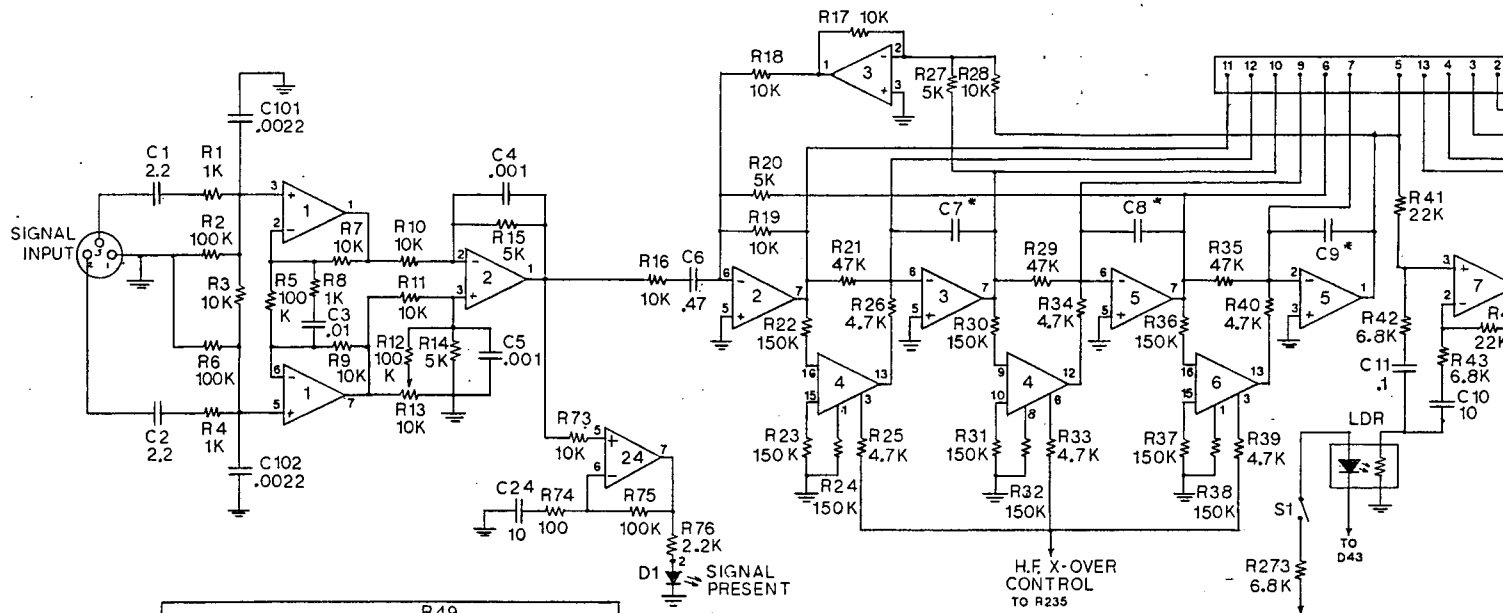
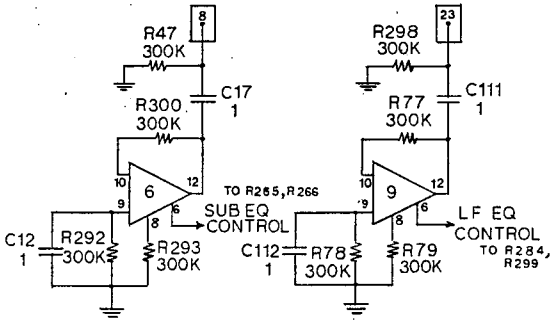
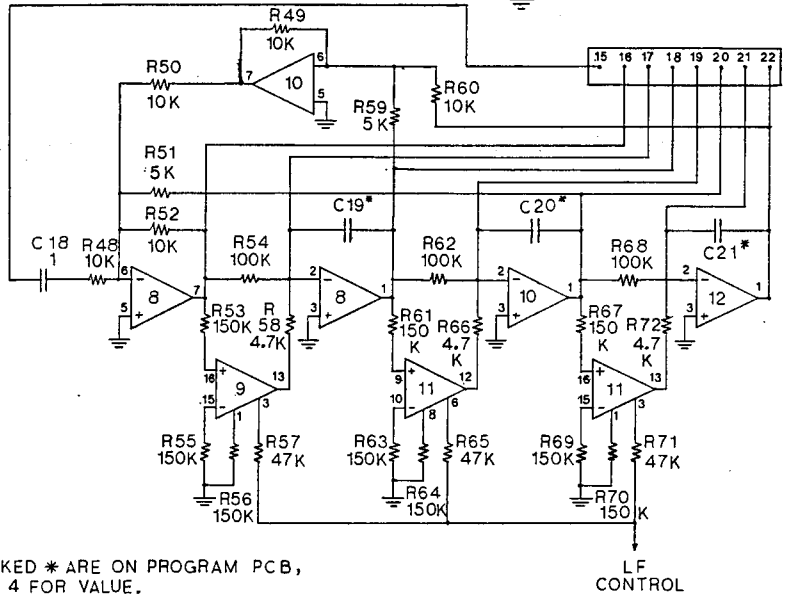


REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	PRODUCTION RELEASE	5/7/88	A.U.
B	SEE SHEET 4		
C	SEE PC 2	10/18/88	
D	SEE PC 2, B00 201	10/13/88	
E	SEE PC 2 + PC 4	2/11/89	



F	SEE PC 3 SUB UNIT B00 249	3-18-90	
G	SEE PC 4 B00 201	11-26-90	
H	SEE SMT. 2, 4, 5. ECD 319, 325	6-1-92	FO



ON THIS PAGE  
 R1→79 + 290→293 + 300  
 C1→24 + 101, 102, 111, 112  
 U1→12+24  
 D1  
 R297→299 NOT USED

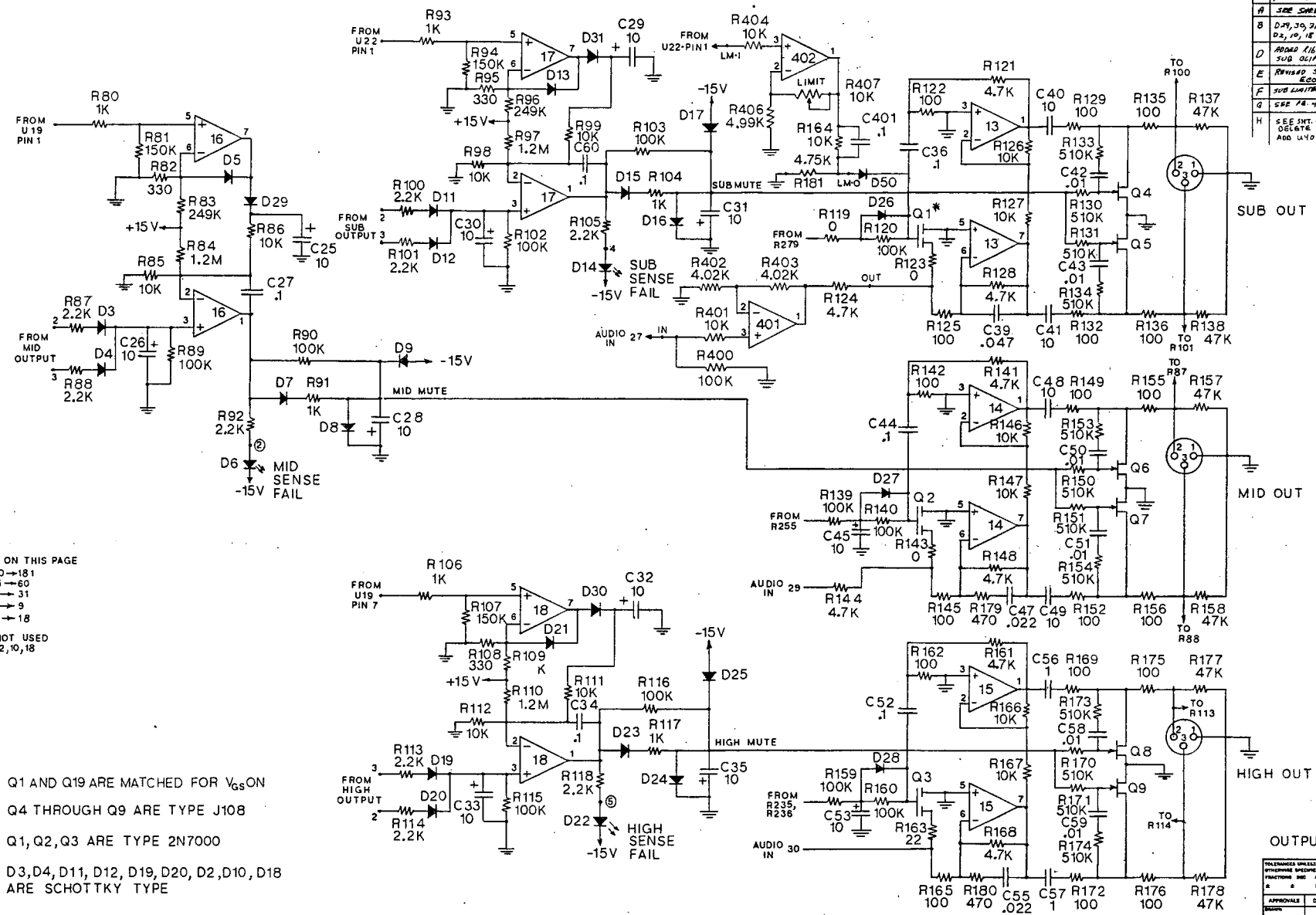
ON PROGRAM MODULE  
 R20→27+45, 46, 294  
 C7, 8, 9, 13→16, 19→21, 103→106

PARTS MARKED \* ARE ON PROGRAM PCB,  
 SEE PAGE 4 FOR VALUE.

APPROVALS		DATE	SCALE	SIZE	DRAWING NO.
DESIGNED				D	
CHECKED					
DO NOT SCALE DRAWING SHEET 1					

RENKUS-HEINZ  
 SCHEMATIC, X-31  
 PROCESSOR

REV. NO.	DESCRIPTION	DATE	APPROVED
1	PRODUCTION RELEASE	5/9/88	R.V.
2	SEE SHEET 4		
3	D29, 30, 31 WERE SWAPPED THE D2, 10, 18 WERE IN THE ECG 204	8/13/88	R.V.
4	ADDED C16, R11, 1 DED SUB OUT OCT. ECG 201	8/27/88	R.V.
5	REVISED SCHEM FOR EXT. ECG 210	2/10/89	R.V.
6	SUB LIMITING CHANGE ECG 204	3/11/90	R.V.
7	SEE 7A-4 ECG 201	11-24-90	R.V.
8	SEE SHT. 4.5 ECG 314, 325 DELETE C36, V1, V4 ADD U401, 402 AND ASSOC. C-CRKT	5-25-91	R.V.

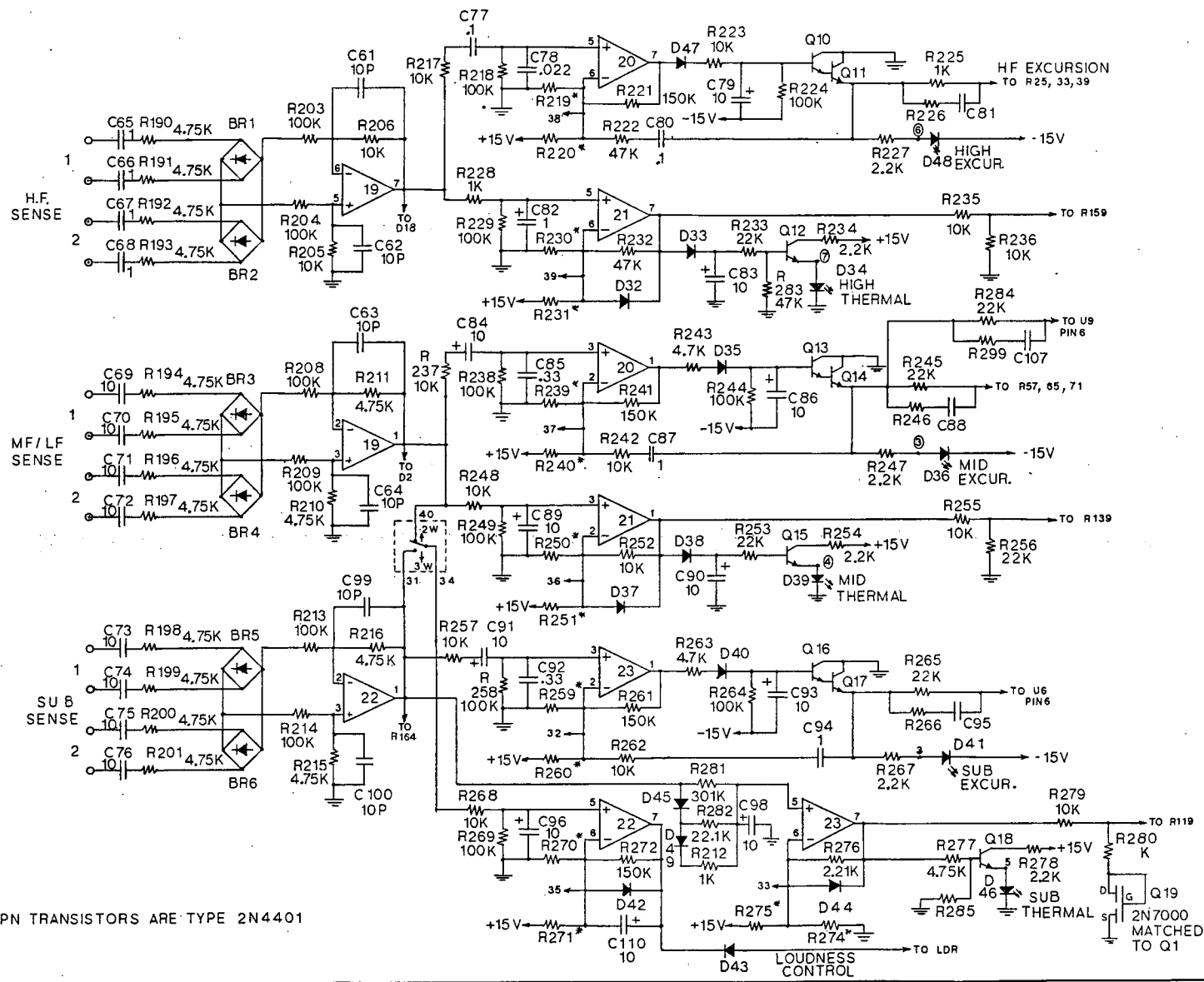


ON THIS PAGE  
R80 → 181  
C25 → 60  
D2 → 31  
Q1 → 9  
U13 → 18  
NOT USED  
D2, 10, 18

Q1 AND Q19 ARE MATCHED FOR  $V_{GS(ON)}$   
Q4 THROUGH Q9 ARE TYPE J108  
Q1, Q2, Q3 ARE TYPE 2N7000  
D3, D4, D11, D12, D19, D20, D2, D10, D18 ARE SCHOTTKY TYPE

APPROVALS		DATE	SCALE	SHEET	DRAWING NO.
SIGNATURE				D	
CHECKED					
DESIGNED					
DRAWN					
REVISIONS					

RENKUS-HEINZ  
SCHEMATIC, X31  
PROCESSOR  
DO NOT SCALE DRAWING SHEET 2



NPN TRANSISTORS ARE TYPE 2N4401

REVISIONS			
LTN	DESCRIPTION	DATE	APPROVED
	PRODUCTION RELEASE	5/17/68	
A	SHE SHEET 4		
B	SHE PG 2	11/15/68	
D	SHE PG 2 EOO 201	10/21/68	
E	SHE PG 2 + PG 4	2/11/69	
F	SUB LAYER CHANG EOO 247	3/11/70	
G	SHE PG 4 EOO 491	4-16-70	
H	SEE-SMT. 2,4,C EOO 314,325	6-1-72	F.O.

ON THIS PAGE  
 R190 → 285, 299  
 C65 → 100, 107, 110  
 D30 → 49  
 Q10 → 19  
 U19 → 23

NOT USED  
 C108, 109, 97  
 R202, 207

SENSE, CONTROL			
RENKUS-HEINZ			
SCHEMATIC, X31 PROCESSOR			
APPROVALS	DATE	SCALE	SIZE (DRAWING NO.)
DESIGN			D
CHECKED			
DO NOT SCALE DRAWING			SHEET 3

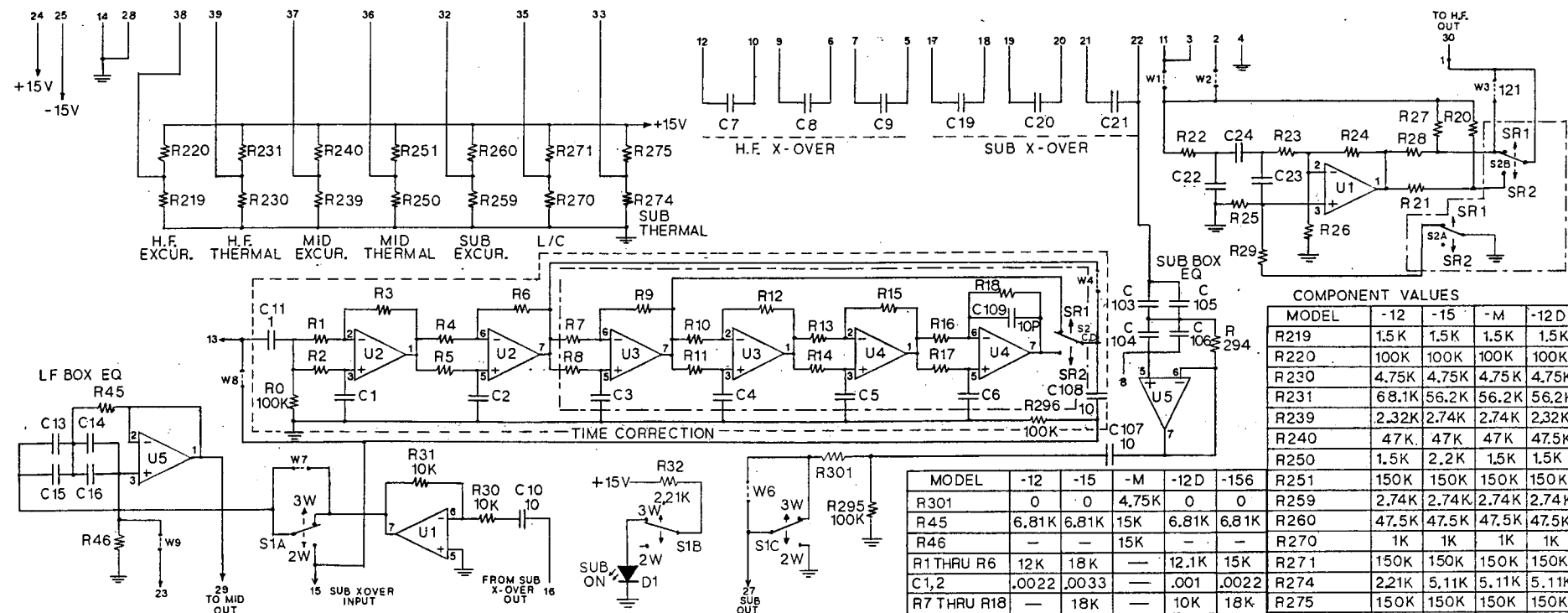
$$F_2 = \frac{1}{2 \times \pi \times C7 \times 47.5K}$$

1.5KHz (-12)  
1KHz (-15)  
2.2KHz (-M)

$$F_1 = \frac{1}{2 \times \pi \times C19 \times 100K}$$

106Hz (-12, -15)  
338Hz (-M)

REVISIONS			
LT#	DESCRIPTION	DATE	APPROVED
	PRODUCTION RELEASE ADDED P, E, MTE	5/11/88	R.H.
	ADDED W, RELOCATED R301 SEE ECO 173	7/1/88	
B	SEE PG 2	8/13/88	R.H.
D	SEE PG 2 ECO 201	10/27/88	
E	ADDED -12 -156 MODULES SEE ECO 218 - 221	1/6/89	R.H.
F	2.8 UNIT CHANGE ECO 249	3-14-90	
G	THREE PARTION SW PASTE SW. ECO291	11-24-90	R.U.
H	SEE INT 2,5 - ELO 314, 325 USE REV.C PROGRAM MODULE	5-24-92	F.O.



COMPONENT VALUES

MODEL	-12	-15	-M	-12D	-156
R219	1.5K	1.5K	1.5K	1.5K	1.5K
R220	100K	100K	100K	100K	100K
R230	4.75K	4.75K	4.75K	4.75K	4.75K
R231	68.1K	56.2K	56.2K	56.2K	56.2K
R239	2.32K	2.74K	2.74K	2.32K	2.74K
R240	47K	47K	47K	47.5K	47.5K
R250	1.5K	2.2K	1.5K	1.5K	2.21K
R251	150K	150K	150K	150K	150K
R259	2.74K	2.74K	2.74K	2.74K	2.74K
R260	47.5K	47.5K	47.5K	47.5K	47.5K
R270	1K	1K	1K	1K	1K
R271	150K	150K	150K	150K	150K
R274	2.21K	5.11K	5.11K	5.11K	5.11K
R275	150K	150K	150K	150K	150K
R294	6.81K	6.81K	6.81K	6.81K	6.81K
R301	0	0	4.75K	0	0
R45	6.81K	6.81K	15K	6.81K	6.81K
R46	-	-	15K	-	-
R1 THRU R6	12K	18K	-	12.1K	15K
R7 THRU R18	-	18K	-	10K	18K
C1,2	.0022	.0033	-	.001	.0022
C3 THRU C6	-	.0033	-	.0022	.0022
C7, 8, 9	.0022	.0033	.0015	.0033	.0033
C19, 20, 21	.015	.015	.0047	.015	.015
C13, 14	.1	.1	.1	.1	.1
C15, 16	-	.022	-	-	.022
C103, 104	.1	.1	.1	.1	.1
C105, 106	.047	.047	.047	.047	.047
C22	.0033	-	.001	.001	-
C23	.001	470P	470P	.001	.001
R20, 21	-	6.81K	-	-	-
R27, 28	10K	10K	6.81K	10K	10K

MODEL	-12	-15	-M	-12D	-156
R219	1.5K	1.5K	1.5K	1.5K	1.5K
R220	100K	100K	100K	100K	100K
R230	4.75K	4.75K	4.75K	4.75K	4.75K
R231	68.1K	56.2K	56.2K	56.2K	56.2K
R239	2.32K	2.74K	2.74K	2.32K	2.74K
R240	47K	47K	47K	47.5K	47.5K
R250	1.5K	2.2K	1.5K	1.5K	2.21K
R251	150K	150K	150K	150K	150K
R259	2.74K	2.74K	2.74K	2.74K	2.74K
R260	47.5K	47.5K	47.5K	47.5K	47.5K
R270	1K	1K	1K	1K	1K
R271	150K	150K	150K	150K	150K
R274	2.21K	5.11K	5.11K	5.11K	5.11K
R275	150K	150K	150K	150K	150K
R294	6.81K	6.81K	6.81K	6.81K	6.81K
R301	0	0	4.75K	0	0
R45	6.81K	6.81K	15K	6.81K	6.81K
R46	-	-	15K	-	-
R1 THRU R6	12K	18K	-	12.1K	15K
R7 THRU R18	-	18K	-	10K	18K
C1,2	.0022	.0033	-	.001	.0022
C3 THRU C6	-	.0033	-	.0022	.0022
C7, 8, 9	.0022	.0033	.0015	.0033	.0033
C19, 20, 21	.015	.015	.0047	.015	.015
C13, 14	.1	.1	.1	.1	.1
C15, 16	-	.022	-	-	.022
C103, 104	.1	.1	.1	.1	.1
C105, 106	.047	.047	.047	.047	.047
C22	.0033	-	.001	.001	-
C23	.001	470P	470P	.001	.001
R20, 21	-	6.81K	-	-	-
R27, 28	10K	10K	6.81K	10K	10K

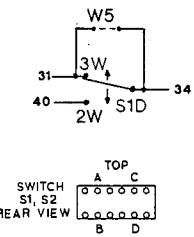
NOTE:  
SHEET 5 IS  
SIZE A.

REVISIONS UNLESS OTHERWISE SPECIFIED	DATE	APPROVED
REVISION	DATE	APPROVED
DESIGNER	DATE	APPROVED
CHECKER	DATE	APPROVED
SCALE	SIZE	DRAWING NO.
	D	
DO NOT SCALE DRAWING		SHEET 4

SWITCHES, JUMPERS

MODEL	X31-12	X31-15	X31-M1	-12D	-156
S1	x	x	x	x	x
S2	x	x	x	x	x
W1	x	x	x	x	x
W2	x	x	x	x	x
W3	x	x	x	x	x
W4	x	x	x	x	x
W5	x	x	x	x	x
W6	x	x	x	x	x
W7	x	x	x	x	x
W8	x	x	x	x	x
W9	x	x	x	x	x

\*SPECIAL JUMPER IN PLACE OF S2.



COMPONENTS INSIDE BOX ARE DELETED IN -12 MODULE AND -M MODULE.

ALL IC'S ARE TYPE 4560  
ON REV. B PCB R301 IS LABELED W6