



User Manual

# Contents.

3	COPYRIGHT INFORMATION.
4	THANK YOU.
5	SAFETY INFORMATION.
6	FRONT PANEL.
7	REAR PANEL.
8	OPERATION.
10	DIGITAL SIGNAL PROCESSING.
11	DSP CONTROLS
15	UTILITIES
16	TECHNICAL SPECIFICATION.
17	QUICK REFERENCE.
19	WARRANTY.

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# Thank You.

By buying this DLX200 series processor, you have joined the ranks of the thousands of professional engineers, installers and musicians who choose LA Audio. We hope your DLX200 series processor brings you many years of enjoyable DSP system management.

This manual should get you up to speed with the DLX200's capabilities, controls and specifications. It also details safety precautions that must be taken for the safe use of this equipment. Please take the time to read this information carefully and store this manual for future reference.

# Safety Information.



Please read carefully and keep the following instructions and safety information. Heed all warnings and follow all instructions.

- Do not remove covers. There are no user serviceable parts inside, please refer servicing to qualified service personnel.
- This equipment must be earthed.
- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
- Only use attachments/accessories specified by the manufacturer.
- Servicing is required when the apparatus has been damaged in any way, such as 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 dropped.

## REGULATORY COMPLIANCE

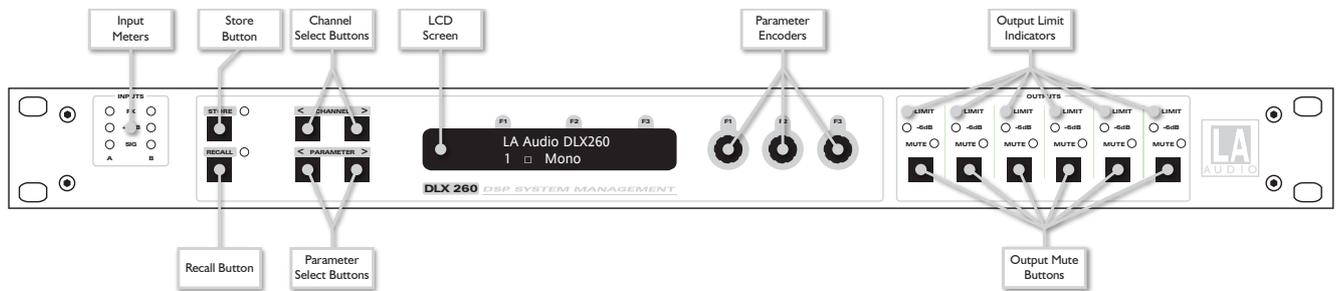
This product complies with both the EMC Directive (89/336/EEC) and the Low Voltage Directive (73/23/EEC) as issued by the Commission of the European Community.

Compliance with these directives imply conformity with the following European standards:

- EN60065      Product safety
- EN55103-1    Electromagnetic Interference (Emission)
- EN55103-2    Electromagnetic Susceptibility (Immunity)

This product is intended for operation in the E2 (commercial & light industrial) and E3 (urban outdoors) Electromagnetic Environments.

# Front Panel.



## INPUT SIGNAL INDICATORS

A pair of 8-segment LED bargraph meters indicate input level for each channel. These read peak level from signal present at  $-40\text{dBu}$  to clip warning at  $+19\text{dBu}$ . When the clip warning light first illuminates, there is an additional 1dB of headroom available as a safeguard.

## STORE AND RECALL

These controls provide access to the unit's 45 presets. To see them in action, go to page 10.

## CHANNEL SELECT BUTTONS

The currently selected channel is displayed on the top left hand corner of the LCD. Pressing the channel buttons scrolls through the available input and output channels and finally through the utility functions. If the current preset is stereo linked, the screen will show the channel pairing whose parameters will both be edited.

## EDIT SELECT BUTTONS

The currently selected edit page is displayed on the bottom left corner of the LCD. Pressing the edit select buttons moves through the available parameters for the currently selected channel.

## TEXT DISPLAY

The main display shows preset, channel, parameter and status information. In most screens the currently selected channel is displayed on the upper line and the edit parameter on the lower line.

## PARAMETER KNOBS

These velocity sensitive encoders are associated with the current on-screen parameters. For example, the value shown on the screen above the letter F1 is controlled by knob F1.

## OUTPUT LEVEL INDICATORS

Two LEDs are provided for each output channel. These show the signal level relative to the limiter threshold. The green LED will light when the signal is 6dB below the threshold and the red 'limit'

LED will light when the limiter threshold is reached.

## MUTES

Each output has a mute button and associated status LED.

Note that the mute buttons do not function when the Secure mode is activated. See below for details of Secure mode.

# Rear Panel.



## POWER INLET

The LA Audio DLX200 series unit should be connected to a suitable mains electricity supply using the cable supplied. The processor has a switch mode power supply that is capable of operating with a nominal mains voltage of 85V to 240V, 50/60Hz without re-configuration.

## BVNET CARD SLOT

To allow for future developments. See [www.laaudio.com](http://www.laaudio.com) for all news and product information.

## AUDIO INPUT CONNECTORS

All audio connections are fully balanced and wired pin-1 ground, pin-2 hot & pin-3 cold. The two inputs have pin-1 connected directly to the chassis and feed the signal processing chains. If an unbalanced source is used, a connection should be made between the pin-3 'cold' signal and the ground connection of the unbalanced source.

## AUDIO OUTPUT CONNECTORS

The processed outputs are impedance balanced, and wired pin-1 ground, pin-2 hot and pin-3 cold. An unbalanced input may be driven by connecting pin-3 'cold' signal to the ground connection of the unbalanced destination input. Note that output pin-1's are ground lifted at audio frequencies but connected to ground at RF for good EMC performance. The intention being that the amplifiers being driven by the processor should be responsible for the grounding of their input cable shields.

## SECURE BUTTON

A momentary button is recessed into the rear panel, between the output XLRs and RS232 port. When activated, this will disable all the front panel controls so they cannot affect the signal path, making the unit secure against tampering. When in secure mode, the indicators still operate normally. Note that the communications port is still active in secure mode.

## COMMUNICATIONS PORT

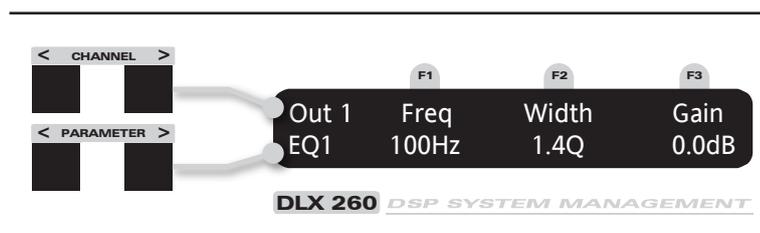
Allows PC control using PodWare. For more information, see your PodWare user guide, or go to [www.laaudio.com](http://www.laaudio.com).

# Operation.

The unit will power up as soon as power is applied to the IEC inlet as there is no power switch. During the start up process the firmware application model number and version numbers are displayed and the outputs are muted until the unit has completed its internal checks – this should take around 5-10 seconds. Once the start-up routines are complete, the processor will restore the settings as they were, previous to the unit being powered down and gradually ramp up the audio signal to its correct level.

## NAVIGATION

Pressing the channel select buttons will scroll through the channels, then through utilities and back to the default screen. The currently selected channel is shown in the top left hand corner of the display. When operating in stereo mode (more on this shortly) the channel selection will reflect this by showing the names of both paired channels.



Pressing the edit navigation buttons gives access to the various pages of parameters available for each channel. The currently selected page is shown in the bottom left hand corner of the display. The screen shows up to three parameters for a given part of the processing functions on a given channel.

The edit buttons allow you to scroll in either direction through the different processing pages for a given Channel. When you go past the last page, you will be returned to the default page.

If you're scrolling through channels and notice that the edit page has changed, fear not: this is probably because the selected channel doesn't have the selected edit parameters. For example, inputs do not have a low-pass filter.

## PRESETS

Your DLX200 processor has 45 presets, each of which capture a complete snapshot of the unit's settings. Aside from the unit's two 'Base Presets', described below, you are free to store settings wherever you wish. To save confusion over which preset does what, your DLX200 also allows you to name your presets with text labels. Just how sensible they are is entirely up to you.

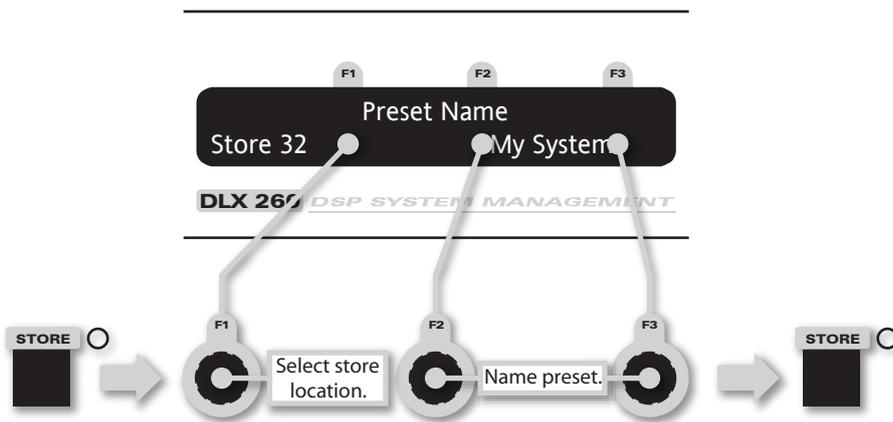
## BASE PRESETS

The unit has two 'Base Presets', mono and stereo. These are empty templates from which you can quickly configure your own settings. They are stored in locations 1 and 2 respectively. Although the base presets are locked and cannot be overwritten, you can edit a base preset to your heart's content and then store your new settings into any unlocked location (i.e. not 1 or 2).

Details of the base presets and a space for noting your own preset details can be found in Appendix A.

## PRESET STORE

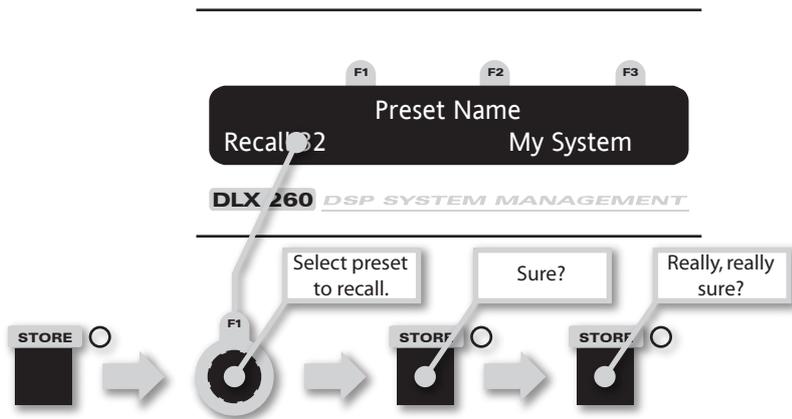
To store the current settings, press [Store]; the button label will illuminate and the store page will appear. Use parameter knob F1 to select a storage location. Once you've chosen a location, the other two knobs to enter your own preset name – F2 selects characters while F3 moves along the screen. Pressing the Store Button again completes the process and stores the Preset. Pressing any other button will cancel the operation.



If you see 'LOCKED PRESET', this means that you're trying to store your settings in location 1 or 2. This is where the base presets are stored, so go find somewhere else to put your settings!

## PRESET RECALL

To select an existing preset, press the Recall Button, the button label will illuminate and the recall page will appear. Turn parameter knob F1 until the required preset number is shown on the display. Base Presets are indicated by a box symbol appearing after the preset number. Press the Recall Button again to activate the Preset. You will be asked to confirm one more time and if you're really, really sure, press recall again. As with storing, pressing any other button cancels the operation.

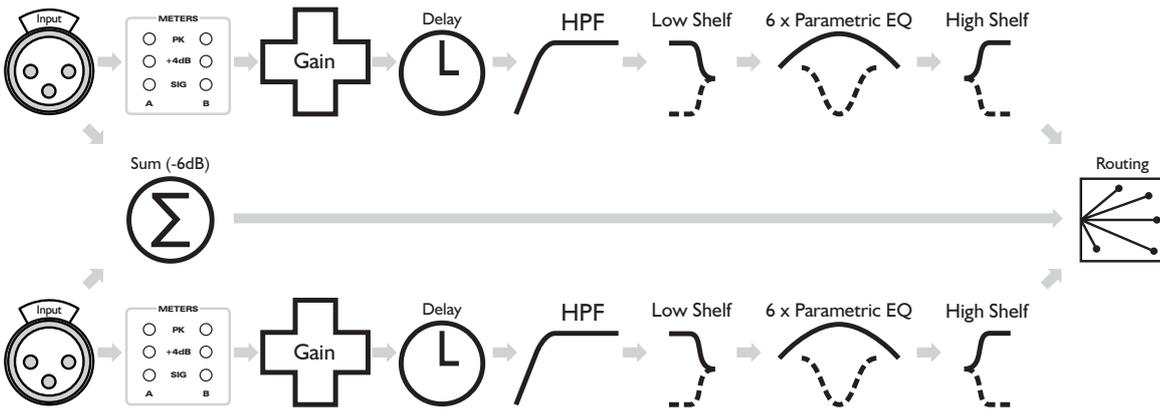


**!** Recalling a preset will clear the currently loaded settings. To keep these, or save changes to an existing preset, first store them, as described above, before attempting to recall another preset.

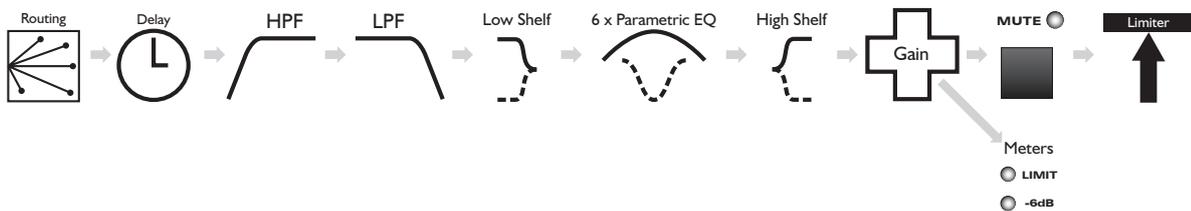
**!** Inappropriate crossover settings for a given system can cause expensive, sometimes irreparable damage to attached devices such as amplifiers and loudspeakers. Be certain before recalling a preset that any attached devices are muted and that you check settings before passing audio.

# Digital Signal Processing.

## INPUT DSP BLOCK DIAGRAM



## OUTPUT DSP BLOCK DIAGRAM



## STEREO / MONO FORMATS

Formats affect the way the above DSP modules are controlled. In Mono format, all outputs have unique parameter settings and flexible routing.

Stereo format pairs the inputs and outputs for stereo operation, the parameters of each member of the pair being identical. The routing of inputs to outputs is fixed. This format is intended for symmetrical stereo operation, eliminating the need to make identical parameter adjustments for each channel. The channel pairing is differs for four and six output units:

### DLX 240

<b>Left</b>	Input A	Output 1	Output 2
<b>Right</b>	Input B	Output 3	Output 4

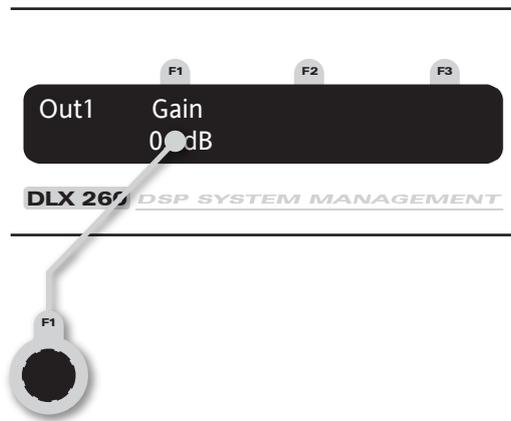
### DLX 260

<b>Left</b>	Input A	Output 1	Output 2	Output 3
<b>Right</b>	Input B	Output 4	Output 5	Output 6

# DSP Controls

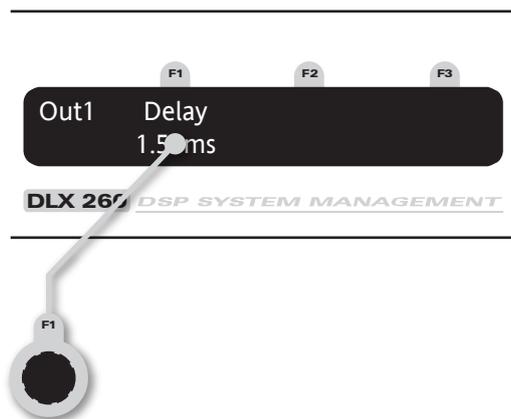
This section describes each of the DSP modules and its controls. As you can see from the diagram above, some modules are common to both inputs and outputs, while some are specific to one or the other. Consequently, this section describes all DSP functions, with notes where they are channel-specific.

## GAIN



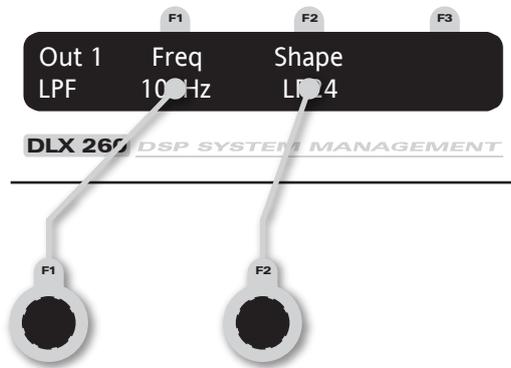
- F1: Gain, adjustable in 0.2dB steps from -80 dB to +20dB

## DELAY



- F1: Delay, adjustable in variable steps from 0 to 400ms

## HIGH AND LOW PASS FILTERS (LPF ON OUTPUT ONLY)



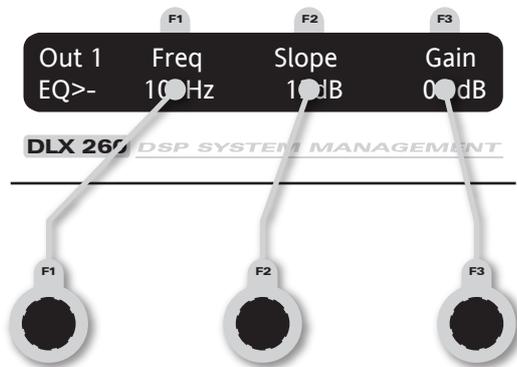
- F1: Frequency, <<out, 10.0Hz to 25.6kHz, out>>
- F2: Filter shape/slope.

The bottom left hand corner of the display will indicate whether the filter is high or low pass. As you can see from the diagram above, input channels have one high pass filter while outputs have one high and one low pass. Filter shape and slope is selectable from Butterworth, Bessel, Linkwitz-Riley and Hardman. Filter slopes of up to 8th order or 48dB / octave are provided, although not all filter types are available in all slopes.

The Hardman type filter is particularly interesting. Rather than following a linear slope, Hardman filters become progressively steeper, allowing you to create more precise crossovers with less overlap. Because of their nonlinear shape, dB/octave measurements are not truly representative of Hardman filters' responses; they are always described by their order rather than their slope.

## EQ

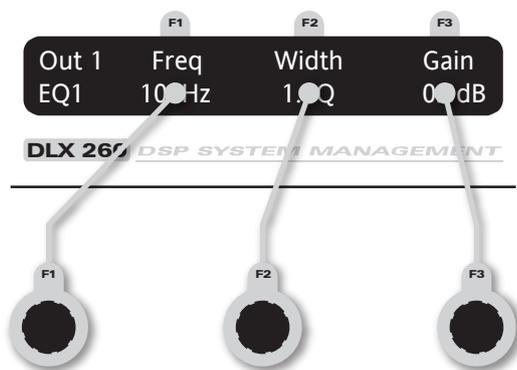
### HIGH AND LOW SHELving FILTERS



- F1: Frequency, 10.0Hz to 25.6kHz in variable steps
- F2: Slope, 6 to 12dB / octave in 1dB steps
- F3: Gain, +/-15dB in 0.2dB steps

The frequency shown is the 'turnover' point, where the filter deviates by 3dB.

### PARAMETRIC EQ



- F1: Centre Frequency, 10.0Hz to 25.6kHz in variable steps
- F2: Width, display selectable for either Q or bandwidth (BW). See utilities below to change view options. BW adjustable from 0.05 to 5 octaves in variable steps Q adjustable from 14.2 to 0.2 in variable steps.
- F3: Gain, +/-15dB in 0.2dB steps.

## IMPORTING PARAMETRIC EQ SETTINGS

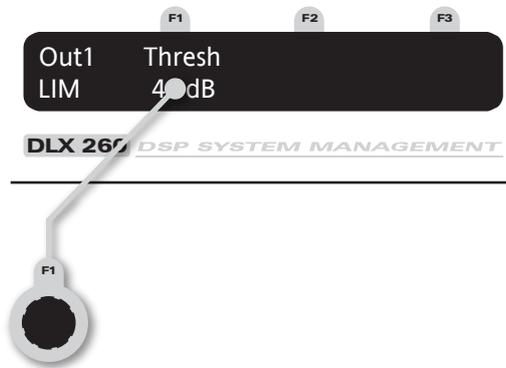
Care should be taken when importing the EQ settings from other speaker management units as the results may not be quite what you expect. This is because the 3 parameters of Frequency, Boost/Cut and Q (or Octave Bandwidth) do not give a complete definition of the actual filter shape. Although Frequency and Boost/Cut are absolute values, Q (or Octave Bandwidth) is generally only correct at one Boost/Cut setting. This is usually at or near maximum boost or cut. At all lower settings, the actual Q will be lower, i.e. the Octave Bandwidth will be wider. The variation in actual Q can be between almost nothing in a “Constant Q” design to considerable in a “Proportional Q” design.

An additional source of error can result from confusion between Q and Octave Bandwidth. At least one other manufacturer calculates Octave Bandwidth by simply assuming that it is the reciprocal ( $1/x$ ) of Q. This would indicate that a Q of 1 would be an Octave Bandwidth of 1. In fact, a Q of 1 is really an Octave Bandwidth of 1.39! A clearer indication of the scale of the error is apparent with a Q of 4.5, which is actually one third of an octave. The reciprocal of 4.5 would imply that it is only one fifth of an octave.

A simple “rule of thumb” to convert Octave Bandwidth to Q is to divide the Square Root of 2 ( $\approx 1.414$ ) by the Octave Bandwidth. Alternatively, to convert Q to Octave Bandwidth, divide the square root of 2 by Q. Although this is not 100% accurate, it will return an error of less than +/-2% between Q values of 1 and 10.

## LIMITERS (OUTPUTS ONLY)

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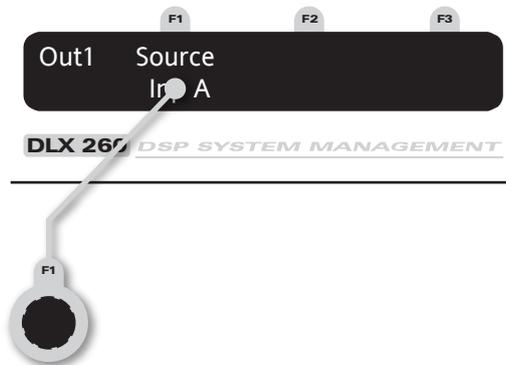


- F1: Threshold, -40dBu to 20dBu in 0.2dB steps

A high performance, low distortion limiter is provided on each output. Threshold is user adjustable; all other parameters are carefully calculated dependant on configuration to provide clean and effective control of signal dynamics. The front panel limit indicators show when the threshold is reached. For system protection this module cannot be bypassed, but setting the threshold to its maximum level will cause limiting only when it is absolutely necessary.

## ROUTING (OUTPUTS ONLY)

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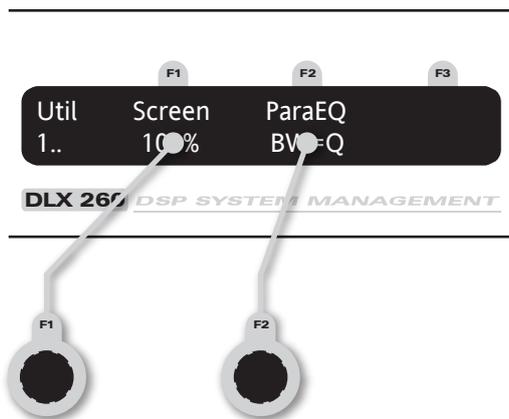
- F1: Output source, selectable; Input A, Input B or Sum A+B

In mono mode, this selects the source for a given output. In stereo mode, routing is preset to the format shown above on page 12.

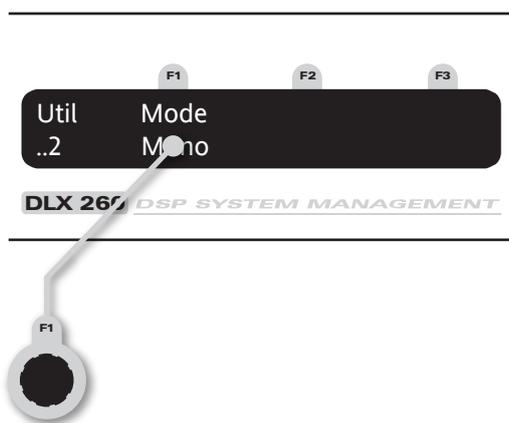
# Utilities

## UTILITY FUNCTIONS

Two utility pages are provided to adjust infrequently used settings. These can be found by pressing the channel buttons until you pass the last output or before input 1.



Utility page 1 sets system-wide display parameters. Screen contrast allows you to adjust the display for different viewing angles. Parametric EQ bandwidths can be set to display in as 'Q' values, or in octaves.



Utility page 2 sets the current format to mono or stereo.

**!** Care should be taken when swapping between mono and stereo mode as the parameter set for the left-hand channels will be copied to, and overwrite the right-hand settings. This is not reversible and could be a real pain if you've just spent ages setting up the right side of your system! For more information on formats, see page 12.

# Technical Specification.

## GENERAL

Inputs	2
Input Impedance	>10k $\Omega$ Electronically balanced
Maximum Input Level	+20dBu
Outputs	4 [DLX240], 6 [DLX260]
Output Impedance	<100 $\Omega$ Ground Balanced
Maximum Output Level	+20dBu into 600 $\Omega$ load.
Sample Rate	96kHz
Bit Depth	24bit
Frequency Response	10Hz to 40kHz $\pm$ 3dB (Filters disabled) (20Hz to 20kHz) $\pm$ 0.5dB (Filters enabled)
THD	<0.01% (+10dBu, 20Hz to 20kHz, 30kHz bandwidth)
Dynamic Range	>112dB (A-weighted, 22kHz bandwidth) >109dB (Unweighted, 22kHz bandwidth)
Serial Comms Data	38.4kbaud, format 8 data, 1 stop no parity

## PROCESSING

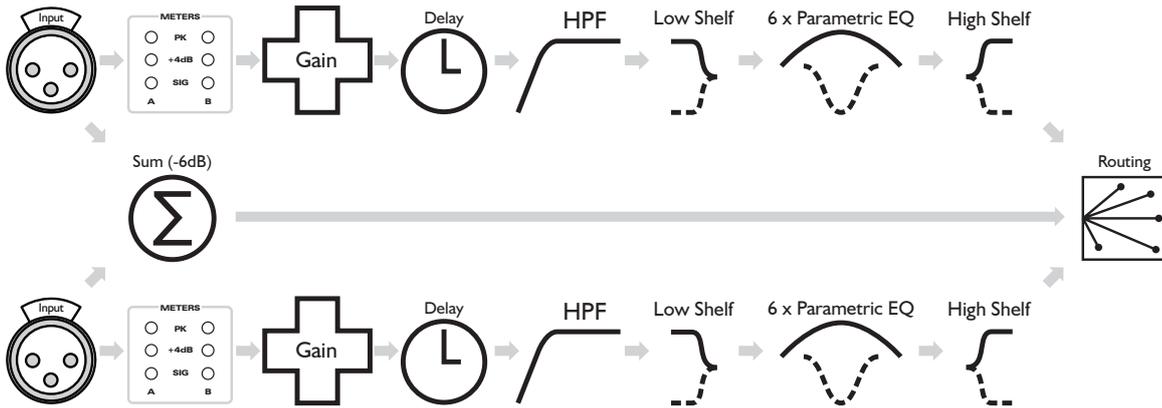
Gain	-80 to +20dB and Mute, 0.2dB steps.
Output Channel Source	Input A, Input B and SUM
HP Filter Frequency	Off, 10Hz to 25.4 kHz, 1/36 octave steps.
LP Filter Frequency	10Hz to 25.4kHz and off, 1/36 octave steps
LP/HP Filter Types	12, 18 & 24 dB/oct Bessel and Butterworth 12, 24 & 48 dB/oct Linkwitz Riley 4th or 8th order Hardman
Delay	Input 400ms, Output 80ms
Limiter	High Performance Limiter, adjustable threshold in 0.2dB steps, automatic time constants.
EQ Frequency	10Hz to 25kHz, 1/36 octave steps
EQ Gain	-15 to +15, 0.2dB steps
EQ Width	0.1 to 5.0 octaves bandwidth, 1/36 octave steps

## CONNECTORS

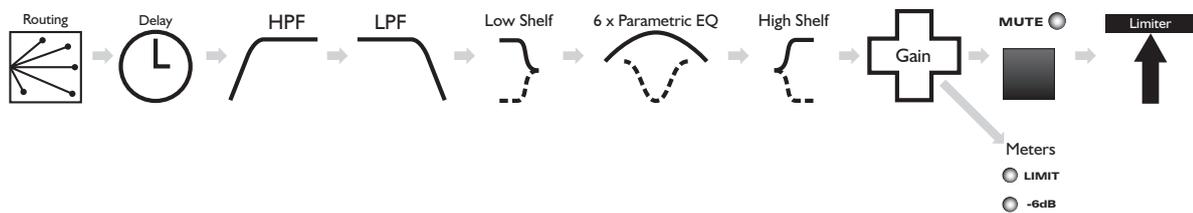
Audio Inputs	3 pin Female XLR
Audio Outputs	3 pin Male XLR
Serial Comms	9 pin D type
Network Comms	Neutrik EtherCon
Mains	3 pin IEC
Mains Power	Universal switch-mode PSU, 85 to 250V AC, 50-60 Hz
Power Consumption	<25W
Dimensions	44H, 482W, 254D mm
Weight	2.7kg Net

# Quick Reference.

## INPUT DSP BLOCK DIAGRAM



## OUTPUT DSP BLOCK DIAGRAM



Page	Channels	F1	F2	F3	Notes
Gain	Ins + Outs	Gain (dB)			
Delay	Ins + Outs	Delay (ms)			In ≤ 400ms. Out ≤ 80ms.
HPF	Ins + Outs	Freq (Hz)	Filter type and slope (dB/oct)		4th or 8th order Hardman.
LPF	Outputs only	Freq (Hz)	Filter type and slope (dB/oct)		See above.
Hi Shelf	Ins + Outs	Freq (Hz)	Slope (dB/oct)	Gain (dB)	
Lo Shelf	Ins + Outs	Freq (Hz)	Slope (dB/oct)	Gain (dB)	
Para EQ	Ins + Outs	Freq (Hz)	Width		6 bands per channel.
Limiter	Outputs only	Threshold (dBu)			
Routing	Outputs only	Source			Input A, input B or sum A+B.
Utilities I	-	Screen Contrast	EQ display		Q or BW (octaves)

Utilities 2	-	Preset Format			Mono or Stereo.
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### TO RECALL A PRESET:

- Ensure that any current unsaved settings are stored.
- Press [Recall].
- Use knob F1 to select a preset.
- Press [Recall] to select the preset, and [Recall] again if you're certain.

Base presets “Mono” and “Stereo” are stored in locations 1 and 2 respectively. Pressing any other button will cancel the operation.

### TO STORE A PRESET:

- Set the unit as desired.
- Press [Store].
- Use knob F1 to select a preset location.
- Use knobs F2 (characters) and F3 (cursor) to create a preset name.
- Press [Store] to write to the preset location.

Storing will overwrite any existing settings stored in the selected preset location. Base presets in locations 1 and 2 cannot be overwritten.

### TO CHANGE MONO/STEREO FORMAT:

- Navigate past the last channel (or before the first) to Utilities page 2.
- Use knob F1 to select mono or stereo mode.

Selecting stereo mode will copy the settings from the left side to the right.

### TO SET DELAY:

Distance (m)	Delay (ms)
10	29.4
50	147.1
100	294.1

- Navigate to the desired channel.