

EQ2029 Technical Specifications

Input Type:	(Note: 0 dB reference is .775 Vrms) Balanced and unbalanced via male and female XLR connector or 1/4" phone jack.
Input Impedance:	20 K Ω balanced 10 K Ω unbalanced
Maximum Input Level:	+20 dBV balanced or unbalanced.
Output Type:	Balanced and unbalanced via male XLR connector or 1/4" phone jack.
Output Impedance:	150 Ω unbalanced / 300 Ω balanced.
Maximum Output Level:	
Unbalanced:	+20 dBV (7.8 Vrms) into a 600 Ω load or greater.
Balanced:	+26 dBV (15.6 Vrms) into a 1200 Ω load or greater.
Input Gain Control:	+6 dB to full attenuation.
Boost/Cut:	\pm 15 dB at each band center frequency.
Center Frequencies:	25, 31.5, 40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1K, 1.25K, 1.6K, 2K, 2.5K, 3.15K, 4K, 5K, 6.3K, 8K, 12.5K, and 16K \pm 5%.
Filter Type:	Active Bandpass Filters (no inductors or gyrators).
Frequency Accuracy:	\pm 5% of nominal center frequency.
Frequency Response (with all sliders centered):	\pm 1 dB, 20 Hz to 20 Hz.
Bandwidth (-3 dB points):	7 Hz -85 kHz.
Distortion:	less than .01% THD from 20 Hz to 20 kHz at any level up to full output.
Noise (unweighted, 20 kHz bandwidth):	104 dB below full output.
Slew Rate:	9 volts per microsecond.
Power Requirements:	120 or 240 VAC, 50 or 60 Hz.
Package:	Standard 19" rack mount.
Dimensions:	19" wide, 3 1/2" high, 7" deep.
Net Weight:	8 3/4 pounds.

Limited Warranty

Your Carvin Professional Series Product is protected against failure for 1 YEAR. Carvin will service the unit, supply all parts, and pay the RETURN shipping charges at no charge to the customer providing the unit is under warranty. CARVIN WILL NOT PAY FOR PARTS OR SERVICING OTHER THAN OUR OWN.

This warranty is extended to the original purchaser only and is not transferable. THIS WARRANTY DOES NOT INCLUDE FAILURES CAUSED BY INCORRECT USE, INADEQUATE CARE OF THE UNIT, OR NATURAL DISASTERS. A COPY OF THE ORIGINAL INVOICE IS REQUIRED TO VERIFY YOUR WARRANTY.

Carvin takes no responsibility for any horn driver or speaker damaged by this unit.

This warranty is in lieu of all other warranties, expressed or implied. No representative or person is authorized to represent or assume for Carvin any liability in connection with the sale or servicing of Carvin products. No liability is assumed for damage due to accident, abuse, lack of reasonable care, loss of parts, or failure to follow Carvin's directions. CARVIN SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

In the interest of creating new products and improving existing ones, Carvin is continually researching the latest state of the art audio design methods, and modern packaging and production techniques. Thus, Carvin reserves the right to make changes in its products and specifications without notice or obligation.

EQ2029

CARVIN

EQ2029

Factory Servicing

We highly recommend utilizing our specialized servicing staff to bring your unit up to factory specifications. Regardless of your warranty status, please follow these guidelines when returning units for service:

1. Enclose a full description of the malfunction. Please use the "Service Authorization Form" included with this manual.
2. Include a copy of the original invoice to verify your warranty.
3. Return the product in its original carton with the original packing material. NEITHER CARVIN NOR THE SHIPPING COMPANY WILL ASSUME LIABILITY FOR IMPROPERLY PACKED UNITS. Ship the unit by UPS if possible. You must pre-pay the shipping cost.
4. Please allow 5 working days for servicing plus shipping time to and from destination. All repairs in by MONDAY will be ready by the following MONDAY.
5. Carvin will pre-pay the shipping back to you providing the unit is covered under warranty. If you wish to have it sent back by AIR, you will be required to pay the difference COD.
6. If your unit is out of warranty, you will be charged a modest fee (generally lower than typical repair shops). You must pay shipping charges both ways. These charges will be collected COD.
7. If in doubt about the malfunction, please call a Carvin salesman toll-free at 800-854-2235 (in Calif. 800-542-6070). Occasionally we receive merchandise that works fine, but because of an oversight, the unit was returned needlessly.

Servicing in Your Area

You may select your own service center or have your own qualified technician work on the unit at your own expense. This will not void the warranty for future repairs unless damage was done because of improper servicing or component replacement. If damage was done, a normal fee for parts and servicing will be charged.

Under the 1 YEAR WARRANTY, Carvin will ship parts pre-paid to you or your technician providing that the defective part(s) are first returned for our inspection.

If you do not have a qualified service person, we ask that you do not involve yourself in servicing the unit. By sending the unit back to us, you may save time, money, and frustration. Also, you will know that your unit was serviced according to factory specifications.

If it is necessary to have your unit serviced locally, we strongly recommend that you have your technician call us before servicing your unit. We find that those who do this are able to make necessary repairs faster, and for less money. We are glad to help in this manner because we have pride in our products and we want them to work properly for many years.

REMEMBER: CARVIN DOES NOT PAY FOR SERVICING OR PARTS OTHER THAN OUR OWN — NO EXCEPTIONS. IF YOU ELECT TO HAVE YOUR OWN SERVICING DONE, THESE BILLS MUST BE PAID BY YOU.

CAUTION — TO PREVENT ELECTRIC SHOCK DO NOT DEFEAT THE SAFETY GROUND ON THE POWER CORD. DO NOT REMOVE COVER. NO USER-SERVICEABLE PARTS INSIDE. WARNING — TO PREVENT FIRE OR SHOCK HAZARD DO NOT EXPOSE TO RAIN, MOISTURE, EXPLOSIVE ATMOSPHERE OR INSTALL AN IMPROPER FUSE!

Carvin 1/3 Octave Equalizer

EQ2029

PEAK

15

10

5

0

-5

-10

-15

INPUT LEVEL

25

31.5

40

50

63

80

100

125

160

200

250

315

400

500

630

800

1K

1.25K

1.6K

2K

2.5K

3.15K

4K

5K

6.3K

8K

12.5K

16K

OUT

15

10

5

0

-5

-10

-15

POWER

1/3 Octave Graphic Equalizer

OPERATION MANUAL

EQ2029

The EQ2029 is a professional 1/3 octave graphic equalizer suitable for remote broadcasts, recording, or sound reinforcement. Its design offers high fidelity performance characteristics, extended frequency response, wide dynamic range, and noise free performance. The EQ2029's high reliability and durable construction are designed to withstand abusive handling on the road.

I. UNPACKING

Open the carton by carefully cutting and removing the staples. Lift the unit out of the carton. **SAVE THE CARTON AND ALL PACKING MATERIALS.** In the event the unit is re-shipped **ALWAYS** use the original carton and packaging material to assure that your equalizer is not damaged or defaced in shipping. Neither CARVIN nor the shipping company can accept liability for damage which occurs in shipping due to improper packing. **SAVE YOUR INVOICE.** It will be required for warranty servicing in the event that servicing is necessary. If you did not receive all the items you ordered, then the packages probably became separated in shipping. Please allow several days for the rest of your order to arrive before inquiring.

II. INSPECTION

Inspect your equalizer (and its packaging) for damage that may have occurred in shipping. If damage is found, notify the shipping company immediately and file a damage claim with the company. The claim must be filed by you, the consignee. Save all packaging for proof of damage and please notify CARVIN of any damage done.

III. INTERFACE and OPERATION

In general, the EQ 2029 graphic equalizer can be inserted into the audio signal path at any convenient point where there is a nominal "line level" signal. About the only signals with which it would not be appropriate to use the EQ 2029 would be very low level signals (i.e., microphone lines before the mic preamp) or very high level signals (i.e., loudspeaker lines). The EQ 2029 will provide excellent results when used with signals and input/output impedances normally found in recording studios, sound reinforcement systems, or home Hi-Fi. Further details on installation and operation are provided below for various applications. Please refer to the section that most closely matches your application.

A. Recording Studio Applications

The EQ 2029 has a variety of applications in the recording studio. However, the primary application will likely be to precisely correct frequency response errors in the control room monitoring system. In order to create a well balanced product it is essential that a professional recording studio utilize an audio monitoring system that is a "neutral" or "colorless" as possible. The EQ 2029 was specifically designed for the task of removing color, or "neutralizing" audio monitoring systems. An appropriate point at which to insert the EQ 2029 in the listening chain is between the mixer's control room outputs and the inputs of the stereo power amps. Of course, two EQ 2029's will be required for stereo operation. Input and output connections to the EQ can be made by way of either the balanced XLR connectors or the unbalanced 1/4" phone jacks. If the EQ 2029 is to be used for a variety of recording applications rather than as a dedicated monitor equalizer, then the best place to interface it is the central patch bay. By making the EQ's inputs and outputs available at the patch bay the EQ can be patched into input or output channels of the mixer as desired. In addition to the infinite variety of audio frequency response contours that can be created using the unit's 29 sliders, signals outside the audio band can be controlled by switching in the 18 dB/octave low cut and high cut filters at 20 Hz and 20 kHz.

B. Sound Reinforcement Applications

There are many applications for the EQ 2029 in professional sound reinforcement or "P.A." systems. The most popular use of the EQ is to provide 1/3 octave equalization of the main speaker systems to correct response errors in the speakers and compensate for room acoustics. (Note that two units will be required for a stereo P.A. system.) The unit can also be used to great advantage on the stage monitoring system where its ability to control feedback will be of great value. For feedback control, a good technique is to raise the level of the monitor system to the threshold of feedback (i.e., to the point where the monitors just begin to ring) and then locate the slider that controls the "ringing" frequency. Reduce the level of that slider until the ringing is eliminated. Again increase the overall monitor level until the system just begins to ring (at a new frequency) and repeat the sequence until the desired monitor loudness can be achieved without ringing or obvious feedback. An appropriate place to insert the EQ into the system is between the outputs of the mixer (main or monitor) and the inputs of the power amplifiers. In addition to using the EQ 2029 to equalize loudspeaker frequency response, the unit can be used as a program equalizer on individual channels or subgroups to establish optimum tonal balance. In the latter case the EQ would be patched into the appropriate channel or subgroup at the console.

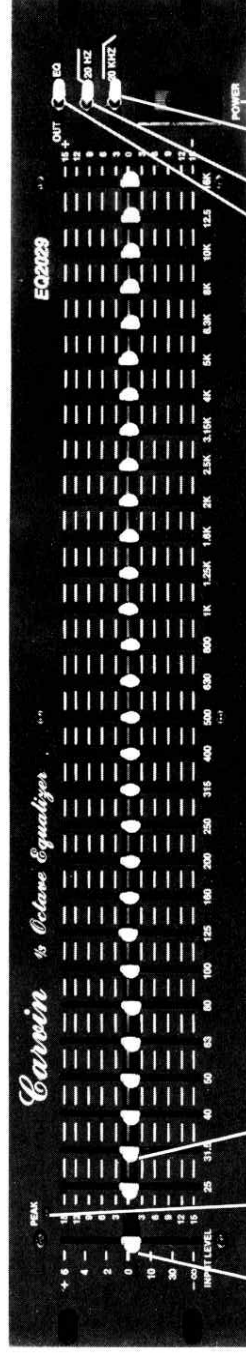
The low cut filter (18 dB/octave below 20 Hz) constitutes an excellent sub-sonic filter and can provide a high degree of protection to the woofers in a sound system from unexpected sub-sonic transients (such as might result from a dropped microphone, intermittent connection, or other audio hazards associated with live sound). The low-cut filter will also help conserve amplifier power and reduce woofer cone excursion so that higher sound pressure levels can be achieved before running out of amplifier headroom. The hi-cut filter can provide a degree of protection to high frequency horns or tweeters from inaudible ultrasonic oscillations in system components ahead of the EQ 2029.

C. Home Hi-Fi Application

The EQ 2029 is an excellent equalizer for home Hi-Fi use. Those audiophiles who appreciate professional grade audio equipment will appreciate the value the EQ 2029 represents in addition to the professional quality it provides. The primary application of a 1/3 octave graphic equalizer in a home Hi-Fi system will likely be to establish a highly accurate frequency response in the listening room. In this case the equalizers (two units are required for stereo) can be interfaced at the tape monitor of the systems "receiver" or "pre-amp". The equalizer can also be inserted between the stereo pre-amp and stereo power amp of a system with separate pre and power amps. For the case of a typical Hi-Fi stereo receiver the left and right "tape outputs" would be connected (by way of an appropriate cable) to the inputs of two EQ 2029 units (most likely by way of the 1/4" phone jacks). The outputs of the units would then be connected back into the left and right "tape inputs" of the stereo receiver. Depressing the "tape" switch on the receiver would then connect the EQ into the system.

Other home Hi-Fi applications for the EQ 2029 are those relating to home recording. Connecting the EQ between the preamp output and the tape recorder input allows equalization of the material being recorded. This configuration could be used to make tape dubs of older recordings with equalization according to your own musical taste.

EQ 2029 Front Panel



3. FREQUENCY BAND SLIDERS

2. PEAK OVERLOAD INDICATOR

1. INPUT LEVEL CONTROL

4. EQ BYPASS SWITCH

5. LO CUT FILTER

6. HI CUT FILTER

7. POWER ON/OFF SWITCH

EQ 2029 Front Panel

1. INPUT LEVEL CONTROL

The input level control located at the far left of the front panel is used to establish an optimum signal level for the equalizer and following equipment. This control allows for 6 dB of gain and provides infinite attenuation when fully cut. A center detent position provides unity gain or 0 dB gain. Under most circumstances the unity gain setting will provide the best results. However, if a high degree of boost or cut is employed the input level control can be used to adjust the overall signal level and avoid overdriving the unit on peaks.

2. PEAK OVERLOAD INDICATOR

Just above and to the right of the input level control is a small red LED peak indicator which illuminates whenever the signal level at any stage in the EQ comes within 6 dB of clipping. The peak detection circuit is quite sophisticated as it monitors the signal level at all critical points and employs a "peak stretching" stage to insure that even overloads on brief transients are clearly indicated. When the peak indicator flashes, the only action required to insure distortion free operation is to reduce the setting of the input level control until the flashing ceases.

3. FREQUENCY BAND SLIDERS

Each of the EQ 2029's 29 sliders provide a full 15 dB of boost or cut about a 1/3 octave band of frequencies centered on the frequency indicated below the slider. The EQ 2029 is the only 1/3 octave graphic EQ we know of that provides a full 15 dB of boost or cut. Conventional designs are limited to only 10 or 12 dB of action due to severe interaction between adjacent bands. To overcome this limitation Carvin's engineers created a new equalizer topology that minimizes interaction between adjacent frequency bands and allows a full 30 dB control range on each slider. Each precision slider has a positive center detent to assure a flat response in frequency bands that require no correction.

4. EQ BYPASS SWITCH

At the far right of the front panel is a group of switches. The top switch is the EQ bypass switch. In the right ("EQ") position the EQ circuitry is in the signal path. Moving this switch left ("out") bypasses the EQ circuitry completely and allows for easy A/B comparisons of the audible effect of your equalization. This is a true "hard wire" bypass from input to output so that when the EQ is switched out it is totally removed from the audio signal path.

5. LO CUT FILTER

The 20 Hz switch at the right of the front panel switches in a low cut filter which is down 3 dB at 20 Hz and has a cutoff slope of 18 dB/octave below 20 Hz. The subsonic filter is useful in both recording and live sound applications. Moving the switch to the left takes the low cut filter out of the signal path and provides wideband (-3 dB at 7 Hz) low frequency performance.

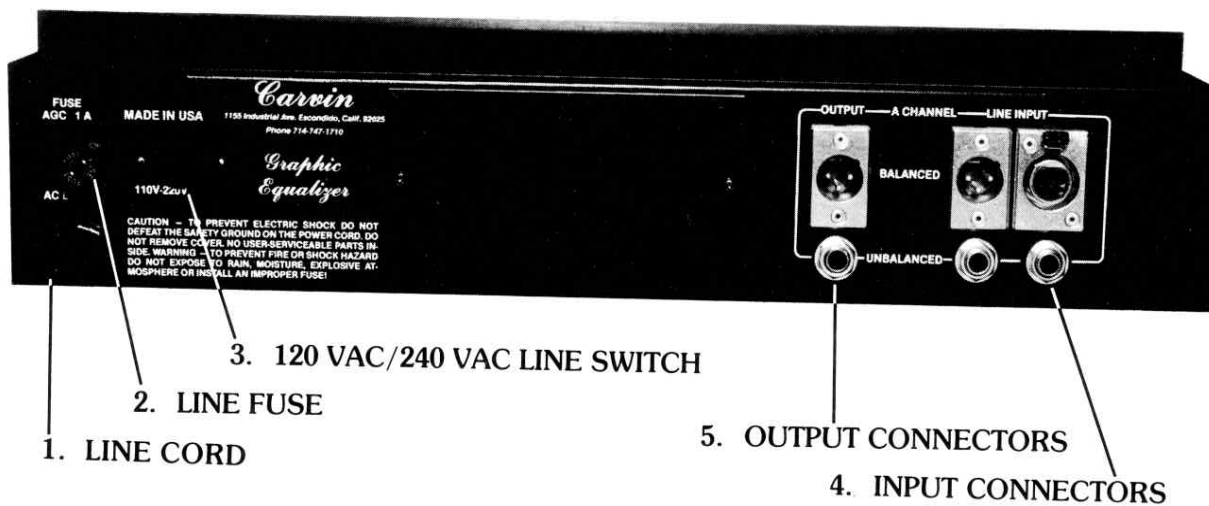
6. HI CUT FILTER

The 20 KHz switch at the right of the front panel switches in a high cut filter with frequency response down 3 dB at 20 KHz. Above 20 KHz the response rolls off at a rate of 18 dB/octave. The ultrasonic filter has uses in both live and recorded sound engineering. Moving the switch to the left takes the high cut filter out of the signal path and provides wideband (-3 dB at 85 kHz) high frequency performance.

7. POWER ON/OFF SWITCH

The main power on/off switch for the EQ 2029 is located at the far right of the front panel below the bypass and filter switches. The switch illuminates to indicate that the unit is switched on.

EQ 2029 Rear Panel



EQ 2029 Rear Panel

1. LINE CORD

The AC line cord for the EQ 2029 is a 3 conductor type with equipment safety ground for greatly reduced chance of electrical shock. If the EQ 2029 is to be plugged into a 2 prong outlet, use a quality 3 to 2 prong grounded adaptor and be sure to tie the wire "pigtail" to a good ground. IT IS UNSAFE TO DEFEAT THE GROUNDING PIN as safe operation cannot be assured under these conditions.

2. LINE FUSE

For continued fire safety and product protection the AC line fuse should only be replaced with a fuse of the same rating. Should the fuse blow, determine the cause of the failure and correct the problem before replacing the fuse. Refer all servicing to qualified personnel. CAUTION! UNDER NO CIRCUMSTANCES SHOULD THE FUSE BE DEFEATED BY PLACING A FOREIGN OBJECT IN THE FUSEHOLDER.

3. 120 VAC/240 VAC LINE SWITCH

Your EQ 2029 can be operated from either 120 VAC or 240 VAC power mains. The AC line switch has been set at the factory for 120 VAC operation. Should it be necessary to operate your unit from 240 VAC power mains, remove the plug covering the switch and slide the switch to the "240" setting using a pencil or other non-metallic object. Replace the plug and your unit is now ready to operate from 240 VAC.

4. INPUT CONNECTORS

The input connectors to the EQ 2029 are located at the far right of the rear panel. There are four input connectors in total: a female 3-pin XLR connector, a male 3-pin XLR connector, and two 1/4" phone jacks. The XLR connectors are wired in parallel as are the two phone jacks to facilitate distribution of the input signal to other equipment. The XLR connectors will accept either balanced or unbalanced input signals as the EQ 2029 employs an active differential input stage. The 1/4" phone jacks accept unbalanced signals. The maximum input signal the unit can accommodate without distortion is 20 dBv (10 Vrms). Operation with input signal levels below -20 dBv (100 millivolts) will result in a poor signal to noise ratio.

5. OUTPUT CONNECTORS

The output connectors to the EQ 2029 are located to the left of the input connectors and consist of a male 3-pin XLR connector and a 1/4" phone jack. The XLR connector provides an active balanced output signal while the phone jack provides an unbalanced signal. Output signals have the same polarity as the corresponding input signals (i.e. the EQ 2029 does not invert the signal polarity). The maximum output level is 20 dBv into a high impedance load or 18 dBm into a 600 ohm load. The outputs are also short-circuit-proof.

Using The EQ2029

Some comments on using $1/3$ octave equalizers to establish a flat frequency response from loudspeakers.

- 1. A $1/3$ Octave Equalizer** provides the capability to make very fine corrections to the frequency response of a loudspeaker system. There is no question about that. However, many users of such equalizers have only a vague idea of how to actually achieve an accurate frequency response using a $1/3$ octave equalizer. A loudspeaker's worst problems can be corrected "by ear" to an extent depending on the skill of the individual. But in order to achieve the precise correction the EQ is capable of providing it is necessary to see the actual frequency response of the system. This requires a spectrum analyzer.
- 2. An Audio Spectrum Analyzer** is an electronic device which provides the user with a frequency response display of the signal provided to the input of the analyzer. In the case we are discussing, the input to the analyzer would be taken from a microphone placed in the room with the loudspeakers we wish to equalize. The sound energy in the room would then be displayed on the analyzer as a graph of amplitude (loudness) on the vertical axis versus frequency (pitch) on the horizontal axis. If a " $1/3$ octave" spectrum analyzer is used then there will be a display of about 29 columns with the height of each column indicating the loudness of the sound in that frequency band. The 29 columns cover the 10 octave audio frequency spectrum in $1/3$ octave steps. Assuming that both the equalizer and the analyzer have their frequency bands centered on the standard (ISO) $1/3$ octave frequency centers, then for each slider on the EQ there is a corresponding column in the analyzer's display. If music is played through the loudspeakers, then the analyzer display will dance about to indicate the sound energy in the room as it varies in frequency and loudness. The analyzer would not be expected to display a flat response curve under these conditions because music generally does not have equal energy in each frequency band but rather has energy at changing frequencies and with changing loudness. This brings up a question: If music played through the loudspeaker cannot be expected to produce a flat frequency response on the spectrum analyzer, then is there a signal that will? And the answer is yes; there is a special test signal that when played through an accurate loudspeaker system and picked up by an accurate microphone will result in a flat frequency response (each column at the same height) on the spectrum analyzer display. This test signal is called "pink noise."

- 3. Pink Noise** is simply a signal that contains all the audio frequencies at once with the frequencies in each octave (or $1/3$ octave) band having the same energy (loudness) as the frequencies in each of the other bands. If the pink noise is fed directly into the spectrum analyzer then a perfectly flat display will result. If the pink noise is fed to the loudspeakers and the sound energy from the speakers picked up by the microphone and fed to the analyzer, then the combined response of the loudspeakers and room (and microphone) will be seen on the analyzer display. Now the appropriate sliders on the equalizer can be adjusted to provide a precisely flat frequency response. Because the microphone is included in the system response curve it is important that the microphone have a flat frequency response itself. Otherwise you'll be equalizing your loudspeakers for the microphone response also. This would result in inaccurate response from the loudspeakers themselves.

The description of the equalization procedure may sound complex but the actual procedure can be performed with surprising ease. That's because the spectrum analyzer is doing all the work! It is simply necessary to plug the output of the pink noise generator into an appropriate input of your audio system and play the pink noise over the loudspeakers at a level well above the background noise. An accurate microphone is placed near the usual listening position and the output of the speakers is displayed on the analyzer. From the display it can be seen which frequency bands need to be boosted or cut to achieve the same level in each band (flat response). Tweak the equalizer and note the display. Continue to adjust the equalizer until a satisfactorily accurate response is obtained. Because the response will vary with microphone location it is a good idea to look at the response for several microphone locations around the listening position and equalize for the flattest average response.

One of the shortcomings of the pink noise equalization technique is the fact that the analyzer displays both the direct sound from the loudspeaker and the reverberant sound field set up in the room. Ideally we want to obtain a flat frequency response for the direct sound from the loudspeakers. The reverberant sound field cannot be expected to have a flat response and typically has a decreasing high frequency response. This means that if the net pink noise response has a flat high frequency response then the direct sound from the loudspeaker will tend to have a rising high frequency response (to compensate for the reverberant sound field). The net result is an overly bright sounding high frequency characteristic for loudspeaker systems which have been equalized to provide a flat pink noise response. The approach used to compensate for this is to tailor the pink noise response to start falling gently above about 2 kHz at a rate of 1 or 2 dB per octave.

There is another equalization method which avoids the high frequency errors encountered in the pink noise technique and this is the "impulse response" technique. In recent years impulse testing and equalization have become increasingly more popular with loudspeaker manufacturers due to the high accuracy and repeatability of this technique. As impulse analyzers become more readily available we hope to see them used more for $1/3$ octave equalization of loudspeakers in the field. Until then don't throw out your pink noise generator and don't be afraid to trust your ears.

Frequency response of the EQ2029 for various control settings.

- Figure 1:**
- All bands at full boost/cut
 - Individual bands boost/cut
 - All bands centered

- Figure 2:**
- Response of one band for 3, 6, and 15 dB of boost/cut
 - Response with the 20Hz and 20kHz filters in and out

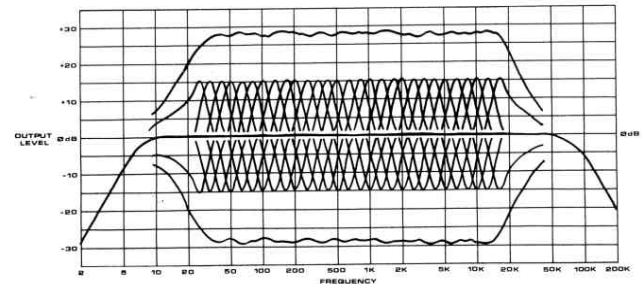


Figure 1

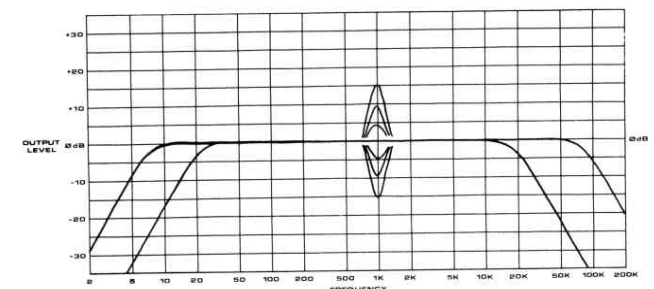


Figure 2