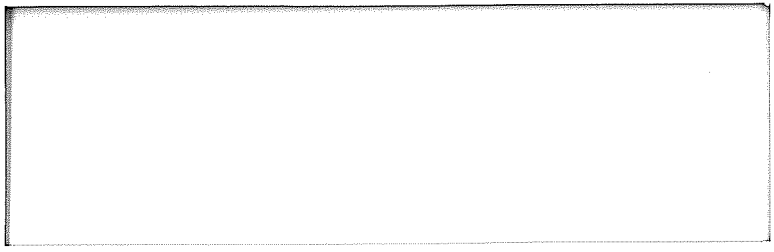
C-101

EQUALIZER / ANALYZER

OWNER'S MANUAL

AudioControl™



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EQUALIZER / ANALYZER

OWNER'S MANUAL

AudioControl™

22313 70th Ave. W., Mountlake Terrace, WA 98043 (206) 775-8461

Congratulations.

You've just purchased a unique window to the world of sound.

A measuring tool.

A teaching tool.

And one heckuva light show.

This manual is designed to help you get everything you can out of it. So, even though you're dying to see the thing in action, please take twenty minutes or so to slog through our not-so-weighty prose and advice on how to run your new analyzer.

Anything with as many lights and buttons as your C-101 or C-50A has deserves all the explanation it can get.

Whoa!

Before you control audio with your Audio Control, you should first control your eagerness and...

FILL OUT THE WARRANTEE CARD AND STAMP IT.

After you've played with it a while, give us a comment or two and send it in.

NEXT, PUT THE SALES SLIP OR STEREO STORE RECEIPT AWAY IN A SAFE PLACE.

It's *very important* in the unlikely event you'd ever need service. You'll get some pretty blank looks from the store people if you don't have the receipt to prove when and where your C-101 or C-50A was purchased. Besides it's good for insurance purposes. Which brings us to the third important admonition:

RECORD THE SERIAL NUMBER OF YOUR UNIT.

Sure, theft is now the farthest thing from your mind, but, well... things DO happen and insurance adjusters don't have very big imaginations when you lack any proof you ever owned something.

Last (and this ends the nagging section), is to be sure and SAVE THE BOX.

It would O.D. your garbage can anyway, and it will insure the safety of your analyzer should you move or need to return it for repair.

Okay. Onward to the good parts!

THE NUMBERS RACKET: AN EXPLANATION

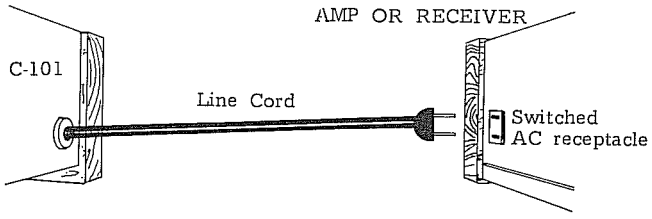
The C-101 Real Time Spectrum Analyzer/Equalizer is a C-50A Real Time Analyzer joined to a C-22 Active Equalizer. The same operation instructions pertain to both the C-101 and C-50A, as do many of the same hook-up instructions. *Any time* an instruction differs between the C-50A and the C-101, *we'll note it.* You'll see guide tabs on the edges of pages to key the section, too. Otherwise, we'll refer only to the C-101.

SEEING THE LIGHT: PLACEMENT

Unlike most pieces of hi-fi equipment, you'll want to put the C-101 where it can be easily seen from your listening position. If that's with the rest of your stereo, fine. The C-101 may be mounted into a rack or simply left on top a tape deck or receiver. (Watch blocking any vents of the BACK of the amp or receiver top, though.)

However, if your stereo turntable and receiver are a bit out of the way, consider purchasing two long sets of RCA-type patch cords and moving your C-101 to a position directly between your speakers. This will enable you to watch the music while being directly in line with the stereo image of your speakers. "Detours" of up to 30 feet will not electronically or sonically impede the performance of the C-101, should you decide to make your unit the center of attraction.

POWER. THE MOST IMPORTANT HOOK-UP OF ALL



Unless the C-101 is far-removed from the rest of your hi-fi, the best place to plug it in is the SWITCHED plug on the back of your amp or receiver. What? There's already a turntable plugged into that socket?

No sweat. Get a multiple socket or "splitter" from your local hardware store and plug both the C-101 and your turntable in at once. Yes, this *looks* like it violates what Sparky the Firedog taught you about electrical safety in gradeschool. But not really.

Combined, the turntable and C-101 don't begin to exceed the wattage rating for a switched socket on a modern receiver.

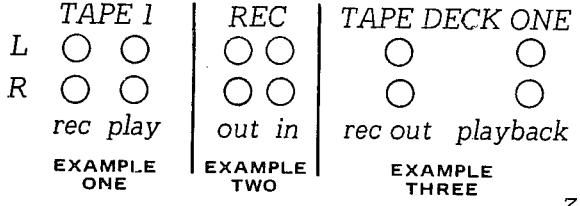
Or, you can always just plug it into a wall socket.

HOOKING UP THE C-101

There are at least three different ways to hook up your C-101, depending on how you want to use it and what kind of electronics you're connecting it to. Read through each before you get ensnared in hook-up plugs. And, by all means, turn off ALL equipment before hooking in the unit. A surprising number of audiophiles find their woofers on the floor after a 60-cycle buzz during hook-up.

A. LOOPING THE LOOP

The recommended way to hook in your C-101 is to put it in the tape monitor loop of your amp or receiver. That way you can activate it by pushing in the TAPE MON button. Look on the back of your amp or receiver for two or more sets of RCA sockets marked TAPE. Two will be marked OUT or REC; two will say IN or MON.



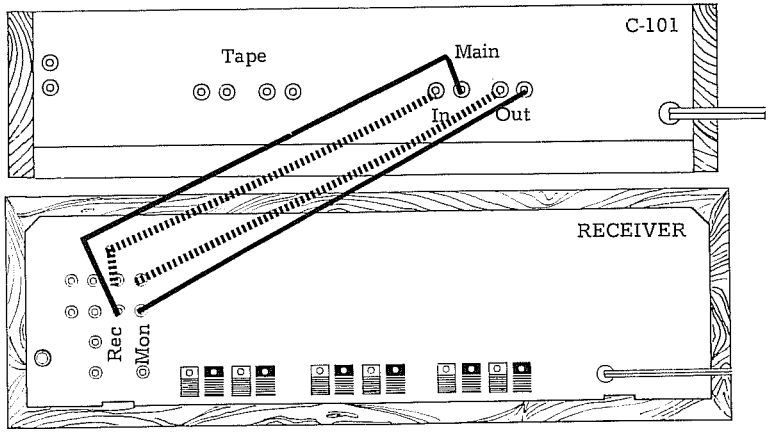
1. Connect a pair from TAPE OUT to the two sockets on the back of your C-101 marked MAIN IN. Now signals coming out of your receiver's TAPE circuit will be routed to the equalizer whenever you push the TAPE MONITOR button.

2. But, we have to get those signals back somehow, too. So, connect another set of cables from the C-101 MAIN OUT plugs to your receiver's sockets marked TAPE IN.

For those of you without any sort of tape recording equipment or outboard devices such as expanders or special generators, that's it.

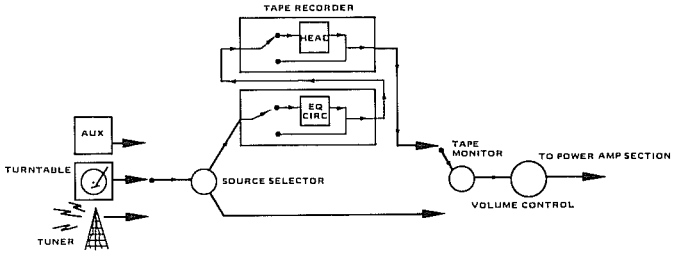
FINITO.

3. Just turn on the C-101 POWER BUTTON, push the TAPE MON button on the front of your amp and receiver and spend a minute appreciating the light show. Then turn to page 12 for Analyzer instructions or page28 for Equalizer instructions.



HOOKING UP THE C-101 AND AN AMP OR RECEIVER. A very basic hook-up using two sets of patch cords and the Record and Monitor jacks on the amp or receiver' tape monitor circuit.

UNDERSTANDING THE TAPE MONITOR LOOP AND THE C-101



This section isn't required reading, but it will help you understand how to and why the C-101 fits into your receiver or amp circuit, and also how to integrate other goodies like cassette tapes into the hook-up.

Below is the signal path from the sources such as turntable or FM tuner all the way through to the actual amp.

As you can see, the tape monitor LOOP is just that, a detour through which the signal can be routed. When recording, any of the sound sources are routed to it. When playing a cassette deck, pressing the tape monitor switch routes signals from the deck through the volume control and into the amp.

It is into this tape monitor loop that the Audio Control equalizer is placed. With, or in place of, a cassette deck.

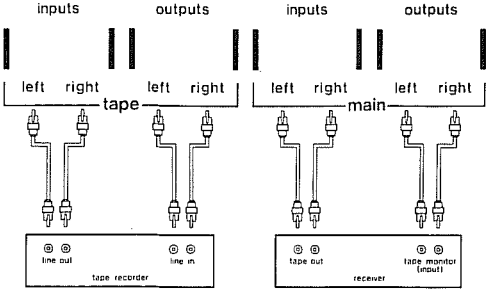
Any number of devices can be added into this loop. Each has their own "detour" loop so you can switch them out of the circuit. Here's an exaggerated example.

Since each has a tape monitor switch, you can use any combination of devices and still run a cassette deck in the tape monitor system.

B. HOOKING IN A TAPE DECK WITH THE C-101

"But if the C-101's taking up my tape sockets on the back of the amp, where do I plug in my tape deck?", you may ask.

That's why we provided the C-101 with its OWN set of tape INs and OUTs – in essence, its own "tape monitor" loop.



1. Connect one set of hook-up cords from the IN or REC sockets of your *tape deck* to the TAPE OUT sockets on the *C-101*.

2. Now do the same between the OUT or PLAY *cassette deck* sockets and the *C-101's* TAPE IN plugs.

3. Viola!

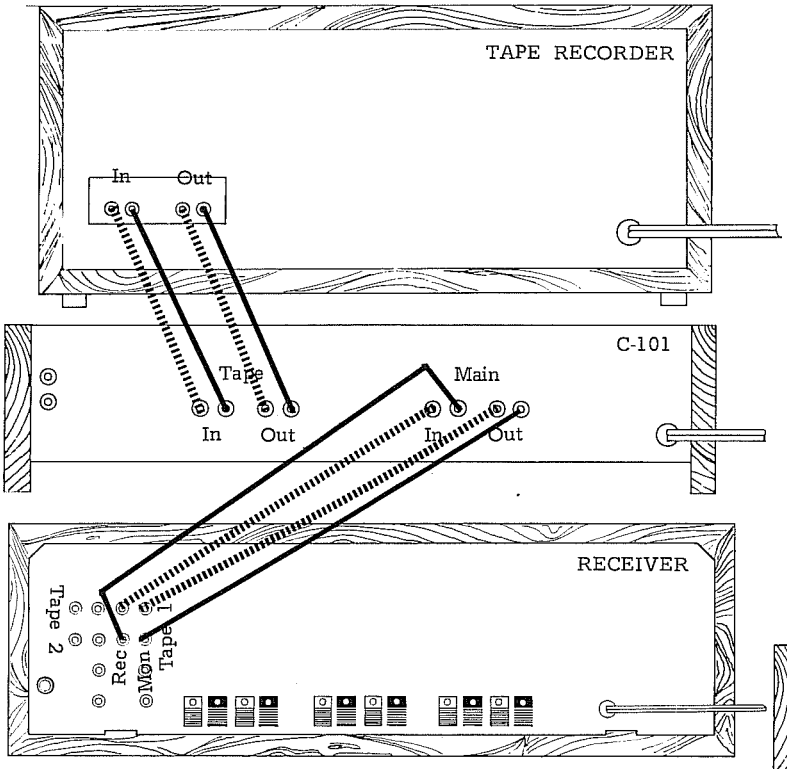
Your cassette deck and the C-101 can now make beautiful music together.

C. HOOKING IN ANY OTHER OUT-BOARD DEVICES

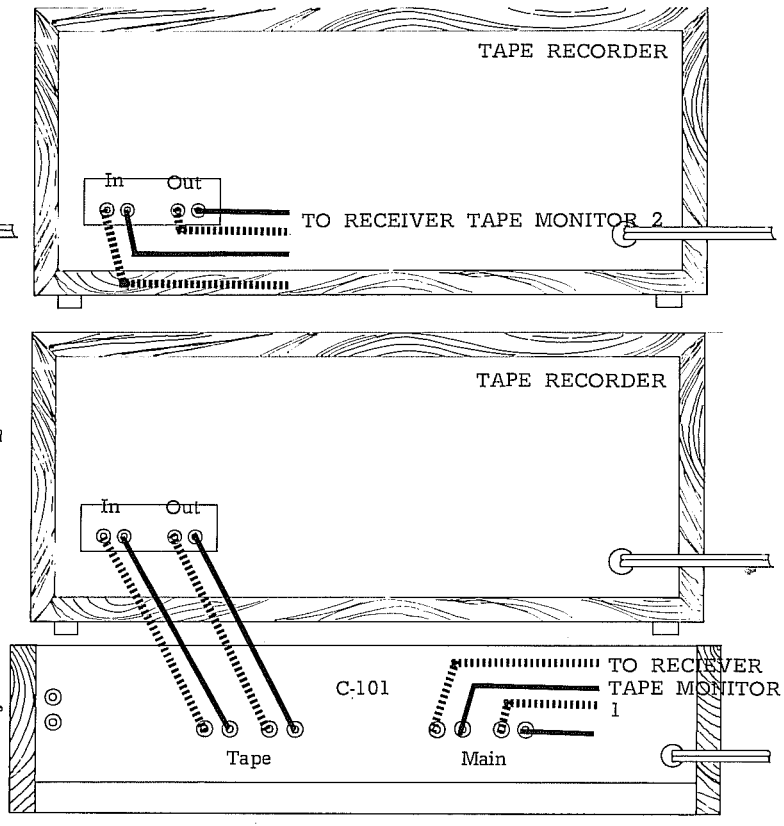
We recommend placing other equalizers, dynamic expanders, click and pop filters and special synthesizers JUST BEFORE the C-101 or C-50A. That wav. their effects will show up on the C-101 display.

1. Simply route the hook-up cord from TAPE OUT on your *receiver*, to the INPUT of the *device* to the MAIN IN sockets on the C-101.

There's ONE EXCEPTION to this recommendation. Noise reduction devices such as Dolby*B, Dolby Hi-Q* or dbx 122, 128 or 158 should be placed after the C-101 and preferably in the tape circuit described above. Both brands of units artificially compress and equalize signals for encoding on tape. The devices' output will seem rather weird when viewed on the C-101 display and shouldn't be equalized anyway.

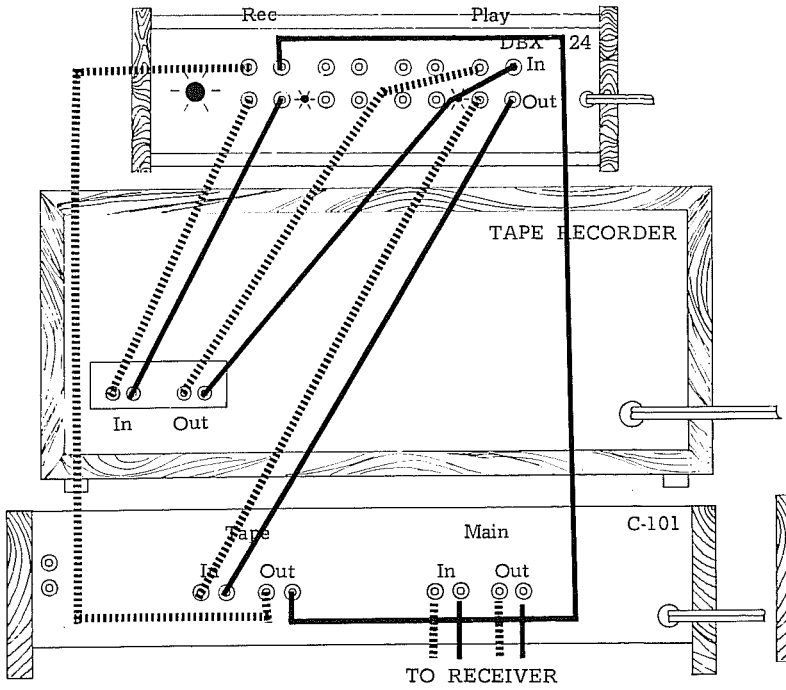


HOW TO HOOK UP THE C-101 WITH A RECEIVER AND TAPE DECK.

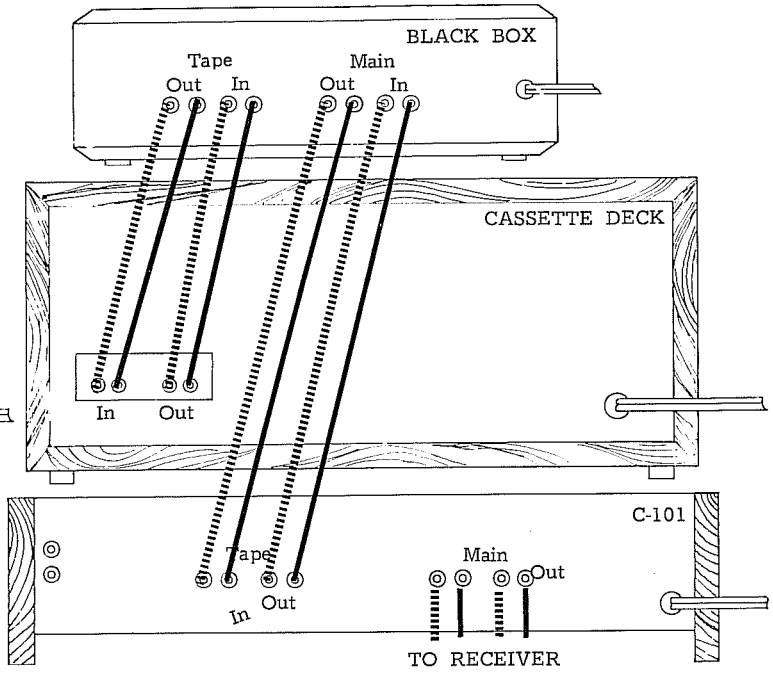


HOW TO HOOK UP TWO CASSETTE DECKS WITH THE C-101.

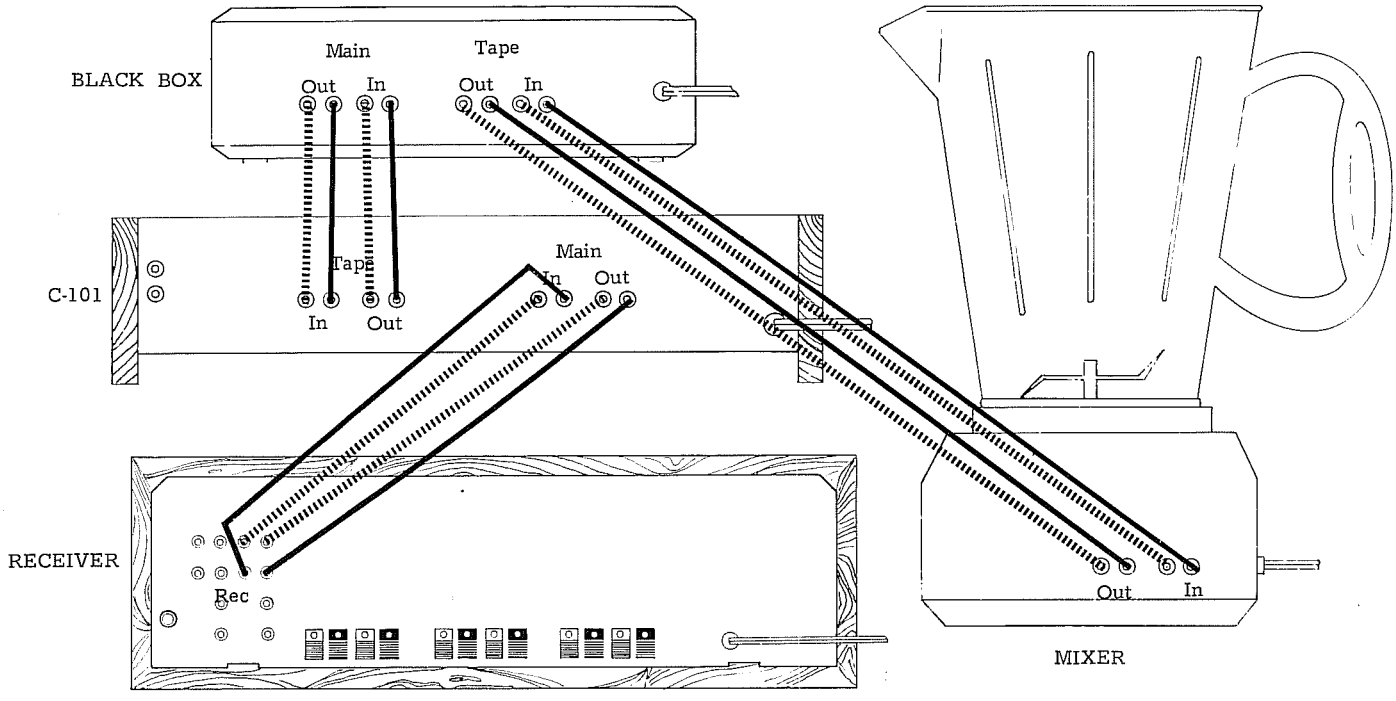
We ran out of space so you'll have to use your imagination on the receiver.



HOOKING UP A DBX, TAPE DECK AND C-101. A fairly complicated hook-up. Consider weaving patch cords into a tasteful basket design. If you have two tape decks, call us or dbx and hope for the best.



HOOKING UP A "BLACK BOX", TAPE DECK AND C-101. The phrase "black box' refers to other signal processing devices.



HOOKING UP A "BLACK BOX", C-101, RECEIVER AND MIXER. The ultimate audiophile' hook-up for the person who has everything. Consult the appendix for a great equalized guacamole recipe.

D. ANOTHER WAY TO HOOK-UP THE C-101 or C-50A

This is an unrecommended method which makes your C-101 an integral part of your amp or receiver, without using the tape monitor loop.

It has two drawbacks: 1) You can't use the C-101 to equalize tape recordings, 2) You have to adjust the analyzer input level knob every time you adjust the volume control.

Still, we feel compelled to mention it. If you're interested, check Appendix F in the back of this manual.

C-50A AND C-101 ANALYZER SECTIONS— A QUICK RUNDOWN

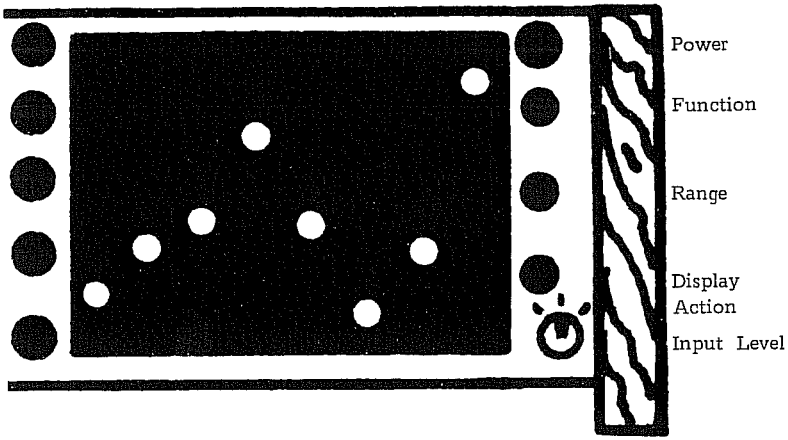
Here, from top to bottom, are their functions.

POWER BUTTON. Pretty self-explanatory.

FUNCTION. This button controls the two types of measurements possible with the C-101.

1. In the OUT position, SPL (sound pressure level), 10 red horizontal LED's (entire width of screen) illustrate sound intensity or unweighted dBA (acoustic decibels) when used with the Audio Control microphone. SPL is read on the far right scale on the edge of the LED display. (Note that you *must* set the button below range, OUT (4dB) to read the SPL level correctly. More on this setting under HOW TO MEASURE SOUND PRESSURE LEVEL and SPEAKER EFFICIENCY).

2. Pushed IN, the FUNCTION button divides the audio spectrum into 10 equal octave-wide segments and displays their amplitudes. You'll note that we have conveniently made them exactly the same increments as the accompanying equalizer sliders.



RANGE. In the OUT position, there are four dB between each LED. Pushed IN, there are two dB per LED. Think of the LED's as marks on a ruler. To measure a wider range, we couldn't add more LED's, so we gave you a button to "stretch" or "shrink" the ruler: same marks, but representing two different ranges.

1. The four dB range covers a wider area and has its application analyzing music with a wide dynamic range like (digital direct disks), or for making the first rough room equalization measurements. And, of course, when using the C-101 in its SPL mode.

2. The two dB range is most handy in making final room equalization measurements, or for analyzing older records with less dynamic range. Frankly, it also provides a livlier light show.

Both scales are printed to the immediate right of the display panel.

DISPLAY ACTION.

1. The SLOW mode is used for making room equalization measurements where the averaging nature of this display makes it easier to make measurements.

Also, many sounds occur so quickly that the slower display action is preferable, since it "averages" sounds when seriously analyzing musical passages.

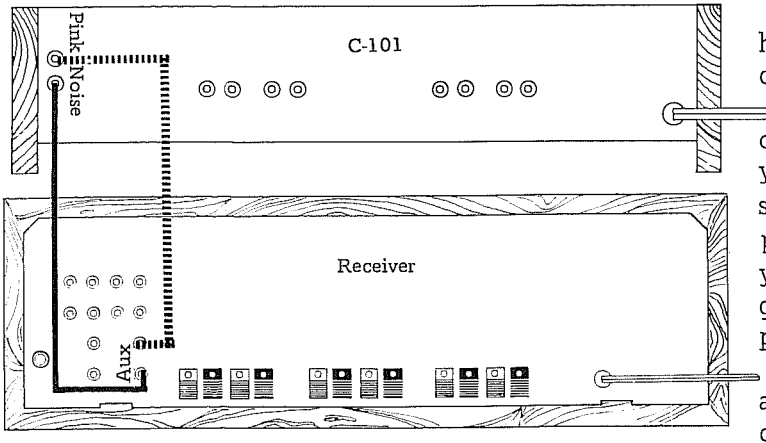
2. The FAST display mirrors more accurately what is going on in music at any given instant. It's also there to impress friends, hypnotize your parakeet, and to learn a tremendous amount about sound frequencies and equalization. (See RECREATIONAL WATCHING section.)

INPUT LEVEL CAL. This control has a number of important applications.

1. For response analysis, it lets you "center" the response curve of your speakers and room with the green LED's at 0dB. When looking at music you can use this control to center the response on the screen.

2. Another use is adjustment of the SPL scale. The printed scale of dBA goes up to 92. But you might want to see if your system can crack the Guiness' World Book record set by Deep Purple at 122 dBA. So, we've given you a way to extend the scale. By reducing the input level -10dB, the 92dB range is expanded to 102dB and so forth. Turn the input knob down -20dB and 92dB equals 112dB. Remember to have the RANGE scale in the 4dB mode.

THE C-50A AND C-101 PINK NOISE AND MIKE SYSTEM



THE PINK NOISE TO AUX HOOK-UP using an extra set of patch cords. Finally uses that ridiculous Aux circuit you never thought you'd use on your receiver.

Before you use the C-101 to learn how flat your speakers are, three more connections need to be made.

PINK NOISE GENERATOR. Over on the far left side of the C-101's backside you will notice two phono sockets. They should be connected with the patch cords provided to the AUX (auxilliary) inputs of your amp or receiver. (See, you really *do* get to use what you always figured was a pretty useless feature of your receiver.)

Flip the receiver source switch to aux and give a listen to the sound coming out of your speakers.

That's genuine pink noise.

See the box at page 17 for an explanation.

WHAT IS PINK NOISE?

Simply put, PINK NOISE is EQUAL PARTS of EACH OCTAVE of the audio spectrum. It sounds like a deeper form of what you hear between radio stations or on unoccupied TV channels: an airy rushing sound.

Since it contains equal parts of ALL frequencies, it's the perfect test sound source for speakers. Any increase or lack of a frequency band can be instantly attributed to the speaker or room acoustics, and compensated for.

Our pink noise circuits are carefully designed to be extremely accurate, since any variation in the pink noise source would be wrongly attributed to inadequacies in room or speakers.

Incidentally, pink noise is very psychologically relaxing and is used by some dentists to soothe patients, and in "sleep machines" which mask other sounds when one wants to fall asleep.

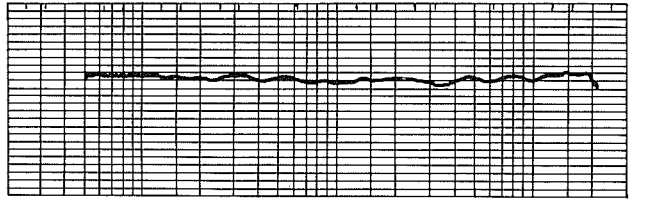
End of lecture. We just wanted you to understand the importance of pink noise before you got into its many uses or blamed your speakers for deficiencies.

ABOUT THE MICROPHONE

The Audio Control laboratory microphone is a precision non-directional, phantom-powered condensor type; designed ONLY for the measurement of acoustics. It is intended for use ONLY with the Audio Control C-101 analyzer/equalizer and C-50A analyzer. Do not attempt to use it for voice or music recording, or with any other phono-jack input on tape decks or amps.

Also, don't plug any other microphone into this C-101 or C50A's rear phono jack unless you are contemplating potential destruction to your mic. Condensor microphones such as the Audio Control laboratory microphone require a power supply. That's what the term "phantom-powered" refers to: A viable power supply within the analyzer. So the phono plug on the Audio Control microphone is actually a mono-microphone plus a +5 volt input. Not at all the sort of thing you would want to plug a regular mic into.

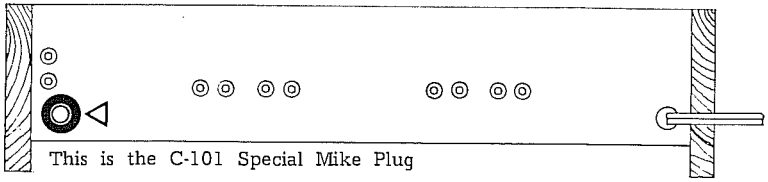
The actual microphone element exhibits a typical response that is as flat as other very expensive ($200 and up) "laboratory" reference microphones. It is your foundation for making accurate readings with your analyzer.



TYPICAL RESPONSE

Even a few years ago such a microphone would have been prohibitive in cost for the home audiophile. Luckily, high-quality condensor elements have broken through the same barrier that pocket calculators, pong games and tiny TV's have and so now you possess an accurate and affordable reference microphone. Enjoy!!!

MICROPHONE JACK. Under the pink noise output is a socket where you plug in the Audio Control laboratory microphone.



This is the C-101 Special Mike Plug

HOW TO EQUALIZE YOUR SPEAKERS

Basically, your speakers are going to project pink noise into your listening room where it will be picked up by the Audio Control microphone. The speaker's ability to reproduce all frequencies equally will be displayed by the C-101. By adjusting the sliders on the C-101's equalizer portion, you can compensate for peaks and dips in this display until you get as "flat" a response as is possible from 32 to 15.5K.

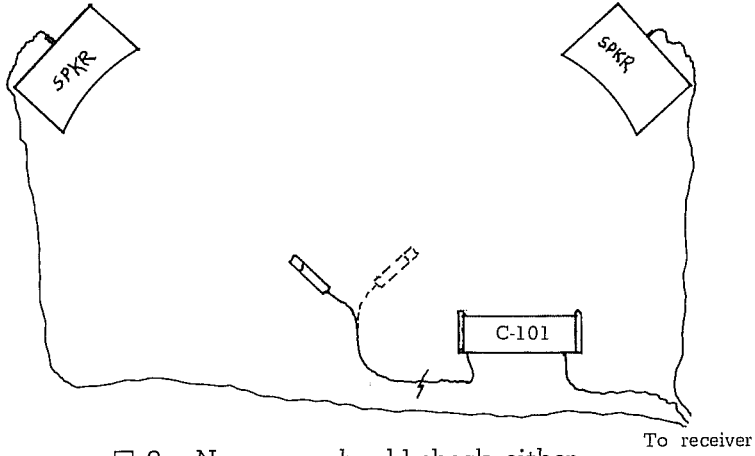
WHAT BUTTONS TO PUSH:

- ☐ C-101 power, ON;
- ☐ function, RTA;
- ☐ range, 4dB;
- ☐ display action, SLOW;
- ☐ equalize program, IN;
- ☐ all equalizer sliders, AT O (centers click stop);
- ☐ input level control at -10dB;
- ☐ receiver source, AUX.

☐ WHAT YOU WILL NEED:
C-101,
Audio Control microphone,
receiver,
speakers.

☐ 1. Since we are trying to keep as many things constant as possible, it is necessary to first adjust any control on the speakers. You'll see them on the back as either rotary knobs or switches.
Play pink noise through one speaker by turning the receiver balance control full left or right.
Place your ear between the woofer (largest speaker) and the mid-range (medium-size speaker) – or if your speakers have only two drivers each, place your ear between them.
Now adjust the midrange level control up until the pink noise rushing sound seems to blend instead of sounding like more is coming out of one driver than the other.

Repeat this with your ear between the mid-range and tweeter while adjusting the tweeter (presence) control.
Repeat for the other channel/ speaker.

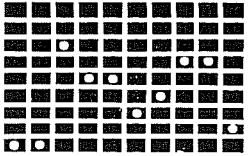


☐ 2. Now you should check either method of speaker adjustment by ear with the following quick "A-B" comparison: With both speakers in the position they will be listened to, sit *in front of* and *between* them.

Have someone rotate the balance control from hard right to hard left VERY QUICKLY. Compare the sound of the pink noise from each speaker. It should be identical. If it isn't, check the level adjustments on the back of the speakers again.

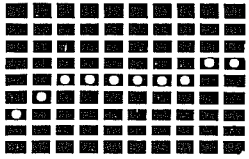
☐ 3. Now you're ready for the fun part.
Set all C-101 sliders at 0.
Play pink noise through the left speakers by turning your balance control hard left.
Mount microphone to a stand at your listening position *pointing directly at the speaker* in use.
Note what you see on the C-101 display.
Adjust the tone controls on your amp or receiver. You will actually see the broad effects they have on the response of your speakers as the LED's move

A. TYPICAL C-101 OUTPUT OF UNEQUALIZED ROOM.



In this example, low bass is practically non-existant, there is a big resonant peak at 120, a crossover dip in the midrange and an absorption of highs due to room acoustical treatment.

B. TYPICAL OUTPUT AFTER EQUALIZATION.



We fixed the low end, as much as is possible (almost NO speaker is flat down at 32Hz.).

up or down. Adjust the bass and treble to improve any overall trends away from a flat response.

☐ 4. Now, use the C-101 equalizer to make any adjustments with the left 960, 1920, 3840, 7680, 15.5K sliders. Start by reducing the octaves with too much output by sliding the proper slider downward. Next, boost the ranges that do not show enough output – usually the low frequency ranges.

Now push the 4/2dB button in for your final ± 2dB fine-tuning equalization.

☐ 5. Repeat steps 3 and 4 for the right speaker after rotating the BALANCE control the opposite way, hard RIGHT.

☐ 6. Now point the mic directly between the two speakers and move the receiver BALANCE control to center.

Adjust the 32, 60, 120, 240 and 480* equalizer sliders to flatten the lower octave of your speaker's response. Don't expect all speakers to be flat at 32 even with +12dB equalization, especially if they are very small speakers. Only so much is possible within the design constraints of your particular system.

*One quick explanation why we don't have you try to equalize the high end of both speakers at the same time is because of phase cancellation and reinforcement at the high frequencies. To experience this phenomenon, stand in front of and between the speakers and move your head from side to side. (Be sure to plug one ear and turn the other ear directly at the center between the two speakers.) You will be able to hear the effect of high frequency phasing.

Now you have successfully response-analyzed your speakers in the realm in which they are used. Any time you buy new speakers or change listening rooms, you should repeat this process.

HOW TO MEASURE SOUND PRESSURE LEVELS

☐ WHAT YOU WILL NEED:
C-101, amp or reciever,
Audio Control laboratory microphone.

☐ WHAT BUTTONS TO PUSH:
Everything the same as before, except the C-101 function button.

Leave it at the SPL position.

☐ 1. Set the C-101 input level at 0 (cal.).

☐ 2. Set the mic in your listening position. Put on your favorite record and adjust the volume to the levels you normally listen at. Note the average sound pressure level in dBA on the C-101.

☐ 3. Also, as previously mentioned, the SPL test is good for determining maximum system output for discos, heavy metal rock fans and wild parties.

Speakers put out varying amounts of sound when fed the same input power. While you cannot easily derive the sort of specs you read about in hi-fi magazines, you can compare any two speaker systems.

☐ a. Measure the SPL of the first set of speakers as above.

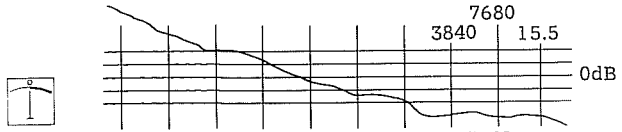
☐ b. Now, without changing the VOLUME control setting, repeat the test of the second set of speakers. Any differences in efficiencies will become obvious by a different SPL level.

Of course, efficiency isn't everything. While you have both sets of speakers in your listening room, by all means test their frequency response, too.

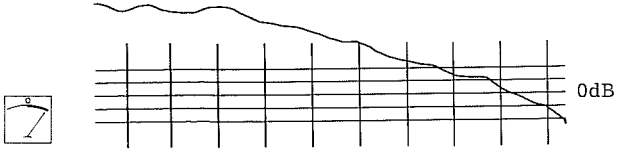
HOW TO USE THE C-101 AS A RECORDING LEVEL METER

The idea of recording level is to avoid saturation and distortion of the tape with too much input level. However, your ear is mostly sensitive to saturation in the mid-range and higher frequencies. Below that, the tape can sustain as much as +10VU distortion without very audible degradation of sound.

A regular meter can't break down



TYPICAL FREQUENCY MAKE-UP OF MUSIC. Note that most of the energy is in the low end. Tape exhibits a corresponding ability to store more energy in the low end, too. Yet a "VU" meter represents the average of this waveform which is of course inaccurately skewed to the bass side. Thus the recordist tends to back off his record level, mistakenly thinking that the high end is in danger of saturation.



RECORDING IT HOT WITH THE C-101. Although the low end may be technically reaching saturation, the audible high-mid and high end are well within the specs of the tape used, resulting in an increased signal-to-noise ratio of from 5-10dB depending on tape formulation and whether you're a hard rock freak making car tapes for a Camaro.

these frequencies the way a C-101 can, and thus can't give you critical information on how just the mid-range and high end are reacting. The result is that you can usually squeeze more onto a tape by analyzing signal level octave by octave.

☐ WHAT YOU WILL NEED: C-101, tape deck, receiver.

WHAT BUTTONS TO PUSH:

☐ Receiver, set source to AUX;
☐ Audio Control function, RTA;
☐ range, 2dB;
☐ display action, FAST;
☐ equalize program, OUT;
☐ equalize tape, OUT;
☐ tape monitor, OUT.

☐ 1. Put the tape into record pause to monitor the pink noise fed by the receiver aux into the deck.

Adjust the deck's input level controls until the meter reads 0VU.

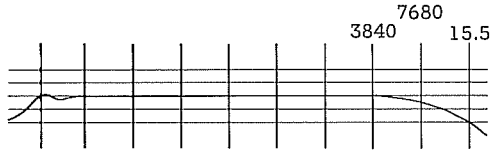
☐ 2. Push the C-101 TAPE MONITOR button in to enable the analyzer to "see" the output of the tape recorder. (The output of the tape deck tracks the VU meter.)

Adjust the C-101 INPUT LEVEL until a line of red LED's are at 0 (center). Now 0dB on the C-101 display is 0VU on the tape deck.

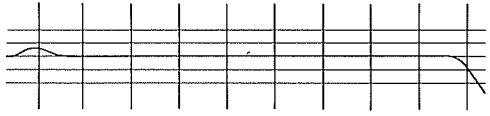
☐ 3. To set actual recording levels while transcribing records or for broadcasts, watch the C-101's last five rows of LED's. These are the frequencies where *audible* distortion occurs as the signal level exceeds 0VU. Careful attention to these LED's can allow you to get higher overall signal levels onto tape, since you can let the low frequencies distort somewhat as long as the highs do not distort.

HOW TO SET RECORDER BIAS AND EQUALIZATION

As more cassette decks provide variable bias and EQ and as more and more good tapes emerge which need to be fitted to your particular deck, the C-101 can help you get the most out of a particular tape.



TYPICAL RESPONSE OF PINK NOISE RECORDING BEFORE BIASING AND EQ ADJUSTMENTS. The low end "bump" is an unavoidable contour effect caused by the tape heads.



IMPROVED RESPONSE AFTER TWEAKING 36Hz BAND AND CAREFULLY ADJUSTING BIAS AND EQ. The contour bump is still there but overall response is improved.

☐ WHAT YOU'LL NEED: Same as above, plus a cassette or reel-to-reel tape to be tested.

☐ WHAT BUTTONS TO PUSH: Same as above, but with C-101 equalize tape button in.

☐ 1. With any *variable* EQ or bias knobs set at 0 and any switches set at the recommended positions, record a one minute segment of pink noise at -20VU. Make sure all equalizer sliders are flat.

☐ 2. Now switch receiver source to TAPE, rewind and play the recorded pink noise back. Check the response on the C-101 display. Chances are the high end will drop a bit. (If you have a three-head deck you can combine steps 2 and 3 by just continuously monitoring the pink noise, instead of having to record it, rewind and play back.)

☐ 3. Now, go back and record another segment of pink noise, this time changing Bias and then EQ every ten seconds or so.

☐ 4. Play back this segment and note which change made the most improvement on high end playback performance.

☐ 5. Now it's time to add a little help from the C-101. Record a longer segment of pink noise with optimum Bias and tape EQ at -20VU. Play it back and note the display. Adjust the 7680Hz and 15.5 KHz sliders to flatten the response.

☐ 6. Write down these settings and equalize future tapes of that brand for optimum high end performance.

Why is the Audio Control C-101 called a *real time analyzer?* Are there UNreal time analyzers?

Yes.

Such a device sweeps through the frequency spectrum slowly, analyzing and recording as it goes. The only problem is that you cannot look at the full audio spectrum at the same time.

Great for laboratories, but very unresponsive to music. And not very visual.

The C-101 works in real time as the sounds occur, instantly.

PUTTING THE C-101 EQUALIZER SECTION TO WORK IN YOUR STEREO SYSTEM

Don't panic!

Sure, there are twenty-five controls, but using your equalizer is easy once you understand just what all those sliders and buttons do.

First, the five buttons just to the right of the C-101's 20 equalization sliders.

Each has a valuable function when combined with the octave equalizer sliders.

TO EQ OR NOT TO EQ ... THE EQ LINE SWITCH

This is the switch that lets you get rid of the equalizer when you don't want it. Only no one ever seems to not want to use it, any more than they would hock the volume control.

The purpose of a switch that lets you equalize incoming signals from FM, records, or tapes when pushed in (and which circumvents the equalizer when left out), is to allow comparison between *no equalization* and whatever settings to which you have adjusted your equalizer. You can reference a "setting" to "no setting" instantly. This is especially valuable when you're first experimenting with equalization and need to know just how much more or less of a frequency there is with the unit in. But even most recording engineers use this comparison constantly when adjusting equalization in the studio...so it's valid any time.

THE RECORDING ENGINEER BUTTON, EQ TAPE

This is the button that lets you equalize tapes while you record by running signals bound for tape recorder, through your C-101 first.

Just push EQ TAPE and your unit is ready to equalize when you make tape recordings. (Just how to adjust the controls is covered further on.) The EQ TAPE is interlocked with the EQ LINE button to prevent them both from being pushed at the same time. This prevents the possibility of feedback.

THE HEARING AID ... TAPE MON

If you have a three-head tape deck you can actually monitor the tape as it is being made.

So, you have three different ways to listen to sound being equalized during recordings:

1. Sound entering the equalizer (EQ LINE out).
2. Equalized sound entering the tape deck (EQ TAPE in).
3. Sound leaving tape deck (TAPE MON in which can be clicked in and out during recording for comparison).

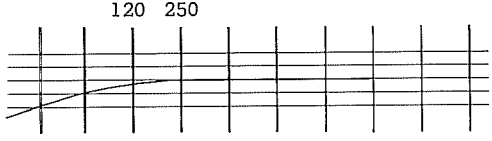
That's a monitoring combination so nifty you ought to run right out and buy a tape deck if you don't have one.

CATCHING MONO IN THE BASS... THE PHASE CORRELATION RUMBLE REDUCER BUTTON

The Audio Control C-101 octave equalizer has a circuit not found on any other stereo component being made in the world: A device that tightens up your system's bass response without even touching the equalizer's tone controls. Quite simply, this switch cuts turntable rumble, reduces acoustic feedback and even reduces the "thumps" that occur if you lower the cartridge too quickly onto a record.

About the best way to explain its function is to put on a record, boost bass, and then turn it up. Now click the rumble reduction button in and out. The difference can be dramatic. NO OTHER EQUALIZER HAS A CIRCUIT SUCH AS THIS. After you've tried it you'll see why. And you'll never switch it back out.

Now, STEREO is a wonderful phenomenon, and we have nothing against it. But, at very low frequencies – for most folks, under 200Hz – directionality and the



AREA OF MONO EFFECT. Don't confuse this with a roll-off. What we're representing is the area of phase cancellation.

stereo effect is totally un-noticeable. Bass drums and bass guitars just aren't mixed Left and Right in the stereo field, just put smack in the middle. So, this switch isn't affecting the accuracy of the music for 99.9% of listeners. Rather, it is making your electronic's job easier in an area fraught with inter-modulation and power supply difficulties.

You'll hear what we mean.

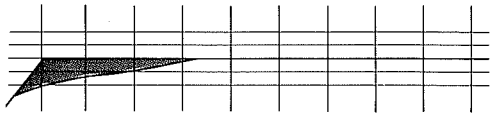
GETTING RID OF INVISIBLE MONSTERS OR YOU NEVER HAVE TO CLEAN YOUR SUBSONIC FILTER

Subsonics are just what their name implies: Sounds below the range of human hearing.

You don't need them.

In fact, you shouldn't have them. Here's why. Your speakers insist on trying to waste energy and motion reproducing these inaudible, ultra-low frequency tones. Warped records, turntable rumble, the thump made when a tone arm is lifted off the record, the interference between stations when dialing FM or the feedback caused by placing a turntable close to the speakers all can literally beat a woofer to death.

Amplifier power is wasted. And, since the speaker is trying to accommodate sound you don't hear, it messes up audible sounds (intermodulation distortion), especially in a two-way system where the woofer is also handling some of the mid-range chores.

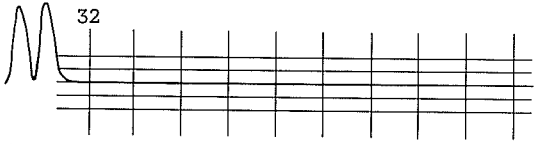


COMPARISON of the usual puny 6dB/octave subsonic filter found in may receivers and amps (lower line) with macho 18dB/octave subsonic filter in C-101. Shaded area is the gain in audible bass.

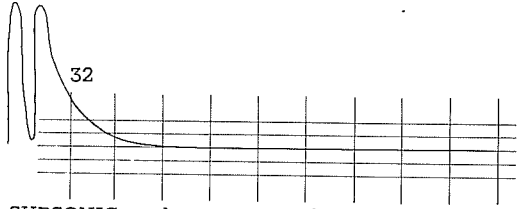
Reflex and vented speaker systems particularly are prone to this sort of potentially destructive woofer cone movement.

If you have such a system, ALWAYS leave the subsonic filter button on. To tell if your speaker system is vented, remove the grille cloth and look for a hole leading into the enclosure. If there is one and you can feel a motion of air when you play the system, you have a vented or reflex system rather than an acoustic suspension (sealed box) system.

The Audio Control octave equalizer uses a sophisticated 3-pole, 18dB per octave subsonic filter to do away with subsonic interference for good, and without any audible side effects. The bass response of your system will sound more solid and in most cases you can safely use a more powerful amplifier. Just press the button... not a bad deal!



A SUBSONIC occurring below 32Hz.



A SUBSONIC made more nasty by boosting of 32Hz bass. That's why we added it: So you can boost the lowest AUDIBLE bass without encouraging destructive hanky-panky an octave below.

A SIDE NOTE: ON MUSICAL TRUTH AND ASSORTED JIVE

You've been hearing about Musical Fidelity, and Flatness and Accuracy and Closeness to Musical Truth for so long that you're probably under the impression that the Brain Police will batter down your door and arrest you if you dare fiddle around with tone and equalization.

Not true.

Musical Truth is a fine concept for cartridges, turntables, amps and speakers. And it is fine to use the C-101 to help your listening room get closer to this Mystical Musical Truth.

But then, when you've cleaned the "sound canvas" of smudges in your sustem's sound, THAT'S THE TIME TO PAINT SOME GLORIOUS SONIC PICTURES WITH THE C-101!

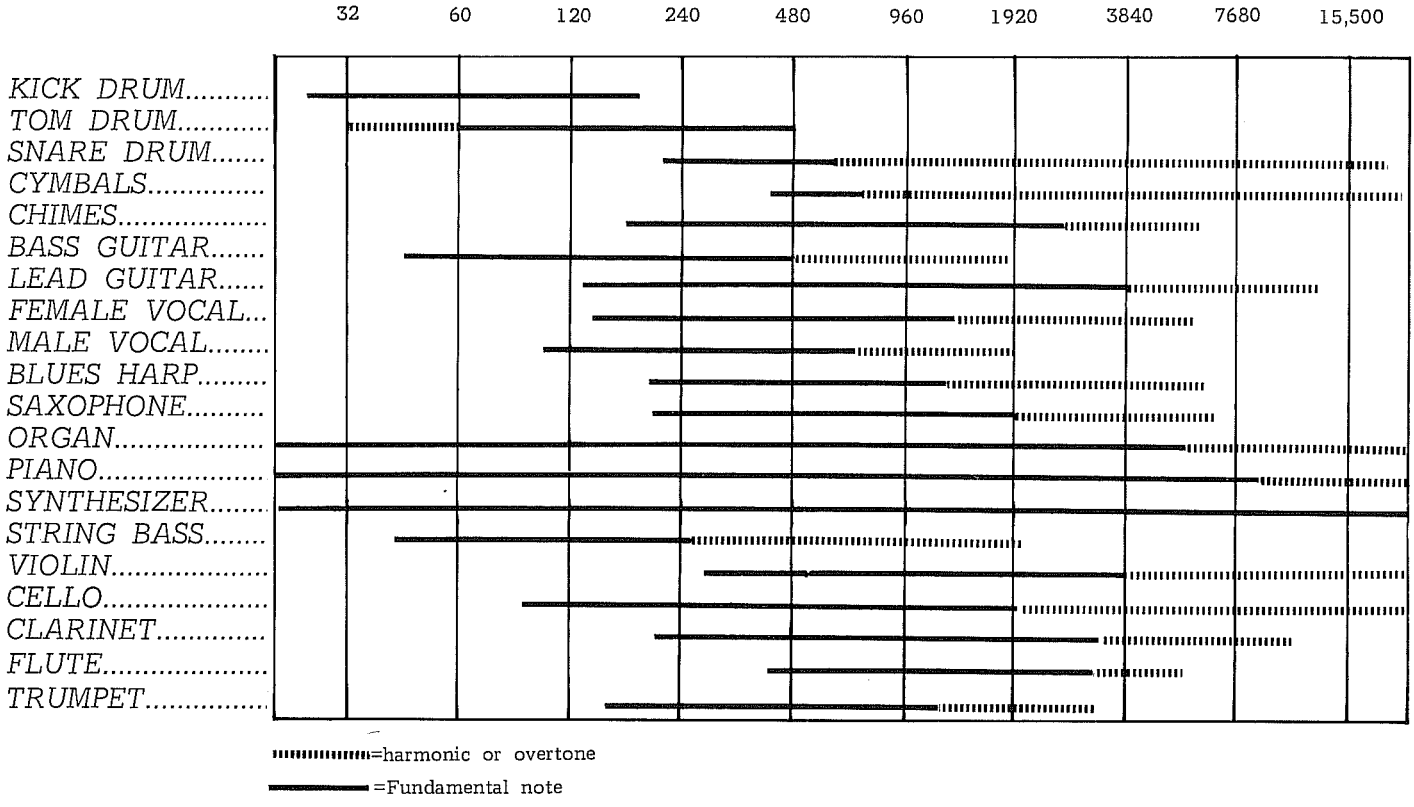
If you like tons of bass, order some up.

If you can't hear a vocal, boost it.

If you just want to fiddle around, fiddle around!

That's what the recording producer and engineer did. And now it's your turn as well.

USING THE C-101 OCTAVE SLIDERS: FACE THE BLACKBOARD, PLEASE



WHERE MUSICAL INSTRUMENTS LIE ON THE SOUND SPECTRUM.

Forget the Audio Control for a minute. Just think sounds.

All natural and recirded sounds are measured in a term called hertz. Not a rent-a-car, but a measure of the frequency or number of vibrations per second. (We'll be battinq this term around quite a bit.)

A cymbal's crisp treble sounds occur at the high end of the frequency spectrum. 10,000 to 18,000 Hertz. Most adult's hearing falls off rapidly at around 15,000 so we consider this the top end of the spectrum.

A bass drum's low thud sounds between 30 to 200 Hertz on the very low end of the audio spectrum. We consider 30 cycles about the lowest reproducible sound possible, and the low end of the hearing range.

In between falls every musical instrument and vocal sound you hear. We've assembled the following chart after consulting with a number of recording engineers and acoustic specialists. It's more than just an informative chart of sound. It's a chart of what you can control now that you have an equalizer ... AND what you'll see on the analyzer section.

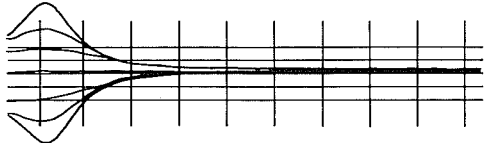
Note that we've diagrammed the range of any possible instrument. That doesn't mean you have to slide all the sliders within that range, though.

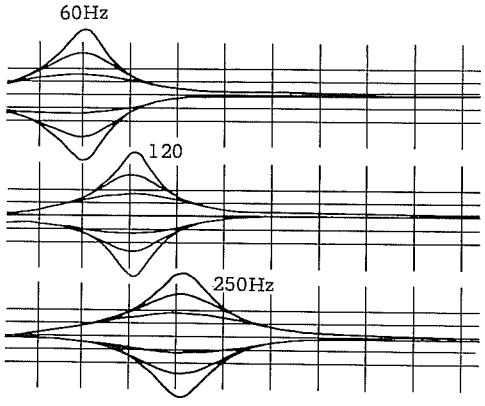
This is where the analyzer section comes in so handy. Watch where a particular instrument or voice occurs on the display. Then go to work on that slider first. Consider that the recording engineer has intentionally boosted certain ranges to give that instrument a special sound.

(Some bass guitars have all their midrange cut off, leaving a very deep "thump". Other producers actually downplay the lowest frequencies in favor of a sharper, more audible boost at about 1K, for example.)

Also, consider that on many pop records EACH TRACK will be different. Again, use your ears (and eyes!) to get the sound *you* like. Which brings us to . . .

32Hz, 60Hz, 120Hz, 250Hz: THE SLIDERS THAT SHOOK THE WORLD!





The four bottom sliders on your C-101 roughly correspond to the bass control on your amp or receiver – or rather we should say that your receiver's bass tone control is what's rough.

32Hz. Truly a piece of the rock. This lowest of lows is what you've always wanted more of. It's the frequency that you *feel* as well as hear. The frequency that kicks you at live concerts.

Unfortunately, the whole signal chain conspires to remove it. Even $1000 microphones aren't flat that low; studio recorders roll off in this area. It's hard to master onto vinyl. Tough to pick up with most styli, and pretty near impossible for most speaker woofers to reproduce.

So, even if you run the 32Hz slider up to +15Hz, your speakers will probably be 5dB or more down at this gutrocking frequency.

Lay it on thick. If you have the woofers and amp power to handle it.

60Hz. Here's the bass you were after when you used to turn on the loudness or bass tone control. It's the deep, tight, strong bass that makes rock solid and disco kick. It's also where most speaker systems start giving out, as you probably saw when you response-analyzed your speakers and room. But, if it didn't take a lot to flatten the response of your system, feel free to add some more.

Most studio producers and engineers actually *cut down* on this frequency to compensate for teeny, tiny AM radios and bubblegummers' cheap compact stereos, so adding some 60Hz is not "gonna be no sin", as B.B. King put it.

It's the slider that makes the bass drums and floor toms "bigger" and broadens bass guitar parts. And, even does surprising things to operatic basso voices. (Forget it on Neil Young's, though.) 60Hz also falls under Admonition 1 farther on.

120Hz. This is the bass that juke boxes and cheap stereos specialize in. It has a boom quality that can get very tiresome to the ears after a while.

That's not to knock it. Push the 120Hz slider to MINUS 5dB and you'll find a lot of what you might have *thought* was bass will be gone.

So, run it up to PLUS 15. Sounds great for just a few minutes. Then your ears will begin to feel like they've been beaten with Hank Aaron's baseball bat.

You see, if 36Hz and 60Hz were the flour and eggs of a cake, the 120Hz band is the vanilla extract and sugar – the flavoring of bass. Boosting it too high is like guzzling straight extract and sugar syrup. Use 120Hz sparingly, as a seasoning, the way producers do.

Maybe +3 to pump up a vocal or a bass guitar part. A bit more if you're a drum freak. Also good for acoustic bass, virtually all symphonic music and your Aunt Tillie's goiter.

240Hz. This is on the upper fringes of bass. Fiddle with it and you'll see it has relatively little to do with bass guitar or kick drum. It does have a lot to do with voices and lead guitar solos, though. Without it they lack body. Add 240Hz to "flesh out" thin vocals or older records with narrower dynamic ranges.

BRINGING THEM FORWARD AND MOVING THEM BACK: 480Hz, 960Hz, 1920Hz, 3480Hz

These sliders control the core of music. Melody instruments, vocals, midrange percussion – almost everything we associate with music. With care, you can substantially change the sound of most melody instruments as well as vocals. Each cut and album will be different, so experiment.

In our experience the 960 slider does most for all-around human voice presence. 480 is great for male voices and jazz tenor saxes. Some solo piano benefits by a little boost here, too.

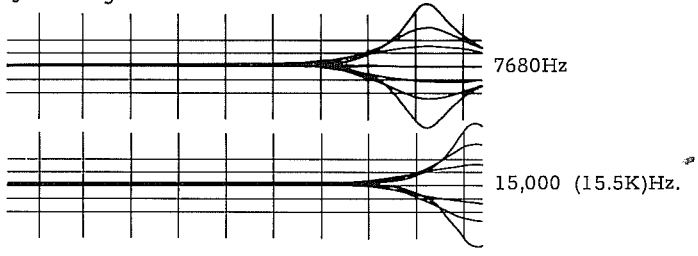
In practice, folks seem to roll off the 1920 and 3840's as much as they boost them. There seems to be plenty of these frequencies in most contemporary pop cuts. The question is, is there too much? Particularly as high sound pressure levels. Try it for yourself.

GETTING VERY HIGH: 7680 AND 15.5K

Oddly enough, neither of these frequencies is as ear-piercing as you might think. What you thought was tinny treble is really lower down at 1920 and 3840. Up at 7680 you'll be surprised how few instruments are actually affected. The tips of womens' vocals, snare drums, some synthesizer and higher brass and woodwinds. But you can use more of it than you might first suppose by its classification as "treble".

As for 15.5 KHz, well, it's the icing on that audio cake we were describing earlier. The crisp sizzling of cymbals, the high harmonic overtones that bring music to life . . . they're all here.

Unfortunately, this is also a frequency which involves (dare we bring it up?) *your age.* From young adolescence on we start to lose the high end of our hearing. It's the ultimate finito frequency roll-off and there's little that can be done about it. Not that we're saying you are getting deaf when you reach thirty. But you can hear less 15.5K than you could ten years ago. That's all.



Boosting this band 3–5dB can "flatten" your hearing curve again and bring a lot out. Just don't get vain and leave it at 0dB.

That's a rundown on the basic purposes of each band. Here are some other uses for the whole group.

APPENDICES

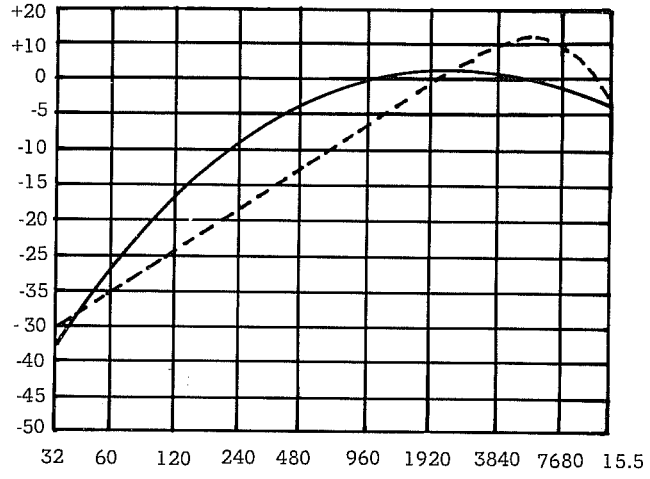
APPENDIX A:
GETTING RID OF HISSES
ST. PATRICK'S CURVE—

Tape hiss won't show up on the response display, but it will be noticeable to your ears.

You can't get rid of all of it because it's mixed with the music. But, some adjustment can knock out the most obvious parts.

Note these graphs. They represent two attempts to pinpoint which hiss frequencies are most audible. The solid line is an older curve called the "A-weighted" curve. The new one is called the CCIR/ARM curve, a 5dB dip at 7680 and 3dB at 3840 seem to get rid of the most hiss and least music.

Experiment, using the A-weight and the CCIR/ARM curves as guides and your ears as judge.



APPENDIX B: EQUALIZING TAPES

Car 8-track or cassette tapes can be graphically improved with your equalizer. In a car, different acoustic properties are encountered and speakers are considerably more limited in their frequency response. So your equalizer can help make complicated tonal adjustments not possible with the crude controls found on most car decks.

32Hz. Many true, died-in-the-wool car stereo nuts totally roll-off this frequency as much as 12dB, when equalizing a car tape. The rationale: Car speakers usually can't handle this low sound and putting it on the tape invites saturation at a lower volume point anyway.

60Hz. Add some, since this is the really good bass area, but remember, car speakers don't go this low too easily and will draw enormous amounts of power doing so.

120 and 250Hz. Here's a case where these frequencies can be cut for good effect. The small drivers used in car systems usually resonate in this frequency range causing an over-abundance of sound. Cutting this frequency range back a little has another advantage, and that is that it will help reveal the lower bass that we are going to talk about in the next paragraph.

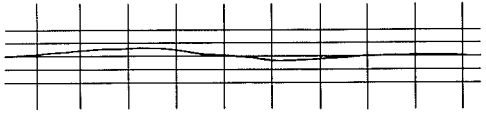
8K and 15.5. While most car speakers put out sufficient 8K highs, almost none do justice to the crisp, tingling, zingy highs at 15.5. Boosting these highs NOW, instead of with the "tone control" on the deck means you are only boosting musical highs, not tape hiss highs.

Equalizing home tapes. If you really get into adjusting your C-101, you'll find that almost every album can be improved in some way and that your speakers can always be improved. Which can mean different settings for each album.

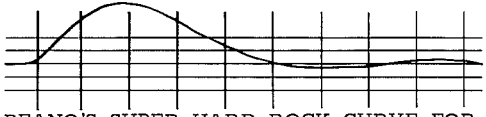
Not if you transcribe them to reel-to-reel or cassette with the EQ TAPE switch in. Now you've captured the EQ setting permanently and can use the equalizer only to compensate for speaker and room problems. Or leave the EQ LINE totally out and just enjoy the subsonic and mono bass settings.

Recording instruments. First, let us say that your Audio Control C-101's PHYSICAL ENCLOSURE IS NOT DESIGNED FOR THE RIGORS OF SOUND REINFORCEMENT USE and IS NOT WARRANTIED FOR SUCH APPLICATIONS!! In other words, the electronics are professional grade, but the case is not armored for months on the road or getting crammed into the lounge band's equipment case.

Its applications in a recording studio are obvious though, and we think it does every bit as good a job as much more expensive ten-bands. So, it you have a home recording set-up, the Audio Control is well suited. Even if you just have a single mic and plink a guitar or piano onto cassette once in a while, your equalizer can improve sound. Refer to the chart of musical sound frequencies for insight into which ones to vary to change which sounds.

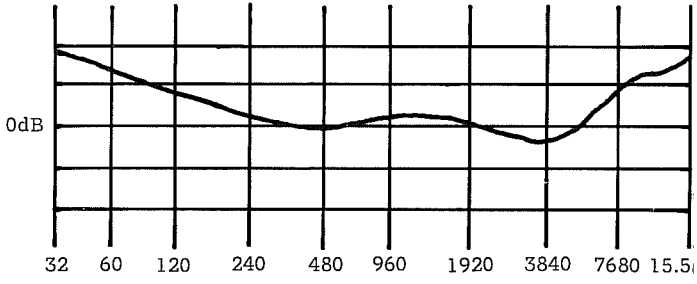


AJAX's PERSONAL HI-END EXPENSIVE CAR-FI CURVE.
-6@32, +3@60, +3@120, -3@480, -3@960, +3@15.5



BEANO'S SUPER HARD ROCK CURVE FOR CHEAP CAR-FI.
-15@ 32, +6@120, -3@480, -6@960, -3@1920, +3@7680, +6@ 15.5

APPENDIX C: HOW TO MAKE AN ACCURATE LOUDNESS CURVE



Even though you probably used the LOUDNESS button on your receiver as a way to make your speakers sound better, what it was REALLY for was to compensate for your ear's selective sensitivity to different frequencies when the volume is reduced.

Turn your hi-fi down low and you will hear predominantly mid-range. Bass and treble recede.

That's partially explained by the natural sensitivity of our ears to certain frequency ranges. Originally, natural selection and evolution provided us with ears made to hear animal calls, the cries of other humans, rustling leaves, running water and crackling fire. All are sounds falling mostly in the 500KHz to 3840Hz range.

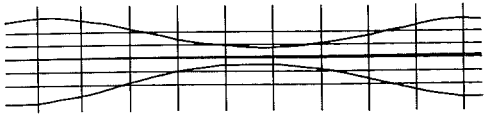
Thus, our ears are much more sensitive to sounds in these ranges, Two scientists named Fletcher and Munson made a graph of this.

It represents the intensity of each frequency needed to sound the same. Note that we need much less of certain frequencies.

In terms of your stereo and the C-101, it means that as you crank up the SPL (sound pressure level) you can adjust for your ears' increased sensitivity to the mid-range. If you want sound real low for a party or relaxing — but still want to hear the nice, deep bass and crisp little sizzles — you can compensate the other way. Note that as SPL changes, the curve changes.

And, of course, you KNOW the SPL because you can measure it, courtesy of you C-101.

APPENDIX D: THREE HUMBLE PIECES OF CAUTIONARY ADVICE FROM THE OLD STEREOPHILE ON THE MOUNT



TYPICAL AMBIGUOUS BROADBRUSH TONE CONTROL EFFECTS.

1. Consider: A 10 inch woofer must move upwards of a hundred square inches of cone, an inch or so, in-and-out against the pressure of the room air and sealed box. While a tweeter moves less than a thousandth of an inch.

So, guess which type of driver takes up to 80% of your poor stereo's power?

You guessed it. And that's before you arm yourself with a C-101 and boost the bass a lot more.

Say you have a 60 watt amp. Turn the volume knob to the twelve o'clock position and you're probably clipping your speakers somewhat. Crank it up to five o'clock and, chances are, you're gonna blow something up due to the amp's inability to put out enough power.

Now hook the C-101 in, equalize your system, and you discover you need +12dB at 32, +10 at 60Hz, and +3 at 120 to make the speakers flat in response.

Now your poor 60 watts-a-channel receiver is gasping at even lower overall sound pressure levels due to the increased bass power requirements of the 60 and 120Hz boosts.

SO MAKE SURE YOUR AMP CAN TAKE THE EXTRA POWER DEMANDS PUT ON IT BY BOOSTING THE C-101's LAST FOUR OCTAVES'

2. Don't totally stop using your receiver's tone controls. Remember when we had you use them to make "broad stroke" room EQ adjustments before fine tuning with the C-101? Heavy-handed and pretty general in effect, but sometimes their effect is the same as what you were trying to do with five or six sliders. Check your amp or receiver's owner's manual for the specs of the tone controls. Now that you've been working with the C-101 you'll understand better what your old tone controls can and can't do.

3. Stay loose. This supposed to be a FUN hobby.

APPENDIX E: FOR-WHAT-IT'S-WORTH DEPARTMENT

1. Compare a digital recording of, say, Stravinsky's Firebird, with a well-recorded conventional record of the same piece. Note the increased dynamics and extended frequency response. Note how single bands tend to react without "dragging" other Accent Bands along with it.

Play a record made in the mid or early 60's. Note the lack of 32, 60, 7680 and 15.5K.

Compare a well-recorded home-made tape with a mass-produced pre-recorded cassette . . . and try to keep from throwing up.

Now that you can "see" sound, high fidelity and higher fidelity and frequency response are going to start to make more sense.

2. Consider what a marvelous children's teaching tool the C-101 makes. Think how much farther you might have gotten into music if you had such a visual window on sound during YOUR inquisitive years.

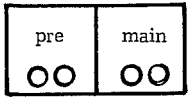
First, it's something your children can watch without "touching daddy's or mommy's stereo."

It's also a great accompaniment to your kid's fave records. (Yes, Kermit *does* look different on the C-101 or C-50A display than Miss Piggy.)

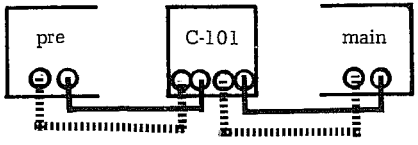
Invest in a sound effects record, too. It's one demo your kids won't yawn through.

3. On a related subject . . . as long as your amp is kept at a relatively low sound level (say nine o'clock on the volume knob), there is VIRTUALLY NOTHING on the C-101 that can't stand the inquisitive touch of an older child. This is one piece of gear that can be exempt from the "Hands-Off-Or-Else" policy.

APPENDIX F: DIVIDE AND CONQUER— ANOTHER WAY OF HOOKING UP THE C-101 OR C-50A NOT RECOMMENDED



RECEIVER



What you really own is a power amp and a pre-amp hooked together with VERY short cords. The plugs on the amp or receiver back let you interpose any number of devices between the control section (pre-amp) and power amp, which just amplifies signals.

Just pull out the two short "U" plugs connecting PRE and MAIN on your amp or receiver. Connect amp PRE to the equalizer's IN; connect the equalizer's OUT to your amp's MAIN. Now the Audio Control is actually part of your amp, just like the tone controls on its front.

Don't try it if you're EQing tapes, however, since the pre-amp gain control would also control tape input gain.

DIVIDING AND CONQUERING THE ALREADY DIVIDED. The true audiophile has a separate pre-amplifier and one or more hugh, industrial strength power amps hulking on his shelf. For them, there's no need to dig around for the PRE and MAIN outlets. His amplification is already divided. Again, the Audio Control may be inserted as an integral part of the system between the pre-amp and the
the pre-amp out and the power amp in.

Well, that's it. If you have any questions, gripes, additions, or raves concerning this manual, write us: Attention Ajax at the same address given for factory service at the end of this manual.

APPENDIX G: SPECIFICATIONS

MODEL 101.

DISTORTION:
Less than 0.25% (at 1 volt from 20Hz to 20kHz)

FREQUENCY RESPONSE:
From 3Hz to 100 kHz, plus or minus .75dB

HUM AND NOISE:
Minus 90dB re 1 volt, minus 96dB re 2 volts, (10kHz bandwidth)

MAXIMUM INPUT: 7 volts

MAXIMUM OUTPUT: 7 volts

INPUT IMPEDANCE: 100Kohms

OUTPUT IMPEDANCE: 150ohms

CONTROL BANDWIDTH: („Q"):2.5

CONTROL CENTER POINTS: 32, 60, 120, 480, 960, 1920, 3840, 7680, 15.5kH

CONTROL RANGE: Plus or minus 12-15dB

SUBSONIC FILTER:
18dB/octave Tchebychev alignment

SUBSONIC ROLLOFF RATE:
-1dB @ 25Hz, -3dB @ 20Hz, -21dB @ 10Hz

SIZE: 19" (48.2cm) W, 3.5" (8.9cm) H, 6.5" (16.5cm) D standard EIA rack mount

WEIGHT: 6.75 lbs. (3.2kg.)

APPENDIX H: AN INTRODUCTION TO THE AUDIO CONTROL CONDITIONAL WARRANTY

People are scared of warranties. Lots of fine print. Lots of non-cooperation. 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 Audio Control product.

Also, warranties help us keep track of our customers so we can let you know of any modifications, dangers or improvement. The old factory recall thing. Now, that doesn't mean you are going to get put on a mailing list, and get weird Aztec porno or free deodorant samples. Your name and address on the warranty are strictly confidential to Audio Control.

So, go ahead and read through your warranty, then enjoy your equalizer for a few days before sending in the warranty and any comments.

CONDITIONAL WARRANTY

"Conditional" doesn't mean anything ominous.

The Federal Trade Commission tells all manufacturers to use the term to indicate certain conditions you have to meet before they'll honor the warranty.

If you honor these conditions, we will warrant all materials and workmanship on your Audio Control product for one year from the date you bought it, and will fix or replace it 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 have purchased your Audio Control product.
2. You must keep your sales slip or receipt so you have proof of when, and from whom, you bought your equalizer. We're not the only company to require this, so it is a good habit to get into with any hi-fi purchase.
3. Your Audio Control product has to have been originally purchased from an authorized Audio Control dealer. You do not have to be the original owner to take advantage of the one-year warranty, but the date of purchase is still important so be sure to get the sales slip from the original owner.
4. You can't let anybody who isn't (a) an authorized Audio Control service center; (b) the Audio Control factory; or (c) someone authorized in writing by us, work on your Audio Control unit. If anyone other than (a), (b) or (c) messes with it, that voids the warranty.
5. The warranty is also NOT in effect if the serial number has been altered or removed, or if the Audio Control unit 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 do if you need service.)

Legalese section.

This is the only warranty given by Audio Control. This warranty gives you specific legal rights, and you may also have rights which vary from state to state. Promises of how well your Audio Control product will work are not implied by this warranty. Other than what we've covered in this warranty, we have no obligation, express or implied. Also, we will not be obligated for direct or indirect consequential damage to your system caused by hooking up the Audio Control equalizer.

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

What to do if you need service.

First, contact Audio Control. In writing, at: 22313 70th Ave. West, Mountlake Terrace, WA 98043 (Attention: Service Dept). 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 ONE day! 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.

Stop the presses!

The C-101 is now covered by a five-year warranty. All references to a one year warranty should now be read as a five year warranty.

THE AUDIO CONTROL STORY

We could be making electric toothbrushes, but we're not.

Audio Control's president made that observation while explaining why we design and handcraft stereo equalizers and other sound products. Of all the things a group of employees could legally produce in a Lynnwood, Washington factory, we think a device that lets you hear music better is just about the best thing we could be making.

We incubate and hatch our products in a modern plant complete with solder baths, non-stop FM over half dozen big speakers, a ping pong table in the breakroom, a Lab with a matched set of frisbees, more test equipment than a Japanese sci-fi flick, and employees so friendly that the UPS man regularly stops in to have lunch with us.

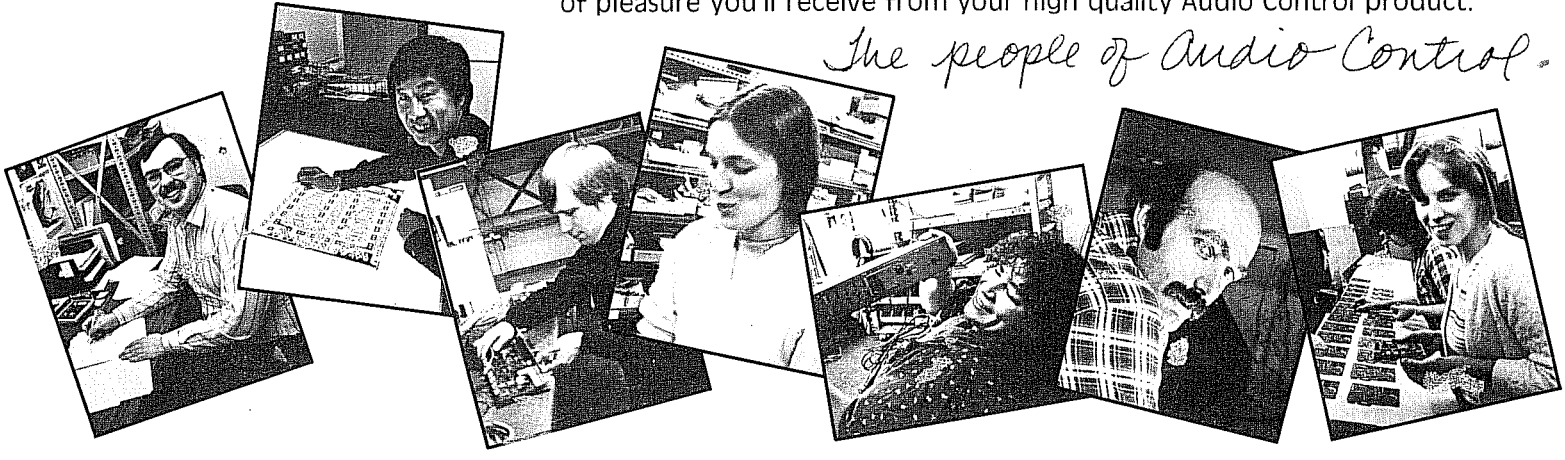
Maybe it's that we're located out here in the misty rain forest of the Northwest where moss grows on the windshields, the sun rarely makes it through the overcast, and Boston ferns grow so well they've formed a union. This fertile soil has grown Carver, Phase Linear, Speakerlab, and Tapco.

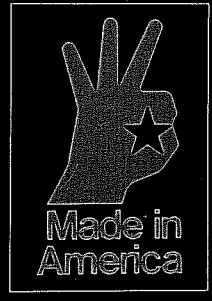
Whatever it is here in the Northwest, we're perfectly content to stay here and keep producing high quality, well-engineered, affordable hi-fi equipment without so much as a glimmer of the sort of greed and me-too-manship that so often pervades the stereo market. We like producing a high quality product that is useful and gives people pleasure without wasting energy or resources. Something nobody else thought of, though should have.

Thus, we're not only interested in what goes out of Audio Control, we're interested in the comments which come back. Our fearless leader and production staff still read every warranty card, suggestions from which have lead to customer-based product changes instead of marketing department speculation.

We're really glad you bought something from us. Our appreciation will come back to you in the thousands of hours of pleasure you'll receive from your high quality Audio Control product.

The people of Audio Control.





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22410 - 70th Ave. W. Mountlake Terrace, WA 98043

Phone (206) 775-8461