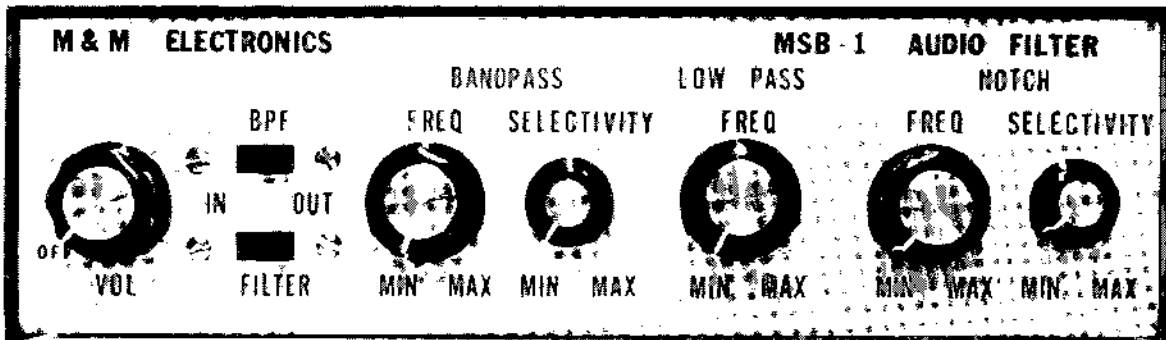


MSB - 1 AUDIO FILTER

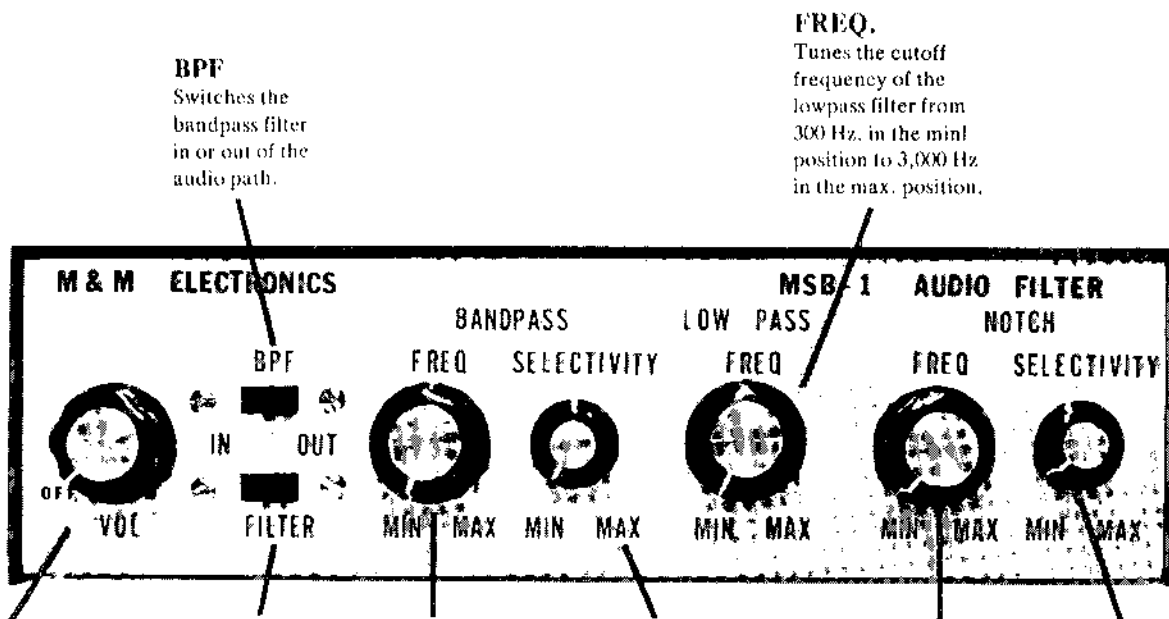


M&M ELECTRONICS, INC.

P. O. BOX 1206/BREWTON, ALABAMA 36427/PHONE (205) 867-2496

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BPF
Switches the bandpass filter in or out of the audio path.

FREQ.
Tunes the cutoff frequency of the lowpass filter from 300 Hz. in the min position to 3,000 Hz in the max. position.

VOLUME CONTROL
Turns the power on and controls the audio output from the filter when the filter is switched in,

FILTER
Switches the filter in or out of the audio path,

FREQ.
Tunes the center of the bandpass filter from 300 Hz. in the min. position to 3,000 Hz. in the max. position.

SELECTIVITY
Adjust the bandwidth of the bandpass filter from 1,500 Hz. in the min. position to less than 75 Hz. in the max. position.

FREQ.
Tunes the notch frequency from 300 Hz. in the min. position to 3,000 Hz. in the max. position.

SELECTIVITY
Adjusts the bandwidth of the notch filter.

The MSB-1 Audio Filter consists of four basic filters arranged to provide the maximum in flexibility and effectiveness during CW or SSB reception. The four basic filters are as follows:

1. Fixed tuned HIGHPASS filter with a 3dB cutoff frequency of 300 Hz.
2. NOTCH FILTER tunable from 300-3,000 Hz. The bandwidth of the notch is also adjustable. Notch depth is greater than 50 dB.
3. Eight pole LOWPASS FILTER tunable from 300-3,000 Hz.
4. BANDPASS FILTER tunable from 300-3,000 Hz. The 3 dB bandwidth is adjustable from less than 75 Hz. to greater than 1,500 Hz.

The fixed tuned highpass filter, tunable notch filter, and tunable lowpass filter are engaged at all times. The tunable bandpass filter can be switched in for further shaping of the audio. This means that all three tunable filters can be engaged at the same time and tuned independently.

INSTALLATION

1. Connect one end of a cable(not supplied)to the headphone(or speaker)jack of the receiver and the other end of the cable to the input jack of the MSB-1 located on the rear of the unit.
2. Plug a set of headphones or a speaker into the jack labeled "Output" on the rear of the MSB-1.
3. Connect an external voltage of 12 volts @300 ma. to the "External PWR" jack on the rear of the MSB-1. The tip of the external power plug should be positive.
4. This completes the installation of the MSB-1 Audio Filter. Proceed to the operating instructions for specific information on the adjustment of the MSB-1 Audio Filter for SSB or CW operation.

SSB OPERATION

The tunable lowpass, bandpass, and notch filters can be used together to greatly reduce interference due to splatter and other extraneous noises. It is recommended that the MSB-1 controls be preset as follows:

Lowpass Filter	Frequency	Maximum
Bandpass Filter	BPF Switch	In
	Frequency	3 O'clock
	Selectivity	Minimum
Notch Filter	Frequency	Maximum
	Selectivity	Maximum

The Notch Filter can be used to remove heterodynes and to reduce splatter. To remove a heterodyne or tone, simply turn the frequency control until the heterodyne or tone disappears. This adjustment can be made easier if the selectivity control is turned to 12 O'clock. This will make the notch bandwidth wider (see Figure 10). Splatter can be reduced by turning the selectivity control to 12 O'clock and then tuning the frequency control until the splatter is reduced. The splatter cannot be completely removed with just the notch filter due to the changing frequency content of a voice signal.

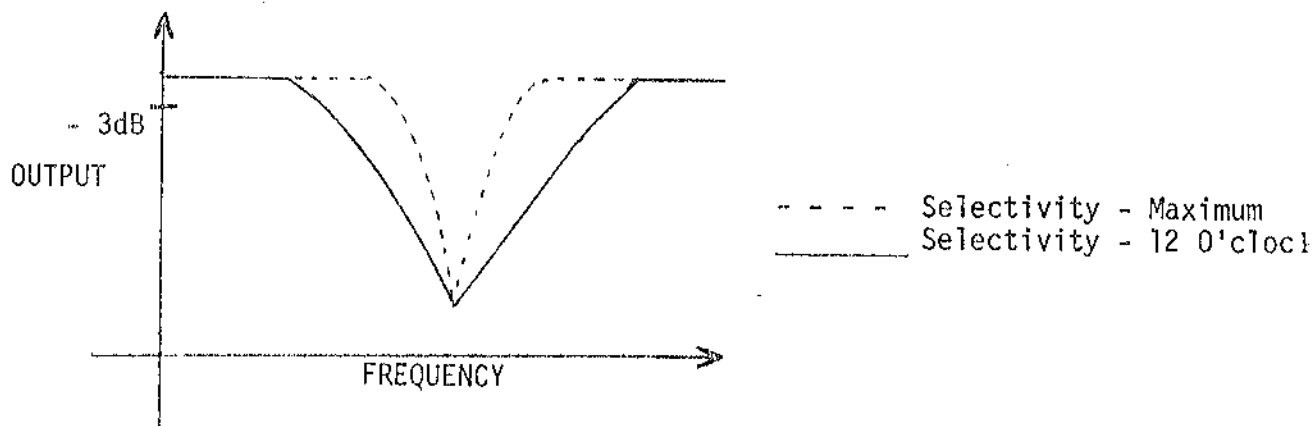


FIGURE 10

The Tunable Lowpass Filter can be used to reduce both natural and manmade interference. This is accomplished by turning the lowpass frequency control until the interference is eliminated or reduced. It should be noted that there is a point at which the desired signal will become distorted due to the reduced frequency response. The final setting of the frequency control will have to be a compromise between this distortion in the desired signal and a reduction in the interfering signal. This effect is minimized in the MSB-1 by making the tunable lowpass filter an 8-pole filter with a rolloff above the -3 dB cutoff frequency of 48 dB/octave. This is graphically illustrated in Figure 11.

SSB continued

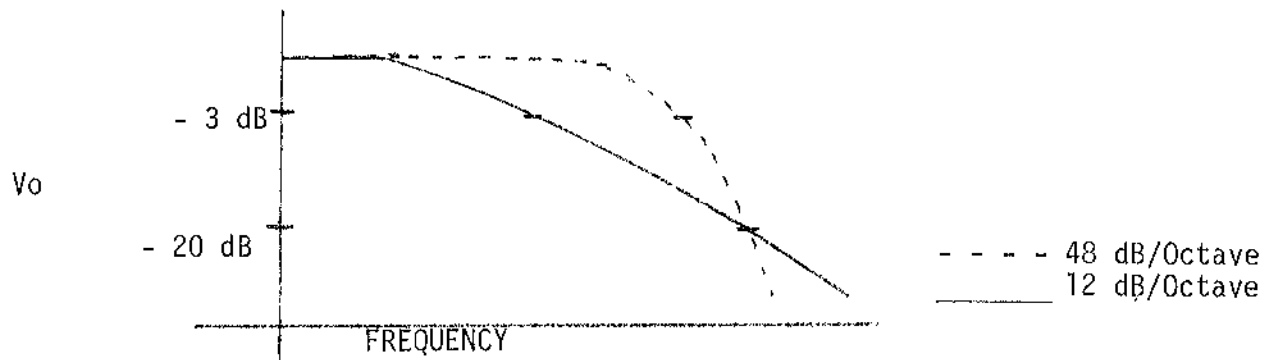


FIGURE 11

The Tunable Bandpass Filter can be tuned to peak the desired voice. The frequency control is tuned for best reception. The selectivity control can be turned clockwise to narrow the band of frequencies passed by the bandpass filter (see Figure 12). The exact settings of the frequency control and selectivity control will vary from voice to voice and will, therefore, have to be determined experimentally. The initial settings will give you a good starting point.

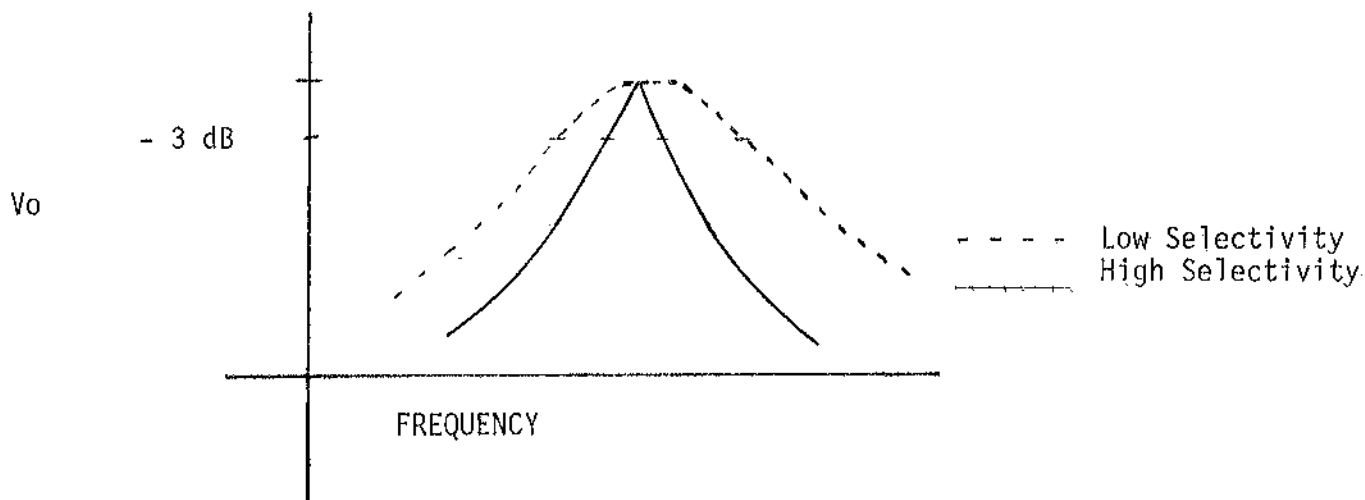


FIGURE 12

NOTE: Figures 10, 11, and 12 are not drawn to scale. They are meant only to give a general understanding of the effect of changing the various filter controls.

CW OPERATION

The MSB-1 Audio Filter provides superb CW operation. It is recommended that the MSB-1 controls be preset as follows:

Lowpass Filter	Frequency	Maximum
Bandpass Filter	BPF Switch	IN
	Frequency	12 O'clock
	Selectivity	9 O'clock
Notch Filter	Frequency	Minimum
	Selectivity	Maximum

Turn the Tunable Lowpass Filter control counterclockwise until you notice a drop in the amplitude of the desired CW signal. Turn the lowpass frequency control slowly clockwise until the desired CW signal is at its original level. This must be done carefully due to the steep skirts of the lowpass filter.

Turn the Tunable Bandpass Filter frequency control until the desired CW signal is peaked. The selectivity control can be turned clockwise to further reduce the band of frequencies passed if needed. It is recommended that the selectivity control be increased only to the point necessary to provide good copy of the desired signal.

The Tunable Notch Filter can be used to eliminate any interfering CW signal that might remain. Tune the frequency control until the interfering CW signal is removed. It is recommended that the selectivity control remain in the maximum position to insure minimum interaction between the notching of the interfering signal and the reception of the desired signal. It has been our experience that the notch filter is seldom needed during CW reception due to the sharp skirts of the lowpass/bandpass filter combination.

RTTY OPERATION

The MSB-1 can be used to great advantage during RTTY operation. It is recommended that the MSB-1 controls be preset as follows:

Bandpass Filter	BPF Switch	IN
	Frequency	3 O'clock
	Selectivity	Minimum
Lowpass Filter	Frequency	Maximum
Notch Filter	Frequency	Minimum
	Selectivity	Minimum

These settings should provide a convenient starting point.

Adjust the Tunable Lowpass Filter frequency control until there is a noticeable change in the response of the upper RTTY frequency. This should set the cutoff point of the lowpass filter at the upper RTTY frequency.

The Tunable Bandpass Filter frequency control should now be adjusted to pass the upper and lower RTTY frequencies. The selectivity control can be adjusted to lower the bandwidth of the bandpass filter until it just passes the two desired frequencies.

The Tunable Notch Filter frequency control can be adjusted to provide additional rejection on the lower side if needed.

MSB-1 DATA SHEET

FILTERS:

Tunable Bandpass Filter

Fbp = 300 - 3,000 Hz.
Bandwidth - Less than 75 Hz. to Greater than 1,500 Hz.

6-pole fixed highpass filter

Fhp = 300 Hz.
36dB/octave rolloff

Tunable Notch filter

Fnotch = 300 - 3,000 Hz.
Notch depth > 50 dB.

8-pole tunable lowpass filter

Flp = 300 - 3,000 Hz.
48dB/octave rolloff.

AUDIO AMPLIFIER

Po = 1 watt

SEMICONDUCTORS

12 integrated circuits
1 zener diode
4 small signal diodes

INPUT IMPEDANCE

100 K ohms (can be easily changed upon special order)

POWER REQUIREMENTS

12-14 vdc @ 300 ma (maximum audio output)

INPUT - OUTPUT CONNECTIONS

1/4 " phone jacks

EXTERNAL POWER CONNECTION

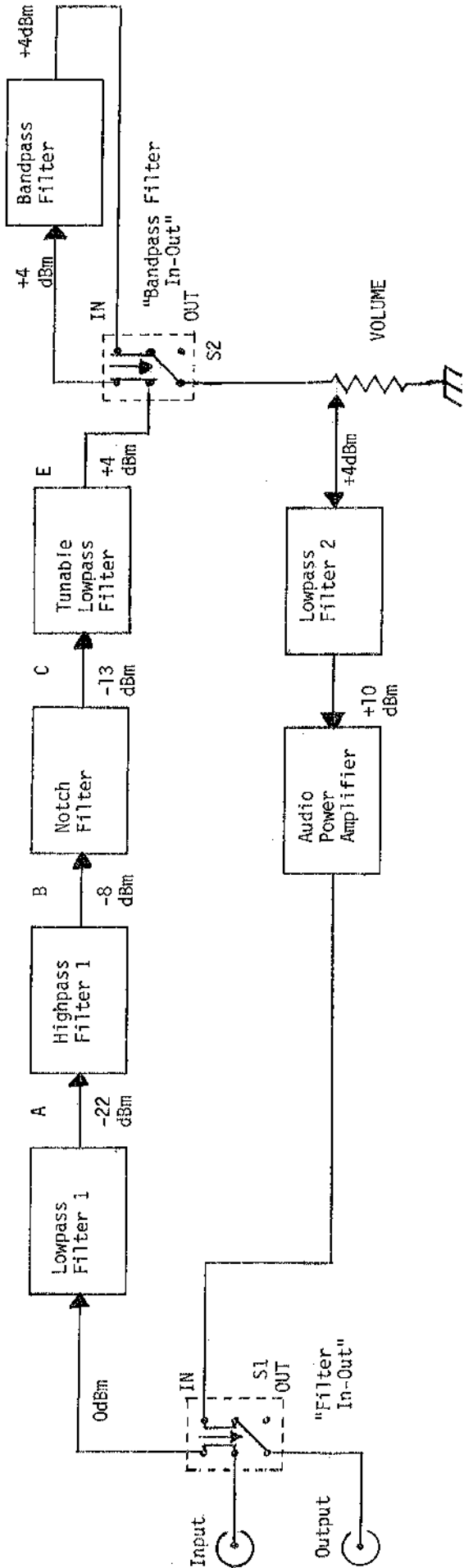
3.5 mm miniature phone jack

SIZE

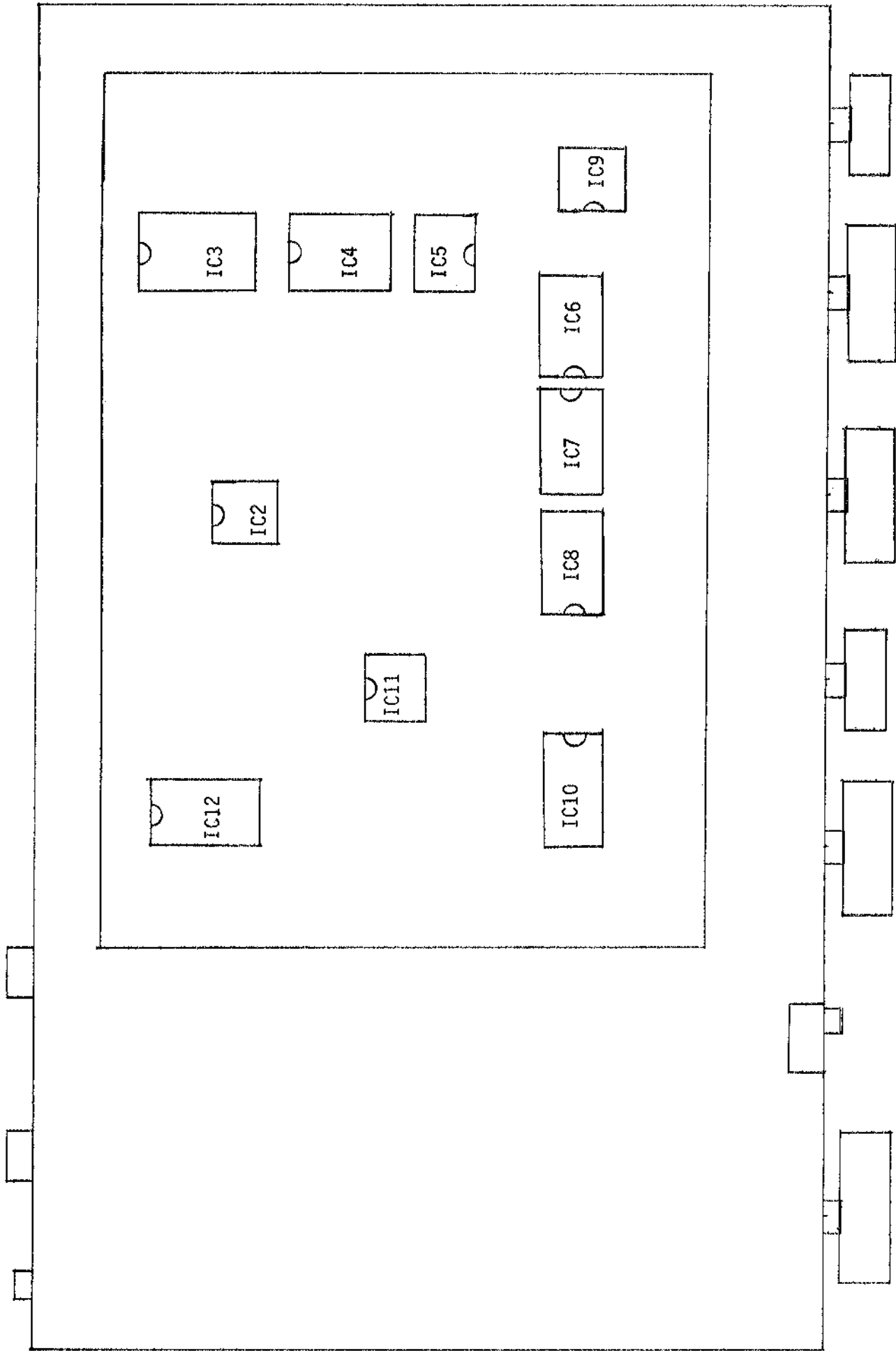
10" W x 3" H x 6" D

COLOR

Silver with black top and lettering



MSB-1 BLOCK DIAGRAM



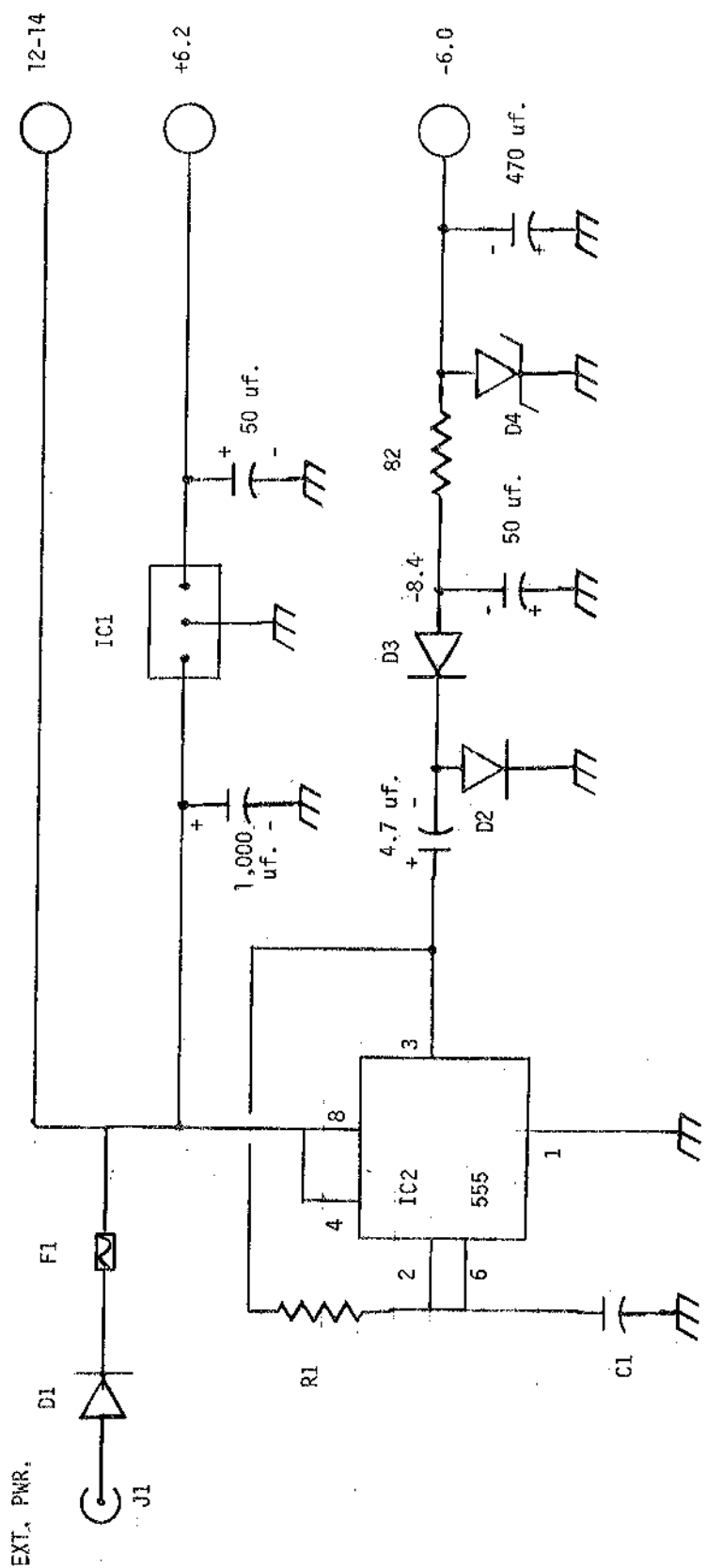
FRONT

POWER SUPPLY - FIGURE 1

The MSB-1 requires an external power source of 12-14 vdc @ 300 ma. The external power is applied to the MSB-1 thru the external power jack on the rear of the unit. Diode D1 protects the unit from a polarity reversal at the input. Fuse F1 provides protection in the event of a component failure resulting in excess current drain. The MSB-1 uses three different voltage levels which are as follows:

- | | |
|--|------------|
| 1. Audio power amplifier and DC-DC converter | 12-14 vdc. |
| 2. Filter circuits | +6.2 vdc. |
| 3. Filter circuits | -6.0 vdc. |

The 12-14 vdc. is supplied thru the external power jack. The +6.2 volts is obtained from the 12-14 vdc line with a three terminal fixed IC voltage regulator (IC1). The -6.0 volts is obtained thru a DC-DC converter composed of IC2 and associated components. IC2 is a NE555 timer configured to function as an astable multivibrator with a frequency of approximately 10 KHz. Resistor R1 and capacitor C1 set the frequency of the astable multivibrator. The output of the astable multivibrator is (pin 3) fed to a full wave rectifier/filter composed of diodes D2-D3 and a 50 uf. capacitor. The 82 ohm resistor and zener diode D4 limit the output voltage to -6.8 volts to insure that the maximum ratings of the ICs used in the filter circuits are not exceeded by the combination of the +6.2 vdc and -6.0 vdc supply lines.



($V_{in} = 13.6$ vdc
at the external
power jack)

- D1
- D2-D3
- D4
- IC1
- IC2
- C1
- R1
- J1
- F1

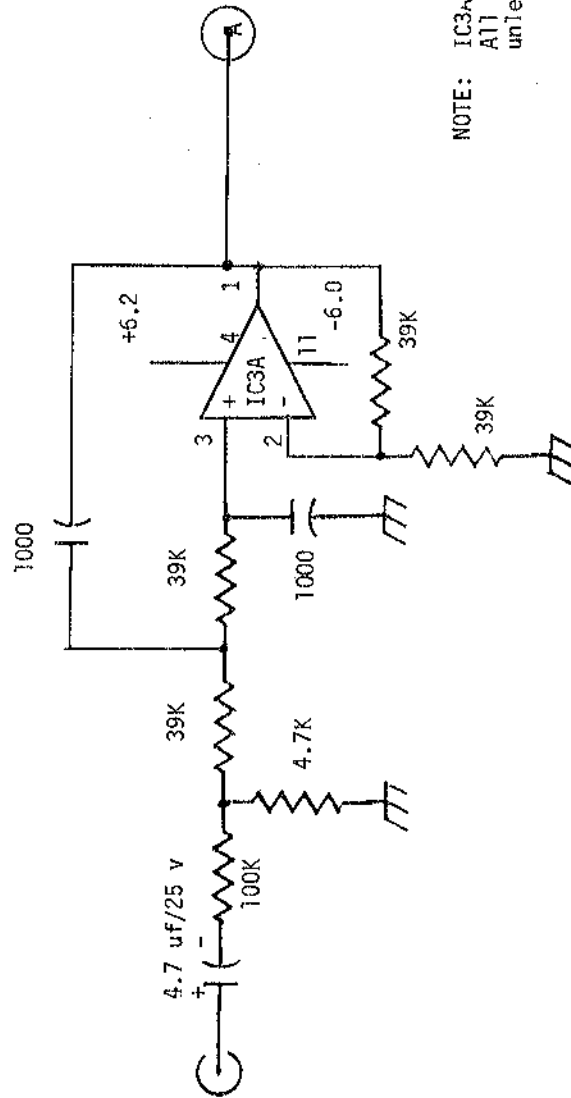
- 1N4001
- 1N4148
- 1N4736 A, 6.8 volt, 1 watt
- MA78L06CLP
- NE555
- 1000 pf, polystyrene, 5%
- 68K, $\frac{1}{4}$ watt, 5%
- 3.5 mm miniature phone jack
- $\frac{1}{4}$ amp, fast blow

FIGURE 1
8/28/80

POWER SUPPLY

FIXED LOWPASS FILTER 1

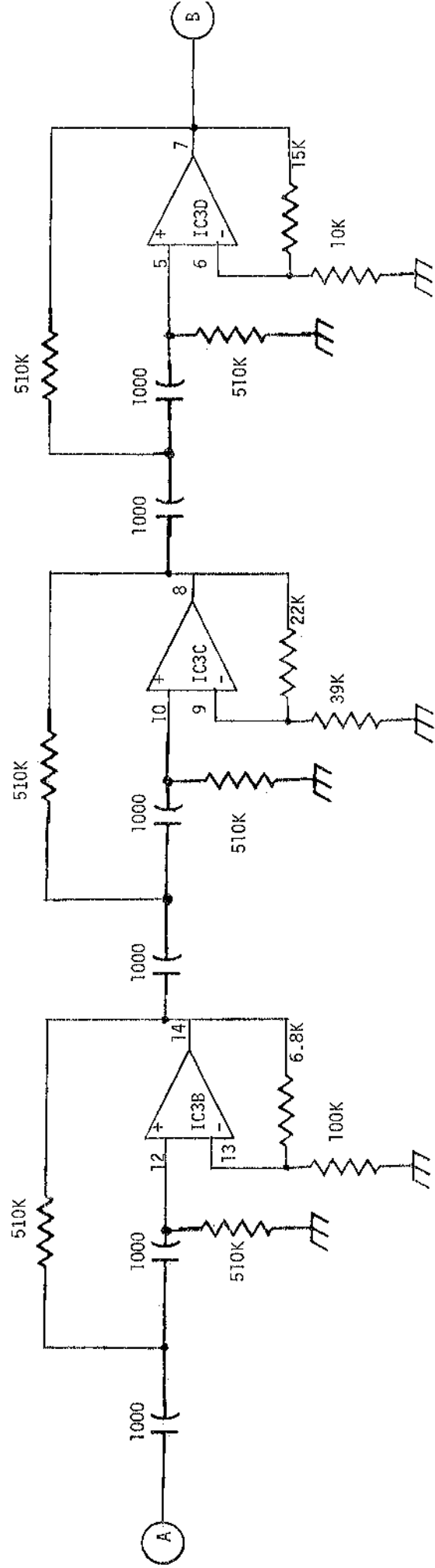
Fixed lowpass filter 1 is a voltage controlled voltage source (VCVS) lowpass filter with a -3 dB cutoff frequency of 5,000 Hz. Resistors R2 and R3 form a voltage divider to reduce the input signal to a level that will not saturate the following active filters. The filter attenuates signals above 5Khz. to limit any mixing with the oscillator in the tunable lowpass filter control circuit. This stage has 22 dB of attenuation from the input jack to the output of the lowpass filter.



NOTE: IC3A $\frac{1}{2}$ - LM324N
All capacitors in picofarad unless marked otherwise.

FIGURE 2
8/28/80

FIXED LOWPASS FILTER 1



FIXED HIGHPASS FILTER

This filter is a 6-pole butterworth VCVS highpass filter with a -3 dB cutoff frequency of approximately 300 Hz. This filter attenuates interference such as AC hum. This stage has 14 dB of gain.

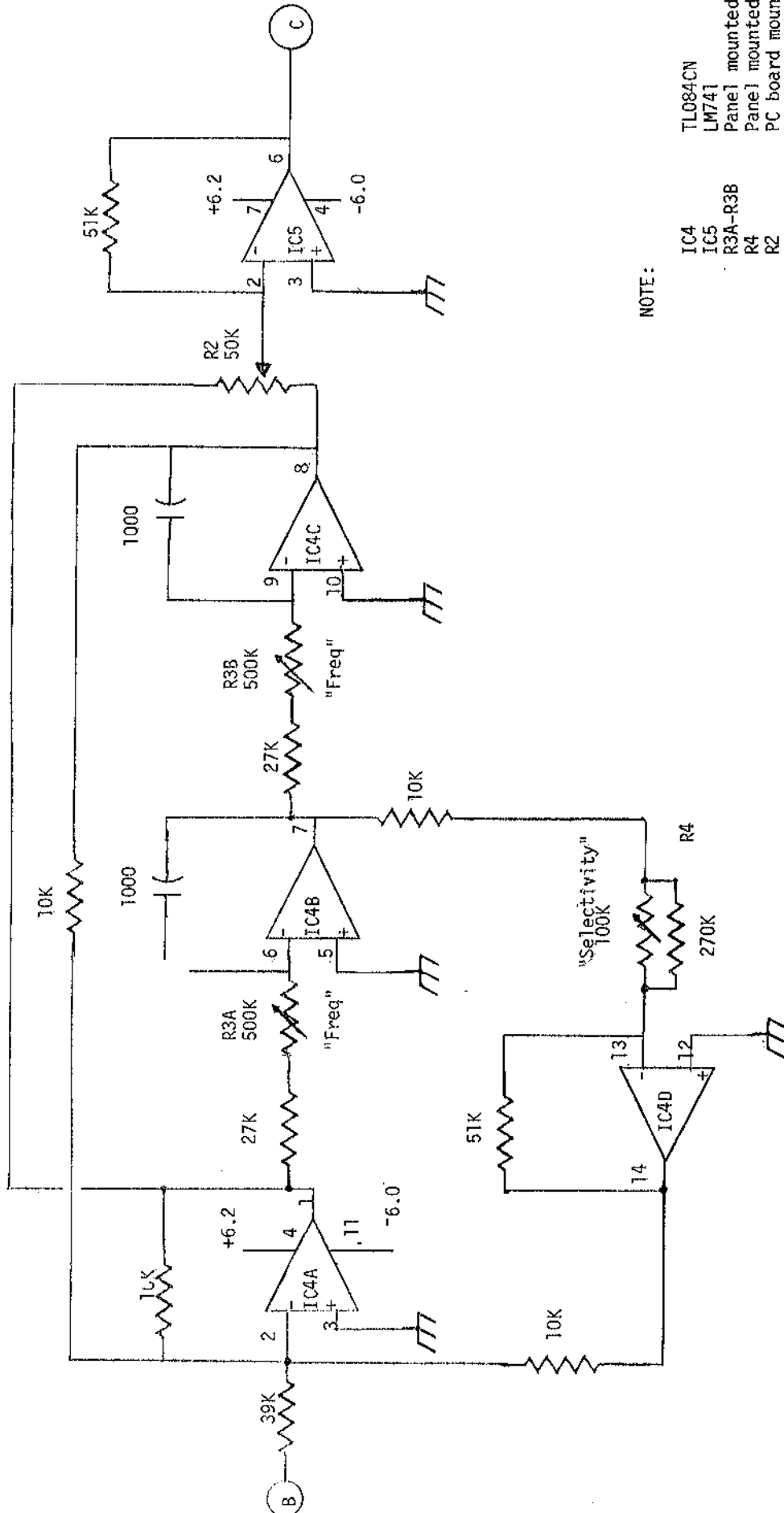
NOTE: IC3B-IC3D $\frac{1}{4}$ - LM324N

FIXED HIGHPASS FILTER

FIGURE 3 8/28/80

TUNABLE NOTCH FILTER

The tunable notch filter is designed around the basic state variable filter. The notch function is obtained by summing the lowpass and highpass output in IC5. The notch frequency is varied by tuning dual ganged pot R5. The selectivity is varied by tuning pot R5. The notch depth and frequency response is adjusted by varying printed circuit board mounted trimmer resistor R2. The notch frequency can be varied from 300 Hz to 3,000 Hz.



NOTE:

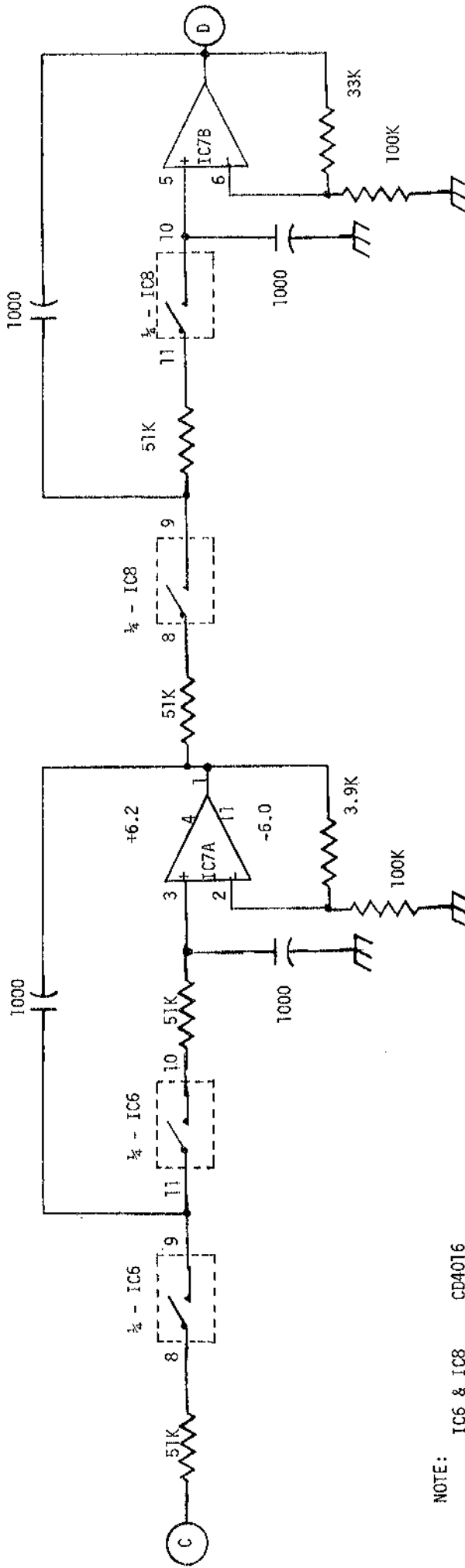
- IC4 TL084CN
- IC5 LM741
- R3A-R3B Panel mounted ganged pot
- R4 Panel mounted pot.
- R2 PC board mounted trimmer.

FIGURE 4
8/28/80

NOTCH FILTER

TUNABLE LOWPASS FILTER

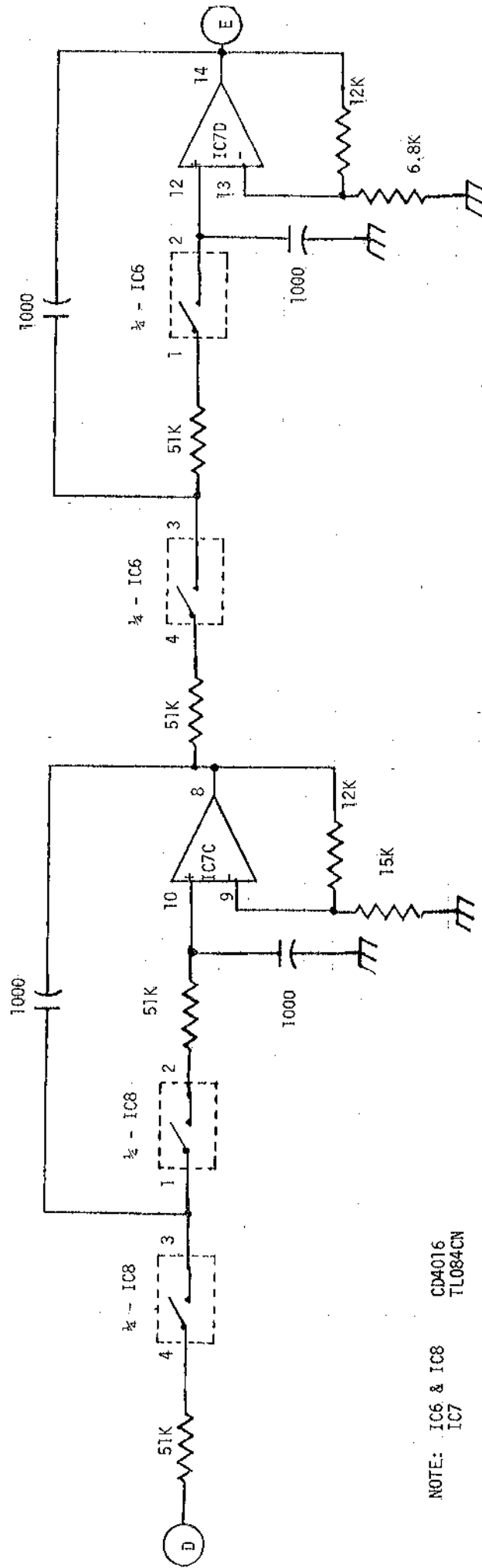
The tunable lowpass filter is an 8-pole butterworth voltage controlled voltage source filter. The -3 dB cutoff frequency is varied by front panel mounted potentiometer R5 (see Figure 7 circuit description for details). The filter is tunable from 300-3,000 Hz. with the filter response dropping off at 48 dB/octave above the -3 dB cutoff frequency. This filter has 17 dB gain.



NOTE: IC6 & IC8 CD4016
IC7 TL084CN

TUNABLE LOWPASS FILTER - STAGES 1 & 2

FIGURE 5 8/28/80

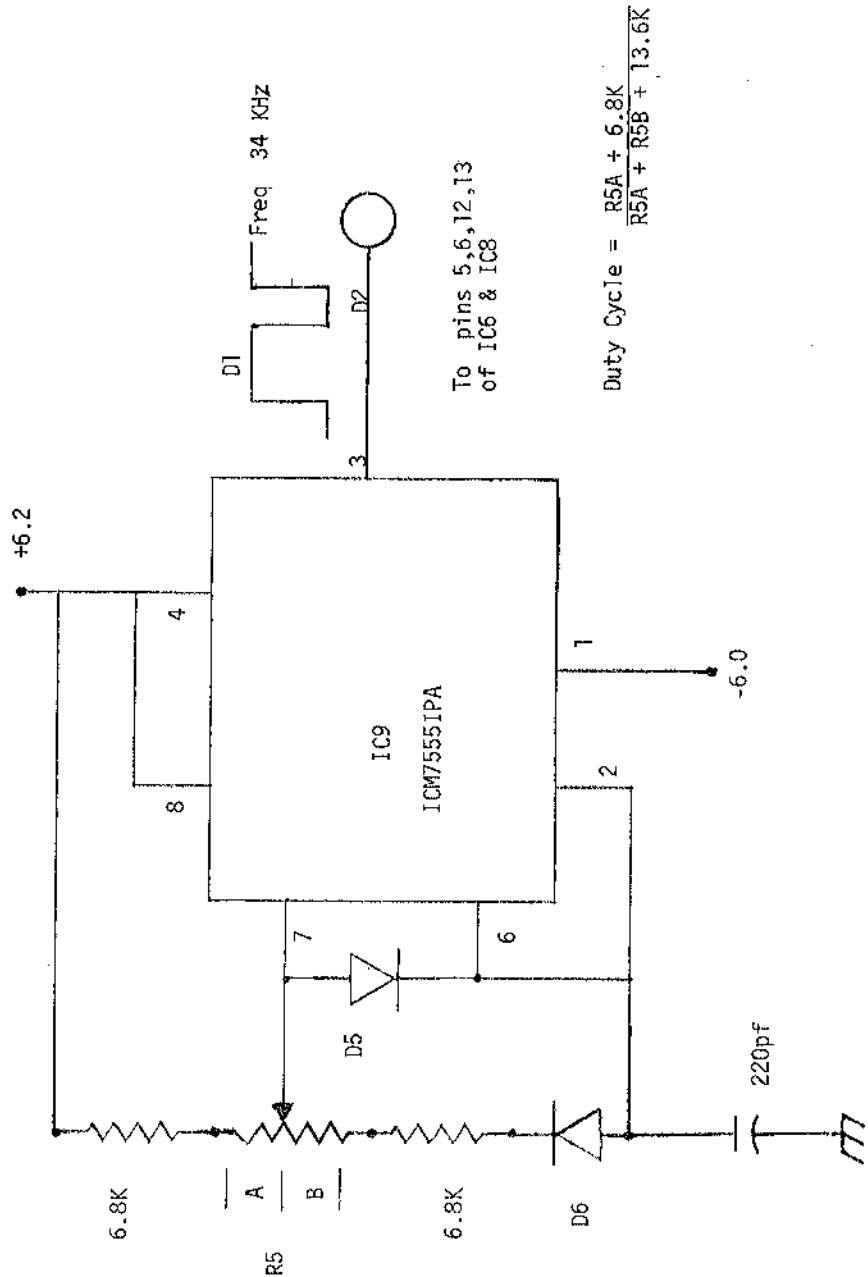


NOTE: IC6 & IC8 CD4016
IC7 TL084CN

FIGURE 6 8/28/80

TUNABLE LOWPASS FILTER CONTROL CIRCUIT

This circuit controls the ± 3 dB cutoff frequency of the tunable lowpass filter by changing the ON/OFF duty cycle of the analog switches that are in series with the 51 K resistors (see Fig. 5 & 6). The average current thru the series connected 51 K resistor and analog switch is varied according to the duty cycle of the control voltage applied to the analog switches. The 51 K resistor will act like a 102 K resistor when the duty cycle is 50%. At a 10% duty cycle it will look like a 510 K resistor. The duty cycle is changed by changing the position of the arm of potentiometer R5. The duty cycle will be 50% with the arm in the center.

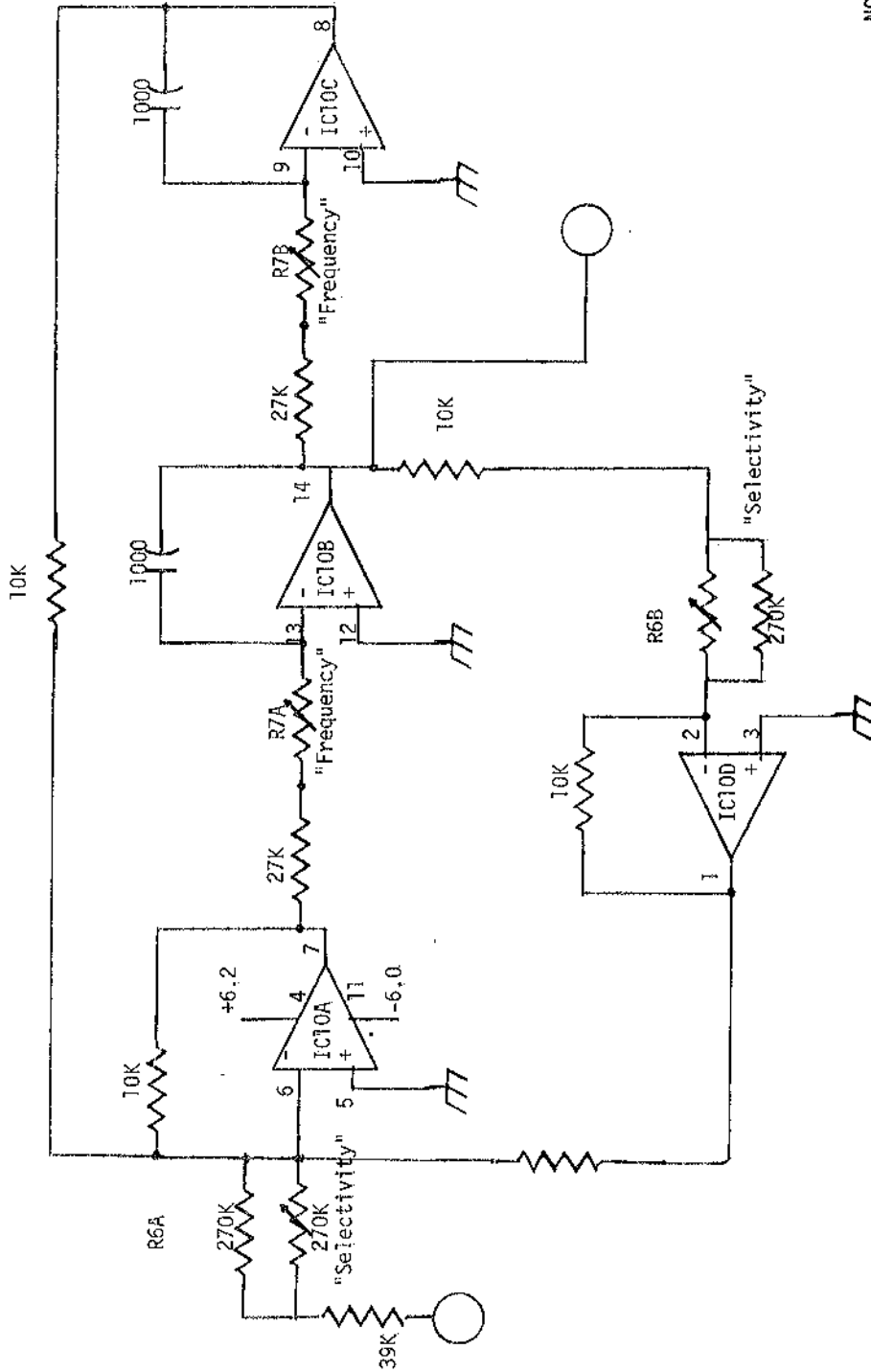


TUNABLE LOWPASS FILTER CONTROL CIRCUIT

FIGURE 7
8-28-80

TUNABLE BANDPASS FILTER

The tunable bandpass filter is designed around the basic state variable filter. The selectivity is variable from less than 75 Hz at 750 Hz to greater than 1500 Hz at 1600 Hz. The gain of the filter is held constant as the selectivity is changed by using a ganged pot for the selectivity control (R6). The frequency is variable from 300 Hz to 3000 Hz by rotating dual control R7. The gain of the filter is fixed at unity.



NOTE: IC10
R6
R7

TL084CN
Panel mounted ganged 500K pot
Panel mounted ganged 500K pot

TUNABLE BANDPASS FILTER

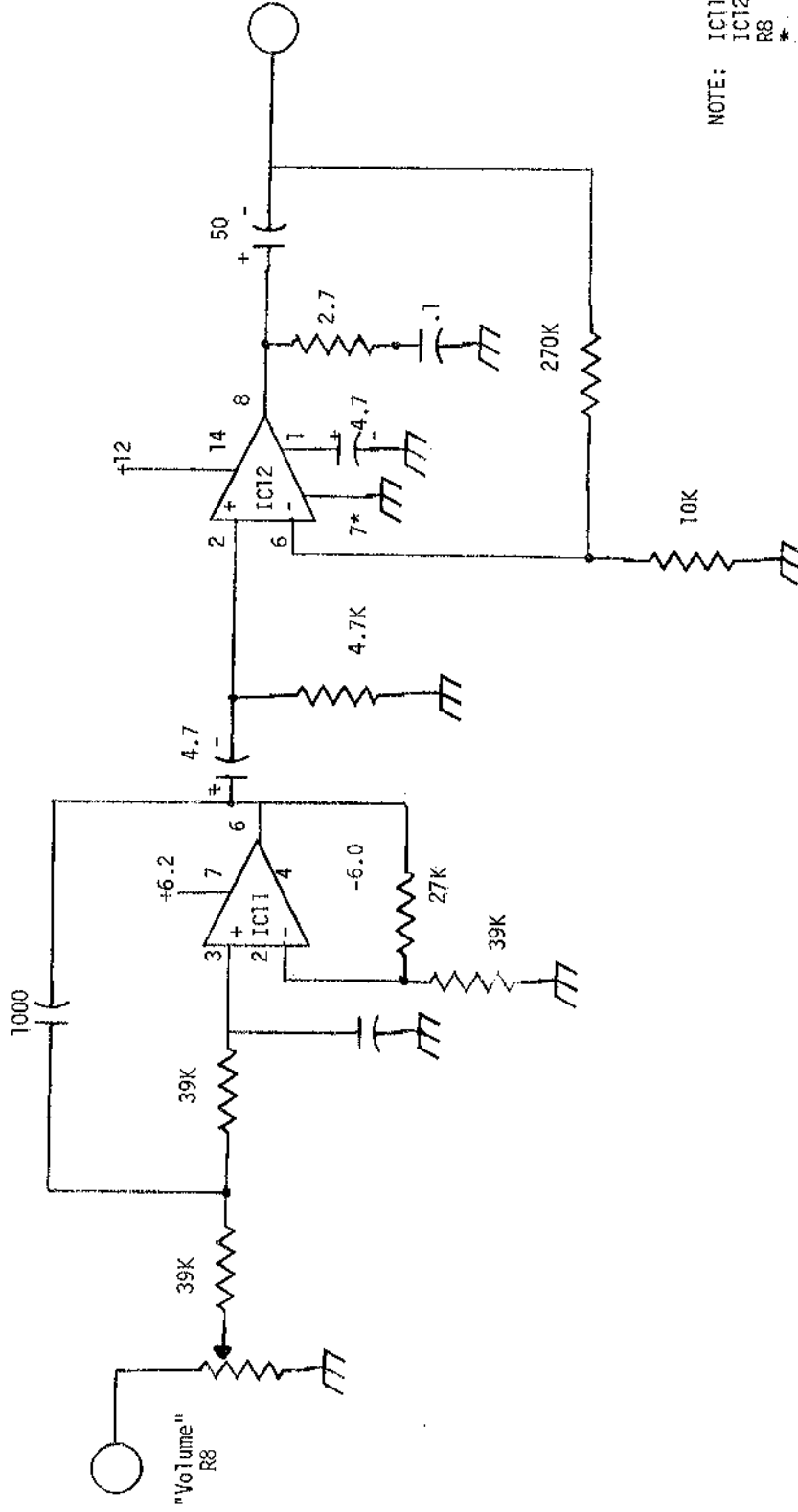
FIGURE 8
8/28/80

LOWPASS FILTER 2 & AUDIO POWER AMPLIFIER

Lowpass filter 2 is a voltage controlled voltage source lowpass filter with a gain of 6 dB. The -3 dB cutoff frequency is approximately 4,000 Hz. The main purpose of this filter is to smooth out switching transients from the tunable lowpass filter and to attenuate any component of the oscillator signal which may have reached this point. The panel mounted potentiometer R8 controls the volume from the audio power amplifier. This potentiometer also has a switch for connecting power to the MSB-1.

The audio power amplifier is based upon a LM380N audio power amplifier IC. This integrated circuit is capable of delivering 2 watts RMS into an 4 ohm load. The gain of the LM380 is reduced by the application of negative feedback from the output to the input via the 270K/10K voltage divider. This feedback enhances the stability and eliminates microphonics which can otherwise occur when this particular IC is used. The amplifier can conservatively deliver 1 watt RMS to an 8 ohm load with low distortion.

LOWPASS FILTER 2 & AUDIO POWER AMPLIFIER



NOTE: IC11
IC12
R8 *

LM741
LM380
Panel mounted 5K pot
Pins 3,4,5,10,
11 & 12 are also
grounded.

FIGURE 9 8/28/80

WARRANTY

M & M Electronics, Inc. warrants this product to be free from defects in workmanship for a period of one year from the date of purchase.

1. The purchaser must retain his dated proof of purchase (cancelled check, bill of sale, etc.). The original proof of purchase or a machine copy must be submitted with the defective product to M & M Electronics, Inc.
2. M & M Electronics, Inc. agrees to repair or replace at M & M Electronics, Inc.'s option without charge to the original owner any defective M & M Electronics product provided the product is returned to M & M Electronics postage prepaid.
3. All products to be serviced should be returned to M & M Electronics, Inc.
P. O. Box 1206
McDowell Lane
Brewton, Al. 36427.
4. A description of the problem must be enclosed with the returned product.