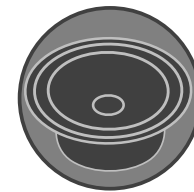


EQ300

installation manual ■ ■ ■ a/d/s/



analog and digital systems, inc
300 wildwood avenue
woburn, ma 01801

319-0724 revA 3/99

analog and digital systems

frequency	level preset 1	level preset 2	level preset 3	level preset 4	
25Hz	---	--	--	--	-
31.5Hz	---	--	--	--	-
40Hz	---	--	--	--	-
50Hz	---	--	--	--	-
63Hz	---	--	--	--	-
80Hz	---	--	--	--	-
100Hz	---	--	--	--	-
125Hz	---	--	--	--	-
160Hz	---	--	--	--	-
200Hz	---	--	--	--	-
250Hz	---	--	--	--	-
315Hz	---	--	--	--	-
400Hz	---	--	--	--	-
500Hz	---	--	--	--	-
630Hz	---	--	--	--	-
800Hz	---	--	--	--	-
1000Hz	---	--	--	--	-
1250Hz	---	--	--	--	-
1600Hz	---	--	--	--	-
2000Hz	---	--	--	--	-
2500Hz	---	--	--	--	-
3150Hz	---	--	--	--	-
4000Hz	---	--	--	--	-
5000Hz	---	--	--	--	-
6300Hz	---	--	--	--	-
8000Hz	---	--	--	--	-
10000Hz	---	--	--	--	-
12500Hz	---	--	--	--	-
16000Hz	---	--	--	--	-
20000Hz	---	--	--	--	-

warranty information

There are two things you must do to ensure trouble free service in the event you need warranty repairs.

- 1 - Keep your original sales receipt in a safe place. A copy of the receipt will be required to obtain warranty service.
- 2 - Be sure your retail dealer has written the date, the model number, and the serial number (if applicable) of the Product on the receipt.

To give yourself an extra measure of protection, make a separate record of the information about your purchase and keep it in a safe place. In the event you misplace the sales receipt, your dealer may be able to give you a copy.

Take a moment now to read the terms of your warranty. Check to be sure your sales receipt is dated and has the Product model number and serial number (if applicable) on it. Then put it away in a safe place.

When shipping a Product in for service:

- Enclose a copy of your original sales receipt that has the date, the Product model number and serial number (if applicable) written on it.
- Always ship Products in the complete original packing material.
- Avoid shipping Products via the Postal service. If you must use the Postal service, be sure to register and insure the package.

a/d/s/ Limited Warranty

Analog and Digital Systems, Inc. (a/d/s/) warrants to the original consumer purchaser of the a/d/s/ Products described in this manual, that the Product will be free from defects in materials and workmanship for a period of one (1) year after the date of purchase. If the product is installed by an authorized a/d/s/ retail dealer, the warranty is extended to three (3) years, a/d/s/ sole obligation under this warranty shall be to provide, without charge, parts and labor necessary to remedy the defects, if any, that appear during the warranty period.

This warranty is the sole and exclusive express warranty given with respect to the Product. All other express warranties are hereby excluded. Neither a/d/s/ nor the authorized dealer who sells the Product is responsible for indirect, incidental, or consequential damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

IMPORTANT - Keep your original sales receipt. Be sure the retail dealer has written on it the date, model number, and serial number (if applicable) of the Product. This information is required for warranty service.

This warranty is limited to:

- Products purchased from authorized a/d/s/ retail dealers in the United States. a/d/s/ will supply a list of authorized dealers on request.

In order to obtain warranty service you must:

- Return the Product, freight prepaid, to the a/d/s/ dealer from which it was purchased, an authorized a/d/s/ independent service agency, or to a/d/s/. If necessary you may call a/d/s/ Customer Service Department for the names and addresses of authorized independent service agencies in your area.
- Provide proof of purchase in the form of a copy of your original sales receipt. The date, model number, and serial number (if applicable) of the Product must be written on the sales receipt.

This warranty does not cover:

- Damage that is the result of misuse, abuse, accident (including but not limited to damage by water), faulty hookup, defective or maladjusted associated equipment, or the use of the Product with equipment for which it was not intended.
- Cosmetic defects that appear more than thirty (30) days after the date of purchase. Cosmetic damage caused by improper handling is also excluded.
- Products that are used for commercial purposes.
- The cost of removing or reinstalling the Product.
- Damage that occurs while the Product is being shipped to whoever will service it. See the information above regarding shipping procedures.

This warranty is void if:

- The Product identification or serial number label is removed or defaced in any way.
- The Product is serviced or repaired by any one other than a/d/s/ or an authorized a/d/s/ dealer or service agency.

introduction

Thank you for your purchase of the a/d/s/s EQ300. The latest technological advancement in car audio signal processing. The EQ300 processes all the equalization in the digital domain and comes equipped with both analog to digital and digital to analog converters. The EQ300 contains four preset stations called "presets" which allow storage of several useful equalization curves. This is especially useful in sound-off competition where the EQ300 presets can be set for "Sound Quality", "RTA", "SPL" and regular listing. The addition of a EQ300 to a system is a must for a competition system or for people who demand the best.

This manual is designed to answer your questions about this product. To accomplish this task, the manual is divided into several different sections according to the type of questions you may have. These sections are Introduction, What's in the Box, Technical Overview, System Planning, Installation, User Interface, International Reference, Trouble Shooting, Specifications and Warranty. In the event you have questions not covered in this reference, please refer questions to your local Authorized a/d/s/ Dealer. Additionally, you can call a/d/s/s Technical Support Hotline at 781.729.1140 for assistance.

Record your serial number and date:

Serial Number:

Date of Purchase:

what's in the box

QTY	Description
1	EQ300
1	4 conductor 12 gauge power connector
4	#8 Phillips Pan Head Screws
1	EQ300 Reference Manual

technical overview

Designed for the person who competes or wants the maximum performance possible, the EQ300 is a must for all high-end systems. Each channel of the EQ300 can be adjusted individually or be linked together. The EQ300 can accept direct digital input (TOSLINK and COAX) from a digital output source unit or changer, RCA input or Balanced input (Mini-XLR) for use with balanced output signal processors or OEM integration. The EQ300 process all Equalizer and output level functions digitally. After the information is processed, The EQ300 can transmit the information digitally (via TOSLINK or COAX) for an outboard Digital-to-Analog converter or can convert the digital signal internally with its built-in Digital-to-Analog converter for either balanced output or conventional RCA. There is also a serial data port for future remote and IBM compatible laptop computers control.

True Digital Equalization: All equalization is performed digitally by proprietary digital algorithms. Digital equalization achieves perfect phase response. The signal-to-noise ratio is unaffected by equalization adjustments. Frequency centers, boost levels and "Q" values are exact. There is no variance like analog circuits. Additionally, digital equalization eliminates oscillations normally associated with analog circuits.

30 bands separate left and right adjustment: 30 bands of equalization set to the exact frequencies on 1/3 Real Time Analyzers. Left and right channels can be adjusted individually.

4 presets: 4 working presets allows for different preset curves for different listening preferences.

Analog Input Section: The EQ300 Uses an 18 bit balanced sigma delta analog-to-digital converter with 196 times oversampling. It accepts both RCA and Balanced (Mini XLR) inputs. Left and right input sensitivity adjustments are fully variable and independent.

Digital Input Section: The digital input section uses a Professional Grade SPDIF receiver. This is the same receivers used in high-end home audio and professional applications. The EQ300 supports 44.1 kHz and 48 kHz sampling frequencies and both TOSLINK and COAX digital inputs.

Analog Output Section: The analog output section is a wide dynamic range 18 bit continuous bitstream calibration digital-to-analog converter (made by Phillips) with 196 times oversampling. It has low total harmonic distortion with no "zero crossover" distortion and incorporates digital de-emphasis. The EQ300 has both RCA and Balanced (Mini XLR™) Outputs. The output voltage is 9 Volts rms. output for the RCA outputs and 18 Volts rms. output (9 Volts rms. output per phase) for a balanced system.

Digital Outputs: Digital outputs use Professional Grade SPDIF transmitters. These are the same receivers used in high-end home audio and professional applications. The output frequency 44.1 kHz. The EQ300 supports both TOSLINK and COAX digital formats.

C-Lock™ Anti-Jitter Reduction Circuit: C-Lock anti-jitter clock recovery system virtually eliminates jitter from a digital signal. Jitter in a digital signal creates amplitude errors in rapidly changing signals. The C-Lock circuitry strips away the existing clock information and replaces it with a reconstituted correctly time clock. The result is a perfectly timed digital signal.



Power Supply: The power supply used in the EQ300 is a balanced high-frequency power supply. For optimal noise isolation, power and signal grounds are isolated.

Computer interface: The EQ300 uses a RJ-11 port that supports a IBM computer compatible RS-232 data interface that will be released in the future.

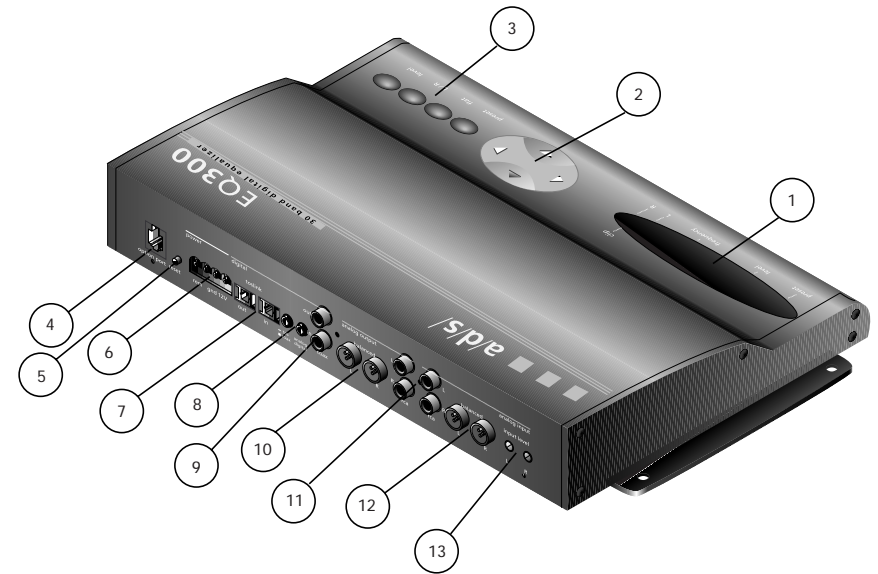
symptom	probable cause	action to take
Poor bass response	poor output connections	Check output connections and fix or replace as needed
	Signal processors are blown or damaged	Check system with know working signal processors and fix or replace as needed
	Amplifiers are blown or damaged	Check system with know working amplifiers and fix or replace as needed
	Speakers are blown or damaged	Check system with know working speakers and fix or replace as needed
Battery fuse blowing	Speakers wired with wrong polarity causing cancellation at low frequency	Check speaker polarity and fix as needed
	Balanced inputs are wired with wrong polarity causing cancellation at low frequency	Check Balanced cable polarity and fix as needed
	Short in power wire or incorrect power connections.	Check power and ground connections and fix or repair as needed
	Fuse used is smaller than recommended	Replace with proper fuse size
	Too much current being drawn	Check power and ground connections and fix or repair as needed
	Too much current being drawn	Check power and ground connections and fix or repair as needed
	Fuse used is smaller than recommended	Replace with proper fuse size

troubleshooting

symptom	probable cause	action to take
No output	Low or no remote turn-on input	Check remote turn-on voltage output at amplifier and fix as needed
	Fuse blown	Check power wire integrity and check for speaker shorts. Fix as needed and replace fuse
	Power wires not connected	Check power wire and ground connections and fix or replace as needed
	Audio input not connected	Check input connections and fix or replace as needed
	Audio output not connected	Check output connections and fix or replace as needed
	Speakers are blown	Check system with known working speaker and fix or replace speakers as needed
No output	Amplifier not working	Test with known working amplifier and repair or replace amplifier as needed.
	Analog/Digital input selector improperly configured	Reconfigure Analog/Digital input selector to its proper setting
	TOSLINK/COAX input selector improperly configured	Reconfigure TOSLINK/COAX input selector to its proper setting.
Audio cycles on and off	Analog input gains set to low	Reset input gains. Refer to the section "SETTING ANALOG INPUT LEVELS" in this manual for details.
	Thermal protection engage when unit temperature exceeds 90°C	Make sure there is proper ventilation for unit and improve ventilation as needed
	Loose or poor audio input	Check RCA connections and fix or replace as needed
	Loose power connections	Check power wire and ground connections and fix or replace as needed
Distorted output	Units input sensitivity set too high. Exceeding maximum capability of audio outputs	Reset input gain. Refer to section "SETTING ANALOG INPUT LEVELS" in this manual for detailed instructions

call out features

1. LED Display
2. Parameter Adjustment Key Pad
3. Parameter Selection Buttons
4. RS-232 Data Control Port
5. DSP Reset Button
6. Power connections
7. TOSLINK digital inputs and outputs
8. Digital input selection switches
9. COAX digital inputs and outputs
10. Balanced outputs
11. RCA inputs and outputs
12. Balanced inputs
13. Analog input level adjustment



installation

The installation of all a/d/s/ components will determine the overall performance result. Improper installation will not only limit the performance of your a/d/s/ system but also potentially compromise the reliability of this digital processor. To ensure proper sonic results and component reliability, please refer to your Authorized a/d/s/ dealer for installation assistance or advice. If you decide to perform the installation yourself, read the entire installation section of this manual before beginning the installation.

tools for the trade

Listed are the majority of the tools required to perform the installation. Having the proper tools will make the installation that much easier. Some of these tools are necessities. Some make the job much easier.

- marking pen
- electric drill with assorted drill bits
- utility knife
- Phillips and flat blade screw drivers
- pliers (standard and needle nose)
- wire brush or sandpaper for chassis grounding
- solder iron and solder
- grommets
- heat shrink tubing
- nylon tie straps
- volt ohm meter (optional)
- wire cutters
- wire crimpers
- wire strippers
- RTA (real time analyzer)
- Reference CD with 1 kHz Sine Wave at 0dB level (all bits high)

power connections

EQ300's power supply is an ultra-quiet balanced high-frequency supply. All power and signal grounds are isolated for complete noise rejection.

- Power connections made through large four terminal removable connector.
- Accommodates up to 12 gauge wire.
- Connect 12V+ to the battery through fuse holder. This connection provides +12V main power to the EQ300.
- Power wire must be fused less than 18" from battery.
- Ground unit to chassis as close as possible.
- Connect one REM terminal to remote turn-on lead from source unit. This connection provides +12V power to turn-on the EQ300.
- Connect one REM terminal to REM terminals on amplifiers and additional trunk mounting signal processors. This connection provides +12V to the remote turn-on leads of the amplifiers to amplifiers on.

NOTE: A power reset button located next to the power connections terminal is useful resetting the microprocessor in the unlikely event of processor lock up.

SPECIAL NOTE: There is an internal 3 AMP AGU fuse located internally in the EQ300. This fuse is designed to blow only in extreme situations like power surges in the vehicles electrical system. In this type of situation, the internal fuse serves to protect the EQ300 for potential damage.

specifications

True digital equalization

All equalization is performed by a proprietary digital algorithms
Achieves perfect phase response
Signal-to-noise ratio unaffected by equalization adjustments
Eliminates oscillations associated with analog circuits
Frequency centers, boost levels and "Q" values are exact. No variance like analog circuits.

30 bands separate left and right adjustment

30 bands of equalization set to the exact frequencies on 1/3 Real Time Analyzers.
Left and right channels can be adjusted individually.

4 preset working presets.

4 working presets allows for different preset curves for different listening preferences.

Analog Input Section

18 bit balanced sigma delta analog-to-digital converter.
196 times oversampling
Accepts both RCA and Balanced (Mini XLR) inputs
Separate left and right input level setting

Digital Input Section

Professional Grade SPDIF receiver
Same receiver used in high-end home audio and professional applications
Supports both 44.1 kHz and 48 kHz sampling frequencies
Supports both TOSLINK and COAX digital inputs

Power Supply

Balanced high-frequency power supply
Power and Signal grounds floating for complete noise isolation.

C-Lock Anti-Jitter Reduction Circuit

Eliminates Jitter from any digital source

Analog Output Section

18 bit continuous bitstream calibration digital-to-analog converter (Phillips)
196 times oversampling
Low total harmonic distortion
No "zero crossover" distortion
Digital De-emphases
wide dynamic range 18 bit d/a converter
RCA and Balanced (Mini XLR) Outputs
9 Volts rms output (per phase)
Signal-to-noise ratio greater than 100 dB

Digital Outputs

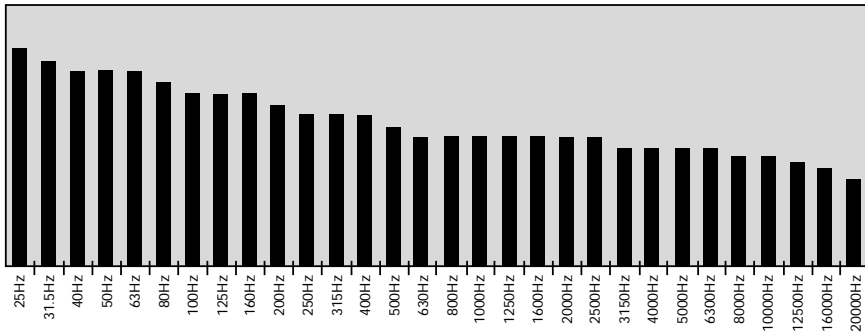
Professional Grade SPDIF transmitters
Same receiver used in high-end home audio and professional applications
Output frequency 44.1 kHz
Supports both TOSLINK and COAX digital formats

Dimensions

(L x W x H) · 8.75" x 11.75" x 2" · 222mm x 298mm x 51mm

Corrected Response

The above corrected response is not a perfectly flat curve. For good sound quality in a vehicle a flat curve may sound great when the vehicle is stopped and the engine is off. However, most people put system in cars to listen to great music with the engine running while driving. The above response is not a mandate for good quality sound in a vehicle but one example of a frequency response that has smooth transitions from octave to octave and compensates for the road and vehicle noise. To get the best sound quality in a system, use an RTA to detect and resolve problems but use your hearing to determine if the finished product is acceptable. Because your the one listening and enjoying the system, not the RTA and a/d/s/ brings you one step closer with the EQ300. Enjoy!



analog inputs

Capacitor Value C1= 10mF non-polar capacitor Resistor Value R1= 20W to 100W Connect A & D to the chassis ground of the radio Connect B to the left speaker positive Connect C to the left speaker negative wire Connect E to the right speaker positive Connect F to the right speaker negative wire

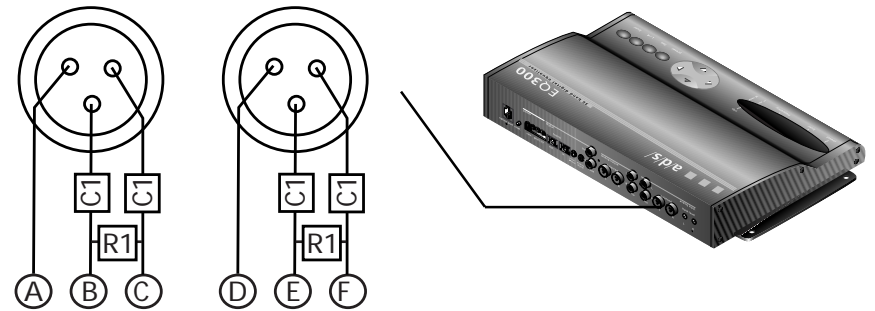
The EQ300 can accept either balanced (Mini-XLR) inputs or RCA inputs. However, only one input can be chosen per installation. The EQ300 was not designed to be a multi-source input selector. The system designer / installer must determine which configurations will work and yield the best sound quality.

The input sensitivity is adjusted with separate left and right input level potentiometers. Input range from 150 mV up to 10 volts rms. (per phase). The balanced inputs are perfect for an OEM interface. (See diagram below) The added capacitors eliminate any potentially damaging DC offset from an OEM source unit. The added resistors load the source unit so that a power fader, if applicable, will operate correctly.

The analog to digital conversion is handled by an 18 bit balanced sigma delta analog-to-digital converter. It has 196 times oversampling. It is the same converter used in high-end professional recordings. The result is a near invisible conversion from the analog to the digital domain.

Properly setting the level of the EQ300 requires a test disc with a tone recorded at all bits high (the highest possible recording level). A clip indicator informs you if the level is too high. If you do not have a test disc you can still adjust the input levels but it is much more difficult to maximize the system.

The beauty of EQ300 is that the signal-to-noise ratio to not degrade with boost. As long as the equalizer is not clipped, boosting the EQ300 will not add any distortion or noise. Since most musical recordings never reach a high recording level in the upper frequency range, the EQ300 will allow you to boost the upper bands without penalty.



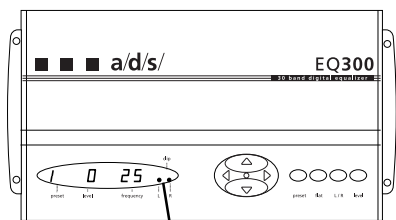
capacitor value C1=100uF non-polar capacitor
resistor value R1= 20 Ohms to 100 Ohms
connect A & D to the chassis ground of the radio
connect B to the left speaker positive
connect C to the left speaker negative wire
connect E to the right speaker positive
connect F to the right speaker negative wire

setting analog input levels

1. Install EQ300 into your system.
2. With your source unit volume control set at a low position, test the function of the system. Once satisfied proceed to the next step.
3. Turn the gain controls of the EQ300, your amplifiers and other components in your system to their minimum position.
4. Cue up the reference CD to the track with the 1 kHz test tone at "all bits high". If you do not have a CD player, see Non CD Setup.
5. Set your volume on your source unit to 3/4 volume.
6. Slowly turn up the gain controls on the EQ300 until you can hear the pure tone. **HINT!** The lower the initial volume the better.
7. Turn up your volume of your source unit until the output of the pure tone becomes distorted (sounds like fuzziness in the tone) and then turn back down until you hear a pure tone again. The maximum undistorted output of the source unit is now set.
8. Disconnect the output of the EQ300 from the rest of the system.
9. Leaving the Source units volume control set, slowly increase the left gain of the EQ300 until the "CLIP" LED indicator become illuminated. The output of the EQ300 is currently clipped.
10. Turn down the left gain control until the LED goes out. **HINT!** The closer the gain is set to the point where the LED goes out the better signal-to-noise ratio and channel output balance you will have. The output of the EQ300 is now optimally set for the left channel.
11. Repeat steps 9 & 10 for the right channel gain. Your EQ300 is now perfectly level matched for your system. Maximum output on your CD player will yield more than 9 volts rms. (per phase) output. The EQ300 is also optimally configured for digital output.

"CLIP" LED Illuminates when input is overloaded.

Non CD Setup: Set source unit to 3/4 volume with dynamic content music. Set amplifier gains to their minimum position. Slowly turn up the gain controls of the EQ300. Be careful not to exceed the maximum output of the EQ300. Maximum output is exceeded when the "CLIP" LED indicator is illuminated.



clip indicators



gain controls

Time Alignment Error Problems

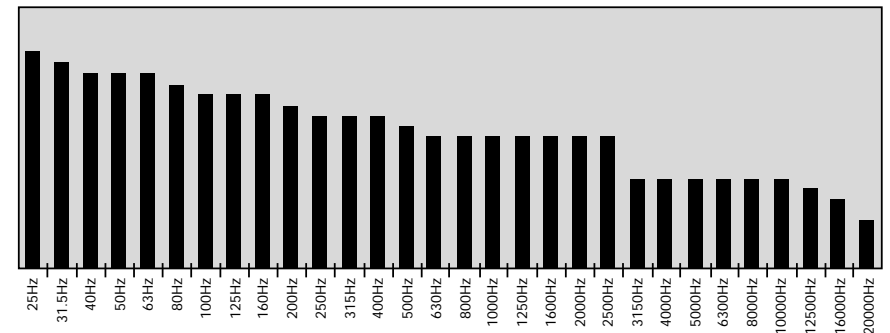
Time alignment errors are caused by speaker that are located at different distances relative to the listening position. Time alignment errors are difficult to detect only using an RTA. In some cases, time response errors can be indicated by a shelving effect of a particular driver (in the above situation the tweeters) in such a way that the response is smooth but appears to be disjointed from the adjacent drivers.

Non-Equalizer Solutions

This problem can be better identified by using a time delay device (usually digital) to delay the apparent louder drivers. In the above situation, this would be the midrange. When using time alignment, first integrate the midrange and tweeters then add the woofers. If you delay a set of drivers and the response does not change, then the problem is not time related and you should employ methods discussed in "Output Level Incompatibility Problems"

Equalizer Solutions

Use the EQ300 first as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you changes adjacent bands. When boosting the EQ300 is required, take care not to exceed the maximum undistorted output level of the EQ300. For reference, an illuminated "Clip" LED indicates that the maximum output level has been exceeded. Periodically listen to your system during this process to make sure that the changes improve the system.



Absorption/Reflection Related Non-Linearity Problems

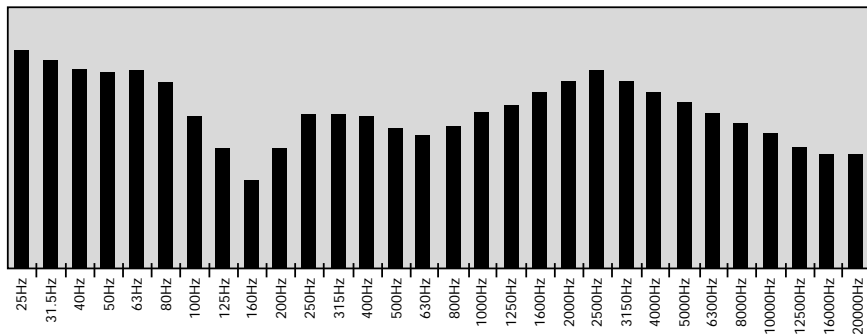
Absorption/Reflection Related Non-Linearity Problems are caused by the interaction of speakers with the interior acoustics of the vehicle. Examining the speaker mountings and locations may give clue to potential problems and potential solution. Be sure that the speakers have an unobstructive path to the listen position and also directly behind the speaker. Any object in the speakers path will affect the sound quality of the system.

Non-Equalizer Solutions

Examine the surrounding of the speaker. If any object block the path of the speakers remove it. If this is not possible, minimize the effect of the obstruction by applying a type of absorption material on the object like a felt or high density fiberglass. or install some absorption material in the path between the speaker and the obstruction so as to minimize the effect. If the rear of the speaker (midrange or woofer) is close to a reflective panel, place damping material between the speaker and the reflective baffle. Also if any frequency response errors occur near crossover points, try changing speaker polarity of on the speakers or try using different crossover frequencies.

Equalizer Solutions

Use the EQ300 first as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you changes adjacent bands. When boosting the EQ300 is required, take care not to exceed the maximum undistorted output level of the EQ300. For reference, an illuminated "Clip" LED indicates that the maximum output level has been exceeded.. Periodically listen to your system during this process to make sure that the changes improve the system.



digital inputs

The EQ300 can accept a direct digital signal from a Compact Disc, Mini Disc or DAT source unit (44.1 kHz and 48 kHz sampling frequencies). Both TOSLINK and COAX connectors interface with a professional grade SPDIF receiver. That allows direct access into the digital processor inside.

Selecting Digital Inputs

The Analog/Digital push button selector switch determines whether analog or digital inputs are used. When the push button switch is in the out position, the EQ300 is configured for analog input (RCA or Balanced). When the push button switch is in the in position, the EQ300 is configured for digital input. (TOSLINK or COAX). When the digital output is selected, the level button when pressed accesses a digital attenuation control. This can be used for a volume control or to set the digital level of the system.

The TOS/COAX push button selector switch determines whether the TOSLINK or COAX digital input is used. When the push button switch is in the out position, the EQ300 is configured for TOSLINK (optical) digital input. When the push button switch is in the in position, the EQ300 is configured for COAX (cable) digital input..



analog and digital outputs

The internal analog to digital converter uses a 18 bit continuous bitstream calibration digital-to-analog converter made by Phillips. It has 196 times oversampling and features low harmonic distortion, no "zero crossover" distortion and digital de-emphasis for smooth highs and controlled low frequency response. The 18 bit wide dynamic range d/a converter is coupled with an ultra quiet pre-amplifier stage to deliver over 9 volts per phase (18 volts balanced) to either RCA or Balanced XLR). Think of the EQ300 as a high performance digital to analog converter with a built-in 30 equalizer!

Digital outputs incorporate a professional grade SPDIF transmitter that supports both TOSLINK and COAX digital connections. This allows for an outboard digital-to-analog converter or more digital processing.

You can choose any and all of the analog digital outputs dependent on your systems needs. Make sure to make connections while the EQ300 is not powered on. Failure to do to may result in damage to your speaker system.



user interface

The user interface controls are designed to be concise and user friendly. Listed below are the descriptions of the user interface functions.

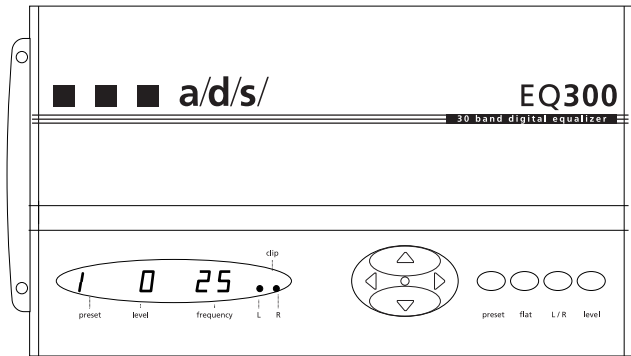
Digital Display

"**PRESET**" - Indicates which preset you are working in. There are four presets that store all information. To access the different presets, simply press the button marked "Preset".

"**LEVEL**" - Shows the amount of boost or cut in dB of a given frequency displayed in the frequency window. Range from -12dB to 12dB in 1dB increments.

"**FREQUENCY**" - Displays which frequency parameter

the EQ300 is currently adjusting. ·
Preset 1 Selected · 0 dB of equalization · Frequency selected 25 Hz



user interface LED indicators

"**CLIP**" - When illuminated, indicates the EQ has clipped its output. There are three solutions to this problem: Reset input gains, turn down source unit (if using analog input) or lower boost on boosted frequencies.



"**L**" & "**R**" - Indicates which channel is to be equalized. In the default setting, both LED are illuminated indicating that both the left and right channels can be adjusted simultaneously. The channels are "LINKED"



When only the "**L**" LED is illuminated, only the left channel is being adjusted. The channels are "UNLINKED"



When only the "**R**" LED is illuminated, only the right channel is being adjusted. The channels are "UNLINKED"



NOTE: When channels are unlinked, the left and right equalization can be adjusted independently.

Roll-Off Response Problems

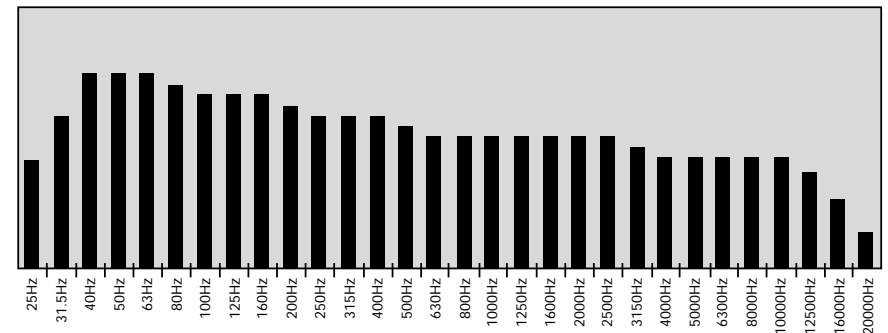
Roll-off response errors are caused by deficiencies in driver performance, driver placement, enclosure design and vehicle acoustics. This type of response errors usually is inaudible in all but the most demanding music. However for competition system's potential points can be lost with a system that has deficiencies in these areas.

Non-Equalizer Solutions

Changing the tweeter positioning can improve the response of the system. Modifying the crossover works exceptionally well in passive crossover design that uses a resistor to attenuate the tweeters output. This can be accomplished by placing a capacitor between the positive input lead of the crossover and the tweeter positive output lead. Use a capacitor from this formula $[C = 1 / (2(3.14)Rf)]$ where **C** is the capacitor value in farads **f** is the starting frequency where the roll-off begins and **R** in the nominal impedance of the tweeter. In the above situation the nominal impedance is 4 Ohms, the starting roll-off frequency is 12,500Hz. The capacitance would be $[1 / (2 \times 3.14 \times 4 \times 12,500)]$. The answer is 3.18×10^{-6} F or a approximate 3.3mF. Try larger and smaller values to create different response curves. For low frequency drivers you can try a different enclosure type or placement.

Equalizer Solutions

In this situation, boosting the EQ300 is really the only solution. Care must be taken not to exceed the excursion limits of the woofers and the power handling of the tweeter. Also important, do not exceed the maximum undistorted output level of the EQ300. Exceed the maximum output level is indicated by the illumination of the "Clip" LED location of the front display are of the EQ300.



Off-Screen Response Problems

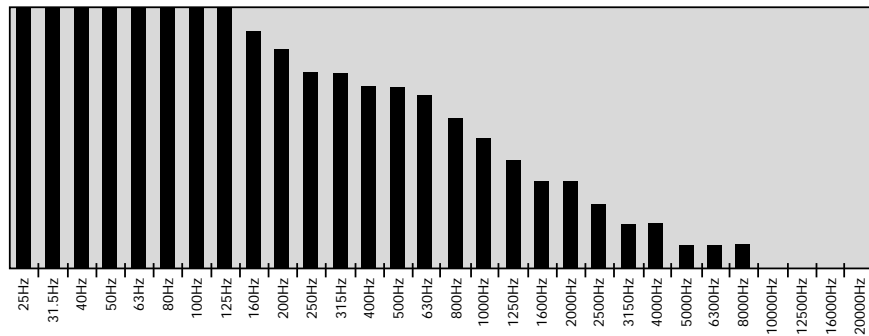
Off-screen response problems are often a result of a system with a large quantity of woofers. In some situations, this may be a desirable result. If so, look for smooth transition from octave to octave. If your goal is competition, you must have all the bands on display at one time. This problem is very similar to the Output Level Incompatibility Problems discussed earlier.

Non-Equalizer Solutions

Since this situation is similar to Output Level Incompatibility Problems discussed earlier, the solution to this particular problem is the same. First try balancing the output between the midrange and tweeter. For this example, reduce the level of the tweeter. If you have passive crossovers between the midrange and the tweeters, attenuate the level of the tweeter. If you have an active system, balance the level between the midrange and the tweeter by raising the level of the midrange. Once you have achieved a balance between the tweeter and midrange integrate the level of the woofer by similar tuning techniques.

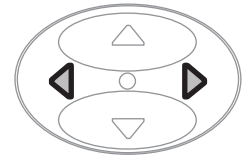
Equalizer Solutions

Use the EQ300 as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you changes adjacent bands. Periodically listen to your system during this process to make sure that the changes you make equalizing does not adversely affect the detail and sound quality of the system.

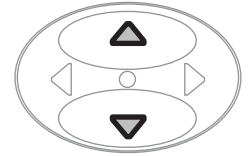


user interface controls

Pressing the left and right sides of the main user interface button selects one of 30 frequency bands in 1/3 octave increments from 25 Hz to 20 kHz.



Pressing the up and down sides of the main user interface button changes the output level of selected frequency band from -12dB to 12 dB in 1 dB steps.



Pressing the "PRESET" button selects between 4 presets. Each preset stores all individual band settings and level settings.



Momentarily pressing the "FLAT" button resets the boost level of the displayed frequency to 0 dB. Holding down the "FLAT" button for 4 seconds resets the entire preset (working "PRESET") to the 0dB flat default position.



Pressing the "L/R" button selects the EQ300 for either left channel, right channel or both channels to be adjusted. The channel being adjusted will be indicated by the illuminated LED indicators.



Pressing the "LEVEL" button reconfigures the main interface button to control the digital output level of the EQ300. Use the up and down of the main user interface button to control the digital output level integrate the EQ300 into a system with digital output source unit.



basic equalization

The EQ300 is a highly advanced signal processor. However, "highly advanced" does not mean difficult to use. There is two different levels of use for the EQ300. This section explains the basic utilization of the EQ300. To proceed, it is important that you familiarize yourself with the user interface display information and controls outlined in the previous section as the functionality of the EQ300 will be referenced but not outlined.

Preparation for equalization

The EQ300 is one of many pieces in a system tuning process to achieve an awesome sound system. The purpose of equalization is only to smooth out slight imperfections in your system's frequency response. You should add an equalizer to a system not as a solution to a problem but as an addition to an already awesome system. To take full advantage of the EQ300, first optimize your system setup without it.

Before you begin equalization it is strongly recommended that you accomplish the following:

- Choose good quality speakers (a/d/s/ of course)
- Determine the best location for the midrange and tweeters. Speaker placement will make the most difference in sound quality, imaging etc.
- Choose an enclosure that best achieves your sonic and performance goals.
- Properly level set your system. This is the most important and most overlooked part of a system setup.
- Properly select crossover points and crossover slopes and speaker polarity. This part here has a great effect on sound quality and frequency response.

Only at this point, once you have accomplished the above items can you effectively and correctly equalize your system.

To begin with basic equalization, first, familiarize yourself with user interface controls as described in the "USER INTERFACE" section of this manual. In this section we will be equalizing both channels together. For optimum performance the EQ300 is designed to smooth out irregularities in your system frequency response. This section will deal with basic equalization without the use of any measurement device like a "RTA" (Real Time Analyzer).

When given the choice of boosting certain frequencies or cutting others, it is always better to cut frequencies. Boosting the equalizer requires the amplifier to produce more power. Boosting the equalizer 6dB is asking the amplifier to produce 4 times the power. It is easy to see how an amplifier can be easily overdriven at higher listening levels when the EQ300 is boosted.

With frequency response irregularities, human hearing is more sensitive to information added as opposed to taken away. As a result, you can use the EQ300 to locate and determine problem frequency areas. To accomplish this, choose music that you are very familiar with. For best results, choose music that is well recorded with acoustical instruments such as a piano or guitar and with both male and female singing voices. Also, an excellent reference is also recommended. A reference can be a piano that you can hear or an excellent sounding home audio system of which you enjoy the sound. Become familiar with your reference and feel free to refer to it to refresh your memory.

Using your reference material, listen to your system at moderate listening levels. Do not choose listing levels too high as this will affect your results with potential overdriving of your amplifier and listening fatigue. Listening in short intervals 15 minutes with a rest period of at least 30 minutes will decrease your tuning time by reducing the possible mistakes in tuning that are made as a result of listening fatigue. As you become more aware of the effects of listening fatigue, you can better judge the duration of your listening interval to minimize this effect.

Output Level Incompatibility Problems

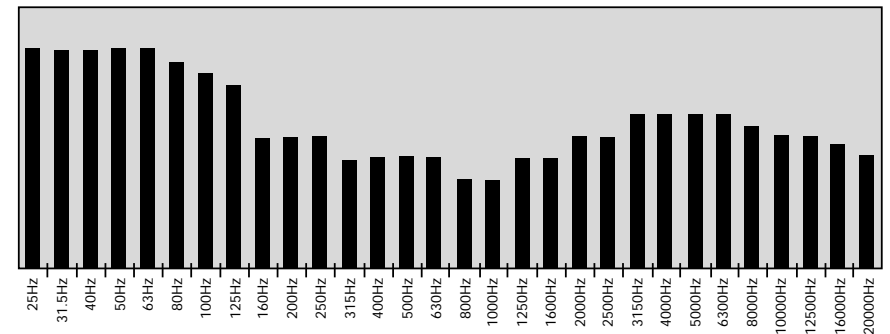
Output Level Incompatibility Problems are caused by a miss-match in output levels between woofers, midranges and tweeters. In the above graph, the midrange frequencies output level is lower than what is needed to match to the woofers and tweeters. This is usually an easy problem to solve without the use of an equalizer.

Non-Equalizer Solutions

First try balancing the output between the midrange and tweeter. For this example, reduce the level of the tweeter. If you have passive crossovers between the midrange and the tweeters, attenuate the level of the tweeter. If you have an active system, balance the level between the midrange and the tweeter by raising the level of the midrange. Once you have achieved a balance between the tweeter and midrange integrate the level of the woofer by similar tuning techniques.

Equalizer Solutions

If you have followed the instructions above, there should be little need for equalization. However, if equalization is still required, use the EQ300 as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you changes adjacent bands. Periodically listen to your system during this process to make sure that the changes you make equalizing does not adversely affect the detail and sound quality of the system.



Crossover Points & Speaker Polarity Phase Shift Problems

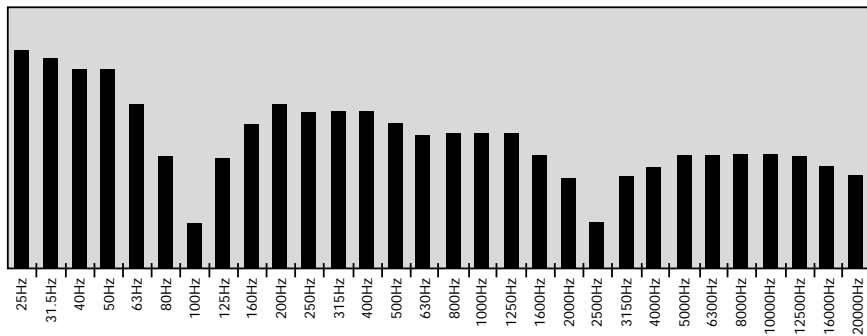
Crossover Points & Speaker Polarity Phase Shift Problems are cancellations caused by destructive interference as a result of integrating two drivers with crossovers. The above situation is a three way system with crossover points of 100 Hz and 2,500 Hz. In both situation, the driver interaction has caused a destructive interference at the crossover frequency.

Non-Equalizer Solutions

The first thing to try is to change the polarity of one of the drivers. A general rule of thumb, change the polarity of the driver the has a lower operating band. In the above situation, first try inverting the polarity of the midrange to see if there is an improvement. If this does not improve the situation, return the polarity to its original setting and try using different crossover points for both the midrange and tweeter. Remember to use crossover frequencies that is at least as high as the recommended operating range. When dealing with multiple response errors, start with the highest frequency problem area and work downward.

Equalizer Solutions

Use the EQ300 as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you changes adjacent bands. Periodically listen to your system during this process to make sure that the changes you make equalizing does not adversely affect the detail and sound quality of the system.



While listening to your reference music, listen for irregularities in your system. These irregularities can best be described as tonal qualities your hearing finds offensive or irritating. To better locate a particular frequency range that needs correction, boost individual frequency bands (one at a time) until you find a the offensive band. Remember to reset the non-effective bands back to 0dB to better locate the offensive band.

Once you have located the frequency band, slowly cut that particular band until the frequency aberration disappears. For best results, use the least amount of equalization (in this case cut) as possible. This is important because as you reduce the offensive output, you also reduce the sonic information in that frequency range which will negatively affect the nuances and detail of the music. Also when performing this correction, use different reference music to ensure that the equalization you are performing is correction problems with your system and not a particular recording. Continue this process until all the frequency irregularities have been eliminated.

Since the EQ300 have four preset working presets, work in three of the preset and maintain another as a reference. Periodically, check the sound quality of the "corrected" response with the reference. If you find that the corrected reposes sounds terrible in comparison to the reference response, take a listening break and listen to it again. Also, if you find you like the improvements of a particular preset but believe that it could be improved, leave it alone and set another preset to the same settings and continue. Compare the Reference, first setting the most recent setting to see if actual improvements have been made. As before, take listening breaks often. Your hearing can be easily affected by extended listening and will limit you ability to make sonic improvements to your system.

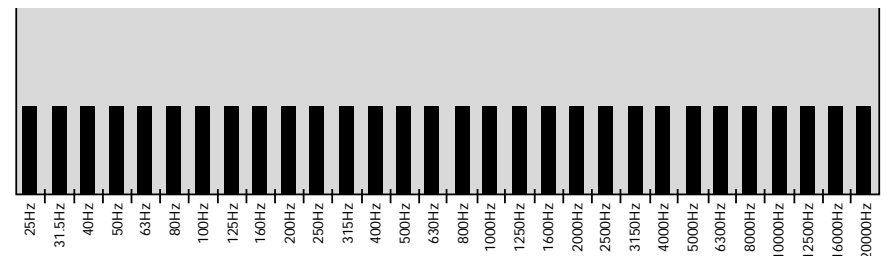
advanced equalization

Perfectly Flat Curve

This section is designed for people who will use the EQ300 in competition or people who desire the ultimate performance in their system. The EQ300 not only performs all of the equalization in the digital domain, it also has the ability to adjust equalization independently for the left and right channel. To fully take advantage of the EQ300, it is recommended to use a RTA (Real Time Analyzer). Several companies offer excellent units: Audio Control 3050A, Cooustic RT33, Linear X PC RTA. In this section we will use the RTAs to evaluate and tune the EQ300.

An RTA (Real Time Analyzer) is a measurement device that provides a visual display of a system's frequency response. Typically, this response is displayed in 1/3 octave bands. A 1/3 octave has enough resolution to detect non-linear frequency response. Optimized to work in conjunction with the RTA, the EQ300 frequency centers correspond to the frequency centers of an RTA.

For a system to have decent sound, there needs to be a relative smoothness from band to band, octave to octave. For competition, a perfect system would have the same amplitude over the entire audible range. Listed is different types of frequency response problems and what course of action should be taken either with the EQ300 or other system adjustments or modifications.



Resonance Problems

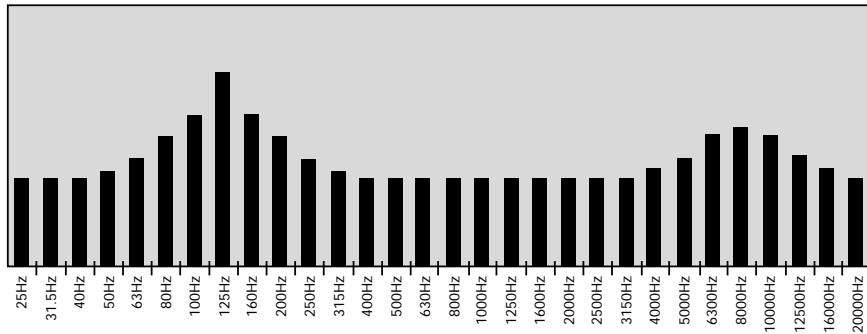
Resonance is the tendency of a system to vibrate at a certain frequency when excited by an external force and remain vibrating after the force is removed. In the car audio environment, resonance frequency response errors are caused by vehicle acoustics. The lower resonant peaks are most often caused by the interior shape size and volume of the vehicle. The high frequency resonant peak are often found in vehicles where the tweeters are located near glass (windows and windshields) .

Non-equalizer solutions

First try to see if the problem area is near a crossover point in your system. If so, try different crossover frequencies, staggered frequencies and different polarity of drivers to see if this improves the situation. For resonance problems in the high frequency tweeter range. Try different tweeter angles and position to see what improvements can be made to the system's frequency response.

Equalizer Solutions

Second, use the EQ300 as a cut only device to try to smooth out the non-linearity of the system. Cut frequencies gradually starting with the center point of the problem area. Do not cut the centered band to get the frequency response to the flat position for it will dip below when you changes adjacent bands. Periodically listen to your system during this process to make sure that the changes you make equalizing does not adversely affect the detail and sound quality of the system.



Constructive & Destructive Interference Problems

Constructive and Destructive interference occurs when two or more speakers (or a speaker and a reflective panel or baffle) interact with each other such a way that the erratic but repetitive frequency response errors. The response errors are determined by the frequency (wavelengths) and the speaker locations and phase relationships relative to the listening area. This type of frequency response error is different from resonance errors due to erratic nature (non-smooth peaks or dips) in the frequency response as well as the repetitive shape of the frequency response error itself.

Non-equalizer solutions

First, locate how the this problem is being created. What two drivers (or reflective surface or baffle) are causing this problem. Try changing the polarity of one the speakers to see if the situation improves. For high-frequency problems, try changing mounting angle and position as well as the polarity of the tweeters. For problems with drivers on the same channel, try changing the crossover point.

Equalizer Solutions

If the problem occurs between channels. Use the EQ300 to equalize the left and right channels separately. First pan to the left channel and smooth out non-linearities by using the EQ300 to as a cut device first. Then pan to the right channel and repeat. Then sparingly use the EQ300 to boost the deficient frequencies for the left and right channels separately. Periodically listen to your system during this process.

