LAX
SONIC SOLUTION

DSP4000

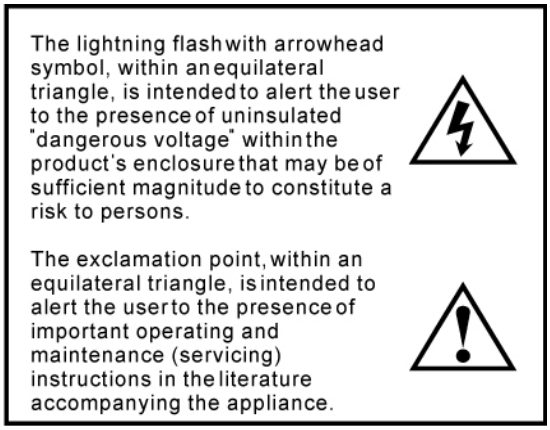
USER'S MANUAL
用户使用手册



锐丰企业:
Tel: 020-84817168
Fax: 020-84817238

HTTP://WWW.LAX-PRO.COM





Important Safety Instructions

1. READ THESE INSTRUCTIONS
All the safety and operating instructions should be read before the product is operated.

2. KEEP THESE INSTRUCTIONS
The safety and operating instructions should be retained for future reference.

3. HEED ALL WARNINGS
All warnings on the product and in the operating instructions should be adhered to.

4. FOLLOW ALL INSTRUCTIONS
All operating and use of instructions should be followed.

5. DO NOT USE THIS APPARATUS NEAR WATER
Do not use the product near water. For example, near a bathtub, washbowl, kitchen sink, or laundry tub, in a wet basement, or near a swimming pool, and the like.

6. CLEAN ONLY WITH DRY CLOTH
Unplug the unit from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.

7. DO NOT BLOCK ANY VENTILATION OPENINGS
Slots and openings in the cabinet back or bottom are provided for ventilation, to ensure reliable operation of the limit and to protect it from overheating. These openings must not be blocked or covered. The openings should never be blocked by placing the product on a bed, sofa, rug, or similar surface. This product should never be placed near or over a radiator or heat source. This product should not be placed in a built-in installation such as a bookcase or rack unless proper ventilation is provided or the manufacture's instructions have been adhered to.

8. DO NOT INSTALL NEAR ANY HEAT SOURCES
This Product should be situated away from heat sources such as radiators, stoves, or other products (including amplifiers) that produces heat.

9. DO NOT DEFEAT THE SAFETY PURPOSE OF THE POLARIZED OR GROUNDING-TYPE PLUG
A Polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prongs are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

10. PROTECT THE POWER CORD FROM BEING WALKED ON OR PINCHED PARTICULARLY AT PLUGS, CONVENIENCE RECEPTACLES, AND THE POINT WHERE THEY EXIT FROM THE APPARATUS.

11. ONLY USE ATTACHMENTS/ACCESSORIES SPECIFIED BY THE MANUFACTURER.

12. USE ONLY WITH CART, STAND, TRIPOD, BRACKET, OR TABLE SPECIFIED BY THE MANUFACTURER, OR SOLD WITH THE APPARATUS. WHEN A CART IS USED, USE CAUTION WHEN MOVING THE CART/APPARATUS TO AVOID INJURY FROM TIP-OVER.
Do not place this unit on an unstable cart, stand, tripod, bracket, or table. The unit may fall, causing serious injury to someone, and serious damage to the appliance. A unit and cart combination should be moved with care. Quick stops, excessive force, and uneven surfaces may cause the product and cart combination to overturn.

13. UNPLUG THIS APPARATUS DURING LIGHTNING STORMS OR WHEN UNUSED FOR LONG PERIODS OF TIME.
For added protection for this unit during a lightning storm, or when it is left unattended and unused for long periods of time, unplug it from the wall outlet and disconnect the antenna or cable system. This will prevent damage to the unit due to lightning and power line surges.

14. REFER ALL SERVICING TO QUALIFIED SERVICE PERSONNEL. SERVICING IS REQUIRED WHEN THE APPARATUS HAS BEEN DAMAGED IN ANYWAY, SUCH AS WHEN THE POWER SUPPLY CORD OR PLUG IS DAMAGED, LIQUID HAS BEEN SPILLED OR OBJECTS HAVE FALLEN INTO THE APPARATUS, THE APPARATUS HAS BEEN EXPOSED TO RAIN OR MOISTURE, DOES NOT OPERATE NORMALLY, OR HAS BEEN FROPPED.

15. WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPARATUS TO RAIN OR MOISTURE.

16. APPARATUS SHALL NOT BE EXPOSED TO DRIPPING OR SPLASHING AND NO OBJECTS FILLED WITH LIQUIDS, SUCH AS VASES, SHALL BE PLACED ON THE APPARATUS.

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1.0 Introduction

The DSP4000 is a complete 4 input - 8 output digital loudspeaker management system designed for the touring or fixed sound installation markets. The absolute latest in available technology is utilized with 32-bit (40-bit extended) floating point processors and high performance 24-bit Analog Converters. The high-bit DSP prevents noise and distortion induced by truncation errors of the commonly used 24-bit fixed-point devices. A complete set of parameters include I/O levels, delay, polarity, 6 bands of parametric EQ per channel, multiple crossover selections and full function limiters. Precise frequency control is achieved with its 1 Hz resolution. Inputs and outputs can be routed in multiple configurations to meet any requirement. The DSP4000 can be controlled or configured in real time on the front panel or with the intuitive PC GUI accessed via the RS-232 interface. Software upgrade for CPU and DSP via PC keeps the device current with newly developed algorithms and functions once available. Multiple setup storage and system security complete this professional package.

Shipped contents:

- DSP4000 unit
- User Manual
- XLink Software CD

2.0 Features

> 4 Inputs and 8 Outputs with flexible routing

> 32-bit (40-bit extended) floating point DSP

> 96kHz Sampling Rate Selectable

> High Performance 24-bit A/D Converters

> 1 Hz Frequency Resolution

> 6 Parametric Equalizers for each Input and Output

> Multiple Crossover types with Full Function Limiters

> Precise Level, Polarity and Delay

> CPU and DSP upgrade via PC

> Individual Channel Buttons with Linking capability

> 4-Line x 26 Character Backlit LCD Display

> Full 5-segment LED’s on every Input and Output

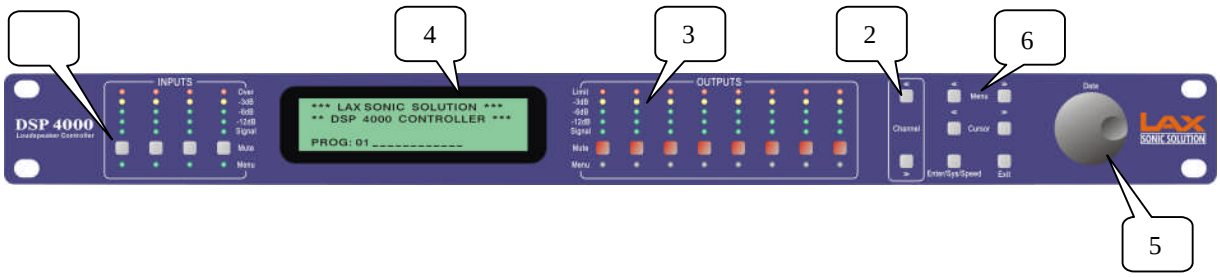
> Storage of up to 30 Program Setups

> Multiple Levels of Security Locks

> RS-232 Interface for PC Control and Configuration

> Future options available

3.0 Front Panel Functions



1. **Mute keys** - Mute/Unmute input and output channels. When an input channel is muted, a red LED will come on for indication.

2. **Gain/Menu keys** - Selects the corresponding channel for the LCD menu display.

3. **Peak Level LED** - Indicates the current peak level of the Signal: Signal, -12dB, -6dB, -3dB, Over/Limit. The Input **Over** LED references to the device's maximum headroom. The Output **Limit** LED references to the threshold of the limiter.

4. **LCD** - Shows all the necessary information to control the unit.

5. **Rotary Thumb Wheel** - Changes parameter data values. The wheel has travel velocity sensing which ease large incremental data modifications. For modifying delay and frequency (1 Hz resolution), pressing the **Speed** key simultaneously will increment/decrement the data value by 100X.

6. **Menu Control keys** - There are 6 menu keys: **<<Menu** (Menu Down), **Menu>>** (Menu Up), **<<Cursor** (Cursor Down), **Cursor>>** (Cursor Up), **Enter/Sys/Speed** and **Exit**. The functions of each key is explained below:

   <<Menu: Previous menu screen

   Menu>>: Next menu screen

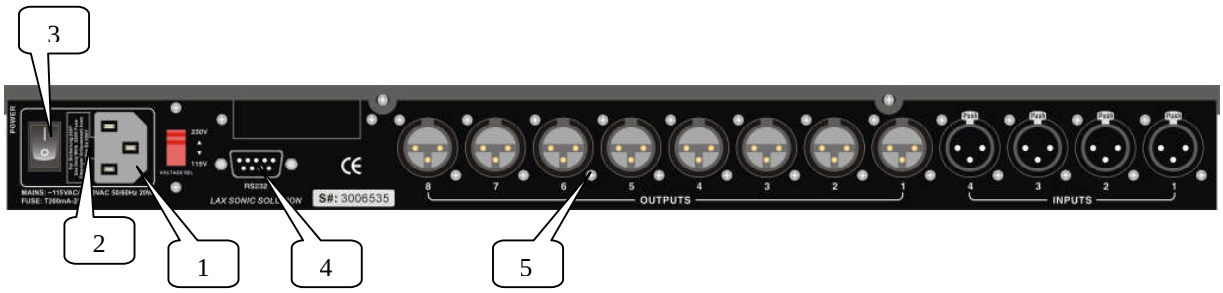
   <<Cursor: Previous cursor in the menu screen

Cursor>>: Next cursor in the menu Screen

Enter/Sys/Speed: **Enter** is used only in the **System Menu** to proceed with selected actions
Sys enters the **System Menu** from the main menu
Speed modifies delay and frequency (1 Hz resolution mode) data values by 100X.

Exit: Exit to the **Main Menu**

4.0 Rear Panel Functions



1. **Main Power** - Connects via a standard IEC socket. A compatible power cord is supplied with the unit. The voltage input is either 115VAC or 230VAC and is clearly specified on the unit. Voltage requirement has to be stated upon ordering.

2. **Main Fuse** - T200mA-250V. Slow blow type.

3. **Power switch** - Controls power On/Off.

4. **RS232** - a standard female DB9 socket. A straight through cable is required for PC connection.

5. **XLR input and outputs -** Separate 3-pin XLR connectors are provided for each audio input and output. The device's output stage employs the balanced impedance topology. All I/O connectors have pin 1 as ground (shield), pin 2 as + and pin 3 as -.

5.0 Powering Up the Device

- After powering up the unit, the following initialization screen is displayed on the LCD:

```
*** LAX SONIC SOLUTION ***
** DSP 4000 CONTROLLER ***

------ INITIALIZING ------
```

- The initialization process takes about 8 seconds and during that period the unit boots and displays the DSP4000 firmware version.

- After the initialization process is finished the DSP4000 displays its main screen:



- The screen shows the current program number and program name assigned to the unit. The program assigned is always the last program the user recalled or stored before powering down the unit.

- Now the DSP4000 is now ready to operate.

6.0 Operating the Device

Tips: Channel Linking - If the user presses one of the Input or Output **Menu** keys, holds it down and press any other **Menu** key(s) in the same group (Input or Output group), then the channels are linked together. The green menu LEDs for the linked channels are lit. Any modification of the data for the selected channel will be applied to the linked channels as well. To cancel the linking, just press any other **Menu** key or the **Sys** key after releasing the held key.

6.1 Input menus

Each of DSP4000 input channels has a separate **Menu** key. There are 3 menus for each input channel.

Signal - Signal parameters

```
IN_1:XXXXXX  MENU:Signal
LEVEL:0.00dB
POL  :+
DELAY:0 (000.000ms)
```

- LEVEL - Gain, -40.00dB to +15.00dB in 0.25dB steps.
- POL - Polarity, can be normal (+) or inverted (-).
- DELAY - Delay in 21us steps. Can be displayed in ms, ft or m. The time unit of the delay can be changed in the **System** menu. The maximum delay permitted is 21,600 steps (450ms).

EQ - EQ parameters

```
IN_1:XXXXXX  MENU:EQ
EQ#  :1        BW:0.33oct
LEVEL:0.00dB      Q=4.36
FREQ :1000Hz TYPE:Param
```

- EQ# - Selects one of the 6 available Equalizers.

- LEVEL - EQ level gain. Ranges from -30.00dB to +15.00dB in 0.25dB steps.
- FREQ - EQ center frequency. Ranges from 20 to 20,000Hz in either 1Hz steps or 1/36 octave steps. The frequency steps can be selected in the **System Menu**.
- BW - EQ Bandwidth. Ranges from 0.02 to 2.50 octaves in steps of 0.01 octave steps for PEQ. The Q value is automatically shown beneath the octave value. For Lo-Slf or Hi-Shf, it is either 6 or 12dB/Oct.
- Type - Type of EQ. The types can be parametric (PEQ), Lo-shelf (Lo-shf) and Hi-shelf (Hi-shf).

Ch-Name - Channel Name

```
IN_1:XXXXXX  MENU:Ch-Name

NAME:XXXXXX
```

- Name - Channel name. It is 6 characters in length.

6.2 Output Menus

Each output channel of the DSP4000 has a separate menu key. There are 6 menus for each output channel.

Signal - Signal parameters

```
OUT_1:XXXXXX MENU:Signal
LEVEL:0.00dB
POL  :+
DELAY:0 (000.000ms)
```

- Refer to the Input Menus for details

EQ - EQ paramters

```
OUT_1:XXXXXX MENU:EQ
EQ#  :1        BW:0.33oct
LEVEL:0.00dB      Q=4.36
FREQ :1000Hz TYPE:Param
```

- Refer to the Input Menus for details

X'Over **-** Crossover parameters

```
OUT_1:XXXXXX MENU:XOver
FTRL:Off     FTRH:Off
FRQL:1000Hz  FRQL:1000Hz
SLPL:24dB    SLPH:24dB
```

- FTRL - Filter Type of low frequency crossover point (high pass). Types can be Buttwrth (Butterworth), Link-Ri (Linkritz Riley) or Bessel.

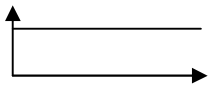
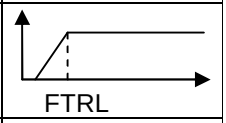
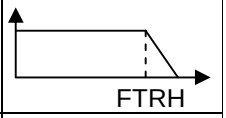
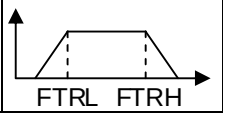
- FRQL - Filter cut-off Frequency of low frequency crossover point (high pass). Ranges from 20 to 20,000Hz in either 1Hz steps or 1/36 octave steps. The frequency steps can be selected in the **System Menu**.

- SLPL - Filter Slope of low frequency crossover point (high pass). Ranges from 6 to 48dB/octave in 6dB/octave steps. If the selected Filter Type is Linkritz Riley, the available slopes are 12 / 24 / 36 / 48 dB/octave.

- FTRH - Filter Type of high frequency crossover point (low pass).

- FRQH - Filter cut-off Frequency of high frequency crossover point (low pass).

- SLPH - Filter Slope of high frequency crossover point (low pass).

Filter Configuration	Low crossover point (FTRL)	High crossover point (FTRH)	
None	Off	Off	
Highpass	NOT Off	Off	
Lowpass	Off	NOT Off	
Bandpass	NOT Off	NOT Off	

Limit - Output Limter

```
OUT_1:XXXXXX  MENU:Limit
THRESH :+20.0dBu
ATTACK :100ms
RELEASE:32x
```

- THRESH - Limit Threshold. Ranges from -20 to +20dBu in 0.5dB steps.
- ATTACK - Attack time. Ranges from 0.3 to 1ms in 0.1ms steps, and ranges from 1 to 100ms in 1ms steps.
- RELEASE - Release time. Can be set at 2X, 4X, 8X, 16X or 32X the attack time.

Source - Input Source

```
OUT_1:XXXXXX  MENU:Source
1:On     4:Off
2:Off
3:Off
```

- 1,2,3,4 – Input channel source for the current output channel. Can be set to enable the input source (On) or disable it (Off). If more than one input source are enabled, they will be added together as the source for the current output channel.

Ch-Name - Channel Name

```
OUT_1:XXXXXX  MENU:Ch-Name
NAME:XXXXXX
```

- Refer to the Input Menus for details

6.3 System Menus

The **System Menus** allow the user to control and change parameters that are related to the system behavior and general operation. It can be accessed by pressing the **Sys** key in the main menu (when no Input/Output or System Menu is activated). All System Menus require the Enter key to be pressed for the selected action.

Recall - Program Recall

The DSP4000 has a built in non-volatile memory that can store up to 30 different program setups. A program can be recalled using this menu.

```
SYSTEM-SETUP MENU:Recall
PROG:01
NAME:XXXXXXXXXXX
```

- PROG - Program Number to be recalled..
- NAME - Program Name of the program. This is read only, the user has no access to them.

Store - Program store

The DSP4000 has a built in non-volatile memory that can store up to 30 different program setups. A program can be stored using this menu. The old program with the same program number will be replaced. Once the program is stored in the flash memory, it can be recalled at a later time, even after power down.

```
SYSTEM-SETUP MENU:Store
PROG:01
NAME:XXXXXXXXXXXX
```

- PROG - Program Number for the current data to be stored.
- NAME - Program Name, allows a maximum length of 12 characters.

Config - Device Configuration

```
SYSTEM-SETUP MENU:Config
MODE:2-Way
```

- MODE - configures the mode of operation.

Mode:	Out 1	Out 2	Out 3	Out 4	Out 5	Out 6	Out 7	Out 8
None	Any	Any	Any	Any	Any	Any	Any	Any
Stereo 2-Way	In1	In1	In2	In2	Any	Any	Any	Any
Stereo 3-Way	In1	In1	In1	In2	In2	In2	Any	Any
Stereo 4-Way	In1	In1	In1	In1	In2	In2	In2	In2

The unit assigns the Input source for the corresponding outputs when the Mode of Configuration is selected. The crossover point parameters like the filter type, cut-off frequency and slope have to be configured manually in the **Xover** Menu in each Output menu.

*Note: The configuration mode configures the input sources when selected. The user can change the source afterwards if desired. It does not keep the configuration in memory.

Copy - Copy channels

```
SYSTEM-SETUP  MENU:Copy
SOURCE:In1
TARGET:In2
```

Copy Channels from the source to the target. When the Source and Targets are both Inputs or Outputs, all audio parameters will be copied. When one of the Source or the Target is an input while the other is an output, only the Level, Polarity, Delay and EQ are copied.

- SOURCE - Channel to be copied from.
- TARGET - Channel to be copied to.

General - General system parameters

```
SYSTEM-SETUP MENU:General
FREQ MODE :All Freq
DELAY UNIT:01
DEVICE#   :1
```

- FREQ MODE - Selects the frequency control mode for EQ and crossover filters. Can be 36 steps/octave or All Frequencies (1 Hz resolution).
- DELAY UNIT - ms, ft or m.
- DEVICE# - Assigns the device ID from 1 to 16. This ID is useful when a network of more than 1 unit is present.

Security - Security Locks

The DSP4000 enables the user to secure the unit and prevent undesired changes in the setup. In order to switch between the security level the user must enter the correct password.

```
SYSTEM-SETUP MENU:Security
MENU:In-Signal
LOCK:No
PASSWORD:XXXX
```

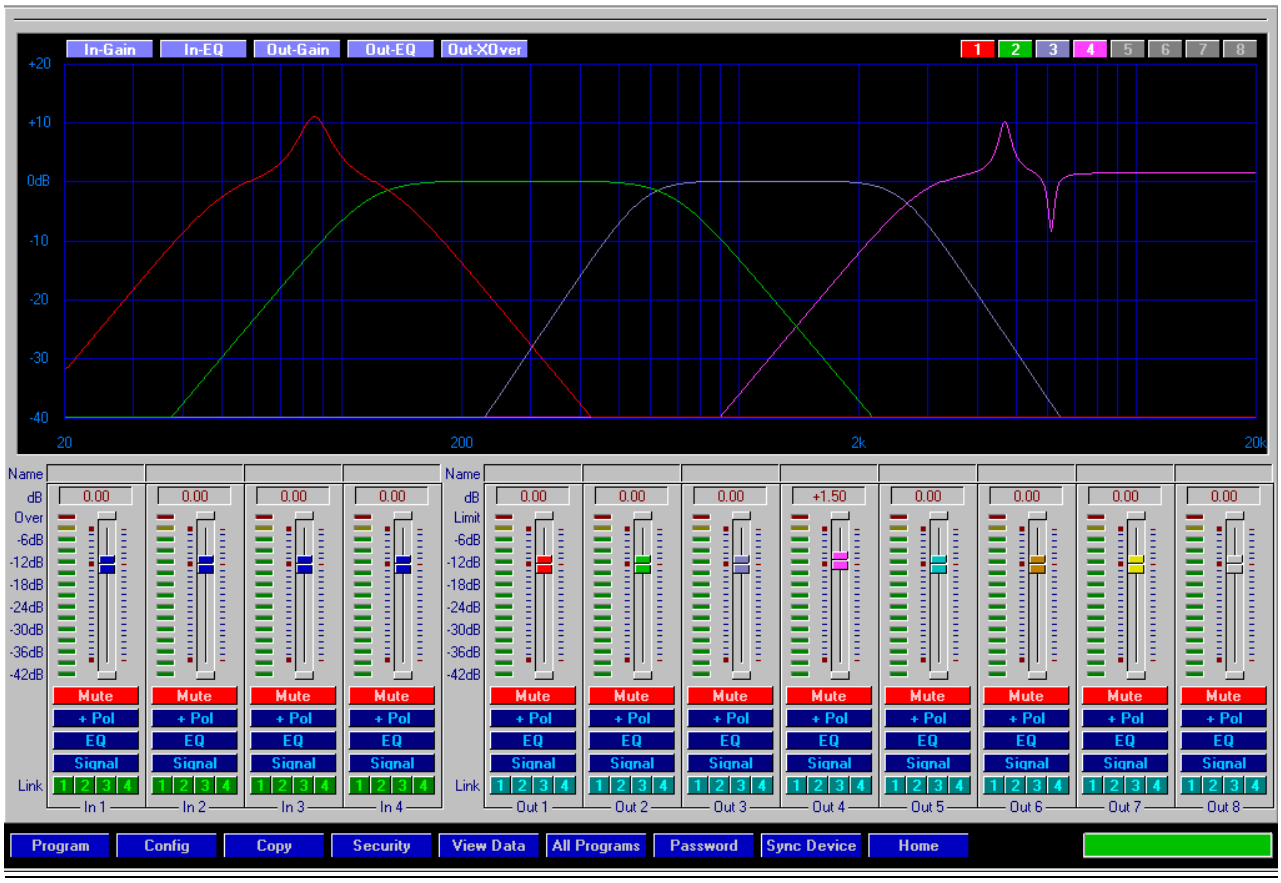
- MENU - Selects the menu to be locked/unlocked. The options are:
  - In-Signal - Input Signal Menu (Level, Polarity, Delay).
  - In-EQ - Input EQ Menu.
  - In-Name - Input Channel Name Menu
  - Out-Signal - Output Signal Menu (Level, Polarity, Delay).
  - Out-EQ - Output EQ Menu.
  - Out-Xover - Output Crossover Menu.
  - Out-Limit - Output Limit Menu.
  - Out-Source - Output Source Menu.
  - Out-Name - Output Channel Name Menu.
  - System - System Menu
- LOCK - Selects to lock (Yes) or unlock (No) the corresponding menu.
- PASSWORD – The password of the DSP4000 is 4 characters in length. The user can change it via the PC application software. The factory default of a new unit does not require a password.

7.0 Quick Reference

Parameters	Menu <<Menu>>	Field <<Cursor>>	Min	Max	Steps	Units
Level	Signal	LEVEL	-40	+15	0.25	dB
Polarity	Signal	POL	+ / -			
Delay	Signal	DELAY	0	21,600	1	21us steps
EQ Number	EQ	EQ#	1	6	1	
EQ Level	EQ	LEVEL	-30	+15	0.25	dB
EQ Frequency	EQ	FREQ	20	20,000	1	Hz
EQ Bandwidth	EQ	BW	0.02	2.50	0.01	Octave
Crossover Low	XOver	FTRL	Off / Butterworth / Linkwitz-Riley / Bessel			
Crossover Low	XOver	FRQL	20	20,000	1	Hz
Crossover Low	XOver	SLPL	6	48	6	dB/octave
Crossover High	XOver	FTRH	Off / Butterworth / Linkwitz-Riley / Bessel			
Crossover High	XOver	FRQH	20	20,000	1	Hz
Crossover High	XOver	SLPH	6	48	6	dB/octave
Limiter Threshold	Limit	THRESH	-20	+20	0.5	dBu
Limiter Attack	Limit	ATTACK	0.3	100	0.1/1	ms
Limiter Release	Limit	RELEASE	2 / 4 / 8 / 16 / 32X Attack time			
Source Select	Source	1, 2, 3, 4	Off / On			
Channel Name	Ch-Name	NAME	6 characters			

8.0 PC Control Software

The DSP4000 is shipped with a special PC Graphic User Interface (GUI) application - XLink. XLink gives the user an option to control the DSP4000 unit from a remote PC via the RS232 serial communication link. The GUI application makes it much easier to control and monitor the device, allowing the user to get the whole picture on one screen. Programs can be recalled and stored from/to PC's hard drive, thus expanding the storage to become virtually limitless.



9.0 Specifications

Inputs and Outputs

Input Impedance:	>10k Ohms
Output Impedance:	50 Ohms
Maximum Level:	+20dBu
Type:	Electronically balanced

Audio Performance

Frequency Response:	+/- 0.1dB (20 to 20kHz)
Dynamic Range:	115dB typ (unweighted)
CMMR:	> 60dB (50 to 10kHz)
Crosstalk:	< -100dB
Distortion:	0.002% (1kHz @+4dBu)

Digital Audio Performance

Processor:	32-bit (40-bit extended)
Sampling Rate:	96kHz
Analog Converters:	High Performance 24-bit
Propagation Delay:	3ms

Front Panel Controls

Display:	4 x 26 Character Backlit LCD
Level Meters:	5 segment LED
Buttons:	12 Mute Controls
	12 Gain/Menu Controls
	6 Menu Controls
Dial Encoder:	Embedded Thumb Wheel

Connectors

Audio:	3-pin XLR
RS-232:	Female DB-9
Power:	Standard IEC Socket

General

Power:	115 / 230 VAC (50 / 60Hz)
Dimensions:	19”x1.75”x8” (483x44x203 mm)
Weight:	13.2 lbs / 6 kg

Audio Control Parameters

Gain:	-40 to +15dB in 0.25dB steps
Polarity:	+/-
Delay:	Up to 450ms per I/O

Equalizers (6 per I/O)

Type:	Parametric, Hi-shelf, Lo-shelf
Gain:	-30 to +15dB in 0.25dB steps
Bandwidth:	0.02 to 2.50 octaves (Q=0.5 to 72)

Crossover Filters (2 per Output)

Filter Types:	Butterworth, Bessel, Linkwitz Riley
Slopes:	6 to 48dB/oct

Limiters

Threshold:	-20 to +20dBu
Attack:	0.3 to 100ms
Release:	2 to 32X the attack time

System Parameters

No. of Programs:	30
Program Names:	12 character length
Delay Units:	ms, ft, m
Frequency Modes:	36 steps/oct, 1Hz resolution
Security Locks:	Any individual menu
Copy channels:	All parameters
Channel Names:	6 character length

Note: Specifications subject to change without notice

10.0 Warranty

The DSP4000 is warranted covering materials and workmanship for a period of one (1) year, as determined by the date of retail purchase (according to the sales receipt from an authorized dealer) or the date of manufacture if the sales receipt is not available (according to the serial number). This warranty applies to the product; therefore, the remainder of the warranty period will be automatically transferred to any subsequent owner. This warranty applies only to failure of a LAX product caused by defects in materials and workmanship during the stated warranty period. It does not apply to a unit that has been subjected to abuse, accident, modification, improper handling/installation, or repairs made without factory authorization or by anyone other than authorized LAX Field Service Stations. This warranty is void if the serial number has been defaced, altered or removed. Products covered by this warranty will be repaired or replaced at the option of LAX, without charge for materials or labor, provided all the terms of this warranty have been met.

For factory service, please call or email for a Return Authorization (RMA) number before shipping. If the product is shipped, the following information must be included in the package:
1. Owner’s complete name, daytime phone number, return street address and return authorization number.
2. The serial number of the product being returned and a copy of the retail sales receipt, if possible.
3. A complete description of the problem(s) experienced, including a brief description of how the equipment is being used and other equipments involved.