LANCe
DESIGN

ADX-120E

ANNOUNCER UNIT

[ENTERTAINMENT VERSION]

Operation Manual

Firmware Version 5.0

ADX-120E

DESCRIPTION

The ADX-120E Commentary Unit (announce box) is designed to provide an 'all-in-one' facility for live broadcast announcer requirements, with all audio and control between the mobile unit and the booth being transported by standard Ethernet, on either copper or fiber. It is tailored to the requirements of entertainment productions, but may be useful in a wide variety of production environments.

A single ADX-120E unit provides the following functions:

1) Two high-quality microphone channels; one on a front panel XLR for headset use, and a second on a rear-panel XLR.

2) A Program Channel and two (2) Communications channels to the announcer's headset. There are three volume controls on the top of the unit to control the headset mix of these sources. Each of the three may be routed to the left ear only, right only, or both.

3) A two-channel wet (RTS-Format) IFB. This output has enough DC current available to operate two IFB beltpacks. This output may also be switched to a dry balanced output, selectable to either of the two program channels.

4) A two-channel wet (RTS-Format) TW intercom. There are two active hybrids in the unit, one for each channel. The truck-end connections are four-wire, and so this eliminates the need for external 4W to 2W converters. The DC current available is sufficient to operate two BP325-type beltpacks. There are noise gates on the TX side of the hybrids, so that any trans-hybrid leakage is minimized on the truck (4W) end.

5) An illuminated, latching "ON AIR" button, and two talk buttons for the two communications channels assigned to the headset. Colors may be assigned via the remote control (from the ADX2400) menus.

Other features include:

1) Power provided by the ethernet connection. The ADX-120E adheres to the 802.3af POE specifications, but this standard does not allow sufficient power for four RTS beltpacks. Lance Design has available a 1RU switch/power supply (ADX-8000) which provides robust power for up to eight ADX-120Es, with ample reserve for the full beltpack complement. In addition, this supply contains redundant, load-sharing high-efficiency power supplies with fault indication for maximum reliability, and provides the ethernet switch and fiber interface functions..

(continued)

ADX-120E Features - continued

2) The unit is very compact, and simple to implement. In a typical application, a single CAT5E cable connects each announce box to an ADX-8000 switch/power supply, or other equipment providing ethernet connectivity and DC power.

3) There are several methods of providing partial or full network redundancy. Each ADX-120E has two ethernet ports, which allow for a completely redundant network, if desired. In addition, most ethernet switches have trunking or 'port aggregation' capability, which allows redundant fiber (or copper) connections between switches. Contact Lance Design for more information.

4) The audio quality is very high. The microphone preamps are extremely low-noise, transparent parts made by THAT Corp (formerly DBX), and considered to be some of the industry's best. Preamp gain is remotely-controlled over a wide range, with peak hold headroom indication provided.

   Having the preamps almost right at the microphone connector eliminates interference, capacitive roll-off, and noise caused by long cable runs. The A/D converters are highest-quality 24-bit devices, and the digital audio paths are all 20-bit uncompressed. Talkback, IFB and PL circuits are all full bandwidth, program-quality channels, so all of these paths are extremely clean, and provide excellent audio quality to the announcers' headsets and the PLs.

5) Latency through the ethernet transport is low. From the microphone connector to the audio output at the truck is approximately 2.2 milliseconds. The IFB and PL paths are the same.

System Overview

The ADX announce system consists of the following elements:

- One or more ADX-2400 frames which serve as the 'head end' or truck end of the system, and provide all inputs and and outputs for the truck or control room.

- One or more ADX-120E Announce Boxes or ADX-140 Interface Frames which function as the remote units in the booth or other remote location.

- ADX-800 or other 48-volt power supplies as required to power the ADX-120E units.   48 volts DC should be applied to the spare pairs in the Cat 5 cable.

- Network infrastructure as required, consisting of standard layer-2 Ethernet switches, fiber optic elements, media converters, fiber and copper interconnects, etc. This is referred to in this manual as 'the network'.

Each ADX-2400 unit can support up to three ADX-120E units, operating in the 'normal' mode (not announce booth mode)

The Truck End

ADX-2400 Front Panel

The ADX-120E Commentator Units connect via Ethernet (copper or fiber) to a standard ADX-2400 Audio Distribution unit in the truck.   These units are available in either analog or AES configurations, and have been well-proven through several years of widespread application in high-end mobile units and other applications.

Front panel metering and headphone monitoring is available for all paths.

ADX-2400N Rear Panel

All DB25 connectors are wired in the industry-standard Tascam/Pro Tools format, and breakout cables and pre-wired jackfields are available from a wide variety of suppliers.   One is Audio Accessories, Inc.   (www.patchbays.com)

Audio Routing and Configuration

NOTE: The ADX-120E utilizes channels differently than the standard ADX-120, and the nomenclature and routing available in the ADX-2400 when in the announce booth mode are not applicable and will be confusing. The ADX-2400 should be operated in the NORMAL mode (dipswitch #3 off).

The 'Low-Latency' mode must be selected, however (dipswitch #4 ON).

The remote devices are identified by the ADX-2400s by a **SYSTEM ID** number, which is set by a two-digit rotary switch on the remote device (rear panel of the ADX-120E, front panel of the ADX-140).   Each remote device must be set to a unique system ID (01-99).

The Bundle Numbers used by the ADX-120E are as follows:

Transmits on: *SYSTEM ID + 300*
Receives on: *SYSTEM ID + 400*

The receive bundle on the ADX-2400 should be set the same as the transmit of the ADX-120E, and vice-versa.

Example: Let's say the system ID on the ADX-120E is set for 01.   This unit will transmit on bundle 301 and receive on bundle 401.

If you set the ADX-2400 RX1 bundle to 301, and the TX1 bundle to 401, the audio to the ADX120E (pgm, PL tx) will be ADX-2400 inputs 1-6, and the audio from the ADX-120E (mics, PL rx) will appear on ADX-2400 outputs 1-6.

Channel Assignments to/from the ADX-120E are as follows:

Transmit Bundle (from ADX-120E to ADX-2400)

Ch 1   -   Mic 1 (front-panel XLR)
Ch 2   -   Mic 2 (rear-panel XLR)
Ch 3   -   PL 1 TX (ADX-120E talk)
Ch 4   -   PL 2 TX
Ch 5   -   PL 3 TX
Ch 6   -   PL 4 TX

Receive Bundle (to ADX-120E)

Ch 1   -   Program 1
Ch 2   -   Program 2
Ch 3   -   PL 1 RX (ADX-120E listen)
Ch 4   -   PL 2 RX
Ch 5   -   PL 3 RX
Ch 6   -   PL 4 RX

Note that it is important to set up the ADX-2400 properly.

- The Low-Latency Mode must be turned on (dipswitch section #4 on)

- Network outputs for the bundles used must be set to LOCAL source

- Local outputs for the bundles used must be set to NETWORK source

- Levels should all be set to UNITY in most cases

- Delays should all be set to zero.

Remote Control

The ADX-120E announce boxes support full remote control from the truck via the ADX-2400 front panel, as well as GPI control of the ON AIR button, with tally status returned via GPI.

Important Note:

With older versions of firmware, the tens digit of the system ID had to match in order for the remote control to work properly. With version 5.x firmware this requirement has been eliminated. You may set the ADX-120Es and the ADX-2400s to be any ID numbers, just so long as they are all unique.

Note that units with version 5.x firmware (either ADX-2400s or ADX-120Es) are not compatible with older versions of firmware. Audio transmission will work fine, but the remote control and GPIs will not work.

GPI Setup

In addition to the tens digit matching, some other menu options must be set properly for the GPI control to work.

- The GPI menu item in the 2400 must be set to 'MASTER'.   This causes the 2400 to act as the gpi controller, and poll the remote device(s).

- There are two GPI Remote ID menu items on the 2400; one for the gpi 1/3 pair, and one for the gpi 2/4 pair.   These items should be set to match the System ID of the remote device for which control is desired on that given gpi pair.

- Lastly, in the menu of the ADX-120E (accessed from the 2400 front panel), the 'Remote GPI' item must be set to the desired control pair (1/3 or 2/4).

System Configuraton

Configuration of the system takes place both in the ADX-2400 and in the remote devices (ADX-120E/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 saving and recalling the configurations to/ from user memory files, and some status displays.

2. ## The ADX-2400 Channel Setup

    The sources, levels and delays for each output (local or network) are set using the channel setup buttons.

3. ## The Remote Device menus

    Each remote device (ADX-120E/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-120E 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 impedence (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-120Es, 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-120E. 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).

Any numbers from 01 through 99 are valid as system IDs. The only requirement is that each device have a unique number, and that bundle numbers be set appropriately to establish the desired audio routing.

Accessing Remote Menus from the ADX-2400

The configuration items for the ADX-120E and ADX-140 units are accessable 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 01      ADX120E-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, it's 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):

```
ADX120E-01      Config 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.

ADX-120E   Remote Menu Items

The ADX-120E menu items for firmware version 1.0 are listed below. These items may be accessed from the ADX-2400 front panel, or via the RS-232 remote port on the ADX-120E rear panel.

Config Item 01 – Mic 1 Gain (15-60dB)

This is the preamp gain for microphone input 1 (the front-panel headset input).   It would typically run around 40 or 45 dB for normal sports use.   A headroom indication is also provided in the lower right corner of the display (HR=XXdB). This headroom is calculated from the peak audio levels, and has about a one-second update rate. It is accurate, and will give a good indication of headroom before either preamp or A-to-D clipping.

Config Item 02 – Mic 2 Gain (25-70dB)

Same as above for microphone input 2 (rear-panel XLR).   When this input is in the 'Line In' mode, the gain is fixed, and Item 02 will indicate that the input is in line mode.

Config Item 03 – Channel 2 Input (Mic or Line)

This selects either mic or line input mode for the rear-panel XLR input. When in Mic mode, Item 02 sets preamp gain.   When in Line mode, the gain is fixed through at unity through the system.   The nominal 0VU level is +4dBm.   Output level at the truck is still adjustable on the ADX-2400.   Line input mode is indicated by a yellow LED on the rear panel.

Config Item 04 – Mic 1 Phantom (On / Off)

Turns on phantom power for Mic 1.   Indicated by a green LED on the rear panel.

Config Item 05 – Mic 2 Phantom (On / Off)

Turns on phantom power for Mic 2.   Indicated by a green LED on the rear panel. Phantom power for Mic 2 will automatically be turned off when Line In mode is selected.

Config Item 06 – Hdst Pgm Select

Controls the signal routing for the program feed to the headset. The selections are as follows:

Off   -   No program audio
Pgm 1   -   Program 1 feeds the headset
Pgm 2   -   Program 2 feeds the headset

Config Item 07 – Com A Sel

Selects which PL the Com A volume control and talk button will access.   The selections are as follows:

Off   -   Com A is disconnected
PL 1   -   Com A is assigned to PL 1 (and Ch1 of wet PL on rear pnl).
PL 2   -   Com A is assigned to PL 2 (and Ch2 of wet PL on rear pnl).
PL 3   -   Com A is assigned to PL 3.
PL 4   -   Com A is assigned to PL 4

Config Item 08 – Com B Sel

Same as above for Com B volume control and talk button.

Config Item 09 – Hdst Pgm To

Controls to which side(s) of the headset the selected Program audio will be routed.

Left
Right
Both

Config Item 10 - Com A To
Config Item 11 - Com B To

Same as above for the Com A and Com B listens

Config Item 12 – Hdst Volume (Normal, High)

This controls the amplitude range of the signals feeding the headphones (front-panel jack). It is really an adjustment for headphone impedence; e.g., it matches the range of the volume control knobs to the impedence of the headphones. Normal should be used unless high-impedence headphones cause the volume to be inadequate. The High setting provides a 10dB increase in signal level.

Config Item 13 - IFB 2 Mode

This controls the output mode of the IFB 2 connector on the rear panel. The selections are:

Wet - 2 Ch   -   The connector is configured for wet (RTS) 2-Ch operation.
Dry - Ch 1   -   Configured as a balanced dry output of the Ch 1 selection.

Config Item 14 - IFB2 Ch1

Selects the source for Channel 1 of the IFB 2 connector (if wet), or the balanced out (if dry). Available selections are:

**Off
Pgm 1
Pgm 2
Mic 1
Switched Mic 1
Tone**

Config Item 15 - IFB2 Ch2

Same as above for Channel 2 of the IFB 2 connector when in wet mode.

Config Item 16 – On-Air Off Clr

This sets the color of the illumination for the On-Air button when it's in the off state.

Config Item 17 –On-Air On Clr

This sets the color of the illumination for the On-Air button when it's in the on state.

Config Item 18 –Com A Off Clr
Config Item 19 –Com A On Clr
Config Item 20 –Com B Off Clr
Config Item 21 –Com B On Clr

Config Item 22 – Local GPI (Disabled / Enabled)

Enables operation of the three GPI inputs on the rear panel (D9 connector). The inputs are available for hand-held or footswitches, and operate the On-Air, Com A Talk and Com B Talk.

Config Item 23 – Remote GPI

Disabled	-	Remote GPIs are disabled
GPI 1/3	-	The Remote GPI pair 1/3 will be used for On-Air sw/tally.
GPI 2/4	-	The Remote GPI pair 2/4 will be used for On-Air sw/tally.

The remaining menu items are status items

Status Item 01 – PCB Temperature

This item displays internal temperature of the ADX-120E in degrees Centigrade. Nominal temperature is in the 35 - 45 degree range, depending on ambient and PL and IFB loading.   Temperatures above 55 degrees are cause for concern and operating conditions should be investigated.

Status Item 02 – PL Current (xxx ma)

DC Current drawn by the external PL beltpacks. This should be less than 100 milliamps. The PL power supply will go into a shutdown condition if current is greater than 140 ma.

Status Item 03 – PL Voltage (xx.x Volts)

DC Voltage of PL power supply.   Nominally 25 volts.

Status Item 04 – IFB Current (xxx ma)

DC Current drawn by the external IFB beltpacks. This should be less than 100 milliamps. The IFB power supply will go into a shutdown condition if current is greater than 140 ma.

Status Item 05 – IFB Voltage (xx.x Volts)

DC Voltage of IFB power supply.   Nominally 25 volts.   Note that if a dry mode is selected for IFB2, the power supply will be turned off and voltage will read zero.

Status Item 06 – Firmware Version

Display of the version number of the firmware installed in the ADX-120E.

Resetting the ADX-120E Menu Variables to a Standard Configuration

The menu variables in the ADX-120E may be reset to a known standard configuration by holding down any of the front-panel buttons for five seconds when powering up the unit. (Hold one of the buttons down and apply power. After the unit initializes the menus will be reset).

The standard configuration is:

Both Phantoms Off
Mic 1 Preamp Gain = 25dB
Mic 2 Preamp Gain = 35dB
Channel 2 set for Mic Input
Hdst Pgm=Pgm 1
Com A = PL 1
Com B = PL 2
Pgm, Com A, and Com B to both sides of headset.
IFB2 = Dry Ch1 mode.
IFB2 Ch1 Source = Pgm 1
IFB2 Ch2 Sourch = Pgm 2
Headset Volume set to Normal
All buttons in off state = Blue
On-Air = Red
Com A Talk = Yellow
Com B Talk = Yellow
Local GPIs = Disabled
Remote GPIs = GPI 1/3

Accessing the ADX-120E Menu Via the Remote Connector

The ADX-120E menus are also accessable via the RS-232 port in the Remote Control connector on the rear panel. Although it's unlikely that you would need this function it allows configuration of the unit in a case where it might be operated with Cobranet hardware other than the ADX-2400.   We also use it for test purposes in the shop.

The connector has a standard old-fashioned PC modem pinout, and will connect directly to a PC comm port or a USB-Serial adapter.   The PC will need to run a generic terminal application (like Hyperlink, or one of the many shareware terminal apps available).

The baud rate is 38.4K, no parity, one stop bit.   When the PC is connected, press return, and you'll see the the ADX-120E menus.   The space bar will toggle between item select mode and variable set mode. The comma and period keys ('<' and '>') take the place of the knob to step through the items or to change the settings.

Reliability Considerations

Since the commentary microphones and communications are typically provided by this system, 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-120E and the headset.

- Use the ADX-8000 to provide power for the ADX-120Es. This unit contains redundant power supplies and will provide highly-reliable power, even in the event of the failure of one of the supplies.

- 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 an hour or more of 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 fiber GBIC ports available. If the switches support this type of operation (trunking), 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. This could mean putting two switches on each end of the system connected by redundant fiber paths, Two Ethernet cables could be run from each ADX120, one to each switch. This would protect against switch and fiber failure. At a minimum, consider having available a spare switch which could be substituted for a failed switch.

- Another single-point failure possibility is the ADX-2400 in the truck. The ultimate in reliability would be to have a second unit with booth traffic split between them. This would insure that a failure of that unit would not disable all booth facilities.

NOTES

ADX-120E Specifications

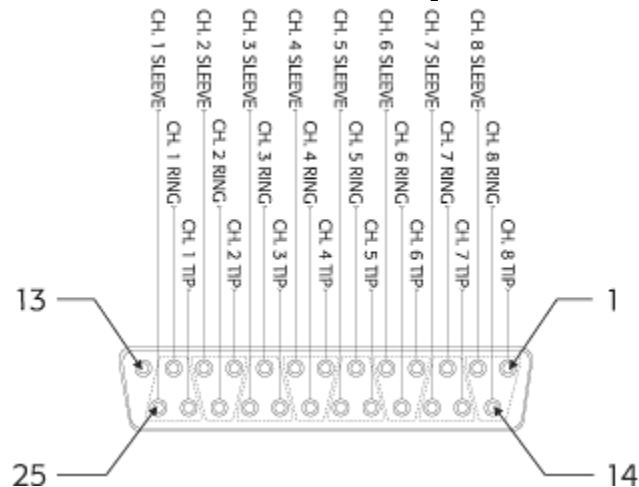|	
Microphone Inputs	2 low-impedence balanced. Phantom power available
Preamp Gain (total path)	+25dB to +70dB
Freq Response	20-20KHz, +/- 0.5 dB
Microphone Channel EIN	125 dB, bandwidth-limited to 25KHz
System Signal/Noise	>100 dB below peak level, bandwidth-limited to 25KHz
Path Distortion	<0.05% for Mic/Line and Dry IFB. <0.1% for PL / Wet IFB
Microphone Preamps	THAT Corporation 1570 / 5171
A-D and D-A Conversion	24-bit
Digital Processing	Dual-core 32-bit ARM dsp
Cobranet Transmission	20-bit uncompressed
Sample Frequency	48 kHz
Path Latency	Approx 2.25 Milliseconds on all paths (analog to analog)
Headset Outputs	2 channel dry unbalanced. Max power in 600 ohms is 120mw.
IFB 2 Outputs	2 channel wet RTS-format or single-channel dry +4dB nom.
PL Interface (Booth End)	2 channel wet RTS-format. DC current to support 2 beltpacks
PL Interface (Truck End)	4-wire dry +4dBm nominal. 8 assignable 4W Ports
PL Trans-hybrid Loss	Greater than 55 dB
Remote Control	From ADX-2400, From rear-panel RS232, or GPI
Front Panel Switches	Three; On-Air, Com A Talk, Com B Talk. RGB Illumination
System Addressing	Rear panel two-digit rotary switches. Address 01-99
Bundle Numbers	Set automatically based on System Address
Power Requirements	48 Volts DC, 195 ma. 320 ma with four RTS/Telex beltpacks.
Power Source	48V on spare Cat5 pairs
Ethernet Interface	100baseT Standard Ethernet (redundant RJ45 ports)
Ethernet Bandwidth Req'd	Approximately 8 megabits each direction per ADX-120E
Dimensions	9" wide x 5.5" deep x 2.5" high Weight approx. 2.5 pounds

Lance Design ADX-2400N Analog Pinout (Inputs and Outputs)

Audio Channel	D-25 Pin		Audio Channel	D-25 Pin		Audio Channel	D-25 Pin
CH 1 +	24		CH 9 +	24		CH 17 +	24
CH 1 -	12		CH 9 -	12		CH 17 -	12
CH 1 SHLD	25		CH 9 SHLD	25		CH 17 SHLD	25
CH 2 +	10		CH 10 +	10		CH 18 +	10
CH 2 -	23		CH 10 -	23		CH 18 -	23
CH 2 SHLD	11		CH 10 SHLD	11		CH 18 SHLD	11
CH 3 +	21		CH 11 +	21		CH 19 +	21
CH 3 -	9		CH 11 -	9		CH 19 -	9
CH 3 SHLD	22		CH 11 SHLD	22		CH 19 SHLD	22
CH 4 +	7		CH 12 +	7		CH 20 +	7
CH 4 -	20		CH 12 -	20		CH 20 -	20
CH 4 SHLD	8		CH 12 SHLD	8		CH 20 SHLD	8
CH 5 +	18		CH 13 +	18		CH 21 +	18
CH 5 -	6		CH 13 -	6		CH 21 -	6
CH 5 SHLD	19		CH 13 SHLD	19		CH 21 SHLD	19
CH 6 +	4		CH 14 +	4		CH 22 +	4
CH 6 -	17		CH 14 -	17		CH 22 -	17
CH 6 SHLD	5		CH 14 SHLD	5		CH 22 SHLD	5
CH 7 +	15		CH 15 +	15		CH 23 +	15
CH 7 -	3		CH 15 -	3		CH 23 -	3
CH 7 SHLD	16		CH 15 SHLD	16		CH 23 SHLD	16
CH 8 +	1		CH 16 +	1		CH 24 +	1
CH 8 -	14		CH 16 -	14		CH 24 -	14
CH 8 SHLD	2		CH 16 SHLD	2		CH 24 SHLD	2

6 FEMALE CONNECTORS ON CHASSIS [INPUT AND OUTPUTS]

Remote / GPI Connector Pinout for ADX-120E

Connector is DB9F

Pin #	Function
1	Ground
2	RS232 Data Out (TX)
3	RS232 Data In (RX)
4	(no connection)
5	Ground
6	GPI 1 In (On-Air)
7	GPI 2 In (Com A Talk)
8	GPI 3 In (Com B Talk)
9	Ground

GPI inputs are TTL-compatible inputs, pulled up to +5 volts with a 5K resistor.   They should be pulled to ground with a dry switch closure to activate.

RS232 Remote port is 38.4K Baud, One Stop Bit, No Parity

Remote Control Connector Pinout for ADX-2400

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.