SAC 23

STEREO CROSSOVER

IMPORTANT SAFETY INSTRUCTIONS

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with a dry cloth.
7. Do not block any ventilation openings. Install in accordance with manufacturer's instructions.
8. Do not install near any heat sources such as radiators, registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord and plug from being walked on or pinched particularly at plugs, convenience receptacles, and the point where it exits from the apparatus.
11. Only use attachments and accessories specified by Rane.
12. Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
15. The plug on the power cord is the AC mains disconnect device and must remain readily operable. To completely disconnect this apparatus from the AC mains, disconnect the power supply cord plug from the AC receptacle.
16. This apparatus shall be connected to a mains socket outlet with a protective earthing connection.
17. When permanently connected, an all-pole mains switch with a contact separation of at least 3 mm in each pole shall be incorporated in the electrical installation of the building.
18. If rackmounting, provide adequate ventilation. Equipment may be located above or below this apparatus, but some equipment (like large power amplifiers) may cause an unacceptable amount of hum or may generate too much heat and degrade the performance of this apparatus.
19. This apparatus may be installed in an industry standard equipment rack. Use screws through all mounting holes to provide the best support.

WARNING: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture. Apparatus shall not be exposed to dripping or splashing and no objects filled with liquids, such as vases, shall be placed on the apparatus.

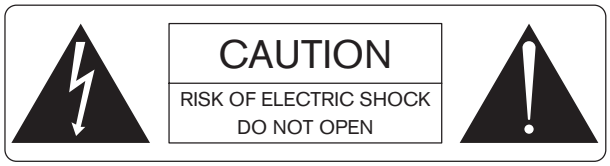
NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION: Changes or modifications not expressly approved by Rane Corporation could void the user's authority to operate the equipment.

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

WARNING

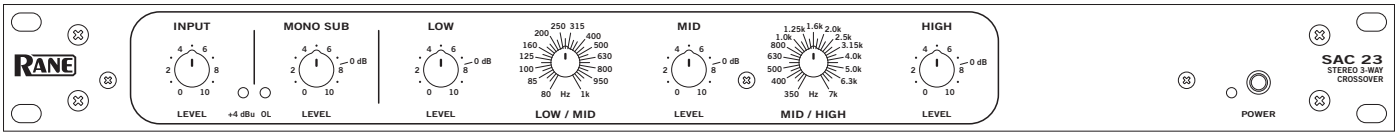


To reduce the risk of electrical shock, do not open the unit. No user serviceable parts inside. Refer servicing to qualified service personnel.

The symbols shown below are internationally accepted symbols that warn of potential hazards with electrical products.

This symbol indicates that a dangerous voltage constituting a risk of electric shock is present within this unit.

This symbol indicates that there are important operating and maintenance instructions in the literature accompanying this unit.



QUICK START

Whoa, hold on there. Even if you don't read manuals as a matter of principle, at least read this section to avoid hurting yourself or your equipment.

Connect the SAC 23 with the **POWER** *off*. Balanced XLR cables are recommended, but if you must convert to ¼" connectors, consult the RaneNote, "Sound System Interconnection," included with this booklet. *This device uses low impedance balanced line drivers. Do not connect the "+" or "–" output pins to ground, as this may cause the power supply to shut down. For unbalanced use, leave the unused output pin ("+" or "–") unterminated.*

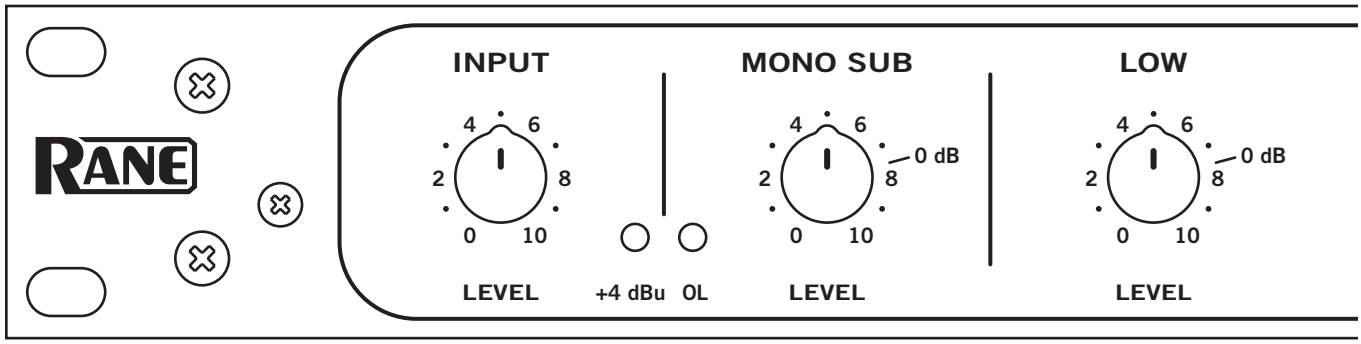
Consult the speaker manufacturers for the correct crossover **FREQUENCY** settings. As rugged as some drivers are, many (especially compression drivers) will not accept frequencies outside of their normal range without producing distortion and possibly self-destruction.

With all equipment turned off and **LEVEL** controls down, begin making connections to the system as shown on page Manual-6. When turning on the system, switch on the power amplifiers *last*. Now, feed the SAC 23 some program material. Start by turning up the **LOW LEVEL, MID LEVEL** and **HIGH LEVEL** to the **0 dB** marks. Slowly increase the **INPUT LEVEL**, even if it goes all the way to **10**, so the **+4 dBu** (green) light blinks occasionally and the **OL** (red) light stays out. This delivers the best signal-to-noise performance.

The **MONO SUB OUTPUT** is a sum of the Left and Right Low Outputs. The **MONO SUB LEVEL** adjusts only this Output and is not affected by the **LOW LEVEL** control. When using a single mono bass bin along with stereo mid- and high-range cabinets, set the **100 Hz FILTER** to **OUT**, allowing the front panel **FREQUENCY** to control the subwoofer crossover point. When used with 3-way cabinets and a subwoofer, set the **100 Hz FILTER** switch to **IN** to allow only frequencies below 100 Hz at this output jack. This way, the SAC 23 almost does the job of a Stereo 4-Way crossover, but without removing that awesome bass from the Left and Right Low Outputs.

WEAR PARTS: This product contains no wear parts.

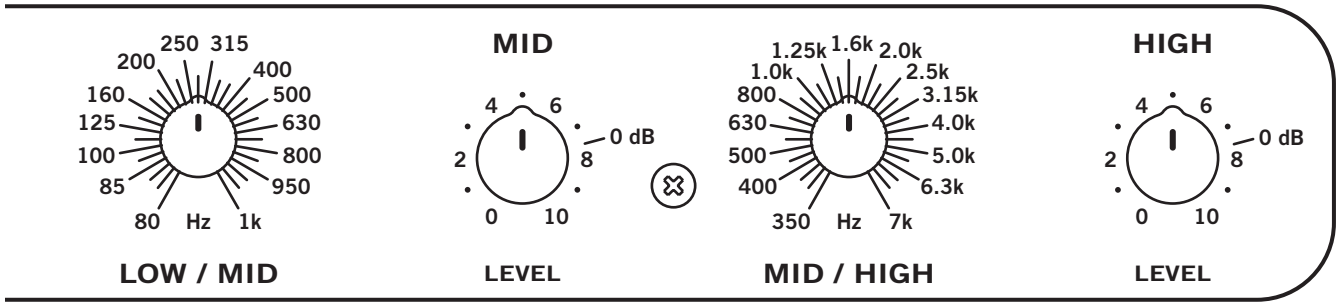
FRONT PANEL DESCRIPTION



INPUT LEVEL control and indicators
This controls the overall level without altering the relative settings of the Low, Mid and High frequency Outputs. Input gain is +6 dB at "10". With signal applied, set this control so the +4 dBu LED lights occasionally, indicating sufficient signal. Flashing of the OL (overload) LED during peaks can be avoided by turning the INPUT LEVEL down.

MONO SUB LEVEL and LOW LEVEL controls
These control the signal levels going to the respective OUTPUT jacks. Unity gain is reached at the "0 dB" mark with the INPUT LEVEL set to "10". The LOW LEVEL control does not affect the MONO SUB LEVEL— they are independent. Refer to Operating Instructions on page Manual-4.

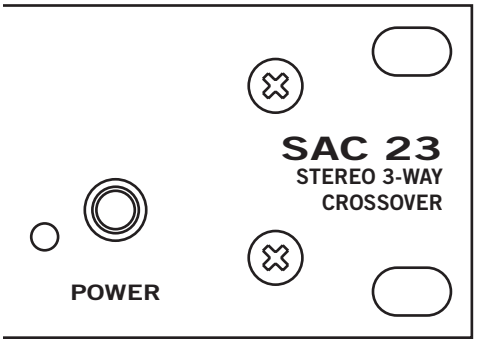
MID & HIGH LEVEL controls
This controls the level of signal going to the HIGH OUTPUT jacks. Unity gain is reached at the "0 dB" mark with the INPUT LEVEL set to "10". Refer to Operating Instructions on page Manual-4.



LOW/MID Frequency control
This 31-position selector sets the crossover frequency between the Low and MId frequency Outputs in both channels. Consult the manufacturer of the drivers or cabinets for the correct setting.

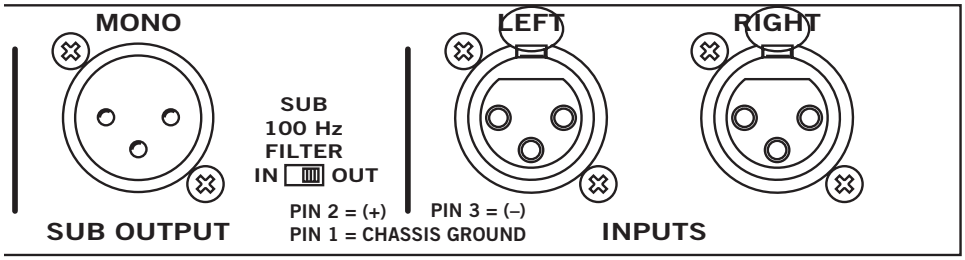
MID/HIGH Frequency control
This 31-position selector sets the crossover frequency between the Mid and High frequency Outputs in both channels. Consult the manufacturer of the drivers or cabinets for the correct setting.

Power ON switch and LED
Your basic, straightforward power switch. When the yellow LED is lit, the SAC 23 is ready to go.



Cable Wiring

In agreement with IEC and AES/ANSI standards, Rane wiring convention is pin 2 Positive (hot), pin 3 Negative (cold or return), and pin 1 signal grounded and chassis grounded (to allow unbalanced operation). The XLR case is chassis grounded. *This device uses low impedance balanced line drivers. Do not connect the "+" or "–" output pins to ground, as this may cause the power supply to shut down. For unbalanced use, leave the unused output pin ("+" or "–") unterminated.*



MONO SUB OUTPUT

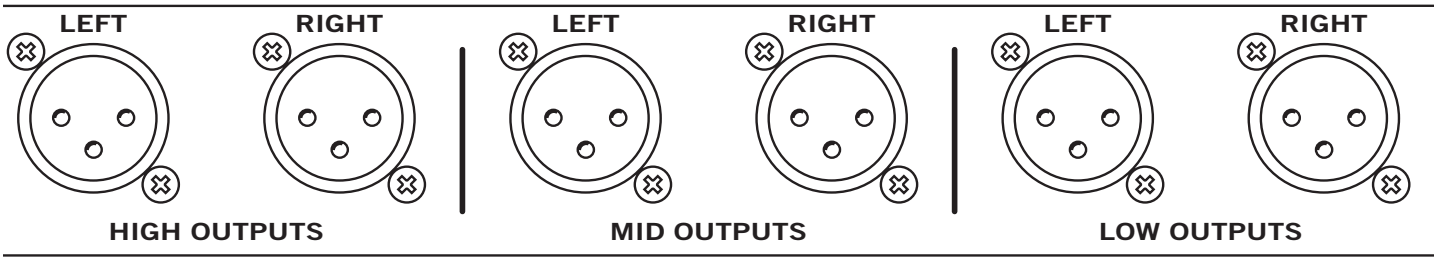
This Output contains the summed signals of the LEFT and RIGHT LOW OUTPUTS. It may be used instead of, or along with the LOW OUTPUTS.

SUB 100 Hz FILTER

Switch the 100 Hz FILTER to IN for best results when using a subwoofer along with the LOW OUTPUTS. This sends only the very lowest frequencies to the subwoofer. With the switch OUT, the MONO SUB OUT still produces the summed LOW OUTPUTS without the 100 Hz FILTER.

INPUTS

These are balanced Inputs. It is best to use balanced lines, most important when connecting cables over 10 feet (3 meters) in length. If you are feeding the SAC 23 from a device that does not have XLR connectors, consult the SOUND SYSTEM INTERCONNECTION section elsewhere in this manual.



HIGH OUTPUTS

These are balanced Output jacks. Connect the LEFT HIGH OUTPUT to the left channel input of the high frequency amplifier, and the RIGHT HIGH OUTPUT to the right channel input of the high frequency amplifier. When using different model amplifiers for the low and high outputs, use the amplifier with the most wattage for the low outputs.

MID OUTPUTS

These are balanced Output jacks. Connect the LEFT MID OUTPUT to the left channel input of the mid frequency amplifier, and the RIGHT MID OUTPUT to the right channel input of the mid frequency amplifier.

LOW OUTPUTS

Connect the LEFT LOW OUTPUT to the left channel of the low frequency amplifier, and the RIGHT LOW OUTPUT to the right channel of the low amplifier. When driving a single subwoofer, use the MONO SUB OUTPUT jack instead and switch the 100 Hz FILTER OUT.

OPERATING INSTRUCTIONS

Selecting Crossover Frequencies

Most speaker manufacturers supply low and/or high frequency cut-off points for each driver, especially if these are supplied in a system. These cut-off frequencies are based on each driver's performance, with a certain safety margin to accommodate more gentle filter roll-offs.

The SAC 23 utilizes 31-position precision DC control voltage potentiometers to select the frequency points. This crossover design assures consistent accuracy from channel-to-channel and unit-to-unit. This is a distinct advantage over continuously variable designs using ganged potentiometers which can yield large variations in channel-to-channel matching. Even with 31 choices it is possible that the exact recommended crossover frequency may not fall on one of the selector detents. Not to panic, for drivers have their own gradual rolloffs and tolerance variations. Just pick the closest one. When in doubt, choose the higher frequency setting.

For best overall system results, try to choose the speaker components so that each operates well within its recommended limits. This provides valuable leeway so that crossover points may be adjusted in order to fine-tune the system. This also yields higher system reliability. If at all possible, always use some kind of realtime analyzer to tune your crossover, and then fine-tune each system with an equalizer. Keep reading for further alignment details.

Setting the Output Level Controls

The INPUT LEVEL is an overall system sensitivity adjustment. Use this control to decrease the overall sensitivity of the entire sound system, including the mono subwoofer if you are using one. You will generally want to start with this control in the full clockwise (or "10") position.

The LOW, MID, HIGH, and MONO SUB OUTPUT LEVEL controls allow you to compensate for sensitivity variations in amplifiers and drivers. Do not use these to adjust overall system sensitivity unless you plan to re-align the system afterward. With these set to the 0 dB mark and the INPUT LEVEL set to 10, the crossover yields no level change from input to output. This is the best gain structure and provides the best signal-to-noise performance.

Crossover Philosophy

Now it gets real fun. The idea is to set the output LEVEL controls on the crossover so that the entire speaker system has a uniform, flat response. Unfortunately, the *room* in which the speakers are placed has a habit of always getting into the act, so things get messy. As a result there seems to be two schools of thought regarding the use of active crossovers.

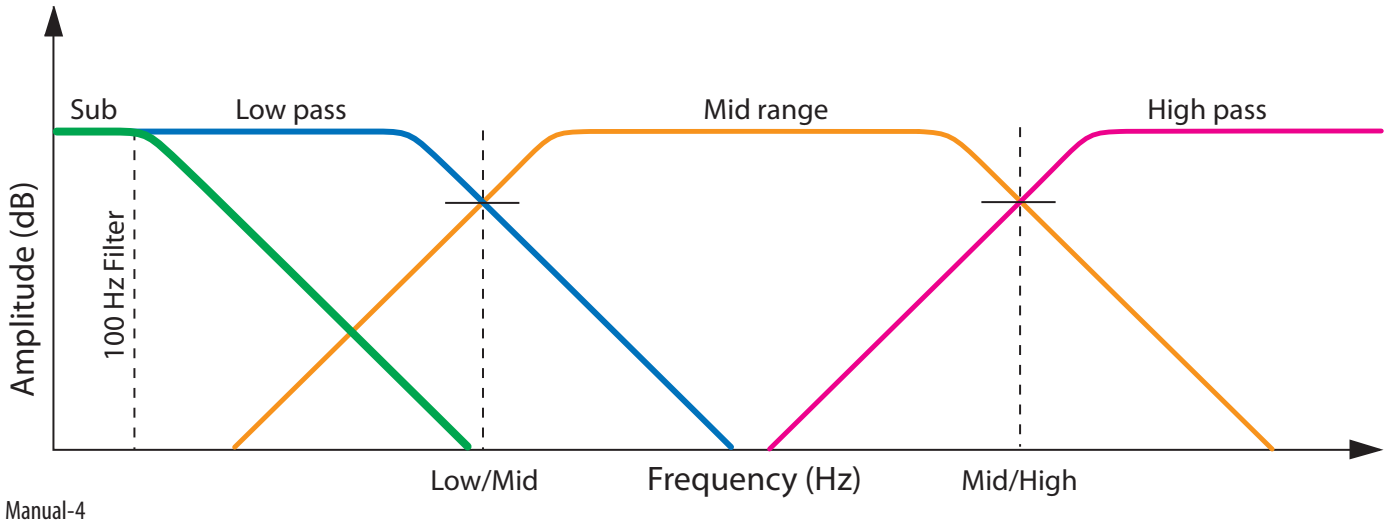
The Set-It-Once-And-Glue-It School

The philosophy here is to use the crossover to flatten system response as much as possible *without* room acoustics involved. This means setting up the system outside (unless you happen to have a *very* large anechoic chamber handy) and with the aid of a real-time analyzer and pink noise source, adjust all of the crossover outputs so that the system is as flat as possible. Once the system is tuned, the crossover is then locked behind a security cover (posted guard is optional) and never again touched. It is then the job of the system *equalizer(s)* to normalize or flatten the response for each different room.

The Fix-It-With-The-Crossover School

Here the crossover knobs get a good workout, for the crossover is used at each location to help flatten the system along with the equalizer.

Regardless of which school you profess, the absolute importance and effectiveness of some kind of realtime analyzer in your system cannot be overstressed! An analyzer saves tremendous amounts of time and provides the absolute consistency, accuracy, and plain old good sound that very few ears on this earth can deliver. They are affordable, easy to use and amazingly effective. You owe it to yourself and your audience to at least look into one of today's cost-effective analyzers—you'll wonder how you managed at all without one.



Setting Levels With a Realtime Analyzer

1. Set the INPUT LEVEL as described previously on page Manual-2, and the LOW, MID, and HIGH LEVEL controls to minimum; leave the FREQUENCY controls as set previously.
2. Place the analyzer microphone at least 15 feet (5 meters) away from the speaker stack, on axis (dead ahead) and about chest level. Minimize any background noise (fans, air conditioners, traffic, wild animals, etc.) that could affect readings.
3. Run pink noise through the system, either through a mixer channel or directly into the crossover. Turn all amplifier controls at least half way up.
4. Slowly turn up the LOW LEVEL control until you hear a healthy level of noise through the low frequency drivers (it should sound like rumble).
4. Adjust the display controls on the analyzer so that it shows the greatest number of 0 dB LED's (green on Rane equipment) below the crossover frequency.
6. Now slowly turn up the MID LEVEL control until the display shows the same high frequency output level average as the low frequency section.
7. Repeat this procedure for all crossover frequency sections, lowest to highest, so the end result is as flat response as possible on the analyzer display near each crossover point.

IMPORTANT: Compression driver or horn high frequency roll-off, bass roll-off, and room acoustics usually cannot be corrected by the crossover.

If, for example, you are adjusting the HIGH LEVEL control and observe a decline in frequency response somewhat above the Crossover point, then set the HIGH LEVEL control for equal display level near the crossover point and leave it there. Use an equalizer to correct the roll-off problem.

If you are tuning the system in a room, the acoustics will greatly influence the system response, as shown by the analyzer.

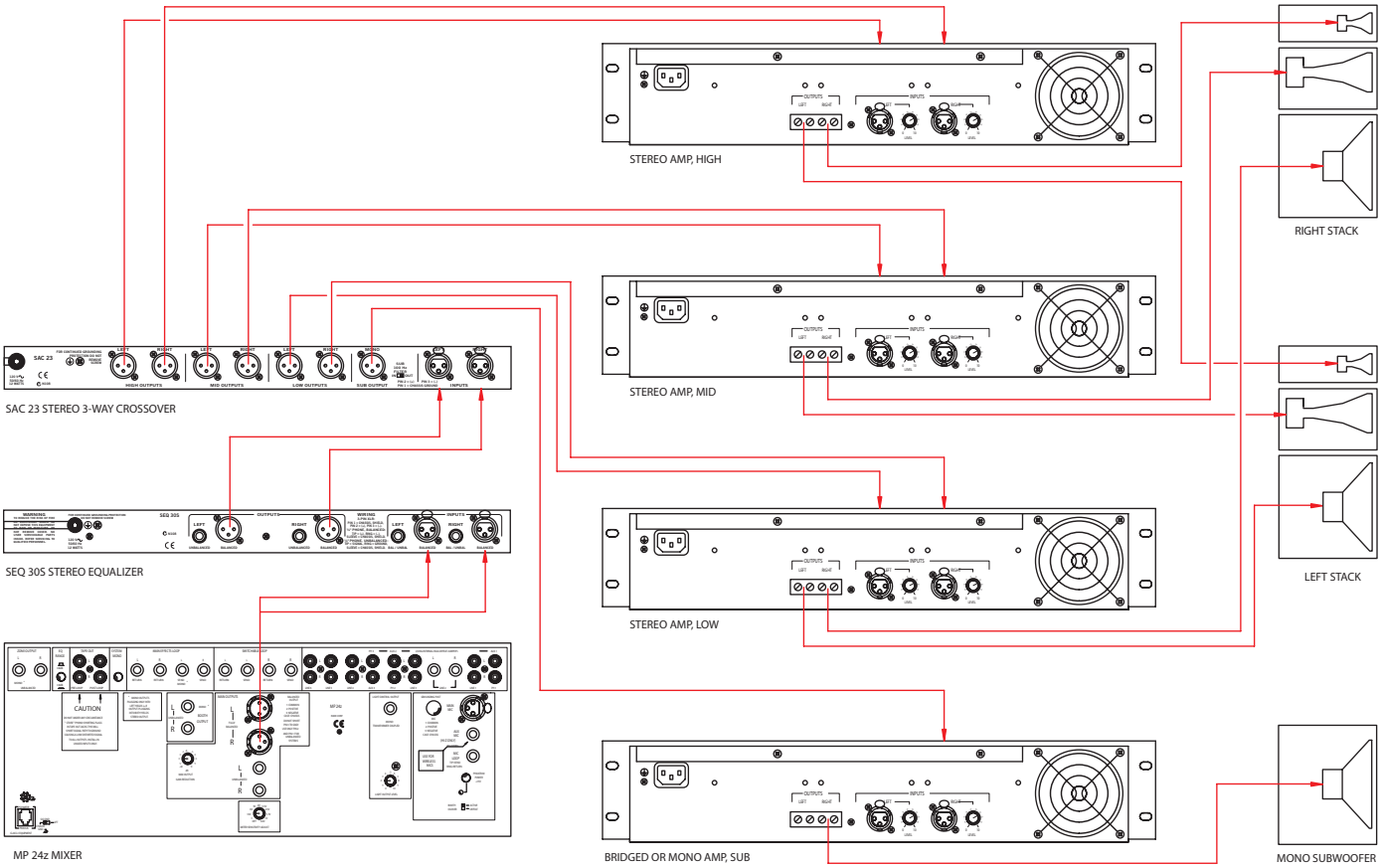
Move the microphone and check the analyzer system response at several other locations. Adjust the crossover to reach a fixed compromise setting as necessary. If you plan to use the analyzer only once to set the crossover, set up the speaker system in a quiet place *outside* or in a very large concert theater, and run pink noise at low levels with closer microphone placement to keep the room acoustics out of the picture as much as possible.

Setting Levels With an SPL Meter & Pink Noise Generator

1. Run pink noise into the crossover Inputs (through the mixer or directly, as is convenient).
2. Make sure all crossover LEVEL(s) are turned all the way down and all amplifier level controls are at least half way up to start with.
3. Turn the crossover INPUT LEVEL all the way up. Place the SPL meter at least 15 feet from the speaker stack and about chest high. Once positioned, make sure that the SPL meter remains in the *exact* same location for the rest of the procedure. Minimize all background noise (fans, air conditioners, traffic, wild animals, etc.) to get accurate readings. Set the SPL meter to "C-weighting" and "slow" if those switches are present.
4. Slowly turn the LOW LEVEL up until there is a healthy rumble coming from the bass speakers. Adjust the SPL meter and/or LOW LEVEL until you get a 0 dB reading on the meter. *After this point do not change the controls on the SPL meter.*
5. Make a note of the LOW LEVEL control setting at the 0 dB adjustment just obtained, then reduce the LOW LEVEL to "0" so that the pink noise disappears from the bass speakers (revel in the silence...).
6. Now slowly turn up the MID LEVEL control so that pink noise is heard from the high frequency speakers. Without changing any settings on the SPL meter, adjust the crossover MID LEVEL control until you obtain a 0 dB reading on the SPL meter.
7. Turn down the MID LEVEL and repeat this process for the HIGH LEVEL. Return the LOW and MID LEVELS to the previously recorded settings. Now all drivers are set at the same level. Make any overall level adjustments with the INPUT LEVEL controls and leave the output LOW, MID and HIGH LEVEL controls unchanged.

It is possible to turn one of the frequency section output LEVEL controls all the way up and still not have enough volume for a 0 dB reading (as determined by previous section levels). This is probably due to different sensitivities of amps, speakers and other level controls in the system. When this happens, re-set the SPL meter so that it reads 0 dB on this frequency section (you may have to "down range" the meter and re-adjust the crossover INPUT LEVEL control). Now go back and re-adjust the previous crossover LEVEL controls, turning these down to get a 0 dB reading on the meter.

APPLICATION — Active 3-Way with (or without) Mono Sub



Connect as shown for a mono subwoofer. Set the SUB 100 Hz FILTER switch to the IN position. If a mono subwoofer is not used, the FILTER switch setting will not matter. The front panel LOW/MID Frequency control determines the frequency division between the low and mid drivers. LEFT and RIGHT LOW summed frequencies below 100 Hz are additionally sent to the mono subwoofer.