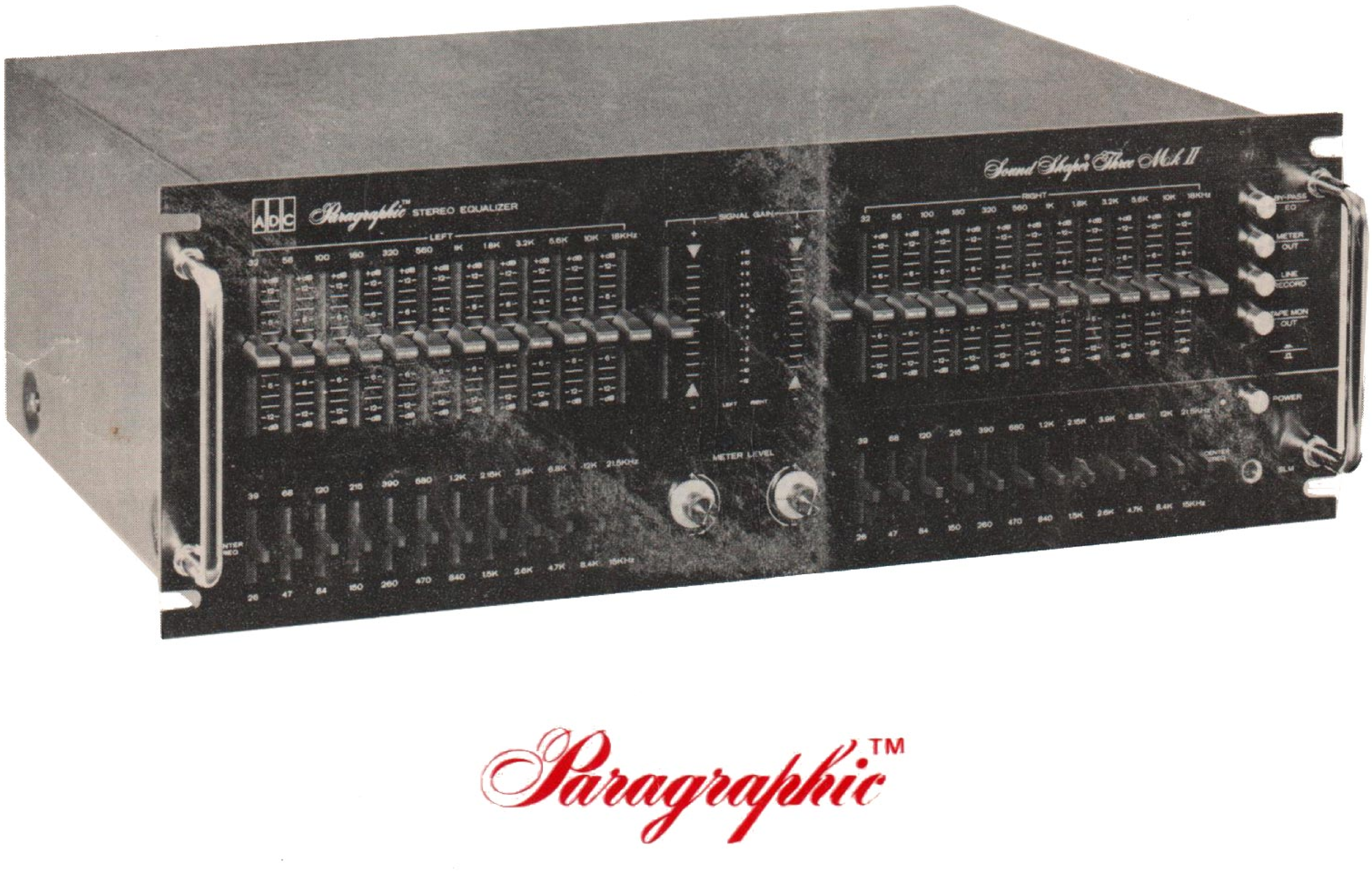
Sound Shaper® Three

ADC

mark II

OWNER'S MANUAL



Paragraphic™

STEREO FREQUENCY EQUALIZER

Audio Dynamics Corporation

ADC PARAGRAPHIC STEREO EQUALIZER
SOUND SHAPER THREE MK II

The Audio Dynamics Corporation "SOUND SHAPER THREE MK II" Frequency Equalizer is unique in design, in that, it offers greater flexibility by combining features of both parametric and graphic equalization.

The audio spectrum being divided into 12 frequencies can be boosted or cut 12 dB and each center frequency shifted up or down by approximately 20% to accommodate problems where any of the center frequencies may not coincide with the room acoustics or equipment deficiencies.

Signal gain controls, with LED indicators, simplify channel balancing and level setting of the equalized signal to, virtually, the same as the input level, to achieve unity gain.

A dual 13 segment "LED Display" is calibrated in 2 dB increments from −12 dB to +12 dB, for visual monitoring of the signal level to each channel.

A sound level meter input jack is provided for the interested audiophile to achieve "Total Equalization" when used with the sound level meter and pink-noise record available as an accessory.

The Equalizer may be used with a receiver, integrated amplifier or separate pre-amplifier and amplifier. It is designed to be connected to the "TAPE MONITOR" function of the sound system.

Sound from the Equalizer is purposely delayed 5 to 6 seconds after turn-on by a built-in muting circuit.

The front panel has been designed for standard EIA 19" rack mounting.

DESIGN AND OPERATING FEATURES

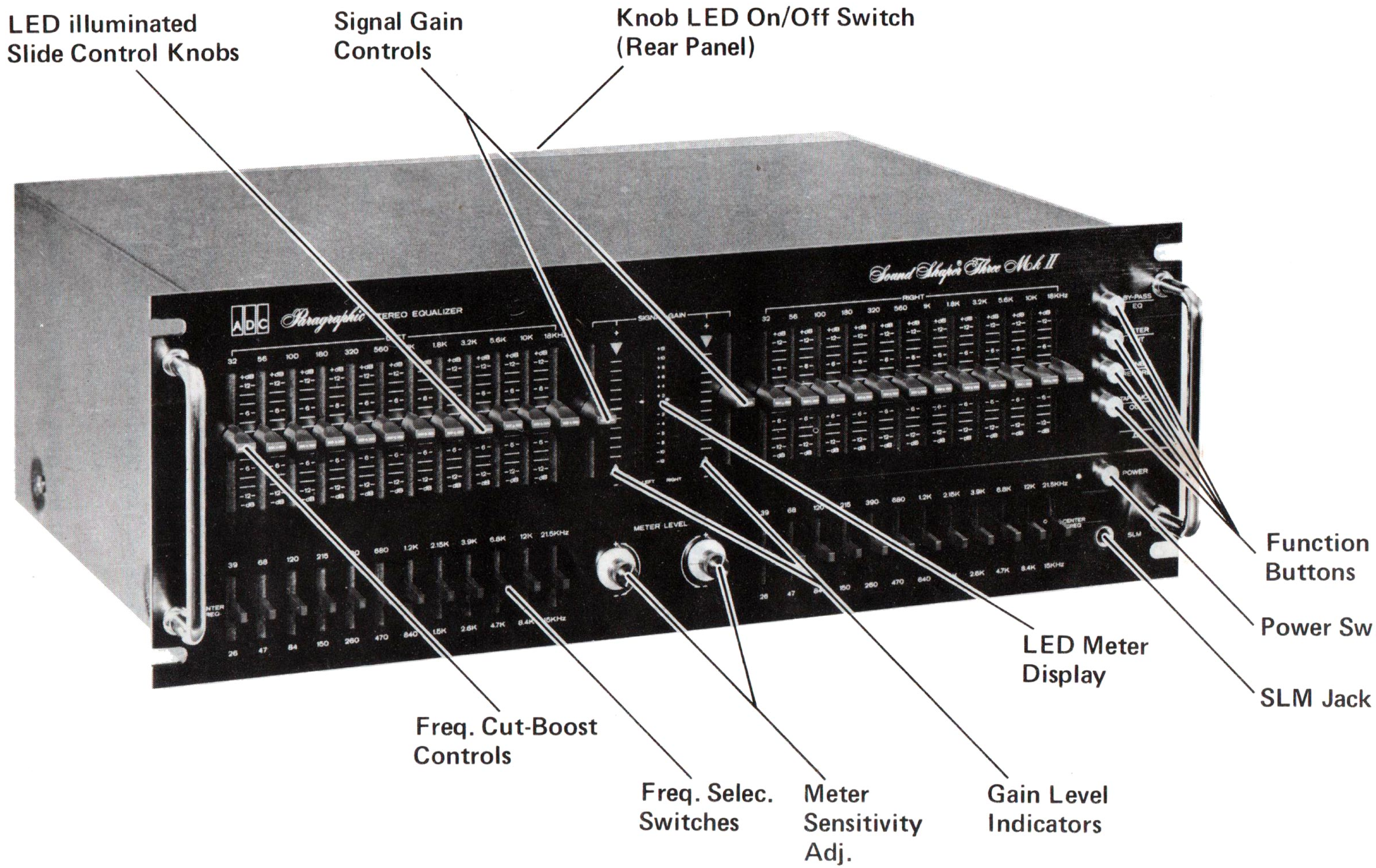


Figure 1

Safety Instructions

1. Read Instruction — All the safety and operating instructions should be read before the appliance is operated.
2. Retain Instructions — The safety and operating instructions should be retained for future reference.
3. Heed Warnings — All warnings on the appliance and in the operating instructions should be adhered to.
4. Follow Instructions — All operating and use instructions should be followed.
5. Water and Moisture — The appliance should not be used near water — for example, near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool, etc.
6. Mount the appliance either on a stable shelf or table.
7. Ventilation — The appliance should be situated so that its location does not interfere with its proper ventilation. For example, the appliance should not be situated on a bed, sofa, rug, or similar surface that may block the ventilation openings; or, placed in a built-in installation, such as a bookcase or cabinet that may impede the flow of air through the ventilation openings.
8. Heat — The apppliance should be situated away from heat sources such as radiators, heat registers, stoves, or other appliances (including amplifiers) that produce heat.
9. Power Sources — The appliance should be connected to a power supply only of the type described in the operating instructions or as marked on the appliance.
10. Grounding instructions or polarized connectors, if described in the operating instructions must not be defeated.
11. Power-Cord Protection — Power-supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit from the appliance.
12. Cleaning — Clean the equipment with a dry dust cloth. If a dust cover is provided and is charged with static electricity, remove it from the equipment and wipe with a damp cloth.
13. Nonuse Periods — The power cord of the appliance should be unplugged from the outlet when left unused for a long period of time.
14. Object and Liquid Entry — Care should be taken so that objects do not fall and liquids are not spilled into the enclosure through openings.
15. Damage Requiring Service — The appliance should be serviced by qualified service personnel when:
    - A. The power-supply cord or the plug has been damaged; or
    - B. Objects have fallen, or liquid has been spilled into the appliance; or
    - C. The appliance has been exposed to rain; or

D. The appliance does not appear to operate normally or exhibits a marked change in performance; or

E. The appliance has been dropped, or the enclosure damaged.

16. Servicing — The user should not attempt to service the appliance beyond that described in the operating instructions. All other servicing should be referred to qualified service personnel.

IMPORTANT – BEFORE OPERATING

All EQUALIZERS are designed for "UNITY GAIN", in other words, the level of signal "OUT" is the same as the level of signal "IN" **WHEN ALL FREQUENCY CONTROLS ARE SET AT "0".**

If one or several frequency controls are boosted in either or both channels (Stereo), the output level from your EQUALIZER will increase within the range of frequencies affected by those controls, thereby, increasing the sound level or power output of your amplifier. Depending on the master volume control setting, this can result in overdriving of the power amplifier and/or speaker system and incurring possible damage.

It is suggested you reduce the master volume control setting of your sound system before switching the EQUALIZER "IN" or "OUT" of the system and then restore the master volume control setting to your listening preference.

Please refer to the sections in the manual titled, "SIMPLIFIED OPERATING INSTRUCTIONS" and "SIGNAL GAIN CONTROLS" to adjust the EQUALIZER for "UNITY GAIN".

Do not use the EQUALIZER to increase volume, IT IS NOT AN AMPLIFIER, it is designed to tailor the frequency response of your system, either to your personal preference or help correct deficiencies of the sound system or room acoustics.

INSTALLATION:

As with other quality sound equipment, adequate ventilation will extend the trouble-free life of your equalizer. You should not install this unit in an overly confined area along with other heat generating equipment.
Connect to an AC Outlet providing the proper voltage 120 V AC 50/60 Hz (Export version 220/240 V AC 50/60 Hz). The power consumed is 25 Watts and if available, the un-switched accessory outlet of your amplifier may be used to turn the unit "ON" or "OFF" with your sound system's main power switch. Refer to back of manual for PX version Power (Mains) connections.

CONNECTING THE SOUND SHAPER THREE MK II:

The SOUND SHAPER THREE MK II Frequency Equalizer can be used with a receiver, integrated amplifier or with a system employing separate pre-amplifier and amplifier.

If your sound system does not provide a "TAPE MONITOR" function, it will not be possible to connect the EQUALIZER to your system.

The tape recording "TAPE OUT" outputs of your pre-amplifier, integrated amplifier or receiver should be connected to the two input jacks (left and right) or the equalizer.

The two output (left and right) jacks of your equalizer should be connected to the "TAPE MONITOR" inputs on your pre-amplifier, integrated amplifier or receiver.

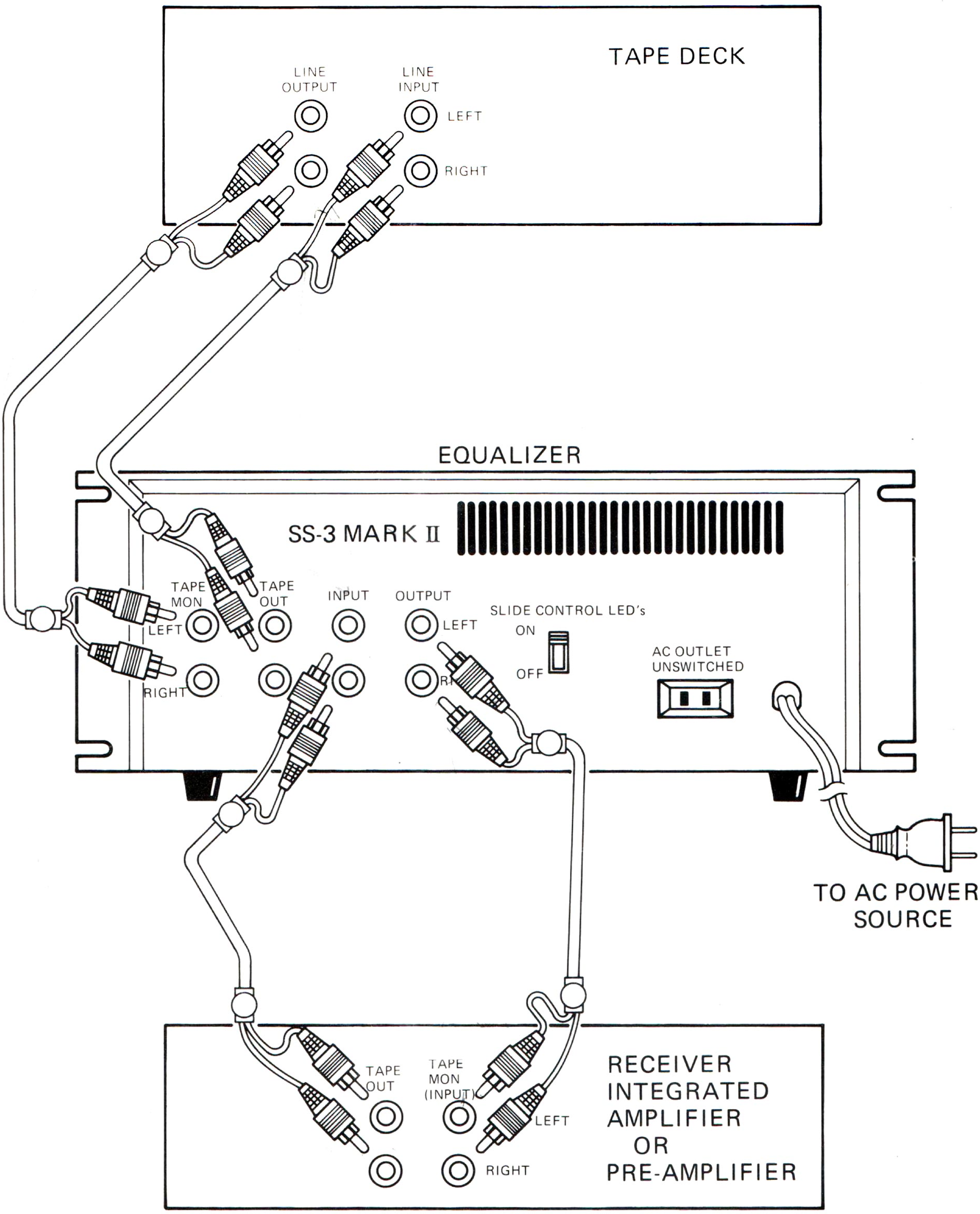
The "TAPE OUT" jacks of the equalizer are connected to the input of the tape recorder and the output of the tape recorder connected to the "TAPE MONITOR" jacks of the equalizer.

Input and output connections should be made using shielded audio cables with standard phono connectors. Observe color coding of the left and right channel connections to your sound system.

Two pairs of shielded audio cables have been included with your EQUALIZER for inter-connection to your sound system.

Refer to Figure 2 for detailed connecting information.

CONNECTIONS:
YOUR SYSTEM MUST HAVE A TAPE MONITOR SWITCH WHICH MUST BE LEFT IN THE "TAPE MONITOR" POSITION. THIS SWITCH IS USUALLY A FRONT PANEL CONTROL OF THE PRE-AMPLIFIER, INTEGRATED AMPLIFIER OR RECEIVER.



- Set the TAPE MONITOR switch of the stereo system to "ON".
- Set LOUDNESS switch of stereo system to "OFF".

Figure 2

SIMPLIFIED OPERATING INSTRUCTIONS

1. Sound system "off".
2. Connect Equalizer to sound system. See pictorial "Connections" Fig. 2.
3. All frequency slide controls on "0" dB and all frequency selector switches at mid-position.
4. Meter level controls set at maximum. (Left meter control counterclockwise and right meter control clockwise).
5. Signal gain controls at mid-position.
6. Function buttons — EQ-Bypass and Meter pushed in, all other buttons out.
7. Turn sound system and equalizer "on". "0" dB LED's and the signal gain LED's should be lit.
8. Select an FM station or play a record at normal volume setting.
9. Return the EQ-Bypass button to the "out" position. The "0" dB LED's will go out and the LED meters will now display the variations in level of the program material.
   NOTE: Reduce the meter level control setting by an equal amount so that the LED indication is within the range of the "LED METERS".
10. Increase, by approximately 4 or 5 dB, the setting of two or three slide controls at mid-frequency; for example, 560 Hz, 1 KHz, 1.8 KHz and note the change in emphasis on either or both left and right channels.
11. You will also observe that the LED's associated with the signal gain controls are no longer of equal brightness. Adjust the signal gain controls until both upper and lower "LED" indicators are of equal brightness.
    NOTE: When both upper and lower LED's are of equal brightness the signal level into your amplifier and speaker system is the same as the signal into the equalizer. This prevents overdriving your amplifier and speaker system resulting in distortion.
    Remember the equalizer is not intended to be used as an amplifier — it is designed to tailor the frequency response to your personal preference.
12. Feel free to alter the settings of the frequency slide controls and become accustomed to the effect on frequency response — don't forget to readjust for equal brightness of the signal gain LED's after changing the settings of the frequency slide controls of each channel.
    There are a multitude of effects that can be achieved by sliding one or more controls up or down a few dB's. Try different settings on both channels until the tonal quality of reproduction best suits your taste.
    Be your own sound engineer. After re-setting for equal brightness the meter level controls should be adjusted so the LED meter display stays within the 24 dB range (+12 to −12 dB).

OPERATING CONTROLS AND FUNCTION

FREQUENCY SLIDE CONTROLS

Control over the response curve is accomplished by twelve(12) Slide Controls per channel (Total 24), permitting a Boost or Cut of 12 dB minimum at the following frequencies: 32 Hz, 56 Hz, 100 Hz, 180 Hz, 320 Hz, 560 Hz, 1 KHz, 1.8 KHz, 3.2 KHz, 5.6 KHz, 10 KHz and 18 KHz.

In this way, the Equalizer is used to flatten the often uneven frequency response of stereo components, such as phono cartridges and speakers and to compensate for peculiarities in room acoustics and also to reduce noise in program sources.

Referring to the "FREQUENCY RANGE CHART FOR MUSICAL INSTRUMENTS AND VOICE" and the "MUSICAL SPECTRUM" section in this manual, you can determine what controls are most effective in achieving a smooth response. By moving the appropriate controls up or down a few dB, you can alter the tonal quality to suit your personal preference.

LED (Light Emitting Diode) illumination of the Slide Frequency Controls incorporated in the Equalizer provides a visual display of the controls, depicting graphically the curves you have created, to assist in tailoring the frequency response to your preference. A switch is located on the rear panel providing you the option to turn off the LED's, should you so desire.

FREQUENCY SELECTOR SWITCHES

The frequency marking above each of the 24 Slide Frequency Controls is effective when the Frequency Selector Switch is in the mid-position. In the "up" position a frequency shift of approximately 20% higher than the Slide Control center Frequency marking is effective and when the Frequency Selector Switch is in the "down" position a shift in frequency of approximately 20% lower occurs. The center frequencies are clearly marked at each selector switch.

USEFULNES OF THIS FEATURE:

A. Moving one or several adjacent frequencies closer together to any of the main center frequencies will provide you with a wider bandwidth to correct for non-linear frequency response of speaker systems or phono cartridges which may show up as a gradual trough or "hill". Whereas, acoustic feedback only requires a narrow bandwidth and by attenuating that control nearest the feedback frequency then using the Frequency Selector Switch, a more precise adjustment is achievable.

B. Trouble frequencies encountered in acoustics may occur at one of several frequencies. By moving one or two frequencies closer to a center frequency a gradual wider band of boost or cut will reduce or eliminate the trouble areas.

Obviously, with a little experimentation, bandwidth adjustment and center frequency shift can satisfy a multitude of conditions caused by deficiencies of sound system components and/or room acoustics.

A typical graphic representation of the effect on bandwidth by Frequency Selector Switches is illustrated in Figure E, on page 17.

SIGNAL GAIN CONTROLS

PURPOSE – The Slide Frequency Controls will change the average level of the program material (signal) into the equalizer as they are moved up or down from the "0" dB flat position. After having equalized your system to compensate for sound system components and/or room acoustics or tailored the frequency response to satisfy your personal preferenece, the average signal level to each channel of your amplifier may be higher or lower than the input signal to the equalizer.

In order to restore the output level from each channel of the equalizer to the input level, the Signal Gain controls must be adjusted. Located above and below each control, the Triangular shaped LED's (lights) are used as indicators for setting the channel signal levels. This will preclude overdriving your amplifier or speakers which can result in distortion and insure the signal level to each channel is the same.

METHOD OF ADJUSTMENT – The "LED" indicator lights will glow at different intensity (brightness) after equalization. By moving the Signal Gain control for each channel, up or down, it is possible to adjust the LED's to glow with equal intensity. It is this position of the Signal Gain controls that the average signal level into the equalizer is the same as the output level (UNITY GAIN).

PUSH BUTTON FUNCTIONS – Located on the right side of the front panel, five push-button function switches are provided for selecting equalized or unequalized program material for listening, recording or tape recorder playback along with "LED" Meter switching and power on/off. Refer to the section on "PUSH BUTTON SWITCH FUNCTIONS".

LED METERS

The dual 13 segment (per channel) "LED METER" displays signal levels in 2 dB increments and is accurate to within ±0.5 dB. It is used for stereo balance, signal level indication and frequency response measurements of your sound system components and room acoustics analysis when used in conjunction with a test record and sound level meter.

METER LEVEL CONTROLS

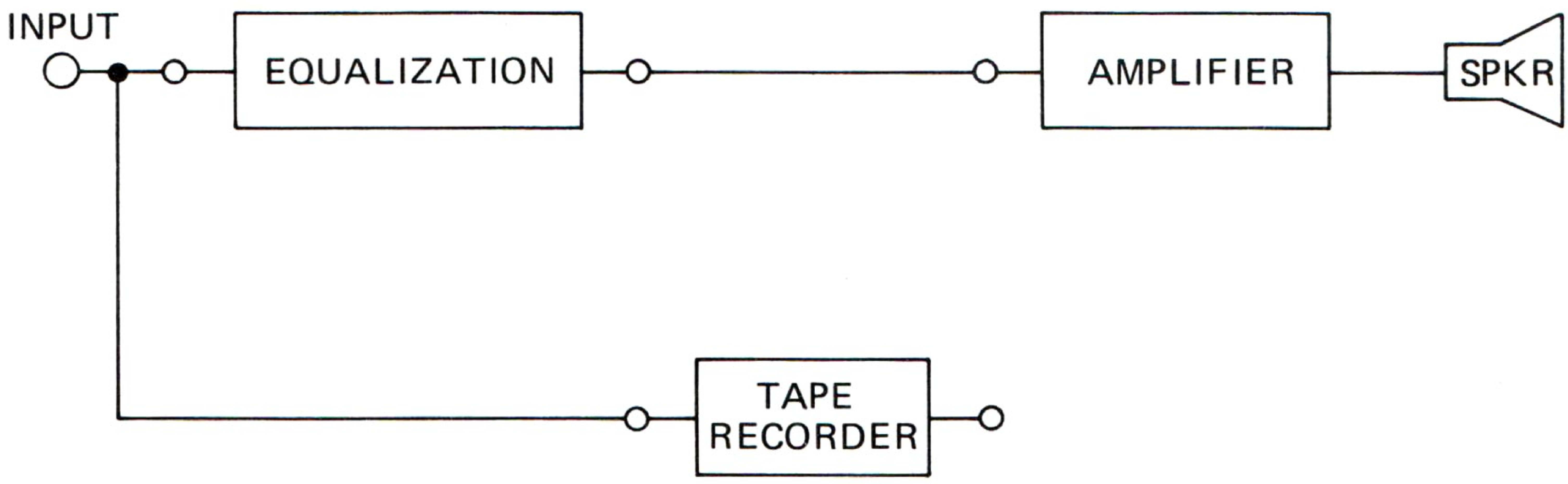
These controls vary the sensitivity of the "LED METERS" and are adjusted so that the loudest or softest sounds do not cause the LED's to remain "On".

SLM JACK

When used with the Audio Dynamics SLM-300 Sound Level Meter, Pink-Noise Record and 20 foot Interconnecting Audio Cable, the right channel "LED METER" on the equalizer will read the output of the sound level meter directly. This permits you to adjust the equalizer at the equalizer position when compensating your sound system or room acoustics.

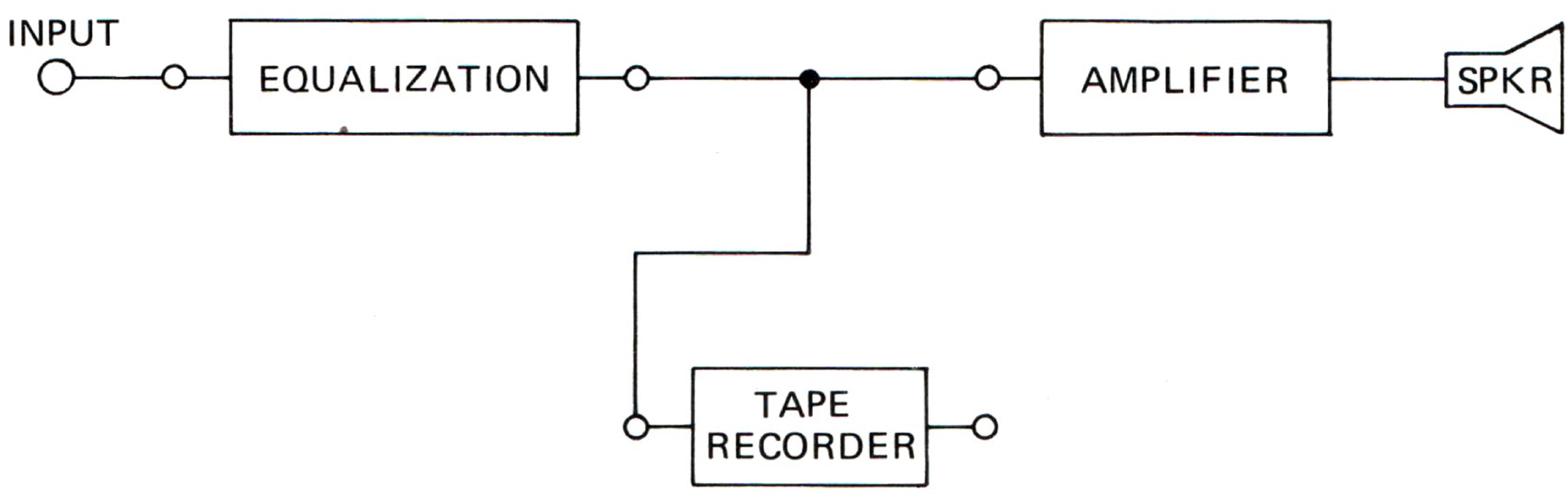
PUSH BUTTON SWITCH FUNCTIONS

ALL PUSH-BUTTON FUNCTIONS – "OUT" POSITION



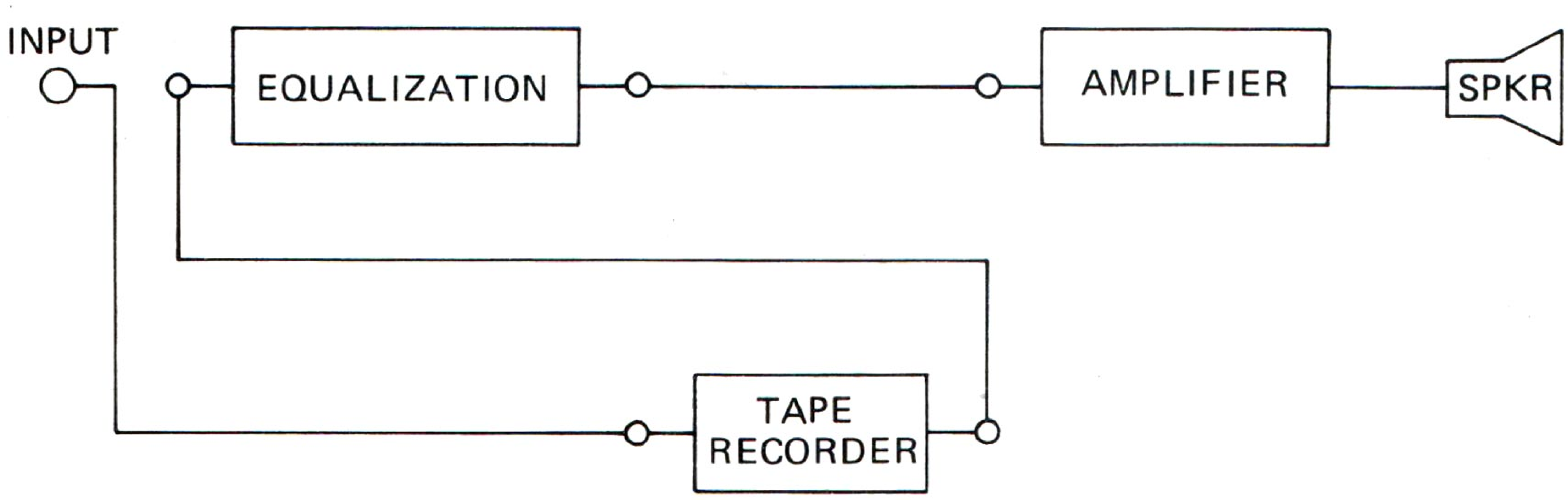
1. YOU ARE LISTENING TO PROGRAM MATERIAL **EQUALIZED.**
2. **UNEQUALIZED** PROGRAM MATERIAL CAN BE RECORDED ON TAPE DECK.

LINE-RECORD PUSH-BUTTON FUNCTION – "IN" POSITION
All other push-buttons "out"



1. YOU ARE LISTENING TO PROGRAM MATERIAL **EQUALIZED.**
2. **EQUALIZED** PROGRAM MATERIAL CAN BE RECORDED ON TAPE DECK.

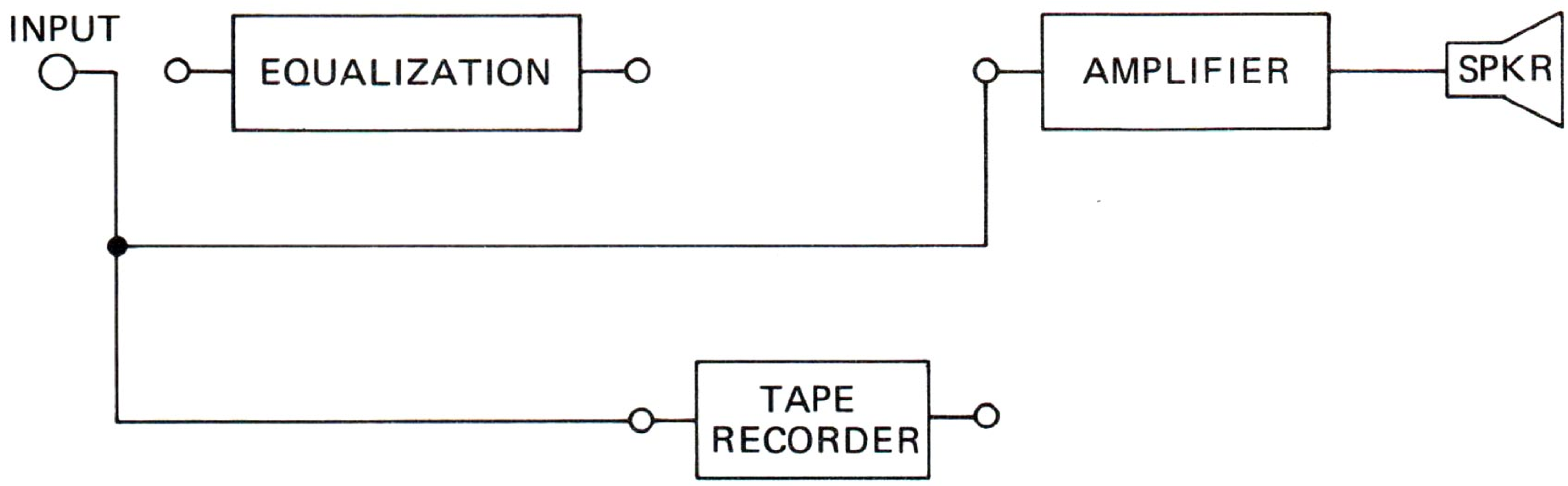
MONITOR PUSH-BUTTON FUNCTION – "IN" POSITION
All other push-buttons "out"



1. YOU ARE LISTENING TO THE TAPE DECK PLAYBACK AND CAN EQUALIZE TO YOUR LISTENING PREFERENCE.

BY-PASS PUSH-BUTTON FUNCTION – "IN" POSITION

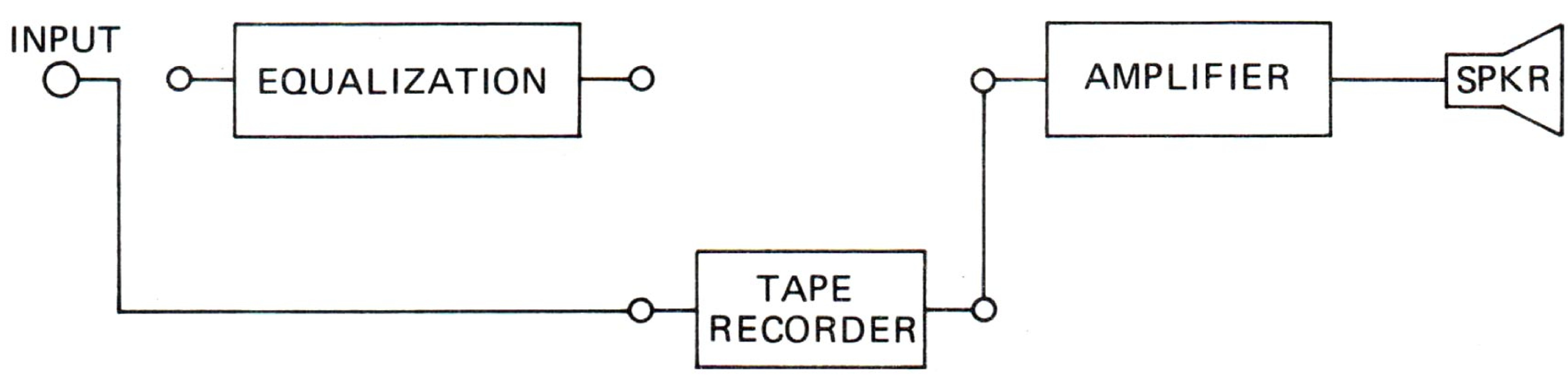
All other push-buttons "out"



1. YOU ARE LISTENING TO PROGRAM MATERIAL **UNEQUALIZED.**
2. **UNEQUALIZED** PROGRAM MATERIAL CAN BE RECORDED ON TAPE DECK.
3. WHEN DEPRESSED THE EQUALIZER IS DISCONNECTED FROM THE SYSTEM, THE SLIDE CONTROL LED's WILL GO OUT AND THE "LED" METERS WILL INDICATE "0" dB. THE "TAPE MONITOR" SWITCH WILL STILL FUNCTION.

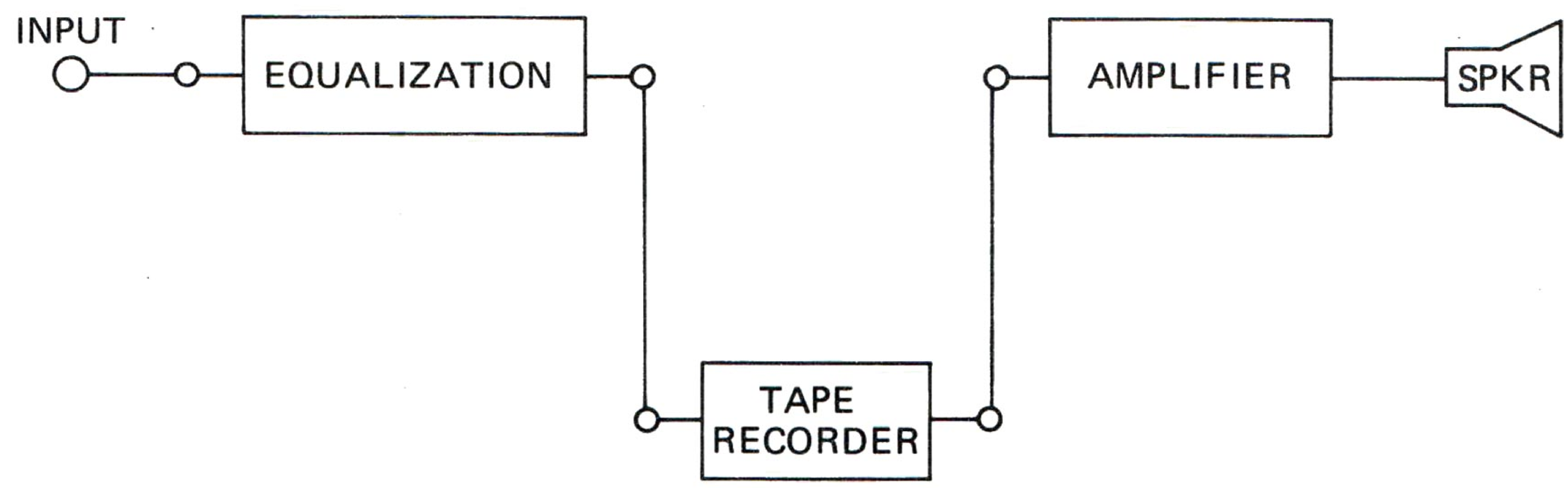
MONITOR & EQ-BYPASS PUSH-BUTTON FUNCTIONS – "IN" POSITION

All other push-buttons "out"



1. YOU ARE LISTENING TO THE TAPE DECK PLAYBACK **UNEQUALIZED.**

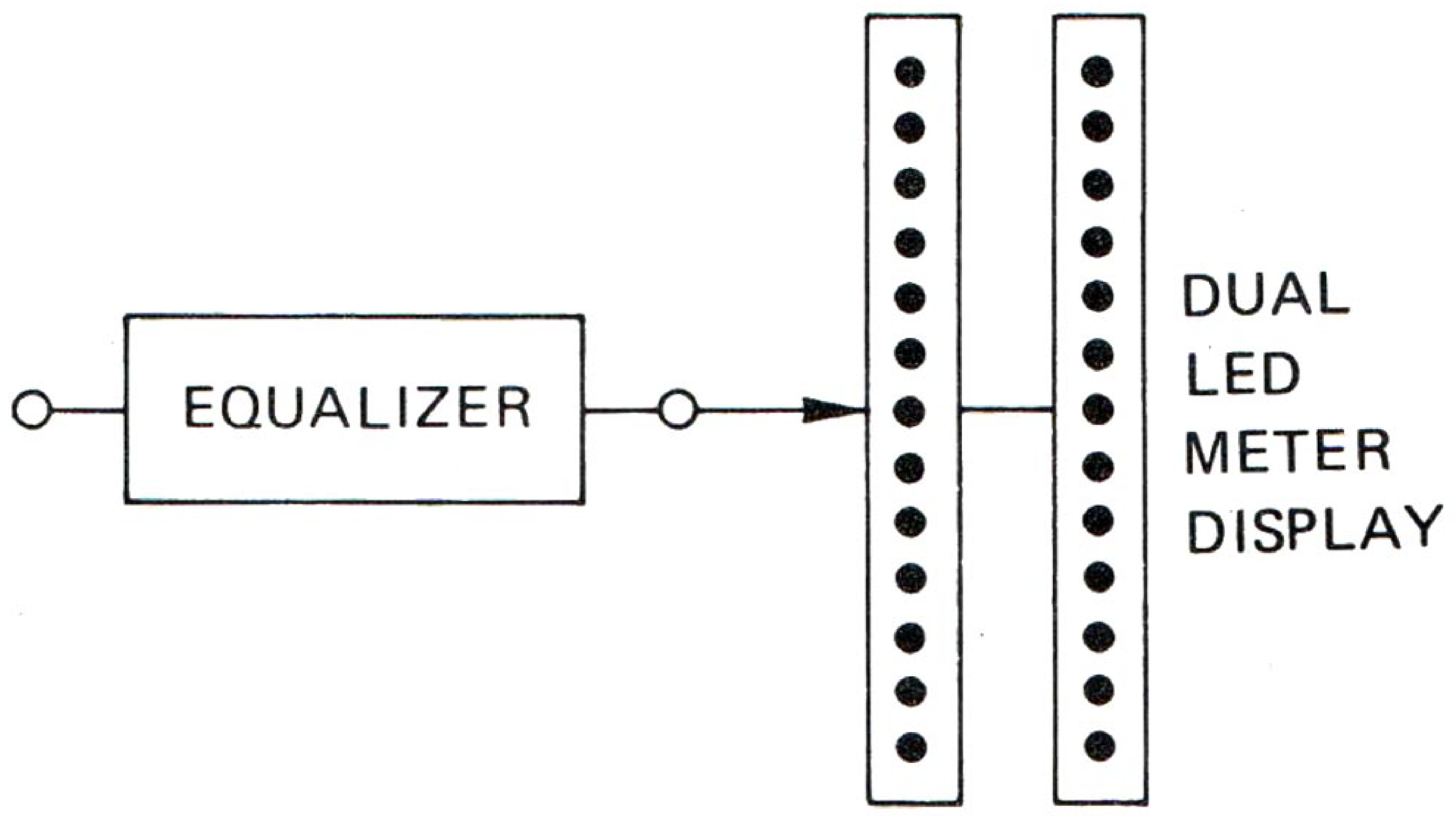
MONITOR & LINE-RECORD PUSH-BUTTON FUNCTIONS – "IN" POSITION
All other push-buttons "out"



1. YOU ARE LISTENING TO THE 3rd HEAD PLAYBACK OF THE TAPE DECK WHILE **EQUALIZED** PROGRAM MATERIAL IS BEING RECORDED.

METER PUSH-BUTTON FUNCTION – "IN"

"LED METER" and "SIGNAL GAIN" lights are "ON". "LED METER" "0" dB lights "ON" only when EQ-BYPASS switch depressed and Meter push-button "OUT".



DUAL 13 SEGMENT PER CHANNEL SOLID STATE LED dB METER INDICATES LEFT AND RIGHT CHANNEL OUTPUT LEVEL.

THE MUSICAL SPECTRUM

This chart correlates familiar musical instruments with the numerical frequencies that they produce. Given the often talked about musical range of 20 Hz to 20 KHz, it is surprising to see how low musical fundamentals actually are. (Almost all are under 3500 Hz.) It should be understood however that if all instruments were perceived only by their fundamental frequency output (black bands), they would all sound alike. It is the harmonics or overtones (grey bands) that give each individual instrument its character or timbre and set it apart from the rest.

Interestingly enough, the human ear is more sensitive to certain octaves in the musical spectrum than to others. Whoever designed this engineering marvel deemed it necessary to tune the ear more toward the midrange frequencies where speech and voice communication occur than to the outer octaves of low bass and high musical overtones. As a result, very small energy changes here will cause a more drastic psychoacoustic effect than larger changes would at the frequency extremes.

In order to discuss the qualitative effects of adjustment in tonal balance, it is best to arbitrarily divide the musical spectrum into five ranges.

The Bass (approx. 20–140 Hz). There is little musical material with fundamental frequencies below about 60 Hz, and what is normally perceived as low bass material is actually in the 60–140 Hz range. The very lowest frequency controls can be used to enhance output for the few instruments in that range (organ, contrabassoon, etc.) or they can be used to reduce rumble, acoustic feedback and other low frequency aberrations. A control in what is normally labeled the 60–90 Hz area will usually cause the greatest perceptible changes in "bass response".

The Mid-Bass (approx. 140–400 Hz). An over accentuated mid-bass region will yield a very muddy and "boomy" quality to the music. A system shy of mid-bass will sound hollow and thin. Controls in this region are important for good overall balance.

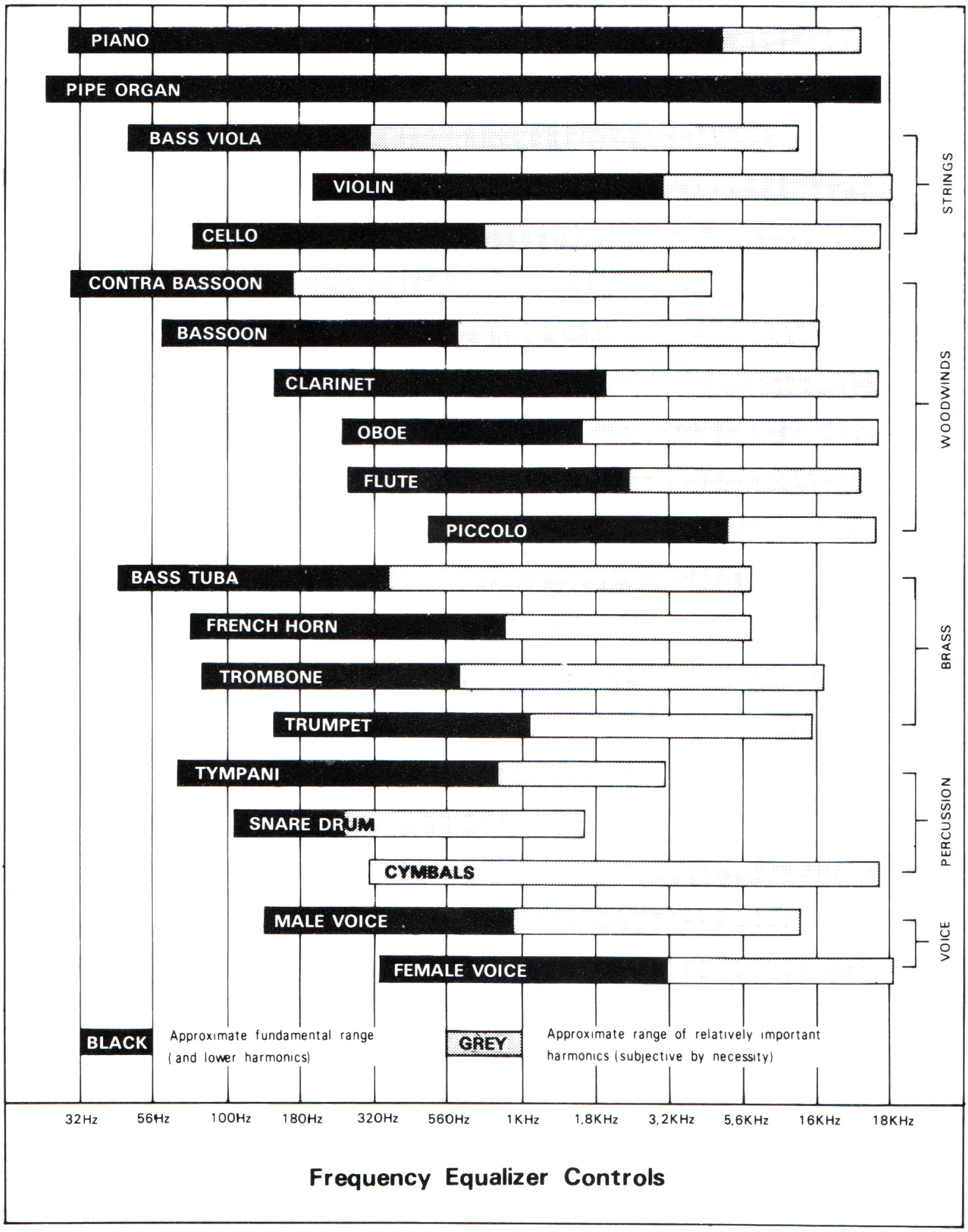
The Mid-Range (approx. 400–2600 Hz). As the area where the ear is most sensitive to tonal balance, the mid-range is important in adjusting the qualitative sonic characteristics of your system. There is controversy among engineers and audiophiles as to what the proper balance should be in this range. Moreover, you will find some settings optimum for certain types of music with other settings just right for different types.

The Upper Mid-Range (approx. 2600–5200 Hz). Speaker designers often boost output in this range to effect a quality of "presence" to the music. Too much energy, on the other hand, sounds overbearingly harsh and strident. A good balance should be achieved between this and a more muffled sound.

The High End (approx. 5200–20,000 Hz). The region up to only about 12 KHz or so is what is normally perceived as high frequencies. Adjustment in this range affects the brilliance of music, with too much boost in energy yielding an unpleasant and piercing quality.

The last 8,000 Hz contains very little musical material. And most adults have hearing which rolls off rapidly above 16 or 17 KHz. As a consequence, any control in the 14–20 KHz range will have a very subtle effect. It can be used to add a little more dimension to the sound or as very high frequency noise filter.

Approximate Frequency Ranges for Musical Instruments and Voice



TYPICAL FREQUENCY RESPONSE CURVES

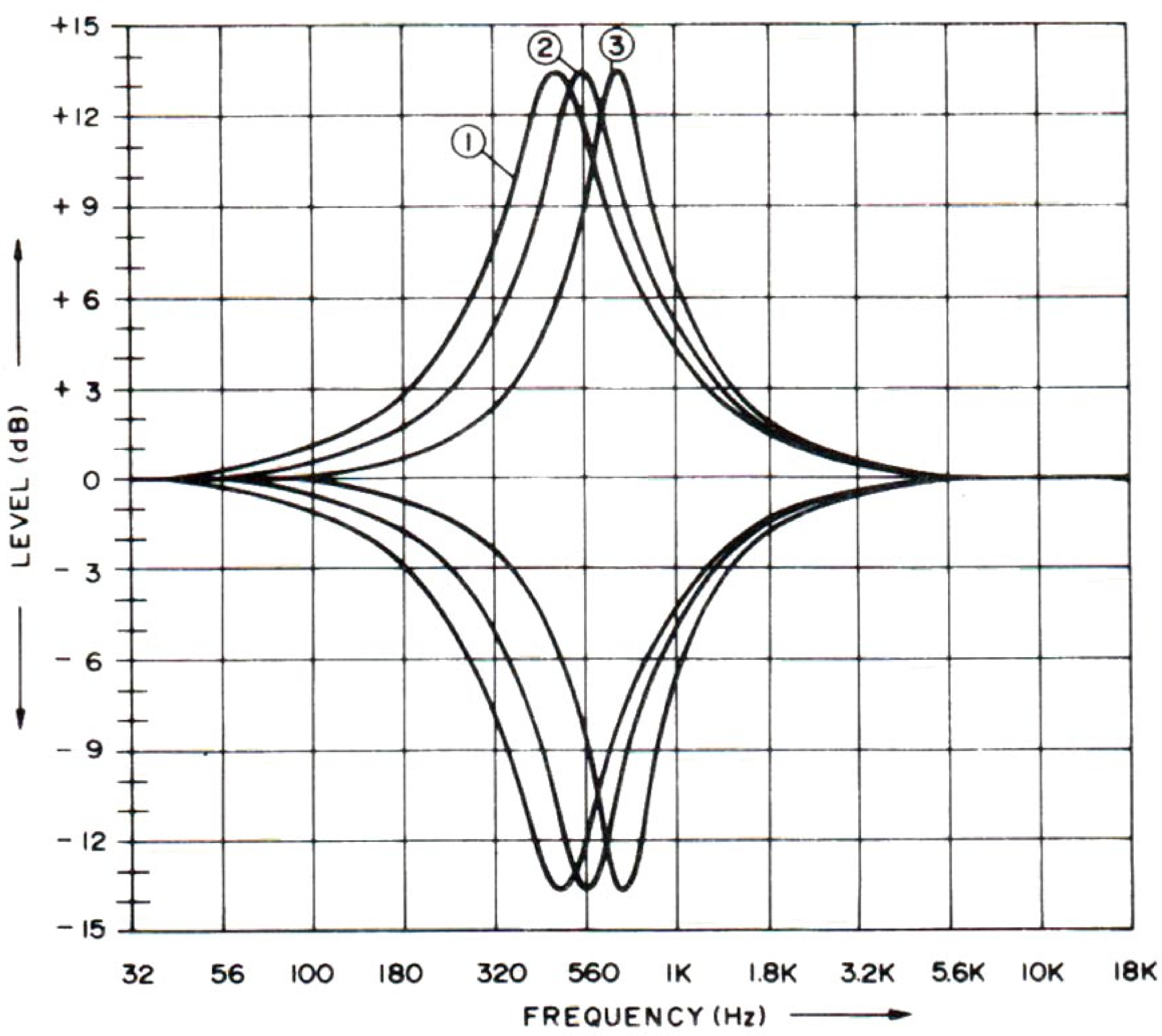


Figure A

Typical Frequency Response

1 470 Hz Full Boost/Cut
2 560 Hz Full Boost/Cut
3 680 Hz Full Boost/Cut

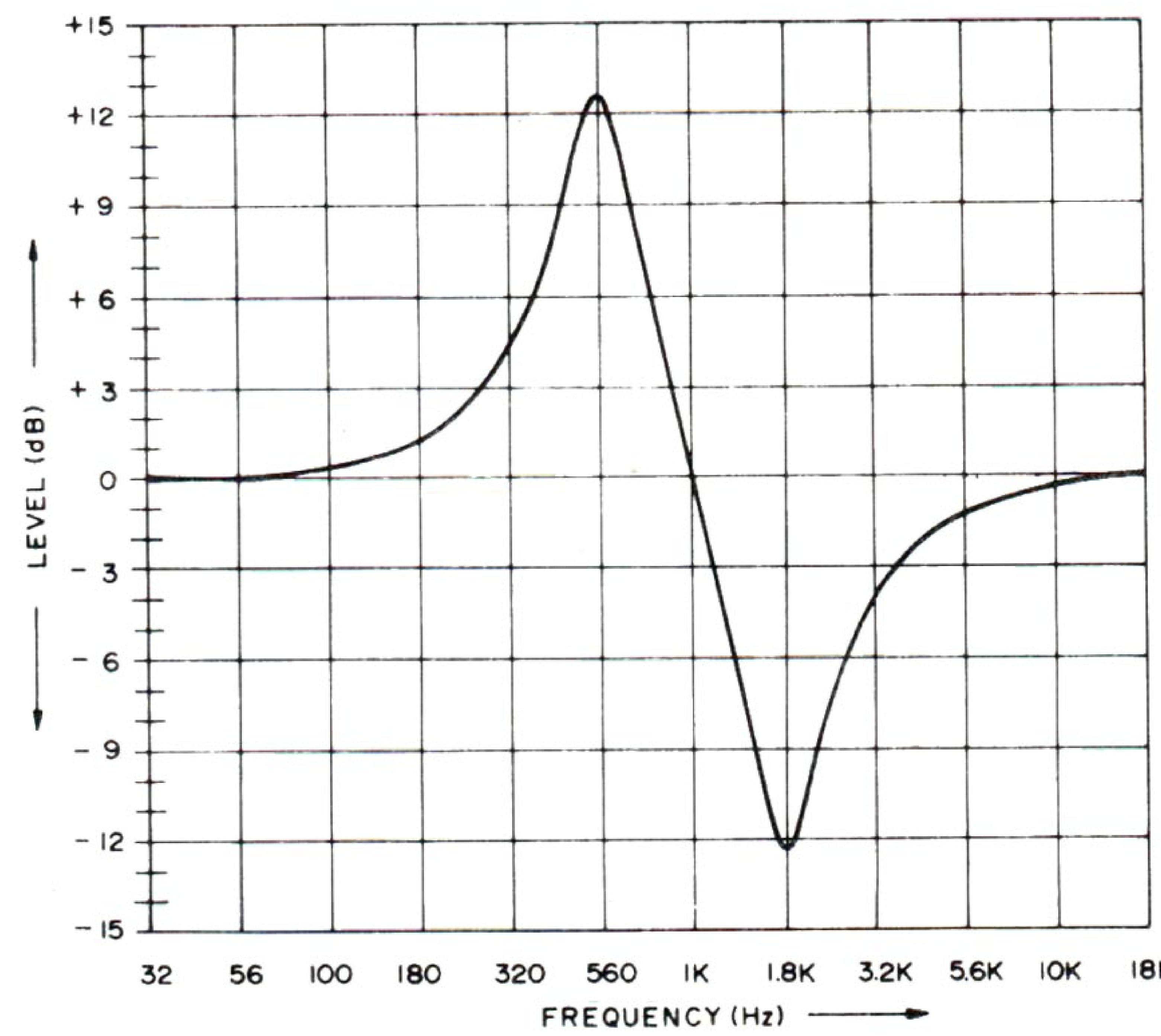


Figure B

Typical Frequency Response

560 Hz Full Boost
1.8 KHz Full Cut

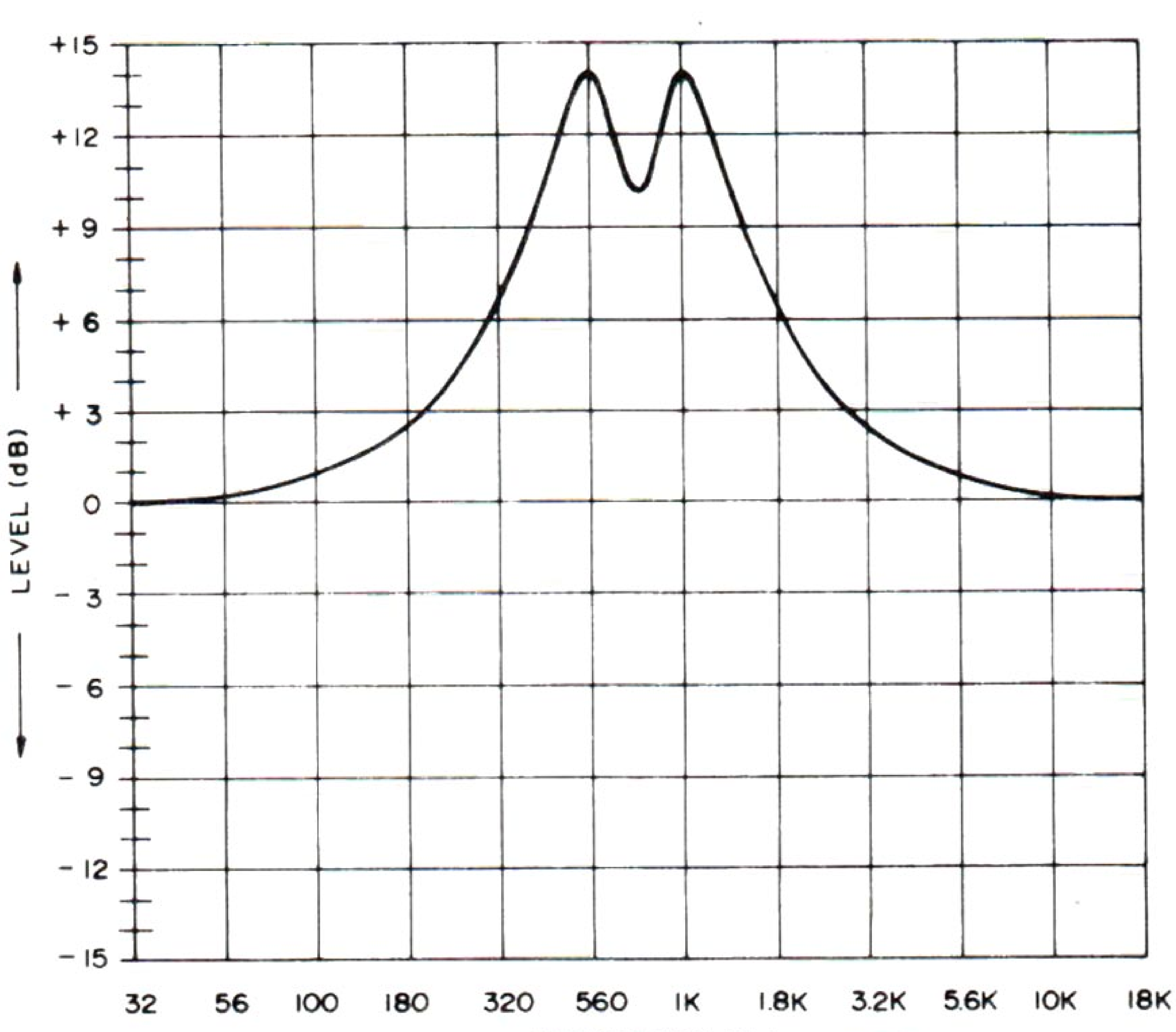


Figure C

Typical Frequency Response

560 Hz Full Boost
1 KHz Full Boost

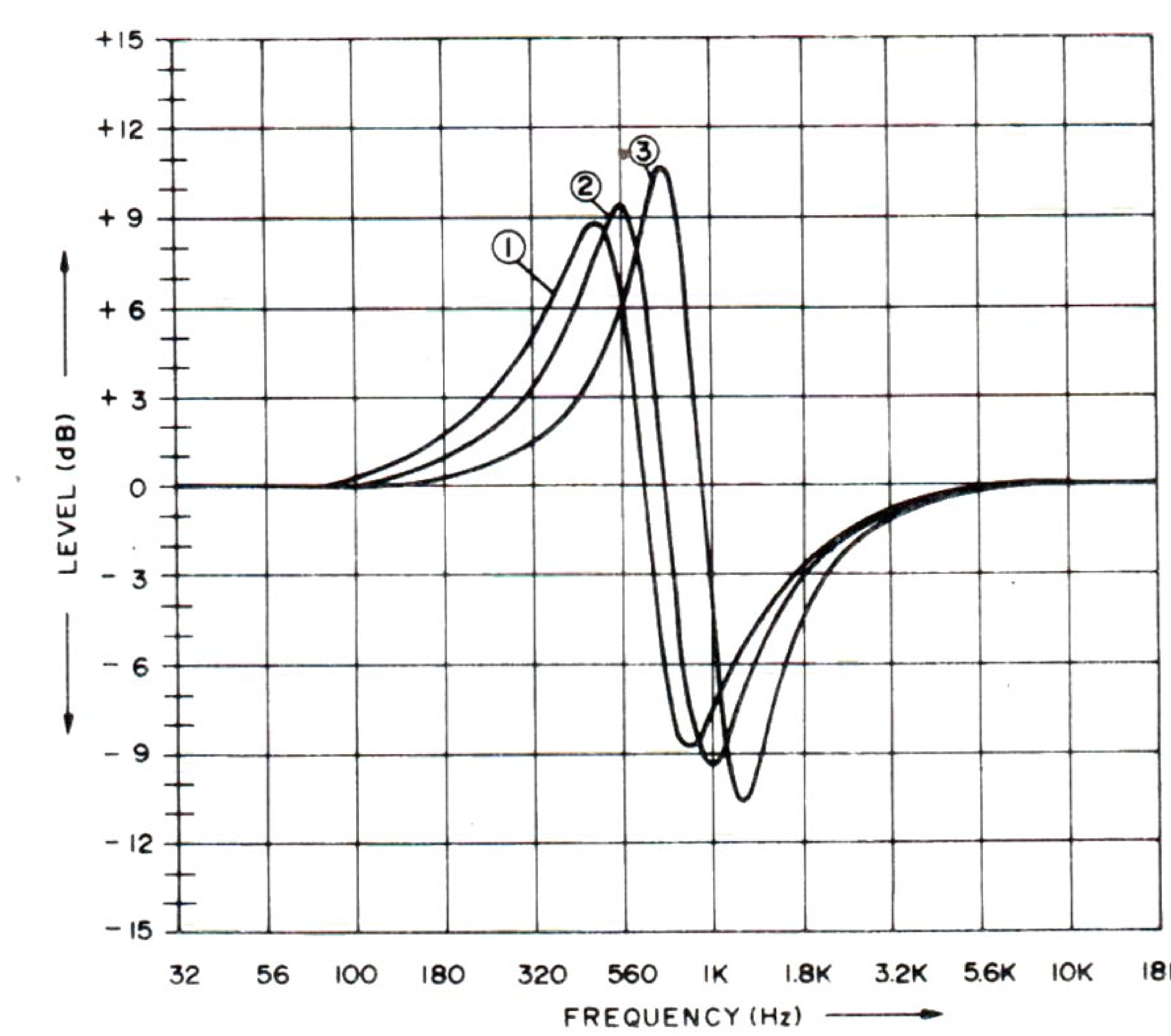


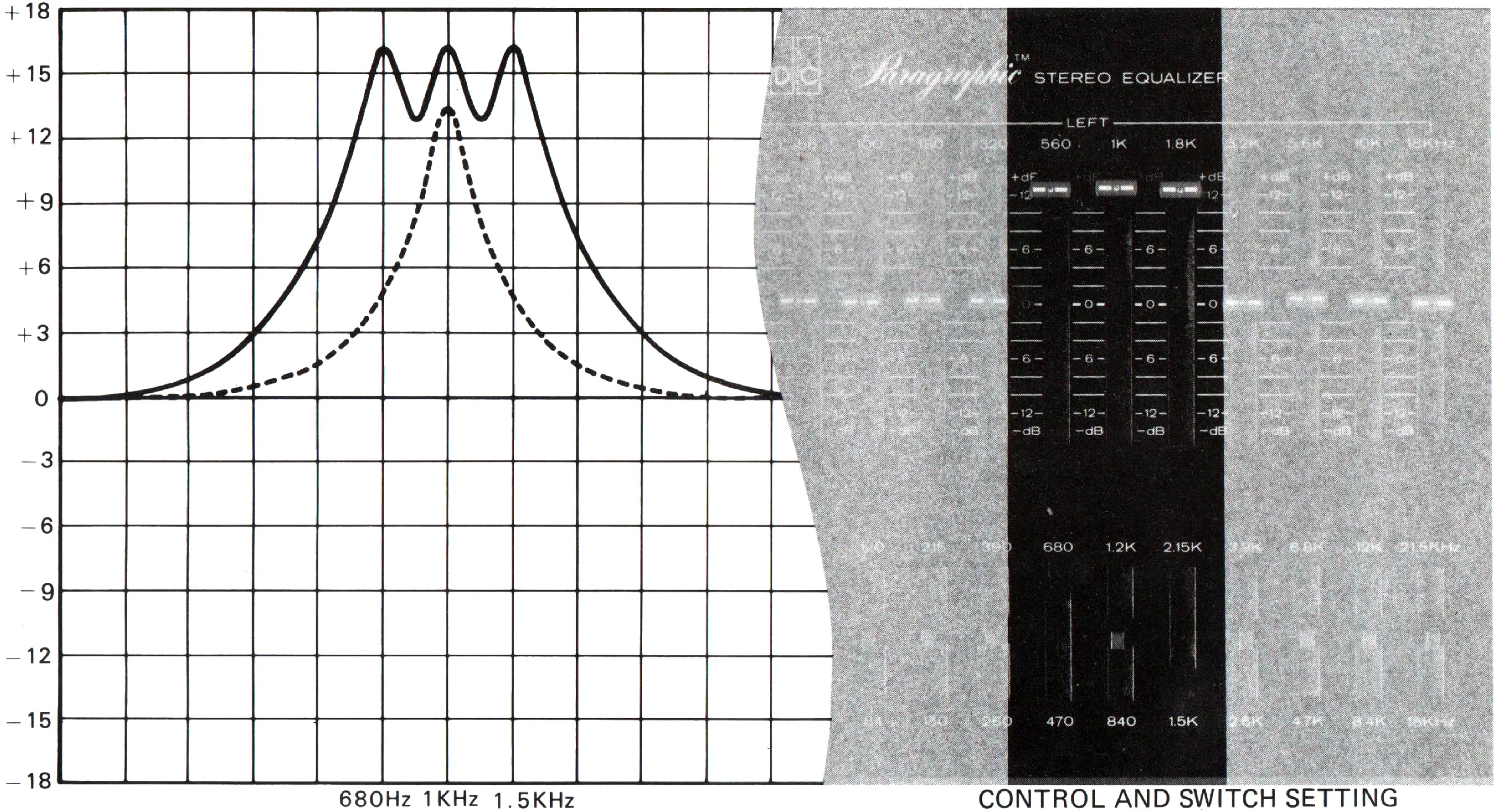
Figure D

Typical Frequency Response

1 470 Hz Full Boost
  840 Hz Full Cut
2 560 Hz Full Boost
  1 KHz Full Cut
3 680 Hz Full Boost
  1.2 KHz Full Cut

FREQUENCY SELECTOR SWITCH CONTOUR EXAMPLE

Effective use of Frequency Selector Switches



Dotted Line - - - - - - - - 1 KHz Center Frequency

Solid Line ———— Net effect of adjacent Frequency Selector Switches to achieve increased BANDWIDTH

Figure E

SPECIFICATIONS
(Typical)

FREQUENCY RESPONSE	5 Hz TO 100 KHz $^{+0.5}_{-1.0}$ dB
CONTROL FREQUENCIES Center frequency shifted by switch below each slide control.	LOW / CENTER / HIGH (see below)
CONTROL RANGE	±12 dB Minimum
HARMONIC DISTORTION At 1 volt output 20 Hz TO 20 KHz	0.018%
HUM AND NOISE At 1.0 V (input shorted)	90 dB
INTERMODULATION DISTORTION 70 Hz/7 KHz @ 4 : 1 ratio	0.02%
DYNAMIC RANGE 10 K Ohm Load	10 Volts RMS
GAIN (ALL CONTROLS FLAT)	0 dB ± 1 dB
INPUT IMPEDANCE @ 1 KHz	75 K Ohms
OUTPUT IMPEDANCE @ 1 KHz	100 Ohms
LED METERING TOLERANCE	+12 dB ± 0.5 dB 0 dB ± 0.5 dB –12 dB ± 0.5 dB Other ± 1.0 dB
LED "METER"	Dual (13 segment per channel) solid state display in 2 dB increments
INPUTS	2 Main, 2 Tape Monitor
OUTPUTS	2 Main, 2 Tape Out
SIGNAL GAIN CONTROLS	For setting Unity Gain
METER LEVEL CONTROLS	Metering Sensitivity Adjust
ACCESSORY POWER OUTLET	Unswitched 200 watts
CONTROLS	Power, Line/Record, Tape Monitor, EQ/Bypass, Meter, 24 Frequency Slide Controls (12 per channel) with 3 position detent (+6, 0, –6 dB), "0" used for setting to Flat response, LED Illuminated, 2 Signal Gain, 2 meter adjust, 24 Frequency Selector Switches Slide Control LED's ON/OFF Switch

Control frequencies:

LOW	CENTER	HIGH	
26	32	39	Hz
47	56	68	Hz
84	100	120	Hz
150	180	215	Hz
260	320	390	Hz
470	560	680	Hz
840	1 K	1.2 K	Hz
1.5 K	1.8 K	2.15 K	Hz
2.6 K	3.2 K	3.9 K	Hz
4.7 K	5.6 K	6.8 K	Hz
8.4 K	10 K	12 K	Hz
15 K	18 K	21.5 K	Hz

SEMI-CONDUCTORS	25 Transistors, 50 Diodes, 17 Integrated Circuits, 55 LED's
DIMENSIONS	19″ wide (484 mm), 6-5/6″ high (160 mm), 12″ deep (304 mm)
POWER CONSUMPTION	120 V AC 50/60 Hz, 25 watts Export; 220/240 V AC, 25 watts
ACCESSORIES AVAILABLE	ADC Sound Level Meter including Test Record (Pink Noise) and 20 feet Interconnecting Cable. Model SLM-300.

DESIGNED FOR STANDARD 19″ EIA RACK MOUNTING

In the space provided below, record the Serial Number located on the rear panel of the Equalizer. Retain this number for future reference.

Serial No.____________________

CAUTION: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

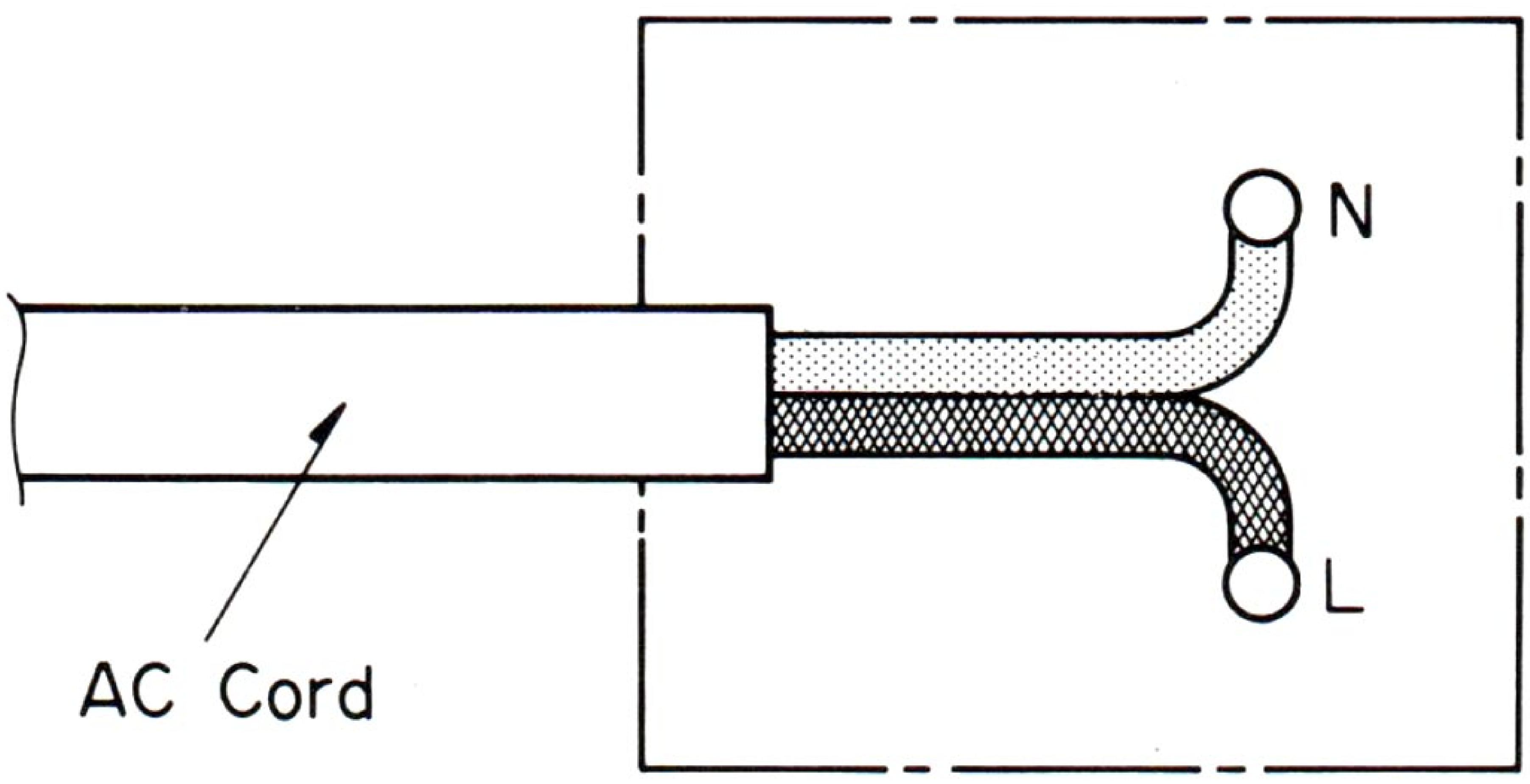
ADDENDUM for UK MODELS

CAUTION for MAINS CONNECTIONS

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug proceed as follows:

- The wire which is coloured BLUE must be connected to the terminal which is marked with the letter N or coloured BLACK.
- The wire which is coloured BROWN must be connected to the terminal which is marked with the letter L or coloured RED.

This equipment must be protected by a 3 A fuse if a 13 A (B.S 1363) plug is used.
If another type of plug is used a 5 A fuse or lower shall be used, either in the plug or adapter or at the distribution board.



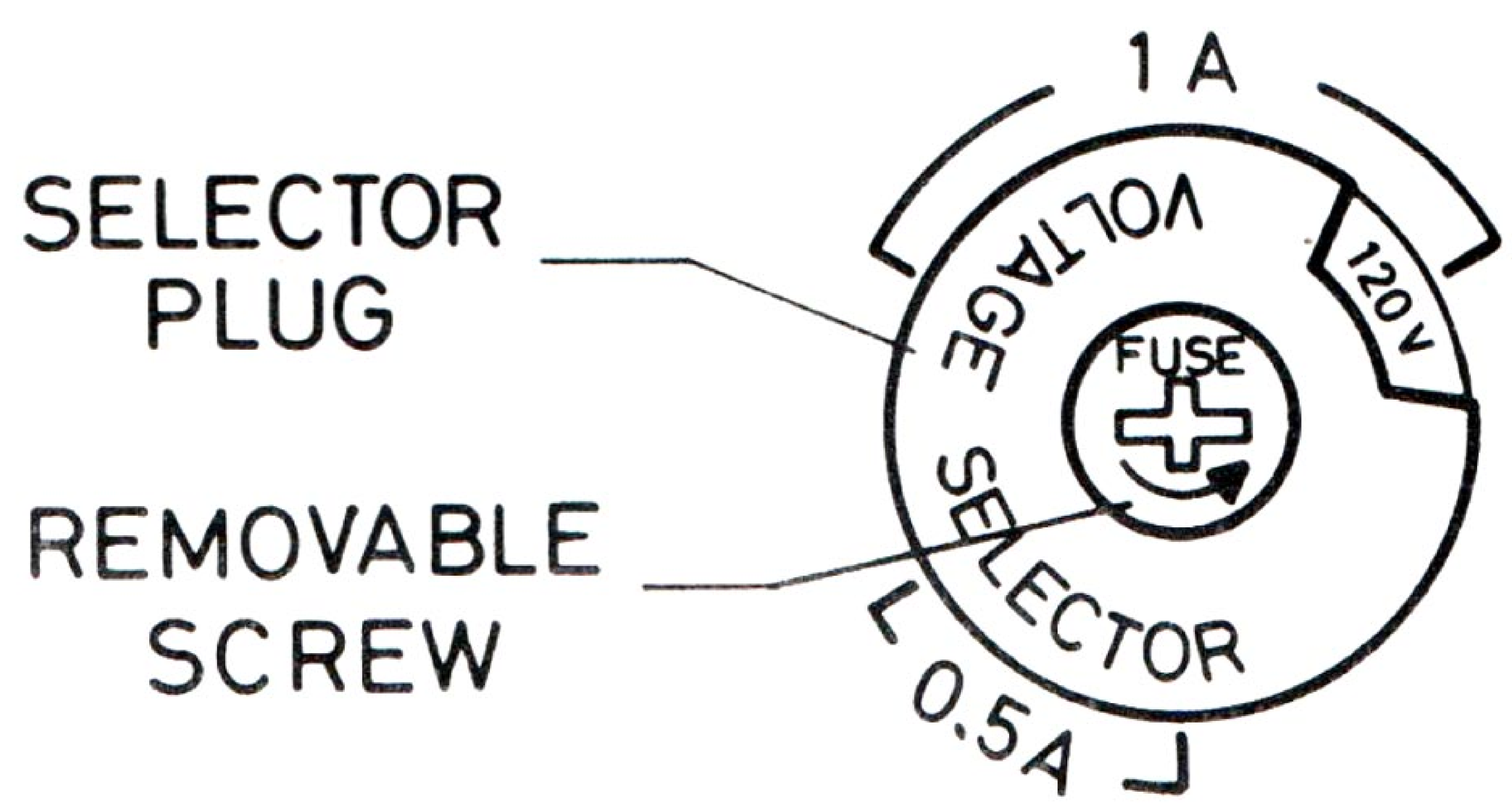
N : NEUTRAL ----- BLUE
L : LIVE --------- BROWN

ADDENDUM for PX VERSION

When this unit is despatched it is set to operate on 120 volts. This should be checked against the mains supply figure. If the figures do not agree then the following procedure must be followed before operating. Voltages of 100/120/220/240 are accommodated.

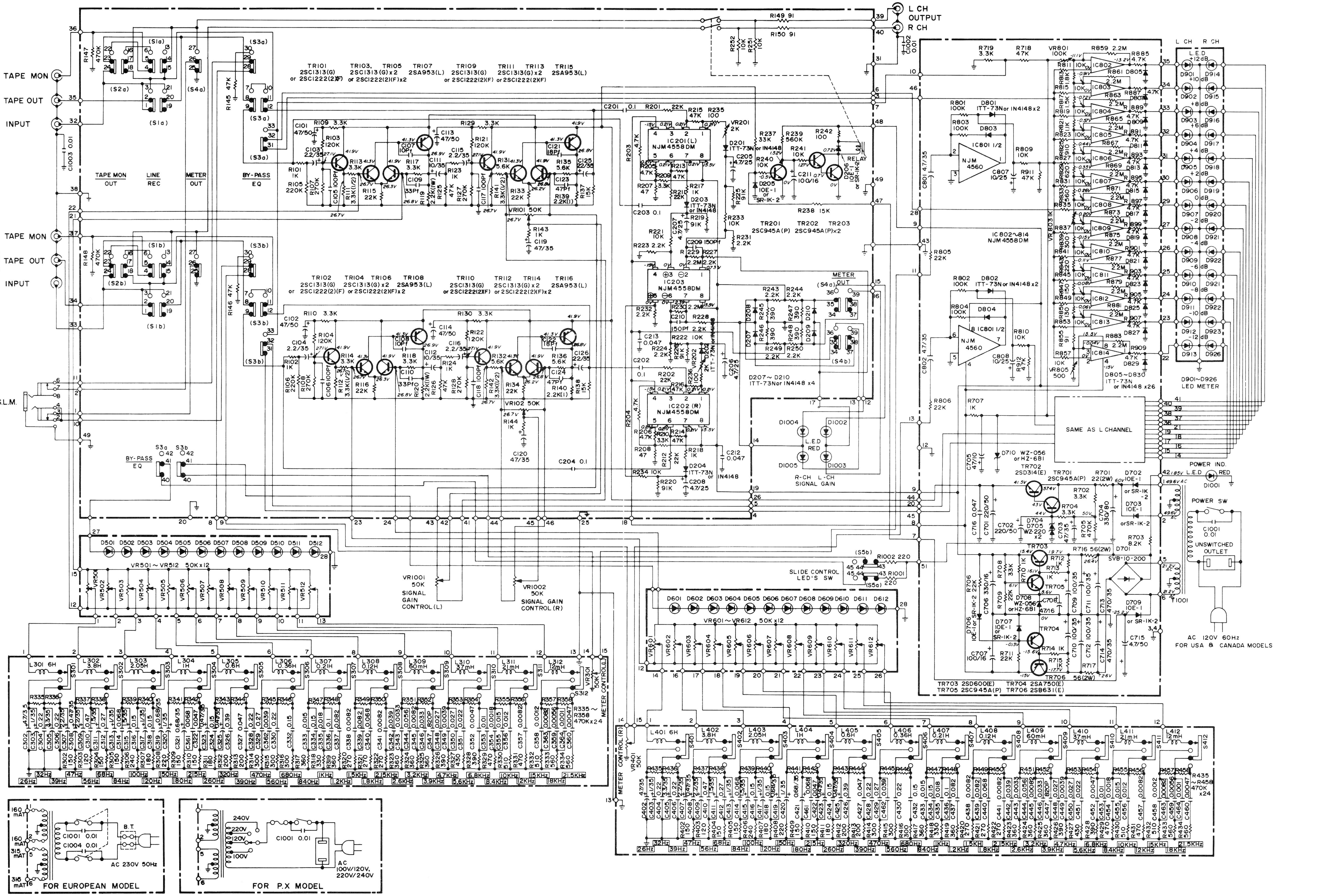
1. Ensure the SS-3 is unplugged from the mains outlet.
2. The voltage selector socket is situated on the rear of the Sound Shaper (See Dia).
3. Remove the centre screw holder and fuse by using a PHILLIPS screw driver.
4. The voltage selector plug may now be pulled out revealing alternative operating figures.
5. The plug should be reinserted so the correct operating voltage figure is visible (See Dia).
6. If operating on 220/240 volts, exchange the Fuse for a 0.5 A ϕ 6 x 30 mm type.
7. Replace the fuse and screw holder.

The unit may now be plugged into the mains supply and switched on. When moving to another area/country please recheck the supply voltage.



— NOTE —

SCHEMATIC DIAGRAM



NOTE: (1) ALL RESISTANCE VALUES ARE INDICATED IN "Ω" ($K = 10^3 \Omega$)

(2) ALL CAPACITANCE VALUES ARE INDICATED IN "μF" ($P = 10^{-6} \mu F$)

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