

PARTS LIST * AR-318 * VC CLOCK, NOISE GENERATOR, AND SAMPLE/HOLD

NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
C1, 2, 3, 6, 11, 14, 26, 28	8	Capacitor, Disc	0.1 mfd, 50v
C4, 5, 8, 19	4	" "	0.01 mfd
C7, 20, 27, 29	4	" "	0.001 mfd
C9, 12, 15, 18, 21, 24	6	" "	33 pf
C10, 13	2	Capacitor, Tantalum	10 mfd, 20v
C16	1	Capacitor, Disc	150 pf
C17	1	Capacitor Mylar, Mica, or Polycarb	0.056 mfd, 10%, 25v
C22	1	Capacitor, Tantalum	1 mfd, 50v
C23, 25	2	Capacitor, Disc	100 pf
D1 thru 9	9	Diode, Silicon	1N914 or 1N4148 or equivalent
P1	1	Potentiometer, 1/4" shaft	100k linear
P2	1	" "	10k, linear
Q1	1	Transistor, NPN	2N5172
Q2, 4, 7, 8, 12, 14		Transistor NPN	2N3393 or TE3393
Q3, 6, 9, 13,	4	Transistor, PNP	2N3638
Q5	1	Field Effect Transistor, N-Channel	E212 (siliconix)
Q10	1	Transistor, Unijunction	2N4870
Q11	1	Transistor, PNP	MPS-A65
R1, 9, 13, 15, 34	5	Resistor, Carbon	1meg, 10%
R2, 3	2	" "	4.7 meg, 10%
R4, 7, 16, 21, 27, 30, 46, 52, 53, 55	10	" "	1k, 10%
R5	1	Resistor, Carbon	3.9k, 10%
R6, 12, 14, 17, 18 19, 24, 25, 26 32 } 19		" "	100k, 10%
R35, 36, 37, 38 40, 43 57, 58, 59 }			
R10, 20, 29, 31 51, 54, 56, 60		" "	10k, 10%
R11	1	" "	10 meg, 10%
R22, 23, 28	3	" "	100 ohm, 10%
R8	1	" "	39k, 10%
R33	1	" "	150k, 10%
R41	1	" "	56k, 10%
R42, 45	2	" "	470k, 10%
R44, 61	2	" "	3.3k, 10%
R47	1	" "	10 ohm, 10%
R48	1	" "	15k, 10%
R39	1	" "	390k, 10%
R49	1	" "	8.2k, 10%

NUMBER	QUANTITY	DESCRIPTION	VALUE & RATINGS
R50,66	2	Resistor, Carbon	33k, 10%
R62,65	2	" "	2.2k, 10%
R63	1	" "	4.7k, 10%
R64	1	" "	390 ohm, 10%
S1	1	Switch, toggle	SPDT
S2	1	Switch, momentary button	SPST
T1	1	Trimpot	50k, linear
U1,2,3,4,5,7,8,9	8	Operational Amplifier	LM301A
U6	1	FET Operational Amplifier	NE536
	12	Jack, mini-phone	
	1	Printed Circuit Board	
	1	Front Panel	
	2	Knob, 1/4" shaft	
	1	Module frame	
	2	brackets	
	6	Screw, 4-40 x 3.8"	
	6	Nut, 4-40 hex	
	2	PC card guide	

ARIES System 300 Music Synthesizer
Module AR 318
Sample/Hold, Clock, Noise Generator Assembly Instructions

The previous pages were written as a general guide, to familiarize the builder with the components. Here, now, are the specific assembly instructions for building your

It is recommended that you do the following before you proceed:

Find a place where you can work through completion, without disturbing your set-up.

Use adequate lighting.

Wash your hands before starting. This removes contaminating oils and perspiration and makes assembly more comfortable.

As you proceed, check off each step with a pencil.

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1. Preparation

Lay the circuit board down on a sheet of white paper. PLACE METAL SIDE DOWN! Turn board so that connector strip is to the left.

Lay the assembly drawing 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 strippers

Small long-nose pliers

Regular pliers

Flat blade screw driver

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2. Jumpers

Find jumper J1 on the drawing. Measure J1 on the PCboard. Cut a piece of insulated wire one inch longer than J1 measures on the PC board. 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 to hold the wire in place. Solder and cut off the excess. (Refer to the introduction on parts installation.) Install all 12 jumpers in the same manner.

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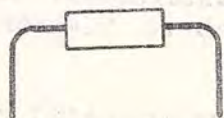
3. Resistors

Carefully install all 66 resistors on the circuit board. (R1 through R66) Install trim pot T1 when all the resistors are installed.

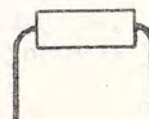
To avoid breaking the resistors leads, bend the leads at least 1/16 of an inch away from the body of the resistor.

For example:

Correct



Incorrect



- () 4. Diodes
Carefully install all 9 diodes on the circuit board. (D1 through D9) Be careful to observe correct polarity.
- () 5. Capacitors
Carefully install all 22 capacitors on the circuit board. (C1 through C22) Capacitors with polarity markings must be installed correctly.
- () 6. Transistors
Carefully install all 14 transistors on the circuit board in this suggested sequence. Double check pin orientation and board placement.
Q1 2N5172
Q5 E212
Q10 2N4870
Q3,6,9,13 2N3638
Q2,4,7,8,12,14 2N 3393 or TE3393
Q11 MPS-A65
- () 7. Integrated Circuit Amplifiers
Carefully install all 9 Integrated Circuit Amplifiers. First, install U6 NE536. All other Integrated Circuit Amplifiers LM301 can now be installed.

MODULE ASSEMBLY-- Please refer to Module Assembly Drawing

- () 1. Unpack the frame, bag of hardware, and front panel.
- () 2. Snap the two plastic card guides into the holes in the frame.
Be sure that the pairs of tabs in the guides which hold the board point toward the rear of the frame. (The bottom one is shown installed in the drawing.)
- () 3. Slide the circuit board into the frame, holding the top and bottom of the frame together against the board so that the board fits snugly in the card guides. Be sure that the pairs of plastic tabs pinch the edge of the circuit board properly.
- () 4. Using 4-40X3/8" screws and nuts, mount the two angle brackets to the frame as shown in the drawing. The brackets should be entirely on the component side of the board.
- () 5. Now screw the board to the brackets. Insert the 4-40 X 3/8" screw from the foil side of the board. **DOUBLE CHECK THAT THE HEAD OF THE SCREW DOES NOT TOUCH ANY FOIL!!!**
- () 6. Unpack the front panel carefully. Avoid scratching its surface.
AT THIS POINT you may if you wish skip steps 7-8 and proceed through the first few steps in the panel wiring (those in which wiring is done between components on the panel, but not to the board) before finishing the module assembly.
- () 7. Mount the top of the panel to the top of the module frame using the top two potentiometers as follows: If there are tabs sticking up parallel to the shaft on the pots, bend .90 degrees inward out of the way. Put the locking washer on the pots. Insert the pot shafts through the matching 3/8" holes in the frame and the top of the panel. Put on the nuts and tighten them very snugly, but avoid scratching the panel.
- () 8. Attach the bottom of the panel to the frame using the remaining 4-40 screws and nuts.
- () 9. Install the other pots onto the panel.
- () 10. Install all 12 mini-phone jacks as shown in the panel drawing.
- () 11. Turn all pot shafts fully counterclockwise and mount the knobs pointing to the leftmost number. Tighten knob screws.

THIS COMPLETES MODULE ASSEMBLY

PANEL WIRING---Refer to panel wiring diagram and board assembly drawing.

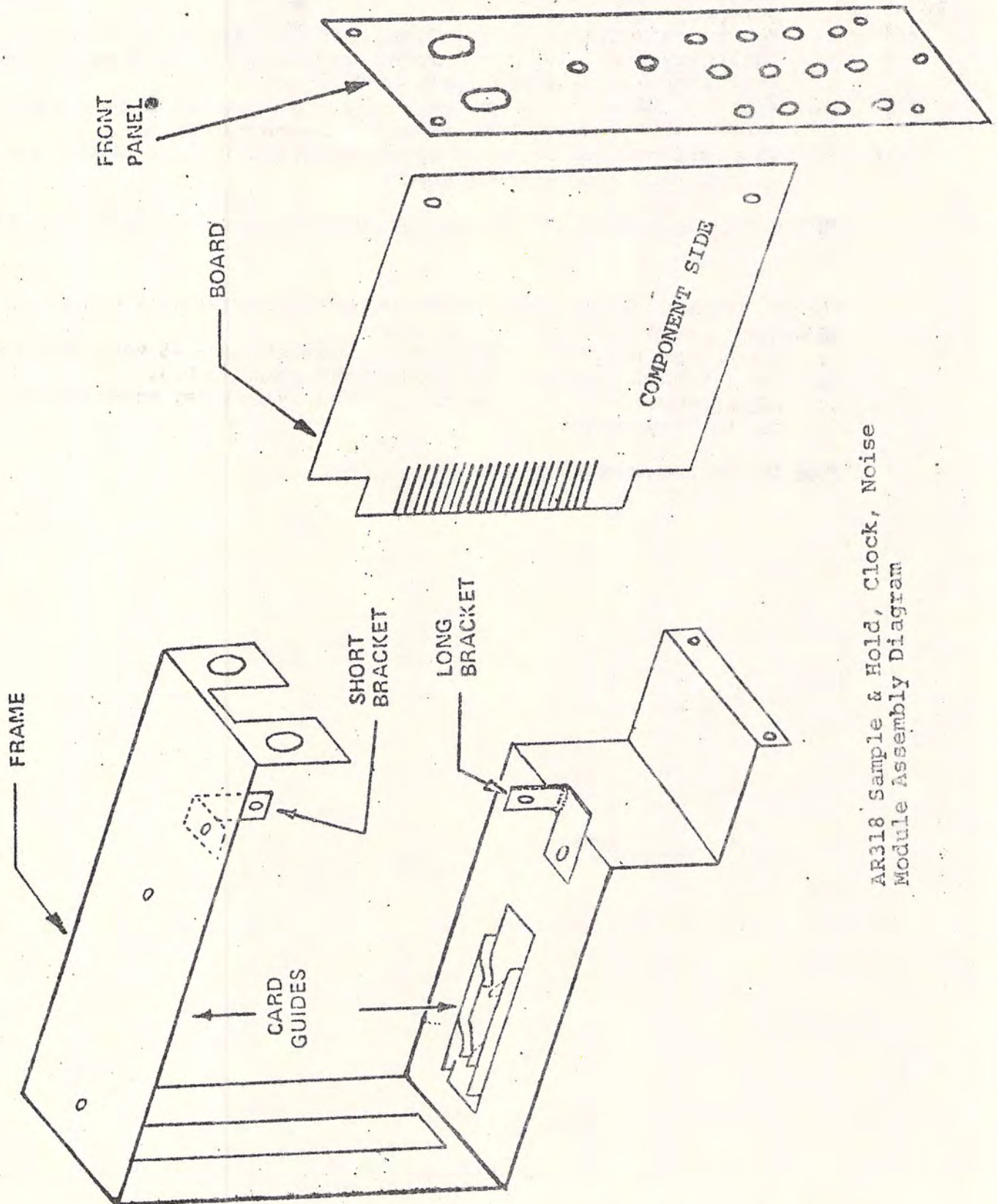
- () 1. Run a wire connecting the grounds of all 12 mini-jacks, as shown, and from there to the point on the board labelled M on the assembly drawing.
- () 2. Run a wire connecting pins 1,2,and 3 of each pot on the panel to the appropriate point on the board as labelled on the assembly drawing. Wire one pot at a time to avoid confusion.
- () 3. Wire all jacks with arrows and a letter designation to the appropriate point on the board as labelled on the assembly drawing.
- () 4. Wire both switches S1 and S2 to the appropriate points on the board as labelled on the assembly drawing.

THIS COMPLETES ASSEMBLY OF YOUR AR 318 SAMPLE/HOLD, CLOCK, NOISE GENERATOR

The AR 318 Sample/Hold, Clock, Noise Generator requires only one adjustment and this can be done by ear.

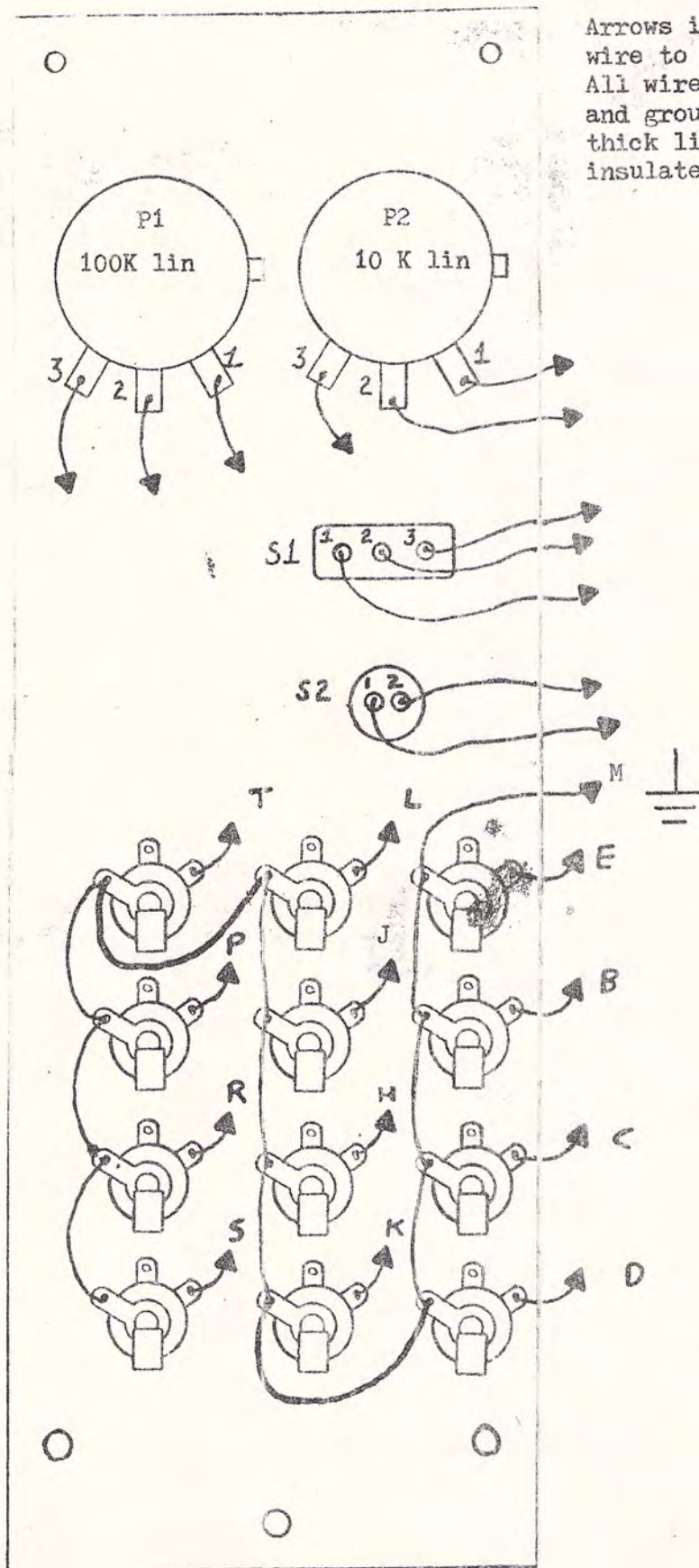
1. Connect the module to a properly regulated + and - 15 volt supply.
2. Set the Clock frequency pot on the front panel to 0.3.
3. Adjust trim pot T1 for approximately one cycle every three seconds at the Clock output.

Your AR 318 is now ready to use.



AR318 Sample & Hold, Clock, Noise
Module Assembly Diagram

AR 318 SAMPLE/HOLD, CLOCK, NOISE GENERATOR PANEL WIRING DIAGRAM--rear view



THEORY OF OPERATION-AR-318

SAMPLE/HOLD, CLOCK, AND NOISE GENERATOR

I. Sample/Hold

This is basically an input buffer, electronic switch, capacitor, and output buffer. The signal input is attenuated by a factor of two (to place less of a demand on the switching circuit), and buffered by a voltage follower consisting of U5 with current booster Q2 and Q3. The booster is biased by Q4, which is a constant current source. The output goes to a FET switch Q5, which is normally off. However, when any wave form with a sharp rise is applied to the S/H TRIG input, or when the MANUAL TRIGGER button is pressed, a short pulse is applied to the base of Q7. This, in turn, turns on Q6, so the voltage at the cathode of D3 momentarily jumps from about -14 volts (which holds Q5 off), to plus 15v. This lets R24 reduce Q5's gate-source voltage to 0, which makes Q5 conduct. The output of Q2 and Q3 is thus briefly connected to C17. In a very short time C17 charges up (or down) to 1/2 the S/H input voltage. After the pulse is over, it stays charged, because both Q5 (when off) and U6 have an extremely high impedance. However, U6 does buffer C17's voltage, and amplify it by a factor of 2 (to make up for the input loss).

A positive voltage (of at least 2 volts) at the GATE input will keep the switch Q5 on continuously until the input voltage drops. Then, the output will follow, or TRACK, the input.

II. Clock

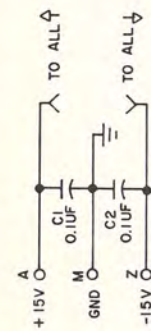
This is basically a voltage controlled sawtooth oscillator. U7 sums voltages from the CLOCK FREQUENCY control (P1) and any control input present. The inverted sum is attenuated by R43 and R44, and applied to Q8 and Q9, which form an exponentially controlled current source. The current is trimmed to the right range by T1 (CLOCK FREQ. trim). Now, C22 is initially discharged (both sides at -15v). As current from Q9 charges it up, the voltage on the plus side of C22 rises uniformly, until it reaches about -5 volts. This voltage triggers unijunction transistor Q10, which suddenly discharges C22, and the cycle repeats. If the current from Q9 is made to increase by turning up the CLOCK FREQ. control, C22 charges faster, discharges sooner, and therefore the frequency increases. Now, the resulting sawtooth waveform across C22 is buffered by emitter follower Q11, and biased by R50, R66, and U8 to give an output waveform of 0 to +10 volt level. The sawtooth appearing at pin2 of U9, however, varies from approximately +3 volts to -3v. This is converted to a square wave of about -15v to +13v level by U9, which is open loop. D6, R64, and R65 provide the 0 to +10 volt square wave output. The square wave is also differentiated by C26 and R60, and rectified by D7 to give a trigger pulse output. This trigger operates the S/H in the "clock" position of the S/H TRIG switch.

THEORY OF OPERATION-AR-318 (cont)

Any fast rising waveform, such as a square wave, applied to the CLOCK SYNC input, is differentiated to form a pulse by C27, R57, and R58. This turns on Q14, Q13, and Q12 momentarily, which discharges C22 and thus synchronizes the clock oscillator. The SYNC pulse also appears at the CLOCK TRIG outputs, due to D8 and R62, and also triggers the S/H. C28 holds the pulse on for about 0.4ms, in case the sync. output is very short.

III. Noise Generator

Q1 is operated in the reverse-breakdown mode, with current supplied through R1. This generates a few millivolts of white noise, which is coupled by C3 into U1. U1 has D C feedback through R2 and R3, but has essentially no feedback at audio frequencies. The noise is amplified to the clipping point by U1, and filtered above 20 KHz by R4, C5, and R5. The output, even though clipped, is still "white", that is, equal energy per cycle of frequency over the audio range. U2, with its associated components, provides a decreasing frequency response of 3db per octave, plus some gain at the lower frequencies, to provide pink noise. This has equal energy per octave across the audio range, and sounds uniform, because we hear on an octave basis, not per cycle of frequency. The output is rectified by D9, which generates strong, low, frequencies. These are selected and amplified by C10, R12, U3, R13, and C11. R11 biases the output of U3 to be negative, so C13 is properly biased. U4 completes the amplification and filtering (with C14 and R15). The output is a slow, random, waveform containing frequencies from approximately 0.2 Hz to 7Hz.

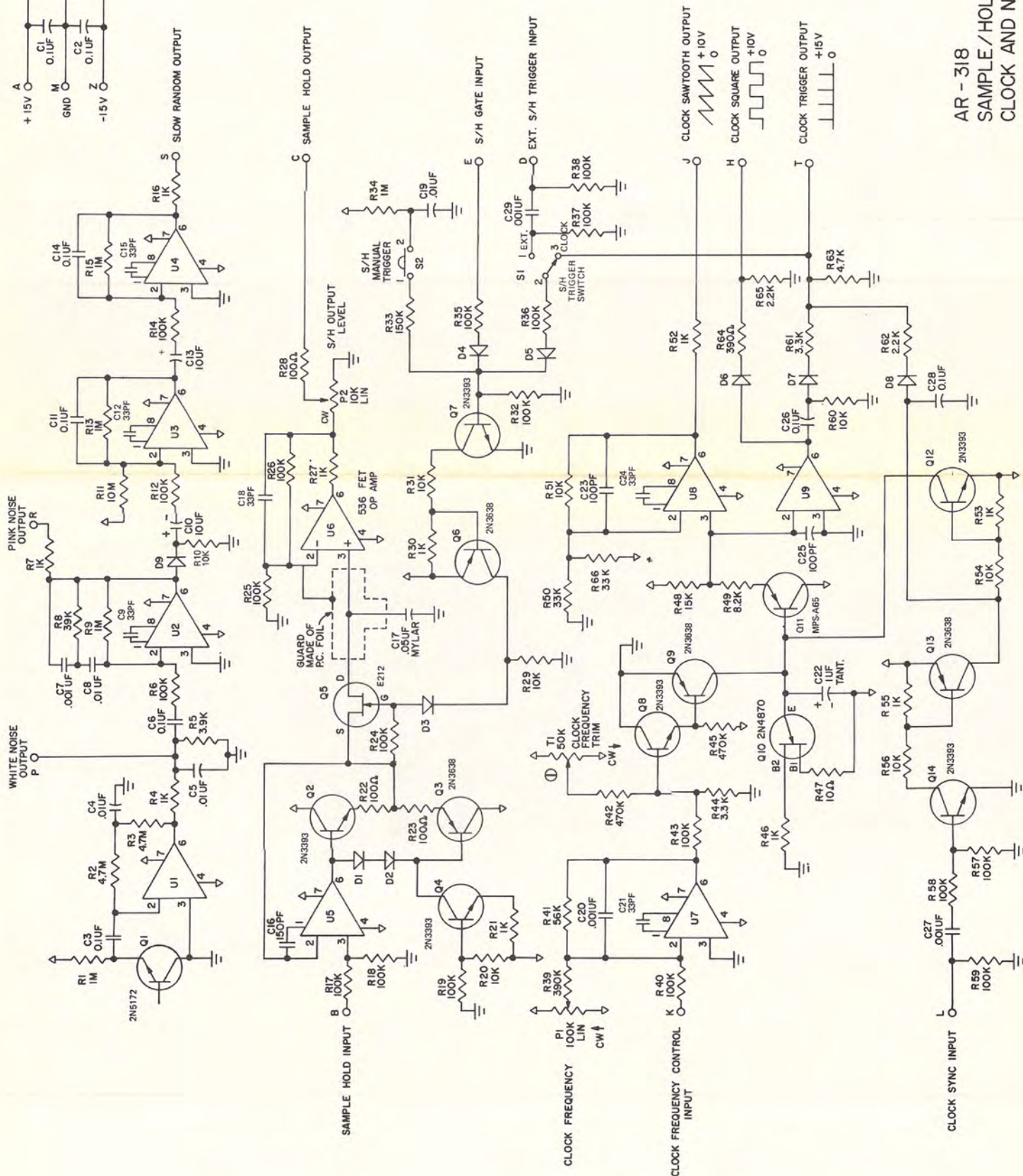


NOTES:

1. ALL OP AMPS (U1 - U9) EXCEPT U6 ARE LM301A.
2. ALL RESISTORS ARE 1/4W 10% CARBON.
3. ALL DIODES ARE SILICON 1N4148

HIGHEST REFERENCE DESIGNATION:

C29
 D9
 P2
 Q14
 R66
 S2
 U9



AR - 318
 SAMPLE/HOLD,
 CLOCK AND NOISE GENERATOR

