



# onpointaudio®

ACOUSTIC EXCELLENCE®

## EQUALIZATION AND FILTER RECOMMENDATIONS

(Updated 1-2014)

On Point Audio professional loudspeaker systems are used in a wide variety of applications with greatly differing venue acoustics. It is frequently necessary to apply active equalization to the speakers to enhance their performance or correct the system/room interactions. This application note will provide filter recommendations for both DSP-based processors as well as 1/3-octave equalizers. Additionally, bi-amp recommendations are provided for adding a subwoofer to the sound system.

On Point Audio always suggests the use of a DSP (Digital Signal Processor) based filter and equalization system to provide the most flexible and tunable filtering and equalization. Our most important recommendation is to always use a high-order high-pass filter to protect the loudspeaker and amplifier from damaging subsonic signals. These subsonic signals are input signals below the natural cutoff frequency of the loudspeaker system and are typically not audible but can produce significant harmonic distortion and can adversely affect system reliability. These subsonic signals also substantially reduce the amplifier's available headroom. The general practice is to employ a 24 dB-per-octave high pass filter 5 Hz to 10 Hz below the loudspeaker's natural cutoff frequency. Loudspeaker systems should NEVER be boosted below the natural cutoff frequency of the enclosure. In a general sense, this cutoff frequency should be taken to be the published -3 dB limit of the loudspeaker. This parameter is always noted on the product's specification sheet.

When a 1/3-octave equalizer is used in a system, the recommendations listed below are "starting points" since individual filter bands may require adjustments to deal with system feedback issues related to the position of stage equipment, microphones and the loudspeaker systems in a live sound venue. For music playback, the recommended 1/3-octave settings may be set to the values listed.

It is worth noting that individual listener preferences may require modification to these recommended settings. The settings below will achieve relatively smooth free-field amplitude response but room acoustics, various equipment combinations and musical preferences may require adjustments.

## **OPALine** (used without subwoofer, wall-mounted)

### DIGITAL PROCESSOR RECOMMENDATIONS

<u>Frequency</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Filter Type</u>
80 Hz	N/A	N/A	High-Pass 24 dB/octave Butterworth (minimum – can be higher)
500 Hz	-2.0 dB	0.3 octave	PEQ
2,000 Hz	-2.0 dB	0.3 octave	PEQ

## **OPALine** (used without subwoofer, away from walls)

<u>Frequency</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Filter Type</u>
80 Hz	N/A	N/A	High-Pass 24 dB/octave Butterworth (minimum – can be higher)
80 Hz	+3.5 dB	0.3 octave	PEQ
100 Hz	+3.0 dB	0.3 octave	PEQ
125 Hz	+2.0 dB	0.3 octave	PEQ
160 Hz	+1.0 dB	0.3 octave	PEQ

\*PEQ refers to “Parametric EQ”

# OPA 8 NP

## DIGITAL PROCESSOR RECOMMENDATIONS

<u>Frequency</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Filter Type</u>
80 Hz	N/A	N/A	High-Pass 24 dB/octave Butterworth
800 Hz	-3.0 dB	0.3 octave	PEQ
1,000 Hz	-2.0 dB	0.3 octave	PEQ
3,150 Hz	-3.0 dB	0.3 octave	PEQ
4,000 Hz	-1.5 dB	0.3 octave	PEQ
16,000 Hz	-4.0 dB	0.3 octave	PEQ

## 1/3-OCTAVE GRAPHIC EQ RECOMMENDATIONS

(Any 1/3 octave filter center frequencies not referenced should be left at 0 dB gain)

20 Hz	Full Attenuation	1/3	N/A
25 Hz	Full Attenuation	1/3	N/A
31.5 Hz	Full Attenuation	1/3	N/A
40 Hz	Full Attenuation	1/3	N/A
50 Hz	Full Attenuation	1/3	N/A
63 Hz	Full Attenuation	1/3	N/A
80 Hz	0 dB	1/3	N/A
800 Hz	-3.0 dB	1/3	N/A
1,000 Hz	-2.0 dB	1/3	N/A
3,150 Hz	-3.0 dB	1/3	N/A
4,000 Hz	-1.5 dB	1/3	N/A
16,000 Hz	-4.0 dB	1/3	N/A

\*PEQ refers to "Parametric EQ"

# OPA 12

## DIGITAL PROCESSOR RECOMMENDATIONS

<u>Frequency</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Filter Type</u>
60 Hz	N/A	N/A	High-Pass 24 dB/octave Butterworth
3,150 Hz	-2.0 dB	0.3 octave	PEQ
4,000 Hz	-2.0 dB	0.3 octave	PEQ
16,000 Hz	-3.0 dB	0.3 octave	PEQ

## 1/3-OCTAVE GRAPHIC EQ RECOMMENDATIONS

(Any 1/3 octave filter center frequencies not referenced should be left at 0 dB gain)

20 Hz	Full Attenuation	1/3	N/A
25 Hz	Full Attenuation	1/3	N/A
31.5 Hz	Full Attenuation	1/3	N/A
40 Hz	Full Attenuation	1/3	N/A
50 Hz	Full Attenuation	1/3	N/A
63 Hz	0 dB	1/3	N/A
3,150 Hz	-3.0 dB	1/3	N/A
4,000 Hz	-1.5 dB	1/3	N/A
16,000 Hz	-4.0 dB	1/3	N/A

\*PEQ refers to "Parametric EQ"

# OPA 15 NP

## DIGITAL PROCESSOR RECOMMENDATIONS

<u>Frequency</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Filter Type</u>
37 Hz	N/A	N/A	High-Pass 24 dB/octave Butterworth
50 Hz	+1.5 dB	0.3 octave	PEQ
800 Hz	-2.5 dB	0.3 octave	PEQ
1,250 Hz	-2.0 dB	0.3 octave	PEQ
4,400 Hz	-2.5 dB	0.4 octave	PEQ

## 1/3-OCTAVE GRAPHIC EQ RECOMMENDATIONS

(Any 1/3 octave filter center frequencies not referenced should be left at 0 dB gain)

20 Hz	Full Attenuation	1/3	N/A
25 Hz	Full Attenuation	1/3	N/A
31.5 Hz	Full Attenuation	1/3	N/A
40 Hz	0 dB	1/3	
50 Hz	+1.5dB	1/3	N/A
800 Hz	-2.5dB	1/3	N/A
1,250 Hz	-2.0dB	1/3	N/A
4,000 Hz	-1.5dB	1/3	N/A
5,000 Hz	-1.5dB	1/3	N/A

\*PEQ refers to "Parametric EQ"

# OPA 15 YNP

## DIGITAL PROCESSOR RECOMMENDATIONS

<u>Frequency</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Filter Type</u>
37 Hz	N/A	N/A	High-Pass 24 dB/octave Butterworth
63 Hz	+2.0 dB	0.3 octave	PEQ*
1,250 Hz	-2.0 dB	0.3 octave	PEQ
3,150 Hz	+2.0 dB	0.3 octave	PEQ
5,000 Hz	-2.0 dB	0.3 octave	PEQ

## 1/3-OCTAVE GRAPHIC EQ RECOMMENDATIONS

(Any 1/3-octave filter center frequencies not referenced should be left at 0 dB gain)

20 Hz	Full Attenuation	1/3	N/A
25 Hz	Full Attenuation	1/3	N/A
31.5 Hz	Full Attenuation	1/3	N/A
40 Hz	0 dB	1/3	N/A
63 Hz	+2.0 dB	1/3	N/A
1,250 Hz	-2.0 dB	1/3	N/A
3,150 Hz	+2.0 dB	1/3	N/A
5,000 Hz	-2.0 dB	1/3	N/A

\*PEQ refers to "Parametric EQ"

# OPA 15 NPM

## DIGITAL PROCESSOR RECOMMENDATIONS:

<u>Frequency</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Filter Type</u>
45 Hz	N/A	N/A	High-Pass 24 dB/octave Butterworth
1,250 Hz	-1.5dB	0.3 octave	PEQ*
4,500 Hz	-2.5dB	0.5 octave	PEQ
7,500 Hz	-3.0dB	0.6 octave	PEQ

## 1/3-OCTAVE GRAPHIC EQ RECOMMENDATIONS

(Any 1/3 octave filter center frequencies not referenced should be left at 0 dB gain)

20 Hz	Full Attenuation	1/3	N/A
25 Hz	Full Attenuation	1/3	N/A
31.5 Hz	Full Attenuation	1/3	N/A
40 Hz	0 dB	1/3	N/A
1,250 Hz	-1.5 dB	1/3	N/A
4,000 Hz	-2.0 dB	1/3	N/A
5,000 Hz	-2.0 dB	1/3	N/A
6,300 Hz	-1.5 dB	1/3	N/A
8,000 Hz	-2.0 dB	1/3	N/A

\*PEQ refers to "Parametric EQ"

# OPA 28 NP

## DIGITAL PROCESSOR RECOMMENDATIONS:

<u>Frequency</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Filter Type</u>
80 Hz	N/A	N/A	High-Pass 24 dB/octave Butterworth
100 Hz	+3.0 dB	0.3 octave	PEQ
125 Hz	+2.5 dB	0.3 octave	PEQ
160 Hz	+1.5dB	0.3 octave	PEQ
3,150 Hz	-2.0dB	0.3 octave	PEQ
4,000 Hz	-2.0dB	0.3 octave	PEQ

## 1/3-OCTAVE GRAPHIC EQ RECOMMENDATIONS

(Any 1/3 octave filter center frequencies not referenced should be left at 0 dB gain)

20 Hz	Full Attenuation	1/3	N/A
25 Hz	Full Attenuation	1/3	N/A
31.5 Hz	Full Attenuation	1/3	N/A
40 Hz	-12 dB	1/3	N/A
50 Hz	-8 dB	1/3	N/A
80 Hz	- 3 dB	1/3	N/A
3,150 Hz	-2.0 dB	1/3	N/A
4,000 Hz	-2.0 dB	1/3	N/A

\*PEQ refers to "Parametric EQ"



# OPA 118 SUB and OPA 218 SUB

The successful addition of the OPA 118 Sub or the OPA 218 Sub to a sound system requires an active crossover. Although an analog active crossover may be used, On Point Audio recommends the use of a high-quality DSP (Digital Signal Processor) based active processor with selectable crossover filters in its menu to optimize performance and flexibility

## LOW FREQUENCY OUTPUT

<u>Frequency</u>	<u>Gain</u>	<u>Bandwidth</u>	<u>Filter Type</u>
35 Hz	N/A	N/A	High-Pass 24 dB/octave Butterworth
80 Hz	0 dB User Adjustable*	N/A	Low-Pass 24 dB/octave Linkwitz-Riley
50 Hz	+3 dB	0.5 octave	PEQ

## HIGH FREQUENCY OUTPUT

80 Hz	0 dB	N/A	High-Pass 24 dB/octave Linkwitz-Riley
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**NOTE:** All other high frequency output gains and EQ settings should be chosen for the specific full-range enclosure used with these subwoofers. See recommended settings above for each On Point Audio model.

\*The recommended gain setting for the frequency output of “user adjustable” is based on individual user requirements for the ratio of sub output to high output. The initial setting should be at 0 dB gain and then adjusted upward based on the room’s acoustic requirements, program material and listener preference.

In all cases, level and EQ boost should be used judiciously so as to not “over-EQ” the system. The use of EQ requires more amplifier power, which reduces the amplifier’s headroom and potentially lowers the system’s reliability.