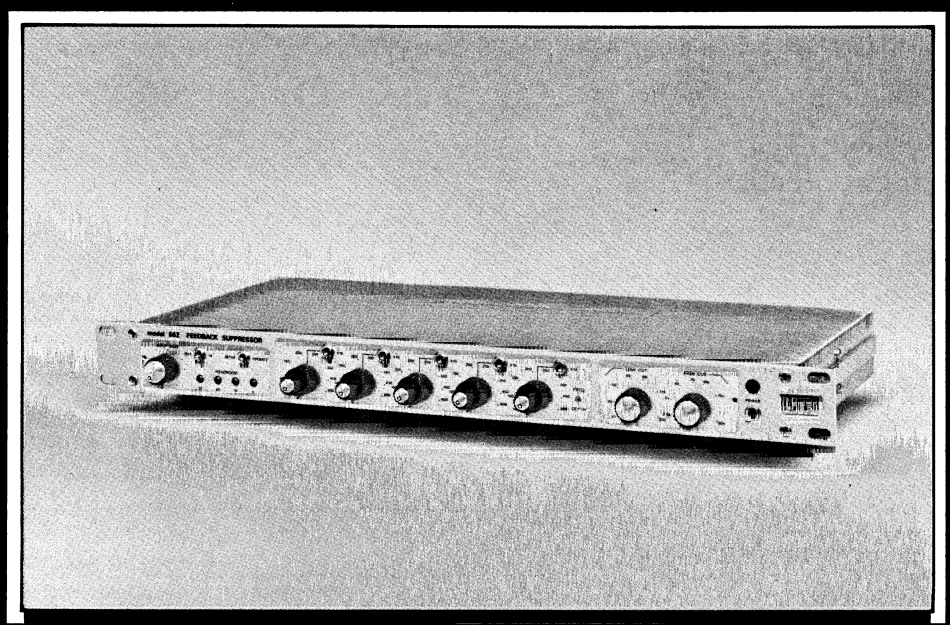
562 FEEDBACK SUPPRESSOR



FEATURES:

5 independently adjustable notch filters.

Narrow notches minimize sound coloration.

Built in peak clipper for driver protection during setup tuning.

High cut and low cut end filters.

Headroom indicator monitors signal levels and approach of overload.

Bypass switch for easy setup and A-B comparison.

The Model 562 Feedback Suppressor has been designed to reduce feedback in sound reinforcement systems such as fixed and portable installations, in auditoriums, concert halls, meeting rooms, schools and churches. Experience with narrow band notch filters has demonstrated that in a typical sound reinforcement system, gain before feedback can be significantly improved by centering a narrow band-reject filter on four or five of the most prominent system resonant frequencies. It has also been found that rolling off the low and high frequency ends of the spectrum to pass only a required program's bandwidth, increases gain before feedback at the band edges. In addition, many sound systems are improved through the application of broad or narrow band equalization.

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The 562 contains 5 active notch filters, each continuously adjustable in notch depth from 0 to 20 dB, and in frequency from 60 Hz to 6000 Hz. Low cut and high cut filters with 12 dB/octave slopes are tunable from 20 to 200 Hz and 2.5 to 20 kHz respectively. The Model 562 has front panel adjustable gain, ranging from −10 to +20 dB and headroom indicators to optimize the signal level. A bypass switch allows A-B comparison, and a setup switch provides system protection during tuning. XLR/QG connectors and terminal strips are provided for both input and output.

In using the Feedback Suppressor, the system's gain is slowly increased until the first sustained feedback occurs. One notch filter is then "tuned" until the feedback ceases. The gain is increased again, and the next resonance attenuated with the second filter. This procedure is repeated with filters 3 through 5. If feedback occurs at the extreme high or low end it can be reduced by using the end cut filters. A typical result is an increase of several dB in actual system gain before feedback. In addition intelligibility is improved without undesirable changes in fidelity.

SPECIFICATIONS

ELECTRICAL:

INPUT:	
Input Impedance:	40 kohms balanced, 20 kohms unbalanced.
Maximum Input Level:	+20 dBu
Gain:	Variable −10 dB to +20 dB with front panel level control.
Headroom Indicator:	4 LED indicators showing maximum signals: 0, −10, −20, −30 dB relative to overload.
NOTCH FILTERS:	
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).
END CUT FILTERS:	
Low Cut Filter:	12 dB per octave filter slope, continuously adjustable from 20 Hz to 200 Hz.
High Cut Filter	12 dB per octave filter slope, continously adjustable from 2.5 kHz to 20 kHz.
OUTPUT:	
Output Circuit:	Floating, transformer isolated.
Output Load:	600 ohms or greater.
Power Output:	+20 dBm
Distortion:	Less than 0.5% THD, 30 Hz to 15 kHz at maximum rated output.
Frequency Response:	±0.5 dB, 20 Hz to 20 kHz (EQ out). +0.5 dB, −1.5 dB, 20 Hz to 20 kHz (EQ in).
Output Noise:	Less than −90 dBm (15.7 kHz noise bandwidth, input and output terminated with 600 ohms; controls set for unity gain).
Power Requirements:	Less than 10 W. 100-125 V AC or 200-250 V AC, 50/60 Hz, switch selectable.
Environment:	Operating 0°C to +50°C (+32°F to +122°F). Storage −20°C to 60°C (−4°F to +140°F).

PHYSICAL:

Connections:	Input and output on rear panel barrier strip and 3-pin XLR/QG connectors. Power through 3-wire IEC style connector.
Dimensions:	483 × 44 mm rack panel, depth behind panel 248 mm, (19 in × 1 3/4 in x 9 3/4 in).
Finish:	Panel is 3.18 mm (1/8 in) brushed clear anodized aluminum in two shades. Chassis is cadmium plated steel.
Weight:	4.31 kg (9.5 lb).
Shipping Weight:	6.35 kg (14 lb).
Accessory:	Model SC-3 Security Cover; smoke gray transparent plastic; covers all operating controls.

Note: 0 dBm = 1 mW
0 dBu = 0.775 volts

JBL/UREI continually engages in research related to product improvement. New materials, production methods and design refinements are introduced into existing products without notice as a routine expression of that philosophy. For this reason, any current JBL/UREI product may differ in some respect from its published description but will always equal or exceed the original design specifications unless otherwise stated.

JBL UREI ELECTRONIC PRODUCTS

JBL Professional, 8500 Balboa Boulevard, P.O. Box 2200, Northridge, California 91329 U.S.A.

BEFORE PROCEEDING WITH COMPLETE UNPACKING AND SETUP
PLEASE READ THE SECTION ON UNPACKING AND INSPECTION

model 562

FEEDBACK SUPPRESSOR

UREI Incorporated
8400 BALBOA BOULEVARD
NORTHRIDGE, CA. 91325-4100 U.S.A.
PHONE: (818) 895-UREI (895-8734)
FAX: (818) 891-5475

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SECTION I

INTRODUCTION

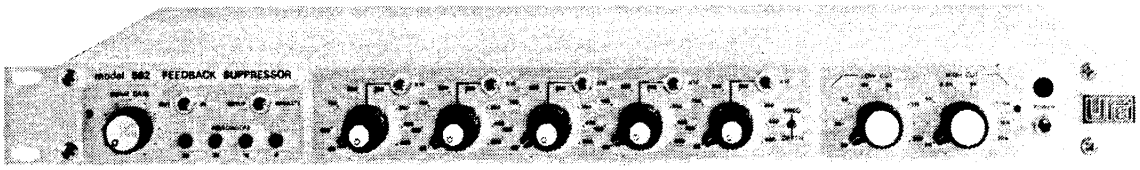


FIGURE 1-1. MODEL 562 FRONT PANEL.

1.1 DESCRIPTION

The Model 562 Feedback Suppressor has been designed to reduce feedback in sound reinforcement systems without affecting room equalization. Experience with narrow band notch filters has demonstrated that, in a typical sound reinforcement system, gain before feedback can be significantly improved by centering a narrow band reject filter on four or five of the most prominent system resonant frequencies. It has also been found that rolling off the low and high frequency ends of the spectrum, to pass only a program's required bandwidth, increases gain before feedback at the band edges.

The Model 562 contains 5 active notch filters, each continuously adjustable in notch depth from 0 to 20 dB, and from 60 Hz to 6,000 Hz. In addition, low cut and high cut filters with 12 dB/octave slopes are tunable from 20 Hz to 200 Hz and 2.5 k to 20 kHz respectively. The Model 562 has front panel adjustable gain, ranging from -10 to +20 dB, and headroom indicators to optimize the signal level. This allows the unit to be sourced from low level "semi-pro" equipment and high level professional equipment. A bypass switch allows A-B evaluation of feedback suppression, and a setup switch provides system protection during tuning by limiting maximum output level. XLR/QG connectors and terminal strips are provided for both input and output signals.

In using the Feedback Suppressor, the system's gain is slowly increased until the first sustained feedback occurs. One notch filter is then "tuned" until the feedback ceases. The gain is then increased again, and the next resonance attenuated with the second filter. This procedure is repeated with filters 3 through 5. If feedback occurs at the extreme high or low end, it can be reduced by using the end cut filters, thus making all 5 notch filters available for use in the passband. A typical result is an increase of 12 dB or more in actual system gain before feedback. In addition, intelligibility is improved without undesirable changes in fidelity.

1.2 SPECIFICATIONS

ELECTRICAL:

Input

INPUT CIRCUIT:	Balanced bridging, differential amplifier.
INPUT IMPEDANCE:	40 kohms, used as balanced input. 20 kohms, used as unbalanced (single-ended) input.
MAXIMUM INPUT LEVEL:	+20 dB (7.75 volts).
GAIN:	Variable, -10 dB to +20 dB, with front panel control.
HEADROOM INDICATOR:	4 LED indicators showing maximum signals; 0, -10, -20, -30 dB relative to overload.

Notch Filters

FREQUENCY RANGE:	60 Hz to 6 kHz, continuously variable in two ranges.
NOTCH DEPTH:	0 to -20 dB, continuously variable.
FILTER BANDWIDTH:	Approximately 1/6-octave at 5 dB notch depth (-3 dB points).

End Cut Filters

LOW CUT FILTER:	12 dB/octave filter slope, continuously adjustable from 20 Hz to 200 Hz.
HIGH CUT FILTER:	12 dB/octave filter slope, continuously adjustable from 2.5 kHz to 20 kHz.

Output

OUTPUT CIRCUIT:	Floating, transformer isolated.
OUTPUT LOAD:	600 ohms or greater.
POWER OUTPUT:	+20 dBm into 600 ohm load (7.75 volts).
DISTORTION:	Less than 0.5% THD, 30 Hz - 15 kHz at maximum rated output.
FREQUENCY RESPONSE:	±0.5 dB, 20 Hz - 20 kHz (EQ out), +0.5 dB, -1.5 dB, 20 Hz - 20 kHz (EQ in).

OUTPUT NOISE:	Less than -90 dBm (15.7 kHz noise bandwidth, input & output terminated w/ 600 ohms, controls set for unity gain).
POWER REQUIREMENTS:	100 - 125 VAC, or 200 - 250 VAC, 50/60 Hz, switch selectable, less than 10 watts.
ENVIRONMENT:	Operating, 0°C to +50°C (+32°F to +122°F); Storage, -20°C to +60°C (-4°F to +140°F).

PHYSICAL:

DIMENSIONS:	483 x 44 mm rack panel, depth behind panel 248 mm, (19" x 1-3/4" x 9-3/4").
FINISH:	Panel is 3.18 mm (1/8") brushed clear anodized aluminum in two shades. Chassis is cadmium plated steel.
NET WEIGHT:	4.31 kg (9.5 lbs).
SHIPPING WEIGHT:	6.35 kg (14 lbs).
ACCESSORY:	Model SC-3 Security Cover; smoke gray transparent plastic; covers all operating controls.

1.3 CONTROLS AND INDICATORS

GAIN:	Continuously variable control of input stage gain, from -10 dB to +20 dB.
HEADROOM INDICATOR:	4 LED indicators showing maximum signal levels: 0, -10, -20, -30 dB relative to overload.
NOTCH 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 to be bypassed.
SETUP/OPERATE:	Toggle switch activates clipper to protect loudspeakers during adjustment of Feedback Suppressor.

LOW CUT FILTER: Continuously adjustable from 20 Hz to 200 Hz.

HIGH CUT FILTER: Continuously adjustable from 2.5 kHz to 20 kHz.

POWER: Toggle switch with LED to indicate when the Model 562 is powered.

1.4 CONNECTIONS

All connections for input and output are made on the rear panel through barrier strip and 3-pin XLR/QG connectors. Power is applied through a 3-wire IEC-style connector. (See Installation Instructions, Section 2.5, Figures 2-1 and 2-2.)

SECTION II

INSPECTION AND INSTALLATION

2.1 UNPACKING AND INSPECTION

Your Model 562 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 562 Feedback Suppressor

UREI Instruction Manual (this book)

Two-part Warranty Card bearing the same serial number as the Model 562.

Screws and finish washers for mounting the unit into a standard 19" rack.

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 562 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 562 TO THE MAINS.

AC mains power is supplied to the Model 562 through an IEC-style 3-conductor receptacle mounted on the rear of the chassis, and a matching 3-wire power cable. The ground pin of the connector is tied to the chassis of the Model 562 in order to comply with electrical codes. 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 562, and may cure the hum or buzz, but is not a substitute for proper system grounding. Be aware that unless the Model 562 Feedback Suppressor 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 562 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. Connections may be made to either the barrier strip or the XLR/QG connectors on the rear panel.

NOTE: The pins of the XLR's are wired as follows:
#3 to "±" of input and output,
#2 to "Common" of input and output,
#1 to Ground (chassis).
To accommodate other wiring practices, the connection to the barrier strips may be changed inside the Model 562.

If the Model 562 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 562. (See Section 2.6 regarding input termination).

(See Figures 2-1 and 2-2 on the following page)

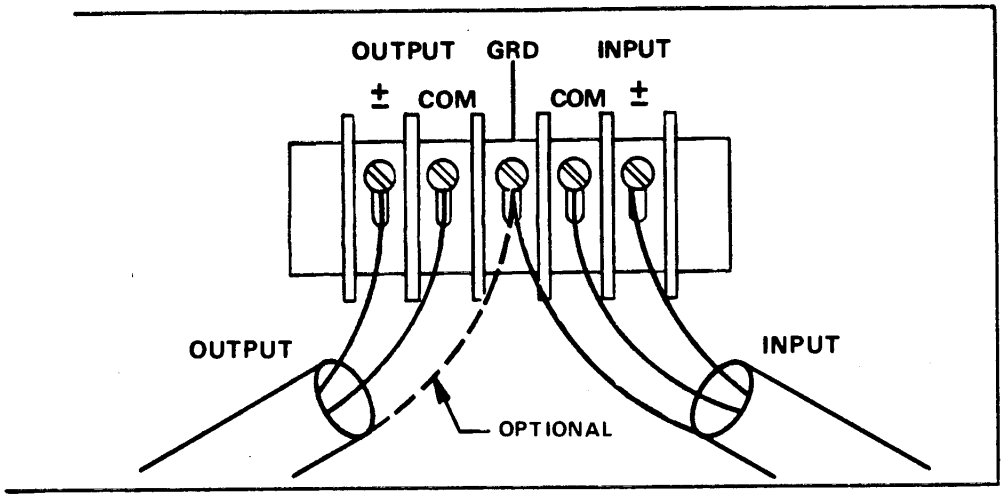


FIGURE 2-1. CONNECTING THE MODEL 562 WITH BALANCED INPUT AND BALANCED OUTPUT CIRCUITS.*

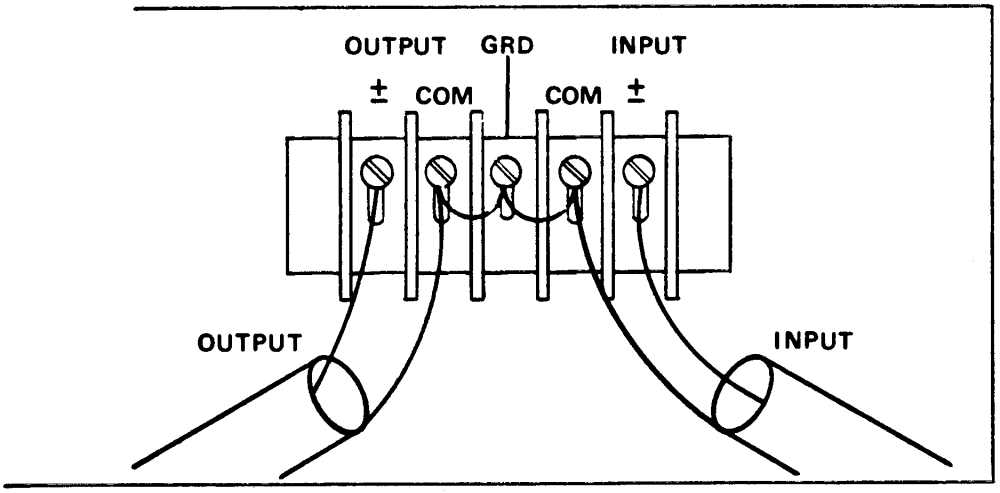


FIGURE 2-2. CONNECTING THE MODEL 562 WITH UNBALANCED INPUT AND UNBALANCED OUTPUT CIRCUITS.*

*With a balanced input and unbalanced output, or vice-versa, use the appropriate connections suggested by each of the above diagrams. No special switching or transformers are needed.

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 562 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 562 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 562 input.

2.7 SIGNAL LEVEL AND HEADROOM INDICATOR

The Model 562's differential input amplifier is capable of accepting signals up to a level of +20 dBm, above which level 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.

2.8 ACCESSORIES

An optional Security Cover, Model SC-3, is available to cover all operating controls of the Model 562, and to protect against any inadvertent misadjustment of critical settings.

SECTION III

OPERATING INSTRUCTIONS

3.1 SETUP PROCEDURE

This portion of the manual gives a step-by-step procedure for setting of all controls on the Model 562.

1. Set the Feedback Suppressor's Bypass to "In" position.

2. Set the Setup/Operate switch to "Setup" position.

3. Set the Gain control to mid position.

4. Set the Depth control fully counterclockwise.

5. Set the Frequency control fully counterclockwise.

6. Set the Frequency Range switches to "X1" position.

7. Slowly increase the microphone level (using the mixer's level control) until the first feedback frequency becomes detectable and has stabilized.

8. 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.

9. Increase the microphone level so the next feedback frequency will appear, and repeat the procedure of step 8. Similarly, continue to increase the microphone level and eliminate the third, fourth and fifth feedback frequencies.

10. The Suppressor In/Out switch can be set to "Out" to assess the effect of the Feedback Suppression settings.

    CAUTION: After setup, be sure to de-activate the clipper by returning the Setup/Operate switch to the Operate position. Otherwise severe signal distortion will result.

11. Use the Endcut filters to restrict the bandwidth of the processed program material as desired.

12. 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.

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 562 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.

3.2 DISCUSSION OF FEEDBACK

3.2.1 GENERAL

The quality of amplified sound in a room depends not only on the microphone, amplifier, loudspeakers, etc., but also to a large degree on the acoustical characteristics of the room itself.

Sounds reflected by walls and ceiling add to and subtract from the direct sound from a loudspeaker as it arrives at a listener's ear. Various frequencies reflect in different amounts, and resonant peaks and dips will occur. Peaks in the frequency response cause coloration of the original sound. They will mask adjacent frequencies of the program material. Aside from adversely influencing the quality of music and the intelligibility of speech reproduction, these peaks in the frequency response also reduce the maximum obtainable average sound level throughout the audio spectrum. The average sound level is limited by those frequencies whose amplitude approach or exceed a system gain of unity.

This condition is marked by ringing and feedback. Ringing is a prolongation of the reverberation time for those frequencies which are approaching unity gain. Feedback is a spontaneous oscillation at the frequency where loop gain (including the acoustic environment) exceeds unity.

Reduction of acoustic resonances will produce the following desirable results:

a) More sound level through higher achievable gain.

b) More freedom for performers.

c) Improvement of sound quality (i.e., greater clarity of music and words).

The 562 Feedback Suppressor is not a cure-all for serious sound system deficiencies. It will not make inferior components perform like superior ones, nor will it completely correct poor acoustic conditions or poorly engineered installations.

3.2.2 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.

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.

3.2.3 HOW MUCH ADJUSTMENT?

Theory says that for a given change in amplitude response, using a minimum-phase filter network, there will be a corresponding phase change. While you may not hear the amplitude response change, you may hear the effects of the phase angle rotation. Since the minimum amplitude response change generally causes the minimum change in phase response, the shallower the notches for feedback suppression, the less likely that they will be audible.

When adjusting the Model 562 in the field, it is often possible to ignore the above considerations. Program material and deficiencies in the speaker system and acoustic environment are usually several orders of magnitude larger than the effects introduced by the notch filters, even at extreme settings. This is especially true in vocal reinforcement; music reinforcement systems are typically less tolerant. When using the Model 562 in a system intended to reproduce music, care should be taken not to notch out too much program material. Once the feedback modes have been found and the filters are adjusted according to the procedure in Section 3.1, the depth controls may be backed off to determine if a notch less deep will still suffice.

3.2.4 INTELLIGIBILITY AND FREQUENCY MASKING

Most of the discussion on the use of the Model 562 has focused on the reduction of feedback. However, in some instances this may not be its most important function. Sometimes a system may already provide adequate gain before feedback, and other times a system may have so many modes that notching out four or five of them with a Model 562 will not provide a signficant increase in useable gain. In either of these cases, however, there may be masking of important mid and high frequency sounds by peaks in the bass range. Bass peaks tend to occur due to typically longer reverberation times at low frequencies. Here, the Model 562 may be used to reduce the bass peaks and hence improve speech intelligibility and reduce frequency masking of music.

3.2.5 USE OF ENDCUT FILTERS

The endcut filters of the Model 562 are used to restrict the bandwidth of the program material for one of several reasons:

1) It may be necessary to remove feedback modes at very high and very low frequencies that are beyond the range of the notch filters. This might occur in a situation where the microphone and loudspeaker are fairly close to each other. For example, consider a stage monitor system where a speaker is located close to the microphone and aimed directly at it. In this instance, feedback at frequencies (above 6 kHz) may occur due to an unusually high level of high frequency gain available for feedback. (Very high frequencies do not generally reach the microphone due to their greater absorption in air, and due to greater speaker directivity at high frequencies.)

2) In small rooms, feedback at very low frequencies may be a problem. Bear in mind that the acoustical treatment of many smaller rooms that have not been designed for music utilizes acoustic materials and methods that are only effective at middle and upper frequencies. For instance, it would not be unusual to find a conference room designed for NC-30* which actually has 90% absorption of signals in the mid to high frequencies, but less than 10% absorption for low frequencies. Additionally, low frequency reflections can be greater because of the proximity of the walls.

* NC-30 is a standard Noise Criteria curve of frequency vs. level showing an average of 30 dB SPL permissible background noise.

3) It is usually desirable to restrict the upper and lower bandwidths to only that necessary for the program material. In the case of voice this may be a considerable reduction. This avoids the amplification of such extraneous sounds as rustling paper, power line hum, air conditioning noise, mic stand rumble, and leakage from on-stage bass instrument amplifiers.

NOTE: Care should be taken in adjusting the endcut filters so that the program material is not adversely affected. Use your ears to evaluate the adjustments. If it sounds good, it is good.

3.3 GAIN STRUCTURE AND SIGNAL-TO-NOISE

Only the correct gain structure throughout the entire audio system will enable the user to take advantage of the optimum signal-to-noise ratio built into the individual components. In this discussion, the matching between the equalizer and a following power amplifier is considered.

The Model 562 was designed for a maximum average signal level at its input of approximately 0 dB (Ref. 0.775 V rms). This guarantees 20 dB of headroom; that is, peaks may be 20 dB above the average level before any clipping could occur. Residual output noise from the Model 562 is 90 dB below the average signal level, or greater than 110 dB below maximum output level, and therefore inaudible.

For signal levels from equipment with less output capability, the Input Level control of the Feedback Suppressor provides a convenient preamplifier for additional gain, up to 20 dB above unity, without reducing the excellent signal-to-noise ratio.

SECTION IV

THEORY OF OPERATION

4.1 GENERAL

This section provides a generalized description of the 562 circuitry, and should be used in conjunction with the schematic at the end of the manual.

4.2 INPUT AMPLIFIER

The signal is applied to a differential input amplifier (IC 1, sections C and D). The input accepts either balanced or unbalanced sources (see also Installation, Section 2.5). Common mode rejection is factory adjusted with R1 and is typically better than 40 dB.

4.3 GAIN AMPLIFIER

IC 1A is a variable gain amplifier providing -12 to +18 dB of gain. Thus the stage has a gain range of 30 dB, allowing adjustment through the Model 562 from from -10 to +20 dB, referenced to unity gain.

4.4 FEEDBACK SUPPRESSOR

There are five identical notch filter sections in the Model 562. 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 R36 over the ranges from 60 to 600 Hz and 600 to 6000 Hz, depending on the setting of the multiplier switch.

The signal output of amplifier section D (at pin 14) 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). Notch Depth is variable from 0 dB to 20 dB with the third section (center shaft) of the potentiometer R36. A loss of approximately 0.8 dB is taken through each filter section for a total of 4 dB through the 5 sections.

4.5 ENDCUT FILTERS

IC 8A and IC 8B and associated components are a voltage controlled voltage source high pass (low frequency cutoff) and low pass (high frequency cutoff) filters respectively. Both filters are 12 dB/octave Butterworth types. The high pass section has 4 dB of voltage gain; the low pass section is unity gain.

4.6 INVERTER

IC 8C is configured as an inverting, unity gain buffer amplifier. Its purpose is to maintain correct input/output polarity with the suppressor section switched OUT. Components R85, R86 and R87 form an offset adjustment circuit which allows any DC offset at the input of the output amplifier to be matched to an equal offset at the output of IC 8C for minimal "click" when the suppressor is switched IN or OUT.

4.7 OUTPUT AMPLIFIER

IC 8D, Q1, Q2 and additional components comprise the output amplifier. It has a voltage gain of 1.4 dB and drives transformer T1. With switch S1 in the IN position, input signal is connected from the low pass filter through C84 and R84. C84 provides AC coupling for the signal. R84 is essentially ignored by the high impedance input of the Op amp. With switch S1 in the OUT position, the signal path is through IC 8C. The relatively low output impedance of IC 8C effectively short circuits the signal coming through R84. This provides proper isolation between the IN/OUT conditions of the bypass switch.

Switch S2 in the setup position places diodes CR1 and CR2 across the signal line, limiting the maximum peak-to-peak signal to approximately 1.2 volts for setup purposes.

4.8 HEADROOM INDICATOR

IC 1B is a half wave rectifier with its input driven from the variable gain amplifier. The output is filtered by R8 and C4, and drives the negative inputs of IC 2, sections A, B, C and D, which are used as window comparators. The thresholds for the individual sections are derived from the voltage divider consisting of R9 through R13.

4.9 POWER SUPPLY

The power supply is bipolar, employing two integrated circuit voltage regulators, VR1 and VR2, to provide low ripple, ±18 volt DC. Additional filter capacitors ensure 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 562 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 562 is factory warranted to the orignal 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 ADJUSTMENTS

These controls have been carefully set at the factory and should not require adjustments except after service work.

5.3.1 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 "±" and "COM" input terminals together and apply an input signal between this connection and the GND terminal (100 Hz, 3 V rms).

With EQ OUT, measure the signal with an AC VTVM or DVM across the output terminals of the Model 562. Adjust the trimpot R1 for a minimum reading, switching the voltmeter to more sensitive ranges as required. It should be possible to obtain a reading below 0.03 volts (40 dB down).

5.3.2. OFFSET ADJUSTMENT

The internal trimpot R87 affects this adjustment. It should only be necessary to change the factory setting if ICs are replaced. The adjustment is correct when the DC voltage at both sides of the open position (EQ in) of the EQ switch is the same. No "click" will be generated when the EQ switch is operated if this adjustment is correct.

NOTE: If the offset control is severely misadjusted, large voltage pulses are generated in the filter when the EQ switch is operated. This could overload or damage unprotected equipment which may be connected to the output of the Model 562. UREI cannot be responsible for consequential damages due to misadjustment of this control.

PREFERRED METHOD

With no input signal applied, set the EQ switch to the "IN" position. Measure the DC offset voltage of IC 8 (orange wire at the EQ switch) and adjust R87 until the DC voltage at the red wire of the EQ switch measures the same value. The range of the adjustment is approximately ±30 mV.

ALTERNATE METHOD

Connect the output terminals of the Model 562 to a high gain amplifier and loudspeaker. With no input signal applied switch the EQ IN and OUT.

Listen to the loudspeakers and adjust R87 for minimum audible "click" while operating the EQ switch.

5.4. CLEANING

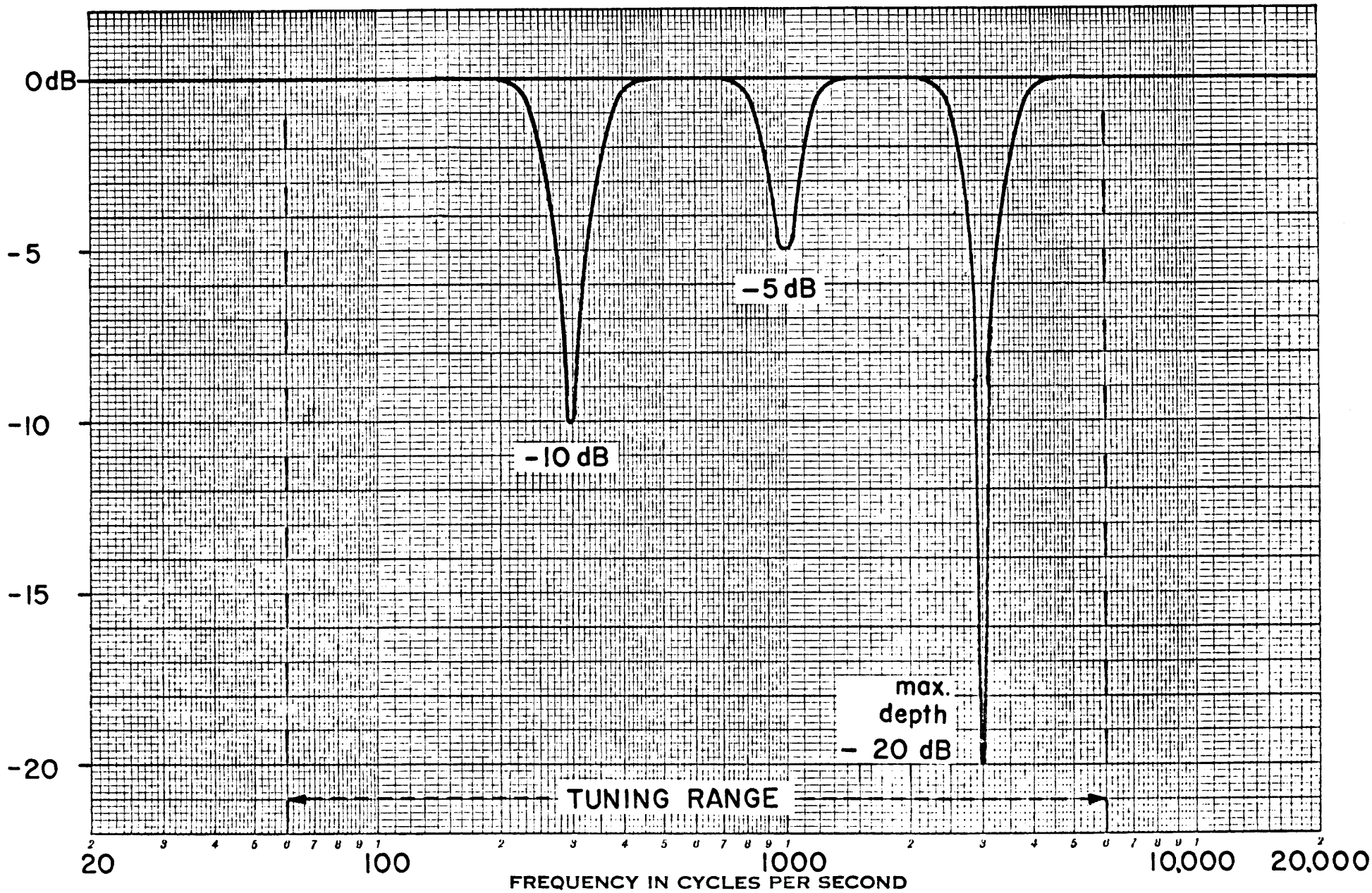
The front panel of the 562 may be cleaned with a non-abrasive cleanser such as "Formula 409" or "Fantastic" applied with a soft clean cloth. Additional protection of the anodized panel can be afforded through a light application of a spray wax preparation such as "Pledge." Never spray the panel directly, as the cleanser or wax may adversely affect the controls.

5.5 ON OP AMPS

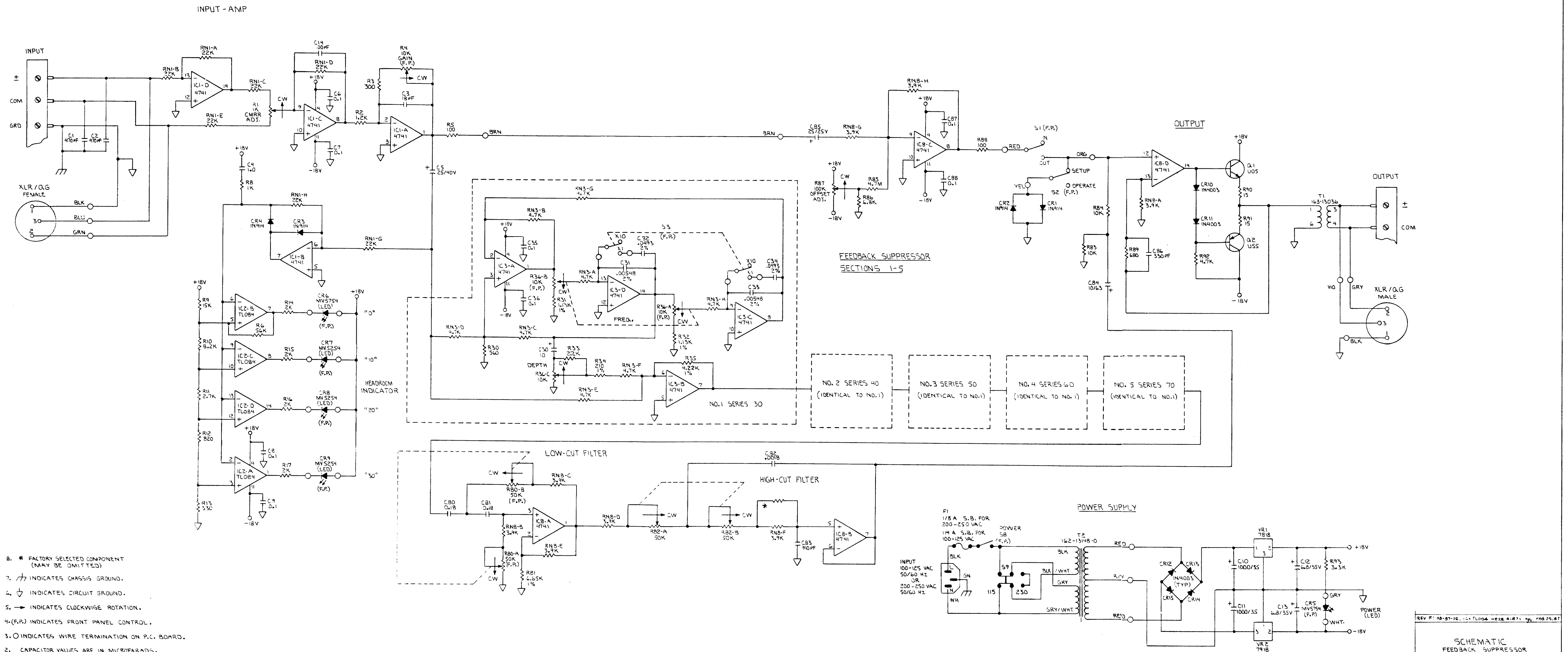
The Model 562 Feedback Suppressor makes extensive use of integrated circuit operational amplifiers (IC op amps). During the last several years, much research and development work has been done by the semi-conductor manufacturers to improve their products, and more is anticipated. We expect that better op amps at lower cost will be available as this development work continues. At the time of the design of the Model 562, we anticipated this and have made every effort to design the circuit so that as improved parts become available they may be incorporated into the Model 562 with little, if any, modification. We also realize that occasionally an IC will fail. For this reason, the table below lists a number of different operational amplifiers which will function as direct, pin-for-pin replacements for the op amps in the 562. For one reason or another, they may not function as well as the op amps originally supplied with this unit, but for emergency repairs, if the original types are not available, these will get the instrument back into service.

	MODEL or TYPE	MANUFACTURER
ORIGINAL	HA 4741-5	HARRIS
	TL 084	TEXAS INSTRUMENTS
REPLACEMENTS	HA 4741-5	RAYTHEON
	TL 074	TEXAS INSTRUMENTS
	RC 4156	RAYTHEON
	LM 347	NATIONAL SEMICONDUCTOR

All of the above "replacement" op amps should be considered interim replacements until the correct "original" device can be obtained and substituted.



TYPICAL ATTENUATION CURVES



NOTES: UNLESS OTHERWISE SPECIFIED.

1. RESISTOR VALUES ARE IN OHMS ± 5% 1/2W.
2. CAPACITOR VALUES ARE IN MICROFARADS.
3. ○ INDICATES WIRE TERMINATION ON P.C. BOARD.
4. (F.P.) INDICATES FRONT PANEL CONTROL.
5. → INDICATES CLOCKWISE ROTATION.
6. ▽ INDICATES CIRCUIT GROUND.
7. ⏚ INDICATES CHASSIS GROUND.
8. * FACTORY SELECTED COMPONENT (MAY BE OMITTED)

REV F: 08-87-02, ICs TL084 WERE 4147s FEB 25,87

SCHEMATIC
FEEDBACK SUPPRESSOR

REV. E PER ECO - 562-009 1-28-85 MRM
REV. D PER ECO-0562-008 11-16-82 R.P.MARIN
REV. C PER ECO-0562-006 5-20-82 R.P.MARIN
REV. B PER ECO-0562-005 8-18-80 R.P.MARIN
REV. A PER ECO-0562-001 3-21-80 R.P.MARIN

SIZE	MODEL	DRAWING NO.	REV
R	562	R13246	F
DATE 9-5-79	DR. BY. R.P.MARIN	SHT 1 OF 1	