

EQN1

EQUALIZER-NOTCH FILTER

OPERATING INSTRUCTIONS and trouble-shooting guide

LECTROSONICS, INC.
Rio Rancho, NM

INTRODUCTION

The EQN1 Equalizer/Notch Filter Module is designed to provide sophisticated system equalization capabilities in a compact, low-cost module. The signal processing functions included on the EQN1 are a variable frequency low-cut filter, a ten band 1/3 octave equalizer for voice band signals, a high frequency contour with variable hinge frequency and variable cut/boost, and three variable depth and frequency notch filters.

The EQN1 occupies two standard widths in a Modular Audio Processor mainframe. All controls are recessed, and are covered by a supplied panel to prevent accidental mis-adjustment.

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GENERAL TECHNICAL DESCRIPTION

The architecture of the EQN1 is composed of a number of signal processing blocks in series with one another. After the balanced input, the signal passes through the variable frequency low-cut filter.

This filter is an 18dB/octave state variable Butterworth filter. The -3dB corner frequency is adjustable from 20-200Hz. The state variable filter topology offers both straightforward adjustment and very low component sensitivity. This insures that drift from initial settings over time is minimized.

After the low-cut filter, the signal passes to the 10 band 1/3 octave equalizer. The frequencies covered are 320Hz to 2.5kHz, on ISO center frequencies. The filters provide a 12dB cut/boost range. Each filter section uses only resistors, capacitors, and active devices to implement the required frequency response. This approach avoids the hum susceptibility and component drift often associated with equalizers using inductors.

From the equalizer, the signal goes to the high frequency contour circuitry. The contouring consists of a hinge frequency which is adjustable from 1kHz to 8kHz. A maximum of 12dB cut or boost may be introduced. The cut or boost begins at the hinge frequency and moves toward the amount of cut or boost (as set by the cut/boost control) at a rate of approximately 3dB/octave.

The final section of processing in the EQN1 is a set of three independent notch filters. These filters have a variable center frequency from 90-9kHz in two ranges, as well as an "out" position. Notch depth is adjustable from 0 to 15dB. Notch width is fixed at 1/6 of an octave. The notch filter sections also employ state variable topology for stable performance over time.

The output circuit is an electronically balanced and floating type, which is RF filtered.

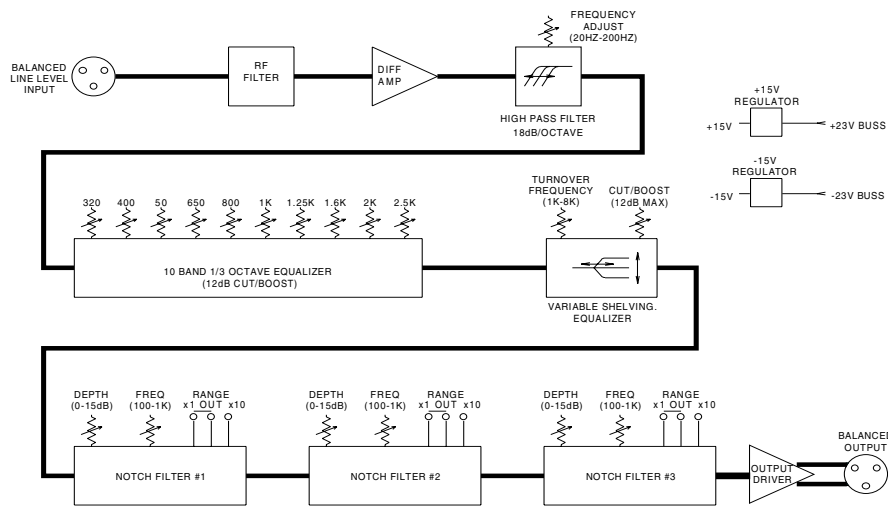


Figure 1 - EQN1 Block Diagram

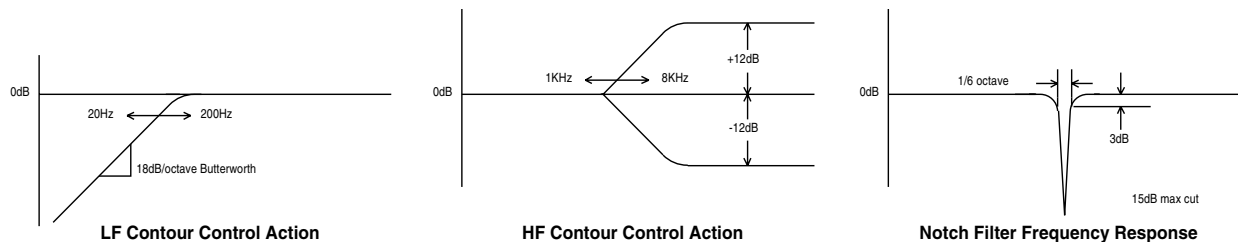


Figure 2 - EQN1 Adjustment Effects

FRONT PANEL DESCRIPTION

LF CUT - Set the -3dB frequency of the low-cut filter. The 20Hz setting provides subsonic filtering, but has no effect in the audible band. Settings higher than 20Hz filter progressively more room rumble, mic handling noise, and "popping" type breath noise.

1/3 OCTAVE EQ CONTROLS - Set the amount of cut/boost desired in the selected frequency range. Fully clockwise is 12dB of boost, and fully counterclockwise is 12dB of cut.

HF CONTOUR, LEVEL - Sets the amount of cut or boost introduced by the HF contour controls. The range of the Level control is +/-12dB.

HF CONTOUR, FREQ - Sets the hinge frequency for the contour circuit. The frequency is variable from 1kHz to 8kHz.

NOTCH FREQ - Sets the center frequency of the notch filter over a 10:1 frequency range.

NOTCH FREQ RANGE SWITCH - Sets the range of frequencies over which the notch filter operates. In the x1 position, the range is 100-1kHz. In the x10 position, the range is 1kHz-10kHz. The center position provides an "out" setting, where there is no filtering action from that filter.

NOTCH DEPTH - Sets the attenuation of the notch filter at its center frequency. This is adjustable from 0dB to 15dB of attenuation.

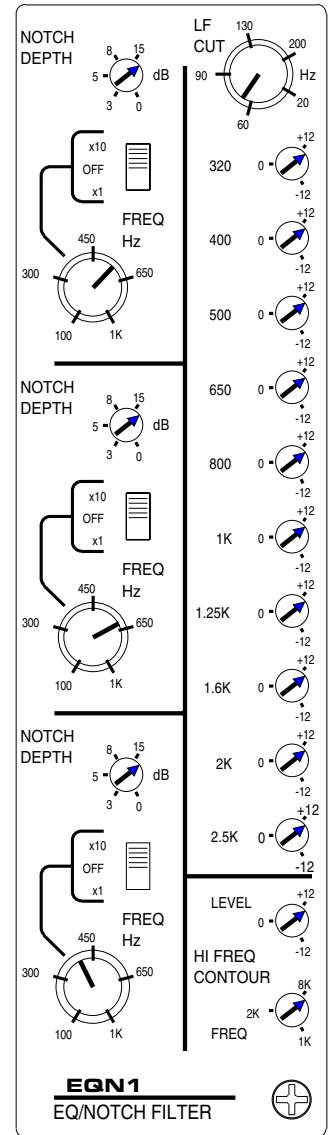


Figure 3 - EQN1 Front Panel

REAR PANEL DESCRIPTION

INPUT - Provides a balanced, RF filtered, XLR type line level input to the EQN1.

OUTPUT - Provides a balanced and floating, RF filtered, XLR type line level output from the EQN1.

OPERATING INSTRUCTIONS

The following instructions assume a properly set up automatic or standard system.

- 1) Set the LF CUT control to the desired frequency. The setting will be determined both by the desired low frequency response of the system, and the amount of low frequency background noise present.
- 2) Using a pink noise generator as input to the EQN1 and a 1/3 octave analyzer, adjust the 10 band equalizer for the desired response in the voice band. Next, set the high frequency contour controls (if desired) to smooth the high frequency response of the system.
- 3) Reconnect the Main output to the EQN1 input, such that the sound system is operational. If the system is automatic, set the mic preamps in the direct mode. Slowly raise system gain until feedback just begins. Set the Notch Depth to 15dB, and adjust the range control and range switch until the feedback stops. Repeat for the remaining notch filters. Depending on the maximum system gain needed, the Notch Depth attenuation may be decreased, as long as system stability is maintained at maximum system gain.

INSTALLATION

The EQN1 module is installed from the rear of the Modular Audio Processor mainframe. The printed circuit board fits into one of the ten sets of card guides provided in the mainframe. The module is then slid forward in the mainframe until the female edge connector on the board is firmly seated on the male pins of the main bus board. Care should be taken when inserting the edge connector onto the pins to be sure there is correct alignment. Four #4 machine screws are provided to fasten the rear panel to the top and bottom rear rails of the Modular Audio Processor mainframe. In addition, four #4 countersink machine screws are provided to secure the cover panel, also provided, on the front of the Modular Audio Processor mainframe after system adjustment is complete.

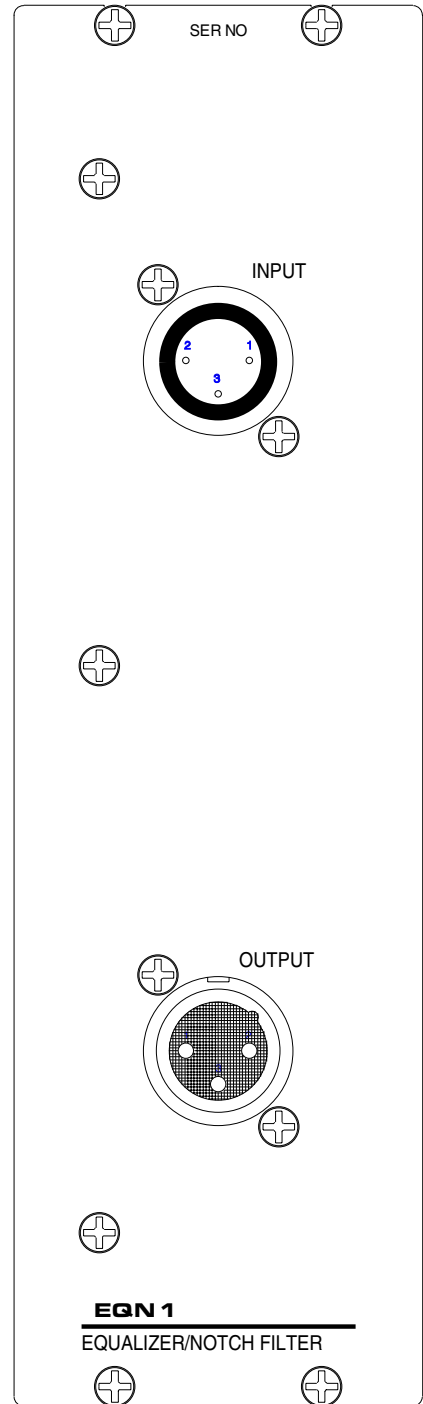


Figure 4 - EQN1 Rear Panel

SERVICE AND REPAIR

If your system malfunctions, you should attempt to correct or isolate the trouble before concluding that the equipment needs repair. Make sure you have followed the setup procedure and operating instructions. Check out the inter-connecting cords and then go through the TROUBLE SHOOTING section in the manual

We strongly recommend that you **do not** try to repair the equipment yourself and **do not** have the local repair shop attempt anything other than the simplest repair. If the repair is more complicated than a broken wire or loose connection, send the unit to the factory for repair and service. Don't attempt to adjust any controls inside the units. Once set at the factory, the various controls and trimmers do not drift with age or vibration and never require readjustment. **There are no adjustments inside that will make a malfunctioning unit start working.**

LECTROSONICS service department is equipped and staffed to quickly repair your equipment. In-warranty repairs are made at no charge in accordance with the terms of the warranty. Out of warranty repairs are charged at a modest flat rate plus parts and shipping. Since it takes almost as much time and effort to determine what is wrong as it does to make the repair, there is a charge for an exact quotation. We will be happy to quote approximate charges by phone for out of warranty repairs.

RETURNING UNITS FOR REPAIR

You will save yourself time and trouble if you will follow the steps below:

- A. DO NOT return equipment to the factory for repair without first contacting us by letter or by phone. We need to know the nature of the problem, the model number and the serial number of the equipment. We also need a phone number where you can be reached 8 am to 4 pm (Mountain Standard Time).
- B. After receiving your request, we will issue you a return authorization number (R.A.). This number will help speed your repair through our receiving and repair departments. The return authorization number must be clearly shown on the outside of the shipping container.
- C. Pack the equipment carefully and ship to us, shipping costs prepaid. If necessary, we can provide you with the proper packing materials. UPS is usually the best way to ship the units. Heavy units should be "double-boxed" for safe transport.
- D. We also strongly recommend that you insure the equipment, since we cannot be responsible for loss of or damage to equipment that you ship. Of course, we insure the equipment when we ship it back to you.

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SPECIFICATIONS

Lf Cut Section:

Filter Type: 18dB/octave state variable, Butterworth alignment
Frequency Range: 20-200Hz, continuously variable

Equalizer Section:

Filter Type: Simulated inductor active filter, 1/3 octave
Center Frequencies: 320, 400, 500, 650, 800, 1K, 1.25K, 1.6K, 2K, 2.5K
Maximum Cut/Boost: 12dB

HF Contour Section:

Turnover Frequency Range: 1kHz-8kHz
Maximum Cut/Boost: 12dB

Notch Filter Section:

Filter Type: State variable two-pole bandstop
Center Frequency Range: 100-1kHz and 1kHz-10kHz
Maximum Notch Depth: 15dB

THD @ +4dBu: Less than .02%
(All controls flat)

IMD @ +4dBu (60/7KHz): Less than .02%
(All controls flat)

Noise, 20-20KHz: -90dBu

Input Impedance: 20K balanced, 10K unbalanced

Output Impedance: 100 ohms balanced, 50 ohms unbalanced

Maximum Input Level: +20dBu

Maximum Output Level: +20dBu

Input/Output Connectors: 3 Pin XLR

Maximum Power Consumption: 100mA at +/-15 volts

LIMITED ONE YEAR WARRANTY

The equipment is warranted for one year from date of purchase against defects in materials or workmanship provided it was purchased from an authorized dealer. This warranty does not cover equipment which has been abused or damaged by careless handling or shipping. This warranty does not apply to used or demonstrator equipment.

Should any defect develop, we will, at our option, repair or replace any defective parts without charge for either parts or labor. If we cannot correct the defect in your equipment, we will replace it at no charge with a similar new item. We will pay for the cost of returning your merchandise to you.

This warranty applies only to items returned to us, shipping costs prepaid, within one year from the date of purchase.

This warranty gives you specific legal rights. You may have additional legal rights which vary from state to state.

LECTROSONICS, INC.

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