SYSTEMS
417 Broadway
Santa Cruz, CA 95060
(408) 429-9147

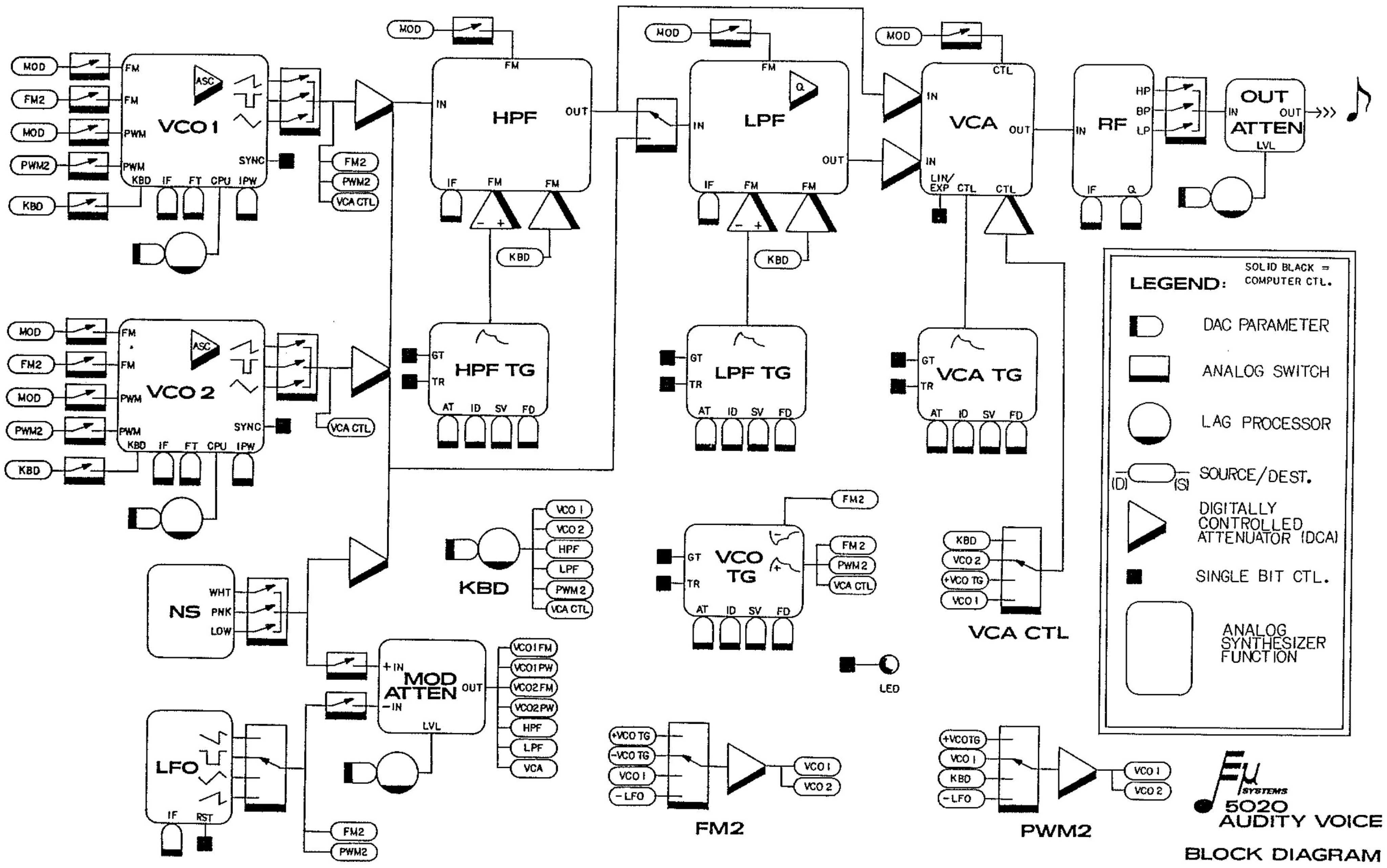
E-MU AUDITY VOICES - GENERAL DESCRIPTION 5 DECEMBER 1979

THE E-MU AUDITY VOICE CARDS ARE DESIGNED TO BE COMPLETELY COMPUTER CONTROLLED SYNTHESIZER VOICES OF GOOD QUALITY AND MODERATE COMPLEXITY. THEY CAN BE INTERFACED TO ANY COMPUTER VIA "MEMORY-LIKE" INTERFACE, OR INTERFACED VIA AN E-MU SUPPLIED Z-80 MICROPROCESSOR BASED COMPUTER.

THE CARDS ARE PHYSICALLY DESIGNED TO FIT IN A RACK-MOUNTABLE CARD CAGE LESS THAN 21 INCHES HIGH AND 16 INCHES DEEP. EACH CARD HAS TWO IDENTICAL BUT SEPARATE OUTPUTS.

EACH CARD CONTAINS 2 VOLTAGE CONTROLLED OSCILLATORS WITH SAWTOOTH, VOLTAGE CONTROLLED WIDTH PULSE, AND TRIANGLE WAVEFORMS, A VOLTAGE CONTROLLED LOWPASS FILTER, A VOLTAGE CONTROLLED HIGHPASS FILTER, A VOLTAGE CONTROLLED AMPLIFIER, A PROGRAMMABLE RESONANT (PARAMETRIC) FILTER, A LOW FREQUENCY OSCILLATOR, A NOISE SOURCE, FOUR ADSR TYPE TRANSIENT GENERATORS, AND NUMEROUS CONTROLLABLE PATCH SWITCHES AND ATTENUATORS. A TOTAL OF 58 8 BIT WORDS CONTROL THE CARD.

THE ATTACHED DIAGRAM SHOWS THE BASIC PATCH POSSIBILITIES.


VCO 1
VCO 2
ASC
FM
PWM
KBD
IF
FT
CPU
IPW
SYNC
MOD
FM2
PWM2
VCA CTL
HPF
LPF
VCA
RF
OUT ATTEN
IN
OUT
LVL
Q
HP
BP
LP
LIN/EXP
CTL
HPF TG
LPF TG
VCA TG
VCO TG
GT
TR
AT
ID
SV
FD
KBD
VCO 1
VCO 2
NS
WHT
PNK
LOW
MOD ATTEN
+IN
−IN
VCO1 FM
VCO1 PW
VCO2 FM
VCO2 PW
LFO
RST
LED
FM2
+VCO TG
−VCO TG
−LFO
PWM2
VCA CTL
LEGEND:
SOLID BLACK = COMPUTER CTL.
DAC PARAMETER
ANALOG SWITCH
LAG PROCESSOR
SOURCE/DEST.
(D)
(S)
DIGITALLY CONTROLLED ATTENUATOR (DCA)
SINGLE BIT CTL.
ANALOG SYNTHESIZER FUNCTION
SYSTEMS
5020
AUDITY VOICE
BLOCK DIAGRAM

SYSTEMS
417 Broadway
Santa Cruz, CA 95060
(408) 429-9147

E-MU AUDITY VOICE CARD - PARAMETER DEFINITIONS 14 JANUARY 1980

I. GENERAL DESCRIPTION

THE INFORMATION GIVEN IN THIS DOCUMENT DESCRIBES THE ADDRESSES AND FUNCTIONS OF THE DIGITAL CONTROL OVER THE E-MU AUDITY VOICE CARDS. IT IS ASSUMED THAT THE READER IS FAMILIAR WITH THE VOICE CARD BLOCK DIAGRAM AND SYNTHESIZER TERMINOLOGY.

ADDRESSES ARE GIVEN IN VALUES FROM 00-3F HEXADECIMAL. A GIVEN CARD WILL HAVE A BASE OFFSET ADDED TO THIS ADDRESS CORESPONDING TO THE CARD NUMBER.

ALL PARAMETERS ARE EIGHT BIT WORDS. UNUSED BITS ARE INDICATED IN DESCRIPTIONS AND WILL BE IGNORED BY THE VOICE CARD, THOUGH FAITHFULLY RETAINED IN THE VOICE CARD MEMORY. SIMILARLY UNUSED PARAMETER LOCATIONS WITHIN THE CARD ADDRESS SPACE WILL NOT BE USED BY THE VOICE CARD BUT RETAINED IN ITS MEMORY. IT IS RECOMMENDED THAT UNUSED PARAMETERS AND BITS BE KEPT AT ZERO.

PARAMETERS ARE UPDATED ON AN ASYNCHRONOUS REFRESH CYCLE OF APPROXIMATELY 2.5 MILLISECONDS.

II. LIST OF CONTROLLABLE PARAMETERS

THE FOLLOWING IS A LIST OF CONTROLLABLE PARAMETERS FOR THE VOICE CARD. FOR QUICK ADDRESS REFERENCE, SEE THE REFERENCE TABLE AT THE END OF THIS DOCUMENT.

VCO (CONTROLLABLE FOR BOTH VCO 1 AND VCO 2):

INITIAL FREQUENCY
FINE TUNE
AUTOMATIC SENSITIVITY CONTROL
INITIAL PULSE WIDTH
MODULATION SOURCES & SYNC
WAVESHAPE
ATTENUATION
AUXILIARY CPU CONTROL
AUXILIARY CPU LAG TIME

AUXILIARY VCO SECTION (COMMON TO VCO 1 AND VCO 2):

KEYBOARD CONTROL VOLTAGE
KEYBOARD PORTAMENTO TIME
VCO TRANSIENT GENERATOR GATE & TRIGGER
VCO TRANSIENT GENERATOR ATTACK TIME
VCO TRANSIENT GENERATOR INITIAL DECAY TIME
VCO TRANSIENT GENERATOR SUSTAIN VOLTAGE
VCO TRANSIENT GENERATOR FINAL DECAY TIME
"FM2" BUS SIGNAL SOURCE
"FM2" BUS SIGNAL LEVEL
"PWM2" BUS SIGNAL SOURCE
"PWM2" BUS SIGNAL LEVEL

NOISE SOURCE:

SPECTRUM (WHITE-PINK-LOW FILTERED)
ATTENUATION INTO VCF SECTION

LOW FREQUENCY OSCILLATOR:

INITIAL FREQUENCY
WAVESHAPE
RESET (SYNC)

MODULATION BUS:

NOISE ON/OFF
LFO ON/OFF
LEVEL
LAG TIME ON LEVEL CHANGES

HIGHPASS FILTER:

INITIAL FREQUENCY
KEYBOARD TRACKING AMOUNT
TRANSIENT GENERATOR ATTACK TIME
TRANSIENT GENERATOR INITIAL DECAY TIME
TRANSIENT GENERATOR SUSTAIN VOLTAGE
TRANSIENT GENERATOR FINAL DECAY TIME
TRANSIENT GENERATOR GATE AND TRIGGER
TRANSIENT GENERATOR FREQUENCY CONTROL AMOUNT
FREQUENCY MODULATION BUS ON/OFF
OUTPUT LEVEL TO VCA

LOWPASS FILTER:

INITIAL FREQUENCY
KEYBOARD TRACKING AMOUNT
TRANSIENT GENERATOR ATTACK TIME
TRANSIENT GENERATOR INITIAL DECAY TIME
TRANSIENT GENERATOR SUSTAIN VOLTAGE
TRANSIENT GENERATOR FINAL DECAY TIME
TRANSIENT GENERATOR GATE AND TRIGGER
TRANSIENT GENERATOR FREQUENCY CONTROL AMOUNT
FREQUENCY MODULATION BUS ON/OFF
SIGNAL SOURCE (SERIES=HPF OR PARALLEL=OSCILLATORS & NOISE)
RESONANCE (Q) AMOUNT
OUTPUT LEVEL TO VCA

VOLTAGE CONTROLLED AMPLIFIER:

TRANSIENT GENERATOR ATTACK TIME
TRANSIENT GENERATOR INITIAL DECAY TIME
TRANSIENT GENERATOR SUSTAIN VOLTAGE
TRANSIENT GENERATOR FINAL DECAY TIME
TRANSIENT GENERATOR GATE AND TRIGGER
EXPONENTIAL OR LINEAR CONTROL BY TRANSIENT GENERATOR
AMPLITUDE MODULATION BUS ON/OFF
AUXILIARY AMPLITUDE MODULATION SOURCE SELECTION
AUXILIARY AMPLITUDE MODULATION LEVEL

RESONANT FILTER:

INITIAL FREQUENCY
RESONANCE (Q)
OUTPUT MIXTURE (FROM HP-BP-LP)

OUTPUT ATTENUATOR:

ATTENUATION
LAG TIME ON ATTENUATION CHANGES

MISCELLANEOUS:

TEST LED OFF/ON
EXTERNAL KEYBOARD CV INPUT (NOT IMPLEMENTED ON FIRST BOARD RUN)

III. LIST OF PARAMETERS WITH ADDRESSES AND DETAILED FUNCTIONAL DESCRIPTIONS

THE FOLLOWING LIST IN ORDER OF ADDRESS LOCATION GIVES THE COMPLETE FUNCTIONAL DESCRIPTION OF EACH PARAMETER WORD OR BIT. FOR INDEXING FROM PARAMETER NAME, SEE THE PARAMETER REFERENCE TABLE AT THE END OF THIS DOCUMENT.

ADDRESS 00 - KEYBOARD CONTROL VOLTAGE:
THIS PRECISE SIGNAL IS PASSED THROUGH THE PORTAMENTO CIRCUIT AND USED AS THE SYSTEM KEYBOARD CONTROL VOLTAGE. WHEN PATCHED TO THIS SIGNAL, THE VCO'S WILL TRACK AT PRECISELY 1 OCTAVE FOR EVERY 24 STEPS (18 HEXIDECIMAL), THUS GIVING 2 STEPS PER SEMITONE. OSCILLATORS AND FILTERS WILL ONLY BE MOVED UP IN PITCH BY THIS SIGNAL, HENCE THEIR INITIAL FREQUENCIES SHOULD BE SET TO THE POINT DESIRED WITH ZERO (LOWEST) KEYBOARD CV.

ADDRESS 01 - VCO 2 PULSE WIDTH:
THIS SIGNAL DETERMINES THE PULSE WIDTH OF THE VCO2 PULSE WAVEFORM. 80 HEX (128 DECIMAL) IS TRIMMED TO GIVE A PRECISE SQUARE WAVE. VARIATIONS FROM THIS 50% DUTY CYCLE ARE AT 0.42%/STEP, I. E. 50.42% DUTY CYCLE RESULTS FROM A VALUE OF 81 HEXIDECIMAL.

ADDRESS 02 - VCO1 INITIAL FREQUENCY:
THIS SIGNAL DETERMINES THE VCO1 FREQUENCY WHEN NO OTHER MODULATION IS GIVEN. IT IS TRIMMED TO GIVE 880 HZ WHEN GIVEN A VALUE OF 90 HEXIDECIMAL, AND VARIES THE FREQUENCY AT 24 STEPS (18 HEX) PER OCTAVE, GIVING QUARTER TONE RESOLUTION. NOTE THAT THE KEYBOARD VARIES THE FREQUENCY UP FROM THIS VALUE.

ADDRESS 03 - VCO2 FINE TUNE:
THIS PARAMETER, NOMINALLY SET TO 80 HEX, GIVES VERY PRECISE CONTROL OVER THE VCO FREQUENCY. IT SHOULD BE USED BY THE CPU IN CONJUNCTION WITH THE EACH CARD'S FREQUENCY SENSE OUTPUT TO PRECISELY TRIM THE FREQUENCY OF THE VCO TO 880 HZ WITH THE INITIAL FRERQUENCY PARAMETER SET TO 90 HEX AND NO MODULATION. IT VARIES THE VCO FREQUENCY AT 1/128 SEMITONE/STEP, AND CAN BE USED TO "DE-TUNE" VCO'S.

ADDRESS 04 - OUTPUT ATTENUATION:
THIS PARAMETER DETERMINES THE OUTPUT ATTENUATION LEVEL OF THE FINAL STAGE. IT SHOULD BE SET IN NORMAL USE TO AS LOW A VALUE (MINIMAL ATTENUATION) AS POSSIBLE FOR FULL "ON" CHANNELS, AND USED TO FADE OTHERS. THE EFFECT OF THE CONTROL IS LAGGED BY THE "OUTPUT ATTENUATION LAG TIME" PARAMETER TO ALLOW DYNAMIC FADES. THE ATTENUATION IS AT APPROXIMATELY 1/3 DB/STEP, WITH ZERO BEING NO ATTENUATION.

ADDRESS 05 - HIGHPASS FILTER INITIAL FREQUENCY:
THIS PARAMETER DETERMINES THE HIGHPASS FILTER CUTOFF FREQUENCY WHEN NO MODULATION IS PRESENT. AT AN 78 HEX VALUE IT IS TRIMMED TO A 440 HZ VALUE, WITH VARIATION FROM THIS POINT AT 24 STEPS (18 HEX) PER OCTAVE, I. E. QUARTER TONES.

ADDRESS 06 - LOWPASS FILTER INITIAL FREQUENCY:
SAME AS ADDRESS 05 BUT FOR THE LOWPASS FILTER CUTOFF FREQUENCY.

ADDRESS 07 - VCO 2 INITIAL FREQUENCY:
SAME AS ADDRESS 02 BUT FOR OSCILLATOR 2.

ADDRESS 08 - VCO 1 INITIAL PULSE WIDTH:
SAME AS ADDRESS 01 BUT FOR OSCILLATOR 1.

ADDRESS 09 - VCO 2 AUXILIARY FREQUENCY CONTROL:
THIS PARAMETER IS USED TO INCREASE THE FREQUENCY OF VCO 2 AT A RATE OF 1 OCTAVE PER 24 STEPS (18 HEX), WITH A PROGRAMMABLE LAG TIME (ADDRESS 23). WHEN UNUSED IT SHOULD BE SET TO ZERO.

ADDRESS 0A - VCO 1 AUXILIARY FREQUENCY CONTROL:
SAME AS ADDRESS 09 BUT FOR OSCILLATOR 1.

ADDRESS 0B - VCO 1 FINE TUNE:
SAME AS ADDRESS 03 BUT FOR OSCILLATOR 1.

ADDRESS 0C - MODULATION BUS ATTENUATION AMOUNT:
THIS PARAMETER DETERMINES THE ATTENUATION (0=FULL LEVEL) ON THE MODULATION BUS. IT'S SENSITIVITY IS APPROXIMATELY 48 STEPS (30 HEX) PER DECADE ATTENUATION.

ADDRESS 0D - RESONANT FILTER INITIAL FREQUENCY:
THIS PARAMETER DETERMINES THE RESONANT FREQUENCY OF THE RESONANT FILTER. IT IS SET FOR A 880 HZ VALUE AT A SETTING OF 80 HEX, AND VARIES AT 24 STEPS (18 HEX) PER OCTAVE FROM THIS POINT.

ADDRESS 0E - LOW FREQUENCY OSCILLATOR INITIAL FREQUENCY:
THIS PARAMETER DETERMINES THE LOW FREQUENCY OSCILLATOR FREQUENCY. IT IS SET FOR 20 HZ AT A 78 HEX VALUE, AND VARIES AT APPROXIMATELY 24 STEPS (18 HEX) PER OCTAVE. NOTE: THE PARAMETER IS INVERTED - HIGHER VALUES RESULT IN LOWER FREQUENCIES.

ADDRESS 0F - RESONANT FILTER RESONANCE (Q) LEVEL:
THIS PARAMETER DETERMINES THE RESONANCE (Q) OF THE RESONANT FILTER. AT ZERO, THE FILTER HAS NO RESONANCE (Q=0.5), AND THE Q NOMINALLY DOUBLES FOR EACH 32 STEPS (20 HEX).

ADDRESS 10 - HIGHPASS FILTER TRANSIENT GENERATOR INITIAL DECAY TIME:
THIS PARAMETER DETERMINES THE HIGHPASS FILTER TRANSIENT GENERATOR'S TIME CONSTANT FOR INITIAL DECAY. A VALUE OF B0 HEX GIVES A 1 SECOND VALUE FOR A 80% APPROACH, AND THE SENSITIVITY IS APPROXIMATELY 48 STEPS PER DECADE (30 HEX) ABOUT THIS VALUE.

ADDRESS 11 - HIGHPASS FILTER TRANSIENT GENERATOR FINAL DECAY TIME:
SAME AS ADDRESS 10 FOR THE FINAL DECAY TIME.

ADDRESS 12 - HIGHPASS FILTER TRANSIENT GENERATOR SUSTAIN VOLTAGE:
THIS PARAMETER DETERMINES THE INITIAL DECAY APPROACH VOLTAGE FOR THE HIGHPASS FILTER TRANSIENT GENERATOR. IT VARIES FROM ZERO FOR ZERO VOLTS AT A RATE OF 24 STEPS (18 HEX) PER VOLT. THE ATTACK VOLTAGE FOR A TRANSIENT GENERATOR IS 10 VOLTS, SO A VALUE OF 240=F0 HEX GIVES AN A-R TYPE TRANSIENT.

ADDRESS 13 - HIGHPASS FILTER TRANSIENT GENERATOR ATTACK TIME:
THIS PARAMETER DETERMINES THE ATTACK TIME FOR THE HIGHPASS FILTER TRANSIENT GENERATOR. A VALUE OF B0H GIVES A 1 SECOND ATTACK TIME, AND THE SENSITIVITY IS APPROXIMATELY 48 STEPS (30 HEX) PER DECADE ABOUT THIS POINT.

ADDRESS 14 - LOWPASS FILTER TRANSIENT GENERATOR ATTACK TIME:
SAME AS ADDRESS 13 BUT FOR THE LOWPASS FILTER TRANSIENT GENERATOR.

ADDRESS 15 - LOWPASS FILTER TRANSIENT GENERATOR SUSTAIN VOLTAGE:
SAME AS ADDRESS 12 BUT FOR THE LOWPASS FILTER TRANSIENT GENERATOR.

ADDRESS 16 - LOWPASS FILTER TRANSIENT GENERATOR INITIAL DECAY TIME:
SAME AS ADDRESS 10 BUT FOR THE LOWPASS FILTER TRANSIENT GENERATOR.

ADDRESS 17 - LOWPASS FILTER TRANSIENT GENERATOR FINAL DECAY TIME:
SAME AS ADDRESS 11 BUT FOR THE LOWPASS FILTER TRANSIENT GENERATOR.

ADDRESS 18 - VCO TRANSIENT GENERATOR INITIAL DECAY TIME:
SAME AS ADDRESS 10 BUT FOR THE VCO TRANSIENT GENERATOR.

ADDRESS 19 - VCO TRANSIENT GENERATOR FINAL DECAY TIME:
SAME AS ADDRESS 11 BUT FOR THE VCO TRANSIENT GENERATOR.

ADDRESS 1A - VCO TRANSIENT GENERATOR SUSTAIN VOLTAGE:
SAME AS ADDRESS 12 BUT FOR THE VCO TRANSIENT GENERATOR.

ADDRESS 1B - VCO TRANSIENT GENERATOR ATTACK TIME:
SAME AS ADDRESS 13 BUT FOR THE VCO TRANSIENT GENERATOR.

ADDRESS 1C - VCA TRANSIENT GENERATOR ATTACK TIME:
SAME AS ADDRESS 13 BUT FOR THE VCA TRANSIENT GENERATOR.

ADDRESS 1D - VCA TRANSIENT GENERATOR SUSTAIN VOLTAGE:
SAME AS ADDRESS 12 BUT FOR THE VCA TRANSIENT GENERATOR.

ADDRESS 1E - VCA TRANSIENT GENERATOR INITIAL DECAY TIME:
SAME AS ADDRESS 10 BUT FOR THE VCA TRANSIENT GENERATOR.

ADDRESS 1F - VCA TRANSIENT GENERATOR FINAL DECAY TIME:
SAME AS ADDRESS 11 BUT FOR THE VCA TRANSIENT GENERATOR.

ADDRESS 20 - FILTER CONTROL WORD:
BITS 4-7: UNUSED
BIT 3: EXTERNAL KEYBOARD CV ON/OFF - NOT IMPLEMENTED - LEAVE ZERO.
BIT 2: MODULATION BUS TO HIGHPASS FILTER FREQUENCY - A "1" VALUE CAUSES THE MOD BUS TO MODULATE THE HIGHPASS FILTER FREQUENCY.
BIT 1: MODULATION BUS TO LOWPASS FILTER FREQUENCY - A "1" CAUSES FREQUENCY MODULATION BY THE MODULATION BUS.
BIT 0: LOWPASS FILTER SIGNAL SELECTION - A "0" VALUE CAUSES THE FILTERS TO ACT IN SERIES, I. E. THE LOWPASS FILTER OBTAINS ITS SIGNAL FROM THE HIGHPASS FILTER OUTPUT. A "1" VALUE IS FOR PARALLEL OPERATION, THE LOWPASS FILTER'S SIGNAL INPUT IS THE SAME AS THE HIGHPASS FILTER'S, BEING THE SUM OF THE OSCILLATOR AND NOISE ATTENUATOR OUTPUTS.

ADDRESS 21 - HIGHPASS FILTER KEYBOARD TRACKING AMOUNT:
THIS PARAMETER DETERMINES THE EXTENT TO WHIGH THE HIGHPASS FILTER TRACKS THE KEYBOARD CONTROL VOLTAGE. A ZERO VALUE RESULTS IN NO TRACKING, AND THE AMOUNT INCREASES LINEARLY WITH 80 HEX BEING 1 VOLT PER OCTAVE TRACKING.

ADDRESS 22 - LOWPASS FILTER KEYBOARD TRACKING AMOUNT:
SAME AS ADDRESS 21 BUT FOR THE LOWPASS FILTER.

ADDRESS 23 - VCO AUXILIARY CONTROL LAG TIMES:

BITS 4-7: CONTROL THE LAG RATE ON VCO 1 AUXILIARY CONTROL. A "0" GIVES NO LAG, AND THE LAG INCREASES IN LOGARITHMIC STEPS FROM 4 MSEC TO 4 SECS FOR VALUES 2 THROUGH 15. THIS PARAMETER MUST BE LEFT AT ZERO WHEN NOT IN USE.

BITS 0-3: ARE THE SAME AS BITS 4-7 FOR VCO 2 AUXILIARY CONTROL. AGAIN, THIS PARAMETER MUST BE ZERO WHEN NOT IN USE.

ADDRESS 24 - RESONANT FILTER/OUTPUT CONTROL WORD:

BITS 4-7: CONTROL THE LAG TIME ON THE OUTPUT ATTENUATION PARAMETER. A "0" GIVES NO LAG, AND THE LAG INCREASES IN LOGARITHMIC STEPS FROM 4 MSEC TO 4 SEC FOR VALUES FROM 2 THROUGH 15.

BIT 3: RESONANT FILTER HIGHPASS OUTPUT ON - A "1" ALLOWS THE RESONANT FILTER HIGHPASS OUTPUT TO BE MIXED INTO THE FINAL OUTPUT ATTENUATOR.

BIT 2: RESONANT FILTER BANDPASS OUTPUT ON - A "1" TURNS ON THE BANDPASS OUTPUT.

BIT 1: RESONANT FILTER LOWPASS OUTPUT ON - A "1" TRUNS ON THE LOWPASS OUTPUT.

BIT 0: TEST LED OFF - A "0" TURNS THE TEST LED ON THE BOARD ON, A "1" OFF.

ADDRESS 25 - LOW FREQUENCY OSCILLATOR - NOISE SOURCE - MODULATION BUS CONTROL:

BIT 7: LFO RESET (SYNC) - A "1" TO "0" TRANSITION ON THIS BIT FORCES THE LFO SAWTOOTH TO DISCHARGE, THE PULSE TO RISE, AND THE TRIANGLE WAVEFORM TO JUMP TO THE MAXIMUM POINT IN THE WAVEFORM.

BITS 5-6: THESE BITS SELECT THE LFO WAVEFORM:

0 (00)=INVERTED SAWTOOTH (JUMP TO +10 VOLTS, RAMP TO ZERO).
1 (01)=SQUARE WAVEFORM (ZERO TO +10 VOLTS)
2 (10)=TRIANGLE WAVEFORM (+5 TO -5 VOLTS)
3 (11)=SAWTOOTH WAVEFORM (RAMP TO +10 VOLTS, JUMP BACK TO ZERO)

BIT 4: A "1" CONNECTS THE LFO OUTPUT INTO THE MODULATION BUS ATTENUATOR.

BIT 3: A "1" SUMS WHITE NOISE INTO THE NOISE SOURCE OUTPUT.

BIT 2: A "1" SUMS PINK NOISE (-3DB/OCTAVE FILTER) INTO THE NOISE SOURCE OUTPUT.

BIT 1: A "1" SUMS LOW FILTERED NOISE (-6DB/OCTAVE FILTER) INTO NOISE OUTPUT.

BIT 0: A "1" SUMS THE NOISE SOURCE INTO THE MODULATION BUS ATTENUATOR.

ADDRESS 26 - MODULATION LAG TIME:

BITS 4-7: UNUSED

BITS 0-3: CONTROL THE LAG TIME ON CHANGES IN THE MODULATION BUS ATTENUATION (ADDRESS 0C). A "0" GIVES NO LAG, AND THE LAG INCREASES IN LOGARITHMIC STEPS FROM 4 MSEC TO 4 SEC FOR VALUES FROM 2 THROUGH 15.

ADDRESS 27 - GATES AND TRIGGERS:
BIT 7: VCA TRANSIENT GENERATOR TRIGGER - A "0" TO "1" TRANSITION MUST ACCOMPANY ANY SUCH TRANSITION ON THE GATE BIT FOR CORRECT FUNCTION. IF ADDITIONAL ATTACK PHASES ARE DESIRED (RETRIGGERING) THIS BIT MAY BE BROUGHT TO "0" WITH NO EFFECT. WHEN A NEW "0" TO "1" TRANSITION OCCURS AND THE TRANSIENT GENERATOR IS IN INITIAL DECAY PHASE, A NEW ATTACK PHASE TO +10 VOLTS AT THE ATTACK TIME WILL BEGIN.
BIT 6: VCA TRANSIENT GENERATOR GATE - A "1" CAUSES THE VCA TRANSIENT GENERATOR TO FIRE (MUST BE ACCOMPANIED BY A "1" ON THE TRIGGER FOR CORRECT FUNCTION). WHEN THE GATE IS PRESENT, THE TRANSIENT GENERATOR WILL ATTACK TO +10 VOLTS AT THE ATTACK TIME, THEN DECAY TO THE SUSTAIN VOLTAGE AT THE INITIAL DECAY TIME. WHENEVER THE GATE IS BROUGHT TO "0", THE TRANSIENT GENERATOR WILL DECAY TO ZERO VOLTS AT THE FINAL DECAY TIME.
BIT 5: LOWPASS FILTER TRANSIENT GENERATOR TRIGGER.
BIT 4: LOWPASS FILTER TRANSIENT GENERATOR GATE
BIT 3: HIGHPASS FILTER TRANSIENT GENERATOR TRIGGER.
BIT 2: HIGHPASS FILTER TRANSIENT GENERATOR GATE.
BIT 1: VCO TRANSIENT GENERATOR TRIGGER.
BIT 0: VCO TRANSIENT GENERATOR GATE.

ADDRESS 28 - HIGHPASS FILTER TRANSIENT GENERATOR FREQUENCY MODULATION LEVEL:
THIS PARAMETER DETERMINES THE SIGN AND AMOUNT OF MODULATION ON THE HIGHPASS FILTER CUTOFF FREQUENCY BY THE HIGHPASS FILTER TRANSIENT GENERATOR. THE SENSITIVITY IS LINEAR WITH 80 HEXIDECIMAL BEING NO MODULATION, FF HEX BEING UNITY GAIN POSITIVE MODULATION, AND ZERO BEING UNITY GAIN NEGATIVE MODULATION.

ADDRESS 29 - LOWPASS FILTER TRANSIENT GENERATOR FREQUENCY MODULATION LEVEL:
SAME AS ADDRESS 28 BUT FOR THE LOWPASS FILTER.

ADDRESS 2A - VCA AUXILIARY AMPLITUDE MODULATION LEVEL
THIS PARAMETER DETERMINES THE LEVEL OF THE SELECTED AUXILIARY AMPLITUDE MODULATION SIGNAL (ADDRESS 2B). THE RESPONSE IS LINEAR WITH ZERO BEING OFF AND FF HEX BEING UNITY GAIN.

ADDRESS 2B - VCA CONTROL WORD
BITS 4-7: NOT USED
BIT 3: A "0" ALLOWS THE VCA TRANSIENT GENERATOR TO VARY THE SIGNAL AMPLITUDE IN A LINEAR FASHION. A "1" CHANGES THAT RELATIONSHIP TO EXPONENTIAL.
BIT 2: A "1" ALLOWS THE MODULATION BUS TO AMPLITUDE MODULATE THE SIGNAL. THIS EFFECT IS MULTIPLIED WITH THE TRANSIENT GENERATOR AND IS EXPOENTIAL IN EFFECT, THUS A CONSTANT DB MODULATION LEVEL WILL RESULT THROUGHOUT THE TRANSIENT GENERATOR CYCLE.
BIT 0-1: VCA AUXILIARY MODULATION SIGNAL SELECTION (SEE ADDRESS 2A)
0 (00)=KEYBOARD CONTROL VOLTAGE
1 (01)=VCO 2 OUTPUT
2 (10)=VCO TRANSIENT GENERATOR
3 (11)=VCO 1 OUTPUT

ADDRESS 2C - HIGHPASS FILTER OUTPUT LEVEL
THIS PARAMETER DETERMINES THE AMOUNT OF HIGHPASS FILTER OUTPUT ROUTED TO THE VCA. ZERO IS OFF, AND THE VARIATION IS LINEAR WITH FF HEX BEING UNITY GAIN.

ADDRESS 2D - LOWPASS FILTER OUTPUT LEVEL
SAME AS ADDRESS 2C BUT FOR THE LOWPASS FILTER

ADDRESS 2E - LOWPASS FILTER RESONANCE (Q)
THIS PARAMETER DETERMINES THE RESONANCE OF THE LOWPASS FILTER. ZERO IS NO RESONANCE (Q=1/2). THE RESONANCE INCREASES TO OSCILLATION AT F0 HEX. THE OSCILLATION LEVEL VARIES SLIGHTLY WITH FREQUENCY, SO VALUES BELOW E0 HEX SHOULD BE USED AS A MAXIMUM VALUE TO GUARANTEE LACK OF OSCILLATION.

ADDRESS 2F - PORTAMENTO TIME
BITS 4-7: NOT USED
BITS 0-3: CONTROL THE PORTAMENTO TIME FOR THE KEYBOARD CONTROL VOLTAGE. A "0" GIVES NO PORTAMENTO, AND THE TIME CONSTANT INCREASES LOGARITHMICALLY FROM 4 MSEC TO 4 SECS FOR VALUES FROM 2 TO 15.

ADDRESS 30 - VCO 1 MODULATION CONTROL WORD:
BIT 7: NOT USED
BIT 6: NOT USED
BIT 5: A "1" ALLOWS THE "PWM2" BUS TO MODULATE THE PULSE WIDTH.
BIT 4: A "1" ALLOWS THE MODULATION BUS TO MODULATE THE PULSE WIDTH.
BIT 3: A "1" CAUSES THE VCO TO SYNC TO THE OTHER VCO. WHEN THE OTHER VCO DISCHARGES ITS SAWTOOTH, THIS VCO IS ALSO FORCED TO DISCHARGE.
BIT 2: A "1" ALLOWS THE "FM2" BUS TO MODULATE THE FREQUENCY.
BIT 1: A "1" ALLOWS THE MODULATION BUS TO MODULATE THE FREQUENCY.
BIT 0: A "1" CAUSES THE VCO TO TRACK THE KEYBOARD CONTROL VOLTAGE.

ADDRESS 31 - VCO 1 AUTOMATIC SENSITIVITY CONTROL:
THIS PARAMETER SHOULD NOMINALLY BE SET TO 80 HEXIDECIMAL. IF THE COMPUTER DETERMINES BY MEANS OF THE FREQUENCY SENSE OUTPUT FROM THE CARD THAT THE VCO IS NOT TRACKING AT PRECISELY 1 OCTAVE/24 STEPS FROM THE FREQUENCY CONTROLS, THIS PARAMETER CAN BE VARIED. A LARGER VALUE WILL RESULT IN LESS SENSITIVITY TO THE FREQUENCY PARAMETERS, I. E. HIGHER PITCH AT FREQUENCIES BELOW 880 HZ.

ADDRESS 32 - VCO 2 MODULATION CONTROL WORD:
SAME AS ADDRESS 30 BUT FOR VCO 2.

ADDRESS 33 - VCO 2 AUTOMATIC SENSITIVITY CONTROL:
SAME AS ADDRESS 31 BUT FOR VCO 2.

ADDRESS 34 - VCO WAVEFORM SELECTION:
BIT 7: NOT USED
BIT 6: A "1" SUMS VCO 2 SAWTOOTH INTO THE VCO 2 OUTPUT.
BIT 5: A "1" SUMS VCO 2 PULSE INTO THE VCO 2 OUTPUT.
BIT 4: A "1" SUMS VCO 2 TRIANGLE INTO THE VCO 2 OUTPUT.
BIT 3: NOT USED
BIT 2: A "1" SUMS VCO 1 SAWTOOTH INTO THE VCO 1 OUTPUT.
BIT 1: A "1" SUMS VCO 1 PULSE INTO THE VCO 1 OUTPUT.
BIT 0: A "1" SUMS VCO 1 TRIANGE INTO THE VCO 1 OUTPUT.

ADDRESS 35 - VCO 1 OUTPUT ATTENUATOR:
DETERMINES THE LEVEL AT WHICH VCO 1 IS PATCHED TO THE FILTERS. A VALUE OF FF HEXIDECIMAL IS OFF, AND 00 HEXIDECIMAL IS FULL LEVEL. THE RELATIONSHIP IS NON-LINEAR, AND EQUATIONS AND GRAPHS OF THE RESPONSE ARE GIVEN AT THE END OF THIS SECTION.

ADDRESS 36 - VCO 2 OUTPUT ATTENUATOR:
SAME AS ADDRESS 35 BUT FOR VCO 2.

ADDRESS 37 - NOISE SOURCE OUTPUT ATTENUATOR:
SAME AS ADDRESS 35 BUT FOR THE NOISE SOURCE LEVEL INTO THE FILTERS.

ADDRESS 38 - "PWM2" BUS LEVEL:
THIS PARAMETER DETERMINES THE LEVEL OF THE SELECTED "PWM2" SIGNAL (ADDRESS 3A) ONTO THE "PWM2" BUS. THE RESPONSE IS LINEAR WITH ZERO BEING OFF AND FF HEX BEING FULL LEVEL.

ADDRESS 39 - "FM2" BUS LEVEL:
THIS PARAMETER DETERMINES THE LEVEL OF THE SELECTED "FM2" SIGNAL (ADDRESS 3A) ONTO THE "FM2" BUS. THE RESPONSE IS LINEAR WITH ZERO BEING OFF AND FF HEX BEING FULL LEVEL.

ADDRESS 3A - "FM2" AND "PWM2" SIGNAL SELECTION:
BITS 4-7: NOT USED
BITS 2-3: SELECT THE "FM2" BUS SIGNAL FOR ATTENUATION (ADDRESS 39)
- 0 (00)=+VCO TRANSIENT GENERATOR
- 1 (01)=-VCO TRANSIENT GENERATOR
- 2 (10)=VCO 1 OUTPUT
- 3 (11)=INVERTED LFO (MODULATES FREQUENCY DOWNWARD)

BITS 0-1: SELECTS THE "PWM2" BUS SIGNAL FOR ATTENUATION (ADDRESS 38)
- 0 (00)=VCO TRANSIENT GENERATOR
- 1 (01)=VCO 1 OUTPUT
- 2 (10)=KEYBOARD CONTROL VOLTAGE
- 3 (11)=INVERTED LFO

ADDRESS 3B - NOT USED
LEAVE ZERO IF POSSIBLE

ADDRESS 3C - NOT USED
LEAVE ZERO IF POSSIBLE

ADDRESS 3D - NOT USED
LEAVE ZERO IF POSSIBLE

ADDRESS 3E - NOT USED
LEAVE ZERO IF POSSIBLE

ADDRESS 3F - NOT USED
LEAVE ZERO IF POSSIBLE

SIGNAL ATTENUATOR RESPONSE

THE SIGNAL ATTENUATORS (ADDRESSES 35,36,37) HAVE A NON-LINEAR RESPONSE ALLOWING PRECISE SIGNAL LEVEL CONTROL OVER A WIDE DYNAMIC RANGE. MATHEMATICALLY, FOR A PARAMETER VALUE N WHERE N VARIES FROM ZERO TO 255, THE ATTENUATION IN DB IS GIVEN BY THE EQUATION:

ATTENUATION (DB) = 20 LOG [(255-N)/(11N+256)]

GRAPHICALLY, THE ATTENUATION VERSUS PARAMETER VALUE PLOT IS:

```
N= 0    20    40    60    80   100   120   140   160   180   200   220   240 255
DB |     |     |     |     |     |     |     |     |     |     |     |     |   |
0  *
5       *
10             *
15                       *
20                                  *
25                                              *
30                                                         *
35                                                                *
40                                                                       *
45                                                                          *
50
55                                                                           *
60
65
70                                                                            *
INFINITE                                                                       *
```

ADDR	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
00	KYBD	VCO2PW	VCO1IF	VCO2FT	OUTATT	HPFIF	LPFIF	VCO2IF	VCO1PW	VCO2CL	VCO1CL	VCO1FT	MODATT	RFIF	-LFOIF	RFQ
10	HPFID	HPFFD	HPFSV	HPFAT	LPFAT	LPFSV	LPFID	LPFFD	VCOID	VCOFD	VCOSV	VCOAT	VCAAT	VCASV	VCAID	VCAFD
20	FILTER	HPFKBD	LPFKBD	VCOLAG	RF/OUT	LFO/NS	MODLAG	GATES	HPFTGA	LPFTGA	VCAMDA	VCA	HPFAMP	LPFAMP	LPFQ	PORT
BIT 7	------	LEVEL	LEVEL	VCO1CL	OUTLAG	LFOSNC	------	VCA T	+/-LVL	+/-LVL	LEVEL	------	LEVEL	LEVEL	Q LVL	------
BIT 6	------	"	"	"	"	LFOWF1	------	VCA G	"	"	"	------	"	"	"	------
BIT 5	------	"	"	"	"	LFOWF0	------	LPF T	"	"	"	------	"	"	"	------
BIT 4	------	"	"	"	"	LFOMOD	------	LPF G	"	"	"	------	"	"	"	------
BIT 3	EXTKBD	"	"	VCO2CL	RFHP	WHITE	MODLAG	HPF T	"	"	"	EXP'L	"	"	"	PORT
BIT 2	HPFMOD	"	"	"	RFBP	PINK	"	HPF G	"	"	"	VCAMOD	"	"	"	"
BIT 1	LPFMOD	"	"	"	RFLP	LOW	"	VCO T	"	"	"	VCAMS1	"	"	"	"
BIT 0	PARALL	"	"	"	LEDOFF	NSMOD	"	VCO G	"	"	"	VCAMS0	"	"	"	"
30	VCO1	VCO1AS	VCO2	VCO2AS	VCOWF	VCO1AT	VCO2AT	NSATTN	PWM2A	FM2A	FMPWM					
BIT 7	------	ASC	------	ASC	------	ATTEN	ATTEN	ATTEN	LEVEL	LEVEL	------					
BIT 6	------	"	------	"	VCO2ST	"	"	"	"	"	------					
BIT 5	PWM2	"	PWM2	"	VCO2PL	"	"	"	"	"	------					
BIT 4	PWMOD	"	PWMOD	"	VCO2TR	"	"	"	"	"	------					
BIT 3	SYNC	"	SYNC	"	------	"	"	"	"	"	FM2S1					
BIT 2	FM2	"	FM2	"	VCO1ST	"	"	"	"	"	FM2S0					
BIT 1	FRQMOD	"	FRQMOD	"	VCO1PL	"	"	"	"	"	PWM2S1					
BIT 0	KYBD	"	KYBD	"	VCO1TR	"	"	"	"	"	PWM2S0					

VCO1	VCO2	VCOAUX	NS	LFO	MOD	HPF	LPF	VCA	RF	OUT	MISC	LFOWF	FM2SEL	PWM2SEL	VCAMSEL
IF 02	IF 07	KYBD 00	SPEC 25	-IF 0E	LAG 26	IF 05	IF 06	TGAT 1C	IF 0D	LAG 24	-LED 24	0= -ST	0= +TG	0= +TG	0= KYBD
FT 0B	FT 03	PORT 2F	ATTN 37	SYNC 25	ATTN 0C	KYBD 21	KYBD 22	TGID 1E	Q 0F	ATTN 04	XKBD 20	1= SQ	1= -TG	1= VCO1	1= VCO2
ASC 31	ASC 33	1CPU 0A	MOD 25	MOD 25	SRC 25	TGAT 13	TGAT 14	TGSV 1D	HP 24			2= TRI	2= VCO1	2= KYBD	2= VCOTG
IPW 08	IPW 01	2CPU 09		WAVE 25		TGID 10	TGID 16	TGFD 1F	BP 24			3= +ST	3= -LFO	3= -LFO	3= VCO1
MODS 30	MODS 32	1LAG 23				TGSV 12	TGSV 15	TR/G 27	LP 24						
WAVE 34	WAVE 34	2LAG 23				TGFD 11	TGFD 17	EXPL 2B							
ATTN 35	ATTN 36	TGAT 1B				TR/G 27	TR/G 27	MOD 2B							
		TGID 18				TGLV 28	TGLV 29	MDLV 2A							
		TGSV 1A				MOD 20	SIGS 20								
		TGFD 19				LVL 2C	Q 2E								
		TR/G 27					MOD 20								
		FM2S 3A					LVL 2D								
		FM2L 39													
		PWMS 3A													
		PWML 38													

E-mu SYSTEMS
417 Broadway
Santa Cruz, CA 95060
(408) 429-9147

E-MU AUDITY VOICE CARD - SIGNAL DEFINITIONS AND SPECIFICATIONS 14 JANUARY 1980

I. GENERAL DESCRIPTION

THIS DOCUMENT DESCRIBES INPUT AND OUTPUT SIGNALS FROM THE E-MU AUDITY VOICE CARDS WITH MEMORY-LIKE DIGITAL INTERFACE. SIGNAL LEVELS, IMPEDANCES, AND TIMINGS ARE DISCUSSED.

POWER SUPPLY REQUIREMENTS ARE GIVEN.

DIGITAL SIGNALS, THEIR FUNCTIONS, LOADINGS, AND TIMINGS ARE DISCUSSED.

ANALOG OUTPUT SPECIFICATIONS ARE GIVEN.

II. POWER REQUIREMENTS

ONLY THREE POWER SUPPLIES ARE REQUIRED:

+5 VOLTS - USED FOR DIGITAL CIRCUITRY. NEITHER GREAT STABILITY NOR LOW RIPPLE AND NOISE ARE REQUIRED. WE RECOMMEND A SWITCHING SUPPLY IF POSSIBLE.
VOLTAGE: +5 VDC +/- 5%
CURRENT: 6 AMPERES AT OPERATING TEMPERATURE
LINE AND LOAD REGULATION: 1% OVER RATED RANGE
RIPPLE AND NOISE: 50 MILLIVOLT PEAK TO PEAK MAXIMUM
TEMPERATURE STABILITY: WITHIN 1% OVER OPERATING TEMPERATURE

+20 VOLTS - USED FOR CMOS AND ANALOG CIRCUITRY. POST REGULATED ON EACH CIRCUIT BOARD. NEITHER GREAT STABILITY NOR LOW RIPPLE AND NOISE ARE REQUIRED. WE RECOMMEND A SWITCHING SUPPLY IF POSSIBLE.
VOLTAGE: +20 VDC +/- 5%
CURRENT: 14 AMPERES AT OPERATING TEMPERATURE
LINE AND LOAD REGULATION: 1% OVER RATED RANGE
RIPPLE AND NOISE: 100 MILLIVOLTS PEAK TO PEAK MAXIMUM
TEMPERATURE STABILITY: WITHIN 1% OVER OPERATING TEMPERATURE

-20 VOLTS - USED FOR ANALOG CIRCUITRY. POST REGULATED ON EACH CIRCUIT BOARD. NEITHER GREAT STABILITY NOR LOW RIPPLE AND NOISE ARE REQUIRED. WE RECOMMEND A SWITCHING SUPPLY IF POSSIBLE.
VOLTAGE: -20 VDC ;/- 5%
CURRENT: 10 AMPERES AT OPERATING TEMPERATURE
LINE AND LOAD REGULATION: 1% OVER RATED RANGE
RIPPLE AND NOISE: 100 MILLIVOLTS PEAK TO PEAK MAXIMUM
TEMPERATURE STABILITY: WITHIN 1% OVER OPERATING TEMPERATURE

THE POWER SUPPLIES SHOULD BE MOUNTED AS FAR FROM THE VOICE CARD CAGE AS PRACTICAL TO MINIMIZE TEMPERATURE CHANGES AT THE VOICE CARDS. A SEPARATE ENCLOSURE WOULD BE DESIRABLE. THE SPECIFICATIONS ARE TO BE MEASURED AT THE VOICE CARD CAGE CONNECTIONS; REMOTE SENSING MAY BE NECESSARY.

II. ANALOG SIGNAL OUTPUTS

EACH VOICE CARD HAS TWO EQUIVALENT OUTPUTS. THEY ARE TYPICAL OF MODERN SYNTHESIZERS SUCH AS ARP AND E-MU< BEING A 1.0K OHM 1/4 WATT RESISTOR DRIVEN BY AN OP-AMP WITH +/- 15 VOLT SUPPLIES.

OUTPUT IMPEDANCE 1.0K OHM, SINGLE ENDED. 2 INDEPENDENT CHANNELS CARRYING THE SAME SIGNAL ON EACH BOARD.

NOMINAL OUTPUT LEVEL: 10V PEAK TO PEAK FOR TYPICAL LEVEL OUTPUT SIGNAL.
OUTPUT LEVEL AT CLIPPING: 25V PEAK TO PEAK.
MAXIMUM OUTPUT CURRENT: +/- 5 MILLIAMPS TOTAL CURRENT BOTH OUTPUTS
MAXIMUM DC OFFSET WITH MAXIMUM ATTENUATION AT OUTPUT ATTENUATOR: 50 MILLIVOLTS.
MAXIMUM DC OFFSET AT ANY OUTPUT ATTENUATION: 500 MILLIVOLTS.

THE OUTPUT ATTENUATOR ON EACH CHANNEL MAY BE USED TO PROGRAM THE OUTPUT LEVEL TO ANY VALUE BELOW THE MAXIMUMS GIVEN ABOVE WITH LITTLE SIGNAL/NOISE PENALTY.

WE RECOMMEND THE OUTPUTS BE CARRIED FROM THE BOARDS BY SHIELDED CABLES. IF A BALANCED OUTPUT IS REQUIRED, MATCHING TRANSFORMERS ARE RECOMMENDED.

III. DIGITAL SIGNALS AND COMPUTER INTERFACE

THERE ARE THREE VARIETIES OF DIGITAL SIGNALS TO AND FROM THE DIGITAL INTERFACE. A DATA BUS 8 BITS WIDE CARRIES DATA TO AND FROM THE CARDS. AN ADDRESS BUS 12 BITS WIDE SELECTS THE CARD AND WORD TO BE ADDRESSED. CONTROL LINES DETERMINE THE FUNCTION TO BE PERFORMED.

ALL SIGNALS ARE TTL COMPATIBLE. THE LOADING ON ANY INPUT IS TYPICALLY ONE TTL UNIT LOAD. ANY OUTPUT IS CAPABLE OF DRIVING AT LEAST TWO TTL UNIT LOADS.

ALL SIGNALS SHOULD BE CONNECTED USING TWISTED PAIRS WITH GROUND.

TWO FUNCTIONS CAN BE PERFORMED - READ AND WRITE. THE CYCLES WILL BE DESCRIBED SEPARATELY. REFER TO TIMING DIAGRAMS AT THE END OF THIS SECTION.

A READ CYCLE BEGINS WITH A FALLING EDGE ON THE SYNTHRQ (USER REQUEST) LINE WHILE THE READ LINE IS LOW. THE ADDRESS LINES SHOULD BE THE VALID ADDRESS OF THE WORD TO BE READ AT THIS TIME, AND THE WRITE LINE SHOULD BE HIGH. THE DATA BUS SHOULD BE IN A HIGH IMPEDANCE STATE READY TO ACCEPT OUTPUT DATA. THE ADDRESS BUS SHOULD REMAIN VALID, THE READ LINE LOW, AND THE WRITE LINE HIGH THROUGHOUT THE READ CYCLE.

A FEW NANOSECONDS AFTER THE SYNTHRQ LINE FALLS, THE INTERFACE WILL ENABLE ITS DATA BUS DRIVERS. WITHIN 1.2 MICROSECONDS AFTER THE FALLING EDGE OF SYNTHRQ, THE VALID DATA WILL BE PRESENT ON THE DATA BUS. THE DATA WILL REMAIN VALID UNTIL THE SYNTHRQ LINE GOES HIGH. THIS MUST BE NO LONGER THAN 30 MICROSECONDS AFTER THE FALLING EDGE OF SYNTHRQ. SYNTHRQ MUST REMAIN HIGH FOR NO LESS THAN 200 NANOSECONDS TO COMPLETE THE CYCLE. THE DATA BUS WILL RETURN TO A HIGH IMPEDANCE STATE WITHIN 200 NANOSECONDS OF THE RISING EDGE OF SYNTHRQ.

A WRITE CYCLE IS SIMILAR TO A READ CYCLE EXCEPT THAT IT BEGINS WITH THE WRITE LINE LOW AND THE READ LINE HIGH. ALSO AT THE FALLING EDGE OF SYNTHRQ, THE ADDRESS BUS SHOULD BE THE VALID ADDRESS OF THE WORD TO BE WRITTEN AND THE DATA BUS SHOULD BE THE VALID DATA. THE WRITE LINE SHOULD REMAIN LOW, THE READ LINE HIGH, AND THE DATA AND ADDRESS BUSSES VALID THROUGHOUT THE WRITE CYCLE.

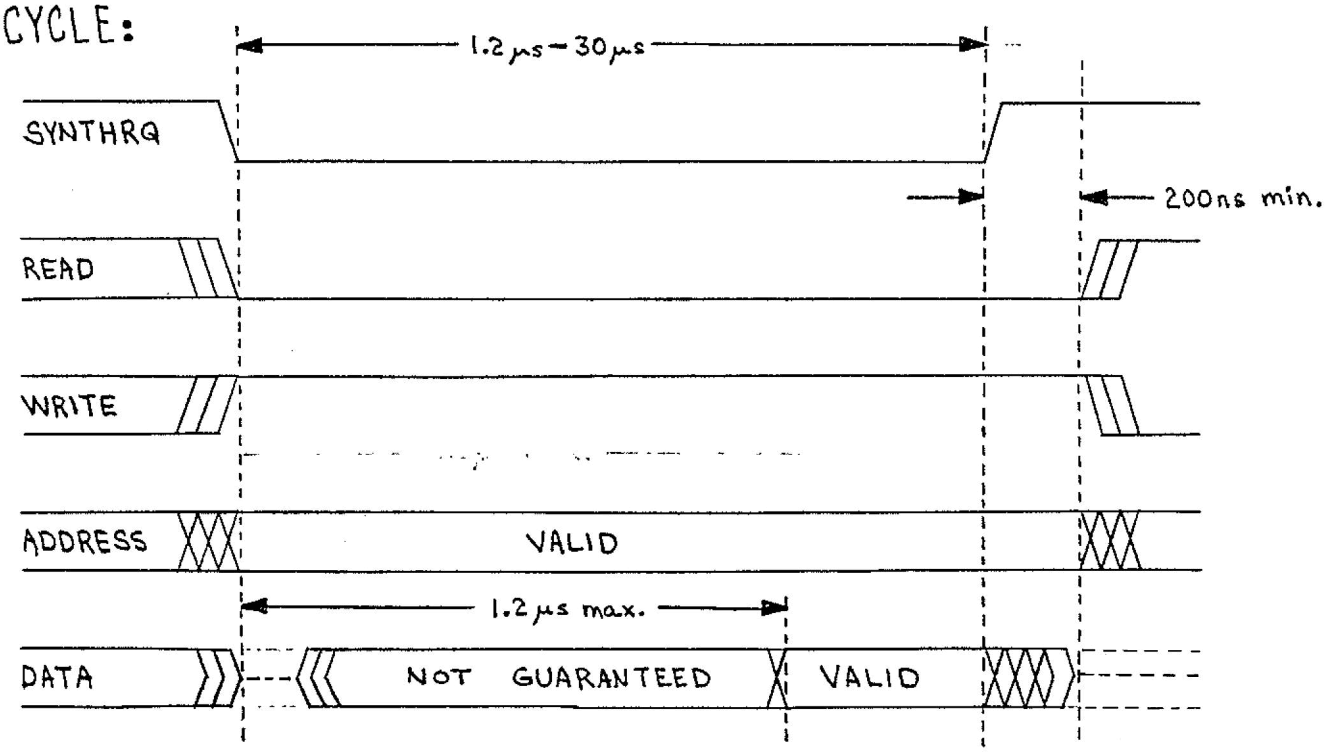
THE WRITE OPERATION WILL BE COMPLETED WITHIN 1.2 MICROSECONDS OF THE FALLING EDGE OF SYNTHRQ. AT THIS TIME, OR UP TO 30 MICROSECONDS AFTER THE FALLING EDGE OF SYNTHRQ, SYNTHRQ SHOULD BE BROUGHT HIGH. THE ADDRESS AND DATA BUS SHOULD REMAIN VALID, THE READ LINE HIGH, THE WRITE LINE LOW, AND THE SYNTHRQ LINE HIGH FOR AT LEAST 200 NANOSECONDS AFTER THE RISING EDGE OF SYNTHRQ TO COMPLETE THE WRITE CYCLE.

ALL SIGNALS WILL BE WIRE-WRAPPED ON THE CARD CAGE BY THE USER.

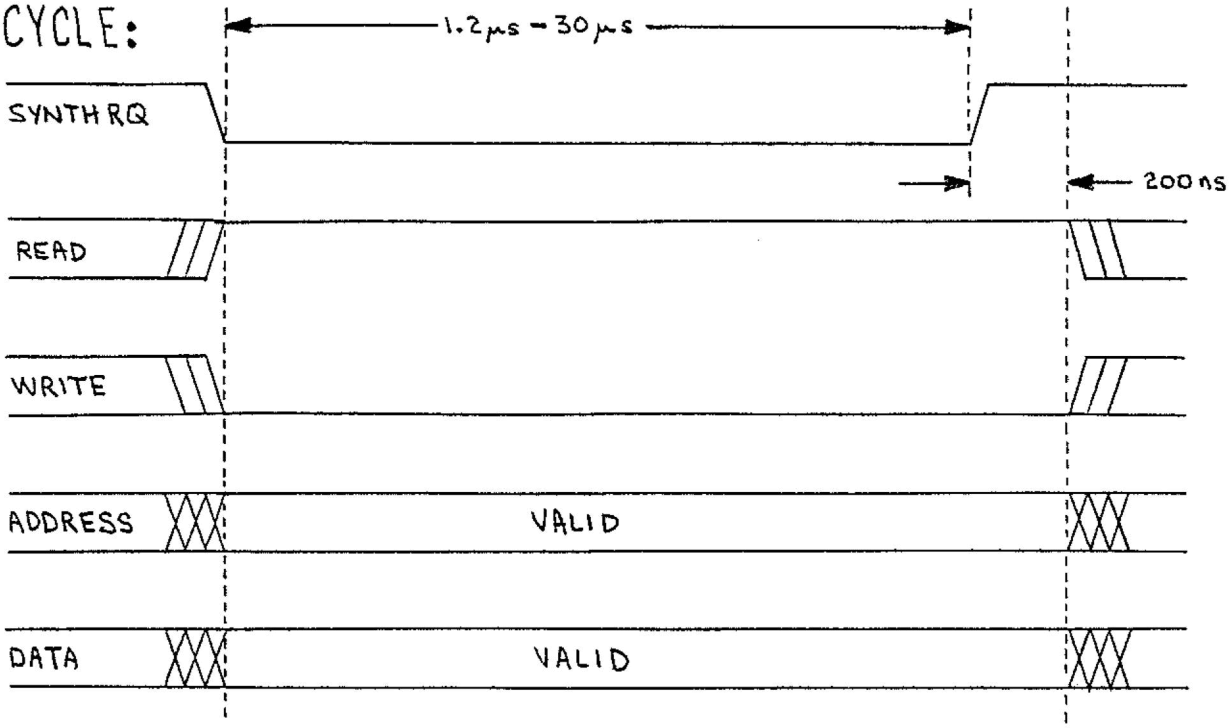
THE USER SIGNALS ARE ALL PREFIXED BY "USER". THEY ARE:

USER ADDRESS BUS (UA0-UA11) 12 LINES.
USER DATA BUS (UDB0-UDB7) 8 LINES.
-USER READ REQUEST
-USER WRITE REQUEST
-USER REQUEST (SYNTHRQ)

READ CYCLE:



WRITE CYCLE:



Eµ SYSTEMS	5 DEC 79
DWN: [illegible]	CK: [illegible]
DOC Nº	
TIMING DIAGRAM — MEMORY-LIKE INTERFACE	

E-mu SYSTEMS
417 Broadway
Santa Cruz, CA 95060
(408) 429-9147

E-MU AUDITY VOICE BOARD - AUTOTUNE INSTRUCTIONS 14 JANUARY 1980

I. GENERAL DESCRIPTION

This document describes the E-mu AUDITY voice board provisions for the autotune function, and the general guidelines the user should follow to implement the autotune function.

The autotune function is ABSOLUTELY NECESSARY in any computer controlled synthesizer situation. The function should be available as a routine executed by the computer either automatically periodically throughout use, or called by the user as well as automatically after power-up.

II. THE AUTOTUNE FUNCTION

The autotune function performs two independent calibrations on each VCO in the system. These are the two most critical trims in the system, and adjust the VCO frequency and tracking.

The autotune performs these trims by first sensing actual VCO frequency and then adjusting parameters in the voice to make the voice respond correctly. This might be repeated if substantial corrections are necessary.

There are two parameters per VCO to be adjusted. The FINE TUNE parameter adjusts the initial frequency of the VCO to exactly 880 Hz. The ASC parameter (for automatic sensitivity control) adjusts the response of the keyboard to be precisely 24 (18 Hex) steps per octave.

The autotune procedure should be executed in steps:

First, the computer should force the VCO in question to produce a square waveform of what is expected to be 880 Hz. It is recommended this be accomplished by eliminating all FM and PWM, patching the keyboard to the VCO, setting the initial frequency to 30 Hex, the VCO CPU control to 0, and the keyboard with portamento off to 60 Hex. At least 5 msec should be allowed after this has been done to allow the refresh to bring the parameters to the desired levels.

Second, the computer should sense the VCO frequency. This is accomplished using the FREQUENCY SENSE outputs from the voice cards. These outputs are open-collector TTL compatible signals for maximum flexibility. The value will be high impedance when the VCO pulse is in the low state (initial pulse width is FF Hex), and results in a square wave when the VCO pulse output gives a square waveform. It is recommended that the falling edges be used for minimum jitter effects. A pull up is required on the outputs, which can be wire-AND tied.

Two methods suggest themselves. The computer can implement separate counting hardware for each FREQUENCY SENSE output. The time between a small number of falling edges is counted using a crystal clock, and the frequency computed from the count. Alternatively, all the FREQUENCY SENSE outputs can be wire-AND tied, and the computer can set all VCO's not to be counted such that their pulse waveforms never go high (No PWM and FF Hex initial pulse width is sufficient). Then the FREQUENCY SENSE bus can be implemented with a single counter for all VCO's. The latter approach requires less hardware, but will require more time to implement the AUTOTUNE function and requires all VCO's be disabled during autotune.

The frequency count should be accurate to 0.05% at least. The number of cycles required to be counted will be determined by the frequency of the crystal clock used. It is recommended that more than one cycle be used to average jitter effects.

Third, the error from 880 Hz to the actually detected frequency is computed as a number of 1/128 semitone intervals. The FINE TUNE parameter for the VCO in question is then changed by this number (an increase in value increases the frequency) to result in a VCO at 880 HZ +/- 1/128 semitone.

Fourth, the computer then changes the keyboard parameter down two octaves (with the values given, to 30 Hex), and a 5 msec wait is again required. This should bring the VCO frequency down to 220 Hz.

Fifth, the frequency is again measured, as above.

Sixth, the error from 220 Hz is computed in increments of 1/400 semitones, and the result added to ASC parameter for the VCO in question (an increase in value for this parameter will increase the frequency is if the frequency near 220 Hz.)

Seventh, the entire process is repeated if the errors found were large.

III. SOFTWARE IMPLEMENTATION

The frequency sensing can actually be done nearly entirely by software if sufficient time is allowed and the CPU is running in an interrupt-disabled state with a crystal controlled CPU clock. The number of CPU instructions executed is counted, and this is used to determine the frequency. The appended Z-80 assembly language listing illustrates this technique for the FINE TUNE correction only.

```
LOC    OBJ CODE M STMT SOURCE STATEMENT

                     1                    ;
                     2                    ; AUTOTUNE
                     3                    ;
0000   DD2100F8      4  AUTOTN LD     IX,VOICE0
0004   DDE5          5         PUSH   IX
0006   D1            6         POP    DE
0007   3E10          7         LD     A,16     ; FILL 16 VOICES WITH NULL STUFF
0009   21AC00   R    8  SETUP  LD     HL,CALVC
000C   014000        9         LD     BC,40H
000F   EDB0         10         LDIR
0011   3D           11         DEC    A
0012   20F5         12         JR     NZ,SETUP
0014   CD6200   R   13  AUTOLP CALL   TESTVC   ; TEST IF VOICE PRESENT
0017   2038         14         JR     NZ,NXTVC
0019   DD360880     15         LD     (IX+VCO1PW),128
001D   DD362400     16         LD     (IX+LED),0       ; LED ON DURING TUNE
0021   CD7100   R   17         CALL   WAIT     ; WAIT FOR EFFECT
0024   CD7A00   R   18         CALL   FREQ     ; GET VALUE FOR VCO1 FREQ
0027   CD9E00   R   19         CALL   TUNER
002A   DD660B       20         LD     H,(IX+VCO1FT)
002D   84           21         ADD    A,H
002E   DD770B       22         LD     (IX+VCO1FT),A
0031   DD3608FF     23         LD     (IX+VCO1PW),255
0035   DD360180     24         LD     (IX+VCO2PW),128
0039   CD7100   R   25         CALL   WAIT
003C   CD7A00   R   26         CALL   FREQ
003F   CD9E00   R   27         CALL   TUNER
0042   DD6603       28         LD     H,(IX+VCO2FT)
0045   84           29         ADD    A,H
0046   DD7703       30         LD     (IX+VCO2FT),A
0049   DD3601FF     31         LD     (IX+VCO2PW),255
004D   DD362401     32         LD     (IX+LED),1
0051   114000       33  NXTVC  LD     DE,40H
0054   DD19         34         ADD    IX,DE
0056   DDE5         35         PUSH   IX
0058   D1           36         POP    DE
0059   2140FC       37         LD     HL,VOICE0+17*40H
005C   A7           38         AND    A
005D   ED52         39         SBC    HL,DE
005F   20B3         40         JR     NZ,AUTOLP
0061   C9           41         RET
                    42                    ;
0062   DD7E00       43  TESTVC LD     A,(IX)
0065   2F           44         CPL
```

```
 LOC    OBJ CODE M STMT SOURCE STATEMENT                                 ASM 5.8

0066    DD7700       45          LD      (IX),A
0069    DDBE00       46          CP      (IX)
006C    2F           47          CPL
006D    DD7700       48          LD      (IX),A
0070    C9           49          RET
                     50                          ;
0071    212C01       51   WAIT   LD      HL,SCANTM
0074    2B           52   SCANLP DEC     HL
0075    7C           53          LD      A,H
0076    B5           54          OR      L
0077    20FB         55          JR      NZ,SCANLP        ; WAIT TILL VALUES IN EFFECT
0079    C9           56          RET
                     57                          ;
007A    F3           58   FREQ   DI                  ; NO INTERRUPT DURING COUNT ROUTINES
007B    210000       59          LD      HL,0        ; HL COUNTS LOOPS
007E    067B         60          LD      B,123       ; COUNT 123 CYCLES
0080    DB09         61   LOOPHI IN      A,(9)       ; WAIT TILL HIGH STATE
0082    E620         62          AND     MASK
0084    28FA         63          JR      Z,LOOPHI
0086    DB09         64   LOOPLO IN      A,(9)       ; NOW FIND FALLING EDGE
0088    E620         65          AND     MASK
008A    20FA         66          JR      NZ,LOOPLO
008C    DB09         67   CLOW   IN      A,(9)       ; COUNT LOOPS WHILE LOW
008E    23           68          INC     HL
008F    E620         69          AND     MASK
0091    28F9         70          JR      Z,CLOW
0093    DB09         71   CHIGH  IN      A,(9)       ; NOW COUNT WHILE HIGH
0095    23           72          INC     HL
0096    E620         73          AND     MASK
0098    20F9         74          JR      NZ,CHIGH
009A    10F0         75          DJNZ    CLOW        ; AND COUNT B CYCLES TOTAL
009C    FB           76          EI                  ; TOTAL TIME IS 8+3*B+72*HL CYCLES
009D    C9           77          RET                 ; 880 HZ WOULD BE 8717 COUNTS
                     78                          ;
009E    110C22       79   TUNER  LD      DE,8716
00A1    A7           80          AND     A
00A2    ED52         81          SBC     HL,DE
00A4    7D           82          LD      A,L
00A5    CB2C         83          SRA     H
00A7    1F           84          RRA
00A8    CB2C         85          SRA     H
00AA    1F           86          RRA                 ; A IS HL/4
00AB    C9           87          RET
                     88                          ;
```

SYSTEMS
417 Broadway
Santa Cruz, CA 95060
(408) 429-9147

PARTS LIST - E-mu Systems SSM Chip Voice Demo Board

QTY	PART	MFR'S PART NUMBER
1	Circuit Board	Available from E-mu - $50 by itself
1	Edge Conn.	TEKA TP5-W01-50 or any S-100 type.

The following parts are required for the on-board power supply. None are required if +/- 15V are supplied to the board externally. The user must supply fused 110VAC to the board's power connector.

1	Power Conn.	MOLEX 09-65-1031
1	Mating Conn.	MOLEX 09-50-3031 with 3 08-50-0106 pins
1	Transformer	SIGNAL TRANSFORMER ST 4-36
2	200uF 40V Cap	SPRAGUE 500D208G050FF7
4	1N4002 Diode	MOTOROLA
2	2N4923	MOTOROLA
2	Heatsinks	THERMALLOY 6073
2	Hdwe for above	2 ea. 4-40x1/2" screw, nut, lockwasher
1	741 opamp	NATIONAL LM741CN
1	723 requlator	NATIONAL LM723CN
1	2N3904	MOTOROLA
4	3.01K 1% Res	DALE RN55D
1	3.32K 1% Res	DALE RN55D
1	9.09K 1% Res	DALE RN55D
2	3.9 ohm Res	Any 1/4 watt 5%
1	200 ohm	"
1	470 pF Cap	SPRAGUE 5GA-T47

The following parts are required depending on filter option:

LOWPASS:

4	1000 pF Cap	SPRAGUE 5GA-D10
5	10K Res	Any 1/4 watt 5%

HIGHPASS:

4	2000 pF Cap	SPRAGUE 5GA-D20

ALLPASS (Phase-shifter):

4	2000 pF Cap	SPRAGUE 5GA-D20
5	10K Res	Any 1/4 watt 5%

The remaining parts are required for stuffing the board as per schematics:

QTY	PART	MFR'S PART NUMBER
1	741 opamp	NATIONAL LM741CN
4	1458 dl opamp	NATIONAL LM1458CN
4	dl bifet opamp	TEXAS INSTRUMENTS TL082CP or NATIONAL LF353N
1	SSM2020 Custom IC, available from E-mu for $7.50 ea.	
2	SSM2030 Custom IC, available from E-mu for $10.00 ea.	
1	SSM2040 Custom IC, available from E-mu for $10.00 ea.	
2	SSM2050 Custom IC, available from E-mu for $7.50 ea.	
8	1N914 Diode	FAIRCHILD or any 1N914 or 1N4148
2	10K Trimmer	BECKMAN 91BR10K
2	20K Trimmer	SPECTROL 64Y203 (20 turn)
1	20K Trimmer	BECKMAN 91BR20K
4	100k Trimmer	BECKMAN 91BR100K
2	121 ohm 1% R	DALE RN55D
2	54.9K 1% Res	DALE RN55D
2	90.9K 1% Res	DALE RN55D
2	100K 1% Res	DALE RN55D
2	267K 1% Res	DALE RN55D
3	1.0K Tempco R	TEL LABS Q-81, available from E-mu for $3.50 ea.
3	5 pF Cap	SPRAGUE 10TSV33
3	22 pF Cap	SPRAGUE 10TSQ22
4	100 pF Cap	SPRAGUE 10TST10
4	1000 pF Cap	SPRAGUE 5GAD10
2	1000 pF PolyS	MALLORY SXM110, available from E-mu for $0.45 ea.
2	0.01 uF Cap	SPRAGUE TG-S10
14	0.1 uF Cap	SPRAGUE 3CZU104D8050C5
2	10 uF 35V Tant	SPRAGUE 196D106X0035PE4
4	200 ohm Res	All following are any 1/4 watt 5%
11	1.0K	
6	2.2K	
2	7.5K	
10	10K	
4	15K	
4	20K	
4	22K	
2	27K	
8	47K	
1	56K	
1	91K	
29	100K	
2	150K	
5	270K	
6	330K	
2	470K	
2	1.5M	
2	2.2M	
2	2.7M	
2	10M	

Except parts so specified above, E-mu will not sell listed parts separately. Add $2.00 for handling on all orders for parts alone.

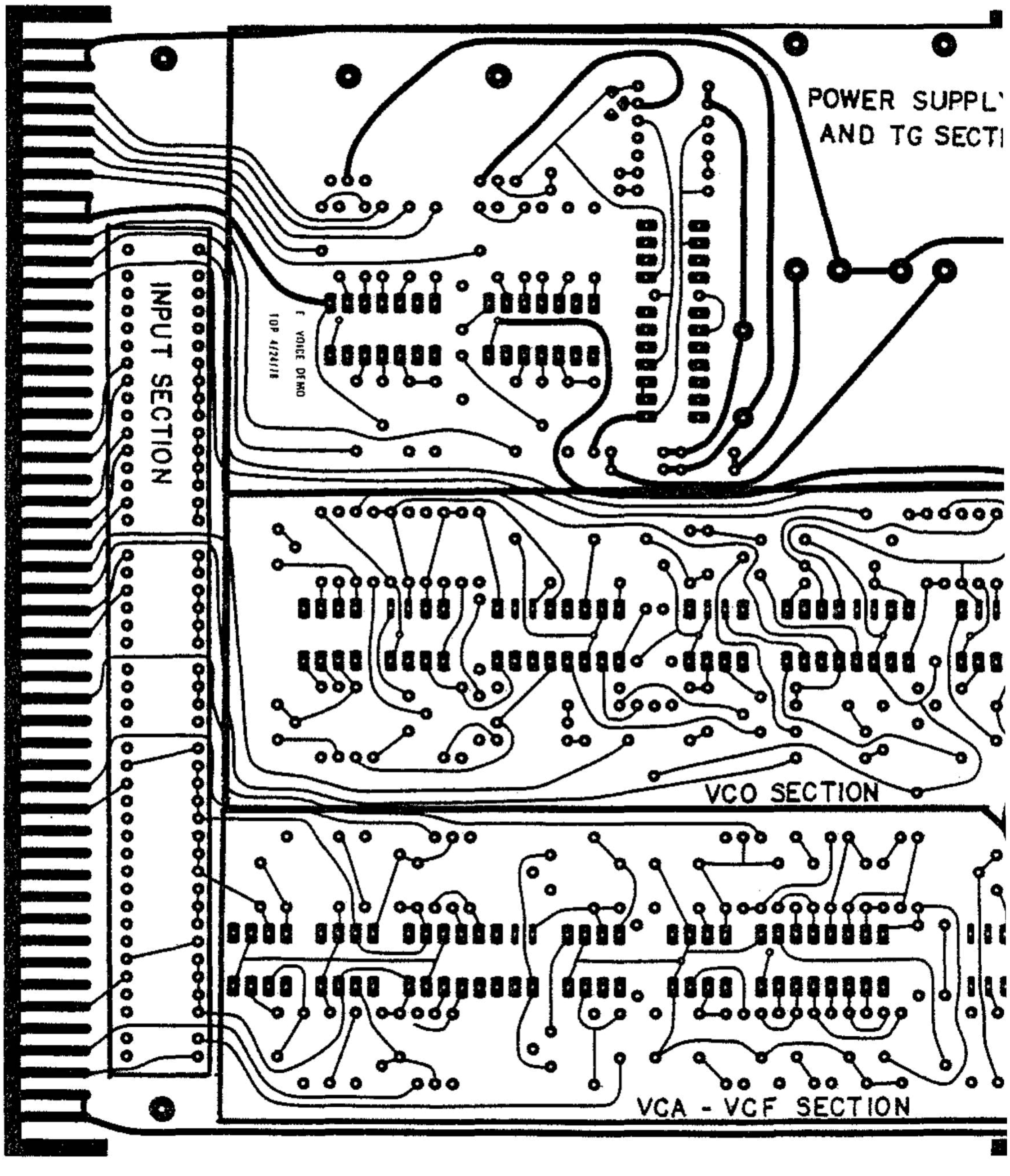
The following kit prices include handling charge:

E-mu Voice Evaluation Kit: Includes circuit board, the 6 SSM IC's, 3 Tempco resistors, and 2 Polystyrene caps. -- $100.00 postpaid

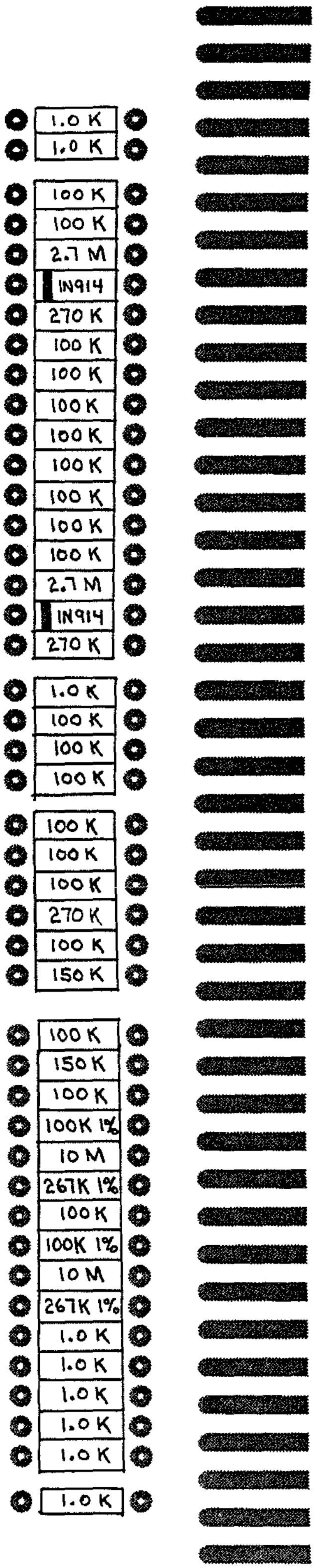
E-mu Voice Kit (complete parts): Includes all parts listed above. If you have trouble obtainig parts, you should order this. -- $250.00 postpaid

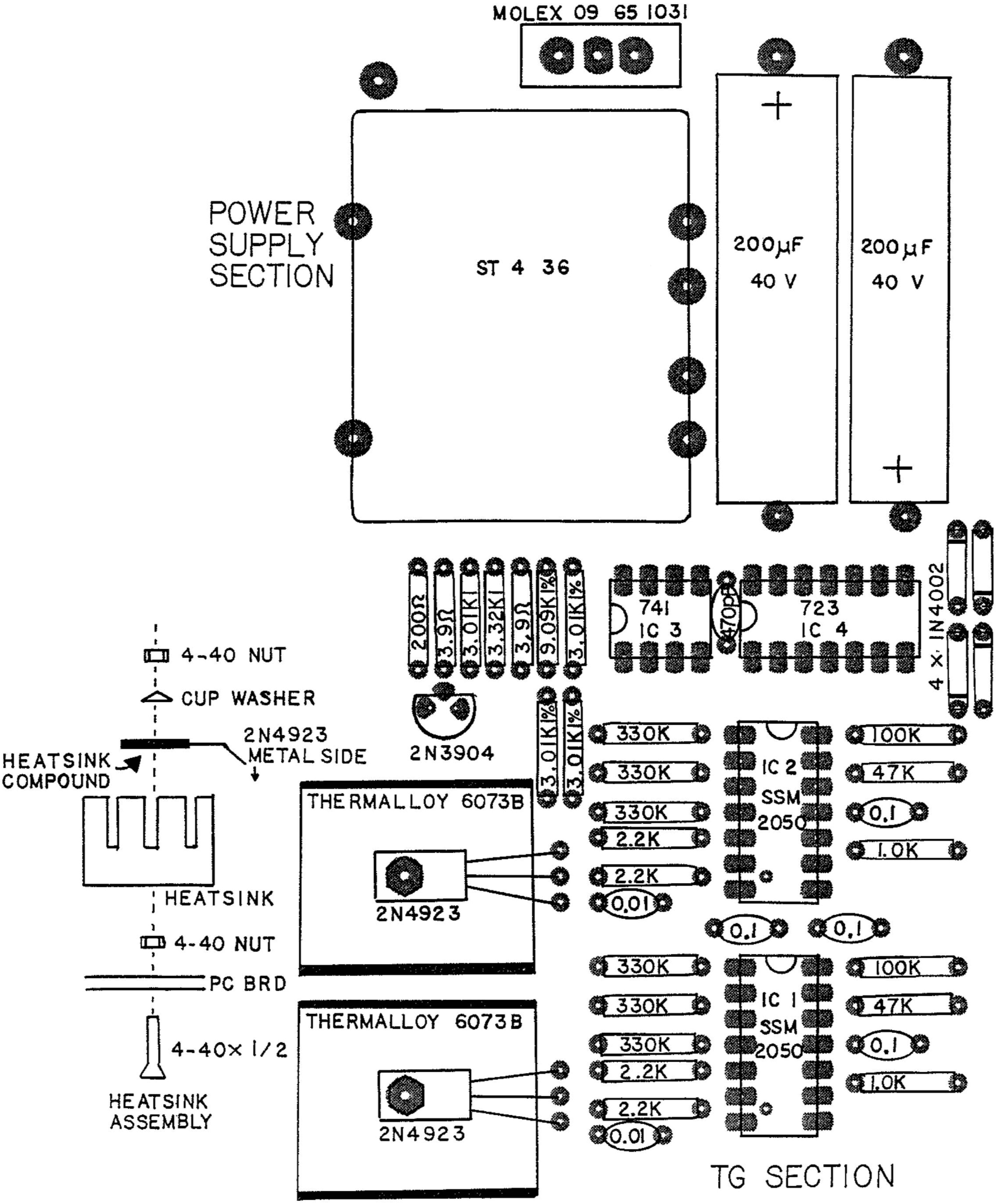
E-mu Voice (assembled and tested): Complete board, assembled & tested. -- $450 postpaid

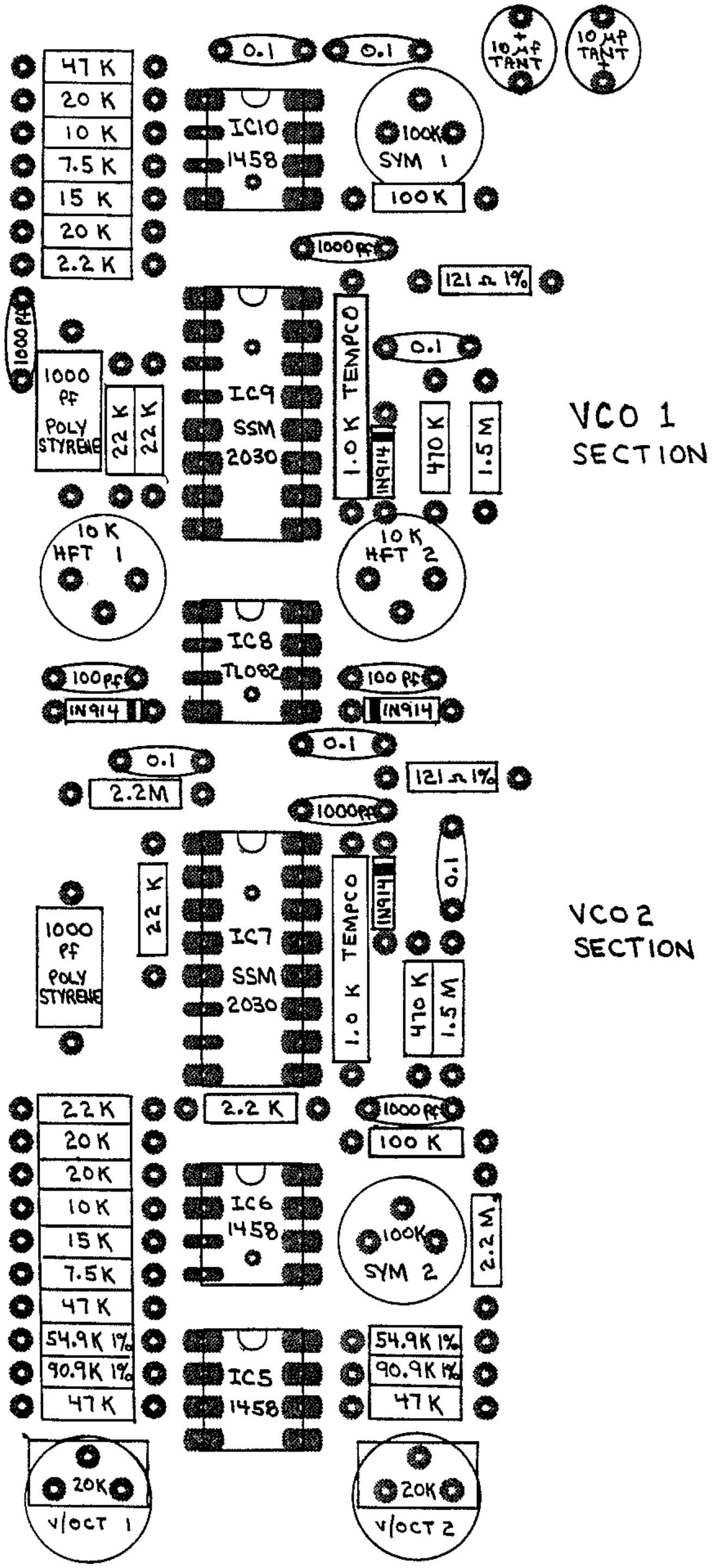
CALIFORNIA RESIDENTS - ADD SALES TAX!

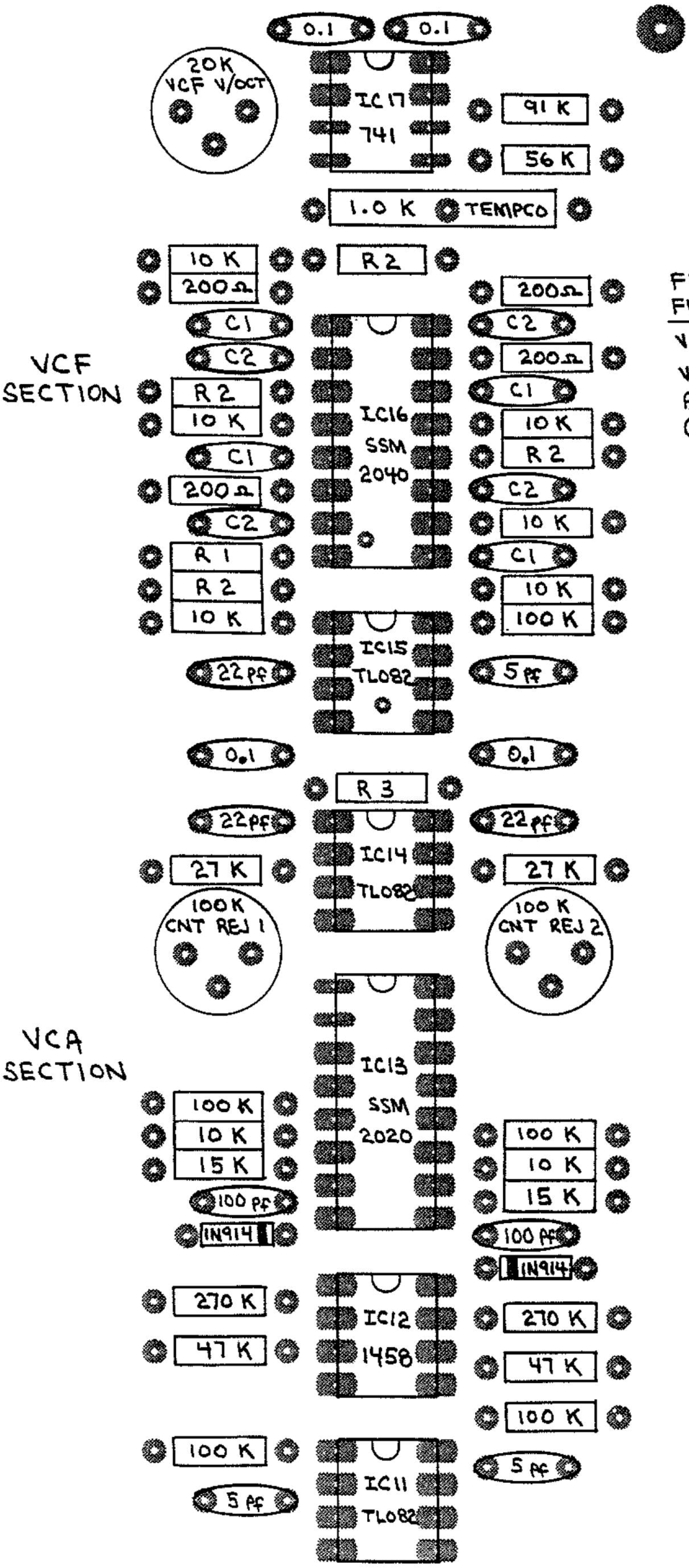

POWER SUPPLY
AND TG SECTI
VOICE DEMO
INPUT SECTION
VCO SECTION
VCA - VCF SECTION

INPUT SECTION

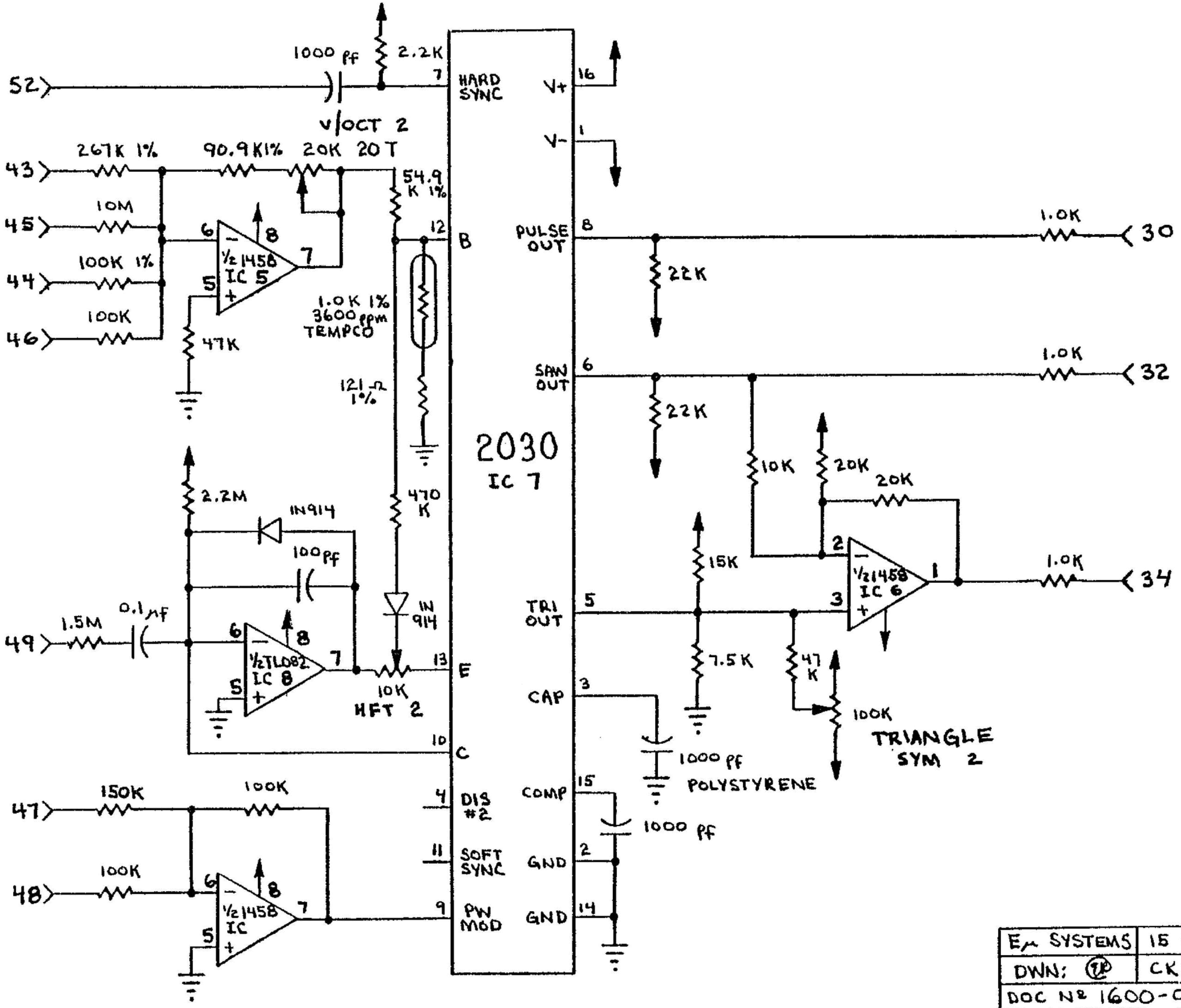



MOLEX 09 65 1031
POWER SUPPLY SECTION
ST 4 36
200µF 40 V
200µF 40 V
200Ω
3.9Ω
3.01K1
3.32K1
3.9Ω
9.09K1%
3.01K1%
741 IC 3
470pF
723 IC 4
4 × IN4002
2N3904
3.01K1%
3.01K1%
4-40 NUT
CUP WASHER
2N4923 METAL SIDE
HEATSINK COMPOUND
HEATSINK
4-40 NUT
PC BRD
4-40× 1/2
HEATSINK ASSEMBLY
THERMALLOY 6073B
2N4923
THERMALLOY 6073B
2N4923
330K
330K
330K
2.2K
2.2K
0.01
IC 2 SSM 2050
100K
47K
0.1
1.0K
0.1
0.1
330K
330K
330K
2.2K
2.2K
0.01
IC 1 SSM 2050
100K
47K
0.1
1.0K
TG SECTION

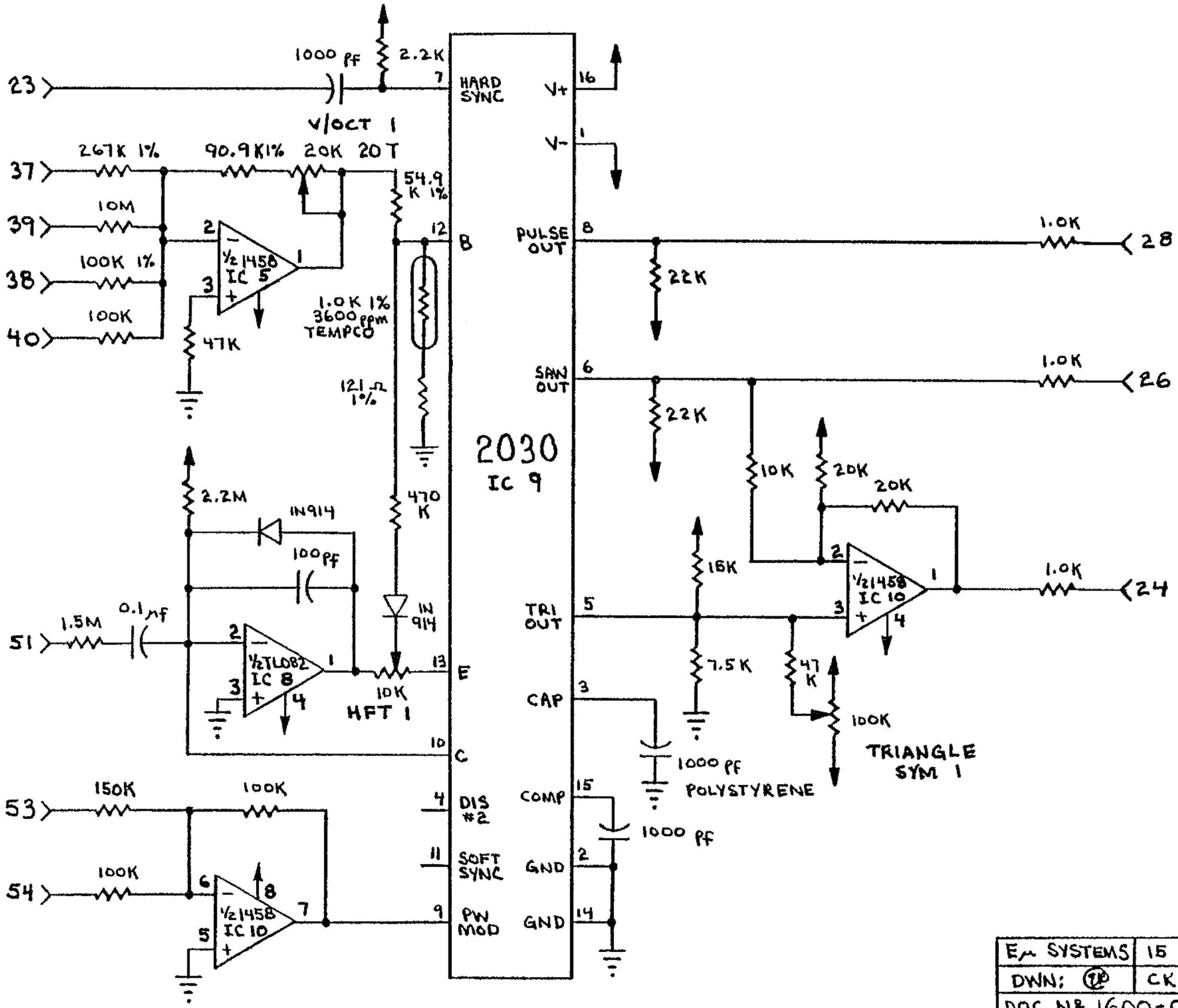

0.1
0.1
10 μF TANT
10 μF TANT
47 K
20 K
10 K
7.5 K
15 K
20 K
2.2 K
IC10
1458
100K
SYM 1
100 K
1000 pf
121 Ω 1%
1000 pf
1000 pf
POLY
STYRENE
22 K
22 K
IC9
SSM
2030
1.0 K TEMPCO
0.1
IN914
470 K
1.5 M
VCO 1
SECTION
10 K
HFT 1
10 K
HFT 2
IC8
TL082
100 pf
100 pf
IN914
IN914
0.1
0.1
121 Ω 1%
2.2M
1000 pf
22 K
1000
pf
POLY
STYRENE
IC7
SSM
2030
1.0 K TEMPCO
IN914
0.1
VCO 2
SECTION
470 K
1.5 M
2.2 K
2.2 K
1000 pf
20 K
100 K
20 K
10 K
IC6
1458
15 K
100K
SYM 2
2.2 M
7.5 K
47 K
54.9K 1%
54.9K 1%
90.9K 1%
90.9K 1%
47 K
47 K
IC5
1458
20K
V/OCT 1
20K
V/OCT 2



FILTER FUNCTION:	C1:	C2:	R1:	R2:	R3:
VCLPF	1000pf	—	10K	10K	—
VCHPF	—	2000pf	—	—	—
ALL PASS (PHASE SHIFT)	—	2000pf	—	10K	10K

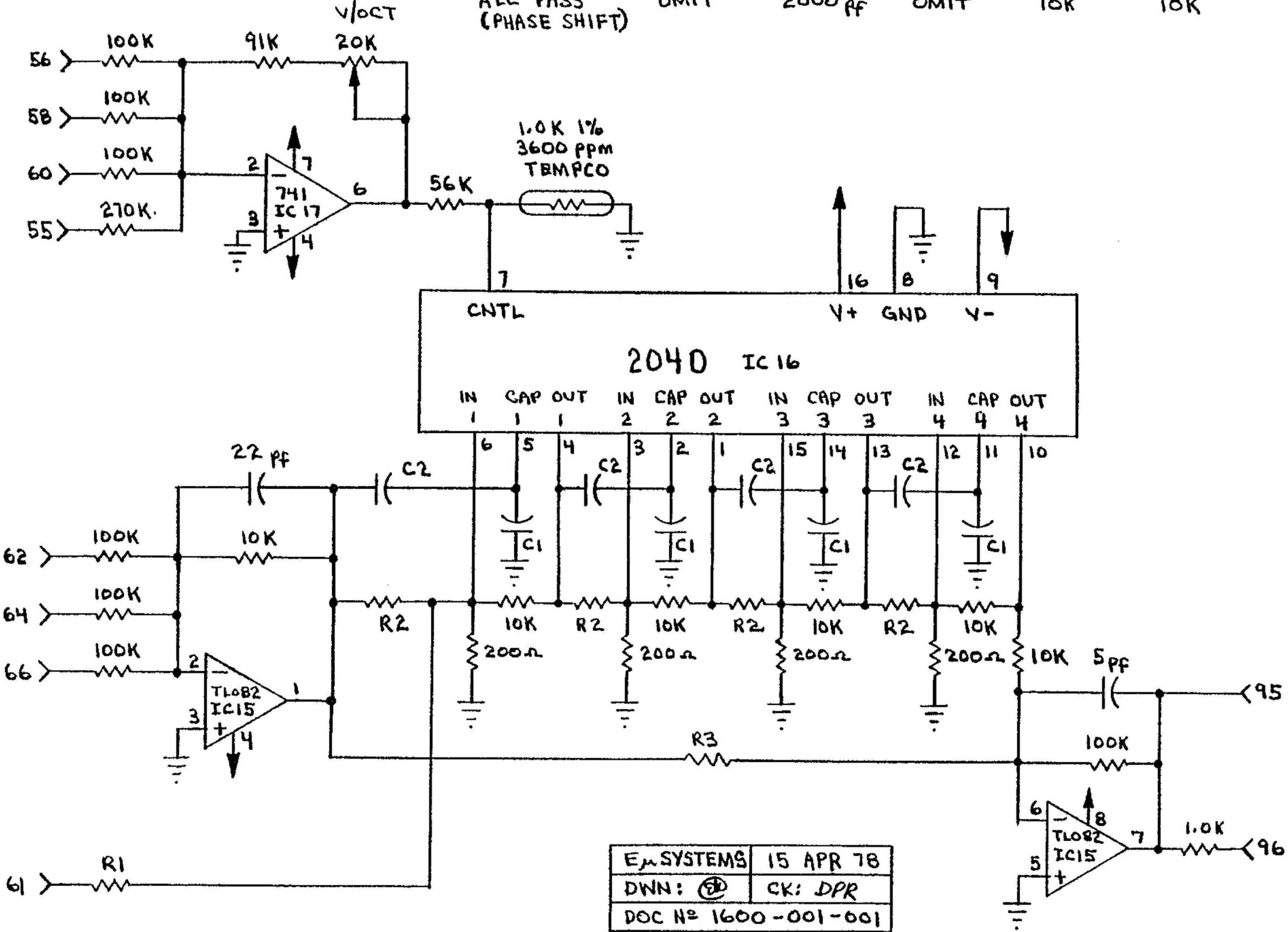


Eµ SYSTEMS	15 APR 78
DWN: ⓡ	CK: DPR
DOC Nº 1600-001-001	
SCHEMATIC ~ Eµ VOICE DEMO, VCO 2	

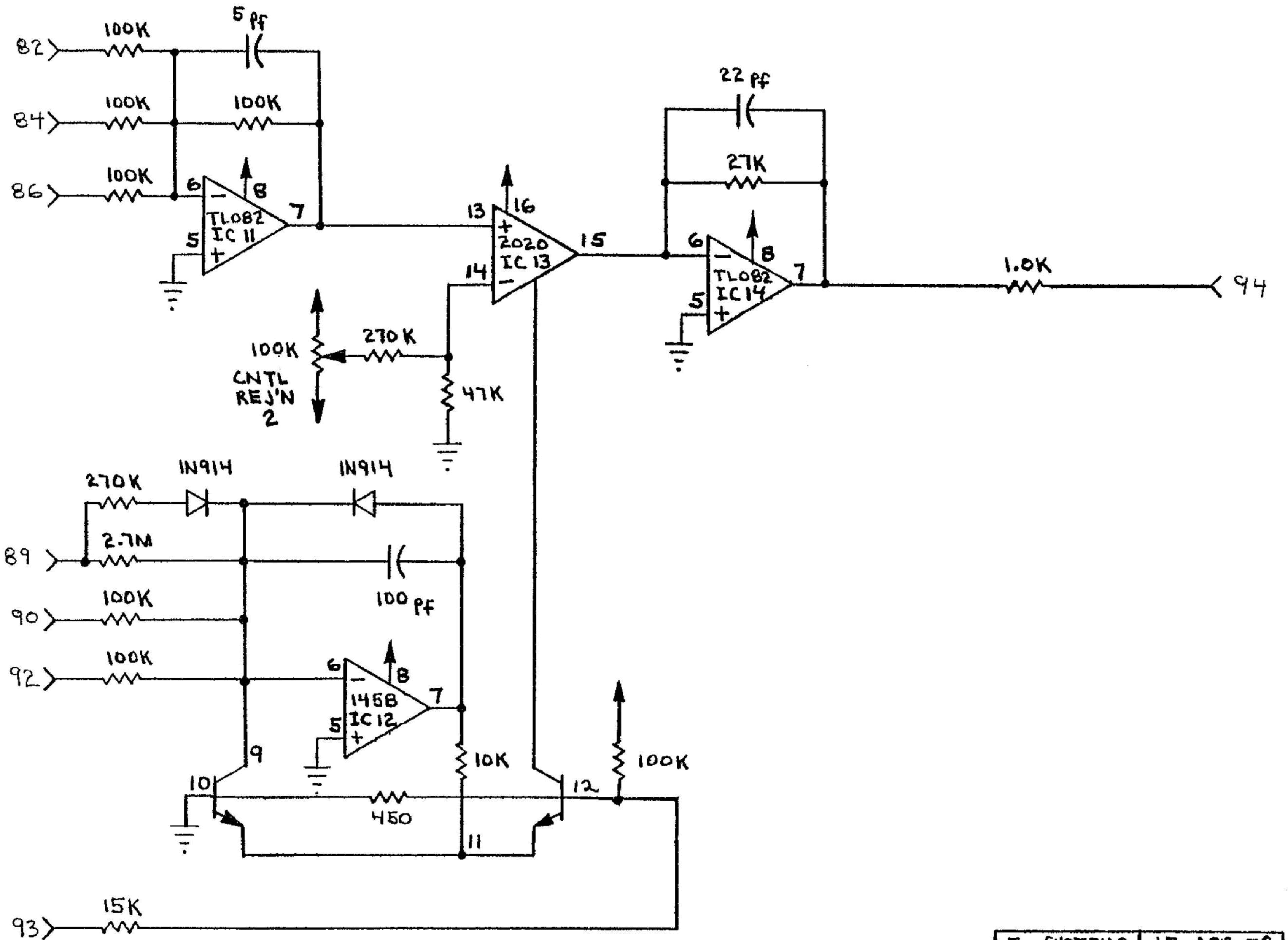


Eμ SYSTEMS	15 APR 78
DWN: (initials)	CK: DPR
DOC № 1600-001-001	
SCHEMATIC ~ Eμ VOICE	

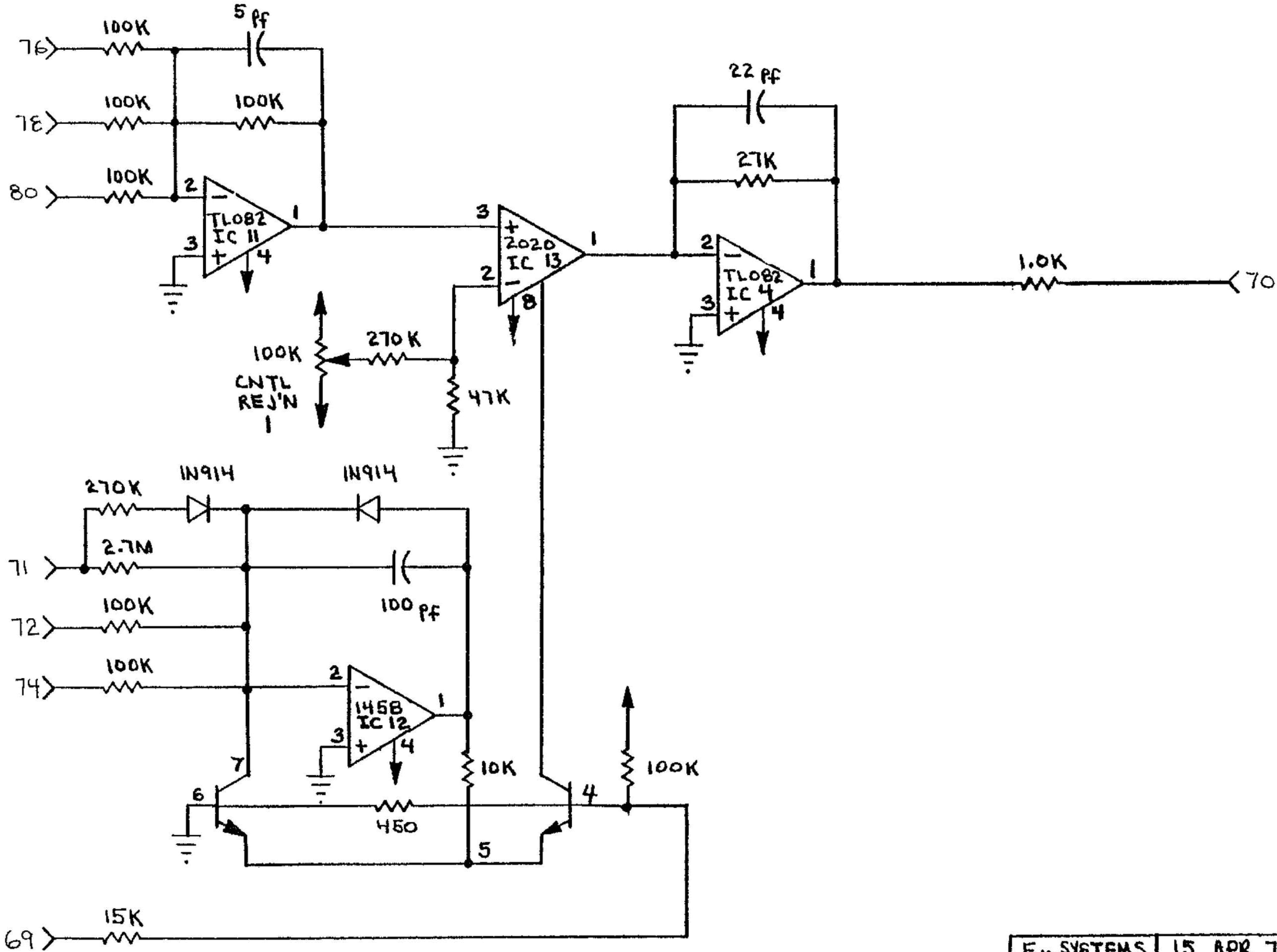
FUNCTION:	C1:	C2:	R1:	R2:	R3:
VCLPF	1000pf	OMIT	10K	10K	OMIT
VCHPF	OMIT	2000pf	OMIT	OMIT	OMIT
ALL PASS (PHASE SHIFT)	OMIT	2000pf	OMIT	10K	10K



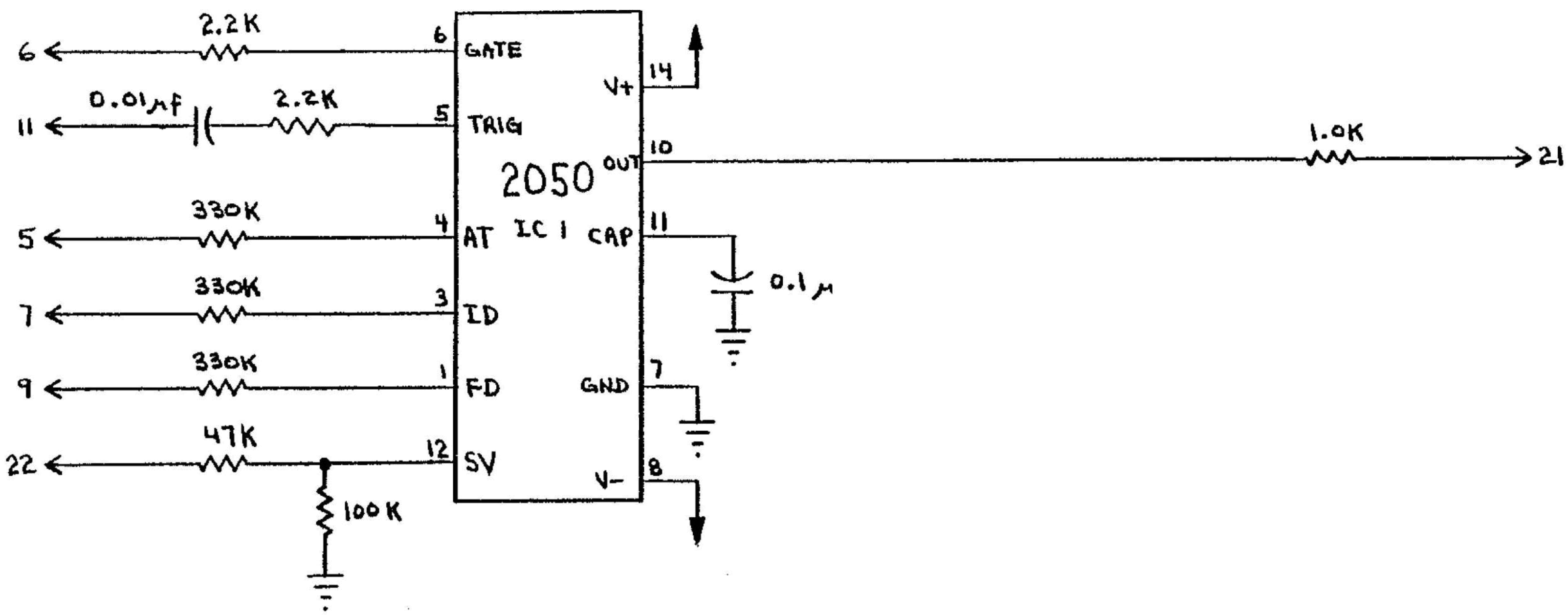
EμSYSTEMS	15 APR 78
DWN: (SD)	CK: DPR
DOC № 1600-001-001	
SCHEMATIC ~ Eμ VOICE DEMO, VCLP/HP FILTER	

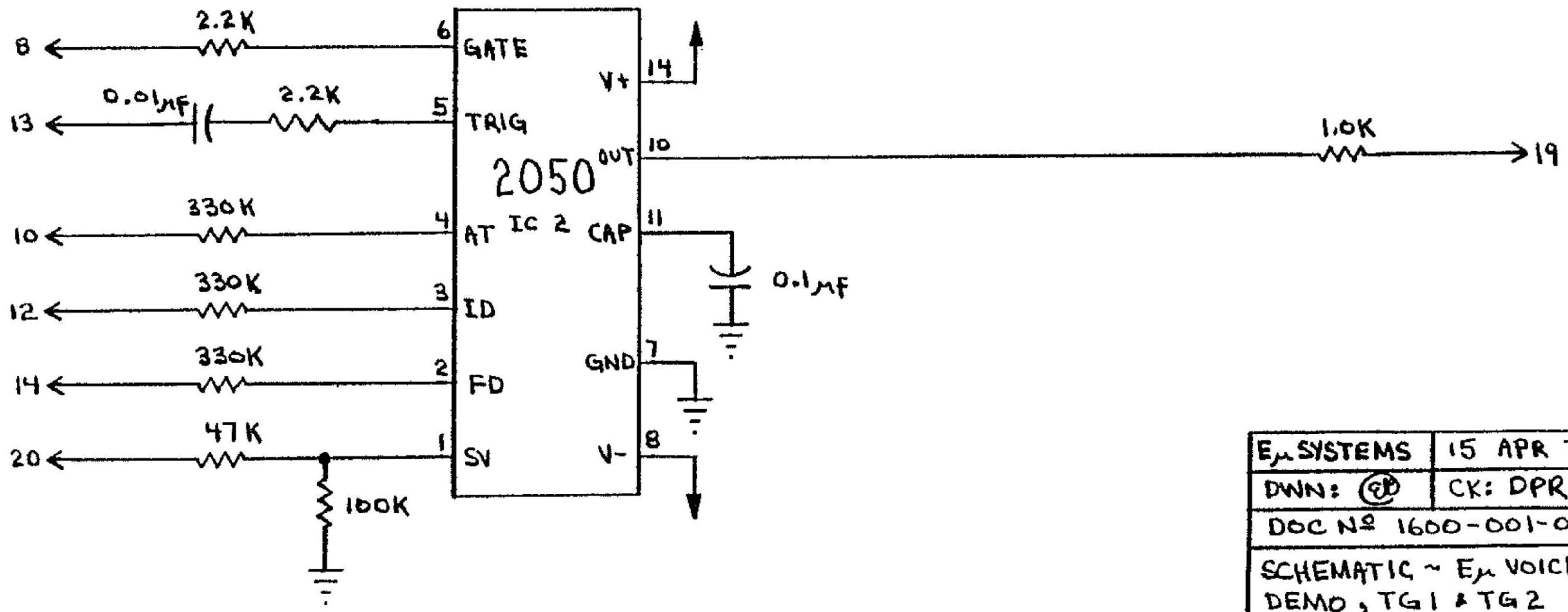


Eμ SYSTEMS	15 APR 78
DWN: [initials]	CK: DPR
DOC № 1600-001-001	
SCHEMATIC ~ Eμ VOICE DEMO, VCA 2	

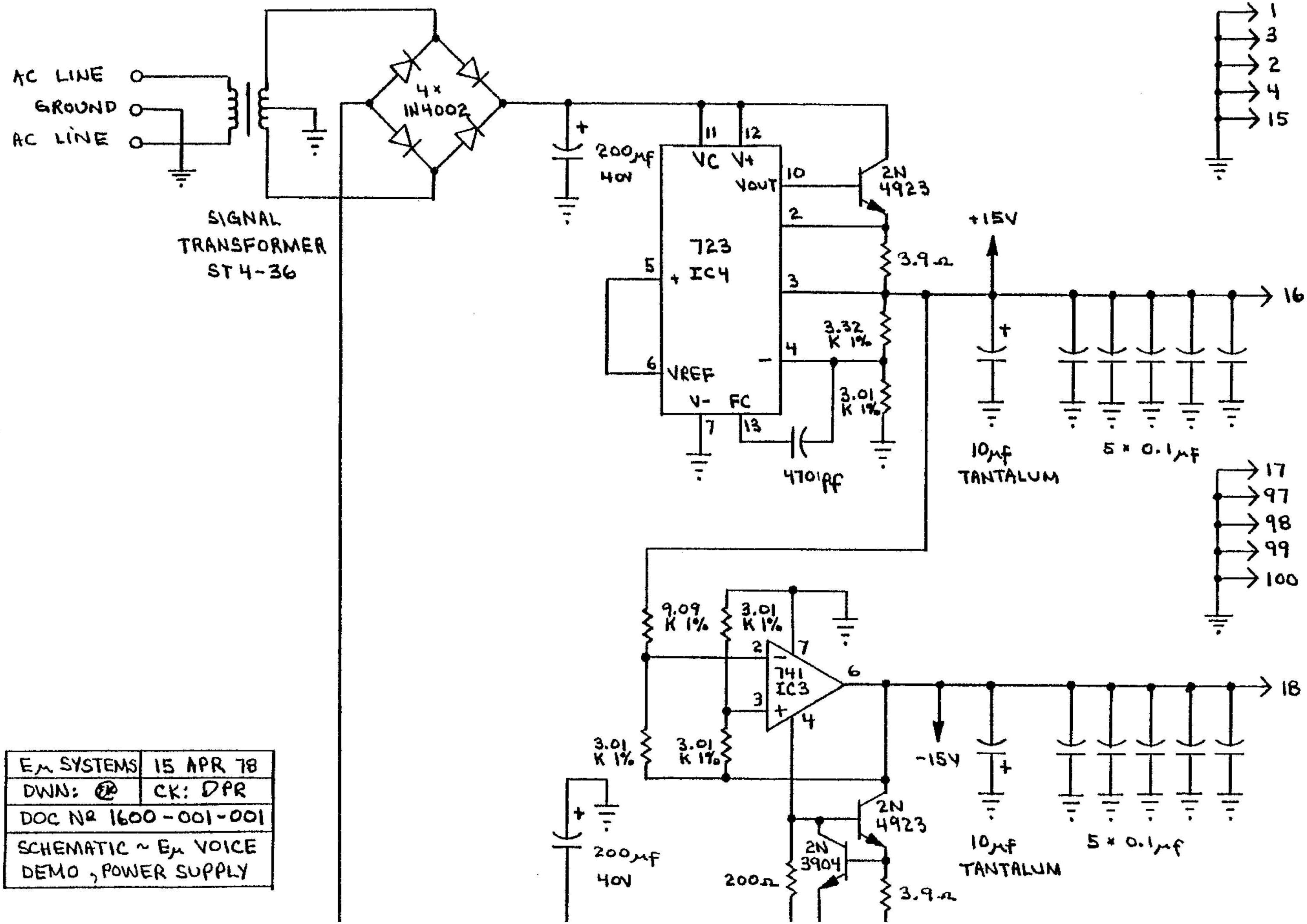


Eμ SYSTEMS	15 APR 78
DWN:	CK: DPR
DOC № 1600-001-001	
SCHEMATIC ~ Eμ VOICE DEMO, VCA 1	





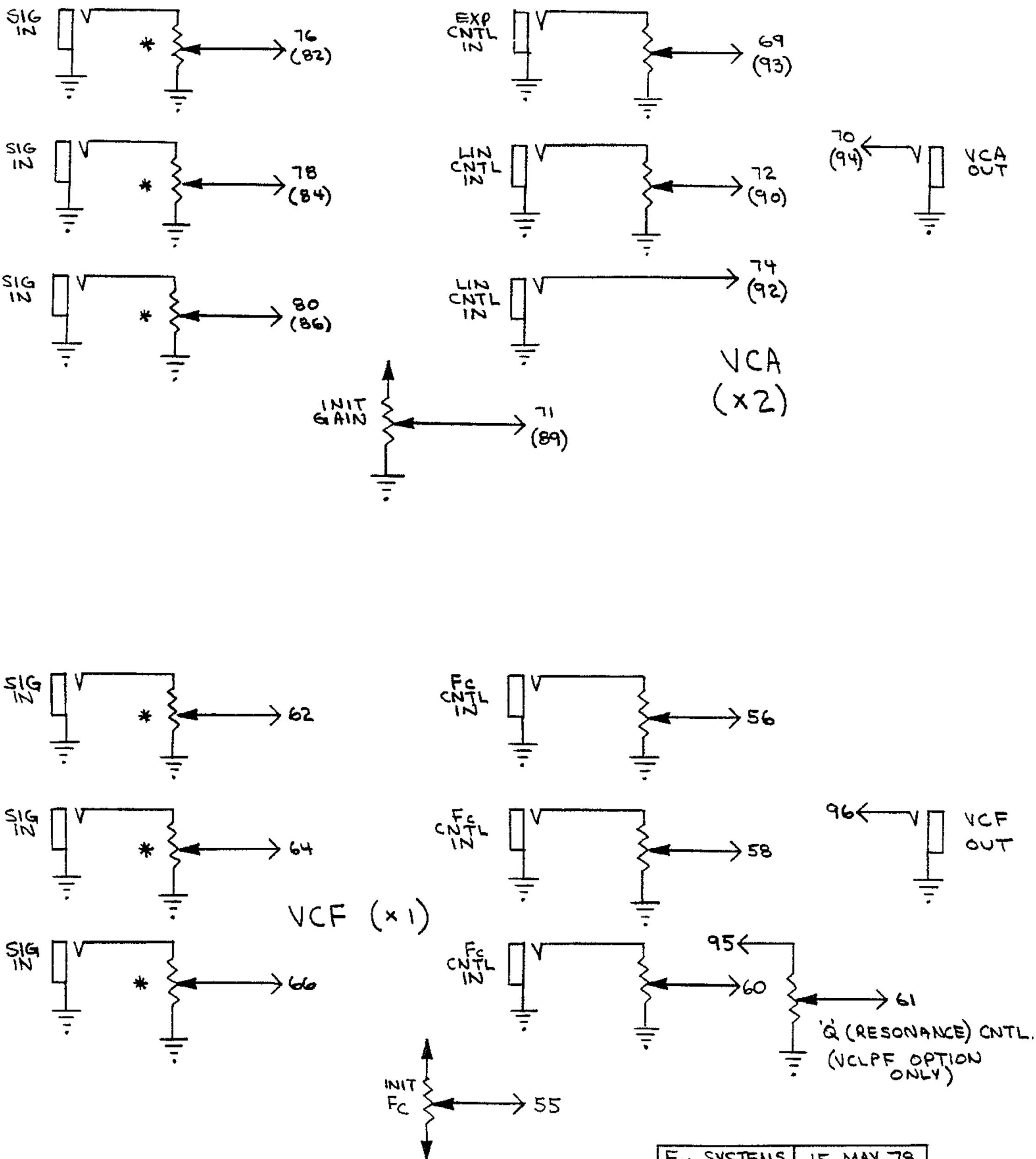
Eμ SYSTEMS	15 APR 78
DWN: (SB)	CK: DPR
DOC Nº 1600-001-001	
SCHEMATIC ~ Eμ VOICE DEMO, TG1 & TG2	



Eµ SYSTEMS	15 APR 78
DWN: EK	CK: DPR
DOC Nº 1600-001-001	
SCHEMATIC ~ Eµ VOICE DEMO, POWER SUPPLY	

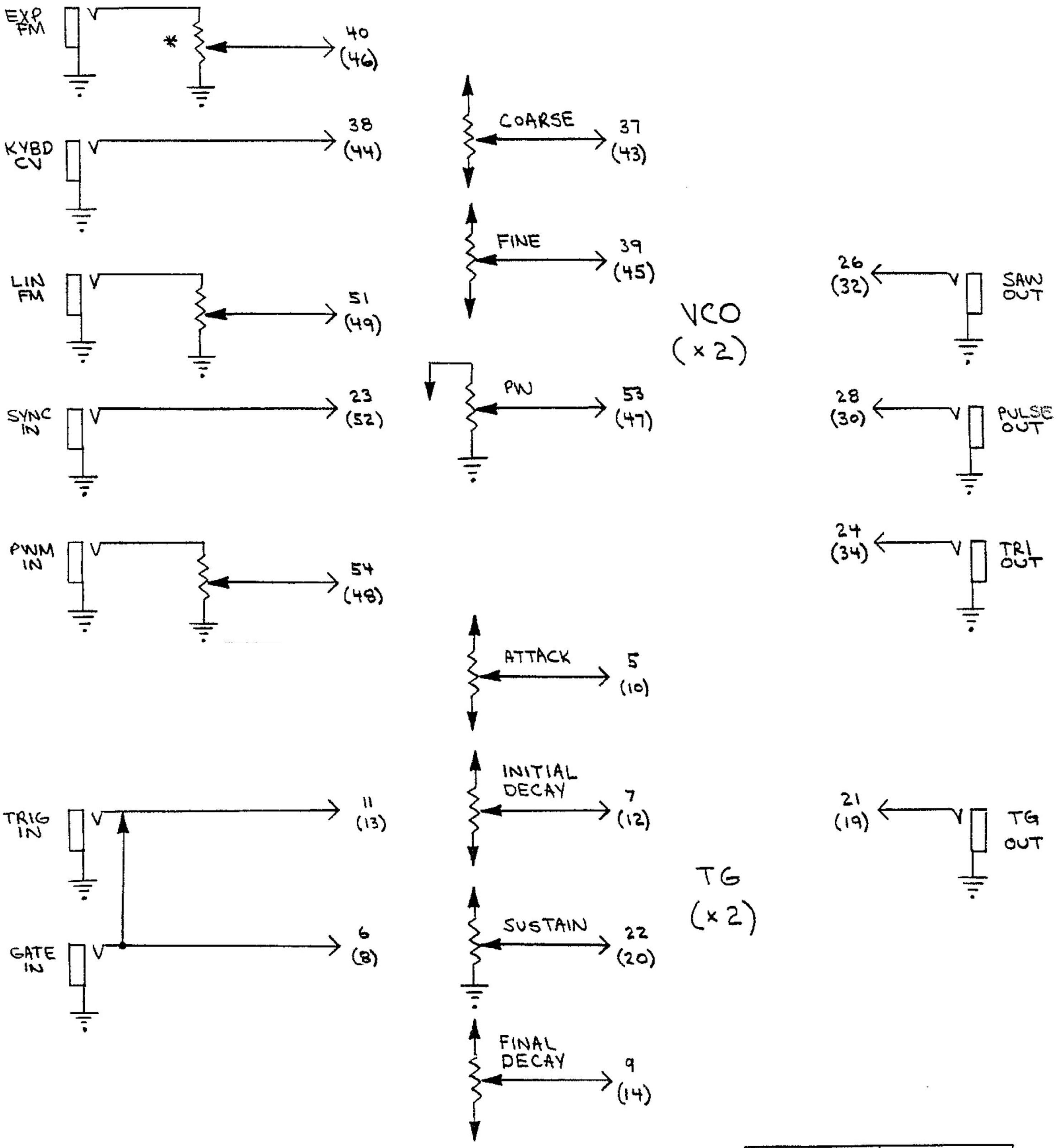
E-mu Systems Voice Demo Board - Pinouts

Pin #	Signal Name	Typical Connection
1-4	Ground	Panel Ground
5	TG1 Attack Input	TG1 Attack Pot
6	TG1 Gate Input	TG1 Gate Input Jack
7	TG1 Init Decay Input	TG1 Initial Decay Pot
8	TG2 Gate Input	TG2 Gate Input Jack
9	TG1 Final Decay Input	TG1 Final Decay Pot
10	TG2 Attack Input	TG2 Attack Pot
11	TG1 Trigger Input	TG1 Trigger Input Jack
12	TG2 Init Decay Input	TG2 Initial Decay Pot
13	TG2 Trigger Input	TG2 Trigger Input Jack
14	TG2 Final Decay Input	TG2 Final Decay Pot
15	Ground	Panel Ground
16	+15V	Panel +15 for Pots
17	Ground	Panel Ground
18	-15V	Panel -15V for Pots
19	TG2 Output	TG2 Output Jack
20	TG2 Sustain V Input	TG2 Sustain Voltage Pot
21	TG1 Output	TG1 Output Jack
22	TG1 Sustain V Input	TG1 Sustain Voltage Pot
23	VCO1 Sync Input	VCO1 Sync Input Jack
24	VCO1 Triangle Output	VCO1 Triangle Output Jack
26	VCO1 Sawtooth Output	VCO1 Sawtooth Output Jack
28	VCO1 Pulse Output	VCO1 Pulse Output Jack
30	VCO2 Pulse Output	VCO2 Pulse Output Jack
32	VCO2 Sawtooth Output	VCO2 Sawtooth Output Jack
34	VCO2 Triangle Output	VCO2 Triangle Output Jack
37	VCO1 Init Freq Coarse	VCO1 Initial Freq Coarse Pot
38	VCO1 Keyboard Input	VCO1 Keyboard Input Jack
39	VCO1 Init Freq Fine	VCO1 Initial Freq Fine Pot
40	VCO1 Freq Mod Input	VCO1 Frequency Modulation Input Attenator
43	VCO2 Init Freq Coarse	VCO2 Initial Freq Coarse Pot
44	VCO2 Keyboard Input	VCO2 Keyboard Input Jack
45	VCO2 Init Freq Fine	VCO2 Initial Freq Fine Pot
46	VCO2 Freq Mod Input	VCO2 Frequency Modulation Input Attenuator
47	VCO2 Pulse Width Cntl	VCO2 Pulse Width Pot
48	VCO2 Pulse Width Input	VCO2 Pulse Width Mod Input Attenuator
49	VCO2 Linear FM Input	VCO2 Linear FM Input Attenuator
51	VCO1 Linear FM Input	VCO1 Linear FM Input Attenuator
52	VCO2 Sync Input	VCO2 Sync Input Jack
53	VCO1 Pulse Width Cntl	VCO2 Pulse Width Pot
54	VCO1 Pulse Width Input	VCO1 Pulse Width Mod Input Attenuator
55	VCF Initial Freq Input	VCF Initial Frequency Pot
56,58,60	VCF Freq Cntl Inputs	VCF Freq Cntl Input Attenuators
61	VCF Resonance Input	VCF Resonance Control
62,64,66	VCF Signal Inputs	VCF Signal Input Attenuators
69	VCA1 Exp'l Cntl Input	VCA1 Exp'l Gain Cntl Input Attenuator
70	VCA1 Output	VCA1 Output Jack
71	VCA1 Init Gain Input	VCA1 Initial Gain Pot
72,74	VCA1 Gain Cntl Inputs	VCA1 Gain Control Input Attenuators
76,78,80	VCA1 Signal Inputs	VCA1 Signal Input Attenuators
82,84,86	VCA2 Signal Inputs	VCA2 Signal Input Attenuators
89	VCA2 Init Gain Input	VCA2 Initial Gain Pot
90,92	VCA2 Gain Cntl Inputs	VCA2 Gain Control Input Attenuators
93	VCA2 Exp'l Cntl Input	VCA2 Exp'l Gain Cntl Input Attenuator
94	VCA2 Output	VCA2 Output Jack
95	VCF Resonance Output	VCF Resonance Control
96	VCF Output	VCF Output Jack
97-100	Ground	Panel Ground



ALL POTS 100K
LINEAR ALWAYS OK
* = LOG PREFERRED
(n) = 2nd SECTION REF.

Eμ SYSTEMS	15 MAY 78
DWN: (EM)	CK: [signature]
DOC No 1600-001-001	
SCHEMATIC ~ Eμ VOICE DEMO: TYP. FRONT PANEL	



ALL POTS 100K
LINEAR ALWAYS OK
* = LOG PREFERRED
(n) = 2nd SECTION REF.

Eμ SYSTEMS	15 MAY 78
DWN: ©	CK: [illegible]
DOC Nº 1600-001-001	
SCHEMATIC ~ Eμ VOICE DEMO: TYP. FRONT PANEL	

E-mu SYSTEMS
417 Broadway
Santa Cruz, CA 95060
(408) 429-9147

E-MU SYSTEMS VOICE DEMO - TRIM PROCEDURE

OCILLATOR TRIMS (2 each):

SYM: Monitor triangle output of VCO with 'scope or ear. With 'scope, adjus for minimal glitch on triangle waveform. With ear, adjust for minimal buzz; this is best done at lower frequencies. The waveform will never be quite perfect.

V/OCT: Monitor sawtooth output of VCO. Adjust for precisely 1 octave shift from 100 to 200 Hz for a 1 volt change at the keyboard input. This is usually best done by ear, but a good 'scope can be used. The 1 volt source is usually the system keyboard if one is used, but any precise 1 volt reference will do. The most important thing is that the oscillators track.

HFT: Do this after V/OCT. This trim optimizes the VCO tracking at high frequencies. While monitoring the sawtooth output of the VCO, adjust for precisely 1 octave shift from 2000 to 4000 Hz for a 1 volt change at the keyboard input. You may wish to re-trim the V/OCT trim after you first adjust the HFT.

FILTER:

V/OCT: With the lowpass configuration, turn up the "Q" until the filter oscillates. Adjust so that a 1 volt change on a frequency control input results in a 1 octave shift in frequency from 250 to 500 Hz. With highpass or allpass configuration the trim is much more difficult It is usually satisfactory to just center the trimmer, but you may either adjust the trimmer for precisely 18.02 mV change at pin 7 of IC 16 at room temperature for 1 volt change on a frequency control input, or adjust such that the output waveform from a VCO tracking the filter stays constant.

VCA (2 each):

CNT R: Connect a 1 KHz triangle waveform to a gain control input, and monitor the output of the VCA. Adjust for minimal audio output. The signal inputs to the VCA must be open.