

# 4XS™

## Concert Series CROSSOVER/CONTROLLER OWNER'S MANUAL AND CONSCIOUSNESS COURSE

**Congratulations** on buying the state of the art crossover/controller—the 4XS. It will give you countless hours of improved autosound performance and enjoyment by virtue of its advanced design, careful construction and astonishing array of features and flexibility. Please take a minute to familiarize yourself with the many capabilities of the 4XS by reading this manual.

Here's what you can expect from your 4XS:

- A 2 way/4 channel, 3 way/2 channel, or 4 way/2 channel 18dB/octave programmable, active, electronic crossover network
- Independent programmable subwoofer output with bridging adapter(18dB/octave)
- Programmable Frequency Match circuit (18dB/octave) for speaker control and amplifier protection
- Non-fading bass for 4 channel operation
- Noise rejecting, optically isolated, PWM switching power supply for quiet operation and high headroom
- Output gain controls to best balance your system
- Astonishing specifications of total harmonic distortion of 0.005% and signal to noise of -110 dB
- Highest quality, designed and built in America from this award winning Washington state manufacturer
- Envious friends.

### Getting to Know Your 4XS

The AudioControl 4XS is a compact, audiophile grade programmable crossover, subwoofer controller, level matcher, and bridging adapter with non-fading bass. In short, loaded with real world features.

#### INPUTS.

Lurking on the lower left of the 4XS are RCA-type jacks for both the 2 and 4 channel inputs. These will be connected to your source or equalizer.

#### OUTPUTS.

To the right of the input jacks are the output jacks. These will be connected to your power amplifiers. You may find that you will not use all of them depending upon your system design.

#### OUTPUT LEVEL CONTROLS.

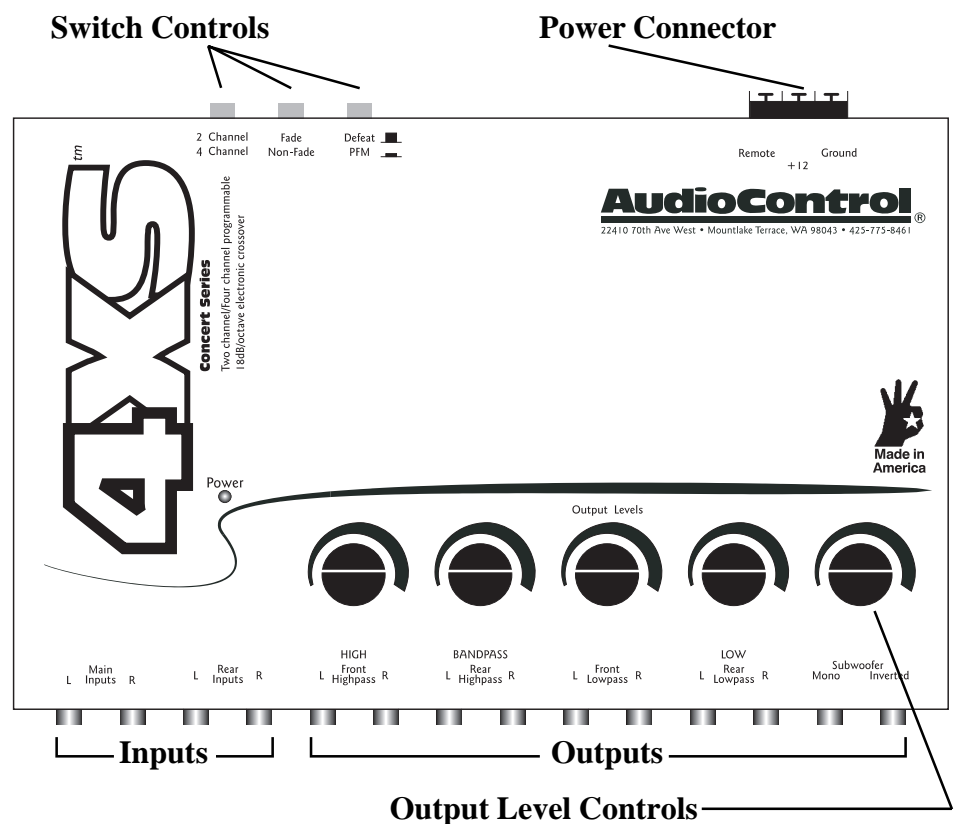
Power amplifiers are choosy about their input level and speakers have different efficiencies, meaning they play at varying volume levels even with the same amount of power. Unfortunately, this is not standardized, so you need a way to control and balance the system. The output level controls relate to the output jacks below them. The level controls allow you to precisely set the gain not only for best sound balance but also for maximum signal to noise.

#### SWITCH CONTROLS.

On the upper left of the 4XS, are three switches which let you select 2 or 4 channel mode, non-fading or fading bass, and whether or not the Programmable Frequency Match circuit is engaged.

#### POWER CONNECTOR.

You'll also notice on the top surface a terminal strip with screws set in it. This is where you connect the +12 volt and ground connections which power the 4XS. The third terminal is for remote turn-on of the 4XS and it connects to the remote output from the headunit or the power antenna lead. This allows you to activate the 4XS simply by firing up your source unit.



#### PROGRAMMABLE MODULES.

The modules which control the crossover, the subwoofer, and the Programmable Frequency Match circuit are underneath the top cover of the unit. More about this later.

#### BLOCK DIAGRAM.

To help you understand the incredible flexibility and control of the 4XS, please refer to these block diagrams for both 2 and 4 channel operation. As a hint, notice how you can start with a 2-way system and easily use the 4XS to help upgrade to a 3-way system in the future.

#### QUICK REFERENCE GUIDE TO INSTALLING THE 4XS

**THE MOST IMPORTANT INSTRUCTION OF ALL.** Fill out the WARRANTY CARD and mail it in! It's also critical that you keep your invoice or sales slip, since it is your proof of purchase should anything happen to your 4XS while you are off catching some rays in a sunny location some distance from our very damp rainforest.

**IMPORTANT DECISION TIME.** Do you install the 4XS yourself or have an installer do it? While actual installation is relatively simple, selection of the programmable modules and adjustment of the level control can be quite complex. For best possible performance, we recommend that you have the 4XS adjustments done by an AudioControl Performance Match dealer equipped with a one third octave real time analyzer like the SA-3055.

**MOUNTING.** Theoretically, you can place the 4XS anywhere that it can receive power. The two most convenient places are under the seat and in the trunk. If possible, we suggest you mount it close to the power amplifiers for ease of connecting power and remote turn-on wires. Needless to say, make sure you can get at the various knobs, switches, and modules. Be sure to use 100% shielded audio cable for the best results. Wherever you mount the 4XS, consider the following guidelines:

- Avoid mounting near a heater, in front of the firewall, or anywhere else where it can get really hot.
- The mounting location must be safe from water or beer seepage. Check for old stains or wetness.
- The 4XS must be firmly mounted to the car. This protects connections from breaking and stress and the possibility of the 4XS becoming un-attached when you blast over a speed bump.
- Avoid any location where mounting screws may potentially pierce a gas tank, or gas, brake or electrical lines.

Otherwise, the 4XS installs just like a power amplifier, secured by four (not three or two) screws and lock washers (yes, use them).

We have designed the 4XS with very high quality parts and in a manner which reduces mass related circuit board stress (a typical failing of a lot of car gear). Still, all electronics have a limit to environmental stress. So, no fair mounting it to the front bumper or under the oil pan.

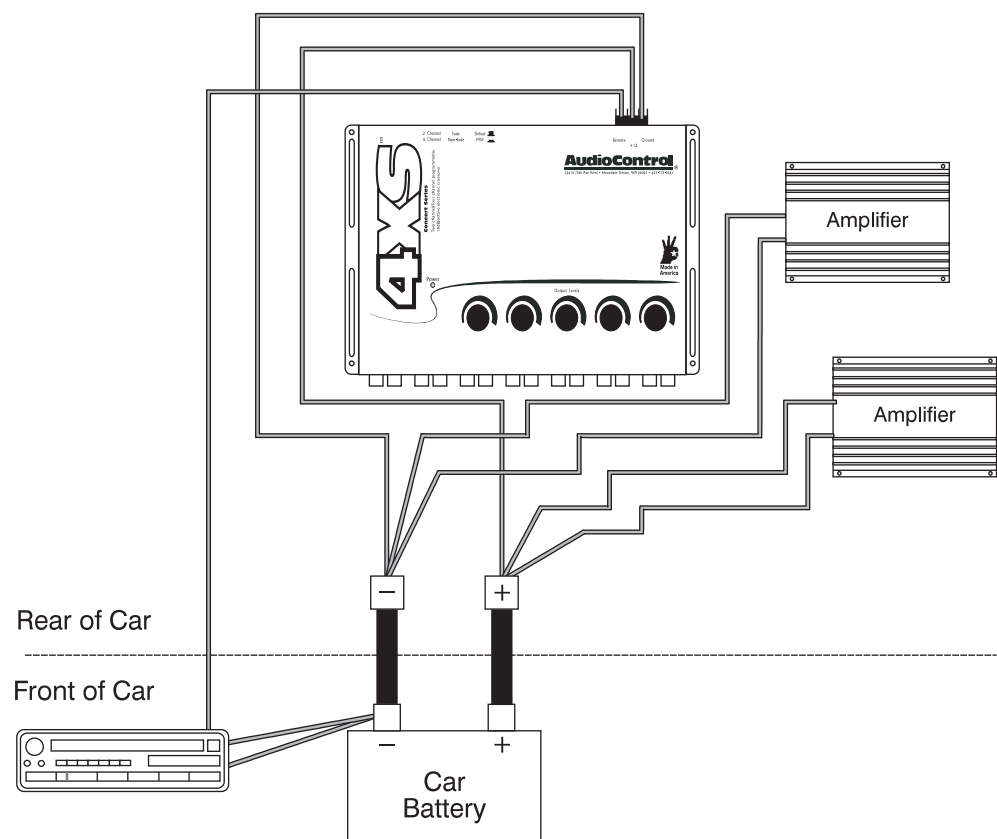
**AUDIO WIRING.** It is extremely important to use high quality, 100% shielded, stereo RCA cables. The idea is to minimize potential interference, noise and intense electromagnetic fields that automobiles generate. This interference can compete with your

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music as clicking, whining, ticking, or buzzing. Theoretically, all RCA-type cables are shielded. Unfortunately, cheapoid cables skimp on shielding since interference is not a problem in most home hi-fi hook-ups. Avoid the temptation to use "that old set" laying around the house from your brother-in-law's \$99 stereo. Remember it's better to invest in good cable, than to try to trace a problem once all the cables are buried. Also keep these audio cables away from other car wiring, amplifier power cables and speaker wiring.

**POWER WIRING.** This is a lecture on the mind boggling, earth shaking, noise reducing importance of star ground and power connections! Sound like a science fiction movie? Actually, it's the ONLY recommended method of +12 volt and negative ground connection. For best protection from noise, there should be ONE and ONLY ONE path each from ALL your car stereo components to the positive and negative side of your vehicle's electrical system. If you don't follow this advice, the result can be like flushing a toilet while you are in the shower. Pay attention to this diagram; do what it says. Make sure all ground wires, including the head unit, connect together as shown and that a heavy wire connects to the battery's negative terminal or grounding strap. The nearest piece of bare metal isn't necessarily a true ground. Sometimes it may be necessary to replace the battery ground itself. Remember: the alternator is the ULTIMATE source of power in your electrical system. Somehow all power and ground connections must return there. Why not make it easy?



Use proper gauge wire for the size of your system. If in doubt, thicker is better. And remember, ALWAYS DISCONNECT THE NEGATIVE TERMINAL OF THE BATTERY BEFORE WORKING ON ELECTRICAL CONNECTIONS.

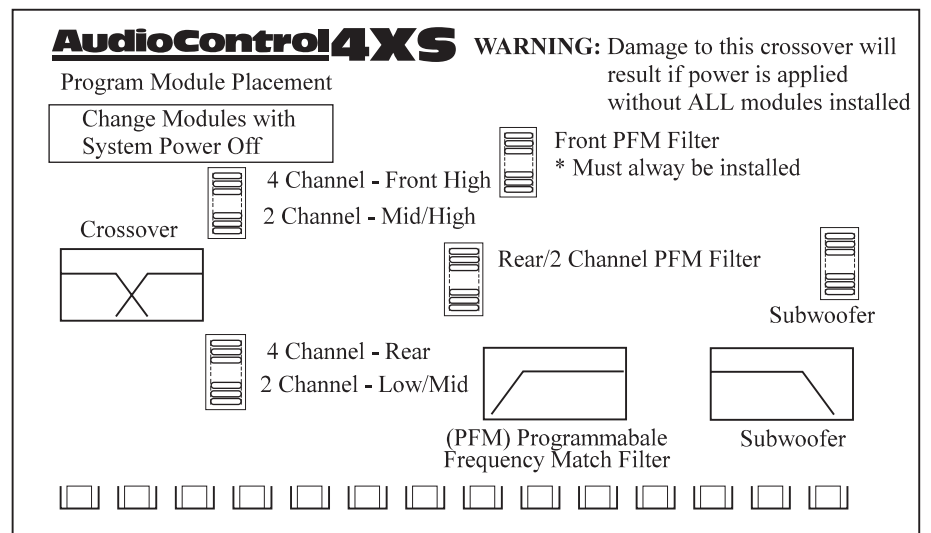
**OUTPUT LEVEL CONTROLS.** These controls provide two very useful functions. First, they control the overall balance between high, mid, low, and subwoofer levels. This is particularly useful when the power amps do not have input level controls or only a switch with two settings. Second, these controls on the 4XS can provide extra gain or attenuation if needed. Some head units have very weak output levels while other systems have problems with extremely high levels. Adjust these controls for best balance between amplifiers and to give you a volume control on your head unit which is truly half volume when half way turned up.

If you have made it this far, take a break. Take a walk. Raid the 'fridge, but be sure to come back because we are getting to some really good stuff.

## A QUICK TOUR OF THE INSIDE

All program modules are under the top cover of the 4XS. Never remove this cover with power connected to the unit or you may get an extra little tingle in your day, not to mention sending square waves to your speakers. OUCH! After disconnecting power, remove the four screws on the top surface, and gently lift straight up. Turn this top over and you will see a label affixed to the inside showing the location of the modules which control the crossover frequencies, the subwoofer output frequency, and the Programmable Frequency Match circuit.

**Important note:** All 5 modules MUST be installed before reconnecting power to the 4XS or you very likely WILL DAMAGE something in your sound system.



Inside Label

## 4XS Limited 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 4XS. So go ahead and read through 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 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 4XS for ONE YEAR from the date you bought it, and will fix or replace it, at our option, during that time.

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 purchased your 4XS.
2. You must keep your sales slip or receipt so you have proof when and from whom you bought your 4XS. We're not the only company to require this, so it's a good habit to be in with any stereo purchase.
3. Your 4XS 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 one year warranty, but the date of the 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 to service your 4XS. If anyone other than (a), (b), or (c) messes with your 4XS, that voids the warranty.
5. The warranty is also void if the serial number has been altered or removed, or if the AudioControl 4XS 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, things will go wrong.

Assuming you conform to number 1-5, 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 that vary from state to state. Promises of how well your 4XS will work are not implied by this warranty. Other than what we've covered in the warranty, we have no obligation, express or implied. Also, we will not be obligated for direct or indirect damages to your system caused by hooking up the AudioControl 4XS.**

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

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# Hints, Tidbits and Other Useful Information

**CROSSOVER FREQUENCY SELECTION.** We recommend that you pick the crossover frequency according to the characteristics of the speaker drivers. The manufacturer designed the speaker to operate best in a certain frequency range (the linear zone) and if they operate outside that zone, sound reproduction is inaccurate and the loads to the amplifiers may be VERY different from the nominal (eg. 4 ohm nominal) loads. In general, the higher frequency driver can handle less power safely than lower frequency drivers, so the higher you cross over, the better the reliability when you decide to crank it. We have installed two 3.5kHz and 90Hz programmable crossover modules and one 33Hz Programmable Frequency Match module at the factory. (See diagram at right.)

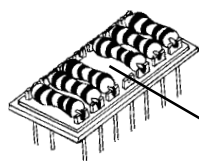
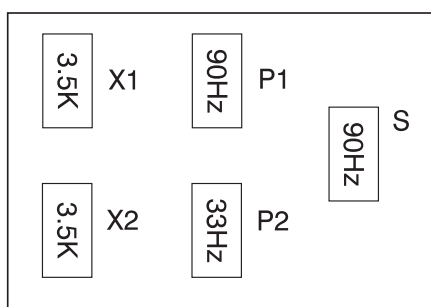
We do not recommend you pick a crossover frequency to adjust for an acoustical problem with the car. A product designed for that specific purpose (an equalizer) is the correct solution for an acoustical adjustment. Frequently, the acoustical problem will demand a crossover point outside the linear zone of the drivers, injuring sound quality and, possibly, jeopardizing speaker life.

For an in-depth discussion of this topic, mail us a stamped self-addressed large envelope marked "Tech Paper 104" and we will mail you the AudioControl Technical Paper, "Crossovers and Bi-amplification."

**MAKING A MODULE.** All modules in the 4XS, for the crossover frequencies, the subwoofer, and the Programmable Frequency Match circuits, are interchangeable. Since they are all 18 dB/octave (though the circuit designs do differ), they all use the same module. These modules program the various circuits and the reason we use this design is that it is the most reliable, accurate, and STABLE over time. Plus, when you throw a package or spare tire in your trunk, you don't accidentally hit the crossover and change the settings.

AudioControl Performance Match dealers have kits of already prepared modules to make this programming simple, and they are experts at adjusting the 4XS, so consider having them do the installation for you. However, if you want to make your own modules, the necessary parts are 5% or better carbon or metal film resistors (6 per module) and 14 pin DIP headers. Since Radio Shack tends to stock 16 more often than 14, you can use a 16 pin DIP header and cut off the end. But try to hold out for 14 if you can.

To compute the resistor value for the crossover point you want, use the formula below. **Note:** all resistors in the module must be the same value or weird mutant monsters will rise up from the ocean and eat San Diego.



Note: Center left blank

$$\text{Resistor value (Kohms)} = \frac{7200}{\text{frequency}}$$

Example: for the desired crossover frequency of 240 Hertz

$$\frac{7200}{240} = 30 \text{ Kohms resistor value}$$

## Programmable Frequency Match:

### What it is and Why You Need It

The 4XS has a unique, special and very useful feature called the Programmable Frequency Match (PFM) circuit. It is an adjustable high pass filter programmed by the same type modules used for the crossover. To understand why it is so useful takes a little background knowledge so face the blackboard please. While modern speakers are amazingly good, a single driver cannot produce sound for the full range of human hearing (20 to 20,000 Hertz). A speaker driver has a linear zone as we mentioned in the crossover section. Trying to operate that speaker outside that zone produces nothing good and only problems. You can use the PFM circuit to keep speakers happy. For example, if the largest front drivers in a 4 channel system are 5 1/4", set the PFM front module at 150 Hz and keep these speakers from trying to produce lower sounds. Your ears and amplifier will thank you.

Secondly, when using a subwoofer in an autosound system, most of the time, best results come from putting that driver in an enclosure or box. The size of the box in a car is very much a compromise but that enclosure size dictates the acoustical properties. This is known as the law of physics. Almost always, the size of the box is smaller than optimum which results in the woofer being uncontrolled by the enclosure lower than a certain frequency and visibly flopping around. This flopping will shorten the life of your subwoofer and interferes with proper bass reproduction. Here again you can use the PFM circuit to keep the speaker in control and make friends with your amplifier. Or, in a ported enclosure, you can set the PFM at the port tuning frequency and greatly increase your power handling capabilities. Like a subsonic filter, the PFM can prevent frequencies that rob amplifier power, may cause intermodulation distortion, and can cause speaker damage.

## Non-Fading Bass

If your woofer, the largest speaker in the system, is in the back of the car and you use the fader to direct the sound to the front of the car, all the bass disappears. This is because the woofer no longer receives any musical signal and generally the speakers in the front are too small to produce deep bass. At the touch of a switch, the 4XS gives you a solution. The non-fading feature of the 4XS diverts the lower frequency part of the FRONT signal to the back of the car for the woofer. Now you can fade to the front and still have bass. Take a look at the block diagrams above to understand more about this wonderful feature.

## Noise Rejection Power Supply

From an audio standpoint, car electrical systems are about as quiet as a rock concert in a motorcycle factory during an earthquake. Along with alternator whine, ignition "ticking," turn signal clicks and dash lamp dimmer buzz, some power amplifiers themselves add noise.

While AudioControl guarantees the 4XS will not contribute to this electronic cacophony, it must be capable of REJECTING everything else thrown at it. It does this with a special optically-coupled power supply that's completely isolated so it can ignore electronic trash thrown its way. If your system is noisy after proper installation of the 4XS, it was noisy beforehand, too. That may sound arrogant, but what the heck. . . we worked. . . we slaved. . .

## A Brazen Plug for Other AudioControl Products

If you like the 4XS, we have a couple of other great products in our award winning Concert Series that are just begging to be part of your system:

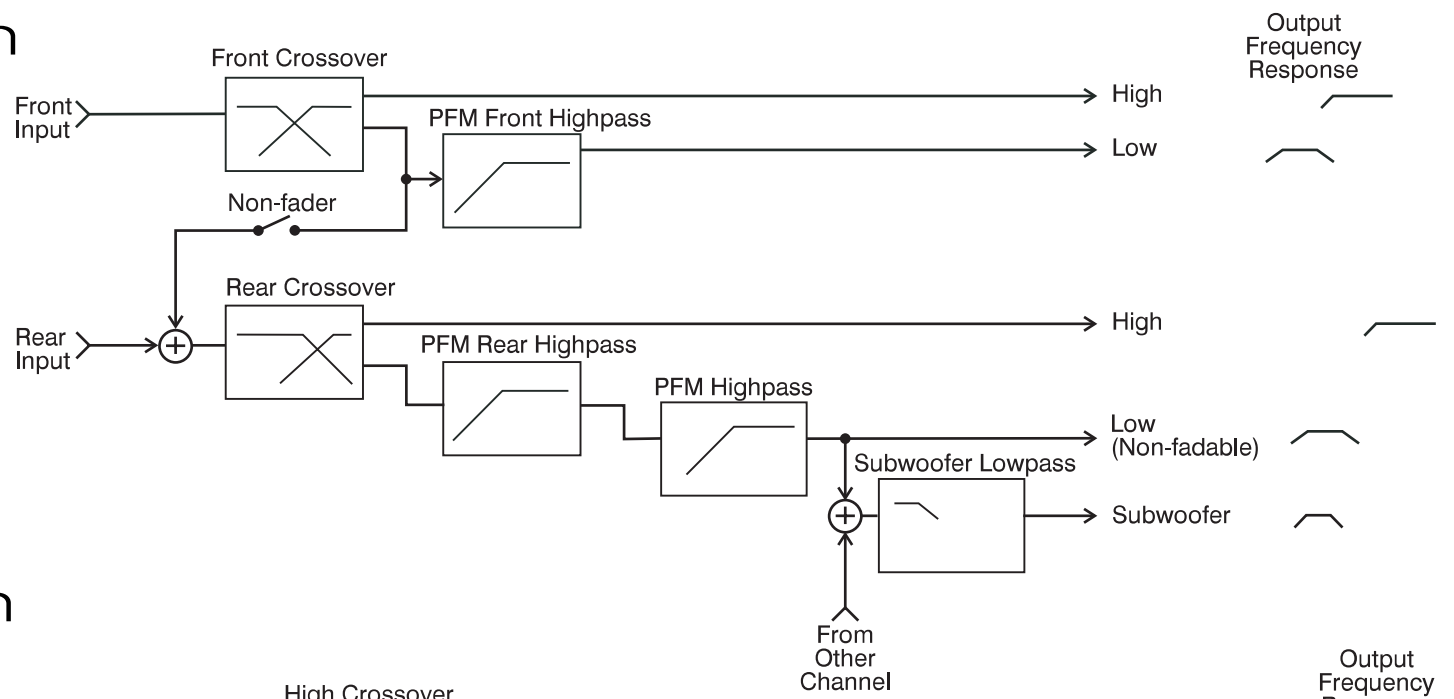
- The **EQX™**, a 2 channel compact audiophile-grade, digital-ready 13 band equalizer, line level preamp, bridging adaptor, and programmable electronic 24dB per octave crossover. Winner of the autosound Grand Prix award for equalizer of the year in 1987, 1989 and 1990 along with many other industry honors.
- The **EQL™**, all the above except the crossover. 1988 and 1991 equalizer of the year Grand Prix award winner.
- The **EQT™**, the world's only ONE-THIRD OCTAVE (that's 30 bands, but whose counting) Constant-Q autosound equalizer. Yep, this one won a few Grand Prix awards too!
- The legendary, car-shaking, **THE EPICENTER™**. It detects and digitally restores low bass that has been lost in the recording process. Mediocre woofers beware! Its effect is astonishing. If you want MORE BASS LOUDER, The Epicenter is for you! Ask for a demo at your AudioControl dealer. Another Grand Prix award winner.

Each of these components will deliver significant improvements in the sound of any car system and are part of the AudioControl Performance Match system. Check with your AudioControl dealer for the juicy details.

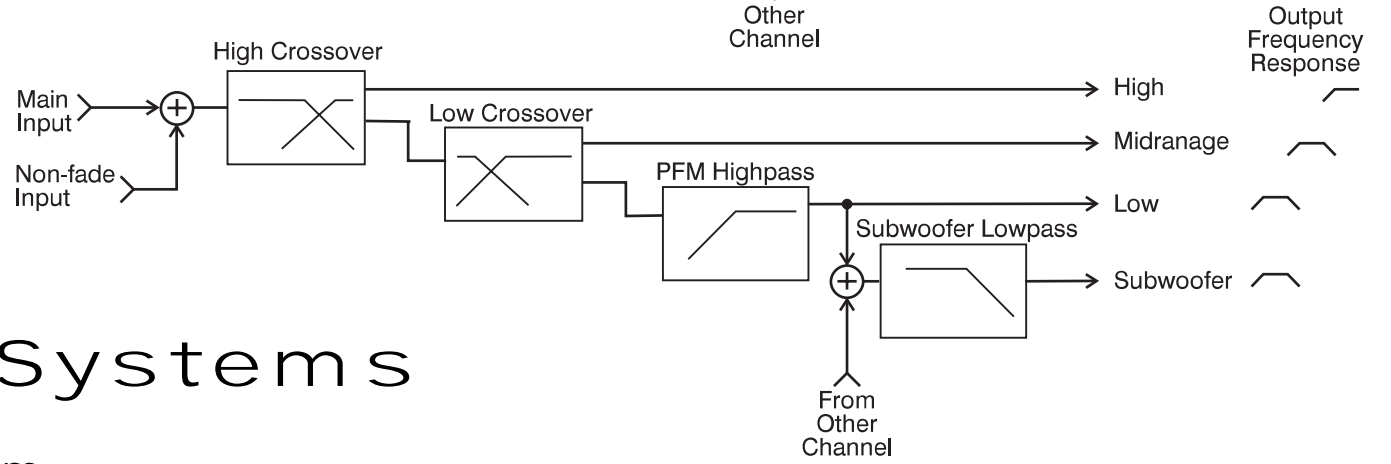
## 4XS Specifications

All specifications are at 14.4 volts DC (standard automotive voltage)	
Total Harmonic Distortion	0.005%
Signal to Noise Ratio (rated full output)	-110dB
Input Impedance	20K ohms
Output Impedance	150 ohms
Maximum Output Level	9.5 volts RMS
Output Gain	±12dB
Frequency Response	20Hz-20KHz; ±0.5dB
Crossover Slopes	18dB/Octave
Crossover Frequencies	Programmable*
PFM (switchable high pass)	Programmable*
Power Supply	Transformer balanced, switching DC/DC converter with optical coupler
Size	1.25"H x 8.75"L x 5.75"W
Country of Origin	USA
*While these come pre-set, they can be programmed for almost any frequency from 15 Hz to 20,000 Hz.	

# 4 Channel In Block Diagram

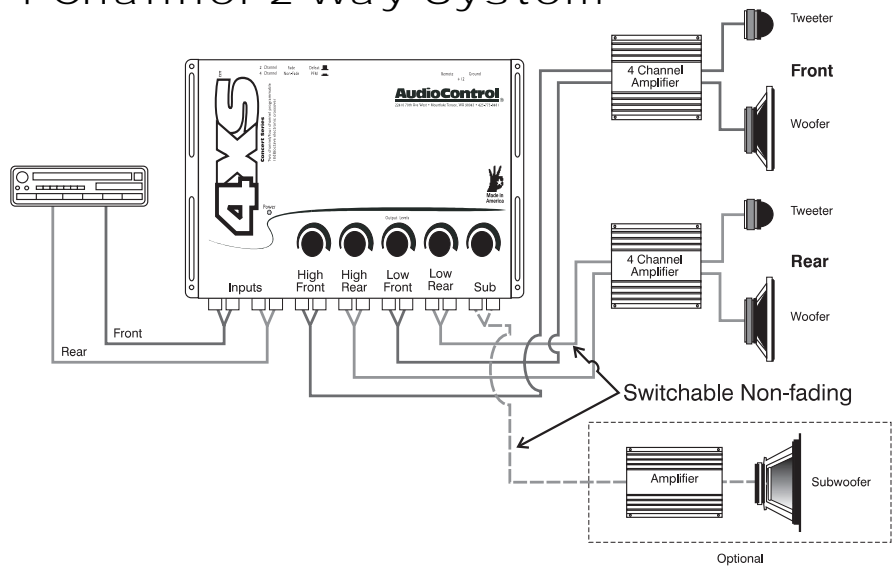


# 2 Channel In Block Diagram

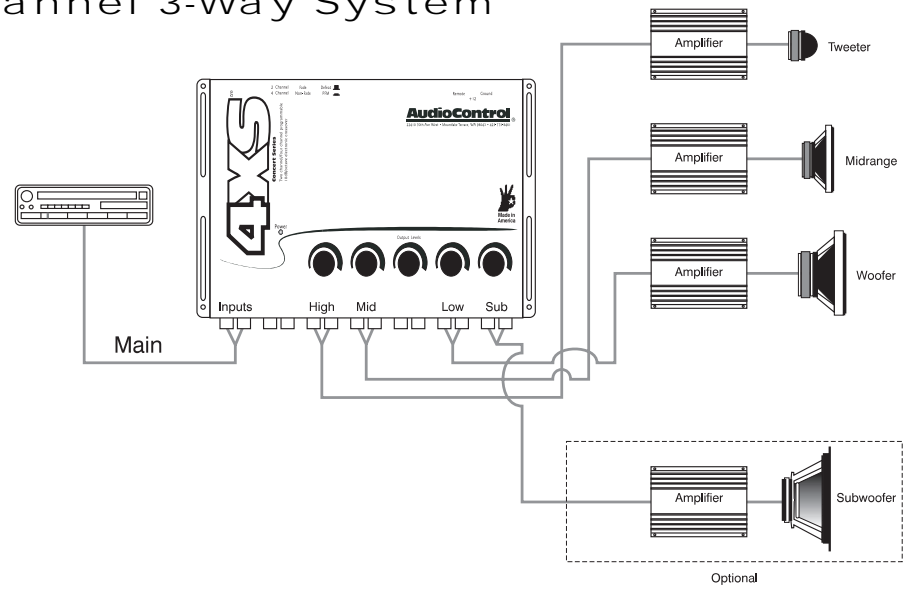


## Example Systems

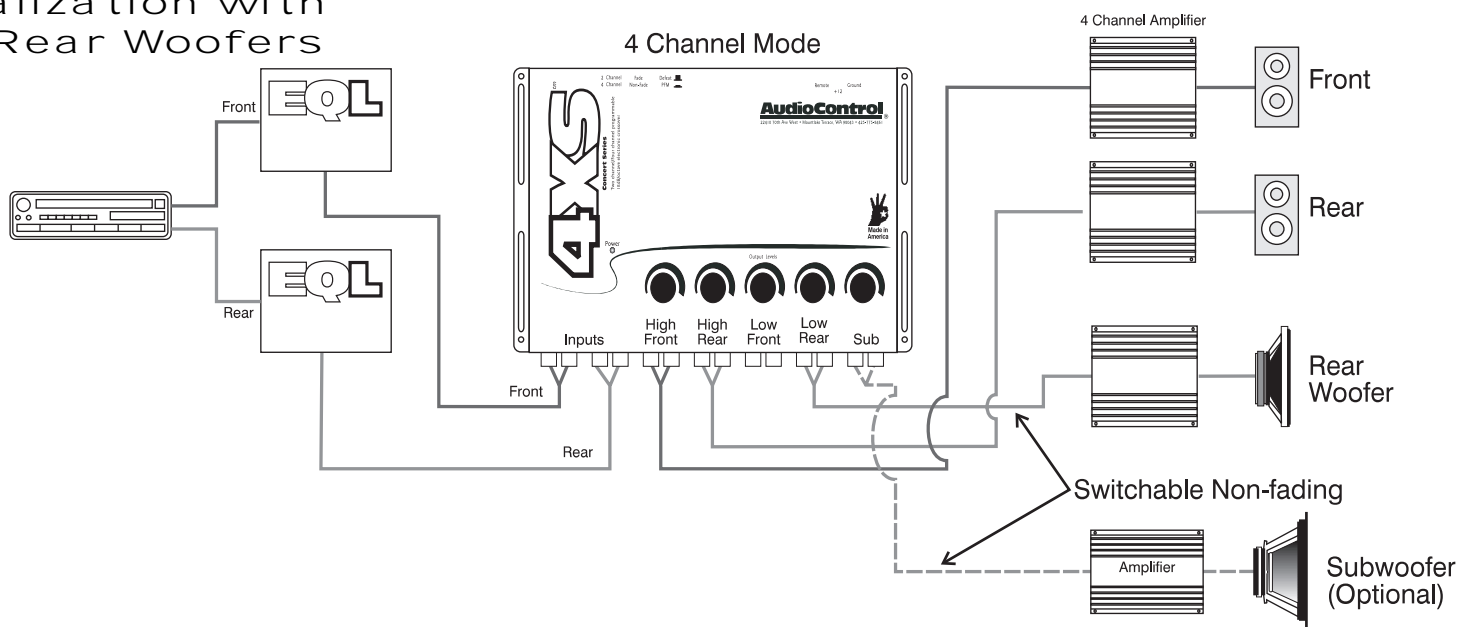
### 4 Channel 2-Way System



### 2 Channel 3-Way System



### Adding Equalization with Non-fading Rear Woofers



### 2 Channel 4-way System

