Price $75.00

AudioControl®

making good stereo sound better®

System90™
Powered Signal Processor

PROFESSIONAL INSTALLER'S MANUAL

System90

AudioControl
22410 70th Avenue West / Mountlake Terrace, WA 98043 / 206-775-8461 · Fax 206-778-3166

THANK YOU AND CONGRATULATIONS

We at AudioControl want to thank you for your professionalism, and for your devotion to the proper installation of Car Audio products. In addition, we want to congratulate you on being one of a select number of installer's recommended by our company to install properly AudioControl products. Hey, we put a lot of sweat into this product, and we don't want just anybody installing it. You know what we mean.

We realize the importance of having our products installed by knowledgable professionals. Because of this, we have gone out of our way to offer incentives for customers to seek out the services of people like yourself. Our customers can enjoy a two year warranty, but only if they have their system installed by a professional installer, at an authorized AudioControl dealer.

AN IMPORTANT OBLIGATION

WE MUST insure our customers receive their proper warranty protection, therefore we require your help.

You need to do just one thing for the customer, fill out and attach the provided "warranty installation sticker" to the unit during installation.

In addition, fill out the warranty card, and send or have the customer send, it to us. Lastly, please remember to give the "owner's manual" to the customer.

So, now that's over with, let's do it

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PRECAUTIONS AND SAFETY TIPS

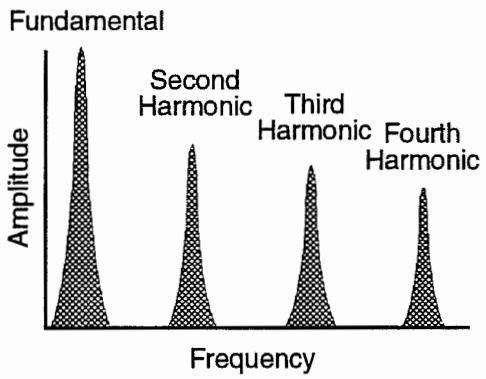
AudioControl realizes your extensive experience in car audio installs, however bear with us, it never hurts to review. Besides, you deserve a break don't you ?

a. Disconnect the battery negative lead first, and the positive lead second, before making any connections to the *System90.*
b. YOU MUST always install a 20-amp in-line fuse in the positive power wire, and locate it close to the battery. The fuse holder should be secure, and have good connections.
c. The *System90* MUST NOT be used in a positive ground electrical system.
d. DO NOT use common-ground wiring for speaker connections.
e. Make sure to check all connections to the *System90* for pinched or nicked wires.
f. Analyze your mounting location very carefully in order to avoid gas tanks, gas lines, brake lines, beer coolers, control computer lines and other electrical wiring.
g. Install the *System90* in a location where it will have good ventilation and protection from, direct exposure to sunlight, moisture, heater vents, french fries, baby bottles, whatever.
h. DO NOT install a *System90* in an engine compartment. Also, installation either on front or rear bumber is not suggested.
i. Remember, prolonged listening to music at extreme volume levels will cause permanent hearing loss.

▼ General Information

SOME ADDITIONAL NOTES BEFORE YOU BEGIN

If you've opened the *System90*, Powered Signal Processor shipping box, you've no doubt already figured out that this is not your average "power amplifier". The *System90* combines a number of innovative and exciting, technologies into one compact, and you'll soon find, easy to install unit. Before you start installation, you should be familiar with just what's inside an AudioControl *System90* Powered Signal Processor.



Bass Restoration

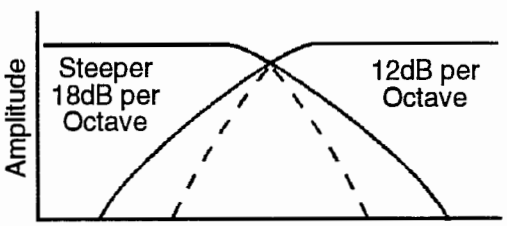
Bass Restoration

Inside each Model 20 and Model 40 you'll find our patented bass restoration technology, made famous by AudioControl's The Epicenter. This circuit detects harmonic artifacts, and then digitally restores the underlying bass, resulting in fast, tight, fundamentals.

No doubt you've found The Epicenter "remote". We'll address the use, and installation of this remote later in the manual. If you've already installed The Epicenter once or twice, this will be a piece of cake.

Electronic Crossover - State Variable

All the *System90's* have built-in state variable electronic crossover technology. The Model 20 incorporates a programmable, 18dB per octave, 2-way electronic crossover, while the Model 48 and Model 40 have two of the same. They are both programmable using plug-in modules. You may be familiar with these modules as they are the same as used in our 2XS, and 4XS crossovers. We'll expain this further in sections on individual models.



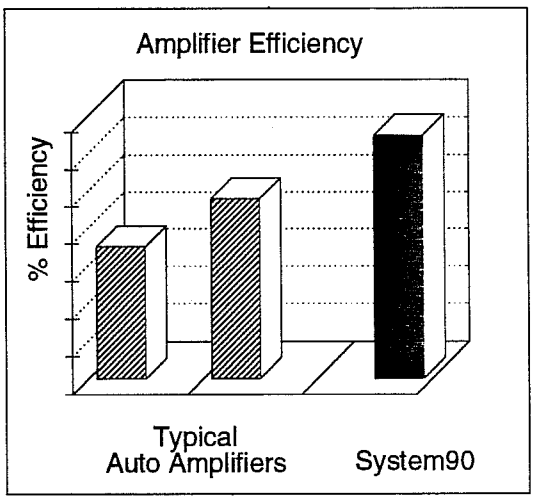
Electronic Crossover and Programmable PFM Filter

Programmable Frequency Match (PFM) Filter

You've witnessed the damage that sub-sonics can do to car audio systems. In addition, you know that they can rob amplifier power. The Model 20 and Model 40 has a built in 18dB per octave filter to prevent this. It is programmable by plug-in modules the same as the programmable crossovers. Sound familiar ? If you guessed it's the same as the PFM filter in the 4XS, "go to the head of the class." More about this later.

Efficient Power

Typical car amplifiers are not all that efficient. Add to that the additional products normally associated with a "high-end" install, and you know from experience the drain on a car's electrical system. We have taken great care and time to insure the *System90* power section is 35-50% more efficient than the other car amplifiers.



Protection

We believe that you, more than others, will appreciate the protection built-in to all *System90*s. Nothing can be more frustating than to spend hours on an install only to have it go up in smoke when its finally fired up. Particularly on the night when you've got that perfect date planned in less than an hour. Don't you hate it when that happens! DC offset, short-ciruit, high-temp, and high-battery voltage protection are just a few of the protection circuits built into the *System90*. In all of our field testing to date, not one *System90* has been hurt.

Acoustical Control

Your car was not designed to sound like a recording studio. When music is played, the sound bounces around the various shapes and materials (glass, vinyl, leather) and is changed. To further complicate things, most speakers are mounted down low by your feet or on the rear deck. In an environment like this, it is tough to accurately reproduce music. By having acoustical control, like equalization, you can adjust your system to compensate for your car's sound imperfections.

POWERED SIGNAL PROCESSOR'S FACTORY INSTALLED MODULES

With all the preceeding going on inside the *System90*, you're probably asking yourself, "self, I bet the factory has tried to help me with this install." Well you're right!! We've taken some liberties, thrown some switches, and installed a few modules. Please, read on.

▼ General Information

Programmable Frequency Match Filter Module

We mentioned the Model 20 and Model 40 incorporate a Programmable Frequency Match Filter. Remember it is programmable by installing different modules like the 4XS, and the EQX Series II. PFM Modules are available from AudioControl, or built yourself. All Model 20's and Model 40s are shipped from the factory with a 30Hz PFM module. To change factory setting please refer to sections on individual models.

State Variable Electronic Crossover Factory Module

Most *System90*s include at least one built-in state variable electronic crossover. They are programmable by selecting different crossover modules. It is important to note that most *System90*s are shipped from the factory with a 90Hz module in the crossover(s). To change the module please refer to sections on individual models.

Power Configuration

System90 amplification sections are, as you know, designed to be used for different applications. In Sections III, IV and V you will find system diagrams which will be helpful during your installation, however you'll need to note that all the *System90s* are shipped with a switch set in a "bi-amp" mode. Once again, to change the configuration refer to System diagrams in sections on individual models.

Important Caution for the Impatient. . .
Bass Restoration Enclosed

If you are not already familiar with the AudioControl The Epicenter, please note that the bass restoration technology built into the Model 20 and Model 40 are capable of unleashing incredible bass - unlike anything you may be used to. Prior to firing it up, please take the following precautions:

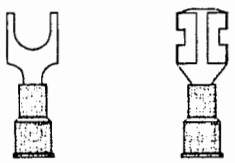
- Make sure that any drastic low end equalization or bass boost is turned down.
- If an additional sub-woofer amp is being used, turn the sensitivity level down.
- Use speakers capable of handling fundamentals down to 27Hz.

MATERIALS NEEDED TO INSTALL A *SYSTEM90tm* POWERED SIGNAL PROCESSOR

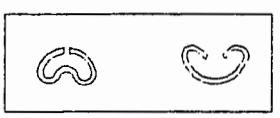
Certainly nothing on this list will come as a surprise to you, but here goes. To install a *System90* properly you'll need to have:

1. Electric drill with several size bits.
2. Metal scribe or other sharp instrument.
3. Quantity of sheet metal screws, or bolts and nuts with lock washers.
4. Wire cutters and wire strippers.
5. Pliers and screwdrivers.
6. Quantity of spade lugs.
7. Quantity of ring tongue lug terminals.
8. In line fuse holder, 20AMP fuse.
9. Soldering iron, electrical tape or preferably shrink tubing.
10. Wire crimping tool.
11. Power wire of the correct gauge and sufficient length.
12. Supply of speaker wire.
13. A charming assistant to hand you tools, beverages and the like.
14. HIGH QUALITY 100% SHIELDED PATCH (RCA) CORDS.

Ring Tongue for Power Connections



Spade and Push On for Speakers



Crimping Method
Right Wrong

▼ General Install Hints

MOUNTING LOCATIONS FOR THE *SYSTEM90tm*

AudioControl recommends mounting the *System90* in the trunk or cargo area of the vehicle. An alternative location would be under the front seat of your car given enough room. When choosing a location for the *System90* please keep in mind;

1. The *System90* does include a high-power amplifier section and it needs adequate ventilation. Do not mount near heater vents or where airflow to the unit will be blocked.
2. The mounting location must be protected from water seepage and should be protected from exposure to direct sunlight.
3. The *System90* must be securely mounted.
4. Carefully analyze the location to make sure drilled mounting holes will not puncture gas tanks, brake lines, etc.
5. Selected location should allow for screwdriver clearance, and accessibility to input and output terminals.

MOUNTING THE POWERED SIGNAL PROCESSOR

1. Position the *System90* where you intend to mount it and mark the mounting surface with a scribe or other sharp instrument to locate at least four of the six mounting holes made available.
2. If you are mounting the *System90* on a carpeted surface, cut away small circles in the carpeting for the mounting hole locations.
3. Drill a small pilot hole at each mark.
4. Drill a larger hole that corresponds to the actual size required for the mounting screws or bolts.
5. Secure the *System90* to the vehicle using either the appropriate size sheet metal screws or appropriate bolts and nuts with lock washers.
6. Be sure to allow clearance for subsequent level adjustments, input/ output terminal accessibility.

STAR GROUND CONNECTIONS

The modern car electrical system is filled with many potential sources of noise and interference. For the best protection from noise, there should be one and only one path each from all your car audio components to the positive and negative sides of your vehicles electrical system.

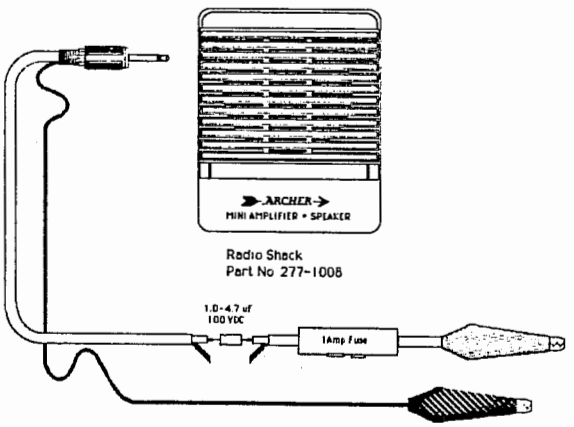
For power connections, if possible run individual +12 volt wires for each component to the positive side of the battery. For ground connections, proper Star Ground configuration means hooking the ground terminals of the head end unit, and the *System90* together as shown in the illustration that follows, and routing that common heavy-gauge ground wire to the battery or to a place you're sure is actually part of the negative side of the car's electrical system.

▼ General Install Hints

Remember. . . the nearest piece of bare metal is not necessarily a true "hard" ground. . . 90% of all car stereo noise problems are related to ground loops.

This looks to be a great spot for a plug. If you haven't yet, for some unknown reason, come across a copy of the April-May 91 issue of "Autosound 2000 Tech Briefs", look it up. There's some great information on ground currents and noise.

One piece of info included in this little gem you'll love is how to build what we'll call a "ground sniffer", for less than $20. You'll need to go down to your local Radio Shack and pick up a few items. First, look for a small amplified speaker. Then, just get yourself a 9 volt battery, a mini plug, some spare shielded cable, a pair of alligator clips, a 1 amp fuse, and last but not least a 100VDC crossover capacitor with a value between 1.0 and 4.7 microfarads. Put it all together as shown in the diagram, and bingo, you're in business.

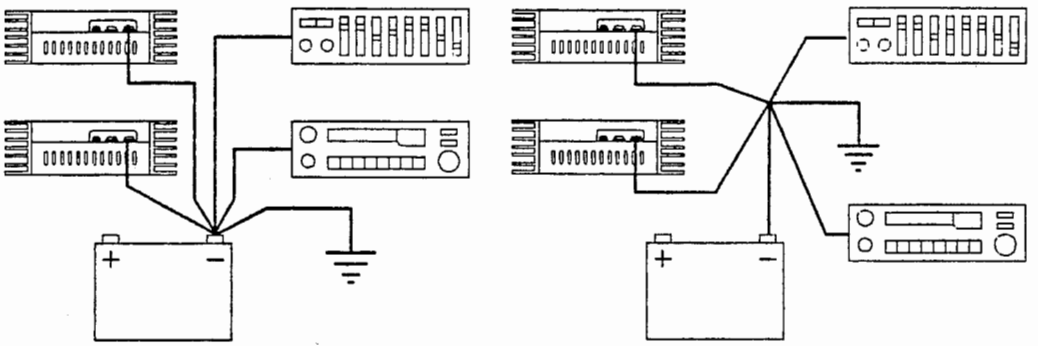


You're ready to check specific grounding points throughout the vehicle you're working on. Let's try a test. Turn on the little amplified speaker. Clip the fused alligator clip to the positive battery post. Now quickly touch the other alligator clip to the negative battery post or better still the back of the alternator. That loud whining noise is the alternators's charging ripple, congratulation, you've passed the test. Now test other points in the car that you might be thinking of using for a ground.

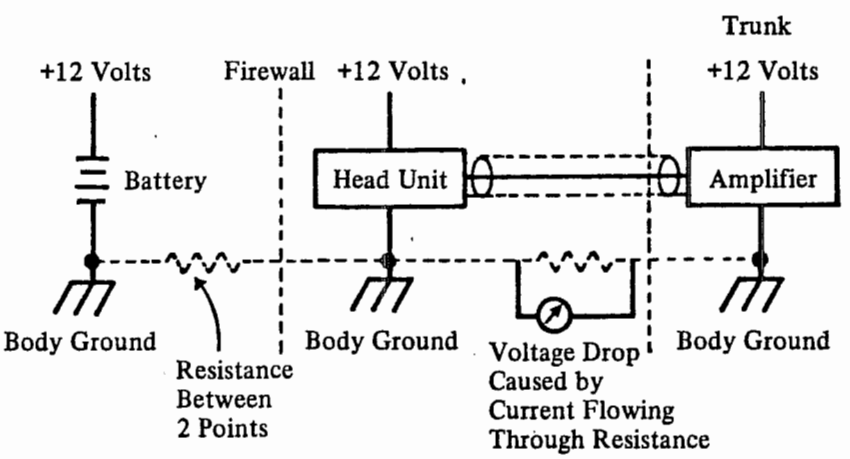
If you think this is a good tip (which it is), call Autosound Tech briefs at 209-456-3450 and order up a subscription. One issue is worth the $35 price of a year's subscription.

▼ General Install Hints

The Star Ground



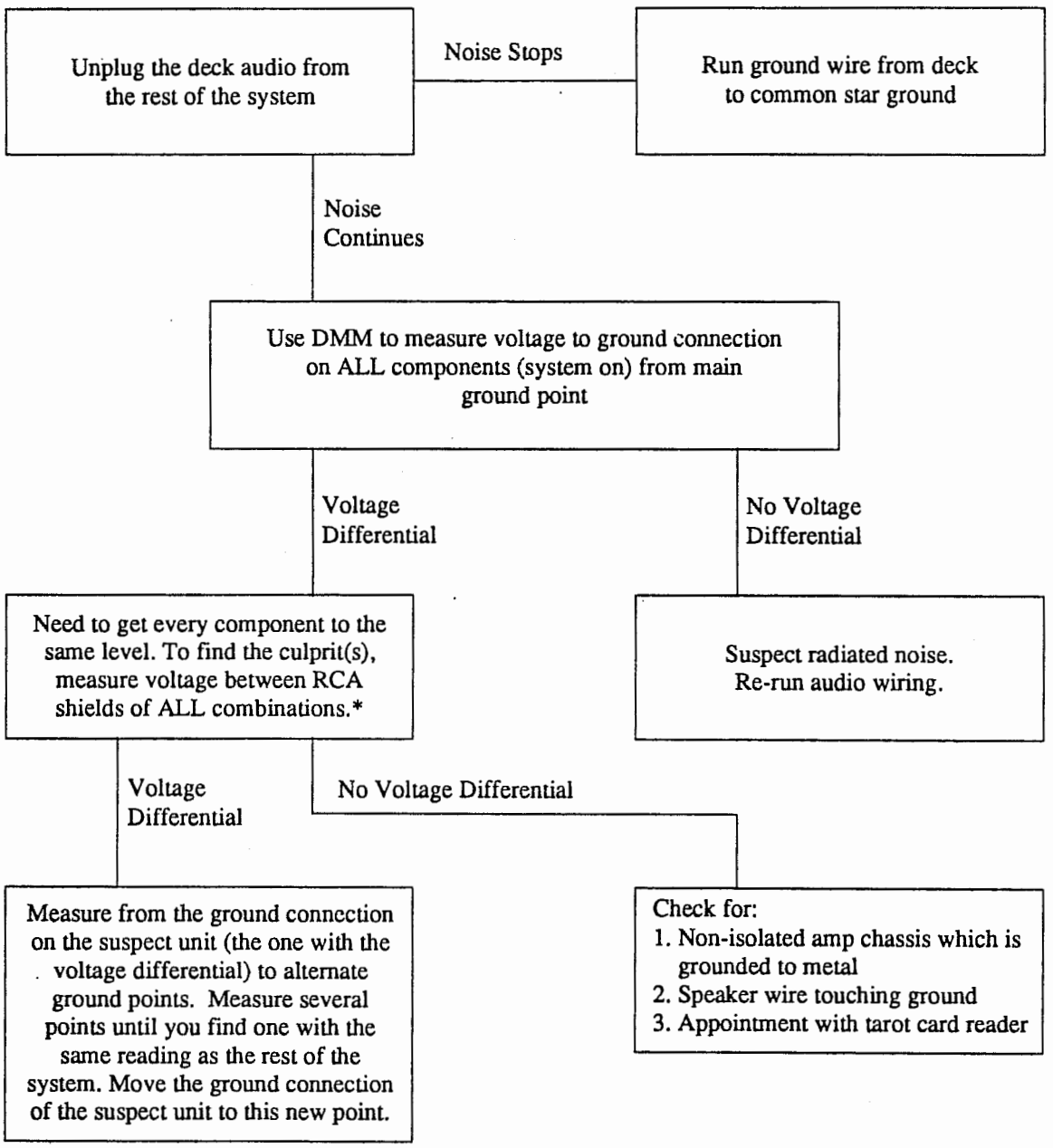
The Anatomy of a Ground Loop



Remember:
Ground is not always ground!

Ground Loop Road Map

90% of all car stereo noise is ground loop related. Follow the procedure below to identify where the problem is. This procedure requires the use of a digital voltmeter or digital multimeter (DMM).



* Do these measurements carefully. Sneaky things can be happening. Often through the signal ground a third unit, is the conduit between two other units that have a ground loop. The third unit may be totally isolated between signal and power (like the opto-isolated AudioControl products). So measure all combinations.

▼ General Install Hints

If in doubt, it is far better to run these wires directly to the battery's negative terminal. In any case, use the shortest power cables possible and make sure they are not close to or bundled in with line-level signal input cables. Also, there should be one and only one signal ground path from the head unit to the *System90*, and the signal and chassis ground must be isolated from each other.

AUDIO WIRING CONSIDERATIONS

1. For line-level connections use high-quality, 100% shielded, coded RCA patch cords.
2. For power connections Ring (lug) Tongue connectors are recommended.
3. DO NOT run audio wiring along side of power wiring.

SPEAKER WIRING NOTES

1. DO NOT use common grounding or the car chassis as a ground.
2. Determine the speaker wire type and lengths required for your installation before you begin.
3. Route the speaker wires where they will be out of harm's way and connect them to the *System90* using spade lugs. At the speaker end use push-on connectors or solder the wires directly to the speaker terminals.
4. Check all channels for correct phasing (polarity). If you used color-coded speaker wire, now you'll remember why you did. A lot easier to check isn't it !
5. For connections to the *System90* speaker terminals we strongly suggest using spade lug connectors. These make excellent contact with the screw terminals on the *System90*, and will minimize the possibility of short circuits due to frayed wiring.
6. If you have to extend wires running to the speakers, we recommend using new wire of the correct length and gauge.
7. Maintain correct speaker polarity with the use of color-coded wire.

POWER WIRING NOTES

1. Power wires for connecting the *System90* to the battery positive and negative terminals MUST be well insulated and capable of handling a 20-amp load. Minimum recommended wire gauge for one direction is:

   5 foot run - 12AWG
   10 foot run - 10AWG
   15 foot run - 8AWG

2. You will also need one 22 to 18 gauge conductor for the Remote Turn On connection.
3. The *System90* incorporates multiple system protection circuits, however YOU MUST use an in-line fuse (20amp) in the positive power line located near the battery.

INSTALLING THE MODEL 20

Before proceeding, we suggest you familiarize yourself with the diagrams located in this section. These will help the installation process of the *System90* be much easier.

Installation can begin by removing the top cover of the Model 20 by unscrewing the 6 socket-head screws with a 3/32" hex wrench.

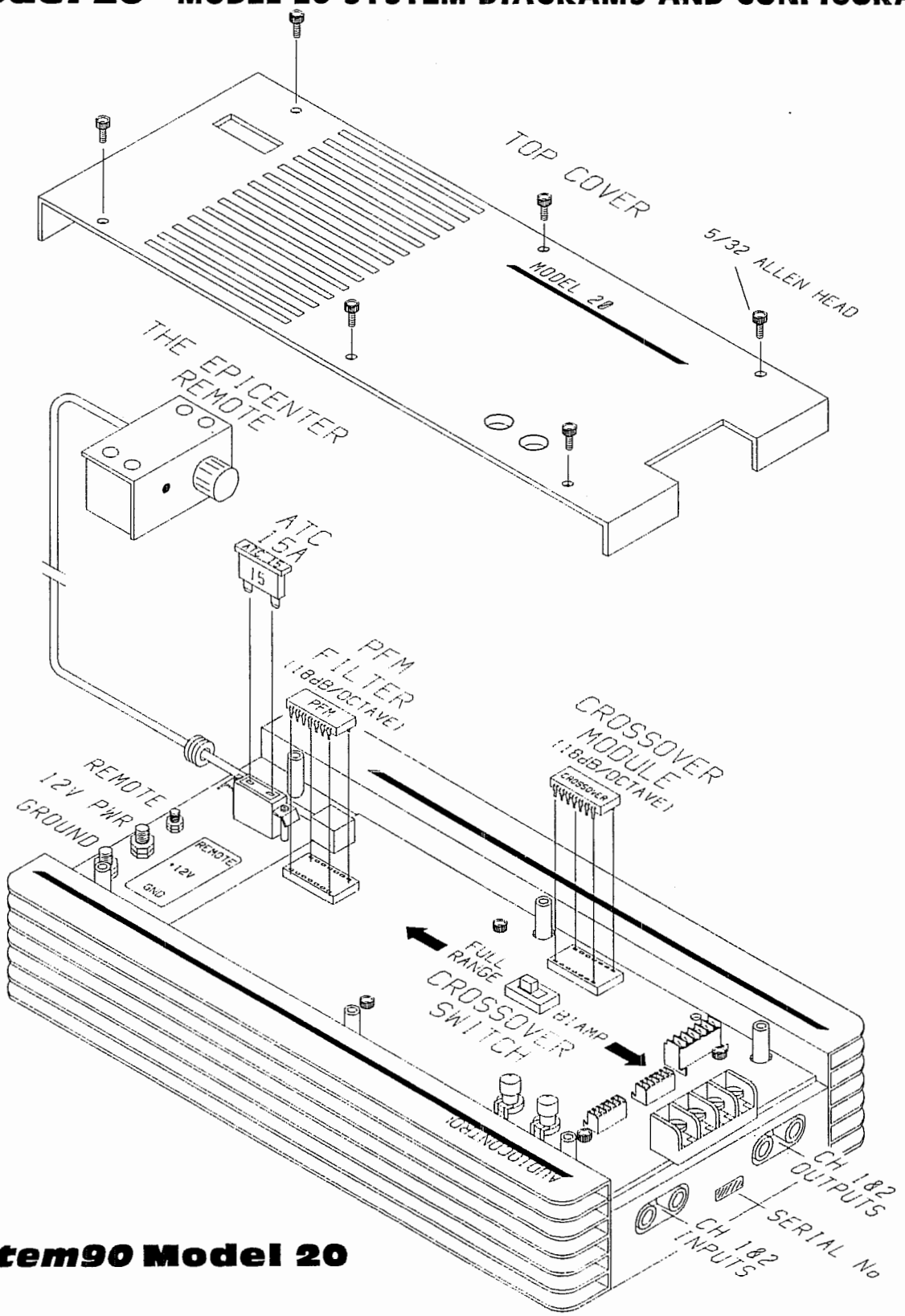
FACTORY SETTINGS AND INSTALLED MODULES

a. The Model 20 is shipped from the factory with the crossover switch set in the "bi-amp" mode. In this position, the Model 20's power section is set to be used ideally as a Sub-Woofer Amp, utilizing The Epicenter technology. The Line Outputs function as High-Pass outputs. To change the factory setting see diagrams on following pages.

b. The Programmable Frequency Match Filter module is 30Hz. To change this module, select the PFM module frequency desired, and refer to diagram in this section.

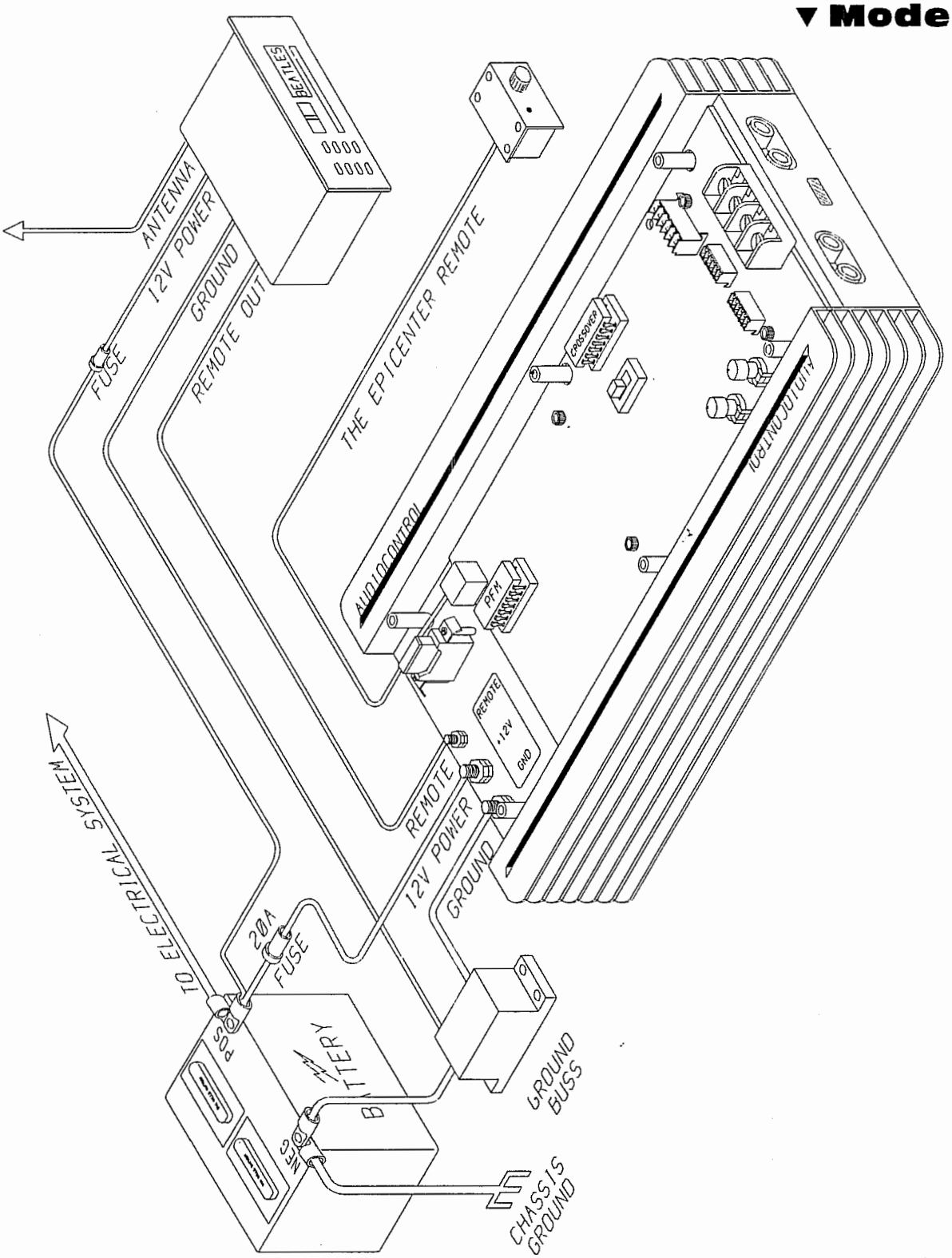
c. The crossover module installed in the Model 20 is 90Hz. Again, as seen with the PFM filter, to change the factory module, select the frequency desired and refer to diagram.

▼ Model 20 MODEL 20 SYSTEM DIAGRAMS AND CONFIGURATIONS:



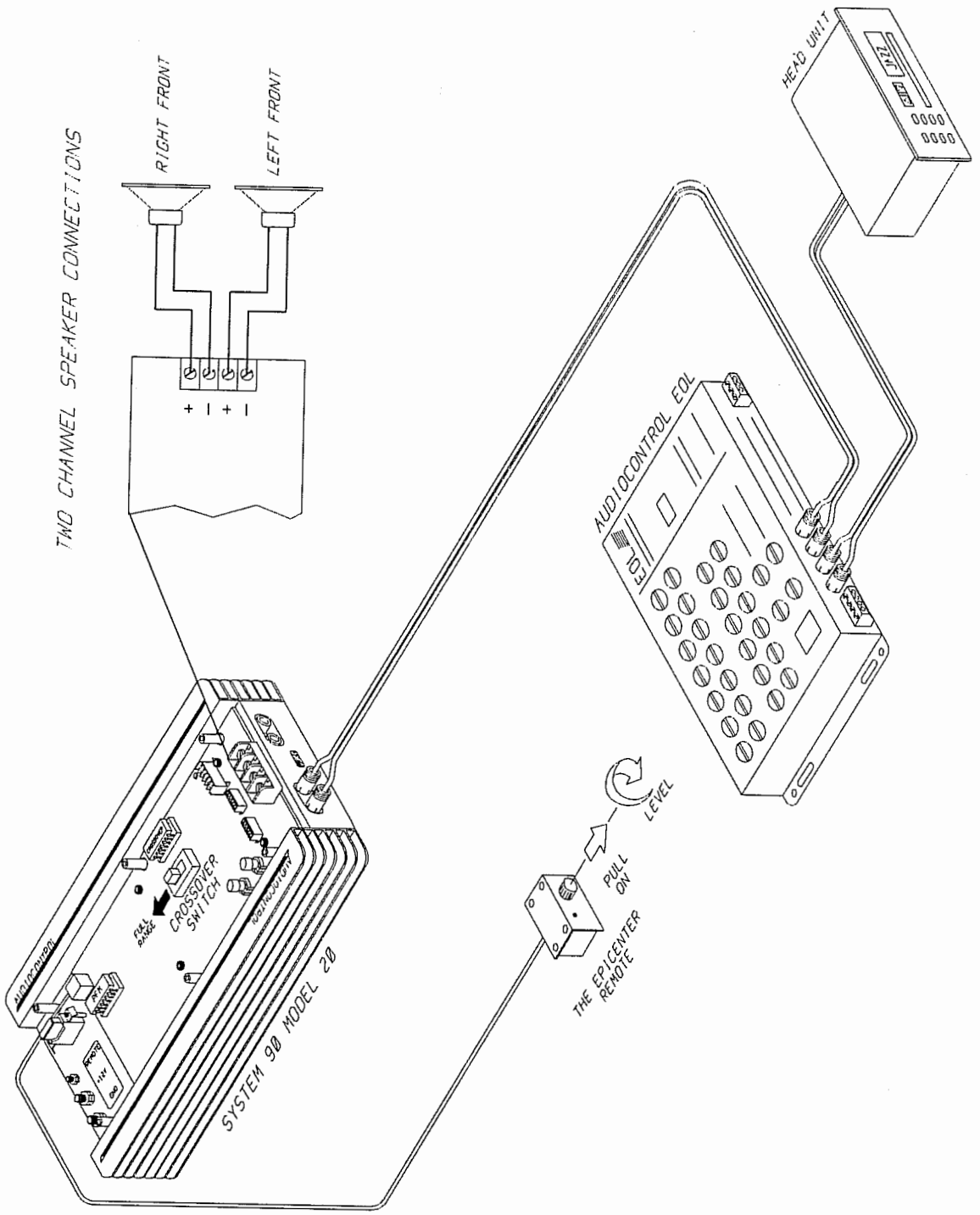
System90 Model 20

▼ Model 20



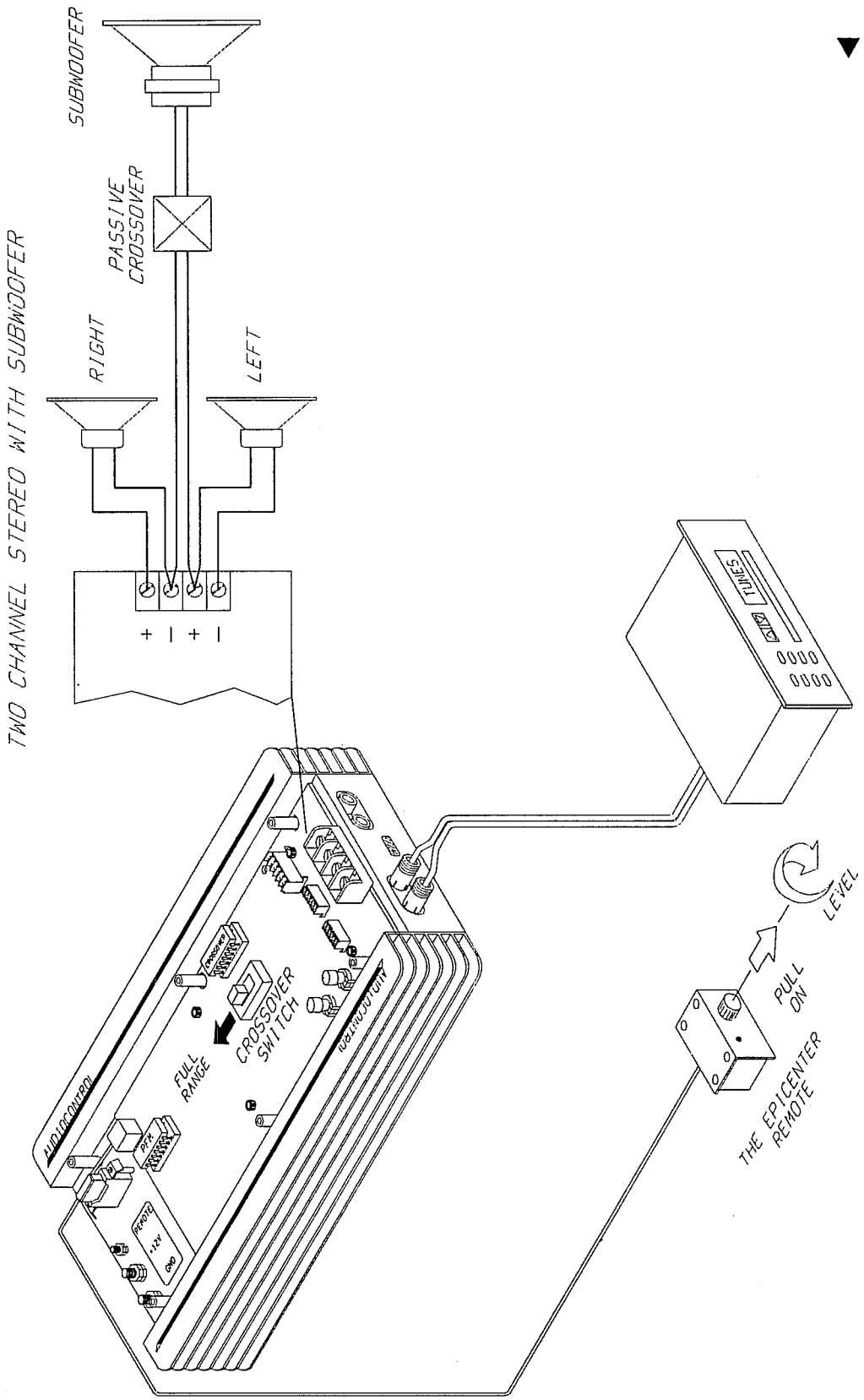
Star Ground 12 volt Power Wiring

▼ Model 20



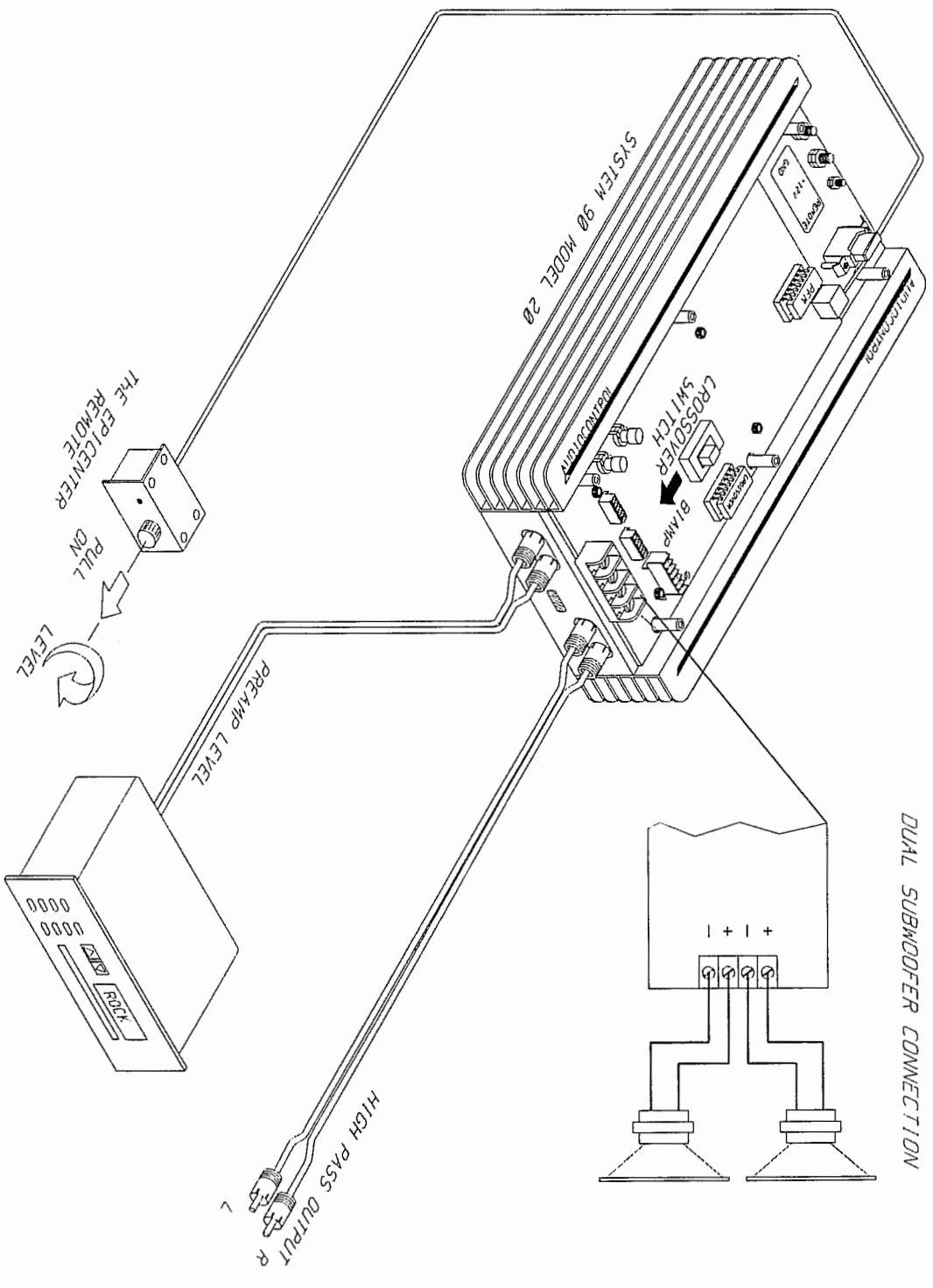
Equalized Full Range 2-channel System

▼ Model 20



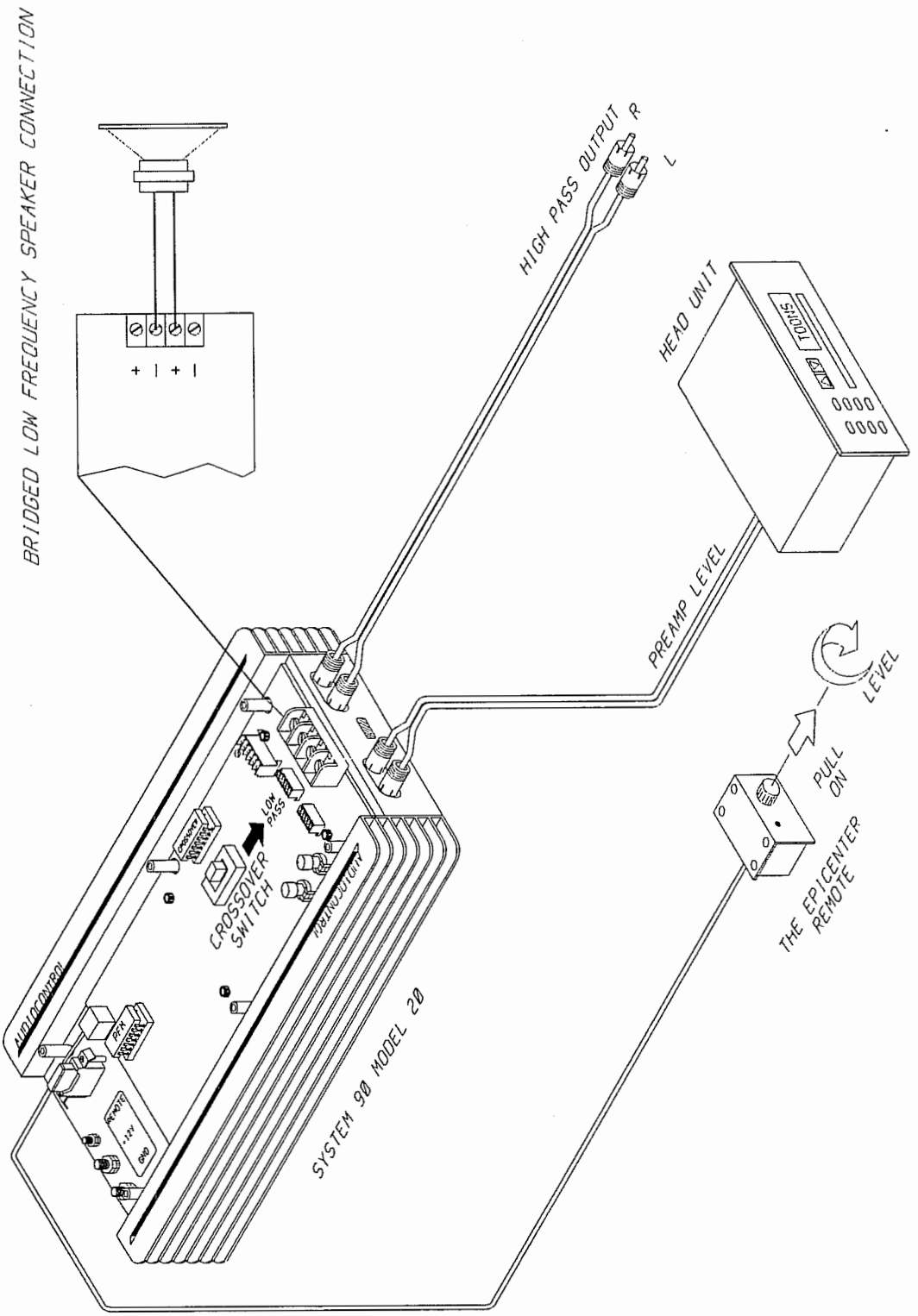
Stereo-mono 2-channel System

▼ Model 20



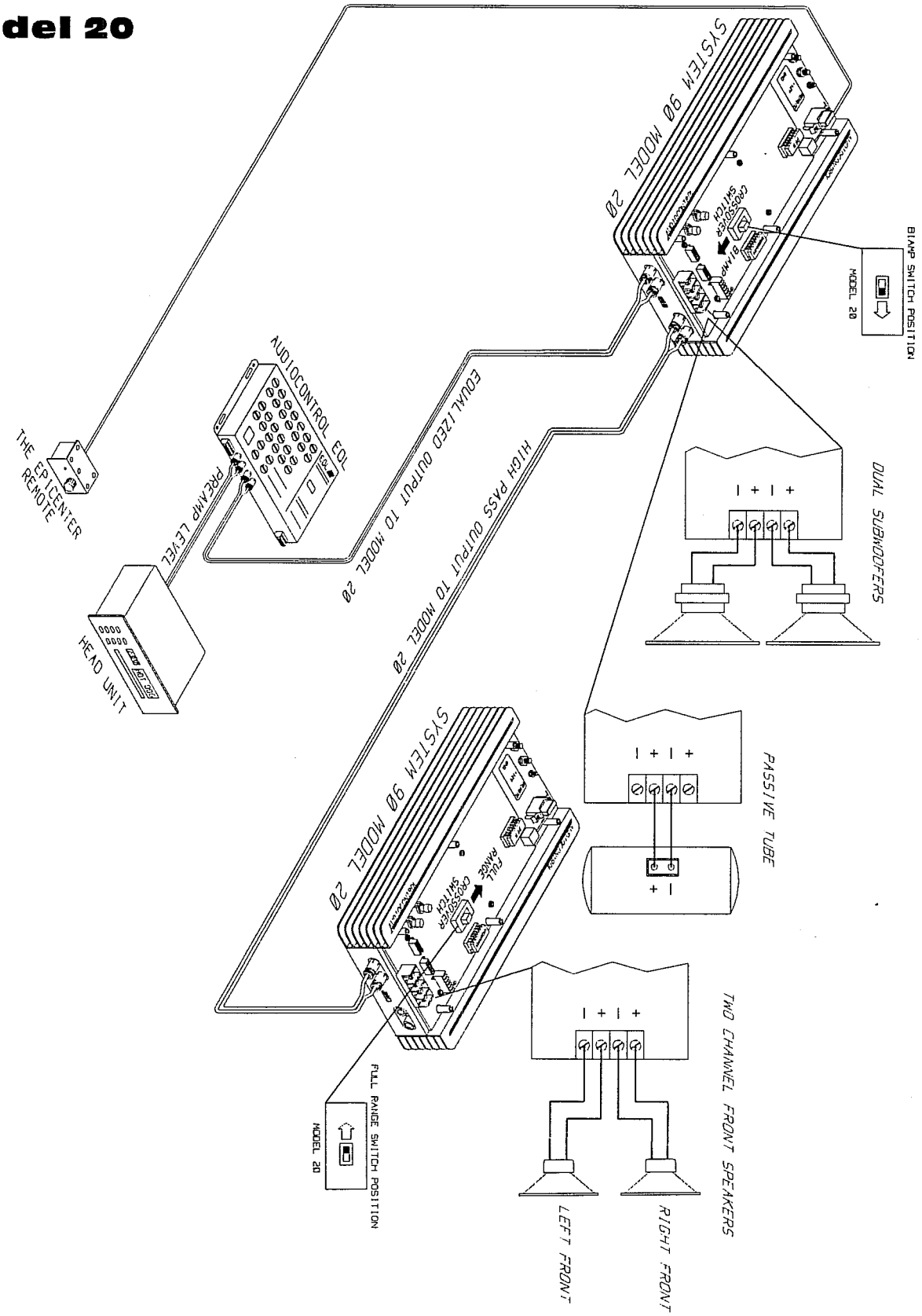
Dual Subwoofer Output

▼ Model 20



Bridged Mono Subwoofer Output

▼ Model 20



Equalized Two Way System

▼ Model 20

Upgraded OEM System with Bridged Subwoofer

▼ Model 20 AUDIO WIRING

Having reviewed the preceeding system diagrams and configurations, you will know the job you intend the Model 20 to perform in your installation. Given that, remember:

1. Use high-quality patch cords, and route the signal leads away from all power and speaker wiring.
2. Make sure the outer shields of the RCA jacks do not make electrical contact with the Model 20 chassis. This will create a ground loop.
3. When using the Model 20 in its "bi-Amp" mode, the line-level outputs are used as high-pass outs for multiple amplifier systems.
4. Speaker wiring should be no smaller than 18 AWG. Actual gauge of wire is of course dependent on length of run.
5. For speaker wiring, do not use common grounding or the car chassis as a ground return.
6. Remember to use color-coded speaker wire, making polarity checking a lot easier.
7. We repeat, but it's important, never run audio wiring along side power wiring.

POWER WIRING

1. When installing a *System90* Powered Signal Processor, make sure your battery is disconnected prior to beginning installation. Disconnect negative battery wire first.
2. Refer to "star Grounding" in Section II.
3. Install the in-line fuse holder in the positive power wire and locate it near the battery. Carefully insulate them with electrical tape or heat-shrink tubing. DO NOT install fuse at this time. Connect this power cable to the positive terminal on the Model 20 using an insulated ring-tongue terminal connector.
4. Connect another power cable from the Model 20 negative terminal to the negative battery terminal, ground bus, or a verified ground location. Insulated lugs should be firmly connected by using a proper crimping tool.
5. Connect an 22 to 18AWG wire from the head-unit's remote turn-on lead to the remote terminal on the Model 20.
6. Re-Check the power wiring and remote wiring to insure they are secure, and routed where they are protected against chafing, pinching, etc...
7. Reconnect the vehicle's battery, connecting the positive terminal first, then the negative.
8. Install the fuse in the fuse holder of the Model 20's power line.

PROGRAMMABLE FREQUENCY MATCH FILTER SELECTION

▼ Model 20

The Programmable Frequency Match (PFM; you know what this really stands for) filter can be considered an adjustable subsonic filter. In engineering terms, it is called a high pass or in real people terms a low blocking filter. Its purpose is to eliminate the problems of the system playing too low.

Playing too low does not sound like a problem since we all work hard to get systems to do just that. But you can play too low. If the system is uncontrolled by a PFM filter it will try to reproduce sounds below human hearing (and believe us, they are on some CD's; we think they may be bearing rumble from the air conditioning). These sounds eat up tremendous amounts of amplifier power, cause intermodulation distortion and doppler shift effects. The bottom line is the sound is muddled, the amp overloads, and the speakers call in sick.

So the PFM filter is good but the really trick use for it is to tune your subwoofer. That is, with the PFM you can keep a driver from trying to play down to 25 when it unloads at 33 Hz, for example.

The PFM filter is an 18 dB/octave filter and takes the same modules as the crossover in the System90 and other AudioControl products. There is no difference in the modules for the PFM and the crossover (except the frequency selected).

Changing the value of the PFM filter is accomplished by simply changing the plug-in module. Values available from AudioControl are listed on page VIII-1.You can make your own as explained in Section VIII.

CROSSOVER MODULE SELECTION

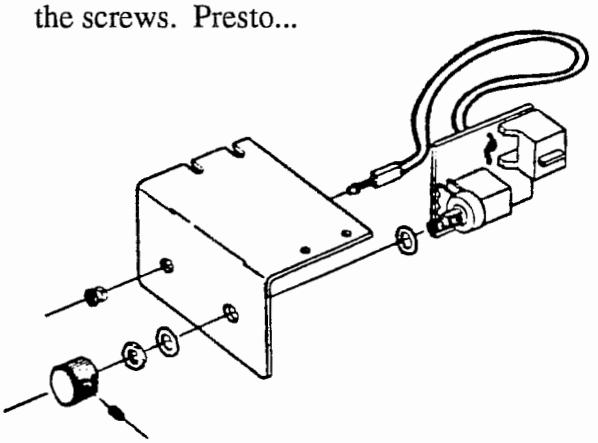
A single driver can not produce sound for the full range of music and human hearing. All driver have a linear zone where their frequency response is more or less flat. All speakers also have a impedance curve. Though this may come as a shock, 4 ohm (or any other impedance) rated speakers vary from about a 1/2 ohm to more than 10 ohms depending on the frequency.

So the crossover (or turnover) point you select should be based upon the frequency response and impedance characteristics of the drivers. Some companies give great information on this, though you may have to call many to get the data.

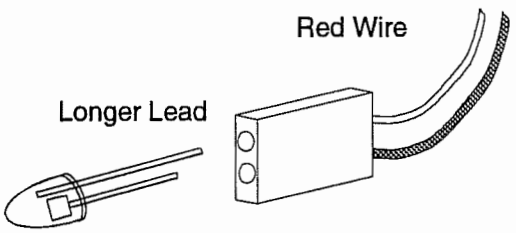
Just like the PFM filter, changing the value of the crossover is accomplished by simply changing the plug-in module. Values available from AudioControl are listed on page VIII-1.You can make your own as explained in Section VIII.

▼ Model 20 THE EPICENTER REMOTE HOOK-UP

1. The Epicenter Remote may be installed under the dash, in its own bracket, or through the dash. It should be within reach of the driver of the vehicle, and where the Digital Restoration LED is plainly visible.
2. The Epicenter Remote is most easily mounted with screws under the dash.
   - Slide in upside down to get a clear view of the underside of your dash, and at this point, we hope you have a charming assistant to hand you things like scissors, scaple, diet Coke or Pepsi or even 7Up.
   - Place the Remote in it's mounting position, and mark the two holes and remove the unit. Drill the required holes into the dashboard underside, replace the unit and secure it with the screws. Presto...



3. For that custom finished stealth look, go in-dash. This is a little more difficult, and takes some patience and planning, but most of the time it's worth the extra effort (It's fun to see a customer's face when they can't find their remote, and you point to what they thought was the cigarette lighter).
   - Disassemble the Remote unit. First gently push the LED from its black plastic holder on the bracket. Do not remove the actual LED from its wiring!
   - Remove the circuit board and rotary control from the bracket. Take off the knob by loosening its set screw then unscrew the lock nut and washer.
   - Take a deep breath. (smok'em if you got'em)
   - Drill a 9/32" hole in the dashboard.
   - Drill a 1/8" hole for the lock tab. Or remove the lock tab if you're sure you can keep the circuit board from rotating.
   - Drill a 13/64" hole for the black LED holder.



- Remove the black plastic LED holder from the remote bracket and push it into the 13/64" hole.
- Apply the pressure-sensitive remote label.
- Insert the rotary control/circuit board into the 9/32" hole, and the LED assembly into its black plastic holder.
- Replace the lock nut and washer and tighten securely.
- Finally, put the knob back on and tighten its set screw.

Remember what you need to get the most out of Bass Restoration circuitry. Sufficient cone area, and in-out cone excursion. The more woofer area you have, the more bass you can expect. Not only the size of the speakers affect the bass output, but also the quality. Generally, look for speakers with high-quality cone material, and large magnet structures.

The knob on The Epicenter remote must be pulled out for operation. When operating, the red light on the unit is illuminated. With the knob out and light on, turn the knob to the "max" and then to the left until you find a setting best suited to the installation. Of course, setting will differ depending on personal tastes, type of song, CD vs FM radio, etc.

SENSITIVITY CONTROL ADJUSTMENTS

The input sensitivity of the Model 20 must be adjusted to match the output of the head unit you are installing, or the next audio component upstream in the system, ie. and of course we suggest an AudioControl equalizer. In general, following these few steps will insure proper hook-up:

1. Make sure the volume of the system is turned down prior to adjustments.
2. Slowly increase the volume of the head-unit, or AudioControl equalizer output to 3/4 rotation with an appropriate source of material provided.
3. Adjust the sensitivity controls in equal amounts until the system is playing very loudly, but not distorting!
4. Reduce the volume level of the head-unit to a comfortable volume level, and check for overall balance.
5. Position the "soundstage" where it is most pleasing.
6. You may need to experiment with The Epicenter remote variations for final settings.

INSTALLING THE MODEL 40

Before proceeding, we suggest you familiarize yourself with the diagrams located in this section. These will help the installation process of the *System90* be much easier.

Installation can begin by removing the top cover of the Model 40 by unscrewing the 6 socket-head screws with a 3/32" hex wrench. Please store them in a safe place.

FACTORY SETTINGS AND INSTALLED MODULES

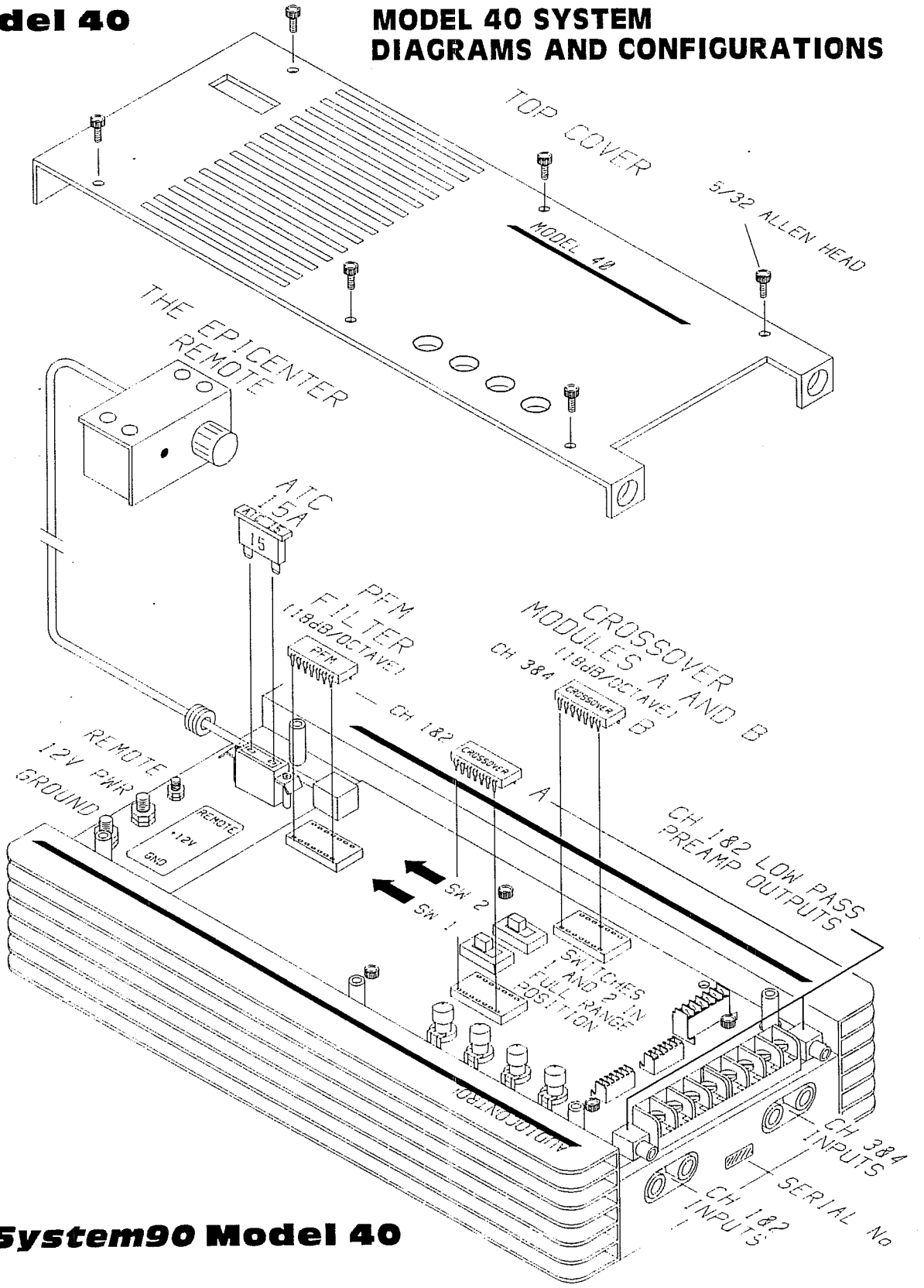
a. The Model 40 is shipped from the factory with the crossover switch set in the four channel mode. In this position, the Model 40's power sections are set to be used ideally as a full-range (90Hz and up), four channel amplifier. The Epicenter technology is utilized in conjunction with the left and right sub-woofer outputs. To change this factory setting refer to diagrams in this section.

b. The Programmable Frequency Match Filter Module installed is 30Hz. To change this setting,, select the PFM module frequency desired, and refer to the following pages.

c. The two crossover Modules installed in the Model 40 are 90Hz. Again, as seen with the PFM filter, to change the factory setting, select the frequency desired and refer to the diagram.

▼ Model 40

MODEL 40 SYSTEM DIAGRAMS AND CONFIGURATIONS



System90 Model 40

Switch Positions for a 4-channel System:

SW 2 
SW 1 

When the Model 40 is used as a 4-channel amplifier BOTH switches must be set as shown to the left. The frequency response of the amplifier (High pass or Full range) will be determined by crossover modules A and B.

NOTE: If the low pass line outputs are going to be used to drive a subwoofer amplifier, modules A and B MUST have the same crossover point.

Switch Positions for a 2-way 2-channel System:

SW 2 
SW 1 

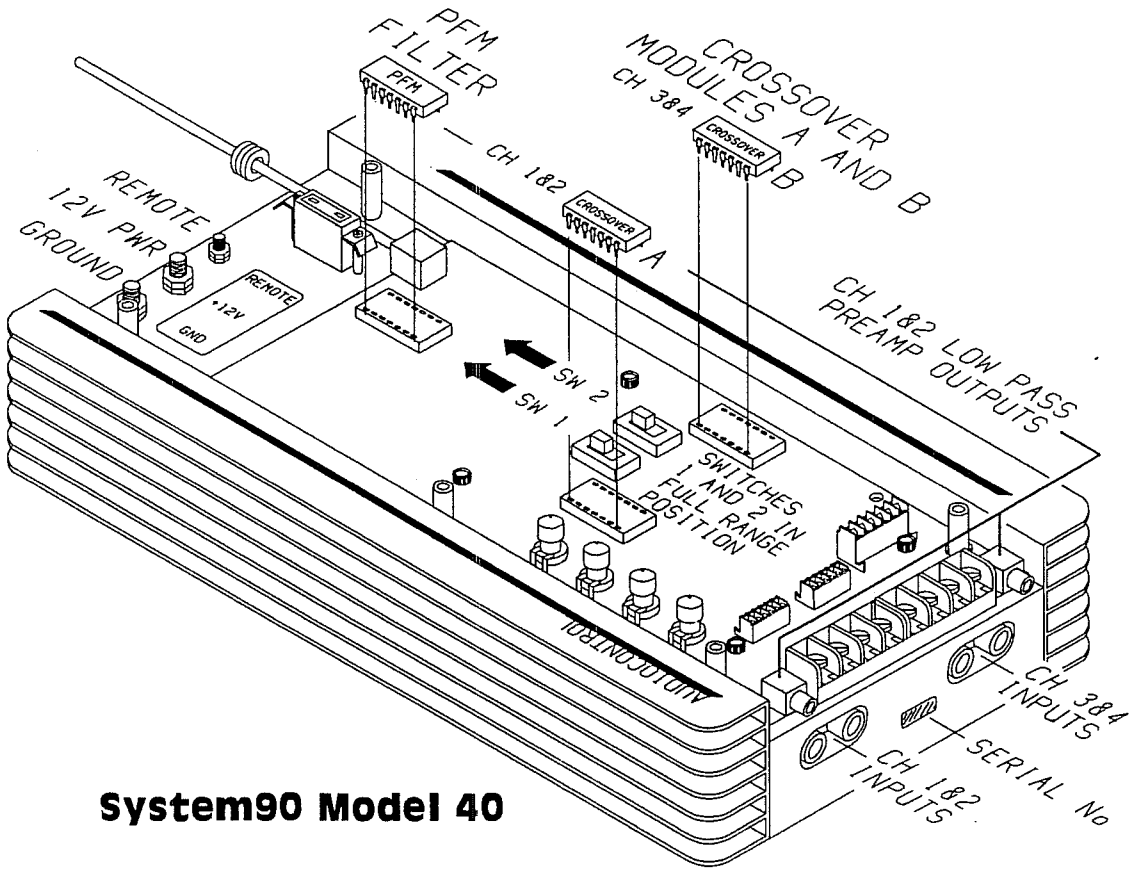
With the switches set as shown to the left, the Model 40 will operate as a 2-way (Bi-amplified) 2-channel unit and *crossover module A* will determine the system crossover frequency. In this mode the high pass output will use channels 1 and 2 and the low pass output will use channels 3 and 4.

Switch Positions for a 3-way 2-channel System:

SW 2 
SW 1 

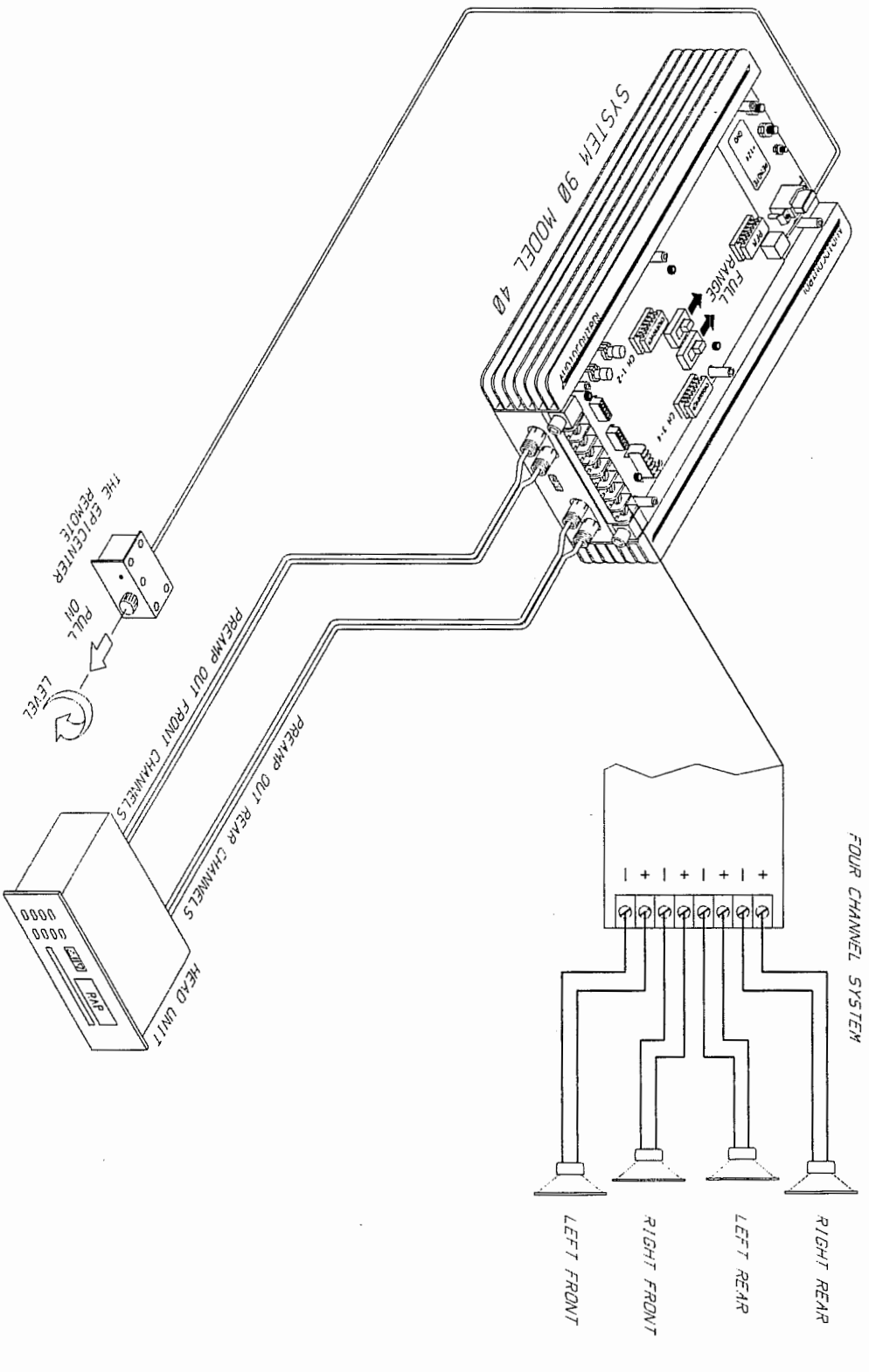
To use the Model 40 as a 3-way (Tri-amplified) system position the switches as shown to the left. As a 3-way system the high pass output will appear at the channel 1 and 2 outputs and the high pass crossover frequency will be set by *crossover module A.* The band pass (Mid-Bass) output will use channels 3 and 4. The low pass preamp output will be used to drive a subwoofer amplifier and the crossover frequency will be set by *crossover module B.* The frequency range of channels 3 and 4 will be the *difference* between module A and module B.

NOTE: All 3 modules (crossovers A & B and the PFM module) MUST me installed for the Model 40 to function properly.



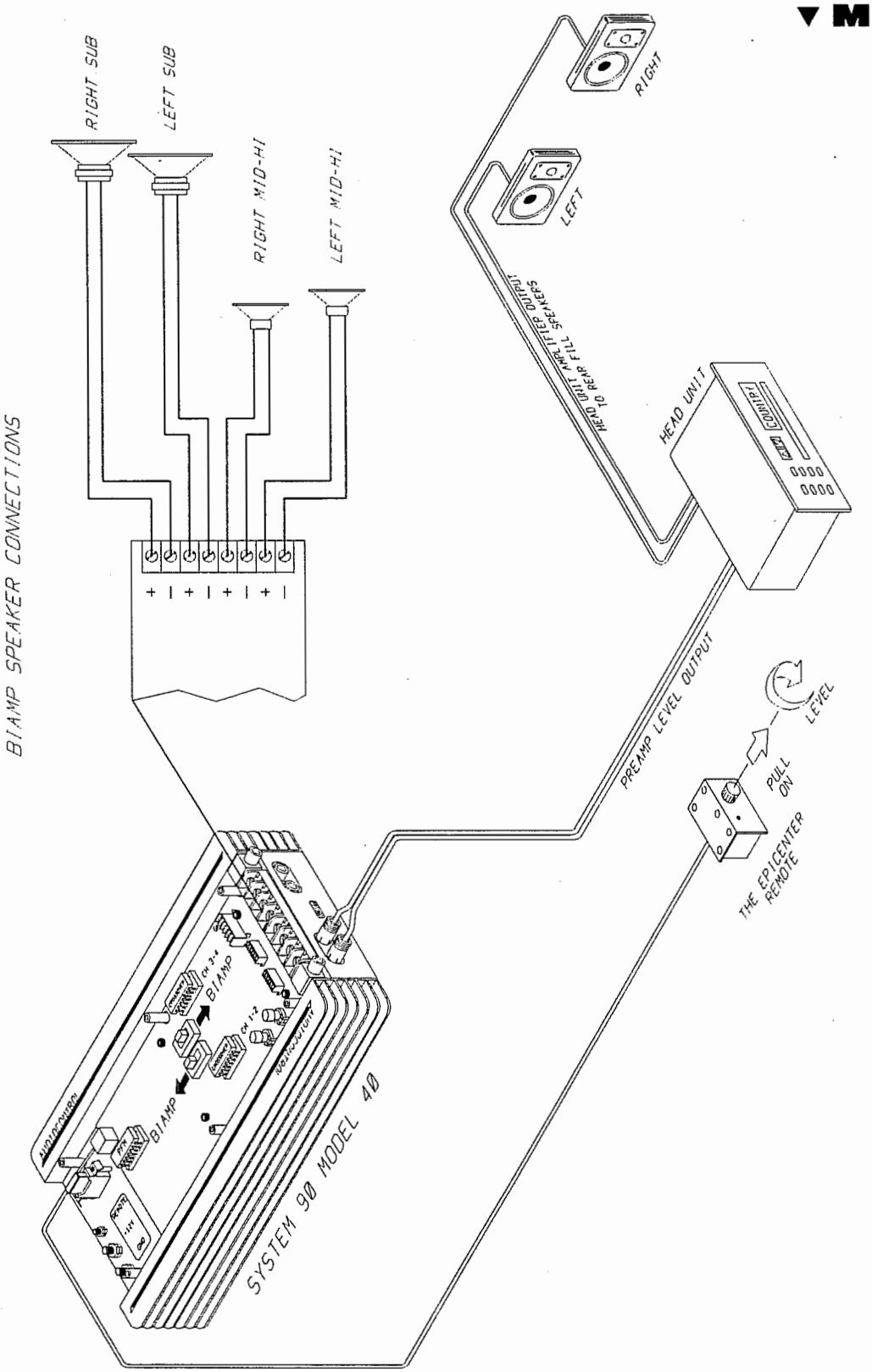
System90 Model 40

▼ Model 40



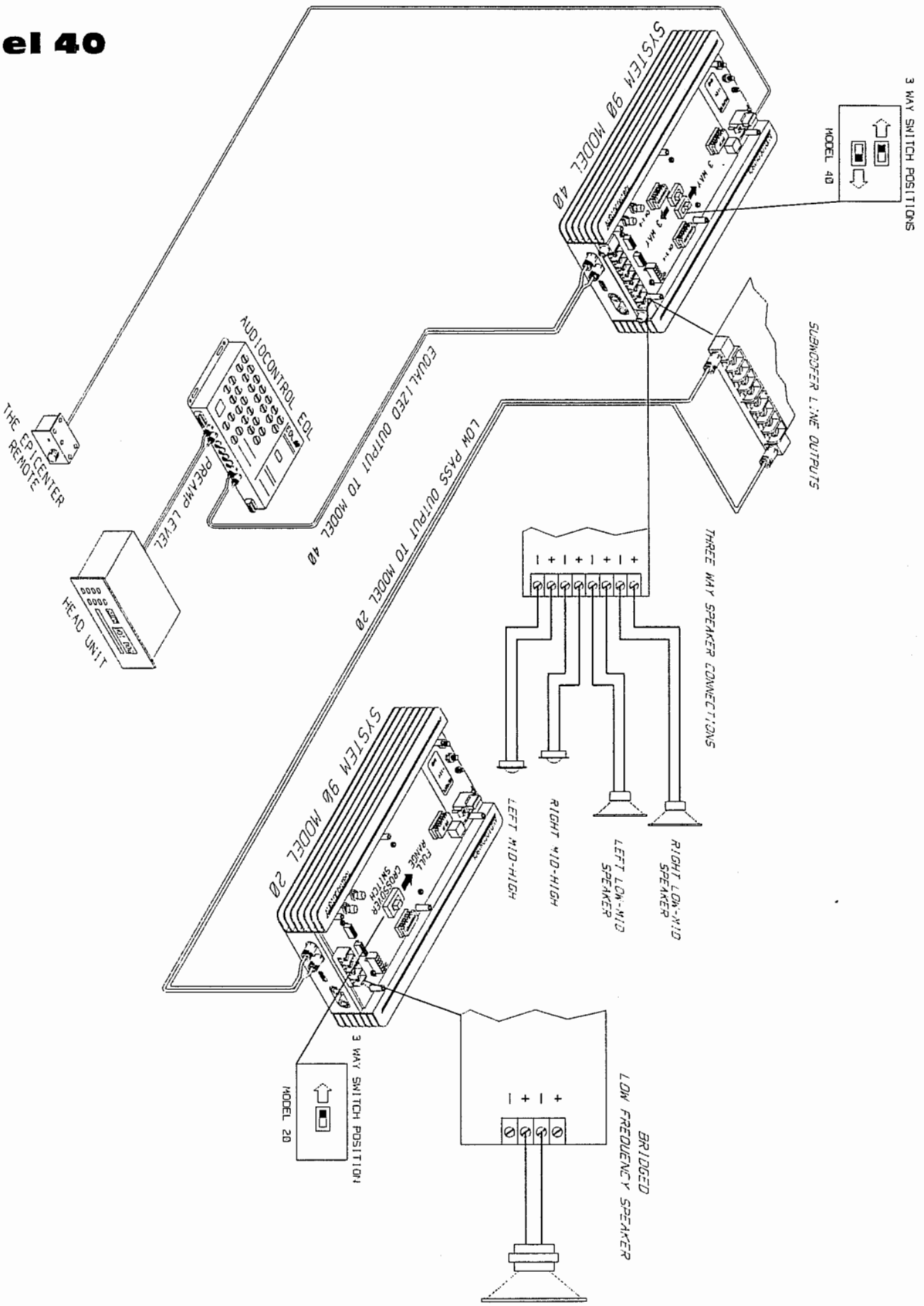
Full Range 4-channel Front-rear Fader System

▼ Model 40



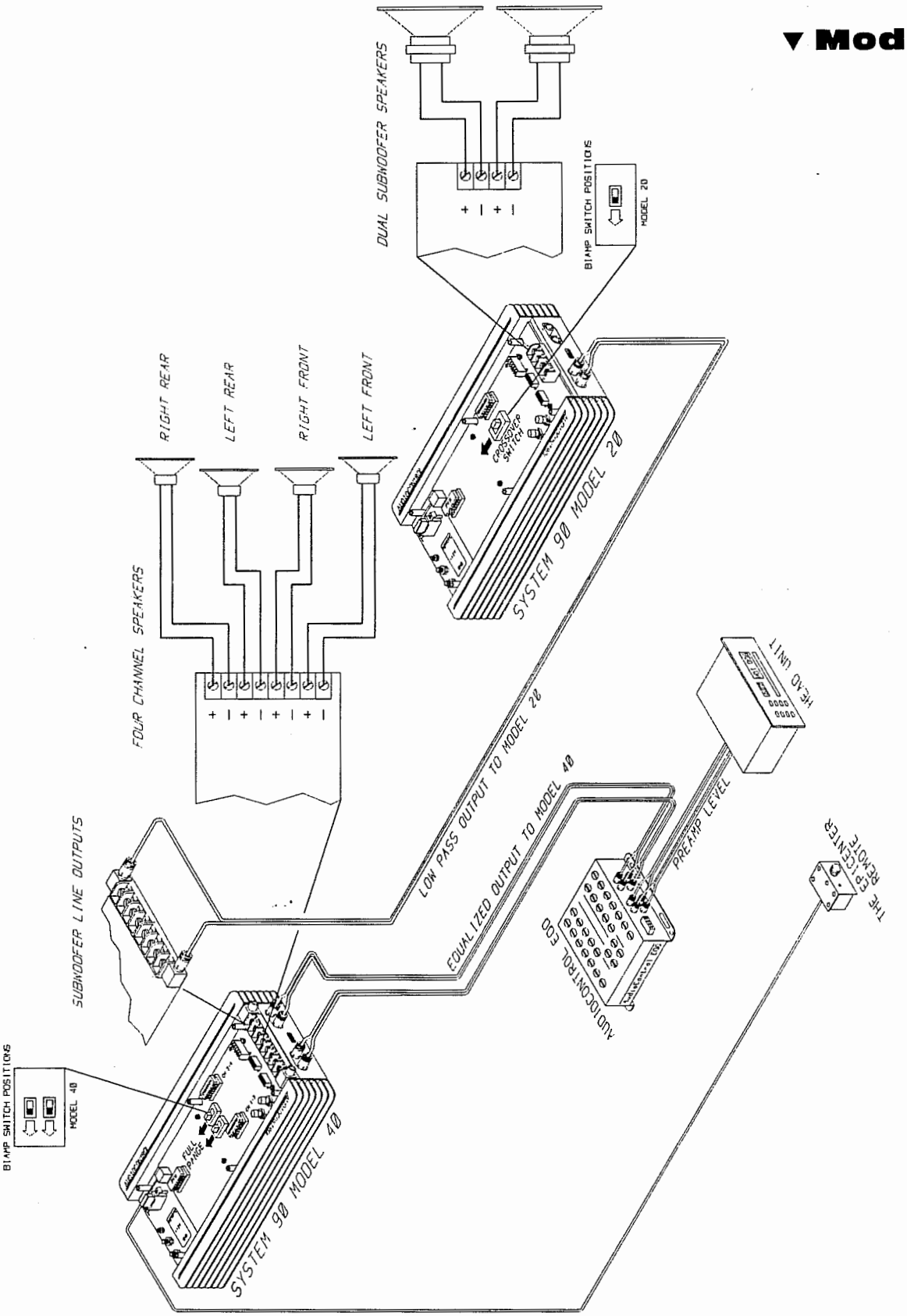
Biamp 2-channel System

▼ Model 40



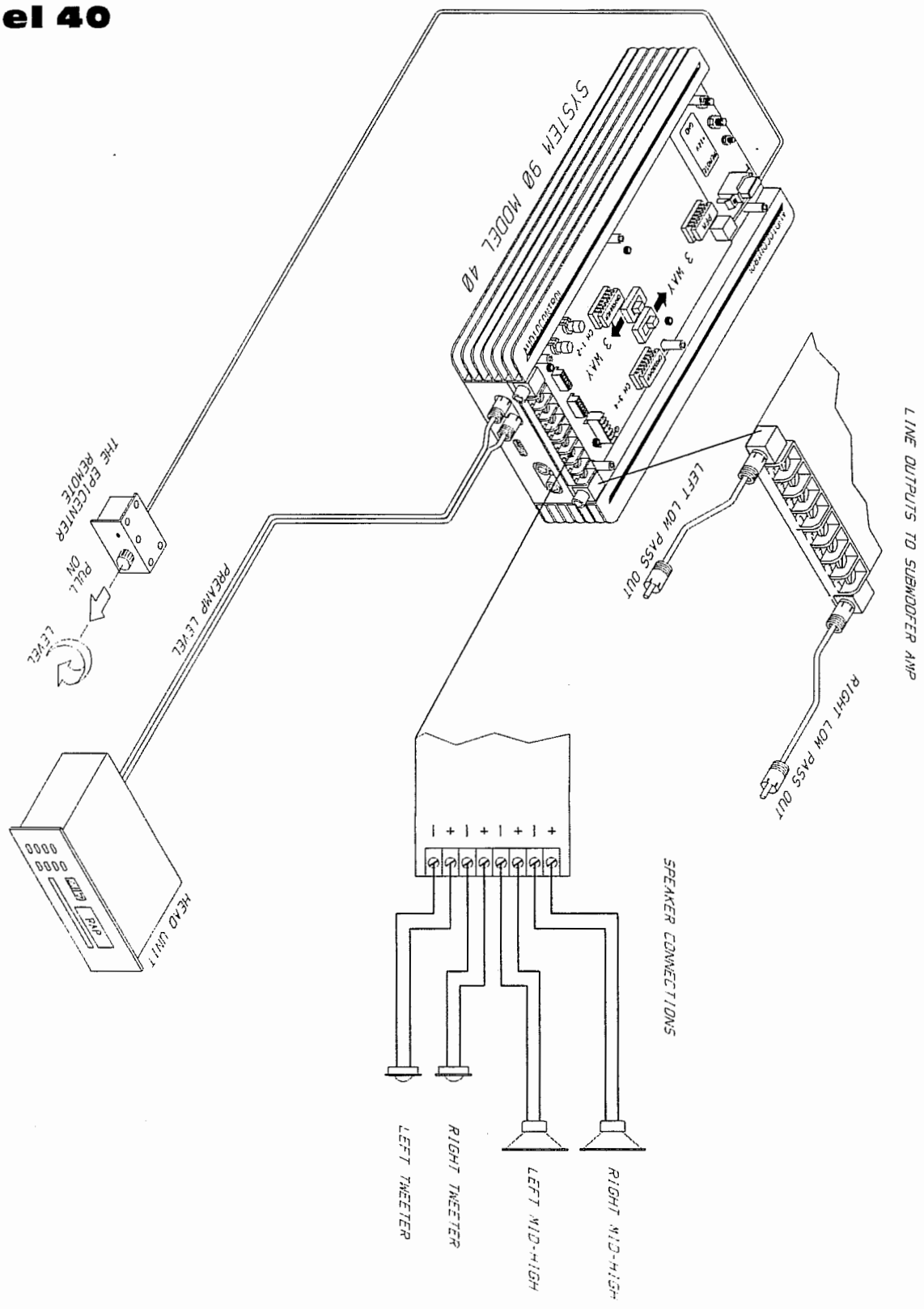
3-way Equalized 2-channel System

▼ Model 40



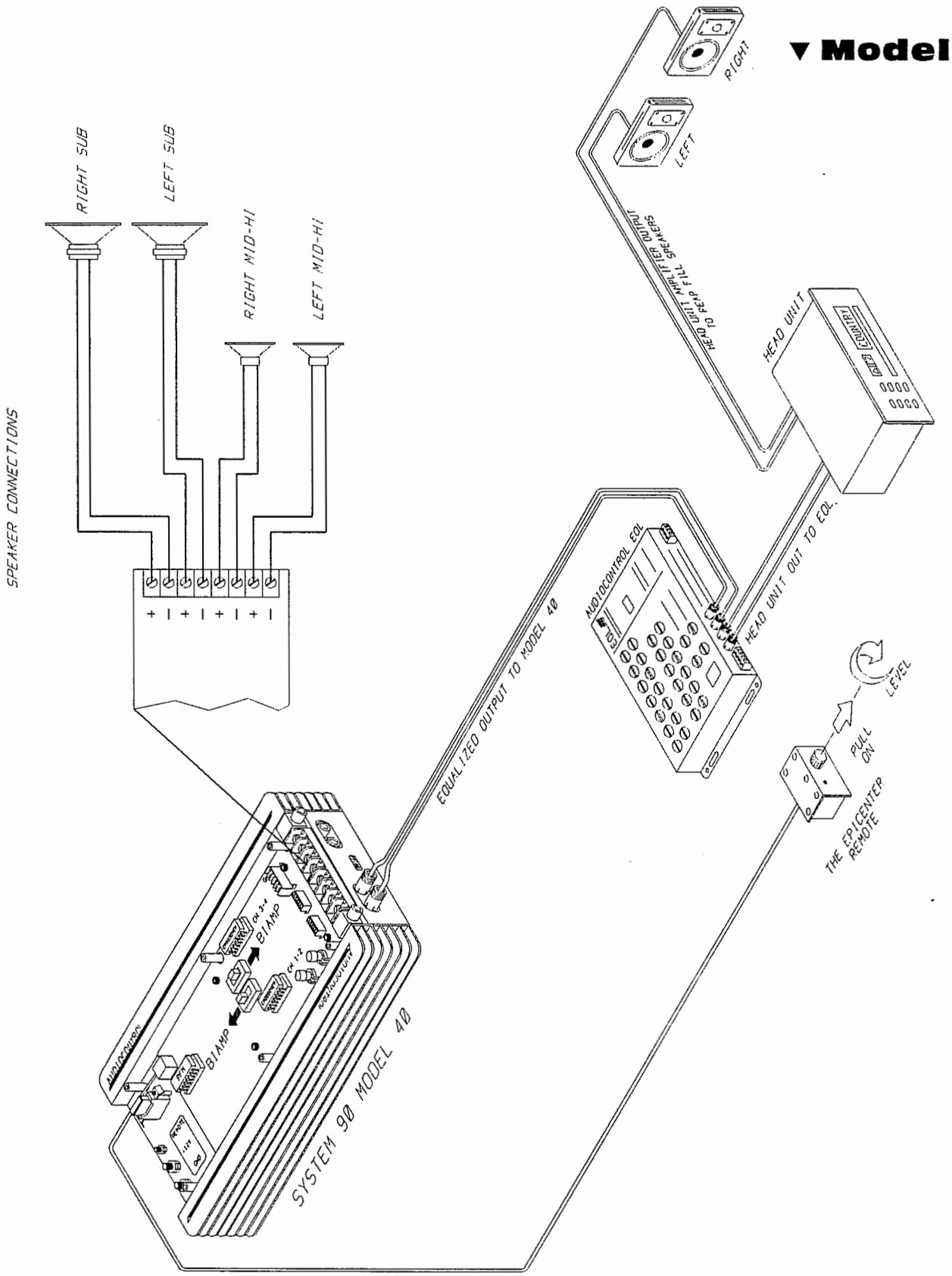
Biamplified 4-channel System with Equalization

▼ Model 40



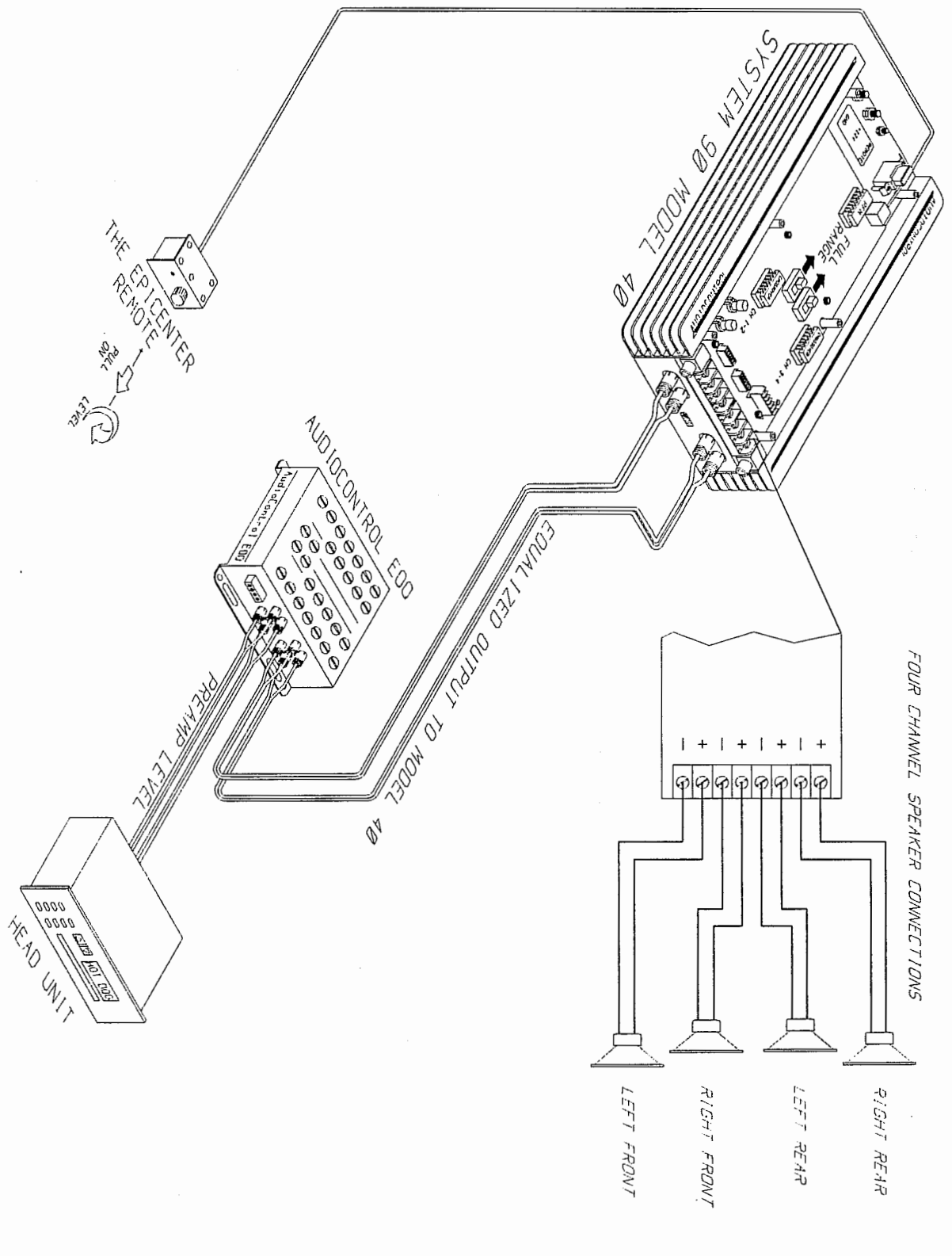
3-way 2-channel System

▼ Model 40



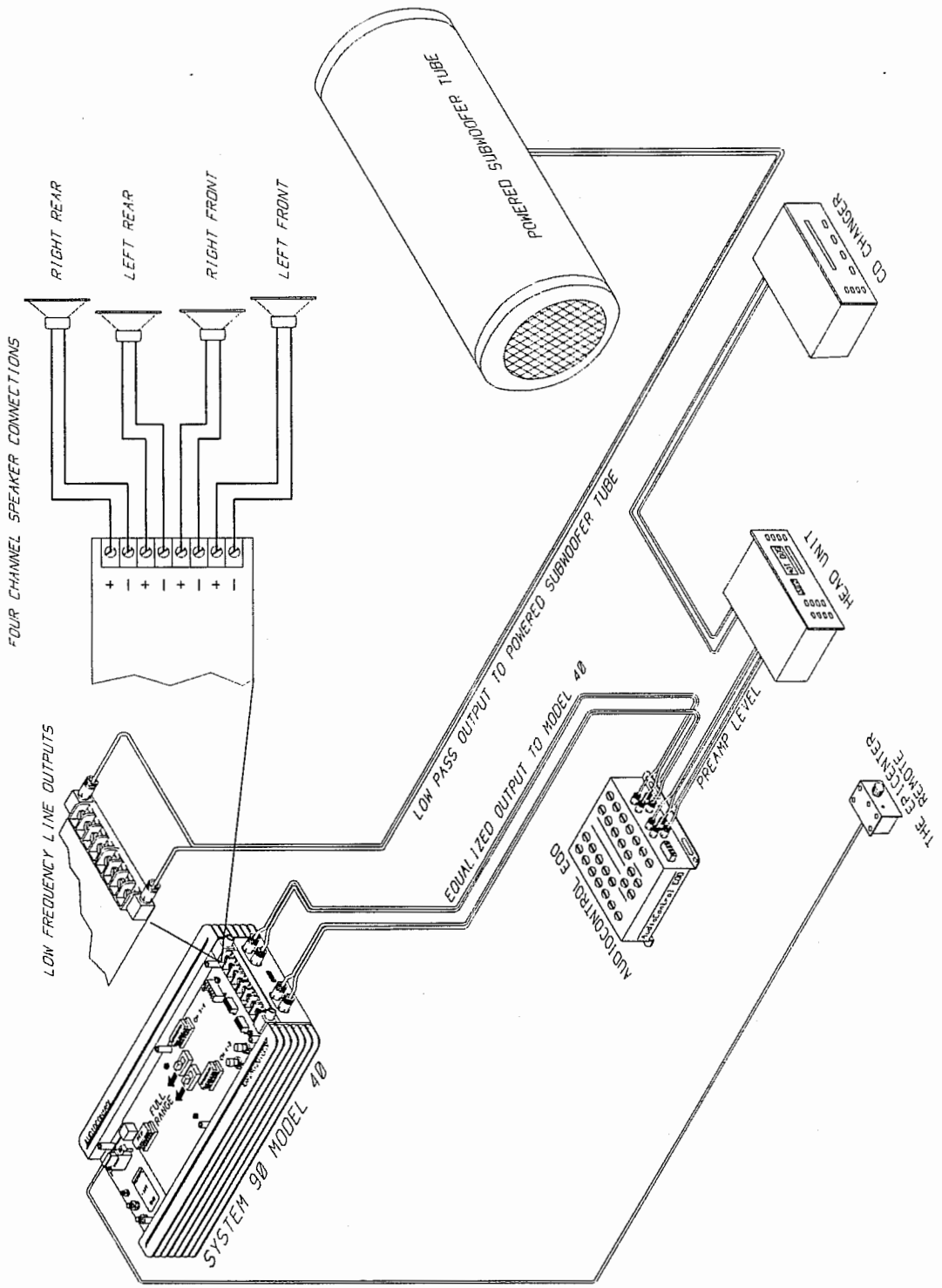
Bi-amplified System with Rear Fill

▼ Model 40



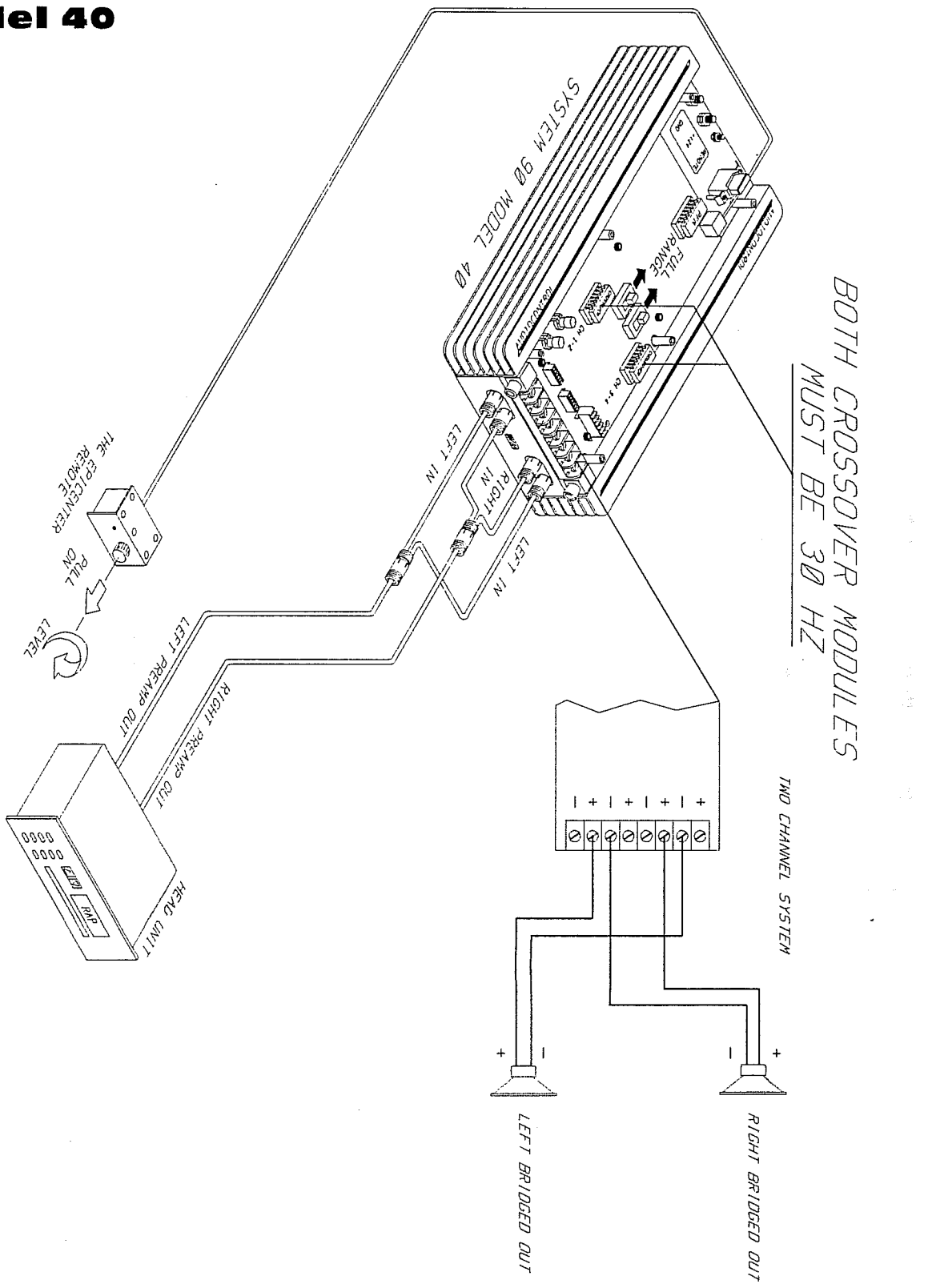
Equalized Four Channel System

▼ Model 40



Four Channel Bi-amp with Powered Subwoofer

▼ Model 40



Bridged 2 channel output Full Epicenter Capability

AUDIO WIRING

▼ Model 40

Having reviewed the preceeding system diagrams and configurations, you will know the function you intend the Model 40 to perform in your installation. Given that, remember;

1. Use only high-quality patch cords, and route the signal leads away from all power and speaker wiring.
2. Make sure the outer shields of the RCA jacks do not make electrical contact with the Model 40 chassis, This will create a ground loop.
3. When using the Model 40 in it's full-range mode, the line-level outputs are stereo sub-woofer outs, and utilize The Epicenter technology built into the Model 40.
4. Speaker wiring should be no smaller than 18AWG.
5. For speaker wiring, do not use common grounding or the car chassis as a ground return.
6. Remember, use color-coded speaker wire, making polarity checking a lot easier.
7. It's important, so we'll repeat it again. DO NOT run audio wiring near power wiring.

POWER WIRING

1. When installing any *System90* Powered Signal Processor, make sure your battery is disconnected prior to beginning installation. Disconnect negative battery wire first.
2. Refer to "star grounding" in Section II.
3. Install the in-line fuse holder in the positive power wire and locate it near the battery. Carefully insulate with electrical tape or heat-shrink tubing. DO NOT install fuse at this time. Connect this power cable to the positive terminal on the Model 40 using an insulated ring-tongue terminal connector.
4. Connect another power cable from the Model 40 negative terminal to the negative battery terminal, ground bus, or a verified ground location. Insulated lugs should be firmly connected with the use of a proper crimping tool.
5. Connect an 22 to 18AWG wire from the head-unit's remote turn-on lead to the remote terminal on the Model 40.
6. Re-check the power and remote wiring to insure they are secure, and routed where they are protected against chafing, pinching, etc...
7. Reconnect the vehicle's battery, connecting the positive terminal first, then the negative.
8. Install the fuse in the fuse holder of the Model 40's power line.

▼ Model 40 PROGRAMMABLE FREQUENCY MATCH FILTER SELECTION

The Programmable Frequency Match (PFM; you know what this really stands for) filter can be considered an adjustable subsonic filter. In engineering terms, it is called a high pass or in real people terms a low blocking filter. Its purpose is to eliminate the problems of the system playing too low.

Playing too low does not sound like a problem since we all work hard to get systems to do just that. But you can play too low. If the system is uncontrolled by a PFM filter it will try to reproduce sounds below human hearing (and believe us, they are on some CD's; we think they may be bearing rumble from the air conditioning). These sounds eat up tremendous amounts of amplifier power, cause intermodulation distortion and doppler shift effects. The bottom line is the sound is muddled, the amp overloads, and the speakers call in sick.

So the PFM filter is good but the really trick use for it is to tune your subwoofer. That is, with the PFM you can keep a driver from trying to play down to 25 when it unloads at 33 Hz, for example.

The PFM filter is an 18 dB/octave filter and takes the same modules as the crossover in the System90 and other AudioControl products. There is no difference in the modules for the PFM and the crossover (except the frequency selected).

Changing the value of the PFM filter is accomplished by simply changing the plug-in module. Values available from AudioControl are listed on page VIII-1.You can make your own as explained in Section VIII.

CROSSOVER MODULE SELECTION

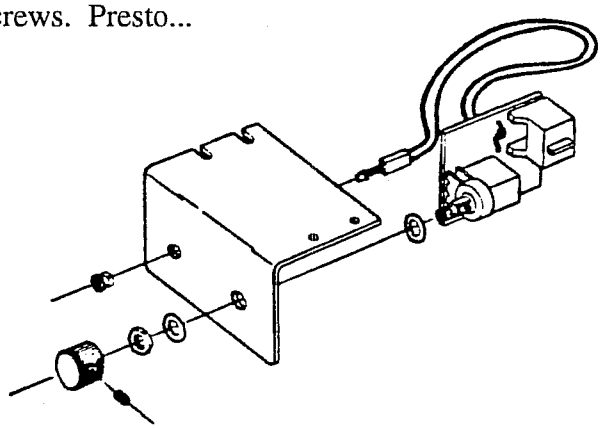
A single driver can not produce sound for the full range of music and human hearing. All driver have a linear zone where their frequency response is more or less flat. All speakers also have a impedance curve. Though this may come as a shock, 4 ohm (or any other impedance) rated speakers vary from about a 1/2 ohm to more than 10 ohms depending on the frequency.

So the crossover (or turnover) point you select should be based upon the frequency response and impedance characteristics of the drivers. Some companies give great information on this, though you may have to call many to get the data.

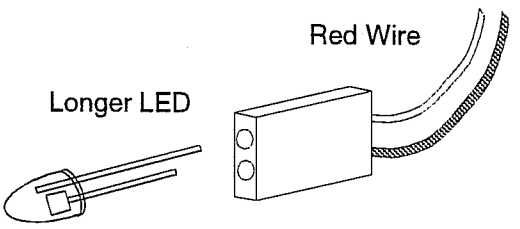
Just like the PFM filter, changing the value of the crossover is accomplished by simply changing the plug-in module. Values available from AudioControl are listed on page VIII-1.You can make your own as explained in Section VIII.

THE EPICENTER REMOTE HOOK-UP ▼ Model 40

1. The Epicenter Remote may be installed under the dash, in its own bracket, or through the dash. It should be within reach of the driver of the vehicle, and where the Digital Restoration LED is plainly visible.
2. The Epicenter Remote is most easily mounted with screws under the dash.
   - Slide in upside down to get a clear view of the underside of your dash, and at this point, we hope you have a charming assistant to hand you things.
   - Place the Remote in it's mounting position, and mark the two holes and remove the unit. Drill the required holes into the dashboard underside, replace the unit and secure it with the screws. Presto...



3. For that custom finished stealth look, go in-dash. This is a little more difficult, and takes some patience and planning, but most of the time it's worth the extra effort.
   - Disassemble the Remote unit. First gently push the LED from its black plastic holder in the bracket. DO NOT remove the actual LED from its wires.
   - Remove the circuit board and rotary control from the bracket. Take off the knob by loosening its set screw then unscrew the lock nut and washer.



   - Take a deep breath. (smok'em if you got'em).
   - Drill a 9/32" hole in the dashboard.
   - Drill a 1/8" hole for the lock tab. Or remove the lock tab if

you're sure you can keep the circuit board from rotating.
- Drill a 13/64" hole for the black LED holder.
- Remove the black plastic LED holder from the remote bracket and push it into the 13/64" hole.
- Apply the pressure-sensitive remote label.
- Insert the rotary control/circuit board into the 9/32" hole, and the LED assembly into its black plastic holder.
- Replace the lock nut and washer and tighten securely.
- Finally, put the knob back on and tighten its set screw.

Remember, what you need to get the most out of Bass Restoration circuitry. Sufficient cone area, and in-out cone excursion. The more woofer area you have, the more bass you can expect. Not only the size of the speakers affect the bass output, but also the quality. Generally, look for speakers with high-quality cone material, and large magnet structures.

The knob on The Epicenter remote must be pulled out for operation. When operating, the red light on the unit is illuminated. With the knob out and light on, turn the knob to the "max" and then to the left until you find a setting best suited to the installation. Of course, setting will differ depending on personal taste, type of music, CD vs. FM radio, etc.

SENSITIVITY CONTROL ADJUSTMENTS

The input sensitivity of the Model 40 must be adjusted to match the output of the head-unit you are installing, or the next audio component upstream in the system, ie. an AudioControl equalizer would do nicely. In general, following these few steps will insure proper hook-up:

1. Make sure the volume of the system is turned down prior to adjustments.
2. Slowly increase the volume of the head-unit, or AudioControl equalizer output to 3/4 rotation with an appropriate source of material provided.
3. Adjust the sensitivity controls in equal amounts until the system is playing very loudly, but not distorting!
4. Reduce the volume level of the head-unit to a comfortable volume level, and check for overall balance.
5. Position the "soundstage" where it is most pleasing.
6. You may need to experiment with The Epicenter remote variations for final settings.

INSTALLING THE MODEL 48

Before proceeding, we suggest you familiarize yourself with the diagrams located in this section. These will help the installation process of the *System90* be much easier.

Installation can begin by removing the top cover of the Model 48 by unscrewing the 6 socket-head screws with a 3/32" hex wrench. Please store them in a safe place.

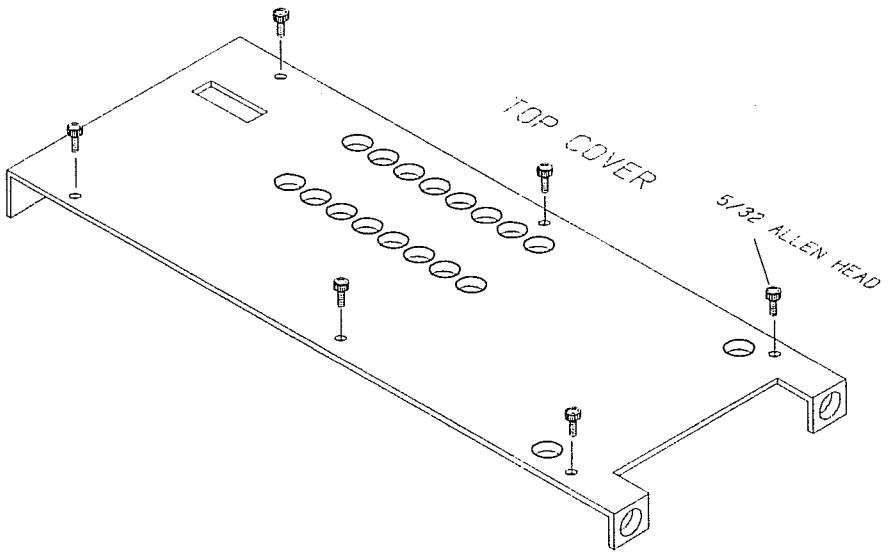
FACTORY SETTINGS AND INSTALLED MODULES

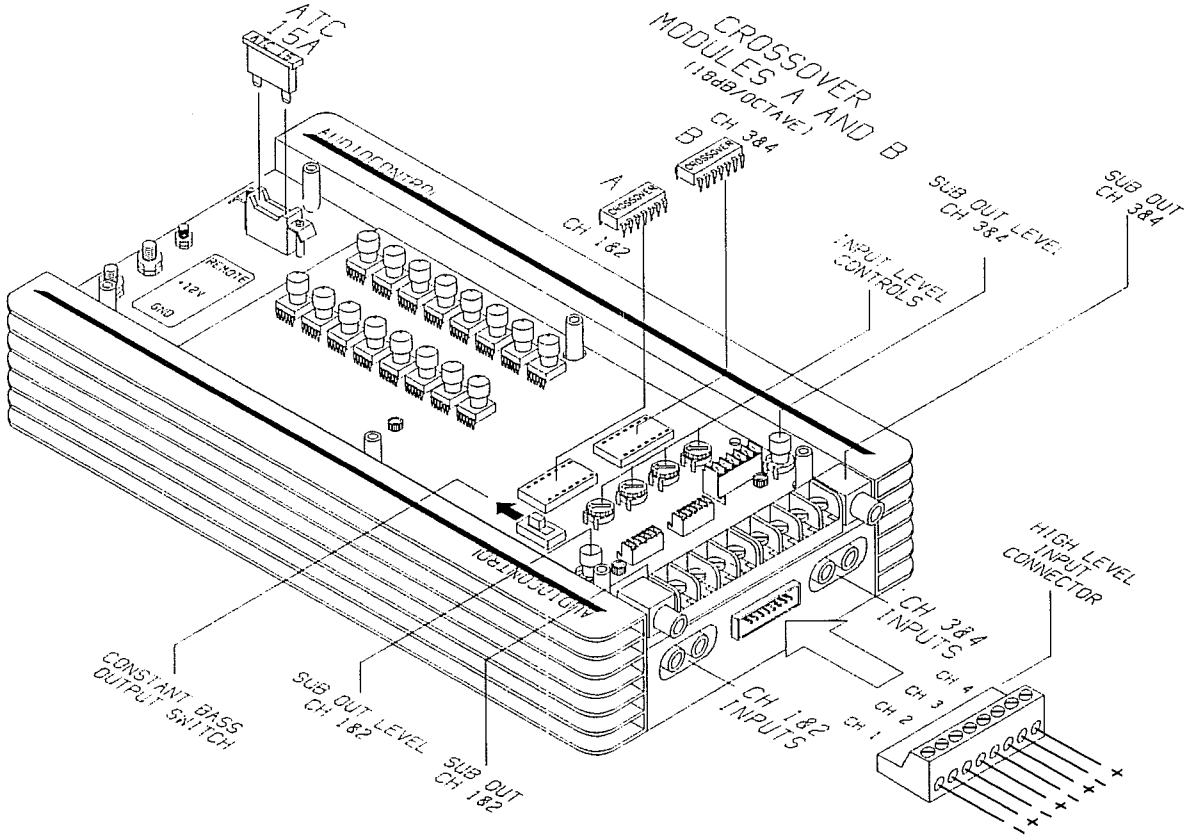
a. The Model 48 is shipped from the factory with the constant bass switch set in the four channel mode. In this position, the Model 48's power sections are set to be used ideally as a full-range (30Hz and up), four channel amplifier.

b. The equalization band controls affect the front and rear channels independently.

c. The two crossover Modules installed in the Model 48 are 30Hz. If the 30Hz modules are replaced with a 90Hz or suitable crossover module, 4 channel constant bass output is available at the left and right sub out jacks. To change the factory setting, select the frequency desired and refer to the diagram.

▼ Model 48 MODEL 48 SYSTEM DIAGRAMS AND CONFIGURATIONS





System90 Model 48

Switch Positions

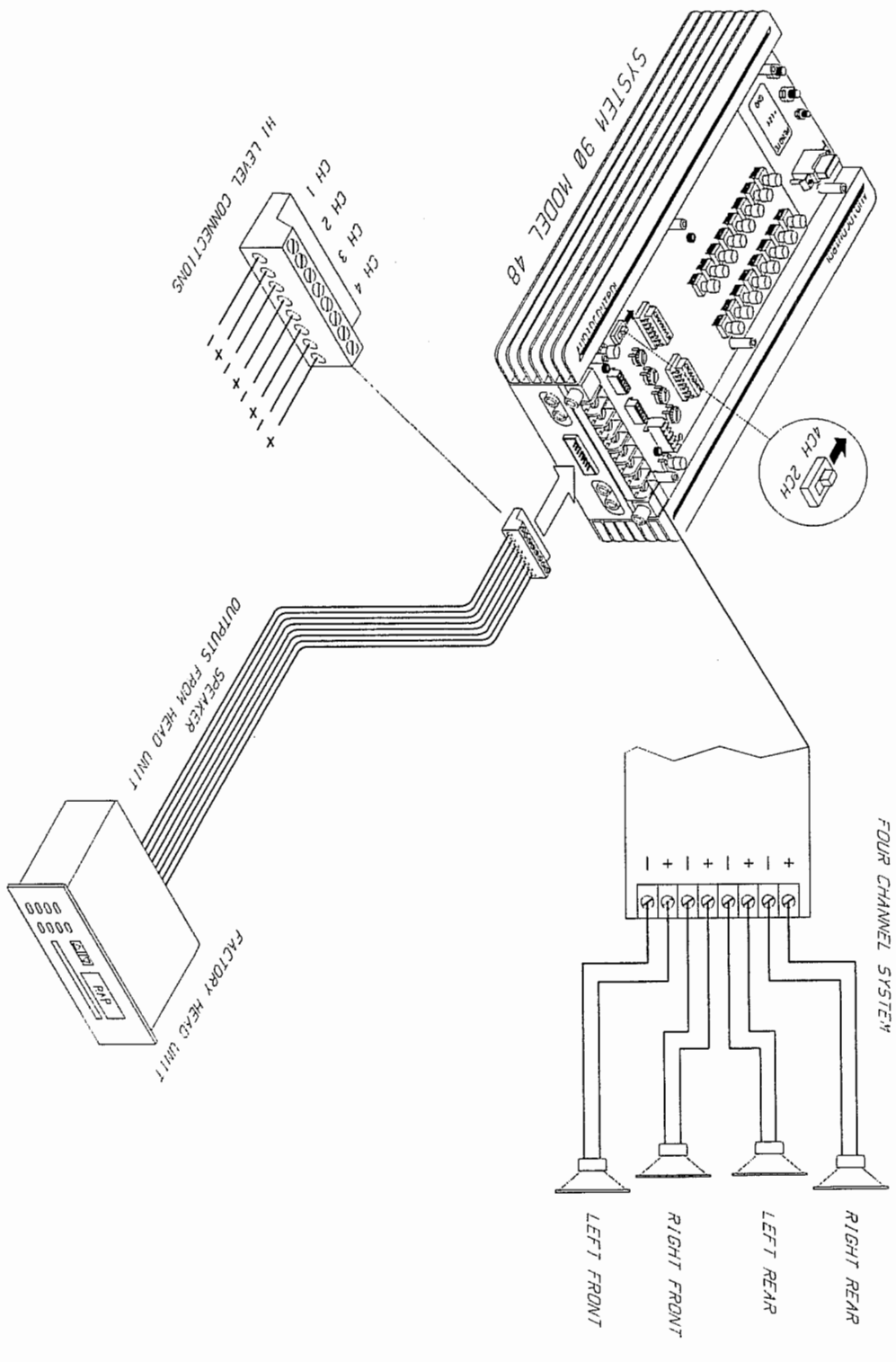
4 Ch 

2 Ch 

If the Model 48 is used in a front rear fader system the constant bass switch should be in the four channel position. This mode uses the low frequency information from all four channels for the sub out RCA jacks. If the switch is in the two channel position, only bass signals from channel one (1) and two (2) will be available at the sub outputs.

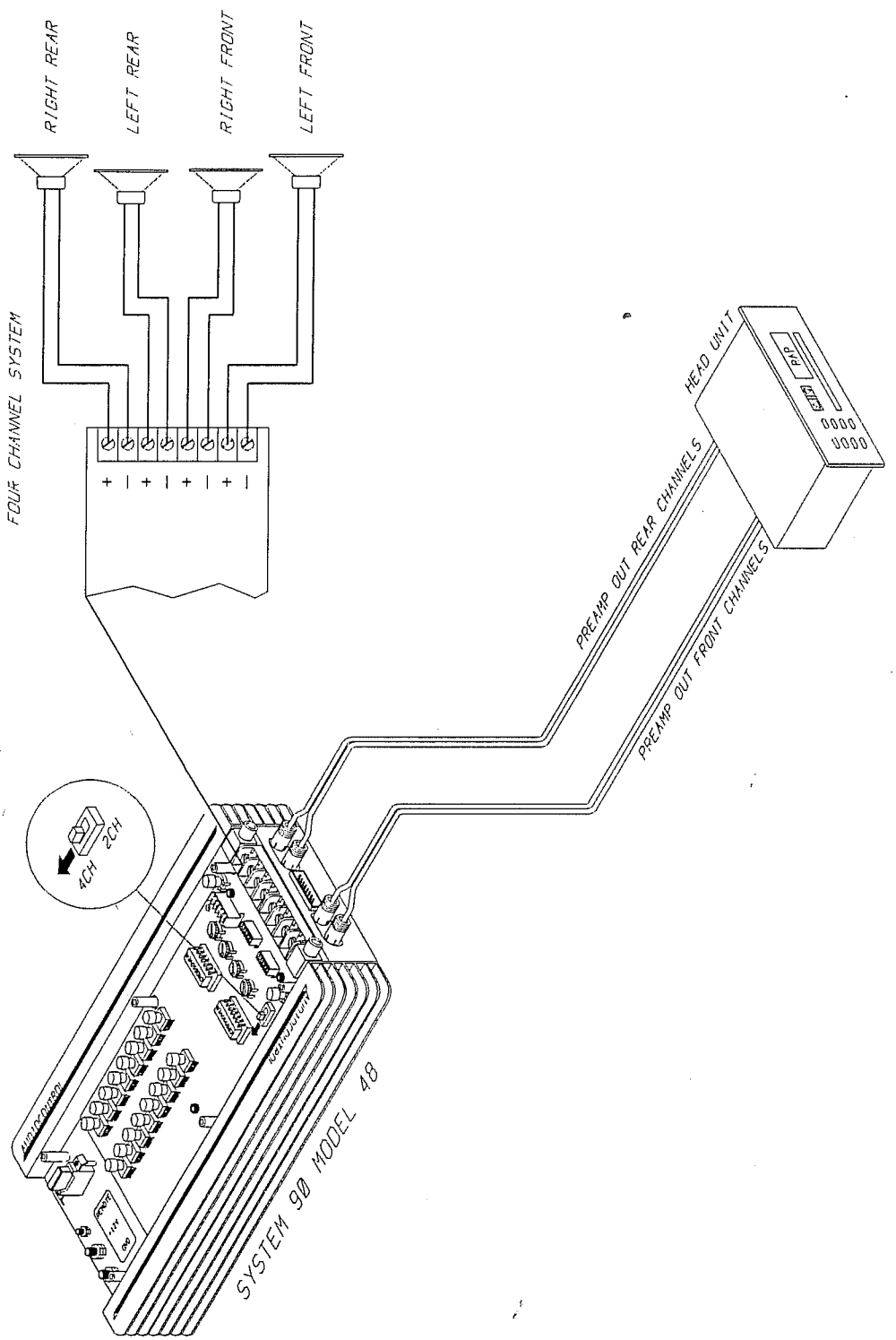
Also if the sub outputs are going to be used the crossover module must be changed to 90Hz or suitable crossover point.

▼ Model 48



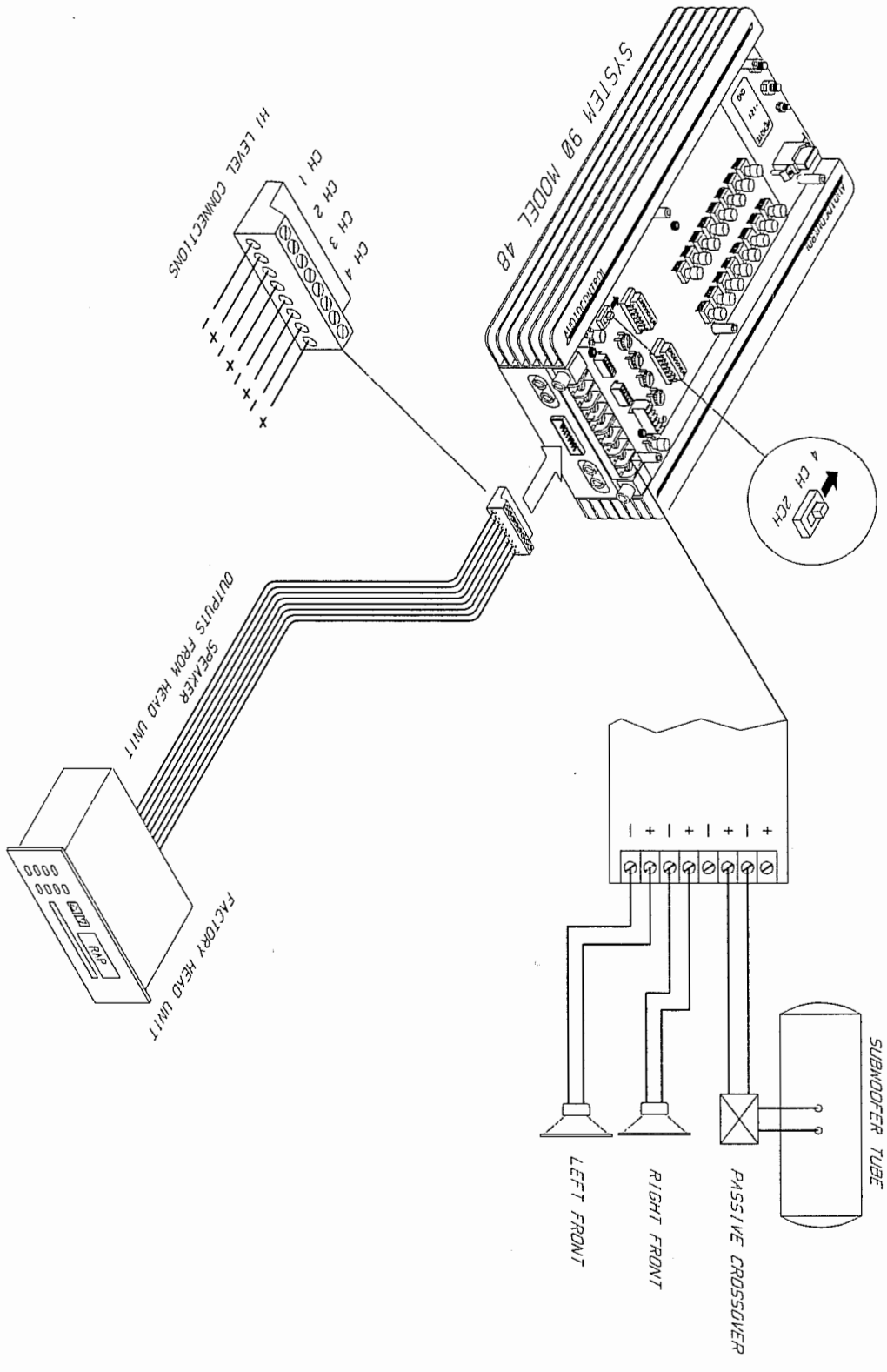
Full Range 4-channel Front-rear Fader System
Using Speaker Level Inputs

▼ Model 48



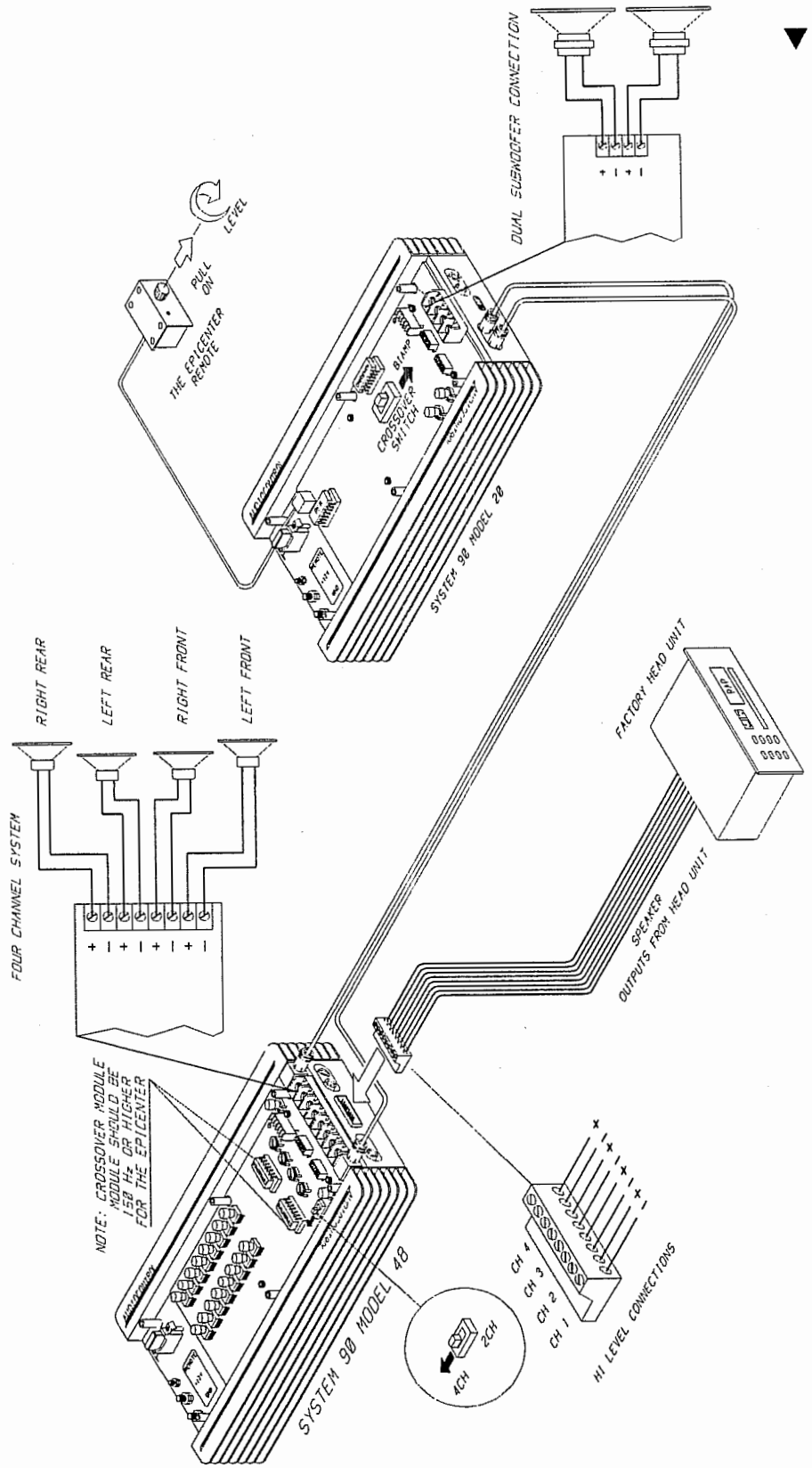
Full Range 4-channel Front-rear Fader System Using Preamp Inputs

▼ Model 48



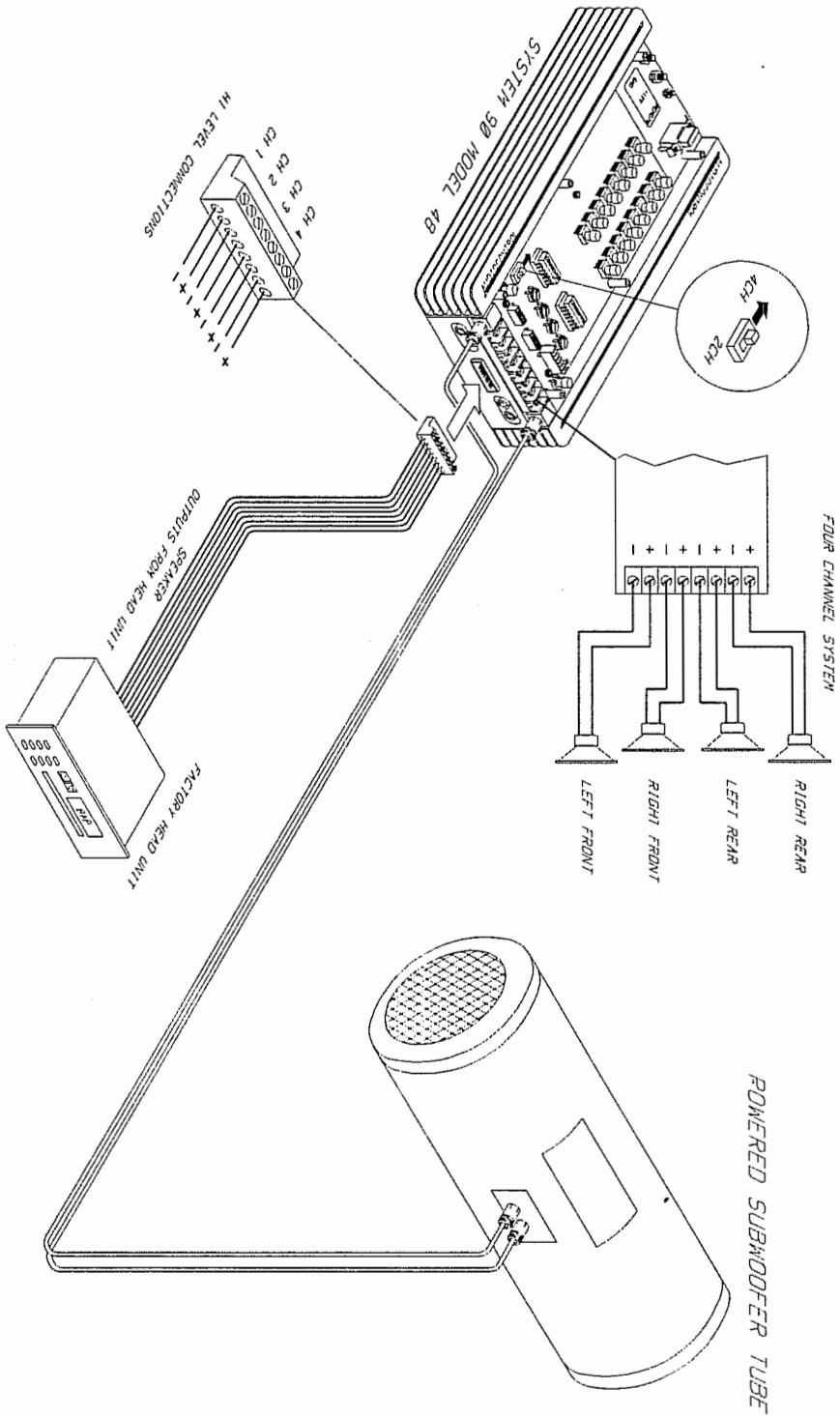
Biamp 2-channel System with Passive Crossover Using OEM Speaker Level Imput

▼ Model 48



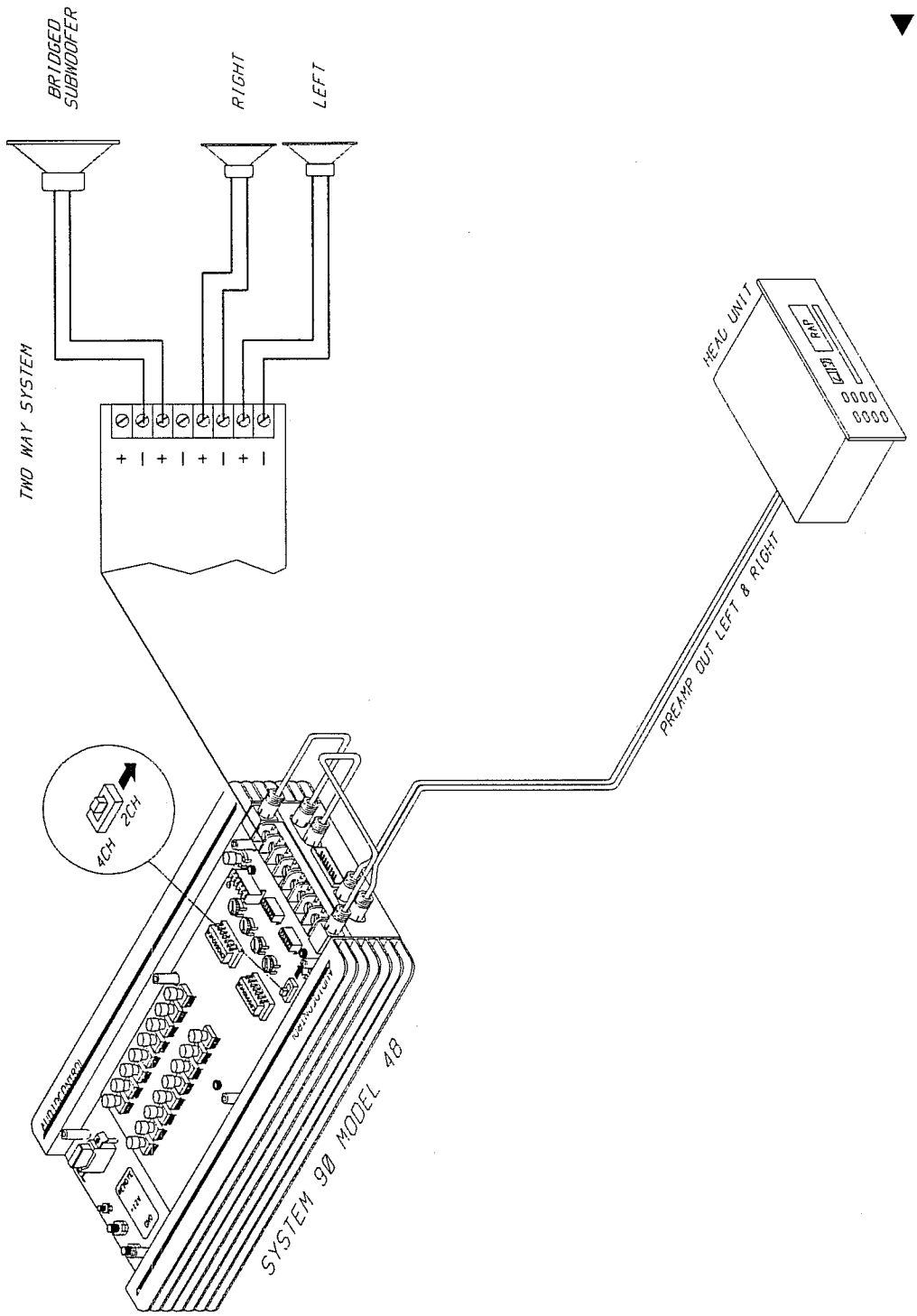
4-channel Blamp System with The Epicenter

▼ Model 48



Biamplified 4-channel System with Powered Tube

▼ Model 48



Module "A" = Crossover Point
Module "B" = PFM (30 Hz)

Bridged, 2-way System

▼ Model 48 AUDIO WIRING

Having reviewed the preceeding system diagrams and configurations, you will know the function you intend the Model 48 to perform in your installation. Given that, remember;

1. Use only high-quality patch cords, and route the signal leads away from all power and speaker wiring.
2. Make sure the outer shields of the RCA jacks do not make electrical contact with the Model 48 chassis, This will create a ground loop.
3. When using the Model 48 in it's full-range mode, the line-level output frequencies are controlled by the crossover modules.
4. Speaker wiring should be no smaller than 18AWG.
5. For speaker wiring, do not use common grounding or the car chassis as a ground return.
6. Remember, use color-coded speaker wire, making polarity checking a lot easier.
7. It's important, so we'll repeat it again. DO NOT run audio wiring near power wiring.

POWER WIRING

1. When installing any *System90* Powered Signal Processor, make sure your battery is disconnected prior to beginning installation. Disconnect negative battery wire first.
2. Refer to "star grounding" in Section II.
3. Install the in-line fuse holder in the positive power wire and locate it near the battery. Carefully insulate with electrical tape or heat-shrink tubing. DO NOT install fuse at this time. Connect this power cable to the positive terminal on the Model 48 using an insulated ring-tongue terminal connector.
4. Connect another power cable from the Model 48 negative terminal to the negative battery terminal, ground bus, or a verified ground location. Insulated lugs should be firmly connected with the use of a proper crimping tool.
5. Connect an 22 to 18AWG wire from the head-unit's remote turn-on lead to the remote terminal on the Model 48.
6. Re-check the power and remote wiring to insure they are secure, and routed where they are protected against chafing, pinching, etc...
7. Reconnect the vehicle's battery, connecting the positive terminal first, then the negative.
8. Install the fuse in the fuse holder of the Model 48's power line.

UPGRADING A FACTORY (OEM) SYSTEM

Replacing a factory (OEM)* radio gets harder each model year. Besides the non-standard sizes, new models even feature volume and tuning controls imbedded right in the steering wheel It's great for convenience, but tough on the knuckles. It seems the boys in Detroit and Japan want to make sure you don't throw out the original radio and replace it with some better model.

In all fairness, today's crop of factory radios is better, So rather than lose those nice steering wheel volume controls, we've come up with a way of improving your sound system by using the High Level Inputs on the Model 48 and the speaker leads from your factory radio.

It's as simple as moving the wires from the speakers to the Model 48. Don't worry, the Model 48 is designed to effortlessly handle the higher signal levels coming form the factory radio, without a trace of overload or added distortion.

CROSSOVER MODULE SELECTION

A single driver can not produce sound for the full range of music and human hearing. All drivers have a linear zone where their frequency response is more or less flat. All speakers also have a impedance curve. Though this may come as a shock, 4 ohm (or any other impedance) rated speakers vary from about a 1/2 ohm to more than 10 ohms depending on the frequency.

So the crossover (or turnover) point you select should be based upon the frequency response and impedance characteristics of the drivers. Some companies give great information on this, though you may have to call many to get the data.

Changing the value of the crossover is accomplished by simply changing the plug-in module. Values available from AudioControl are listed on page IX-1. You can make your own as explained in Section IX.

*(OEM) stands for Original Equipment Manufacturer, which used to mean that a car manufacturer actually built and installed each radio. Nowadays, a factory radio is made by an aftermarket company for installation by the car manufacturer.

▼ Model 48 Adjusting The Equalization Bands

1. Turn on the head unit or radio. On the Model 48 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(preferably one containing a variety of acoustic instruments).

3. A third-octave real time audio analyzer (see below) is the ultimate tool for getting the best sound quality from the acoustical controls of the Model 48. If you are in a real hurry, you can set the controls by ear.

4. Set all of the equalization controls to the flat (i.e. 0) position.

Most car audio systems have different sized speakers in the front then in the rear. Because of this, as well as the various speaker mounting locations, you will want to adjust the front and rear bands individually. Use the fader control to go back and forth between the front and rear.

5. Listen to the vocals and instruments, and try cutting the frequencies in the mid-bass(80 to 180Hz) and mid-range(1 to 5kHz) spectrum. The mid-bass response is usually a problem area due to standing waves caused by a 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. Also consider what frequencies the speakers will handle.

6. Continue listening and try boosting the low bass frequencies in the 45 Hz area. Usually this area needs help due to design limitations of smaller woofers and loss of bass in cassettes.

7. 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 professional-strength AudioControl Industrial SA-3050A) 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 your realize how far off the mark *Def Leppard* really is!

SENSITIVITY CONTROL ADJUSTMENTS

The input sensitivity of the Model 48 must be adjusted to match the output of the head-unit you are installing, or the next audio component upstream in the system. In general, following these few steps will insure proper hook-up:

1. Make sure the volume of the system is turned down prior to adjustments.
2. Slowly increase the volume of the head-unit, or AudioControl equalizer output to 3/4 rotation with an appropriate source of material provided.
3. Adjust the sensitivity controls in equal amounts until the system is playing very loudly, but not distorting!
4. Reduce the volume level of the head-unit to a comfortable volume level, and check for overall balance.
5. Position the "soundstage" where it is most pleasing.
6. You may need to experiment with equalization controls for final settings.

MODEL 20 SPECIFICATIONS

Unless otherwise noted the battery voltage is 13.8VDC

Power Output
70 Watts per channel into 4 Ohms 20-20Khz
105 Watts per channel into 2 Ohms 20-20Khz
180 Watts in bridged mode into 4 Ohms at 2Khz
45 Watts per channel into 8 Ohms 20-20Khz

Power Bandwidth - 5Hz to 70Khz +0 -1dB (amplifier section)

Distortion at rated power (4 Ohms both Ch driven)
Less than .08% THD 20-20Khz

Input attenuation range - 13 dB

Signal to noise - Greater than 100dBA

Damping Factor - Greater than 101 from 100 Hz to 10Khz

Slew Rate - 10 V/uS

Idle current - 600 - 700 mA

Standby current - 10 mA

Remote turn on current - 100 μA (microamps)

Soft start turn on delay - 2 - 3 Sec

Circuit Topology (power supply) - Power MOSFET PWM system

Circuit Topology (amplifier) - Class AB bipolar amplifier with FET input stage and a complementary feed back pair output stage.

▼ Product Specifications

MODEL 20 SPECIFICATIONS (continued)

Protection networks

DC offset

The output offset circuit will shut the power supply off if a DC voltage greater than ±5V is present at either amplifier output terminal.

Out of band high frequency

High frequency output above 50kHz with an amplitude equal to the no load rail voltage activates the input muting circuit and will shut off the power supply.

Short circuit

If the output terminals are shorted, the input muting circuit activates and the power supply will shut off.

High temperature

If excessively high temperatures are encountered under extreme operating conditions, the Model 20 will mute the input signal until the temperature of the unit has dropped to a safe level.

High Battery voltage

Battery input voltages greater than 14.6 VDC will cause the power supply to go into a reduced pulse width duty cycle which prevents the amplifier circuits operating under excessively high ± power supply rails.

Low battery voltage

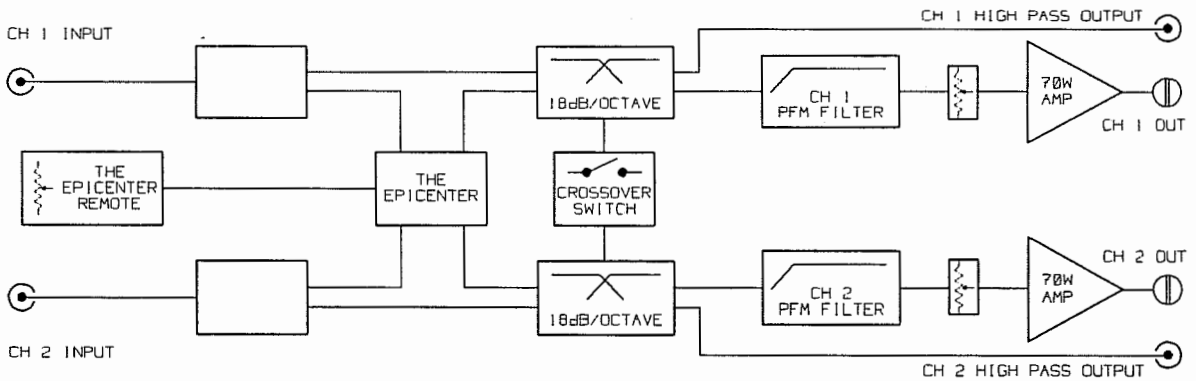
If the electrical system voltage drops below 9 volts the power supply will shut off.

Soft start and muting

A power supply turn on delay of 1 second allows the switching FETs to ramp up from 0 to 95% duty cycle (fully on). The ramp up time is approximately 200 mS and limits the battery inrush current to <30ADC. A secondary delay of 1-2 seconds is provided for the input mute circuit. This allows all external electronics to stabilize when the system is powered up.

The muting circuit activates within 10 mS when the system is turned off.

MODEL 20 BLOCK DIAGRAM



▼ Product Specifications

MODEL 40 SPECIFICATIONS

Unless otherwise noted the battery voltage is 13.8VDC

Power output
40 Watts per channel into 4 Ohms 20-20Khz
60 Watts per channel into 2 Ohms 20-20Khz
110 Watts x 2 in bridged mode into 4 Ohms
22 Watts per channel int 8 Ohms

Power Bandwidth - 5Hz to 65Khz +0 -1dB (amplifier section)

Distortion at rated power into 4 Ohms
Less than .06% THD 20-20Khz

Input attenuation range - 13 dB

Signal to noise - Greater than 100 dBA

Damping Factor - Greater than 80 from 100 Hz to 10Khz

Slew Rate - 8 V/uS

Idle current - 950 mA

Standby current - 10 mA

Remote turn on current - 100 uA (microamps)

Soft start turn on delay - 2 - 3 Sec

Circuit Topology (power supply) - Power MOSFET PWM system

Circuit Topology (amplifier)
Class AB bipolar amplifier with FET input stage and a complementary feed back pair output stage.

MODEL 40 SPECIFICATIONS (continued)

Protection networks

DC offset

The output offset circuit will shut the power supply off if a DC voltage greater than ± 5V is present at either amplifier output terminal.

Out of band high frequency

High frequency output above 50kHz with an amplitude equal to the no load rail voltage activates the input muting circuit and will shut off the power supply.

Short circuit

If the output terminals are shorted, the input muting circuit activates and the power supply will shut off.

High temperature

If excessively high temperatures are encountered under extreme operating conditions, the Model 40 will mute the input signal until the temperature of the unit has dropped to a safe level.

High battery voltage

Battery input voltages greater than 14.6 VDC will cause the power supply to go into a reduced pulse width duty cycle which prevents the amplifier circuits operating under excessively high ± power supply rails.

Low battery voltage

If the electrical system voltage drops below 9 volts the power supply will shut off.

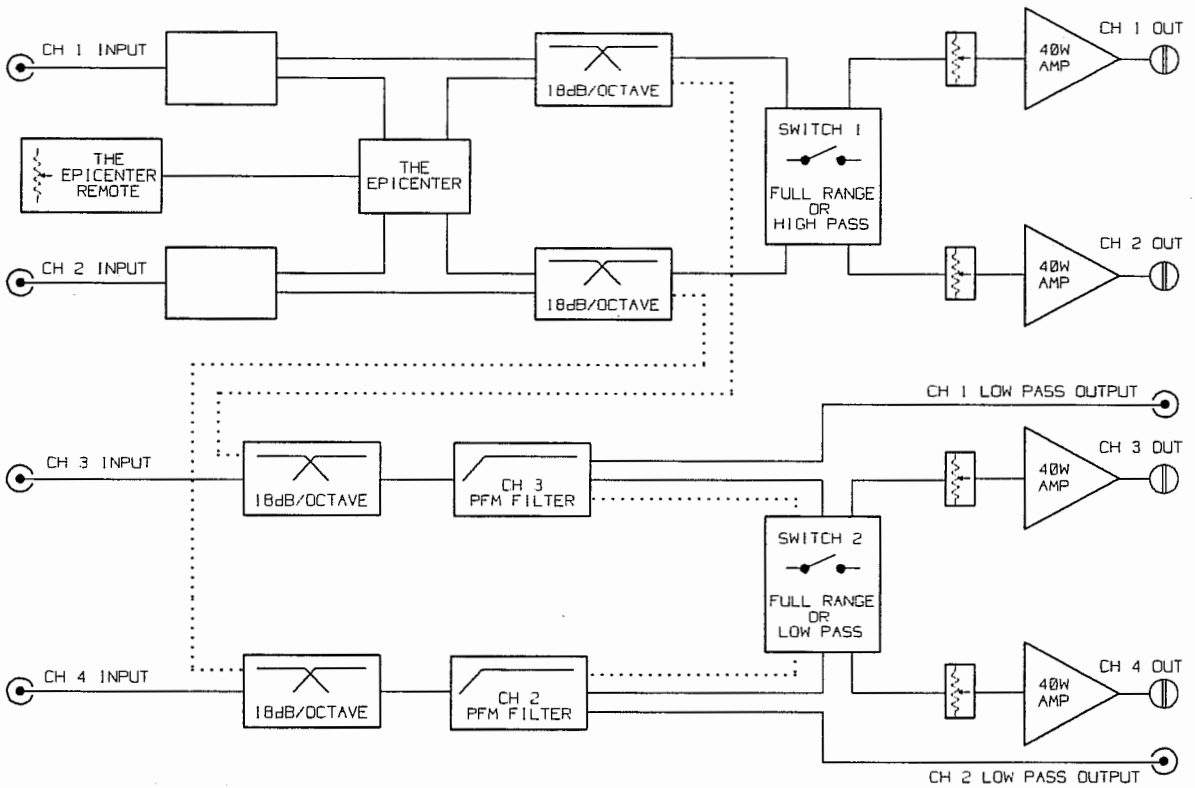
Soft start and muting

A power supply turn on delay of 1 second allows the switching FETs to ramp up from 0 to 95% duty cycle (fully on). The ramp up time is approximately 200 mS and limits the battery inrush current to<30 ADC. A secondary delay of 1 - 2 seconds is provided for the electronics to stabilize when the system is powered up.

The muting circuit activates within 10 mS when the system is turned off.

▼ Product Specifications

MODEL 40 BLOCK DIAGRAM



MODEL 48 SPECIFICATIONS

Unless otherwise noted the battery voltage is 13.8VDC

Power output
40 Watts per channel into 4 Ohms 20-20Khz
60 Watts per channel into 2 Ohms 20-20Khz
110 Watts x 2 in bridged mode into 4 Ohms
22 Watts per channel int 8 Ohms

Power Bandwidth - 5Hz to 65Khz +0 -1dB (amplifier section)

Distortion at rated power into 4 Ohms
Less than .06% THD 20-20Khz

Input attenuation range - 18 dB

Signal to noise - Greater than 100 dBA with 1 volt input

Damping Factor - Greater than 80 from 100 Hz to 10Khz

Slew Rate - 8 V/uS

Idle current - 850 mA

Standby current - 10 mA

Remote turn on current - 1.4 μA (microamps)

Soft start turn on delay - 2 - 3 Sec

Circuit Topology (power supply) - Power MOSFET PWM system

Circuit Topology (amplifier)
Class AB bipolar amplifier with FET input stage and a complementary feed back pair output stage.

Line Level Sub Out Range
Plus 6 minus 4 dB referenced to line level input signal

MODEL 48 SPECIFICATIONS (continued)

Protection networks

DC offset

The output offset circuit will shut the power supply off if a DC voltage greater than ± 5V is present at either amplifier output terminal.

Out of band high frequency

High frequency output above 50kHz with an amplitude equal to the no load rail voltage activates the input muting circuit and will shut off the power supply.

Short circuit

If the output terminals are shorted, the input muting circuit activates and the power supply will shut off.

High temperature

If excessively high temperatures are encountered under extreme operating conditions, the Model 40 will mute the input signal until the temperature of the unit has dropped to a safe level.

High battery voltage

Battery input voltages greater than 14.6 VDC will cause the power supply to go into a reduced pulse width duty cycle which prevents the amplifier circuits operating under excessively high ± power supply rails.

Low battery voltage

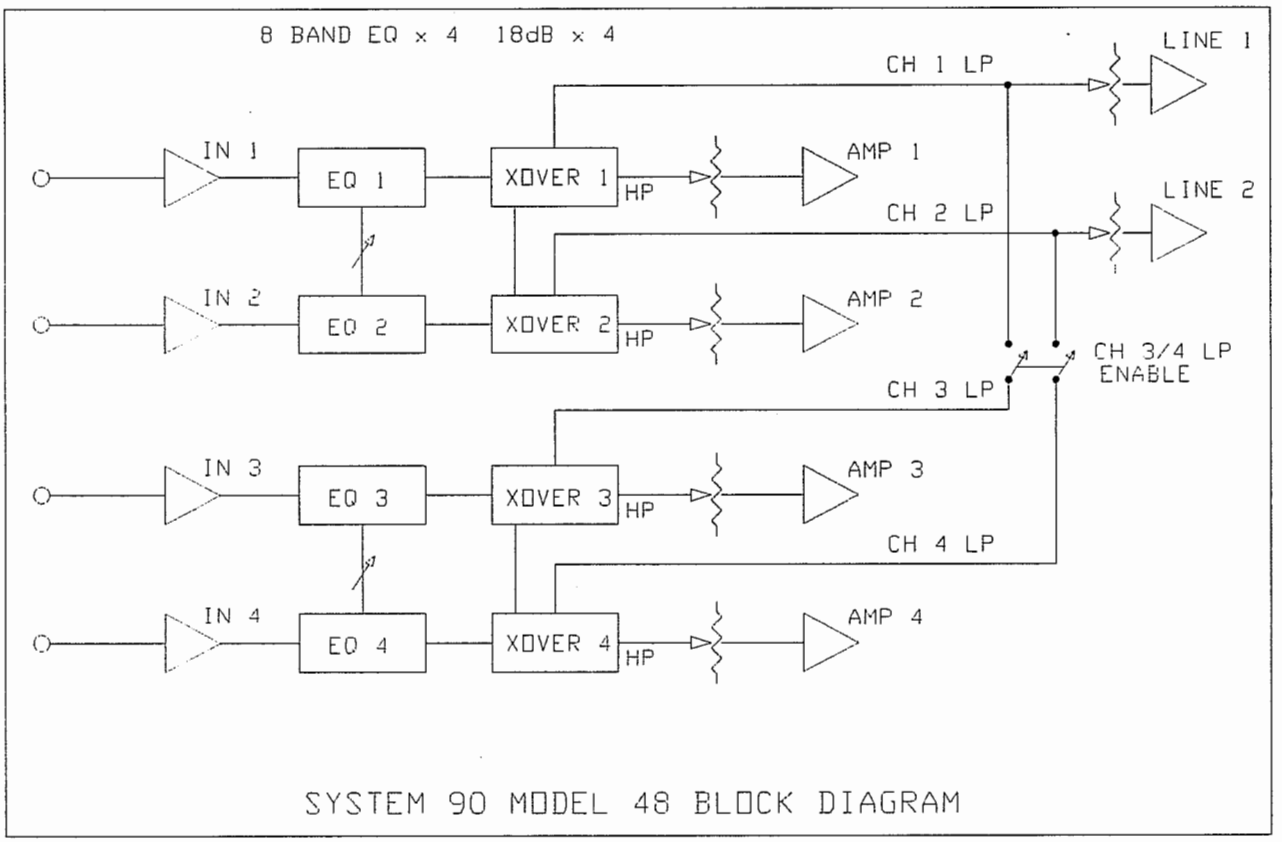
If the electrical system voltage drops below 9 volts the power supply will shut off.

Soft start and muting

A power supply turn on delay of 1 second allows the switching FETs to ramp up from 0 to 95% duty cycle (fully on). The ramp up time is approximately 200 mS and limits the battery inrush current to<30 ADC. A secondary delay of 1 - 2 seconds is provided for the electronics to stabilize when the system is powered up.

The muting circuit activates within 10 mS when the system is turned off.

MODEL 48 BLOCK DIAGRAM



SYSTEM 90 MODEL 48 BLOCK DIAGRAM

TROUBLE SHOOTING

Almost all problems can be eliminated by re-checking the wiring and settings of the *System90* Powered Signal Processor. If a problem cannot be solved using the guide below, please call AudioControl for further assistance:

1. No Sound:
- Verify that the head-unit is working properly.
- Check all fuses.
- Check the connections to the remote turn-on wire.

2. No Bass:
- Pull out the Knob on The Epicenter Remote.
- If the power light on the remote unit is not on, check wiring to the unit.
- Check crossover module frequency.

3. No Highs:
- Check internal crossover switch for proper setting.

4. Sound Un-Balance:
- Check all sensitivity control settings.
- Somebody has messed around with your original settings.
- Check stereo sound source, head-unit for balance setting.

5. Noise in System:
- Check input-output sensitivity levels of individual components in system to insure proper level matching.
- Check Star Ground.
- Check all ground connections for good electrical contact.
- Check to make sure signal lines are isolated from the power lines.

6. System Shut-Down:
- Check fuses.
- Speaker impedance may be too low, or there is a short circuit in the system. Check all wiring.
- Power section of the *System90* is being overdriven. Turn down volume, and refer to #2 above.

7. Speakers Buzzing or Cracking:
- Turn down the bass (45 Hz and 80 Hz) frequencies.

GENERAL MAINTAINANCE

The *System90* has been designed to require very little routine maintainance. However, it is always a good idea to keep the chassis free from dirt by gently sweeping in between the cooling fins (heat sinks) with a soft brush. Clean the outside of the *System90* with a soft cloth and mild soap solution. DO NOT use solvents or liquid cleaners on the chassis. Whenever the unit is cleaned, make a routine check of wiring to make sure everything remains secure and free of contamination.

LIMITED WARRANTY

The *System90* has been designed and manufactured for easy installation, and years of faithful service. We want you to enjoy installing the unit, and the customer to enjoy listening to it. AudioControl will warrant all materials and workmanship on the *System90* for a full two years providing you do the following:

1. As a professional, authorized AudioControl installer, you perform the installation, and authenticate the install by filling out the provided sticker, and attaching it to the unit.
2. You, or the customer, must fill out the warranty card and send it to us within 15 days.
3. Provide the sales slip, or receipt of purchase and installation to the customer.
4. DO NOT remove, or tamper with the serial number on the unit.

LEGALESE SECTION

This is the only warranty given by AudioControl. This warranty gives the customer specific legal rights which vary from state to state. Promises of how well the *System90* works are not implied by this warranty. Other than what we've covered in this warranty, we have obligation, expressed or implied. Also, we will not be obligated for direct or indirect consequential damage to the system. Failure to send in a properly completed warranty card negates any service claim.

18dB per Octave, Crossover & Programmable Frequency Match Filter Modules That Are Available From AudioControl:

20Hz	200Hz
25Hz	270Hz
35Hz	350Hz
40Hz	500Hz
45Hz	725Hz
50Hz	950Hz
60Hz	1500Hz
70Hz	2000Hz
80Hz	2600Hz
90Hz	3000Hz
100Hz	3500Hz
120Hz	4000Hz
130Hz	4500Hz
150Hz	5500Hz
170Hz	6000Hz
	and blank