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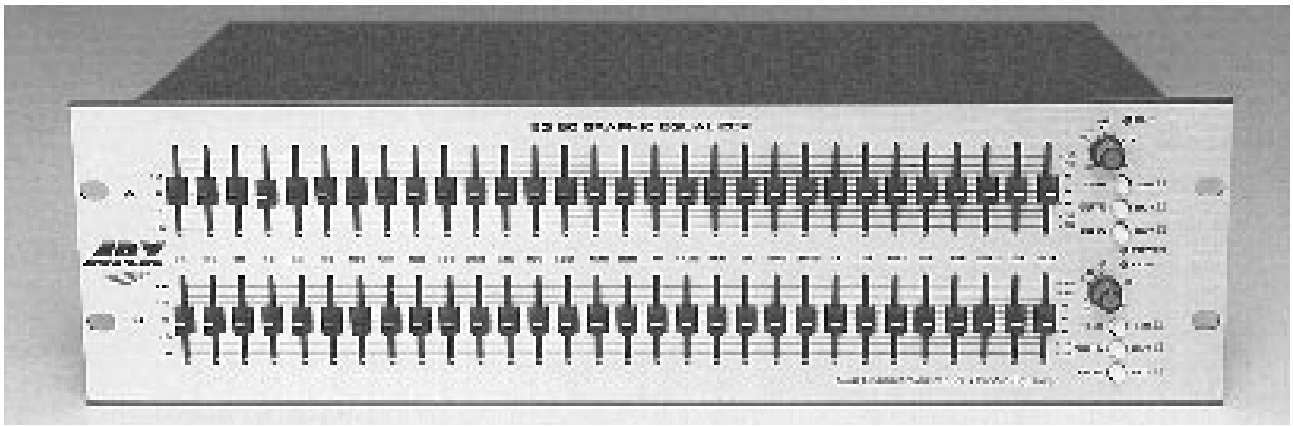
Lab Report

ARX Systems EQ60 1/3rd Octave Graphic Equalizer



GENERAL INFORMATION

If you've always thought of Australia as a land filled with nothing but Koala Bears, Kangaroos and Wallabies (plus a few million people who speak English with a strange accent), you may be surprised to learn the land-down-under has a thriving professional and consumer audio industry.

One company that has made its mark both below and above the equator is ARX Systems, whose excellent 1/3rd octave dual channel graphic equalizer we have just tested and used. The ARX EQ60 stereo graphic equalizer provides two channels of 1/3rd octave equalization in a compact rack-mountable package that occupies only three rack-units of height. The company also makes a single channel model, known as the EQ 30, which is identical in all other respects to the dual channel EQ60 we tested. As we learned soon after hooking up the EQ60 to our test equipment and plotting a few curves, the EQ60 features innovative "Constant Q" circuitry developed by ARX engineers so that relative slopes of each 1/3rd octave band are identical.

This feature makes it possible to tailor your final EQ curve much more precisely than would otherwise be the case. The maximum boost and cut range of each of the EQ controls can be set to 6 dB (for precise resolution) or when necessary, to 15 dB where extreme cut or boost is required.

The EQ60 features balanced inputs and outputs,

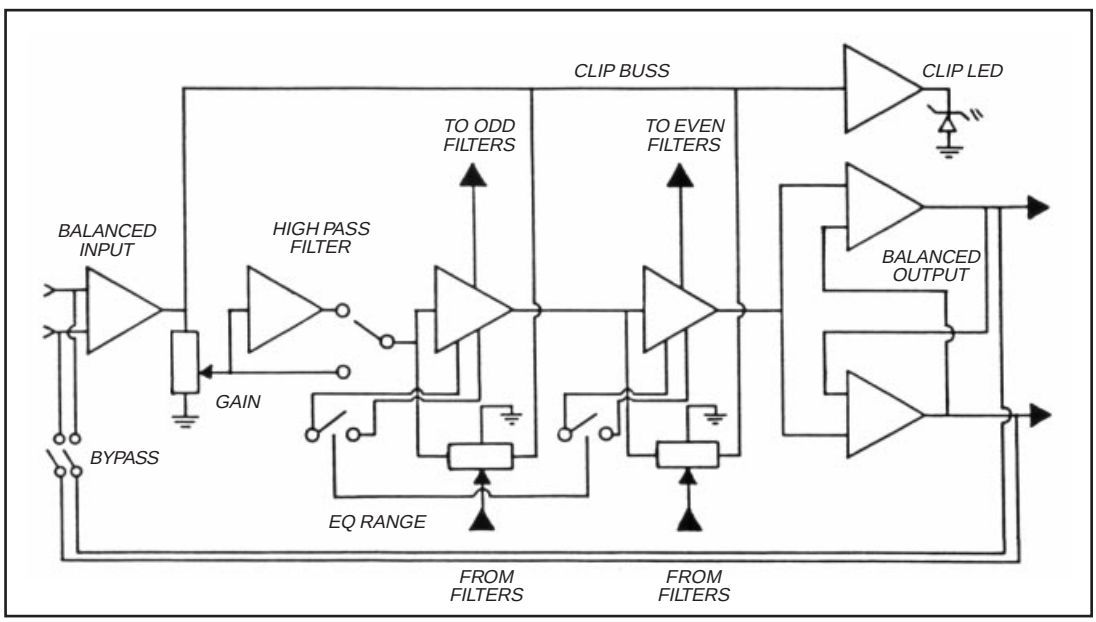


Figure 1. Block diagram of a single channel of the ARX EQ60. There is also an otherwise identical EQ30 version that is single channel only.

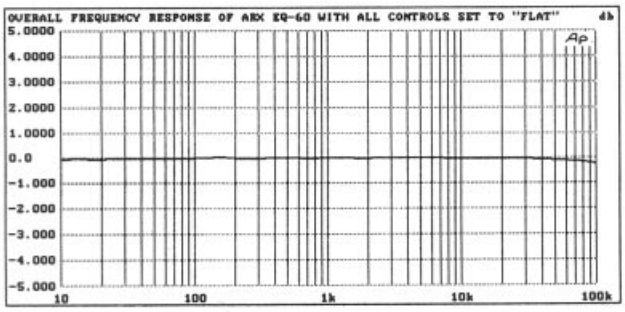


Figure 2.
Frequency response plot, all controls set for "flat"

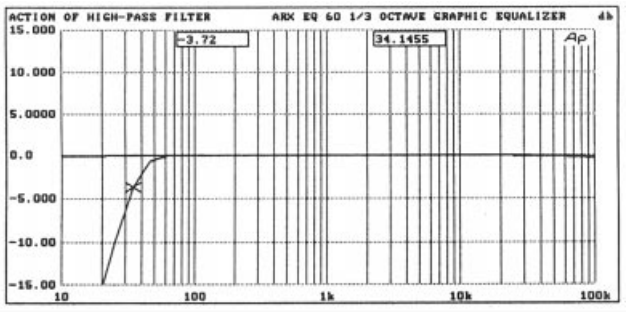


Figure 3.
Action of the high-pass filter. The nominal cutoff for a -3 dB point is listed by ARX as 30 Hz.

and when we took the cover off and examined the internal construction of the unit, we were pleased to note the extensive use of low-noise components as well as the intelligent layout of the pc boards. Of the three pc boards used, one houses all of the 60 smooth-acting slider EQ controls (30 per channel) and is mounted vertically behind the front panel. A second board houses the equalizer filter circuitry while the third, smaller board houses level controls, high-pass filters and bypass switches as well as other input and output components.

The signal circuits are well-shielded from the power transformer by means of a steel box that is attached to the entire rear section of the EQ60. The EQ60 is housed in an all-steel chassis with a satin-finish brushed-aluminum front panel. Should something go wrong with this or any other ARX product (which is highly unlikely, judging by the care with which this unit has been assembled), you won't have to ship it back to Australia. ARX products are distributed in the United States by ARX North America, CA. Interestingly the sample we tested was shipped to **db Magazine** directly from Australia, but seemed none the worse for its long journey.

CONTROL LAYOUT

Most of the EQ60's front panel is taken up by two identical horizontally laid out rows - one below the other - of 30 slider controls each. The controls have center detent positions. Although the detents don't feel quite as positive as some others we've used, once you are at a detent, the control is center-grounded so flat response for that 1/3 octave of the audio spectrum is assured. At the upper right corner of the front panel is a red LED that illuminates at approximately 2 dB before clipping occurs. The clip indicating circuit is arranged so it detects any clipping at all vital stages throughout the equalizer circuitry and not just at the output stages.

Each channel is also equipped with an overall level control. When set to its center position, the level control provides unity gain (0 dB), while when set clockwise, up to 6 dB of gain is provided. Rotating the control fully clockwise provides infinite attenuation. Each channel is also equipped with three push-buttons. The first button is used to select either 6 dB or 15 dB of maximum boost or cut for each EQ control. The second button inserts a high-pass filter that attenuates response sharply below 30 Hz to reduce the amplitude of any stage rumbles or other subsonics. The third button is used to bypass the equalizer entirely as shown in the block diagram of *Figure 1*. A green LED acts as a power indicator. There is no on/off switch.

The EQ60's rear panel is equipped with XLR input and output connectors for each channel as well as with ¼-inch phone jacks. Either the XLR con-

Figure 4 (A).
The range of all equalizer controls versus frequency at the 6 dB settings.

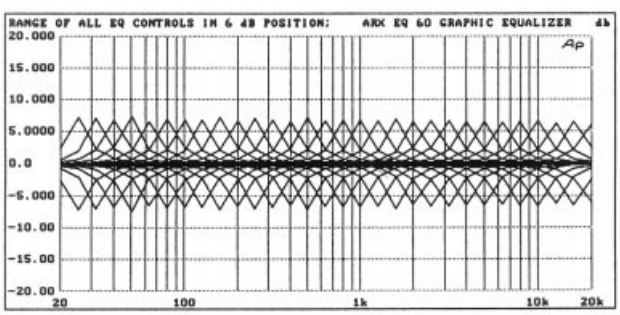
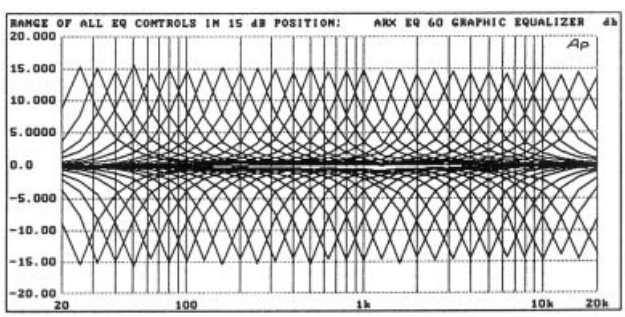


Figure 4 (B).
The range of all equalizer controls versus frequency at the 15 dB settings.



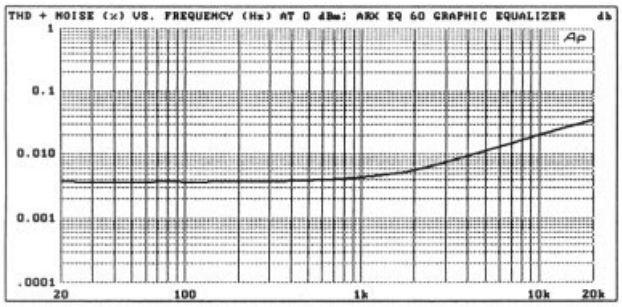


Figure 5.
Harmonic distortion plus noise-versus-frequency with level controls set for unity gain.

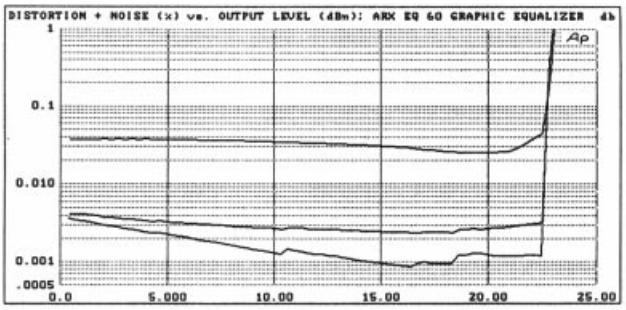


Figure 6.
Harmonic distortion plus noise (%-versus-output in dBm). Lowest TDH curve is for 20 Hz, middle is for 1 kHz, highest TDH curve is for 20 kHz

nectors or the jacks, when used with ring-tip-sleeve plugs can be used for balanced inputs and outputs. If; however you use tip-sleeve phone plugs, the jacks can be used to feed unbalanced inputs to the equalizer. We were pleased to see that ARX labels the pins in a diagram screened right onto the back panel. Specifically pin 2 is *hot*, pin 3 is *cold* and pin 1 is *ground*. A fuseholder containing a 1 ampere fuse (for U.S. operation at 120 volts A.C.) and, of course, the power cord (terminated in a three-prong, grounded-type plug), completes the rear-panel layout.

LABORATORY MEASUREMENTS

With all slider controls set flat, but with the equalizer circuitry active, overall frequency response was extremely flat from 10 Hz to beyond 100 kHz, as shown in *Figure 2*.

At 100 kHz, response was down by only about 0.2 dB! Our earlier concerns about the "softness" of the detent setting were baseless. Once a control is seated in the detent, flat response is assured. For *Figure 3*, we switched in the high-pass (low-cut) filter. Our test equipment is able to display actual data at any point in a plot, and the "X" cursor seen in *Figure* 3 corresponds to a frequency of 34.1455Hz, at which time the high-pass filter attenuated response by 3.72 dB. In other words, the cutoff point of this filter was slightly off since the "specs" call for a -3 dB cutoff point at 30Hz. The difference is hardly worth quibbling about, however.

"The ARX EQ60 is one of the most precise graphic equalizers we have ever tested."

You begin to appreciate how well-designed this equalizer is when you examine Figures 4(A) and 4(B). Here, we plotted the maximum boost and cut of each of the 30 1/3 octave EQ controls for the 6 dB maximum settings (Figure 4(A), and for the alternate 15dB maximum boost or cut position of the equalizer range switch (Figure 4(B). Notice how precise the maximum boost and cut range is for each of the 30 center frequencies. Those center frequencies, incidentally, are a standard as set by the ISO, and range from 25 Hz to 20 kHz. Notice, too, that the slopes of all the bands are virtually identical as is the spacing across the band. The graphs of Figures 4(A) and 4(B) were made by running successive response sweeps, each with one of the 30 slider controls in either its maximum boost or its maximum cut position. Thus, it took 60 response plots to create the graphs of Figures 4(A) and 4(B).

Using an input level of 0dBm, and with the level controls set for unity gain, we plotted harmonic distortion plus noise-versus-frequency for the EQ60. Results are shown in Figure 5. At low- and mid-frequencies, THD plus-noise varied from about 0.0038 percent to around 0.006 percent. THD rose slightly at higher frequencies, reaching a level of 0.036 percent at 20 kHz. Unweighted signal-to-noise ratio, referred to 0 dBm input and output, measured an impressively high 113 dB.

When an A-weighting filter was added, the S/N reading improved to nearly 120 dB below reference level. We don't know whether ARX's published S/N specs of 93 dB and 98 dB are simply the result of extremely conservative specification writing or the result of a different method of measurement. In any case, ARX's contention that the EQ60 is an ideal equalizer for use in digital audio applications is certainly well justified.

To check the signal-handling capability of the EQ60, we next plotted THD-plus-noise versus output, in dBm, for test frequencies of 20 Hz, 1 kHz and 20 kHz. There was good correlation between these measurements and those of Figure 5, and we found that overload occurred at an output level of approximately 23 dBm. Worst-case THD was measured, as before, for the 20 kHz test signal.

ARX EQ60 VITAL STATISTICS

SPECIFICATION	MFR'S CLAIM	db MEASURED
Frequency Response (±0.25 dB)	10 Hz to 20 kHz	10 Hz to 100 kHz
Center Frequency Accuracy	±2%	Confirmed
Maximum cut or boost	±6 or 15 dB	Confirmed
High-Pass Filter	-3 dB @ 30 Hz	-3.7 dB @ 34 Hz
Maximum In/Out Level	+23 dBm	Confirmed
Distortion, 0 dB Gain		
100 Hz	0.004%	0.0038%
1 kHZ	0.0035%	0.0042%
10 kHz	0.01%	0.02%
Signal to Noise Ratio		
Unweighted	93 dB	113 dB
A-weighted	98dB	120dB
Input Impedance	20 k ohms	Confirmed
Output Impedance	150 ohms	Confirmed
Dimensions (WxHxD, inches)	19 x 5¼ x 9	Confirmed

CONCLUSIONS

The ARX EQ60 is one of the most precise graphic equalizers we have *ever* tested. Ergonomically, the control layout makes it easy to use and adjust, and because of the uniformity of slopes or "Q's" of each band, you can be certain the shape of the response curve you "draw" with the slider controls is the exact shape of the overall response you actually get when this component is installed in the audio signal path of a sound-reinforcement system or recording studio.

For precision equalization tasks, the availability of the lower boost/cut range of 6dB is a welcome feature, since in today's studio environment, a full 15 dB of cut or boost would seldom be needed. The switch alters the maximum boost and cut range of all the sliders.

All things considered, ARX has managed to provide the maximum amount of EQ flexibility in a well engineered, well executed and very reasonably priced product.

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