



Concert Series

EQUALIZER/CROSSOVER/LEVEL MATCHER

OWNER'S MANUAL

AudioControl[®]

making good stereo sound better[®]

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Quick Installation Info

Refer to Figures 3 through 5 (pages 9 to 11) when installing the EQX Equalizer/Crossover.

The unit is shipped from our factory with a 90 Hz crossover module already installed, and the Programmable Frequency Match filter module set at 33 Hz (see page 18 to change these).

For information on other system applications or related topics, please read further.

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Congratulations!

You have purchased one of the most exciting and innovative audio products available for your car stereo system - the AudioControl EQX Equalizer/Crossover/Level Matcher.

The EQX can make any system sound better. Even if you have followed the true path of enlightenment and are having your new EQX professionally installed, it doesn't hurt to read this manual. There's nothing but reruns on the tube anyway!

The EQX carries on a great tradition started back in 1985, when we introduced the original EQX. It was the first serious stereo component for mobile audio. Since then, AudioControl has gone on to win numerous awards and collect many glowing reviews for its innovative autosound products. We have learned a great deal about cars, stereos, and acoustics over the years. All of this has been poured into the new EQX to give you the tools to make your car stereo the envy of all your pals.

We design, test, and build each EQX Equalizer/Crossover right here in the misty rain forests¹ of the Pacific Northwest. When you look inside the rugged two-piece steel chassis, you'll find we use only premium electronic parts and gold-plated RCA jacks.

It all adds up to a product that will provide you with many years of listening enjoyment and will literally outlast your vehicle.



¹At last count, we see the sun only 129 days each year, so we use the abundant indoor hours doing what we do best - improving and inventing audio products - besides, it keeps us from going insane.



➤ *Dual Bandwidth Equalizer - 13 bands*

The dual bandwidth design of the EQX concentrates more control in the lower bass frequencies where the interior of an automobile causes problems. The higher frequency controls are spaced on octave centers to give you complete control up to 16,000 Hz. No simple dash-mount equalizer gives you this kind of flexibility.

➤ *Programmable 24 dB/Octave 2-way Crossover*

With module programmability, the electronic crossover in the EQX can be matched up to any stereo system. The 24 dB/Octave Linkwitz-Riley² (who!?) design was previously available in the finest home and professional crossovers. Now this state-of-the-art crossover is yours also.

²Linkwitz-Riley aren't our attorneys - Linkwitz and Riley are a couple of smart guys who designed a very effective fourth-order filter for bi-amplified systems. You hear it each time you see a movie at your local THX theater - we like it! If you want to know more about this exotic filter, check out our Technical Paper #102, appropriately titled **Crossover Networks from A to Linkwitz-Riley**.

➤ *Level Matching*

True standards in car stereo are hard to find. Every manufacturer has a slightly different interpretation of things. The input and output level controls on the EQX Series II bring everything together. Now any head unit can be connected to any amplifier and make the system sound great.

➤ *Balanced Input*

The EQX takes noise rejection a step further than the average by incorporating balanced differential input circuitry. By looking at the output from your source unit in a different way the EQX can reject up to 60 dB of radiated noise.

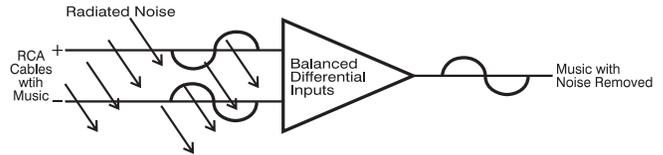
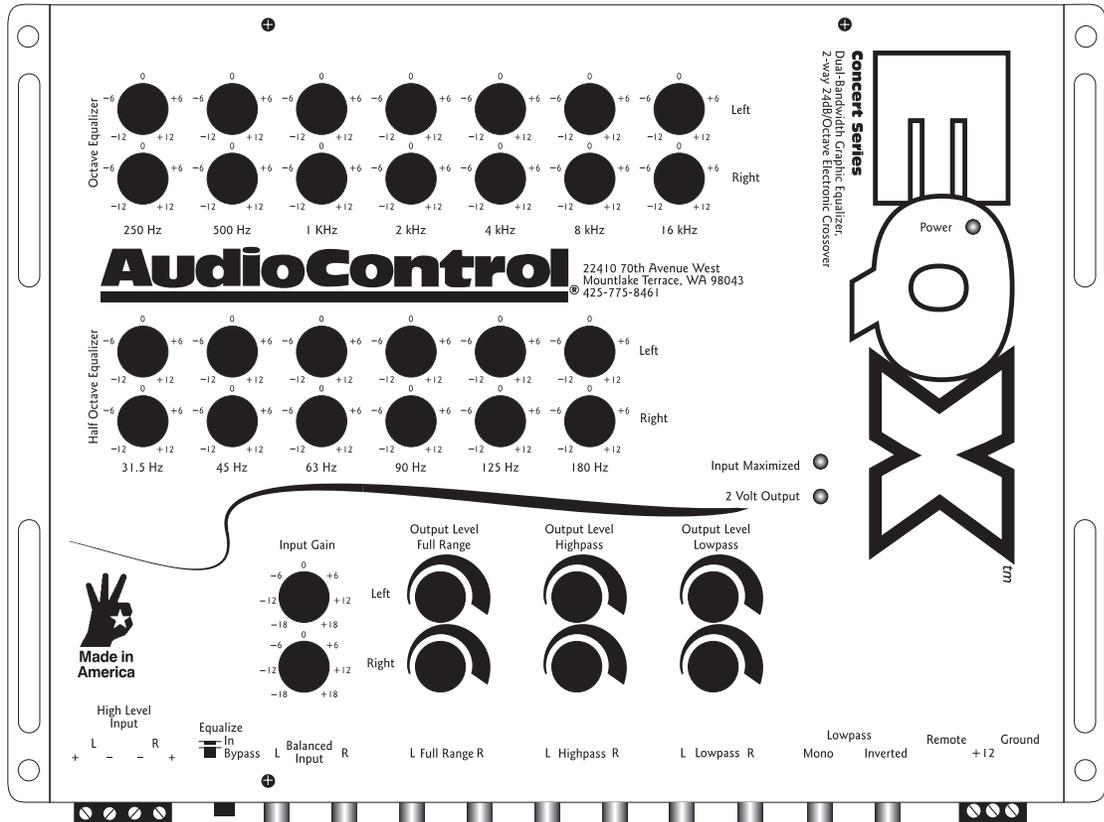


Figure 1. Top panel layout for EQX Equalizer/Crossover/Level Matcher.



Description

We've created the EQX Equalizer/Crossover/Level Matcher to make any system sound better. This Performance Match™ Component³ features straightforward connections and easy-to-adjust equalizer and level controls. To learn more, read on.

Equalizer and Input/Output Level Controls and Indicators

The top panel contains all equalizer controls, input/output controls, and system indicators. The equalizer controls are grouped by channels in ascending frequencies from left to right, as shown in Figure 1 on the opposite page.

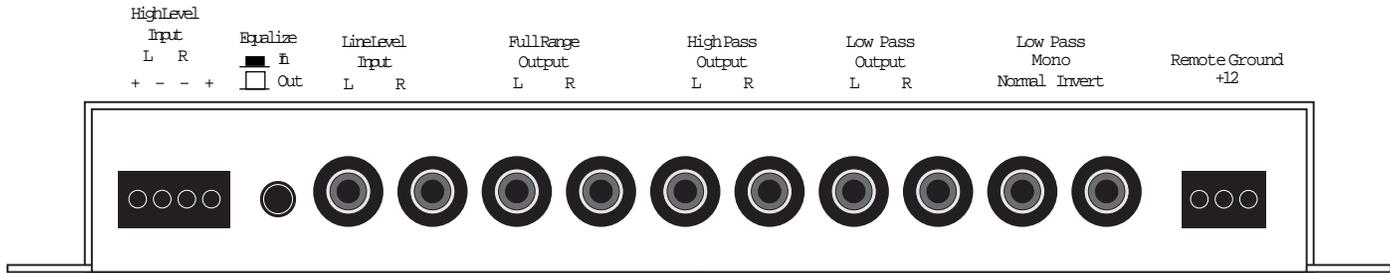
Each equalizer control provides 12 dB of boost and cut for each channel. The Input Gain controls allow you to adjust the Left or Right input gain over a range of ± 18 dB. Output attenuators provide up to 30 dB of gain trim for each of the

³Our line of Performance Match Components takes the guess-work out of creating the best-sounding system by "matching" autosound components to your vehicle. For more information, see page 22.

Full Range, High Pass, or Low Pass outputs. The top panel also includes several indicators to confirm power and help set output levels.

- HALF OCTAVE BASS EQUALIZER - six half-octave bass equalizer controls for each channel with frequency centers at 31.5, 45, 63, 90, 125, and 180 Hz.
- OCTAVE EQUALIZER - seven full octave equalizer controls with frequency centers at 250 and 500 Hz; and 1, 2, 4, 8, and 16 kHz.
- INPUT GAIN - variable gain controls to adjust Left and Right input levels.
- OUTPUT LEVEL - three output attenuators for each channel to lower the gain of the Full Range and the crossover High Pass and Low Pass Outputs.
- INPUT MAXIMIZED - indicator for monitoring the Input level to detect and set an optimum level.
- 2 VOLT OUTPUT - indicator for monitoring the output level when it reaches 2 volts.
- POWER - indicator confirms power is reaching the EQX.

Figure 2. Front panel layout for EQX Equalizer/Crossover/Level Matcher.



Connections and Equalizer Bypass

The front panel contains power and input/output connections, as well as an equalizer bypass button, as shown in Figure 2 (above).

- **HIGH LEVEL INPUT** - Our handy 4 pin plug for connection of speaker outputs from a deck or factory stereo.

- **EQUALIZE IN/OUT** - Press in to engage the equalizer settings on your EQX Series II.
- **LINE LEVEL INPUT** - RCA jacks for connection of low-level stereo signals from a head unit.
- **FULL RANGE OUTPUT** - RCA jacks for connection of all frequencies to inputs of an amplifier.

- ▶ **HIGH PASS OUTPUT** - RCA jacks for connection of high frequencies above the crossover point to the inputs of the mid/high frequency amplifier.
- ▶ **LOW PASS OUTPUT** - RCA jacks for connection of low frequencies below the crossover point to the inputs of the low frequency amplifier.
- ▶ **LOW PASS MONO NORMAL/INVERT** - RCA jacks for connection of mono low pass signals below the crossover point for mono or bridged amplifier configurations.
- ▶ **REMOTE/+12/GROUND** - Our handy 3 pin plug for power connection of vehicle's Remote Turn-On, +12 Volts, and Power Ground.

Crossover/Programmable Frequency Match Modules and Ground Isolation Selector (Inside)

The crossover and PFM filter modules, as well as the ground isolation selector, are internal and can be accessed by removing the four top screws and lifting the top panel off the base (refer to Figure 8 on page 20). Be sure to turn off the power before you open the EQX.

We ship each EQX with the crossover installed at 90 Hz and the Programmable Frequency Match filter set at 33 Hz. Refer to page 18 for information on how to create your own custom crossover and PFM modules.



Installation

We strongly suggest you have the EQX professionally installed, but if you are doing it solo, this section lists the procedures you'll need to install the EQX in your vehicle. Before you begin, we suggest you read the next few sections to plan the type of system you want.

System Applications

Although the EQX Equalizer/Crossover/Level Matcher is often used in bi-amplified systems (refer to Figure 3), it is quite versatile and is designed to also work perfectly in single-amplifier and bi-amplified bridged subwoofer systems, as shown in Figures 4 and 5. For more information on bridging, read the section on Amplifier Bridging on page 16.

Installation Precautions

- Do not mount the EQX Equalizer/Crossover/Level Matcher where it will be exposed to outside elements or extreme temperatures. Avoid areas that are subject to extreme road vibration or shock. The front bumper is definitely out-of-bounds.
- Select an installation site that provides short cable runs for minimum pick-up of engine noise and RFI (radio frequency interference). Keep RCA cables together, away from speaker wires or power cables.
- At the proposed installation site, make sure the holes you plan to drill will not hit the fuel tank, fuel lines, brake lines (under the chassis), or go through any electrical wiring.
- Use high-quality, fully-shielded RCA cables.
- Plan on a single-point grounding scheme that is common to grounded parts of the system. Use no less than 16-gauge stranded copper wire for the ground connection.

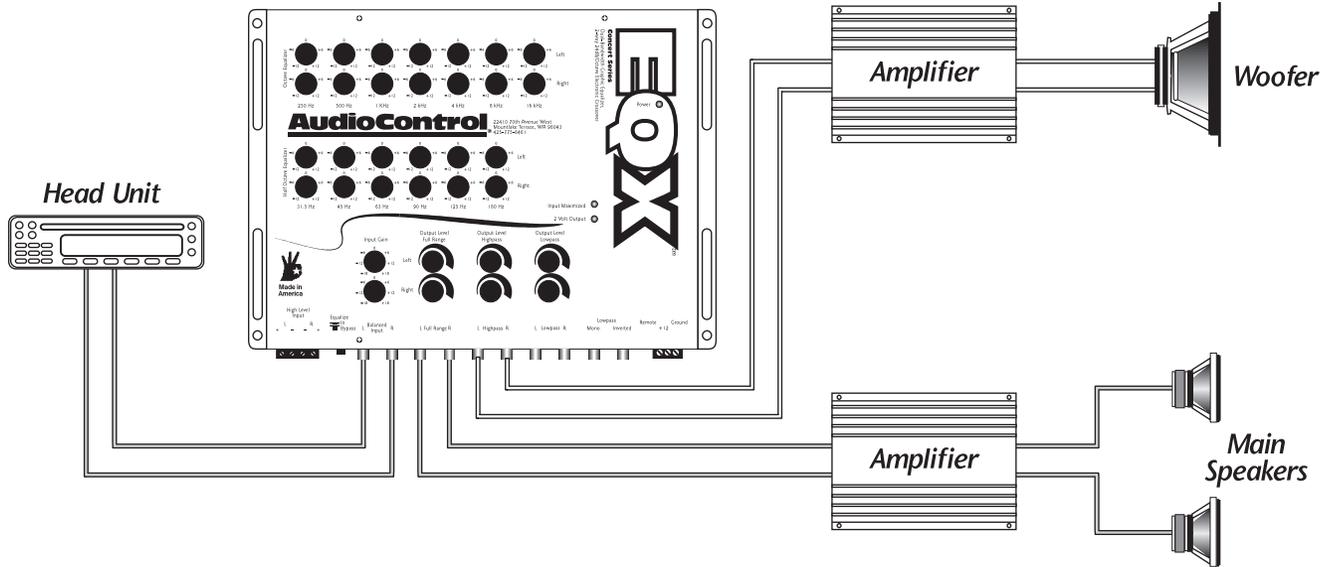


Figure 3. Wiring diagram for EQX in a bi-amplified system.

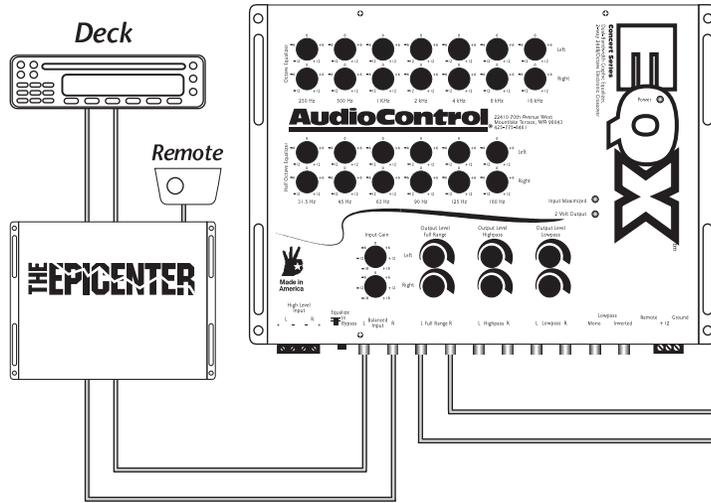


Figure 4. Wiring diagram shows an EQX in a single-amplifier system using a deck and The EPICENTER.

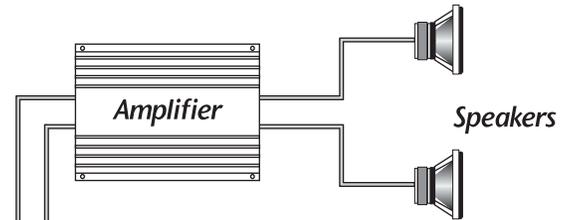
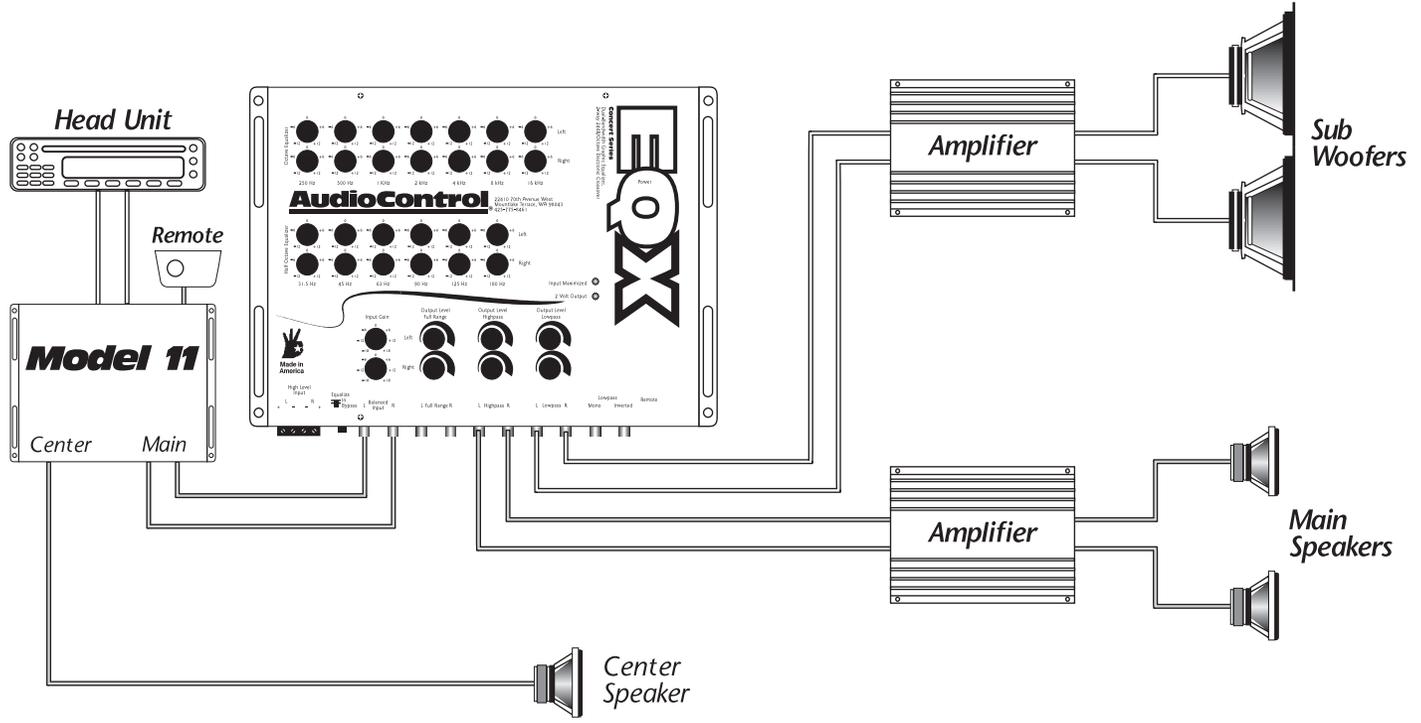


Figure 5 (on opposite page). Wiring diagram shows an EQX in a bi-amplified system with an Model 11 Amplified Center Channel Image Processor.





WARNING

Before installation, turn off the power to the head unit or radio and disconnect the negative (-) lead of your vehicle's battery.

Mounting the EQX

1. Select a permanent mounting site for the EQX. Make sure you observe the Installation Precautions listed on page 8.
2. Position the unit and use either a felt-tip pen or spring-loaded center punch tool to mark locations for the four mounting holes.
3. Drill a small pilot hole at each marked location.
4. Secure the EQX with self-tapping screws.

Connecting the EQX

1. With ignition off, disconnect the negative (-) lead from the vehicle's battery.
2. Connect +12 Vdc and Ground from the vehicle's electrical system to the corresponding +12 and GROUND terminals on the EQX. Also connect the Remote turn-on signal from the head unit to the REMOTE terminal.
3. Connect a set of RCA cables from the head unit Left and Right outputs to the LINE LEVEL INPUT (LEFT and RIGHT) on the EQX Series II.

DO NOT CONNECT OUTPUTS AT THIS TIME!

NOTE: For high-level signals, splice speaker cable onto the radio's speaker wires and connect the other end to the HIGH LEVEL INPUT (Left and Right).

4. On the EQX, set all equalizer controls to the flat (i.e., "0") position. Set the INPUT GAIN controls for minimum gain (i.e., "-18"). Set all OUTPUT LEVEL controls for maximum attenuation (i.e., "-∞"). Press the EQUALIZE button IN.
5. Reconnect the vehicle's negative (-) battery lead and proceed to the next section.

Adjusting the EQX

1. Turn on the head unit or radio. On the EQX, you should see the (red) POWER indicator illuminate. If not, check the power connections, and try again. A test light or digital multi-meter works great for this.
2. Play a favorite tape or CD with consistent music and turn up the volume control on the head unit or radio to maximum level.

NOTE: Since the outputs are not connected, you won't hear any sound at this point.

3. Adjust the INPUT GAIN control until the yellow INPUT MAXIMIZED LED starts to flicker. Now back the control off until the LED just goes out.
4. Next, start the track over so that you are referencing the same musical information as in step 3. Adjust the OUTPUT LEVEL until the 2 Volt Output light is flickering steadily. If you find that you have turned the OUTPUT LEVEL all the way up without the 2 Volt Output light coming on, you may leave this control at "0" (or its fully clockwise position.)
5. Turn down the volume and power off the head unit or radio.
6. Connect the EQX outputs to the amplifier(s) inputs according to your system plan.



Adjusting the EQX (cont'd)

NOTE: Consult the amplifier owner's manual for information on setting its input sensitivity. If adjustable, set each amplifier to accept a signal between 1.0 and 2.0 volts (1000 and 2000 mV). This may be a minimum setting on your amp. Don't worry, the EQX can still drive it to full volume. If your amp cannot accept 2V you may need to turn the Output Level down a bit.

7. Play a tape or CD (preferably one containing a variety of acoustic instruments).
8. With the deck's volume set to a normal listening position (i.e., about one-third on), adjust the OUTPUT LEVEL controls until the system is playing at a comfortable level.
9. A third-octave real time audio analyzer is the ultimate tool for getting the best sound quality from your new EQX. If you are in a real hurry, you can set the equalizer by ear.

10. Listen to the vocals and instruments, and trying cutting the frequencies in the mid-bass (90 to 250 Hz) and mid-range (2 to 4 kHz) spectrum. The mid-bass response is usually a problem area due to standing waves caused by sound resonating in the passenger compartment. The mid-range frequencies are most sensitive to the ear and usually need to be brought down a bit.
11. Continue listening and try boosting the low bass frequencies in the 31.5 to 63 Hz area. Usually this area needs help due to design limitations of smaller woofers and loss of bass in cassettes.

NOTE: If the (yellow) OVERLOAD indicator comes on, something is boosted too much. Either bring down the suspect frequency control or adjust the INPUT GAIN controls to reduce the overall gain.

- As a final check, press the EQUALIZE switch OUT and IN to compare the sound without and with equalization. Try different program sources and make any final adjustments.

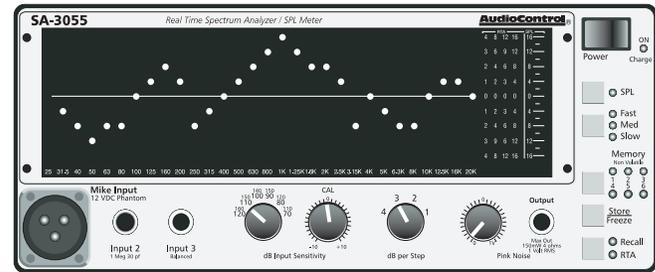
Using a Real Time Audio Analyzer (RTA)

For a really well-balanced system, we highly recommend using a Real Time Analyzer (like the AudioControl SA-3055) to adjust your vehicle's sound system. This tool is especially helpful in performing the initial adjustments for multi-amplifier installations.

Balancing a system "by ear" should be performed as fine-tuning after using a Real Time Analyzer, since our ears adapt very quickly to any new frequency adjustments.

In fact, if you listen to a badly-adjusted system long enough, it will actually start sounding pretty good. Only later, when your hearing "refreshes" and your buddies come to audition your new system, will you realize how far off the mark *Def Leppard* really is!

Now... do yourself a big favor and ask an authorized AudioControl dealer about this professional sound-balancing option.



AudioControl SA-3055 Third-Octave Real Time Audio Analyzer

Amplifier Bridging

The EQX comes with LOW PASS MONO Outputs, so you can create a bridged amplifier system that will drive a subwoofer at maximum power output, as shown in Figure 6.

This concept will work on almost any amplifier not already equipped with bridging outputs (i.e., an amplifier without common speaker output grounds). Check your amplifier owner's manual to verify that it meets these conditions.

In the bridged mode, each channel of the amplifier sees half of the load impedance (i.e., 2 ohms versus 4 ohms). It outputs one channel in phase with the system and the other 180 degrees out of phase. In other words, one channel supplies the positive half of the signal and the other the negative side. The voltages are summed at the subwoofer for a fourfold increase in power, as demonstrated by the following calculations:

The formula for output power of an amplifier (single channel) is:

$$\frac{(\text{Peak Voltage} \times .707)^2}{\text{Load impedance (ohms)}} = \text{Output Power (watts)}$$

For a normal amplifier (rated at 25 watts per channel) driving a nominal 4 ohm load, the output power is:

$$\frac{(14 \times .707)^2}{4} = 24.49 \text{ watts}$$

For a bridged amplifier (rated at 25 watts per channel) driving a nominal 4 ohm load, the voltage is doubled and the output power is quadrupled:

$$\frac{(28 \times .707)^2}{4} = 97.97 \text{ watts}$$

As this example illustrates, a 25 watt amplifier can provide 100 watts of power in the bridged mode, for a noticeable increase in bass sound.

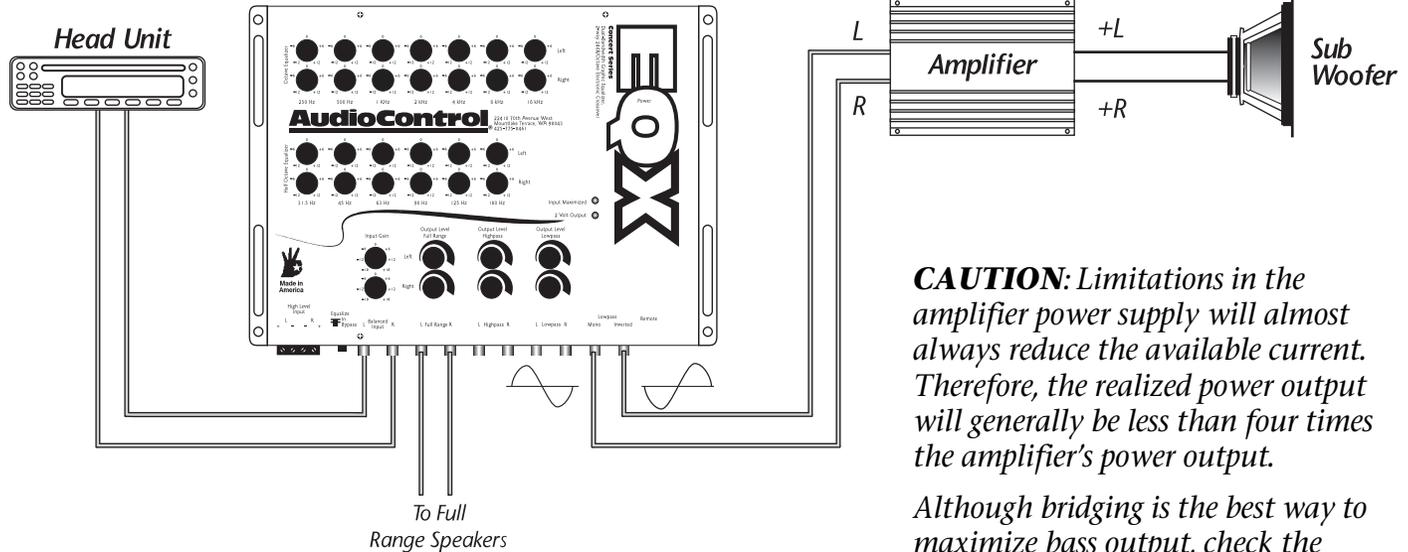


Figure 6. Wiring diagram for a bridged amplifier system.

CAUTION: Limitations in the amplifier power supply will almost always reduce the available current. Therefore, the realized power output will generally be less than four times the amplifier's power output.

Although bridging is the best way to maximize bass output, check the amplifier's manual to make sure it is capable of driving a 2 ohm load, and that it is not already bridged internally.

Making Your Own Crossover and Programmable Frequency Match Modules

A crossover network is a circuit that divides the bandwidth of an audio signal into two or more frequency bands, as shown here.

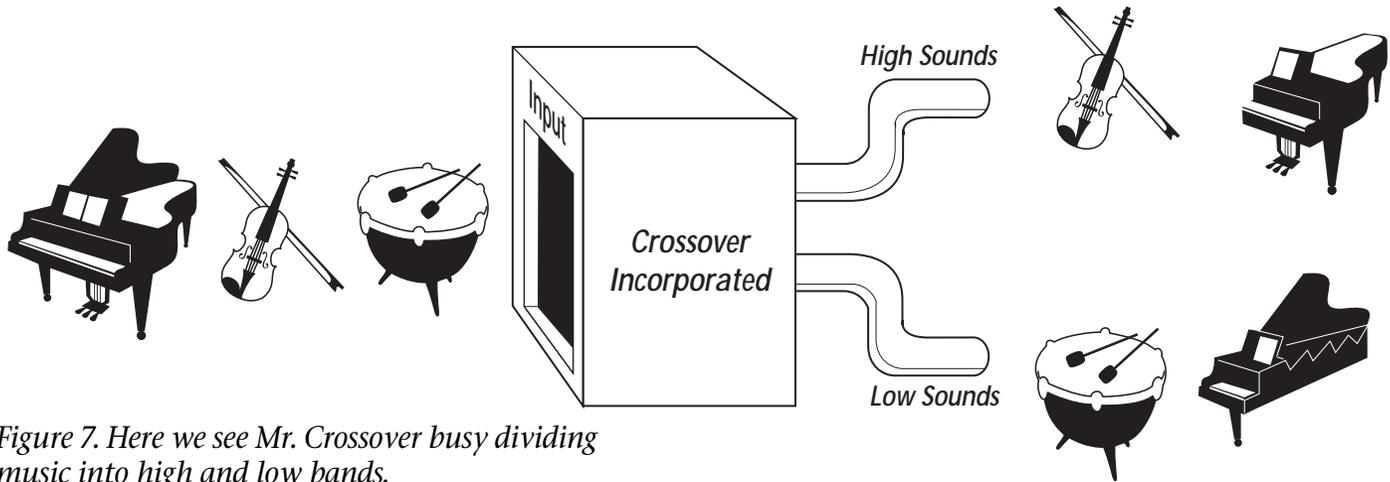


Figure 7. Here we see Mr. Crossover busy dividing music into high and low bands.

Since component speakers (like woofers, mids, and tweeters) are designed only to reproduce certain frequencies, a crossover allows us to match the speakers needs to the appropriate frequency range⁴.

The correct crossover frequency greatly depends on your choice of speakers. This section presents techniques for improving your installation, especially if you are planning a bi-amplified system or are considering adding a subwoofer.

We recommend choosing a crossover frequency based on using the frequency response of the higher-frequency speaker to be connected to the crossover. For example, in a 2-way system with an 8" speaker for low to mid frequencies and 2" dome tweeter for the highs, use the tweeter's frequency specifications to determine the optimum crossover point.

⁴(Sure seems like there's a lot of footnotes in this manual!) For more details, read our Technical Paper #104, *Crossovers and Bi-amplification*.

Most manufacturers list a recommended crossover frequency as part of the speaker's specifications. Choosing an even higher crossover point will provide increased speaker reliability, especially at higher volume levels.

The EQX comes with a programmable 24 dB per octave Linkwitz-Riley crossover module set at the factory for 90 Hz. This is a common subwoofer/woofer crossover point.

We also include an 18 dB per octave Programmable Frequency Match low-cut filter module already set to 33 Hz. This will act as a subsonic filter, protecting your woofers. If you have large woofers (i.e., 12" or 15"), you may want a lower frequency module. With smaller woofers (i.e., 6" or 8"), use a higher frequency Programmable Frequency Match module.

Making Your Own (cont'd)

Additional modules with pre-set frequencies are available from an authorized AudioControl dealer, or you can create a custom crossover and/or low cut filter by using the following formula⁵:

$$\frac{7200}{\text{Frequency (in Hz)}} = \text{Resistor Value (in kohms)}$$

EXAMPLE - For a 2500 Hz crossover, the formula yields a resistor with a value of:

$$\frac{7200}{2500} = 2.88 \text{ kohms}$$

NOTE: Use only resistors having a tolerance of five percent or better (i.e., 5%, 2%, etc.).

⁵(HEY! Not another #*&% plug disguised as a #*&% footnote!) – ok, OK, OKAY! – We'll make a deal with you. Send us ten bucks, and we'll send you the whole set of Tech Papers (which includes our Technical Note #1005 Crossovers Modules). And you won't have read another tiny footnote – unless you want to.

WARNING

TURN OFF THE SYSTEM BEFORE CHANGING MODULES, OR ELSE SOMETHING IN YOUR SYSTEM WILL BE DAMAGED!

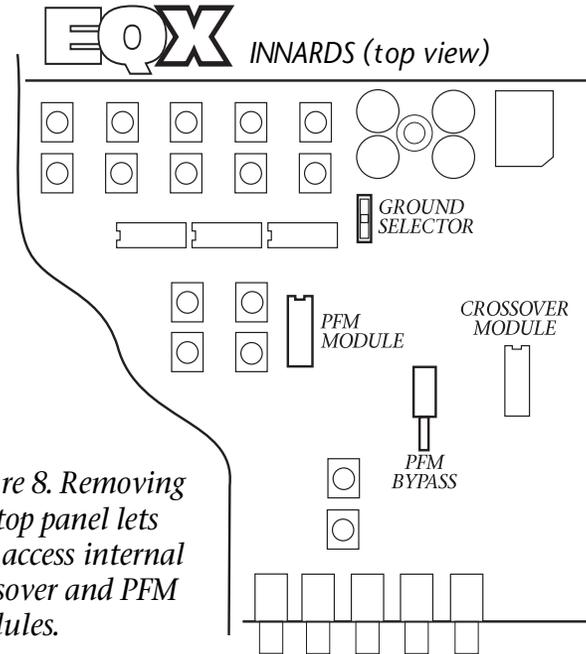


Figure 8. Removing the top panel lets you access internal crossover and PFM modules.

1. Turn the system power off.
2. Remove the top panel and locate the crossover or Performance Frequency Match module, as shown in Figure 8 (on the opposite page).
3. Change the appropriate module.
4. Replace the top panel and tighten the screws.
5. Turn the system power on.

Troubleshooting

1. If you hear a “buzz” or “whine,” you may have a grounding problem. Check all power connections and cables. Are all components in the system routed to a common ground point? Does the head unit have a clean ground? The factory wire harness doesn’t count.
2. If the condition still exists, turn the system off and remove the top panel of the EQX (refer to Figure 8). Locate the GROUND SELECTOR and switch it to a different position.
3. Apply power and listen. If the condition still exists, you’ve got bigger problems. You’ll need to contact an authorized AudioControl dealer to solve this issue.

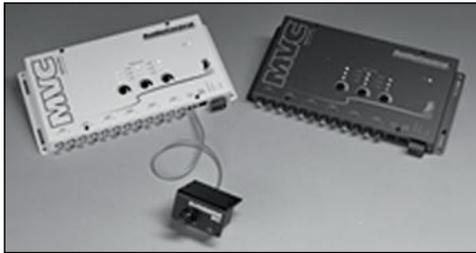
Unabashed Plug!

In addition to the EQX, we manufacture a unique line of high-quality Performance Match Components, all designed to work together to give you the best-sounding system, regardless of the type of vehicle you own. These components have won so many awards, the walls in our lobby are SAGGING!

The Master Volume Control (MVC) is the ultimate in high Signal-to-Noise design. With your

source unit all the way up it is at its maximum S/N ratio, not to mention approaching its

highest voltage out. Pipe this hot clean signal down the line and control it with the MVC just prior to the signal's entry into the amps.



The Epicenter™ is our patented bass restoration solution that will dramatically add impact or depth to your sound system, so you can really feel the bass.



The ESP-2™ restores spaciousness to recordings to fill your vehicle with concert hall sound.

So visit an authorized AudioControl dealer and ask a salesperson about them. AudioControl specializes in making good stereo sound better™!

Warranty

People are scared of warranties. Lots of fine print. Lots of noncooperation. Months of waiting around. Well, don't be scared of this warranty. It's 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 EQX. So go ahead and read this warranty, then enjoy your new component for a few days 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 honor these conditions, we will warrant all materials and workmanship on your EQX for Five Years from the date you bought it, if installed by an authorized AudioControl dealer, and will fix or replace it, at our

option, during that time. For you do-it-yourselfers we will warrant your EQX for One year.

Here are the conditions that make this warranty conditional:

1. You have to fill out the warranty card and send it to us within 15 days after you purchase your EQX.
2. You must keep your sales slip or receipt so you have proof when and from whom you bought your EQX. We're not the only company to require this, so it's a good habit to be in with any stereo purchase.
3. Your EQX has to have been originally purchased from an authorized AudioControl dealer. You do not have to be the original owner to take advantage of the warranty, but the date of purchase is still important, so be sure to get a copy of the sales slip from the original owner.



4. You cannot let anybody who isn't: (a) the AudioControl Factory; (b) an authorized service center; or (c) someone authorized in writing by AudioControl service your EQX. If anyone other than (a), (b) or (c) messes with your EQX Series II, that voids the warranty.
5. The warranty is also void if the serial number has been altered or removed, or if the AudioControl EQX is used improperly. Now, that sounds like a big loophole, but here is all we mean by it.

Unwarranted abuse is: (a) physical damage (our mobile products are not meant to be used as jack stands for your car); (b) improper connection (we have done the best we can to protect the inputs, however, 120 volts into the jacks can fry the innards of the poor beast); (c) sadistic things.

This is the best mobile product we know how to manufacture, but if you use it for the

front bumper of your Baja bug and get it full of water and dirt, things will go wrong.

Assuming you conform to numbers 1 through 5, and it isn't all that hard to do, we get the option of deciding whether to fix your old unit or replace it with a new one.

Legalese Section

This is the only warranty given by AudioControl. This warranty gives you specific legal rights which vary from state to state.

Promises of how well your EQX will work are not implied by this warranty. Other than what we've covered in this warranty, we have no obligation, express or implied. Also, we will not be obligated for direct or indirect consequential damage to your system caused by hooking up the AudioControl EQX.

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

Block Diagram

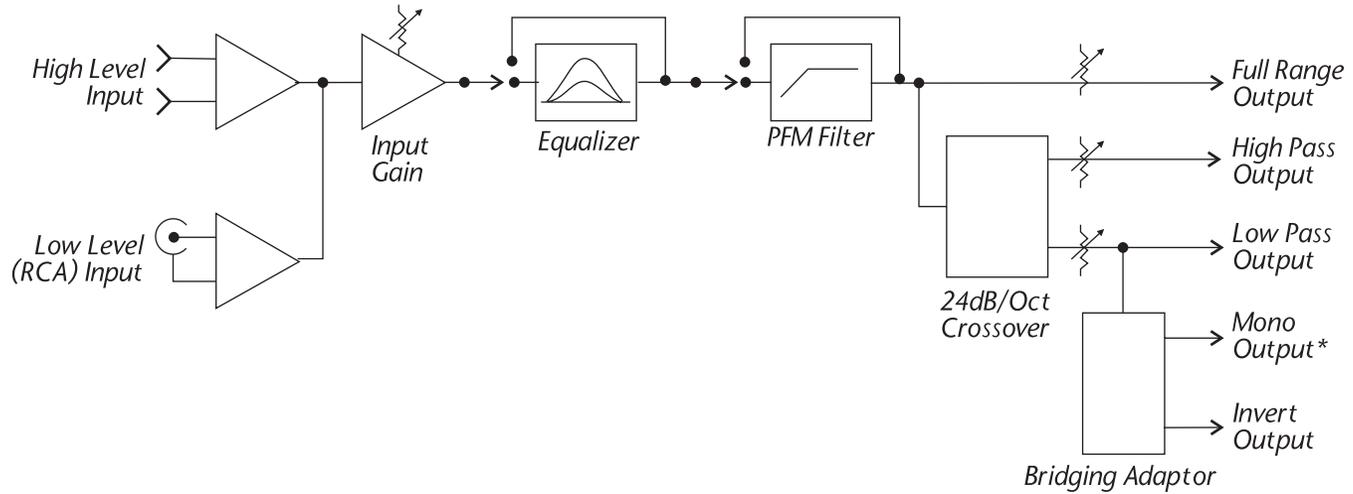


Figure 10. Block diagram of the EQX Equalizer/
Crossover/Level Matcher.

**NOTE: The Mono Output can be split with a 'Y' cord if your amp needs dual mono inputs.*



Specifications

All specifications are measured at 14.4 Vdc (standard automotive voltage).

| | |
|-----------------------------------|----------------------------------|
| Frequency Response: | 10 Hz to 20 kHz \pm 1 dB |
| Total Harmonic Distortion (THD): | 0.005% |
| Signal to Noise Ratio (SNR): | 110 dB at full output |
| Maximum Output Level: | 9.5 volts rms |
| Input Gain: | \pm 18 dB |
| Crossover Slope: | 24 dB per octave |
| Crossover Type: | 2-way Linkwitz-Riley |
| Programmable Crossover Frequency: | 50 to 6500 Hz |
| PFM Filter Slope: | 18 dB per octave |
| PFM Frequency: | Programmable 15 to 100 Hz |
| Power Supply: | Transformer-isolated switch mode |
| Fuse Rating: | 2 amps |
| Size: | 1.25"h x 8.9" w x 6.9" d |
| Weight: | 3 lbs |
| Balanced Input | Yes |
| Ground Isolation Jumpers | Yes |
| Country of origin: | USA |

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This manual was probably written, designed, printed, folded and stuffed into a box in the U.S.A., on a miserably drizzly day - considering where we live.

P/N 794083