PARTS LIST * ARIES MODULE 317 * V C O

PART NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
C1,2	2 3	capacitor, tantalum	1mfd, 50v
C3, 10	2	capacitor, disc	100pf
C4	1	same as above	33pf
C5,6	2	same as above	20pf
C7, 11, 14	3	same as above	150pf
C8, 13	2	same as above	47pf
C9, 20	2	same as above	.001mfd (1000 pf)
C12	1	same as above	10pf
C15, 17	2	capacitor, mylar, mica, or poly.	.47mf, 25v, 10%
C16, 18	2	same as above	0.001mf, 10%
C19	1	capacitor disc	330pf
D1 thru 6	6	diode, silicon	1N 914, 1N 4148 (or equivalent)
P1,2,4.	3	potentiometer, 1/4" shaft	100K linear
P3	1	same as above	100K log
Q5, 8, 10, 11, 12	5	transistor, NPN	TE-3393 or 2N-3393
Q9	1	field effect transistor N-channel	E 212 (siliconix) KE4392 (")
Q4, 14	2	transistor, PNP	2N 3638
Q6, 7, 13	3		
R1	1	resistor, metal film	150K, 1%
R2	1	resistor, carbon	1.5m, 10%

PARTS LIST * ARIES MODULE 317 * V C O

PART NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
R3,4,5,6,8	5	resistor, metal film	100k, 1%
R7	1	same as above	60.4K, 1%
R10, 11	2	same as above	475K, 1%
R12	1	resistor, carbon	10 ohm, 10%
R13	1	same as above	6.8K, 10%
R14, 38, 64,67	4	same as above	10K, 10%
R15, 16, 36,56 58,61,62,63,69	9	same as above	100k, 10%
R17 40,53,54,65	5	same as above	1K, 10%
R18	1	same as above	4.7K, 10%
R19, 20	2	resistor, metal film	30.1K, 1%
R21	1	resistor, carbon	12K, 10%
R22, 44, 45	3	same as above	33K 10%
R23, 26	2	resistor, metal film	2.0K, 1%
R24, 27	2	same as above	1.0K, 1%
R25,28	2	resistor, carbon	220ohm, 10%
R29, 30	2	same as above	3.3K, 10%
R31	1	same as above	2.2K, 10%
R32, 34	2	same as above	680 ohm, 10%
R33	1	same as above	100ohm, 10%
R35	1	same as above	3.9K, 10%
R37, 46, 48	3	same as above	68K, 10%
R39, 60	2	same as above	1.5K, 10%
R41, 50, 52	3	same as above	47K, 10%
R42, 51	2	same as above	330ohm, 10%

PARTS LIST * ARIES MODULE 317 * V C O

PART NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
R43, 47	2	resistor, carbon	18k, 10%
R49	1	same as above	27k, 10%
R55, 57, 68	3	same as above	39k, 10%
R59	1	same as above	390 ohm, 10%
R66	1	same as above	470 ohm, 10%
R70	1	resistor, metal film	332k, 1%
S1	1	switch, toggle	DPDT
T1, T3, T4	3	trimpot	10k lin
T2, 5, 6	3	same as above	50k lin
U1,3,5,6,7	5	operational amplifier	LM 301 A
~~U2~~ U4	1	operational transconductance amplifiers	CA3080
~~U4~~ U2	1		CA 3080A (RCA)
	1	printed circuit board	
	1	front panel	
	4	knobs, 1/4" shaft	
	1	frame	
	1	bracket, small	
	1	bracket, larger	
	12	jack, miniphone	
	2	p c card guide	
	6	4-40 nut	
	6	4-40x3/8" machine screw	
	2	insulating washer	

ARIES SYSTEM 300 Music Synthesizer
ARIES MODULE AR-317

VOLTAGE CONTROLLED OSCILLATOR ASSEMBLY INSTRUCTIONS

The previous pages were written as a general guide, to familiarize the builder with the components. Here, now, are specific assembly instructions for building your Voltage Controlled Oscillator. It is recommended that you check off each step with a pencil as you proceed.

( ) 1. PREPARATION Lay the circuit board on a sheet of white paper. PLACE METAL FOIL SIDE DOWN! Also, turn board so that connector strip is to the LEFT. Use adequate lighting.

Lay the assembly drawing(layout) down near the board.

Unpack the parts carefully and place in a large box or tray so they won't get lost.

Have the following tools nearby;
Pencil tip soldering iron, hot and tinned(solder-coated)
Solder-Use only thin,rosin-core solder !
Small,diagonal wire cutters
Small wire stripper
Small long-nose pliers

( ) 2. JUMPERS Find jumper wire J1 on the drawing. Cut off a piece of insulated, solid wire, ONE INCH LONGER THAN J1. Strip 1/2 inch of insulation from each end (being careful not to damage the wire itself). Bend the bare ends to a right angle and insert into the holes on the board, according to the drawing. While holding the ends down against the board, bend them at a 45 degree angle on the foil side of the board, to hold the wire in place. Solder and cut off the excess.(Refer to introduction on parts installation.)Repeat for all the remaining jumpers (J2 thru J27.)

( ) 3. RESISTORS Carefully install all 69 resistors (R1 thru 70). Note there is no R9.

( ) 4. INTEGRATED CIRCUIT AMPLIFIERS Install all 7. (U1 thru U7)

( ) 5. DIODES Install all 6 (D1 thru D6). OBSERVE POLARITY!

( ) 6. CAPACITORS Install all 20 (C1 thru C20).On C1 and C2, observe polarity. On C 15,16,17, and 18, observe direction of the band if there is one. If there is no band, the capacitor may be installed in either direction.

( ) 7. TRANSISTORS Install all 11 transistors (Q4 thru Q14).NOTE: There is no Q1, Q2, or Q3. Also, the general shape of transistors may vary from that shown on the assembly drawing. To be sure, check each transistor type on pages 4-6 of the introduction, and make sure that the correct letters (E,B,C, or S,D,G,) are in the proper holes.

ARIES SYSTEM 300-VOLTAGE CONTROLLED OSCILLATOR

( ) 8. TRIMPOTS Install all 6. (T1 thru T6). Make sure you use the correct value. (There are two, 10K and 50K). The 10K trimpots have the number U201R103B or MTC14L4 on them. The 50K trimpots are numbered U201R503B or MTC54L4.

AT THIS POINT , ALL THE BOARD COMPONENTS ARE MOUNTED.

MODULE ASSEMBLY-PLEASE REFER TO MODULE ASSEMBLY DRAWING

( ) 1. Unpack the frame, bag of hardware, and front panel.
( ) 2. Snap the two black plastic card guides into the frame holes. The tabs must point to the rear.(Bottom one is shown, installed, on drawing.)
( ) 3. Slide the board into the frame. Hold top and bottom of frame down upon board, so that the board fits snugly in the card guide tabs.
( ) 4. Mount the board to the two brackets, as shown, using four 4-40X3/8"screws and nuts. Use a fiber or plastic insulating washer on the FOIL side of the board to keep the heads of the screws from making electrical contact with the circuit.

( ) 5. Unpack the front panel carefully. Avoid scratching its surface

( ) 6. Mount the top of the panel to the top of the module frame, using pots P1 and P2. Insert the pot shafts through the frame and panel from behind.
( ) 7. Attach the bottom of the panel to the frame using the remaining 4-40 screws and nuts.

( ) 8. Install the other pots(P3 and P4).
( ) 9. Install switch S1, as shown.
( )10. Install all 12 mini-phone jacks, as shown.
( )11. Turn all potentiometer shafts fully counter-clockwise, and mount the knobs pointing to the left most number. Tighten knob screws.

THIS COMPLETES THE MODULE ASSEMBLY.

AR-317 V.C.O. PANEL WIRING

PLEASE REFER TO PANEL WIRING DIAGRAM AND BOARD ASSEMBLY DRAWING.

( ) 1. Run a wire from pin 1 of part "P1" to pin 1 of "P3" , and to the grounds of all 12 jacks as shown. You may use either separate pieces of wire or one continuous piece.

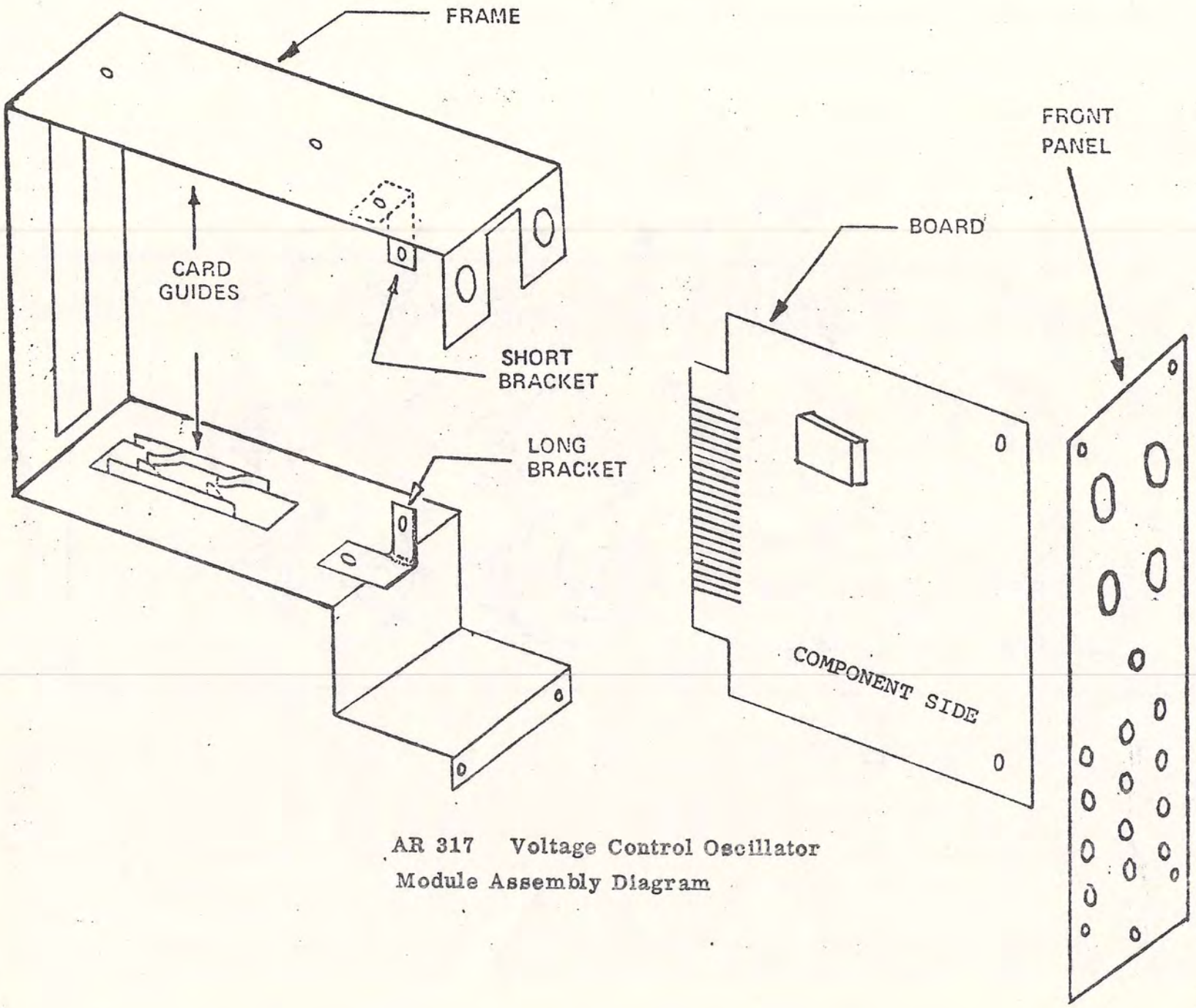
IN THE FOLLOWING STEPS, 2-5, USE INSULATED WIRE!

( ) 2. Cut a piece of wire to fit between "P1" pin1 , and the point on the board called "module ground" on the board drawing. NOTE:Make the wire at least two inches longer than necessary to provide adequate slack.
( ) 3. Run wires from pins 2 and 3 of all four pots (P1 thru 4) to the appropriate points on the board (see board assembly drawing). WIRE ONE AT A TIME TO AVOID CONFUSION!
( ) 4. Run wires from pins 1,2,4, and 5 of switch S1 to the proper board points.

( ) 5. Now, connect a wire from 10 of the 12 jacks, shown by the lettered arrows, to the holes near the edge of the board, labelled by letters on the board drawing. NOTE: The lower two jacks in the middle are unused.

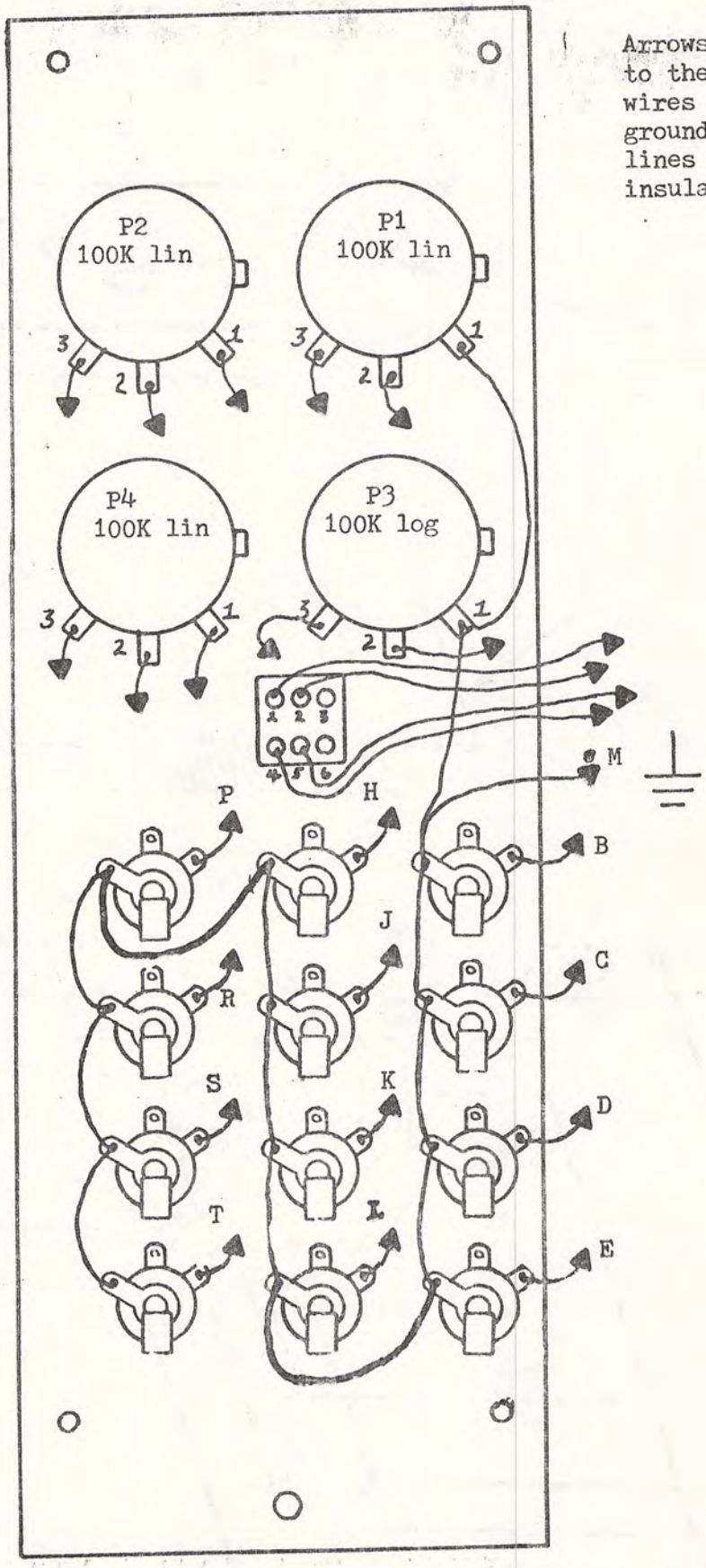
As an option, if LINEAR frequency modulation is desired, you may connect one of these jacks(left unused in previous step) to an additional 330k resistor (not supplied) , and the other end of this resistor to R70, at the side where R70 goes into the potted block on the board.

THIS COMPLETES ASSEMBLY OF YOUR AR-317 V.C.O.



AR 317 Voltage Control Oscillator
Module Assembly Diagram

AR-317 VCO PANEL WIRING DIAGRAM-rear view



Arrows indicate a wire to the PC board. All wires with arrows and ground bus with thick lines must be insulated.

V C O TRIM PROCEDURE

NOTE: Although the V C O may be trimmed by ear, the following procedure is recommended if the test instruments are available.

( ) 1. Assembled V C O.
( ) 2. Power supply, regulated +15v and -15v. IMPORTANT: The V C O should be trimmed using the actual supply you intend to use with it, if possible, as a slightly different supply voltage may change the frequency somewhat. However, if it is necessary to use another supply, the difference is not serious.
( ) 3. Oscilloscope with direct-coupled (DC) vertical input.
( ) 4. Accurate (1%) voltmeter, preferably digital.
( ) 5. A frequency counter is highly desirable, but not absolutely necessary.

NOW, PROCEED WITH THE TRIMMING

( ) 1. With the power supply off connect the +15v, -15v, and ground terminals of the V C O to the power supply. If a connector is not available for the V C O board, you may connect clip leads as follows::

+15 volts to pin 3 of "P2"
-15 volts to pin 1 of "P2"
Ground to pin 1 of "P1"

CAUTION: DOUBLE CHECK THESE CONNECTIONS! Reverse voltage applied, even momentarily, could destroy many components.

( ) 2. Connect the voltmeter negative lead to ground, and the positive lead to pin 2 of "P1".
( ) 3. Connect the scope and a frequency counter, if available, to the sawtooth output.
( ) 4. Set V C O front panel controls as follows:

COARSE FREQ.=256
FINE FREQ.=X1
CONTROL 1=0
PULSE WIDTH 50%
RANGE SWITCH=X1

( ) 5. Turn all trimpots (T1 thru T6) to approximately center position.
( ) 6. Switch power supply on. The scope should show an output. If not, try adjusting trimmer T4.

If still no output, turn off power and check wiring!

( ) 7. Adjust scope to see several cycles of the waveform.
( ) 8. Set T4 (Sawtooth Offset) so that bottom peaks of waveform are at -5 volts on the scope.
( ) 9. Set T3 (Sawtooth Amplitude) so that top peaks of waveform are at +5 volts.
( ) 10. Remove scope from sawtooth output, and connect to sine output.
( ) 11. Adjust T6 (Sine Symmetry) for most symmetrical waveform (top and bottom should have similar shape).

12. Adjust T5 (Sine Purity) for best looking sine wave. If desired, connect to an amplifier and speaker, set V C O frequency to produce a medium pitch sound, and adjust T5 for purest tone.NOTE: A distortion meter may be used to get the purest sine wave.
13. Go back and readjust T5, then T6, again, for the best waveform.
14. Set COARSE FREQ. to 16 and FINE to X1.
15. Connect scope and/or counter to triangle output.
16. Adjust T2 (Initial Frequency) for a frequency of exactly 16 HZ, as closely as possible.
17. Using voltmeter, adjust COARSE FREQ. control (P1) for exactly +9.00 volts at pin 2 of "P1".
18. Adjust T1 (1 volt per octave) for an output frequency of exactly 1024 Hz.

THIS COMPLETES TRIMMING OF YOUR V C O. When and if it is installed in a synthesizer, it is advisable to make a final adjustment of T1, so that all V C O's track in tune with the keyboard.

THEORY OF OPERATION OF AR-317

The basic waveform of the AR-317 is the triangle. The sine and pulse waveforms are derived directly from it and the sawtooth frequency is determined by it even though the sawtooth waveshape is generated separately. The triangle is generated by the loop consisting of U2, Q4, U4, Q5, and Q6. U2 is an operational transconductance amplifier whose output current is determined by the voltage at pin 2 and the current into pin 5. To begin the loop explanation, assume that the voltage at pin 2 of U2 is positive which means that current is flowing into pin 6 from the integrating capacitor, C16. The voltage on C16 is therefore decreasing at a constant rate, as are the voltages on the gate and source of the source follower, Q4. The voltage on the source of Q4 is added to the voltage at the emitters of Q5 and Q6 at pin 3 of U4. So long as this sum is positive (i.e. the voltage at the emitters is more positive than the source of Q4 is negative), the output of U4 at its pin 6 will be positive. This voltage (the balanced emitter follower consisting of Q5 and Q6) and the voltage divider consisting of R18 and R17 will hold the pin 2 of U2 positive as in the initial assumption. When the voltage on the source of Q4 becomes sufficiently negative to overcome the output of the balanced emitter follower, pin 3 of U4 will become negative and pin 6 of U4 will quickly switch to its negative condition. This makes pin 2 of U 2 negative and reverses the direction of current in pin 6. C16 is now being charged and its voltage is rising at a constant rate. Notice that when the output of U4 reversed its polarity its contribution to its own input at pin 3 became such that it latched itself into that condition until the source voltage of Q4 rises enough to again overcome it in the opposite direction. When C16 has charged enough for the voltage at the source of Q4 to overcome the output of Q5 and Q6, the voltage on pin 3 of U4 will become positive, the voltage on pin 6 will become positive, and the voltage of pin 2 of U2 will become positive as in the initially assumed condition.The amplitude at which switching of this loop occurs is determined by the addition of the two voltages at pin 3 of U4. Since R 20 and R 19 are identical (1% resistors) and U4 is going to switch its output condition as its input is within a few millivolts of zero voltage, the circuit will switch when the voltage at the source of Q4 is very nearly identical to the voltage at the emitters of the balanced emitter follower.This voltage is accurately determined by a pair of voltage dividers (R23 and R24 in the positive direction-R26 and R27 in the negative direction) and the clamping diodes D1 and D2.These components combined with the balanced emitter follower transistors cause the emitter voltage to swing accurately between plus 5 volts and minus 5 volts. Corresponding to this, the triangle waveshape appearing at the source of Q4 swings accurately between plus and minus 5 volts. Since the amplitude is determined by the switching levels of the oscillating loop, the frequency is directly related to the charge and discharge currents in C16, which is the output current of U2.

The magnitude of this current (pin 6 of U2) is identical to the current injected into pin 5. To accurately preserve the linear relationship of 1 volt per octave at the input to the VCO, it is necessary to convert the linear input voltage levels into an accurate exponential current which flows throughR13 into U2. This conversion is accomplished by a series of carefully selected and temperature compensated components which have been potted together as part of the printed circuit board.The effect of this potted block is to create exponential currents in R13 and R31 as a function of the voltage at the junction of R8, R10, and R11. U1 is an input operational amplifier which produces the proper amplitude of linear voltage variation for the input of the exponential converter.
The triangle waveshape at the source of Q4 is inverted and isolated by U3 without changing its amplitude. It is then fed to the output connection through R54. It is also fed through Q10 and Q11 to the inputs of U6. By utilizing the base-emitter characteristics of the two transistors to roll off the peaks of the triangle, a waveshape closely resembling a sine wave is produced between the collectors. This is amplified by U6 and applied through R53 to the output connection.

The triangle is also fed through R55 to pin 2 of U7. Since U7 is operating without feedback its output at pin 6 is always at saturation, either positive or negative, depending on the polarity of the voltage between pins 2 and 3. When P4 is at its midpoint and there is no output to the PWM jack, the polarity at pin2 will be the same as the polarity of the triangle wave and and pin 6 will have approximately a square wave on it.If the pulse width control, P4, is moved in the positive direction, pin 2 will be positive for more than half of the period of the triangle and the output will become assymetrical. Carried to the extreme, the control can overcome the contribution of the triangle input and the output will be held in one condition. Diode D4 prevents the output from going negative and R59 and R60 limit the output amplitude to 10 volts. An input voltage to the PWM connector also changes the relative voltage between plus 2 and 3 of U7 which changes the pulse width as before.

The sawtooth waveshape is generated by charging C18 with the second output of the exponential converter. The voltage on C18 will ries until a positive-going change occurs at the output of Q5 and Q6 which turns on Q8 and Q7. Q8 and Q7 hold each other in conduction until the voltage across them decreases to a small value at which time they both stop conducting. C18, then, starts to charge again until the next synchronising pulse is produced by the main oscillating loop.The constant rate-charge and fast

discharge of C18 is the desired sawtooth waveshape which is passed through the source follower Q9 to the operational amplifier U5. The output of U5 is passed through R40 to the output connection.

If the VCO is to be synchronized by an external signal, the incoming voltage is amplified by Q12 and Q13 before being applied to three separate places. The signal applied to point "A" discharges C16 to prepare for the start of a cycle. The signal applied to point "B" drives pin 3 of U4 positive which then is latched by its own feedback--again ready for the start of a cycle. The signal applied to point "C" causes Q8 and Q7 to conduct and discharge C18 for the start of another sawtooth cycle.

THEORY OF OPERATION OF AR-317

The basic waveform of the AR-317 is the triangle. The sine and pulse waveforms are derived directly from it and the sawtooth frequency is determined by it even though the saw-tooth waveshape is generated separately. The triangle is generated by the loop consisting of U2, Q4, U4, Q5, and Q6. U2 is an operational transconductance amplifier whose output current is determined by the voltage at pin 2 and the current into pin 5. To begin the loop explanation, assume that the voltage at pin 2 of U2 is positive which means that current is flowing into pin 6 from the integrating capacitor, C16. The voltage on C16 is therefore decreasing at a constant rate, as are the voltages on the gate and source of the source follower, Q4. The voltage on the source of Q4 is added to the voltage at the emitters of Q5 and Q6 at pin 3 of U4. So long as this sum is positive (i.e. the voltage at the emitters is more positive than the source of Q4 is negative), the output of U4 at its pin 6 will be positive. This voltage (the balanced emitter follower consisting of Q5 and Q6) and the voltage divider consisting of R18 and R17 will hold the pin 2 of U2 positive as in the initial assumption. When the voltage on the source of Q4 becomes sufficiently negative to overcome the output of the balanced emitter follower, pin 3 of U4 will become

negative and pin 6 of U4 will quickly switch to its negative condition. This makes pin 2 of U 2 negative and reverses the direction of current in pin 6. C16 is now being charged and its voltage is rising at a constant rate. Notice that when the output of U4 reversed it's polarity its contribution to its own input at pin 3 became such that it latched itself into that condition until the source voltage of Q4 rises enough to again overcome it in the opposite direction. When C16 has charged enough for the voltage at the source of Q4 to overcome the output of Q5 and Q6, the voltage on pin 3 of U4 will become positive, the voltage on pin 6 will become positive, and the voltage of pin 2 of U2 will become positive as in the initially assumed condition. The amplitude at which switching of this loop occurs is determined by the addition of the two voltages at pin 3 of U4. Since R 20 and R 19 are identical (1% resistors) and U4 is going to switch its output condition as its input is within a few millivolts of zero voltage, the circuit will switch when the voltage at the source of Q4 is very nearly identical to the voltage at the emitters of the balanced emitter follower. This voltage is accurately determined by a pair of voltage dividers (R23 and R24 in the positive direction-R26 and R27 in the negative direction) and the clamping diodes D1 and D2. These components combined with the balanced emitter follower transistors cause the emitter voltage to swing accurately between plus 5 volts and minus 5 volts. Corresponding to this, the triangle waveshape appearing at the source of Q4 swings accurately between plus and minus 5 volts. Since the amplitude is determined by the switching levels of the oscillating loop, the frequency is directly related to the charge and discharge currents in C16, which is the output current of U2.

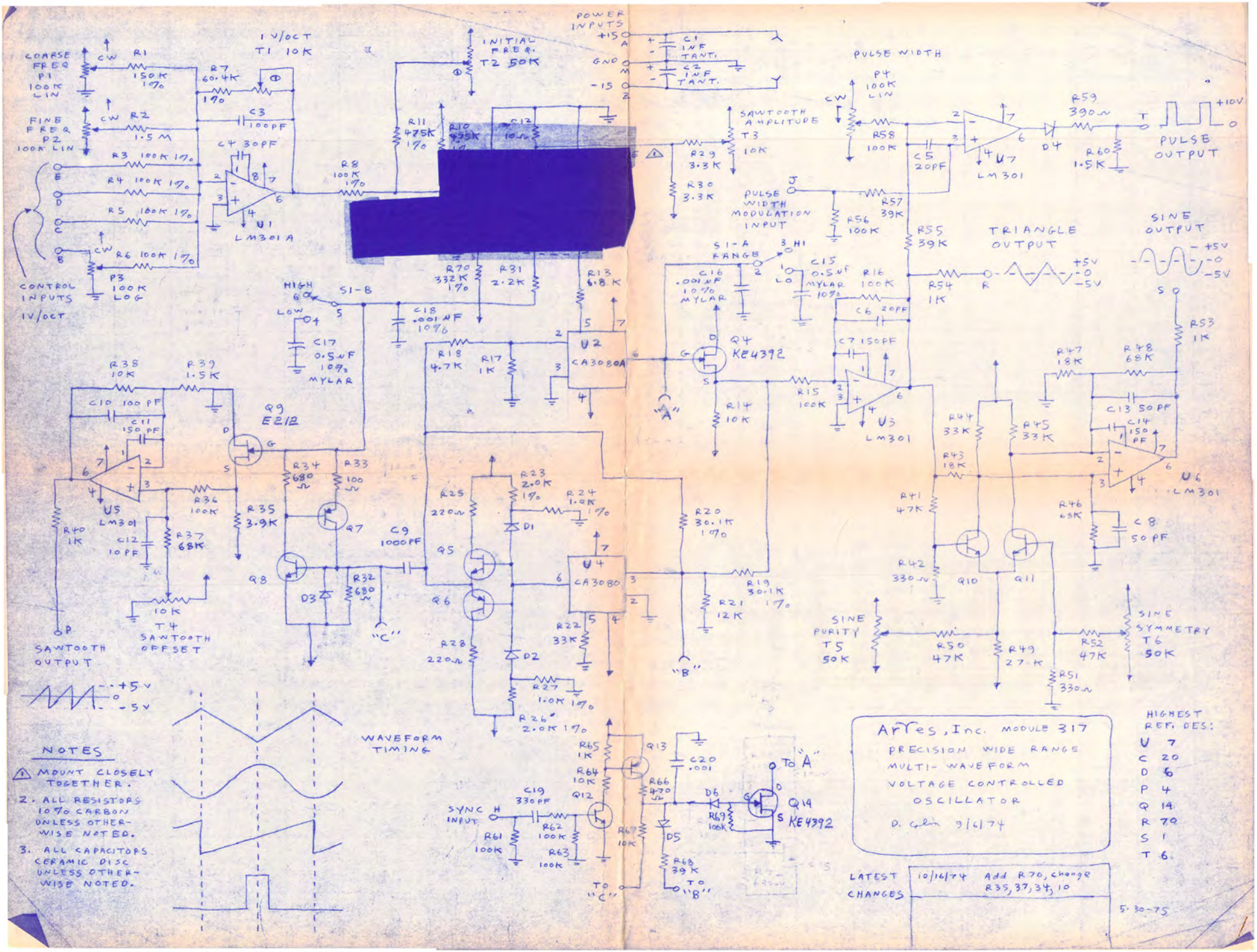
The magnitude of this current (pin 6 of U2) is identical to the current injected into pin 5. To accurately preserve the linear relationship of 1 volt per octave at the input to the VCO, it is necessary to convert the linear input voltage levels into an accurate exponential current which flows throughR13 into U2. This conversion is accomplished by a series of carefully selected and temperature compensated components which have been potted together as part of the printed circuit board.The effect of this potted block is to create exponential currents in R13 and R31 as a function of the voltage at the junction of R8, R10, and R11. U1 is an input operational amplifier which produces the proper amplitude of linear voltage variation for the input of the exponential converter.
The triangle waveshape at the source of Q4 is inverted and isolated by U3 without changing its amplitude. It is then fed to the output connection through R54. It is also fed through Q10 and Q11 to the inputs of U6. By utilizing the base-emitter characteristics of the two transistors to roll off the peaks of the triangle, a waveshape closely resembling a sine wave is produced between the collectors. This is amplified by U6 and applied through R53 to the output connection.

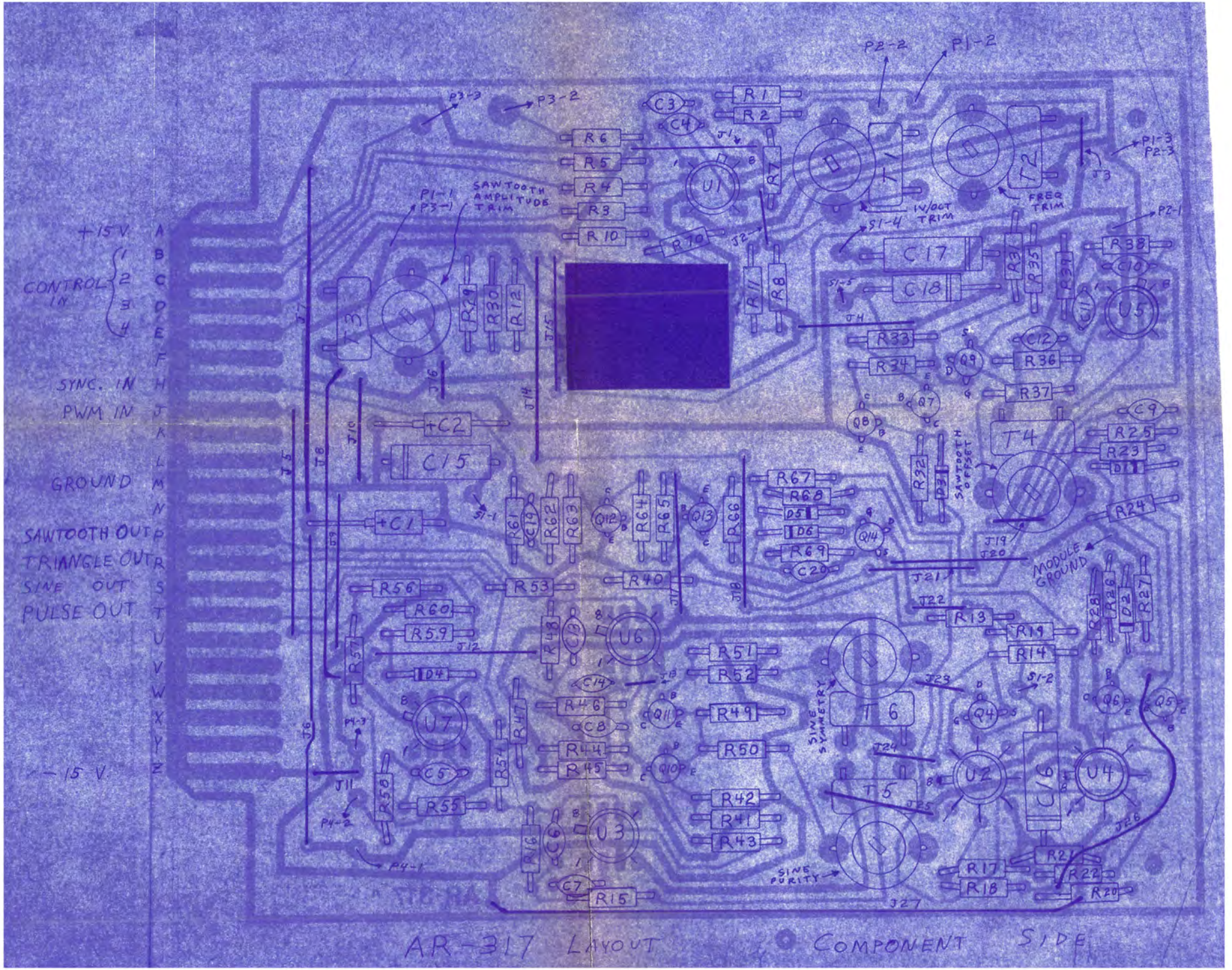
The triangle is also fed through R55 to pin 2 of U7. Since U7 is operating without feedback its output at pin 6 is always at saturation, either positive or negative, depending on the polarity of the voltage between pins 2 and 3. When P4 is at its midpoint and there is no output to the PWM jack, the polarity at pin2 will be the same as the polarity of the triangle wave and and pin 6 will have approximately a square wave on it.If the pulse width control, P4, is moved in the positive direction, pin 2 will be positive for more than half of the period of the triangle and the output will become assymetrical. Carried to the extreme, the control can overcome the contribution of the triangle input and the output will be held in one condition. Diode D4 prevents the output from going negative and R59 and R60 limit the output amplitude to 10 volts. An input voltage to the PWM connector also changes the relative voltage between plus 2 and 3 of U7 which changes the pulse width as before.

The sawtooth waveshape is generated by charging C18 with the second output of the exponential converter. The voltage on C18 will ries until a positive-going change occurs at the output of Q5 and Q6 which turns on Q8 and Q7. Q8 and Q7 hold each other in conduction until the voltage across them decreases to a small value at which time they both stop conducting. C18, then, starts to charge again until the next synchronising pulse is produced by the main oscillating loop.The constant rate-charge and fast

discharge of C18 is the desired sawtooth waveshape which is passed through the source follower Q9 to the operational amplifier U5. The output of U5 is passed through R40 to the output connection.

If the VCO is to be synchronized by an external signal, the incoming voltage is amplified by Q12 and Q13 before being applied to three separate places. The signal applied to point "A" discharges C16 to prepare for the start of a cycle. The signal applied to point "B" drives pin 3 of U4 positive which then is latched by its own feedback--again ready for the start of a cycle. The signal applied to point "C" causes Q8 and Q7 to conduct and discharge C18 for the start of another sawtooth cycle.


POWER INPUTS
+15
GND
-15
C1 1NF TANT.
C2 1NF TANT.
COARSE FREQ P1 100K LIN
FINE FREQ P2 100K LIN
CONTROL INPUTS
1V/OCT
P3 100K LOG
1 V/OCT T1 10K
INITIAL FREQ. T2 50K
R1 150K 1%
R2 1.5M
R3 100K 1%
R4 100K 1%
R5 100K 1%
R6 100K 1%
R7 60.4K 1%
R8 100K 1%
C3 100PF
C4 30PF
U1 LM301A
R10 475K
R11 475K 1%
C12 10PF
R70 332K 1%
R31 2.2K
R13 6.8K
HIGH
LOW
S1-B
C18 .001 NF 10%
C17 0.5NF 10% MYLAR
U2 CA3080A
R18 4.7K
R17 1K
R38 10K
R39 1.5K
C10 100 PF
C11 150 PF
Q9 E212
U5 LM301
R40 1K
C12 10 PF
R37 68K
R36 100K
R35 3.9K
R34 680
R33 100
Q7
Q8
D3
R32 680
C9 1000PF
10K T4 SAWTOOTH OFFSET
SAWTOOTH OUTPUT
"C"
R23 2.0K 1%
R24 1.0K 1%
R25 220
D1
Q5
Q6
R28 220
D2
R27 1.0K 1%
R26 2.0K 1%
U4 CA3080
R22 33K
R20 30.1K 1%
R19 30.1K 1%
R21 12K
"B"
SAWTOOTH AMPLITUDE T3 10K
R29 3.3K
R30 3.3K
PULSE WIDTH MODULATION INPUT
R56 100K
R57 39K
PULSE WIDTH
P4 100K LIN
R58 100K
C5 20PF
U7 LM301
D4
R59 390
R60 1.5K
PULSE OUTPUT
+10V
0
S1-A RANGE
HI
LO
C16 .001NF 10% MYLAR
C15 0.5NF 10% MYLAR
R16 100K
C6 20PF
R54 1K
R55 39K
TRIANGLE OUTPUT
+5V
0
-5V
SINE OUTPUT
+5V
0
-5V
R53 1K
Q4 KE4392
"A"
R14 10K
R15 100K
U3 LM301
C7 150PF
R47 18K
R48 68K
C13 50 PF
C14 150 PF
U6 LM301
R44 33K
R45 33K
R43 18K
R41 47K
R46 68K
C8 50 PF
R42 330
Q10
Q11
SINE PURITY T5 50K
R50 47K
R49 27K
R51 330
R52 47K
SINE SYMMETRY T6 50K
+5V
0
-5V
WAVEFORM TIMING
NOTES
1. MOUNT CLOSELY TOGETHER.
2. ALL RESISTORS 10% CARBON UNLESS OTHERWISE NOTED.
3. ALL CAPACITORS CERAMIC DISC UNLESS OTHERWISE NOTED.
SYNC INPUT
C19 330PF
R61 100K
R62 100K
R63 100K
Q12
Q13
R65 1K
R64 10K
R67 10K
C20 .001
R66 470
D5
D6
R68 39K
R69 100K
Q14 KE4392
TO "A"
TO "C"
TO "B"
Arres, Inc. MODULE 317
PRECISION WIDE RANGE MULTI-WAVEFORM VOLTAGE CONTROLLED OSCILLATOR
D. Glen 9/6/74
HIGHEST REF. DES:
U 7
C 20
D 6
P 4
Q 14
R 70
S 1
T 6
LATEST CHANGES
10/16/74 Add R70, change R35, 37, 34, 10
5-30-75


+15 V
CONTROL IN 1
2
3
4
SYNC. IN
PWM IN
GROUND
SAWTOOTH OUT
TRIANGLE OUT
SINE OUT
PULSE OUT
-15 V
A
B
C
D
E
F
H
J
K
L
M
N
P
R
S
T
U
V
W
X
Y
Z
P2-2
P1-2
P3-3
P3-2
P1-1
P3-1
SAWTOOTH AMPLITUDE TRIM
1V/OCT TRIM
FREQ TRIM
P1-3
P2-3
P2-1
SAWTOOTH OFFSET
MODULE GROUND
SYMETRY
SINE PURITY
AR-317 LAYOUT
COMPONENT SIDE