CEV 3301 EVALUATION BOARD

General Description

The Curtis Electromusic CEV 3301 Evaluation Board allows the user to evaluate the CEM 3310 V.C. Envelope Generator, CEM 3320 VCF, CEM 3330 Dual VCA, and CEM 3340 VCO integrated circuits either individually or as part of a complete system. Measuring 4 by 8 inches, the board contains one of each of the above chips plus the associated external components required in a typical application. For each chip, numerous signal and control inputs and outputs are brought to the bottom edge of the board to allow independent evaluation of each device. At the upper edge of the board is a DIP switch to provide limited interconnection between the devices into a simple synthesizer voice. Also at the upper edge are miniature trim pots which sweep each parameter over their entire range and a miniature push button to trigger the envelope generator. Thus, equipped with only a regulated ±15 ±0.1 volt supply and a sound system, the user can thoroughly evaluate the four chips.

Other Uses and Options

Although the CEV 3301 is primarily intended for evaluation of the CES line of ICs, it was also designed so that a complete synthesizer system could be easily assembled using several of these boards. The basic board comes with all inputs and outputs brought out on a right angle male header at the board bottom edge. Thus, numerous boards may be soldered perpendicularly into a motherboard to allow interconnection between boards and between boards and the rest of the system. The connector

holes have been spaced to allow use of the Molex female header (part No.) as well. Option A (order part No. CEV 3301A) comes with this female header rather than the standard right angle male header; this allows easy insertion and removal of the board onto a mother board equipped with male headers. Or option B may be ordered if neither of these connectors is desired.

In addition, general purpose protoboarding space has been provided just above the connectors which can accomodate up to four 16-pin DIPs. Thus additional circuitry can be added to each board. A typical use for this space might be 8 sample and holds to allow the computer control of 8 of the 9 parameters on the board; figure 2 shows the schematic for such an application.

Finally, one can order option C for a board without the DIP swtich, miniature pots, and push button at the top of the board. The holes for these components may then be used for additional control inputs or for wiring to standard front panel potentiometers and switches. (Note: Several options may be ordered simultaneously. E.g. a CEV 3301 BC board comes without connectors, top edge control pots, DIP switch, and pushbutton switch.)

Basic Operation

Figure 1 shows the block diagram of the entire board. With the first three swtiches of the DIP switch, the waveform outputs of the 3340 VCO may be fed through the 3320 VCF connected as a 4 pole low pass filter. The output of the filter is then routed through one of the amplifiers of the 3330 Dual VCA before

appearing at the final output. The other VCA of the 3330 is used to control the amount of modulation; the 3310 Envelope Generator output is a modulation source normalled into this VCA. The remaining five switches of the DIP switch may be used to connect the modulation VCA output to the modulation inputs for oscillator frequency, pulse width, filter cutoff frequency, final VCA linear gain, and final VCA exponential gain.

In general, all signal and control input impedances are 33-100K, and all signal and control outputs are less than 1K. All control inputs accept 0 to +10 volts and all signal inputs accept 0 to 10VPP. With the exception of the pulse width modulation and sustain level inputs, all inputs, including those from the top edge potentiometers, are summed into virtual ground or near virtual ground summing nodes. When driven by low impedance sources, the two above exceptions look into a 68K resistance and 0 to +2.5 volts depending on the position of the corresponding pot, and the control pot itself will have only half of its normal range. More information on the various inputs, outputs, and control pots are given in Table I and Table II.

All inputs can handle voltages up to either supply and all outputs can be shorted to ground or either supply without damage. The only point of caution (other than connecting up the supply properly) is that the F_O MOD, PW MOD, F_C MOD, LIN GAIN MOD, and EXP. GAIN MOD inputs are hardwired directly to the DIP switches from the modulation VCA output. Thus, when using these inputs for external sources, the corresponding

DIP switch should be in the open position.

Initial Check-Out

Before evaluating any of the devices, it is advisable to give the entire board an initial check-out and calibration. For this procedure, connect a ± 15V ±.1V regulated supply to the appropriate connector pins and a sound system to VCA OUT. Make sure all DIP switches are in the open position, and turn all trim pots, including the calibration trimmers, to the middle of their rotation. With the power on and your amplifier volume turned down, close the PULSE DIP switch. A square wave tone should be heard. Now rotate the VCO FREQ control pot to change the frequency from subaudio to beyond hearing, and the PW control pot to change the harmonic content of the pulse wave. At this point, close the SAW and TRI swtiches, and experiment with different combinations. (With the SAW and PULSE switches closed simultaneously, the result is still a sawtooth waveform into the filter, whose phase is now controlled with the PW Control.)

With one or more waveforms selected, rotate the VCF FREQ control pot to open and close the filter. Now turn the Q control pot clockwise to reduce the amount of resonance and then back counterclockwise until the filterbreaks into oscillation.

Set the VCO and VCF control pots for a non-obtrusive tone, and close the LIN MOD DIP switch; the tone should be completely cut off. Now depress the momentary pushbutton switch and listen for the enveloped tone. Rotate the ATTACK control for minimum attack and the DECAY and RELEASE control pots for a 2-3 second decay and release. While successively depressing the pushbutton,

rotate the MODULATION control for less and greater output volume. Now turn the pot for maximum volume. Open the LIN. MOD switch while closing the EXP. MOD switch. Initiate the envelope again, and notice the difference between a linear and an exponential VCA control scale. (Note: The standard board comes with a jumper between the envelope gate and trigger inputs. This jumper may be removed to evaluate the CEM 3310 with separate gate and trigger signals.)

With the LIN. and EXP. GAIN MOD switches opened, close each of the other three MOD switches one at a time, and activate the envelope generator to sweep each of the various parameters with the envelope. Rotate the MOD control pot to adjust the amount of sweep.

This completes the initial check-out and familiarization with the board.

Calibration

For calibration, there are four trim pots on the bottom half of the board to be adjusted if desired: The two next to the CEM 3340 adjust the control scale for 1 octave/volt, while the other two next to the CEM 3330 adjust the control feed-through for each VCA or distortion on the final VCA.

The procedure for adjusting the VCO scale is as follows: Set the oscillator frequency to around 100Hz. While switching one of the F_0 CNTL inputs between 0 and 1.000 volts with either a power supply or keyboard, adjust the 10 turn trimmer for exactly a one octave change in frequency. Since adjusting this trimmer will also shift the initial frequency of the oscillator, the VCO FREQUENCY control pot will also have to be adjusted at

the same time to keep the initial frequency the same (unless the method used for detecting one octave does not require a constant initial frequency). Once the scale has been adjusted for the 100Hz to 200Hz range, the oscillator frequency is set at about 5KHz. The above procedure is repeated while adjusting the High Frequency Track trimmer for exactly one octave. (Note that the control input used for this scale calibration is the only one precisely calibrated; the other control inputs will be slightly off.)

The Final VCA feedthrough may be trimmed as follows: Open all waveform inputs to the filter and close the LIN MOD switch. With the envelope set for minimum attack and the MODULATION control at maximum, adjust the Final VCA Distortion trimmer for minimum pop while triggering the envelope generator. Since this trimmer is actually the distortion adjust, it may, of course, also be used to adjust the distortion. To do this, a .01% THD sine wave is applied to the VCA Input and the VCA Output measured with a distortion analyzer. The trimmer is then adjsuted for minimum distortion.

To adjust the Modulation VCA for minimum feedthrough, close the VCO F_O MOD switch and adjust the Modulation VCA Feedthrough trimmer for minimum frequency shift while rotating the MOD control pot from minimum to maximum. Better rejection may be realized by removing R67 to change the operation of both VCAs from class AB to class B. (Note that this trimmer is an input trim as opposed to the distortion trim used on the other VCA. Both types of trim have been provided to allow the user to explore the effects of both types. Please consult the CEM 3330 Data Sheet for more information.)

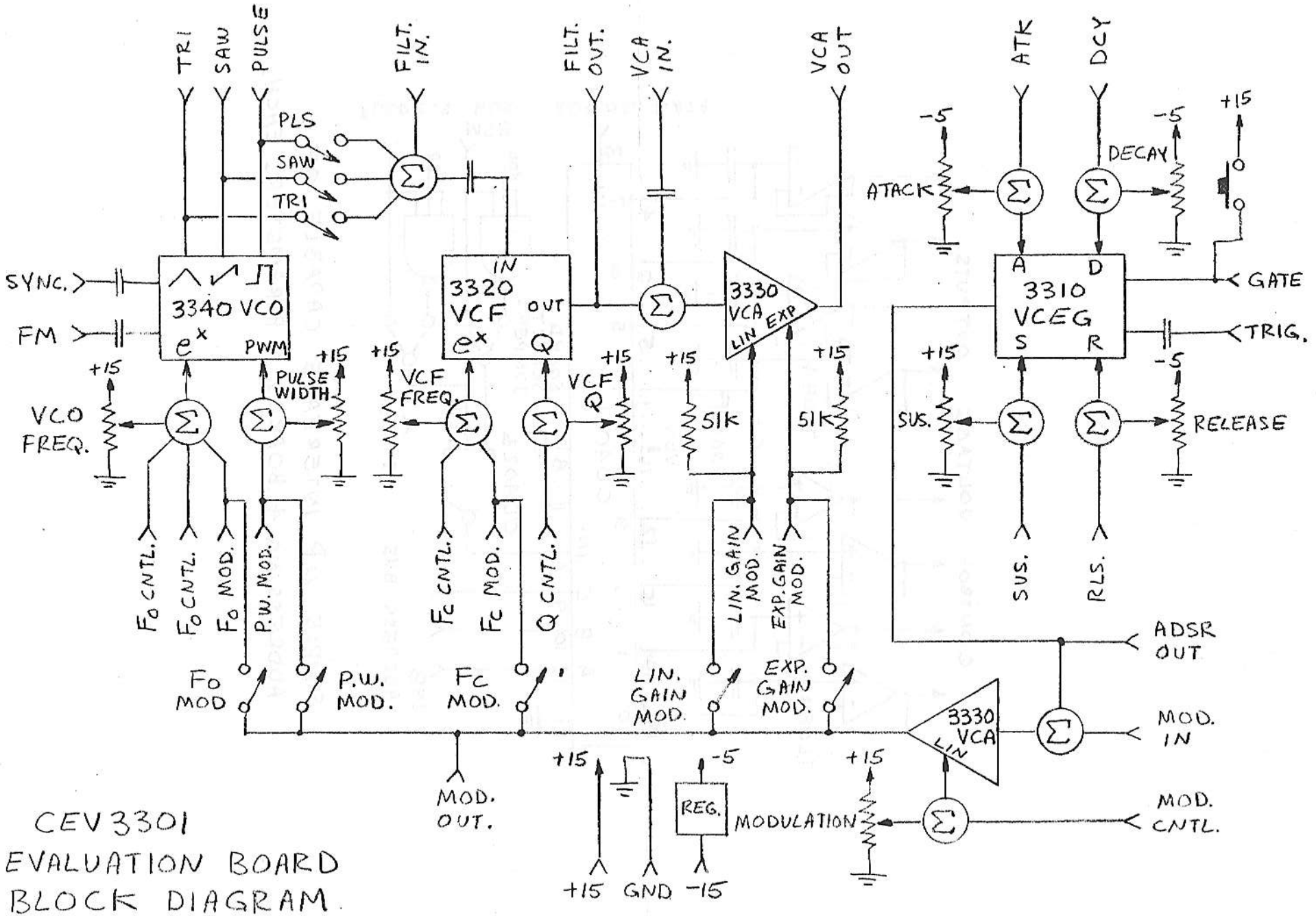
This now completes the board calibration.

TABLE I: CONNECTOR SIGNALS

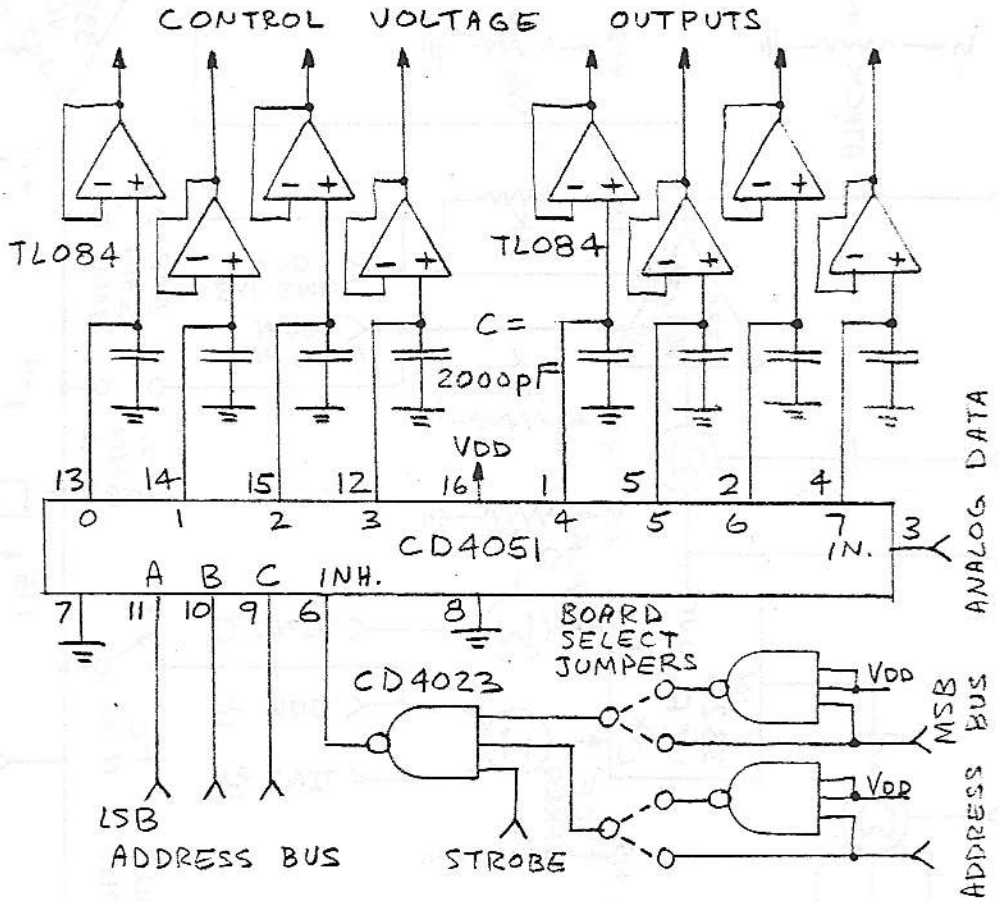
FUNCTION	VOLTAGE RANGE	SCALE	IMPEDANCE	COMMENTS
f_0 MOD	0 to +10V	1 oct/volt	100K	Turn off DIP Switch when using
FM	0 to 10V.P.P.	10%/volt	1M	Capacitively coupled
f_0 CNTL (2)	0 to +10V	1 oct/volt	100K	One is Calibrated with scale adjust
SYNC	5 to 15V.P.P.	-	40K	Capacitvely coupled; edge transition time < 10uS
TRI OUT	0 to +5V	-	500Ω	Excessive loading shifts frequency
PLS OUT	0 to +10V	-	2.2K	
SAW OUT	0 to +10V	-	500Ω	
PW MOD	0 to +10V	10%/volt	68K	Turn off DIP Switch when using
SPARE (3)	-	-	-	User defined
FILT IN	0 to 10V.P.P.	-	270K	Passband gain=.33@ min Q, .08@ max Q
FILT OUT	0 to 12V.P.P.	-	1K	VCO outputs=3-4V.P.P. in passband
Q CNTL	0 to +10V	see data sheet	100K	Oscillation occurs @ 5 - 10V
f_C MOD	0 to +10V	1 oct/volt	100K	Turn off DIP Switch when using
f_C CNTL	0 to +10V	1 oct/volt	100K	
EXP GAIN MOD	0 to +10V	9dB/volt	33K	51K connected to +15V; turn off DIP Switch when using
LIN GAIN MOD	0 to +10V	20% of input/volt	33K	51K connected to +15V; turn off DIP Switch when using
+15V	+15 ± .1V	-	-	+40mA
GND (5)	-	-	-	Power ground
-15V	-15V± .1V	-	-	-40mA
VCA OUT	0 to 25V.P.P.	-	1Ω	System final output
VCA IN	0 to 10V.P.P.	-	51K	Capacitively coupled; gain=2@ V_C=+10V
MOD IN	0 to ±10V	-	100K	Gain=1 @ V_C=+10V
SPARE (2)	-	-	-	User defined
MOD OUT	0 to ±12V	-	1Ω	Envelope output = 0 to +10V
MOD CNTL	0 to +10V	10% of input/volt	100K	
ADSR OUT	0 to +5V	-	500Ω	
ATK CNTL	0 to +10V	÷ 10/2.5 volt	40K	2mS to 20 seconds
GATE	+2.4 to +15V	TTL	500K	
TRIG	+2.4 to +15V	TTL	3K	Capacitively coupled; edge transition time <10uS
DCY CNTL	0 to +10V	÷ 10/2.5volt	40K	2mS to 20 seconds
SUS CNTL	0 to +10V	10% of peak/volt	68K	
RLS CNTL	0 to 10V	÷ 10/2.5volt	40K	2mS to 20 seconds

TABLE II: CONTROL POTENTIOMETERS

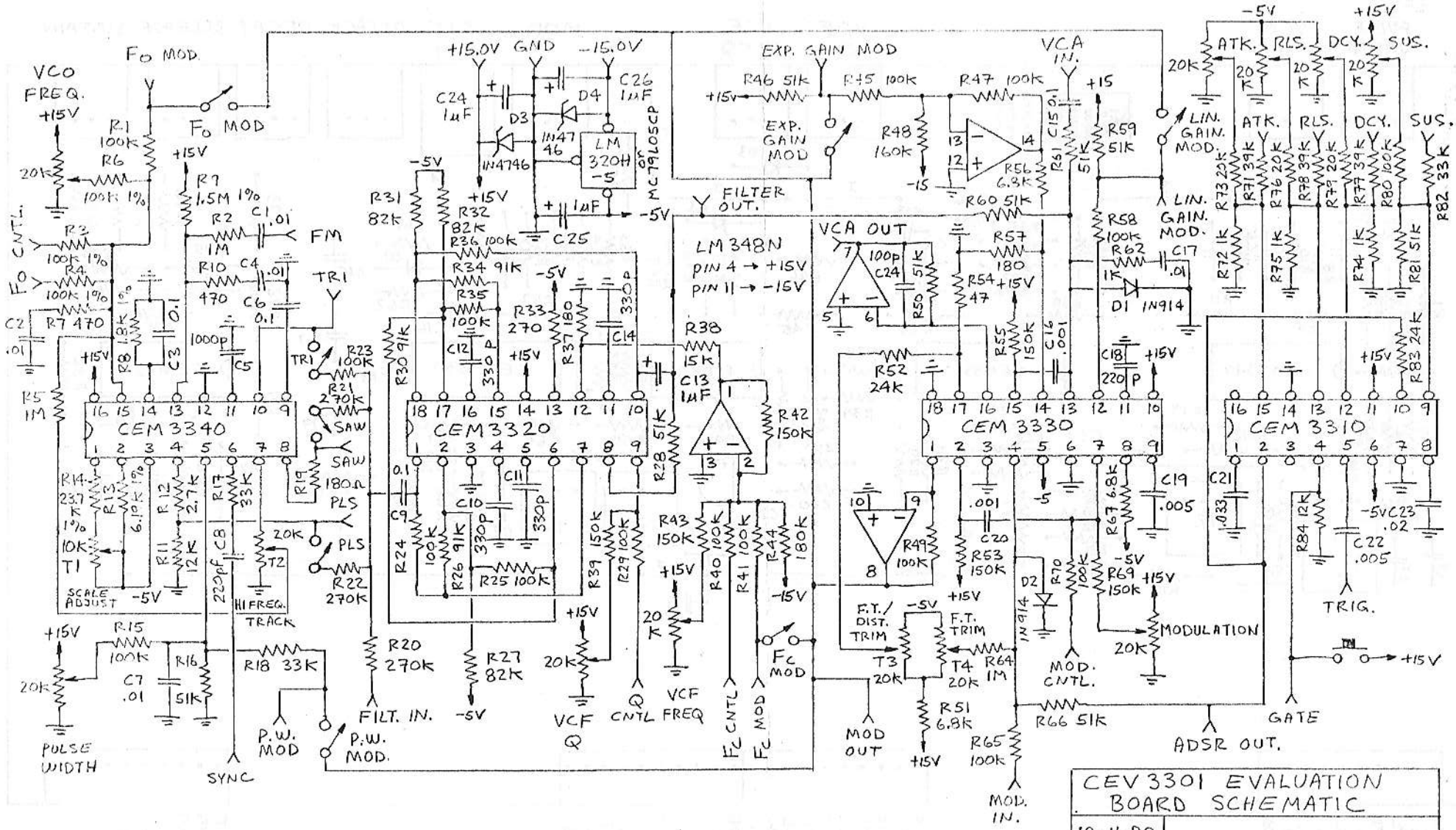
Label	Parameter it Controls	Parameter Range	Comments
PULSE WIDTH	VCO pulse duty cycle	0 to 100%	With P.W. MOD input grounded, range is 0 to 50%.
VCO FREQ	VCO Frequency	.67Hz to 24KHz	
Q	VCF Resonance	0 to 30dB before oscillation	Oscillation occurs nominally @ 3/4 rotation
VCF FREQ	VCF cutoff frequency (-12dB point)	16Hz to 16KHz	
MOD	Amount of modulation	0 to 100% of input	
ATTACK	Envelope attack time constant	2mS to 20 seconds	
DECAY	Envelope decay time constant	2mS to 20 seconds	
RELEASE	Envelope release time constant	2mS to 20 seconds	
SUSTAIN	Envelope sustain level	0 to 100% of peak	With SUSTAIN input grounded, range is 0 to 50%.



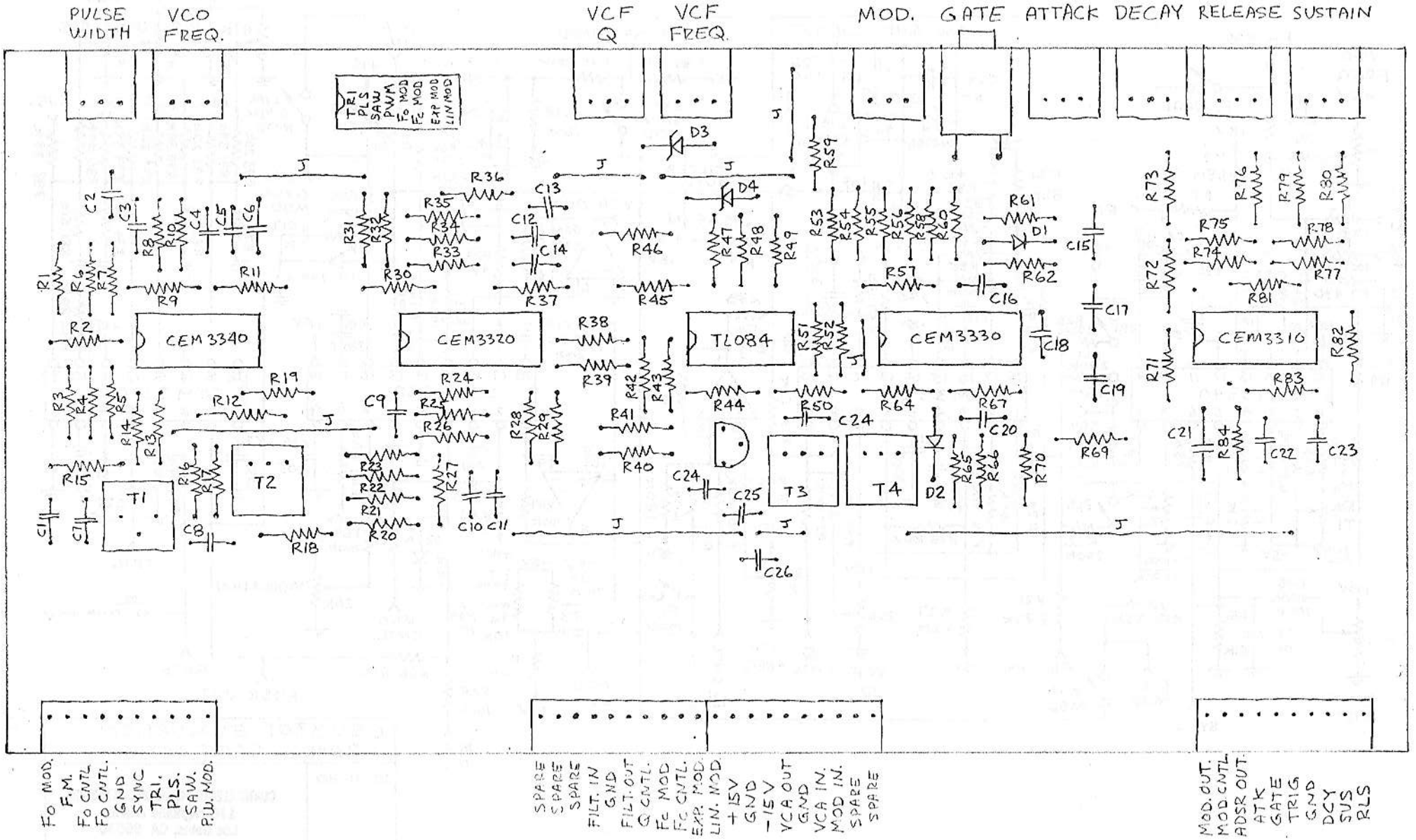
CEV3301
EVALUATION BOARD
BLOCK DIAGRAM.



SIMPLE μP INTERFACE CAPABLE OF ADDRESSING 4 BOARDS, 8 PARAMETERS EACH



CEV3301 EVALUATION BOARD SCHEMATIC	
10-11-80	CURTIS ELECTROMUSIC SPECIALTIES, INC 110 Highland Avenue Los Gatos, CA 95030
	DWG #


PULSE WIDTH
VCO FREQ.
VCF Q
VCF FREQ.
MOD.
GATE
ATTACK
DECAY
RELEASE
SUSTAIN
TRI
PLS
SAW
PWM
Fo MOD
Fc MOD
EXP MOD
LIN MOD
CEM3340
CEM3320
TL084
CEM3330
CEM3310
T1
T2
T3
T4
D1
D2
D3
D4
J
Fo MOD.
F.M.
Fo CNTL
Fo CNTL.
GND
SYNC
TRI.
PLS.
SAW.
P.W. MOD.
SPARE
SPARE
SPARE
FILT. IN
GND
FILT. OUT
Q CNTL.
Fc MOD
Fc CNTL.
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+15V
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