



**Dual 31 Band
Graphic Equaliser &
Dynamics Processor**

User Manual

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Thank you for buying this  product.

As can be found throughout the LA Audio range, your EQ231G-SP has been designed and manufactured to the highest possible standards of performance and reliability. To make the most of your unit, we suggest that you take some time to acquaint yourself with the contents of this manual before you get started.

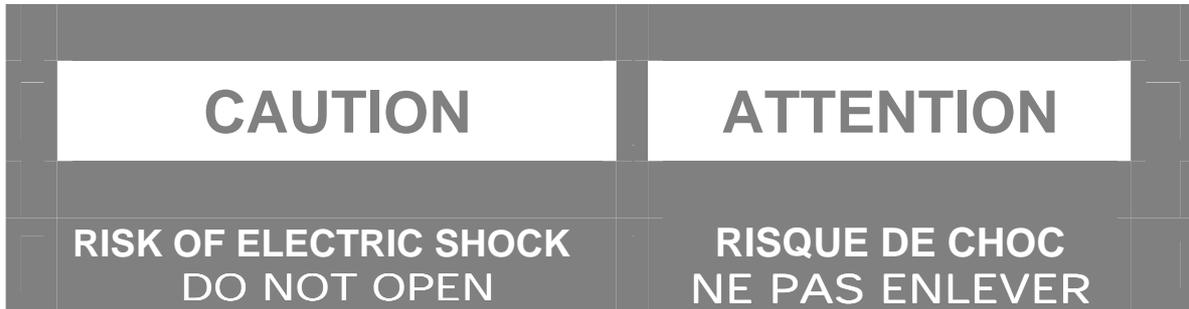
The safety and installation information will help you set up your EQ231G-SP with the minimum of effort, while the operational guide describes the unit's controls and functions. The applications section gives useful hints on how to get the most out of your unit in numerous situations, along with a couple of special effects with which you can experiment.



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IMPORTANT SAFETY INSTRUCTIONS



**PLEASE READ ALL OF THE FOLLOWING
INSTRUCTIONS AND SAVE THEM FOR LATER
REFERENCE BEFORE ATTEMPTING TO
CONNECT YOUR UNIT TO THE AC POWER
SOURCE.**

Safety Information

- EARTH** This unit is connected via its power cord to the mains safety earth. NEVER OPERATE THE UNIT WITH THIS EARTH CONNECTION REMOVED.
- COVERS** DO NOT remove the covers. Refer servicing to qualified personnel only.
- VOLTAGE** The EQ231G-SP is set to operate only at the voltage shown on the outer packaging. CHECK that the correct voltage is available before connecting the AC mains supply.
- FUSES** CHECK that the fuse fitted is of the correct type for the local mains voltage. ALWAYS replace fuse with the correct type.
- MOISTURE** DO NOT expose the unit to rain or moisture. If your EQ231G-SP should become so exposed REMOVE the mains power immediately.
- HEAT** ALWAYS site the unit away from sources of heat including direct sunlight and ensure adequate ventilation around the unit.

1. Introduction

The EQ231G-SP is a high quality dual 31-band 1/3 octave graphic equaliser including variable Hi and Lo-pass filters, Shelving EQ, Gate and Limiter.

The Graphic Equaliser features centre detented, 45mm faders which give up to 12dB of cut and boost at 31 ISO centre frequencies, covering the entire audio spectrum (20 to 20KHz).

The Hi-pass filter uses 4th order bi-quadratic topology giving a 24 dB/octave slope with corner frequency variable from 16 Hz to 160 Hz.

The Lo-pass filter is a 2nd order design (12dB/octave) with the corner frequency variable from 3KHz to 32KHz.

The Shelving Equaliser faders enable control of the amount of cut or boost, a centre detent is provided at 0dB. Two rotary potentiometers enable control of the LF and HF shelf frequency.

A bypass switch allows the whole section to be taken out of circuit.

The Dynamics section uses a fast RMS detector with soft-knee action.

The Limiter has a 3 segment LED gain reduction display.

The Gate has an LED indicator illuminating when the signal is below threshold.

A delayed by-pass relay allows silent on/off switching and also provides direct throughput when the unit is not powered.

Inputs and outputs are electronically balanced. Each channel has a Peak Indicator illuminating for an equivalent output signal of +18dBu.

Options

The unit can be augmented by parallel outputs offering a unique transformer distortion cancellation circuit. This reduces distortion by an order of magnitude compared to conventional designs and also provides galvanic isolation from connected devices for the reduction of interference and hum.

2. Installation

It is important to read this section before applying power to the unit.

2.1. Inspection and unpacking

The EQ231G-SP is carefully packed at the factory in a carton which is designed to withstand handling in transit.

However if transit damage is evident, **DO NOT** discard any of the packaging material and notify the carrier and your dealer immediately.

The shipment should contain the following:

- The Unit, EQ231G-SP Graphic Equaliser
- Power cord
- Technical Manual (this book)

If any of the above items are missing, notify your supplier immediately.

2.2. Operating Environment

The unit is designed to operate between 0° and +50°C (32° - 122° F) in an atmosphere of relative humidity up to 80%.

Should the unit be installed in an equipment rack, it is important to ensure that the operating temperature inside the rack does not exceed the upper limit. This may be the case where the rack contains power amplifiers and a cooling fan may be necessary in such installations.

Although designed to withstand hum pick-up, it is **VERY** important that the unit is not installed close to any strong electro-magnetic fields, such as power amplifiers.

2.3. Power Requirements

The voltage is pre-selected at the factory for the country of destination.

Fuse rating (Note: Fuse must be Slow – Blow T-Type)

115-125 Volts AC 50/60Hz T630mA

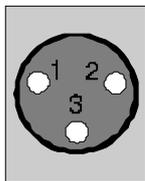
200-250 Volts AC 50/60Hz T315mA

(A 100 Volt special transformer is available for Japan).

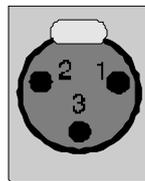
2.4. External connections



The input and output connectors are wired on female and male XLRs respectively, wired as follows:



MALE XLR



FEMALE XLR

Pin 1: Ground

Pin 2: Hot balanced signal

Pin 3: Cold balanced signal

2.5. Impedance & Termination

Most modern audio systems have cable runs of less than 100 meters; the devices used usually have very low output impedance and relatively high input impedance. This allows equipment to be connected in series without regard to "impedance matching" (as long as the succeeding input is greater than the stated minimum for the output it is connected to).

LA Audio products conform to this standard; therefore inputs and outputs are usually indifferent to varying load or source impedance. The only exception to this rule is where the unit is connected to a transmission line or some older vacuum-tube equipment, which require proper impedance matching. This may be achieved by shunting the correct matching resistor across the inputs or outputs. The EQ231G-SP has an input impedance of approximately 20k Ω and an output source impedance of 100 Ω , (20 Ω with the transformer option fitted). Its minimum following stage input impedance should equal or exceed 600 Ω .



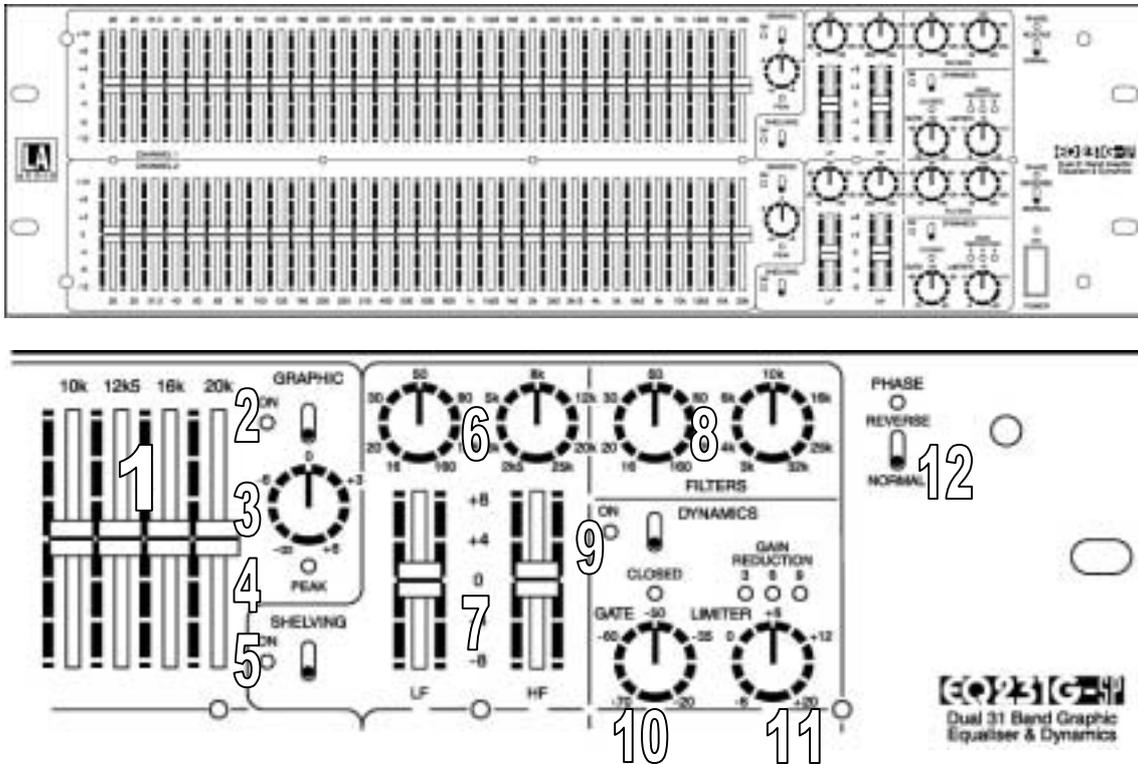
2.6. Signal levels

The unit is designed to accept an input signal level of up to +20dBu (dB referred to 0.775Vrms). Above this, clipping (distortion) of the signal will occur.

It should be noted that the filter amplifiers may be driven into distortion by excessive boost in the unit, and where this is the case the input signal should be reduced sufficiently to allow enough headroom.

3. Operating Instructions

3.1. Controls



1. **EQ faders** allow high-resolution control over EQ gain at 31 ISO frequencies. The frequency is indicated on the front panel, as are the amounts of cut and boost, between -12 and $+12$ dB. Each fader has a centre detent, which allows you to quickly return it to its inactive (0dB) position.
2. **Graphics ON switch** allows the graphic filters to be taken out of circuit for comparison checks. The adjacent LED illuminates when the filters are IN circuit (i.e. the graphic is functioning).
3. **Gain control** adjusts gain at the input stage; ranging from $-\infty$ to $+6$ dB. The centre detent allows the unit to quickly be set to unity gain (0dB).
4. **Peak LED**. This illuminates when the audio signal is within 2dB of clipping ($+18$ dBu) at the output. When this light is on, there is a good chance that boost applied in the equaliser's filters will cause clipping. To combat this, reduce the input gain or the source's output level.

5. **Shelving Filter Bypass switch** allows the filter to be taken out of circuit. This allows you to hear its effects when compared to the unfiltered sound, and also to allow low frequencies to pass unaffected.
6. **Shelving Filter Frequency** rotary potentiometers enable control of the LF and HF shelf frequency.
7. **Shelving EQ** section faders enable control of the amount of cut or boost, a centre detent is provided at 0dB.
8. **The High-pass filter** is a 4th order design (24dB/octave) with the corner frequency variable from 16 Hz to 160 Hz. The Lo-pass filter is a 2nd order design (12dB/octave) with the corner frequency variable from 3KHz to 32KHz.
9. **The Dynamics Bypass** switch allows the whole section to be taken out of circuit.
10. **The Dynamics section** features a Limiter and a Gate. The Gate Threshold potentiometer controls the level of signal necessary to turn on the gate. Below this level, the signal is attenuated in such a way that unwanted noises such as hiss and hum are reduced. The Gate LED illuminates when the signal is below threshold, indicating the gate is "closed".
11. **The Limiter Threshold** potentiometer controls the level above which gain is reduced in order to keep the level constant, thus avoiding damage to succeeding equipment. A 3 LED progressive luminosity bargraph indicates the gain reduction or "amount of limiting". The Threshold ranges of the Gate and Limiter are such that in the extreme positions (Gate at -70dB, Limiter at +20) they can be considered out of circuit.
12. **The Phase Reverse** switch reverses the connections of the output XLR connectors. This passive arrangement guarantees that, even when the unit is off, the phase condition is retained. A red LED illuminates to indicate the Reverse condition.



4. Applications & Techniques

A graphic equaliser may be used in numerous situations, in many different ways. It is impossible to document every implementation, but we hope that the following examples will serve as a useful starting point.

4.1. Some Examples

a) Room equalisation

Every room, whether it be in a studio, theatre or home has a different acoustic response, depending upon room dimensions, fixtures and fittings and any other absorptive or reflective materials such as people, tables or mixing consoles. A graphic equaliser may be used to "correct" the room, i.e. tailor the sound being reproduced so that the room appears to have an even or "flat" response throughout the audio frequency range, thus providing a correct reproduction of the original sound, improved intelligibility, or helping to achieve loud volumes without an abrasive tonal character.

There are several ways of measuring a room's frequency response, and these are usually all similar in technique, although differing in hardware. Using a Real-time analyser, inconsistencies in the system's frequency response can be detected and corrected with the graphic EQ. Alternatively, adjustments can be made by ear in response to trial system output, such as CD playback. It is important to remember that the ear responds differently to the frequency spectrum at different volumes, so adjustments made by ear should be done at or around the intended operational volume.

While the graphic equaliser is a powerful tool, it is worth noting that speaker positioning and balancing along with room adjustments such as using drapes will often prove to be more effective solutions to balance issues than heavy-handed equalisation. The graphic EQ is usually best for fine-tuning system response.

b) Sound-shaping

The graphic equaliser may be used to change an original sound to make it more pleasing to the ear or to blend it in with other audio signals without overlap. This

technique is quite common in recording or production studios to tailor a sound for its eventual reproduction medium.

c) Elimination of "sibilance"

Sibilance is the noise which occurs when someone is speaking who either has a "hissy" voice or who is using words with the letter 's' in them, e.g. 'sibilance'. This can become annoying to a listener and the graphic equaliser can be used to overcome this problem by either removing or reducing the offending frequency.

Graphic equalisers can also be used in conjunction with compressors to create a 'de-esser', which can respond to 's' sounds in a signal and reduce the level accordingly. To create this effect, insert the graphic EQ into the compressor's sidechain and boost the frequencies in which the sibilance occurs. While this seems counterintuitive, boosting increases the compressor's sensitivity to these frequencies, meaning that when they are most present, the compressor will reduce the signal level, thereby stopping the sibilance from reaching its full volume. Because the EQ is inserted into the compressor's sidechain and not the signal path, the EQ boost will be inaudible at the compressor's output.

d) Elimination of "proximity effect"

Cardioid microphones usually have a low frequency emphasis, which in certain situations can present problems. For example, speech over a public address system can sound muffled and lose intelligibility if the microphone's response is particularly bassy. The graphic equaliser can eliminate this by reducing or removing the unwanted frequency.

e) Sound effects

By using the graphic equaliser creatively a sound may be completely changed and effects obtained. The most common sound effect created in this way is the "telephone voice" which can make even an expensive studio microphone sound like a telephone handset. To create this effect, first set the hi-pass filter to its highest frequency (160Hz). Then cut completely frequencies between 20 and 315Hz and those between 4 and 20kHz. The remaining band is roughly equivalent to the bandwidth of a phone line.

Another useful effect that can be created with a graphic EQ is a 'Comb Over'. To give a mono source some interest in a stereo mix, the graphic equaliser can be used to create variances in each side of the stereo signal, thereby widening the sound. Route the mono signal to both channels of the EQ231G-SP and on each channel cut alternate frequencies by around 6dB. With certain source material, you may need to cut less at low frequencies to avoid an imbalance in the stereo image.

f) Reduction of feedback

In many auditoriums, a graphic equaliser may be used to increase the gain before feedback (GBF). Essentially, this involves cutting the frequencies associated with feedback to allow the system to be safely turned up.

The usual method is to set the graphic equaliser to a "flat" position, (i.e. all sliders at 0dB) and to increase the overall level in the auditorium, until feedback commences. Then reducing the level to just under the feedback point, each frequency band in turn is boosted until the feedback frequencies have been identified. Some practice will enable you to identify frequencies by ear to speed this adjustment. By notching the offending bands down slightly, the overall level may be increased. This may be repeated until the overall gain reaches the required level.

It is worthwhile to note that if boosted sufficiently, all frequencies will eventually feed back, so a balance should be struck between gain and tonal integrity, as extreme EQ adjustments can have a detrimental effect on audio quality. Moreover, the graphic equaliser is not the only tool at an engineer's disposal for improving GBF: good microphone and speaker placement will often reduce the severity of EQ required to achieve sufficient gain.

g) Graphic equalisers and dynamics

In most instances, it is good practice to place graphic equalisers before any dynamics processors such as compressors or limiters. This is for two main reasons:

As the graphic equaliser is essentially a set of volume controls (albeit frequency specific ones) and dynamics units respond to volume, it is best to cut or boost frequencies as desired before applying compression. This ensures that the compressor or limiter only acts on frequencies that will be present at the output. This is particularly important with low frequencies, which are more likely to trigger the

compressor or limiter. Placing the graphic equaliser after dynamics could cause the compressor or limiter to react to frequencies not audible in the output, creating unusual undulations in volume not associated with the program material.

The second reason for placing the graphic equaliser before dynamics occurs where the dynamics processor is being used to safeguard PA systems or digital recorders. As the equaliser can create changes in volume (both with EQ and input gain), placing it after a limiter or compressor, may cause increases in gain beyond safe limits.

4.2. A word of caution

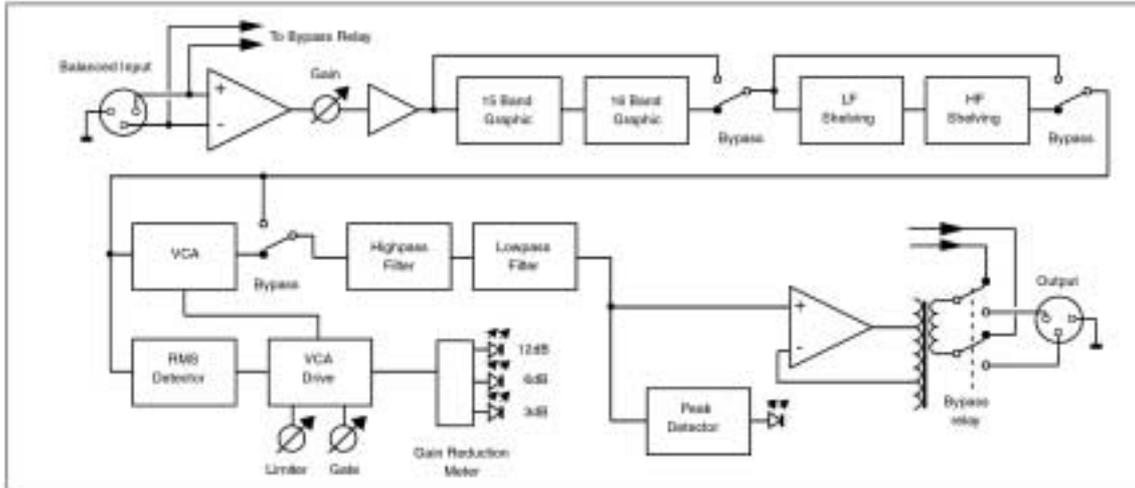
Sadly, graphic EQs can't cure every problem you're likely to encounter as an engineer. Not only that, but it's highly unlikely that you'll ever get a truly flat room response without calling in some builders. Consequently, a compromise must be struck between technical perfection, sonic quality and, very often, the time taken to reach such a balance.

There are three things worth remembering when using your graphic EQ: Avoid extreme settings unless for an effect; they will most likely sound unnatural and may exacerbate balance problems. Boost tends to sound more obvious to the ear, so cut troublesome frequencies rather than boosting nice ones. And finally, remember that while the legend and calibration markings on your EQ231G-SP are a useful guide, they are just that, a guide so be sure to trust your ears.

5. Block Diagram & Specifications

5.1 Block Diagram

BLOCK DIAGRAM





5.2 Specifications

Frequency Response	20 Hz - 20 kHz, -1dB
Signal to Noise Ratio @ +4dBu output	-96dB
Input impedance	20 k Ω balanced
Output impedance	100 Ω balanced
Maximum Output Level (into 600 Ω Load, 1 kHz, 600 Ohms Load)	+20dBu
Total Harmonic Distortion (1kHz, +4dBu Output)	0.003 %
Peak indicator Threshold	2dB before clipping

Centre frequencies :

20, 25, 31.5, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1k, 1k25, 1k6, 2k, 2k5, 3k15, 4k, 5k, 6k3, 8k, 10k, 12k5, 16k, 20k.

Limiter Threshold	-6 to +20dBu
Gate Threshold	-70 to -20dBu
Limiter Ratio	20:1 soft-knee
Gate Ratio	10:1 soft-knee
Hi-Pass Filter corner frequency	16Hz to 160Hz
Hi-Pass Filter slope	24dB/Octave Butterworth
Lo-Pass Filter corner frequency	3KHz to 32KHz
Lo-Pass Filter slope	12dB/Octave Butterworth
LF Shelving EQ Frequency	16Hz to 160Hz
HF Shelving EQ Frequency	2.5KHz to 25KHz
Power Consumption (115/220 VAC, 50-60 Hz)	15 Volt-Amps
Weight	7.2 kg
Dimensions (mm)	483 W x 230 D x 135 H

Note: 0dBu is referenced to 0.775 V RMS.

Product information and specifications are subject to change without notice. E&OE.

6. Repairs and warranty

The EQ231G-SP is a ruggedly constructed solid-state unit that requires no preventative or routine maintenance.

The unit is constructed from the highest quality components, which are selected to provide consistent, long-lasting performance. Each unit is 'soak-tested' before despatch – sifting out any rogue components before they leave the factory. If correctly installed and operated the unit should give years of problem free operation.

Your EQ231G-SP comes with a manufacturers warranty for one year from the date of despatch to the end user.

The warranty covers faults due to defective materials used in manufacture and faulty workmanship only.

During this warranty period LA Audio will repair or at its discretion replace any faulty unit provided it is returned carriage paid to an authorised LA Audio service centre.

We will not provide warranty repair if in our opinion the fault has resulted from unauthorised modification, misuse, negligence, act of God or accident.

We accept liability to repair or replace your EQ231G-SP as described above. We do not accept any additional liability.

This warranty does not affect any legal rights you may have against the person who supplied this product – it is additional to those rights.