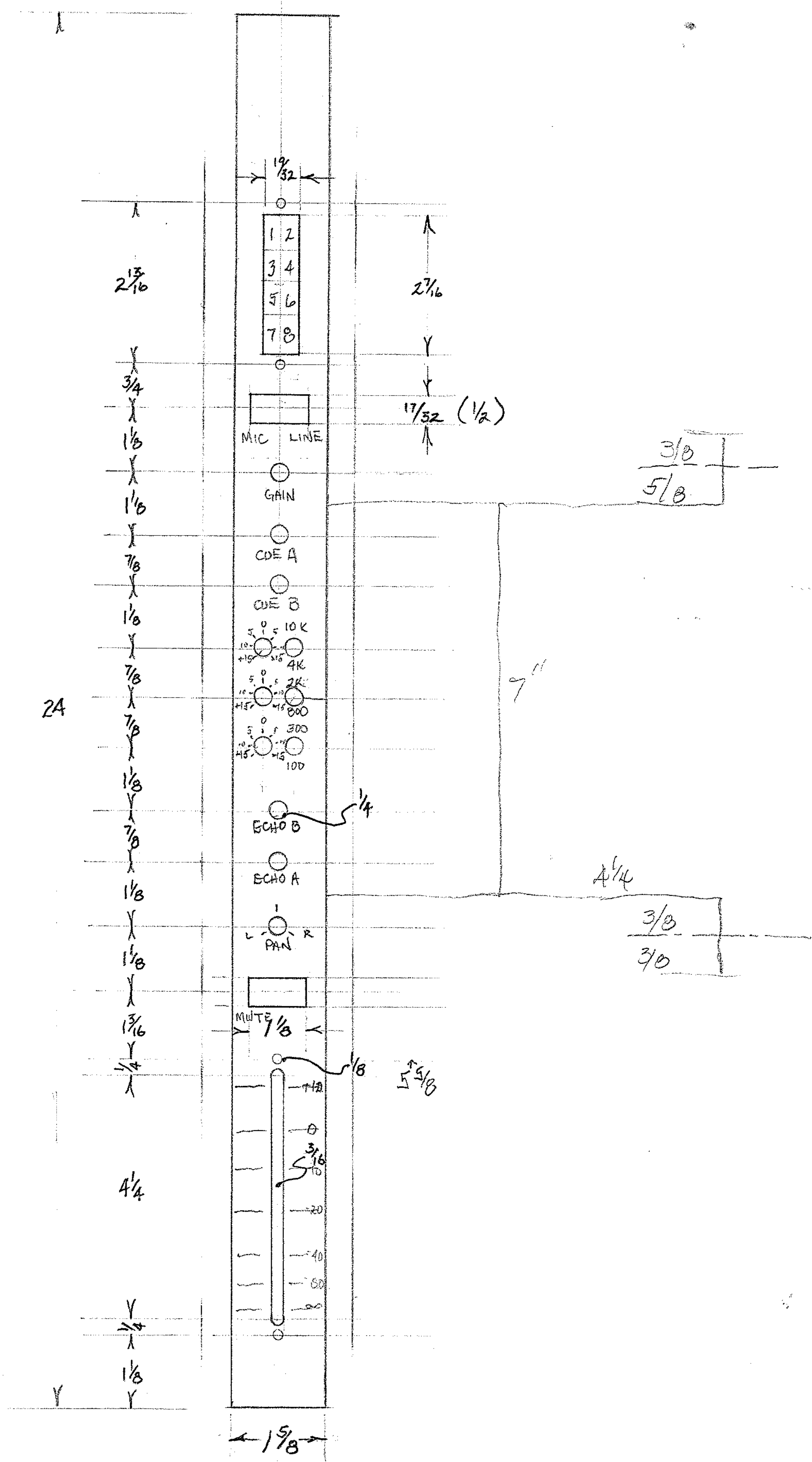
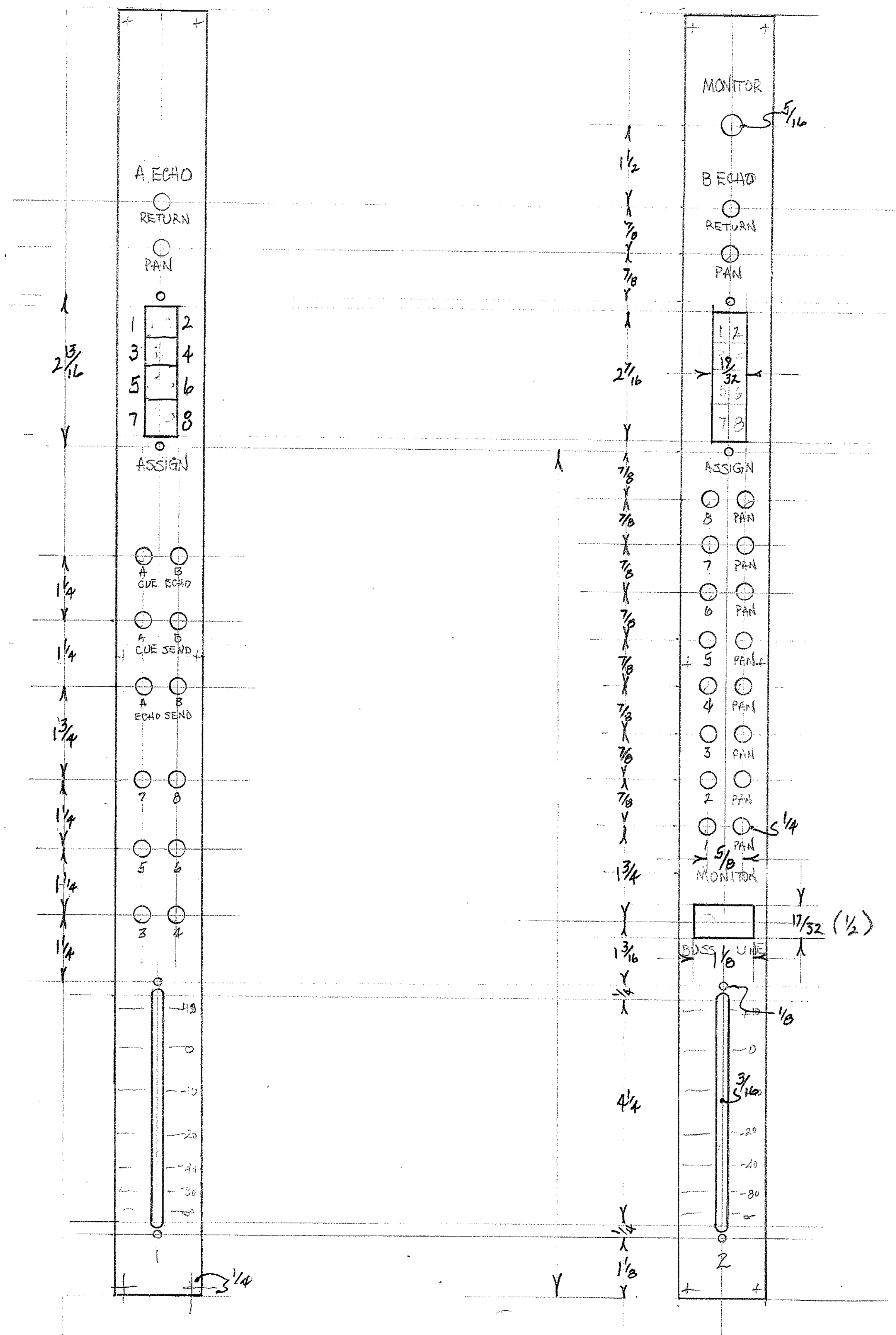
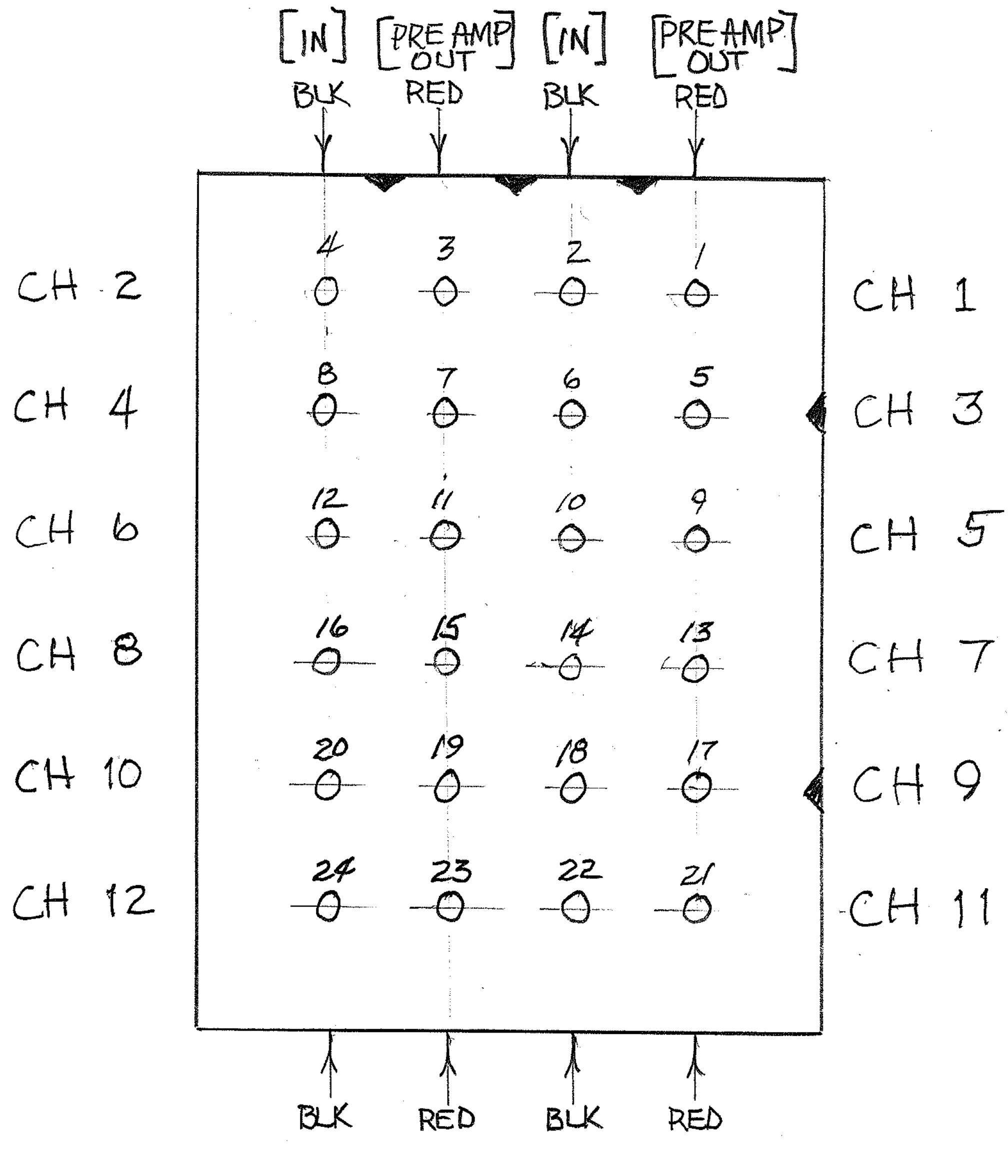


INPUT MODULE SCALE 3/8" = 1"



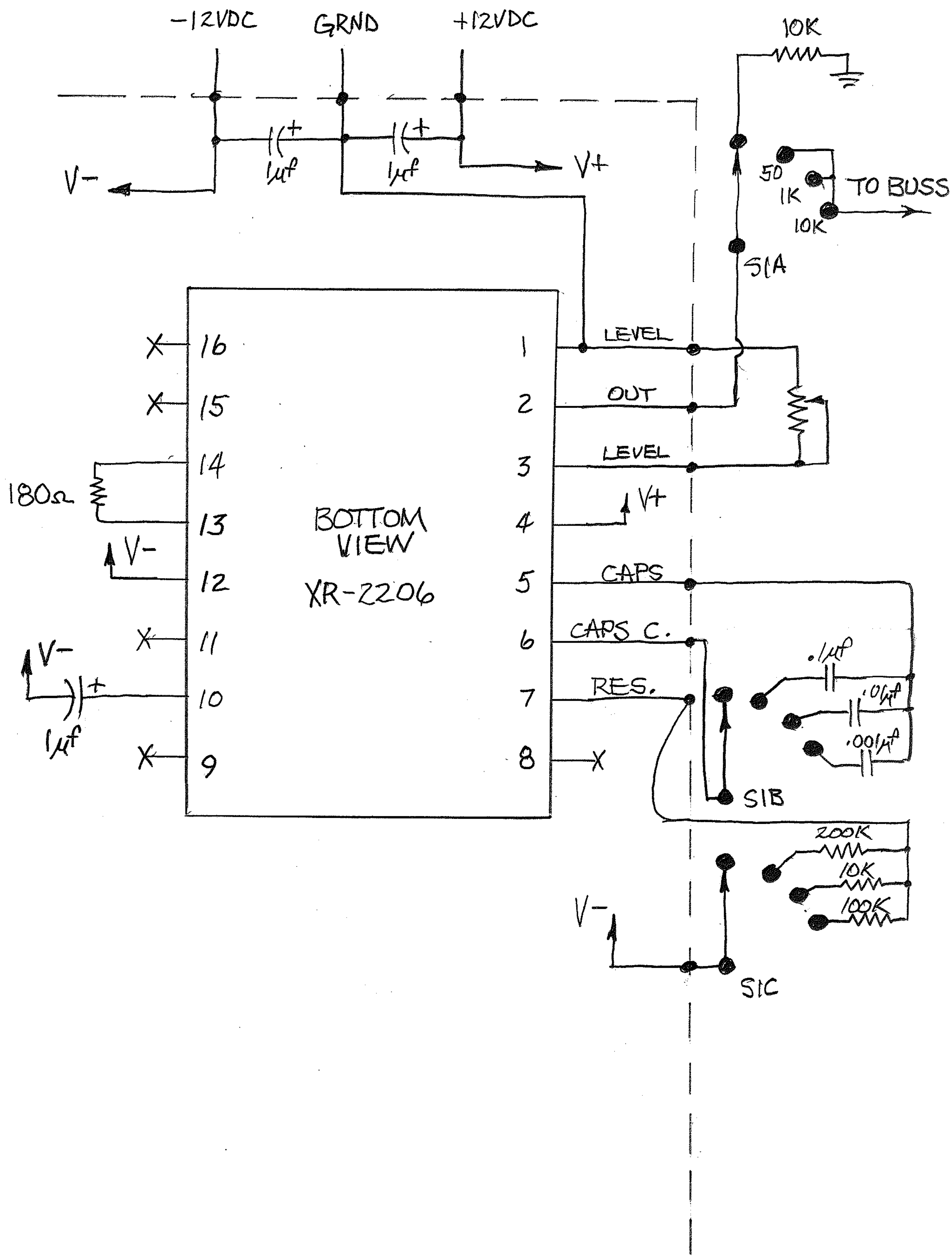
OUTPUT MODULES

CHANNEL PATCH POINTS



MALE CONNECTOR (FR. VIEW)
(FEMALE RE. VIEW)

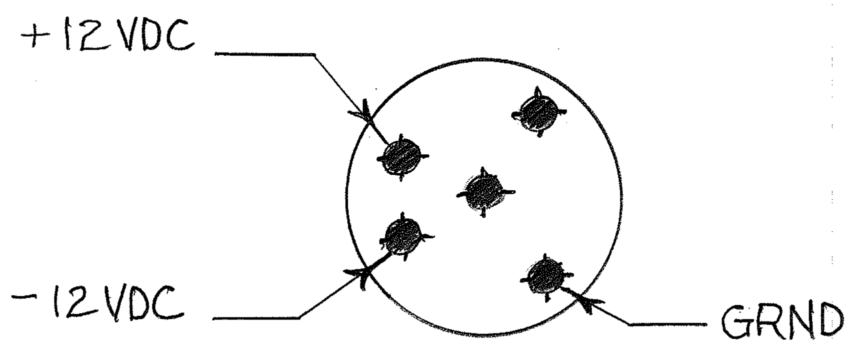
OCSILATOR MODULE



CHANNEL CONNECTOR (1-12)

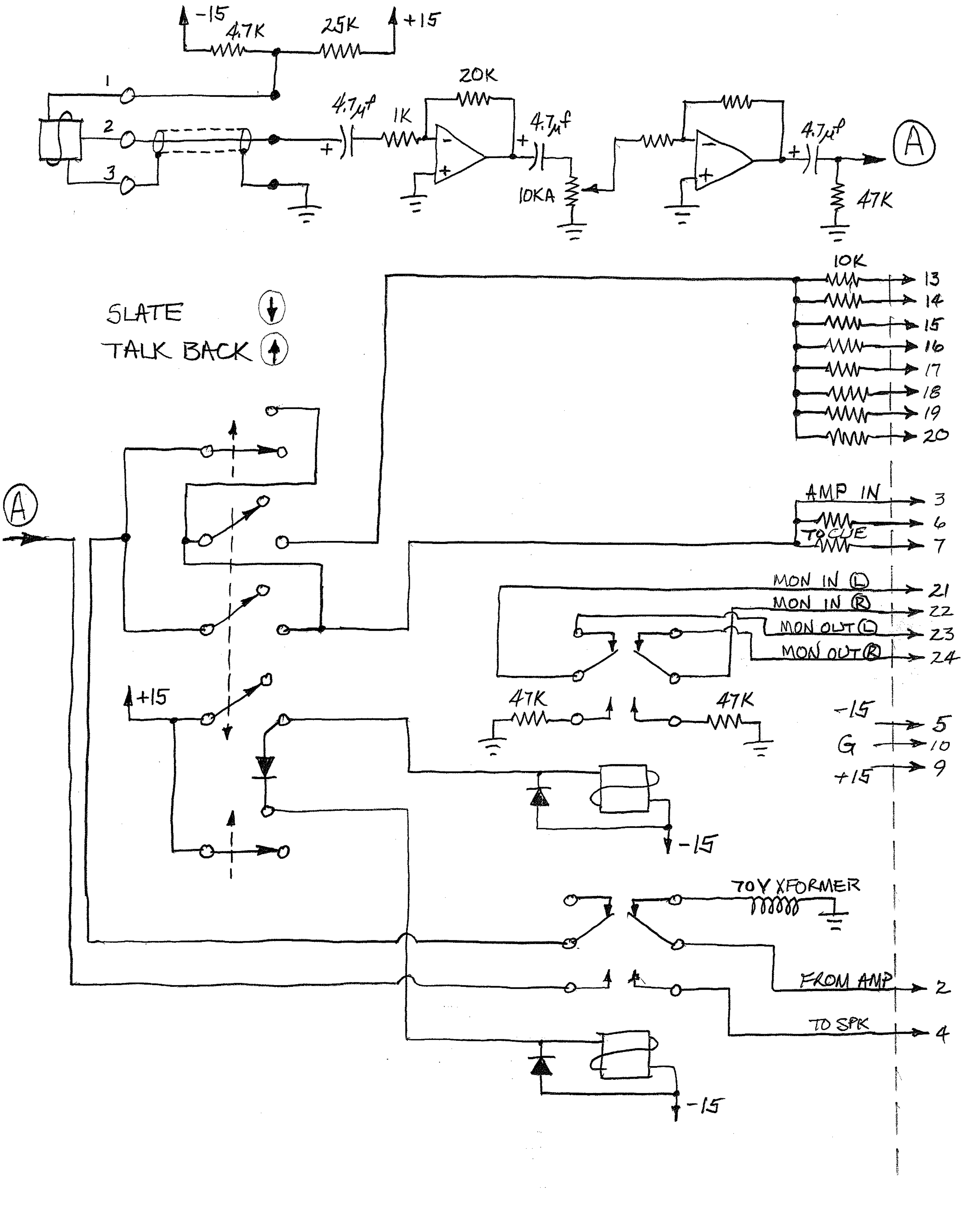
1- SHIELD] MIC GRND
2- RED] MIC LO
3- WHITE] MIC HI
4- LINE IN (WH.)
5- -15 VDC (BLK)
6- CUE SEND A (YL) [PRE-FADER]
7- CUE SEND B (YL) [PRE-FADER]
8- ECHO SEND A (YL) [POST-FADER]
9- +15 VDC (RED)
10- GRND
11- ECHO SEND B (YL) [POST-FADER]
12- * SPARE *
13- BUSS #1
14- BUSS #2
15- BUSS #3
16- BUSS #4 (BLU)
17- BUSS #5
18- BUSS #6
19- BUSS #7
20- BUSS #8
21- PRE AMP OUT
22- PRE AMP IN
23- * SPARE *
24- * SPARE *

DC POWER CONN.

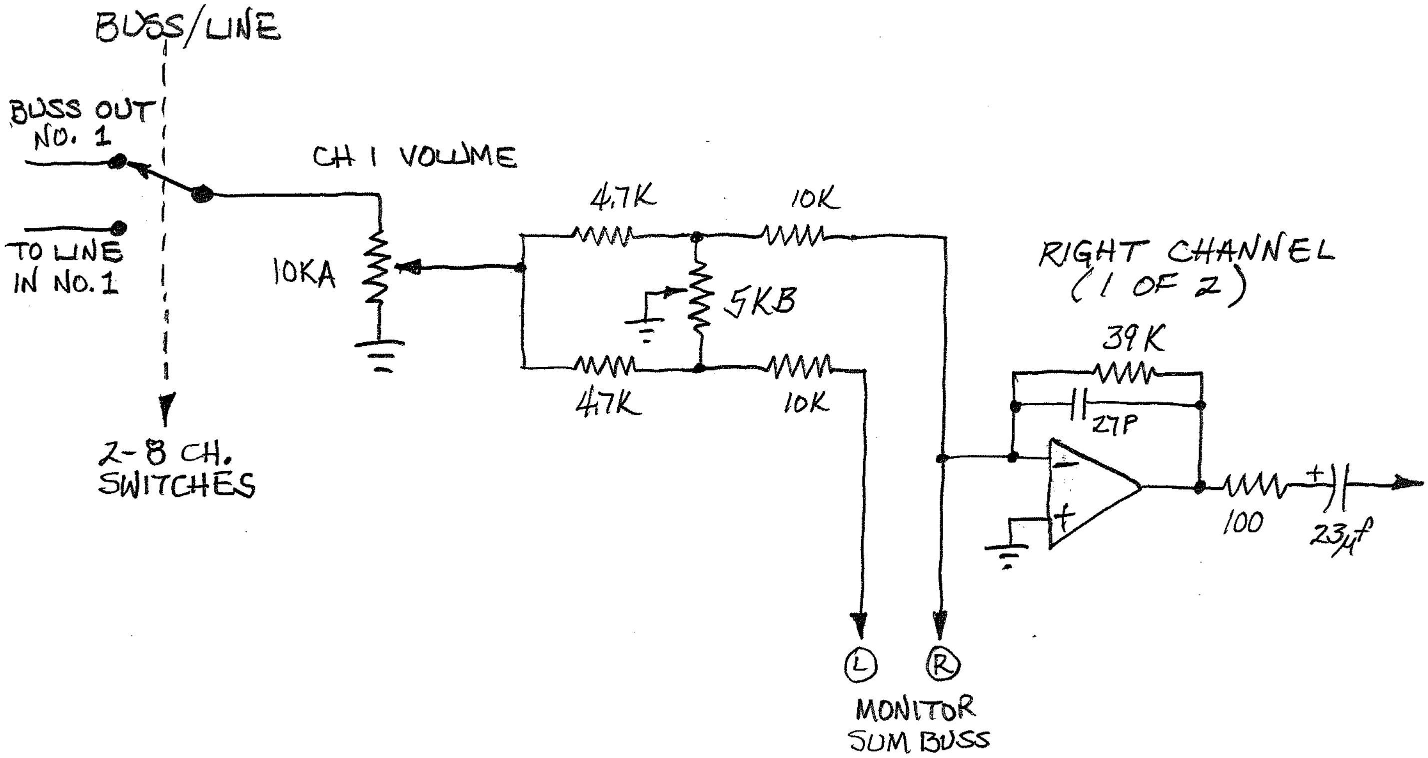


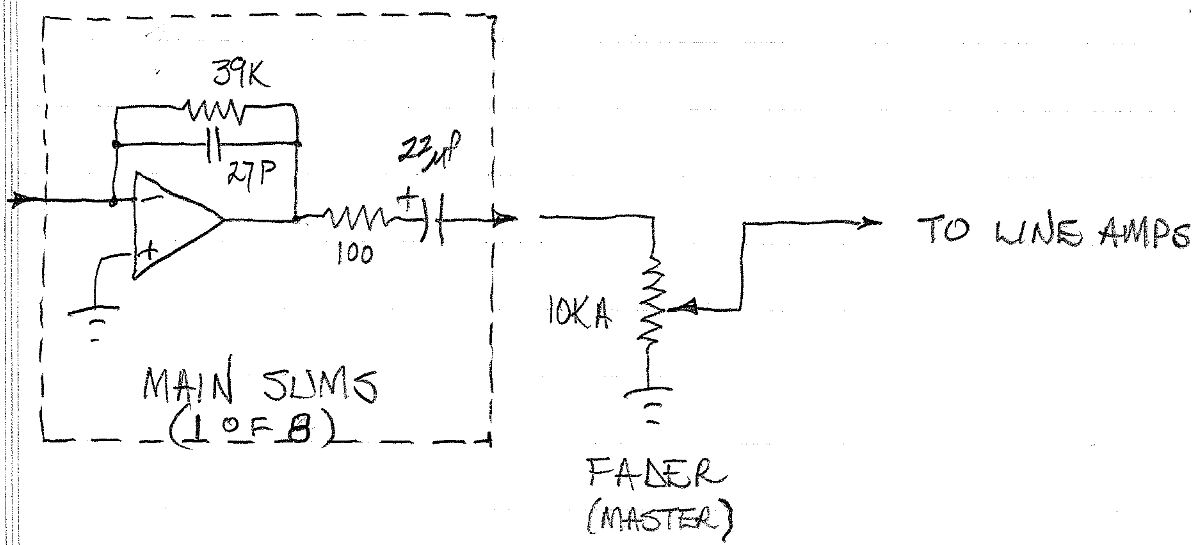
FEMALE CONNECTOR

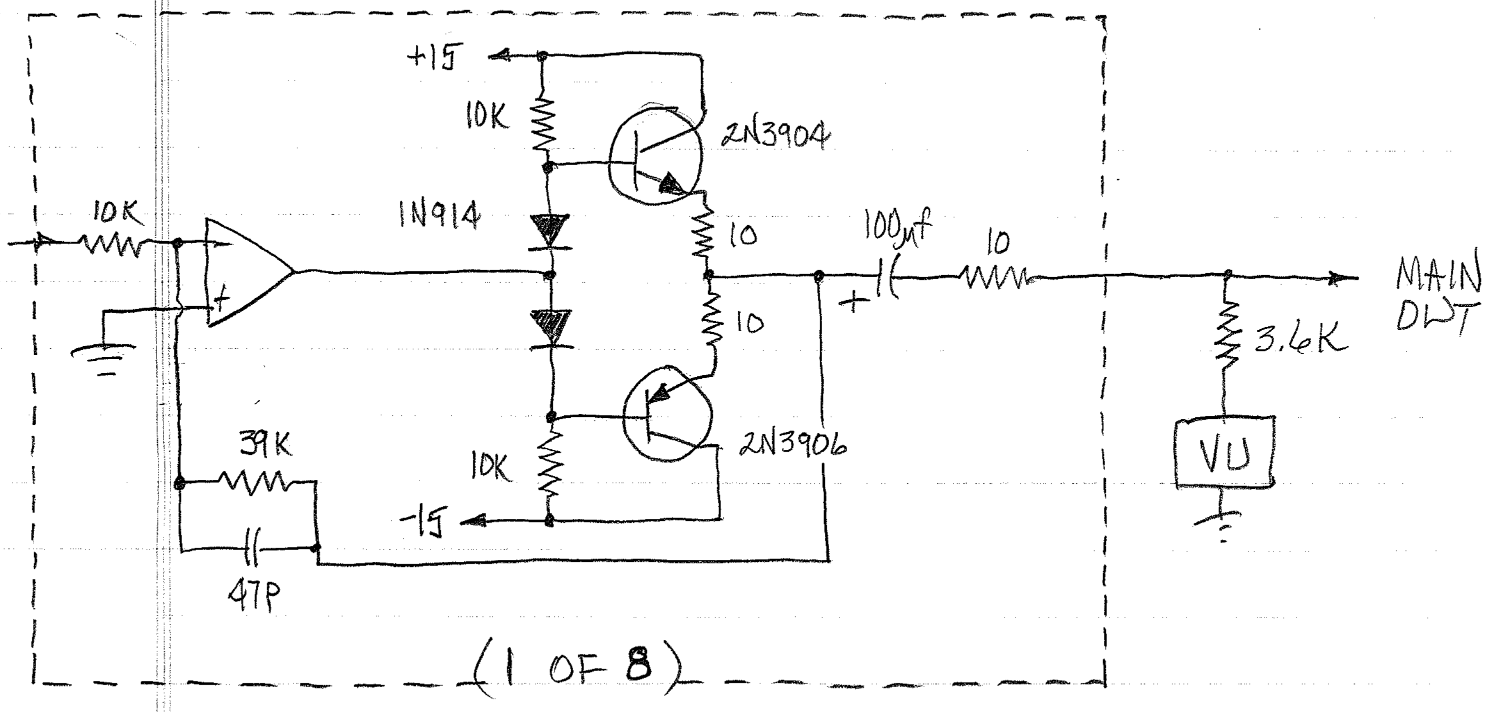
TALK BACK MODULE



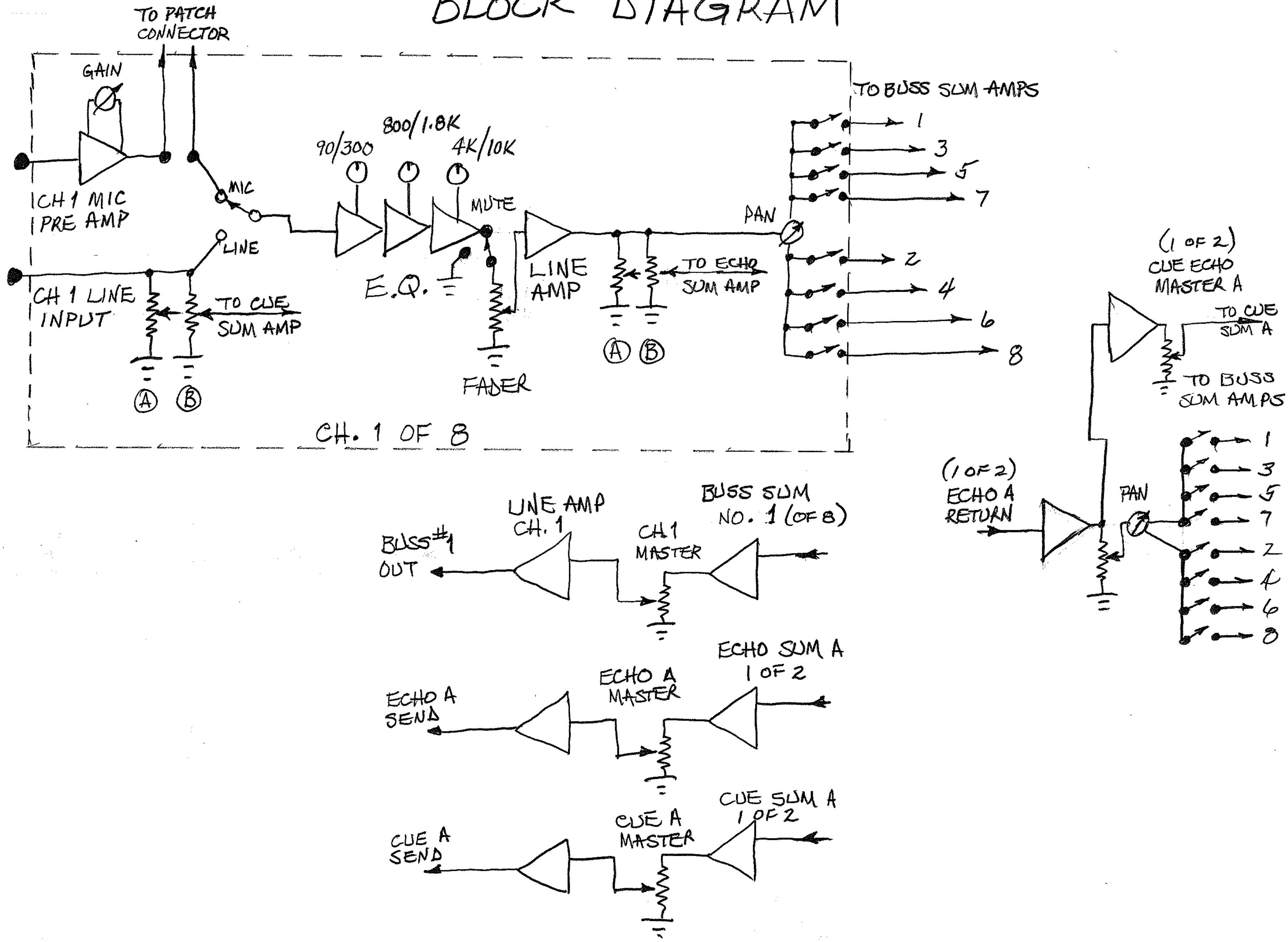
MONITOR SECTION

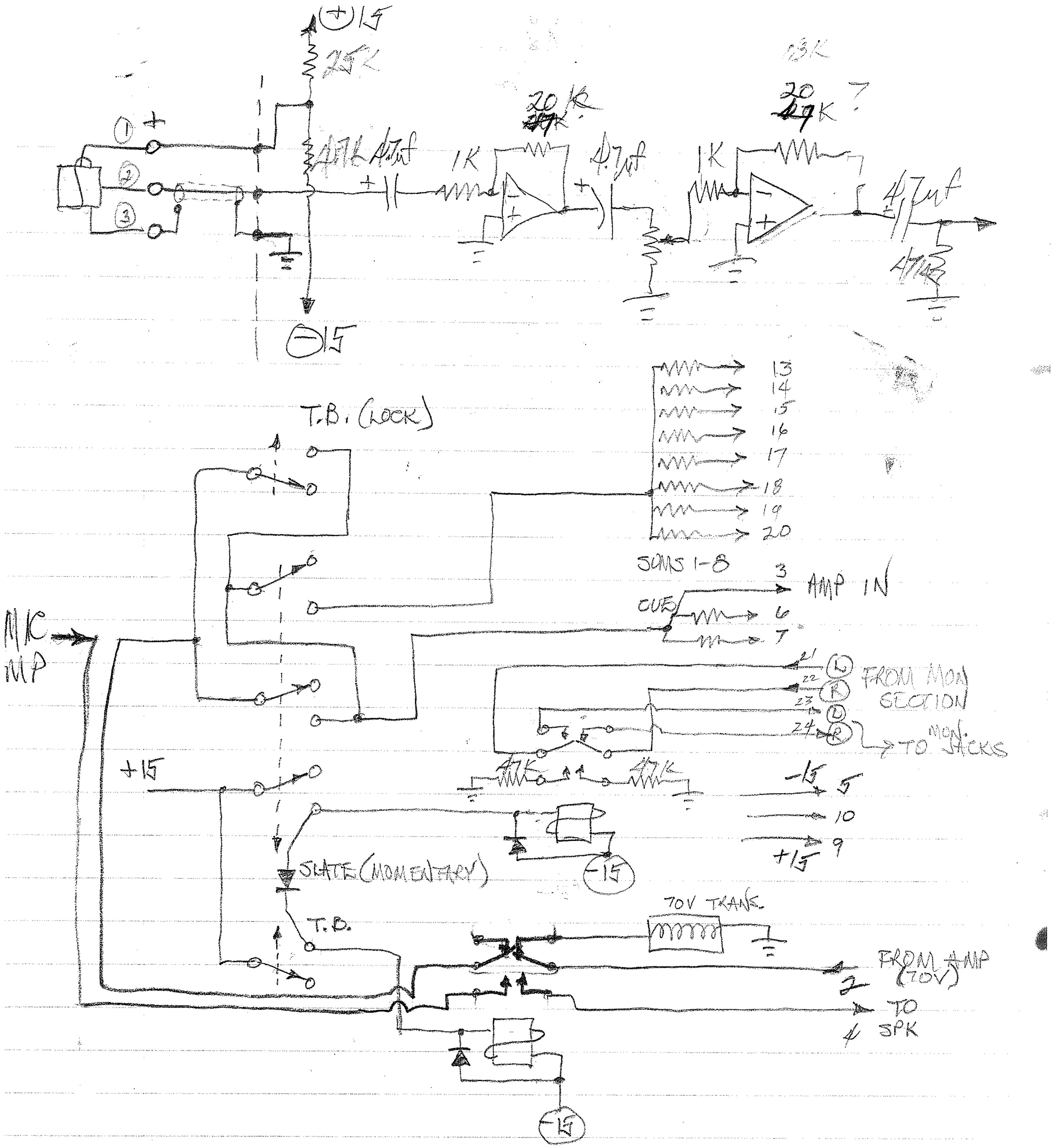



39K
27P
22µf
100
TO LINE AMPS
10KA
MAIN SUMS
(1 OF 8)
FADER
(MASTER)


+15
10K
2N3904
1N914
10K
10
100µf
10
MAIN
OUT
10
3.6K
2N3906
39K
10K
-15
VU
47P
(1 OF 8)

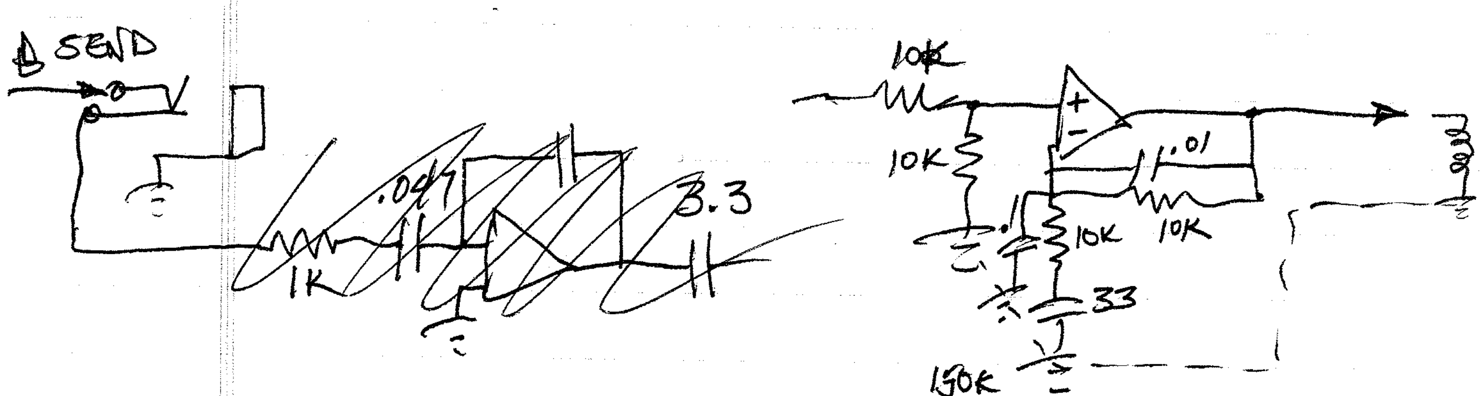
BLOCK DIAGRAM

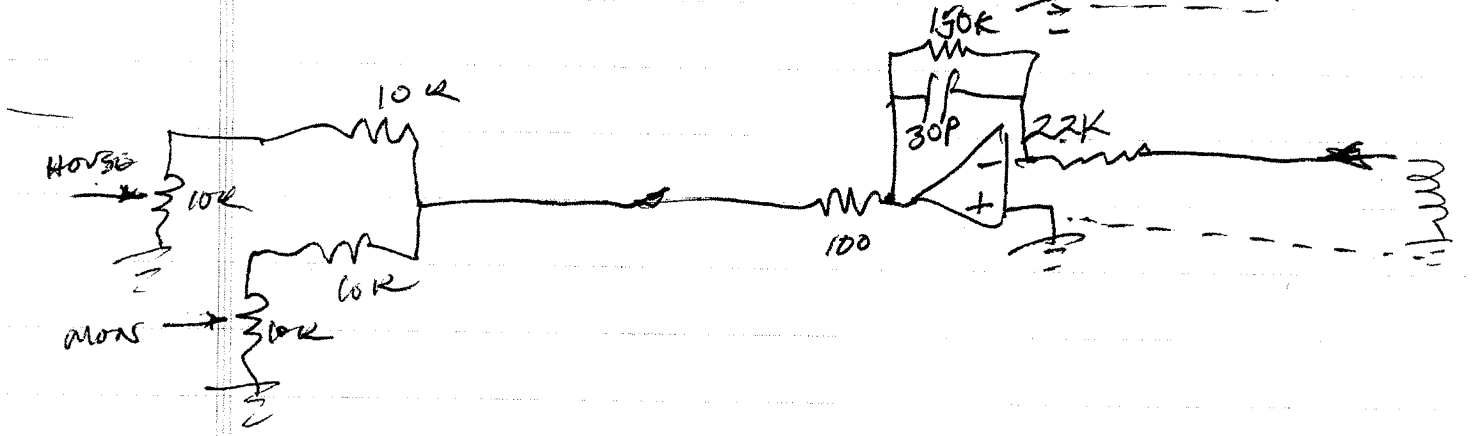


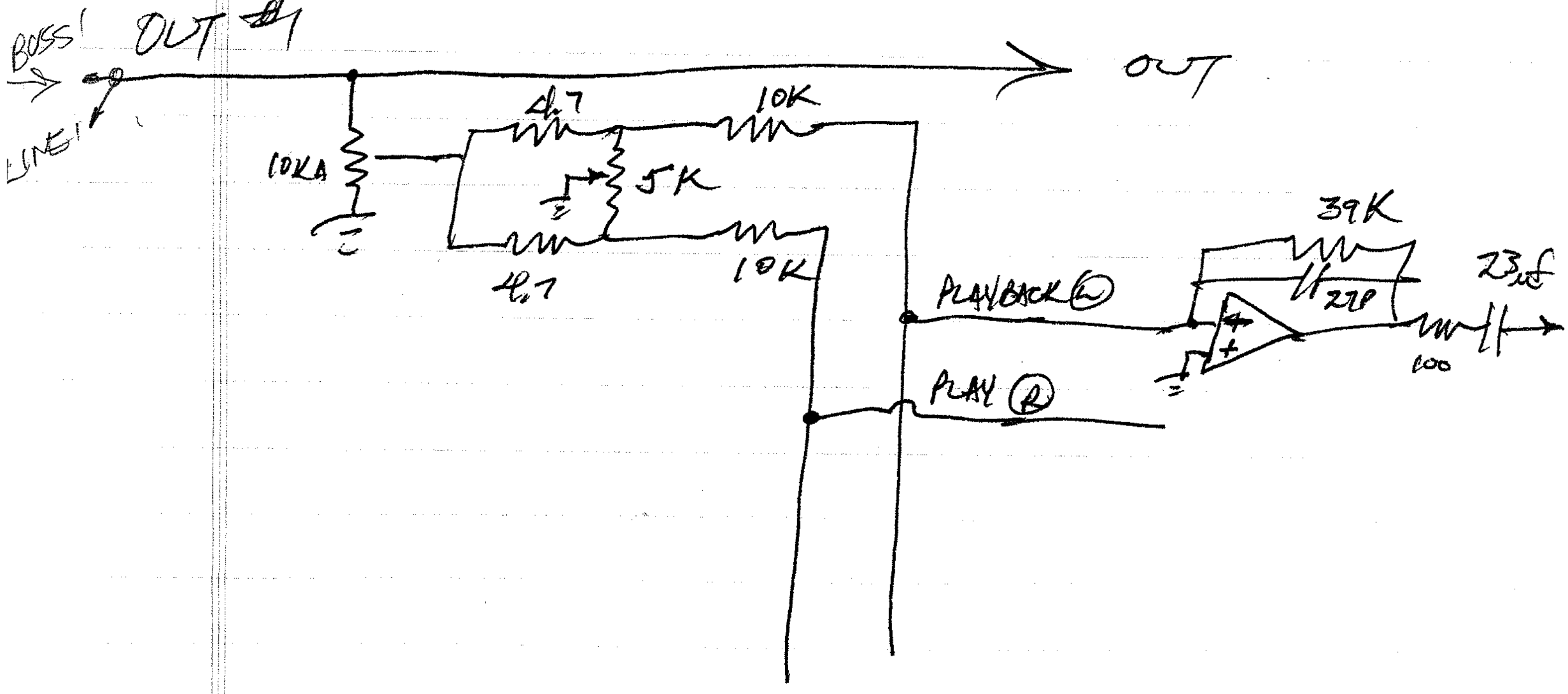


(+)15
25K
1 +
2
3
47K
47uf
1K
20K
4.7uf
1K
20K
4.7uf
47K
(−)15
13
14
15
16
17
18
19
20
SUMS 1-8
T.B. (LOCK)
3
AMP IN
CUE
6
7
MIC
INP
21 L
22 R
FROM MON SECTION
23 L
24 R
TO MON. JACKS
+15
47K
47K
−15
5
10
9
+15
−15
SLATE (MOMENTARY)
T.B.
70V TRANS.
FROM AMP (70V)
2
TO SPK
4
−15

MON. REV. DRIVE



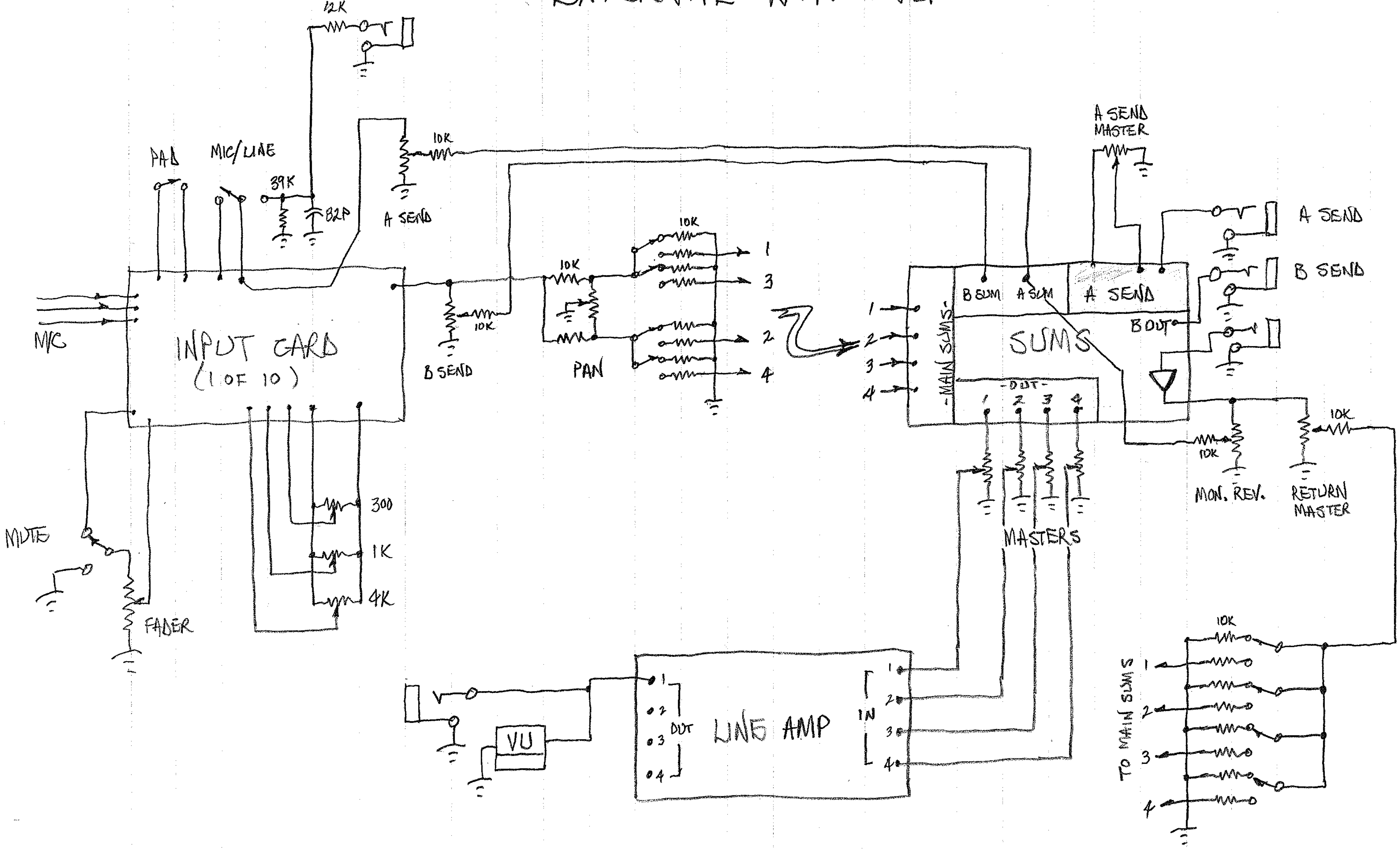


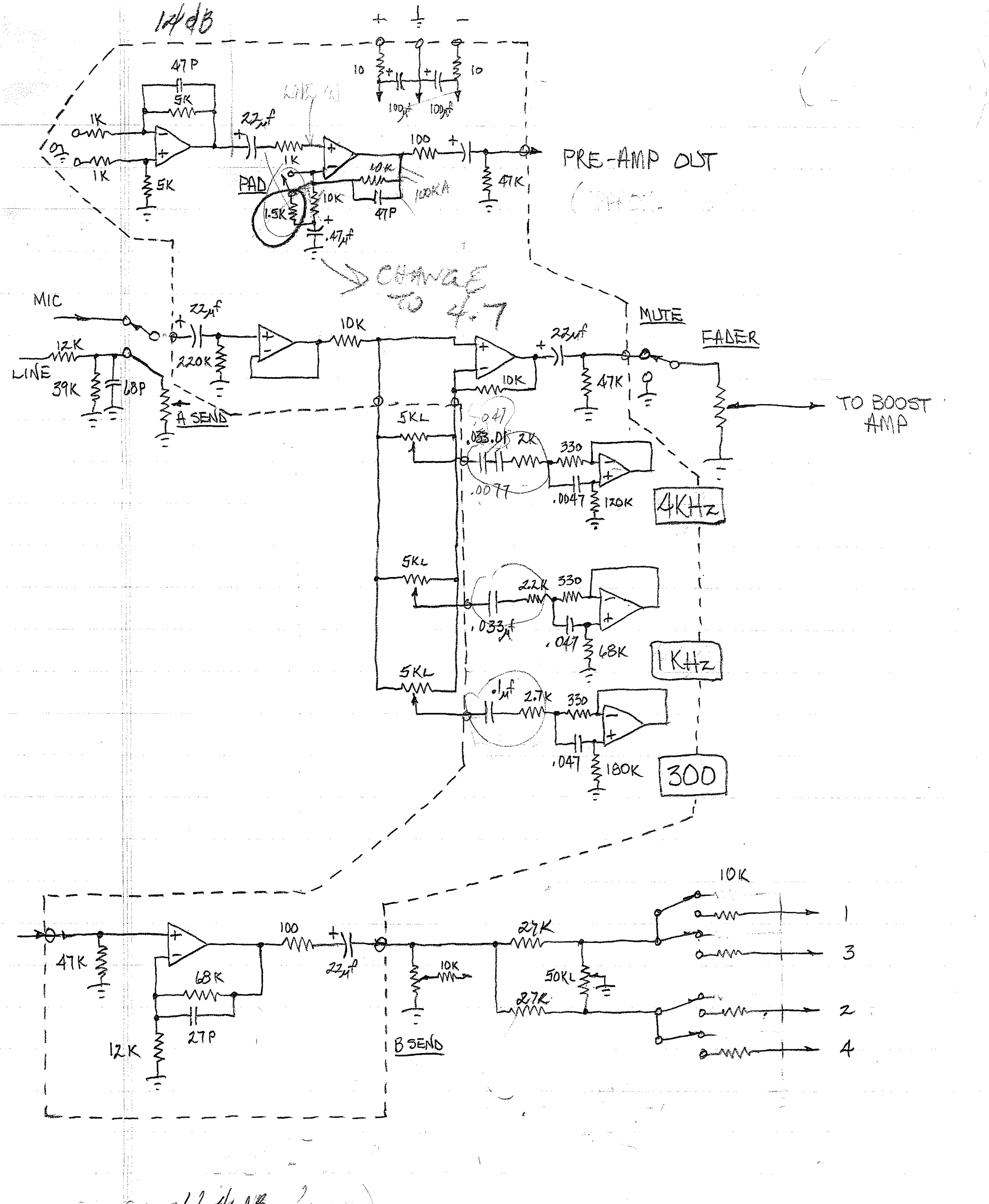


INPUT MODULES

1 SHIELD
2 RED — MIC IN
3 WHITE
4 LINE IN (WH.)
5 -15 (BLK.)
6 PRE-SEND A (YEL.) CUE A
7 PRE-SEND B (YEL.) CUE B
8 POST SEND A (YEL.) ECHO A
9 +15 (RED)
10 GRND (BLK - WH. LEADER)
11 POST SEND B (YEL.) ECHO ~~A~~ B
12 - SPARE -
13 BUSS # 1 (BLUE)
14 " # 2 (")
15 " # 3 (")
16 " # 4 (")
17 " # 5 (")
18 " # 6 (")
19 " # 7 (")
20 " # 8 (")
21 ~~FADER~~ OUT
22 FADER IN

· EXTERNAL WIREING ·

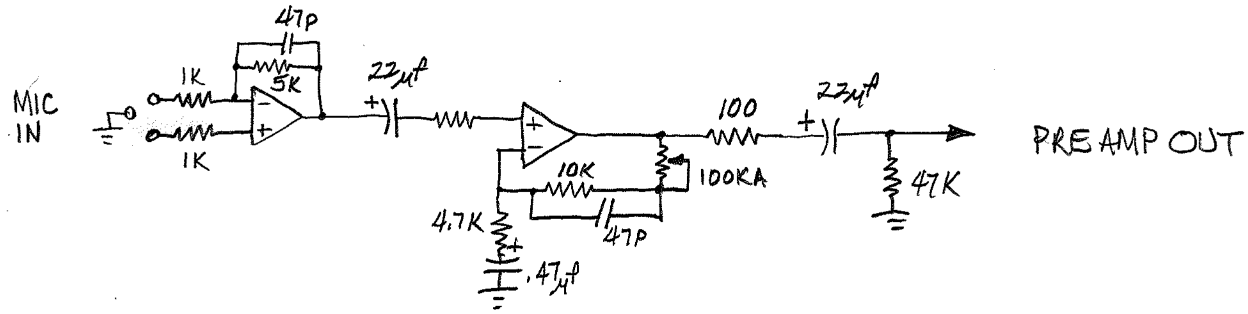


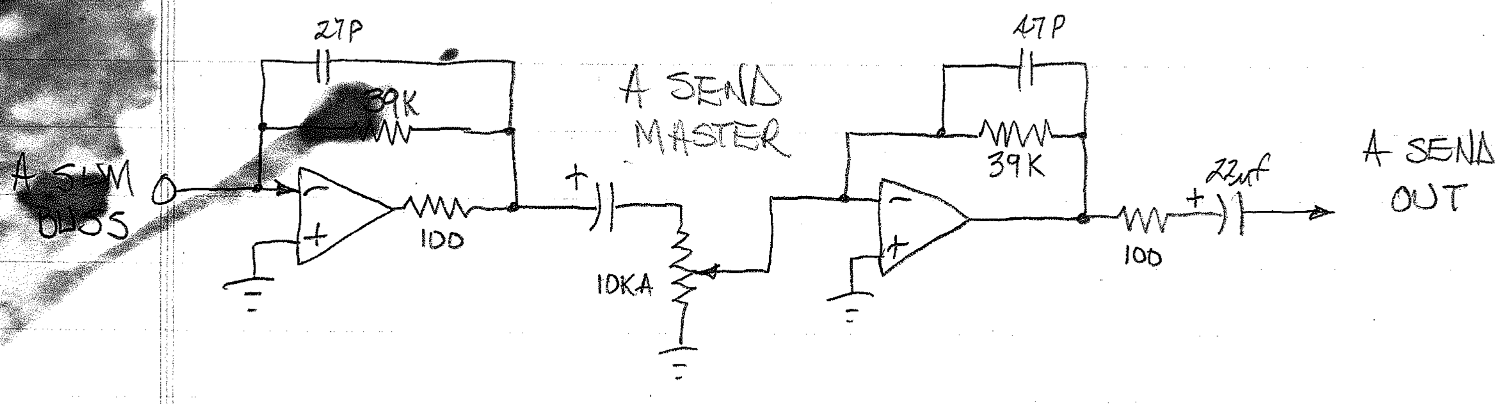


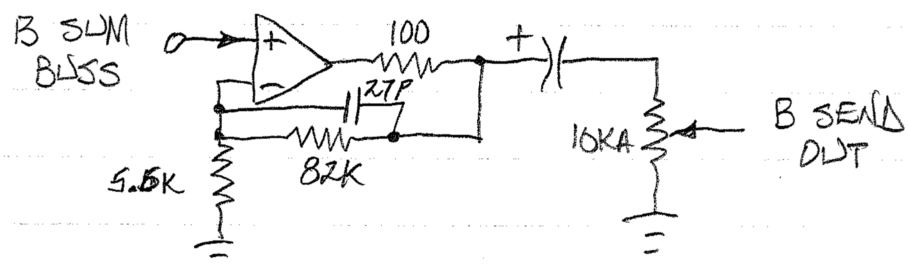
14dB
47P
5K
1K
1K
5K
22µf
1K
PAD
1.5K
10K
.47µf
10K
47P
100KA
100
47K
PRE-AMP OUT
10
10
100µf
100µf
+
-
CHANGE TO 4.7
MIC
LINE
12K
39K
68P
22µf
220K
A SEND
10K
10K
22µf
47K
MUTE
FADER
TO BOOST AMP
5KL
2K
330
.0047
120K
4KHz
5KL
2.2K
330
.033µf
.047
68K
1KHz
5KL
.1µf
2.7K
330
.047
180K
300
47K
68K
27P
12K
100
22µf
10K
B SEND
27K
27K
50KL
10K
1
3
2
4
16.4dB

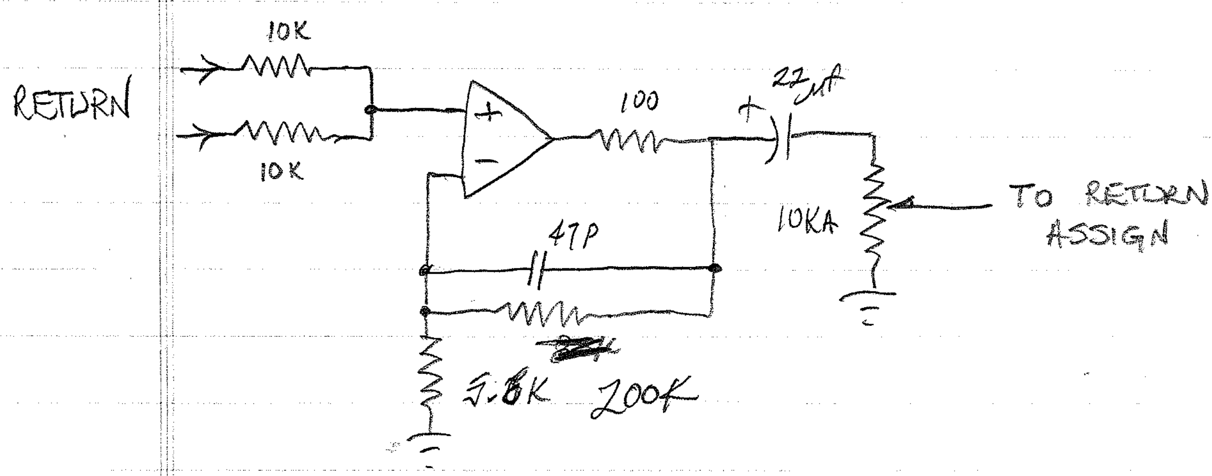
· INPUT CARD ·

CHANNEL CIRCUIT CARD

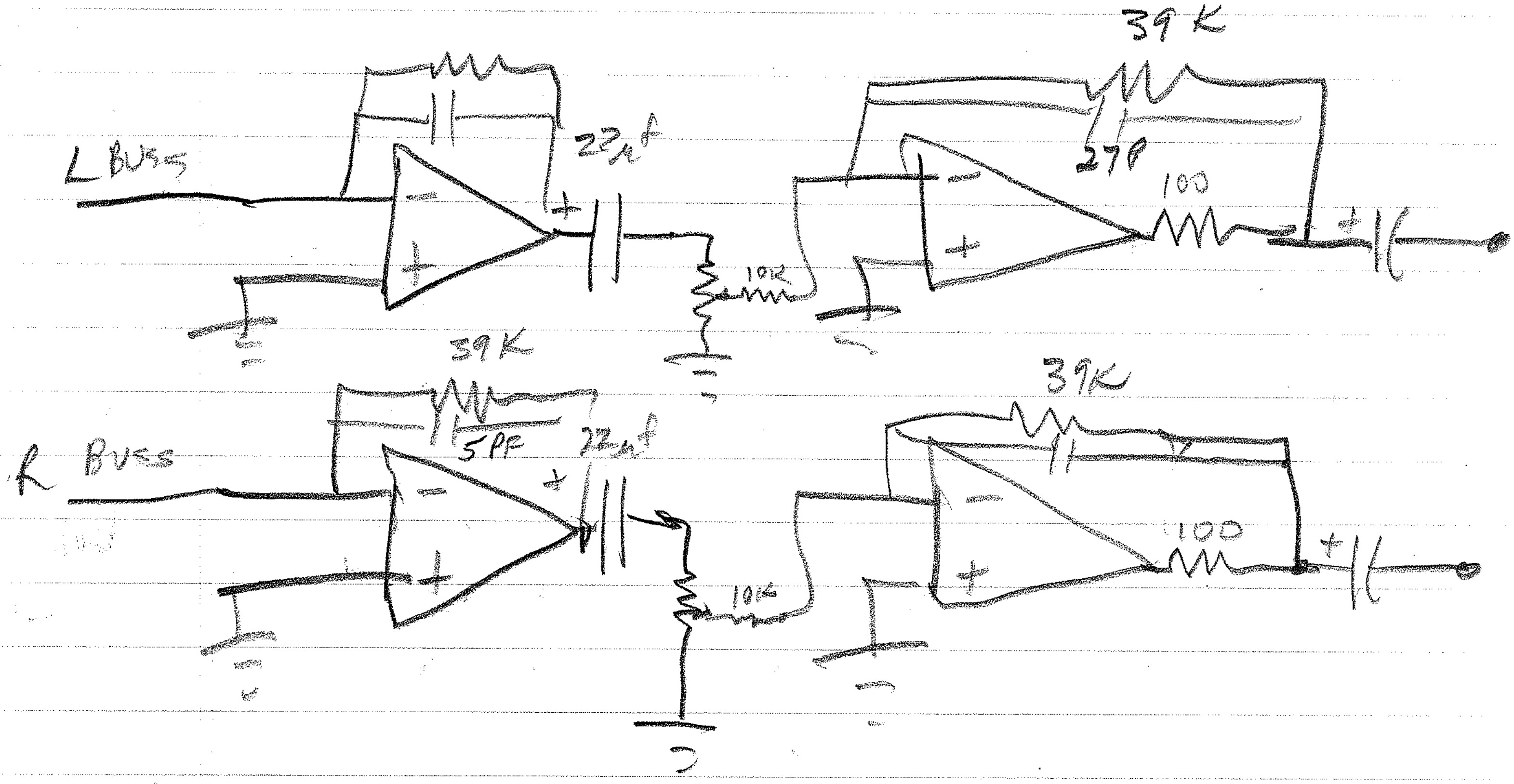



27P
39K
A SUM BUSS
100
A SEND MASTER
10KA
47P
39K
22uf
100
A SEND OUT


B SUM BUSS
100
27P
82K
10KA
B SEND OUT

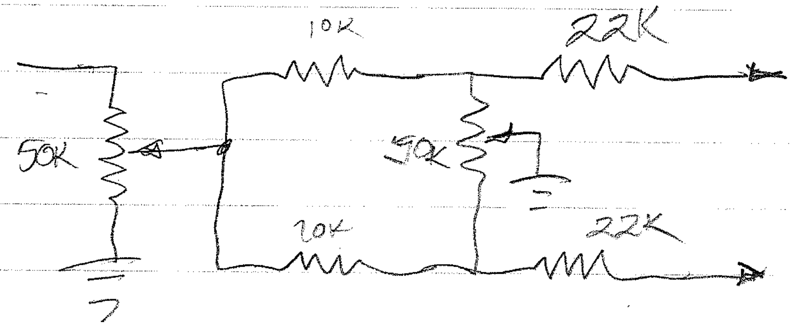

10K
RETURN
10K
100
22uf
10KA
TO RETURN ASSIGN
47P
200K

SUMS

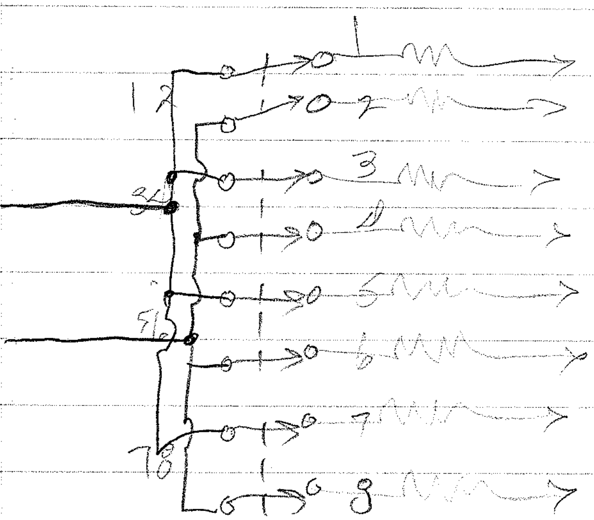


L BUSS
22uf
39 K
27P
100
10K
39 K
R BUSS
5PF
22uf
39K
100
10K

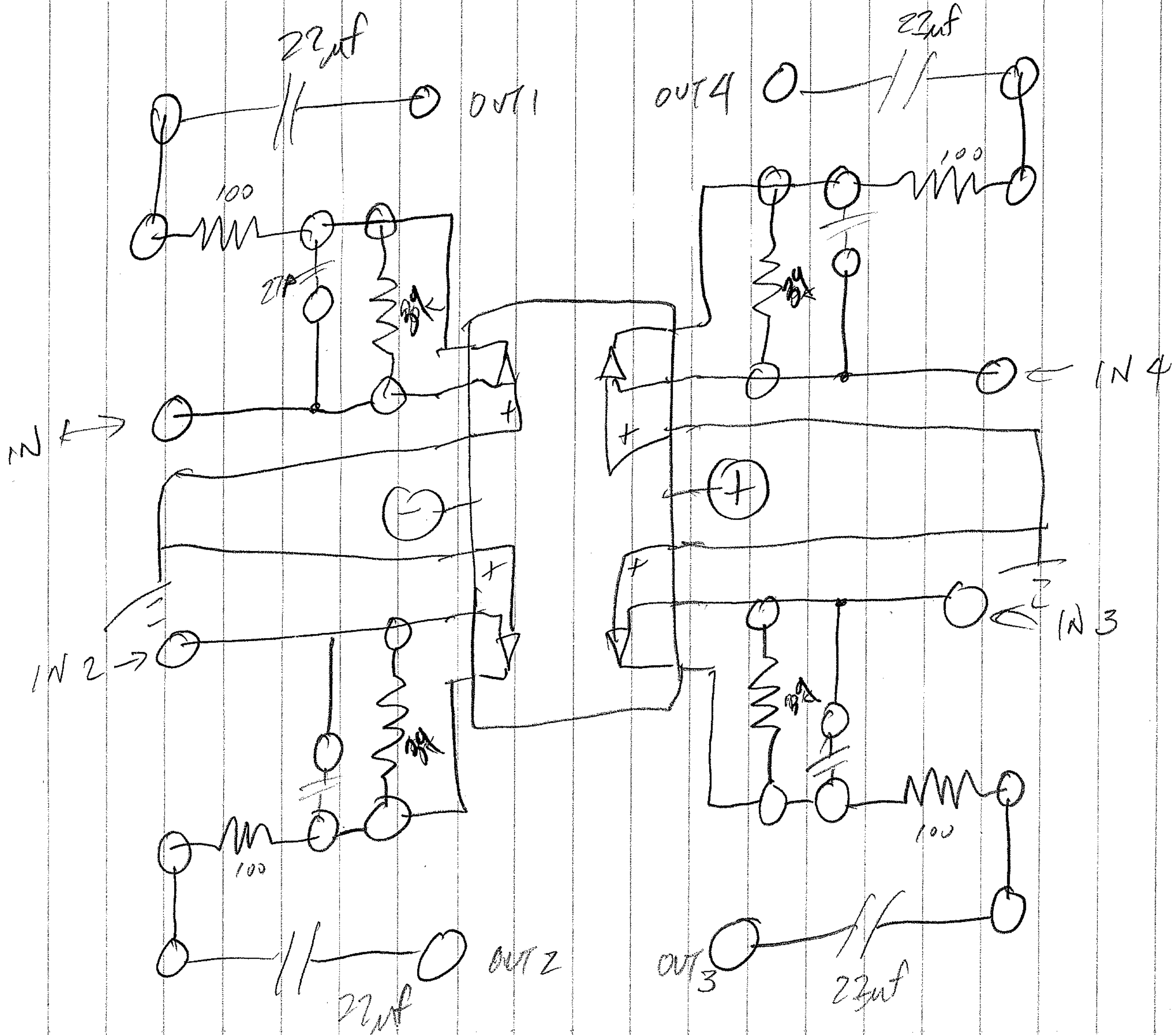
24 x 36 = 21.40



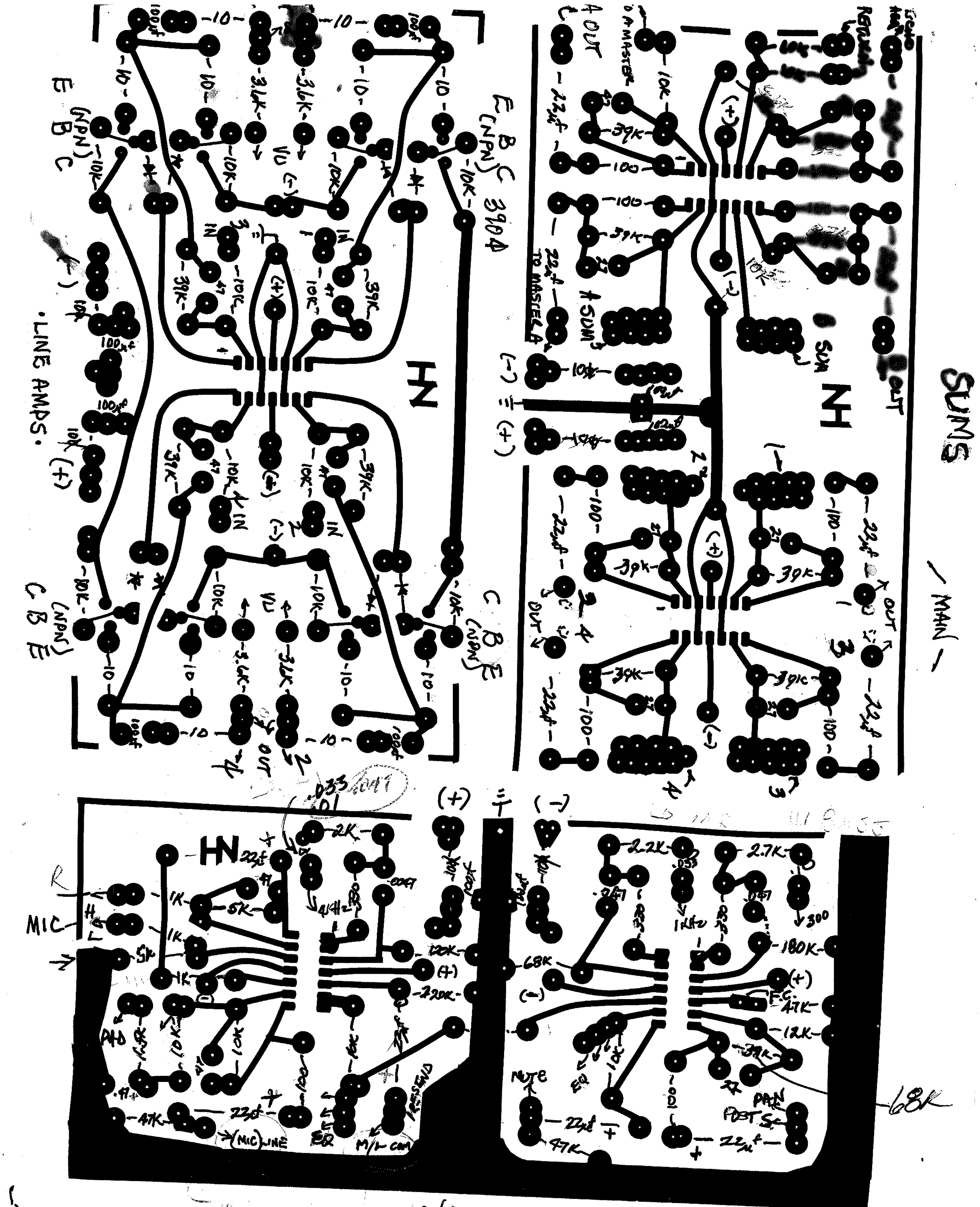
BASS = .5 VOCT EIN



SUM AMPS 1-4



BOTTOM



INPUT

1 GND
2 +5
3 -12
4 KB0
5 KB2
6 KB4
7 KB6
8 GND
9 GND
10 GND
11
12 +12
13
14 GND
15 +5
16 -12
17 KB1
18 KB3
19 KB5
20 KB7
21 KBSTR
22 ACK
23 $\overline{\text{RESET}}$
24 KBSH
25 KBCD

XR-2206

Monolithic Function Generator

The XR-2206 is a monolithic function generator integrated circuit capable of producing high quality sine, square, triangle, ramp and pulse waveforms of high stability and accuracy. The output waveforms can be both amplitude and frequency modulated by an external voltage. Frequency of operation can be selected externally over a range of 0.01 Hz to more than 1 MHz.

The XR-2206 is ideally suited for communications, instrumentation, and function generator applications requiring sinusoidal tone, AM, FM or FSK generation. It has a typical drift specification of 20 ppm/°C. The oscillator frequency can be linearly swept over a 2000:1 frequency range with an external control voltage with very little affect on distortion.

As shown in Figure 1, the monolithic circuit is comprised of four functional blocks: a voltage-controlled oscillator (VCO); an analog multiplier and sine-shaper; a unity gain buffer amplifier; and a set of current switches. The internal current switches transfer the oscillator current to any one of the two external timing resistors to produce two discrete frequencies selected by the logic level at the FSK input terminal (pin 9).

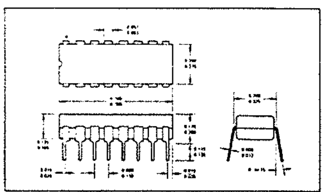
FEATURES

- Low Sinewave Distortion (THD .5%) – insensitive to signal sweep
- Excellent Stability (20 ppm/°C, typ)
- Wide Sweep Range (2000:1, typ)
- Low Supply Sensitivity (0.01%/V, typ)
- Linear Amplitude Modulation
- Adjustable Duty-Cycle (1% to 99%)
- TTL Compatible FSK Controls
- Wide Supply Range (10V to 26V)

APPLICATIONS

- Waveform Generation
  - Sine, Square, Triangle, Ramp
- Sweep Generation
- AM/FM Generation
- FSK and PSK Generation
- Voltage-to-Frequency Conversion
- Tone Generation
- Phase-Locked Loops

PACKAGE INFORMATION



ABSOLUTE MAXIMUM RATINGS

Power Supply	26V
Power Dissipation	750 mW
Derate above 25°C	5 mW/°C
Total Timing Current	6 mA
Operating Temperature	
XR-2206/XR-2206C	0°C to +75°C
XR-2206M	−55°C to +125°C
Storage Temperature	−65°C to +150°C

ORDER INFORMATION

Part Number	Package Type
XR-2206N/XR-2206CN/XR-2206M	Ceramic
XR-2206P/XR-2206CP	Plastic

FUNCTIONAL BLOCK DIAGRAM

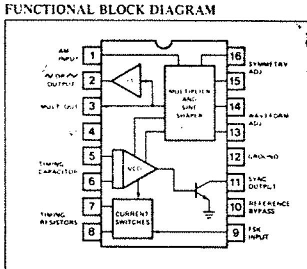


Figure 1.

ELECTRICAL CHARACTERISTICS Preliminary

Test Conditions. Test Circuit of Fig. 2, $V^+ = 12V$, $T_A = 25°C$, $C = 0.01\ \mu F$, $R_1 = 100\ K\Omega$, $R_2 = 10\ K\Omega$ $R_3 = 25\ K\Omega$ unless otherwise specified. S_1 open for triangle, closed for sinewave

CHARACTERISTICS	XR-2206M, XR-2206 MIN.	TYP	MAX	XR-2206C MIN	TYP	MAX	UNITS	CONDITIONS
Supply Voltage								
Single Supply	10		26	10		26	V	
Split Supply	±5		±13	±5		±13	V	
Supply Current		12	17		14	20	mA	$R_1 \geq 10\ K\Omega$
Oscillator Section								
Max. Operating Frequency	0.5	1		0.5	1		MHz	$C = 1000$ pF, $R_1 = 1\ K\Omega$
Lowest Practical Frequency		0.01			0.01		Hz	$C = 50\ \mu F$, $R_1 = 2\ M\Omega$
Frequency Accuracy		±1	±4		±2		% of f_o	$f_o = 1/R_1C$
Temperature Stability		±10	±50		±20		ppm/°C	$0°C \leq T_A \leq 75°C$, $R_1 = R_2 = 20\ K\Omega$
Supply Sensitivity		0.01	0.1		0.01		%	$V_{LOW} = 10V$, $V_{HIGH} = 20V$, $R_1 = R_2 = 20\ K\Omega$
Sweep Range	1000:1	2000:1			2000:1		$f_H = f_L$	f_H – $R_1 = 1\ K\Omega$; f_L – $R_1 = 2\ M\Omega$
Sweep Linearity								
10:1 Sweep		2			2		%	$f_L = 1$ kHz, $f_H = 10$ kHz
1000:1 Sweep		8			8		%	$f_L = 100$ Hz, $f_H = 100$ kHz
FM Distortion		0.1			0.1		%	±10% Deviation
Recommended Timing Components								
Timing Capacitor: C	0.001		100	0.001		100	μF	See Figure 5
Timing Resistors: R_1 & R_2	1		2000	1		2000	KΩ	
Triangle/Sinewave Output								See Note 1, Fig. 3
Triangle Output		160			160		mV/KΩ	Fig. 2 S_1 Open
Sinewave Output	40	60	80		60		mV/KΩ	Fig. 2 S_1 Closed
Max. Output Swing		6			6		Vpp	
Output Impedance		600			600		Ω	
Triangle Linearity		1			1		%	
Amplitude Stability		0.5			0.5		dB	For 1000:1 Sweep
Sinewave Distortion								$R_1 = 30\ K\Omega$
Without Adjustment		2.5			2.5		%	See Figure 10.
With Adjustment		0.4	1.0		0.5	1.5	%	See Figure 11.
Amplitude Modulation								
Input Impedance	50	100		50	100		KΩ	
Modulation Range		100			100		%	
Carrier Suppression		55			55		dB	
Linearity		2			2		%	For 95% modulation
Square Wave Output								Measured at Pin 11
Amplitude		12			12		Vpp	
Rise Time		250			250		nsec	$C_L = 10$ pF
Fall Time		50			50		nsec	$C_L = 10$ pF
Saturation Voltage		0.2	0.4		0.2	0.4	V	$I_L = 2$ mA
Leakage Current		0.1	20		0.1		μA	$V_{11} = 12V$
FSK Keying Level (Pin 9)	0.8	1.4	2.4	0.8	1.4	2.4	V	See Section on Circuit Controls
Reference Bypass Voltage	2.9	3.1	3.3	2.5	3	3.5	V	Measured at Pin 10

Note 1. Output Amplitude is inversely proportional to the resistance R_3 on Pin 3. See Figure 3.

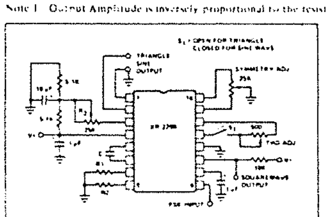


Figure 2. Basic Test Circuit

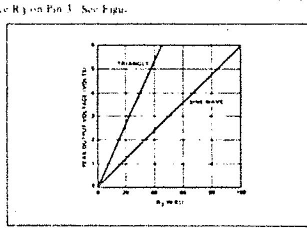


Figure 3. Output Amplitude as a Function of Resistor R_3 at Pin 3

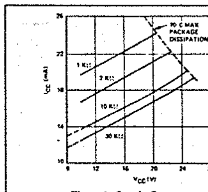


Figure 4. Supply Current vs Supply Voltage, Timing R

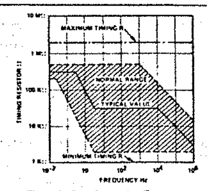


Figure 5. R vs Oscillation Frequency

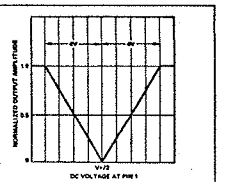


Figure 6. Normalized Output Amplitude vs DC Bias at AM Input (Pin 1).

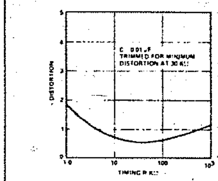


Figure 7. Trimmed Distortion vs Timing Resistor

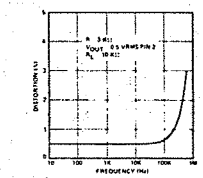


Figure 8. Sinewave Distortion vs Operating Frequency With Timing Capacitors Varied

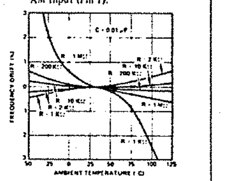


Figure 9. Frequency Drift vs Temperature

DESCRIPTION OF CIRCUIT CONTROLS

FREQUENCY OF OPERATION:

The frequency of oscillation, f_o, is determined by the external timing capacitor C across pins 5 and 6, and by the timing resistor R connected to either pin 7 or pin 8. The frequency is given as

$$f_o = \frac{1}{RC}\ \text{Hz}$$

and can be adjusted by varying either R or C. The recommended values of R for a given frequency range are shown in Figure 5. Temperature stability is optimum for $4\ K\Omega < R < 200\ K\Omega$. Recommended values of C are from 1000 pF to 100 μF.

FREQUENCY SWEEP AND MODULATION

Frequency of oscillation is proportional to the *total* timing current I_T drawn from pin 7 or 8

$$f = \frac{320 I_T\ (\text{mA})}{C\ (\mu F)}\ \text{Hz}$$

Timing terminals (pins 7 or 8) are low impedance points and are internally biased at +3V, with respect to pin 12. Frequency varies linearly with I_T over a wide range of current values, from 1 μA to 3 mA. The frequency can be controlled by applying a control voltage, V_C, to the activated timing pin as shown in Figure 10. The frequency of oscillation is related to V_C as:

$$f = \frac{1}{RC}\left[1 + \frac{R}{R_C}\left(1 - \frac{V_C}{3}\right)\right]\ \text{Hz}$$

where V_C is in volts. The voltage-to-frequency conversion gain, K, is given as:

$$K = \partial f/\partial V_C = -\frac{0.32}{R_C C}\ \text{Hz/V}$$

NOTE: For safe operation of the circuit I_T should be limited to ≤ 3 mA.

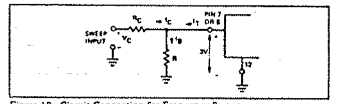


Figure 10. Circuit Connection for Frequency Sweep

OUTPUT CHARACTERISTICS:

Output Amplitude: Maximum output amplitude is inversely proportional to external resistor R_3 connected to Pin 3 (See Fig. 3). For sinewave output, amplitude is approximately 60 mV peak per KΩ of R_3; for triangle, the peak amplitude is approximately 160 mV peak per KΩ of R_3. Thus, for example, $R_3 = 50\ K\Omega$ would produce approximately ±3V sinusoidal output amplitude.

Amplitude Modulation: Output amplitude can be modulated by applying a dc bias and a modulating signal to Pin 1. The internal impedance at Pin 1 is approximately 200 KΩ. Output amplitude varies linearly with the applied voltage at Pin 1, for values of dc bias at this pin, within ±4 volts of $V^+/2$ as shown in Fig. 6. As this bias level approaches $V^+/2$, the phase of the output signal is reversed, and the amplitude goes through zero. This property is suitable for phase-shift keying and suppressed-carrier AM generation. Total dynamic range of amplitude modulation is approximately 55 dB.

Note: AM control must be used in conjunction with a well-regulated supply since the output amplitude now becomes a function of V^+.

FREQUENCY-SHIFT KEYING

The XR-2206 can be operated with two separate timing resistors, R_1 and R_2, connected to the timing pins 7 and 8, respectively, as shown in Figure 13. Depending on the polarity of the logic signal at pin 9, either one or the other of these timing resistors is activated. If pin 9 is open-circuited or connected to a bias voltage ≥ 2V, only R_1 is active. Similarly, if the voltage level at pin 9 is ≤ 1V, only R_2 is activated. Thus, the output frequency can be keyed between two levels, f_1 and f_2 as.

$f_1 = 1/R_1C$ and $f_2 = 1/R_2C$

For split-supply operation, the keying voltage at pin 9 is referenced to V^-.

OUTPUT DC LEVEL CONTROL

The dc level at the output (pin 2) is approximately the same as the dc bias at pin 3. In Figures 11, 12 and 13, pin 3 is biased mid-way between V^+ and ground, to give an output dc level of $\approx V^+/2$.

APPLICATIONS INFORMATION

SINEWAVE GENERATION

A) Without External Adjustment

Figure 11 shows the circuit connection for generating a sinusoidal output from the XR-2206. The potentiometer R_1 at pin 7 provides the desired frequency tuning. The maximum output swing is greater than $V^+/2$ and the typical distortion (THD) is < 2.5%. If lower sinewave distortion is desired, additional adjustments can be provided as described in the following section.

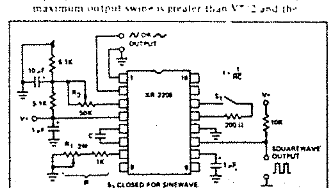


Figure 11. Circuit for Sinewave Generation Without External Adjustment. (See Fig. 3 for choice of R_3)

The circuit of Figure 11 can be converted to split supply operation simply by replacing all ground connections with V^-. For split supply operation, R_3 can be directly connected to ground.

B) With External Adjustment

The harmonic content of sinusoidal output can be reduced to ≈0.5% by additional adjustments as shown in Figure 12. The potentiometer R_A adjusts the sine-shaping resistor, and R_B provides the fine-adjustment for the waveform symmetry. The adjustment procedure is as follows:

1. Set R_B at mid-point and adjust R_A for minimum distortion.
2. With R_A set as above, adjust R_B to further reduce distortion.

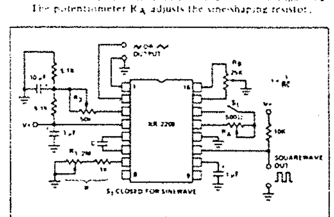


Figure 12. Circuit for Sinewave Generation With Minimum Harmonic Distortion. (R_3 Determines Output Swing – See Fig. 3)

TRIANGLE WAVE GENERATION

The circuits of Figures 11 and 12 can be converted to triangle wave generation by simply open circuiting pins 13 and 14 (i.e., S_1 open). Amplitude of the triangle is approximately twice the sinewave output.

FSK GENERATION

Figure 13 shows the circuit connection for sinusoidal FSK signal generation. Mark and space frequencies can be independently adjusted by the choice of timing resistors R_1 and R_2; and the output is phase-continuous during transitions. The keying signal is applied to pin 9. The circuit can be converted to split-supply operation by simply replacing ground with V^-.

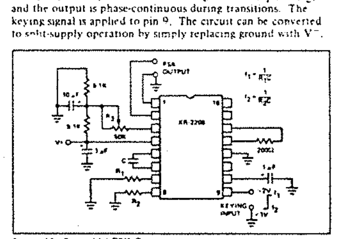


Figure 13. Sinusoidal FSK Generator

PULSE AND RAMP GENERATION

Figure 14 shows the circuit for pulse and ramp waveform generation. In this mode of operation, the FSK keying terminal (pin 9) is shorted to the square-wave output (pin 11), and the circuit automatically frequency-shift keys itself between two separate frequencies during the positive and negative going output waveforms. The pulse-width and the duty cycle can be adjusted from 1% to 99% by the choice of R_1 and R_2. The values of R_1 and R_2 should be in the range of 1 KΩ to 2 MΩ.

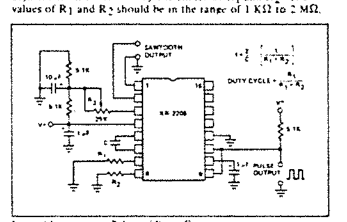


Figure 14. Circuit for Pulse and Ramp Generation