

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

**model 560**  
**FEEDBACK SUPPRESSOR**



**United Recording Electronics Industries**

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## TABLE OF CONTENTS

Page No.

SECTION I	<u>GENERAL INFORMATION</u>	
1-1	Description	1
1-2	Electrical Specifications	1
1-3	Controls	2
1-4	Physical Specifications	3
SECTION II	<u>THEORY OF OPERATION</u>	
2-1	Microphone Input	4
2-2	Line Input	4
2-3	Overload Indicator	4
2-4	Notch Filter	4
2-5	Output Amplifier	5
2-6	Power Supply	5
SECTION III	<u>INSTALLATION</u>	
3-1	Unpacking and Inspection	6
3-2	Environmental Considerations	6
3-3	Powering	6
3-4	External Connections	7
3-5	Level Adjustment	7
3-6	Accessories	8
SECTION IV	<u>OPERATING PROCEDURE</u>	
4-1	General Considerations	9
4-2-0	Adjustment of Filters	10
4-2-4	Protection Circuit	11
SECTION V	<u>MAINTENANCE</u>	
5-1	General	12
5-2	Repairs and Warranty	12
SECTION VI	<u>DRAWINGS</u>	
	Block Diagram	13
	Schematic	14
	Typical Attenuation Curves	15
	Circuit Board Component Layout	16

## SECTION I

### GENERAL INFORMATION

1-1. DESCRIPTION. The UREI Model 560 Feedback Suppressor was designed specifically for use in sound reinforcement systems. The 560 contains four active notch filters, each adjustable in notch depth from 0 to 20 dB and variable in frequency from 60 Hz to 6000 Hz. Microphone preamplification is built in, permitting the filter to be used at either microphone or line level. The preamplifier gain can be varied over a 30 dB range.

XLR-3 connectors allow simple connection between microphone and amplifier, and phone jacks (T.R.S.) are provided for line level input and output.

As optional accessories, rack adaptors are available for mounting one or two 560 units in 3.5" of standard 19" rack space for permanent installation.

### 1-2. ELECTRICAL SPECIFICATIONS.

MICROPHONE INPUT : Bridges low impedance (150-250 ohms) microphones. Transformer isolated.

LINE INPUT : 20 k ohms bridging. Floating, differential. (May be used from balanced or unbalanced sources.)

LOW LEVEL OUTPUT : 150 ohms, transformer isolated. 50 dB below line level output.

LINE LEVEL OUTPUT : To be bridged by 600 ohms or higher impedance load. Transformer isolated.

GAIN : Microphone input, 20 to 50 dB, adjustable. Line input, 0 dB.

FREQUENCY RESPONSE :  $\pm 0.5$  dB, 20 Hz to 20 kHz (filters OFF).

MAXIMUM OUTPUT : 7 V R.M.S. (20 V P.P.) into hi Z load. 6.15 V R.M.S. (+18 dBm) into 600 ohm load.

DISTORTION : Less than 0.5 % at maximum output, 30 Hz to 20 kHz.

EQUIVALENT INPUT NOISE : Microphone input -124 dBV or less. Line input -95 dBV or less.

FILTER TYPE : State variable. Four, independently adjustable.

FILTER RANGES : 60 to 6000 Hz in two ranges.

DIAL CALIBRATION :  $\pm 10\%$  of indicated settings.

FILTER BANDWIDTH : Approx. 1/6 octave at 5 dB attenuation (3 dB points).

POWER REQUIREMENTS : 120/230 VAC (strappable) @ 50-60 Hz 7 watts maximum.

ENVIRONMENT : Operating temperature from 0° C to +50° C.  
Storage temperature from -20° C to +60° C.

1-3. CONTROLS. For each of the four independent notch filters the controls to select frequency and depth are identical as follows:

FILTER FREQUENCY : The black outer knob selects the frequency as indicated by the calibration on the front panel. Together with the frequency multiplier toggle switch the two ranges are from 60 Hz to 600 Hz and from 600 Hz to 6000 Hz.

NOTCH DEPTH : Is controlled with the red center knob from 0 dB to 20 dB attenuation. CCW = no attenuation; CW = full attenuation.

POWER : Toggle switch and pilot light.

OVERLOAD INDICATOR : The pilot light also serves as input overload indicator. Normally ON when the 560 is switched ON, it will flash intermittently when an overload condition occurs.

SIGNAL INPUT

1. MIC LEVEL : XLR-3 female chassis connector; 1 SHLD, 2H, 3L.

MIC SENSITIVITY : Screwdriver adjustable control over a range of 30 dB.

2. LINE LEVEL : Phone jack connector (T.R.S.).

SIGNAL OUTPUT

1. MIC LEVEL : XLR-3 male chassis connector; 1 SHLD, 2H, 3L.

2. LINE LEVEL : Phone jack connector (T.R.S.).

1-4.

PHYSICAL SPECIFICATIONS.

SIZE : 2.5" high, 8.5" wide, 10" deep overall.

WEIGHT : 7.5 pounds.

SHIPPING WEIGHT : 10 pounds.

FINISH : Front panel, horizontally brushed clear  
anodized aluminum.

Chassis, cadmium plated steel. Cover, matte  
black painted steel.

OPTIONAL ACCESSORIES : SR-60 rack adaptor for single mounting (3.5").

DR-60 rack adaptor for double mounting (3.5").

## SECTION II

### THEORY OF OPERATION

For the following text refer to Block Diagram, page #13 and Schematic, page #14.

2-1. MICROPHONE INPUT. The signal is applied to the input pre-amplifier (IC1C) through the input transformer T1. This provides a balanced input to bridge low impedance (150-250 ohms) microphones. Gain through the transformer is 20 dB. The gain of the IC can be varied over a range of 30 dB by means of negative feedback. The total gain through the MIC INPUT stage therefore is 20 to 50 dB.

2-2. LINE INPUT. Signal at line level is applied to a pair of operational amplifiers IC1, sections A and B, which provide a floating differential input with 20 K ohm impedance. This input may be used from balanced or unbalanced sources.

The Common Mode Rejection is typically better than 40 dB. In some units CMR is trimmed with a selected resistor R99 either parallel to R8 or R9.

The input amplifier has unity gain. IC 1, section A acts as a summing amplifier. Its output signal is conditioned by a high frequency de-emphasis network C 19, R 11, to avoid high frequency overload in the filter sections.

2-3. OVERLOAD INDICATOR. Section D of IC 1 is normally biased to draw current through the LED (CR 8). In this steady state the LED functions as a pilot lamp. If the peak output level of the input amplifier reaches a value of +18 dB the threshold of the overload indicator is exceeded causing the LED to flash at a slow repetition rate. At threshold, there remains a headroom of approximately 2 dB before actual overload of the filter or amplifier sections occurs.

2-4. NOTCH FILTER. There are four notch filter sections in the 560 unit, which are identical, with the exception of the summing amplifier of the last filter. The filter type is state variable. Each filter utilizes four operational amplifiers which are on a single chip (4136). Filter #1 will be described:

Frequency selection is variable with the two coupled front sections of R29 over the ranges from 60 to 600 Hz and 600 Hz 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 potentiometer R29. The signal output of amplifier section D

at pin #12 constitutes a bandpass function with the center frequency selected as described previously. This signal is  $180^\circ$  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", page #15.

2-5.        OUTPUT AMPLIFIER. All four Notch Filters are cascaded. The output stage of the last filter differs from the other three, in that its negative feedback includes the power output amplifier stage. To retain flat frequency response the H.F. emphasis network C 21, R 90 is part of the loop. Q 1, 2 and 3 develop the necessary power of the output amplifier. The signal is coupled through C 22 and R 97 into the output transformer which provides isolation and two output levels. The line level output has an internal impedance of 600 ohms, the microphone level output (which is 50 dB below line level) has an impedance of 150 ohms.

2-6.        POWER SUPPLY. The Power Supply is bipolar employing two integrated circuit voltage regulators VR1 and VR2 to provide low ripple plus and minus 15 volts D.C. Tantalum capacitors C 28 and C 29 maintain low output impedance of the supplies at high frequencies.

## SECTION III

### INSTALLATION

3-1. UNPACKING AND INSPECTION. Carefully examine the contents of the shipping carton for any sign of physical damage which could have occurred in transit. Though your 560 was carefully packed at the factory and the container was designed to protect the unit through rough handling, accidents do happen.

IF DAMAGE IS EVIDENT, DO NOT DESTROY ANY OF THE PACKING MATERIAL OR CARTON, AND IMMEDIATELY NOTIFY THE CARRIER OF A POSSIBLE CLAIM FOR DAMAGE. SHIPPING DAMAGE CLAIM MUST BE MADE BY THE CONSIGNEE.

The shipment should include, in addition to the 560 unit itself and this instruction manual:

- a. A two-part warranty card, bearing the same serial number as the unit.
- b. If ordered, an accessory rack mounting kit and hardware.

In order to activate the one-year warranty, the card must be completed and the return portion mailed immediately.

3-2. ENVIRONMENTAL CONSIDERATIONS. The model 560 will operate satisfactorily over a wide range of ambient temperatures, from 0° to +50°C (+32°F to +122°F). If it 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 transformers and other circuitry susceptible to hum pickup are sufficiently shielded against moderate electromagnetic fields, avoid mounting the 560 immediately adjacent to large power transformers, motors, etc.

To comply with existing Electrical Codes, the 560 is supplied with a three-wire AC power cord, the grounding pin of which is connected to the chassis. In some installations, this may create ground-loop situations, if a significant potential difference exists between a grounded metal enclosure in which the chassis is installed, and the AC conduit ground. If hum is experienced, check for this possibility by using a 3-wire to 2-wire AC adaptor at the power receptacle, ungrounding the AC plug.

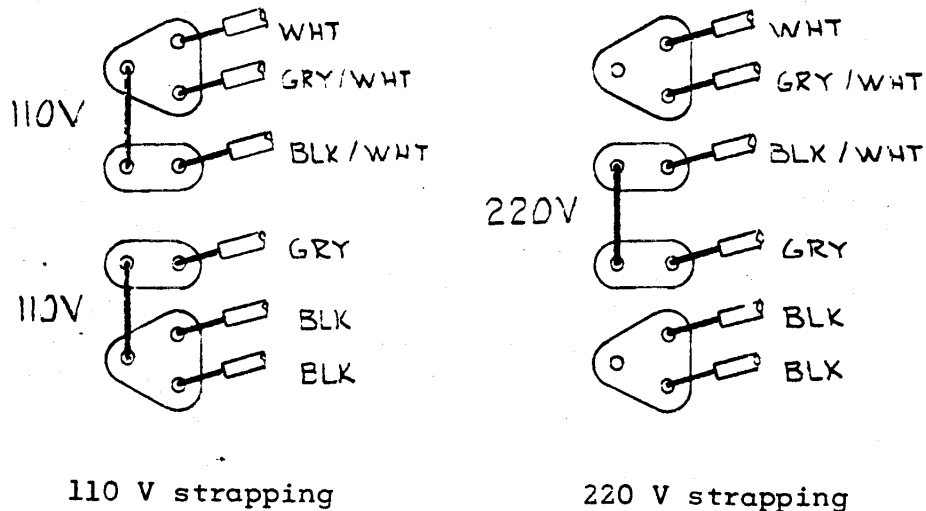
3-3. POWERING. The Model 560 may be operated from either 110-125 VAC or 220-240 VAC main supply, 50 or 60 Hz single phase, depending on the strapping of the power transformer inside the unit on the P.C.



board. Unless a tag on the line cord specifies otherwise, the unit was delivered ready for operation from 110-125 VAC mains.

The fuse should be 1/8 A, slo-blo.

To change for operation with 220-240 VAC, unscrew the four rubber feet and slide the housing off the unit. Change the transformer primary strapping according to the markings on the P.C. board. The line fuse should be changed to 1/16 A slo-blo for proper protection of the 560. (See diagram).



3-4. EXTERNAL CONNECTIONS. Input and Output signal cables should be connected as indicated on the rear chassis following standard practices. External cable connectors are not furnished.

If the line level output is to be connected to a high impedance circuit, a 560 to 620 ohm resistor ( $\frac{1}{2}$  watt) should be shunted across the output terminals to assure proper output loading. This may be installed either on the T.R.S. jack within the 560, or at the input of the following equipment.

3-5. LEVEL ADJUSTMENT. The 560 Feedback Suppressor is designed to operate basically as a unity gain device. If an input signal at mic level is applied, the preamplifier will add 20 to 50 dB of gain to the signal, depending on the setting of the MIC SENSITIVITY control at the rear of the chassis.

Mic level output is always 50 dB below line level output.

3-6.        ACCESSORIES. The model 560 may be installed in a standard 19" rack with the SR-60 rack adaptor. Vertical space required is 3.5". Depth required behind the panel is 9.5". The DR-60 rack adaptor will mount two 560 units side by side in the same space.

## SECTION IV

### OPERATING PROCEDURE

4-1. GENERAL CONSIDERATIONS. 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 sound arriving at a listener's ear directly from the loudspeaker(s). 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 within the acoustical environment. 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. It is limited by those frequencies whose amplitude approach or exceed unity gain within the system.

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 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 better intelligibility of speech.)

The 560 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. Most installations will benefit greatly from the services of a competent sound system specialist to insure that optimum results will be obtained from the equipment available. Broad-band or third-octave "tuning" to smooth the overall frequency response to a desired "house curve" is also recommended, if economics and time permit. For this purpose, we suggest you consider the UREI Model 100-A Sonipulse and either the 527A 1/3-Octave Graphic Equalizer or Model 529 Room Equalizer. The 560 Feedback Suppressor can then be added to reduce microphone "proximity" effect and suppress any remaining high Q resonances.

With a system which has a reasonably flat electrical frequency response (not including the acoustical environment) and some care in microphone and loudspeaker placement, the 560 used alone can significantly improve system gain before feedback, aid speech intelligibility and reduce listener fatigue.

4-2-0. ADJUSTMENT OF FILTERS. It would be of some advantage if the major feedback frequencies were known before attempting to suppress these peaks. However exact measurements are time-consuming and require additional test equipment. The actual application of the 560 Feedback Suppressor is quite simple.

Before inserting the unit the system should be free of hum, noise, non-acoustical oscillations and RF interference, because these are problems which should be solved separately.

CAUTION! (See also 4-2-4 "Protection Circuit").

Turn the volume control of the power amplifier or preamplifier down to prevent unintended feedback while inserting the 560 into the system. Choose the input according to the input signal level available, and connect either line level or mic level output to the appropriate amplifier input.

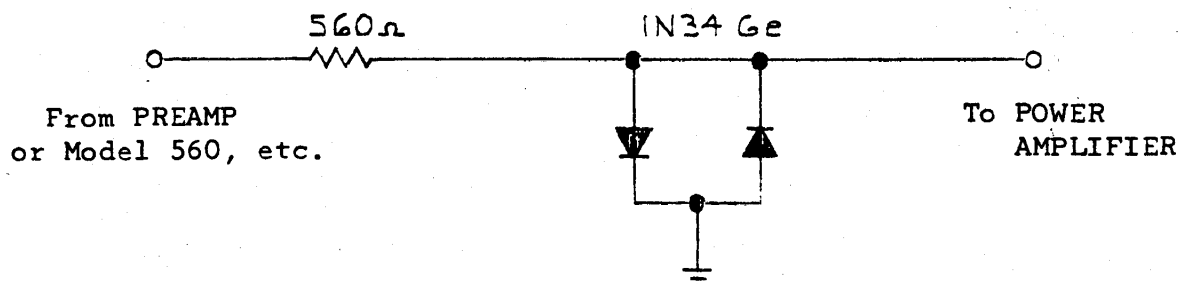
Start with all depth controls fully CCW, and Frequency Multiplier switches to X1. SLOWLY increase the gain of the system and note the maximum gain setting before feedback occurs.

4-2-1. SLOWLY increase the gain for the first feedback frequency to become detectable and stabilize the feedback to a constant, comfortable level. Now turn the first depth control CW and tune the frequency knob until the feedback disappears. Switch the Frequency Multiplier switch to X10 if required. Reduce attenuation of the depth control for a more accurate tuning.

4-2-2. Repeat this procedure for the second, third, and fourth feedback frequencies, additionally increasing the depth of the previous filters and/or retuning the center frequencies if required to prevent recurrence of feedback at previously treated resonances.

4-2-3. The result will be a higher amplifier gain setting than was possible before inserting the Feedback Suppressor. Remember: A gain of 3 dB is equal to twice the previously available power. To avoid ringing it is best to adjust the gain at least 3 dB below the threshold of feedback. Determine this maximum setting by working the microphone at various distances and sound levels which may be normally used.

4-2-4. PROTECTION CIRCUIT. Feedback is not only annoying to the ear but it is also dangerous to unprotected amplifiers and loudspeakers. It is suggested that a simple circuit such as the following be inserted ahead of the power amplifier during tuning:



The two Germanium diodes will limit the voltage supplied to the amplifier to a safer value, clipping excessive levels.

The tuning procedure as described in 4-2-1 may be even more simplified:

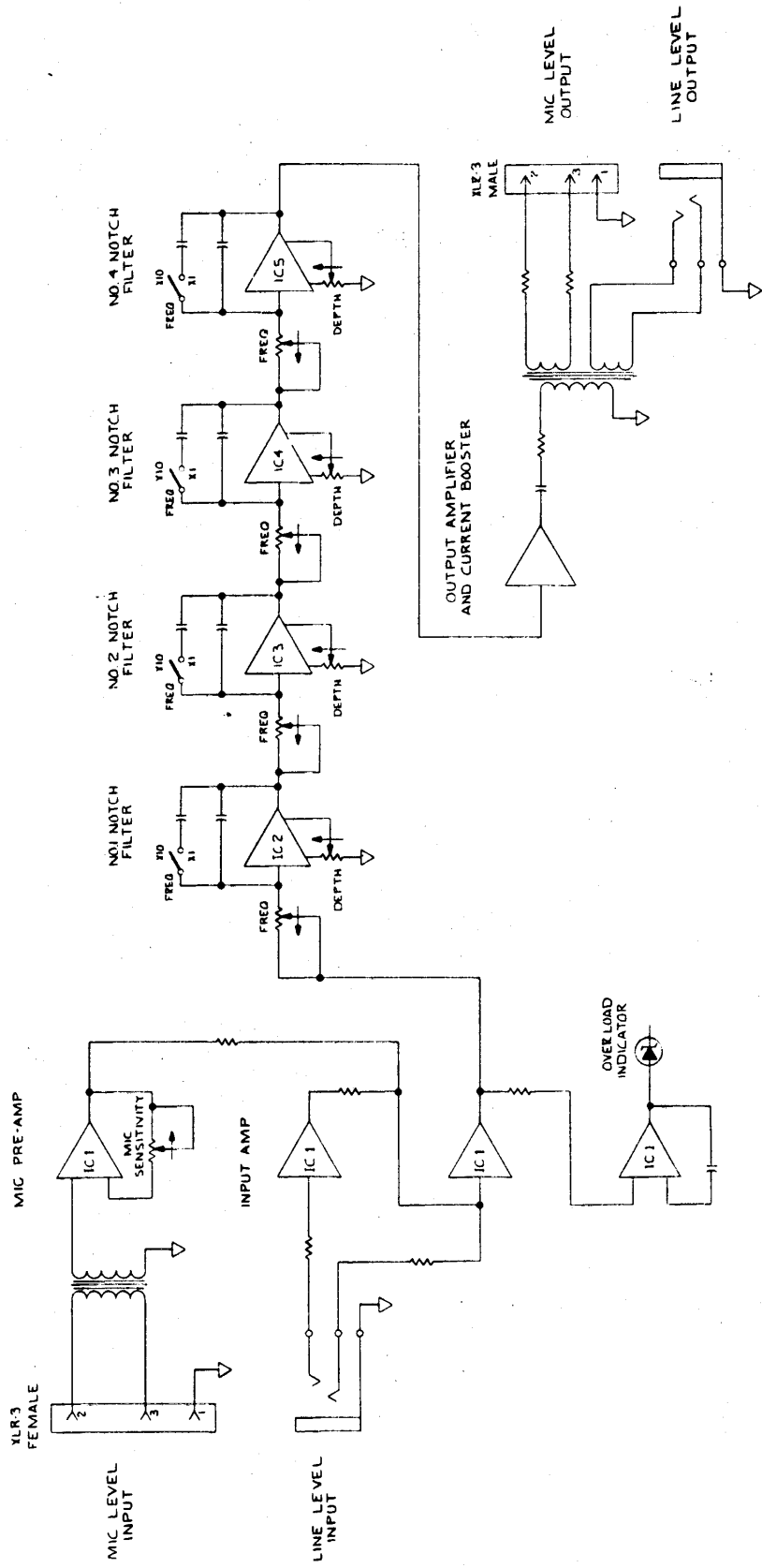
Turn up the gain until feedback occurs. Tune out with first filter. The next strongest feedback frequency will build up. Tune out with second filter; etc.

When all four filters are tuned reduce the gain setting below any feedback and remove the protective circuit.

NOTE: The protective circuitry described is not guaranteed by UREI to prevent damage to amplifiers or speakers. Power amplifiers may be set too high, and signal levels at the protective circuit may be too low to allow the diodes to conduct before dangerous levels are achieved. Be careful of your amplifiers and speakers!

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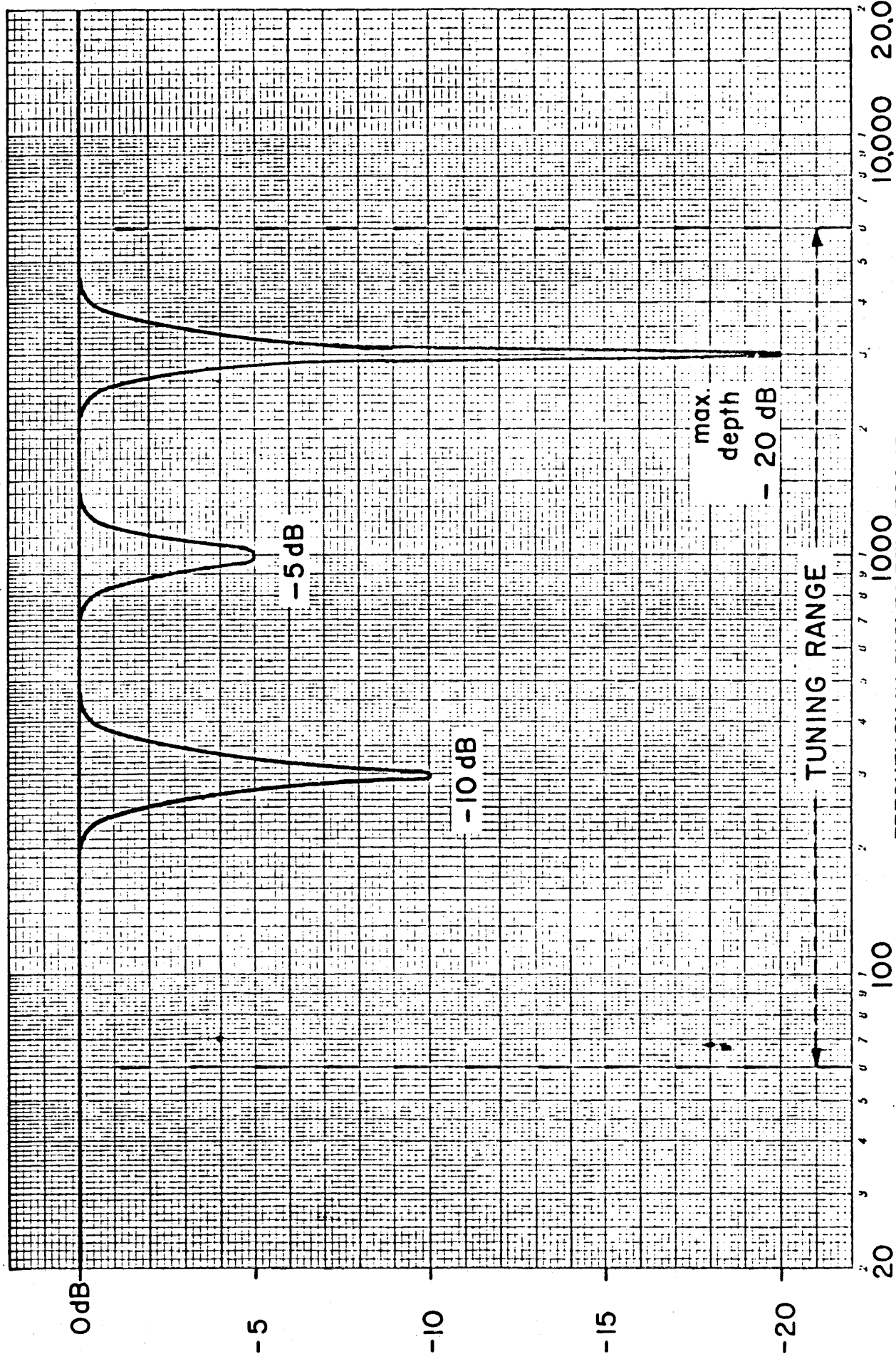
BLOCK DIAGRAM



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DESIGNER	
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BLOCK DIAGRAM, FEEDBACK SUPPRESSOR	
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SCALE	

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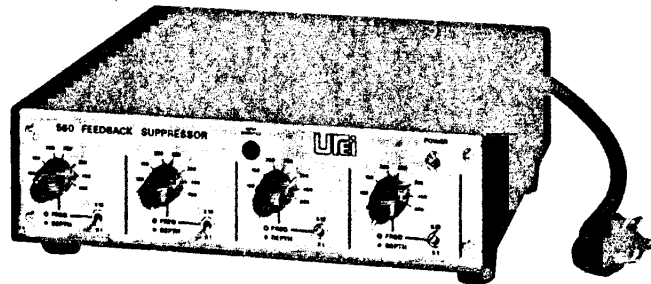


TYPICAL ATTENUATION CURVES



# Universal Audio FEEDBACK SUPPRESSOR

MODEL  
560  
SR-60  
DR-60



Experience with narrow band notch filters has demonstrated that in a typical single-microphone sound reinforcement system, gain before "howlback" can be significantly increased and intelligibility improved by centering a narrow band-reject filter on three or four of the most prominent system resonant frequencies. The Universal Audio 560 Feedback Suppressor provides an inexpensive, convenient, compact way to achieve this result.

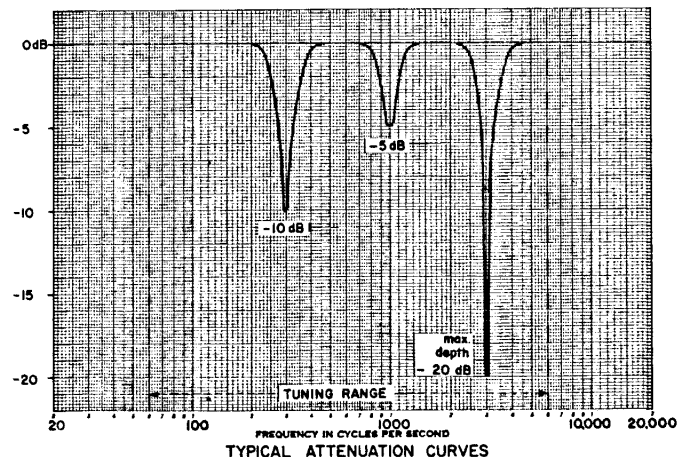
The 560 contains four active notch filters, each adjustable in notch depth from 0 to 20 dB, and adjustable in frequency from 60 Hz to 6000 Hz. Microphone preamplification is built in, permitting the 560 to be used at either microphone or line level. XLR-3 connectors allow simple connection between microphone and amplifier, and phone jacks are provided for line level input and output.

In using the 560, the system gain is slowly increased until the first feedback occurs and is sustained. One notch filter is then switched in and "tuned" until the feedback ceases. The gain is increased again, and the next resonance attenuated by the second filter. This procedure is repeated with filters 3 and 4. A typical result is an increase of 12 dB or more in actual system gain before feedback, and improved intelligibility. No undesirable changes in fidelity are produced. Used alone in this manner, the 560 will find wide application for both temporary and permanent installations in lecture halls, meeting rooms, schools and churches.

Many systems will benefit from more sophisticated broadband and/or  $\frac{1}{3}$ -octave equalization, if budgets permit. The 560 can further improve these installations, providing final "tweaking" to reduce microphone proximity effects and troublesome residual resonances.

## FEATURES

- Compact size: 2.5" x 8.5" x 10". Optional rack mounting.
- Four independently adjustable notch filters.
- Narrow notches minimize sound coloration.
- Microphone or line level inputs and outputs.
- XLR-3 and phone jacks for inputs and outputs.
- Input overload indicator.
- Built-in power supply.
- UREI Quality, of course.

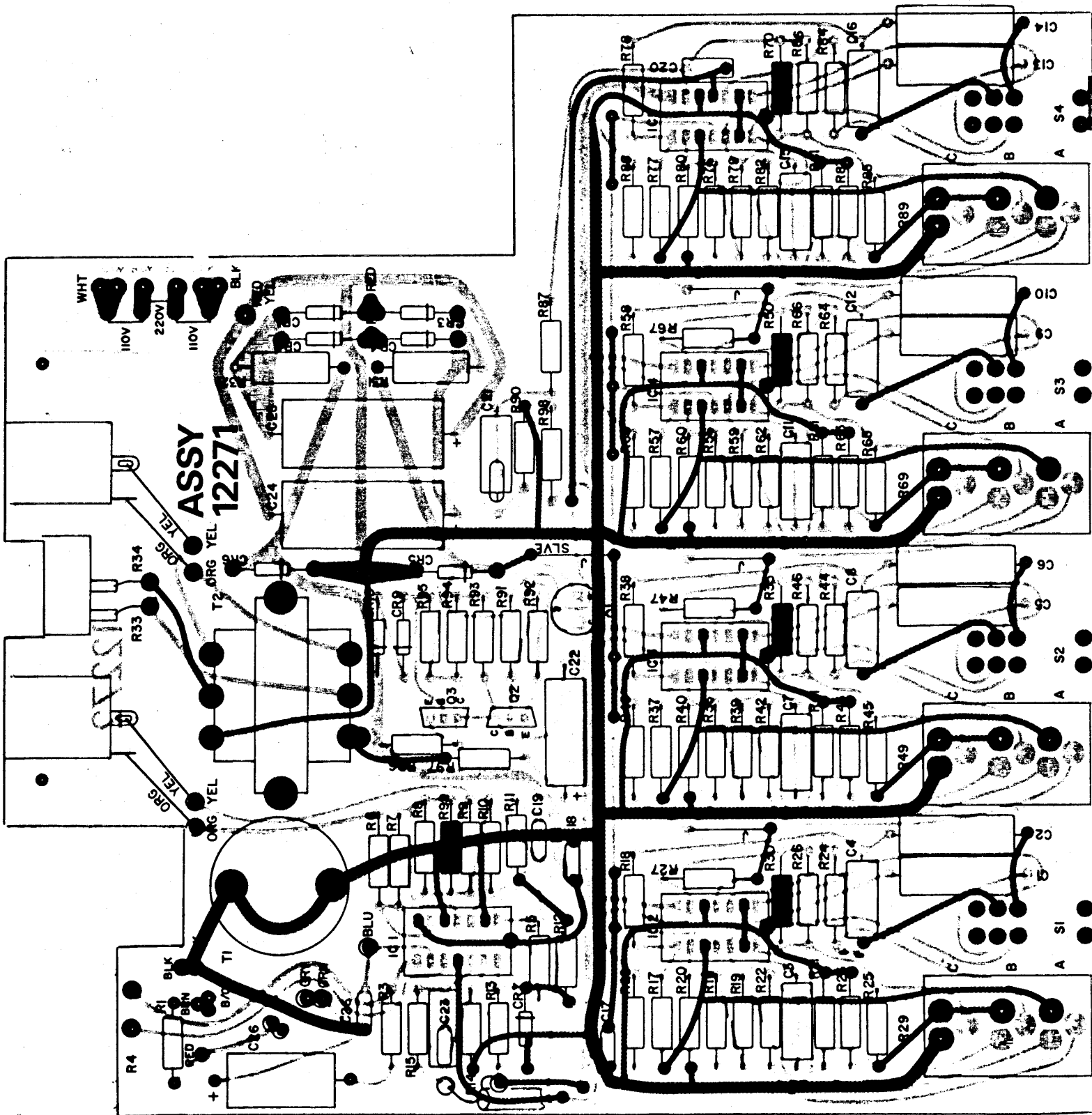


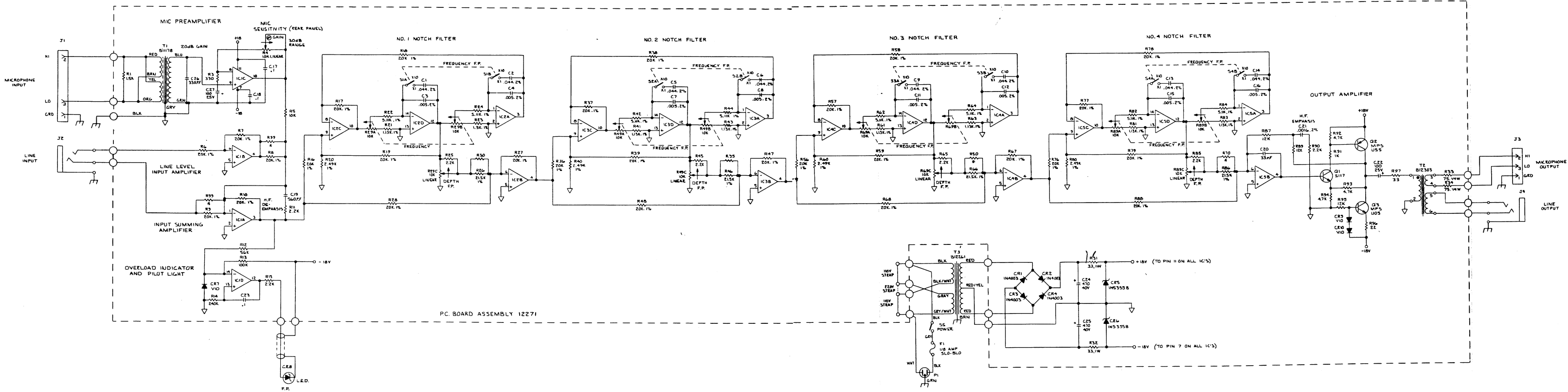
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TELEX 65-1389

MODEL  
560  
SR-60 DR-60





PC. BOARD ASSEMBLY 12271

- 4 F.P. INDICATES FRONT PANEL CONTROL
- 5 ALL IC'S PIN#1 +18V, PIN 7 -18V
- 4 ALL IC'S 4136
- 3 # SYMBOL INDICATES FACTORY SELECTED VALUE
- 2 CAPACITOR VALUES ARE IN MICROFARADS
- 1 RESISTOR VALUES ARE IN OHMS, ± 5%, 1/2 W

NOTES:

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES = .005" = .005" = .005"	CONTRACT NO. APPROVALS DATE 3-17-75	UNITED RECORDING ELECTRONICS INDUSTRIES 12375 SHEET 1 OF 1
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