

BEFORE PROCEEDING WITH COMPLETE UNPACKING AND SETUP,  
CONSULT UNPACKING AND INSPECTION INSTRUCTIONS ON PAGE 6

**model 567**  
**SOUND REINFORCEMENT**  
**PROCESSOR**



**United Recording Electronics Industries**

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SECTION I  
INTRODUCTION

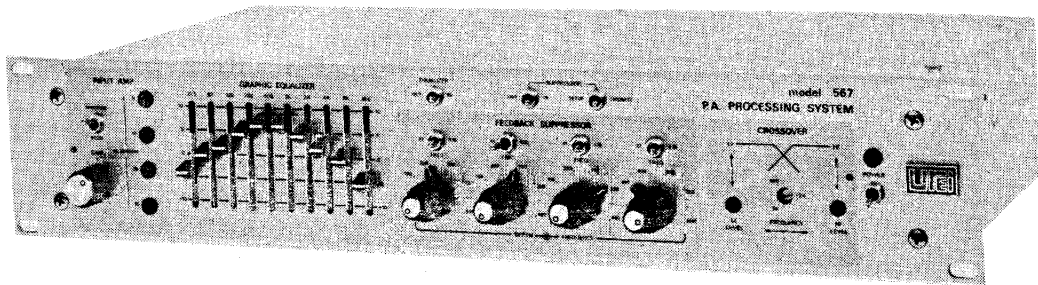


FIGURE 1. MODEL 567 FRONT PANEL

1.1 DESCRIPTION

The Model 567 includes, in one compact rack-mount package: an Input Amplifier/gain control, level monitor, pink noise source for setup, 10-Band Graphic Equalizer, 4-frequency Feedback Suppressor, a 2-way Electronic Crossover with continuously adjustable crossover frequency, and a regulated power supply.

The system is designed to operate at any nominal level from as low as -20 dB (Ref. 0.775 V), allowing the use with low level mixers, high or low impedances, and balanced or single-ended circuits.

A rear panel patch point is provided to allow insertion of other signal processing equipment (such as a Limiter or Leveling Amplifier) between the Feedback Suppressor and Electronic Crossover sections.

1.2 TECHNICAL SPECIFICATIONS

INPUT STAGE:

Type: Balanced, bridging differential amplifier.

Input Impedance: 40 kohms balanced, 20 kohms unbalanced.

Maximum Input Level: +20 dB (Ref. 0.775 V rms).

Gain: Variable, -10 dB to +20 dB, with front-panel Level control.

#### GRAPHIC EQUALIZER:

- Type: 10 bands on 1 octave centers.
- Range of Boost & Cut: 10 dB, single filter section.
- Center Frequencies: Standard ISO (Hz)  
31.5, 63, 125, 250, 500, 1k, 2k, 4k, 8k, 16k.
- Filter Bandwidth: One octave at -3 dB points with 8 dB boost or cut.
- Filter Type: Two pole synthesized LC.

#### FEEDBACK SUPPRESSOR:

- Type: Four notch filters, frequency and depth adjustable.
- Frequency Range: 60 Hz to 6 kHz, continuously variable in two ranges.
- Notch Depth: 0 to 20 dB, continuously variable.
- Filter Bandwidth: Approx. 1/6-octave at 5 dB notch depth (3 dB points).

#### ELECTRONIC CROSSOVER:

- Filter Type: State variable, 2-pole Butterworth, 12 dB/octave.
- Crossover Frequency: Continuously adjustable from 500 Hz to 5 kHz.
- Level Controls: Independent high and low frequency output attenuators.  
Ranges from unity to -50 dB.

#### OUTPUT AMPLIFIERS:

- Output Circuit: Floating, transformer-isolated; activated 6 seconds after power turn-on (to avoid turn on thump).
- Output Load: 150 ohms or greater.
- Power Output: +24 dBm into 600 ohm load (12.28 volts).  
+20 dB into 150 ohm load (7.75 volts).
- Distortion: Less than 0.5% THD, 30 Hz to 15 kHz at maximum rated output.

Frequency Response: Full Spectrum;  $\pm 1$  dB, 20 Hz to 20 kHz.  
High Frequency;  $\pm 1$  dB, 20 kHz, lower  
cutoff frequency adjustable.  
Low Frequency;  $\pm 1$  dB, 20 Hz, upper cutoff  
frequency adjustable.

Output Noise: Less than -85 dBm (15.7 kHz BW, input and  
output terminated with 600 ohms, controls  
set for unity gain).

#### PATCH POINT:

Output Impedance: 100 ohms resistive, unbalanced.  
Nominal Output Level: +4 dB with input Level set for 16 dB  
headroom.  
Maximum Output Level: +20 dB into 10 kohm load or greater.  
+14 dBm into 600 ohm load.  
Input Impedance: 100 kohms.  
Input Level: +4 dB nominal, +20 dB maximum.

#### MISCELLANEOUS:

Power Requirements: 100 - 125 V AC, or 200 - 250 V AC,  
50/60 Hz, switch selectable,  
less than 10 W.  
Environment: Operating 0°C to +50°C.  
Storage -20°C to +60°C.  
Connections: Input and outputs on rear panel barrier  
strips and 2-circuit phone jacks.  
Patch point on barrier strip.

#### PHYSICAL CHARACTERISTICS:

Dimensions: 483 x 89 mm rack panel, depth behind  
panel 248 mm, (19" x 3.5" x 9.75").  
Weight: 4.54 kg (10 pounds).  
Shipping Weight: 6.35 kg (14 pounds).  
Finish: Panel is 3.18 mm (1/8") brushed clear  
anodized aluminum in two shades.  
Chassis is cadmium plated steel.  
Accessory: Model 567 SC Security Cover; smoke gray  
transparent plastic; covers all operating  
controls.

### 1.3 CONTROLS

#### INPUT STAGE:

- Gain: Continuously variable control of input stage; gain from -10 dB to +20 dB.
- Program/Noise Switch: Front panel switch selects either input program, or internal pink noise generator for system setup.
- Headroom Indicator: 4 LED indicators showing maximum signal levels: 0, -10, -20, -30 dB relative to overload, monitored at all critical circuit points.

#### EQUALIZER:

- Band Level Control: Continuously variable slide potentiometer provides 10 dB boost or cut within each octave band.
- Equalizer In/Out: Toggle switch allows Graphic Equalizer section to be bypassed.

#### FEEDBACK SUPPRESSOR:

- Depth: Continuously variable attenuation from 0 to 20 dB.
- Frequency: Varies the notch frequency from 60 Hz to 600 Hz, or 600 Hz to 6 kHz.
- Frequency Range: Toggle switch selects range for x1 or x10.
- Suppressor In/Out: Toggle switch allows Feedback Suppressor section to be bypassed.
- Setup/Operate: Toggle switch activates clipper to protect loudspeakers during adjustment of Feedback Suppressor.

#### CROSSOVER:

- Frequency: Continuously varies the crossover frequency from 500 Hz to 5 kHz.
- HF Level: Varies output level of high frequency crossover. 0 dB to 50 dB of attenuation.

LF Level: Varies output level of low frequency crossover. 0 dB to 50 dB of attenuation.

Low/Full: Rear panel slide switch selects either the Crossover's low frequency band or the full spectrum signal to feed the low frequency output stage.

#### 1.4 CONNECTIONS

All connections for input and output are made through barrier strips and 2-circuit phone plugs at the rear of the chassis. (See Installation Instructions, Section 2.5.)



## SECTION II

### INSPECTION AND INSTALLATION

#### 2.1 UNPACKING AND INSPECTION

Your Model 567 was carefully packed at the factory, and the container was designed to protect the unit from rough handling. Nevertheless, we recommend careful examination of the shipping carton and its contents for any sign of physical damage which could have occurred in transit.

If damage is evident, do not destroy any of the packing material or the carton, and immediately notify the carrier of a possible claim for damage. Shipping claims must be made by the consignee.

The shipment should include:

Model 567 P.A. Processing System

UREI Instruction Manual (this book)

Two-part Warranty Card bearing the same serial number as the Model 567.

Mounting screws and finish washers (for rack mounting).

#### 2.2 ENVIRONMENTAL CONSIDERATIONS

The system will operate satisfactorily over a range of ambient temperatures from 0°C to +50°C (+32°F to 122°F), and up to 80% relative humidity.

If the system is installed in an equipment rack together with high heat producing equipment (such as power amplifiers), adequate ventilation should be provided to prolong the life of components. Also, while circuitry susceptible to hum pick-up is sufficiently shielded from moderate electromagnetic fields, installation should be planned to avoid mounting the system immediately adjacent to large power transformers, motors, etc.

#### 2.3 POWERING

The 567 may be operated from either 100-125 VAC or 200-250 VAC mains (50 or 60 Hz, single phase.) As indicated in Section 2.4, the nominal line voltage may be selected with a rear panel switch. BE SURE TO VERIFY BOTH THE ACTUAL LINE VOLTAGE, AND THE SETTING OF THE VOLTAGE SELECTOR SWITCH BEFORE CONNECTING THE 567 TO THE MAINS.

To comply with most Electrical Codes, the 567 is supplied with a three-wire AC cord, the grounding pin of which is connected to the chassis. In some installations this may create ground-loop problems. Ground loops can become very evident (as hum and buzz) if a significant potential difference exists between the AC conduit ground and the grounded metal enclosure in which the chassis is installed. If hum is experienced, check for the possibility of ground loops by using a 3-prong to 2-prong AC adapter, ungrounding the AC plug temporarily. This ungrounds the Model 567, and will probably cure the hum or buzz, but is not a substitute for proper system grounding. Be aware that unless the Model 567 P.A. Processing Sytem is AC grounded, a safety hazard can exist. UREI accepts no responsibility for legal actions or for direct, incidental or consequential damages that may result from violation of any electrical codes.

#### 2.4 LINE VOLTAGE SWITCH

Unless a tag on the line cord specifies otherwise, the Model 567 was shipped ready for operation with nominal 115 VAC power mains. In order to change this for nominal 230 V (50 or 60 Hz), slide the VOLTAGE SELECTOR switch on the rear panel to the 230 position. The voltage is visible in a window next to the switch slot. Be sure to change the fuse to the correct value: 1/8-amp slo-blo when changing to 230 V operation or 1/4-amp slo-blo for 115 V operation. A small screwdriver should be used to move the recessed switch.

#### 2.5 EXTERNAL CONNECTIONS

Permanent input and output signal wires should be shielded cable, and connected in accordance with standard wiring practice, as indicated on the rear panel barrier strip.

If the Model 567 output is connected to a high impedance circuit, we recommend shunting the "+" and "COM" output terminals with a 620 ohm, 1/2 watt resistor. This assures optimum loading for the 567. (See section 2.6 regarding input termination).

(See Illustrations on the following pages)

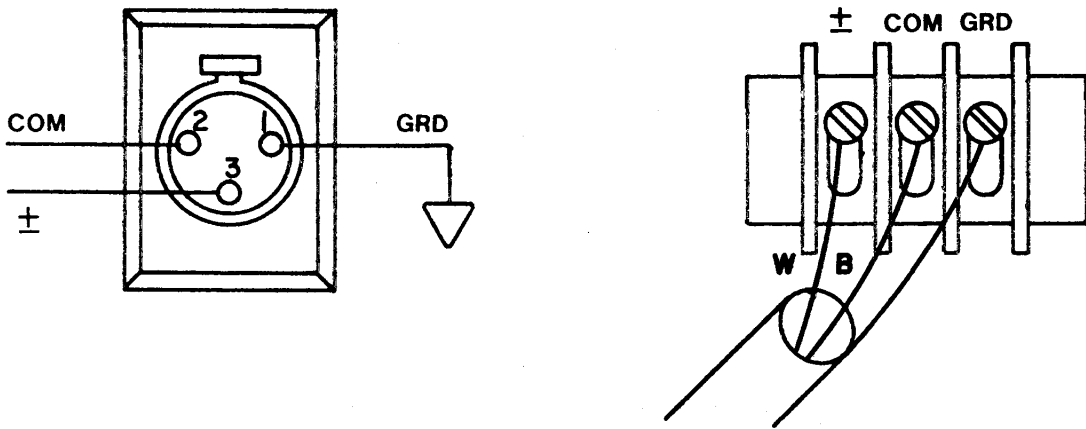


FIGURE 2. CONNECTING THE MODEL 567 INPUT WITH BALANCED CIRCUITS.

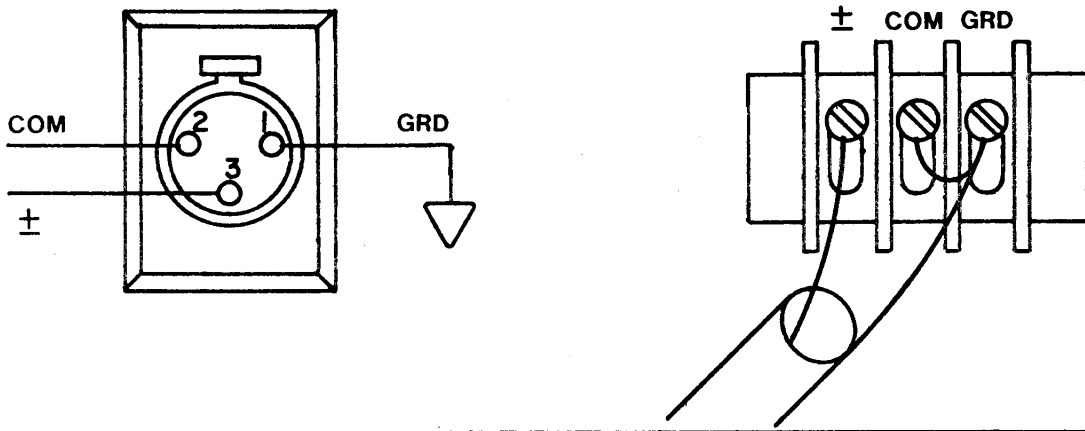


FIGURE 3. CONNECTING THE MODEL 567 INPUT WITH UNBALANCED CIRCUITS.

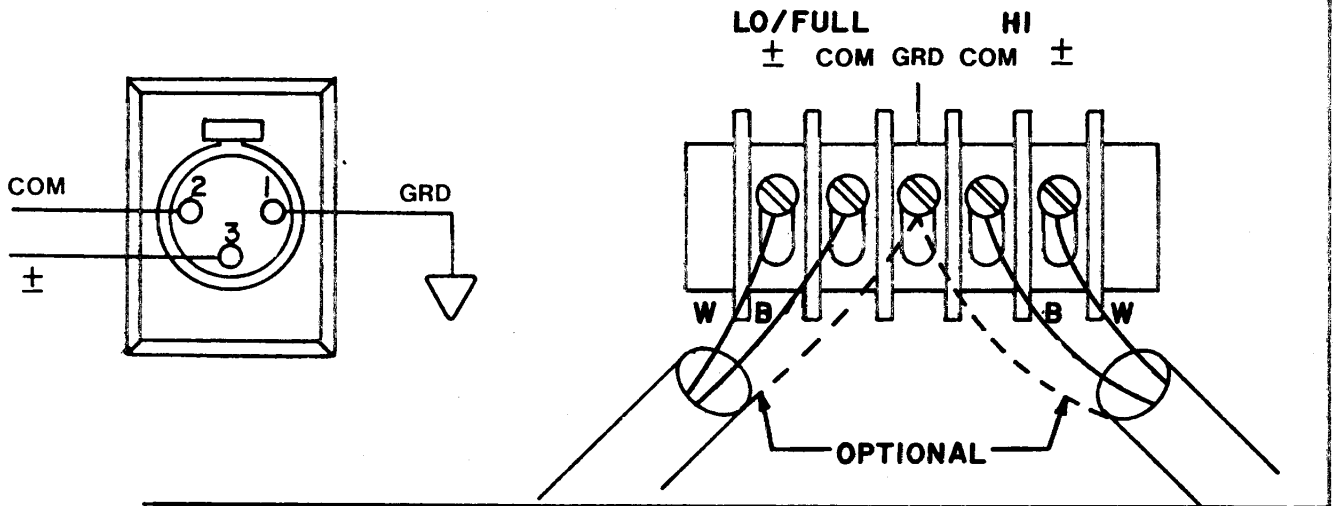


FIGURE 4. MODEL 567 WITH BALANCED OUTPUT CONNECTIONS.

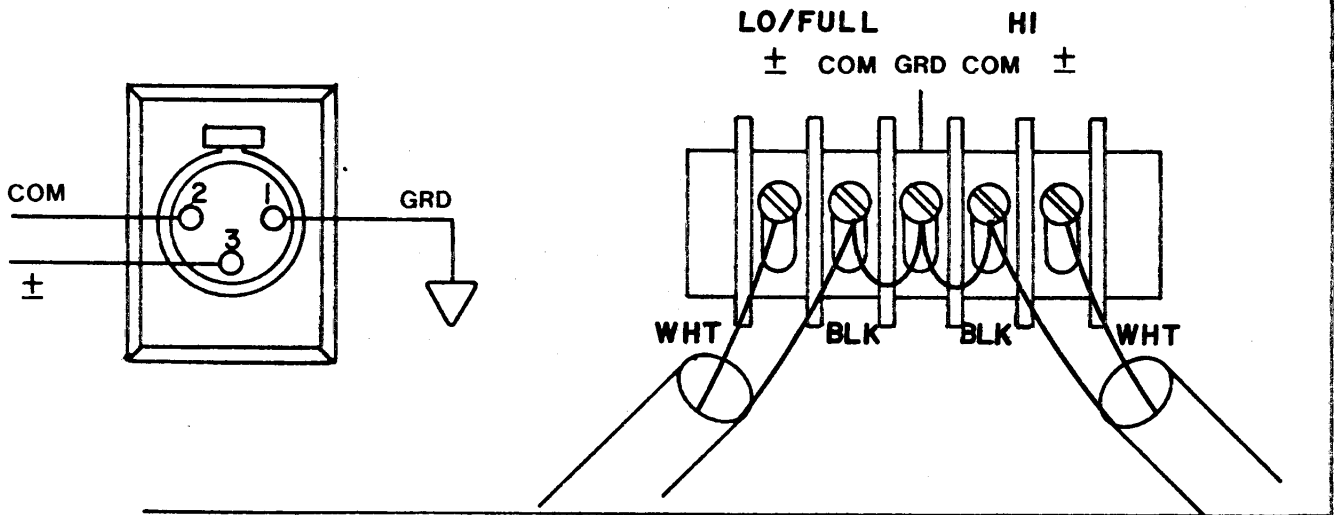


FIGURE 5. MODEL 567 WITH UNBALANCED OUTPUT CONNECTIONS.

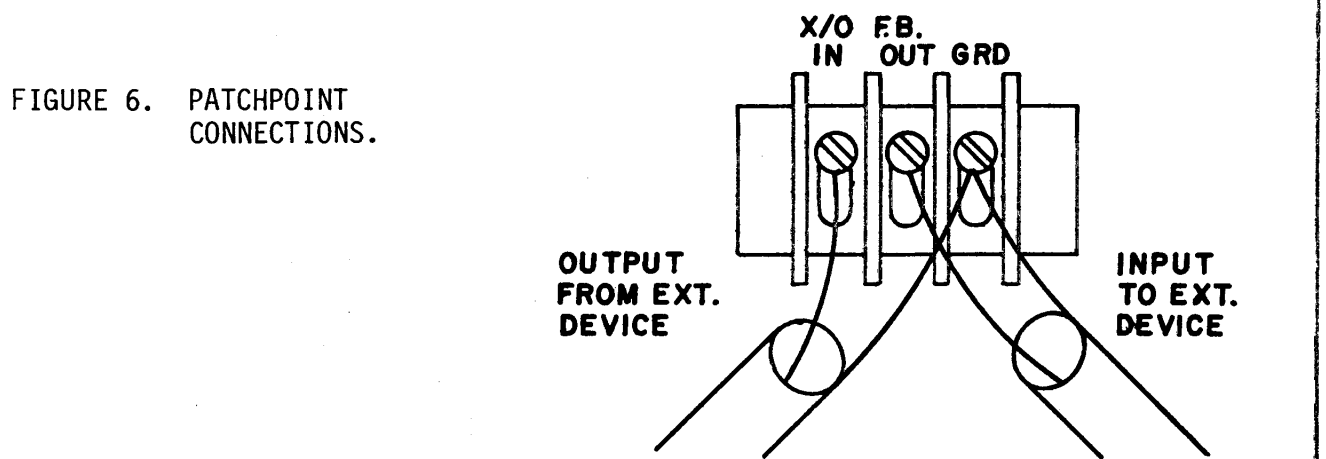


FIGURE 6. PATCHPOINT CONNECTIONS.

## 2.6 IMPEDANCE AND TERMINATION

Audio engineering had its roots in the telephone industry, and "600 ohm circuits" (together with their predecessors, "500 ohm circuits") are carry-overs from telephone transmission practices. Long audio transmission lines, like their video counterparts, must be properly sourced from and terminated in equipment which matches their characteristic impedance, if optimum frequency response and noise rejection are to be achieved.

However, transmission line theory and techniques are not only unnecessary but impractical within modern recording studios, broadcast studios and other local audio systems where transmission circuits are seldom more than several hundred feet in length. The advent of negative feedback circuitry and solid-state electronics has spawned modern audio amplifiers and other signal processing devices having source impedances of only a few ohms. They are essentially indifferent to load impedances and by varying their output current inversely to changes in load impedance, maintain the same output voltage into any load impedance above a rated minimum, with no change in frequency response.

Modern audio systems, therefore, utilize amplifiers and other active devices which have very low output impedances and high (10K to 50K) input impedances. These products may thus be cascaded (operated in series), or many inputs may be connected to a single output of a preceding device, without regard to impedance "matching". Switching, patching, etc. is simplified because "double loads" and "unterminated" bugaboos are essentially eliminated. "Floating" (ungrounded) transformer outputs minimize ground loop problems, and differential transformerless input circuitry (or input transformers) minimize common mode noise or interference which may be induced into the interconnecting wires or cables.

Where audio must be transmitted through cables or wire pairs of more than several hundred feet in length, however, transmission line termination practices should still be observed.

The Model 567 has input impedances of 40 kohms (40,000 ohms) when used in a balanced, differential input configuration, and 20 kohms (20,000 ohms) when used unbalanced (one side grounded). This makes the 567 suitable for use with any nominal source impedance, low or high. Only when it is used from a source which requires a low impedance termination (such as a 600-ohm transmission line or older vacuum-tube equipment) will a source termination resistor be required at the 567 input.

Patch point impedances are 100 ohms for the output (as source) and 100 kohms for the input (as load).

## 2.7 SIGNAL LEVEL AND HEADROOM INDICATOR

The Model 567's differential input amplifier is capable of being driven by signals up to a level of +20 dBm, above which clipping and distortion occurs. The Headroom LEDs indicate the level of the signal relative to overload or clipping. The red "0" LED indicates overload, while the green "10," "20," and "30" LEDs indicate dB level below clipping.

Overload conditions are monitored at the output of each individual section since it is possible, through boost-cut combinations, to overload these circuits even though the input signal level is below +20 dB.

The output amplifier is capable of delivering +24 dBm into a 600 ohm load (12.3 volts) or +20 dB into a 150 ohm load.

## SECTION III

### OPERATING INSTRUCTIONS

#### 3.1 BASIC OPERATION

##### 3.1.0 GENERAL DESCRIPTION

In order to understand the Model 567 as a system, it is best to think of it as four different functional sections (the four shaded areas on the front panel), and then learn how to use each section. The four sections are: Input Amp, Graphic Equalizer, Feedback Suppressor, and Crossover.

##### 3.1.1 INPUT AMPLIFIER

This section has two modes of operation which are determined by the Program/Noise switch. This switch selects either the input connected to the 567 (in Program position), or an internal pink noise generator (in Noise position) as the source signal for the other sections of the 567. The normal operating position is "Program." The Noise position is useful to set up the Graphic Equalizer section while using a real-time spectrum analyzer for a check of the entire sound system, including power amplifiers and speakers.

The Gain control is used to change the level of the input signal to a level that is optimum for the Model 567. The Headroom indicators are very helpful in setting the Gain control, and show how far below overload the signal level is throughout the 567. The Gain control should be set so that during operation the red "0" LED never turns on, and the green "10" LED is illuminated as much as possible (probably less than half the time, depending on the program material).

##### 3.1.2 GRAPHIC EQUALIZER

This section is used to compensate for the tonal colorations and frequency deficiencies of the speaker system and the room acoustics. The Equalizer In/Out switch bypasses this section in the Out position. Each slide control covers one octave of the audio frequency band, and can be adjusted to increase or decrease the level in that octave. These sliders should be adjusted to obtain a natural sounding balance of vocals and instruments, as heard over the P.A. system. The In/Out switch may be used to compare the equalized and unequalized sound while setting the controls.

##### 3.1.3 FEEDBACK SUPPRESSOR

This section is used to eliminate the first four feedback modes that occur in the P.A. system as the microphone level at

the mixer is increased. Each of the four Frequency controls is used to tune the corresponding filter to one feedback frequency. Since the width of the filter is only 1/6-octave, program loss due to the filter insertion remains negligible. The Frequency switch scales the range of the Frequency control to either the low range (x1) or high range (x10).

The Suppressor In/Out switch bypasses this section and allows one to evaluate the effect of the feedback suppression. The Setup/Operate switch is used in the "Setup" position during adjustment to protect the P.A. system amplifiers and loudspeakers. This switch must be in the "Operate" position when program material is played or the output will be clipped and thus sound distorted.

#### 3.1.4 CROSSOVER

The low-level Crossover splits the program signal into high and low frequencies for biamplified speaker systems. Independent high and low frequency output amplifiers supply the signal to the output terminals. A patch point ahead of the Crossover allows additional equipment to be connected, such as a limiter, delay line, etc.

The Frequency control adjusts the crossover frequency and should be set according to specifications given by the manufacturer of the speakers to be used. The Low Out/Full Spectrum switch on the rear panel selects the function of the low frequency output. In "Low Out" position, only the low frequency portion of the full spectrum appears at the low frequency output jack and terminals (for biamp operation). In the "Full Spectrum" position, all frequencies appear at the low frequency output (for non biamplified operation). The LF Level control adjusts the output level of the low frequency output, whether full spectrum or low frequencies only.

The HF Level control adjusts the output level of the high frequency section of the crossover. (Note: The High Frequency output is not affected by the position of the Low Out/Full Spectrum Switch).

### 3.2 SETUP PROCEDURE

#### 3.2.0 GENERAL

This portion of the manual gives a step by step procedure for setting and operating all controls on the Model 567. Each of the four functional sections is treated separately. The Crossover procedure need only be followed each time a different speaker/amplifier system is connected to the Model 567. The Equalizer, Suppressor and Input Amplifier should be adjusted each time the sound system is set up in a different location or whenever the microphone or speaker placement changes.



Begin the setup procedure with the following switch positions:

EQUALIZER: Out.  
SUPPRESSOR: Out, Operate mode.  
INPUT AMP: Gain Control Counterclockwise,  
Program mode.

### 3.2.1 CROSSOVER SECTION SETUP

Select procedure "A" for a full range speaker system, or procedure "B" for a biamplified speaker system, as appropriate.

#### A. 1-Way Full Range Speaker System

1. Set the rear panel switch to Full Spectrum Out position.
2. Turn the front panel LF Level control fully clockwise.
3. Connect an external power amplifier to the LO/Full output.

#### B. 2-Way Biamplified Speaker System

1. Set the rear panel switch to Low Out position.
2. Turn the front panel LF Level and HF Level controls fully clockwise.
3. Connect one external power amplifier to the LO/Full output and another amplifier to the HI output.
4. Set the Frequency control to the speaker manufacturer's suggested crossover frequency. (This may be done by applying an input signal at the crossover frequency, and adjusting the Model 567 Frequency control for equal level at the LO/Full and HI outputs.)
5. It may be necessary to adjust either the HF Level or LF Level control to achieve acoustic balance from the speakers.

### 3.2.2 EQUALIZER SECTION SETUP

If a real-time spectrum analyzer is available, follow procedure "A" (below); if not, use procedure "B."

#### A. Using a Real-Time Spectrum Analyzer

1. Set the Gain control (Model 567 Input section) fully counterclockwise.

2. Set the Input switch to "Noise" position.
3. Set the Equalizer switch to "In" position.
4. Set the Equalizer sliders to "0" position.
5. Turn the Gain control clockwise to bring up the noise level until it is as loud as typical program material.
6. Adjust the Equalizer sliders for the desired display on the real-time spectrum analyzer.
7. Turn the Gain control fully counterclockwise, and move the switch from "Noise" to "Program" position.

#### B. Using Ears as Spectrum Analyzers

1. Set the Gain control (Model 567 Input Section) to the mid position.
2. Set the Input switch to "Program" position.
3. Set the Equalizer switch to "In" position.
4. Set the Equalizer sliders to "0" position.
5. Apply program material to the 567 input, and turn the Gain control clockwise to bring the program up to a typical listening level.
6. Adjust the Equalizer sliders for the desired frequency balance.

#### 3.3.3 FEEDBACK SUPPRESSOR SETUP

1. Set the Feedback Suppressor's Bypass to "In" position.
2. Set the Setup/Operate switch to "Setup" position.
3. The Equalizer should be switched "In" and should already be set up as above.
4. Set the Input switch to "Program" position.
5. Set the Gain control to mid position.
6. Set the Depth controls fully counterclockwise.
7. Set the Frequency control fully counterclockwise.

8. Set the Frequency Range switches to "X1" position.
9. Slowly increase the microphone level (using the mixer's level control) until the first feedback frequency becomes detectable and has stabilized.
10. Turn the first Depth control fully clockwise (maximum depth) and tune the associated Frequency knob until the feedback disappears. If the feedback cannot be tuned out, set the Range switch to "X10" and turn the Frequency knob until the feedback disappears.

With maximum Depth the feedback frequency may be at the skirt of the filter; for a more accurate tuning, reduce the Depth setting and retune the Frequency, if necessary, to eliminate the feedback.

11. Increase the microphone level so the next feedback frequency will appear, and repeat the procedure of step 10. Similarly, continue to increase the microphone level and eliminate the third and fourth feedback frequencies.
12. The Suppressor In/Out switch can be set to "Out" to assess the effect of the Feedback Suppression settings.
13. CAUTION: The Setup/Operate switch must be returned to the Operate position at the conclusion of this procedure.

#### 3.2.4 INPUT AMPLIFIER

With program applied, set the Gain control so that the green "10" LED lights as often as possible without the red "0" LED turning on at all. If the red LED does turn on, the Gain setting should be reduced.

### 3.3 OPERATING THE SYSTEM

Before actual use begins, verify the following switch settings:

PROGRAM/NOISE:	Program.
EQUALIZER IN/OUT:	In.
FEEDBACK SUPPRESSOR IN/OUT:	In.
SUPPRESSOR SETUP/OPERATE:	Operate.

When the P.A. system is actually in operation, it may be necessary to readjust the Model 567 controls for optimum performance. If program levels increase, the Input Gain control should be lowered to avoid turn-on of the red LED. Sometimes a change in audience size will alter the acoustics so that minor equalization adjustments may become desirable. Remember that a change in

equalization could also change the level at which feedback occurs. Therefore, more depth of the Feedback Suppressor may be required.

If your Model 567 is part of a portable sound system to be used in many different locations, it is a good idea to log the positions of the Graphic Equalizer controls and Feedback Suppressor controls. These settings then become a convenient starting point whenever you return to the same location.

#### CAUTION REGARDING FEEDBACK

Feedback is not only annoying to the ear, but is also dangerous to unprotected amplifiers and loudspeakers. The Feedback Suppressor section of the Model 567 incorporates a protection circuit which is activated in the Setup position of the front panel toggle switch. In Setup mode, the output voltage to the power amplifier is limited to a safer value by means of clipping excessive levels. The protective circuitry described is not guaranteed to prevent damage to amplifiers or speakers. Power amplifiers could be set too high and signal levels at the protective circuit may be too low for it to be activated before dangerous levels are achieved. BE CAREFUL OF YOUR AMPLIFIERS AND SPEAKERS.

#### 3.4 DISCUSSION OF EQUALIZATION

The main reason for frequency response tailoring of audio systems is to compensate for response anomalies occurring in the system and its environment, and to adjust the system response curve to some desired shape. In some systems this means adjusting for best overall flatness of response through the entire audio range, and in other instances some different response shape is desirable.

Three important characteristics of audio systems may be improved by judicious application of corrective equalization techniques. They are:

- (1) **DISTORTION OF FREQUENCY RESPONSE BALANCE.**  
Sources of sound which may be amplified through a sound system start out with some specific frequency bands. If, in being processed through an audio system this balance is disturbed by variation in frequency response, then truly the sound has been distorted. For example, an instrument has a specific characteristic with regard to the levels of the various harmonics compared to the fundamental tone. If these signals are processed through an audio system with non-linear frequency response, then the resultant sound is simply not the distinctive sound which that instrument originally produced.

(2) SUSCEPTIBILITY TO FEEDBACK.

In public address and sound reinforcement systems, the maximum acoustic gain that may be obtained for a microphone in the vicinity of a loudspeaker which is part of that system, will be determined by the positive feedback loop created when sound from the loudspeaker enters the microphone, reinforcing the signal level until the system goes into oscillation. This positive feedback problem is aggravated if some frequencies in the audio range are reproduced at a higher level than the rest of the frequency band. If the level of these frequencies which are being reproduced at an exaggerated level can be reduced, then the sound system gain may be increased to some degree without feedback.

(3) INTELLIGIBILITY.

For an audience in an auditorium to understand a lecturer, or for a nightclub audience to hear the words which a vocalist is singing, there are two important requirements:

- (a) The sound level of the source must be sufficiently loud as to be heard clearly and not masked by other sounds which may be present in the listening environment.
- (b) The sound which the listener hears must be intelligible to him. It should not be distorted or garbled. There are a number of causes for poor intelligibility in a sound system. Among them are: amplifier or speaker distortion, frequency band masking, improper balance of direct and reverberant fields, and inadequate projection of the higher frequencies which are necessary for the recognition of words. The frequency band from approximately 1 kHz to 5 kHz is very important to the recognition of sibilant and consonant sounds, and if the sound system has inadequate output in this frequency band, or if other bands have considerably greater output which "cover up" the sounds in the intelligibility band, the words may simply not be understood. Equalization is very helpful to correct some of these problems.

The remainder of this section is concerned with a general description of the equalization process and some suggestions for successful application of the Model 567 are given. Techniques are continuously being improved upon, therefore this discussion should be considered only as a starting point for those who are new to the field, and as a general review for those who are already proficient in the methods used.

Those interested in more complete information on the general subject of sound system design and corrective equalization are encouraged to study specialized literature\* and/or participate in seminars dedicated to audio acoustics, etc.

An excellent series of continuing seminars are conducted in various cities by Don and Carolyn Davis. For further information, and a schedule of their regular seminars, contact:

"Synergetic Audio Concepts"  
P.O. Box 1134  
Tustin, CA 92680

### 3.4.1 BEFORE EQUALIZATION

Corrective equalization is only one of the solutions to the problems faced by designers or users of audio systems. Applied correctly, it is a powerful tool; but if it is assumed to be a cure-all without careful consideration of other possible alternatives, results may be disappointing. If the sound system is not thoroughly checked out before equalization procedures are attempted, much time may be wasted. Therefore we feel that it is important to mention a few of the tests which should be made prior to the start of corrective room equalization. The list is not intended to be exhaustive, rather to point out that unless you know what the sound system IS doing, you may find it difficult (if not impossible) to make it do what it SHOULD do.

#### A PARTIAL CHECK-LIST OF PROCEDURES BEFORE EQUALIZATION:

- (1) At normal operating levels, check the frequency response and the signal-to-noise and distortion characteristics of the individual components of the system and the system as a whole.
- (2) Check phasing (polarity) of signal lines from all inputs through to the amplifier outputs.
- (3) Check loudspeakers to see that all units function, that there are no rattles due to loose screws or units poorly attached to walls. Check phasing of all loudspeakers, even of the several drivers within one cabinet. Check loudspeaker aiming.
- (4) Check phasing of all microphones.

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\* Sound System Engineering, by Don and Carolyn Davis, Published by Howard W. Sams, Inc., Indianapolis, Indiana 46268, Copyright 1975.

- (5) Check that all electronic components of the system are connected correctly, that correct signal levels are observed, that loads are where they should be and not where they should not be. Check the system for oscillations, R.F. interference, and hum.
- (6) Make sure you have a good system ground, and that shielding and grounding are done in accordance with good practices.
- (7) Make sure that the AC electrical power to the system is of good quality, adequately protected, and that the wire size is sufficiently large to avoid excessive voltage drop when large amounts of power are drawn.

### 3.4.2 MEASUREMENT TECHNIQUES

Several different methods are in use to measure the frequency response characteristic of a sound system in its acoustic environment:

- (1) Pink noise, measured in 1/3-octave bands and displayed on a real-time spectrum analyzer or suitable LED-display.
- (2) Swept sine waves, measured on an audio voltmeter or plotted on a graphic recorder.
- (3) Swept sine waves, frequency modulated with a constant percentage bandwidth (Warble Tone) generated and plotted with the UREI 200/2000 Recorder system.
- (4) Pulsed signals, generated and measured with the UREI SONIPULSE™ system.
- (5) Other methods, as for example "Time Delay Spectrometry," are in the development stage and may become important alternate solutions in the future.

Basically, all of the measurement methods are similar in technique, differing only in hardware. They all involve generating a known quantity of audio signal, transmitting it through the sound system, and reading the results through a calibrated microphone and readout device. The results will closely resemble each other if comparative measurements are made, presuming correct application of the various methods.

The microphone is located in the listening area, and its position is changed to see if there are response variations in different locations. The response variations are then averaged together to make what is called the RAW HOUSE CURVE (Figure 7). Corrective

equalization procedures are based on this curve. Many problems associated with level balance between multiple speakers in large areas, acoustic deficiencies, and speaker aiming and locating faults will show up on the curves taken in various locations in the listening area. For good results, these faults should be corrected by re-balancing of levels and re-aiming or relocating speakers -- not by equalization. In a system which uses the electronic crossover with a bi-amplified configuration, the balance should be checked and adjusted between low and high frequencies and between speakers covering different parts of the listening area.

### 3.4.3 ADJUSTMENT OF EQUALIZERS

Room equalization is performed as a series of approximations of control settings. Looking at the sample RAW HOUSE CURVE in Figure 7, we can infer that if an inverse electrical response curve were placed in the audio chain that the result would be a flat frequency response.

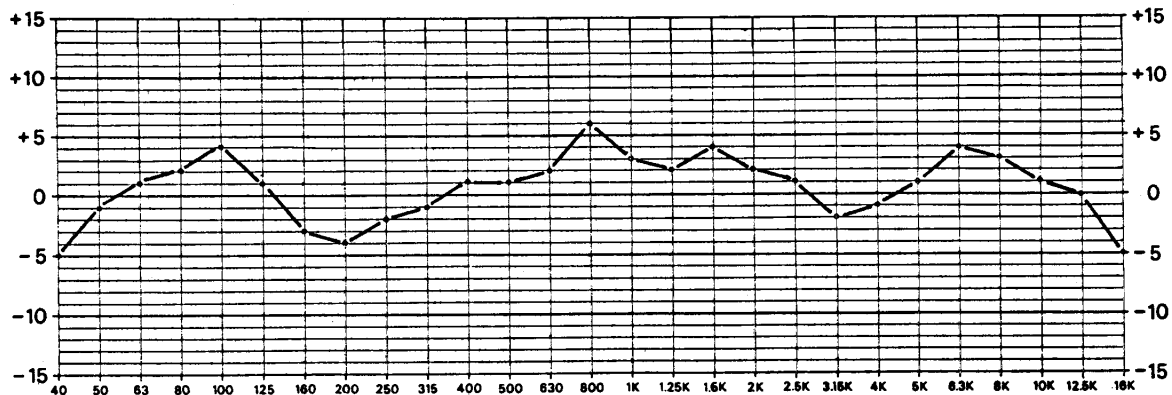


FIGURE 7.  
TYPICAL RAW HOUSE CURVE OBTAINED FROM SONIPULSE™ MEASUREMENTS.

The octave graphic equalizer is the tool with which this inverse curve is approximated. Because there are combining effects between adjacent filters, it is necessary to make settings on the equalizer and then to re-check the room response to see if the adjustments were correct. Additional adjustments and measurements may be made until the desired results are obtained.

### 3.4.4 SOME PROBLEMS WITH CORRECTIVE ROOM EQ

As stated earlier, the process of corrective equalization of sound systems is not a cure-all. There are some rooms which, because of very long reverberation times and poor acoustic configuration, cannot be significantly improved. There are a few others



in which the acoustics and the sound system are already so well balanced that there is little need for correction. It is for the majority of situations which lie between unsolvable and relatively perfect that corrective equalization is intended.

Many of the problems that people seem to have when performing corrective equalization stem from a tendency to "overkill." It has been found in practice that it is not desirable to attempt to equalize to the "last dB" all minor anomalies in the response of an acoustical system, as this often results in an artificial or processed sound. Also, it sometimes requires extreme filter settings with introduction of unwanted phase shift, which may cause more problems than the EQ solves. In general, if the final results are within a 3 dB envelope of the desired theoretical values, the equalization should be considered successful.

Attention should also be given to the fact that different frequencies are attenuated differently when traveling through air. As the distance between the sound source and the listening position (or position of the measuring microphone) increases, it is natural for high frequencies to be attenuated more. Therefore, if equalization is adjusted to create a perfectly "flat" response, particularly throughout a large room, the resulting sound will be excessively bright. A house curve which produces a natural response in sound systems is subjective and a matter of personal preference, as well as a function of the primary use of the location. However, a flat response up to about 3 kHz and then an attenuation of 3 dB per octave above 3 kHz is frequently used in sound reinforcement. In recording studios and monitoring rooms, the response is usually flat to higher frequencies.

Widely disparate settings of adjacent controls should be avoided if at all possible. A control panel in which adjacent adjustment knobs are 8 to 10 dB apart may look interesting, but the resultant sound will not be natural. It is good to remember that the trained human ear is still the ultimate judge of any equalization.

#### 3.4.5 FEEDBACK SUPPRESSION

An improvement of a system's tendency to feedback should be attempted after the general equalization of the frequency response is performed. The result will be a higher amplifier gain setting than was possible before feedback suppression. Remember: an improvement of 3 dB is equal to twice the previously available power. To prevent ringing, it is best to adjust the gain at least 3 dB below the threshold of feedback.

### 3.5 APPLICATIONS

The following paragraphs consider various methods of active crossover connections, patch point configurations, and typical system applications.

#### 3.5.1 CROSSOVER CONFIGURATIONS

##### 1-Way Full Range

Figure 8 shows the Model 567 used with a full range speaker system having its own passive crossover. The rear panel LO/Full switch should be in the Full Spectrum Out position, with the power amplifier connected to the LO/Full output.

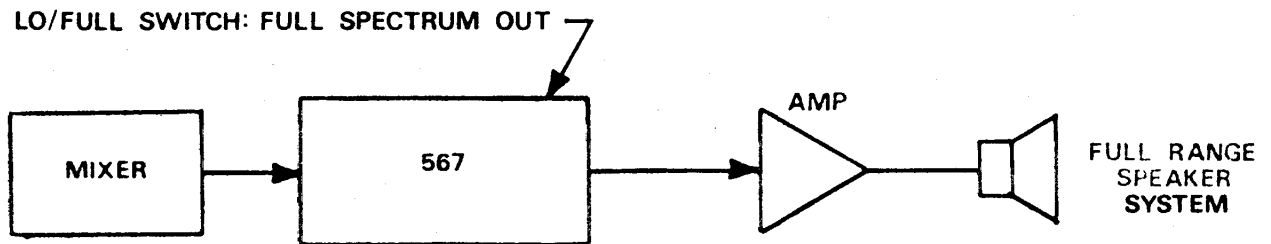


FIGURE 8. 1-WAY FULL RANGE AMPLIFIER/SPEAKER SYSTEM.

##### 2-Way Active

Figure 9 shows a typical 2-way biamp connection of the Model 567. The rear panel LO/Full switch should be in the LO Out position, with the high frequency power amplifier connected to the HI output and the low frequency power amplifier connected to the LO/Full output.

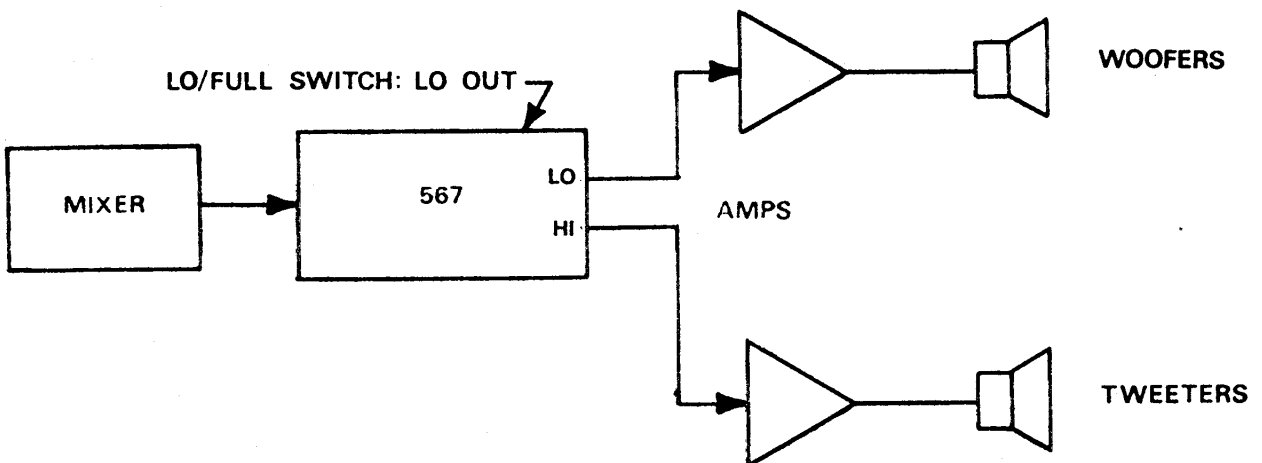


FIGURE 9. 2-WAY ACTIVE AMPLIFIER/SPEAKER SYSTEM.

### 3-Way Active

In Figure 10 the use of a single UREI Model 521 H crossover card is combined with a Model 567 Crossover section to achieve a 3-way triamp system. The Frequency control on the Model 567 is used to set the Low/Mid crossover frequency, while the 521 H splits the HI output of the 567 into mid and high frequencies.

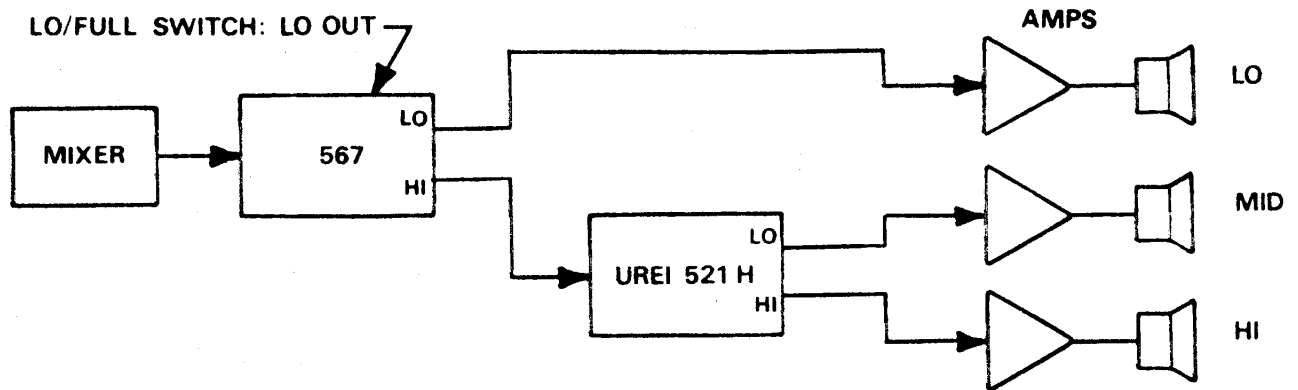


FIGURE 10. 3-WAY ACTIVE AMPLIFIER/SPEAKER SYSTEM

### 4-Way Active

Figure 11 illustrates an extension of the previous 3-way method to form a 4-way system, where 3 crossover frequencies are required. The 567 Crossover divides the spectrum into a low frequency band and a high frequency band. Two UREI 521 cards are then used to further subdivide 567's outputs into low, low-mid, high-mid and high frequency bands.

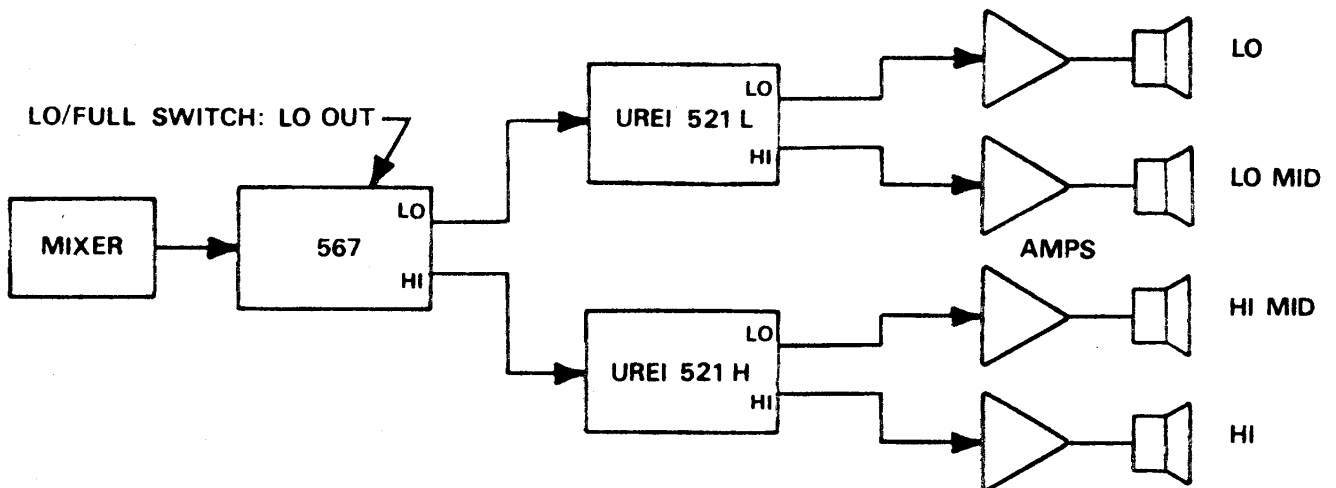


FIGURE 11. 4-WAY ACTIVE AMPLIFIER/SPEAKER SYSTEM

### 3.5.2 PATCH POINT CONFIGURATIONS

#### External Limiters

Figures 12 and 13 show the connection, in the 567 patch point, of a UREI LA-4 for RMS limiting, or a UREI 1176 LN for peak limiting.

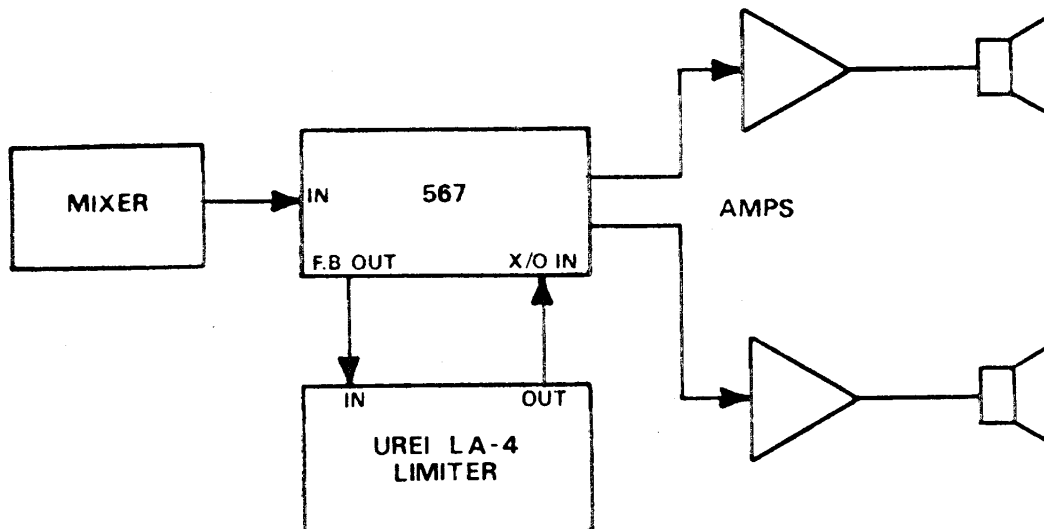


FIGURE 12. THE MODEL 567 WITH A UREI LA-4 RMS LIMITER

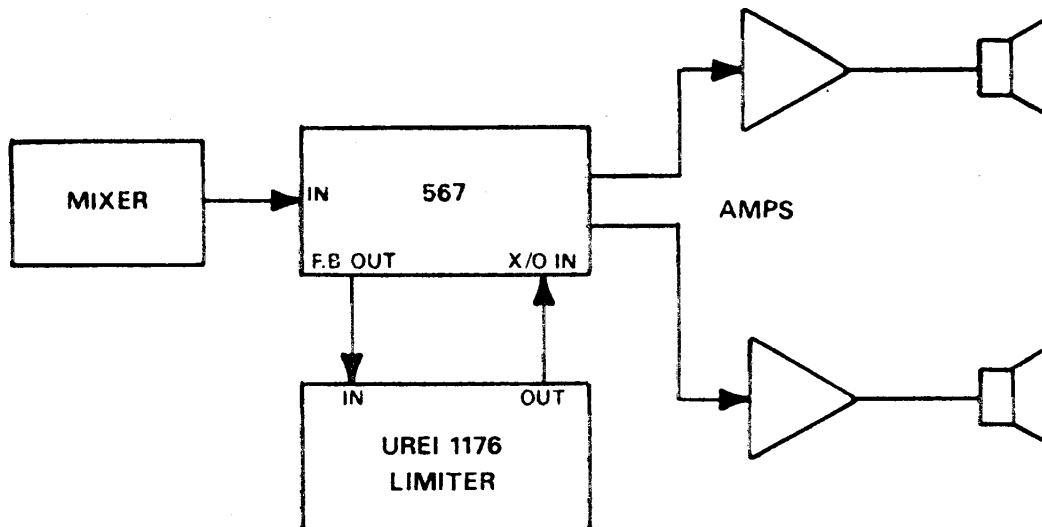


FIGURE 13. THE MODEL 567 WITH A UREI 1176 LN PEAK LIMITER

#### External Delay Line

In Figure 14 the Model 567 and a UREI 927 Digital Delay Line are combined to feed a distributed speaker P.A. system. The 567 Crossover section (HI Out and LO/Full Out) drives the central cluster amplifiers. Simultaneously, the Delay Line input bridges the 567 patch point and drives 4 distributed amplifier/speaker combinations with 4 differently delayed, full-spectrum signals.

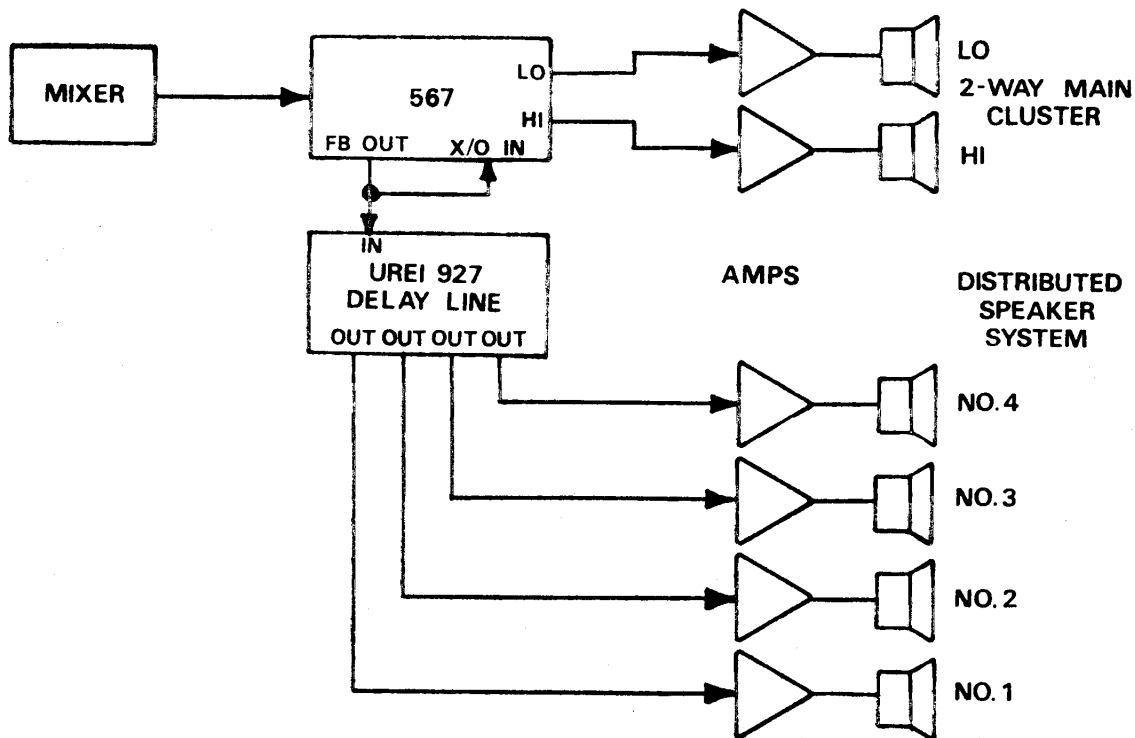


FIGURE 14. MODEL 567 WITH UREI 927 DIGITAL DELAY LINE

External Delay and Limiting

The previous two examples are combined in Figure 15. Here the UREI LA-4 RMS Limiter is employed in the main and distributed speaker system. This is accomplished by bridging the 927 Delay Line input across the LA-4 Limiter output as it connects back into the 567 patch point. Thus the limiting action affects both the direct and delayed speaker/amplifier systems.

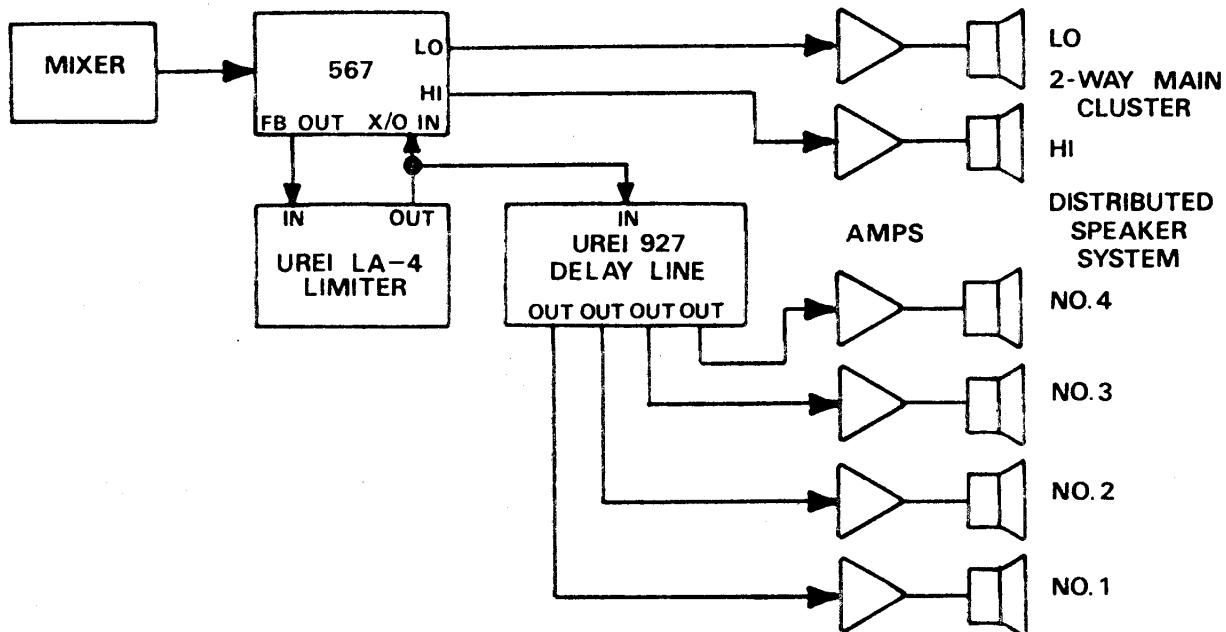


FIGURE 15. MODEL 567 WITH UREI LA-4 AND 927 FOR LIMITING & DELAY

### 3.5.3 TYPICAL SYSTEMS

The Model 567 can be used in a variety of ways, depending on the nature and complexity of the rest of the sound system. The examples given below are typical, but are only a few of the many possibilities.

#### Small P.A. System, Portable or Fixed Installation

The sound system shown in Figure 16 utilizes the Model 567 with a minimum of other components. This system would be well suited to single performers or small bands...for any user who needs maximum versatility from a small P.A. system.

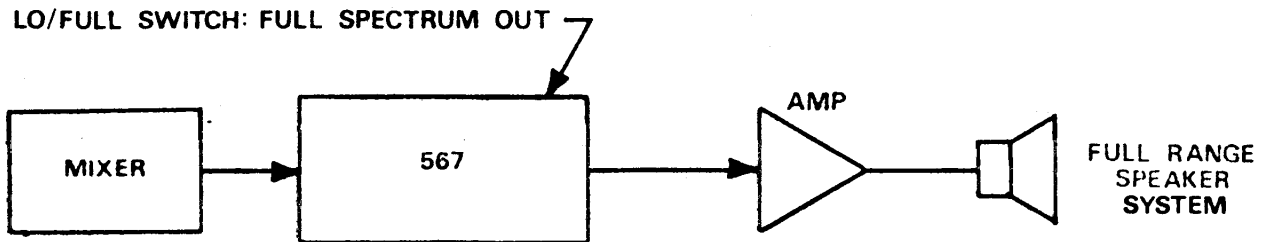


FIGURE 16. SMALL P.A. SYSTEM FOR PORTABLE OR FIXED INSTALLATION

#### Mid Sized P.A. System with Stage Monitor Speakers

The setup in Figure 17 incorporates two Model 567's, one for feeding a 2-way house amplifier/speaker system and the other for driving a single on-stage monitor amplifier/speaker system.

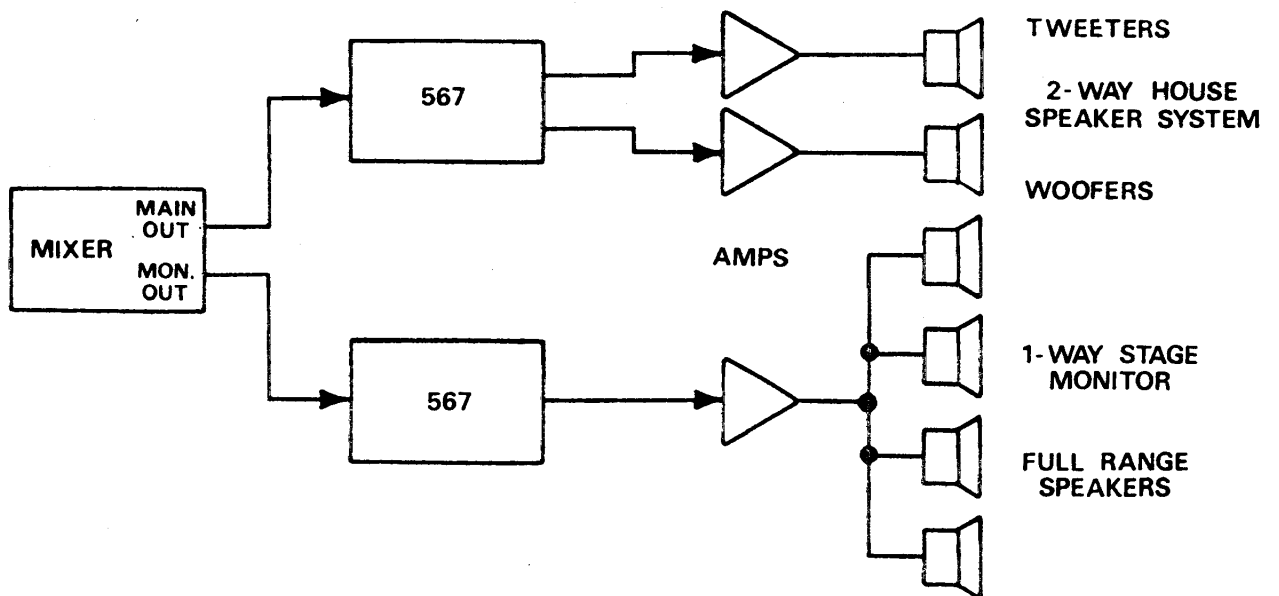


FIGURE 17. MID SIZED P.A. SYSTEM WITH STAGE MONITOR SPEAKERS

Multi-Channel Stage Monitors

In Figure 18 , the 567 is used in the complex stage monitor system of a large P.A. system. The monitor system is capable of providing 4 independent monitor mixes on stage, using separate Model 567's for signal processing in each amplifier circuit. In this example, there are 3 full-spectrum (1-way) floor monitor circuits and 1 biamplified (2-way) side fill circuit.

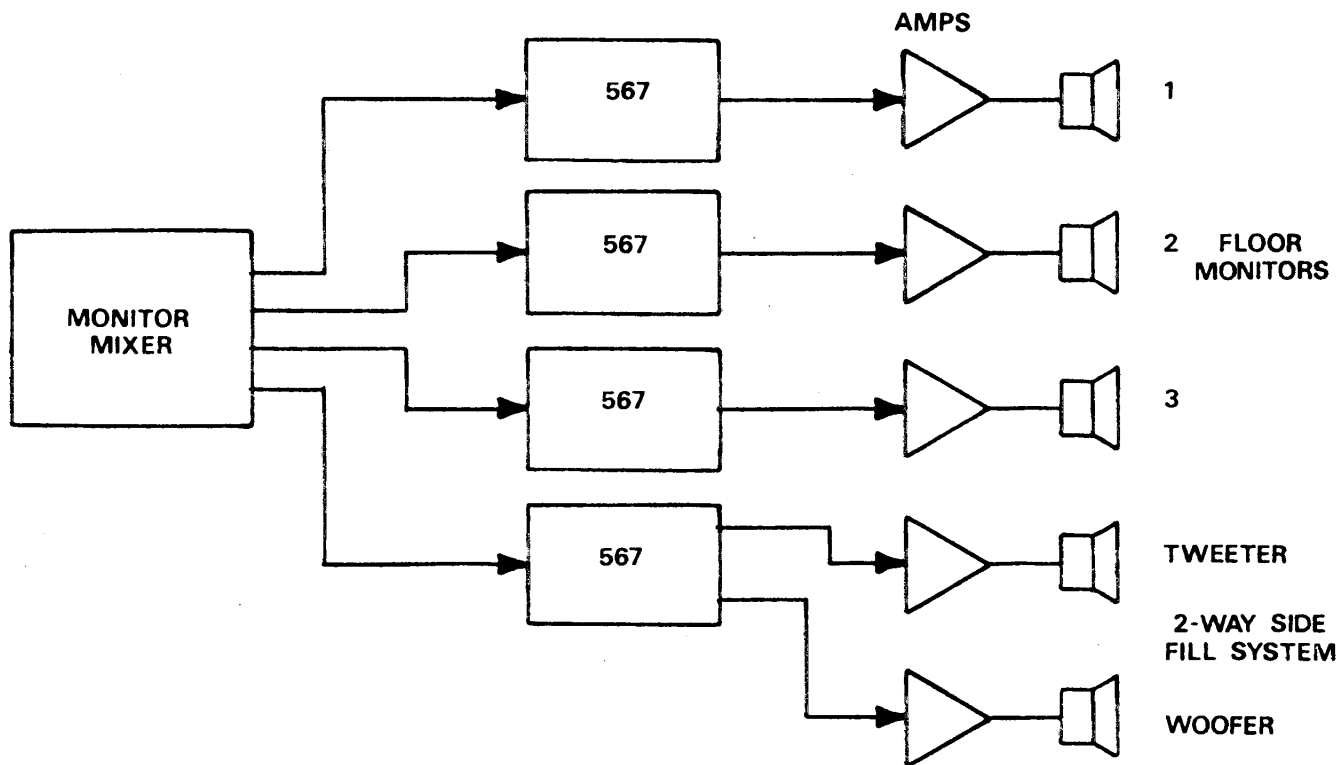


FIGURE 18. MULTI-CHANNEL STAGE MONITOR SYSTEM

Church or Theatre P.A. System

Figure 19 shows a typical P.A. system for a church or theatre, a fixed installation where under-balcony coverage is important. Here the 567 drives the main cluster amplifier system, while a UREI 927 Digital Delay Line bridges the 567 patch point and provides a delayed feed to the under-balcony amplifier/speaker system.

(See Figure 19 on next page)

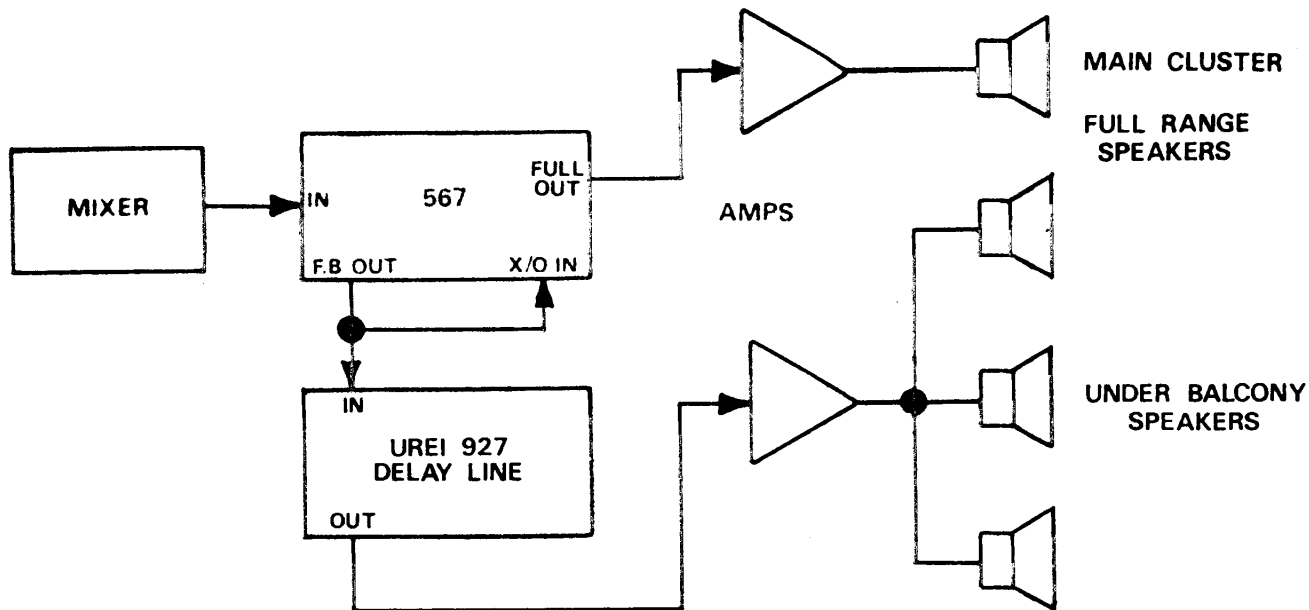


FIGURE 19. CHURCH OR THEATRE P.A. SYSTEM

Bi-amplified Musical Instrument System

Figure 20 depicts another potential application of the 567, a signal processor for a complex musical instrument amplification system. This setup not only allows for biamping, it permits the inclusion of line-level effects devices via the 567 patch point. The 567's Feedback Suppressor is especially helpful with acoustic or electric instruments in that higher gains can be achieved without feedback. The Graphic Equalization may be used to alter the tonal balance of the instrument with much greater precision than is offered by the typical musical instrument amplifier's tone controls.

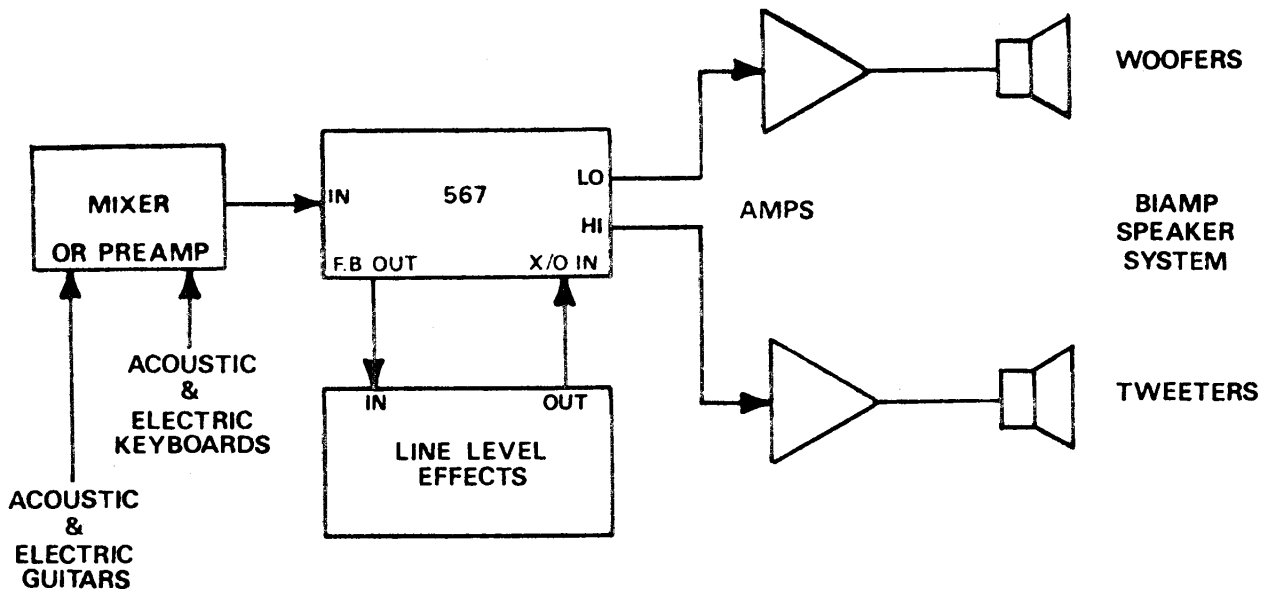


FIGURE 20. BIAMPLIFIED MUSICAL INSTRUMENT AMPLIFIER SYSTEM



## SECTION IV

### THEORY OF OPERATION

#### 4.1 GENERAL

This section provides a generalized description of the 567 circuitry, as shown in the diagrams at the end of the manual. Also, a block diagram showing the layout of the 567's functional sections is included; this may help even the non-technical reader in using and understanding the device.

#### 4.2 INPUT AMPLIFIER

The signal is applied to a differential input amplifier (IC 1, sections A and B). The input accepts either balanced or unbalanced sources (see also Installation, Section 2.6). Common mode rejection is factory adjusted with R1 and is typically better than 40 dB.

#### 4.3 PINK NOISE GENERATOR

IC 3 is a digital, pseudo-random white noise generator. The filter network (R11 and C5 through C9) converts the white noise spectrum (i.e., equal energy per Hertz) to a pink noise spectrum (i.e., equal energy per octave). IC 1C buffers the output of the filter.

#### 4.4 GAIN AMP

IC 1D is a variable gain amplifier providing -12.3 to +17.6 dB of gain. Thus the stage has a gain range of 30 dB, allowing system gain from -10 to +20 dB. Switch S1 selects either the program or noise generator as input to this stage.

#### 4.5 GRAPHIC EQUALIZER

##### 4.5.1 GENERAL

The Graphic Equalizer consists of 10 LCR band filters tuned to ISO center frequencies (IC 4A, 4B, 4C, 4D, 5A, 5C, 5B, 5D, 6A, 6B). Switch S2 selects either the input to or the output from this section as the input to the Feedback Suppressor section.

##### 4.5.2 FILTERS

The output of the gain amplifier is connected to the filter amplifiers IC 6C, 6D and 7D. Each of the filter amplifiers is connected to a group of LCR filters. (Refer to Figure 21, next page.)

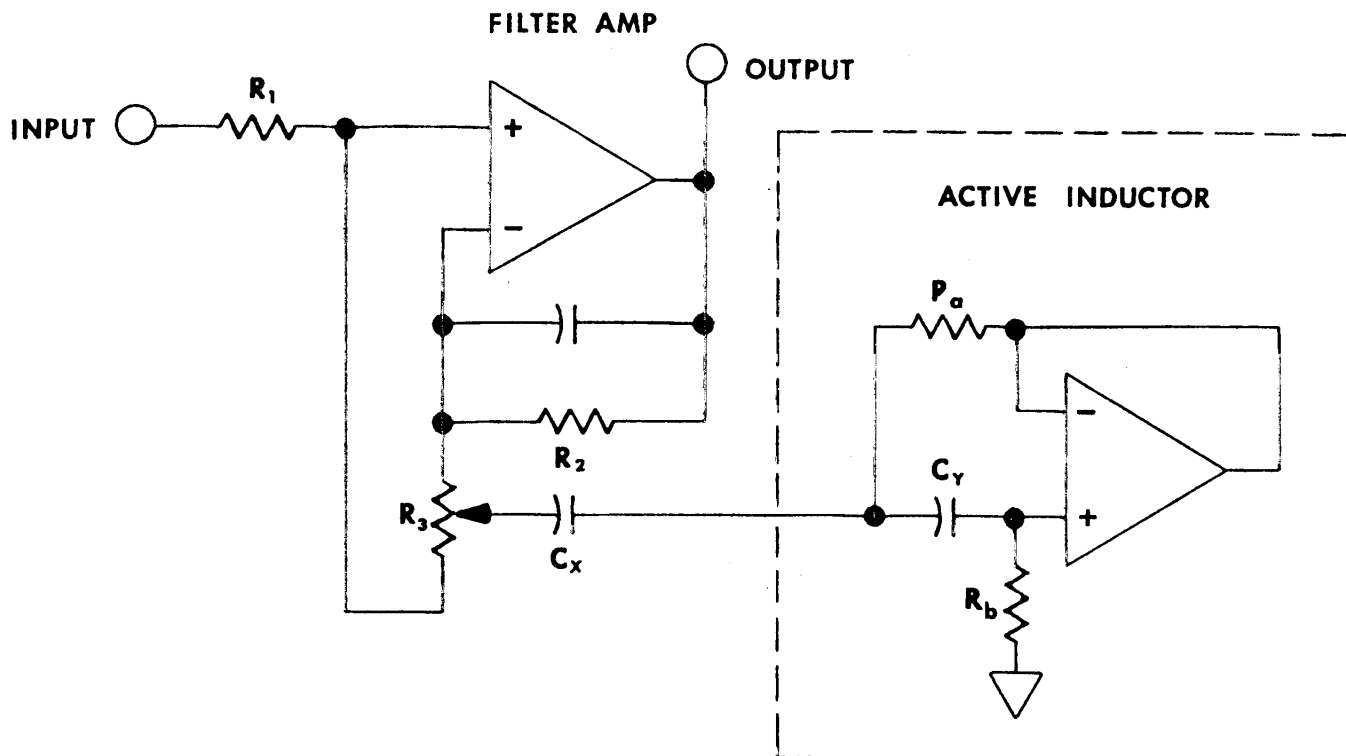


FIGURE 21. TYPICAL FILTER SCHEMATIC.

The filter amplifier is connected as a unity gain follower because  $R_1$  and  $R_2$  are equal. With the potentiometer connected as shown, consider the result if the wiper of the pot were connected to AC ground. As the wiper is moved towards the positive input of the filter amplifier, a voltage division of the input signal takes place, thus reducing the output of the amplifier. As the wiper of the pot is moved towards the negative input of the filter amplifier, a voltage division takes place also, but this voltage division is of the negative feedback; thus, as the impedance at the negative input of the amplifier is decreased, the voltage at the output of the amplifier is increased. With the control at midpoint, any voltage division occurs equally in the input signal and feedback signal, and the filter amplifier is once again a unity gain follower.

In the Model 567, the wiper of the potentiometer is connected to a synthesized series L-C circuit in which component values have been chosen to resonate at a given frequency and with a "Q" of 1 at approximately 8 dB of boost or cut. Because the wiper of the pot is connected to AC ground through the L-C network, the voltage division which takes place in the filter amplifier is effective only for the frequencies in the band covered by the individual L-C network. A total of 10- such L-C-R networks are used in the Model 567.

### 4.5.3 THE ACTIVE INDUCTOR

The Model 567 does not use conventional coils to form its L-C-R networks. Rather, the inductors are synthesized through the use of a circuit known as an active inductor, as shown in Figure 22. To understand the operation of this circuit, examine the frequency response characteristic of a capacitor, as shown in Figure 22 (a) below.

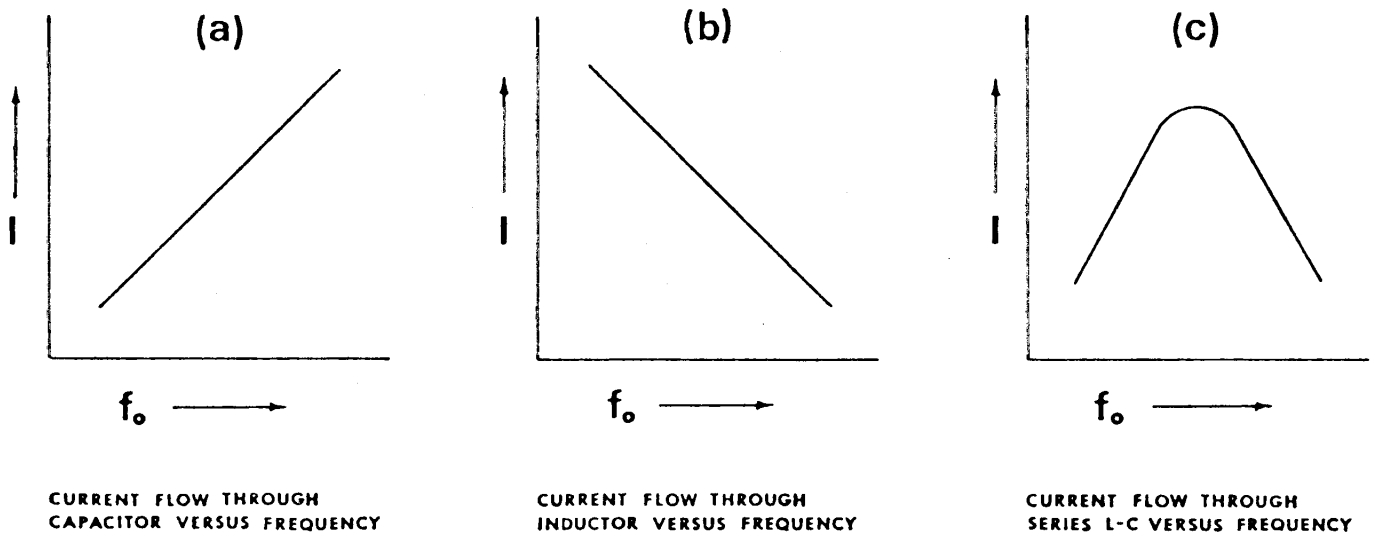


FIGURE 22. CURRENT FLOW VERSUS FREQUENCY CHARACTERISTICS FOR A CAPACITOR, AN INDUCTOR, AND THE TWO IN SERIES.

As frequency increases, capacitive reactance decreases and more current flows through the capacitor. An inductor, as seen in Figure 22 (b), functions in just the opposite manner; as frequency increases, inductive reactance increases and less current flows through the inductor. The active inductor circuit uses a capacitor and an operational amplifier to simulate the action of an inductor. If we remove capacitor  $C_y$  from the circuit in Figure 21, we see that current flows into the circuit through resistor  $R_a$  to the virtual ground of the operational amplifier output. If we now return capacitor  $C_y$  to the circuit we see that with increase in frequency the current flow through the capacitor will increase. This increase in current flow will be seen as an increase in voltage across resistor  $R_b$ , which will be reflected in an increase in output voltage of the operational amplifier. This increased voltage results in a decrease in current flow through resistor  $R_a$ . This change in current flow through resistor  $R_a$  follows the plot in Figure 23 (b), which is that of an inductor. The current flow through the active inductor in series with capacitor  $C_x$  is seen in Figure 23 (c), in which the peak current is achieved when the inductive reactance of the active inductor equals the capacitive reactance of the capacitor; this point is the resonant frequency of the circuit.

#### 4.6 THE FEEDBACK SUPPRESSOR

There are four identical notch filter sections in the 567. The filter type is state variable. Each filter utilizes four operational amplifiers which are on a single IC; filter #1 will be described.

Frequency Selection is variable with the dual front sections of R62 over the ranges from 60 to 600 Hz and 600 to 6000 Hz, depending on the setting of the multiplier switch.

Notch Depth is variable from 0 dB to 20 dB with the third section (center shaft) of the potentiometer R62. The signal output of amplifier section C (at pin 8) constitutes a bandpass function with the center frequency selected as described previously. The signal is 180° out of phase with the input signal. To achieve a notch, some bandpass signal is mixed with the input signal ahead of the summing amplifier (see typical attenuation curves, in Section VI).

Switch S3 selects the input to or the output from the Suppressor section as the source to the patch point. Switch S4 connects two parallel diodes (CR14 and CR15), wired in opposite directions, across the output to limit the signal to 1.4 V P-P in the setup mode. This prevents the feedback oscillations from reaching dangerously high levels.

#### 4.7 CROSSOVER

IC 9D is a unity gain buffer amplifier for driving the crossover filter from the patch point as a source. IC 8A, B, C form a second order state-variable high and low pass filter. A dual potentiometer (R79A and R79B) controls the crossover frequency from 500 Hz to 5 kHz.

#### 4.8 OUTPUT AMPLIFIER

IC 9B, together with transistors Q110 & Q111, form the output amplifier driving the balanced transformer T2 for the HI output. Potentiometer R115 sets the high frequency level as drive to the output amplifier. IC 9A, with transistors Q100 and Q101, transformer T1, and potentiometer R105 provide a similar function for the LO/Full output. Switch S5 selects either the low pass output from the crossover filter or the full spectrum input to the crossover as an input to this LO/Full output amplifier.

#### 4.9 OUTPUT TURN-ON DELAY

IC 10 is a 6-second timer, activated when power is applied to the Model 567. It removes the signals to the output transformer for this period, allowing time for any internal transients or

transients applied to the Model 567 to dissipate before the 567 output is applied to the external power amplifiers and the speakers.

#### 4.10 HEADROOM INDICATORS

IC 7A is a half-wave rectifier with its inputs driven from each of the functional sections of the 567. The filtered DC output of the rectifier is compared to the threshold voltages by IC 2A, B, C & D, and drives the LEDs to indicate the remaining headroom.

#### 4.11 POWER SUPPLY

The power supply is bipolar, employing two integrated circuit voltage regulators, VR1 and VR2, to provide low ripple,  $\pm 18$  V DC. Additional filter capacitors assure power supply stability and low noise.

The pilot LED is connected across the positive and negative sides of the power supply to indicate the power ON condition.

## SECTION V

### MAINTENANCE

#### 5.1 GENERAL

The Model 567 is an all solid-state unit, ruggedly constructed with only the highest quality components. As such, it should provide years of trouble free use with normal care. All parts used are conservatively rated for their application, and workmanship meets the rigid standards you have learned to expect in UREI products.

NO SPECIAL PREVENTIVE MAINTENANCE IS REQUIRED.

#### 5.2 REPAIRS AND WARRANTY

The Model 567 is factory warranted to the original purchaser against defects in material and workmanship for one year after initial purchase. This limited warranty must be activated at the time of purchase by returning the registry portion of the Warranty Card to the factory. Should a malfunction ever occur, the dealer from whom the unit was purchased will be glad to handle return for factory repair; alternately, for prompt service, ship the unit prepaid directly to the factory. Be sure it is well packed in a sturdy carton, with shock-absorbing material such as foam rubber, styrofoam pellets or "bubble-pack" completely filling the remaining space. Particular attention should be paid to protecting the controls and switches. Tape a note to the top of the unit describing the malfunction, and instructions for return. We will pay one-way return shipping costs on any in-warranty repair.

Because of specially selected components in this product, field repairs are not authorized during the warranty period, and attempts to perform repairs may invalidate the warranty.

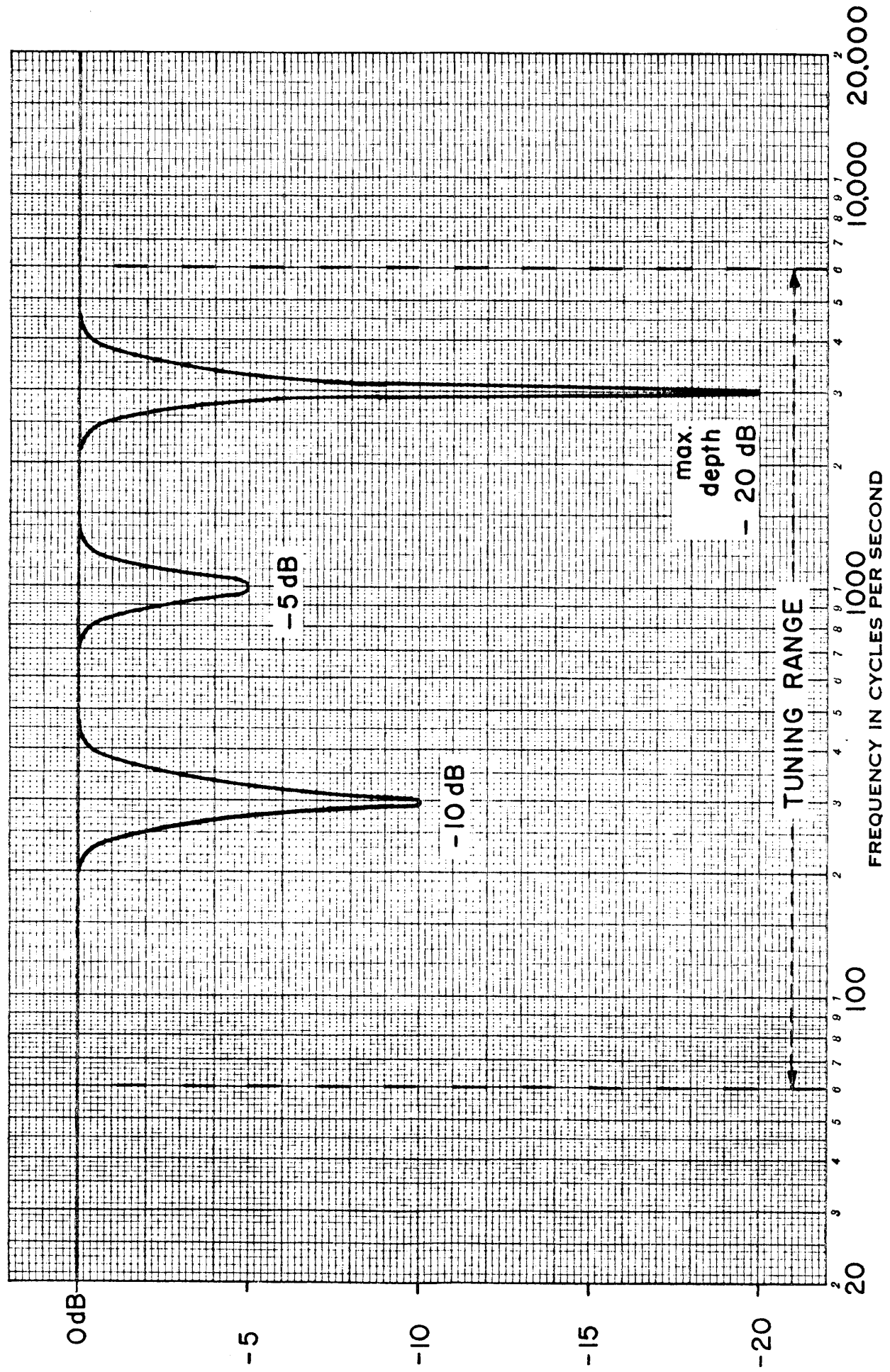
#### 5.3. SERVICE ADJUSTMENT

##### Common Mode Balance

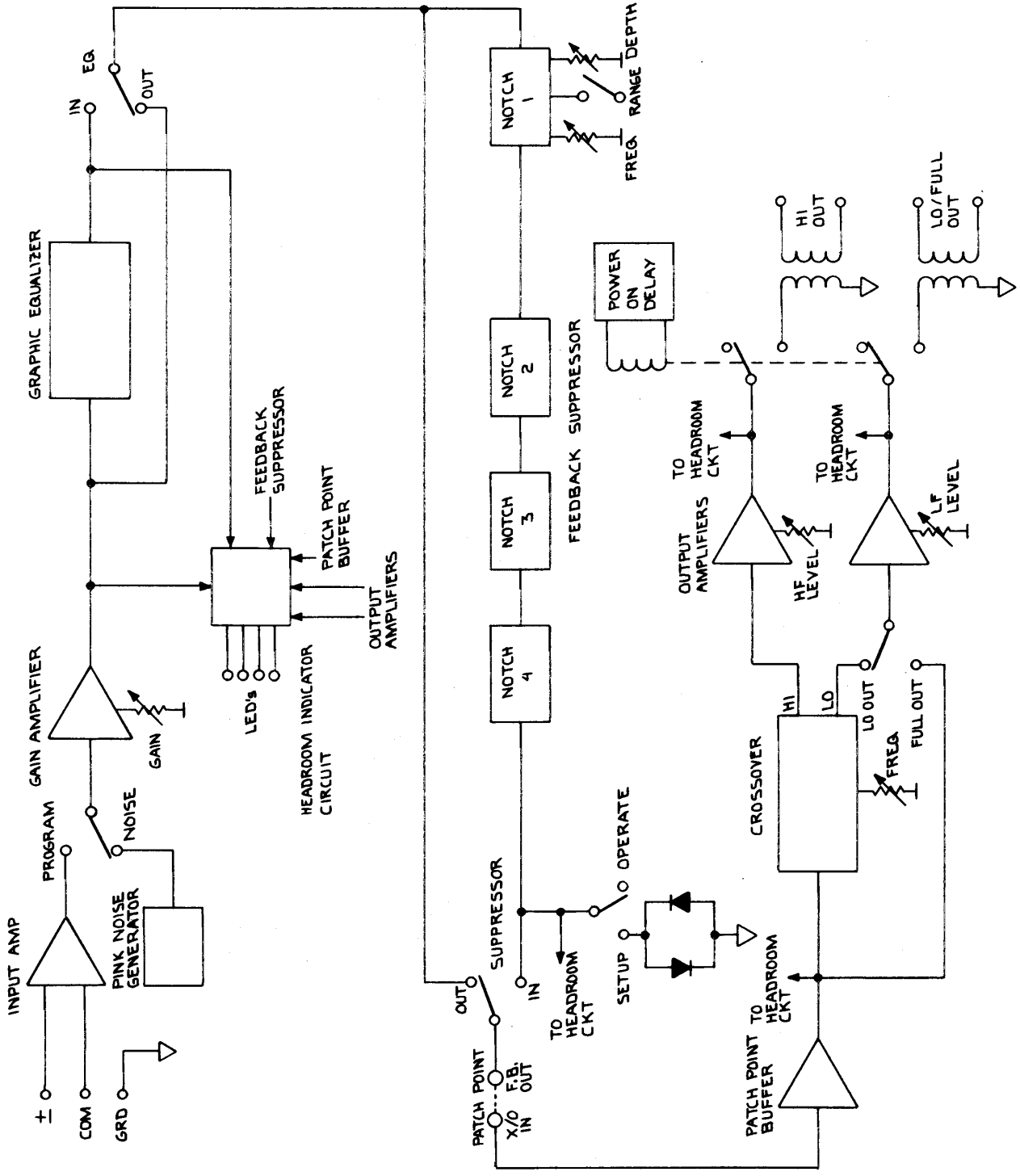
The internal trimpot R1 affects the COMMON MODE BALANCE. If a check or an adjustment is necessary the following procedure should be followed:

Connect the  $\pm$  and COM input terminals together and apply an input signal between this connection and the GND terminal (100 Hz, 3 V RMS).

Switch the EQ OUT and measure the signal with an AC VTVM or DVM across the output terminals of the Model 567. Adjust the trimpot R1 for a minimum reading, switching the voltmeter gradually to more sensitive ranges.



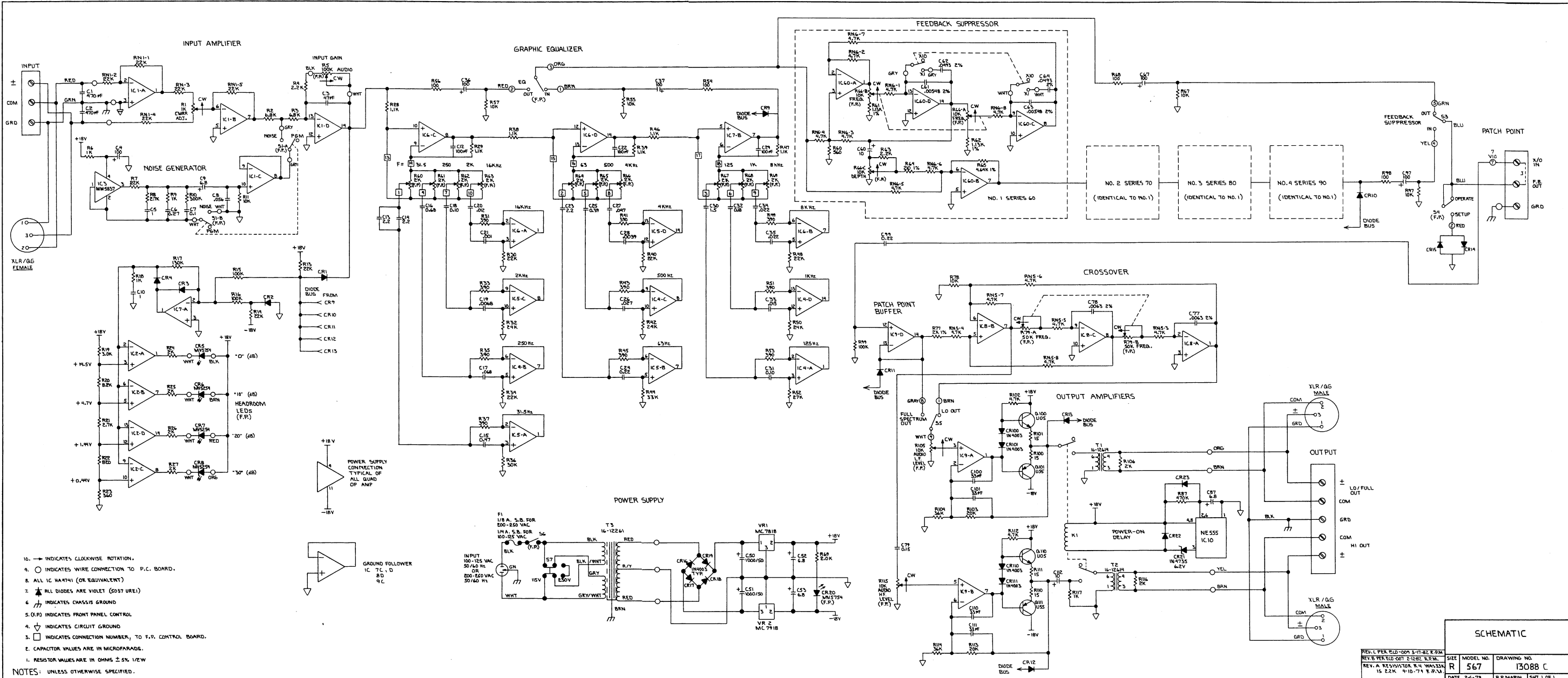
TYPICAL ATTENUATION CURVES OF FEEDBACK SUPPRESSOR



MODEL 567 BLOCK DIAGRAM

<b>UNITED RECORDING ELECTRONICS INDUSTRIES</b> LOS ANGELES CALIFORNIA	DATE 3-2-79	ISSUE 1
	CHECKED R.P. MARIN	APPROVED C.1310





- 10. → INDICATES CLOCKWISE ROTATION.
  - 9. ○ INDICATES WIRE CONNECTION TO P.C. BOARD.
  - 8. ALL IC 741 (OR EQUIVALENT)
  - 7. ▲ ALL DIODES ARE VIOL (5037 URE1)
  - 6. ▭ INDICATES CHASSIS GROUND
  - 5. (F.P) INDICATES FRONT PANEL CONTROL
  - 4. ▽ INDICATES CIRCUIT GROUND
  - 3. □ INDICATES CONNECTION NUMBER, TO F.P. CONTROL BOARD.
  - 2. CAPACITOR VALUES ARE IN MICROFARADS.
  - 1. RESISTOR VALUES ARE IN OHMS ± 5% 1/2W
- NOTES: UNLESS OTHERWISE SPECIFIED.

SCHEMATIC			
REV. C PER ELD-009 3-17-82 R.R.M.	SIZE	MODEL NO.	DRAWING NO.
REV. B PER ELD-007 2-12-82 R.P.N.	R	567	13088 C
REV. A REVISIONS R.W. WASSER 15 2-2K 4-10-74 R.P.N.	DATE	2-6-79	R.P. NARIN SHT 1 OF 1