

## 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 22 with the power *off*. Balanced XLR cables are recommended, but if you must convert to 1/4" connectors, buy or make a cable like the ones on page Manual-11 and keep them as short as possible. *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 manufacturer for the correct crossover **FREQUENCY** setting. 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-4 or 5. When turning on the system, switch on the power amplifiers *last*. Now, feed the SAC 22 some program material. Start by turning up the **LOW 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 subwoofer along with full-range cabinets that have internal crossovers, set the **100 Hz FILTER** to **OUT**, allowing the front panel **FREQUENCY** to control the subwoofer crossover point. When used with biamp 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 22 almost does the job of a Stereo 3-Way crossover, but without removing that awesome bass from the Left and Right Low Outputs.

# 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:

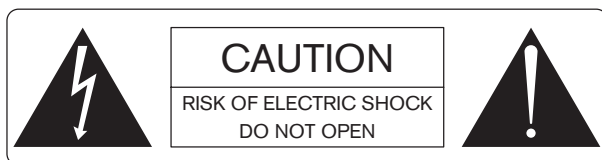
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**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.

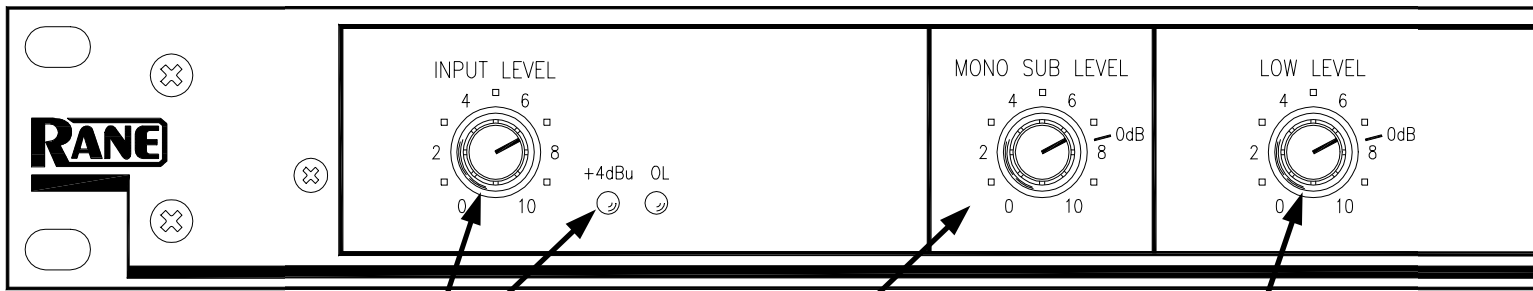
The symbols shown below are internationally accepted symbols that warn of potential hazards with electrical products.



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.



### INPUT LEVEL control and indicators

This controls the overall level without altering the relative settings of the Low 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 OUTPUT LEVEL control

This controls the level of the summed signals of the LEFT and RIGHT LOW OUTPUTS. It may be used instead of, or along with the LOW OUTPUTS. The output may be adjusted with the LEVEL trim from +0 dB to OFF. Unity gain is reached at the "0 dB" mark with the INPUT LEVEL set to "10".

### LOW LEVEL control

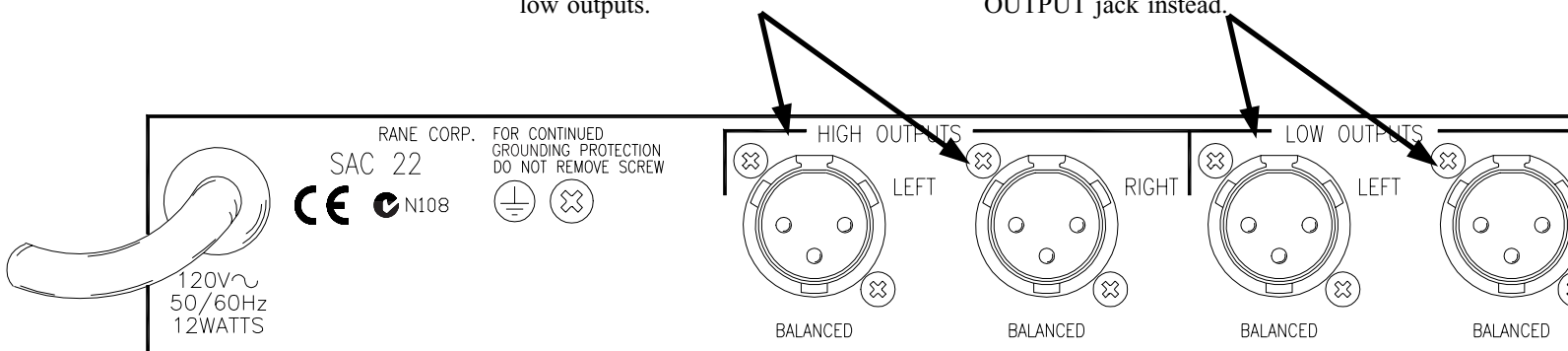
This controls the level of signal going to the LOW OUTPUT jacks. Unity gain is reached at the "0 dB" mark with the INPUT LEVEL set to "10". This control does not affect the MONO SUB OUTPUT level. Refer to Operating Instructions on page Manual-6.

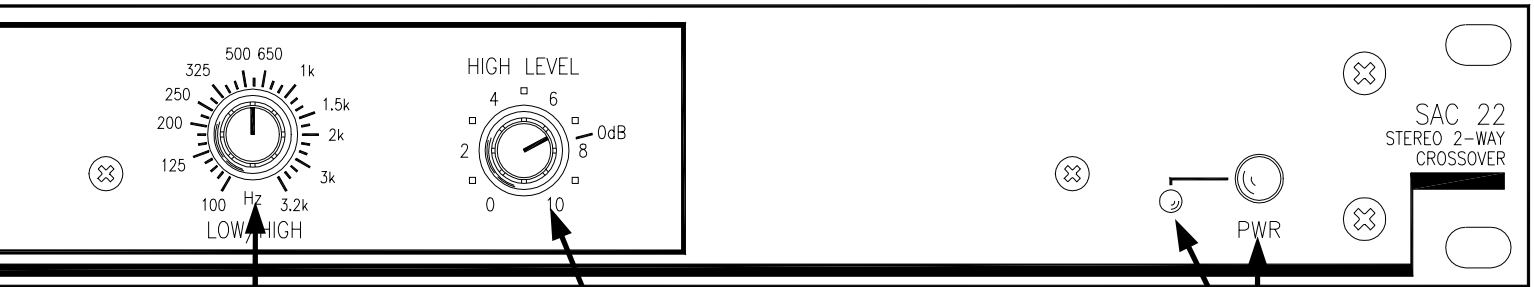
### HIGH OUTPUTS

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 power for the low outputs.

### 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.





**LOW/HIGH FREQUENCY control**

This 31-position selector sets the crossover frequency between the Low and High frequency Outputs in both Channels. Consult the manufacturer of the drivers or cabinets for the correct setting.

**HIGH LEVEL control**

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-6.

**Power ON switch and LED**

Your basic, straightforward power switch. When the yellow LED is lit, the SAC 22 is ready to go.

**MONO SUB OUTPUT and 100 Hz FILTER switch**

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.

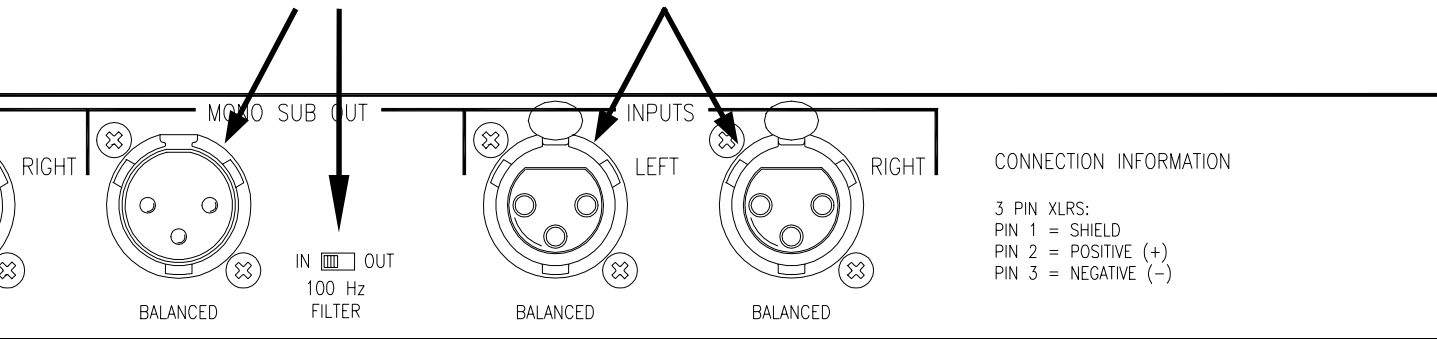
Switch the 100 Hz FILTER to IN for best results when using a subwoofer along with the LOW OUTPUTS. This sends only the very lowest frequencies to the subwoofer. With the switch OUT, the MONO SUB OUT still produces the summed LOW OUTPUTS without the 100 Hz FILTER.

**INPUTS**

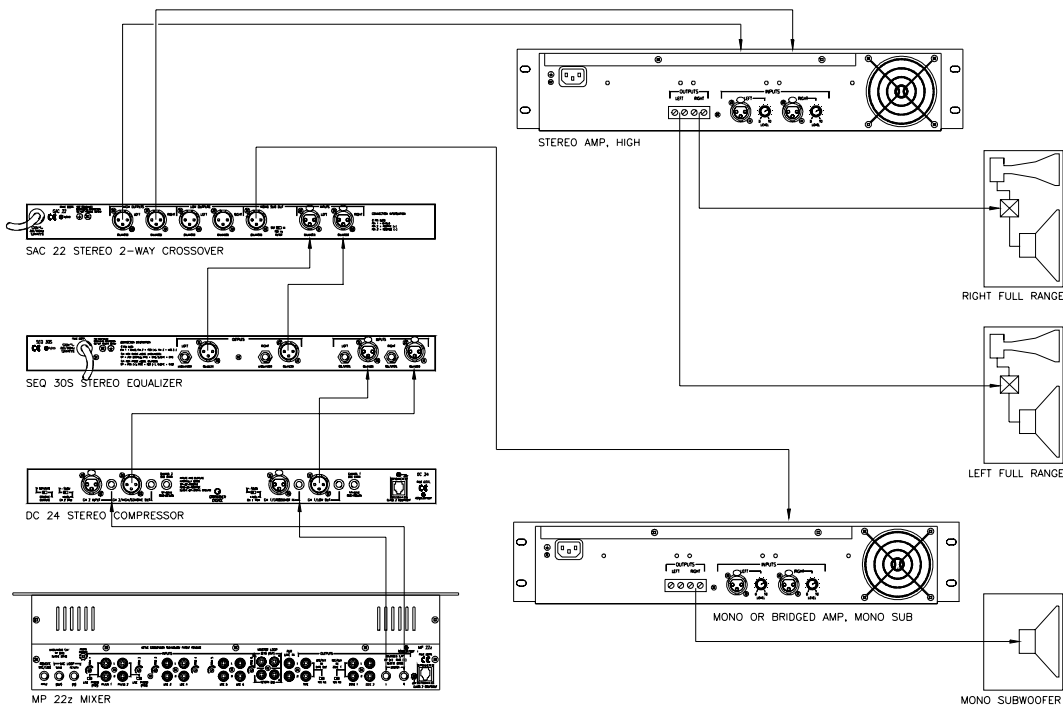
These are balanced Inputs. It is best to use balanced lines, especially when connecting cables over 10 feet in length. If you are feeding the SAC 22 from a device that does not have balanced XLR connectors, consult SOUND SYSTEM INTERCONNECTION on page Manual-10.

**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). *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.*

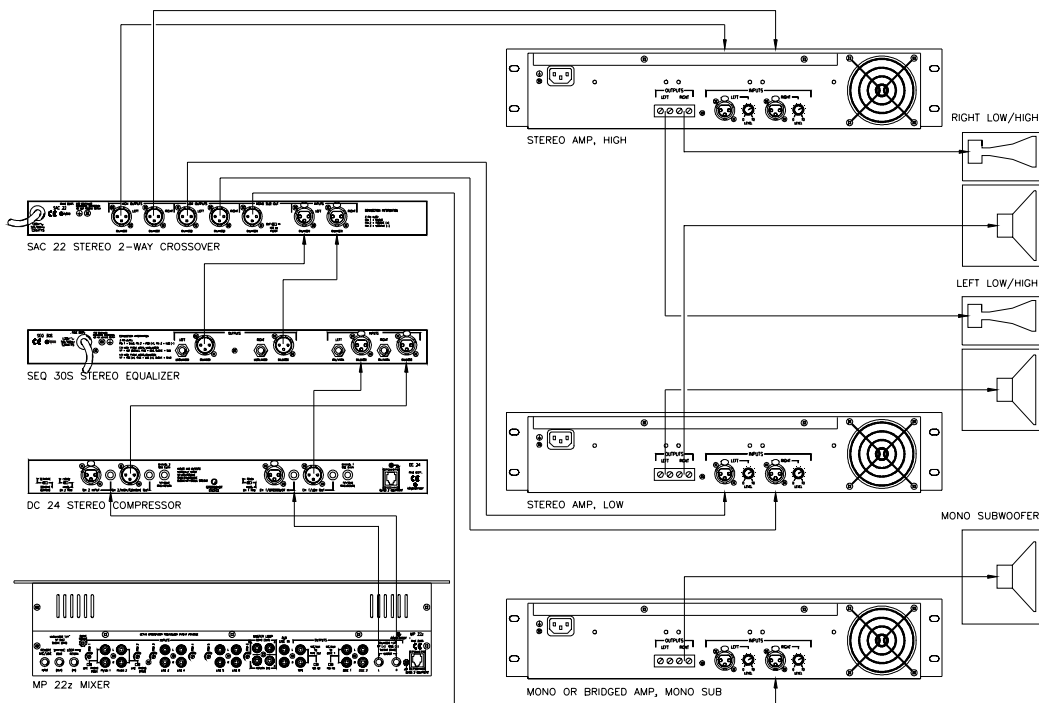


## APPLICATION — PASSIVE 2-WAY WITH MONO SUB



Use this configuration if you have full-range cabinets with passive crossovers built-in, i.e., no separate speaker inputs for the low and high drivers. Connect as shown for a mono subwoofer. Set the 100 Hz FILTER switch to the OUT position. The front panel LOW/HIGH frequency control determines the frequency division between the main cabinets and the mono subwoofer.

## APPLICATION — ACTIVE 2-WAY WITH (or without) MONO SUB



Use this configuration if you have separate speaker inputs for the low and high drivers, regardless of whether they are in the same or different cabinets. Connect as shown for a mono subwoofer. Set the 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/HIGH FREQUENCY control determines the frequency division between the high and low drivers, and the subwoofer also receives the low frequencies below 100 Hz.

# 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 22 utilizes a 31-position precision DC control voltage potentiometer to select the LOW/HIGH FREQUENCY point. This crossover circuit 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 detents on the selector. 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.

The illustration and table below details the crossover frequencies available on the detents that are not labeled. 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.

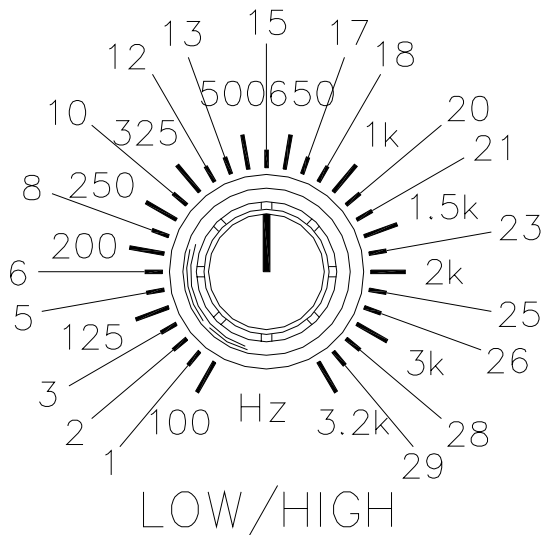


Figure 1. See unmarked Frequency detent steps below.

STEP	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
SILK SCREEN	100				125			200		250			325			500		650			1000			1500			2000			3000		3200
CALC. FREQ.	100	100	100	107	123	141	162	187	214	246	283	325	373	429	492	566	650	746	857	985	1131	1300	1493	1715	1970	2263	2599	2986	3200	3200	3200	

Figure 2. Frequency detent table with actual frequencies of all detent steps.

## 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 LEVEL, HIGH LEVEL 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 realtime 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 the Mono Sub Output Level

Begin with the MONO SUB OUTPUT LEVEL control set at MAX. The LOW LEVEL control has no effect on the MONO SUB OUTPUT. Make subwoofer level changes with either the MONO SUB OUTPUT LEVEL or with the amplifier level control. If you are using the MONO SUB OUTPUT *instead of* the LOW OUTPUTS, be sure the 100 Hz FILTER is switched OUT.

## Setting Levels With a Realtime Analyzer

Any good 1/3-octave realtime analyzer will do, however, Rane makes a rather inexpensive yet accurate one—the RA 27. We had to get our plug in.

1. Set the INPUT LEVEL as described previously on page Manual-2, and the LOW and HIGH LEVEL controls to minimum; leave the FREQUENCY control as it was set previously.
2. Place the analyzer microphone at least 15 feet 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 HIGH LEVEL control until the display shows the same high frequency output level average as the low frequency section.

*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 FREQUENCY 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 Using an SPL Meter and Pink Noise Generator

First, obtain a good SPL meter from a local electronics or hi-fi store. Second, and perhaps a little trickier, get a pink noise generator—again try electronics stores. You may also use a sweep or tone generator in place of a pink noise source—be sure to look at several different tones within each crossover section to get a good average of driver response.

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 HIGH LEVEL control so that pink noise is heard from the high frequency speakers. Without changing any settings on the SPL meter, adjust the crossover HIGH LEVEL control until you obtain a 0 dB reading on the SPL meter.
7. Return the LOW LEVEL to the previously recorded setting. Now the low and high speakers are set at the same level. The crossover should now be aligned. Make any overall level adjustments with the INPUT LEVEL controls and leave the output LOW and HIGH LEVEL controls unchanged.

It is possible that you may 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.