AEQ-26™

Architectural Equalizer

Installation Manual
and Consciousness Guide

AudioControl®

making good stereo sound better®

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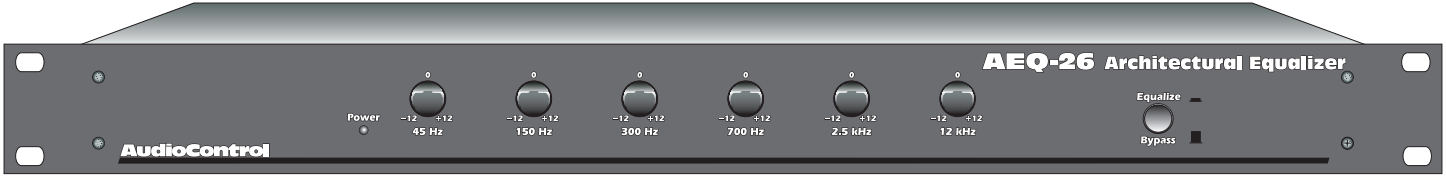
www.audiocontrol.com


AEQ-26 Architectural Equalizer
Power
0
−12 +12
45 Hz
150 Hz
300 Hz
700 Hz
2.5 kHz
12 kHz
Equalize
Bypass
AudioControl

AEQ-26 Architectural Equalizer

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CONGRATULATIONS!

You are now installing a component that will dramatically improve the performance of any multi-zone audio system, especially those utilizing in-wall speakers. The AEQ-26 is an American-designed, American-built "set and forget" component which will provide a lifetime of trouble-free service.

The new AEQ-26 is made by the only electronics company in the world that specializes in equalizers, signal processors and audio analyzers. And the company whose professional sound division sells the most popular one-third octave real time analyzer in the world, the SA-3050. AudioControl's passion for high quality, meticulous attention to detail and pro sound heritage shows itself in the dozens of awards we have won for our designs, products and service. Now, as when we began, our greatest satisfaction is our reputation for sonic excellence and reliability among people just like you throughout the world.

This manual is designed to help you get everything you can out of this new architectural equalizer. So, even though you're dying to see it in action, please take a few minutes to slog through our not-so-weighty prose and learn how to get the most from your new AEQ-26.

The AEQ-26 Product Highlights

Specially Designed Frequency Controls - The AEQ-26 is engineered to provide a dramatic sound improvement for "small" speakers, such as those with 8-inch or smaller woofers. The AEQ-26's 45Hz, 150Hz, 300Hz, 700Hz, 2500Hz and 12kHz band centers were chosen to optimize in-wall and small 2-way box speakers at critical frequencies where adjustment is most advantageous. The bandwidths (or 'Q' as our engineering types call it) have also been optimized for the difficulties that in-wall speakers present. This allows the AEQ-26 to improve the sound of these smaller speakers better than any other equalizer.

Programmable PFM Bass-cut Filter - The AEQ-26's programmable bass-cut circuitry is an installer adjustable low frequency blocking filter which protects small speakers from too much low end and improves their overall sound. The smaller woofers found in most in-wall or bookshelf speakers cannot reproduce the bass of a larger speaker (the laws of physics intervene). If called upon to reproduce a bass note that would cause the speaker to move PAST its maximum cone travel, damage can result - and even if it doesn't, severe audible distortion DOES. The solution is AudioControl's exclusive PFM circuit. It gives small woofers only those frequencies they can use by "chopping off" bass below an installer programmed frequency (40Hz is the factory setting). The woofer is protected and can do a better job of reproducing mid-bass and higher frequencies. It also helps keep the speakers in one piece when the teenagers get control of the stereo.

Made in the Northwest Rainforest - The AEQ-26 began its existence at our factory in Mountlake Terrace, Washington, a few miles north of Seattle. Here, we also build precision test instruments, home audio equalizers and analyzers and a totally awesome line of car stereo components. AudioControl began in 1977 and has won so many audio industry awards for design and engineering excellence that our reception room wall is starting to sag. But enough about us. Let's start getting the most from your audio system!

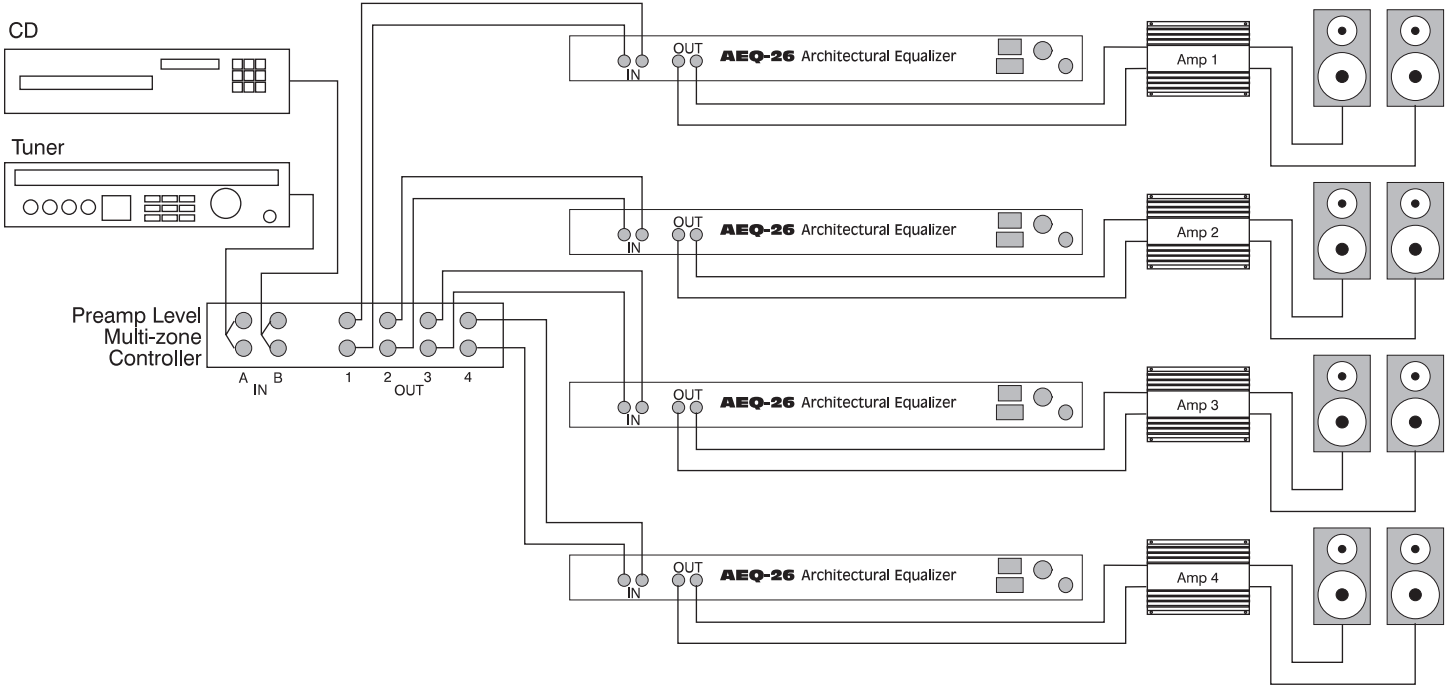
Experienced Installer's Quick Hook-Up Guide

What follows are "Express" hook-up diagrams for professionals and experienced audio buffs.

Make sure to fill out and mail the warranty card.

The PFM filter module comes factory set at 40Hz. See page 15 for details on changing the PFM module. A complete range of frequencies is available from the factory and information is also available on building your own modules in Appendix A. Modules are also available from any Audio-Control car stereo dealer in a pinch.

Final adjustment of The AEQ-26's boost/cut controls in each zone is best done with a one-third octave real time analyzer and pink noise test signal, but it can also be done by ear, especially if you desire to emphasize certain frequencies.

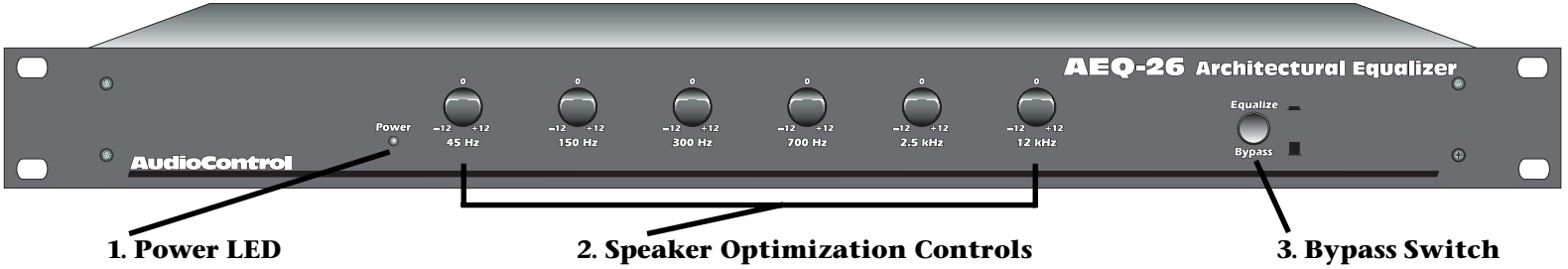


Multi-amp / Zone System

A Guided Tour Of The AEQ-26

Front panel:

1. **Power LED** - Nothing too tricky here. . . if you have the Master Power switch (on the back panel) turned on and the AEQ-26 is plugged into an active AC outlet, this little red light will shine forth.
2. **Speaker Optimization Controls** - This gang of knobs provide up to 12dB boost or cut at 45Hz, 150Hz, 300Hz, 700Hz, 2500Hz and 12kHz. After initial adjustment the only time you would change the control settings are 1) if you connect different speakers into the system, 2) if (assuming the speakers aren't built in) you move them significantly, such as from a bookshelf to floor stands, or 3) if your room acoustics change through addition or rearrangement of furniture, wall or floor coverings, large hairy dogs, or other sound reflective or absorptive surfaces.
3. **Bypass Switch** - This switch allows you to bypass the equalization controls on the AEQ-26. When the button is in the OUT position, the equalizer is defeated.



Back panel:

1. **Input** - These unbalanced RCA inputs connect to your control preamplifier's outputs.
2. **Output** - This pair of jacks feed out into your power amplifier.
3. **AC Power Fuse** - This power fuse is here just in case something really awful goes wrong.
4. **Accessory AC Outlet** - This unswitched and unfused outlet allows you plug in almost any other components that draw less than 500 watts (CD, tuner, VCR, etc.).
5. **Master Power Switch** - This switch shuts off the main AC power. Normally the only time you need to turn off the master power is if the homeowner is going to be gone on vacation for a few weeks.
6. **Power Cord** - The AEQ-26 draws a scant 6 watts (about the same as most clock radios). Don't worry about plugging several AEQ-26's into a power strip.

Installation: The Long Version

What follows is a step-by-step guide to integrating the AEQ-26 into your multi-zone system. If it seems overly detailed, please forgive us. We would rather tell you too much than too little.

First, check your new AEQ-26 for any shipping damage. We pack 'em pretty securely, but it's a vicious world out there and anything can happen between Mountlake Terrace, Washington and your install site.

Paperwork

Yes, filling out the warranty registration card is about as exciting as cleaning out your sock drawer, but we'd definitely like the card back after you've hooked up the AEQ-26 and played with it a while. We DO read each and every incoming card and react to your suggestions. That's how great products like this are created.

Next, record the serial number on the sales receipt and make certain the home owner puts it away in a safe place. Stashing the receipt away is very important in the unlikely event that your AEQ-26 ever needs servicing, or. . . well things do happen. . . you sometimes need to prove to an insurance adjuster that something as great as the AEQ-26 was installed in the system.

Placement

The AEQ-26 is a not very particular about it's location. As with all electronic components, keep it away from any place that is too hot or too wet. Just as a reminder, you should also avoid putting any leaky potted plants in your stereo stack.

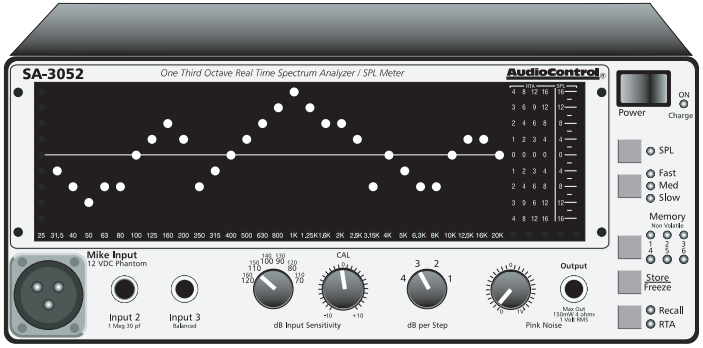
AC Power

Under normal operating conditions, the AEQ-26 only draws 6 watts of AC power. Don't worry about plugging several of these units into a single AC outlet and ganging the power through the convenience outlet on the rear of the AEQ-26.

Hooking Up Your System

What you'll need:

1. The AEQ-26.
2. RCA audio hook-up cables.
3. (Optional) A balanced line driver if you are going to mount the AEQ-26 more than 20 feet from the preamp or amplifiers.
4. Although you can set the speaker optimization controls by ear, a real-time audio analyzer such as the AudioControl SA-3052 is very helpful.



Audio hook-up

If you're an installation veteran, this may seem repetitive, but some things can never be repeated too many times (just ask our Customer Support Department).

1. Turn off ALL components before making any connections.
2. When making connections, designate RED RCA plugs as RIGHT and WHITE, BLACK, or GREY plugs as LEFT. In fact, this is a good idea for ALL signal connections made in your audio system. The key is consistency. Stick with the same color-coding and you'll reduce possible problems.
3. Whenever possible, keep power cords away from signal cables to prevent induced hum. This is especially important if you bundle the cables to keep the installation neat looking.
4. Use quality interconnect cables. We're not going to get into the debate about whether $100/meter cables improve the sound, but we know from experience that really, REALLY cheap cables can cause a multitude of problems. They tend to break inside or corrode, causing a loss of signal or hum. They also have poor shielding.

5. If you need to run the RCA audio cables more than 20 feet you should consider using a balanced line driver for the signals. This will provide better noise rejection against nasty things like hum, spikes, local talk radio, etc. Ask your AudioControl representative for more information about line drivers.

Doing The Deed

Before proceeding on to setting up the Speaker Optimization controls on the AEQ-26, it's a good idea to make sure that you have everything connected and working properly.

1. Double-check all connections. Make certain that all of the audio and speaker connections are firmly seated and tightened down.
2. Turn on your audio system. The Power LED on the AEQ-26 should be on.
3. Continue checking to ensure that every zone plays properly.
4. Congratulations! You're ready to go on to setting the Speaker Optimization controls.

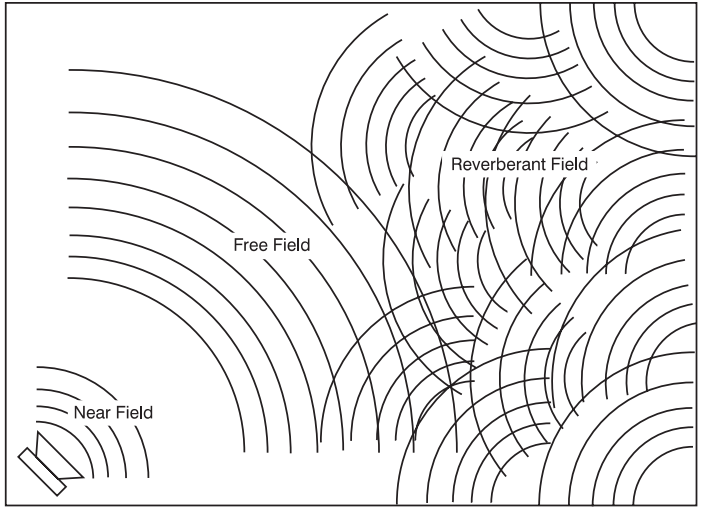
You're almost done! Now for the details of operation. . .

A Short Introduction To Equalizers And Acoustics

Magazine reviewers and audio system owners spend much time critically appraising speaker and other stereo components. Unfortunately, a phenomenon that has a very large effect upon sound is not is easily judged or changed. That effect is the ACOUSTICS of the environment in which you are listening.

Room acoustics is a complicated subject about which entire textbooks have been written. We simply want you to be aware of a few basics that have a direct effect on real time audio analysis.

Sound is waves, as you probably learned in junior high school. In a stereo system, these waves are created by the speakers. Like waves in a pond created by a splash, sound waves emanate from the transducers (drivers) in your speakers and spread out into the room. If your room were infinitely big, that's all there would be to it. But just like waves in a pond reach the bank and reflect back, sound waves bounce off walls, ceilings, and floors, reflecting, reinforcing and canceling each other as shown in the figure above. Since sound is energy, the way it reflects depends upon the angle of the surface, the type of material and the frequency of the sound wave. Because your listening position is likely to be towards the back of the Free Field shown in the diagram, you also get part of the reflected Reverberant Field as well.



Now we add the next set of complications: Different frequencies of sound have different wave lengths (a function of frequency and the speed of sound). Each frequency's wavelength contributes differently to the Free and Reverberant Fields because they are different sizes. For example, a 32Hz bass note has a wavelength of 35 FEET, while a 16,000Hz note has a wavelength of just under a tenth of an inch. Tiny treble waves can be caught and neutralized by draperies, carpeting, upholstered furniture and gangs of indolent Persian cats. . . while gigantic bass waves simply slosh back and forth in the room.

Another set of variables is the shape and volume of your listening room. Large rooms require more bass energy to excite waves within them. Small rooms need less energy, but reflect it differently. And then there's the fact that most rooms don't have four walls anymore, but open into dining rooms, lofts, cathedral ceilings, etc. All of this means that predicting sound interaction patterns is very difficult due to the irregularities of the room shape.

As you can see, room acoustics is an important but complicated subject. (To learn more about room acoustics, download AudioControl's Technical Paper 107, "Small Room Acoustics De-Mythologized" from our website.) The overall point that we're trying to make is that the various rooms in your home function as gigantic mechanical equalizers, boosting or cutting certain frequencies depending on size, shape, volume, acoustic treatment and the position of the speakers.

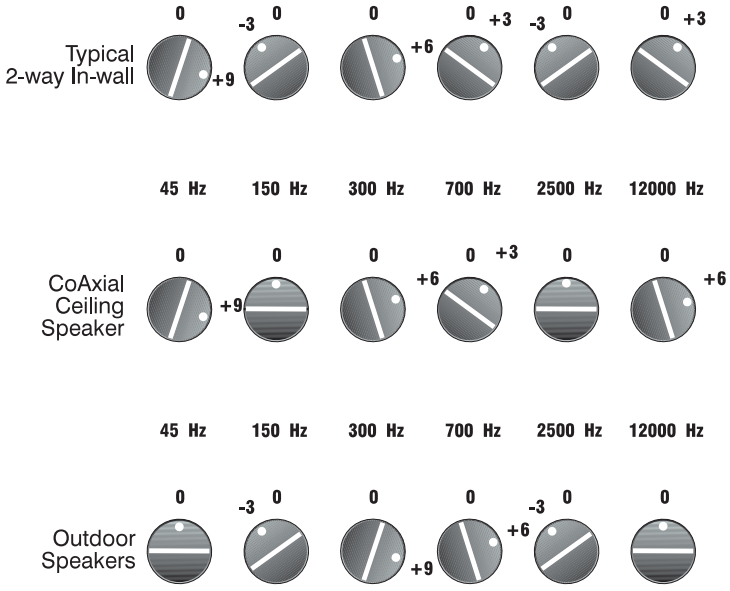
Audio Analysis Using Pink Noise

It may take several series of adjustments since there is some interaction between each eq control. We have included some sample settings and general descriptions of each control's function beginning on the next page.

After initial adjustment the only time you would change the control settings are 1) if you connect different speakers into the system, 2) if (assuming the speakers aren't built in) you move them significantly, such as from a bookshelf to floor stands, or 3) if your room acoustics change through rearrangement of furniture, wall or floor coverings, large hairy dogs, etc.

The following are examples of typical settings along with short descriptions of each AEQ-26 Speaker Optimizer control. Naturally, the results of adjustments will vary depending on the acoustic environment, type of speaker and sound sources you are using, but this is a good starting point.

For an extensive description on the use for the SA-3052 real time spectrum analyzer for these settings, please see that product's manual.



Example Control Settings

Information For Control Freaks

Here is a brief introduction to each of the Speaker Optimization control frequencies and what their effect on your music is.

45Hz - Low bass. This is about the lowest frequency which in-wall, extension and small bookshelf speakers can achieve. Boosting it too far might cause problems, even though The AEQ-26's PFM filter cuts frequencies under 40Hz. But if your speakers can take it, a mild boost will enhance bass instruments such as Fender bass, kick drum, floor toms, timpani and double bass violas.

150Hz - High bass. There's a lot of bass information at this frequency. In fact, most modern music is mixed to enhance this area of the frequency spectrum. 150Hz also determines the depth of male vocals and contains reverberant information which contributes to the spaciousness of sound. Boosting 150Hz can add "POW!" and impact to bass or it can make the sound "bonky" and "boomy". This is a critical adjustment with small or in-wall speakers. Experiment with it.

300Hz and 700Hz - High and low midrange. These controls directly effect the sound of instruments and vocals.

These bands also determine the speaker's presence (whether the music sounds far away or close in). Small speakers often produce too much midrange, so these controls are candidates for being turned down slightly during your initial experimentation. Definitely consider reducing 700Hz if you are only using your extension speakers for background music.

2500Hz - Treble. Female vocals and the "edge" of instruments such as guitars, snare drums, saxes, violins, etc. are found in this range. If accentuated too much (by boosting this control) sounds in the 2500Hz range can seem harsh and fatiguing to the ear due to excessive output by the speaker or because of live, reflective room acoustics.

12kHz - High treble. The fine detail, texture and sheen of music is found here. The breathiness of vocals, the "sheen" of cymbals, the high overtones of piano and strings. Actually, there's audible music information up to 20,000Hz on some CD's and most adult's hearing is still pretty good at 15,000Hz. But we've chosen 12,000Hz because it provides more useful control to compensate for room acoustics and common small-speaker deficiencies.

The Truth About Bass And The Programmable Frequency Match Filter

Now that digital audio is the preferred musical source, there's more low bass running around in a typical system. Low bass injects large amounts of power into ANY kind of speaker - up to 60% of your amplifier's output is being used to reproduce frequencies under 100Hz. That can really tax a system which is driving multiple speakers from a single amplifier channel. The second problem is that bass produces heat in the speaker. If more heat is built up than the speaker can dissipate, the driver coil can literally go into meltdown (or worse).

In addition, ultra-low bass and small speakers don't always get along, ESPECIALLY when you DO have ample power. The low bass music content can cause over-excursion: The speaker cone attempts to travel farther than its physical limits, potentially causing damage (in some cases you can actually hear a clacking sound!) Even before destruction sets in, there are other problems with feeding super-low bass to small speakers. Most bookshelf and in-wall loudspeakers are 2-way systems. That means that the woofer also handles a large part of the critical midrange area. When the woofer is bashing around trying to reproduce unrealistically low bass,

it's ability to produce midrange is compromised due to intermodulation distortion. So not only don't you get low bass, you get lousy vocal and instrumental reproduction.

Pragmatically, it boils down to this: If you want ultra-low, foundation-shaking bass from an in-wall speaker, you should add in a separate subwoofer, a somewhat expensive approach. A more economic approach is to equalize the speaker for maximum low bass output WITHIN IT'S PRACTICAL RANGE and eliminate lower frequencies which either can't be reproduced or which incite excessive cone travel.

The equalization part is handled by the AEQ-26's 45Hz control. The prevention part is handled by the AEQ-26's Programmable Frequency Match filter circuit. While it may seem surprising, actually cutting off some of the lowest bass will make the bass sound cleaner, punchier and even louder.

AudioControl's Programmable Frequency Match circuit is an adjustable subsonic filter which cuts off low frequencies. The PFM filter's cut-off point is adjustable via a small resistor module inside the AEQ-26. When you receive your unit, it is programmed with a 40Hz bass cut-off. Depending on the application, you may want to change the filter frequency. Don't let ego get in the way and set the PFM too low because somebody thinks that a 6" woofer should be able to play down to 20Hz.

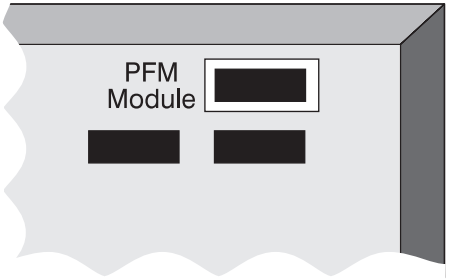
The following standard module frequencies are available from AudioControl: 20, 25, 35, 40, 45, 50, 60, 70, 80, 90, 100, 120, 130, 150, 200, and several higher frequencies going up to 6000Hz which probably aren't applicable except in very special circumstances. Each module's frequency is determined by 6 resistors inside a 14-pin DIP network. See Appendix A for details on building your own modules.

Changing The PFM Module

WARNING: Unplug the AEQ-26 from AC power before beginning. There are dangerous voltages present inside.

The first task in changing the PFM module is to remove the top chassis of the AEQ-26. To do this, remove the 5 screws on the top of the AEQ-26. The PFM module is indicated on the circuit board (see figure).

Use a small screwdriver to gently pry the existing module from it's socket taking care not to bend the contact pins. Now you can install the replacement module. There is NO POLARITY to these modules so they can install in either direction.



Now you can put the top back onto the AEQ-26 and go back to enjoying your music.

A Brazen Plug For Other AudioControl Products

AudioControl started out making graphic equalizers in 1977. In a way, the AEQ-26 is an equalizer and, like our other models, can make a greater improvement in the sound of your system than almost any other addition or upgrade. More bass, better bass, less harshness and the ability to hear music the way you want it.

We make our equalizers easy to use by incorporating features such as paired or ganged sliders, as well as subsonic filters and, in some models, built-in test analyzers that let you make accurate adjustments to instantly compensate for main system speaker and room deficiencies. In fact, AudioControl was the world's first manufacturer of a SEVEN CHANNEL equalizer for home theater use.

We also make other enhancement devices so unique and so dramatically enjoyable that we have received patents for them as well as numerous industry awards. These, along with our Multi-Room Controller and Balanced Line Driver, provide a rich assortment of products to make certain that your audio system sounds it's best.

Okay, enough commercials.

Once again, we thank you for adding an AudioControl component to your system and hope you enjoy a lifetime of performance and convenience.

Appendix A - Building Your Own PFM Modules

AudioControl PFM filters use resistor modules for frequency programming. All modules are constructed in the same way, with the exception of the actual value of the resistors used. In each module, ALL resistor values are equal. The resistor value for any given frequency is chosen according to the following equation:

Resistor (kilohms) = 7200 ÷ frequency (Hz)

Example: To find the resistors needed for 1000 Hz.

R (kilohms) = 7200 ÷ 1000

R (kilohms) = 7.2

R = 7.2 K = 7200 ohms

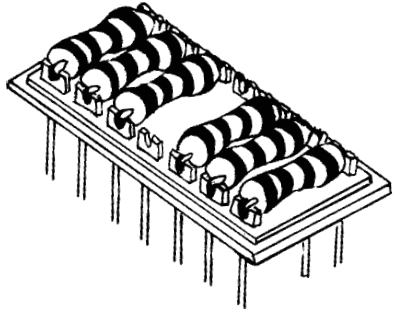
Building Modules

PFM modules require 6 resistors mounted on a 14-pin DIP header. In the 14-pin modules, the middle resistor position is unused and may be left unconnected. We recommend 5% 1/4 watt carbon film resistors, or if you really want to be spot-on, 1% metal-film resistors (difficult to get).

The DIP headers are available from most electronic parts distributors.

It will make things easier if you buy a 14-pin IC socket as well. You can chuck the socket in your vise and have a handy fixture to hold the header while you solder.

Do not be confused by the modules from the factory that do not show individual resistors. They really are there, just encased in plastic.



Frequencies by Resistor Value

Five-percent resistors are available in 24 standard values per decade (this means that from 10 to 100 ohms, there are 24 values). The following table lists the crossover frequencies that result from using these standard 5% values.

Frequency	Value	Frequency	Value
117 Hz	62 KΩ	48 Hz	150 KΩ
106 Hz	68 KΩ	45 Hz	160 KΩ
96 Hz	75 KΩ	40 Hz	180 KΩ
88 Hz	82 KΩ	36 Hz	200 KΩ
79 Hz	91 KΩ	33 Hz	220 KΩ
72 Hz	100 KΩ	30 Hz	240 KΩ
66 Hz	110 KΩ	27 Hz	270 KΩ
60 Hz	120 KΩ	24 Hz	300 KΩ
56 Hz	130 KΩ	22 Hz	330 KΩ
		20 Hz	360 KΩ
		15 Hz	470 KΩ

The WARRANTY

People are scared of warranties. Lots of fine print. Months of waiting around. Well, fear no more. This warranty is designed to make you rave about us to your friends. It's a warranty that looks out for you and helps you resist the temptation to have your friend, who's "good with electronics", try to repair your AudioControl product. So go ahead, read this warranty, then take a few days to enjoy the new AEQ-26 before sending in the warranty card and comments.

"Conditional" doesn't mean anything ominous. The Federal Trade Commission tells all manufacturers to use the term to indicate that certain conditions have to be met before they'll honor the warranty. If you meet all of these conditions, we will warrant all materials and workmanship on the AEQ-26 for five (5) years from the date you bought it, and we will fix or replace it, at our option, during that time.

Here are the conditional conditions:

1. You have to fill out the warranty card and send it to us within 15 days after installing the AEQ-26.

2. You must keep your sales receipt for proof of purchase showing when and from whom the unit was purchased. We're not the only ones who require this, so it's a good habit to get into with any major purchase.

3. The AEQ-26 must have originally been purchased from an authorized AudioControl dealer. You do not have to be the original owner, but you do need a copy of the original sales slip.

4. You cannot let anybody who isn't: (A) the AudioControl factory; or (B) somebody authorized in writing by AudioControl to service the AEQ-26 equalizer. If anyone other than (A), or (B) messes with the AEQ-26, that voids your warranty.

5. The warranty is also void if the serial number is altered or removed, or if the AEQ-26 has been used improperly. Now that sounds like a big loophole, but here is all we mean by it:

Unwarranted abuse is: (A) physical damage (don't use the AEQ-26 to level your projection TV); (B) improper connections (120 volts into the RCA jacks can fry the poor thing); (C) sadistic things. This is the best product we know how to build, but if you use it to level your equipment rack, something might break.

Assuming you conform to 1 through 5, and it really isn't all that hard to do, we get the option of fixing your old unit or replacing it with a new one.

Legalese Section

This is the only warranty given by AudioControl. This warranty gives you specific legal rights, and you may also have rights that vary from state to state. Promises of how well The AEQ-26 will work are not implied by this warranty. Other than what we've said we'll do in this warranty, we have no obligation, express or implied. We make no warranty of merchantability or fitness for any particular purpose. Also, neither we nor anyone else who has been involved in the development or manufacture of the unit will have any liability of any incidental, consequential, special or punitive damages, including but not limited to any lost profits or damage to other parts of your system by hooking up to the unit (whether the claim is one for breach of warranty, negligence of other tort, or any other kind of claim). Some states do not allow limitations of consequential damages.

Failure to send in a properly completed warranty card negates any service claims.

The warranty included with the unit shall supersede this plain-text version if there is any inconsistency between the two.

What to do if you need service

First, contact AudioControl, either by phone 425-775-8461 or FAX 425-778-3166. We'll verify if there is anything wrong that you can fix yourself, or arrange to have it sent back to our factory for repair. Please include the following items with the returning unit:

1) A copy of your proof of purchase (that sales receipt we've been harping about). No originals please. We cannot guarantee returning them to you.
2) A brief explanation of the trouble you are having with the AEQ-26. (You'd be surprised how many people forget this.)
3) A return street address. (No PO Boxes, please)
4) A daytime phone number in case our technician has a question about the problem you are having.

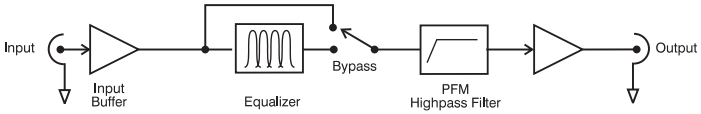
You're responsible for the freight charges to us, but we'll pay the return freight back. We match whatever shipping method you use to send it to us, so if you return the unit overnight freight, we send it back overnight. We recommend United Parcel Service (UPS) for most shipments.

Repair service is available at:

AudioControl

Attn: Service Department
22410 70th Avenue West
Mountlake Terrace, WA 98043 USA
Phone 425-775-8461 FAX 425-778-3166
e-mail: service@audiocontrol.com

AEQ-26 Block Diagram



AEQ-26 Specifications

All specifications are subject to change and improvement

Equalizer Center Frequencies 45Hz, 150Hz, 300Hz, 700Hz, 2500Hz, 12kHz

Subsonic Filter Slope ..... 18dB/octave, Tchebychev

Subsonic Filter Frequency ..... Installer Programmable (Factory setting, 40Hz)

Signal to Noise ratio ..... -120dB (A-wtd, ref. full output)

Total Harmonic Distortion 0.005%

Input Impedance ..... 100 kilohms

Output Impedance ..... 150 ohms

Audio Connections ..... Unbalanced RCA

Power Consumption ..... 6 watts

AC Fuse Rating ..... 125 mA

Unswitched AC Outlet Rating ..... 500 watts

Weight ..... 5 pounds

Dimensions ..... 19"W x 1.75"H x 5.6"D

Country of Origin ..... USA

Warranty ..... 5 years, Parts & Labor

AudioControl®

making good stereo sound better®

Electronic Engineering & Manufacturing, Inc

22410 70th Avenue West • Mountlake Terrace, WA 98043 • Phone 425-775-8461 • Fax 425-778-3166

This manual was written and printed in the USA.

No slugs were harmed in the production of this manual.

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