

Operating Manual

R-130

One-Third Octave
Precision Real Time Spectrum Analyzer

AudioControl®

making good stereo sound better

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CONGRATULATIONS!

You now own one of the most useful and informative frequency analysis devices ever available to the music lover. The R-130's one-third octave configuration lets you see - actually look at - sound more precisely than ever before. Now you can see what you hear. The R-130 will help you get more out of your speakers and your listening room than you thought possible.

For example, now you will be able to change the speaker placement and not only hear the difference but see which frequencies are affected and by how much. You will be able to see how moving furniture in the room acts as a mechanical, acoustical equalizer changing the sound, not always for the better. With the R-130 you can meticulously adjust a high quality one-third octave equalizer, like the AudioControl C-131, to combat the mechanical equalizer effects of room acoustics. And you can check the frequency response of individual components such as tape decks and compact disk players quite easily.

In brief, the R-130 can help you achieve extraordinary sound quality and the sheer pleasure of high end musical systems.

Clearly, these are strong promises. We believe they can be made by AudioControl alone: The only consumer electronics company in the world that specializes in equalizers and spectrum analyzers. And the company whose professional sound division, AudioControl Industrial, manufactures and sells the most popular real time spectrum analyzer in the world, the SA-3050A.

Since 1978, AudioControl has been committed to this specialized area of the audio world. Our passion for high quality, meticulous attention to detail, and our professional sound heritage shows itself in the dozens of awards we have won for our designs, products, service and quality. However, our greatest satisfaction is our reputation for

sonic excellence and reliability with people like you throughout the world.

Today you own a real time spectrum analyzer which is the climax of all that we have learned from years of making and selling spectrum analyzers in the no nonsense world of touring bands, recording studios, and presidential press conferences, which is the world of pro sound. The R-130 is hand crafted in very limited quantities by an elite team of AudioControl's most experienced and meticulous personnel using the finest individual components. These include special custom made filter capacitors, a fully regulated power supply, blindingly fast operational amplifiers, and a custom calibrated microphone.

What follows is a lengthy and occasionally rambling discourse on what is the R-130, how to apply its fantastic abilities, and some information on room acoustics. We hope that you will read it thoroughly. Let the fun begin.

R-130 HIGHLIGHTS

Filter Design

At the heart of any real time spectrum analyzer (and for that matter any equalizer) is filters. The whole point of a spectrum analyzer is to show the user what is happening at a specific bandwidth or frequency range. We want that individual column of lights to show what is happening at the specified frequencies and have the reading not be affected by the bands on either side. You can think of bandpass filters in the R-130 as windows or slots that only let certain sound frequencies through and stop all the others. Equalizers are very similar except the filters correct the sound rather than drive a display.

At AudioControl, we spend our lives working on making better filters since virtually every product we craft includes at least half a dozen. The filters in the R-130 are painstaking designed and manufactured using the latest

computer techniques and custom capacitors made precisely to our specifications. It is a lot of work but, as you will see, the results are worth it.

Multiple Display Options

The R-130 can display on its LED screen a variety of different signal sources in a multitude of ways. It can display music or test tones played through your stereo system; both channels together or each channel individually. Or it can display what a microphone is picking up including your dog's attempt to sing Jingle Bells. The display can have a wide or narrow range, a fast or slow speed, and be in a dot graph or a column bar mode. With increasing experience, you will acquire the ability to SEE the difference in speaker placement and other subtle musical cues. Even when you are not using the R-130 for these important tasks, in the background it makes a fine light show guaranteed to make the neighbors jealous.

Calibrated Microphone

Included with the R-130 is an AudioControl calibrated microphone with uncannily flat response like that of laboratory microphones costing many times more (believe us we own a few and good computers cost far less). This microphone has a funny shape on the business end to lessen any diffraction problems and a long cord so you can easily stretch it from your system to the favorite listening position. To be honest, this microphone is a close cousin to the famous CM-10 that is part of the AudioControl Industrial professional (and more expensive) SA-3050A real time spectrum analyzer. The microphone is a precision back electret condenser microphone with a 1/4" element. Like any precision instrument, handle the microphone with care and use this mike, and only this mike, with the R-130.

*Note: Only use
the supplied
AudioControl
microphone with the
R-130 analyzer*

IMPORTANT INITIAL STEPS

FILL OUT and mail the WARRANTY CARD that came with your R-130. Also, *save the sales slip or invoice* from the store where you bought your R-130. This is extremely important for determining when your warranty coverage began — and also for insurance purposes if (perish the thought) someone appropriates your audio system some dark night when you're vacationing in Tahiti, or if a stray fireplace spark ignites your rare collection of Otto Klemperer 8-tracks.

Also, save the packing box, plastic bag and foam blocks which were used to pack the R-130. Should your equalizer ever need service, it is important that the unit be returned in the original packing.

QUICK HOOK-UP INFORMATION FOR THE IMPATIENT

Since sometimes the best way to learn is just to get started, we have provided fundamental hook-up information first. This is a product with some basic functions but also certain quite advanced capabilities. We urge you to make this manual bedside reading so you completely understand all the wondrous things it can do.

The R-130 may be connected in two different spots and by two different methods:

You can connect it 1) in a Tape Monitor/External Processor loop (the preferred method), or 2) between your preamplifier and power amplifier (see figures 1 and 2). If you choose method 2, be careful when injecting the pink noise as you will need to turn down the level since you are now putting a signal to the amplifier AFTER the volume control.

You can use either conventional "RCA" -type interconnects or balanced XLR connectors in any combination.

Quick Hook-Up Instructions

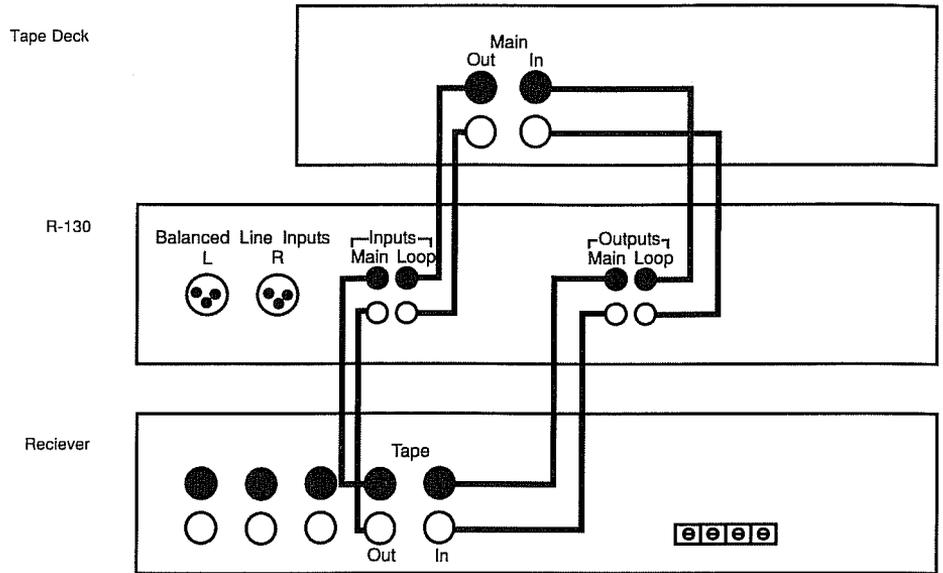


Figure 1.
Tape loop connection

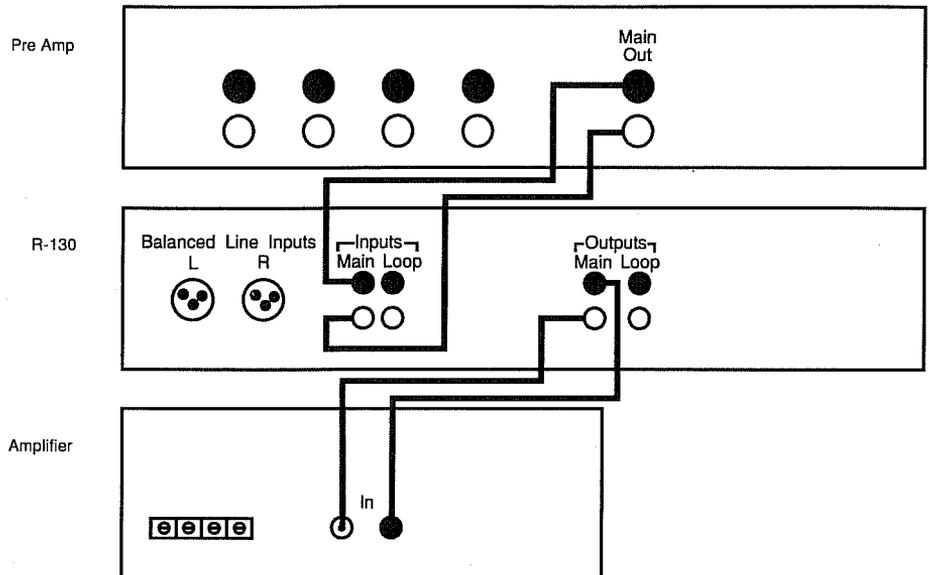
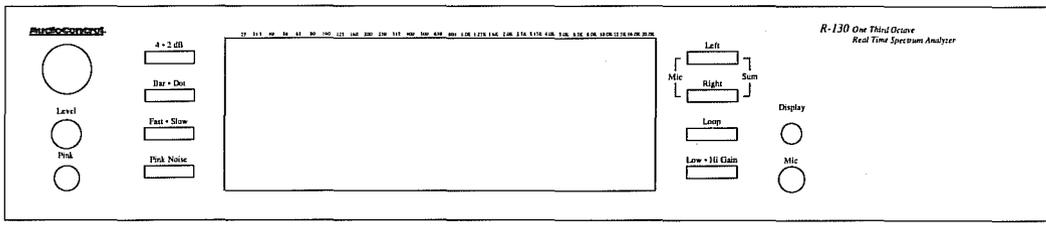


Figure 2.
Preamp connection

After the R-130 connections are complete, you are ready to start analysis (with apologies to Mr. Freud). The process is basically to use the pink noise generator in the R-130 to play pink noise out of your speakers and put the calibrated microphone in your normal listening position. Since the pink noise itself would show as a flat line, though jittering somewhat due to its random character, any deviation from this line is from the components and acoustics between the pink noise source and the microphone. We suggest you read the later section for a more detailed discussion of this process.

FEATURES OF THE R-130

A Tour of the Front Panel



The R-130 is designed so that once you have the signal controls connected on the rear of the unit all analysis and other test work may be carried out using the controls on the front. Starting from the left here is an explanation of those front controls.

Figure 3
R-130 Front Panel

Power. The big round button must be pushed in to turn on the R-130. If some signal is present, you should immediately see a display on the LED screen. If not check connections and, as a last, resort check the fuse on the back of the unit.

Pink Noise Output and Level. There are two pink noise outputs on the R-130. The one on the front of the unit (a headphone type jack for 2 channel output) is always on.

The second output is fed pink noise when the button so labeled on the lower left of the unit is pressed in. This second output is the main output on the back and feeds monophonic pink noise into your preamplifier or amplifier for system and room analysis. Volume of the pink noise is controlled for both these outputs by the conical knob also on the lower left of the front panel. Always start any procedure with the pink noise volume turned down.

Decibels per Step. On the left of the display window are a column of control buttons, the top of which is the decibels or dB per step control. Pressing this control changes the real time display from 2 dB per LED to 4 dB per LED. The 4 dB settings probably will be the one you use most often as this shows the largest dynamic range on the display. Use the 4 dB setting for program (music) monitoring. The 2 dB setting gives a finer resolution for precise measurements or equalizer settings.

Bar and Dot. The R-130 display can either be a dot mode that looks like line graph with 30 dots or a full column bar display. In the bar display mode, all the LEDs under the highest one are illuminated and in this mode, the R-130 may help light a darkened room.

Display Speed. If you are using the R-130 to view music the fast speed is the best as it shows you what your ears hear. However for room analysis using pink noise, you will find the slow speed more helpful since this speed now dampens the randomness of the pink noise.

Pink Noise On/Off. The last button in the left column we have already discussed above when explaining the pink noise jack.

RTA Display. The display window is a LED matrix of 300 LEDs carefully selected for their brightness, shape, speed, and shade. In each of the 30 one-third octave columns there are 10 LEDs. This means at 4 dB per step the range is a total of 40 dB.

Channel Display Options. To the right of the display window is a second column of control buttons. The top two define what signal is being displayed on the screen. It is possible to display both left and right channels together, the left channel alone, the right channel alone, or the microphone only. See the chart at right.

One nifty use for these controls is that when doing a room analysis, you can toggle between the test tone source on one or both of the channels and the microphone to see the difference.

Loop In/Out. Since the R-130 may be occupying a precious tape or external processor loop, this button controls the addition of another such loop to replace the one the R-130 uses. In other words, you can plug something like an equalizer into the back of the R-130 as shown in Figure 2.

Low/High Gain. Use the low gain setting if the R-130 is connected in the "loop" configuration and, most likely, the high setting if the R-130 is between the preamplifier and the amplifier. The high/low here refers to the signal level of the input signal to the R-130.

Level. The conical level knob controls the display level allowing you to center or adjust the display within the RTA window.

Microphone Input. First, NEVER use any other microphone than the official AudioControl R-130 calibrated microphone in this jack. It is possible that you will damage another microphone by connecting it into this receptacle.

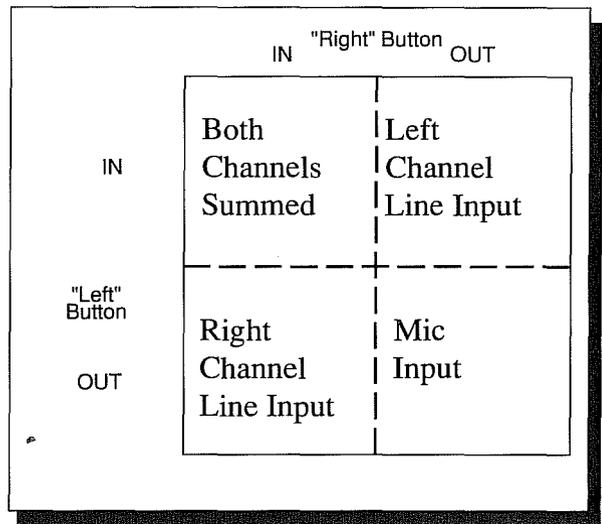


Figure 4
Display Options

The Back Panel of the R-130

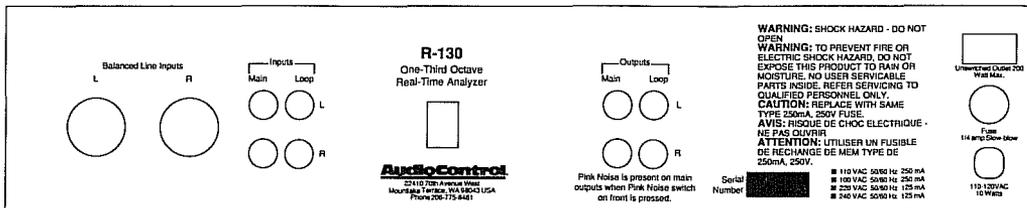


Figure 5
R-130 Rear Panel

Looking at the rear panel of the R-130 and starting at the left side are the balanced, XLR type inputs. Next to these on the right are RCA jack inputs for both line inputs and the "tape loop" inputs.

Similarly, the related outputs are farther to the right. Pink noise is fed to the main outputs when that button is in on the front panel. If you use balanced inputs, you can use the RCA type main outputs without any problems.

The power outlet on the lower right is unswitched but can effectively become switched if you plug the R-130 into the switched outlet on another unit. Be careful to observe and follow the maximum power rating on the switched outlet though.

At the far right of the back panel, is the power cord and the fuse holder. If it is necessary to replace the fuse, look on the panel for the correct type and value and **ONLY** replace the fuse with this one.

Calibrated Microphone

The supplied microphone with the R-130 is a phantom powered, precision back electret, condenser type. The connection is unbalanced and the phantom powering is supplied within the R-130. The microphone has a very flat response and is painstakingly designed to give the very best possible results with the R-130. Do not use any other microphone with this unit other than the official

AudioControl microphone as they may be damaged and most likely will not give proper readings.

The microphone comes with a non removable 20 foot cord that should be sufficient for most circumstances. If you wish a longer cord, you can add another 1/4" type microphone cord commonly available at music stores to the male end. We do not recommend a total cord length over 50 feet.

INSTALLATION; THE LONG VERSION

Placement

The R-130 has distinctive and attractive styling and looks quite good with a stack of product. Being proud parents like we are, we think it looks the best stacked with a pair (or more) of its sibling, the C-131 one-third octave, constant Q precision equalizer. However you stack it, make sure not to block the ventilation slots on any components and avoid placing the R-130 directly over a beefy power amplifier that gets hot, particularly if you have one of those tube amplifiers that some people use to heat their house.

Power Connection

The R-130 draws only eighteen watts and thereby can be connected to the switched AC outlet of any preamplifier or receiver. By the same token, its low power draw means that you can actually leave it on continuously if you have other equipment that is also left on.

General Connection Tips

Although we assume a general level of sophistication in any owner who has acquired an instrument such as the R-130 one-third octave real time spectrum analyzer, the following tips can never be repeated too many times.

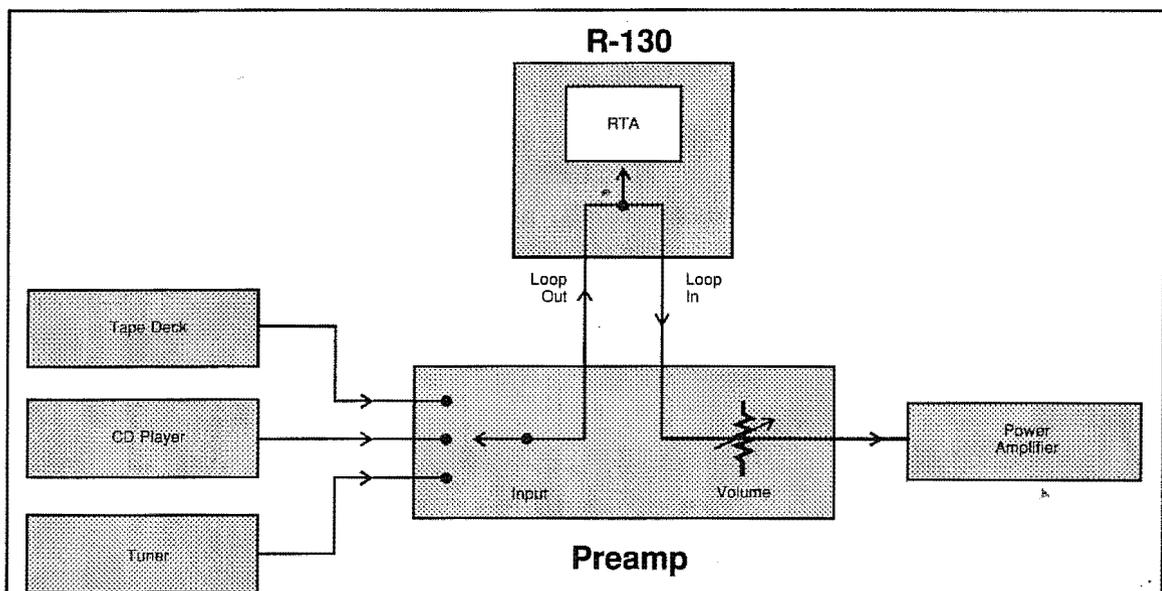
- ☞ Turn off all components before making any connections.

- ☞ If using the R-130's conventional "RCA" input/output sockets, make sure that "left is hooked to left and right is hooked to right" at each connection. The obvious and time honored way to assure this is to assign one hook-up cord plug color to left and the other to right. Generally, Red signifies Right and White, Grey or Black then represents left.

- ☞ Whenever possible, keep power cords away from signal cables (inputs from CD player, tape deck, etc.) to prevent hum (which is not a problem with balanced connections). This is especially important for turntable cables that carry very weak signals. While hum is less of a problem today than it was in the past, noise can still find its way into your system if a component's power cord becomes too intimately wrapped up with a hook-up cable. The R-130's power cord is on the right side of the chassis (when viewed from the posterior). This allows you to bundle all the power cords and keep them separate from signal connections.

- ☞ Types of interconnects There are many different grades of hook-up cables. Some cost as much as \$100 per meter (we hear rumors of some costing more). Whether or not you use "audiophile" interconnects is your choice and depends upon your preference, your ability to discern

minute differences and whether you have the R-130 hooked up in a dead end or through type connection. However, avoid really CHEAP connection cables as they can sometimes disconnect themselves internally causing a loss of signal or hum problems. So, before you send the R-130, or any other components for that matter, in for service, swap hook-up cables to see if they are the culprit.

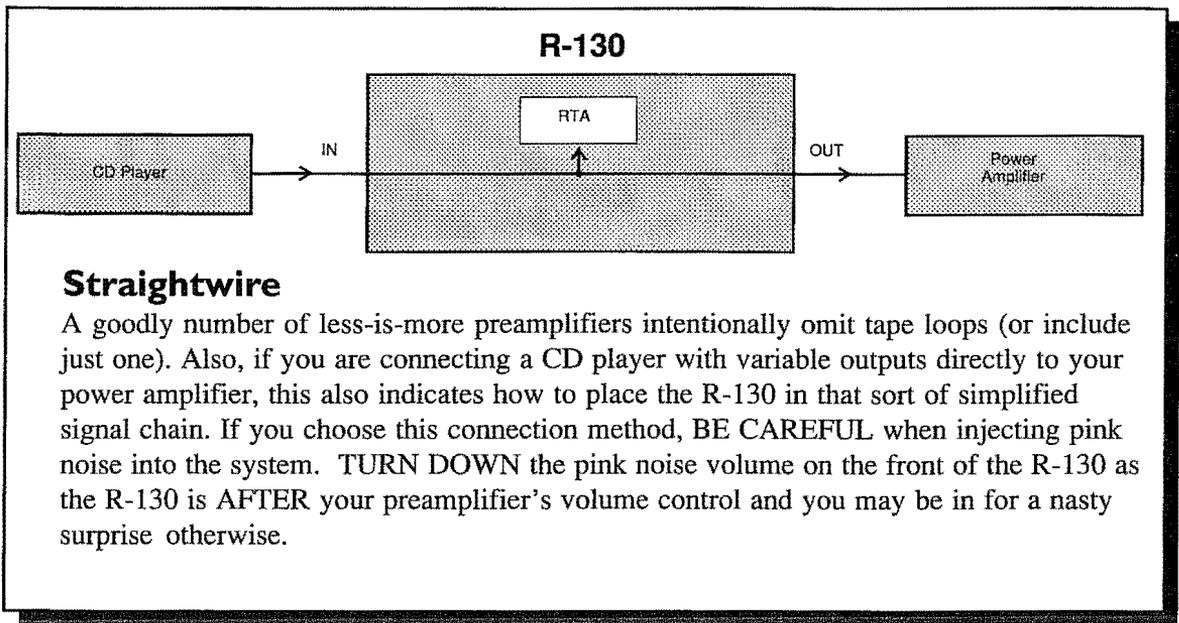


Loop Installation

If your preamplifier has an unused tape monitor loop or dedicated external processor loop, the R-130 may be connected as shown above. Connecting the R-130 in this type of loop is the **PREFERRED** method of connection.

If you own the marvelous C-131 one-third octave, constant Q precision equalizer, you can easily connect the R-130 by using the special output of the C-131.

Installation - Preamp Connection



Straightwire

A goodly number of less-is-more preamplifiers intentionally omit tape loops (or include just one). Also, if you are connecting a CD player with variable outputs directly to your power amplifier, this also indicates how to place the R-130 in that sort of simplified signal chain. If you choose this connection method, **BE CAREFUL** when injecting pink noise into the system. **TURN DOWN** the pink noise volume on the front of the R-130 as the R-130 is **AFTER** your preamplifier's volume control and you may be in for a nasty surprise otherwise.

A Primer on Room Acoustics

Magazine reviewers and owners spend much time critically appraising speakers and other stereo components. Unfortunately, a very large effect upon sound is not so easily judged or changed and that is the acoustics of the environment in which you are listening. Room acoustics is a complicated subject. What we want to do here is point out a few basics and refer you to other sources if you want more detailed information.

Sound is waves, as you probably learned in junior high school. Waves like those on a pond hit each other and get bigger (reinforce) or smaller (cancel). Since sound is energy, the way it reflects depends upon the *angle* of the surface and the *type* of reflecting material and the *frequency* of the wave (among other things, but this is getting complicated enough this fast). Because some sound has more energy than others and may reflect better, some

sounds last longer in a room. Also, some sounds are a more important concern because they create standing waves at certain frequencies i.e. that is a reflection pattern than causes a stationary pattern of sound pressure levels.

Different frequencies of sound have different wave lengths and create acoustical effects in different ways. The wave-length is a function of the frequency and the speed of sound. The table here gives you the equation for sound in air (the speed is different in other things, like water for example) and wave lengths at a number of frequencies. As you can see, wave lengths go from under an inch (2 centimeters) to over 50 feet (15 meters)!

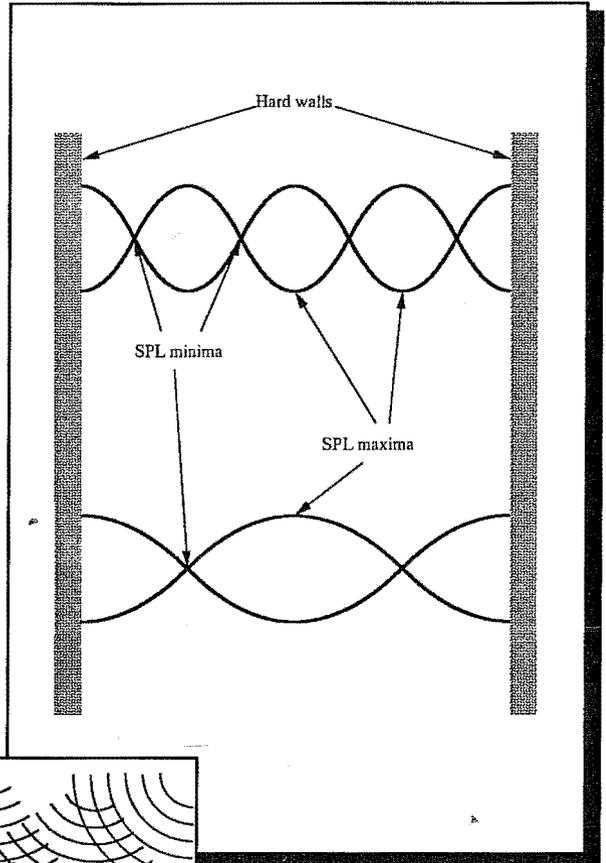


Figure 6 -
Standing waves between two parallel surfaces

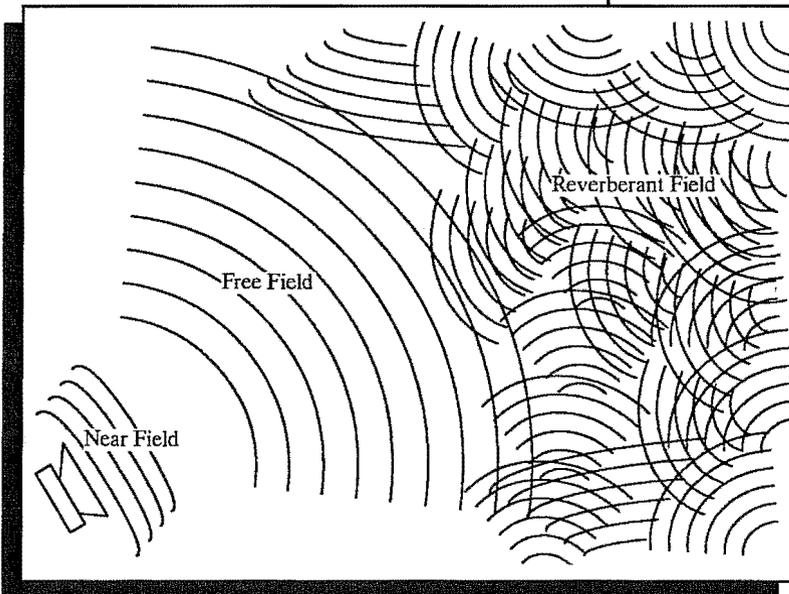


Figure 7 -
Sound fields

Wave Lengths of Sound in Air

$$\text{Wave length (in feet)} = \frac{1120 \text{ (feet per second)}}{\text{frequency (cycles per second)}}$$

Speed of Sound in Air = 1120 fps

Frequency in Hertz	Wave length in feet
20	56
25	44.8
30	37.3
40	28
50	22.4
80	14
120	9.3
200	5.6
300	3.7
500	2.2
1000	1.1
2000	0.6
4000	0.3
8000	0.14
16000	0.07
20000	0.056

References

1. *The Master Handbook of Acoustics*, F. Alton Everest, Tab Books
2. *Handbook for Sound Engineers*, Glen Ballou, SAMS
3. *Sound System Engineering*, Don and Carolyn Davis, SAMS
4. *Acoustics*, Leo Beranek, Old Colony

All of this is greatly complicated by the fact that few listening rooms are perfectly rectangular, which means predicting sound interaction patterns is very difficult due to the irregularities of the room shape. If this isn't enough, sound reflects differently off certain surfaces (glass and sheetrock for example) at high versus low frequencies.

As you can see, room acoustics is an important but involved subject. In effect, the room becomes a mechanical equalizer boosting or cutting certain sounds. The R-130 will let you see the effects of changes and do something

about them. To learn more about room acoustics, please read AudioControl technical paper number 107 enclosed with this unit on small room acoustics.

Additional references for your further study are listed below. One caution though, much of the information published on room acoustics is for large rooms, i.e. concert halls, recording studios. Be sure when you are reading this information, it is also applicable for small listening rooms.

R-130 APPLICATIONS AND TECHNIQUES

Room Measuring Using Pink Noise

Briefly, the procedure is to take a known test sound, play it through the system, pick up the resultant sound with a test type microphone, measure the signal, and display the frequency response on the real time spectrum analyzer. The differences between the test signal and the display are the modifications made by the room and/or stereo equipment. In more detail, here is the procedure with further explanation of some of the terms at the end.

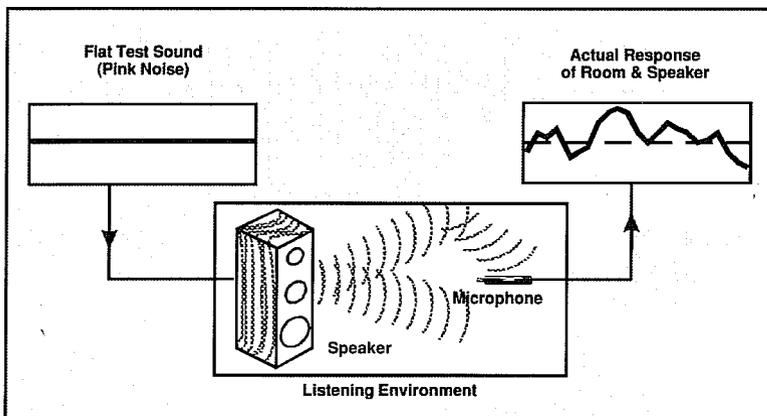


Figure 8 -
Audio Analysis

☞ Connect the pink noise source to the system, preferably via the tape loop as recommended in the installation procedure in this manual. If you look at pink noise directly on the real time spectrum analyzer, it looks like a flat line with some jumping around (due to the random nature of pink noise, see below).

☞ Broadcast the pink noise into the listening space via the loudspeakers. Make sure the level of the pink noise is, at least, 15 dB louder than the background noise level. This means that the pink noise will be playing pretty loud particularly if heavy trucks are going by or the refrigerator is whining about its age.

☞ Position the AudioControl R-130 microphone in your normal listening position carefully. You should move the microphone, while watching the real time spectrum analyzer display, around this selected measurement position in about a foot cube as a test that the spot you picked is not some weird kind of acoustic anomaly. If it is, move your listening position and have an instant improvement in your system!

☞ View the results on the R-130. More than likely, there will be some fairly ugly peaks and dips. Try alternate speaker positions as discussed below and consider some electronic equalization to counteract the effects of the mechanical equalization of the room. Listen, measure, learn and experiment. You'll be amazed at how much you learn about the interactions of sound.

Now here are some of the more detailed explanations we promised.

First, what is pink noise. It sounds like the hiss that is between FM stations but is more than that. Pink noise is random noise with equal energy per octave of sound. So if pink noise has equal energy this means on a spectrum analyzer it will have equal amplitude and thus be a flat line on the display. This is from where, most often, the term "flat response" comes, as the test source is "flat" and if the speaker, tape deck, preamplifier or such make no modifications then the output also should be "flat."

We use pink noise as a test source because it covers the entire spectrum of 20 to 20 kilohertz simultaneously. This allows us to see the "graph" of the frequency response on a real time basis unlike other test sources mentioned below. The display of pink noise shows some jumpiness as this is from the random nature of the source and this jumpiness is more evident at the 2 dB per step setting.

Secondly, what about microphone placement. When measuring, keep any reflecting surfaces away from the microphone. This includes your body if you are hand holding the microphone. The best is a open space of about 3 feet surrounding the mike. This means a mike stand (purchased or even a couple of pieces of wood and a rubber band) is best. Do not put the microphone on a pillow as this will soak up higher frequencies. See figure 9. Also, watch out for the acoustical anomalies mentioned above.

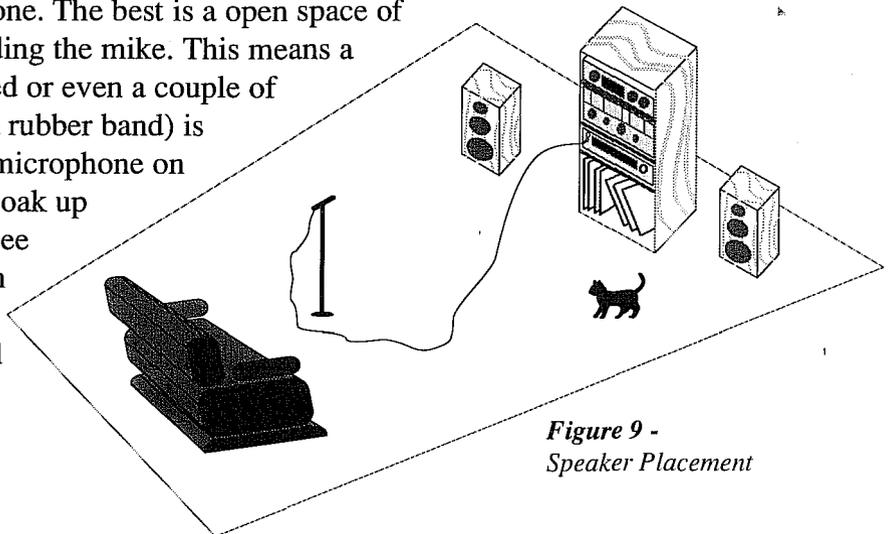


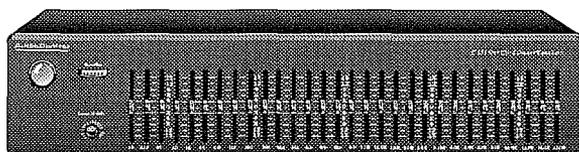
Figure 9 -
Speaker Placement

Measuring Using Other Test Sources

Besides pink noise as a test source, you can use sine waves, either at a single frequency or sweeping, warble tones or noise bursts. All these have specific uses at special times. If you are room measuring, we recommend pink noise. The other sources can show you some particular things, like at what frequency the pictures on the wall resonant. For component checkout discussed below, sine waves can be very useful. Rather than invest in a signal generator to make these measurements, consider a good quality test source CD and a GOOD quality CD player.

Sound system equalization

Most of us do not pick the house we live in purely based on acoustics of the listening room. In addition, most of us live with others who have some say in how the furniture in the room is positioned. This means that few, if any, of us listen in the “perfect” room. There are a number of options to correct this such as speaker placement, domestic strife, acoustic treatment to the walls and ceilings, and electronic control.



*Figure 10 -
AudioControl C-131
One Third Octave Equalizer*

AudioControl makes a number of octave and one-third octave equalizers to help you control sound and make good stereo sound better. This is a plug for using one of them to achieve the sound you want. In particular, we want to draw you attention to the C-131 one-third octave equalizer that is the companion to your R-130. This is the finest piece we have ever built from a award winning company with a long reputation for building the best. A product like the C-131 will give you the ability to control what you can see on the R-130. Here is how to go about it.

The Equalization Process in a Nutshell

- A. Analyze.
- B. Adjust speaker placement and make reasonable changes to room acoustics. (see “Getting Your House In Order”)
- C. Listen using a music source.
- D. Analyze.
- E. Equalize to flat.
- F. Re-adjust to desired listening curve using a familiar musical selection, while incorporating major adjustments from Step D.
- G. Listen
- H. Re-analyze if necessary.
- I. Adjust levels.
A more detailed explanation of this process is in the AudioControl C-131 manual.

Loudspeaker Placement

Every speaker designer we have ever talked with cannot overemphasize the importance of proper speaker placement. Start by consulting the owner’s manual that came with your loudspeakers. Then do not be afraid to experiment. Not only can you hear the differences as result of your experiments but you will be able to see them using pink noise and your R-130.

Make sure you set the level controls on the speakers for best response, then move them around. Pull them out from the wall, move them closer together, and then move them farther apart. You will be astonished at the variation in response that different placements may make. The more you experiment and see the results on the R-130, the more you will learn.

As rules of thumb, changing the elevation of the speakers above the floor often helps peaky bass response. Anemic bass response can often be helped by using corner or floor placement.

Multi-amp balancing

If you are bi-amping your system, you will need to adjust the levels of each amplifier in the system. You can do this by ear, in which case you probably will be attempting to compensate for frequency response problems and the particular source material, or you can use the R-130. Using the R-130 is actually quite easy.

First, play pink noise only through one amplifier, for example, the high frequency side of the system. Set the microphone a short distance from that speaker (one meter is the usual distance). Look at the level on the display that hopefully is pretty flat outside the crossover region. Do the same with the other amplifier and adjust so that the amplitude levels are similar at their respective frequency ranges. You need to make these adjustments because most high frequency speakers are more efficient (play louder with the same amount of power) and amplifiers sometimes have different sensitivities to input signals.

After setting them equal you can then make minor adjustments to your personal taste but with caution. Be careful about attempting to adjust speaker levels to compensate for other problems (like room acoustics) that are best dealt with via speaker placement and equalization.

Component checking

The R-130 displays amplitude at various frequencies of sound. That sound does not have to be picked up by the microphone or played through a loudspeaker to be measured. For instance, it can be the direct output from a CD

player into the R-130. If this seems a little strange, it is because the R-130 is measuring and displaying electrical changes in the sound region. These are the same electrical changes going through your preamplifier and other components.

If you think about this, it opens up a whole new world of test possibilities for your R-130. As diagrammed below,

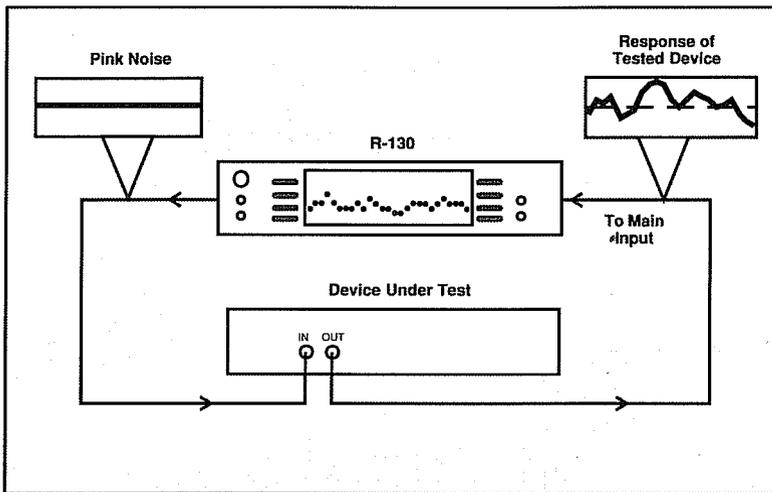


Figure 11 -
Checking units with pink noise: A crossover, eq, preamp, signal processor, etc.

you can use the R-130 to test frequency response and/or see the output of a cassette deck, equalizer, active crossover, preamplifier, surround sound processor, or the like. To test frequency response, you just have to put a known signal in (such as the pink noise from the R-130) and read the frequency response out to see the differences. If you have a complicated system, now you have a way to find out definitely where there is a problem in one channel. You probably can think of some more uses that we have not.

Looking at spectral response and music monitoring

The R-130 is a window into sound. When displaying program material, music being played through the system, the R-130 shows where the greatest energy is. It shows how high and how low the sounds are. This not only tells you more about the music but can show you the effect of different recording mixes. Often you will find on popular, top 40 type music, that there is a distinctive roll off below 90 Hz.

We know you will find displaying or monitoring music a fascinating and enlightening experience.

LIMITED WARRANTY

People are scared of warranties. Lots of fine print. Lots of noncooperation. Months of waiting around.

Well, don't be scared of this warranty. It's designed to make you rave about us to your friends. It's a warranty that looks out for you and helps you resist the temptation to have your friend "Who's good with electronics", try to repair your AudioControl R-130. So go ahead and read through this warranty, then enjoy your new component for a few days before sending in the warranty card and comments.

"Conditional" doesn't mean anything ominous. The Federal Trade Commission tells all manufacturers to use the term to indicate certain conditions have to be met before they'll honor the warranty. If you honor these conditions, we will warrant all materials and workmanship on your R-130 for FIVE YEARS from the date you bought it, and will fix or replace it, at our option, during that time.

Here are the conditions that make this warranty conditional:

1. You have to fill out the warranty card and send it to us within 15 days after you purchased your R-130.
2. You must keep your sales slip or receipt so you have proof when and from whom you bought your R-130. We're not the only company to require this, so it's a good habit to get into with any stereo purchase.
3. Your R-130 has to have been originally purchased from an authorized AudioControl dealer. You do not have to be the original owner to take advantage of the five year warranty, but the date of the purchase is still important so be sure to get a copy of the sales slip from the original owner.

4. You cannot let anybody who isn't (a) The AudioControl Factory; (b) An authorized service center; or (c) Someone authorized in writing by AudioControl to service your R-130. If anyone other than (a), (b), or (c) messes with your R-130, that voids the warranty.

5. The warranty is also NOT in effect if the serial number has been altered or removed, or if the AudioControl R-130 is used improperly. Now, that sounds like a big loophole, but here's all we mean by it. Unwarranted abuse is (a) physical damage(our consumer products are not meant to prop up bookcases or get hauled around in tool cases, etc. This is a HOME hi-fi unit, not a bash-it-about utility equalizer, so if you crunch it, we can't be responsible); (b) improper connection, patch the phono jacks into a line socket or hook it to the speaker terminals on your power amp and we aren't responsible. . . high input signals could fry the innards; (c) sadistic things you shouldn't do to any electronics, such as get them wet, too hot, dirty, etc.

Assuming you conform to numbers 1-5, and it isn't all that hard, we get the option of deciding whether to fix your old unit or give you a new one. (See "What to if you need service.")

Legalese Section

This is the only warranty given by AudioControl. This warranty gives you specific legal rights that vary from state to state. Promises of how well your R-130 will work are not implied by this warranty. Other than what we've covered in the warranty, we have no obligation, express or implied. Also, we will not be obligated for direct or indirect damages to your system caused by hooking up the AudioControl R-130.

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

What To Do If You Need Service

First, contact AudioControl. In writing, at 22410 70th Avenue West, Mountlake Terrace, WA 98043 (Attention: Service Department), by Fax at 206-778-3166, or phone us at 206-775-8461.

We'll help you make arrangements to have the unit sent back to the factory for service. That means recommending shipping methods and working with you to see if it really IS broken.

In either case, proof of purchase **MUST** be included with the unit (that sales slip or receipt we've been harping about). And send a brief note telling us what's wrong with the unit. (You'd be surprised how many folks forget this.)

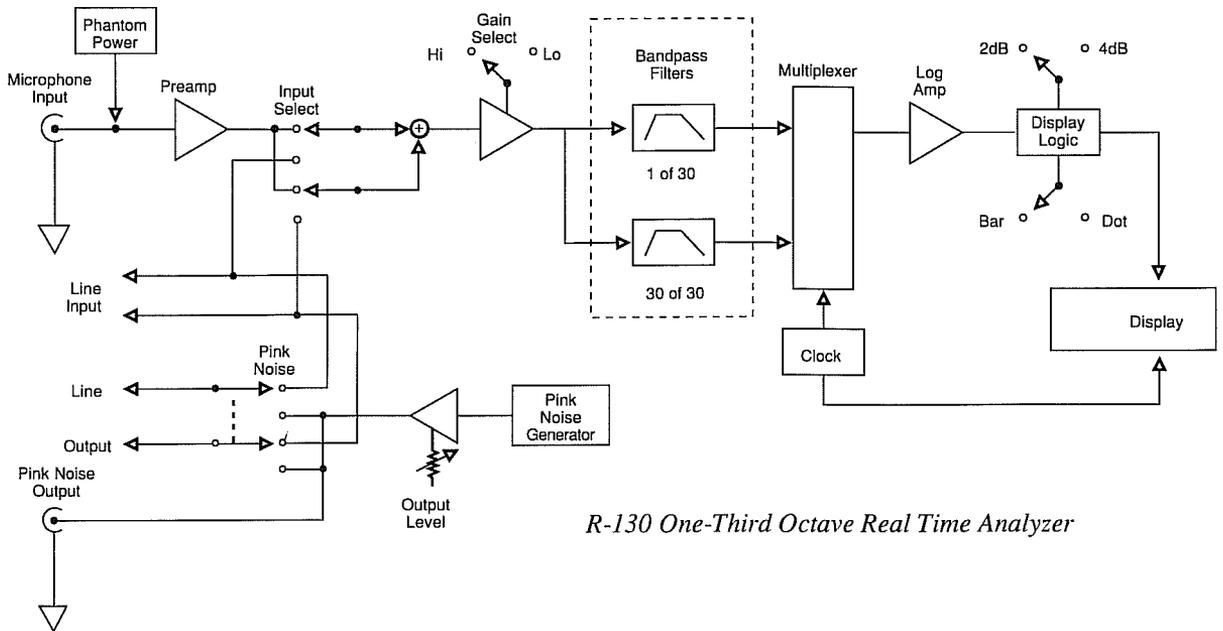
The normal service time at the factory is less than three days! The rest is shipping time.

You're responsible for freight or postage when sending your unit to the factory. Actually, we recommend UPS (United Parcel Service) emphatically over the Pony Express Postal Service. UPS is more reliable and faster, too.

We'll pay return freight, and practice what we preach about using UPS on the return.

Block Diagram

BLOCK DIAGRAM



R-130 One-Third Octave Real Time Analyzer

SPECIFICATIONS

Residual Noise	less than 10 microvolts
Total Harmonic Distortion	0.002%
Frequency Response	10Hz-100kHz+0dB, -1dB
Filters	
Band Centers	30 bands, ISO standard - 1/3 octave
Center Frequency	± 3%
Input Impedance, unbalanced	100k ohms
Input Impedance, balanced	5k ohms
Microphone input	-64dB, ± 3dB
Pink Noise Level	6dBm Max
Pink Noise Flatness	20Hz-20KHz ± 0.2dB
Power consumption	18 watts
Dimensions	3.5"H x 17"W x 11"D
Weight	11 lbs.
Country of Origin	U.S.A.

CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD, RECEPTACLE OF OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

ATTENTION: POUR PREVENIR LES CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR, UNE PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT.

CAUTION: REPLACE WITH 125mA 250V FUSE ONLY

ATTENTION: UTILISER UN FUSIBLE DE RECHANGE DE MEME TYPE DE 125mA 250V.



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