled up to +5 volts with a 5K resistor. They should be pulled to ground with a dry switch closure or O.C. transistor to activate

GPIs used as outputs are open-collector transistors with a 5K pull-up resistor to +5 volts. These transistors pull to ground when the GPI is active. Current should not exceed 200 Ma.

When ADX-2400 is in Master GPI mode, GPIs 1 and 2 are outputs, and GPIs 3 and 4 are inputs.

ADX-2400D Specifications

Local Input Channels	24 AES on 12 unbalanced (BNC female) connectors, 1v p-p
Local Output Channels	24 AES on 12 unbalanced (BNC female) connectors, 1v p-p
AES Reference Input	AES Silence or other AES signal. BNC connector, 75-ohm, 1v p-p
Output Phase Lock Accuracy	+/- 1% of sample period (+/- 200 ns)
Input Phase Requirements	None. Inputs may be free-running
Sample Rate Converters	Highest-quality AD1895. Converters on both inputs and outputs.
Output Impedance	75 Ohms, transformer coupled
Input Impedance	75 Ohms AC termination, transformer coupled
Digital Processing and Delay	24-bit uncompressed
Cobranet Transmission	20-bit uncompressed
Sample Frequency	48 kHz
Adjustable Delay Range	0 milliseconds to 680 milliseconds (>20 frames at 30 fps)
Minimum Delay (AES in to AES out)	1.5 milliseconds
Minimum Delay (through Ethernet)	6.5 milliseconds in standard mode, 2.5ms in low-latency mode
Headphone Jack	1/4" TRS (Stereo) follows Output selection, Low impedance
Menu	Selects Cobranet bundle numbers (address), config store/recall
Remote Control	GPI and RS-232 for special applications. Contact Lance Design
VU Meter	Conventional VU ballistics (300ms), -20 to +3.5 dB scale, follows Output selection. Scale mark at 0 VU.
Display	2x24 VFD
Power Requirements	95 to 250 Volts AC, 50-60 Hz, 15 Watts