

## ARIES WARRANTY

### ARIES WARRANTY PROTECTS YOU TWO WAYS

**FIRST:** If you complete an ARIES Kit, following our instructions, and it fails to perform according to our published specifications, we will repair it for a handling fee of \$15.00, or 10% of the kit price, whichever is greater.

**SECOND:** We will replace any component of an ARIES unit which becomes defective in normal service.

**BOTH PROVISIONS ARE EFFECTIVE FOR 120 DAYS FROM DATE OF SHIPMENT.**

### WHAT YOU MUST DO:

**FIRST:** To validate the warranty, fill out and return the ARIES warranty card within 5 days of receipt of the equipment.

**SECOND:** Pack and wrap all returned equipment **VERY CAREFULLY.**

**THIRD:** Enclose the proper handling fee.

**FOURTH:** Return the package prepaid and insured to:

Service Department  
ARIES, Inc.  
119 Foster Street  
Peabody, MA 01960

### WHAT WE WILL DO:

ARIES will restore your kit to published specifications, charging only for components which, in our opinion, were damaged by the kit builder.

ARIES will return serviced equipment prepaid anywhere in the continental United States. Other areas will be billed shipping costs, or the package will be sent freight collect.

**ATTENTION:** We reserve the right not to honor warranty unless the proper solder is used in construction. This must be specifically electronic solder, **ROSIN CORE FLUX ONLY.** (NOT acid core.) We strongly recommend 60/40, and suggest #22 as a convenient size. In our labs, Ersin and Kester are the two brands used.

<b>ARIES WARRANTY CARD</b>	<b>MODEL AR</b> _____
Shipment date: _____	( ) Kit                      ( ) Wired
<b>NAME:</b> _____	
<b>ADDRESS:</b> _____	
Where did you learn of this product? _____	
Application: ( ) Home ( ) Hobby ( ) Ham Radio ( ) Commercial ( ) Industrial ( ) O. E. M.	
Comments:	

ARIES MUSIC SYNTHESIZER KIT----SYSTEM 300

GENERAL ASSEMBLY INSTRUCTIONS

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THE ARIES Music Synthesizer is both an extremely versatile musical instrument and a highly flexible research laboratory for experimentation with electronic sound production. It may also be used as an audio sweep frequency generator, waveform analyzer, and signal processor. In addition, it can modify external sounds.

The ARIES Music Synthesizer has functions found only in modular synthesizers costing many thousands of dollars, and is not limited by the fixed interconnections of lower cost instruments. Any one of our inputs and outputs may be connected to any other one, or more, resulting in literally billions of different connections. When you consider that even one set of interconnections (called "patches") can produce many different sounds, the total number of sounds available becomes astronomical. These sounds can be as different from each other as a saxophone is from a volcano.

The synthesizer consists of a cabinet with built-in power supply, a choice of up to ten modules (each providing a different function), and, if desired, a 5 octave dual-voice keyboard.

The ARIES Music Synthesizer performs with standards of accuracy, stability, and reliability equal to or better than those of any other synthesizer, regardless of cost. Yet, the synthesizer can be assembled from kits, either all together or one module at a time.

**IMPORTANT!** Read this manual **THOROUGHLY!** Assembly is not difficult and requires no knowledge of electronics or music, but every component and connection must be treated with care. Every step should be checked off (✓) with a pencil.

Aries stands ready to assist you if you have any problem with assembly or operation. Simply write:

Customer Service  
ARIES, Inc.  
P O Box 808  
Peabody, Ma 01960

Fully describe the difficulty and return any defective components. If the problem is simple (or you cannot be delayed by time consuming written correspondence), call 617-532-0450 during regular business hours for immediate assistance.

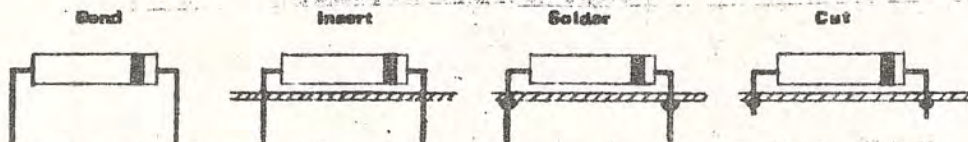
Our unique two-step warranty protects you if you cannot successfully complete this kit. Please read our complete warranty at the back of this manual.

The synthesizer modules each contain a number of miniature components to be soldered onto a printed circuit board. Although the components are heat resistant, a minimum of heat should be used to make the required connections. Accordingly, use only a small, low wattage, "pencil" type soldering iron; a 10 to 30 watt iron with a 1/32 or 1/16 inch tip is ideal. Use only 60/40 grade electrical solder with a non-corrosive rosin core flux. If you are not sure what kind of solder you have, don't take the chance. Solder is inexpensive, and use of the wrong type, such as acid core solder, or a paste flux, may severely damage the boards and components and void the warranty.

**TOOLS** A small pair of wire cutters, needle-nose pliers, wire strippers, and small and medium screwdrivers complete the list of tools you will need. These are standard electronic tools available at most supply houses.

**INSTALLATION OF COMPONENTS** The main assembly job consists of soldering several types of small parts, called components, onto a printed circuit board. Parts are carefully packed at our factory. However, if you find parts to be missing or damaged, please write our customer service office, describing the part carefully so that we can replace it. All parts will be installed on the blank side of the board with their leads extending through the foil side. In attaching components to the board use the following procedure.

1. Bend the leads of the component to align them with the holes in the board.
2. Insert the component into the board, double checking to be sure the part is aligned properly with respect to polarity (if required) and to be certain it is correctly located.
3. Using a minimum of heat and solder, solder the component to the foil pads. Be sure the solder does not flow over onto an adjacent pad, as this could possibly result in damage when power is applied to the circuit.
4. Clip the excess leads off at the "peak" of the solder joint, and inspect the joint to be certain that it is "good" (rounded and shiny, flowing smoothly over the pad and the lead) and that no solder has run over onto nearby pads or leads.



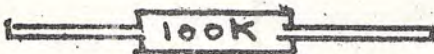
**PARTS ORIENTATION (POLARITY)** IMPORTANT-Some parts must be installed in the proper direction, while others, such as resistors, do not matter. AN INCORRECTLY INSTALLED PART WILL NOT FUNCTION, MAY BURN OUT, AND MAY DESTROY OTHER PARTS! Here is a general outline for proper orientation. Refer to this section during assembly.

ORIENTATION--(cont)

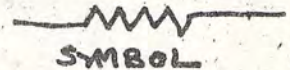
1. Fixed Resistors



A=carbon composition

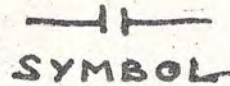


B=metal-film precision

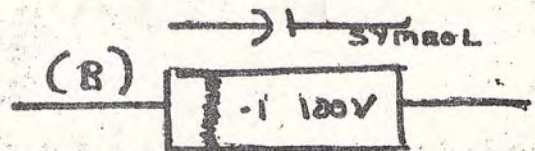
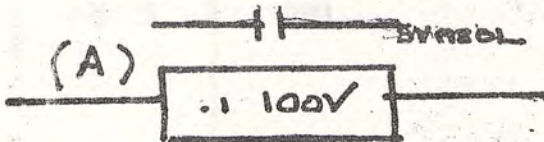


Resistors are not polarity sensitive- that is, they can be installed in either direction. However, for precision resistors which have the value number on them, mounting should be done so that the number is facing up, for purposes of checking.

2. Disc(ceramic) Capacitors- also not polarity sensitive

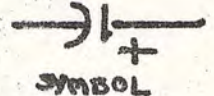
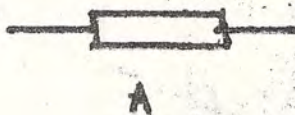


3. Mylar, paper, or polystyrene capacitors are not



polarity sensitive. However, if they have a band at one end, as in B above, it should be installed in the direction shown in the assembly drawing. If there is no band, as in A, it can be installed either way.

4. ELECTROLYTIC OR POLAR CAPACITORS (also Polar Tantalum Capacitors)



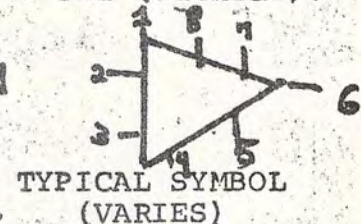
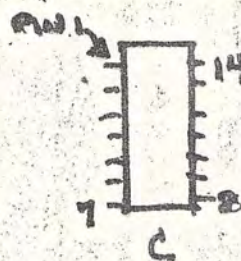
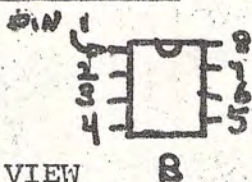
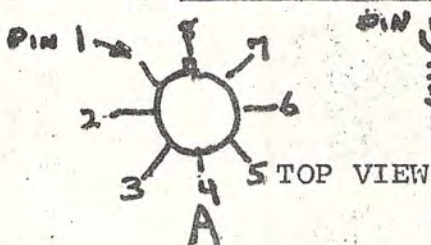
These must be installed correctly. The + sign near one lead indicates a polarity sensitive capacitor.

5. DIODE OR RECTIFIER



Diodes are polarized. Band indicates + end (cathode).

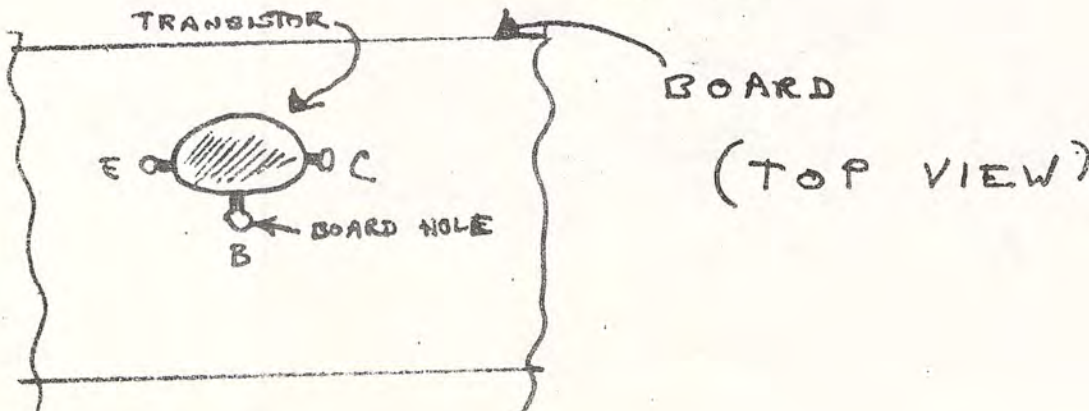
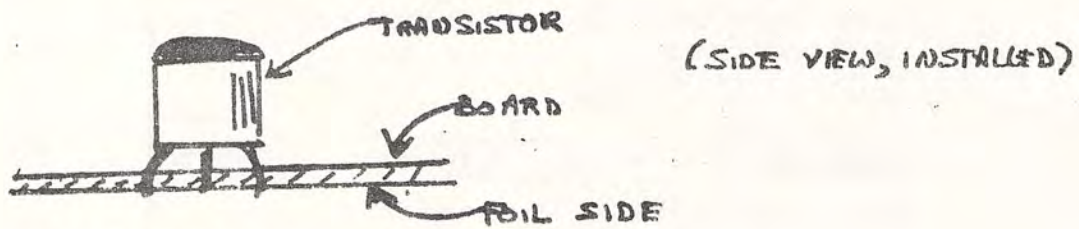
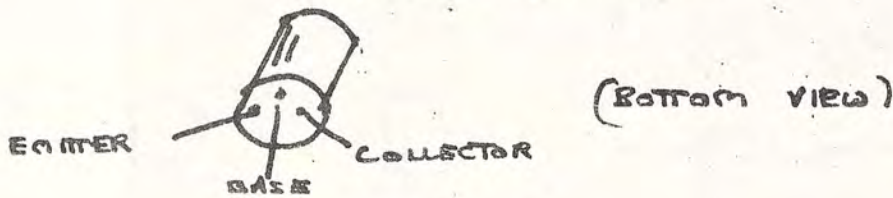
6. INTEGRATED CIRCUIT



INTEGRATED CIRCUIT(cont.) Pins are numbered counter-clockwise when viewed from above the case. Observe tab (round case) or indentation (rectangular case). The number of pins may vary, typically being 8, 14, or 16. NOTICE! The name "Integrated Circuit" just refers to any small package containing circuitry. They may, however, be called by the name of their specific function, as, for example, an "Operational Amplifier" (op-amp for short), "Comparator", "And Gate", "Nor Gate", etc. This need not be of any concern, however. Merely check for the correct part number, for example, "LM301A" or 74122, and be certain to install the pins (bend if necessary) according to the assembly drawing.

7. TRANSISTORS Several types of semiconductor devices are used in some of the ARIES kits. Included here are transistors, dual transistors, field effect transistors (FET's) and dual FET's. Like integrated circuits, they are all polarity sensitive, and must be installed correctly. However, there are so many different types of pin configurations that each type of semiconductor used here must be pictured separately. NOTE: Integrated circuits and transistors are marked with part numbers. Sometimes there are other numbers, too, usually for manufacturing information. Disregard any additional numbers or symbols. Example of Transistor Installation

transistor type=TE3393

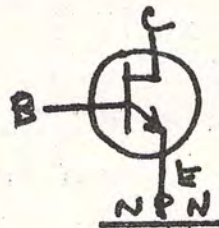


SEMICONDUCTOR BASING (PIN CONFIGURATIONS)

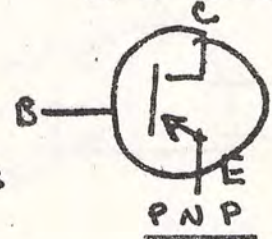


NPN  
T2-81  
2N5249  
2N5172

PNP  
T2-581  
2N5367



SYMBOLS

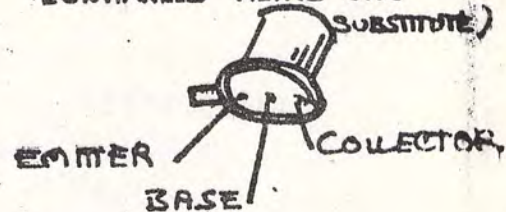


PLASTIC CASE

PNP  
2N3638



(CURVED METAL CAN SUBSTITUTE)



PLASTIC CASE

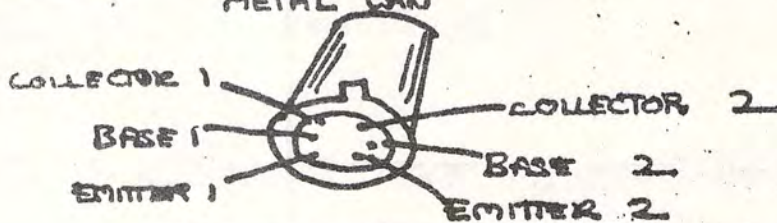
NPN



TE 3393

2N3393

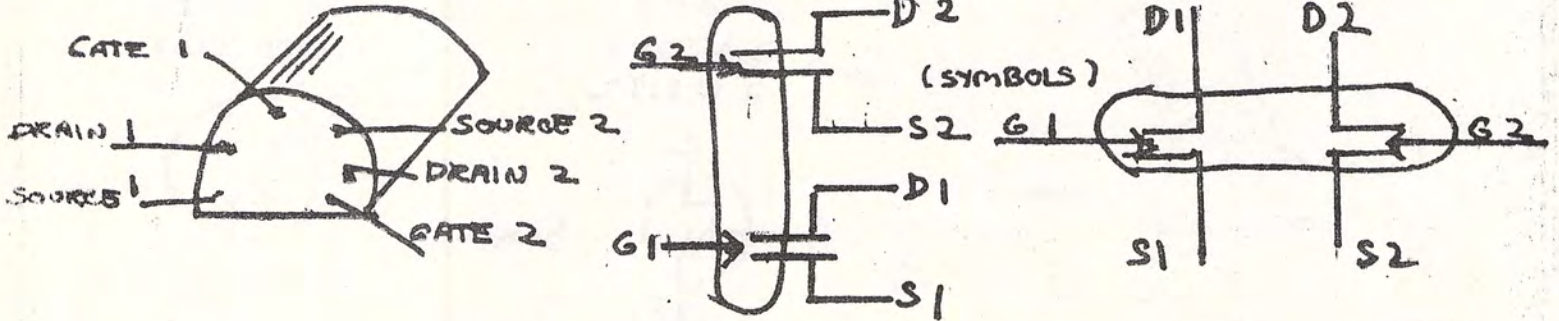
METAL CAN



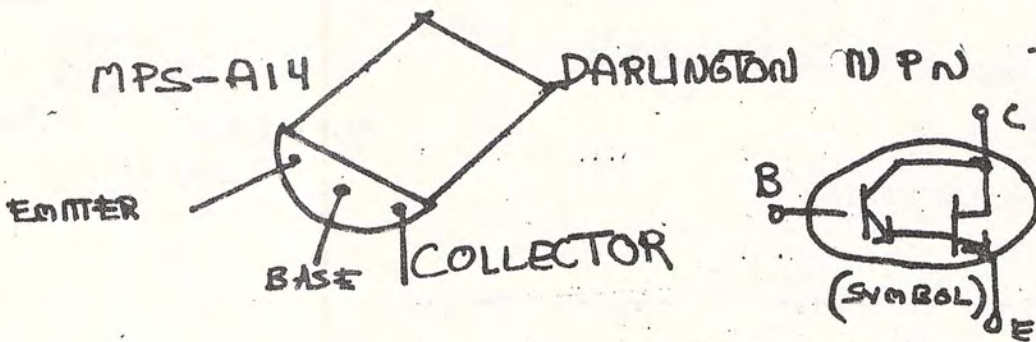
DUAL PNP

3347-1

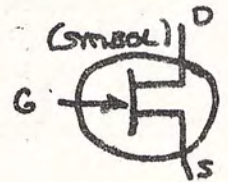
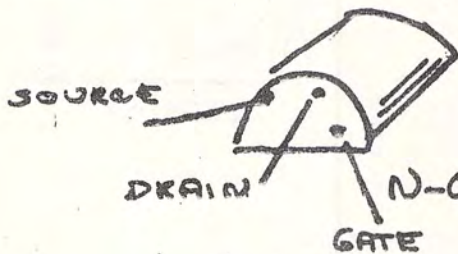
E 411 (SILICONIX) DUAL N-CHANNEL FET



MPS-A14 DARLINGTON NPN TRANSISTOR



KE 4392 E212 (SILICONIX)

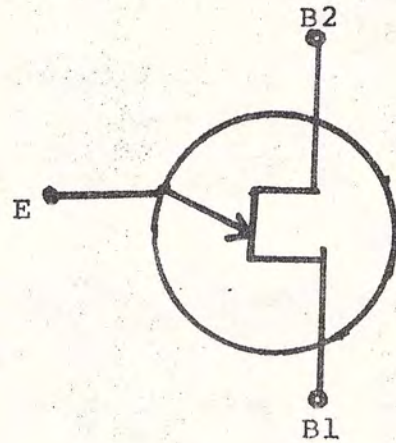
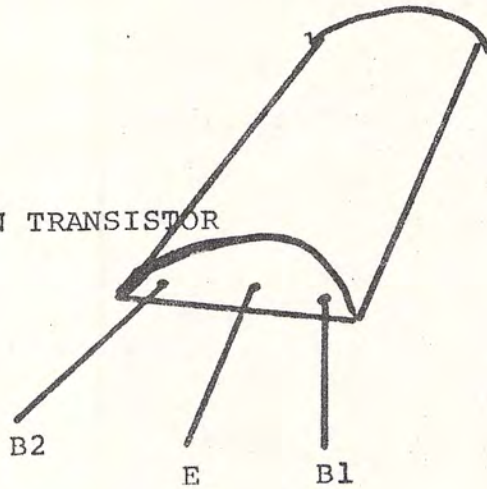


N-CHANNEL FIELD-EFFECT TRANSISTOR (FET)

SYSTEM 300  
GENERAL ASSEMBLY

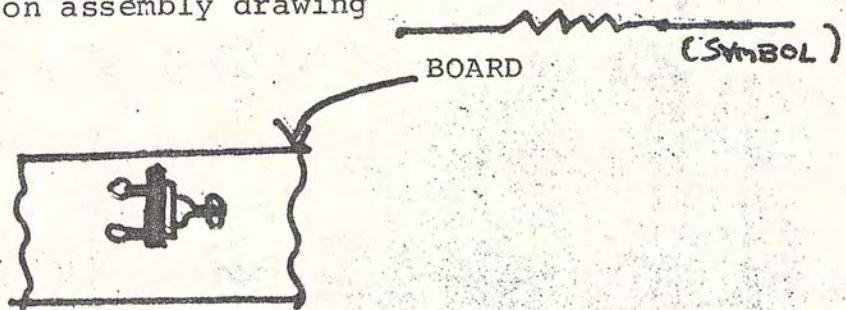
2N4870

UNI-JUNCTION TRANSISTOR



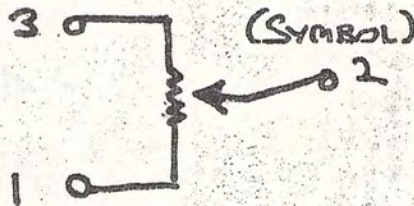
8. TRIMPOTS These are variable resistors mounted on the board. Mount as shown on assembly drawing

TOP VIEW

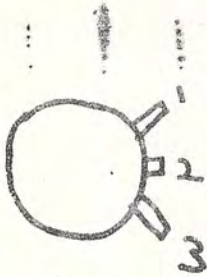


9. FRONT PANEL POTS These usually have 3 terminals which must be wired correctly. Refer to this numbering diagram.

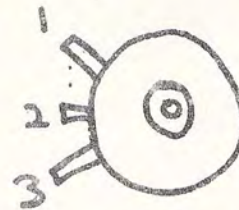
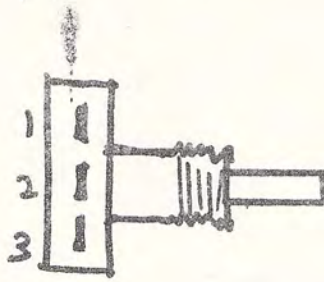
ILLUSTRATIONS ON FOLLOWING PAGE







BACK



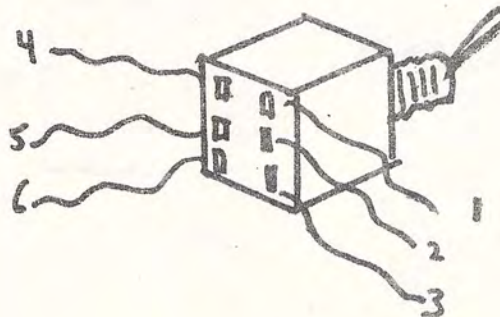
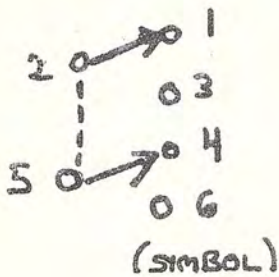
FRONT

Pin 1 is sometimes called CCW(counter clockwise) or low.  
Pin 2 is sometimes called ARM or WIPER.  
Pin 3 is sometimes called CW (clock wise), or high

10. FRONT PANEL SWITCHES There are many types of switches. The exact one used will be pictured in the Assembly Section, but here is an example.

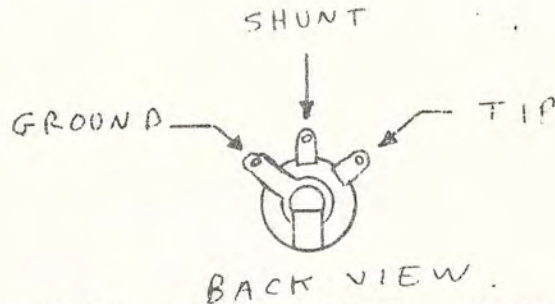
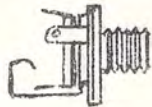
DPDT (Double-Pole. Double-Throw) Toggle Switch

Notice that if the switch is rotated upside down, Pin 1 now becomes Pin 6, because what matters is which pin is up and which is down. Therefore, switches like this should be fastened to the front panel before wiring so that the pins do not get mixed up.

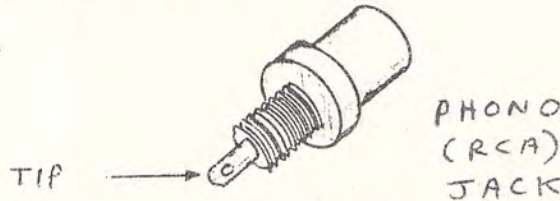


10. (cont.) Switches may also be mounted sideways. In that case, pin 1 is at the upper left (viewed from behind).
11. JACKS There are three kinds of jacks used in the ARIES Synthesizer.
- A) Minijacks-used for patching various modules together. They have 3 terminals.

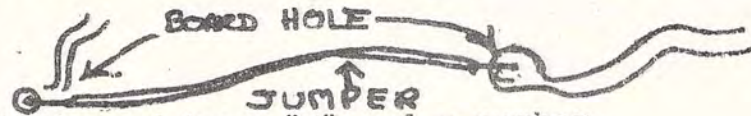
MINI-JACK



- B) Phono (RCA) jacks-used for connecting the synthesizer output to an external amplifier. Used only on OUTPUT/POWER module.

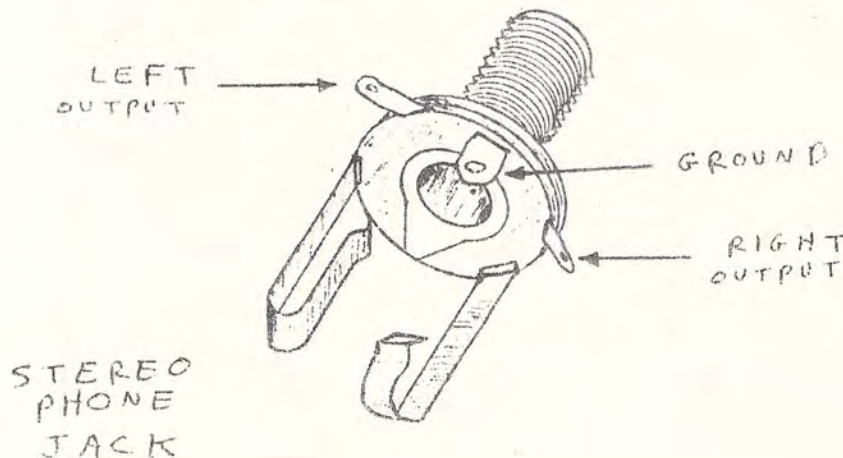


- C) Stereo Phone Jacks- Used only on OUTPUT/POWER module for plugging in stereo headphones.
12. JUMPERS These are plain wires, used to connect two holes on the board together. THEY MUST BE INSULATED EXCEPT AT THE ENDS!



Jumpers are indicated by a "J" and a number.

NOTICE ANY PART NOT DESCRIBED IN THIS SECTION WILL BE SHOWN IN THE ASSEMBLY SECTION.

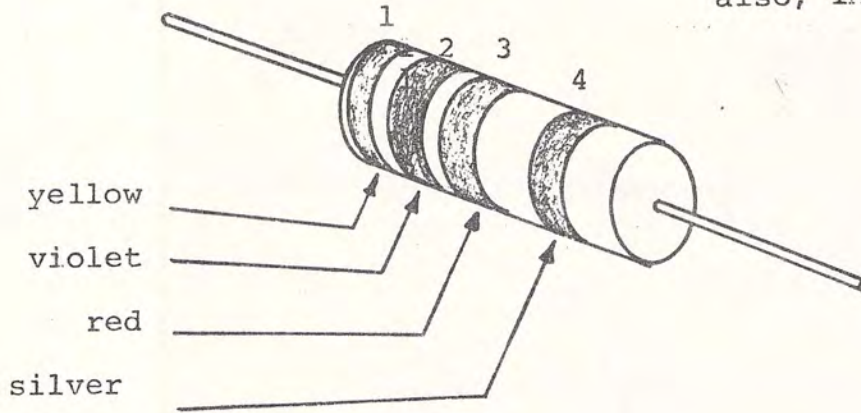


COMPONENT IDENTIFICATION

1. RESISTORS Bands indicate resistance value. Band 1 is closer to the end than any other.

$\Omega$  = symbol for OHM

NOTE:  
1K=1000  $\Omega$   
1 Meg(1M)=1,000,000  $\Omega$   
also, 1M=1,000K



EXAMPLE = 4700 ohms = 4.7 k ohms

Bands 1 and 2 indicate the first two digits of the resistance and band 3 is the multiplier. The fourth band provides the accuracy range (tolerance) of the value.

	Band 1	Band 2	Band 3	Band 4
COLOR				
BLACK	0	0	1	
BROWN	1	1	10	1%
RED	2	2	100	
ORANGE	3	3	1000	
YELLOW	4	4	10,000	
GREEN	5	5	100,000	
BLUE	6	6	1,000,000	
VIOLET	7	7	10,000,000	
GRAY	8	8	100,000,000	
WHITE	9	9	1,000,000,000	
GOLD			mult. by .1	5%
SILVER			mult. by 0.01	10%

MORE EXAMPLES:

- BROWN, BLACK, BLACK, SILVER=10  $\Omega$ , 10%
- BROWN, GREEN, BROWN, SILVER=150  $\Omega$ , 10%
- RED, VIOLET, ORANGE, GOLD=27K, 5%
- ORANGE, WHITE, GREEN, BROWN= 3.9M, 1%

Some 1% resistors may not be color coded. They will either say the value ("100K") or have a number like "1003F". This number is a code. The first three numbers are the first three digits of resistance, and the fourth represents the multiplier or how many zero's to add. In some cases, 5% resistors may be supplied in place of the 10% value as shown on the parts list. This is a valid substitution.

2. CAPACITORS          Disc capacitors can have a number from 5 to 820, if the value is in picofarads (pf's). Numbers from .001 up to .5 indicate microfarads (mf). NOTE: 1000pf=.001mf. Other capacitors, such as mylar, paper, or tantalum, have the value in microfarads. The value may normally differ by 10% without affecting the circuit. For example, although the parts list says "33pf", we may supply a 30 pf disc capacitor. Or a .5mf capacitor may replace one with a value of .47. Also, the tolerance may be lower than in the parts list, or the voltage rating higher, neither of which would affect the results.

PARTS LIST \* AR-310 \* CASE AND BACK PLANE CONNECTORS

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<u>QUANTITY</u>	<u>DESCRIPTION</u>
1	Top, Wood
1	Bottom, Wood
2	End, Wood
1	Back, Masonite
10	22 Pin Connector
24	4-40 x 5/8" Screw
2	Connector Bar 1/2" square
1	Top Front Mounting Strip
1	Bottom Front Mounting Strip
4	1/2" x 1/2" Mounting Brackets
4	4-40 Hex Nut
14	#6 x 1/2" Wood Screw
33	4-40 x 3/16" Screw

# ARIES SYSTEM 300 MUSIC SYNTHESIZER

## AR-310 CASE ASSEMBLY INSTRUCTIONS

### REFER TO ASSEMBLY INSTRUCTIONS

- ( ) 1. Mount the four wooden cabinet pieces together. Use a good wood glue, preferably, although you may use screws or nails if you don't mind them showing. IMPORTANT! It is necessary to insure that the corners are square while the glue is drying. This may be done with a corner clamp, or any carpenter's square, etc. Notice that the backs of all four pieces have a 3/16" recessed notch along the edge, for the cabinet back to fit in. If using glue, allow to dry overnight !
- ( ) 2. Assemble the 10 connectors to the 2 square aluminum bars, using machine screws provided. Be sure that:
  - a) The female sides of connectors point away from the bars (as shown in drawing)
  - b) The letter "A" on each connector is in the same direction. The bar nearest the "A"'s will be the upper one. Tighten screws snugly enough to hold assembly together, but not too tightly to allow some movement of the bars.
  - c) The space at the right end (from front view) has no connector.
- ( ) 3. Fasten one bracket to each end of each bar, as shown, using a machine screw and nut.
- ( ) 4. Locate two points on the inside of each cabinet side, near the back. Both points are 7/8" away from the recessed edge. One point is 1 & 1/16" below the inside cabinet top, and the other is 4" below the first (5 7/16" total from top). Mark with pencil, and indent slightly with nail, punch, etc.
- ( ) 5. Slide the connector and bar assembly in as shown, and fasten with four wood screws to the points marked in step four.
- ( ) 6. There are two "L" shaped module mounting strips. The lower one has single holes; the upper one has double holes. Mount the lower one to the cabinet bottom with 3 wood screws. Make sure the front of this strip is 5/8" behind the cabinet front.
- ( ) 7. Mount the upper strip to the cabinet top, using 3 wood screws. This is also 5/8" in from the cabinet front.
- ( ) 8. If you have an Aries Synthesizer module already, or when you get one, check that it fits properly. Some slight re-positioning of the bars or mounting strips may be required.
- ( ) 9. The back panel may be screwed on if desired, after the synthesizer is wired up.

ARIES MUSIC SYNTHESIZER-SYSTEM 300

KEYBOARD SYSTEM ASSEMBLY

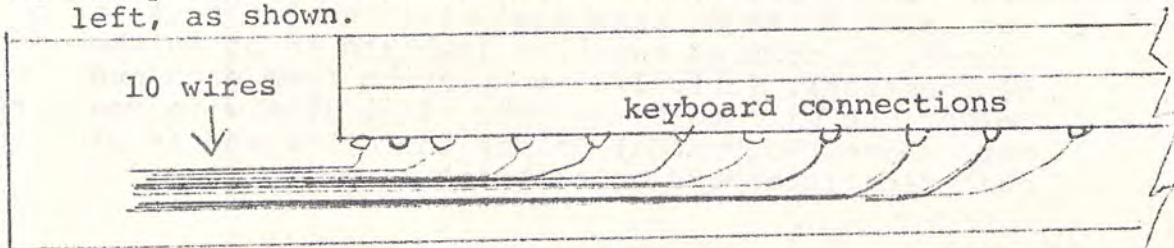
AR-311 KEYBOARD \* AR-313 KEYBOARD INTERFACE \* AR-320 CASE

- I. WIRING OF BOARD "A" TO KEYBOARD. REFER TO AR-311 KEYBOARD CONNECTIONS DRAWING, AND THE AR-313 BOARD LAYOUT CRAWING.
- ( ) 1. Cut three pieces of insulated wire, 48" each, and one piece 10", and strip 1/4" from each end.
  - ( ) 2. Lay the keyboard upside down, as shown in the AR-311 drawing.
  - ( ) 3. Connect one 48" wire to the buss wire labelled "keyboard voice" on the right hand end of the keyboard. Solder. Solder the other end to the hole in the AR-313 Interface board "A" labelled "Keyboard Voice" on the layout drawing.
  - ( ) 4. Solder another 48" wire to the buss wire labelled "Keyboard Gate Switches".
  - ( ) 5. Solder the 10" wire to the left most lug on the keyboard, labelled "Keyboard Low". Solder the other end to the hole in board "A" labelled "Keyboard Lo".
  - ( ) 6. Solder the next 48" wire to the next to last lug on the right side of the keyboard, labelled "Keyboard High". Solder the other end to the hole in board "A" labelled "Keyboard Hi".

II. WIRING OF BOARD "B" TO THE KEYBOARD.

This consists of connecting 61 wires from the keyboard lugs marked "K1", through "K61", to the same points on Board "B". IT IS NOT NECESSARY TO FOLLOW ANY ORDER. That is, K2 on Board "B" may go to K37, or any other "K" number on the keyboard. However, it is recommended that you follow this wiring procedure to avoid the wires interfering with the keyboard action. NOTE: Use thin insulated wire; No. 22 or smaller, and preferably solid.

- ( ) 1. Cut ten pieces of wire, each 29" long, and strip 1/4" of insulation from each end.
- ( ) 2. Solder one of these wires to the lug marked "K1" on the keyboard (see keyboard drawing) NOTE: The first lug is not K1!
- ( ) 3. Solder the other wires to the next nine lugs (K2 thru K10).
- ( ) 4. Grasp all 10 wires together, and pull them tightly to the left, as shown.



SYSTEM 300  
KEYBOARD SYSTEM ASSEMBLY

- ( ) 5. Starting from the end near K1, twist the bundle slightly. While pulling, twist all the way to the end.
- ( ) 6. Find the wire furthest in from the end of the bundle, and cut off all the others to be even with it.
- ( ) 7. Cut ten new wires, each 36" long, and strip the ends.
- ( ) 8. Solder these to the next ten lugs (K11 thru K20).
- ( ) 9. Keeping this bundle separate, pull to the left and twist, like the first 10.
- ( ) 10. Cut off the other ends to be even, as before.
- ( ) 11. Cut ten new wires, each 43" long, and repeat for the lugs K21 thru K30. You should now have three bundles.  
NOTE: They should come to different lengths when pulled to the left.
- ( ) 12. Cut ten more wires, each 50" long, and repeat for K31 thru K40.
- ( ) 13. Cut ten more wires, each 57" long, and repeat for K41 thru K50.
- ( ) 14. Cut eleven finally, each 64" long, and repeat for K51 thru K61. Notice the lug between K60 and 61; do not mistake this for K61.
- ( ) 15. You should now have six neat bundles of wire. They should be held together about every 6" with tape, lacing, or cable ties if possible, and pushed down into the corner of the keyboard case. NOW, WIRE TO BOARD "B".
- ( ) 16. Solder the ends of the longest bundle of wires (the last one wired to the keyboard) to Board "B", in the holes labelled K51 thru K61 (see Board "B" assembly drawing).  
NOTE: Run wires through from the component side of the board. "B".
- ( ) 17. Solder the next longest bundle into holes for K41 thru K50.
- ( ) 18. Repeat for K31 thru K40.
- ( ) 19. Repeat for K21 thru K30.
- ( ) 20. Repeat for K11 thru K20.
- ( ) 21. Repeat for K1 thru K10.

THIS COMPLETES WIRING OF KEYBOARD TO BOARD "B".

### III. POWER CONNECTIONS

You may use any type of wire or connector you wish for the +15v, -15v, +5v, and ground if you're going to use the keyboard with the ARIES SYSTEM 300 Power Supply, however, there is a male plug furnished which fits the power supply.

Recommended Procedure:

- ( ) 1. Cut four pieces of insulated wire, each 6 feet (or longer, if desired to allow keyboard to be further from synthesizer). Strip 1/4" insulation from each end.
- ( ) 2. Solder one wire to Board "A", +15v. (The wire you left bare above the board.) Solder the other end to pin 1 of the male plug (standard octal base).

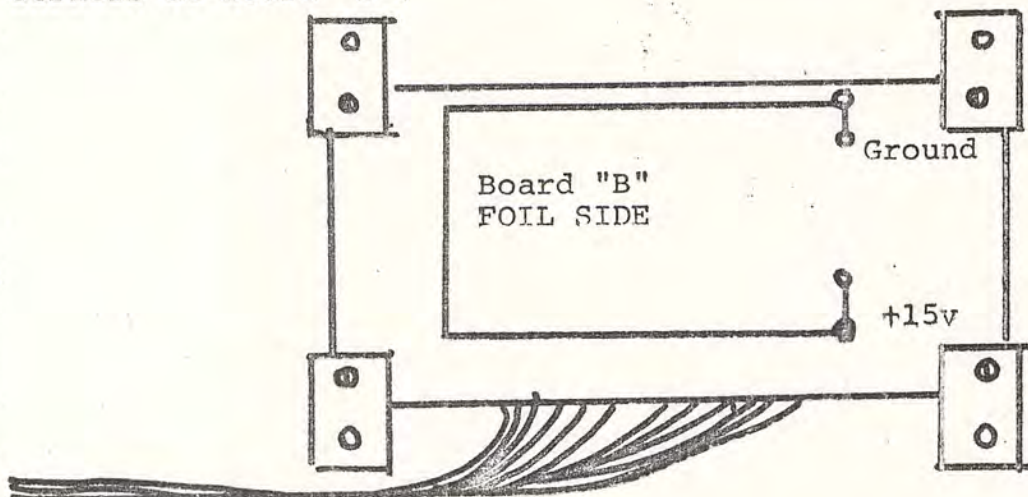


SYSTEM 300  
KEYBOARD SYSTEM ASSEMBLY

- ( ) 3. Solder the second wire to Board "A", -15v. Solder the other end to pin 3 of the plug.
- ( ) 4. Solder the third wire to Board "A", +5v. Solder the other end to pin 5 of the plug.
- ( ) 5. Solder the last wire to Board "A", ground, ( to bare part of wire above board). Solder other end to pin 7 of plug.
- ( ) 6. Twist or harness the four wires together neatly.

THIS COMPLETES ALL WIRING OF YOUR ARIES KEYBOARD SYSTEM.  
PROCEED NOW TO MOUNT THE BOARDS AND PANEL TO THE KEYBOARD CASE.

- ( ) 1. If the case is already assembled, remove the top cover (longwood strip) and the panel board. If the case is not assembled, assemble everything except panel board and top cover. (See AR-320 Case instructions.)
- ( ) 2. Push the wired panel through the hole in the panel board (panel must be on side of board with bevelled outerholes).
- ( ) 3. Fasten panel down to board with four wood screws.
- ( ) 4. Mount Board "A" on bottom of panel board: Push four wood screws through Board "A" from component side. Place four spacers on screws AFTER pushing them through board. Screw into bottom of panel board, roughly in center of board. NOTE: No holes have been provided on panel board on some units.
- ( ) 5. Mount small brackets with small machine screws and nuts on corners of Board "B":

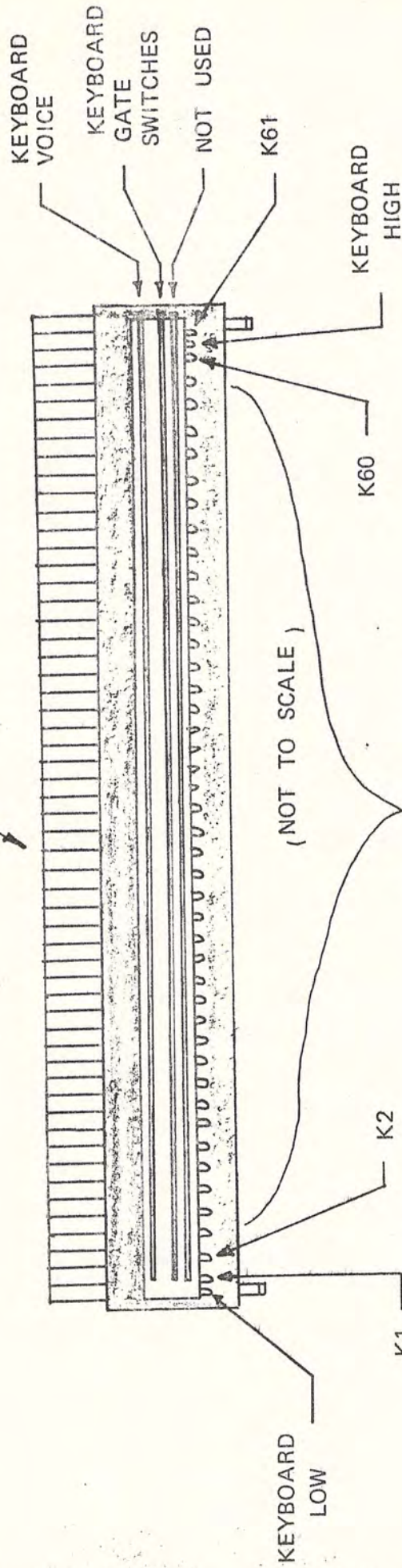


- ( ) 6. Hold Board "B" as shown above. Bend wire bundles down flat against board, and toward bottom left on above drawing as shown.
- ( ) 7. Screw Board "B" brackets to keyboard case, in the four rounded slots provided.

SYSTEM 300  
KEYBOARD SYSTEM ASSEMBLY

- ( ) 8. VERY IMPORTANT! Check that no wires interfere with keyboard contacts" action. Tuck wires into bottom corner of keyboard case. It is advisable to fasten the bundle down with INSULATED staples, cement, or tape.
- ( ) 9. Complete case assembly by fastening down panel board and top cover

AR-311  
KEYBOARD



TRIGGER CONTACTS  
(K3 THROUGH K59)

-----  
BOTTOM VIEW  
-----

-----  
AR-311 KEYBOARD CONNECTIONS  
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PARTS LIST \* ARIES MODULE AR-312 \* ENVELOPE GENERATOR ADSR

NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
C1,2	2	Capacitor, Disc	0.1 mfd, 25v
C3,4	2	" "	.01 mfd
C5	1	" "	.001 mfd
C6	1	Capacitor, Tantalum	2.2 mfd, 22v
D1 thru 15	15	Diode, Silicon	1N 914, 1N4148 or equivalent
Q1,3 4 5 8 9	6	Transistor, NPN	2N3393 or TE3393
Q2,6,7,10,11	5	Transistor, PNP	2N3638
R1,5,8,9,23	5	Resistor, Carbon	100k, 10%
R2	1	" "	2.2k, 10%
R3,4,6,17	4	" "	10k, 10%
R7,32	2	" "	39k, 10%
R10,30	2	" "	470k, 10%
R11, 12, 14, 15	4	" "	33k, 10%
R13	1	" "	68k, 10%
R16	1	" "	180k, 10%
R18	1	" "	1.2k, 10%
R19	1	" "	4.7k, 10%
R20	1	Potentiometer, 1/4" Shaft	100k, linear
R21, 31, 34	3	Resistor, Carbon	22k, 10%
R22	1	" "	47k, 10%
R24,27,28	3	Potentiometer, 1/4" Shaft	1 Meg, Log
R25,26,33	3	Resistor, Carbon	1k, 10%
R29	1	" "	470 ohm, 10%
S1	1	Switch, Pushbutton	Momentary SPST
	2	P C Card Guides	
	1	Printed Circuit Board	
	1	Front Panel	
	4	Knobs, 1/4" shaft	
	1	Frame	
	2	Brackets	
	6	Screw, 4-40 x 3/16"	
	6	Nut, 4-40	
	2	<del>Fiber Washer</del>	
	12	Jacks Mini Phone	

ARIES System 300 Music Synthesizer  
Module AR 312  
ANSR Envelope 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 Envelope Generator. 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.

( ) 1. Preparation

Lay the circuit board down on a sheet of white paper. PLACE METAL FOIL 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

( ) 2. Resistors

Carefully install all 30 resistors on the circuit board (R1 through R34--R20, R24, R27 and R28 are potentiometers and will later be mounted on the panel.) To avoid breaking the resistor leads, bend leads at least 1/16 of an inch away from the body of the resistor.

For example:

Correct



Incorrect



( ) 3. Diodes

Install all 15 diodes on the circuit board. (R1 through R15) OBSERVE POLARITY!

( ) 4. Capacitors

Install all 6 capacitors on the circuit board. (C1 through C6) Observe polarity on C1, C2, and C6. If there is no band or polarity marking, the capacitor may be installed in either direction.

( ) 5. Transistors

Install all 11 transistors on the circuit board. (Q1 through Q11) The general shape of the transistor 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 the correct letters (E,B,C) are in the proper holes. ALL BOARD COMPONENTS ARE NOW MOUNTED.

**MODULE ASSEMBLY-- Please refer to Module Assembly Drawing**

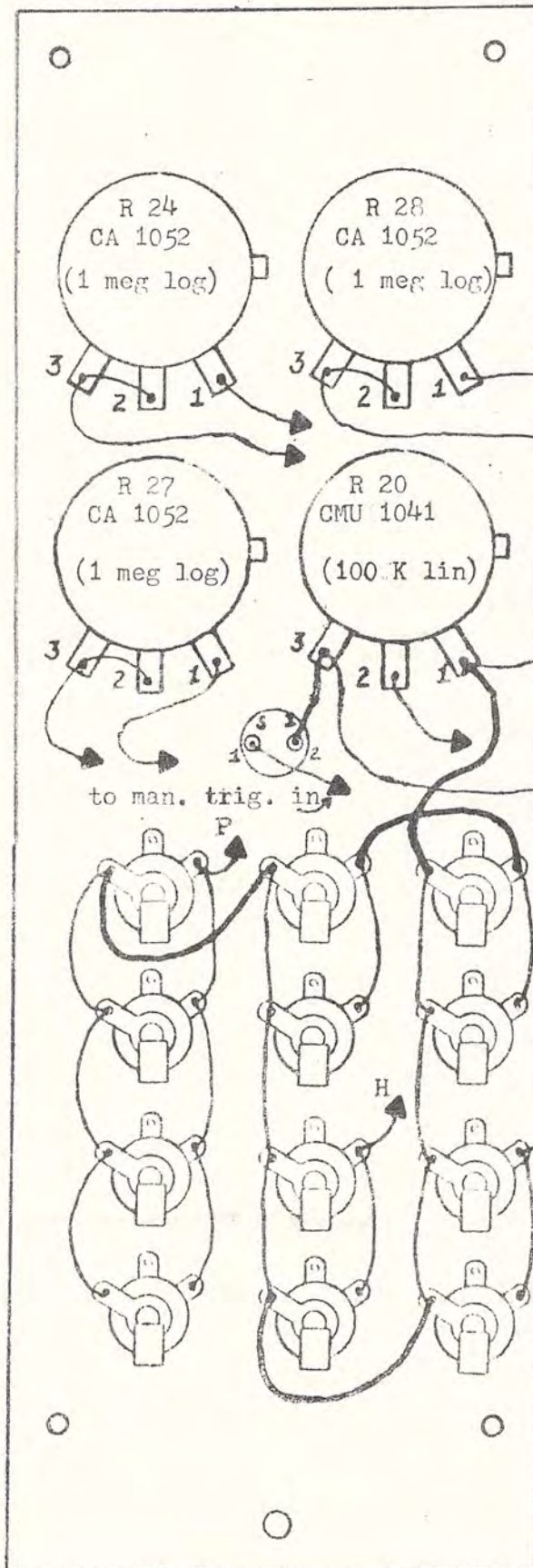
- ( ) 1. Unpack the frame, bag of hardware, and front panel.
- ( ) 2. Snap the two plastic card guides into the holes in the frame. Be sure that the pairs of tabs in the guides which hold the board point toward the rear of the frame. (The bottom one is shown installed in the drawing.)
- ( ) 3. Slide 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.

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

- ( ) 1. Run an insulated wire from pin 1 of R 20 to the grounds of all 12 jacks as shown. You may use either separate pieces of wire or one continuous piece, but it must be insulated between connections where shown.
- ( ) 2. Run a wire connecting the four jacks labelled "patch" on the front panel.
- ( ) 3. Run a wire connecting the four jacks labelled "output" on the front panel and from there to the proper point on the board. NOTE: Make the wire at least two inches longer than necessary to provide adequate slack.
- ( ) 4. Run a wire connecting the two jacks labelled "gate" on the front panel and from there to the proper point on the board.
- ( ) 5. Run a wire connecting the two jacks labelled "trigger" on the front panel and from there to the proper point on the board.
- ( ) 6. Run a wire from pin 1 of switch S 1 to the point labelled "manual trigger in" on the board assembly drawing. Run a wire from pin 2 of S 1 to pin 3 of R 20.
- ( ) 7. Run a wire between pin 2 and pin 3 of R 27. Do the same for R 24 and R 28.
- ( ) 8. Run a wire from pins 1 and 3 of all four pots to the appropriate points on the board (see board assembly drawing).
- ( ) 9. Run a wire from pin 2 of R20 to the appropriate point on the board.

THIS COMPLETES ASSEMBLY OF YOUR AR 312 ENVELOPE GENERATOR.

AR 312 Envelope Generator Panel Wiring - Rear View



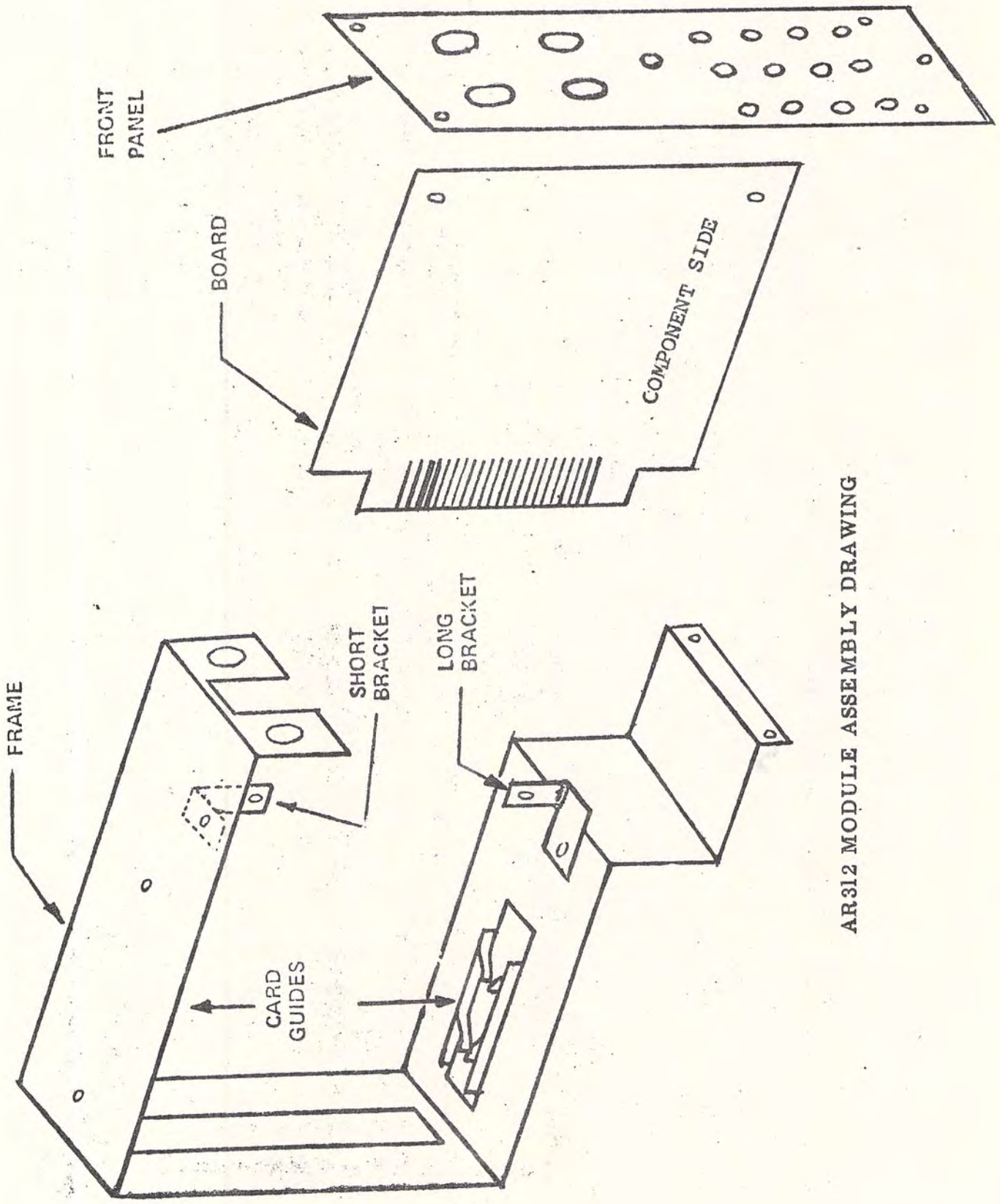
Arrows indicate a wire to the P C board. All wires with arrows and ground bus with thick lines must be insulated.

M  
to "Module Ground"  
on P C board

A  
to +15 volts on  
P C board

NOTE:

H  
Jacks with arrows  
are wired to holes  
in board on  
connector strip.



AR312 MODULE ASSEMBLY DRAWING



## AR 312 ENVELOPE GENERATOR INITIAL TEST PROCEDURE

Your AR 312 Envelope Generator requires no trim or calibration. But, you should perform an initial test to ascertain that everything is functioning properly.

You may use either:

A DC coupled oscilloscope.

A voltage controlled device such as a VCO or VCA. (You will be listening to a change in the parameter being controlled by the Envelope Generator. i.e. pitch or volume)

In order to test the gate and trigger inputs, you will need a gate and trigger such as derived from the AR 313 Keyboard. If this is not available, the test can be performed at a latter time,

Proceed as follows

1. With the power supply off connect the +15V, -15V, and ground terminals of the Envelope Generator to the power supply. If a connector is not available for the board, you may connect clip leads as such:

+15volts to pin 3 of R 20

ground to pin 1 of R 20

solder a wire to the -15 volt terminal and connect there  
**CAUTION: DOUBLE CHECK THESE CONNECTIONS!** Reverse voltage applied, even momentarily, could destroy many components.

2. Connect the output of your Envelope Generator to the oscilloscope or voltage controlled device.
3. Turn Attack, Decay, and Release pot fully counter-clockwise and Sustain pot fully clockwise. Depress the Manual Gate switch and observe a square wave of ten volts at the output.
4. While depressing the Manual Gate switch turn the Sustain pot counter-clockwise. The output should drop as you turn the pot. Turn the pot back to ten. Depress the switch again. The output should be ten volts.
5. Turn the Sustain pot to 5. Turn the Attack pot clockwise and observe an increased Attack time when you depress the switch. Turn the pot back to 0. Depress the switch. Attack time should be very short.
6. Test the Decay in the same manner.
7. Test the Release in the same manner.
8. Apply an external Gate and Trigger to the input jacks on the front panel to initiate the Envelope Generator. Observe a waveform at the output.
9. Run a patch cord to one of the jacks labelled "Patch". Connect the other end to the Envelope Generator output. Check to see that the Envelope Generator output is now available at the other three jacks labelled "Patch".

The Envelope Generator is now ready for use. If any of the above tests did not respond as described, recheck your wiring and parts assembly.

## AR 312 Envelope Generator Circuit Description

The AR 312 Envelope Generator produces a waveform with four variable parameters: Attack, Decay, Sustain, and Release. When applied as a control voltage to a VCO, VCA, or VCF this waveform can provide transient information for the synthesis of sound or music.

The Envelope Generator will initiate upon receipt of a gate and trigger at its input. The output will rise to ten volts (Attack), fall from ten volts to a selected level (Decay), hold that level for the duration of the gate (Sustain), and fall to zero volts when the gate is removed (Release).

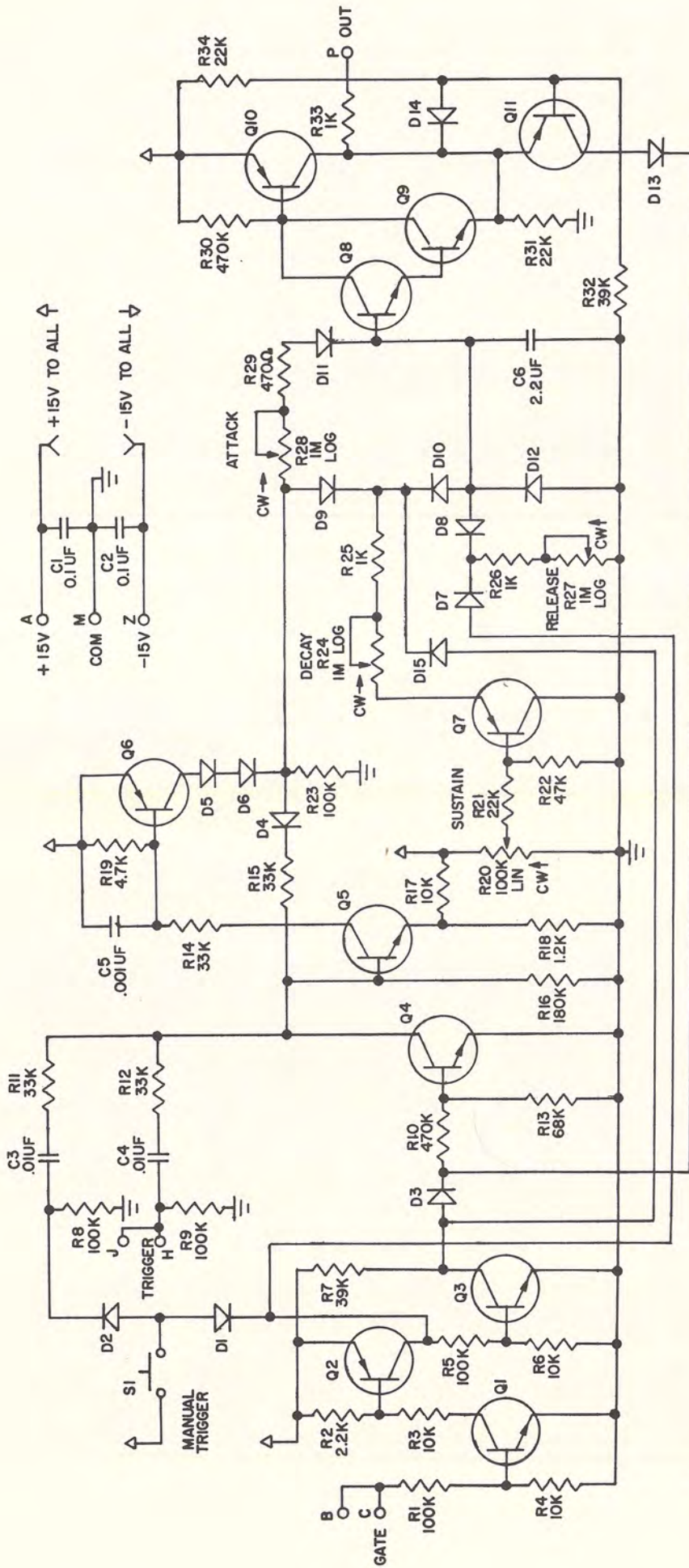
Circuit operation is as follows:

Transistors Q1, Q2, Q3, and Q4, with D1 and D3 act as a trigger enable and set the initial state of the Envelope Generator.

When Q1 receives a positive voltage (gate) at its base, it turns on and its collector drops to ground. This forward biases Q2 and its collector rises to +15. Q3 is now forward biased and its collector drops to ground reverse biasing D3. With D3 effectively an open circuit, Q4 is isolated from its positive bias and turns off. Before the gate was applied Q4 was on and acted to ground out the incoming triggers. Now, a trigger, entering the base of Q5, will initiate the Envelope Generator.

The Manual Trigger switch initiates the Envelope Generator by applying a positive voltage (gate) through D1 to the collector of Q2 and a positive pulse (trigger) through D2, C3, and R11 to the base of Q5.

A trigger at the base of Q5 turns on Q5 which turns on Q6. The collector of Q6 rises to +15. The positive voltage applied through D4, D5, D6, and R15 to the base of Q5 latches on Q5. C6 begins to charge positive through R28, R29, and D11. D9 being forward biased reverse biases D10 and isolates the Decay and Sustain circuitry from C6. A buffer amplifier, consisting of Q8, Q9, and Q10, follows the voltage on C6 and drives the output. A level detector, consisting of Q11 and D14, conducts when the output voltage reaches 10 volts. A positive voltage through D13 turns on Q4 and unlatches Q5 and Q6. D9 and D11 become reversed and C6 begins to discharge through D10, R25, R24, and Q7. When the voltage on the emitter of Q7 drops below the voltage on its base it turns off and C6 can discharge no further. When the gate is removed Q2 drops low reverse biasing D7 and allowing C6 to discharge through D8, R26, and R27. At the same time Q3 goes high reverse biasing D10 and D9 through D15 and isolating C6 from the Decay Sustain Circuitry. D12 is added to insure that C6 does not discharge below ground.

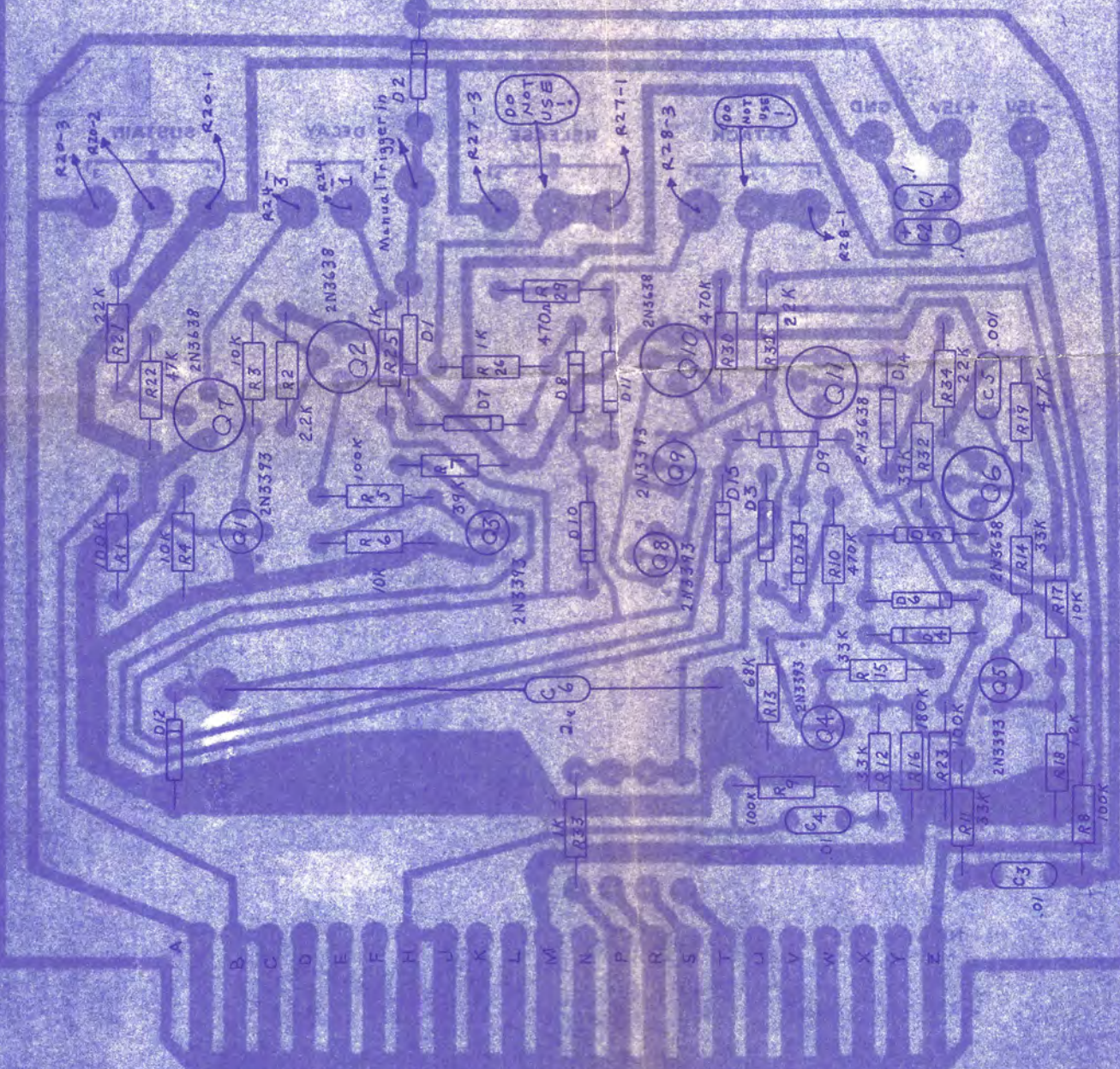
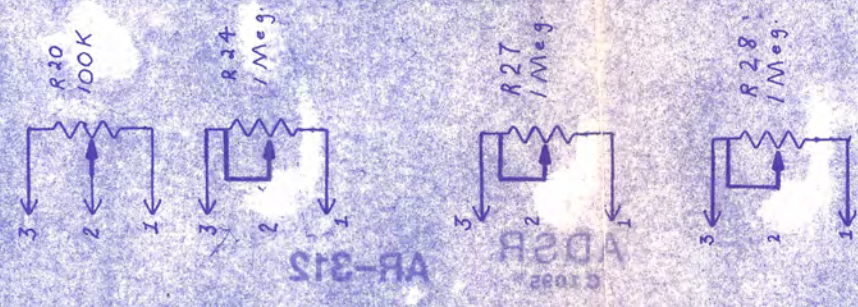


NOTE:  
 ALL DIODES ARE IN4148.  
 ALL NPN TRANSISTORS ARE 2N3393.  
 ALL PNP TRANSISTORS ARE 2N3638.

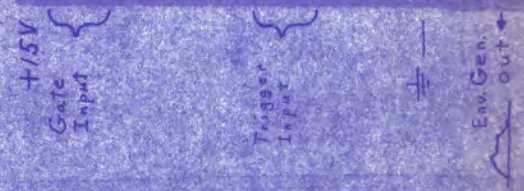
HIGHEST REFERENCE DESIGNATION:  
 C6 Q11 S1  
 D5 R34

AR-312  
 ENVELOPE GENERATOR (ADSR)

# AR-312 ADDRESS ENVELOPE GENERATOR



A B C D E F G H J K L M N P R S T U V W X Y Z



-15V

## PARTS LIST AR-313 \* KEYBOARD INTERFACE

AR313  
PARTS  
Page 1 of 2  
15 IX 75

PART NUMBERS	QUANTITY	DESCRIPTION	VALUE AND RATINGS
C1 thru C61	61	Capacitor, Electrolytic	0.1 mfd, 25v
C62, 70, 73, 74, 85	5	" Disc	0.1mfd, 50v
C63, 65, 67, 68, 72	9	" "	33 pf
76, 77, 80, 82	1	Capacitor-Mylar, Mica, or Poly.	0.47mfd,
C64	1		100v, 10%
C69	1	Capacitor, Tantalum	2.2 mfd, 20v
C71	1	Capacitor, Ceramic	0.68 mfd
C75	1	Capacitor, Disc	0.004 mfd
C66, 78, 81	3	" "	0.001 mfd
C83, 84	2	" "	0.01 mfd
D1 thru 70 (D64 deleted)	69	Diode, Silicon	1N914, 1N4148 or equivalent
P1	1	Potentiometer, 1/4" Slotted Shaft	1k linear
P2	1	" "	10k linear
P3	1	Potentiometer, 1/4" shaft	100k log
P4	1	" "	10k linear
Q1	1	Transistor, PNP	2N3638
Q2	1	Field Effect Transistor n-channel	E212 (Siliconix)
Q3	1	Field Effect Transistor, dual n-channel	E411 (Siliconix)
Q4	1	Transistor, NPN, Darlington pair	MPS A-14
Q5	1	Transistor, NPN	2N3393 or TE-3393
C79	1	Capacitor, Tantalum	47 mfd, 20v
R1 thru 60	60	Resistor, Metal Film	10 ohm, 1% (part of kbrd assembly)
R61 thru 121	61	Resistor, Carbon	1 meg, 10%
R122, 123	2	Resistor, Carbon Film	2.2k, 5%
R 124	1	" " "	820 ohm, 5%
R125, 126, 127, 128, 132, 133	6	Resistor, Carbon	100k, 10%
R134, 145, 146	3	" "	100k, 10%
R129, 137, 144, 149, 187	5	" "	10k, 10%
R130, 136, 139, 141, 151, 156, 161	7		1k, 10%
R131, 159, 160, 163	4	Resistor, Carbon Film	100k, 5%
R135, 168	2	Resistor, Carbon	4.7k, 10%
R138, 150, 165	3	" "	1.8k, 10%
R140, 152	2	" "	5.6k, 10%
R142, 143, 147	3	" "	330 ohm, 10%

PARTS LIST \* AR-313 \* (cont.)

PART NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
R148	1	Resistor, Carbon	100ohm, 10%
R153	1	Resistor, Carbon Film	22k, 5%
R154	1	" " "	82k, 5%
R155	1	" " "	27k, 5%
R157, 162	2	Resistor, Carbon	10 ohm, 10%
R158	1	" "	22 meg, 10%
R162	1	Resistor, Carbon	470 ohm, 10%
R166	1	" "	3.9k, 10%
S1, 2	2	Switch, Toggle	SPDT
U1, 2, 3, 5, 8, 9, 10, 11, 12	9	Operational Amplifier	LM301A
U4	1	Quad Dual Input Nor Gate	CD4001AE
U6, 7	2	Monostable Multivibrator	74122
	1	Front Panel	
	2	Knobs, 1/4" shaft	
	14	Jacks, Mini-Phone	
	2	Printed Circuit Board	
	4	4-40 Nut	
	4	4-40x5/16" Screw	
	4	1/8" Fiber Spacer	
	4	Flat Bracket	
	12	#4x1/2" Wood Screw	

ARIES SYSTEM 300 Music Synthesizer  
ARIES MODULE 313  
AR-313 KEYBOARD INTERFACE ASSEMBLY INSTRUCTIONS

The General Assembly Instructions were written as a general guide, to familiarize the builder with the components. Here, now, are the specific assembly instructions for building your Keyboard Interface. 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.

IMPORTANT! THE AR-313 INTERFACE CONSISTS OF TWO PRINTED CIRCUIT BOARDS ("A" AND "B") AND ONE FRONT PANEL CONTROL UNIT. IT IS DESIGNED TO WORK WITH THE AR-311 KEYBOARD, AND MOUNT IN THE AR-311 KEYBOARD CASE.

I. Board "A" Assembly

- ( ) 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.

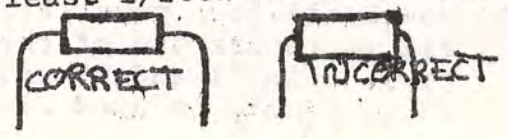
Unpack the parts carefully and place in a large box or tray so they won't get lost.

- 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.)

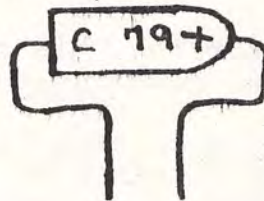
Install J2 through J5 in the same way.

- ( ) 3. RESISTORS Carefully install all 47 resistors (R122 through R168) on the circuit board. To avoid breaking the resistor leads, bend the leads at least 1/16th of an inch away from the body of the resistor. For example:



- NOTE: a) Resistors R1 through R60 are on the keyboard.  
b) Resistors R61 through R121 are on board "B"  
c) Resistor R154 mounts with one lead bent underneath, as shown on the layout.  
d) NOTE: R168 must be mounted as shown, with a piece of insulated wire soldered to one end.

- ( ) 4. CAPACITORS Install all 24 capacitors (C62 through C85). observe polarity where shown. NOTE: C79 is actually much larger than shown on the drawing. Bend the leads like this.



Install, being careful not to let its leads touch any other wires.

- ( ) 5. DIODES Install all 8 diodes (D62 through D70), observing polarity. (There is no D64).  
( ) 6. INTEGRATED CIRCUITS Install all 12 I C's (U1 through U12). OBSERVE ORIENTATION!  
( ) 7. TRANSISTORS Install all 5 transistors (Q1 through Q5).

THIS COMPLETES ASSEMBLY OF BOARD "A"

II NOW, WIRE BOARD "B"

- ( ) 1. Install all 61 resistors (R61 through R121).  
( ) 2. Install all 61 capacitors (C1 through C61).  
( ) 3. Install all 61 diodes (D1 through D61). NOTE: Observe polarity on capacitors and diodes. Don't forget R121, C61, and D61 on the right-hand edge!

THIS COMPLETES ASSEMBLY OF BOARD "B".

III PANEL WIRING

PLEASE REFER TO PANEL WIRING DIAGRAM.

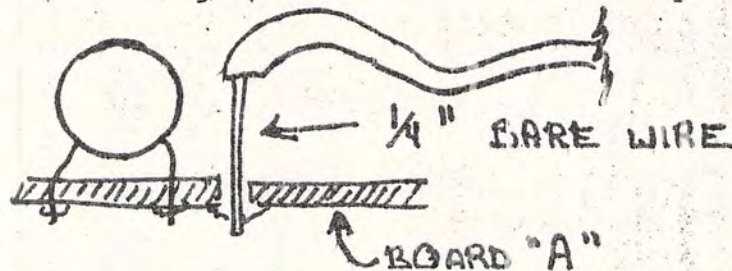
- ( ) 1. Mount the 14 mini-phone jacks in THE EXACT POSITION SHOWN. Tighten all nuts.  
( ) 2. Mount the two switches (S1 and S2) as shown.  
( ) 3. Mount all four pots (P1, P2, P3, P4) as shown. NOTE: Although all four pots are of the locking-nut, screwdriver adjust type, only P1 and P2 will need the locking nut on. P3 and P4 will only be used with knobs.



- ( ) 4. Mount knobs on P3 and P4.
- ( ) 5. Solder a wire to the grounds of the four jacks on the left side (rear view) as shown.
- ( ) 6. Connect the two upper jacks together as shown.
- ( ) 7. Connect all four jacks in the next row down.
- ( ) 8. Repeat for the 3rd row.
- ( ) 9. Repeat for the bottom row.
- ( ) 10. Connect pins 1 and 2 of P2 together.
- ( ) 11. Connect pin2 of S2 to Pin one of P3.
- ( ) 12. Connect pin3 of S1 to pin 2 of P3.

IV NOW PROCEED TO WIRE THE PANEL TO BOARD "A".

- ( ) 1. Cut off 19 pieces of insulated wire, each 11 inches long. Strip 1/2" off each end.
- ( ) 2. Connect the wires from each point on the panel (shown by the arrow) to the corresponding point on Board "A". TO AVOID MISTAKES, CONNECT BOTH ENDS OF EACH WIRE BEFORE GOING TO THE NEXT WIRE. NOTE: When wiring the ground connection to Board "A", strip an extra 1/2" of insulation (one inch total) from the wire end. Push this wire through the board hole leaving 1/4" of BARE wire on top. SOLDER:



This is to allow two additional wires to connect here.

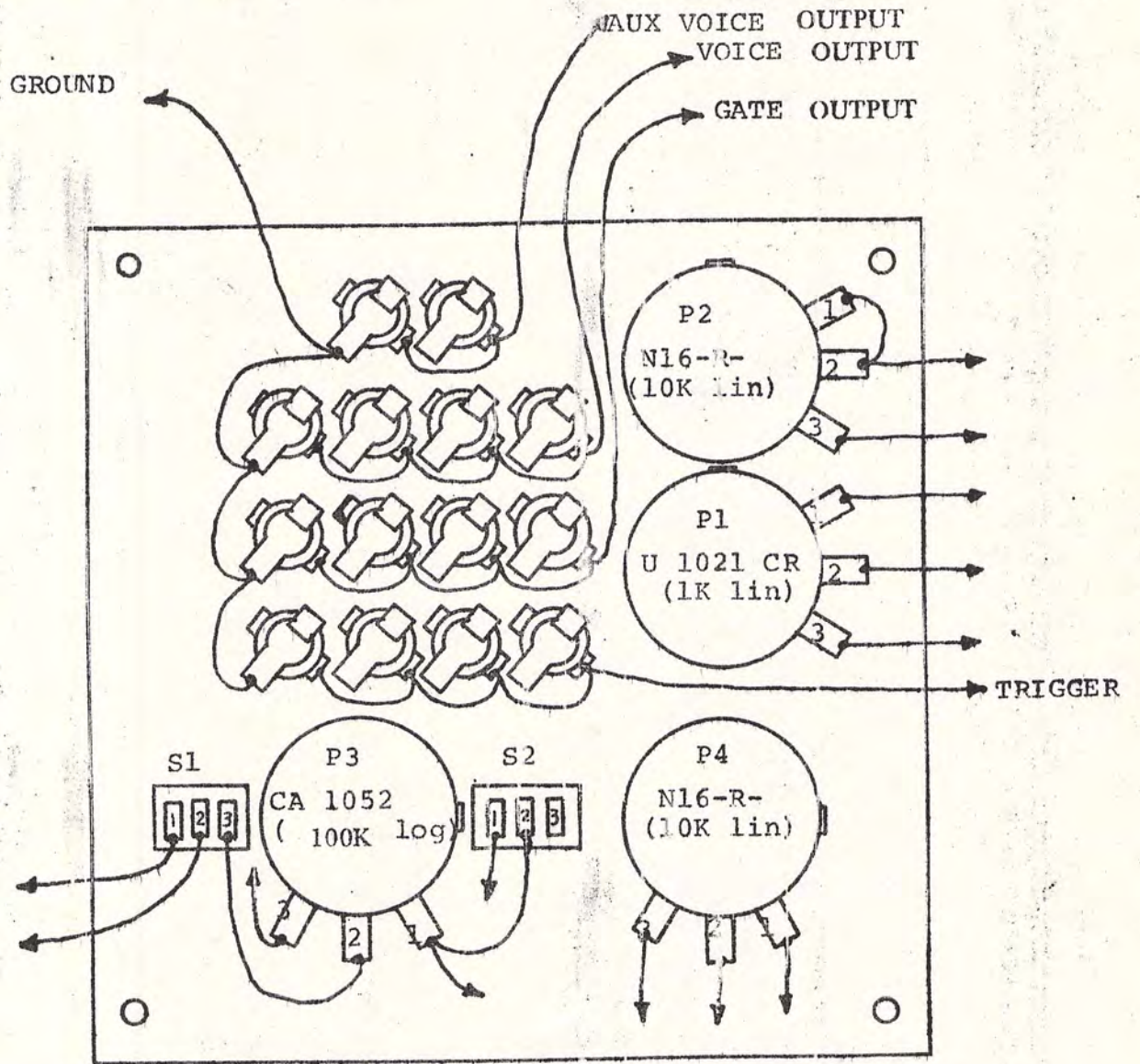
V NOW WIRE BOARD "A" AND BOARD "B" TOGETHER FOR THE POWER SUPPLY.

- ( ) 1. Cut a piece of insulated wire 45" long. Strip 1/2" of insulation from each end. Wrap one end around the bare ground wire on Board "A" (from previous step). Solder. Solder the other end in the hole on Board "B" labelled "GROUND" on the drawing.

- ( ) 2. Cut another 45" piece of insulated wire. Strip one inch of insulation off one end. Push through hole in Board "A" labelled "+15v supply" on drawing, leaving 1/4" bare wire on top, as you did on the ground wire. Solder. Solder the other end to the hole in board "B" labelled "+15 volts".

THIS COMPLETES ASSEMBLY OF YOUR AR-313 KEYBOARD INTERFACE.

ARROW INDICATES A WIRE TO BOARD "A"



AR-313 KEYBOARD INTERFACE

PANEL WIRING-REAR VIEW

AR-313      KEYBOARD INTERFACE

TRIM PROCEDURE ( WITH ARIES SYNTHESIZER)

VOICE TRIM

1. Connect the keyboard power cable to the synthesizer. Turn on.
2. Connect a patch cord from one voice output just to control #2 on one VCO.
3. Set keyboard tuning to center, and portamento off.
4. Mix the sawtooth outputs of this VCO and another one, with NO control inputs, and listen to them. Set both dials to 250 Hz.
5. While holding down the lowest key (c), carefully tune either VCO for zero beat, that is, the same frequency.
6. Loosen locking nut on VOICE INTERVAL trim pot on keyboard panel (if used).
7. Release the lowest key, and hold down the "C" key two octaves up (the 15th white key).
8. Adjust the VOICE INTERVAL trim so that the VCO's are exactly two octaves apart.
9. Repeat steps 5, 7, and 8 until the VCO's are in unison at the lowest key, and two octaves apart at the 15th white key, without needing further trimming.
10. Tighten the lock nut and check the VCO's again.

AUXILIARY VOICE TRIM

1. Now connect a patch cord from the VOICE output to control input #2 of the second VCO. (Leave the first one connected also).
2. While holding the lowest key down, tune the VCO's exactly in unison.
3. Play different notes, and check that the VCO's stay in unison closely. If not, one of them needs adjustment of its "VOLTS PER OCTAVE " trim.
4. Connect a patch cord from one AUX. VOICE output jack to control input #3 of one VCO.
5. Hold the lowest note down, and tune the VCO's exactly in unison.
6. Loosen the locking nut (if used) on the AUX. VOICE INTERVAL trim pot.
7. Simultaneously hold down the lowest key and the one an octave higher (the 8th white key).
8. Adjust the AUX. VOICE INTERVAL trim so the VCO's are exactly one octave apart.
9. Repeat steps 5, 7, and 8 until the VCO's are in unison with only one key down, and one octave apart with two keys an octave apart held down.

NOTE: THIS TRIM MAY BE DIFFICULT BECAUSE IT ALSO AFFECTS THE TUNING. IF YOU HAVE TROUBLE, THE FOLLOWING WILL HELP.

ADDITIONAL TRIM INSTRUCTION

1. Listen only to the VCO which has the AUX. VOICE connection plus the VOICE connection.
2. Hold down the lowest key, and alternately push and release the next octave (8th white key).
3. Adjust the AUX. VOICE INTERVAL trim so that you hear an octave change when you play and release the octave key. When adjusted, tighten the locking nut and check the intervals again.

THEORY OF OPERATION OF AR-313 \* \* \* KEYBOARD INTERFACE  
(WITH AR-311 KEYBOARD)

The AR-311 keyboard has a string of 60 precision 10 ohm resistors in series, forming a voltage divider. One end is grounded, the other end fed by a constant-current source, consisting of C1 and R124, biased by R122, R123, D62, and adjusted by P1. One set of key contacts connects a different tap on the voltage divider to the bus called "KBD,VOICE". The lowest key connects to the grounded end, and the highest key to the other end, of the divider. When one key is depressed, the "VOICE" bus will have a voltage proportional to the number of keys up from ground. The current source is adjusted for 1/12 volt per key, or 1 volt per octave. When two or more keys are depressed simultaneously, the "VOICE" bus voltage depends only on the position of the LOWEST key, since the current through the resistors between the lowest key and ground is constant. However, the voltage at the top of the divider (connection called "KBD HIGH") will drop by 1 volt for each octave interval between the lowest and highest keys depressed simultaneously. When only one key is depressed there is no change in this voltage from no keys depressed. This voltage will be 5 volts (1 volt per octave times five octaves).

In addition, there is a second set of contacts, called "Keyboard Gate Switches". Each note has a capacitor (C1 thru C61), resistor (R61 thru R121) and diode (D1 thru D61). The capacitors are normally charged to +15 volts. When a note is depressed, the capacitor discharges partially through the diode into the resistors R132 and R133, causing the voltage at the output bus to momentarily reach about +14 v. The capacitor will discharge until the 1M resistor supplies enough current to equal that lost through R132, at which time the bus voltage will be 2.4 volts. It will remain at this voltage as long as the key is held down.

Now, when any one key is depressed, there are 4 signal paths affected:

A. The voltage at pin 3 of op amp U3 will reach 7 volts, then remain at 1.2 volts, due to the divider R132 and 133. (C66 filters out any contact bounce noise.) U3 acts as a comparator, since it is open-loop. The voltage on pin 2 is biased by R134 and R135 to +0.7 volts. Therefore, the output will normally be -15 volts, but will jump to +12 volts (saturation voltages of U3) when a key is depressed. This turns on FET switch Q2, which charges up holding capacitor C64 to the voltage on the "KBD, VOICE" bus, which is buffered by voltage follower U9. This same positive output from U3 is inverted by U4A (1/4 of a quad 2-input NOR gate), which goes to logic "0" level (near 0v). U4B will have a similar "low" output unless both inputs (pins 12 and 13) are low.

B. Capacitor C75 couples a momentary pulse (0.8ms) of about +14 volts into Darlington emitter follower Q4, which couples the pulse into pin 3 of U6. U6 is a "one shot" whose output (pin 8) first goes "high" (near +5 volts) when turned on by the pulse at pin 3. After a delay of 7ms (determined by C69), the output goes "low" again. Meanwhile, when the output first goes high, U4B now has one input low and one high, so its output stays low. Therefore, the output of op-amp comparator U5 stays low (-15 volts.) This keeps pin 1 of U6 low, which enables Pin 3 input to work.

However, after the delay of 7 ms, pin 8 of U6 goes low again. Assuming the key is still down, this means both inputs of U4B are low, so its output (pin 11) goes high. This turns on U5 (+12 volts) which causes a gate (+10 v) to appear at the GATE OUTPUT. Notice that the gate is delayed, to give the sample hold (Q2 and C64) a chance to acquire the correct keyboard voice (control voltage) before the gate turns on.

C. The third signal path is through U4C, which inverts the 0.8ms pulse through C75. The resulting negative pulse (actually from +5v to around 0V) is coupled through emitter follower Q5 to pin 2 of U7.

Now, before depressing the key, pins 3 and 1 of U7 were low, and pin 2 was high. When the key is depressed, the rising gate at U5 output turns on the output of U7 (pin 8) for a time of 1.6ms, determined by C71, after which it goes low again. This pulse is amplified by op amp comparator U8 to produce an output trigger pulse of +10 volts and 1.6ms duration, simultaneous with the start of the gate output. 10 microseconds after the start of the gate and trigger, however, C70 charges enough to turn on pin 1 of U7. This inhibits the input at pin 3 from keeping the output of U7 on.

Incidentally, the connection of U5's output to pin 1 of U6 prevents additional pulses due to the depression of more than one key from turning on U6, which would cause a momentary "notch" in the gate output

Now back to U7. Although the positive input at pin 1 inhibits pin 3 from holding U7 high, pin 2 is still free to act. When one or more keys are held down, any additional key will still generate a pulse through C75. The resulting negative pulse at pin 2 of U7 will cause it to generate a trigger pulse.

D. The fourth signal path in from the "KBD VOICE" bus. As already mentioned, Q2 turns on as soon as a key is depressed, charging C64 to the right control voltage. When the key is released, Q2 is open, and the high impedance follower consisting of Q3 and U10 buffers the voltage on C64, without discharging it. This circuit, then "remembers" the keyboard bus voltage.

Now, U10 and follower U11 comprise a feedback circuit to give two types of variable lag (Portamento) to changes in the input.

With S2 in the linear mode, a positive change in voltage across C64 will immediately cause U10's output to go fully positive, since it is open loop. Then, C79 will charge through the counter-clockwise section of P3, the Portamento part. It will charge exponentially toward about 12 volts, but as it nears the new input voltage, feedback from U11 will, after a time, neutralize the input of U10. Since the total change of voltage across C79 is small compared to the initial charging voltage of 12v, the rate of change in output voltage is nearly linear.

On the other hand, putting S2 in the "normal" position adds negative feedback around U10, preventing it from saturating. This causes C79 to charge exponentially, except for large keyboard intervals, when some saturation does occur at first. Thus, the "normal" position is a compromise between exponential and linear portamento.

The output of U11 is coupled into U12, which is a differential amplifier. U11's output appears at U12's output noninverted, with unity gain. Thus, the VOICE OUTPUTS are 1 volt per octave.

The tuning pot, P4, provides a variable voltage from +15v to -15v. (0 volts in the center). However, there is a range near the center where the voltage, after being divided by R165 and R166, is less than the forward drop of D69 and D70, so virtually no voltage appears across R164 and R163. When this range is exceeded, however, the resulting positive or negative voltage gets inverted and summed into the VOICE output, detuning the note flat or sharp, respectively. The "dead space" in the middle of P4's rotation provides a quick return to original tuning (for example, concert pitch, where A=440 Hz.)

There is one additional signal patch when more than one key is depressed simultaneously. This lowers the "KBD High" voltage from its normal 5 volts value. The voltage is buffered by U1, and inverted by U2, R154 compensates for the normal 5 volt level so the AUX VOICE output is normally near 0 volts. The AUX VOICE INTERVAL trim, P2, adjusts the gain for 1 volt change in the AUX VOICE output, per one octave interval between the lowest and highest keys depressed. When summed with the regular VOICE output, by plugging both into the same VCO, the VCO will respond to the highest note played. Together with another VCO only connected to a VOICE output, two notes can be played together.



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NOTES ON ARIES MODIFICATION  
FOR MICHAEL GILBERT, JOB# 1253  
6 MARCH 1976

### NEW PIN ASSIGNMENTS FOR OCTAL ACCESSORY JACK

<u>PIN #</u>	<u>OLD ASSIGNMENT</u>	<u>NEW ASSIGNMENT</u>	<u>CABLE WIRE COLOR</u>
1	} +15V	+15V	RED PAIR
2		VOICE	BLACK
3	} -15V	-15V	YELLOW PAIR
4		2ND VOICE	BLACK
5	} +5V	+5V	BLUE PAIR
6		GATE	BLACK
7	} GROUND	GROUND	BROWN PAIR
8		TRIGGER	BLACK

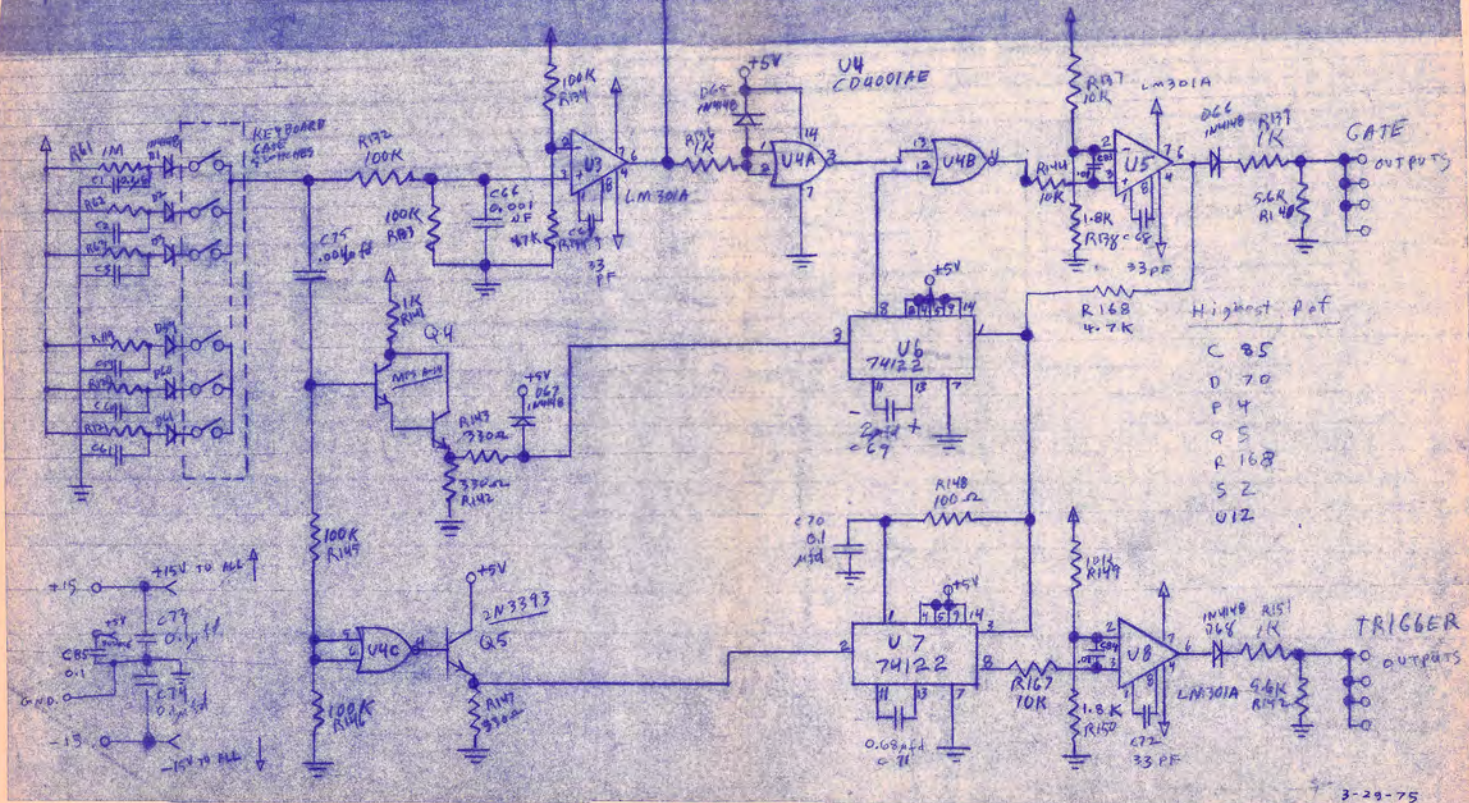
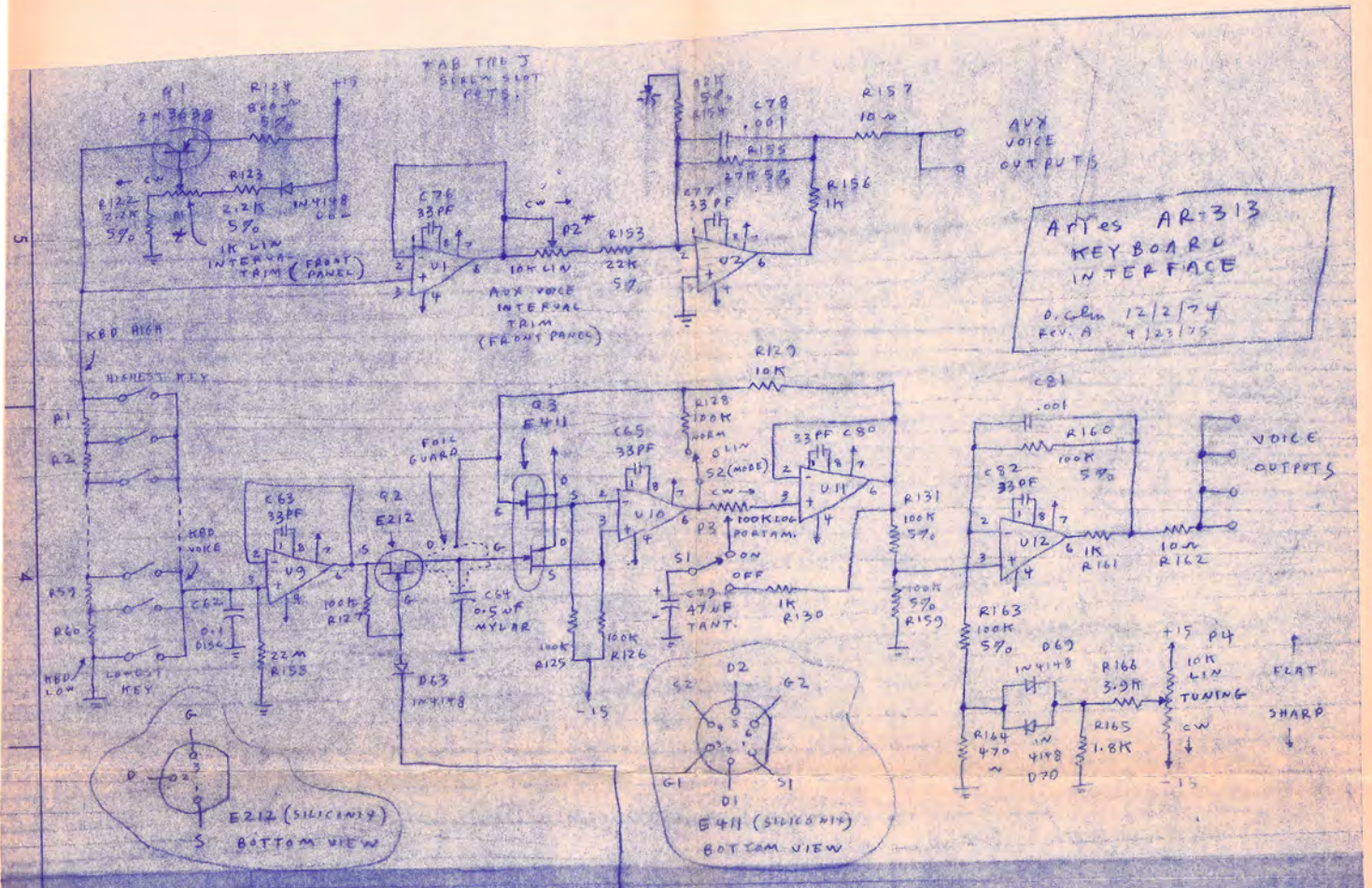
NOTE: BOTH OCTAL JACKS ON BACK OF MAIN CABINET HAVE THIS NEW ASSIGNMENT

### TRIM PROCEDURE FOR KEYBOARD INTERFACE

THIS ASSUMES THAT THE VCO'S ARE TRIMMED REASONABLY CLOSE TO 1V/OCTAVE AND THAT THEY TRACK EACH OTHER VERY CLOSELY.

THE KEYBOARD-TO-VCO TRIMMING SHOULD <sup>ALWAYS</sup> BE DONE THROUGH THE SAME CONTROL INPUTS ON THE VCO'S, AND PREFERABLY NOT THROUGH ATTENUATABLE INPUTS. INPUTS 3 ARE RECOMMENDED.

- connect voice to VCO1, input 3. (KEYBOARD TUNING POT CENTERED) Listen to narrow pulse waves of both VCO'S, TUNED TO EXACT UNISON (AT ABOUT 60 HZ) WHEN LOWEST KEY IS DEPRESSED.
- DEPRESS KEYS IN ASCENDING OCTAVES, ~~FOR~~ ADJUSTING "VOICE TRIM" ~~MANUALLY~~ ON THE KEYBOARD TO CORRECT INTONATION. AFTER EACH ADJUSTMENT OF "VOICE", RETUNE THE OSCILLATORS WITH LOWEST KEY DEPRESSED.
- DISCONNECT VOICE FROM VCO1. CONNECT AUX VOICE TO VCO INPUTS. DEPRESS LOWEST KEY AND TUNE OSCILLATORS TO UNISON. ALWAYS KEEPING LOWEST KEY DEPRESSED, PLAY ALSO HIGHER OCTAVES. IF THE HIGHER OCTAVE IS FLAT, ADJUST "AUX TRIM" CLOCKWISE (PITCH WILL FLATTEN EVEN MORE). IF SHARP, ADJUST counter-clockwise. AFTER EACH ADJUSTMENT, DEPRESS ONLY THE BOTTOM KEY AND RETUNE OSCILLATORS TO UNISON.





## PARTS LIST \* AR-314 \* VOLTAGE CONTROLLED LOWPASS FILTER

PART NUMBERS	QUANTITY	DESCRIPTION	VOLTAGE AND RATINGS
C1, 2	2	Capacitor, Disc	0.01 mfd
C3	1	" "	0.001 mfd
C4	1	" "	33 pf
C5, 7	2	Capacitor, Mica	330 pf
C6, 8	2	Capacitor, Disc	150 pf
Q4, 5	2	N-Channel FET	Siliconix E-212
R1, 38	2	Potentiometer	100K, linear
R2	1	Resistor	150K, 10%
R3, 8, 39, 40, 41	5	Resistor	100K, 5%
R4	1	"	33K, 5%
R5, 6, 20	3	Trimpot	50K, linear
R7	1	Resistor	470K, 5%
R9	1	"	1 meg, 5%
R14	1	"	330K, 5%
R11	1	"	10 ohm, 10%
R12, 21, 25	3	"	4.7K, 10%
R13	1	Trimpot	10K, linear
R15, 18, 19, 22, 29, 34, 35, 36	8	Resistor	100K, 10%
R16, 17	2	"	100 ohm, 10%
R23	1	"	12K, 10%
R24, 27	2	"	33 ohm, 10%
R26	1	"	15K, 10%
R28	1	Potentiometer	1 meg log
R30, 31, 32, 33	4	Resistor	1K, 10%
R37	1	Potentiometer	100K, log
U1, 3, 5	3	Operational Amplifier	LM301A
U2, 4	2	Operational Transconductance Amp	CA3080
	1	Printed Circuit Board	
	1	Front Panel	
	1	Frame	
	4	Knobs	
	12	Jack, Mini-phone	
	1	Bracket, large	
	1	Bracket, small	
	6	Screw, 4-40x3/16"	
	6	Nut, 4-40	
	2	PC Card Guides	

AR314 VCF Assembly p 1 of 4  
ARIES System 300 Music Synthesizer  
Module AR 314  
Voltage Control Filter 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.

- ( ) 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.

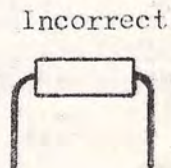
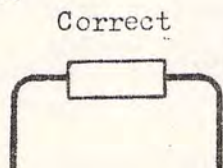
Unpack the parts carefully and place in a large box or tray so they won't get lost.

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

- ( ) 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 3 jumpers in the same manner.

- ( ) 3. Resistors  
Carefully install all 37 resistors on the circuit board. R13 is a 10K trim pot R5,6, and 20 are 50K trim pots. R 1,28,37, and 38 are potentiometers and will later be mounted on the panel.  
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:



- ( ) 4. Capacitors  
Install all 6 capacitors on the board. (C3 through C8)
- ( ) 5. Transistors  
Install both transistors on the board. (Q4 and Q5)
- ( ) 6. Integrated Circuit Amplifiers  
Install all five Integrated Circuit Amplifiers on the board.  
U2 and 4 are CA3080. U1, 3, and 5 are LM301.

ALL BOARD COMPONENTS ARE NOW MOUNTED.

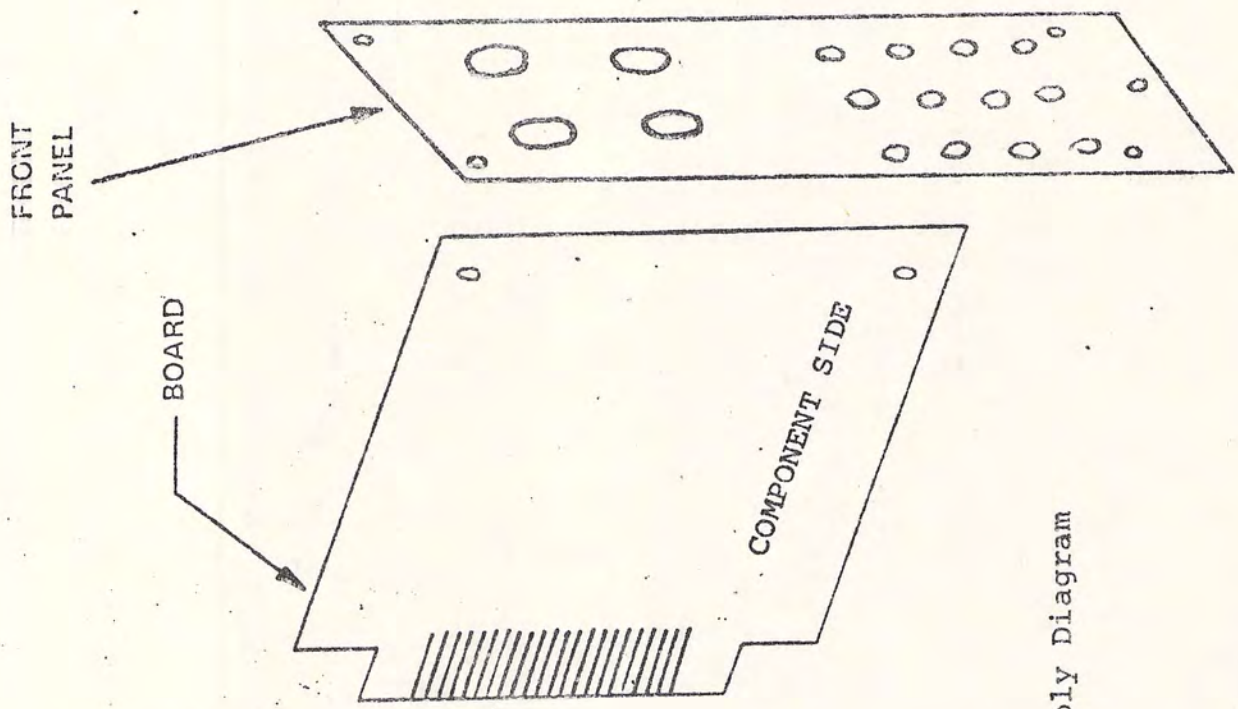
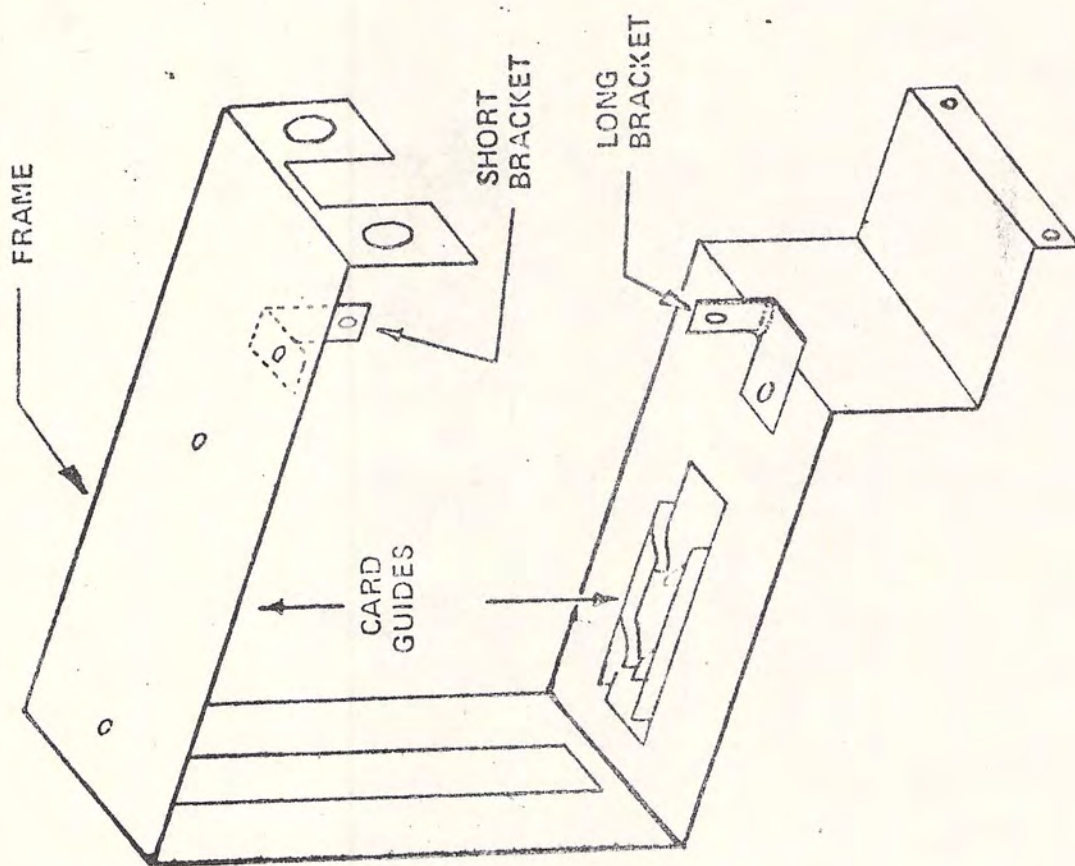
**MODULE ASSEMBLY-- Please refer to Module Assembly Drawing**

- ( ) 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.

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

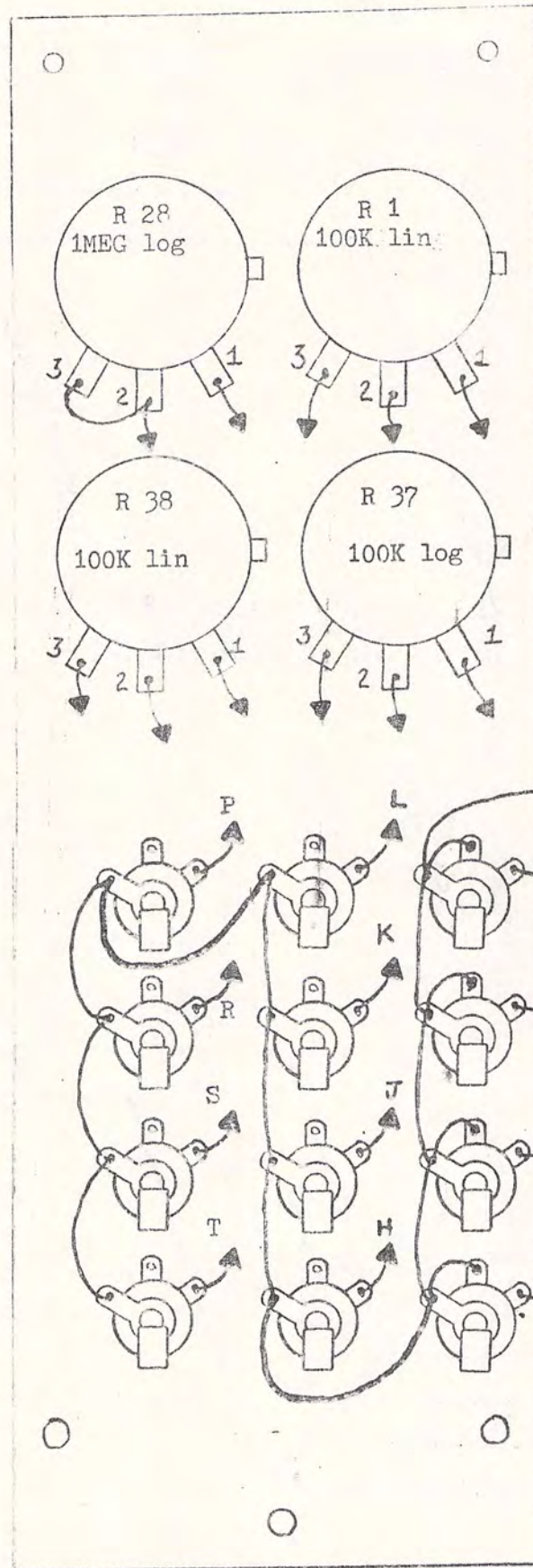
- ( ) 1. Run a wire connecting the grounds of all 12 mini-jacks, as shown, and from there to the point on the board labelled M on the assembly drawing. Note the shunt grounds on the 4 audio input jacks.
- ( ) 2. Run a wire connecting pins 1, 2, and 3 of each pot on the panel to the appropriate point 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.

THIS COMPLETES ASSEMBLY OF YOUR AR 314 VOLTAGE CONTROLLED FILTER.



AR314 VCF Module Assembly Diagram

AR 314 VOLTAGE CONTROL FILTER PANEL WIRING DIAGRAM--rear view



Arrows indicate a wire to the PCboard. All wires with arrows and ground bus must be insulated.



AR-314 V C F TRIM PROCEDURE

RECOMMENDED EQUIPMENT: Audio Sine Wave Generator, or AR-317 VCO, DC and AC voltmeter. OPTIONAL: Square Wave Generator, Oscilloscope

- ( ) 1. Turn all 4 trim pots to center position.
- ( ) 2. Connect a D C voltmeter or scope to one of the outputs.
- ( ) 3. Set FREQ dial to 1 KHz, and RESONANCE at Min.
- ( ) 4. Turn on power, and adjust trim pot R20 for zero volts D C at output (within + or - 0.5 v).
- ( ) 5. Set the RESONANCE control to approximately 2/3 of its maximum, and FREQ to 16 Hz. Connect VCF output to an AC voltmeter or scope. Feed a sine wave of 16 Hz, and about 1 volt RMS, into the variable signal input (#1) of the VCF. Adjust trim pot R6 (Frequency trim) for the maximum amplitude response at the output. Keep the input level low enough to be able to observe a smooth variation of the output as the trim is adjusted, so that the VCF amplifier stages do not clip the waveform at the maximum response. Check the setting by varying the input frequency around 16 Hz and observing the peak response.
- ( ) 6. Change input frequency to 16 KHz. Adjust B (1 volt per octave trim) for maximum output amplitude. Again, keep the input level low enough to avoid distortion. Vary input frequency to verify accurate setting.
- ( ) 7. Repeat steps 5 and 6 once, as they interact slightly.
- ( ) 8. Remove the input. Set the RESONANCE control to minimum, and the FREQ control to 256 Hz. Connect the output to a DC voltmeter or scope. Adjust offset trim pot R20 for zero volts DC, within + or - 0.1 volt.

OPTIONAL SYMMETRY TRIM

FIRST TRIM ACCORDING TO PREVIOUS STEPS 1 through 8.

METHOD A:

- ( ) 1. Set FREQ. control to maximum, and RESONANCE to minimum.
- ( ) 2. Connect a DC voltmeter between R21 and R25, using the ends away from the CA3080 amplifiers.
- ( ) 3. Adjust symmetry trim pot R13 for zero volts DC, within + or - 0.1 volt.

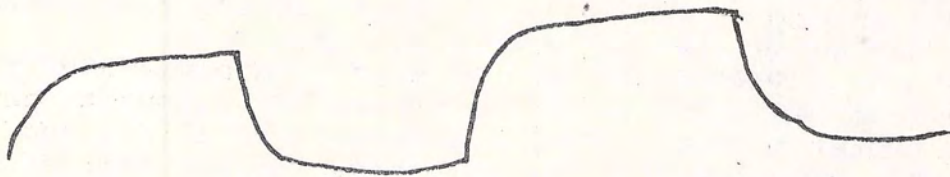
METHOD B : (more accurate)

- ( ) 1. Set FREQ control to 1 KHz, and RESONANCE to minimum.
- ( ) 2. Feed in a square wave, of approximately 200 Hz, and less than 10 v peak to peak, to the VCF variable signal output.
- ( ) 3. Observe output on an oscilloscope. Adjust symmetry trim pot R13 over its full range. Notice that at one end, the square wave "overshoots", that is, it momentarily exceeds its final value. (See next page for illustration.)

Adjust the trim until this overshoot just barely disappears:



WRONG



CORRECT



WRONG

IMPORTANT: If you perform any symmetry trimming, re-adjust the FREQUENCY trim at 16 Hz, per step 5 of the previous procedure.

## THEORY OF OPERATION...AR 314 VCF

The basic VCF circuit involves two feedback loops, two integrators, and two variable gain circuits. It is known as a state-variable filter. To help understand its operation, consider the block diagram. Part numbers refer to schematic diagram.

The two gain blocks are set by the exponential generator to have equal, but variable gains. So, an input signal will be fed to the first integrator, through the second gain block, and will appear out of the second integrator. The signal will be integrated twice. Thus, the overall gain at D.C. will be enormous, and would cause saturation, except for the low frequency feedback path. This causes the output to reach the same D.C. level as the input. Then, the two inputs cancel, resulting in no output from the gain block, and the system is stable.

Thus, the filter always unity gain at D.C. At very high frequencies, the gain of the integrators becomes very low (an integrator has a frequency response that falls off at 6 db. per octave, and always has a phase lag of 90 degrees).

So, very high frequencies will be attenuated by 12 db. per octave total, and shifted a total of 180 degrees.

Now, the frequency where attenuation starts depends on the gain of the gain blocks. If their gain is raised, then it takes a higher frequency to reduce the total forward gain, since the integrators must see a higher <sup>FREQUENCY</sup> to attenuate the signal by as much as the gain blocks have increased it.

There is one frequency where the forward gain equals unity. Now, since the integrators always provide a 180 degree phase shift, there will be positive feedback at the input equal to the output signal. At this frequency, the system would be unstable and oscillate, except for the "resonant frequency" feedback path. This provides negative feedback with a phase lag of 90 degrees. The total filter gain at the response frequency depends on the "Q" control setting. (Q is equal to the gain at this frequency).

The response is, therefore, unity gain at D.C. and starts to roll off at the resonance frequency. If the "Q" is set higher than 0.7, there will be a peak in the response before falling off at higher frequencies.

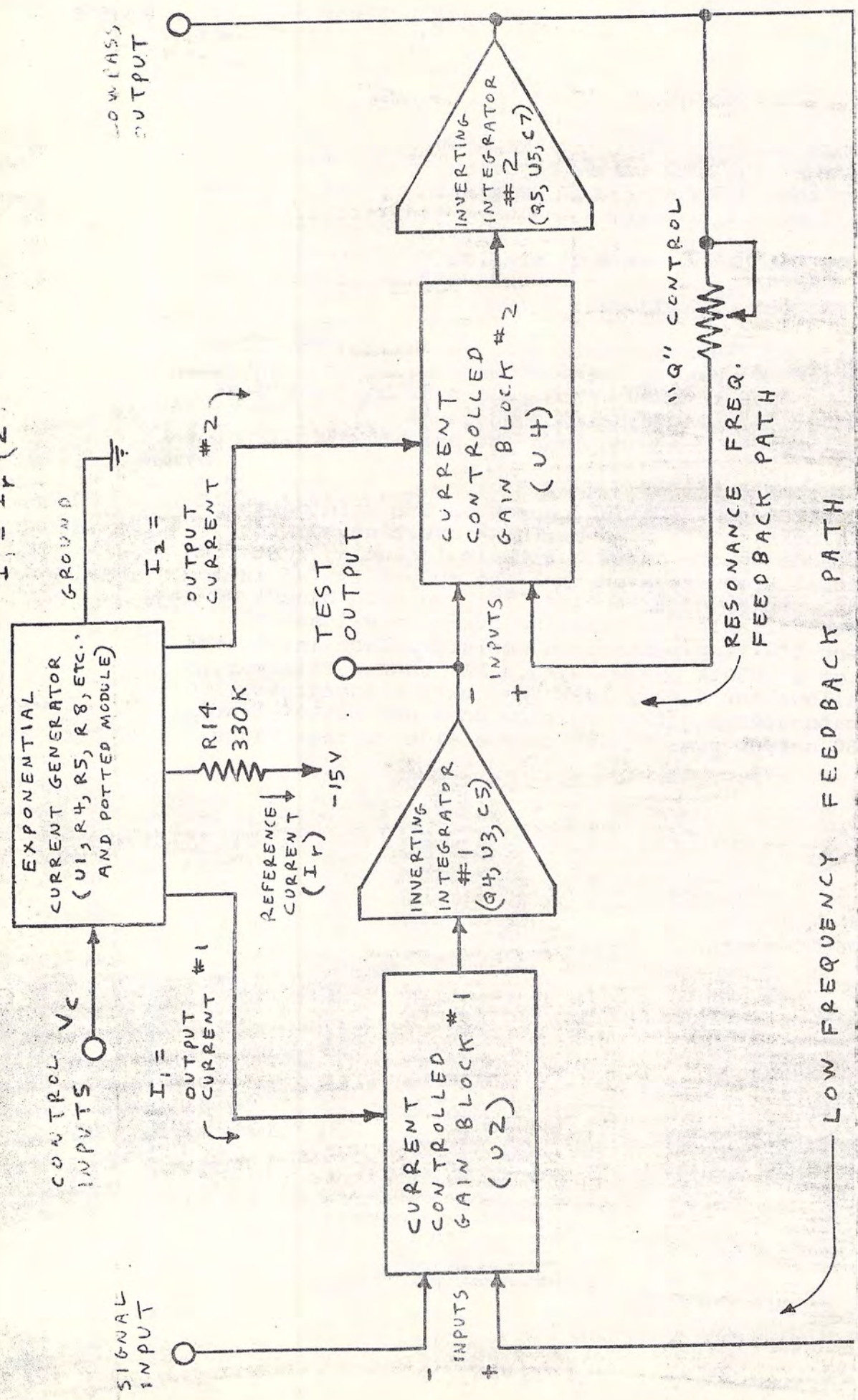
The test output has a response similar to a bandpass filter if the "Q" is high. At low "Q" values, it acts more like a 6 db. per octave lowpass response.

Actually, if the resonance feedback were around the first integrator, the lowpass filter response would be identical but the test output point would be a true bandpass response. However, this was sacrificed because the present configuration provides much less output offset.

Now for some details:

The exponential generator, which varies the gain of the two gain blocks, starts with U1. This inverting, summing amplifier adds up the control signals, including that from the "Initial Frequency" control. The output is fed into the potted module, which supplies the two gain blocks, U2 and U4, with variable but tracking currents. R21 and R25 are current limiting protection resistors. Each integrator consists of a LM301A op-amp with a FET source follower. The FET allows for a very low bias current integrator, and its gate-source offset voltage does not matter, since the CA3080 output can "float" over a wide voltage range.

$I_1 = I_T (2)^{V_c}$



ARIES AR-314 VCF BLOCK DIAGRAM

Notes on the Exponential Current Generator

This is the potted module mounted on the board. It is encapsulated to insure freedom from drift due to temperature changes. Six connections are necessary:

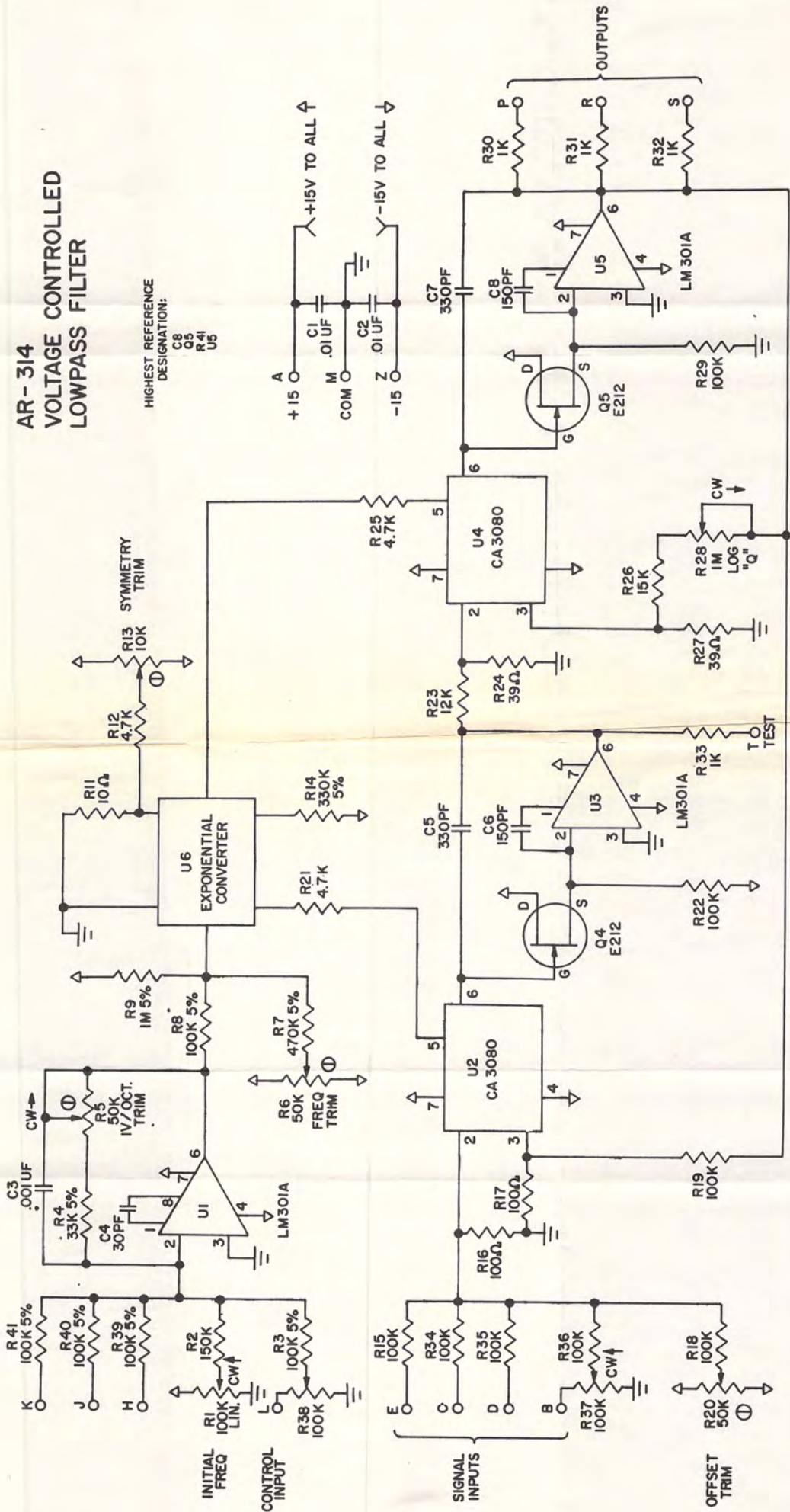
1. Ground
  2. Control voltage summing input. Scale factor = -6 microamps per octave. When connected in series with 160k, scale factor = 1 volt per octave.
  3. Reference current terminal. Needs negative current source, for example 330K resistor to -15 v supply. Typical reference current = 40 microamps.
  4. Output Current #1.
  5. Output Current #2.
  6. Output Current #2 trim. If desired, this terminal is connected to a 10 ohm resistor to ground, and through a resistor of around 4.7K to a 10 K trimpot, which supplies -15v to +15v. This trims output #2 over the range from 1/3 to 3 times output #1.
- When trimmed for 1 volt per octave, the relationship is:

$$\text{OUTPUT CURRENT \#1} = \text{REFERENCE CURRENT} \times (2)^{\text{CONTROL VOLTAGE}}$$

# AR-314 VOLTAGE CONTROLLED LOWPASS FILTER

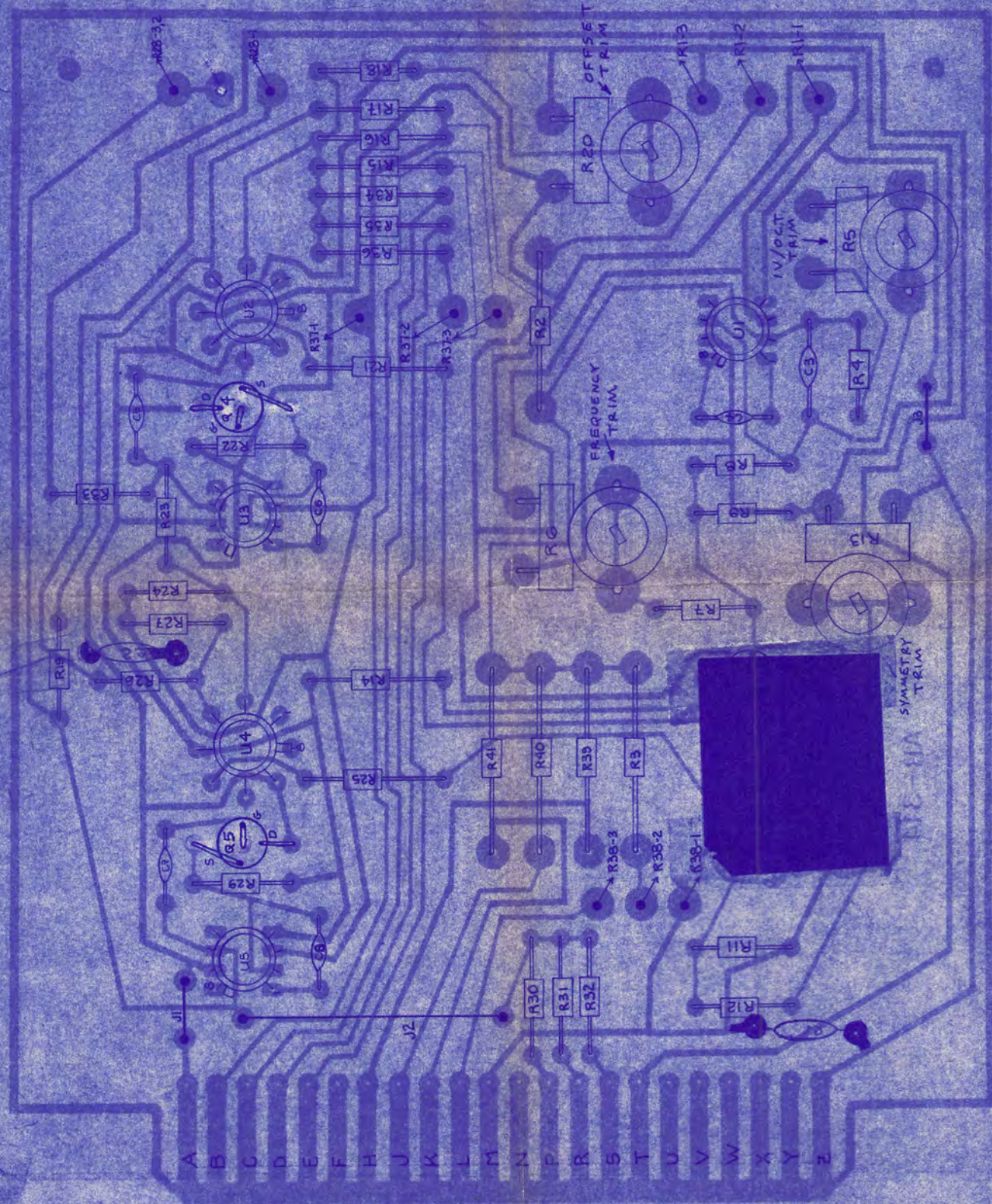
HIGHEST REFERENCE  
DESIGNATION:

C8  
G5  
R41  
U5



4-11-75  
D.C.

3-29-75



3 JUMPERS

AR-314 VCF COMPONENT LAYOUT

- +15 V
- SIGNAL IN 1
- SIGNAL IN 2
- SIGNAL IN 3
- SIGNAL IN 4
- CONTROL IN 4
- CONTROL IN 3
- CONTROL IN 2
- CONTROL IN 1
- GROUND
- OUTPUT 1
- OUTPUT 2
- OUTPUT 3
- TEST OUTPUT
- 15 V

A B C D E F H J K L M N P R S T U V W X Y Z



PARTS LIST \* AR-315 \* BALANCED MODULATOR

NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
C1,2	2	Capacitor, Disc	0.1 mfd, 25v
C3	1	" "	33 pf
C4,5		" "	330 pf
R1,16,17,18	4	Potentiometer, 1/4" shaft	100k linear
R2,3,4,5,14,15	6	Resistor, Carbon	10k 10%
R6,19,22	3	" "	3.3k 10%
R9	1	" "	12k 10%
R8,10,11,21	4	Trimpot	10k linear
R12,13	2	Resistor, Carbon	2.2k 10%
R7	1	" "	6.8k 10%
R23	1	Resistor, Carbon	22k 10%
R24,25	2	" "	1k 10%
R20	1	" "	15k 10%
U1	1	I C Multiplier	MC1595 (Motorola)
U2	1	Operational Amplifier	LM301A
	1	Printed Circuit Board	
	1	Front Panel	
	4	Knobs, 1/4" Shaft	
	1	Frame	
	2	Bracket	
	6	Screw, 4-40 x 3/8	
	6	Nuts	
	12	Jack, mini-phone	

ARLES System 300 Music Synthesizer  
Module AR 315

Balanced Modulator and Attenuators 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.

( )

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

( )

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.)

( )

3. Resistors

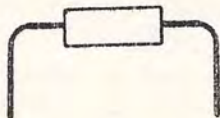
Carefully install all 25 resistors on the circuit board.

R8, 10, 11, and 21 are trim pots. R1, 16, 17, 18 are potentiometers.

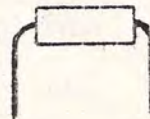
To avoid breaking the resistors leads, bend the leads at least 1/16 of an inch away from the body of the resistor.

For example:

Correct



Incorrect



- ( ) 4. Capacitors  
Install all four capacitors on the board. (C1 through C4)
- ( ) 5. Integrated Circuit Amplifiers  
Install the 1595 Modulator and the LM301 op amp and the board.

ALL BOARD COMPONENTS ARE NOW MOUNTED.

MODULE ASSEMBLY-- Please refer to Module Assembly Drawing

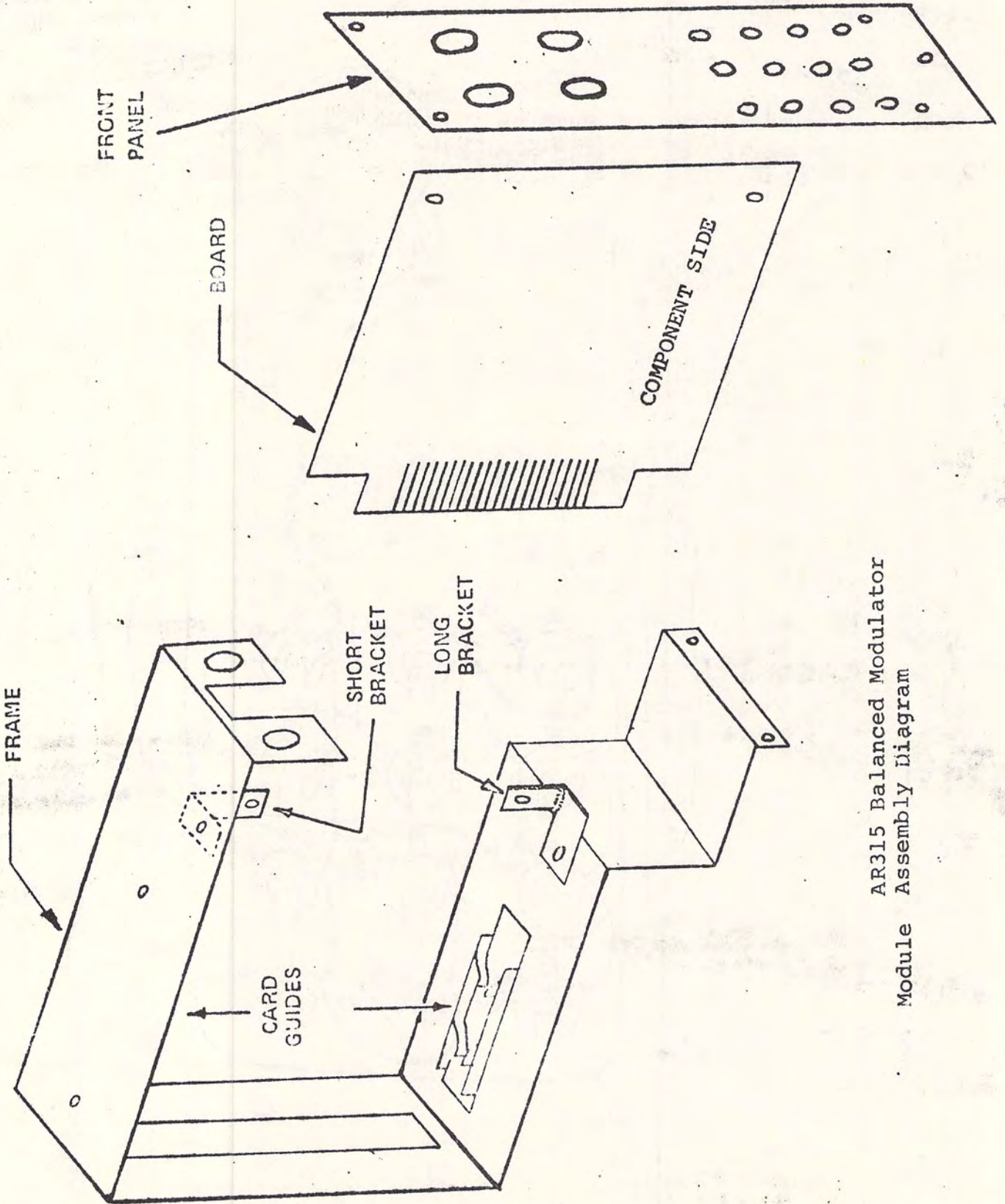
- ( ) 1. Unpack the frame, bag of hardware, and front panel.
- ( ) 2. Snap the two plastic card guides into the holes in the frame.  
Be sure that the pairs of tabs in the guides which hold the board point toward the rear of the frame. (The bottom one is shown installed in the drawing.)
- ( ) 3. Slide 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.

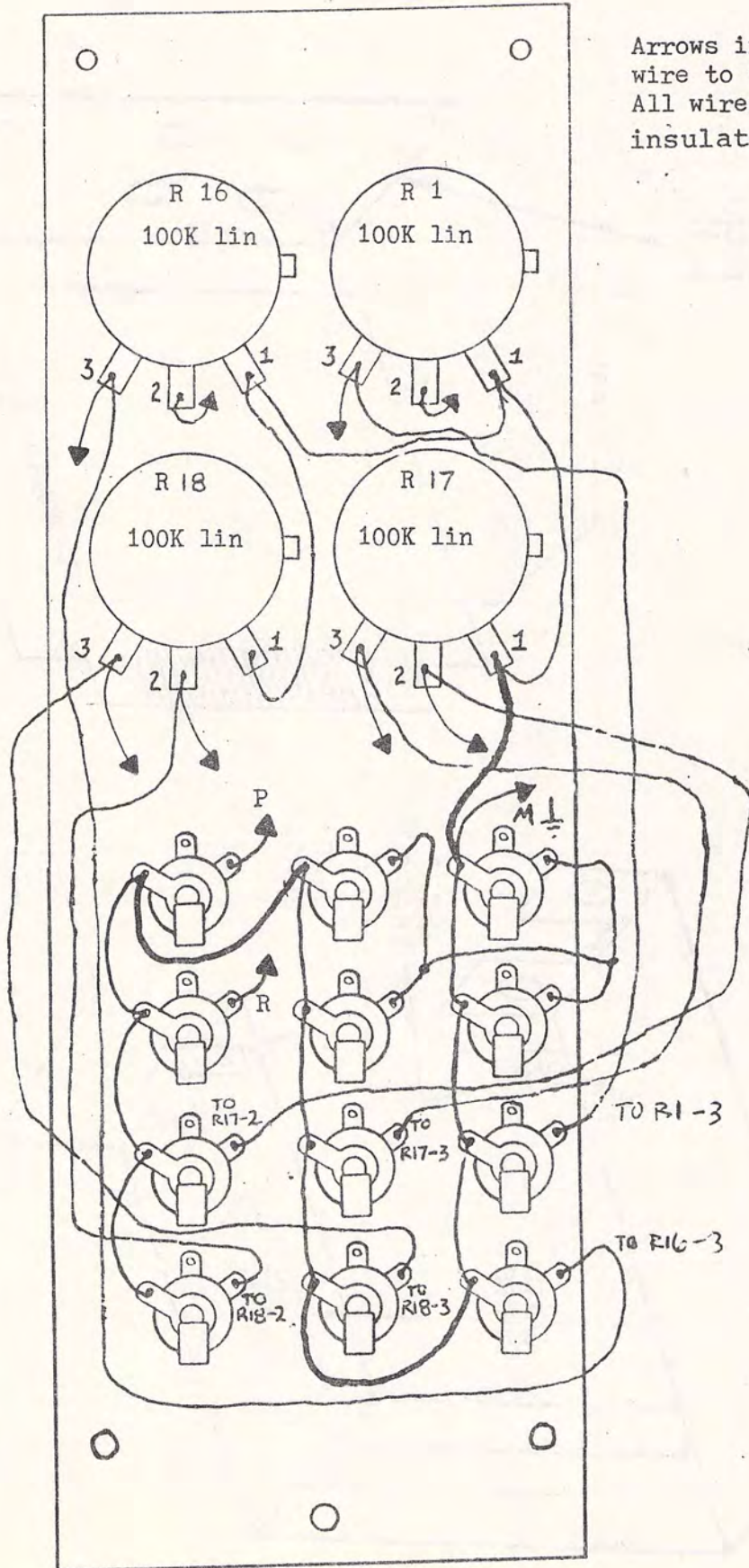
- ( ) 1. Run a wire connecting the grounds of all 12 mini-jacks, as shown, and from there to the point on the board labelled M on the assembly drawing.
- ( ) 2. Run a wire connecting pins 1,2,and 3 of each pot on the panel to the appropriate point on the board as labelled on the assembly drawing. Wire 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.

THIS COMPLETES ASSEMBLY OF YOUR BALANCED MODULATOR AND ATTENUATORS.



AR315 Balanced Modulator  
Module Assembly Diagram

AR 315 BALANCED MODULATOR AND ATTENUATORS PANEL WIRING DIAGRAM--rear view



Arrows indicate a wire to the PC board. All wires must be insulated.

## BALANCED MODULATOR AND ATTENUATORS TRIM PROCEDURE

The following procedure is recommended if the test instruments are available.

1. Oscilloscope with direct coupled (DC) vertical input.
2. 10 volt DC voltage source. (The output from an envelope generator with sustain at maximum may be used for this.)
3. An oscillator with two waveforms.

Trim as follows: Turn all trim pots to center position before proceeding.

1. Turn the Y input attenuator to 0 and apply a 10 volt sawtooth to the X input. X input at 10.
2. Adjust R 10 for minimum signal on the output. ( Oscilloscope gain may be increased for more precise trimming.)
3. Turn X input attenuator to 0 and apply a 10 volt sawtooth to the Y input. Y input at 10.
4. Adjust R 11 for minimum signal at the output.
5. Turn both input attenuators to 0. Adjust R 21 for 0 volts at the output.
6. Apply a 10 volt DC voltage to the inputs of X and Y. pots on 10.
7. Adjust R 8 for 10 volts at the output.

Your Balanced Modulator, Attenuators Module is ready to use.

THEORY OF OPERATION AR-315  
BALANCED MODULATOR

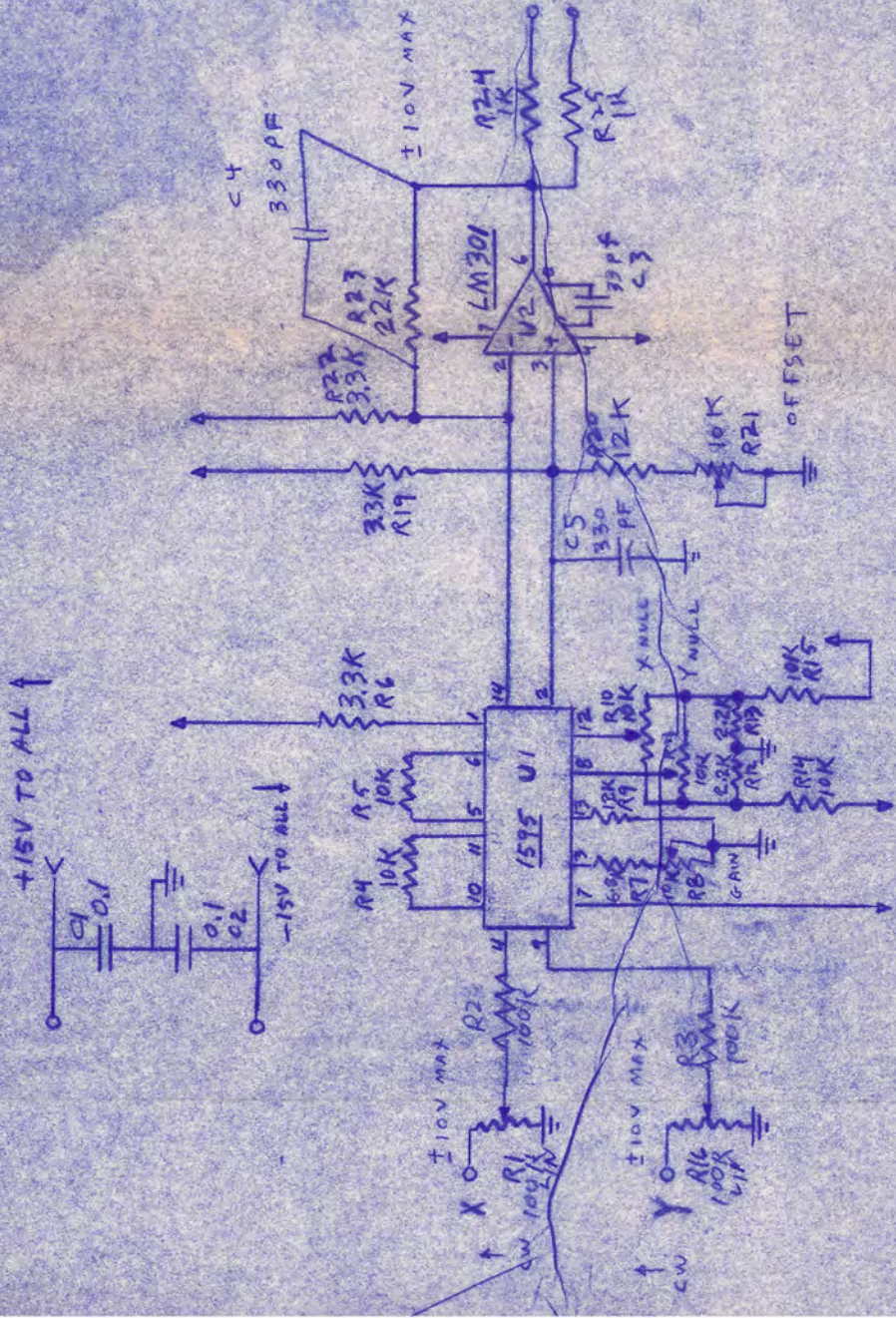
The module has two inputs, called X and Y. Signals from these are fed to U1, which is a 4-quadrant multiplier I C. Its output is amplified by U2, an op amp connected as a differential amplifier. When trimmed, the output voltage should equal  $XY$  over 10. If either input, or both, are 0, the output will be 0. R10 trims the output to within a small fraction of a volt when Y is 0, and R11 does so when X is 0. When both inputs are 0, R21 is used to trim the output to 0 volts D C.

Finally, with 10 volts applied to BOTH inputs, R8 trims the gain for 10 volts output. By multiplying (modulating) two different audio waveform together, a wide variety of new sounds may be generated. The AR-315 module also has two independent controls with inputs and outputs, for use as a variable attenuator, or level control, anywhere in a synthesizer patch.

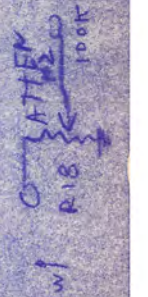
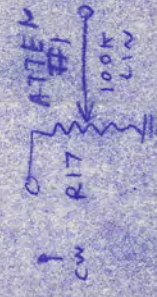
1-R-714  
BALANCED  
MODULATOR

5-30-75

D1  
R25  
C4  
U2



Designed P. 2, 3.  
11/21/74 O.C.M.

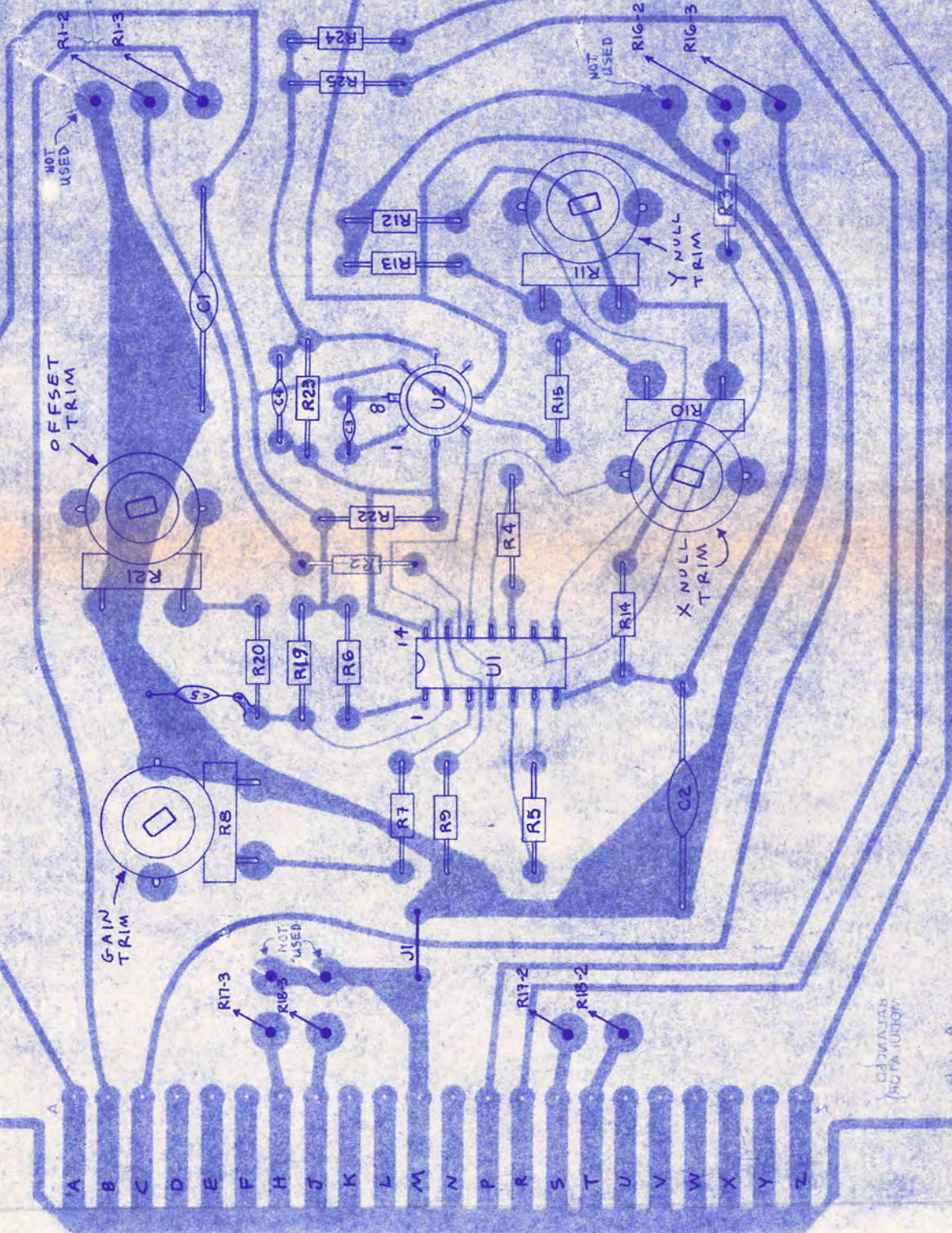




17 JUMPERS

AR-315 BALANCED MODULATOR

AR-312



+15V  
 X INPUT  
 Y INPUT  
 ATTEN 1 IN  
 ATTEN 2 IN  
 GROUND  
 OUTPUT 1  
 OUTPUT 2  
 ATTEN 1 OUT  
 ATTEN 2 OUT  
 -15V

02 AVAILABLE  
 100 PA JUMPER  
 100 PA

## PARTS LIST \* AR-316 \* VOLTAGE CONTROLLED AMPLIFIER

NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
C1,2	2	Capacitor,Tantalum	1 mfd, 25v
C3,4	2	Capacitor,Disc	33 pf
Q1	1	Transistor, NPN	2N3393 or TE3393
Q2	1	Transistor, PNP	2N3638
R1,3	2	Potentiometer,1/4" shaft	100k Log
R2,4,5,6	4	Resistor,Carbon	100k 10%
R7,9	2	" "	220 ohm, 10%
R8	1	" "	330 k ohm, 10%
R11	1	Resistor,Carbon	1.5k, 10%
R12	1	" "	33k, 10%
R10,13,31	3	Trimpot	50k,linear
R14	1	Resistor,Carbon	47k 10%
R15,16	2	" "	1k, 10%
R17,23	2	Potentiometer, 1/4" shaft	100k, linear
R18,19,20,21	4	Resistor,Carbon	100k, 5%
R24	1	" "	2.7k 10%
R25	1	" "	150k 5%
R26	1	" "	56k 5%
R27	1	" "	3.3k 5%
R22	1	Resistor,Carbon	150k 5%
R29	1	" "	1 meg, 5%
R30,33	2	" "	10k 10%
R32	1	" "	15k 10%
S1	1	Switch,Toggle	DPDT
U1	1	Operational Transconductance Amp	CA3080 (RCA)
U2,3	2	Operational Amplifier	LM301A
	2	P C Card Guides	
	12	Jack,Miniphones	
	1	Printed Circuit Board	
	1	Front Panel	
	4	Knob, 1/4" shaft	
	1	Frame	
	2	Bracket	
	6	Screw, 4-40 x 3/8"	
	6	Nut, 4-40	

ARIES System 300 Music Synthesizer  
Module AR 316  
Voltage Control Amplifier 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.

( )

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

( )

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 4 jumpers in the same manner.

( )

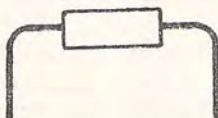
3. Resistors

Carefully install all 29 resistors on the circuit board. R 10,13, and 31 are trim pots. R 1,3,17, and 23 are potentiometers and will later be mounted on the panel.

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. Capacitors  
Install all four capacitors on th board. (C1 through C4)
- ( ) 5. Transistors  
Install all transistors on the board. (Q1 and Q2)
- ( ) 6. Integrated Circuit Amplifiers  
Install all Integrated Circuit Amplifiers. U1 is a CA3080.  
U2 and 3 are IM 301.

**ALL BOARD COMPONENTS ARE NOW MOUNTED**

**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 moduls 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.

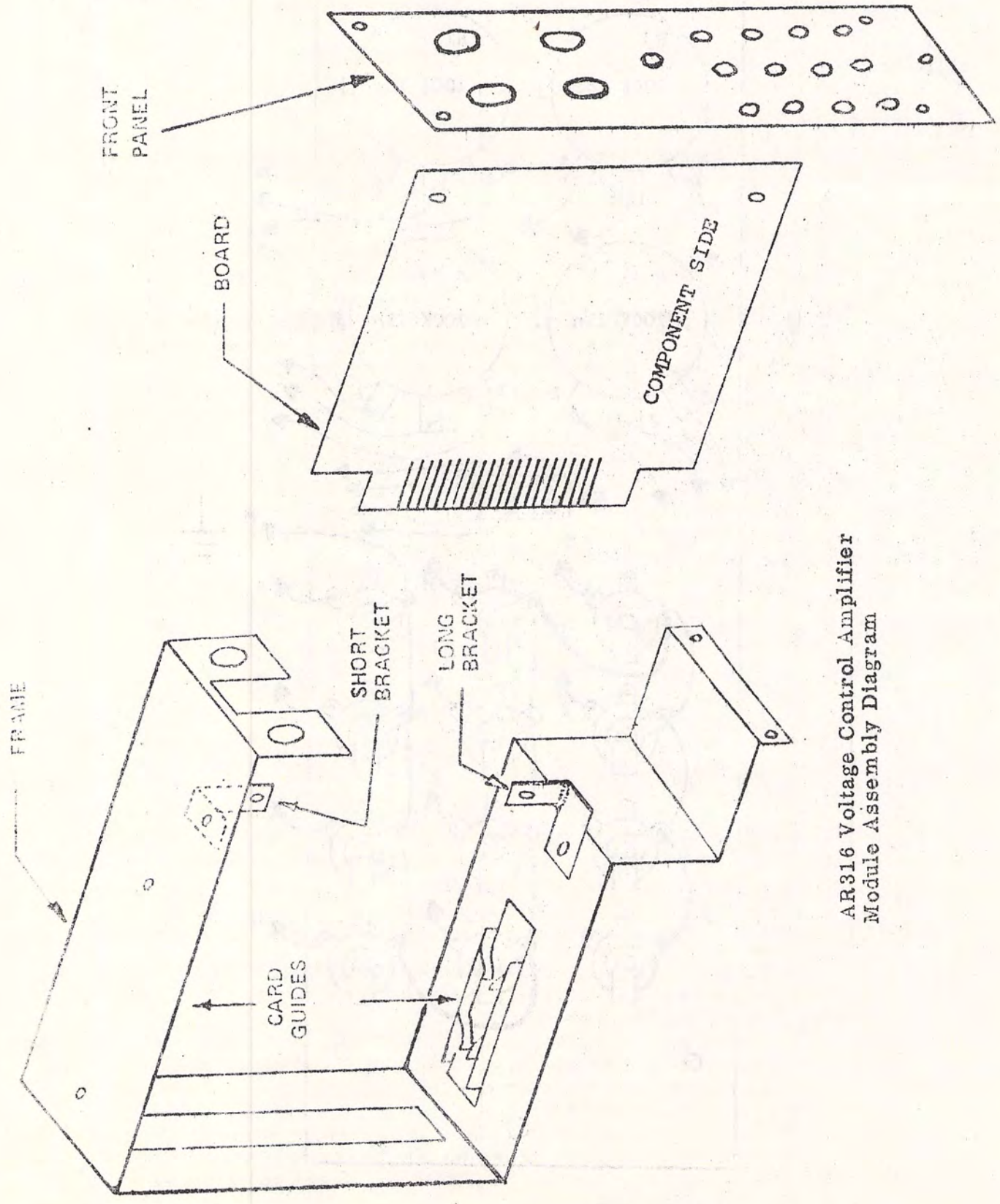
**THIS COMPLETES MODULE ASSEMBLY**

**PANEL WIRING-- Please refer to panel wiring diagram and layout diagram.**

- ( ) 1. Run a wire connecting the grounds of all 12 mini-jacks, as shown, and from there to the ground point on the circuit board near point "M" of the edge connector.
- ( ) 2. Wire the 3 pins of each pot as shown in the panel diagram. Wires indicated with arrow heads connect to the appropriate points on the circuit board, as shown on the layout diagram. Wire one pot at a time to avoid confusion.
- ( ) 3. Wire all jacks with arrows and a letter designation to the appropriate points at the rear edge of the board, as shown in the layout diagram.
- ( ) 4. Wire S1 to the appropriate points on the board as labelled on the assembly drawing.

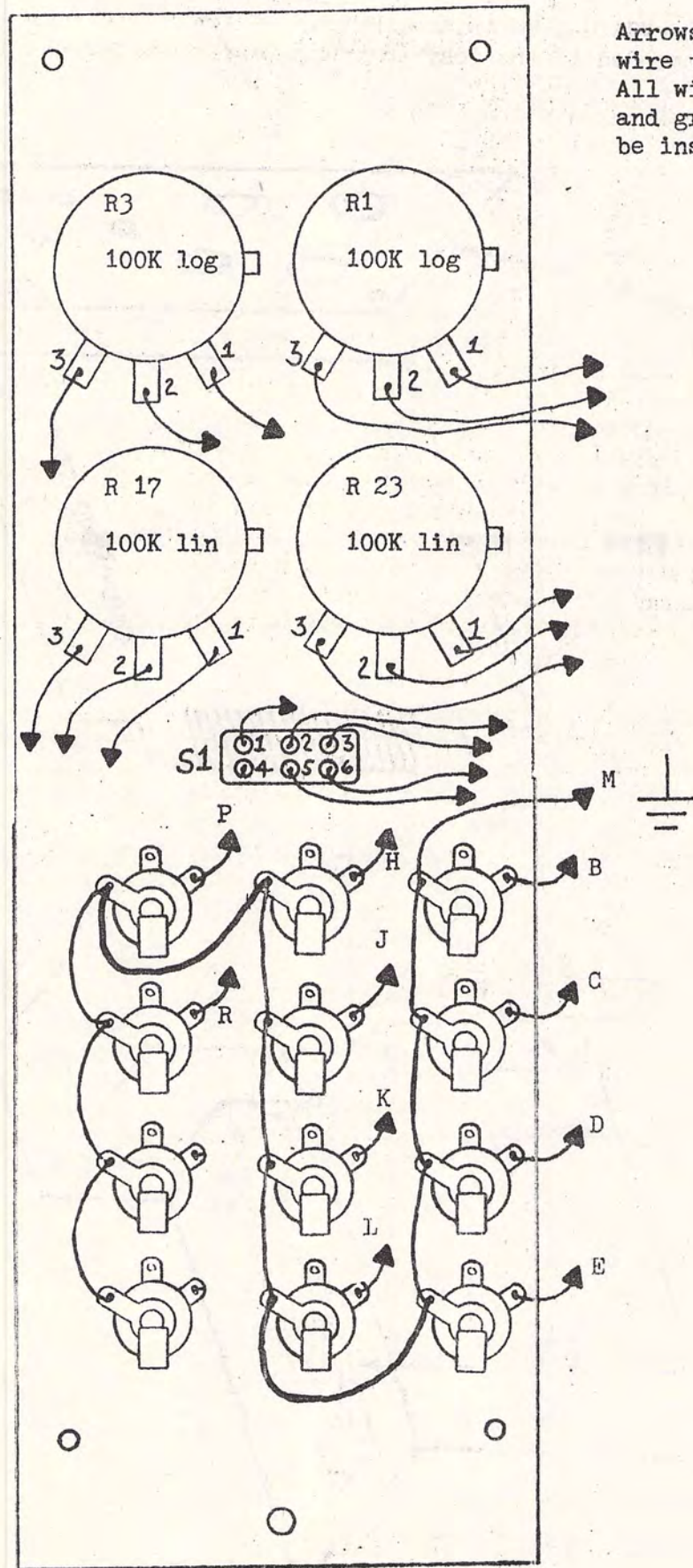
**THIS COMPLETES ASSEMBLY OF YOUR AR 316 VOLTAGE CONTROL AMPLIFIER**

AR316 VCA  
Assembly p 3 of 5



AR316 Voltage Control Amplifier  
Module Assembly Diagram

AR316 VCA Assembly p.4 of 5  
 AR 316 VOLTAGE CONTROL AMPLIFIER PANEL WIRING DIAGRAM--rear view



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

MODULE AR316  
VCA TRIM PROCEDURE

NOTE: The VCA may be trimmed by ear, however, the following test procedure is recommended if the test instruments are available.

1. A regulated + and - 15 volt power supply
2. Oscilloscope with DC coupled vertical input.
3. Envelope Generator or LFO.
4. LFO or VCO.

Trim as follows:

1. Monitor the output with the oscilloscope.
2. With no audio inputs to the VCA and audio level pots at 0, apply a 10 volt square wave to the control input.
3. Adjust R10 for minimum signal at the output. (Increase the gain on the oscilloscope for more precise trimming.)
4. Apply a 10 volt sawtooth to audio input 1 and set the pot to 10.
5. Apply a 10 volt square wave to control input 1 and set the pot to 10. The envelope generator can be used to produce the square wave.
6. Turn the initial gain to 0 and the control mode switch to LIN.
7. Adjust R 13 for a 10 volt sawtooth at the output.
8. Change the control mode switch to EXP.
9. Adjust R 31 for a 10 volt sawtooth at the output.

Your AR 316 is now ready to use.

THEORY OF OPERATION- AR-316  
VOLTAGE CONTROLLED AMPLIFIER

Audio inputs are summed in by R2, 4, 5, and into the inverting input of U1, which is a current-controlled gain circuit. The inputs, after mixing at the input, appear as an output current. This is converted to a voltage by U2, a conventional inverting op amp. The output is of the same polarity as the input, because the two inversions cancel.

Control signals are summed through R18, 19, 20, 21, and 22, and U3. In the LINEAR mode, the output of U3 varies from 0 to +5 volts. This is coupled through emitter follower Q1 into Q2. The two base-emitter drops cancel, since opposite polarity transistors are used. So, the emitter voltage of Q2 varies between 0 and -5 volts. This voltage across R33, determines the current from emitter to collector of Q2, and into the control terminal of U1, the variable gain circuit. When R23, the INITIAL GAIN CONTROL, is to the left, its output of -15 volts is balanced by the +15 volts across R25, so U3 output is 0, as is the current into U1. Then, the gain is 0. (Off). Turning up R23, or applying a positive control input voltage, causes U3 output to become negative, which turns on Q2 and U1. R13, across U2, trims the maximum gain to be unity at full control input of +10 volts.

In the EXPONENTIAL mode, action is similar except (1) R33 is shorted, which makes the current through Q2 change much more rapidly (exponentially) as its base voltage changes, and (2) the resistors across U3 are changed to provide a smaller drive voltage. U3 output now varies between 0 and -0.33 volts. R31 varies the emitter current through Q1, then changing its base-emitter drop by a total of 0.05 volts. This is not significant in the LINEAR mode, but is in the EXPONENTIAL mode, where it is used to trim the maximum gain, also to unity.

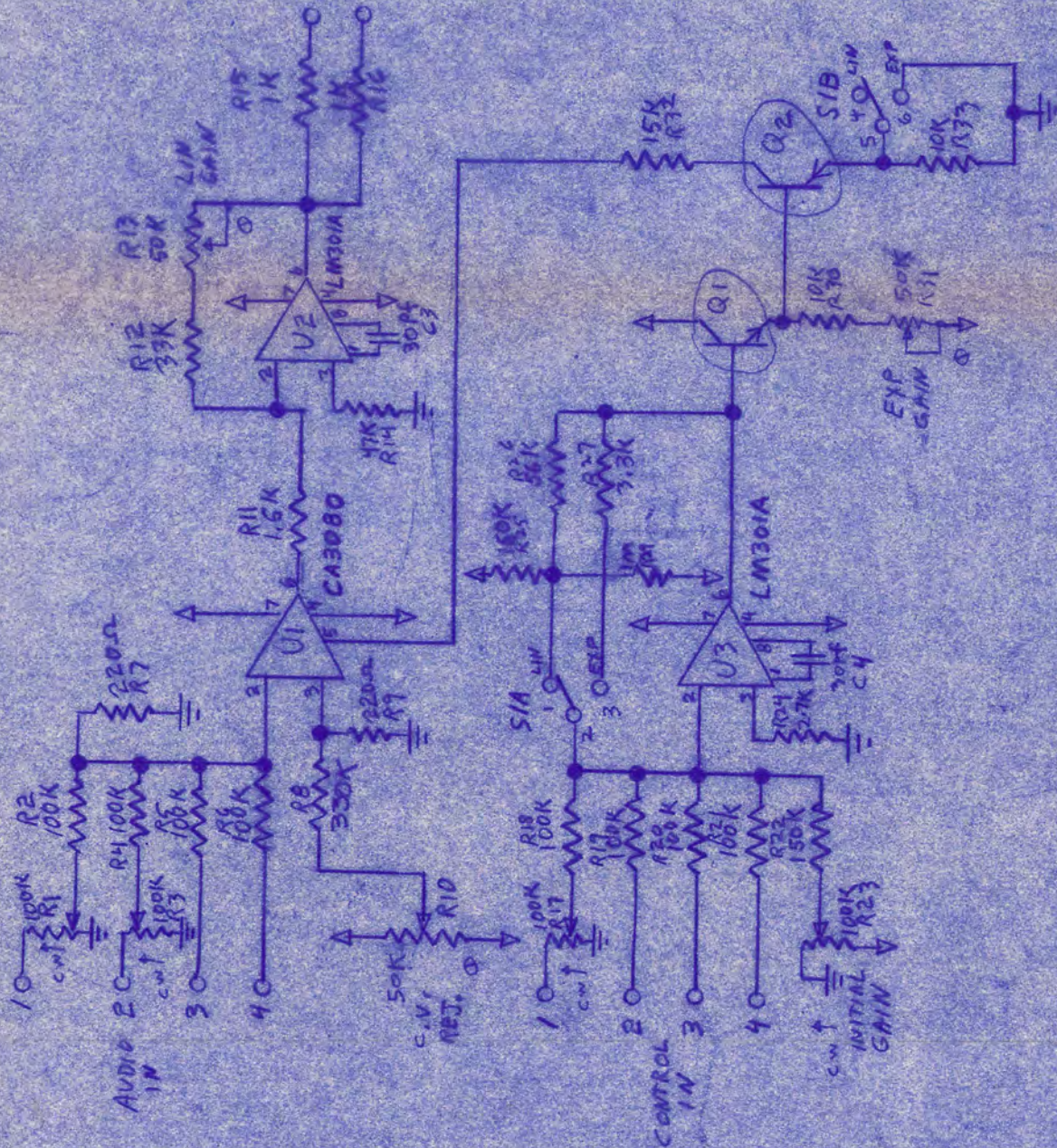
Thus, in both modes, the gain varies from essentially 0 to 1 as the INITIAL GAIN control is varied over its full range. However, in the LINEAR mode, the gain is .5 (-6db) at the mid-position, or with a +5 volt control signal. In the EXPONENTIAL mode, the gain at this point is only 0.003 (-50 db).

Finally, R10 introduces a variable D C offset into U1, which balances out its own internal offset. This prevents varying control signals from carrying a changing D C offset at the final output.



C4  
Q2  
R33  
S1  
6-13-70

VCA  
AR-316





PARTS LIST \* ARIES MODULE 317 \* V C O

PART NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
C1,2	2 2	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	2N-3393 or 2N-3393
Q9	1	field effect transistor N-channel	E 212 (siliconix)
Q4, 14	2	transistor, PNP	KE4392 ( " )
Q6, 7, 13	3		2N 3638
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
<del>U2</del> 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.

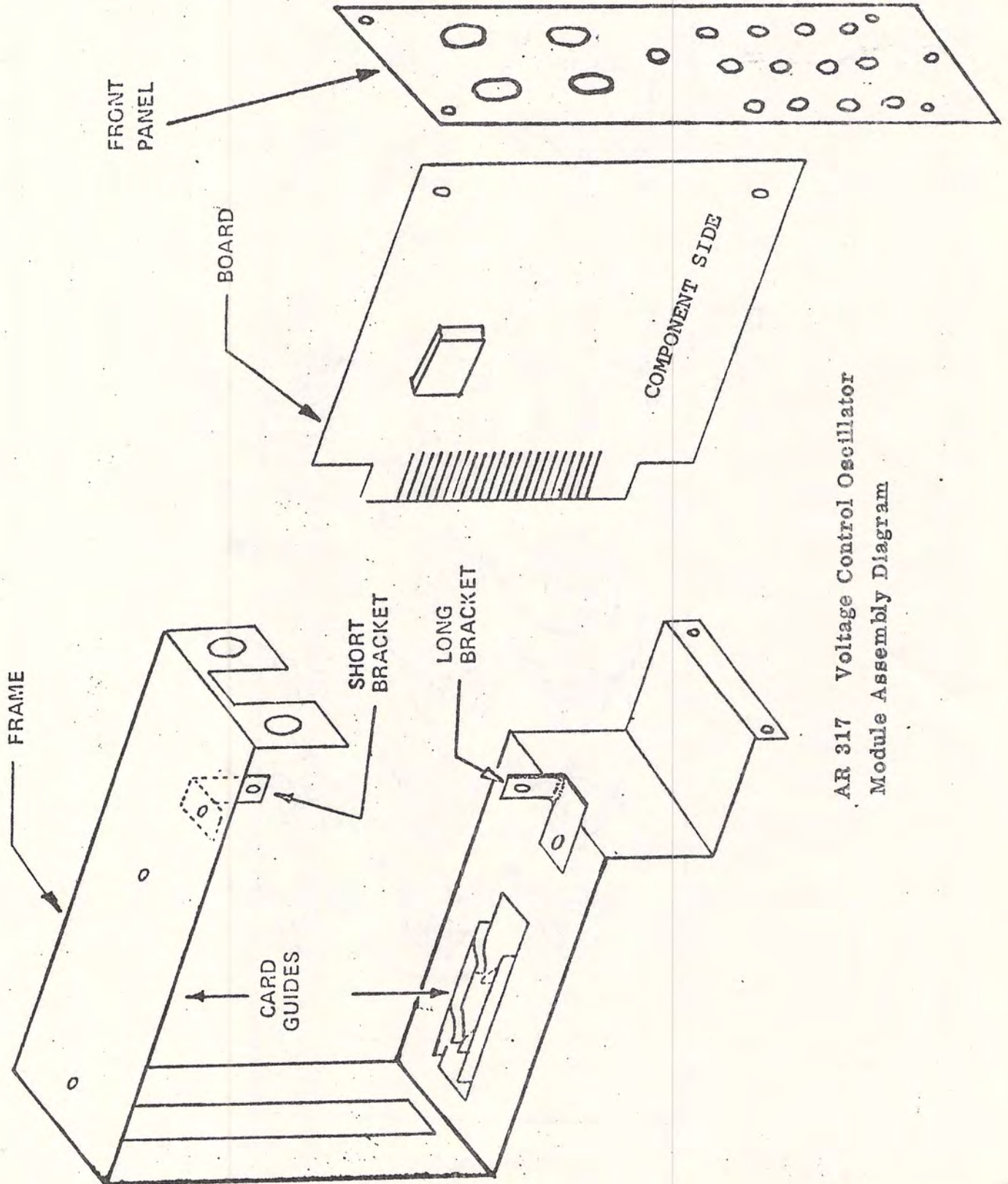
- ( ) 1. Run a wire from pin 1 of part "P1" to pin 1 of "P3" , and to the grounds of all 12 jacks as shown. You may use either separate pieces of wire or one continuous piece.  
**IN THE FOLLOWING STEPS, 2-5, USE INSULATED WIRE!**  
( ) 2. Cut a piece of wire to fit between "P1" pin 1 , and the point 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 I0 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.

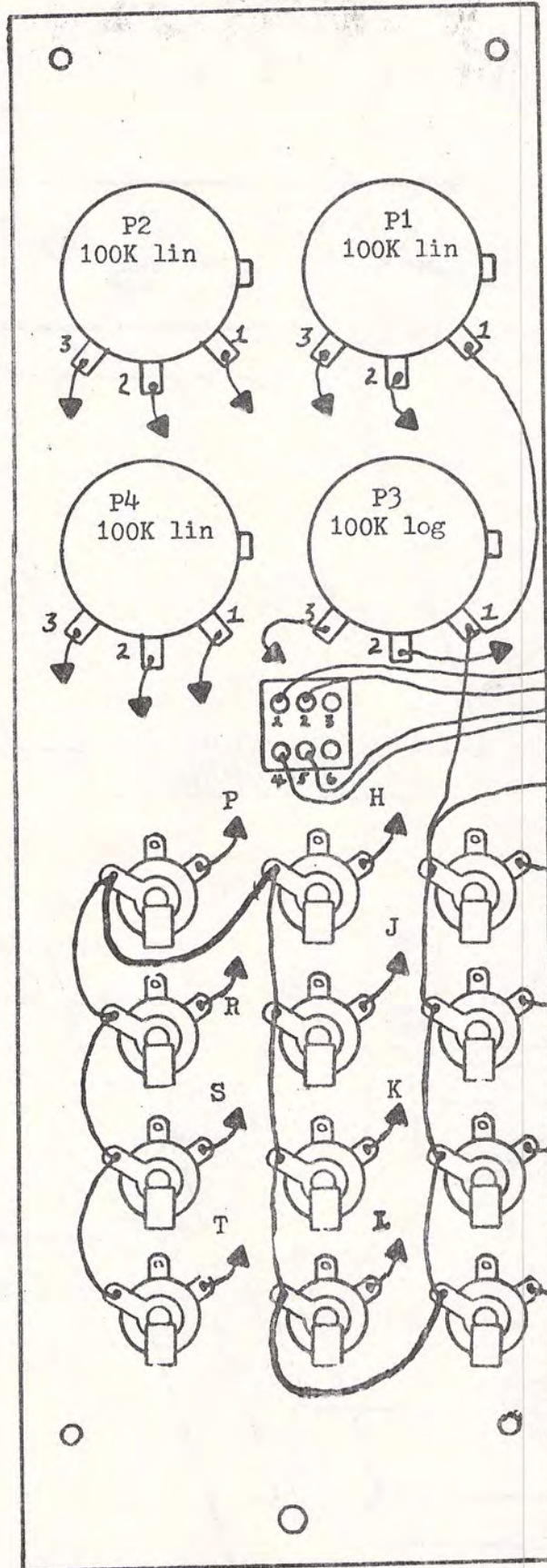
As an option, if LINEAR frequency modulation is desired, you may connect one of these jacks (left unused in previous step) to an additional 330k resistor (not supplied), and the other end of this resistor to R70, at the side where R70 goes into the potted block on the board.

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





AR 317 Voltage Control Oscillator  
Module Assembly Diagram



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 U2 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 R20 and R19 are identical (1k 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 through R13 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 pin 2 will be the same as the polarity of the triangle wave 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 asymmetrical. 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 pins 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 rise 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 synchronizing 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.

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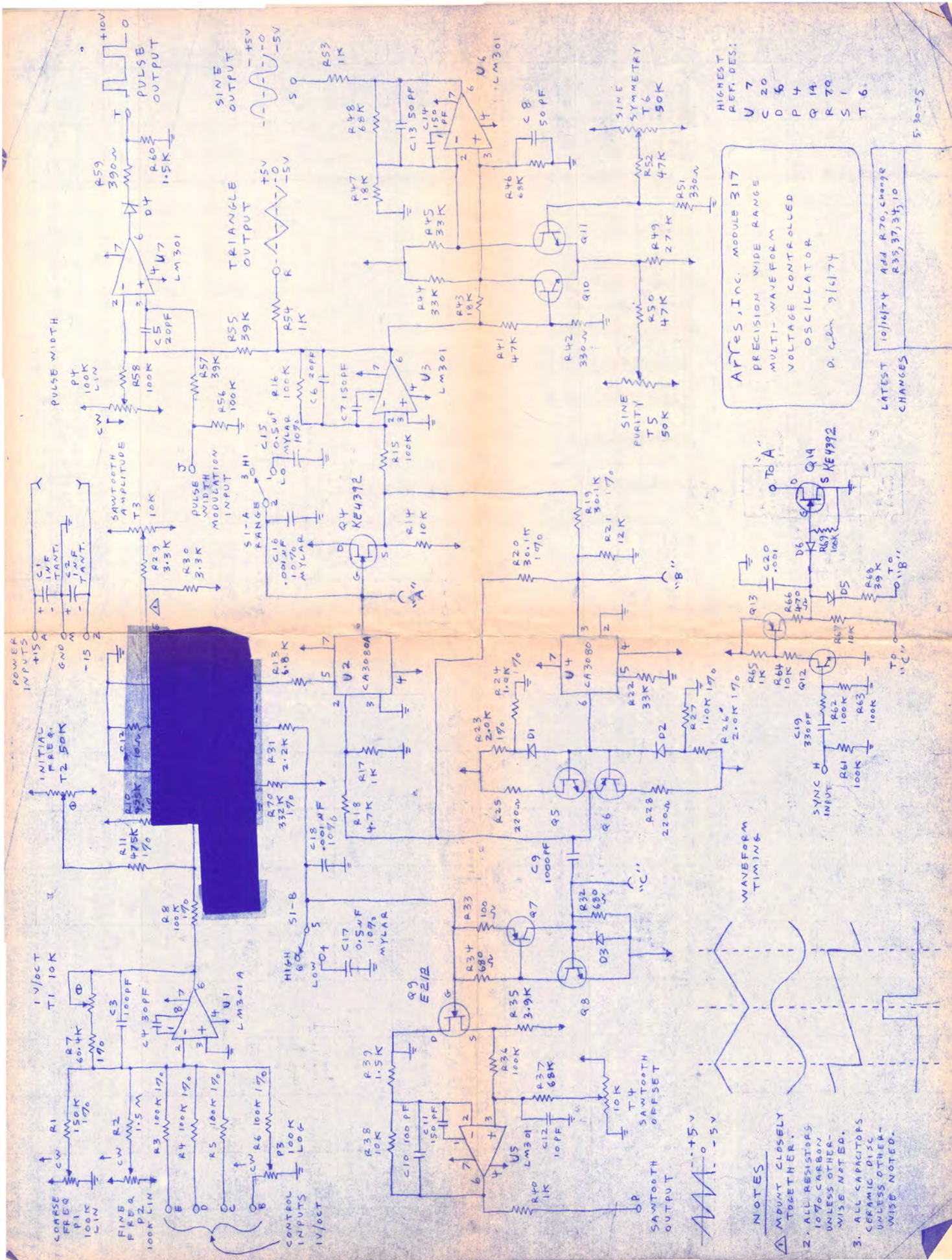
The magnitude of this current (pin 6 of U2) is identical to the current injected into pin 5. To accurately preserve the linear relationship of 1 volt per octave at the input to the VCO, it is necessary to convert the linear input voltage levels into an accurate exponential current which flows through R13 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.

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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 VFO 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.



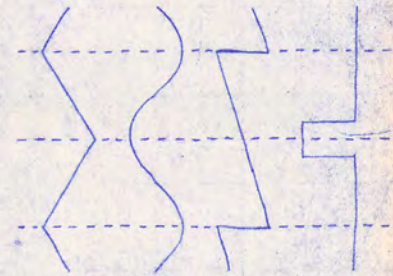
HIGHEST REF. DES:  
 V 7  
 C 20  
 D 6  
 P 4  
 Q 14  
 R 79  
 S 1  
 T 6

APRES, INC. MODULE 317  
 PRECISION WIDE RANGE  
 MULTI-WAVEFORM  
 VOLTAGE CONTROLLED  
 OSCILLATOR  
 P. 6-28 9/6/74

LATEST CHANGES  
 10/16/74 ADD R70, change  
 R35, 37, 38, 10

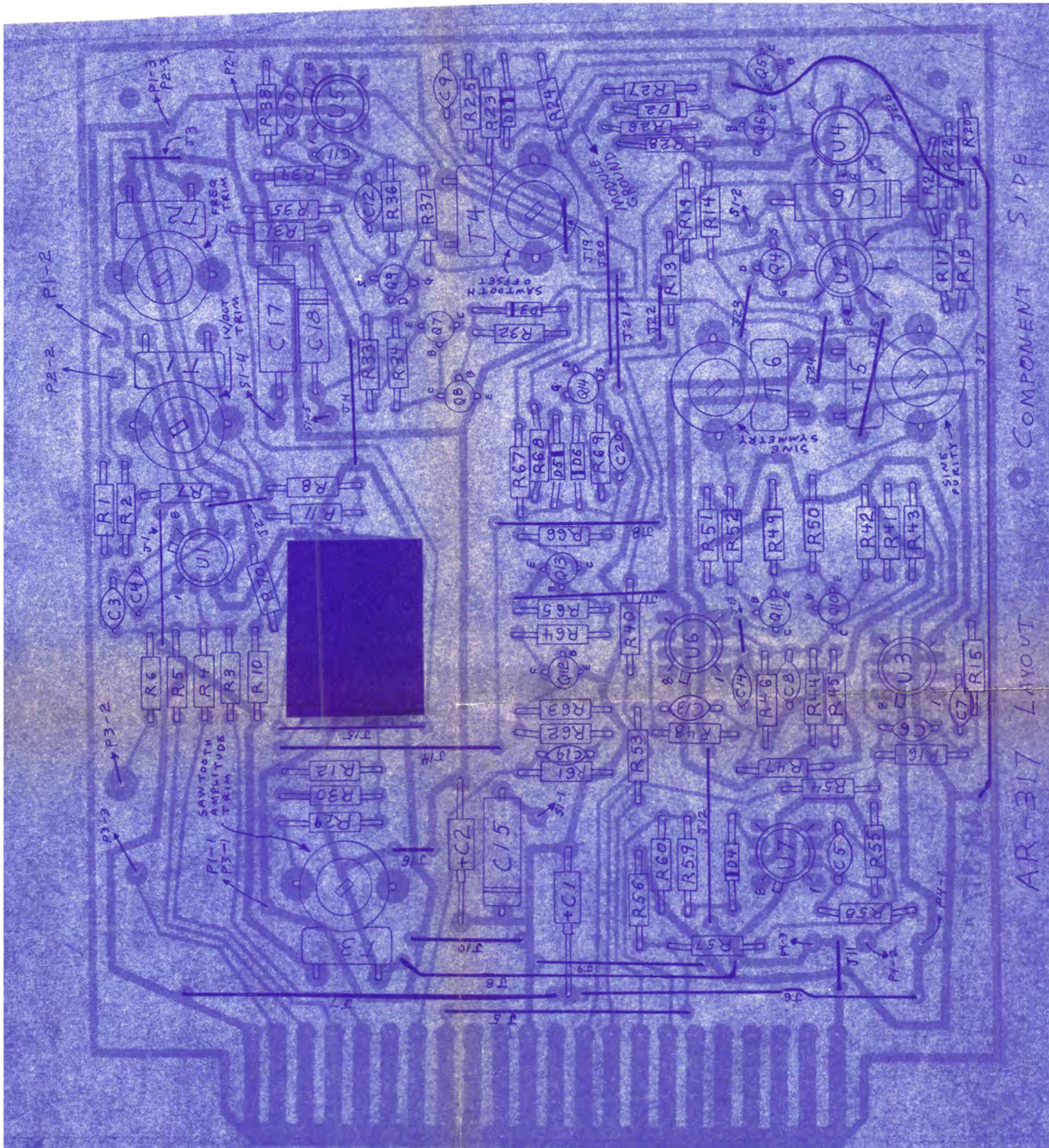
5-30-75

WAVEFORM TIMING



- NOTES
1. ADJUST CLOSELY TOGETHER.
  2. ALL RESISTORS 10% CARBON UNLESS OTHERWISE NOTED.
  3. ALL CAPACITORS CERAMIC DISC UNLESS OTHERWISE NOTED.





AR-317 LAYOUT COMPONENT SIDE

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 R35, 36, 37, 38 40, 43, 57, 58, 59	19	" "	100k, 10%
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 31g  
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.

( )

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

( )

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.

( )

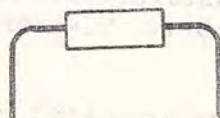
3. Resistors

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

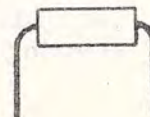
To avoid breaking the resistors leads, bend the leads at least 1/16 of an inch away from the body of the resistor.

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.

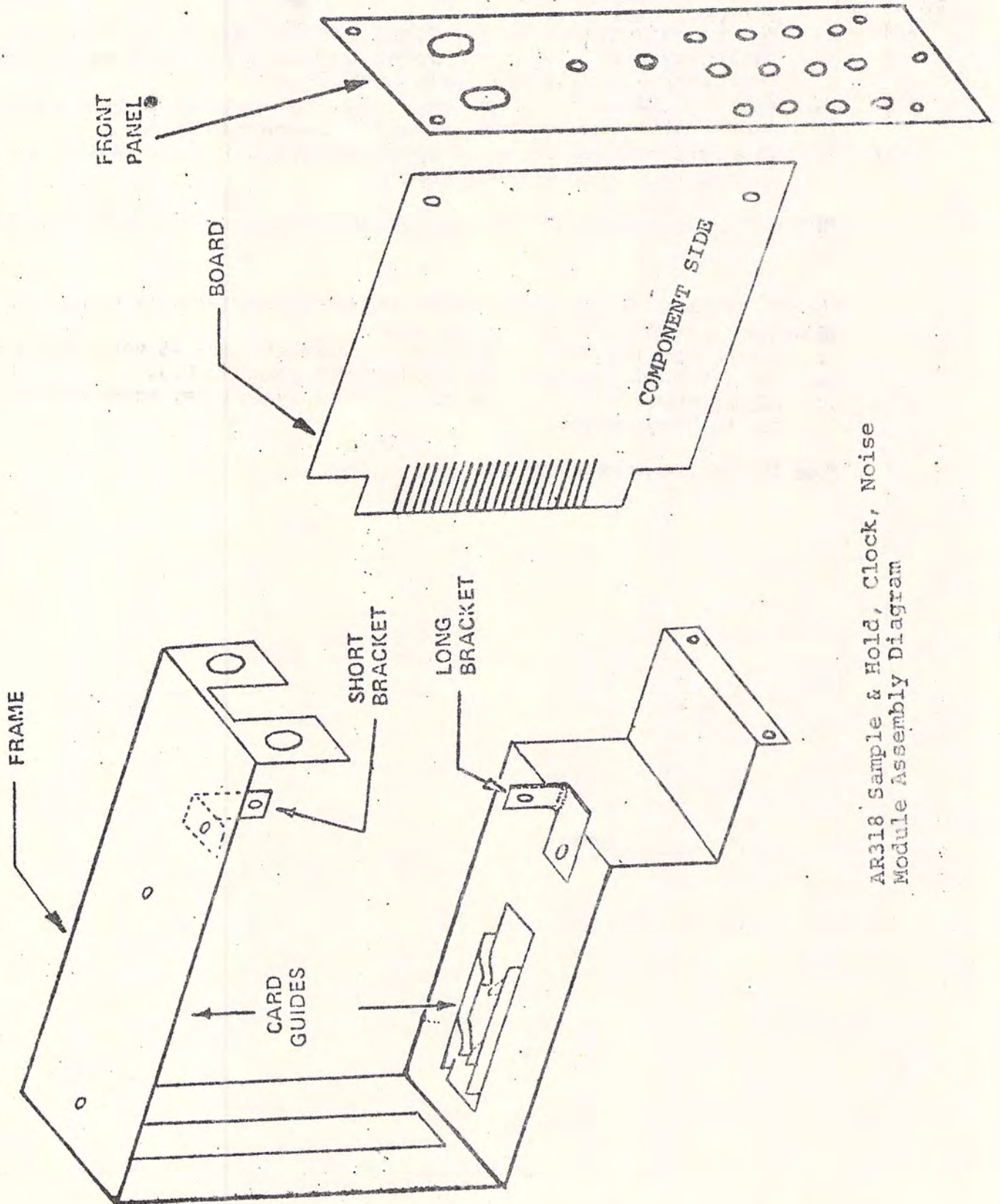
- ( ) 1. Run a wire connecting the grounds of all 12 mini-jacks, as shown, and from there to the point on the board labelled M on the assembly drawing.
- ( ) 2. Run a wire connecting pins 1,2,and 3 of each pot on the panel to the appropriate point on the board as labelled on the assembly drawing. Wire 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.

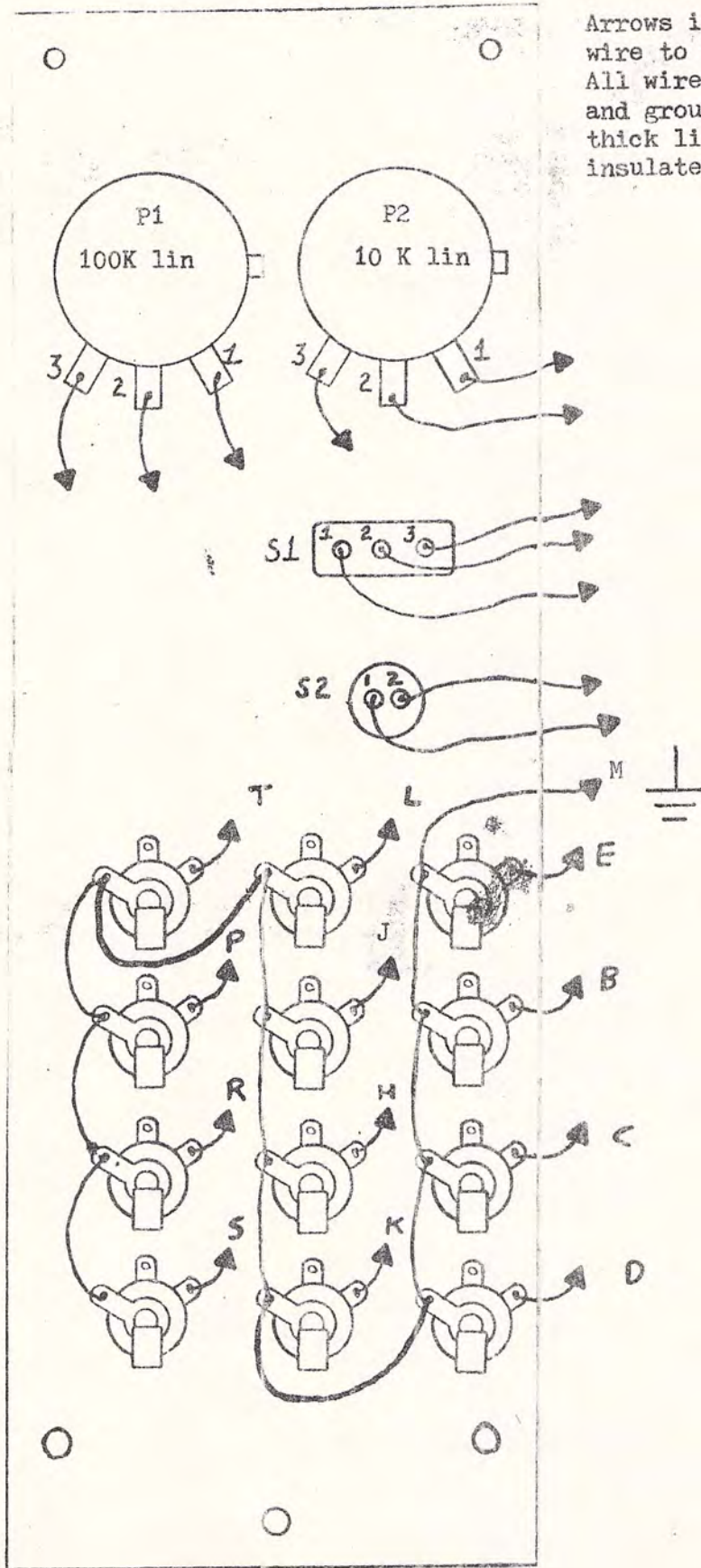
1. Connect the module to a properly regulated + and - 15 volt supply.
2. Set the Clock frequency pot on the front panel to 0.3.
3. Adjust trim pot T1 for approximately one cycle every three seconds at the Clock output.

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



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

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

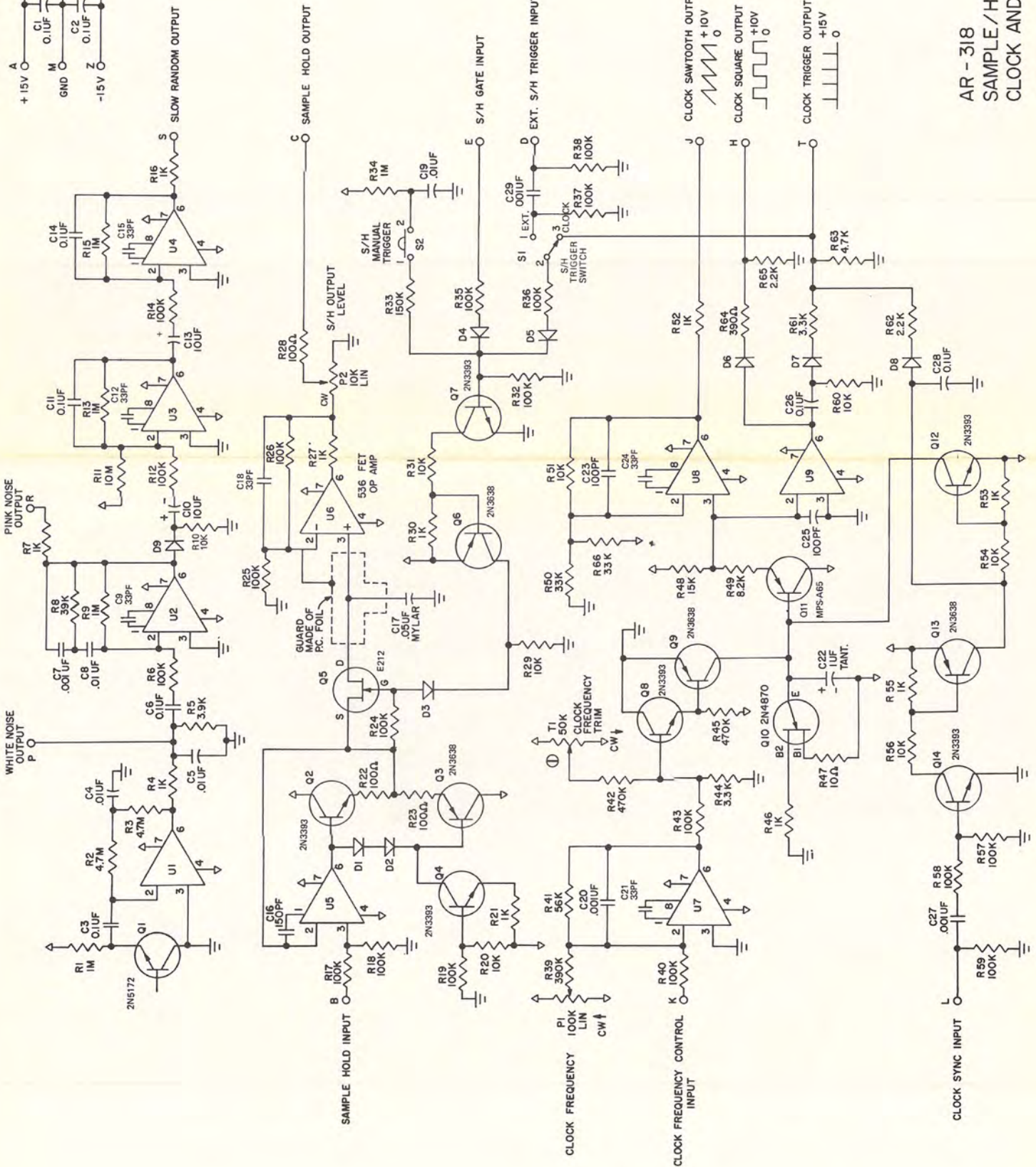
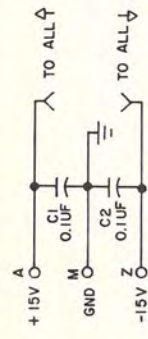
This is basically a voltage controlled sawtooth oscillator. U7 sums voltages from the CLOCK FREQUENCY control (P1) and any control input present. The inverted sum is attenuated by R43 and R44, and applied to Q8 and Q9, which form an exponentially controlled current source. The current is trimmed to the 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.

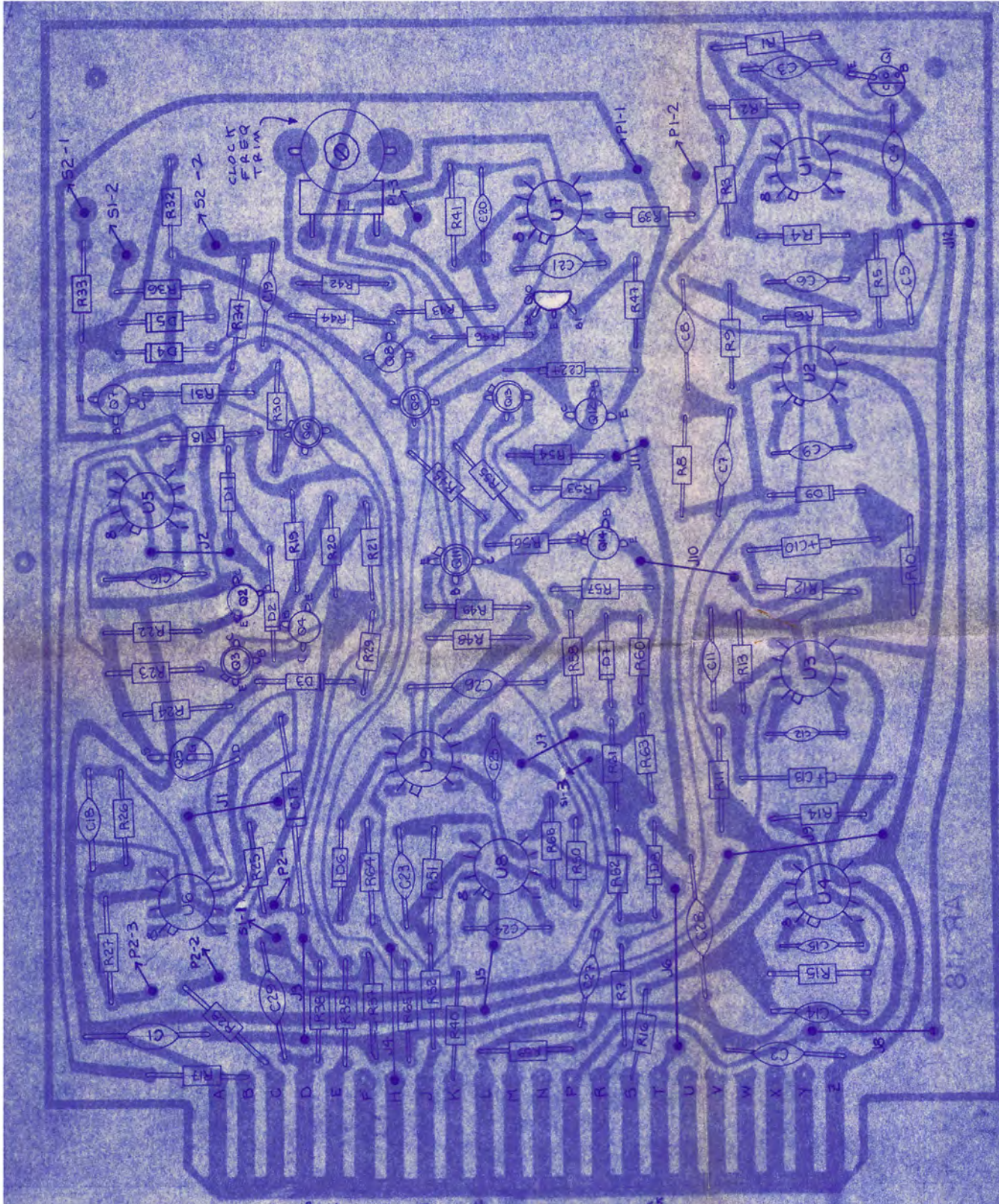


- NOTES:
1. ALL OP AMPS (U1 - U9) EXCEPT U6 ARE LM301A.
  2. ALL RESISTORS ARE 1/4W 10% CARBON.
  3. ALL DIODES ARE SILICON 1N4148

HIGHEST REFERENCE DESIGNATION:

C29 Q14 T1 U9   
 D9 R66 S2   
 P2

AR - 318  
 SAMPLE/HOLD,  
 CLOCK AND NOISE GENERATOR



12 JUMPERS

AR-318 5/H CLOCK, NOISE GEN  
COMPONENT SIDE



817 RA

ARIES MUSIC SYNTHESIZER\* SYSTEM 300

CASE

AR-320 KEYBOARD ASSEMBLY

Refer to Case Assembly Drawing (exploded view)

NOTE: IT IS RECOMMENDED, but not necessary, to assemble the case around the keyboard.

( ) 1. Locate FRONT BASE ( long piece of wood with 2 rounded slots, and 3 holes on bottom). Fasten to front of keyboard with 3 large machine screws. NOTE: rounded slots must be on bottom and pointing toward inside of keyboard.

( ) 2. Locate REAR BASE (same length as FRONT BASE, but not as wide, and with 2 slots but only 2 holes on bottom). Fasten to brackets on rear of keyboard with 2 large machine screws. NOTE: Rounded slots must be on the bottom, and pointing toward inside of keyboard.

( ) 3. Fasten FRONT RISER to FRONT BASE with 3 wood screws (see drawing).

( ) 4. Fasten REAR RISER to REAR BASE with 3 wood screws.

( ) 5. Fasten RIGHT END to right side of keyboard bases and risers. RIGHT END has 6 holes on side. Use only 6 wood screws for now.

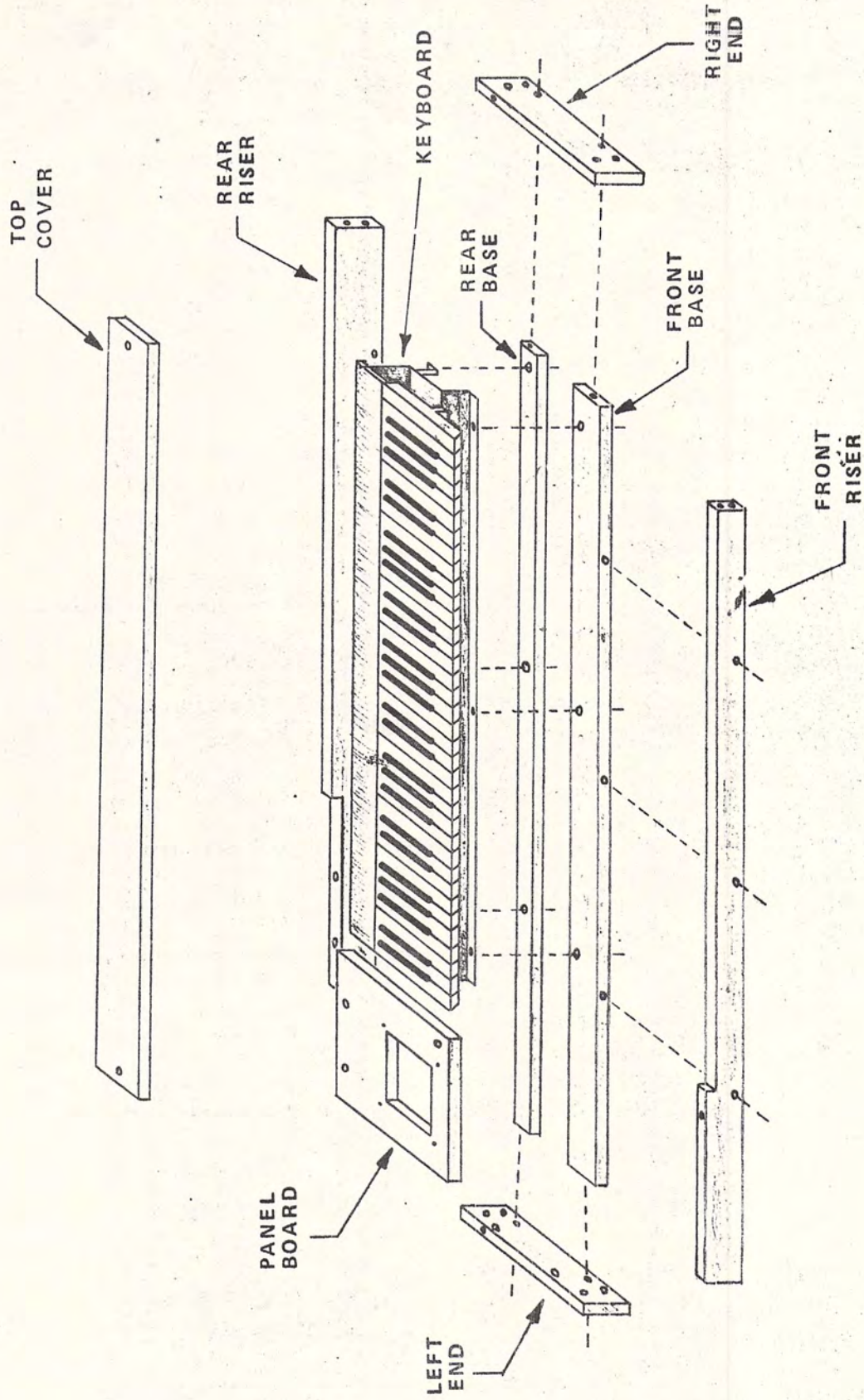
( ) 6. Fasten LEFT END similarly. LEFT END has 8 holes on side. Use only 6 wood screws for now.

NOTE: Before mounting PANEL BOARD, the panel of the AR-313 Keyboard Interface should be mounted. See Keyboard System Assembly (AR-311, AR-313, AR-320).

( ) 7. Place PANEL BOARD down in space at left of keyboard. Screw down with 3 wood screws, and also use 2 screws through LEFT END.

( ) 8. Fasten down TOP COVER (holes bevelled on top) with 2 wood screws.





ARIES AR-311 KEYBOARD & AR-320 KEYBOARD CASE ASSEMBLY

ARIES MUSIC INC.\* AR-321 HEX ATTENUATOR MODULE \* PARTS LIST

---

NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
P1 thru 6	6	Potentiometer, 1/8" shaft	100K Linear
	12	Miniature phone jacks	
	6	Knobs, 1/8" shaft	
	1	Front Panel	

---

MODULE ASSEMBLE PROCEDURE

It is recommended that you do the following before you proceed:  
Find a place where you can work undisturbed through completion.  
Use adequate lighting.  
Wash your hands before starting to remove any contaminating oils and perspiration.  
As you proceed, check off each step with a pencil.

( ) 1. PREPARATION

Unpack the parts carefully and place them in a box so that they won't get lost.

Have the following tools nearby:

Pencil tip soldering iron, hot & tinned (solder coated).

Solder - Use only ROSIN CORE solder!

Small diagonal wire cutters.

Small wire strippers.

Small needlenose pliers.

Regular Pliers

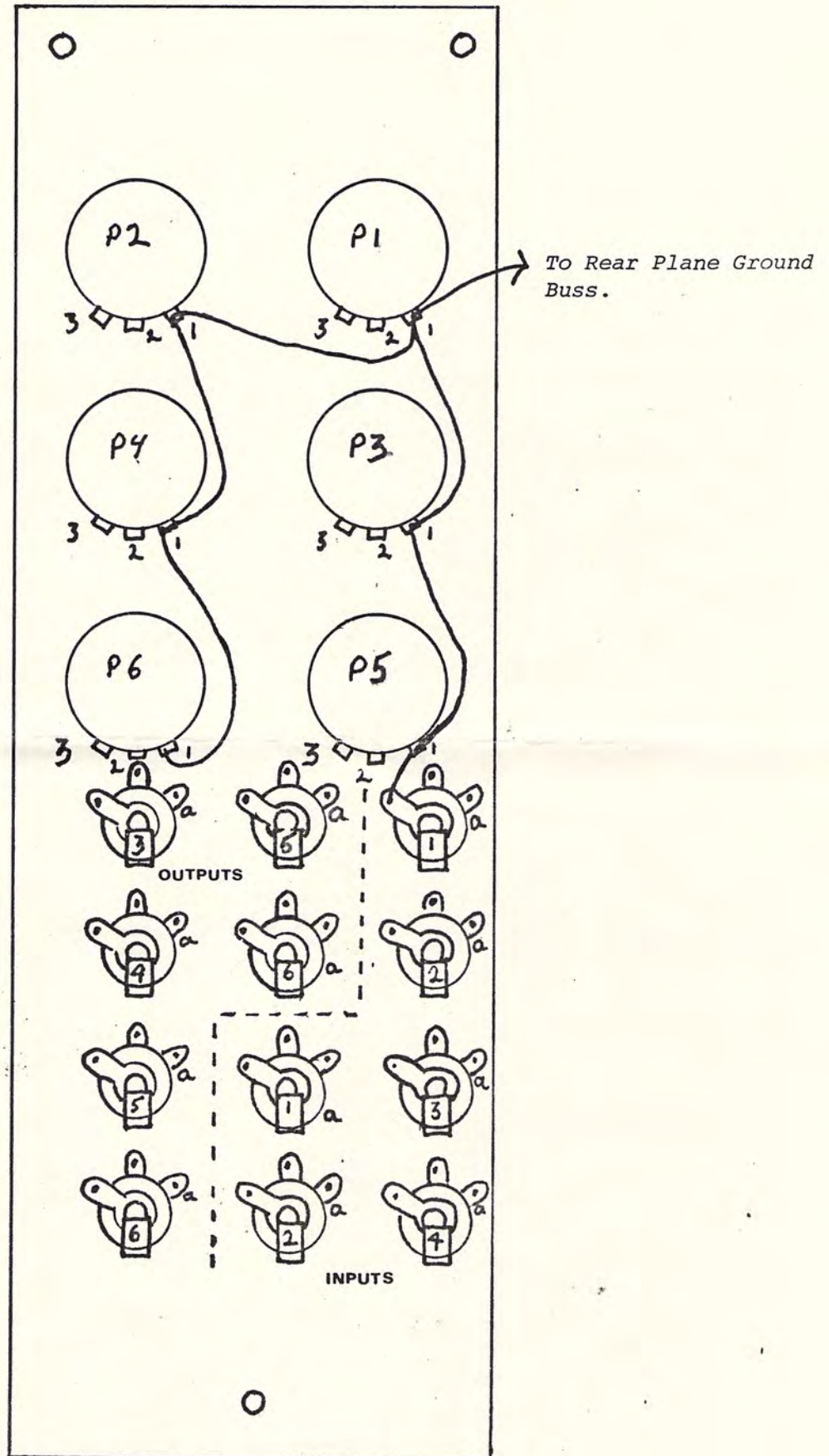
Flat blade screw driver.

Allen (hex key) wrench, 0.050"

PANEL ASSEMBLE AND WIRING

- ( ) 2. Mount the 6 potentiometers on the panel.
- ( ) 3. Mount the 12 miniature phone jacks on the panel.
- ( ) 4. Turn all the pot shafts fully counterclockwise, and mount the knobs pointing to the '0' panel marking. Tighten the set screws.
- ( ) 5. Using insulated wire, connect the ground terminal of one of the miniature phone jacks to Pin 1 of any of the pots (refer to the module wiring diagram). Then connect all Pin 1's on the pots together, as shown, and run a single wire from one of these to the ground buss on the rear plane connectors.
- ( ) 6. Run an insulated wire from P1 terminal 3 to Input jack 1 terminal a. Repeat this procedure for each of the 6 pots.
- ( ) 7. Run an insulated wire from P1 terminal 2 to Output jack 1 terminal a. Repeat this procedure for each of the 6 pots.

The AR-321 is now ready to be installed in your cabinet.



PARTS LIST \* ARIES MODULE AR322 \* POWER SUPPLY

NUMBER	QUANTITY	DESCRIPTION	VALUE & RATINGS
T1	1	Power Transformer	
D1, D2, D3	3	Bridge Rectifier	
C1, C3	2	Capacitor, 3750 mfd at 75v	
C5	1	Capacitor, 32,900 mfd at 20v	
C2, C4, C6	3	Capacitor, 22 mfd at 20v or more	
IC 1	1	Regulator, +15v	LM 340-15K
IC 2	1	Regulator, -15v	LM 320-15K
IC 3	1	Regulator, +5v	LM 309K
F1	1	Fuse, 4 amp at at least 125v	
J1	1	Connector, 4 pin	Cinch-Jones S-304-AB
P2	1	Connector, 4 pin	Cinch-Jones P-304-CCT
J2, J3, J4	3	Connector, Octal Socket	Amphenol 78S8W-0125
P2, P3, P4	3	Connector, Octal Plug	Amphenol 86CP8
	3	Connector Cap for Octal Plugs	Amphenol 324
	1	Circuit Board	Aries #1168a
	1	Fuse Holder	
	1	Line Cord	
	2	Heat Sinks	
	8	1/2" Hex Spacer for 6-32	
	16	6-32 X 1/4" Machine Screw (for mounting heat sinks)	
	11	6-32 X 1/2" Machine Screw	
	11	6-32 Hex Nut	
	4	8-32 X 3/4" Machine Screw (for mounting transformer)	
	4	8-32 Hex Nut	
	3	#6 Solder Lug	
	2	Fiber Shoulder Washer	
	1	Mica TO-3 insulator	
	3	TO-3 IC Socket	
	2	#4 X 1/2" Woodscrew	
	2	Angle Mounting Brackets	
	5 ft.	Hookup Wire 22AWG or heavier	

## Power Supply Assembly Instructions

Begin by reading the System 300 General Assembly instructions to become familiar with the parts and procedures used in assembly of this kit. 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.

Work on a light colored surface.

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.

- ( ) 1. Preparation: 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 (nutdrivers are a help)
  - Flat blade screw driver
- ( ) 2. Unpack the parts carefully and place them in a large box or tray so they won't get lost.
- ( ) 3. Familiarize yourself with the parts provided and check them against the parts list. Identify the positive sides of the capacitors and the positive leads on the diode bridge assemblies. Also examine the integrated circuits and identify the three connection points for each: pin 1, pin 2, and the case.
- ( ) 4. Examine the circuit board. Notice that the board has printed circuit foil on only one side. This side of the board will be referred to as the "foil" side. In assembling the 322 you will mount most of the components on the plain other side, which will be referred to as the "component" side. In this way, the component leads will extend through the board and be soldered to the foil. Notice, however, that the heat sink assemblies mount to the foil side of the board.
- ( ) 5. Mount capacitors C1, C3, and C5 onto the component side of the board. Note that C5 is different from C1 and C3, and is mounted between the latter. Also notice the polarity of the capacitors, matching the "+" on the capacitors to those on the board. Capacitor mounting and connections are accomplished by the same screws. Be sure to tighten these screws firmly for good electrical connection as well as solid physical mounting.

- ( ) 6. Using 6-32 screws and nuts, mount the 4-pin socket (J1) on the circuit board in the orientation shown on the layout diagram. The socket surface and the mounting flanges should be on the foil side of the board with the body of the socket inserted into the square hole. This will put the 4 solder tabs on the component side of the board.
- ( ) 7. Using a 6-32 screw and nut, mount the fuse holder (F1) on the component side of the board.
- ( ) 8. Insert the 4 amp fuse into the fuse holder.
- ( ) 9. Using 4 8-32 screws and nuts, mount the power transformer on the board oriented so that the blue, orange and yellow "secondary" wires are on the side of the transformer away from the fuse holder.
- ( ) 10. Insert the ends of the orange pair of transformer wires through the two small holes on the board marked "O" and solder them. It does not matter which orange wire goes to which "O" solder point on the board. The wires may be shortened for better appearance if desired, but leave enough length for moderate slackness.
- ( ) 11. Solder the two blue wires to the points marked "B" in the same way.
- ( ) 12. Similarly, solder the two yellow wires to the points marked "Y".
- ( ) 13. Solder the 3 diode bridges D1, D2, D3, to the board. BE SURE TO OBSERVE PROPER ORIENTATION: The lead marked "+" (on the top of the component) must be soldered to the point marked "+" on the board.
- ( ) 14. Take the end of the power cord without the plug and insert it through the 1/4" hole in the board near J1, so that the plug is on the foil side. Tie an overhand knot in the cord on the component side of the board, 1 1/2" from the end.
- ( ) 15. Separate the two wires of the power cord down to the knot and strip or trim to get 1/4" of bare wire.
- ( ) 16. Solder one of the power cord leads to one end of the fuse holder, as shown on the layout diagram. Clip any excess wire.

- ( ) 17. Solder the other power cord lead to pin 1 of the 4 pin socket J1. This is best done by tightly twisting the bare wires so they will pass through the hole in the solder tab. Pass the wire through the hole and then bend it around the tab. Now solder it.
- ( ) 18. Solder the black "primary" transformer lead to pin 4 of J1.
- ( ) 19. Solder the white "primary" transformer lead to pin 1 of J1. In this case, strip about 3/16" of insulation from the white lead and wrap the wire around the solder tab below the power lead. Solder.
- ( ) 20. Cut a piece of 22 gauge or heavier hookup wire, 2" in length. Strip about 3/16" of insulation off each end. Solder it between the free end of the fuse holder and pin 2 of J1.
- ( ) 21. Solder the three octal sockets, J2, J3, & J4, to the positions indicated on the layout diagram. BE SURE TO ORIENT THEM CORRECTLY: Pins 1 & 2 are +15v, Pins 3 & 4 are -15v, pins 5 & 6 are +5v, and pins 7 & 8 are ground. (In other words, check this very carefully.)
- ( ) 22. Using 8 of the 6-32 X 1/4" screws, mount the hexagonal spacers on the FOIL side of the circuit board. The feet of the heat sink assemblies will later bolt to these spacers.
- ( ) 23. Using 6-32 X 1/2" screws and nuts, install the LM309K and the LM-340-15K integrated circuits onto one of the heat sinks so that the pins protrude on the same side of the heat sink as its feet. The 6-32 nuts should also be on this side. Both of these integrated circuits have their cases at ground potential so no insulation is necessary between the cases and the heat sink. It is necessary to install a solder lug under the nut on one of the mounting screws of each I. C. for the "case" connection.
- ( ) 24. Press a "TO-3" I. C. socket onto each of the I. C. 's. Solder a 22 mfd capacitor between pin 2 of the socket (the positive side of the capacitor) and the solder lug "case" connection. BE SURE THAT THE POSITIVE (+) END OF THE CAPACITOR IS SOLDERED TO PIN 2. Keep the capacitor leads fairly short (about 1/2" to 3/4") so that the capacitor will be close to the heatsink and not touch the circuit board.

- ( ) 25. Mount the LM-320-15K on the other heat sink. In this instance, the case must be electrically insulated from the heat sink so it is necessary to install the thin mica insulator between them. It is also necessary to install insulating fiber shoulder washers between the nuts of the mounting screws and the heat sink in such a way as to ensure that the mounting bolts cannot touch the heat sink. Be sure that the small raised "shoulder" of the washer fits into the hole in the heat sink to keep the screw centered. The solder lug, of course, is installed between the fiber washer and the nut at one end of the integrated circuit.
- ( ) 26. Press the remaining I. C. socket onto the pins of the LM320-15K. This time solder the positive lead of the 22mfd capacitor to PIN 1 of the socket and the negative lead to PIN 2.
- ( ) 27. Using 22 Gauge wire or heavier, connect the solder lugs and 2 pins of each I. C. socket to the correct points on the circuit board as shown on the layout drawing. The wires should pass through the 1/4" holes in the board as shown, then the end of the wire should be stripped and pushed back through the board and soldered on the foil side.
- ( ) 28. Fold the excess wire and bolt the heat sinks to the outer ends of the hexagonal spacers already installed using the remaining 6-32 X 1/4" screws.

This completes the assembly of the power supply.

The supply should be tested before being connected to other modules. This can be done with a voltmeter at the voltage test points indicated near the output connectors. It will be necessary to make a temporary connection between pins 2 and 4 of the connector J1 to represent the power switch which is part of the AR326 module.  
CAUTION: remember that pins 2 and 4 may have 110v on them....

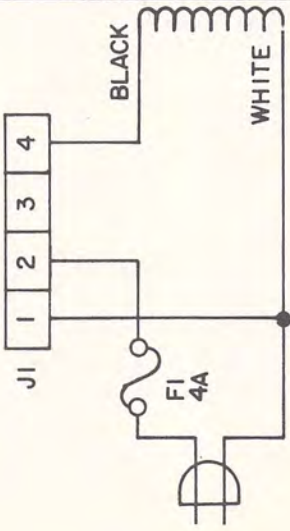
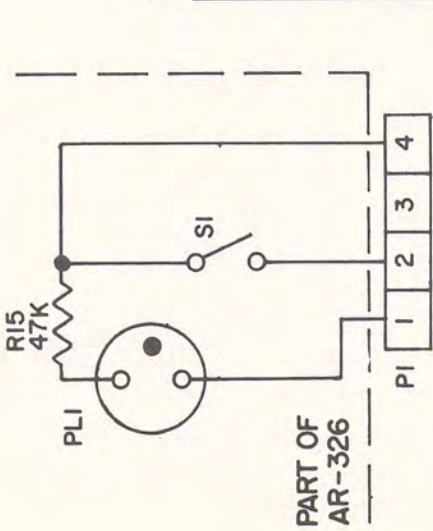
The power supply is normally operated on its side with the fins of the heat sink vertical for best air convection and cooling effect.

The power supply is mounted to the floor of the AR310 main cabinet using the remaining 6-32 screws and nuts, the angle brackets, and the #4 X 1/2" woodscrews. (Refer to the AR310 Cabinet drawing.) The heatsinks should be toward the rear of the cabinet. The circuit should be 1 7/8" in from the recess in the back edge of the floor of the cabinet. The transformer end of the circuit board should be 3" from the inside of the end of the cabinet.

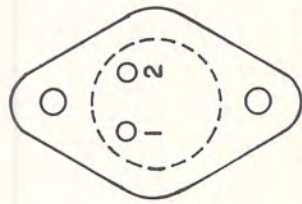


## POWER SUPPLY

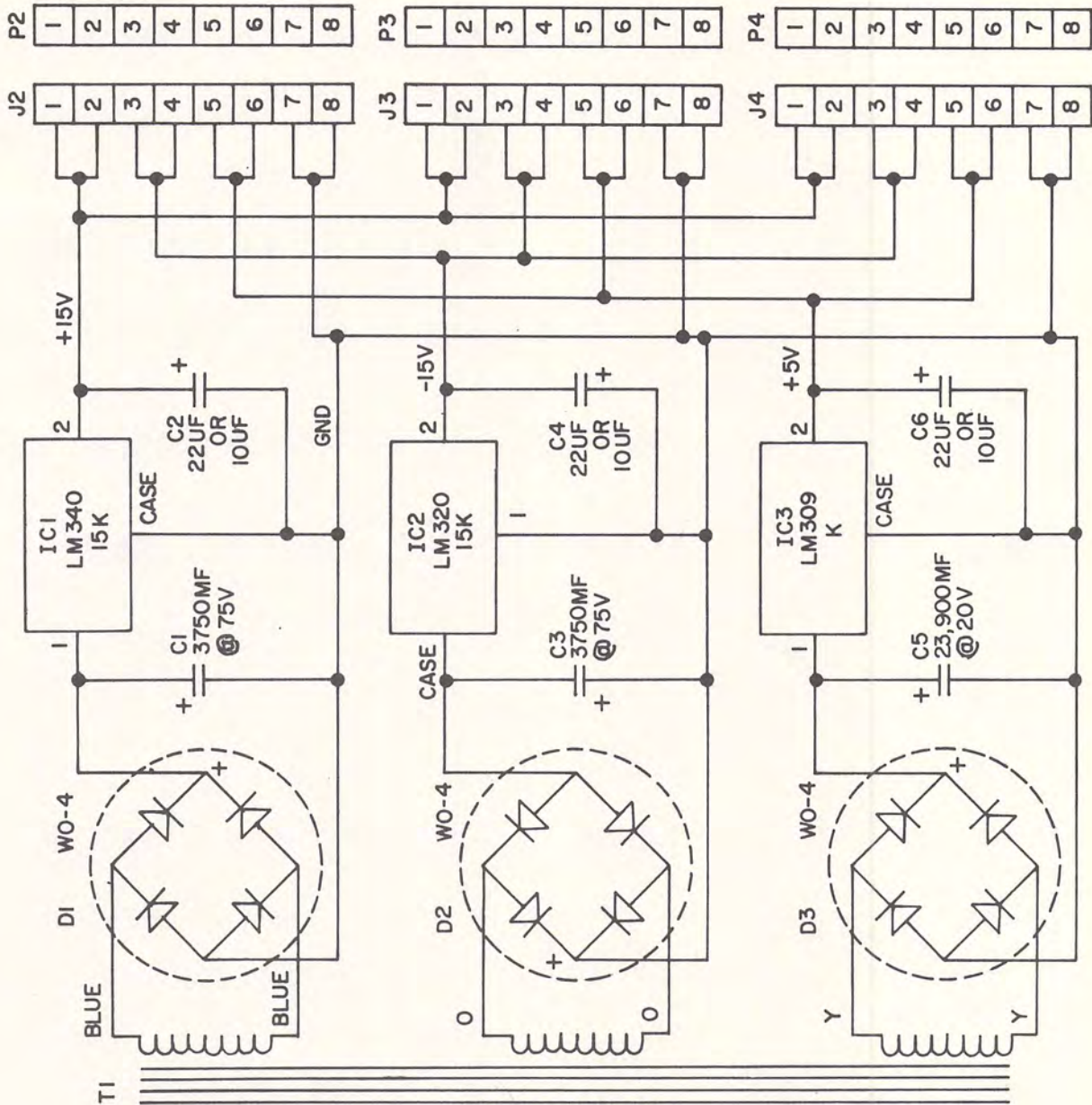
Current from the line voltage comes in through fuse F1 and switch S1. Transformer T1 steps down the voltage in 3 separate secondary windings. Each output is full-wave rectified and filtered by a large capacitor. 3 regulators provide outputs of +15 volts, -15 volts, and +5 volts to the 3 output connectors, which are all the same. Each output will supply up to 1 ampere.



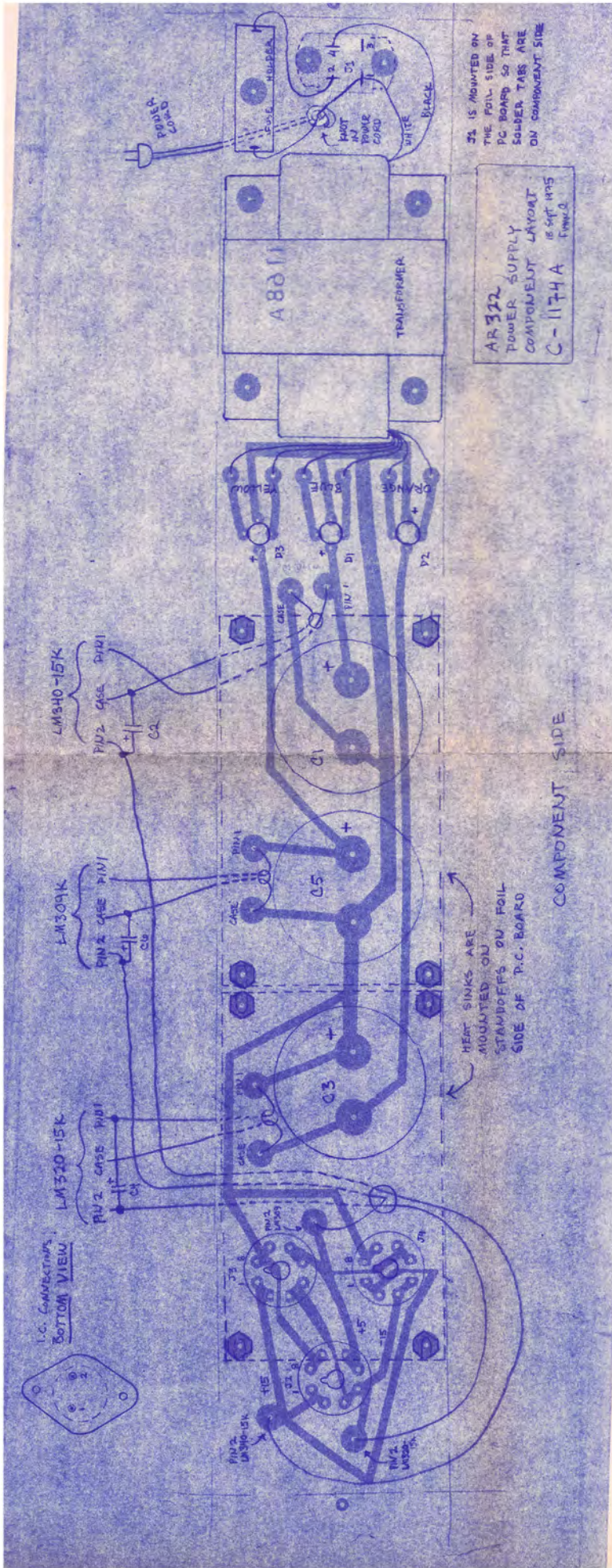
HIGHEST REFERENCE DESIGNATION:  
 C6 IC3 SI  
 D3 J4 T1  
 FI J4 P4



I.C. CONNECTIONS  
 BOTTOM VIEW



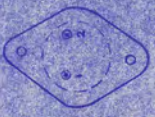
AR-322  
 POWER SUPPLY



32 IS MOUNTED ON THE FOIL SIDE OF PCB BOARD SO THAT SOLDER TABS ARE ON COMPONENT SIDE

AR 322  
POWER SUPPLY  
COMPONENT LAYOUT  
C-1174A  
16 SEP 1975  
P. 100.0

I.C. CONNECTORS  
BOTTOM VIEW



## PARTS LIST \* AR-323 \* DUAL MIXER

NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
C1,3,5,8,10,12	6	Capacitor, Disc	150 pf
C2,4,6,7,9,11	6	" "	33 pf
C13,14	2	" "	0.1 mfd at 50v
P1,2,3,4	4	Potentiometer	100k, linear
R1,2,3,4,5,7,8,9,10,	22	Resistor	100k, 5%
12,13,14,18 19,20,21,			
23,24,26,27,28,29			
R6,11,17,22	4	"	1k, 10%
S1,2,3,4	4	Switch, Toggle	SPDT
A1 thru A6	6	Operational Amplifier	LM301A
	12	Jack, Mini-Phone	
	1	Printed Circuit Board	
	1	Front Panel	
	4	Knob	
	1	Frame	
	2	Brackets (one long, one short)	
	2	P C Card Guides	
			lead
	6	Screw, 4-40 x 3/16"	
	6	Nut, 4-40	

ARIES System 300 Music Synthesizer  
Module AR 323  
Dual Mixer 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 Mixer. 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.

- ( ) 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

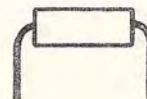
- ( ) 2. Jumpers  
Find jumper J1 on the drawing. Measure J1 on the PC board. Cut a piece of insulated wire one inch longer than J1 measures on the PC Board. Strip 1/2 inch of insulation from each end being careful not to damage the wire itself. Bend the bare ends to a right angle and insert into the holes on the board, according to the drawing. While holding the ends down against the board, 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.) Install J2 in the same way.

- ( ) 3. Resistors  
Carefully install all 22 resistors on the circuit board (R1 through R22). R23 through R26 will later be mounted on the panel. To avoid breaking the resistor leads, bend the leads at least 1/16 of an inch away from the body of the resistor.  
For example:

Correct



Incorrect



4. Capacitors  
Install all 14 capacitors on the board. (C1 through C14)
5. Integrated Circuit Amplifiers  
Install all 6 Integrated Circuit Amplifiers on the board.  
(A1 through A6)

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.

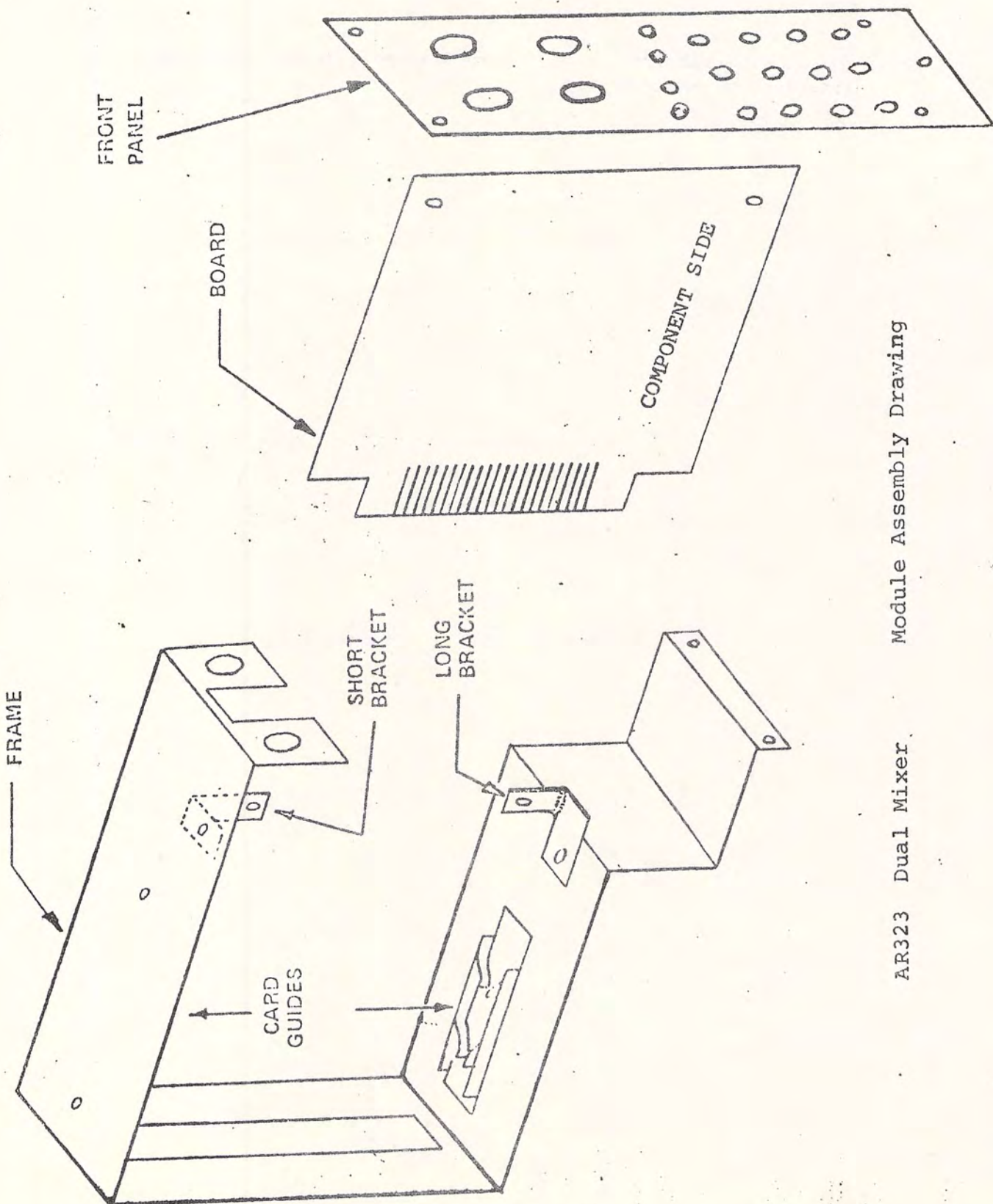
PANEL WIRING--Refer to panel wiring diagram and board assembly drawing.

1. Run an insulated wire connecting pins 1 of all four pots P1 through P4. Run a wire, now, from pin 1 of P2 to the grounds of all 12 jacks, as shown.
2. Connect a 100K resistor to pin 2 of all four pots, as shown. Solder an insulated wire to the unattached end of each resistor 1/16 of an inch away from the body of the resistor. Run the wires to the center terminals of the switches, connecting P1 to S1, P2 to S2, P3 to P3, and P4 to S4.
3. Run an insulated wire connecting the negative terminals of S1 and S2 together and from there to the appropriate point on the board labelled "A-" on the assembly drawing. Wire the positive terminals in the same manner.
4. Wire S3 and S4 as you did S1 and S2
5. Connect pins 3 of all four pots to the appropriate point on the board as labelled on the assembly drawing.

- ( ) 6. Wire all 12 jacks and pin 1 of P2 to the appropriate point on the board near the edge connector corresponding with the letters on the wiring diagram.

THIS COMPLETES ASSEMBLY OF YOUR AR323 DUAL MIXER.

There is no calibration or test procedure required. Your AR 323 Dual Mixer is now ready to use.



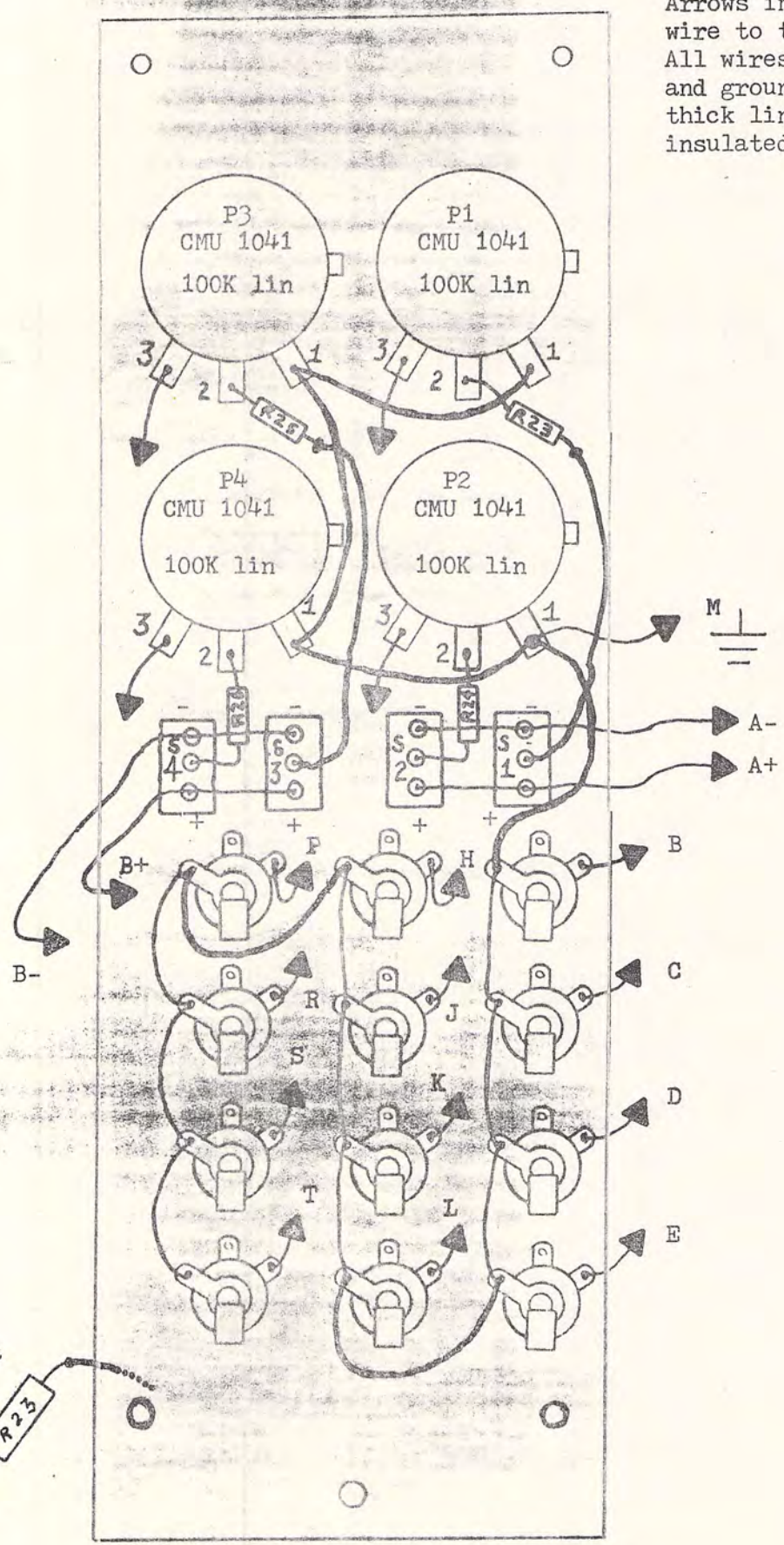
Module Assembly Drawing

AR323 Dual Mixer

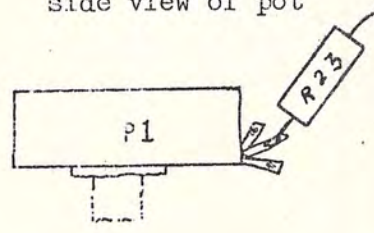


AR 323 DUAL MIXER PANEL WIRING DIAGRAM--rear view

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



side view of pot



## THEORY OF OPERATION AR-323

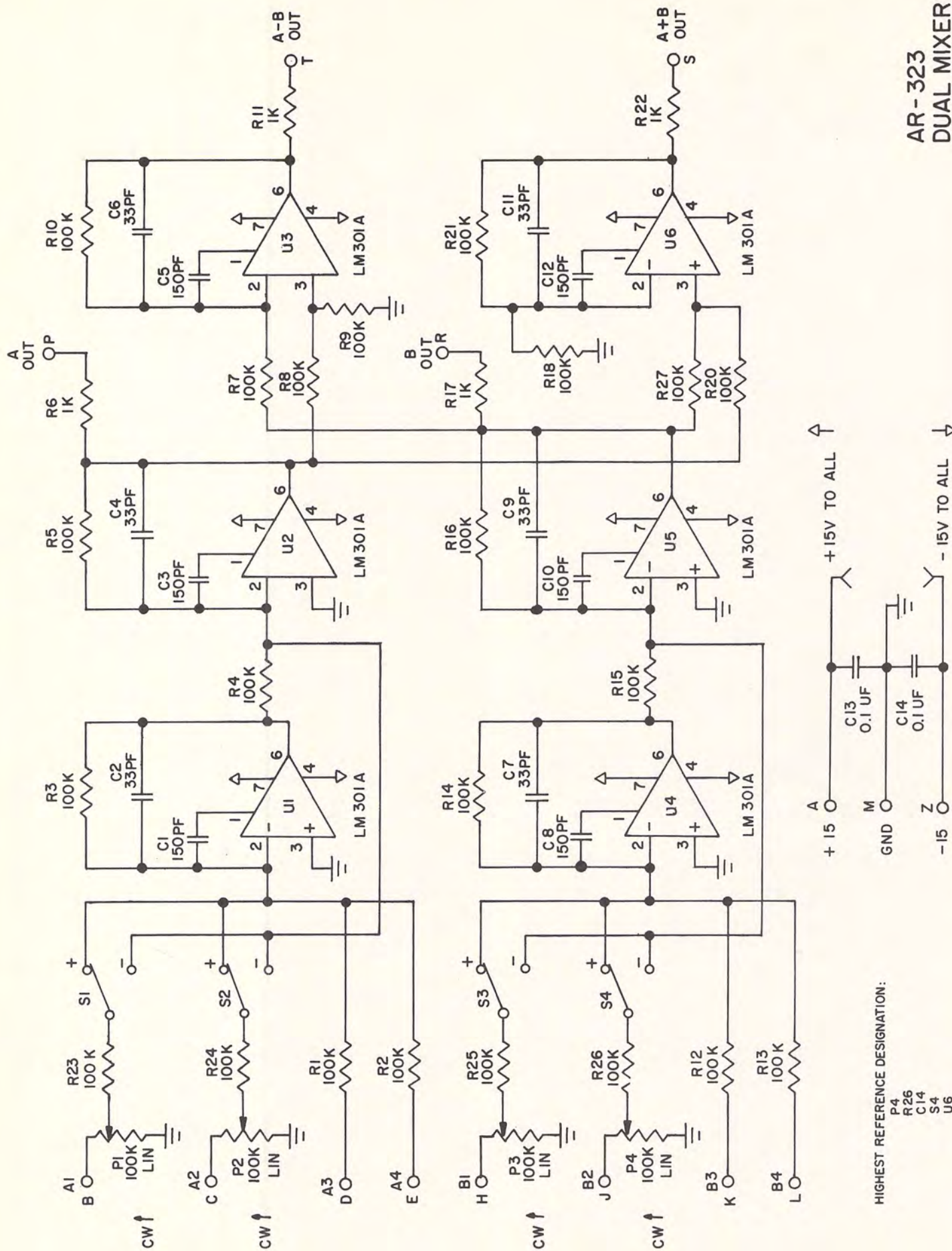
## DUAL MIXER

Signals from inputs A3 and A4 are mixed by R1 and R2 into A1, which inverts the signals. A2 re-inverts the signals to come out non-inverted again. A1 and A2, however, are first controlled in level (attenuated) by P1 and P2, and switch selected to go either directly into A2, in which case they come out inverted, or into A1, in which case they come out non-inverted.

Mixer B works the same way. Now, A3 is a differential amplifier which mixes the outputs of mixer A and mixer B, but B is inverted, while A is not. Thus, the output is A-B.

A6, on the other hand, is a non-inverting mixer which adds the two outputs from A and B to give A+B.

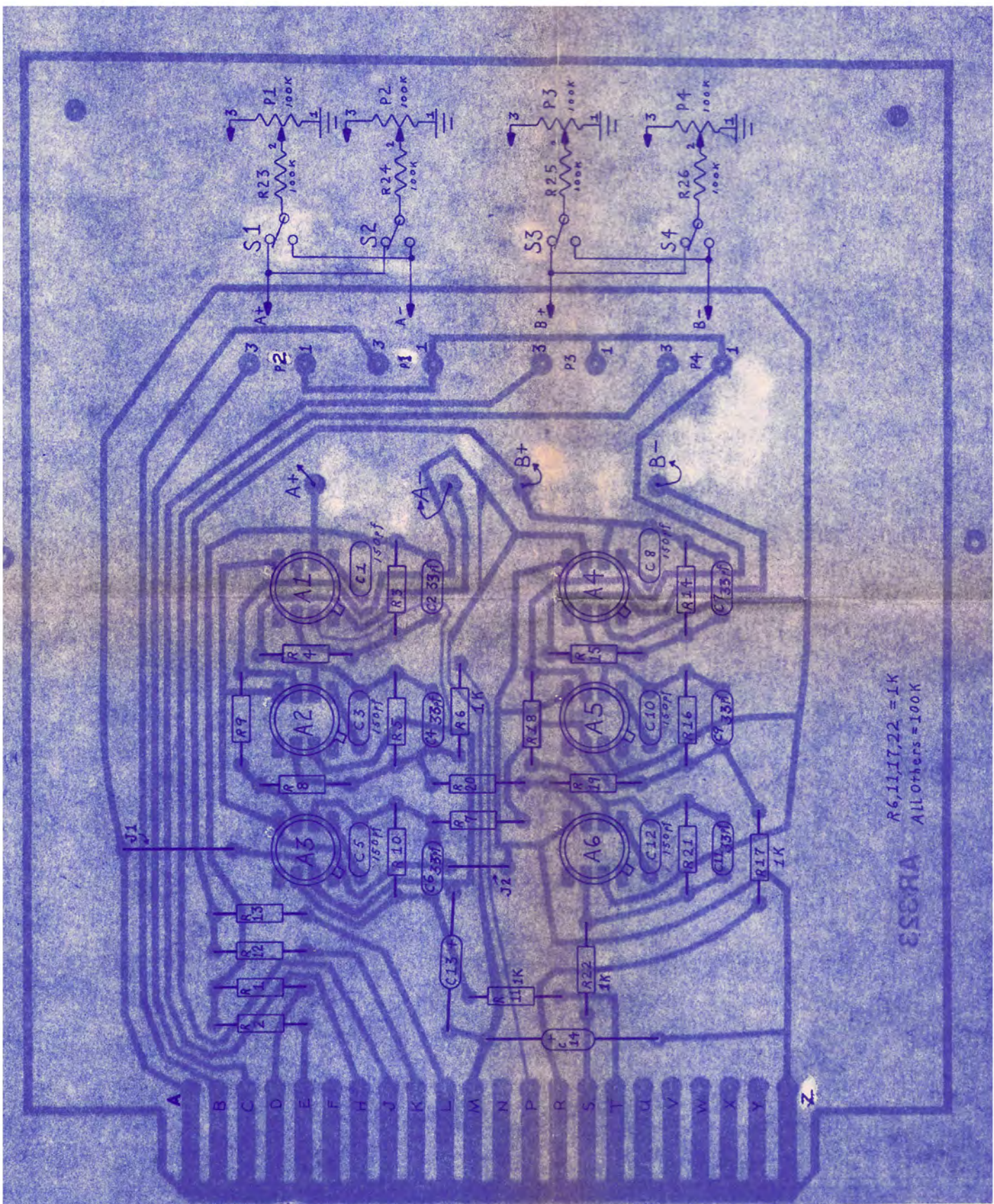
All 6 amplifiers are LM 301A op amps with feed-forward compensation (the 150 pf capacitor) for good high frequency response.



HIGHEST REFERENCE DESIGNATION:

- P4
- R26
- C14
- S4
- U6

AR - 323  
DUAL MIXER



R6,11,17,22 = 1K  
 All Others = 100K

CSERA

+15V

MIXER A INPUTS { A1 A2 A3 A4

MIXER B INPUTS { B1 B2 B3 B4

GROUND

OUT-PUTS { A B A+B A-B

-15V

## PARTS LIST \* AR-324 \* DUAL L.F.O., LAG, INVERTER

NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
NOTE: QUANTITIES FOR LFO PARTS ARE FOR 2			
C1,2	2	Capacitor, Disc	0.1 mfd, 25v
C3,9,11	5	Capacitor, Tantalum	1 mfd, 50v
C4,5,10,12,14	8	Capacitor, Disc	33 pf
C6	2	" "	0.001 mfd
C7,8	4	" "	0.005 mfd
C13	1	Capacitor, Disc	150 pf
D1 thru 6	12	Diode, Silicon	1N914, 1N4148 or equivalent
P1	2	Potentiometer, 1/4" shaft	100k, log
P2	1	" "	1 meg, log
P3	1	" "	100k, linear
Q1,4	4	Transistor, NPN	2N3393 or TE3393
Q2,5	4	Transistor, PNP	2N3638
Q6	2	Field Effect Transistor, N-Channel	E212 (Siliconix)
Q7,8	2	Transistor, Dual PNP	3347-1
R1,2,3,15,27,31	11	Resistor, Carbon	100k, 10%
R4,7	4	" "	10k, 10%
R5,16,19,21,29, 33,34	11	" "	1k, 10%
R6	2	Resistor, Carbon	470 ohm, 10%
R8,9,14	6	" "	47k, 10%
R10,	2	" "	10 ohm, 10%
R11	2	" "	100 ohm, 10%
R12	2	" "	680 ohm, 10%
R13,23	4	" "	2.2k, 10%
R17	2	" "	6.8k, 10%
R18,20,24	6	" "	15k, 10%
R22	2	" "	390 ohm, 10%
R25,26	4	" "	5.6k, 10%
R28	1	" "	1 meg, 10%
R30	1	" "	39 ohm, 10%
R32	1	" "	120k, 10%
T1	2	Trimpot	50k, linear
U1	2	Operational Transconductance Amplifier	CA3080 (RCA)
U2,3,4,5,6	8	Operational Amplifier	LM301A
Q3	2	Darlington Transistor	MPS-A65

PARTS LIST \* AR-324 \* (cont.)

QUANTITY

DESCRIPTION

---

12	Jack, Mini-Phone
1	Printed Circuit Board
1	Front Panel
4	Knob, 1/4" shaft
1	Frame
2	Bracket
6	Screw, 4-40 x 3/16"
6	Nut
2	P C Card Guides

## ARIES System 300 Music Synthesizer

## Module AR 324

## Dual LFO, Lag, Inverter 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 Dual LFO, Lag, Inverter module. 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.

- ( ) 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 long nose pliers

Regular pliers

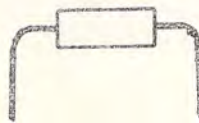
Flat blade screw driver

- ( ) 2. Jumpers  
Find jumper J1 on 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, 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 the introduction on parts installation.) Install J2 through J5 in the same manner.

- ( ) 3. Resistors  
(Remember that you will be assembling two LFOs and one Lag and one Inverter on the same board when you proceed with the following instructions.) Install all 62 resistors on the circuit board. First install R 101 through R 127, then install R 201 through R 227, then install R 28 through R 34. 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. Capacitors  
Install all 24 capacitors on the board. First install C 101 through C 110, then install C201 through C 210, then install C 11 through C 14. Be careful to observe polarity where indicated.
- ( ) 5. Diodes  
Install all 12 diodes on the board. First install D 101 through D 106, then install D 201 through D 206. Be careful to observe polarity where indicated.
- ( ) 6. Transistors  
Install all 8 transistors on the board. Be careful to maintain proper orientation of the leads.
- ( ) 7. Integrated Circuit Amplifiers  
Install all 10 Integrated Circuit Amplifiers on the board. First install U 101 and U201 labelled CA 3080. Observe proper orientation of the leads. Now install all other Integrated Circuit Amplifiers as indicated . ( U 102 through U104, U 202 through U 206)
- ( ) 8. Install all two trim pots on the board, as shown.

MODULE ASSEMBLY-- Please refer to Module Assembly Drawing

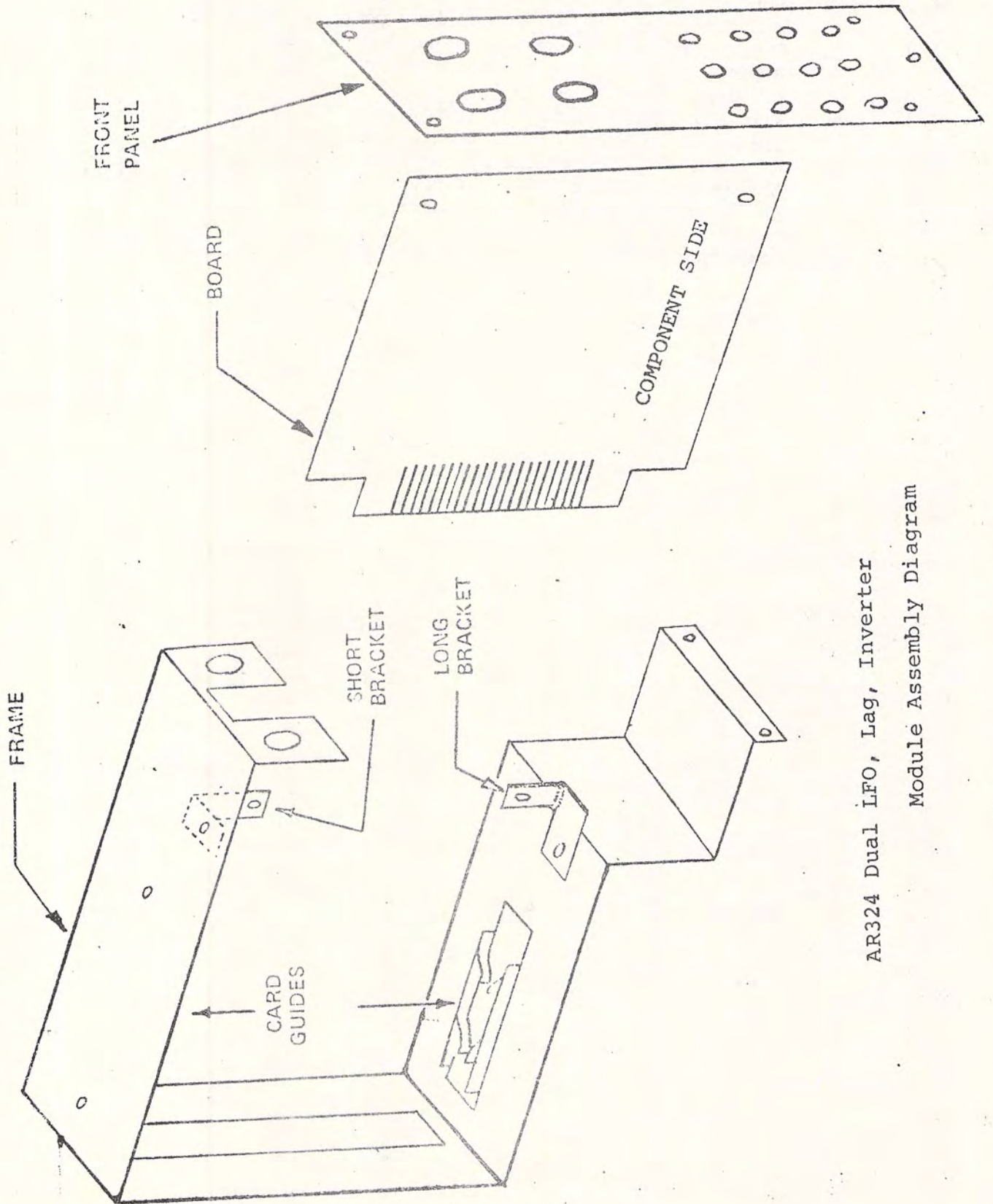
- ( ) 1. Unpack the frame, bag of hardware, and front panel.
- ( ) 2. Snap the two plastic card guides into the holes in the frame. Be sure that the pairs of tabs in the guides which hold the board point toward the rear of the frame. (The bottom one is shown installed in the drawing.)
- ( ) 3. Slide 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.



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

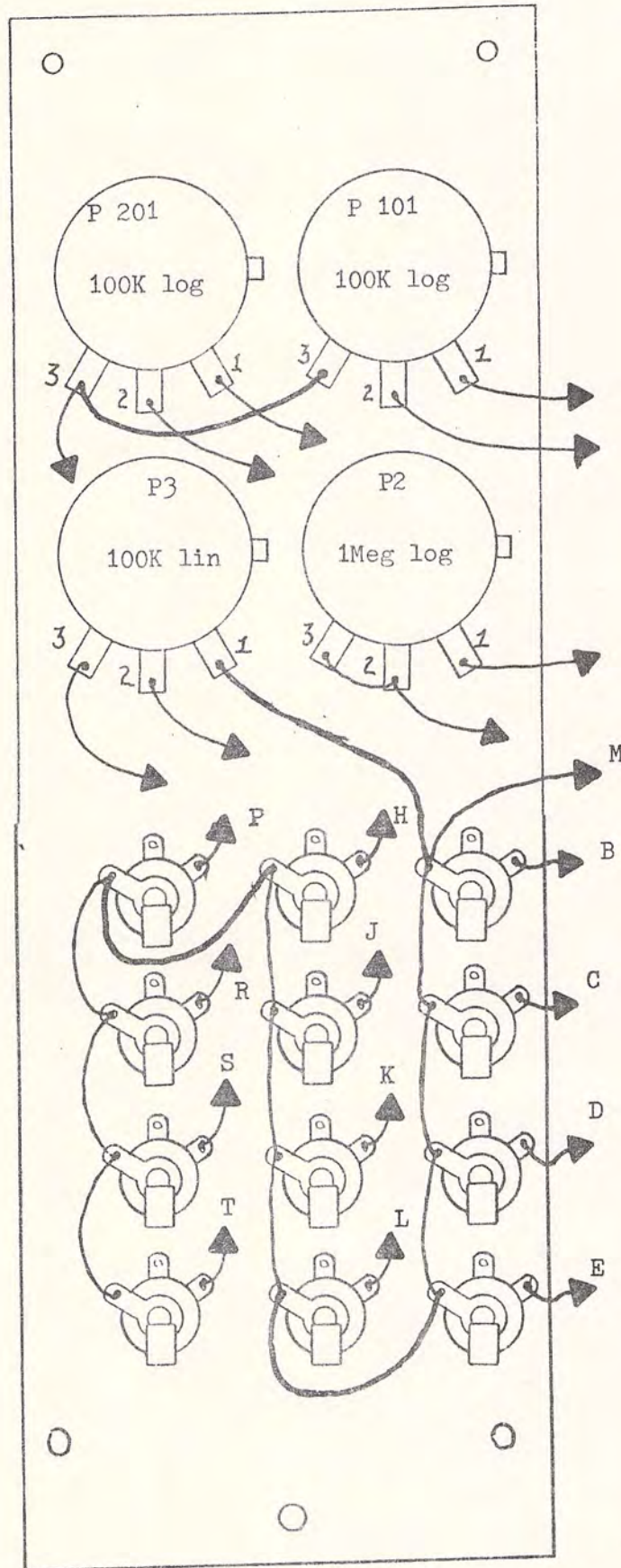
- ( ) 1. Run a wire connecting the grounds of all 12 jacks ,as shown.
- ( ) 2. Run an insulated wire from pin 3 of P 101 to pin 3 of P 201 and from there to the appropriate point on the board.
- ( ) 3. Run a wire connecting pins 2 and 3 of P2 and from there to the appropriate point on the board as indicated on the assembly drawing.
- ( ) 4. Wire all four pots to the appropriate points on the board as indicated on the assembly drawing. Wire one at a time.
- ( ) 5. Wire all 12 jacks to the appropriate point s on the board near the edge connector which correspond with the letters indicated on the wiring diagram. Wire one at a time.

THIS COMPLETES ASSEMBLY OF YOUR AR 324 DUAL LFO, LAG,AND INVERTER,



AR324 Dual LFO, Lag, Inverter  
Module Assembly Diagram

AR 324 Dual LFO, Lag, Inverter Panel Wiring - Rear View



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

NOTE:

Jacks with arrows are wired to holes in the board on the connector strip.

## AR324 Dual LFO, lag, inverter trim procedure

Your AR324 requires only one trim on each LFO, and this is best done with an oscilloscope with DC vertical amplifier. However, with a slow frequency setting, a good approximation can be achieved with a fast voltmeter, or by ear using the LFO to control something on the synthesizer.

1. monitor the LFO sawtooth output with the scope
2. Set the frequency pot at 3
3. Adjust the trim for a 10 volt sawtooth waveform  
(this should be approx. 0v to 10 v)
4. Do the same for the other LFO.

THEORY OF OPERATION AR-324

DUAL LFO, LAG, INVERTER

I. Low Frequency Oscillator (LFO)

There are two identical LFO circuits. The basic waveform is a triangle. Voltage from the logarithmic pot P1 is applied to the emitter resistor, R18, of Q8. D5 balances the base-emitter voltage of Q8. The current from emitter to collector is then an exponential function of the rotation of P1. Now, U3 is a comparator with positive feedback, which will latch on to either +13 volts or -15. Assume it is positive. Then U1 has a positive voltage at pin 2, its negative input. Then, a current will be drawn into pin 6, approximately equal in magnitude to the current from Q8 into pin 5. This causes C9 to charge negatively. The resulting negative-going voltage is buffered by voltage follower U4, and applied to pin 3 of U3 through R26. Then the voltage across R26 is negative enough to compensate for the positive voltage across R24, pin 3 becomes negative. This is the positive input of an op amp, so the input then jumps negative. This, through R24, makes the input even more negative. However, the change in input makes U1 supply current out of pin 6, which reverses the direction of charge of C9. Its voltage rises now, until it becomes positive enough to reverse U3 again. This cycle repeats, and generates a triangle wave, whose frequency rises as more current is put into U1 by turning up P1. Incidentally, the output of U3 is a square wave, which is shifted to a level of 0 to +10 volts by D2, R22, and R23.

Meanwhile, Q7 is adjusted to have the same current range as Q8, by trimpot T1. The current out of the collector of Q7 charges up C3 linearly; that is, its voltage rises uniformly. (Initially, when discharged, the + side of C3 is at -15 volts.) When the output of U3 jumps positive, C8 differentiates the wave to give a pulse. This turns on Q4, which turns on Q5. The two transistors hold one another on, discharging C3 rapidly, until it is so discharged that it can't supply enough current to keep Q4 and Q5 on. Then, they become non-conducting again, and C3 starts to charge again. The current in Q7 is adjusted so that C3 charges by about 7 volts (+side of C3 at -8 volts) by the time the pulse discharges it. The resulting sawtooth wave is buffered by emitter follower Q3, and amplified by U2, to give a sawtooth output level of 0 to 10 volts.

Finally, any fast rising waveform, such as a square wave, applied to the SYNC input, is differentiated by C6, R2, and R3 to give a pulse, which momentarily turns on O1 and O2. C7 holds the pulse appearing at R6 on for about 20 microseconds, which is long enough to reset the oscillator by doing 3 things.

## THEORY OF OPERATION

AR-324 (cont)

1. It makes U3 switch to a positive output (if it is not already positive) .
  2. It allows R27 to turn on FET switch Q6, which discharges C9.
  3. It turns on Q4 and Q5, discharging C3.
- Thus, the oscillator will be synchronized with the external synd input signal.

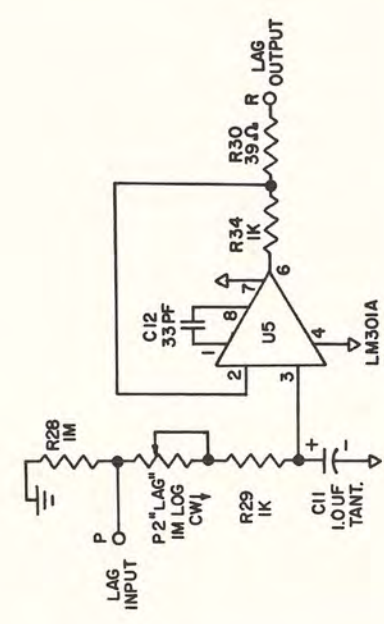
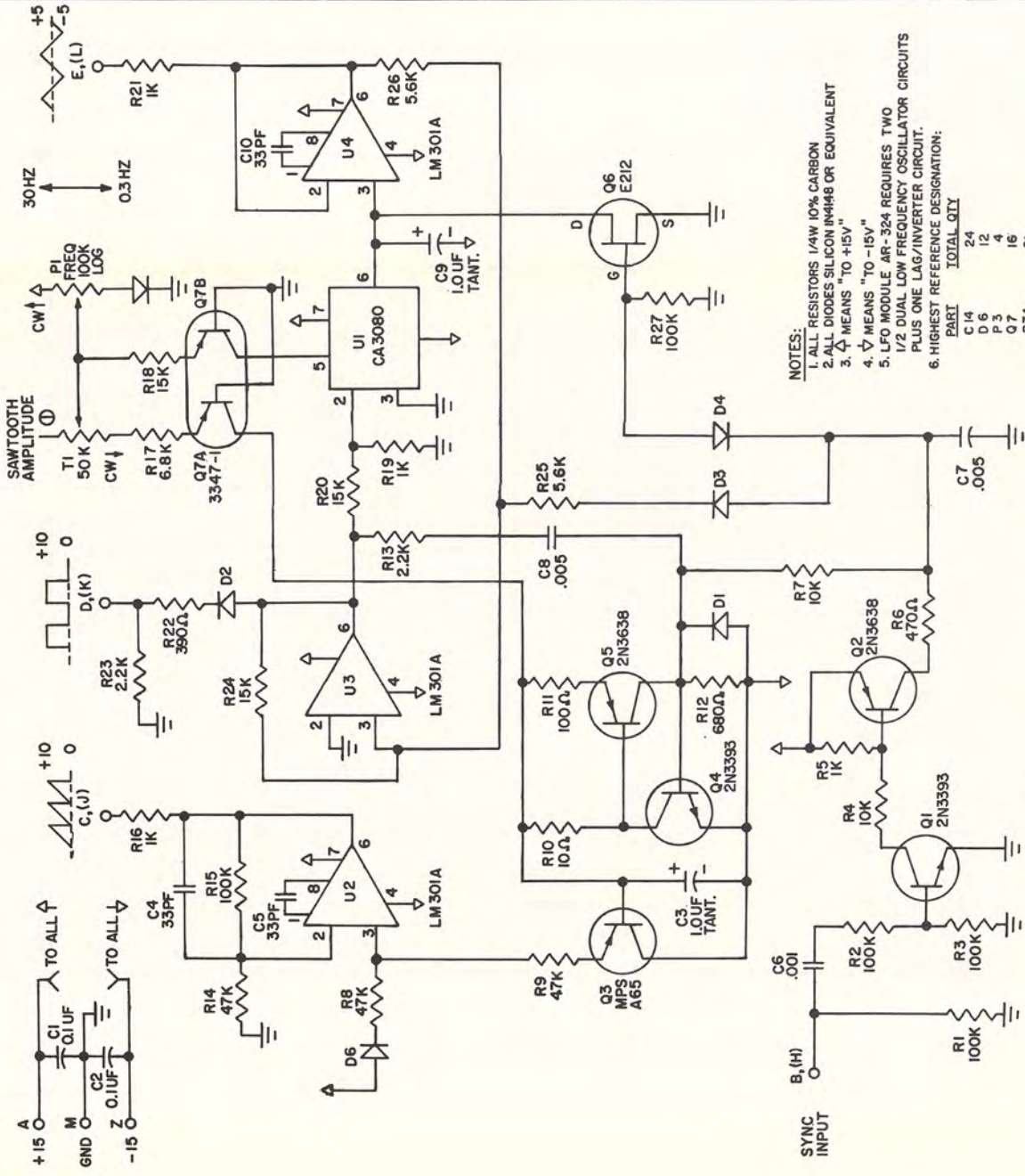
## II Lag Circuit

This is a circuit which provides a variable amount of slowing down, or low pass filtering.

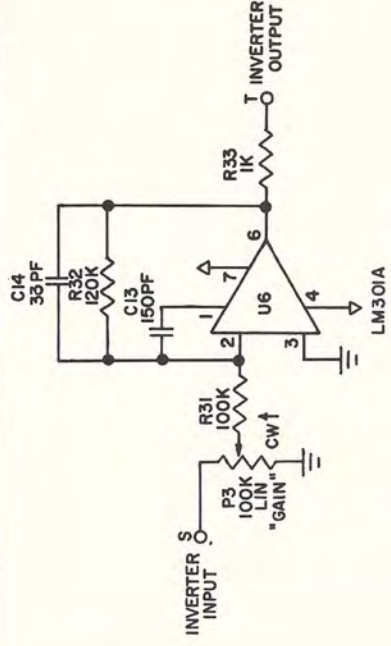
A signal at the input goes through R29 and the variable resistance of P2, and must charge or discharge C11. The higher its resistance, the less current can flow from the signal, and so C11 will take longer to change its voltage. The output is buffered by U5, connected as a high impedance voltage follower. R28 provides a path to ground for C11 and pin 3 of U5 when the input is not connected to anything.

## III Inverter Circuit

This is a standard op amp inverter, coupled to the input through a variable attenuator, or level control (P3). Maximum gain is -1.



LAG CIRCUIT



INVERTER CIRCUIT

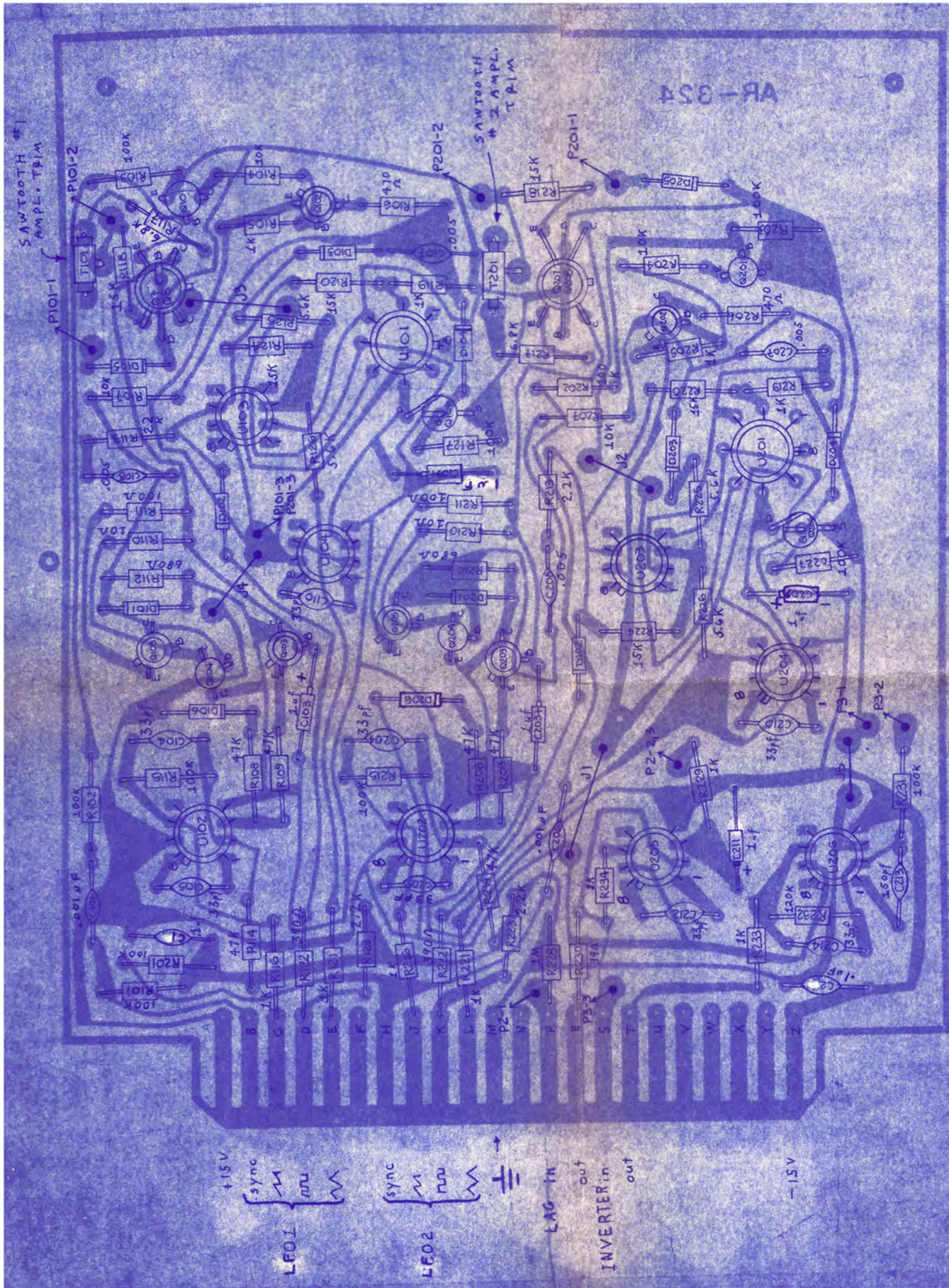
- NOTES:
1. ALL RESISTORS 1/4W 10% CARBON
  2. ALL DIODES SILICON 1N4148 OR EQUIVALENT
  3.  $\nabla$  MEANS "TO +15V"
  4.  $\nabla$  MEANS "TO -15V"
  5. LFO MODULE AR-324 REQUIRES TWO 1/2 DUAL LOW FREQUENCY OSCILLATOR CIRCUITS PLUS ONE LAG/INVERTER CIRCUIT.
  6. HIGHEST REFERENCE DESIGNATION:

PART	TOTAL QTY
C14	24
D6	12
P3	4
O7	16
R34	61
T1	2
U6	10

7. PIN DESIGNATIONS IN PARENTHESES ( ) REFER TO LFO #2.

1/2 DUAL LOW FREQUENCY OSCILLATOR

AR-324  
LAG, INVERTER  
AND  
1/2 DUAL LOW FREQUENCY OSCILLATOR

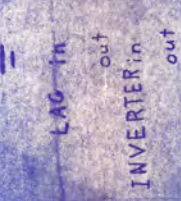
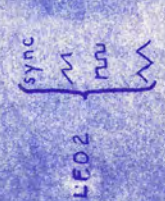
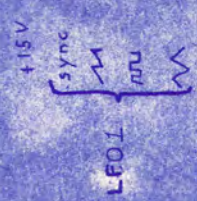


AR-324

5 JUMPERS

AR 324 DUAL LFO, LAG, INVERTER PARTS LAYOUT  
COMPONENT SIDE

REV. A  
5-9-75



$-15V$



# also Engineering changes: LFO, S/H, ask others

## AR-325 NORMALLED PREPATCH KIT

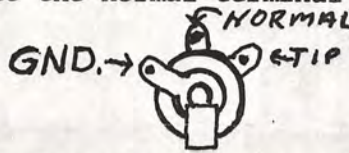
The AR-325 NORMALLED PREPATCH KIT consists of a set of instructions and a set of pressure sensitive adhesive back labels.

Setting up normal connections is a fairly easy procedure which allows the synthesizer user to play his instrument without patch cords, and at the same time retain the flexibility of his instrument because a normal connection can be overridden by the insertion of a patch cord into the appropriate input.

The AR-325 decal set is intended for a system of input normals--that is, a system in which the normal contact is used exclusively on inputs. Using this logic consistently makes it easier to keep track of signal flow. Wiring a normalled patch will not interfere with the removal of a module from the case, but will mean that the modules must be kept in the same module space in the cabinet.

The first step in setting up a normalled prepatch is to work out a block diagram of the basic patch you want to wire. Then repeat the following three steps until it's complete.

- 1) Run an insulated wire from the output terminal on the edge connector of the module producing the desired signal to a spare terminal on the module receiving that signal. Refer to chart of edge connector pin assignments.
- 2) On the P.C. board of the receiving module, locate the edge connector finger corresponding to the spare terminal you've connected. Run a wire from this terminal to the normal terminal on the input jack you wish to have the signal.



- 3) Find a pressure-sensitive adhesive backed label with the name of the output and fix it to the front panel near the input jack.

This completes a normalled connection. Simply repeat this procedure until the patch is complete.

NOTE: A four conductor cable can be run from the AR-313 keyboard interface to the main cabinet to bring keyboard signals there for normalled use.

Here are some suggestions for normalled connections:

1. KBD Voice voltage to VCO's control inputs; KBD Voice voltage to VCF's control inputs.
2. KBD Gate & trigger to envelope generators
3. KBD trigger to LFO inputs
4. VCO outputs to mixer
5. VCO outputs to balanced modulator
6. Mixer outputs to VCF
7. VCF outputs to VCA
8. VCA outputs to output module
9. Envelope generator outputs to VCF control input
10. Envelope generator to VCA control input
11. Envelope generator to floating attenuator & its output to VCO pulse modulation input
12. LFO triangle output to floating attenuator & its output to VCO pulse width modulation input
13. LFO triangle output to VCF

The list could go on and on---you get the idea.



PARTS LIST \* AR-326 \* OUTPUT CONTROL MODULE

NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
C1	2	Capacitor, Disc	0.1 mfd , 25v
C2	2	" "	100 pf
C3	2	" "	33 pf
D1 thru 4	8	Diode, Silicon	1N914, 1N4148 or equivalent
P1	2	Potentiometer, 1/4" shaft	100k, log
Q1, 3	4	Transistor, NPN	2N3393 or TE3393
Q2	2	Transistor, PNP	2N3638
R1	2	Resistor, Carbon	100k, 10%
R2, 3, 4, 5	8	" "	10 ohm, 10%
R6	2	" "	10k, 10%
R7, 13, 14	4	" "	1k, 10%
R8	2	" "	270 ohm, 10%
R9, 10	4	" "	220 ohm, 20%, 1/2W
R11, 12	2	" "	470 ohm, 20%, 1/2W
S1	1	Switch, Toggle	SPST, 117 VAC, 1A
U1	2	Operational Amplifier	LM301A
PL1	1	Pilot Lamp Assembly	
R15	1	Resistor, Carbon	47k10%
	2	Jack, Phono	Switchcraft 3501 fp
	1	Jack, Stereo Phone	Switchcraft 12B
	14	Jack, Miniphone	Switchcraft 42A
	2	Printed Circuit Board	#1162
	1	Front Panel	
	2	Knob	
	9	#4 x 1/2" Wood Screw	
	8	1/8" Phenolic Spacer	
	1	Terminal Strip, 6 Point	

ARIES System 300 Music Synthesizer  
Module AR 326  
Output and Power 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 Output and Power module. 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.

**NOTE!**

The AR 326 Output and Power Module is slightly different in construction from the other ARIES modules. Instead of a frame and regular sized circuit board, two smaller circuit boards and a terminal strip will be mounted on the inside right hand panel of the synthesizer case. PLEASE FOLLOW INSTRUCTIONS CAREFULLY.

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

Find the two circuit boards and lay one aside. Assemble one board completely before you begin assembly of the other one.

Lay the circuit board down on a sheet of white paper. PLACE METAL SIDE DOWN! Turn board so that wire terminals are to the left.

Lay the assembly drawing down near the board.

Have the following tools nearby:

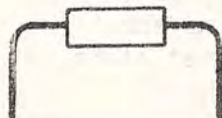
Pencil tip soldering iron, hot and tinned (solder coated)  
Solder--Use only thin rosin core solder!  
Small diagonal wire cutters  
Small wire strippers  
Small long nose pliers  
Regular pliers  
Flat blade screw driver

- ( ) 2. Resistors  
Carefully install all 10 resistors on the circuit board. (R1 through R10)

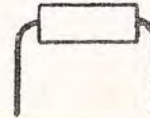
To avoid breaking the resistors leads, bend the leads at least 1/16 of an inch away from the body of the resistor.

For example:

Correct



Incorrect



- ( ) 3. Capacitors  
Install all three capacitors on the circuit board. (C1 through C3)
- ( ) 4. Diodes  
Install all four diodes on the circuit board. (D1 through D4)  
Be careful to observe correct polarity as indicated on the assembly drawing.
- ( ) 5. Transistors  
Carefully install all three transistors. (Q1 through Q3) Double check to insure proper installation.
- ( ) 6. Integrated Circuit Amplifier  
Install the Integrated Circuit Amplifier on the circuit board.
- ( ) 7. Terminal Connections  
Solder an 8 inch piece of wire to each of the seven terminals on the circuit board. Wires are indicated by arrows on the assembly drawing.

Assemble both circuit boards before proceeding.

#### BOARD AND TERMINAL MOUNTING INSTRUCTIONS --

Please refer to module assembly drawing. (page 4)

Also--please see note on bottom of page 3 \*\*\*

- ( ) 1. Unpack the bag of hardware & front panel.
- ( ) 2. Take the terminal strip and attach R11 between pins 1 and 2, and R12 between pins 4 and 5 as shown on the module assembly drawing.  
Also install R13 and R14, as shown at upper right corner of module assembly drawing.
- ( ) 3. With the wood screw provided, mount the terminal strip to the inside right hand panel of the synthesizer case in the approximate center of the panel.
- ( ) 4. Run insulated wires from pins 1, 3, and 5, of the terminal strip to the appropriate power supply connections on the edge connector, pins A, M, and Z, as shown on the module assembly drawing.
- ( ) 5. Using four small wood screws and four 1/4 inch stand off washers, mount a circuit board to the side panel about one inch from the top and two inches from the front edge of the case.
- ( ) 6. Mount the other circuit board about 1/2 inch below the top one.
- ( ) 7. Connect the power supply wires from each board to the appropriate pins on the terminal strip.

The terminal strip and boards are now mounted. Unconnected wires will later be wired to the front panel.

#### FRONT PANEL ASSEMBLY INSTRUCTIONS --

Refer to panel wiring diagram and module assembly drawing. (page 5)

- ( ) 1. Take two 100K log potentiometers and bend the tabs, if any, out flat. Insert the shafts through the panel from behind. Align as shown on the wiring diagram and secure with the nuts. BE CAREFUL NOT TO SCRATCH THE PANEL
- ( ) 2. Install all 14 mini-phone jacks, as shown.
- ( ) 3. Install both RCA output jacks, as shown.
- ( ) 4. Install the stereo output jack and align, as shown.
- ( ) 5. Install the ON/OFF switch, as shown.
- ( ) 6. Install the pilot light. Insert through the front panel and flat retaining clamp. Slide the clamp up the shaft of the light to the front panel until the light is securely held in place.

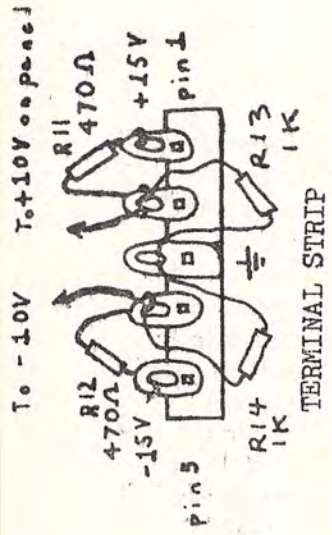
- ( ) 7. Run a wire connecting the tips of each set of four jacks labelled PATCH as shown.
- ( ) 8. Run a wire connecting the grounds of all 14 mini-phone jacks, both RCA output jacks, the stereo output jack and pin 1 of P1 (channel 1), as shown.
- ( ) 9. Cut three pieces of INSULATED 18 GAUGE hookup wire, two pieces 12" long, the third 7 1/2" long. Strip 1/4" of insulation from each end of each wire.
- ( ) 10. Connect one 12" piece between pin 1 of S1 and pin 2 of P1. (P1 is the four pin plug supplied as part of the AR322 Power Supply.)
- ( ) 11. Connect the other 12" piece between pin 2 of S1 and pin 4 of P1.
- ( ) 12. Using solder, splice the 7 1/2" piece of wire so as to extend one of the two leads of the pilot lamp PL1. Carefully insulate the splice with electrical tape.
- ( ) 13. Clip the other pilot lamp lead leaving 1" of wire. Strip 1/4" of insulation from the end. Shorten the two leads of R15 to 3/8". Using solder, splice the shortened pilot lamp lead to one end of the resistor and insulate the splice carefully with electrical tape. Solder the other end of R15 to pin 2 of S1.
- ( ) 14. Using electrical tape, insulate the connections at S1. REMEMBER: THESE CONNECTIONS WILL BE AT LINE VOLTAGE!  
Bundle the three wires leading to P1 into a single cable.
- ( ) 13. Run wires from the +10V and -10V terminals on the terminal strip (pins 2 and 4) to the appropriate jacks on the front panel, as labelled on the panel wiring diagram.
- ( ) 14. Wire the remaining wires on the circuit boards to the appropriate points on the front panel. Wire one circuit board at a time to avoid confusion.
- ( ) 15. Plug the Jones plug into the receptacle on the power supply.
- ( ) 16. With the screws supplied, Mount the front panel to the synthesizer case.

YOUR AR 326 OUTPUT AND POWER MODULE IS NOW READY TO USE.

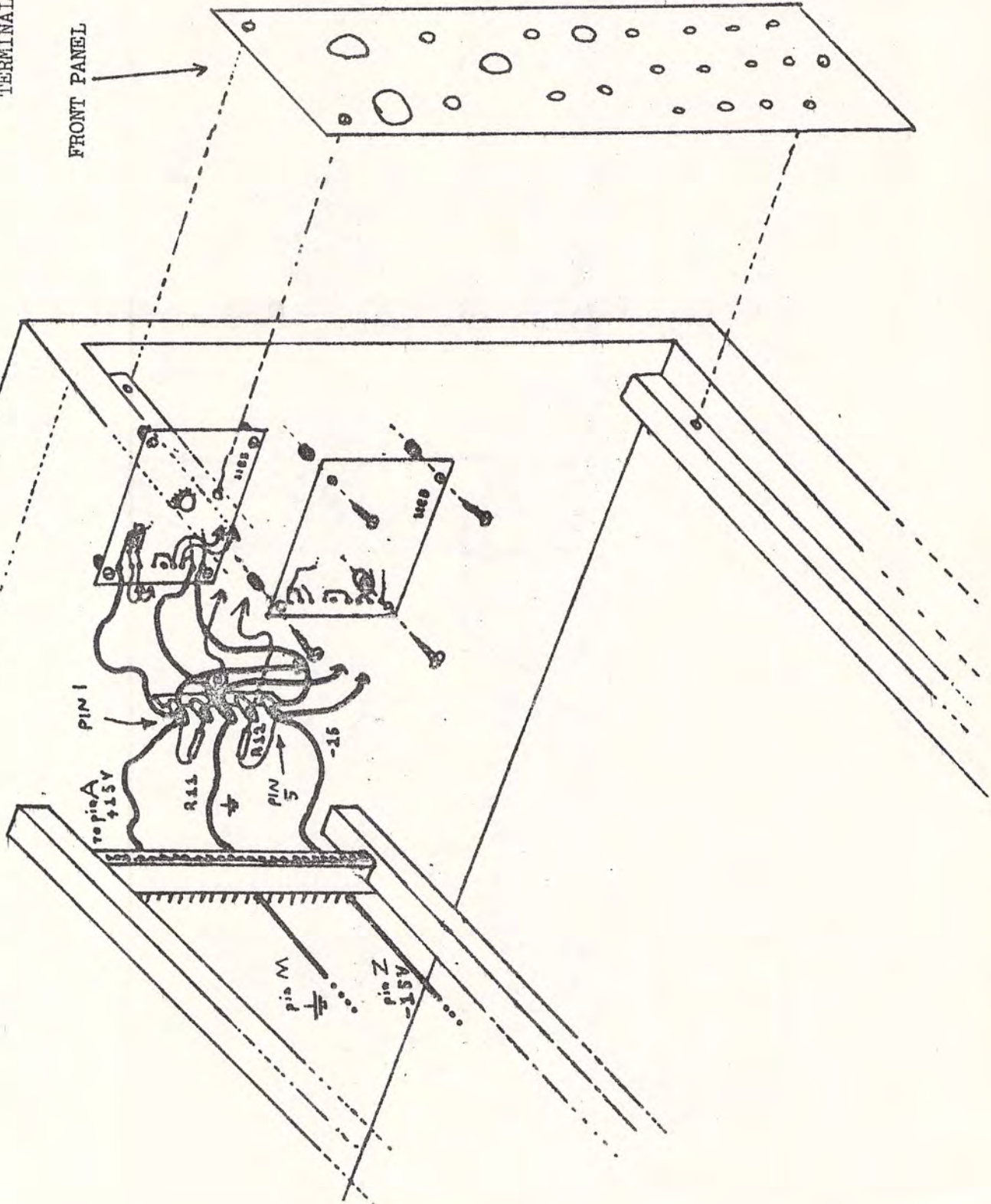
\*\*\* A note about connecting the 5 volt supply:

You will notice that the parts list calls for a 6-point solder terminal, whereas the instructions (on page 2) and the diagram (page 4) only refer to a 5-point terminal. The extra terminal point can be used for the +5v supply to allow for modules of your own design which require +5v. Use pin "N" (the one BELOW ground pin "M") on the edge connector if you wish to bus the 5v as in instruction 4 of the Board & Terminal Mounting Instructions (page 2).

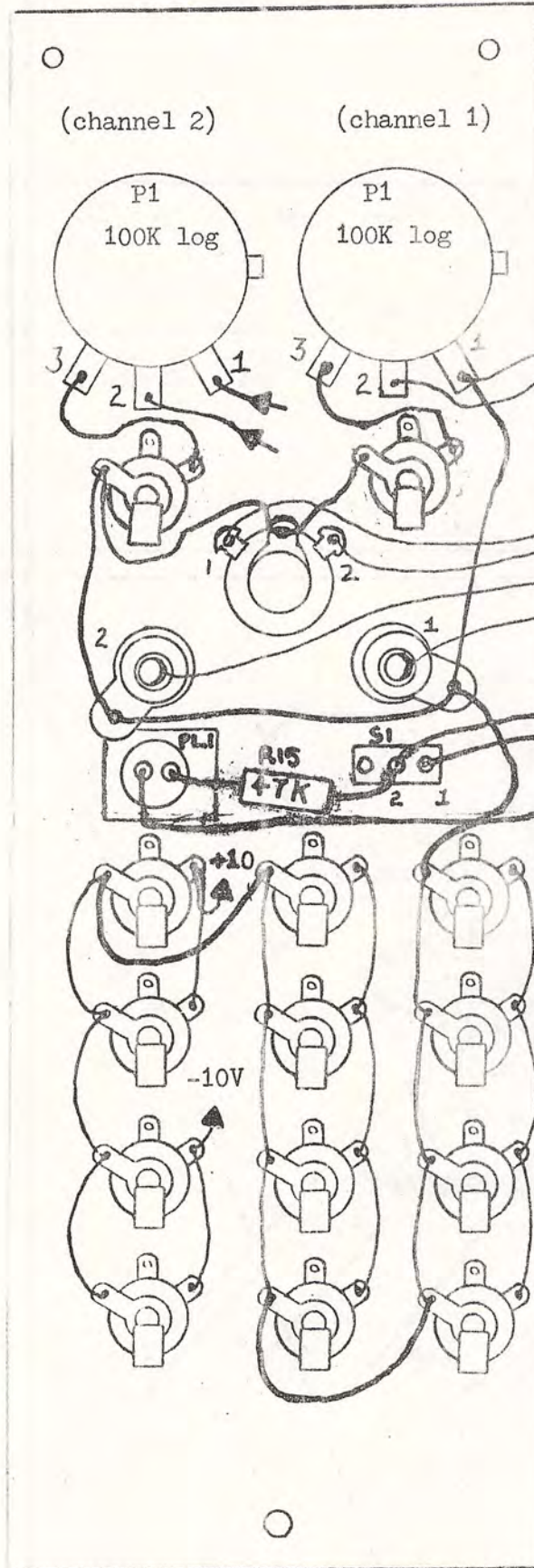
AR 326 MODULE ASSEMBLY DRAWING



FRONT PANEL



AR 326 OUTPUT AND POWER MODULE PANEL WIRING DIAGRAM --- rear view



Arrows pointing in indicate a wire from the circuit board or terminal strip. All wires with arrows and ground bus with thick lines must be insulated. TAKE PARTICULAR CARE to insulate wires associated with PL1, S1, R15 (and P1 of AR322) as these are HIGH VOLTAGE.

from  
channel # (board #)

- 1 } STEREO PHONE JACK
- 2 } JACK
- 2 } RCA OUTPUT JACK
- 1 } JACK

pin # on 4-pin plug (P1 as supplied with AR322 Power supply.



## THEORY OF OPERATION \* AR-326 \* OUTPUT POWER CONTROL MODULE

The AR-326 consists of two identical head phone driver amplifiers. The input, from the lower mini phone jack, is attenuated by P1, and coupled into op amp U1 through C1. U1 drives Q1 and Q2, which form class AB power amp, which is biased by constant-current source (Q3). Feedback from the output to pin2 of U1 establishes the proper gain and keeps distortion low. The output is coupled to (1) 1/2 of a stereo phone jack, and (2) an RCA phone jack. R9 and R10 provide the proper impedance for driving both low and high impedance phones, and also provide short-circuit protection.

In addition, two sets of jacks provide +10 volts and -10 volts (approximately) from voltage dividers R11-R13 and R12-R14.

There are two sets of four jacks connected together, provided for assistance in multiple patching.

Finally, the power switch S1, and pilot light PL1, from the synthesizer power supply are mounted on the front panel.

ARIES SYSTEM 300 MUSIC SYNTHESIZER \*\*\*\*\*  
SYSTEM ASSEMBLY

(AR-310 CASE, AR-322 POWER SUPPLY, AR-326 OUTPUT  
CONTROL MODULE)

- ( ) 1. Mount the power supply to the cabinet. Use two angle brackets mounted to the holes in the lower corner of the power supply board, with machine screws and nuts. NOTE: Some earlier boards do not have holes. If yours doesn't, drill a 1/8" hole, 1/2" up from the bottom and 3/16" in from the side, through each lower corner. Then screw them down to the cabinet, using the dimensions shown on the drawing (Power supply board 1.7/8" in from back recess, and 3" from side).
- ( ) 2. Using a long wire, connect the terminals labelled "A" on all 10 connectors together. You may use bare wire, but run the wire tightly enough so it can't short to any other pin or to the metal bar.
- ( ) 3. Similarly, connect all "M" terminals together.
- ( ) 4. Finally, connect all "Z" terminals together.
- ( ) 5. Cut three pieces of insulated wire, each 30" long, and strip 1/4" of insulation from each end.
- ( ) 6. Solder one wire to terminal "A" of the connector closest to the left side of the cabinet (right side when viewed from rear). Solder the other end to pin 2 of one of the 8-pin (octal) plugs furnished with the power supply.
- ( ) 7. Connect the second wire from terminal "M" of the same connector to pin 8 of the octal plug.
- ( ) 8. Connect the last wire from terminal "Z" of the same connector to pin 4 of the octal plug.
- ( ) 9. Twist, lace, or tape the three wires together neatly.
- ( ) 10. Plug the octal plug into any one of the three sockets on the power supply.
- ( ) 11. Assemble and wire in the AR-326 Output and Control Module if you've not already done so. (Refer to AR-326 Assembly Instructions). However, BEFORE CONNECTING +15v and -15v wires to the module, check the power supply connections as follows: (Disconnect if already wired).
- ( ) 12. Plug in the Jones plug from the AR-326 On-off switch to the power supply.

( ) 13. Plug in the A C Line Cord from the power supply. Connect D C volt meter from the "M" terminal of any module connector to the "A" terminal (+ lead on "A"). Turn on AR-326 switch. Meter should read within 1 volt of 15 volts. If not, TURN OFF! Supply or wiring needs trouble shooting.

( ) 14. Turn off supply. Connect voltmeter from the "Z" terminal of module connector to the "M" terminal (+lead on "M").

( ) 15. Turn on supply. Meter should, again, read within 1v of 15volts.

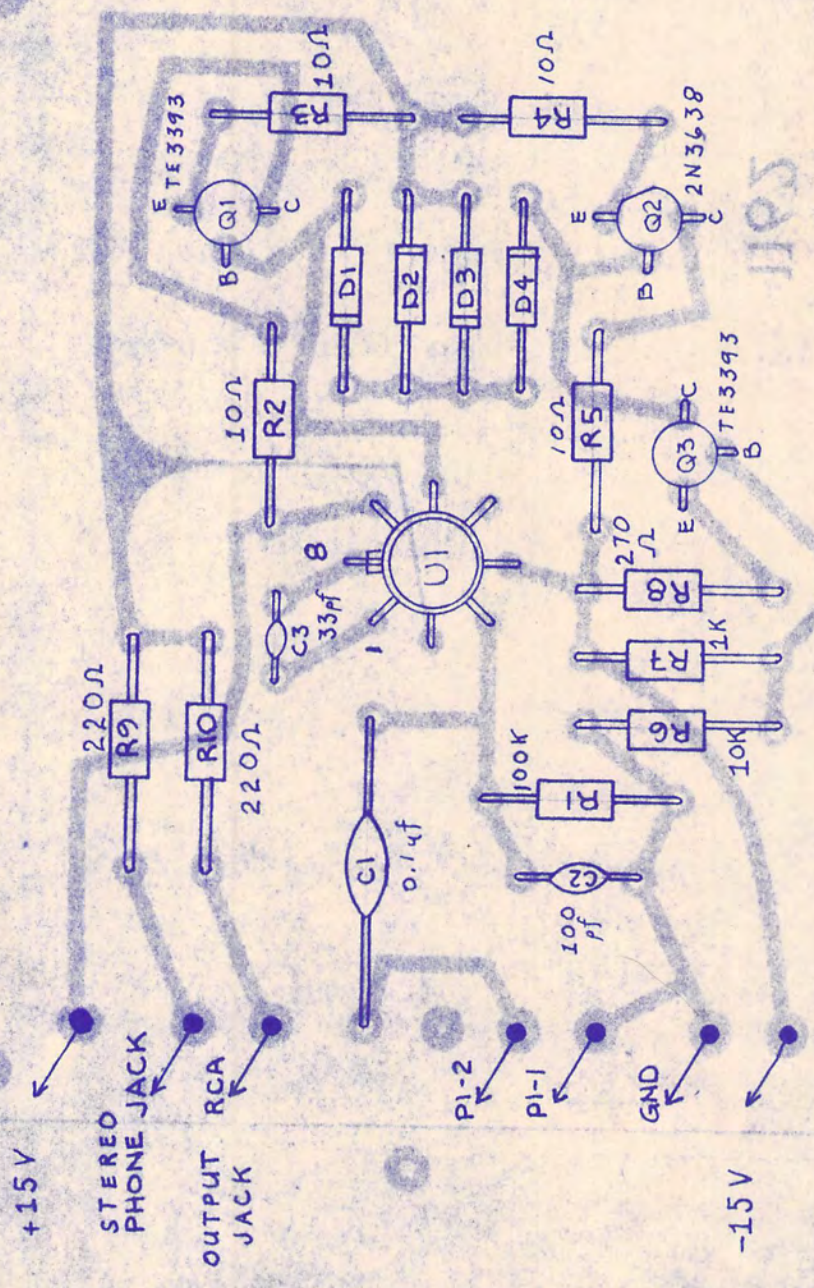
( ) 16. Turn off supply, unplug A C line cord, and finish AR-326 assembly (wire up +15v and -15v lines).

( ) 17. Now plug in all of your synthesizer modules, if you have any. Be sure the board terminals are fully inserted in the connectors .

( ) 18. Trim and test each module, if not already trimmed WITH YOUR POWER SUPPLY.

( ) 19. Screw each module to the mounting strips, using 3 machine screws per module.

YOUR ARIES MUSIC SYNTHESIZER IS NOW READY FOR OPERATION !

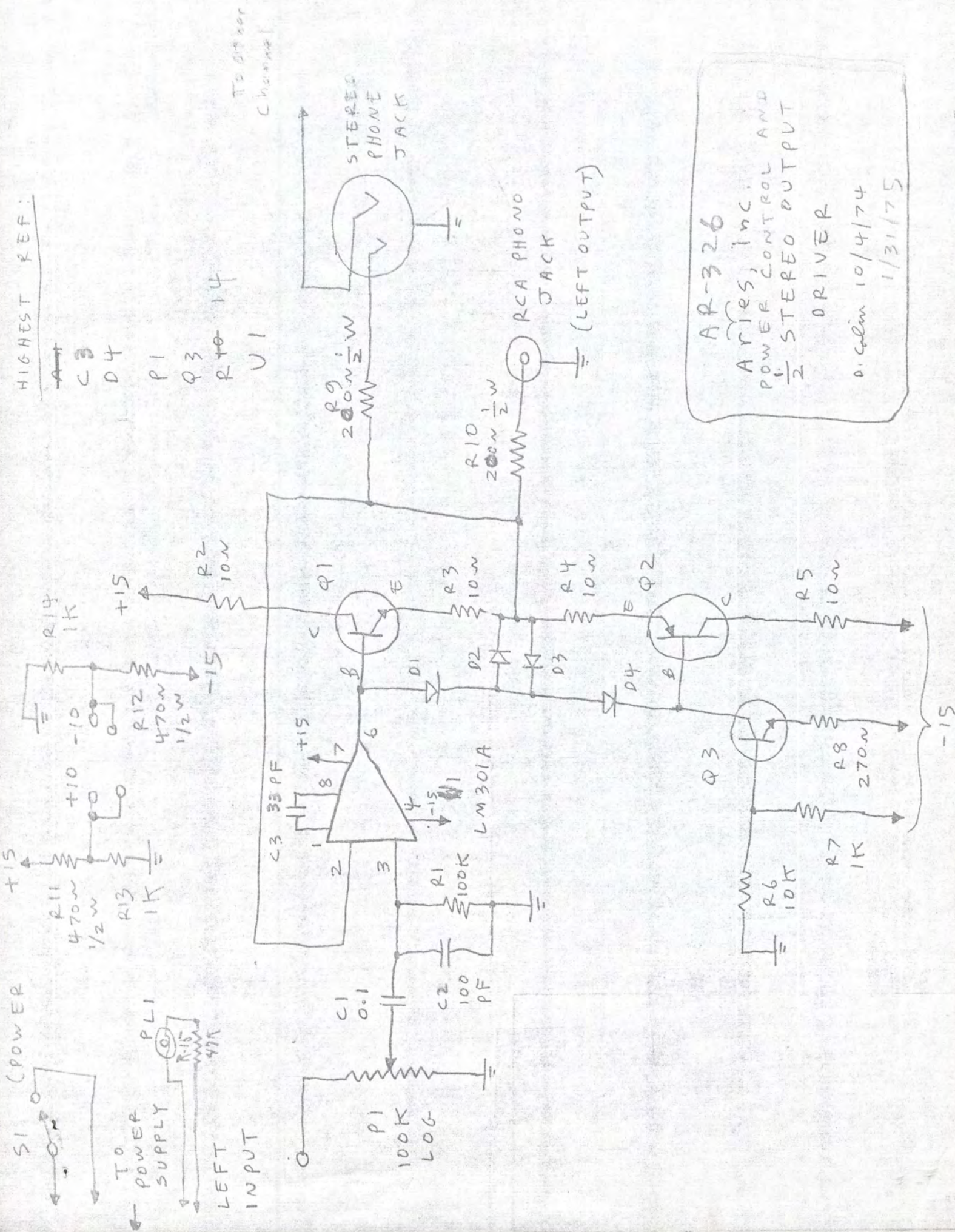


AR-326 AUDIO AMP  
COMPONENT SIDE

HIGHEST REF:

- ~~A~~
- C 3
- D 4
- P 1
- Q 3
- R 10 14
- U 1

To Stereo Channel



AR-326  
 ARIES, Inc.  
 POWER CONTROL AND  
 1/2 STEREO OUTPUT  
 DRIVER  
 o.c.d.m. 10/4/74  
 1/31/75

ARIES System 300 Music Synthesizer Module AR-327  
Multifunction Voltage-Controlled Filter  
Assembly Instructions

(Please refer to the System 300 General Assembly Instructions as a general guide to parts identification and mounting.)

We highly recommend that you:

- (a) Find a place where you can work through completion, without disturbing set-up.
- (b) Use adequate lighting.
- (c) Make sure your hands are free of grease or oil which would interfere with proper soldering.
- (d) Check off each of the following steps, as you proceed.

- ( ) 1. **PREPARATION:** Lay the printed circuit board, METAL FOIL SIDE DOWN, on a sheet of white paper. Turn board so that connector strip is to the left.

Place the LAYOUT DRAWING down flat, near the board.

Unpack all 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, clean, and tinned (solder coated).
- \* Solder—USE ONLY thin ROSIN-CORE (Electronic grade) solder. Any other type will destroy the connections, and voids the warranty!
- \* Small Diagonal wire cutters.
- \* Small wire stripper.
- \* Small long-nose pliers.
- \* Small or medium flat-blade screwdriver.

- (✓) 2. **RESISTORS:** Carefully install all 52 resistors on the board (labelled R1 thru R52 on the Layout drawing, Schematic drawing, and Parts list). NOTE: To avoid possible lead breakage, bend leads about 1/16" away from body of resistor, as shown here:



Incidentally, you should use the same caution on other components.

- (✓) 3. **POTTED EXPONENTIAL BLOCK:** This MAY be already installed on board. If NOT, insert the 6 wires as shown on Layout drawing, and solder.
- (✓) 4. **DIODES:** Install all 4 (D1 thru D4). OBSERVE POLARITY! (Direction of band).
- (✓) 5. **CAPACITORS:** Install C1 through C15. On C1,2,& 14, observe polarity. Note, also, that C8 & C10 are Mica or Film capacitors, rather than Discs.

## ARIES AR-327 Assembly Instructions (cont'd)

- (✓) 6. TRIMPOTS : Install T1 through T6 on the board.
- (✓) 7. TRANSISTORS : Carefully install all 6 transistors, as shown on the Layout drawing.(Q1 thru Q6)  
Note that there 3 different type numbers (see also the Parts List.)
- ( ) 8. INTEGRATED CIRCUITS (301 Type) : Install all 5, paying particular attention to the position of the tab above pin 8. These devices may be labelled LM 301, SG 301, LM 301A, etc., the important thing being the number 301. (U1,2,4,6,8).
- ( ) 9. INTEGRATED CIRCUITS (CA 3080 Type) : Install all 3 (U3,5,7). Observe position of tab.
- ( ) 10. JUMPER WIRES : Cut and strip a piece of INSULATED wire to fit where J1 is shown, on the Layout drawing. Install. Repeat for J2 thru J7.

THIS COMPLETES ASSEMBLY OF THE P.C. BOARD

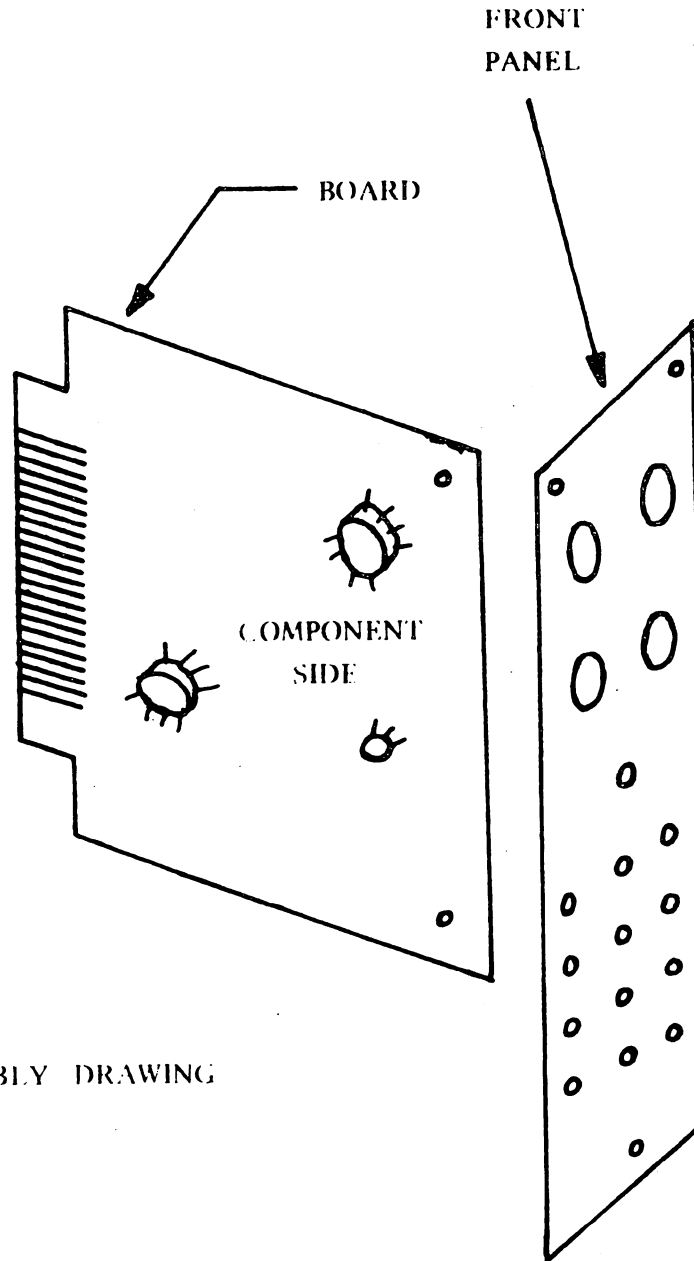
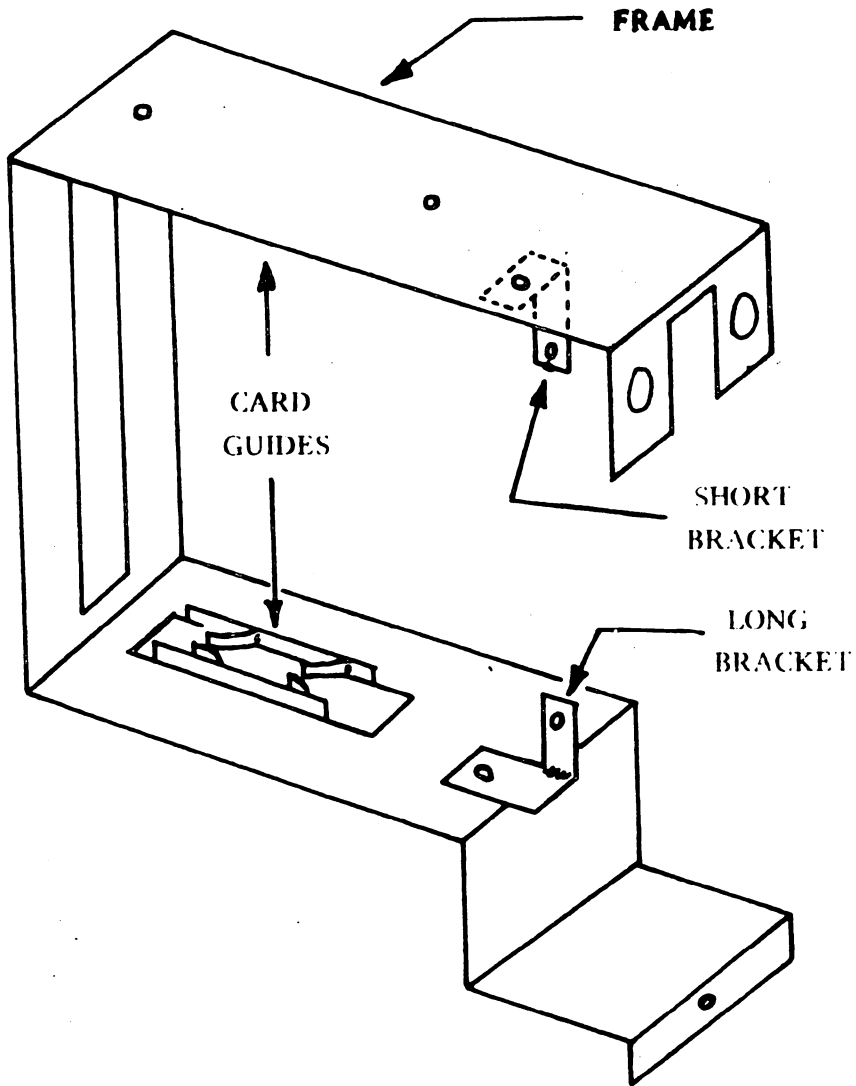
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## MODULE ASSEMBLY &amp; PANEL WIRING :

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 point toward the rear, as shown.
- ( ) 3. Slide the printed circuit board into the frame, holding top and bottom of frame together against board, so that the board fits snugly in the guides, between the tabs.
- ( ) 4. Using the 4-40 x 3/8" screws & nuts, mount the two angle brackets to the frame, as shown. The brackets should be on the component side of the board.
- ( ) 5. Now screw the board to the brackets. Insert the 4-40 x 3/8" screw from foil side of board. **DOUBLE CHECK THAT SCREW HEAD DOES NOT TOUCH ANY METAL FOIL !!!**
- ( ) 6. Refer to PANEL WIRING Diagram. Be careful to avoid scratching front of panel. Mount all 12 mini-phone jacks. Insert jacks from rear, and place washer on front of panel. Tighten nut **WITH JACK IN POSITION SHOWN.**
- ( ) 7. Connect the ground terminals of the jacks together, as shown (labeled "Jack Grounding Wire" on wiring diagram). Use insulated wire.
- ( ) 8. Mount the switch (S1) on the panel, as shown. Tighten nut over washer on front, being careful not to scratch panel surface.
- ( ) 9. Mount the two LOWER potentiometers (pots) only (P3 and P4), as follows: First, if there is a tab sticking up parallel to the shaft, bend it away. Put lockwasher on pot, and insert pot through hole in panel, from rear. Install nut on front; and tighten **WITH POT TURNED IN DIRECTION SHOWN.**

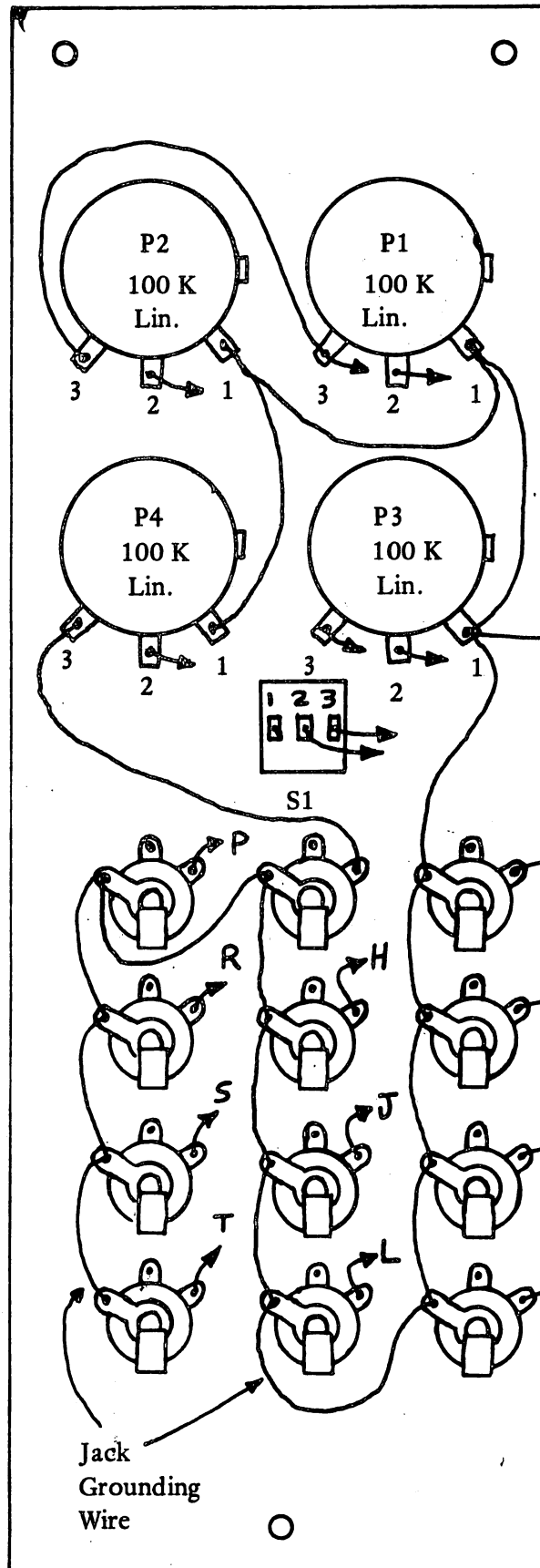
(cont'd on page 5)



MODULE ASSEMBLY DRAWING



AR-327 Multifunction VCF PANEL WIRING DIAGRAM  
(Rear View)



Arrows indicate wires to the P.C. board. All wires, and jack grounding wire, must be INSULATED.

Letters refer to P.C. board edge connector strip.

## ARIES AR-327 Assembly Instructions (cont'd)

- ( ) 10. Refer again to MODULE ASSEMBLY drawing. Mount top of panel to frame, using the two UPPER pots (P1 and P2): Bend tab, if any, away; put on lockwasher; and insert pot shaft through rear of upper holes in front of frame. Bring panel against frame, so these pots also go through matching holes in panel. Tighten nuts on front of panel, with pots oriented in same direction as lower pots.
- ( ) 11. Attach bottom of panel to frame, using remaining 4-40 x 3/8" screws & nuts.
- ( ) 12. Turn all pot shafts fully counterclockwise, and mount the knobs pointing to the leftmost number. Tighten knob screws.

THIS COMPLETES MODULE ASSEMBLY, EXCEPT FOR FINAL PANEL WIRING.

PANEL WIRING ——— Refer to PANEL WIRING diagram and P.C. LAYOUT drawing:

- ( ) 1. Run a wire from the ground of the upper right jack (viewed from rear of panel, as on drawing), to pin 1 of P3; then to pin 1 of P1, to pin 1 of P2, and finally to pin 1 of P4.
- ( ) 2. Now connect a wire from pin 1 of P3 to the hole in terminal "M" of the P.C. board edge connector strip.
- ( ) 3. Run a wire from pin 3 of P4 to the TIP terminal of the TOP CENTER jack, as shown.
- ( ) 4. Run a wire from pin 3 of P2 to pin 3 of P1. Now connect pin 3 of P1 to the point shown on the LAYOUT drawing, labelled "P1-3, P2-3", on the P.C. board.
- ( ) 5. Connect pin 2 of P1 to the corresponding point on the board, as shown on Layout.
- ( ) 6. Connect pin 2 of P2 to its corresponding point on board.
- ( ) 7. Connect pin 2 of P3 to its corresponding point on board.
- ( ) 8. Connect pin 2 of P4 to its corresponding point on board.
- ( ) 9. Connect pin 3 of P3 to its corresponding point on board.
- ( ) 10. Now, wire pins 2 and 3 of switch S1 to their appropriate points on the board. (pin 1 of S1 has no connection.)
- ( ) 11. Finally, wire ONE AT A TIME, the tip terminals of the 11 remaining jacks, to the holes in the board edge connector strip, indicated by the lettered arrows on the PANEL WIRING diagram. Wire in the following order, checking each letter as you go:

( ) P    ( ) R    ( ) S    ( ) T    ( ) H    ( ) J    ( ) L    ( ) B    ( ) C  
 ( ) D    ( ) K

YOUR AR-327 Multifunction V.C.F. is now COMPLETELY ASSEMBLED, and ready for trimming.

NOTE: It is highly advisable to thoroughly dust off the board with a toothbrush, etc., to remove any metal particles, or other debris. If washing the board becomes necessary, use ONLY clean toluene. NEVER use water, alcohol, or anything else!

## ARIES AR-327 Multifunction V.C.F. TRIM PROCEDURE

All that remains now is for the 7 trimpots to be adjusted. Although not difficult, you should approach this procedure with care and patience, in order to obtain maximum performance.

REQUIRED :  $\pm 15$  Volt, dual regulated Power Supply, such as ARIES AR-322

A.C./D.C. Voltmeter or D.C. Coupled Oscilloscope

Audio Sine Wave Generator, such as ARIES AR-317 V.C.O.

OPTIONAL : D.C. Oscilloscope

Square Wave Generator (AR-317 also has square wave.)

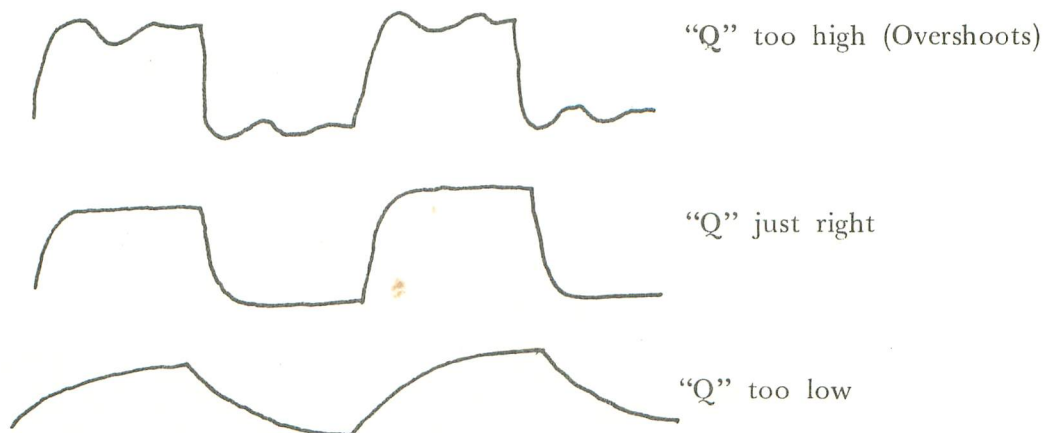
- (✓) 1. Refer to the AR-327 P.C. Layout drawing. Find T7 (H.F. Q. trim). Turn T7 FULLY COUNTERCLOCKWISE (left).
- (✓) 2. Turn ALL 6 OTHER TRIMPOTS to approximate CENTER of their rotation.
- (✓) 3. BEFORE TURNING ON power supply, connect the + 15 V output to terminal "A" of the AR-327 P.C. edge connector strip. Connect power supply GROUND to terminal "M", or to the AR-327 frame. Connect the - 15 V output to terminal "Z".  
CAUTION !! IMPROPER CONNECTIONS CAN DESTROY COMPONENTS !
- (✓) 4. Set Voltmeter (or Scope) on appropriate range for measuring up to 15 volts D.C. Connect POS meter lead to AR-327 frame, and NEG lead to the end of R19 which comes from the potted Exponential module (the end towards connector strip).
- (✓) 5. Set FRONT PANEL controls as follows : FREQUENCY knob up fully ( 16K ), RESONANCE knob fully left ( 0.5 ), AUDIO knob at 0, and Fc CONTROL knob at 0.
- (✓) 6. TURN ON POWER SUPPLY. IMMEDIATELY feel ALL I.C.'s and TRANSISTORS repeatedly, for about 30 seconds, to check for overheating. Slight warming is normal on the I.C.'s, but TURN POWER OFF IMMEDIATELY in the event of any device becoming HOT to the touch! In this case, check your wiring, and check for any shorts, such as metal specks on the board.
- (✓) 7. If all seems well, adjust T1 (Frequency trim) for a reading of 1 Volt on the meter. Now, shift the NEG meter lead to R23 (end towards connector strip). The voltage here should be between 0 and 8 volts.
- (✓) 8. Connect meter NEG lead to the end of R51 nearest the connector strip. Leave the POS lead grounded. Adjust T2 ("Q" trim) for a reading of 11 volts.
- (✓) 9. Reset the following front panel controls: FREQUENCY knob = 1K, RESONANCE = 32. Connect voltmeter NEG lead to frame (ground), and POS lead to the BANDPASS output (terminal "S" on connector strip). The voltage here may initially be anywhere from + 15V to -15V. Adjust T4 ("B" Offset trim) for a reading of 0V,  $\pm 0.1V$ .

## AR-327 TRIM PROCEDURE (cont'd)

- (✓) 10. Connect meter POS lead to the LOWPASS output (terminal "T"). Keep NEG lead grounded. Adjust T3 (Hi - "Q", L-H trim) for 0V,  $\pm 0.1V$ .
- (✓) 11. Set front panel RESONANCE knob down to 0.5. Adjust T5 (Lo - "Q", L-H trim) for 0V,  $\pm 0.1V$  reading at the lowpass output.
- ( ) 12. Set RESONANCE knob to 4. Set meter to 10 Volts A.C., or next higher A.C. range. Connect meter (or Scope, if desired) between BANDPASS output (terminal "S") and ground. Connect a sine - wave generator between AUDIO INPUT 2 (terminal "C") and ground, and set the generator to a frequency of 16 Hz, and a level of approximately 1 volt. Set front panel FREQUENCY knob down to 16, and turn up the AUDIO knob fully. Now, carefully adjust T1 (Freq. trim) for a MAXIMUM A.C. voltage reading at the bandpass output. Check the setting by varying the generator, SLOWLY, above and below 16 Hz. Peak response should be at 16 Hz.
- ( ) 13. Reset FREQUENCY knob to 16 K (up fully). Set generator frequency to 16 KHz. Adjust T6 (1V/Oct. trim) for maximum A.C. voltage reading on meter, at bandpass output.
- ( ) 14. Disconnect audio generator from input. Set front panel controls as follows: FREQUENCY = 16 K, RESONANCE = 512, AUDIO = 0, Fc CONTROL = 2. CAREFULLY make a temporary connection (such as with a clip - lead) from FREQ. CONTROL 1 input jack to the + 15 Volt supply. While watching the A.C. meter, slowly turn T7 (H.F. "Q" trim) clockwise. At some point, the meter should suddenly indicate a signal, which is the filter self - oscillating. Back off the trimpot until the meter indicates that the oscillation has stopped. Remove the connection from +15V to the FREQ. CONTROL input.

THE AR-327 is now FULLY TRIMMED. However, if you have a scope and a square - wave generator, you might want to adjust the "Q" with the following, more accurate trim:

- ( ) 1. Set FREQUENCY = 1K, RESONANCE = 0.5, AUDIO = 5, Fc CONTROL = 0. Feed in a square - wave, at approx. 200 Hz, and 10 Volts peak - to - peak or less (AR-317 VCO output is ideal), to AUDIO INPUT 2.
- ( ) 2. Observe LOWPASS output on scope. Adjust T2 ("Q" trim) for the sharpest corners possible WITHOUT OVERSHOOT, as illustrated. NOTE: If T2 is too far counterclockwise, the filter may distort. It is advisable to start with T2 fully clockwise, and then turn back until the square - wave overshoot just disappears.



~~MISSING~~

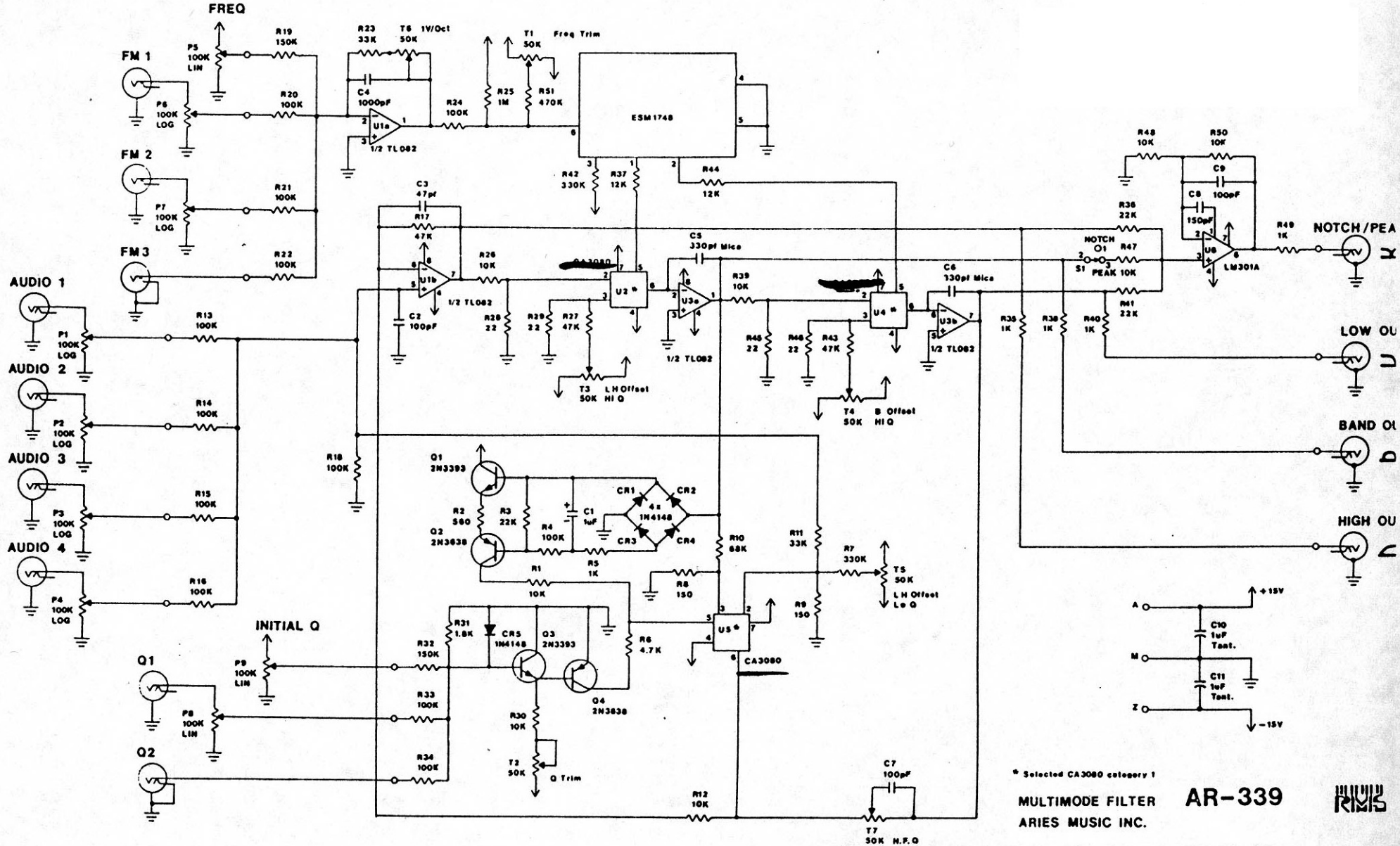
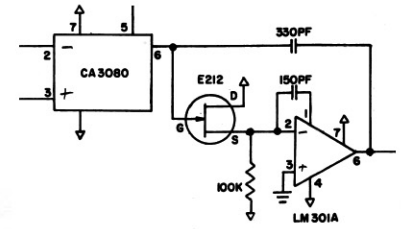
PARTS LIST \* ARIES MODULE AR-327 \* Multifunction Voltage-Controlled Filter

NUMBER	QUANTITY	DESCRIPTION	VALUE & RATINGS
C1, 2, 14	3	Capacitor, Tantalum	1 mfd, 22 V
C3	1	Capacitor, Disc	.001 mfd
C4	1	" "	33 pf
C5	1	" "	47 pf
C6, 9, 11, 13	4	" "	150 pf
C7, 12, 15	3	" "	100 pf
C8, 10	2	Capacitor, Mica or Film	330 pf
D1 thru 4	4	Diode, Silicon	1N 914, 1N4148
P1 thru 4	4	Potentiometer, 1/2" shaft	100K, Linear
Q1, 2	2	F.E.T., N-Channet	E212 (Siliconix)
Q3, 5	2	Transistor, NPN	2N3393
Q4, 6	2	Transistor, PNP	2N3638
R1, 45	2	Resistor, Carbon 1/2 watt	150K, 10%
<del>R2, 3, 4, 7, 20, 26, 42, 46,</del> 47	9	" " "	100K, 10%
R5, 86	2	" " "	33K, 10%
R6	1	" " "	470K, 10%
R8	1	" " "	1 Meg. 10%
R9, 37	2	" " "	330K, 10%
<del>R10, 11, 12, 15, 21, 32, 34,</del> 35, 49, 50, 52	11	" " "	10K, 10%
R13	1	" " "	180K, 10%
R14, 18, 25	3	" " "	47K, 10%
R16, 17, 22, 24	4	" " "	22 ohm, 10%
R51	1	" " "	4.7K, 10%
<del>R27, 28, 29, 30, 41</del>	5	" " "	1K, 10%
<del>R19, 23</del>	2	" " "	12K, 10%
<del>R31, 33, 43</del>	3	" " "	22K, 10%
R38, 39	2	" " "	150 ohm, 10%
R40	1	" " "	68K, 10%
<del>R44</del>	1	" " "	560 ohm, 10%
R48	1	" " "	1.8K, 10%
S1	1	Switch, Toggle	SPST or SPDT
T1 thru T7	7	Trimpot	50K, Linear
U1, 2, 4, 6, 8	5	Operational Amplifier	LM301-A or Equiv.
U3, 5, 7	3	Operational Transconductance Amplifier	CA3080, Selected Category 1
MISC.	1	Exponential Current Source	1748
	2	P.C. Card Guides	
	1	Printed Circuit Board	
	1	Front Panel	
	4	Knobs, 1/2" shaft	
	1	Frame	
	2	Brackets	
	6	Screws, 4-40 x 3/16"	
	6	Nuts, 4-40	
	12	Mini-Phone Jacks	

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QUANTITY	DESCRIPTION
2	P.C. Card Guides
1	Printed Circuit Board
1	Front Panel
4	Knobs, 1/4 " Shaft
1	Frame
2	Brackets
6	Screw, 4-40 x 3/16 "
6	Nut, 4-40
12	Jack, Mini-Phone

The AR-327 filter is similar to the AR-339 but with an E212/LM301 topology instead of TL082 op-amps



\* Selected CA3080 category 1

MULTIMODE FILTER  
ARIES MUSIC INC.

AR-339



## ARIES SYSTEM 300 MUSIC SYNTHESIZER

## Module AR-328

## STEREO REVERB &amp; OUTPUT 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 stereo reverb output module. 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.

## ( ) 1. Preparation:

Lay the circuit board down on a sheet of white paper. PLACE METAL FOIL 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

Flat blade screw driver

1/2" or #16 nut driver

3/8" or #12 nut driver

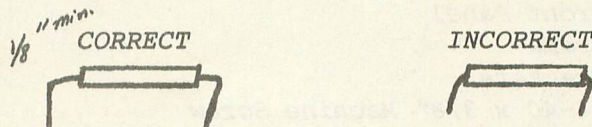
1/4" or #8 nut driver

A pair of regular pliers can substitute for the nut drivers but will not be as easy to use.

## ( ) 2. Resistors:

Carefully install all 40 resistors on the circuit board (R1 through R7 are potentiometers and will later be mounted on the panel). R8 through R14 are 1/4 watt resistors and will be mounted on the potentiometers on the front panel. To avoid breaking the resistor leads, bend leads at least 1/16 of an inch away from the body of the resistor.

For example:



## ( ) 3. Intergrated Circuit Amplifiers: Install all 3 (U1 thru U3)

## ( ) 4. Capacitors 14:

Install all capacitors on the circuit board. (C1 thru C14) Observe polarity. If there is no band or polarity marking, the capacitor may be installed in either direction.

## ( ) 5. Transistors 4:

Install all 4 transistors on the circuit board. (Q1 thru Q4) The general shape of the transistor 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 the correct letters (E,B,C) are in the proper holes.



- ( ) 6. Diodes: Install of 4 (CR1 thru CR4). Observe polarity
- ( ) 7. Trimpots: Install both 2.5K trimpots on the board R51, R56  
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 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 4-40 x 3/8" 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!!!

FRONT PANEL ASSEMBLY--Refer to panel wiring diagram

Now set the module frame aside and carefully unpack the front panel.

- ( ) 1. Install all 14 mini-phone jacks as shown in the panel drawing.
- ( ) 2. Install the two RCA out put jacks as shown.
- ( ) 3. Install the stereophone jack as shown.
- ( ) 4. Install the power switch as shown.
- ( ) 5. Install the pilot light through the front panel. Slide the rectangular lock washer over the pilot light from the rear, concave side toward the panel.
- ( ) 6. Install all six potentiometers as shown on the panel diagram.  
The two top most potentiometers R1 & R3 will be removed later when we attach the front panel to the module frame. Do not overly tighten these two pots. Put the locking washer over the shaft of the pot. Insert the pot shafts through the appropriate holes in the panel. Put on the nuts and tighten them very snugly, but avoid scratching the panel.

PANEL WIRING: Refer to panel wiring diagram & board assembly drawing.

- ( ) 1. Run an insulated wire from pin 2 of R7 to the grounds of all 17 jacks, to the appropriate terminals at each pot, and to shunt of each audio input jack, as shown. You may use either separate pieces of wire or one continuous piece, but it must be insulated between connections where shown. Connect another foot long piece of wire to pin 2 of R7. This will be connected later.
- ( ) 2. Run a wire connecting the tips of each set of four jacks labelled "patch" on the front panel.
- ( ) 3. Run a wire from the tip of the audio input jacks to pin 3 on the first input potentiometers R1, as shown. Connect audio input 2 to R2 in the same way.
- ( ) 4. Connect two 33K ohm resistors to pin 2, the center tap, of audio input pot 1. Connect the end of one resistor to pin 1 of PAN pot 1 (R3) and the end of the other resistor to pin 3 of PAN pot 1. Do the same to input 2. Insulate the leads of these resistors if they are likely to touch the front panel or the case of the pot. Connect a one foot long piece of insulated wire to pins 1 and 3 of each pot.
- ( ) 5. Connect a one foot long piece of insulated wire to pin 2 and 3 of each reverb level pot; (R5 & R6).
- ( ) 6. Connect a 33K ohm resistor from the tip of input jack 1 to pin 3 of the reverb source pot (R7). Connect a 33K ohm resistor from the tip of input jack 2 to pin 1 of the reverb source pot (R7). Connect a one foot long piece of insulated wire to pins 1 and 3.

- (✓) 7. Run a wire connecting the tips of the two +10V jacks. Connect a one foot long piece of insulated wire to the tip of one of the jacks.
- (✓) 8. Run a wire connecting the tips of the two -10V output jacks. Connect a one foot long piece of insulated wire to the tip of one of the jacks.
- (✓) 9. Connect a one foot long piece of insulated wire to each of the RCA jacks and each of the terminals on the stereophone output jack.
- (✓) 10. Solder a 47K ohm resistor to one lead of the pilot light. Insulate this connection with electrical tape or heat shrinkable tubing. Connect the other end of the resistor to pin 2 of the power switch. The body of the resistor should be close to pin 2 (less than 1/8" away) to prevent the resistor lead touching another terminal or the case of the switch.
- ( ) 11. Connect three 18 gauge wires, three feet long to pins 1, 2 & 4 of the male Cinch-Jones plug supplied with the AR-322. Slip the cover over the wires but do not fasten until all of the wires have been connected to the front panel.
- ( ) 12. Connect the wire from pin 1 to the other lead of the pilot light. Solder this connection and insulate it with electrical tape or heat shrinkable tubing.
- ( ) 13. Connect the wire from pin 2 on the plug to pin 1 on the switch.
- ( ) 14. Connect the wire from pin 4 on the plug to pin 2 on the switch. Be careful that no loose strands of wire are touching the case of the switch or the other terminals. Wrap a piece of electrical tape around the switch to totally insulate these connections.
- ( ) 15. Place the cover on the plug.
- ( ) 16. Now complete the module construction by removing the two top most pots on the front panel R1 and R3 and mounting the top of the panel to the top of the module frame, using pots R1 and R3. Insert the pots shafts through the frame and then through the panel. Refasten the pots.
- ( ) 17. Attach the bottom of the panel to the frame using the remaining 4-40 screws and nuts.
- ( ) 18. Consulting the P.C. board assembly drawing, connect the wires from the front panel to the appropriate points on the P.C. board.
- ( ) 19. Turn all potentiometer shafts fully counter clockwise and mount the knobs pointing to the left most panel marking. Tighten knob screws.
- ( ) 20. Take the four shielded cables supplied and install an RCA plug on each. Insert the wires through the rectangular hole at the rear of the module frame on the same side that the components are mounted. Install the other end of the cables on the P.C. board at the appropriate points marked "in" and "out". Take a piece of masking tape or an address label and mark the plugs accordingly.
- THIS COMPLETES ASSEMBLY OF YOUR AR-328 STEREO & OUTPUT MODULE**

#### Reverb Trim Procedure:

Connect the reverb cables to reverb tanks. Observe that the cables from the reverb driver are connected to the reverb inputs and that the inputs to the reverb preamp on the P.C. board are connected to the reverb tank outputs. Supply power to the module. Using either a volt meter or a DC coupled oscilloscope, monitor the outputs of U3 with no input to the module. The outputs at pin 7 & 8 should be adjusted to +7.5V D.C. This biases the output in the middle of its voltage range and allows for equal positive and negative voltage swing.

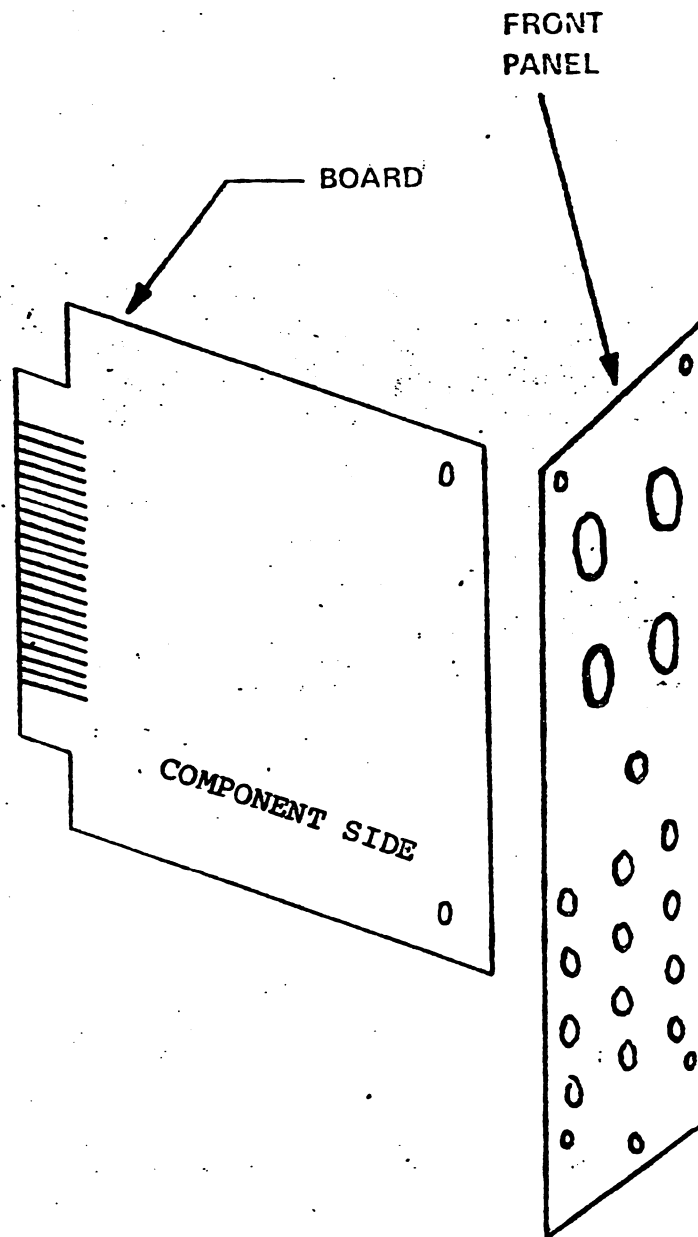
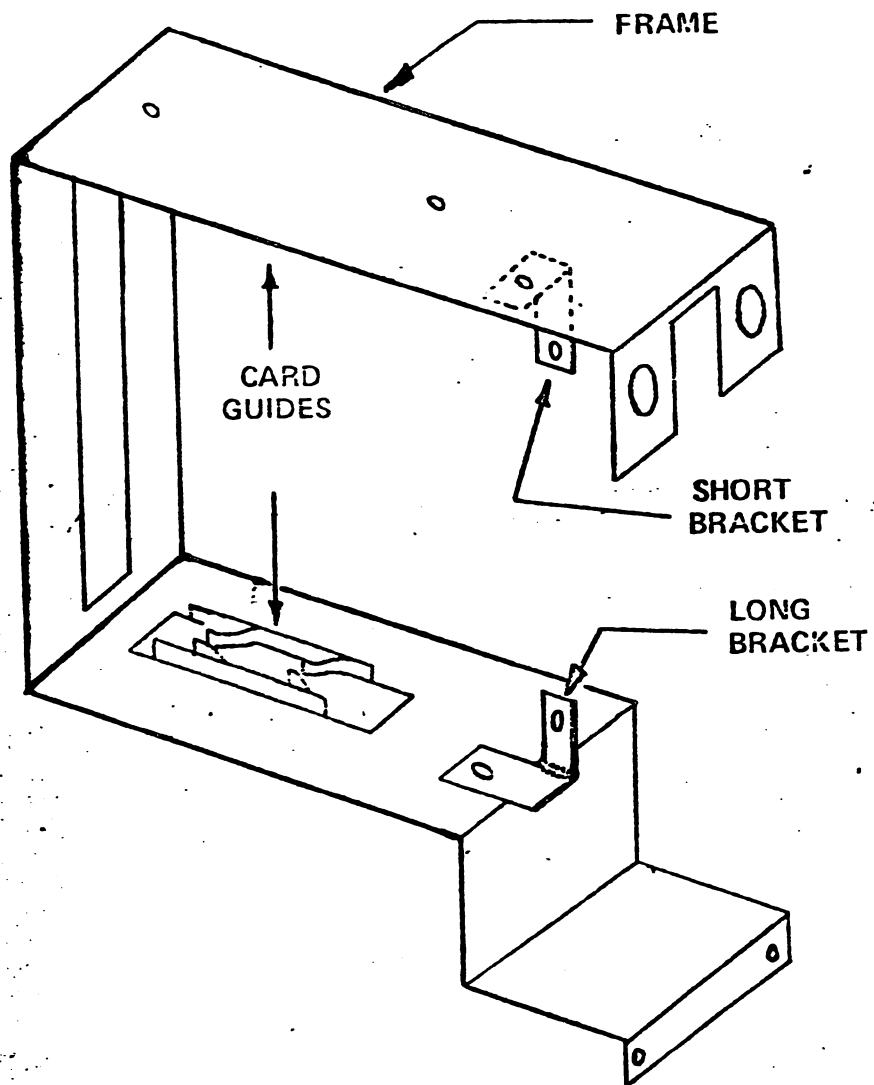
#### Reverb Installation:

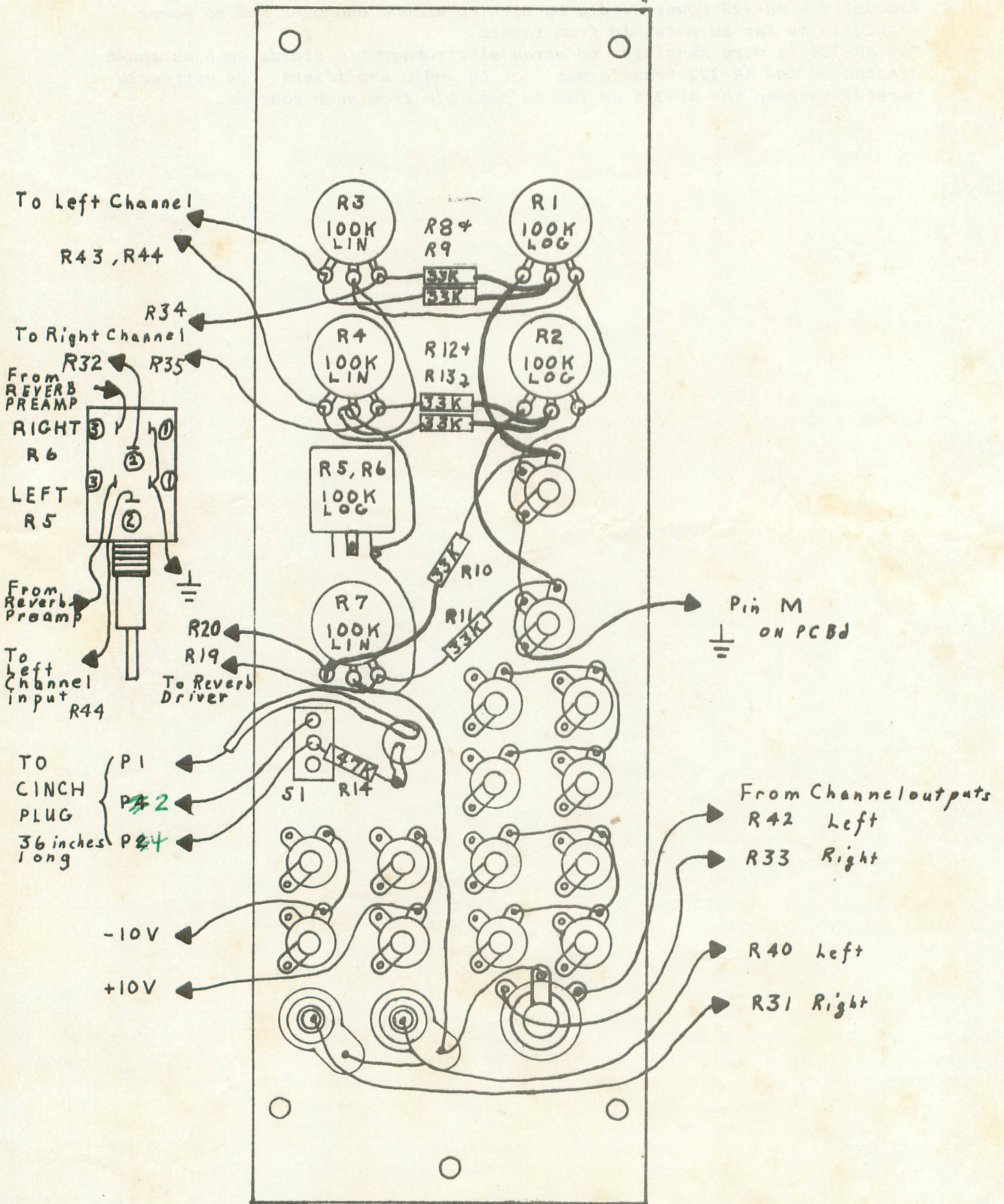
- ( ) 1. A 22 pin edge connector is supplied with your kit. This should be installed on the rear plane mounting bars and wired the way the others are: pin "A" to +15v, pin "M" to ground, pin "Z" to -15v. (Bottom pin should be pin "Z")
- ( ) 2. To connect the Cinch-Jones plug to the AR-322, be sure to run the cable from the AR-322 out over the top of the module frame, as far as possible from the reverb output cables.
- ( ) 3. There are 4 mounting holes on the bottom of each reverb tank. Slip the rubber grommets into these holes and mount them under the AR-328 and adjacent modules

using the 3/4" long wood screws supplied. The output side of the tanks should be as far as possible from the AR-322.

- ( ) 4. Remount the AR-322 Power Supply by turning around end over end so power supply is as far as possible from reverb.
- ( ) 5. The AR-328 is very sensitive to stray electromagnetic fields such as those created by the AR-322 transformer, or by audio amplifiers. Be extremely careful to keep the Ar-328 as far as possible from such sources.



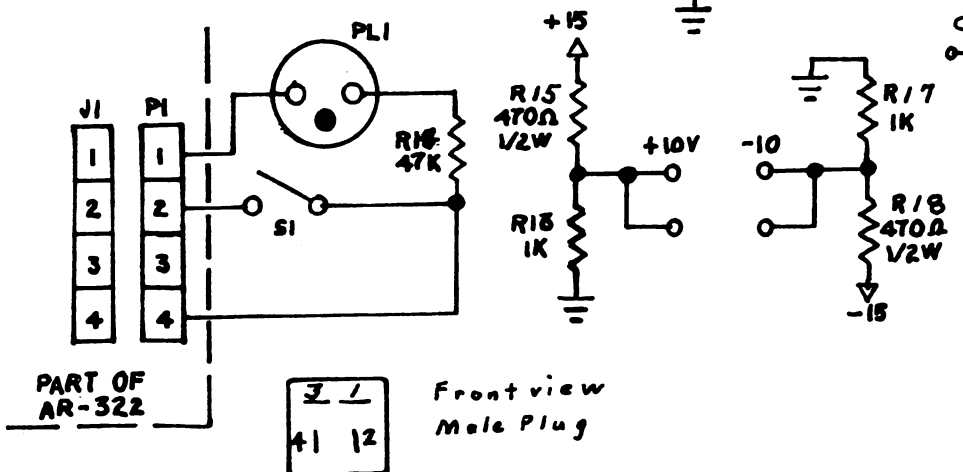
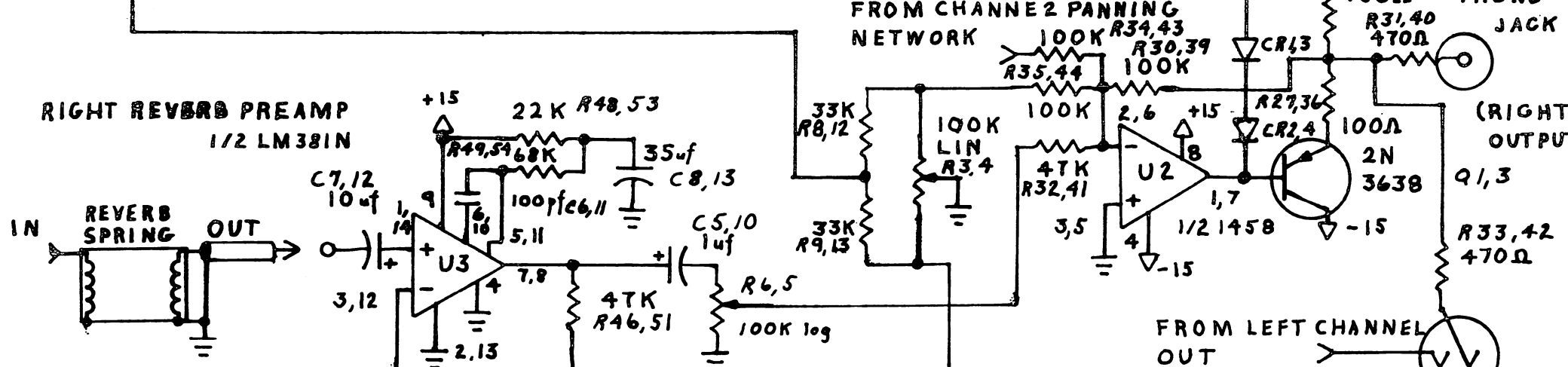
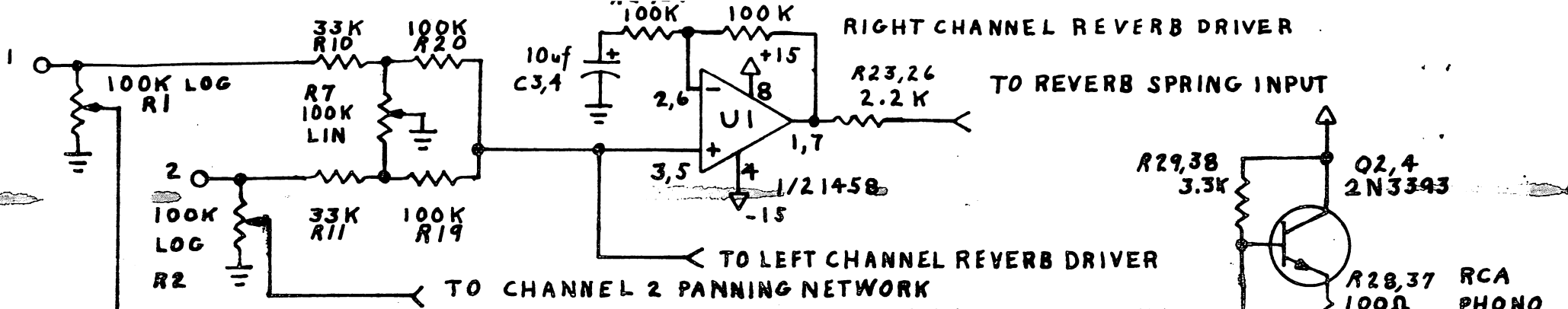


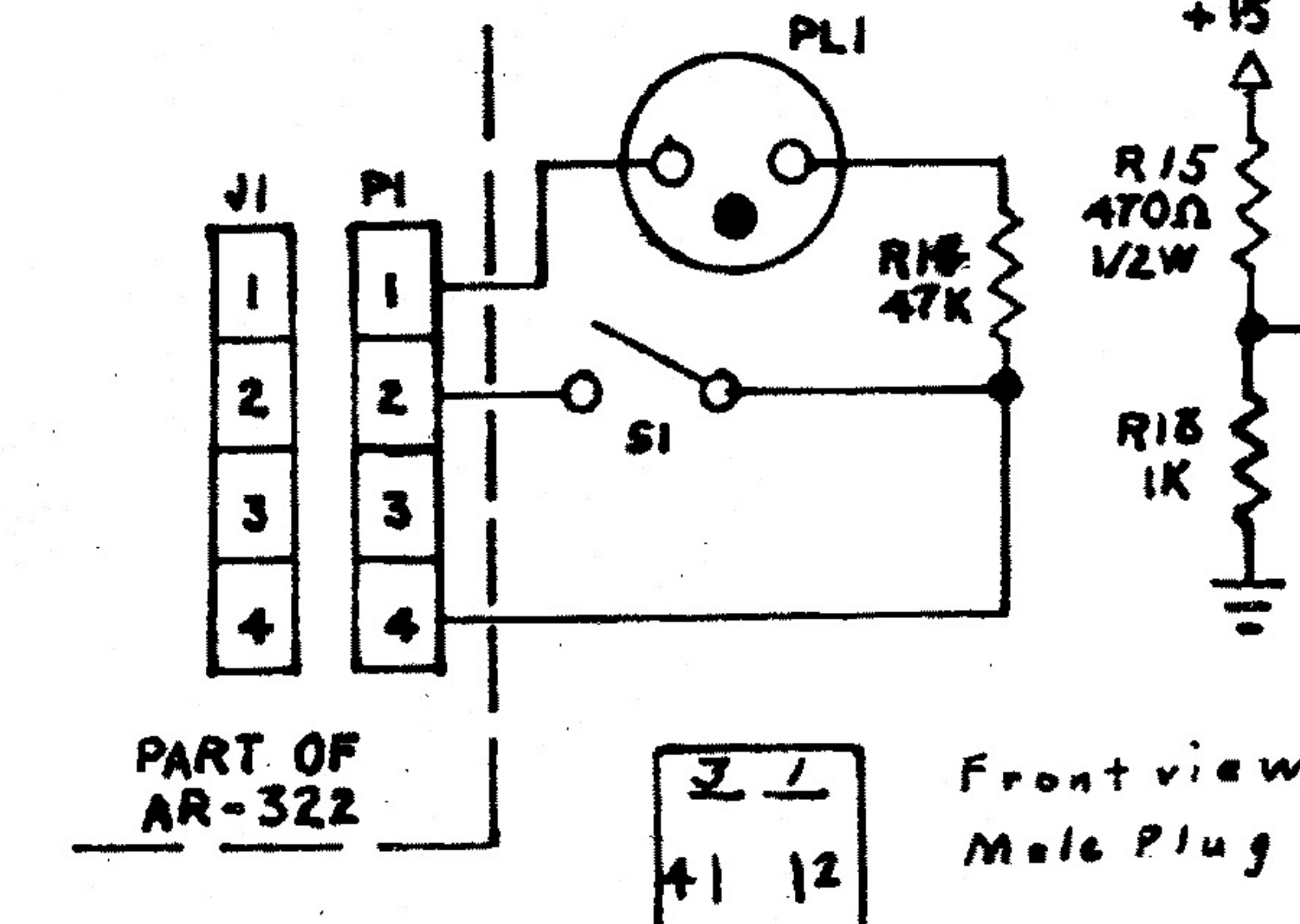
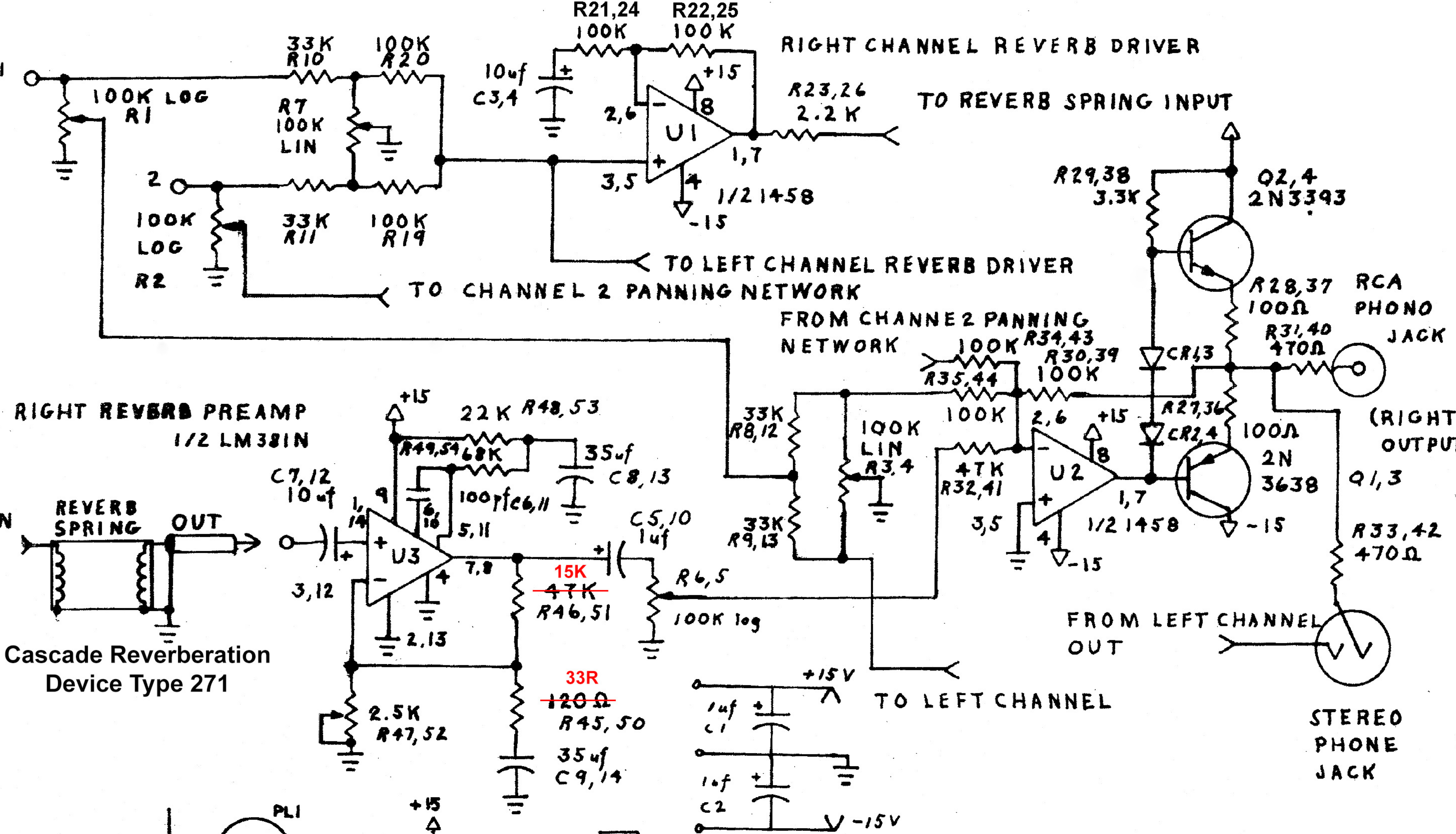


## PARTS LIST \* AR-328 \* STEREO REVERB &amp; OUTPUT MODULE

NUMBER	QUANTITY	DESCRIPTION	VALUE AND RATINGS
	4	Capacitor, tantalum	1uf, 25V
	4	" "	10uf, 25V
	4	Capacitor, Electrolytic	35uf, 25V
	2	Capacitor, Disc	100pf, 25V
	8	Resistor, Carbon	33K, $\frac{1}{2}$ watt
	12	Resistor, Carbon	100K, $\frac{1}{2}$ watt
	2	" "	2.2K, $\frac{1}{2}$ watt
	4	" "	100 $\Omega$ $\frac{1}{2}$ watt
	4	" "	470 $\Omega$ $\frac{1}{2}$ watt
	5	" "	47K, $\frac{1}{2}$ watt
	2	" "	120 $\Omega$ $\frac{1}{2}$ watt
	2	" "	68K, $\frac{1}{2}$ watt
	2	" "	22K, $\frac{1}{2}$ watt
	2	" "	3.3K, $\frac{1}{2}$ watt
	2	" "	470 $\Omega$ $\frac{1}{2}$ watt
	2	NPN Transistor	A-3393
	2	PNP Transistor	2N3638
	2	Dual Operational Amplifier	MC1458
	1	Dual Low-Noise Pre-Amplifier	LM381N
	2	Trimpot (horiz. mtg.)	2.5K
	2	Cascade Reverb	
	1	Toggle Switch	SPDT
	2	Mini Rotary Pots	100K, Log.
	3	" " "	100K, Lin.
	1	Dual Concentric Pot	100K, Log.
	5	Knob; 1/8" shaft	
	1	Knob; concentric	
	1	22 pin edge connector	
	2	P.C. Card Guides	
	14	Mini phone jacks	
	2	R.C.A. (phono) jack	
	1	Stereo $\frac{1}{4}$ " phone jack	
	1	Neon Lamp	
	1	Printed Circuit Board	
	1	Front Panel	
	1	Frame	
	2	Brackets	
	6	#4-40 x 3/8" Machine Screw	
	6	#4-40 Hex Nut	
	1	3' Length shielded cable	
	4	Male R.C.A. plug	
	8	Rubber Grommets	
	8	#6 x 3/4' Wood Screws	

B4I4Q  
 $\frac{1}{18}$  RV  
 QTH?





AR 328  
POWER CONTROL  
AND  
1/2 REVERB AND  
STEREO OUTPUT DRIVER



ARIES System 300 Music Synthesizer

MODULE AR-329

PHASE- FLANGER

The previous pages were written as a general guide, to familiarize the builder with the components. Now are the specific assembly instructions for building your AR-329 PHASE FLANGER module It is recommended that you do the following before you proceed:

Find a place 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

( ) Preparation

lay the circuit board out on a clean sheet of white paper PLACE METAL ( FOIL SIDE ) DOWN Turn board so that the 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 long nose pliers

Regular pliers

Flat blade screw driver

( ) Jumpers

Find J-1 on the drawing. Measure J-1 on the P.C. board. Cut a piece of insulated wire one inch longer than J-1 measures on the P.C. board . Strip  $\frac{1}{2}$ " of the insulation from each end of the wire. Bend the bare end of the wire and insert them into the board, according to the drawing. While holding the jumper against the board , bend the bare ends at a 45 degree angle on the foil side of the board to hold the jumper in place. Solder and cut off the excess. Install J2 through J5 in the same manner , but do not install J6 or J7 at this time as they are long and will get in your way install J6 and J7 after you have installed the resistors that are in there area.

( ) RESISTORS

Install all 48 resistor on the P.C. board to avoid braking the resistor leads bend the leads at least 1/16 of an inch away from the resistor body.

For example:

Correct



Incorrect



( ) CAPACITORS:

Install all 14 capacitors on the P.C. Board—most capacitors on the AR-329 Phase Flanger are ceramic or monolithic disc type and therefor are not polarity sensitive; C-1 & C-2 are tantalum and must be oriented properly.

( ) TRANSISTORS AND F.E.T.S

Install Q1 (2N3393) on to the P.C. Board. Be careful to maintain the proper orientation of the leads. Next install Q2 (E-411) this is a dual n channel fet—as before be careful to maintain the proper lead orientation.

( ) INTEGRATED CIRCUITS AND TRANSISTOR ARRAYS

Install all three CA1458 on to the P.C. Board. Be careful to maintain the proper orientation of the device's.  
Next install the CA-3086 transistor array and as before be careful to maintain the proper orientation of the device.

( ) PD-10 POTTED AND TESTED MODULE

Install the PD-10 potted module on to the P.C. board. Be careful to orientate it correctly. Notice that one end of the module has the leads more closely together. This end goes towards the connector strip.

( ) TRIMPOTS

Install all three of the 50K linear trimpots on to the P.C. board and finally J-6 & J-7.

ALL THE BOARD COMPONENTS ARE NOW MOUNTED

MODULE ASSEMBLY: Please refer to the module assembly drawing.

- ( ) Unpack the frame, and the bag of mounting hardware and front panel. Also a bag of mini phone jacks, knobs.
- ( ) Snap the two black plastic card guides into the frame holes; the tabs must point to the rear (the bottom one is shown installed on the drawing).
- ( ) Slide the P.C. Board into the frame. Hold the top and the bottom of the frame down upon the board, so that the board fits snugly in the card guide tabs.
- ( ) Mount the board to the two brackets, as shown, using four round head screws and nuts. It may be necessary to hold the frame top and bottom together to prevent the P.C. board from slipping out of the guides.
- ( ) Next comes the front panel. Notice that the front panel has two small holes near the bottom of the panel; these mount to the two holes on the bottom of the frame with two 4-40 pan head screws and nuts.
- ( ) Now take two 100K linear pots and bend the tabs, if any, out flat. Insert the shaft through the module frame and the front panel. Align as shown on the panel wiring diagram and secure with two nuts. **BE CAREFUL NOT TO SCRATCH THE FRONT PANEL.**
- ( ) Install the other two pots as indicated on the panel wiring diagram.
- ( ) Install all 12 mini-phone jacks as shown on the panel wiring diagram.
- ( ) Turn all of the potentiometer shafts fully counter-clockwise and mount the knobs pointing to the left most number or mark. Now tighten the knobs set screws.

THIS COMPLETES THE MODULE ASSEMBLY

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

- ( ) Run a wire connecting the grounds of all 12 jacks, as shown. also run a wire from the connector strip point N to one of the grounds on the jacks as shown. and to the three pots P-1,3,4 pins 3 as shown
- ( ) Wire all four pots to the appropriate points on the board as indicated on the assembly drawings. USE INSULATED WIRE.
- ( ) Wire all 12 jacks to the appropriate points on the board near the connector strip . Be careful to wire to the right lettered points. these can be found on the drawing and on the p.c. edge connector.

THIS COMPLETES THE WIRING OF YOUR AR-329 PHASE FLANGER MODULE

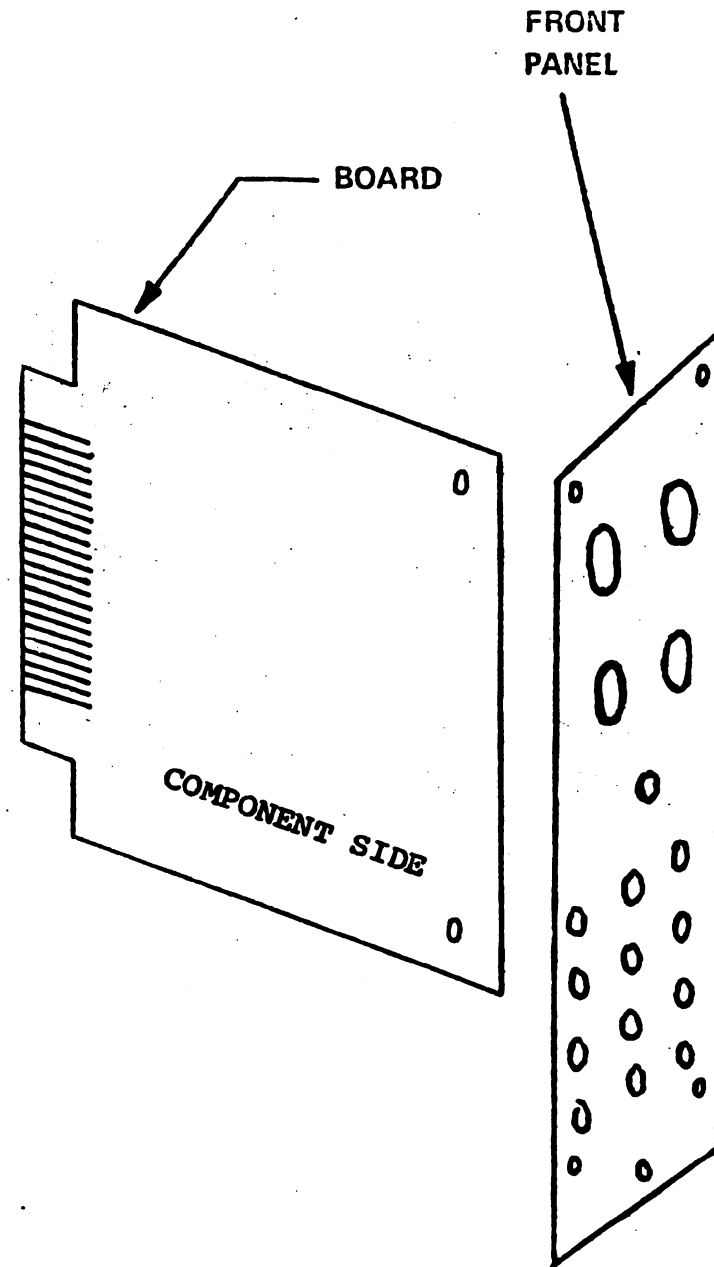
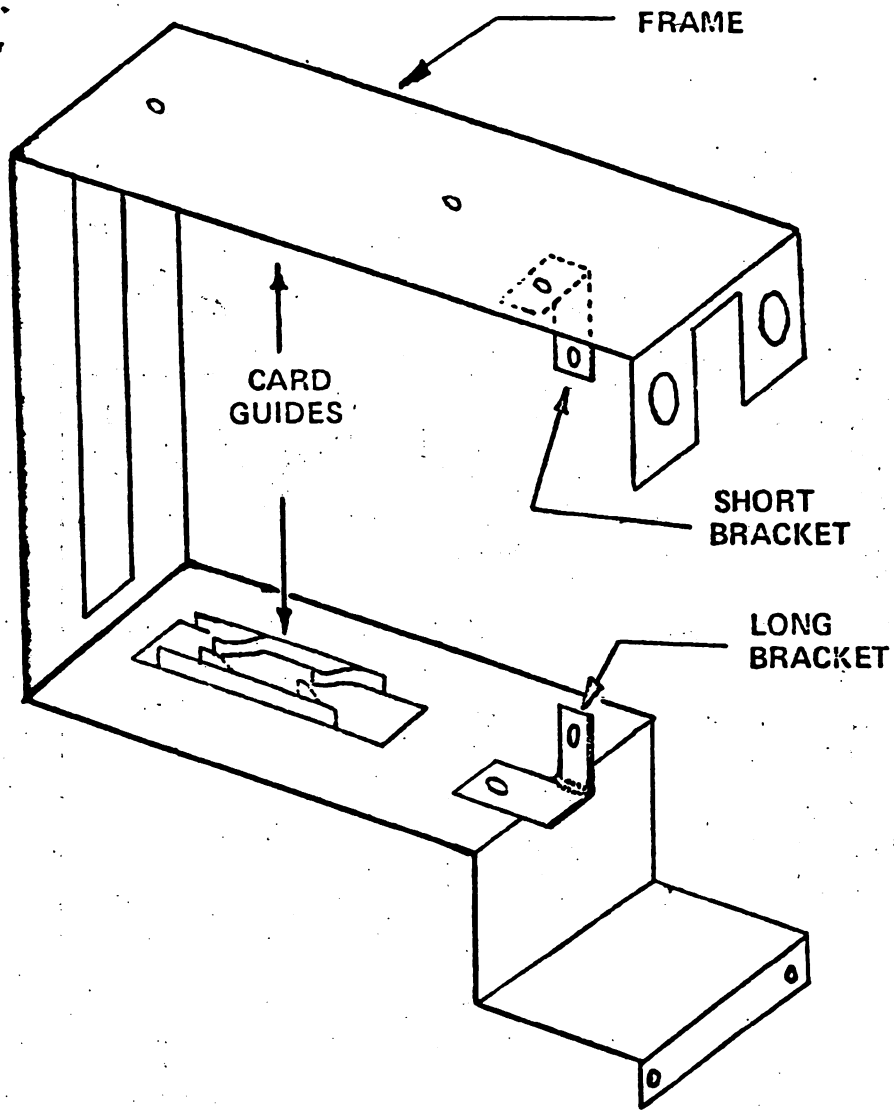
AR-329 TRIM PROCEDURE.

NOTE: you will need the following to trim your phase flanger module

- ( ) Source of + and- 15 volts like the AR- 322 power supply
- ( ) A D.C. Voltmeter
- ( ) A 1Khz. sinewave AR-317 VCO
- ( ) A small screw driver to adjust the trimpots
  
- ( ) **FREQ. TRIM (T-2)**  
Set the freq. knob to its max's, and the resonance knob to its min. Set the audio input knob to its min., and the control knob to its min. set the odd even switch to the odd position. Next connect a DC Voltmeter +lead to R-39 the end nearest to the CA-3086, and the - lead to ground. Now turn on power to the AR-329 and set T-2 for 1.0 volt  $\pm$  0.1 volts
  
- ( ) **GAIN TRIM (T-3)**  
SET freq. knob to its mid. position 12:00  
Feed a 1Khz. sine wave (aprox.) into audio input 1  
Connect an AC. voltmeter or scope to the main output. switch the Bypass/mix switch to Bypass. Adjust the audio input pot for a 2 Volt RMS signal on the meter. Now switch the meter to R-30 the connector end and adjust T-3 for a 1 Volt RMS signal .
  
- ( ) **RESONANCE TRIM (T-1)**  
Switch from Bypass to Mix. Monitor the main output with a scope, meter, or an audio amp. Turn up the resonance pot to its max. Now turn T-1 up to max (fully clockwise) and monitor the output if the output shows any oscillation turn T-1 down just until the signal or oscillation disappears. Now rotate the Freq. knob over its entire range and turn down T-1 further if needed to allow no oscillation at any frequency setting on the freq. knob

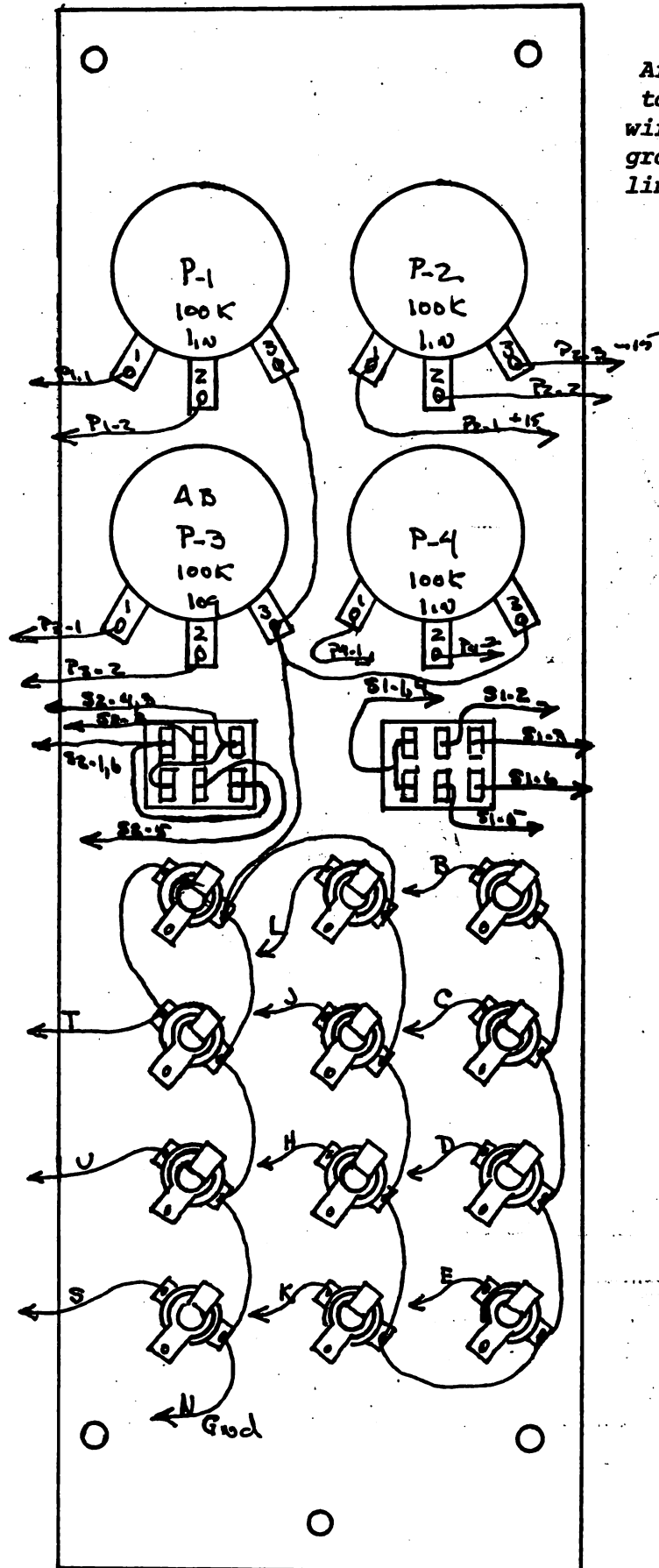
THIS COMPLETES THE TRIMMING OF YOUR AR-329 PHASE FLANGER MODULE

AR-329 PHASE FLANGER



AR-329 PHASE-FLANGER PANEL WIRING DIAGRAM

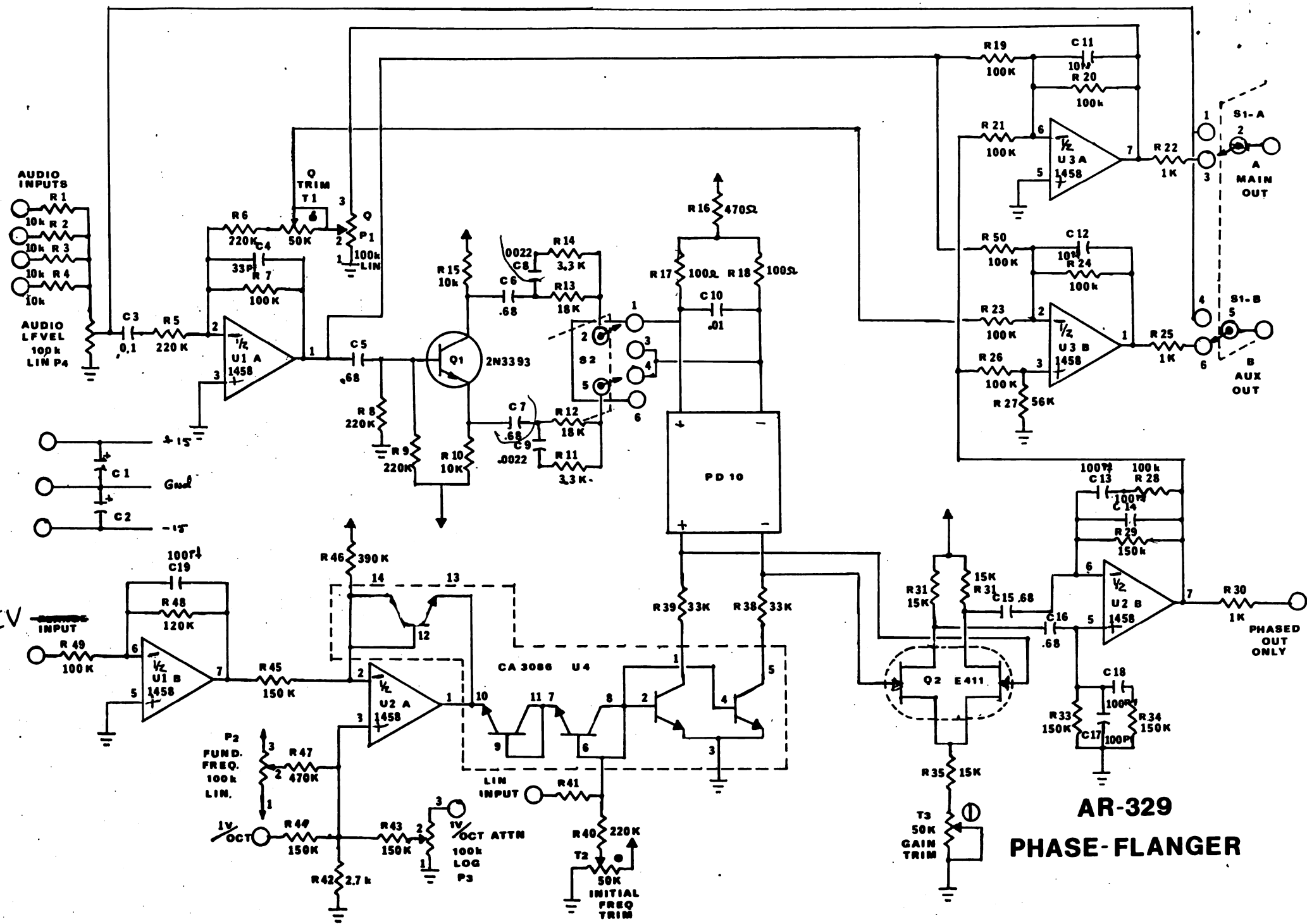
Rear view



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

PARTS LIST \* AR-329\* PHASE FLANGER

NUMBER	QUANTITY	DESCRIPTION	VALUE	RATING
C-5,6,7,15,16	5	Capacitor, Disc	.68 uf	
C-11, 12	2	Capacitor, Disc	10 pf	
C-4	1	"	33 pf	
C-13,14,17,18,19	5	"	100 pf	
C-8,9	2	"	.0022 uf	
C-10	1	"	.01 uf	
C-3	1	"	.1 uf	
C-1,2	2	Capacitor, Tantalum	1 uf	
U-1,2,3	3	Dual Operational Amp.	Mc/CA 1458	
U-4	1	Transistor array	CA-3086	
U-5	1	Potted Module	PD-10	
Q-1	1	Transistor NPN	2N3393	
Q-2	1	F.E.T. dual N channel	E-411	
R-17,18	2	Resistor Carbon	100 ohm, 10%	
R-16	1	" "	470 ohm, 10%	
R-22, 25, 30	3	" "	1K 10%	
R-42	1	" "	2.7K 10%	
R-11,14	2	" "	3.3K 10%	
R-1,2,3,4,10,15	6	" "	10K 10%	
R-31,32,35	3	" "	15K 10%	
R-12,13	2	" "	18K 10%	
R-38,39	2	" "	33K 10%	
R-27	1	" "	56K 10%	
R-7,19,20,21,23				
24,26,28,49,41,50	11	" "	100K 10%	
R-48	1	" "	120K 10%	
R-29,33,34,43,44,45	6	" "	150K 10%	
R-5,6,8,9,40	5	" "	220K 10%	
R-46	1	" "	390K 10%	
R-47	1	" "	470K 10%	
T-1,2,3	3	Trimpot	50K Linear	
P-1,2,4	3	Potentiometer 1/4" shaft	100K Linear	
P-3	1	" "	100K Log	
S-1,2	2	Switch, Toggle	DPDT	
	12	Jack, Mini-phone		
	1	Printed Circuit Board		
	1	Front Panel		
	4	Knobs, 1/4" shaft		
	1	Frame		
	2	Brackets		
	6	Screws, 4-40 x 3/16"		
	6	Nuts, 4-40		
	2	P.C. Card Guides		



**AR-329  
PHASE-FLANGER**

+ 15

1  
2  
3  
4

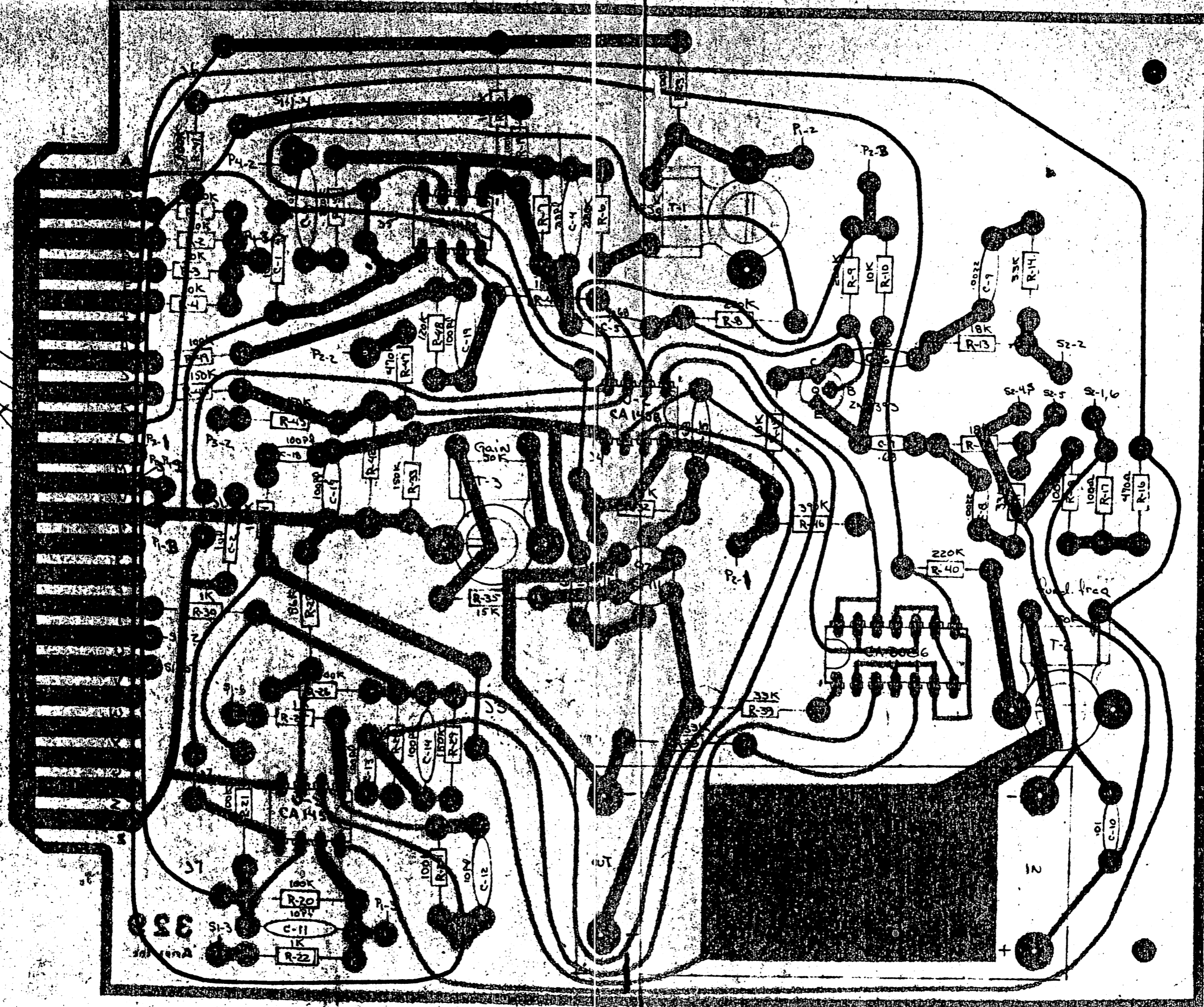
Audio inputs

Flange input  
1/10 oct input  
lineal input  
ATTN 1/10 oct input

Gnd

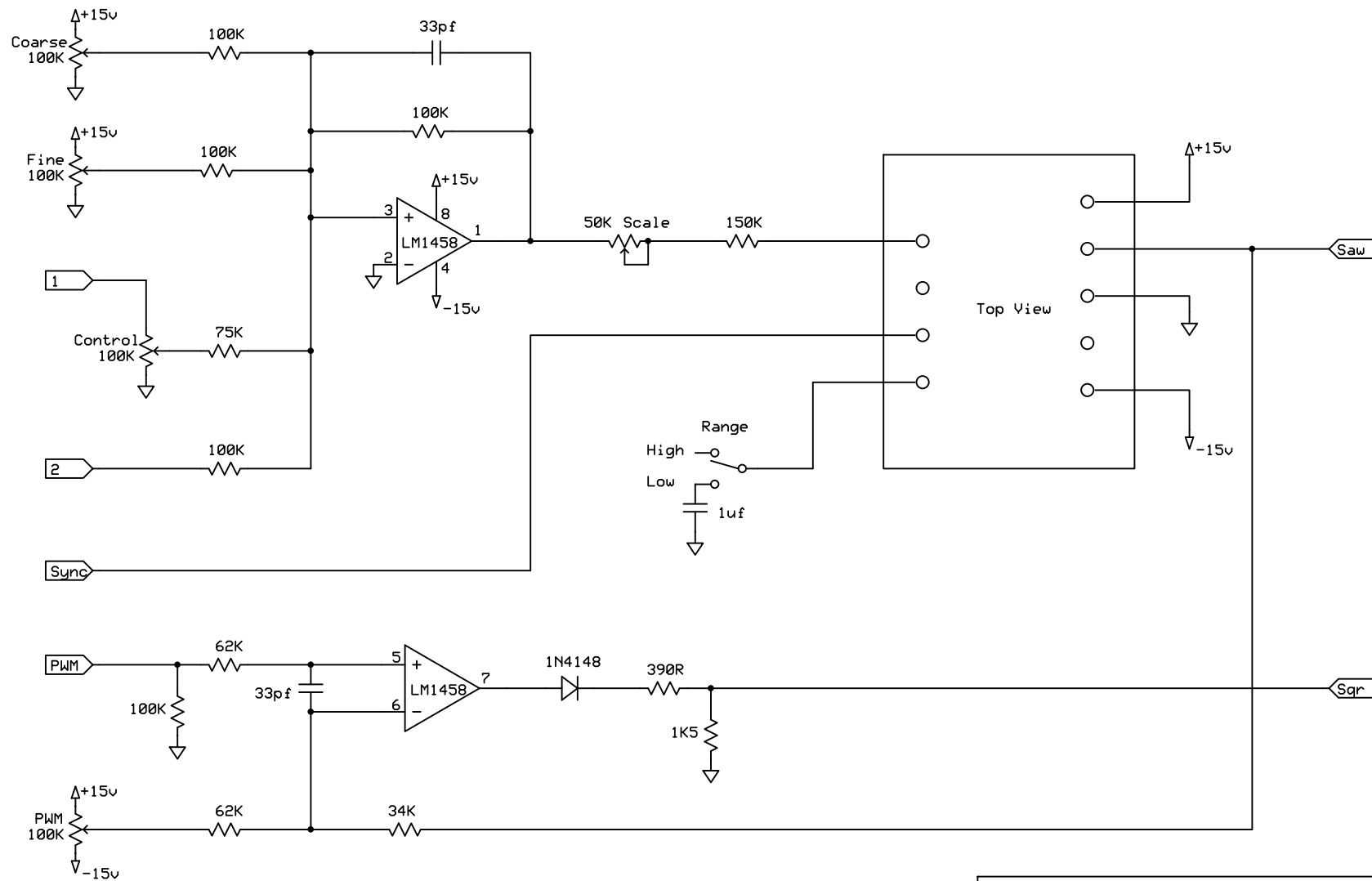
Phase out  
A (main) out  
B (Aux) out

- 15



AR-329





Aries (drawn by ModularSynthesis)

### AR-332 Dual VCO

David J. Brown

Rev 0.0

10/12/2013

1/2 of Dual VCO

## MODULE AR-334

## SEQUENCER ASSEMBLY INSTRUCTIONS

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.

## ( ) 1. PREPARATION:

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

Lay the assembly drawing 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

Flat blade screw driver

1/2" or #16 nut driver

5/16" or #10 nut driver

1/4" or #3 nut driver

A pair of regular pliers can substitute for the nut drivers but will not be as easy to use.

## ( ) 2. RESISTORS:

Carefully install all 84 resistors on the circuit board. See general assembly instructions. Double check your installation against the P.C. board component layout drawing to be sure that the correct value is in the correct location. To prepare the resistor for insertion, hold the body of the resistor between the thumb and index finger of your left hand. With the thumb and index finger of your right hand bend both leads of the resistor at once to form right angles with the body. The resistor will now insert easily into the P.C. board. Once the resistor is inserted, bend the leads on the foil side to hold the resistor in place. Solder the resistors to the board and cut the leads about 1/16 of an inch away from the board.

For ease in reading the resistor values on the P.C. board install the resistors with the gold band facing either the bottom or the right-hand side of the board.

- a) Install the sixteen 330K resistors; R70 - 77 & R58 - 65; solder & cut leads
- b) Install the remaining 330K resistors; R53,48,43,38,33,28,23,18; solder & cut leads
- c) Install the eight 10K resistors; R55,50,45,40,35,30,25,20; solder & cut leads
- d) Install the eleven 1K resistors; R54,49,44,39,34,29,24,19,69,81,57; solder & cut leads
- e) Install the eight 470K resistors; R56,51,46,41,36,31,26,21; solder & cut leads
- f) Install the four 39K resistors; R3,6,14,13; solder & cut leads
- g) Install the four 47K resistors; R1,4,11,6; solder & cut leads
- h) Install the two 220K resistors; R78 & 66; solder & cut leads
- i) Install the one 150K resistor; R-7; solder & cut leads
- j) Install the one 5.6K resistor; R-15; solder & cut leads
- k) Install the twenty-one 100K resistors; R52,47,42,37,32,27,22,17,2,5,12,84,83,82,8,9  
10,79,80,67,68, solder & cut leads

- ( ) 3. DIODES:  
Install diodes CR1 and CR2 on the circuit board. Double check the polarity of the diodes. Solder and cut leads.
- ( ) 4. INTEGRATED CIRCUITS  
At this time install only the two 1458 dual operational amplifiers (A1 & A2). IC 1 & IC 2 are CMOS integrated circuits and are subject to damage from static charges. Do not remove these ICs from their protective conductive foam until all the module assembly steps have been completed. Double check your installation and solder the leads.
- ( ) 5. TRANSISTORS  
Install all 20 transistors on the circuit board. (Q1 through Q20). Check the P.C. board component layout for correct orientation of the transistor leads. Solder and cut the leads.
- ( ) 6. CAPACITORS  
Install capacitors C1 through C9 on the circuit board. Observe polarity. If there is no polarity marking the capacitors may be installed in either direction. Double check your installation. Solder and cut the leads.
- ( ) 7. WIRE SADDLE  
Snap the wire saddle into the hole on the P.C. board as shown on the component layout.  
STILL DO NOT INSTALL THE CMOS ICs AT THIS TIME  
Set the circuit board aside and go on to the front panel wiring instructions.

FRONT PANEL ASSEMBLY PROCEDURE

Due to the size and number of the components on the face panel and to the unusually large number of wires required for this module, we have changed the normal wiring procedure. Rather than mounting all the parts and wiring them, the AR-334 requires that some parts be mounted then wired, then other parts mounted and wired and so on. We suggest that you use the color coded wire for these functions

BROWN: CW TAP P1, CATHODE L1, TIP JACK G1  
 ORANGE: " " P2, " L2, " " G2, TIP JACK A  
 YELLOW: " " P3, " L3, " " G3, CENTER TAP (A) OF ALL 8 INNER POTS  
 GREEN: " " P4, " L4, " " G4, TIP JACK B  
 BLUE: " " P5, " L5, " " G5  
 VIOLET: " " P6, " L6, " " G6  
 GREY: " " P7, " L7, " " G7, TIP JACKS RESET, CLOCK, RUN ENABLE & STEP;  
 SHUNT JACK RUN ENABLE & STEP; STEP & RUN  
 TERMINALS OF SWITCH  
 WHITE: CW TAP P8, CATHODE L8, TIP JACK G8, CENTER TAP (B) OF ALL 8 INNER POTS  
 RED: +15v TERMINAL OF SWITCH, LD FROM LEDS  
 BLACK: GROUND OF JACKS

Refer to the panel wiring diagram.

- ( ) 1. Install all 13 mini-phone jacks as shown on the front panel drawing.
- ( ) 2. Solder a wire to the grounds of all 13 jacks as shown in the panel wiring diagram. Solder a wire from the ground pins of the Reset and Clock jacks to their respective shunt pins as shown on the wiring diagram. This wire does not have to be insulated.
- ( ) 3. Cut and strip 15, 14" long pieces of insulated wire. Solder one end of each wire to the tip of each jack. Solder one end of 14" long wire to the shunt of the Run Enable & Step jack. Solder one end of a wire to the ground of the R, E & S jack.
- ( ) 4. Install the switch S1 on the front panel as shown in the wiring diagram. Be sure

that the momentary action of the switch is toward the Step position.

- ( ) 5. Solder three one foot long pieces of wire to the three terminals of the switch.
- ( ) 6. Now install all eight light emitting diodes. Insert the longer of the two pieces of LED mounting hardware through the front panel so that the washer-like surface rests on the front panel and the cylindrical part extends through and protrudes from the back surface of the front panel. Insert the LED from the back into the cylindrical section so that the rounded end sticks out through the section of washer on the front surface of the panel. Rotate the LED so that the Anode lead is to the left. The anode lead will be the longer and thinner of the two leads. Insert the second piece of mounting hardware over the leads of the LED and the cylindrical section of the first piece. Push the second piece all the way up to the panel so that the two pieces of mounting hardware are clasping the panel and holding the LED firmly in place.
- ( ) 7. Run an insulated wire connecting the anodes of all eight LEDs as shown on the panel wiring diagram. Connect a 12" piece of wire to the anode of LED 4 as shown. These wires should be soldered as close to the body of the LED as practical. Cut the anode lead after the wires have been soldered.
- ( ) 8. Cut and strip eight 14" pieces of wire. Solder one each to the cathode of each LED as shown in the wiring diagram. These wires should be soldered as close to the body of the LED as practical. Cut the cathode lead after the wires have been soldered. With a piece of tape, label the wire from each LED as LED-1, LED-2, etc.
- ( ) 9. Install the four pots P5 through P8 on the front panel. On pots 6, 7, & 8, insert the spacer nut between the body of the pot and the lock washer before installing the pot on the panel. Install all four pots with their pins oriented as shown on the panel wiring diagram. Do not overly tighten pot 5. It will have to be removed later in order to install the frame.
- ( ) 10. Connect an insulated jumper wire between the two clockwise CW terminals of each pot. Do not solder.
- ( ) 11. Connect a 14" long piece of wire to the top, CW terminals of each pot. Solder the CW terminals of the pots. Bundle these together using a piece of tape, wire or ty-wrap.
- ( ) 12. Connect an insulated jumper wire between the counter clockwise CCW terminals of each pot; do not solder.
- ( ) 13. Following the wiring diagram, connect a 2" long piece of insulated wire between the CCW terminals of pot 5 and pot 6. Connect a jumper wire between the CCW terminals of pot 6 and pot 7 and between pot 7 and pot 8. Connect an insulated wire between the CCW terminal of pot 8 and the ground pin of the Run Enable & Step jack. Solder all connections.
- ( ) 14. Solder one end of the 14" piece of wire to the center tap of all four dual pots. Group the four B wires together and label with a piece of tape. Group the four A wires together and label with a piece of tape. It is not important that you separate the wires B1 from B2, etc., or A1 from A2, etc. These wires are returned to the summing node of each channel.
- ( ) 15. Now that pots 5 through 8 are installed and wired, install and wire pots 1 through 4. Repeat steps 9 through 14 for the installation of pots 1 through 4.

- ( ) 16. When all the pots are wired remove pots 1 and 5 from the panel (in preparation for the module assembly) and set the panel aside.

AR-334 MODULE ASSEMBLY INSTRUCTIONS

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 point toward the rear, as shown.
- ( ) 3. Slide the printed circuit board into the frame, holding top and bottom of frame together against the board, so that the board fits snugly in the guides, between the tabs.
- ( ) 4. Using the 4-40 x 3/8" screws and nuts, mount the two angle brackets to the frame, as shown. The brackets should be on the component side of the board.
- ( ) 5. Now screw the board to the brackets. Insert the 4-40 x 3/8" screw from foil side of board. **DOUBLE CHECK THAT SCREW HEAD DOES NOT TOUCH ANY METAL FOIL!!!**
- ( ) 6. Refer again to MODULE ASSEMBLY drawing. Mount top of panel to frame, using the two UPPER pots (P1 and P5). Put on lock-washers and insert pot shaft through rear of upper holes in front of frame. Bring panel against frame, so these pots also go through matching holes in panel. Tighten nuts on front of panel, with pots oriented in same direction as lower pots.
- ( ) 7. Attach bottom of panel to frame, using remaining 4-40 x 3/8" screws and nuts.
- ( ) 8. Turn all pot shafts fully counterclockwise, and mount the knobs pointing to the leftmost number. Tighten knob screws.

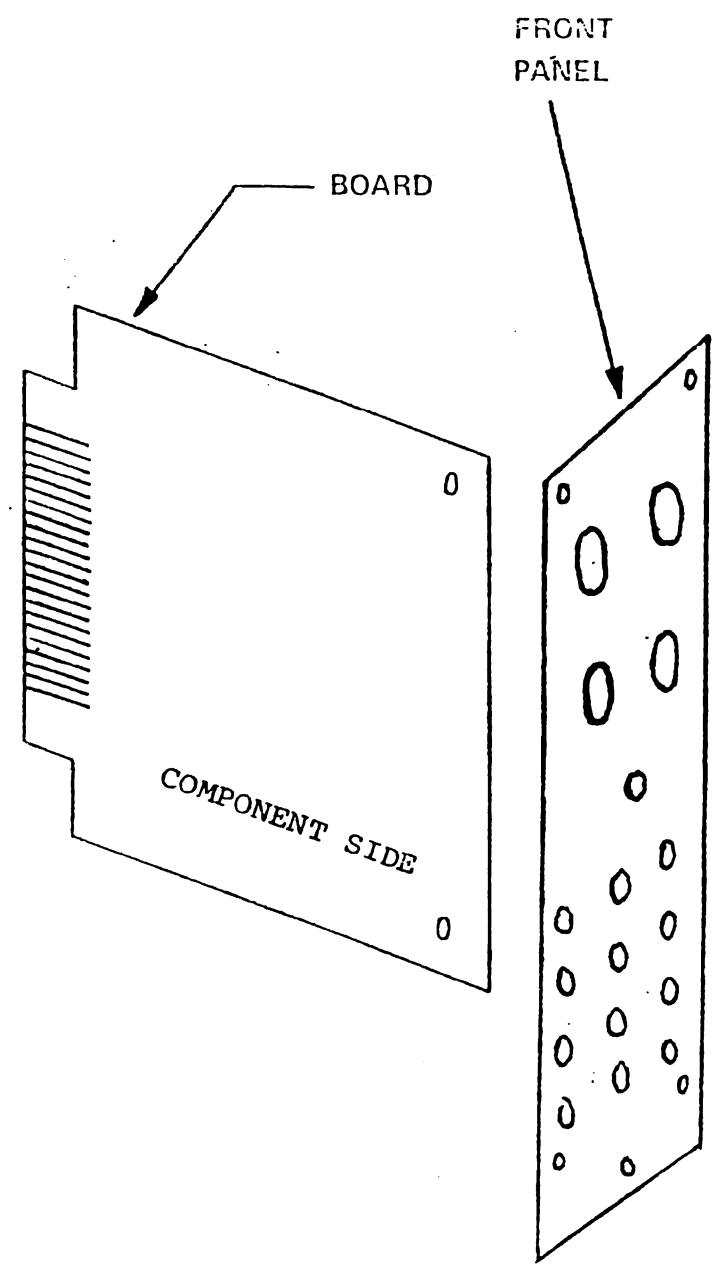
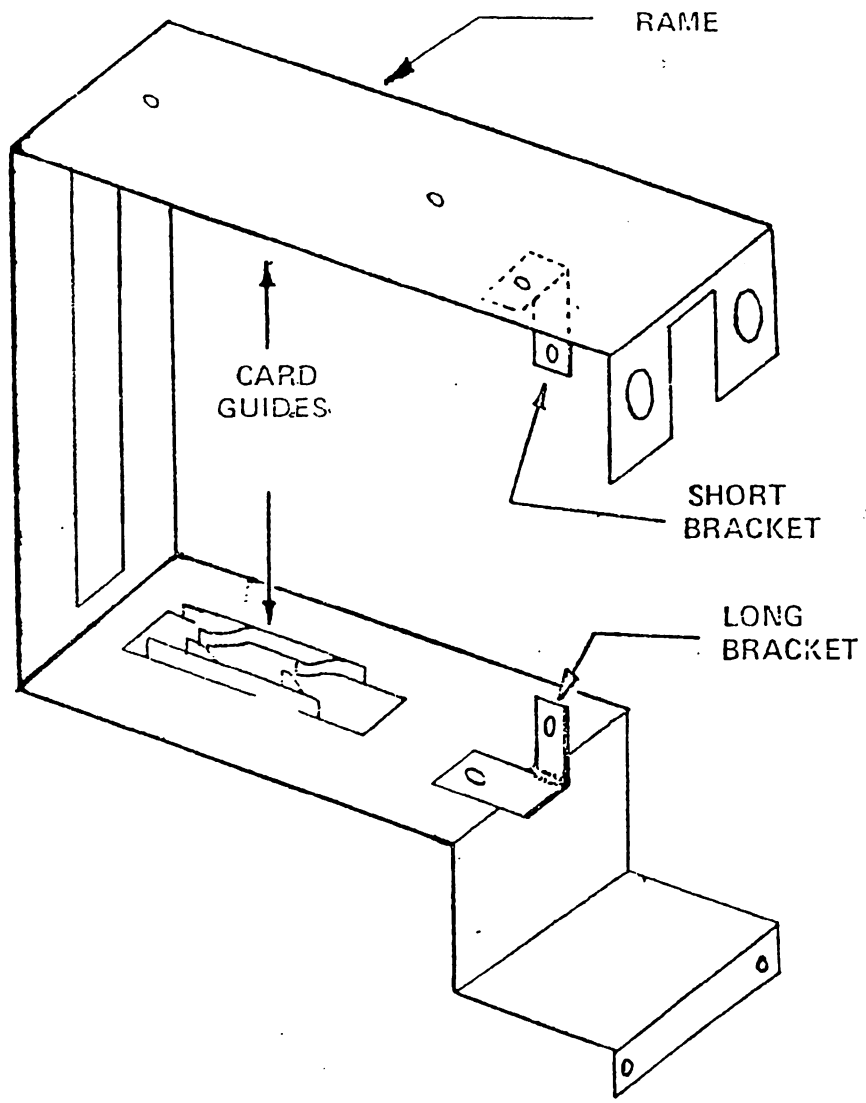
THIS COMPLETES MODULE ASSEMBLY, EXCEPT FOR FINAL PANEL WIRING

Panel wiring---refer to PANEL WIRING diagram and P.C. LAYOUT drawing:

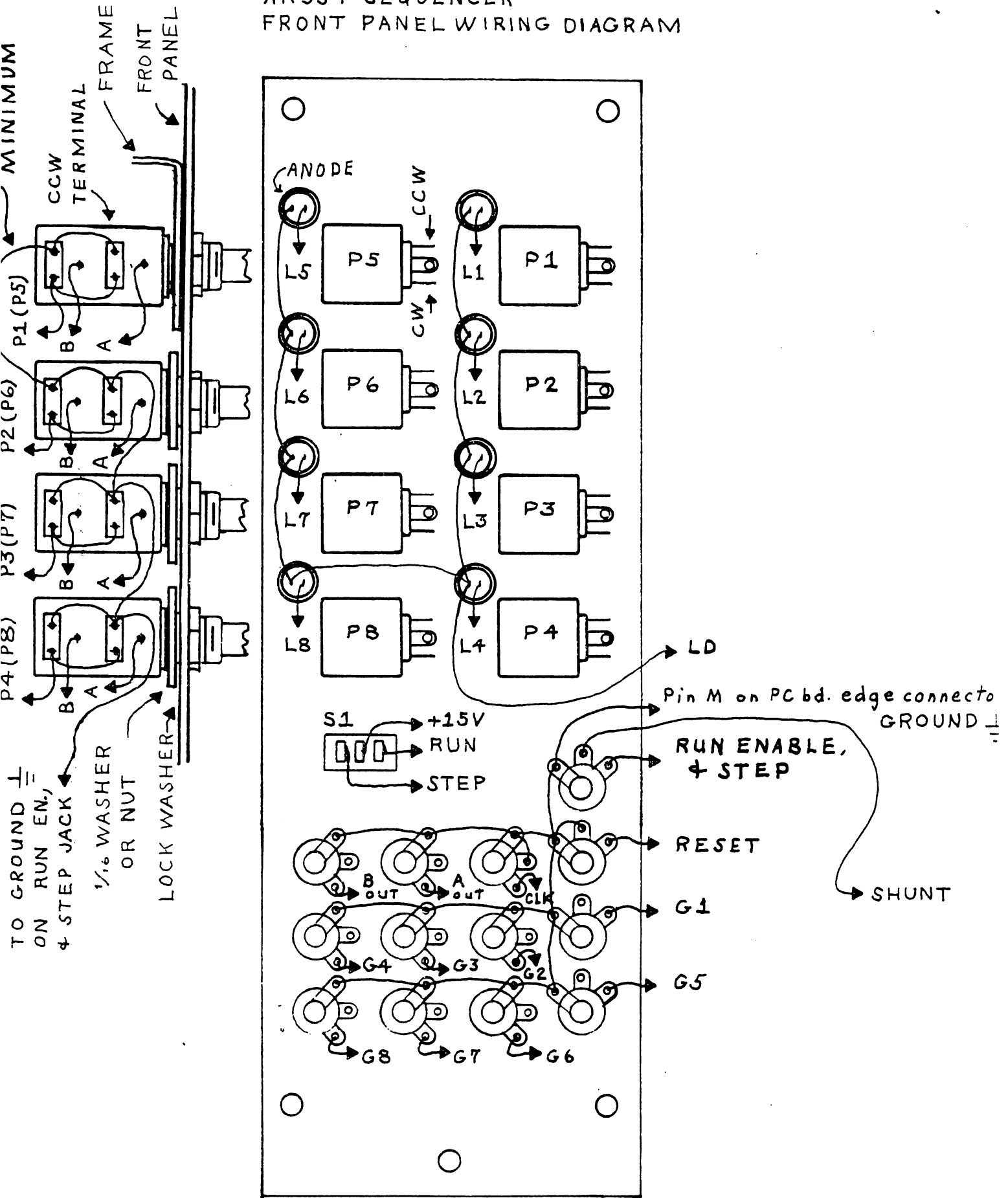
- ( ) 9. Wire each wire from the front panel to the P.C. board. Connect one wire at a time. Run the wire through the wire saddle to the point on the board where it is to be soldered. Cut the wire one inch longer than necessary to allow for some slack. Connect the wires in this order:
  - a) Tips of jack G1 - G8 to G1 - G8 on board
  - b) Tips of jack Reset to Reset on board
  - c) Tips of jack Clock to Clock on board
  - d) Tips of jacks A-out and B-out to A-out & B-out on board
  - e) Ground of jacks Run Enable & Step to M on board
  - f) Shunt of jacks Run Enable & Step to Shunt
  - g) Tip of jack Run Enable & Step to Run, enable & step
  - h) Wires from switch to STEP, +15v & RUN respectively
  - i) LEDs 1 - 8 to 1L - 8L on board
  - j) CW taps of pot 1 - 8 to 1P - 8P on board

Connect all eight A wires on the pots to the AP IN terminals on the P.C. Board.  
It does not matter which wires go to which pad.  
Connect all eight B wires on the pots to the BP IN terminals on the P.C. Board.  
It does not matter which wires go to which pad.  
The panel wiring is now complete.

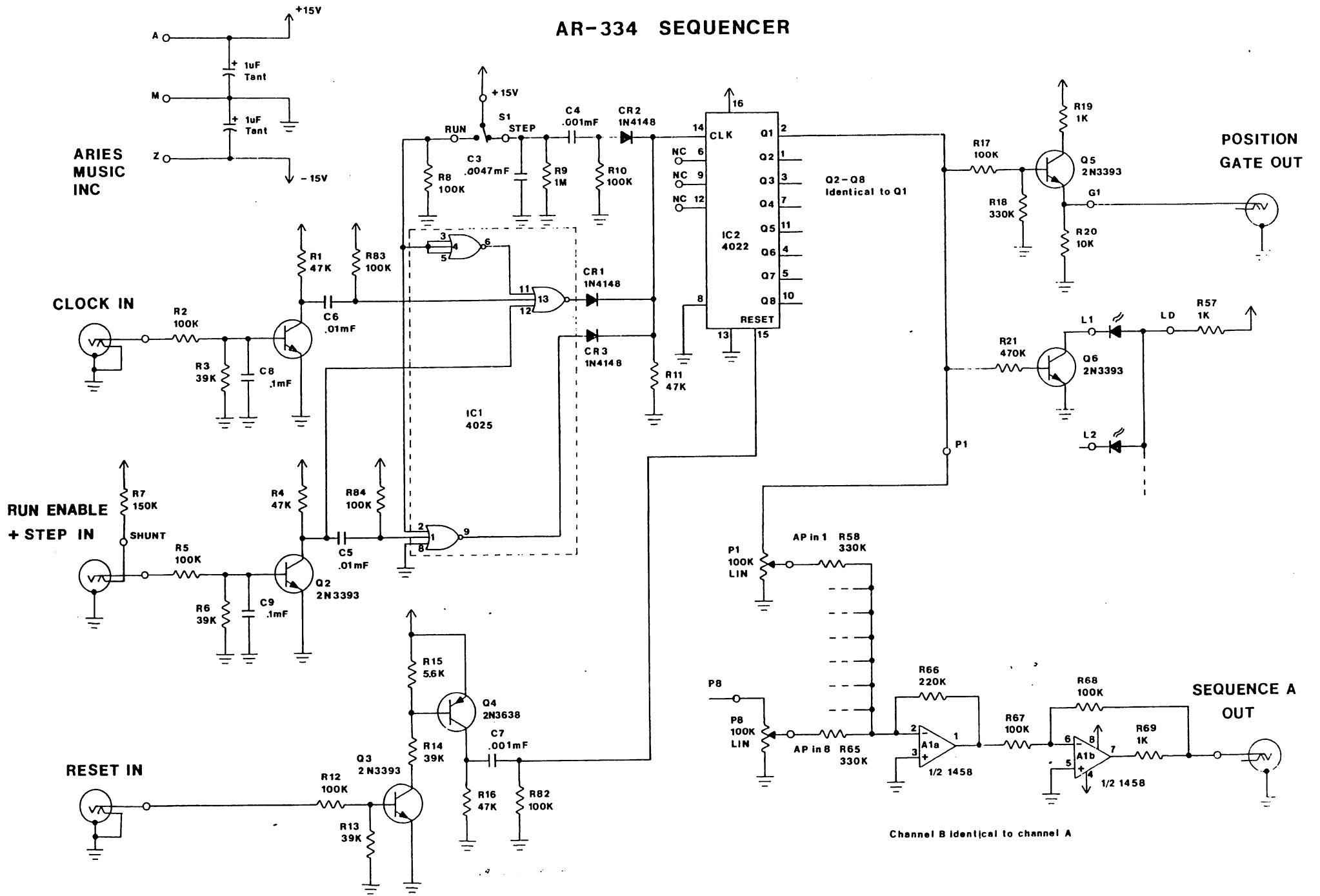
- ( ) 10. Now install IC-1 and IC-2 on the P.C. board and solder in place.  
YOUR AR-334 SEQUENCER IS NOW COMPLETELY ASSEMBLED AND READY TO USE.



AR334 SEQUENCER  
FRONT PANEL WIRING DIAGRAM



# AR-334 SEQUENCER





## AR-334 SEQUENCER Parts

PARTS LIST \* AR-334 \* SEQUENCER

QUANTITY	DESCRIPTION	VALUE
	<b>RESISTORS:</b>	
11	1/2w carbon film 5% tolerance	1K ✓
1	" " " " "	5.6K ✓
8	" " " " "	10K ✓
4	" " " " "	39K ✓
4	" " " " "	47K ✓
21	" " " " "	100K ✓
1	" " " " "	150K ✓
2	" " " " "	220K ✓
24	" " " " "	330K ✓
8	" " " " "	470K ✓
8	Dual Concentric Potentiometers	100K linear
2	Tantalum Capacitor	1 uf ✓
2	Disc Capacitor	.001 uf ✓
2	" "	.01 uf ✓
2	" "	.1 uf ✓
1	" "	.0047 uf ✓
3	Diodes	1N4148 ✓
19	Transistor (NPN)	A3393 or 2N3393 ✓
1	" (PNP)	2N3638 ✓
2	Intergrated Circuit (dual OpAmp)	1458 ✓
1	" " (CMOS)	4025 ✓
1	" " "	4022 ✓
1	Toggle Switch	on - off - on momentary
13	Mini Jacks	
8	LEDs	
8 sets	LED Mounting Hardware	
1	Wire Saddle	
6	3/8" diameter nut	
8 sets	Dual Concentric Knobs	100k lin./100K lin.
1	AR-334 Front Panel	
1	AR-334 P.C. Board	
1	Module Frame	
1	Bracket	large
1	Bracket	small
6	Screws	#4-40 x 3/8"
6	Nuts	#4-40
2	P.C. Card Guides	
1	Black 14" Length wire	
4	Brown " " "	
2	Red " " "	
5	Orange " " "	
12	Yellow " " "	
5	Green " " "	
4	Blue " " "	
4	Violet " " "	
10	Grey " " "	
12	White " " "	
24	AWG gauge copper tinned bus wire	60"

ARIES SYSTEM 300 SYNTHESIZER

Module \*AR-335\*

SWITCHES ASSEMBLY INSTRUCTIONS

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

Review general assembly instructions

( ) 1. PREPARATION:

Lay the circuit board down on a sheet of white paper. PLACE METAL FOIL 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

Thin needle-nose pliers

Flat blade screw driver

½" or #16 nut driver

5/16 or #10 nut driver

¾" or #8 nut driver

A pair of regular pliers can substitute for the nut drivers but will not be as easy to use.

( ) 2. JUMPERS

Find jumper wire J-1 on the drawing. Cut off a piece of solid wire, ONE INCH LONGER THAN J-1, old resistor leads will do fine. Bend the ends to right angle and insert into the holes on the board, according to the drawing. While holding the ends down against component side of the board, bend them at a 45° angle on the FOIL SIDE of the board, to hold the wire in place. Solder and cut off the excess. Repeat for the remaining jumpers (J-2 through J-4).

( ) 3. RESISTORS

Carefully install 128 resistors on the circuit board, (R-1 through R-130; R-122, 111, 88, & 80 have been deleted and will not be shown on the drawing). (P-1 and P-2 are dual potentiometers and will later be mounted on the front panel.) Double check your installation against the P.C. board component layout drawing to be sure that the correct value is in the correct location. To prepare the resistors for insertion, hold the body of the resistor between the thumb and index finger of your right hand. With the thumb and index finger of your left hand bend the leads of the resistor to form right angles with the body. The resistor will now insert easily into the P.C. board. Once the resistor is inserted, bend the leads on the foil side of the board to hold the resistor in place. Solder the resistors to the board and cut the leads about 1/16 of an inch away from the board.

## AR-335 ASSEMBLY, CONT.

## ( ) 4. INTEGRATED CIRCUITS

At this time install only the four 1458 dual op amps. The other 4 IC's are CMOS integrated circuits and are subject to damage from static charges. Do not remove these ICs from their protective conductive foam until all the module assembly steps have been completed. Double check your installation and solder the leads.

## ( ) 5. TRANSISTORS

Sort out the fifteen 2N3638 transistors. Check the P.C. board component layout for the correct orientation of the transistor leads. Match the flat side of the transistor with the flat side on the P.C. board layout. Insert and solder these transistors and cut the leads.

Next, install all seven of the 2N3393 (or A3393) transistors again matching the flat side of the component to the drawing in the layout diagram. The 2N3393 has the same case as the 2N4392 FET, double check the part number on the case and consult the P.C. board assembly drawing to determine where the 2N3393 transistors are to be installed. Solder them and clip the leads. Finally, insert all fifteen 2N4392 transistors, again making sure that the flat sides match the diagram. Solder them and clip the leads.

## ( ) 6. CAPACITORS

Install all nine .001 micro farad (C-3 through C-11) disc capacitors. Solder them in and clip the leads. It may be necessary to bend the leads in the following manner to get the capacitors down near the board.

Install both tantalum capacitors (C-1 & C-2) being sure to orient them in the proper direction.

## ( ) 7. DIODES

Diodes are polarity sensitive components. Make sure that the black band on the diodes (the cathode) is oriented in the same direction as in the layout drawing. Some diodes require that the leads stretch a long distance before going fown into holes on the board. On all diodes in which there is an inch or more of exposed lead, you must insulate the leads by using the insulation (called "spaghetti") supplied in this kit. Measure the correct length of "spaghetti" and slip it over the leads. Insert all 20 diodes, bend the leads, double check their orientation, solder them and clip the leads.

BEFORE YOU GO ON, RE-READ THE PREVIOUS INSTRUCTIONS. DOUBLE CHECK YOUR WORK AND CORRECT ANY ERRORS YOU MAY HAVE MADE.

FRONT PANEL ASSEMBLY PROCEDURE

Refer to panel wiring diagram.

( ) 1. Install all 20 mini jacks as shown on the front panel drawing.

( ) 2. Install all 10 light emitting diodes. Insert the longer of the two pieces of LED mounting hardware through the front panel so that the washer-like surface restson the front panel and the cylindrical part extends through and protrudes from the back surface of the front panel. Insert the LED into the cylindrical section so that the rounded end sticks out through the section of washer on the front surface of the panel. Rotate the LED so that the lead is oriented as shown in the front panel wiring diagram. The anode lead is the longer and thinner of

AR-335 ASSEMBLY, CONT.

the two leads. Insert the second piece of mounting hardware over the leads of the LED and the cylindrical section of the first piece. Push the second piece all the way up to the panel so that the two pieces of mounting hardware are clasping the panel and holding the LED firmly in place.

- ( ) 3. Install the switches T-4, 3 & 2 so that one terminal is above the other. Install switch T-1 as shown in the front panel wiring drawing.
- ( ) 4. Mount the two dual pots but do not tighten them fully. They will be removed later when mounting the panel to the frame.

PANEL WIRING

The AR-335 is not a simple module to wire. Not only are there 47 wires from the panel to the P.C. board, some of the terminals have similar designations. Confusion regarding terminals Q01/0, Q0 0/1, Q0, Q0 and other similar designations can be avoided by following the instructions carefully and accurately. Re-checking every wire that you connect and then re-checking each section before proceeding to the next section will help insure that your AR-335 is successfully assembled.

- ( ) 1. Using bus wire, connect the grounds of all 20 jacks together as shown in the wiring diagram.

USING BLACK WIRE

- 1. Connect the cathodes of all 10 LEDs together. The cathode is the shorter and thicker of the 2 leads. The wires should be soldered as close to the body of the LED as is practical. Cut the excess cathode lead after the wires have been soldered, except for the cathodes of L-1 & L-4.
- 2. Connect the jack ground to the cathode of LED L-1 as shown in the wiring diagram. Cut the excess cathode of L-1.
- 3. With a 3" long wire, connect the CCW top of pot C to the cathode of L-4. Cut excess cathode from L-4
- 4. Connect the CCW tops of all 4 pots together.

USING RED WIRE

- 1. Connect the top terminals of switches T4, T3, & T2 together
- 2. Connect the top terminal of switch T2 to the center terminal of switch T1.
- 3. Connect the CW tops of all 4 pots together.

USING 14" LENGTHS OF COLOR CODED WIRE, SOLDER THE CORRECT COLOR TO EACH OF THE FOLLOWING TERMINALS

- 1. BROWN to CT of pot A
- 2. ORANGE to CT of pot B
- 3. RED to CW of pot B
- 4. YELLOW to CT of pot C
- 5. GREEN to CT of pot D

TIE THESE FIVE WIRES TOGETHER WITH A WIRE TIE PLACED ABOUT 2" BELOW POT B

- 1. GREEN to anode of LED L4 (the anode is the longer, thinner lead)
- 2. YELLOW to anode of LED L3
- 3. ORANGE to anode of LED L2
- 4. BROWN to anode of LED L1

TIE THESE 4 WIRES TOGETHER WITH A WIRE TIE PLACED NEAR LD & ABOUT 2" FROM THE PANEL

AR-335 ASSEMBLY, CONT.

1. BROWN to anode of LED LQ0
2. BROWN to anode of LED LQ1

DO NOT TIE THESE 2 WIRES TOGETHER

1. BROWN to anode of LED LA
2. ORANGE to anode of LED LB
3. YELLOW to anode of LED LC
4. GREEN to anode of LED LD

TIE THESE 4 WIRES TOGETHER WITH A WIRE TIE PLACED REAR LB ABOUT 2" FROM THE PANEL

CUT THE EXCESS ANODE LEAD FROM EACH OF THESE LEDs:

1. VIOLET to bottom terminal of switch T-4
2. VIOLET to bottom terminal of switch T-3
3. VIOLET to bottom terminal of switch T-2
4. WHITE to left terminal of switch T-1
5. RED to center terminal of switch T-1
6. BLACK to right terminal of switch T-1

TIE THE 3 WIRES FROM SWITCH T-1 TOGETHER WITH A WIRE TIE PLACED NEAR T-1 AND ABOUT 2" FROM THE PANEL.

1. WHITE to jack SHT S-4
2. GREY to jack TIP S-4 1/0
3. BROWN to jack TIP 1
4. ORANGE to jack TIP 2
5. YELLOW to jack TIP 3
6. GREEN to jack TIP 4
7. BLUE to jack TIP C4

TIE THESE WIRES TOGETHER ALONG WITH THE VIOLET WIRE FROM T-4 WITH A WIRE TIE PLACED NEAR JACK 4 AND ABOUT 2" FROM THE PANEL

1. WHITE to jack SHT S-3
2. GREY to jack TIP Q0 1/0
3. BROWN to jack TIP Q0
4. ORANGE to jack TIP Q0
5. BLUE to jack TIP C-3

TIE THESE WIRES TOGETHER ALONG WITH THE VIOLET WIRES FROM T-3 AND BROWN WIRE FROM LQ0 WITH A WIRE TIE PLACED NEAR JACK C-3 AND ABOUT 2" FROM THE PANEL.

1. WHITE to jack SHT S-2
2. GREY to jack TIP Q1 1/0
3. BROWN to jack TIP Q1
4. ORANGE to jack TIP Q1
5. RED to jack SHUNT K
6. BLUE to jack TIP C-2

TIE THESE WIRES TOGETHER ALONG WITH THE WIRES FROM SWITCH T-2 AND LED LQ1, WITH A WIRE TIE PLACED NEAR JACK Q1 AND ABOUT 2" FROM THE PANEL

AR-335 ASSEMBLY CONT.

1. BLACK to jack ground (as shown on diagram)
1. WHITE to jack SHUNT S1
3. GREY to jack TIP S1 1/0
4. BROWN to jack TIP A
5. ORANGE to jack TIP B
6. YELLOW to jack TIP C
7. GREEN to jack TIP D
8. BLUE to jack TIP C1

TIE THESE 8 WIRES TOGETHER WITH A WIRE TIE PLACED NEAR JACK A AND ABOUT 2" FROM THE PANEL.

YOUR FRONT PANEL IS NOW WIRED. BEFORE YOU GO ON RE-READ THE PREVIOUS INSTRUCTIONS. DOUBLE CHECK YOUR WORK AND CORRECT ANY ERRORS YOU MAY HAVE MADE.

REMOVE THE POTS AND SET THEM ASIDE IN PREPARATION FOR THE MODULE ASSEMBLY.

AR-335 Module Assembly Instructions:

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 point toward the rear, as shown.
- ( ) 3. Slide the printed circuit board into the frame, holding top and bottom of frame together against the board, so that the board fits snugly in the guides, between the tabs.
- ( ) 4. Using the 4-40 x 3/8" screws and nuts, mount the two angle brackets to the frame, as shown. The brackets should be on the component side of the board. The screws should be on the outside of the frame.
- ( ) 5. Now screw the board to the brackets. Insert the 4-40 x 3/8" screw from foil side of board. DOUBLE CHECK THAT SCREW HEAD DOES NOT TOUCH ANY METAL FOIL!!!
- ( ) 6. Refer again to module assembly drawing. Mount top of panel to frame, using the two dual pots. Put on lock washers and insert pot shaft through rear of upper holes in front of frame. Bring panel against frame, so these pots also go through matching holes in panel. Tighten nuts on front of panel, with pots oriented in same direction as shown in the front panel wiring drawing.
- ( ) 7. Attach bottom of panel to frame, using remaining 4-40 x 3/8" screws and nuts.
- ( ) 8. Turn pot shafts fully counter-clockwise, and mount the knobs pointing to the left-most number. Tighten knob screws

THIS COMPLETES MODULE ASSEMBLY, EXCEPT FOR FINAL PANEL WIRING

FRONT PANEL TO P.C. BOARD WIRING PROCEDURE:

Refer to both panel wiring diagram and P.C. layout drawing.

- ( ) 1. Wire each wire from the front panel to the P.C. board. Connect one wire at a time. Run the wire around the edge to the board whenever possible. Cut each wire about one inch longer than necessary to allow for some slack. Consulting the diagrams connect the wires to the P.C. board in this order:
  1. BROWN from jack Q1 to Q1 0/1 on board
  2. ORANGE from jack Q1 to Q1 0/1 on board
  3. GREY from jack Q1 1/0 to Q1 1/0 on board
  4. WHITE from jack SHUNT S2 to SHUNT Q1 on board
  5. GREEN from jack TIP 4 to 4 0/1 on board
  6. YELLOW from jack TIP 3 to 3 0/1 on board
  7. ORANGE from jack TIP 2 to 2 0/1 on board

AR-335 ASSEMBLY INSTRUCTIONS, CONT.

8. BROWN from jack TIP 1 to 1 0/1 on board
9. GREY from jack TIP S4 1/0 to S4 1/0 on board
10. WHITE from jack SHT S4 to SHUNT S4 on board
11. GREEN from jack TIP D to D 0/1 on board
12. YELLOW from jack TIP C to C 0/1 on board
13. ORANGE from jack TIP B to B 0/1 on board
14. BROWN from jack TIP A to A 0/1 on board
15. WHITE from jack SHUNT S1 to SHUNT S1 on board
16. GREY from jack TIP S1 1/0 to S1 1/0 on board

TIE THESE WIRES TOGETHER WITH A WIRE TIE PLACED NEAR RESISTOR R-46

1. BLUE from jack TIP C4 to C4 on board
2. VIOLET from switch T4 to T4 on board
3. BROWN from LED LQ1 to LQ1 on board
4. GREEN from LED L4 to L4 on board
5. YELLOW from LED L3 to L3 on board
6. ORANGE from LED L2 to L2 on board
7. BROWN from LED L1 to L1 on board
8. VIOLET from switch T2 to T2 on board
9. BLUE from jack TIP C2 to CONTROL 2Q1 on board
10. GREEN from LED LD to LD on board
11. YELLOW from LED LC to LC on board
12. WHITE from UFT term. of switch T1 to A on board
13. BLACK from right term. of switch T1 to  $\bar{A}$  on board
14. ORANGE from LED LB to LB on board
15. BROWN from LED LA to LA on board

TIE THESE WIRES TOGETHER WITH A WIRE TIE PLACED TO THE LEFT OF RESISTOR R45

1. RED from CW top of Pot B to +10v on board
2. GREEN from CT top of Pot D to PD on board
3. YELLOW from CT top of Pot C to PC on board
4. ORANGE from CT top of Pot B to PB on board
5. BROWN from CT top of Pot A to PA on board

TIE THESE WIRES TOGETHER WITH A WIRE TIE PLACED NEAR RESISTOR R-8

1. GREY from jack tip Q01/0 to Q01/0 on board
2. WHITE from jack SHT S3 to Q0 SHUNT on board
3. BROWN from jack TIP Q0 to Q0 0/1 on board
4. ORANGE from jack TIP  $\bar{Q0}$  to  $\bar{Q0}$  0/1 on board
5. RED from jack Center terminal switch T1 to A +15v on board
6. RED from jack SHUNT K (jack C2) to K on board
7. BROWN from LED LQ0 to LQ0 on board
8. BLACK from jack ground (as shown on wiring drawing) to M on board
9. BLUE from Jack TIP C3 to control 3 on board
10. VIOLET from switch T3 to T3 on board
11. BLUE from jack TIP C1 to 1 control on board

TIE THESE WIRES TOGETHER WITH A WIRE TIE PLACED NEAR RESISTOR R-3

AR-335 ASSEMBLY INSTRUCTIONS, CONT.

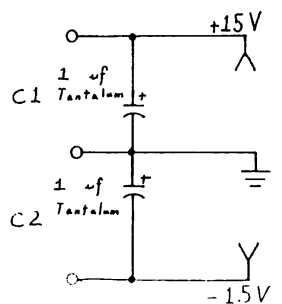
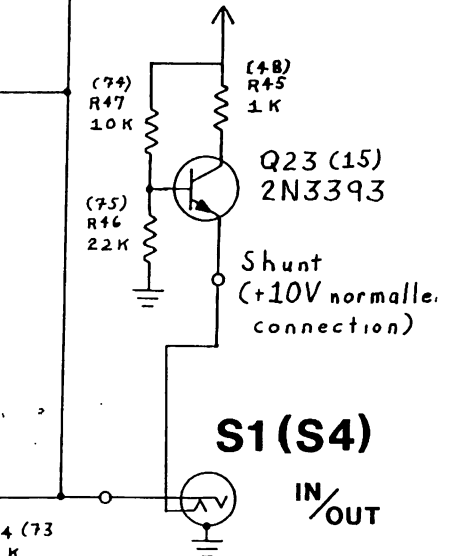
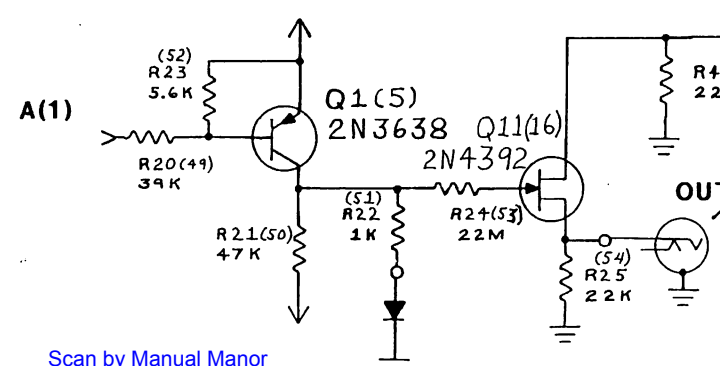
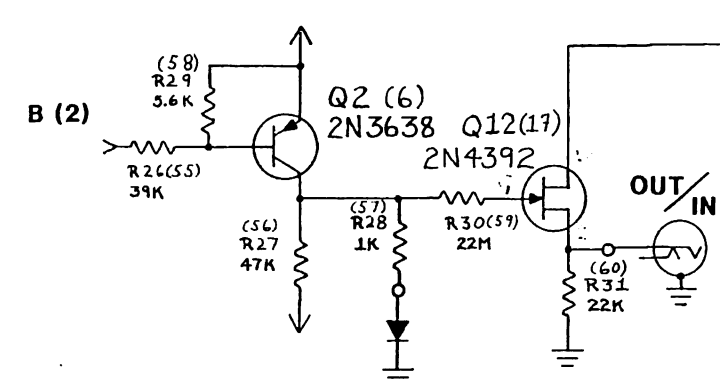
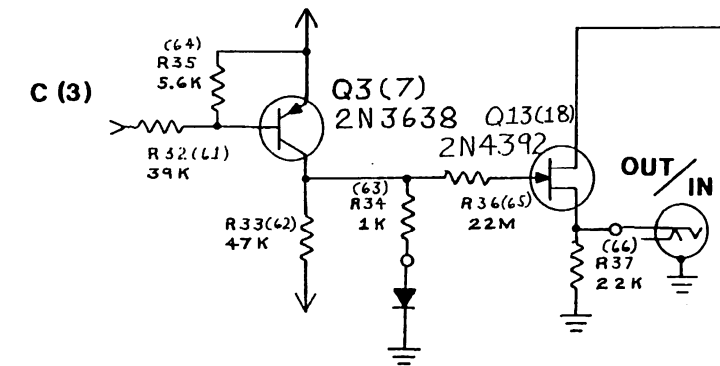
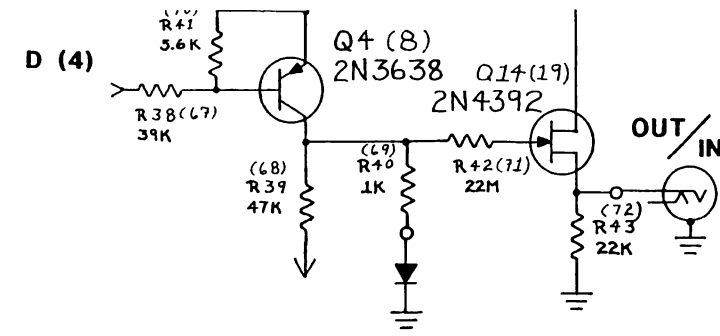
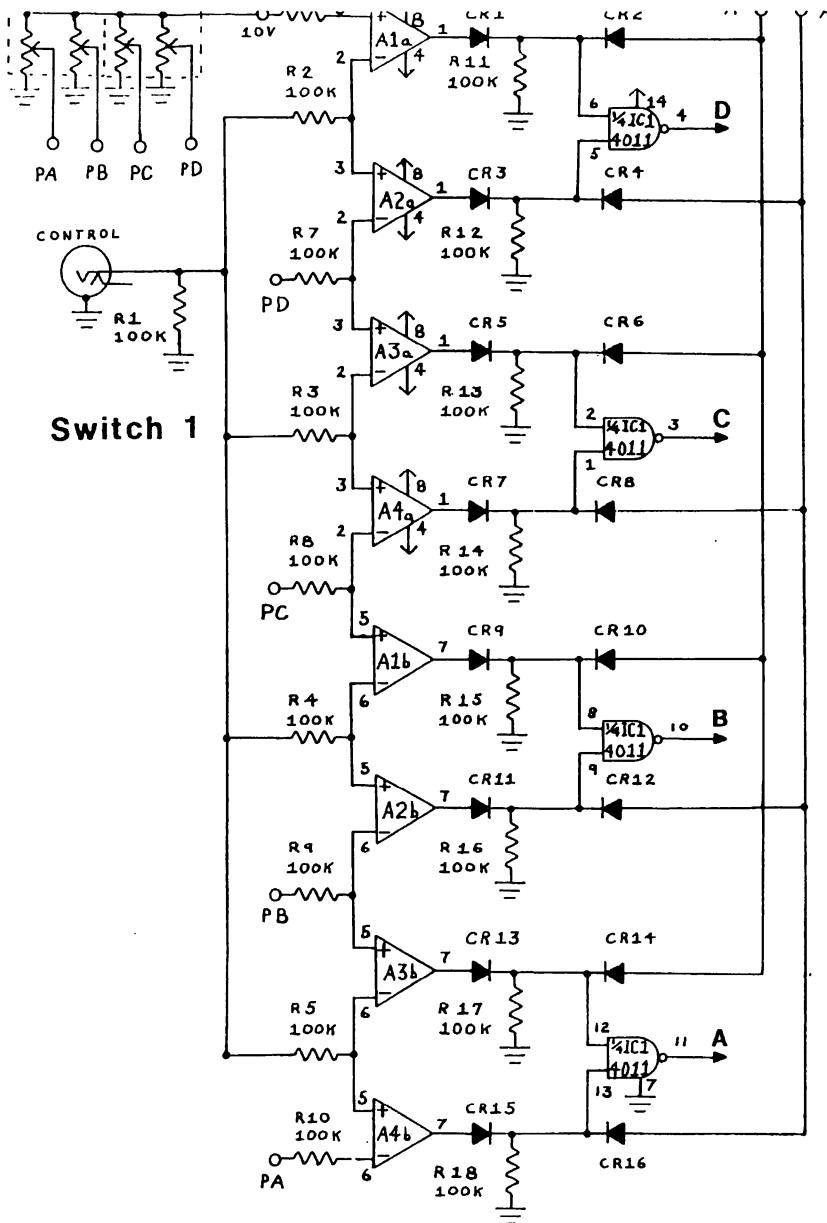
( ) 2. Using additional cable ties, tie the wires which are connected to the same area of the P.C. board together in bunches. This makes the module look neater and makes servicing and trouble-shooting easier.

( ) 3. Finally install IC 1 (4011)  
IC 2 (4013)  
IC 3 (4013)  
IC 4 (4011)

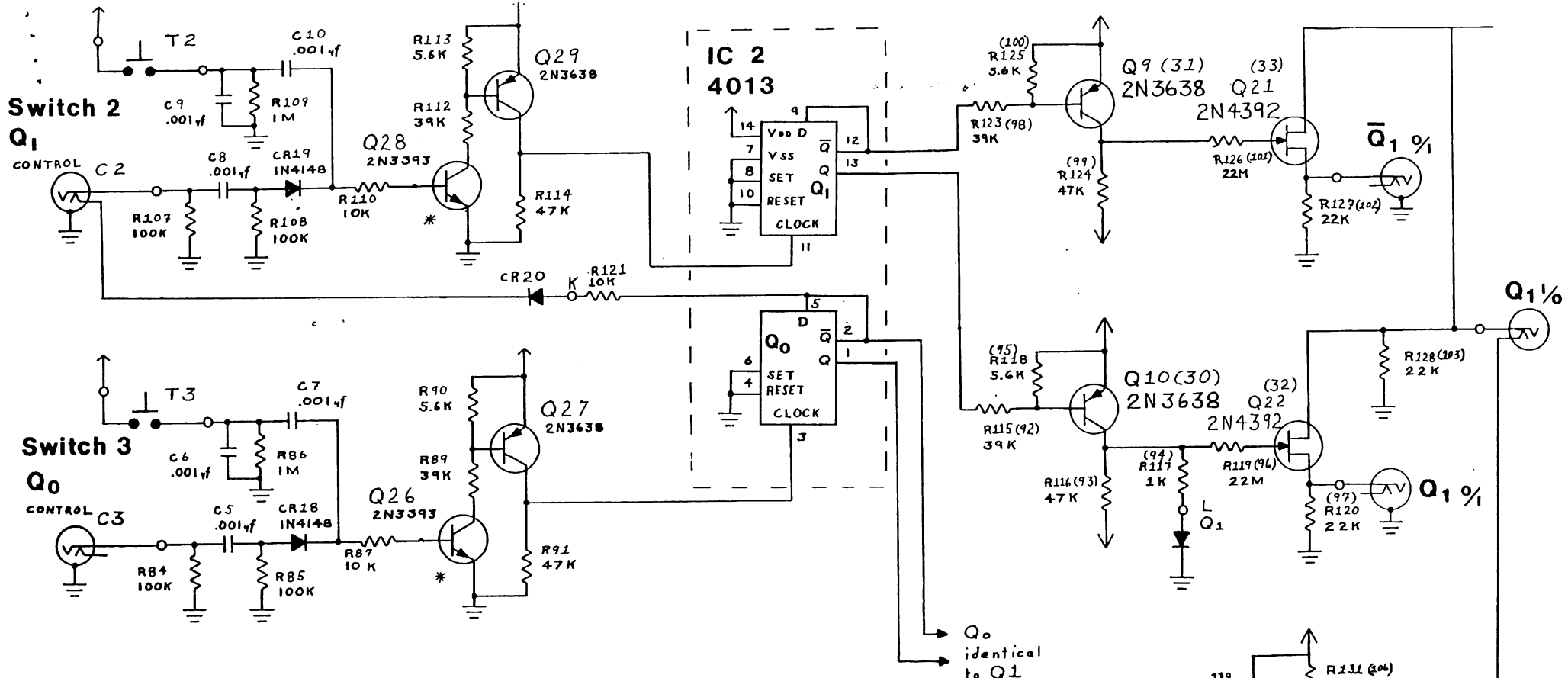
orienting them in the proper direction according to the indentation on the chip and the P.C. board drawing. Solder them in place.

YOU HAVE COMPLETED ASSEMBLY OF YOUR AR-335 SWITCHES MODULE. THIS MODULE NEEDS NO TRIMMING OR CALIBRATION; IT IS READY TO USE.

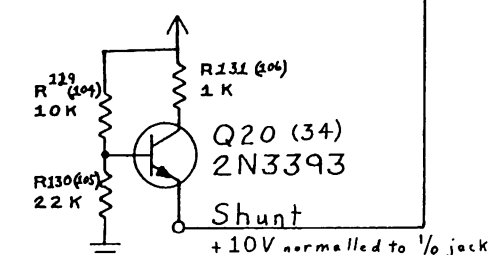
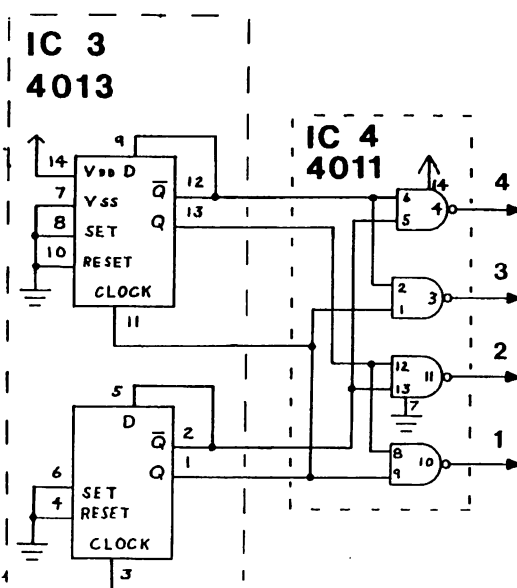
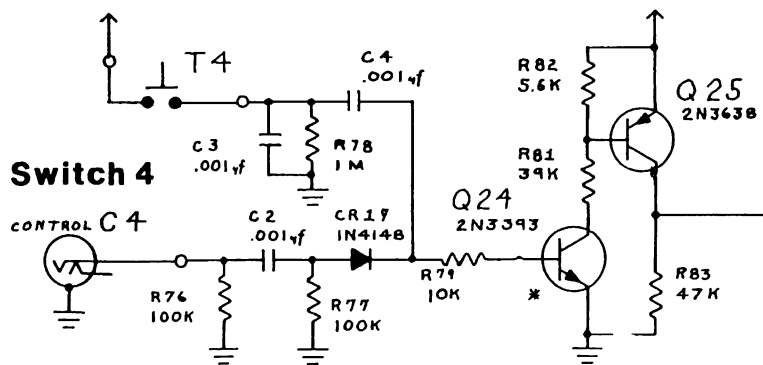




**AR-335  
QUAD SWITCH**



**AR-335  
 QUAD SWITCH**

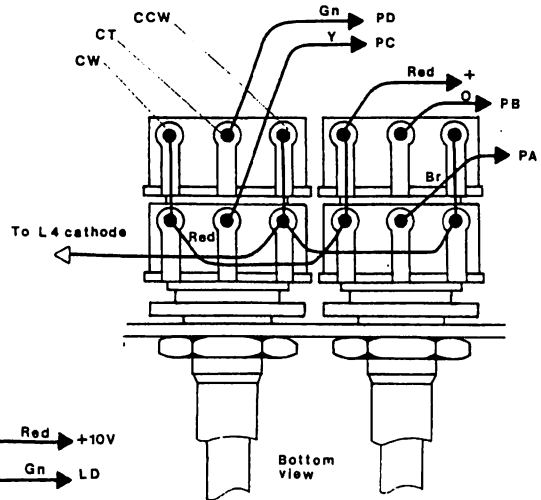
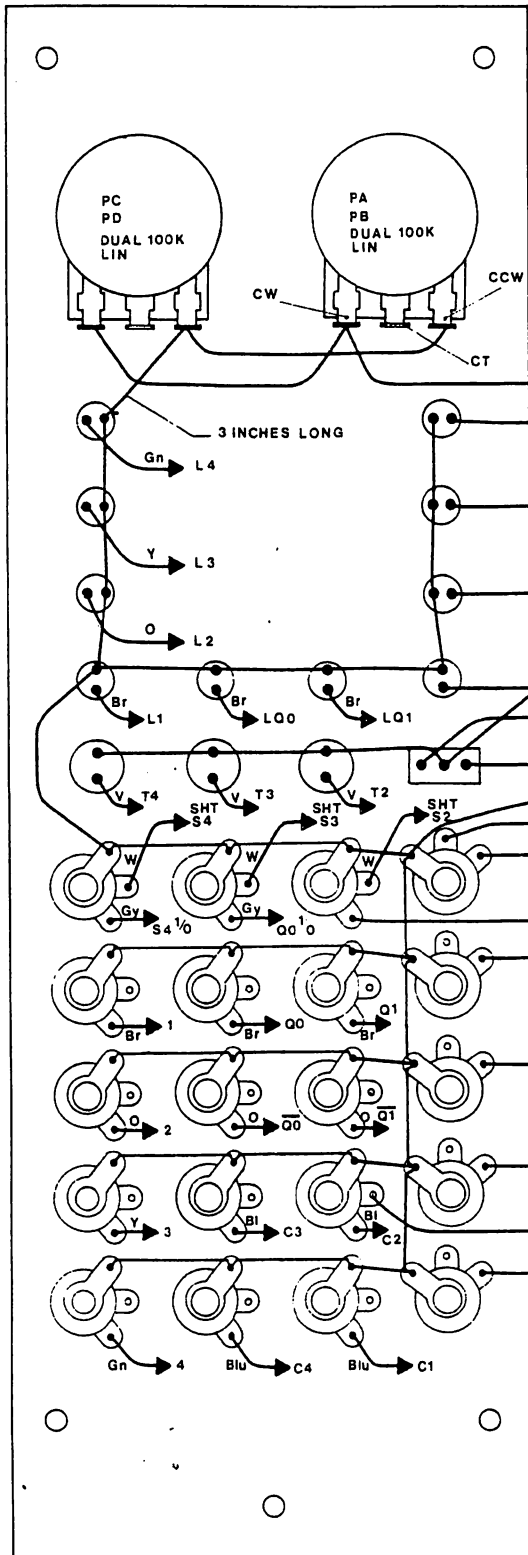


To switches  
 Switches 1, 2, 3, 4  
 are identical to  
 Switches A, B, C, D

\* R 111, 88, 80 Deleted

RMS

**AR-335 SWITCHES**  
**FRONT PANEL WIRING DIAGRAM**

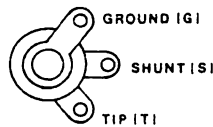


All LED leads drawn with arrows are the anodes

→ OPEN ARROW  
CONNECT TO JACK  
 → FILLED ARROW  
CONNECT TO PC BOARD

**ARIES  
MUSIC  
INC.**

BLACK	Bk
BROWN	Br
RED	Red
ORANGE	O
YELLOW	Y
GREEN	Gn
BLUE	Blu
VIOLET	V
GREY	Gy
WHITE	W



ARIES MUSIC SYSTEM 300 SYNTHESIZER

AR-335 SWITCHES MODULE

PARTS LIST

QUANTITY	DESCRIPTION	VOLTAGE & RATINGS
2	Tantalum Capacitor	1uf
9	Ceramic Disc Capacitor	.001uf
2	Dual Concentric Linear pots	100K
2	Dual Concentric Knobs	
14	1/4w carbon resistor	1K
15	" " "	5.6K
8	" " "	10K
1	" " "	12K
20	" " "	22K
3	" " "	33K
15	" " "	39K
15	" " "	47K
24	" " "	100K
3	" " "	1 meg
12	" " "	22 meg
20	Diodes	1N4148
7	Transistor	2N3393 or A3393
15	"	2N3638
12	F.E.T.	<del>2N4392</del> KE4392
4	Dual op. amp.	1458
2	CMOS IC Quad and Gate	4011
2	CMOS IC Dual "D" Flip Flop	4013
3	Push button Switch	SPST <del>none</del>
1	Toggle Switch	SPDT (on-off-on)
20	Mini Jacks	off
10	LEDs	
10 sets	LED mounting hardware	
1	AR-335 Front Panel	
1	8" Length "spaghetti"	
8	Cable Ties	
1	AR-335 P.C. Board	
1	Module Frame	
1	Bracket, small	
1	Bracket, large	
6	4-40 x 3/8" screws	
6	4-40 nuts	
2	P.C. card guides	
16	Wire ties	
	30" 24 AWG tinned copper bus wire	

14" lengths, color-coded wire (24 AWG 19 strand)

BLACK 6, BROWN 10, RED 7, ORANGE 8, YELLOW 6,  
 GREEN 6, BLUE 5, VIOLET 4, GREY 5, WHITE 6.

## ARIES MUSIC SYSTEM 300 SYNTHESIZER

## AR-338 PMS VOLTAGE CONTROLLED OSCILLATOR

## ASSEMBLY INSTRUCTIONS

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

( ) 1. PREPARATION:

Lay the circuit board down on a sheet of white paper. PLACE METAL FOIL SIDE DOWN! Turn board so that connector strip is on 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-COATED SOLDER!

Small, diagonal, wire cutters

Small wire strippers

Small long-nose pliers

Flat blade screw driver

½" or #16 nut driver

5/16" or #10 nut driver

¼" or #8 nut driver

A pair of regular pliers can substitute for the nut drivers but will not be as easy to use.

( ) 2. RESISTORS:

Carefully install all resistors on the circuit board. Double check your installation against the P.C. board component layout drawing to be sure that the correct value is in the correct location. To prepare the resistor for insertion hold the body of the resistor between the thumb and index finger of your left hand. With the thumb and index finger of your right hand bend both the leads of the resistor at once to form right angles with the body. The resistor will now insert easily into the P.C. board. Once the resistor is inserted, bend the leads on the foil side to hold the resistor in place. Solder the resistors to the board and cut the leads about 1/16 of an inch from the board.

- 1) Install all twelve 100K 5% resistors; R14,15,41,49,50,61,64,  
66,67,68,69,& 71; solder & cut leads
- 2) Install all eight 47K resistors; R1,3,6,19,26,44,48,57; solder & cut leads
- 3) Install all four 1K resistors; R11,30,31 & 72; solder & cut leads
- 4) Install all three 18K resistors; R7, 10, & 73; solder & cut leads
- 5) Install all three 39K resistors; R51, 59, & 60; solder & cut leads
- 6) Install all three 470K resistors; R21, 39 & 42; solder & cut leads
- 7) Install both 330ohm resistors; R2 & 5; solder & cut leads
- 8) Install both 390ohm resistors; R45 & 63; solder & cut leads
- 9) Install both 10K resistors; R33 & 70; solder & cut leads
- 10) Install both 15K resistors; R25 & 37; solder & cut leads
- 11) Install both 20K resistors; R32 & 34; solder & cut leads
- 12) Install both 22K resistors; R29 & 35; solder & cut leads
- 13) Install both 33K resistors; R8 & 12; solder & cut leads

## AR-338 PMS V.C.O.

ASSEMBLY INSTRUCTIONS CONTINUED

- 14) Install both 68K resistors; R9 & 13; solder & cut leads
- 15) Install both 100K, 1% resistors; R20 & 22; solder & cut leads
- 16) Install both 150K resistors; R16, & 17; solder & cut leads
- 17) Install both 1.5K resistors; R62 & 65; solder & cut leads
- 18) Install the 1K tempco resistor; R-43; solder & cut leads
- 19) Install the 2.2K resistor; R-36; solder & cut leads
- 20) Install the 5.6K resistor; R-56; solder & cut leads
- 21) Install the 7.5K resistor; R-27; solder & cut leads
- 22) Install the 12K resistor; R-28; solder & cut leads
- 23) Install the 27K resistor; R4; solder & cut leads
- 24) Install the 54.9K 1% resistor; R-40; solder & cut leads
- 25) Install the 90.9K 1% resistor; R-38; solder & cut leads
- 26) Install the 274K 1% resistor; R-24; solder & cut leads
- 27) Install the 560K resistor; solder & cut leads (R-47)
- 28) Install the 1M resistor; R-18; solder & cut leads
- 29) Install the 2.2M resistor; R-46; solder & cut leads
- 30) Install the 3.3M resistor; R-23; solder & cut leads
- 31) Install the 22M resistor; R-58; solder & cut leads

## ( ) 3. DIODES:

Install diodes CR1 - 5. Double check the polarity of the diodes. Solder and cut leads.

## ( ) 4. Install capacitors. Observe polarity on the tantalum and polystyrene capacitors. Solder and cut leads.

- |                                   |           |
|-----------------------------------|-----------|
| a) 10,000pf polystyrene capacitor | C-5       |
| b) 1000pf " "                     | C-6       |
| c) 1uf tantalum capacitor         | C-12 & 13 |
| d) 10pf disc capacitor            | C-9       |
| e) 20pf " "                       | C-10      |
| f) 50pf " "                       | C-1 & 2   |
| g) 100pf " "                      | C-7       |
| h) 330pf " "                      | C-3       |
| i) 1000pf " "                     | C-4 & 11  |
| j) .1uf " "                       | C-8       |

Capacitor C-8 is optional. If it is inserted it will capacitively couple the linear FM input. If the modulating waveform has a DC component and if it is in the low audio frequency range, this capacitor will block the DC component. The result is that the pitch of the modulated VCO will not be shifted by the DC component. If this capacitor is not installed, a jumper must be installed in its place. We suggest that you 1st complete the module by leaving out this capacitor and later experimenting with capacitively coupling this input by inserting it. In this way you can make your own choice on which you prefer.

## ( ) 5. Install all four transistors. Check from correct orientation of the leads

- a) Install NPN 2N3393 Q1 & 2
- b) Install NPN MPSA-14 Darlington; Q-3
- c) Install PNP 2N3638 Q-4

## ( ) 6. Install all six IC's

- a) Install the three TL82 op. amps. U-1, 2, & 3
- b) Install the two 1458 op. amps. U-5, & 6
- c) Install the SSM 2030's

AR-338 PMS V.C.O.

ASSEMBLY INSTRUCTIONS, CONT.

- ( ) 7. Install the six trim pots
  - a) Install the 20K multi-turn trim T-5
  - b) Install the 10K multi-turn trim T-6
  - c) Install the 50K single turn trim T-1, 2, 3 & 4

SNAP BOTH WIRE SADDLES INTO PLACE

THIS COMPLETES THE ASSEMBLY OF THE P.C. BOARD. FOR THE TIME BEING, LAY IT ASIDE AND GO TO THE NEXT SECTION

## FRONT PANEL ASSEMBLY PROCEDURE (see drawing)

Aries Music front panels are made of anodized aluminum. They will not be scratched in normal operation, but they can be scratched with pliers or a nut driver. When using tools on the front panel, be very careful not to scratch it.

- ( ) 1. Mount the top 2 dual pots. Do not fully tighten the nuts because they will be later removed for final assembly. If the pots have a small flange which prohibits them from being mounted flush against the face panel, bend the flange outward so the pots can be mounted flush.
- ( ) 2. Mount the additional 3 dual pots and the single pot. Pot 3/4 is LOG. On each of these pots there are 2 nuts. Screw the 1st one, the larger of the two, on to the threads and tighten it firmly against the body of the pot. Place the lock washers between this nut and the back side of the front panel. Mount the pots on the panel and attach them with the 2nd nut. Tighten this nut firmly.
- ( ) 3. Mount all 14 jacks as shown in the diagram. The washer goes on the front of the face panel.
- ( ) 4. Mount the 6 terminal switch (S-2) so that the terminals are oriented as in the drawing. It makes no difference which row of terminals is on top. There are 2 nuts with each switch also. Screw the 1st nut onto the bushing about 1/8" from the body of the switch. Next place the lock washer on the bushing and insert switch into the face panel securing it with the 2nd nut. The purpose of the 1st nut is to space the switch so its bushing protrudes from the face panel as far as the jacks' bushings.
- ( ) 5. Mount the 3 terminal switch (S-1) so that the terminals are oriented as in the drawing. It makes no difference which terminal is on the right. Follow the above mounting procedure.

## PANEL WIRING

## USING BUSS WIRE:

- 1) Connect the shunts to the grounds of the following 4 jacks: Jack 3FM, LIN, FM, SYNC & SOFT.
- 2) Connect Grounds of all 14 jacks together as shown in the wiring diagram.

USING BLACK WIRE, MAKE AND SOLDER THE FOLLOWING CONNECTIONS. THESE WIRES SHOULD BE AS SHORT AS CONVENIENTLY POSSIBLE EXCEPT WHERE OTHERWISE INDICATED.

- a) Connect the CCW of P6 to the CCW of P5.

## AR-338 PMS V.C.O.

ASSEMBLY INSTRUCTIONS, CONT.

- b) Connect the CCW of P4 to the CCW of P3
- c) Connect the CCW of P6 to the CCW of P4
- d) Connect the CCW of P6 to GND jack sync
- e) Connect GND jack sync to TERM 6 of S-2
- f) Connect TERM 6 of S-2 to CT of P11
- g) Connect CT of P11 to CCW of P9
- h) Connect CCW of P9 to CCW of P7 (This wire should be 3" long)
- i) Connect CCW of P7 to CW of P8

## USING RED WIRE

- a) Connect the CW of P1 to CW of P2
- b) Connect the CW of P2 to CW of P10

## USING VIOLET WIRE

- a) Connect the CCW of P1 to the CCW of P2
- b) Connect the CCW of P2 to the CCW of P8 (This wire should be 3" long)
- c) Connect the CCW of P8 to the CCW of P10 (This wire should be 3" long)
- d) Connect the CCW of P10 to TERM 4 of S-2

## CONNECT THESE WIRES FROM POTS TO JACKS.

They should run along the face panel in the most direct and logical route. They should be as short as conveniently possible and should not excessively "loop".

- 1) ORANGE from CW P9 to TIP jack TRI PWM
- 2) BROWN from CW P7 to TIP jack PWM SAW
- 3) BROWN from CW P3 to TIP jack 1 FM
- 4) ORANGE from CW P4 to TIP jack 2 FM
- 5) WHITE from CW P5 to TIP jack MOD

## USING 14" LENGTHS OF COLOR CODED WIRE, CONNECT ONE END TO THE FOLLOWING TERMINALS:

- 1) Connect WHITE wire to CCW of P11
- 2) Connect GREY wire to CW of P11
- 3) Connect ORANGE wire to CT of P9
- 4) Connect GREEN wire to CT of P10
- 5) Connect BROWN wire to CT of P7
- 6) Connect YELLOW wire to CT of P8
- 7) Connect VIOLET wire to CCW of P1
- 8) Connect GREY wire to CT of P1
- 9) Connect RED wire to CW of P1
- 10) Connect WHITE wire to CT of P2
- 11) Connect BROWN wire to CT of P3
- 12) Connect ORANGE wire to CT of P4
- 13) Connect WHITE wire to CT of P5
- 14) Connect YELLOW wire to CT of P6
- 15) Connect VIOLET wire to CW of P6
- 16) Connect GREEN wire to terminal 1 of switch S-1
- 17) Connect ORANGE wire to terminal 2 of switch S-1
- 18) Connect BROWN wire to terminal 3 of switch S-1
- 19) Connect BLACK wire to GND of JACK 1FM
- 20) Connect BLUE wire to TIP of JACK SYNC



AR-338 PMS V.C.O.

ASSEMBLY INSTRUCTIONS CONT.

- 21) Connect *YELLOW* wire to *TIP* of *JACK 3FM*
- 22) Connect *GREY* wire to *TIP* of *JACK SOFT*
- 23) Connect *GREEN* wire to *TIP* of *JACK LIN FM*
- 24) Connect *WHITE* wire to *TIP* of *JACK SINE*
- 25) Connect *YELLOW* wire to *TIP* of *JACK TR1*
- 26) Connect *ORANGE* wire to *TIP* of *JACK PAN OUT*
- 27) Connect *BLUE* wire to *TIP* of *JACK PUL OUT*
- 28) Connect *GREEN* wire to *TIP* of *JACK OUT SAW*
- 29) Connect *BLUE* wire to *TERMINAL 5* of *S-2*
- 30) Connect *BLUE* wire to *TERMINAL 2* of *S-2*
- 31) Connect *BLUE* wire to *TERMINAL 1* of *S-2*

*MODULE ASSEMBLY INSTRUCTIONS. PLEASE REFER TO MODULE ASSEMBLY DRAWING.*

- ( ) 1. *Unpack the frame, bag of hardware and front panel*
- ( ) 2. *Snap the 2 plastic card guides into the holes in the frame. Be sure that the pairs of tabs point to the rear, as shown.*
- ( ) 3. *Slide the P.C. Board into the frame holding the top and bottom of the frame together against the board so that the board fits snugly in the guides between the tabs.*
- ( ) 4. *Using the 4-40 x 3/8" screws and nuts, mount the 2 angle brackets to the frame, as shown. The brackets should be on the component side of the board.*
- ( ) 5. *Screw the board to the brackets. Insert the 4-40 x 3/8" screw from the foil side of PC board.*
- ( ) 6. *Refer again to MODULE ASSEMBLY drawing. Mount top of panel to frame using the 2 upper pots. Put on lock washers and insert pot shafts thru rear of upper holes in front of frame. Bring panel against frame, so these pots also go thru matching holes in panel. Tighten nuts on front of panel, with pots oriented as shown in diagram.*
- ( ) 7. *Attach bottom of panel to frame, using remaining 4-40 x 3/8" screws and nuts.*

*FINAL WIRING PROCEDURE*

*Connect the wires from the front panel to the PC board in this order. Run the wires through the specified wire saddle and around the periphery of the board to their designations. Cut each wire about 1" longer than absolutely necessary to provide for some slack. Cut, strip, trim, insert and solder each wire.*

*THROUGH THE BOTTOM WIRE SADDLE*

1. *Connect BLACK wire from jack ground to M on board*
2. *Connect GREY wire from P11 to PAN 2 on board*
3. *Connect VIOLET wire from P2 to -15VZ on board*
4. *Connect WHITE wire from P11 to PAN 1 on board*
5. *Connect GREEN wire from P10 to PWM P~INIT on board*
6. *Connect ORANGE wire from P9 to PWM P~MOD on board*
7. *Connect BLUE wire from S 2.1 to S 2.1 on board*
8. *Connect BLUE wire from S 2.2 to S 2.2 on board*
9. *Connect BLUE wire from jack PUL OUT to PULSE on board*
10. *Connect ORANGE wire from SWITCH S1.2 to S 1.2 on board*
11. *Connect GREEN wire from jack OUT SAW to SAW on board*

## AR-338 PMS V.C.O.

ASSEMBLY INSTRUCTIONS, CONT.

12. Connect *YELLOW* wire from jack *TRI* to *TRI* on board
13. Connect *VIOLET* wire from *P6 CW* to *P6 CW* on board
14. Connect *WHITE* wire from jack *SINE* to *SINE* on board

## THROUGH THE TOP WIRE SADDLE

1. Connect *RED* wire from *P1* to *A + 15v* on board
2. Connect *ORANGE* wire from jack *PAN OUT* to *PAN OUT* on board
3. Connect *GREEN* wire from switch *S1.1* to *S1.1* on board
4. Connect *BROWN* wire from switch *S1.3* to *S1.3* on board
5. Connect *BLUE* wire from jack *SYNC* to *SYNC* on board
6. Connect *YELLOW* wire from *P6* to *INIT PHASE* on board
7. Connect *WHITE* wire from *P5* to *PHASE MOD* on board
8. Connect *GREEN* wire from jack *LIN FM IN* to *FM LINEAR* on board
9. Connect *GREY* wire from jack *SOFT SYNC* to *SOFT SYNC* on board
10. Connect *BLUE* wire from *SWITCH 2.5* to *S 2.5* on board
11. Connect *WHITE* wire from *P2* to *COARSE* on board
12. Connect *GREY* wire from *P1* to *FINE* on board
13. Connect *BROWN* wire from *P3* to *FM1* on board
14. Connect *ORANGE* wire from *P4* to *FM2* on board
15. Connect *YELLOW* wire from jack *3FM* to *FM3* on board
16. Connect *YELLOW* wire from *P8* to *PWM P~INIT* on board
17. Connect *BROWN* wire from *P7* to *PWM P~MOD* on board

## TURN ALL POT SHAFTS FULLY TO THE LEFT &amp; AFIX THE KNOBS IN THIS ORDER

- |         |         |
|---------|---------|
| 1) P-11 | 8) P-3  |
| 2) P-9  | 9) P-4  |
| 3) P-10 | 10) P-1 |
| 4) P-7  | 11) P-2 |
| 5) P-8  |         |
| 6) P-5  |         |
| 7) P-6  |         |

## AR-338 OSCILLATOR TRIM PROCEDURE

In order to trim your AR-338 you will need the following:

- 1) A +15V and -15V regulated power supply such as the AR-322.  
It is important that the AR-338 be trimmed using the supply which will power the cabinet in which the oscillator is to be finally mounted.
- 2) An oscilloscope with a direct coupled (DC) vertical input.
- 3) A calibrated voltage source such as the AR-311 keyboard.

Before turning on the power supply connect the power supply to the edge connector. Connect +15V to pin A, connect ground ⊥ to pin M, and connect -15v to pin Z. Use either an edge connector or clip leads to make this connection. BE CAUTIOUS: Applying reverse voltages to these terminals could destroy many components.

Set up the face panel of the module as follows: turn the Fine and Coarse pots to the center of their rotation. Turn all other pots fully counter clockwise. Set the range switch to Audio. Connect the negative lead of the oscilloscope to the module frame or some equally convenient ground connection. Connect the positive lead to the tip of the sawtooth output jack. Turn the High Frequency Track (HFT) trim pot T6 fully clockwise. Turn all other trims to the center of their rotation. T6 and T5 are 25 turn trims. These trims have a clutch mechanism which allows them to keep turning even though they are at the end of their rotation. When they have reached the end of their rotation they will produce a slight click after each revolution. After you hear the click turn back 12 turns to reach the center of the rotation.

Turn on the power supply.

You should observe a sawtooth on the oscilloscope. If not, turn off the power supply and check your wiring. If you observed a sawtooth, move the scope probe to the triangle output. Adjust T1 for a symmetrical triangle waveform. Next move the scope probe to the sine output. Adjust T2 symmetry for the most symmetrical waveform (top and bottom should have similar shape). Adjust T3 for the best looking sine wave. If desired, connect the sine wave output to an amplifier and speaker, and adjust T3 for purest tone. NOTE: A distortion meter may be used to get the purest sine wave. Readjust T2 and T3 as necessary, for the best wave form.

The volts per octave trims can be easily adjusted. Listen to and monitor on the scope the pulse output. Adjust the width control for a 50% duty cycle squarewave or the hollowest sounding waveform. Connect a voltage source such as the Aries keyboard to the FM3 input. The keyboard must be accurately calibrated to exactly 1 volt per octave. Play low C on the keyboard and tune the oscillator with the Coarse Freq. control to approximately 125 Hz. This is equivalent to the C below middle C on a piano. Counting from the left, pin down the 4th C with a matchbook. Alternately depress and release the lower C. Adjust T5 for a change of pitch between the two notes of exactly 3 octaves. As you adjust T5 the frequency of the oscillator will shift up or down a small amount. You are adjusting for an exact 3 octave change between the two keys. Ignore the overall frequency shift of the oscillator. When you have gotten close to a 3 octave range, press low C again and return the oscillator to 125 Hz, using the coarse freq. control.

Now adjust the High Frequency Tracking trim (HFT) T6. Remove the match book from the 4th C. Alternately play the 4th and 6th C and adjust T6 for an exact two octave pitch change between the two notes. This trim will also change the overall

AR-338 TRIM CONT.

center frequency of the oscillator. It will also slightly alter the original V/oct adjustment of T5. When T6 has been adjusted as close as possible, repeat the trim procedure for T5. These adjustments will have to be repeated about three times. Each repetition will require a smaller and smaller change on the trims.

If you do not have a good ear you can use a square wave reference oscillator to help you make these adjustments. After first tuning the original oscillator to 125 Hz at low C, as described in the previous trim procedure, zero beat the reference oscillator to the original oscillator with C4 pinned. Play low C and adjust the V/oct trim T5 for 3 octaves below the reference oscillators' frequency. Release low C. The original oscillator will have changed pitch slightly. Adjust the reference oscillator to zero beat with the original oscillator. Play low C again and adjust the V/oct trim T5 as before. When you have adjusted T5 for exactly 3 octaves the reference oscillator will no longer need to be retuned.

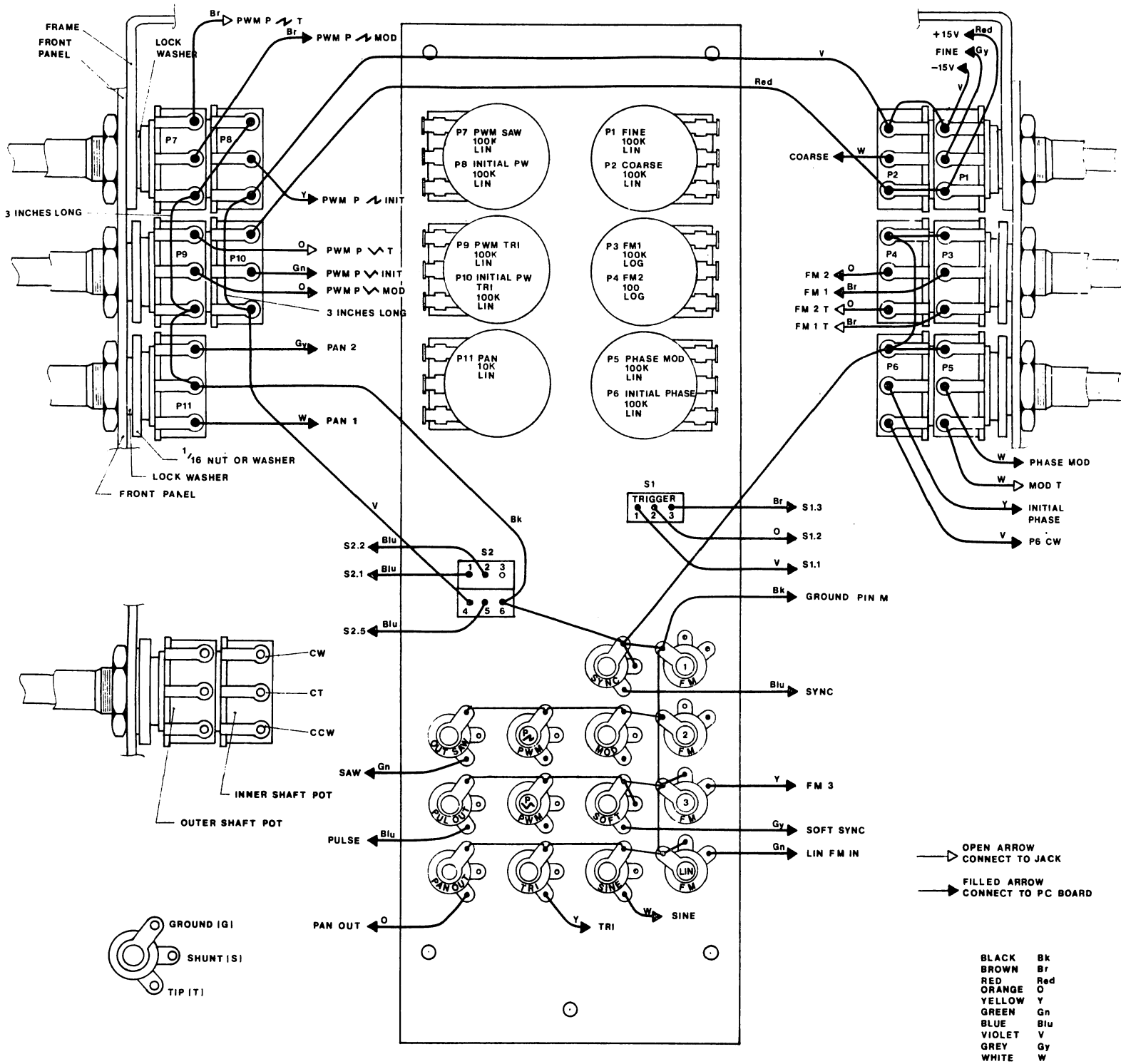
Now go on to T6 the HFT trim. Hold down C4 and zero beat the reference oscillator and the original oscillator. Play C6 and adjust T6 for a two octave change. Play C4 and zero beat the two oscillators.

Play C6 and adjust T6 again. After T6 is adjusted it may be necessary to readjust the V/oct trim T5. It takes about 3 repetitions of these adjustments to bring the oscillator into very accurate tracking.

Once the oscillators are tracking perfectly set the Coarse and Fine Freq. pots to the center of their rotation and adjust T4 the frequency trim for a frequency of 400 Hz or approximately Ab in the middle octave of a piano.

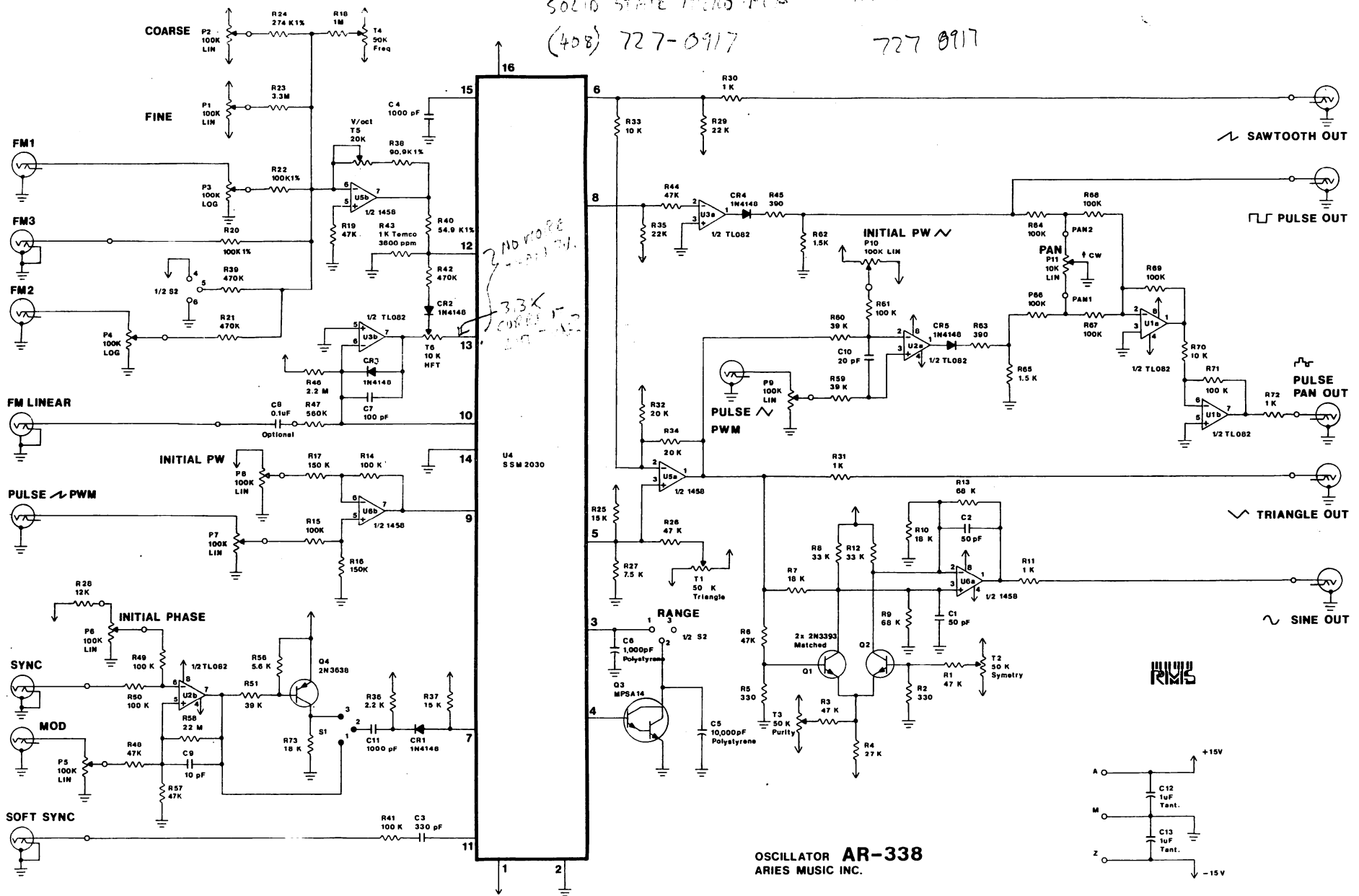
Your AR-338 is now trimmed.

### AR-338 OSCILLATOR FRONT PANEL WIRING DIAGRAM



MAKE FORTON  
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SANTA CLARA  
727 0917



OSCILLATOR AR-338  
ARIES MUSIC INC.

R52,53,54,55 DELETED

## ARIES MUSIC SYSTEM 300 SYNTHESIZER

## AR-338 PMS VOLTAGE CONTROLLED OSCILLATOR

## PARTS LIST

QUANTITY	DESCRIPTION	VOLTAGE & RATINGS
<b>RESISTORS:</b>		
2	$\frac{1}{4}$ w. carbon film; 5%	330 ohm
2	" " " "	390 ohm
8	" " " "	1 K
1	Tel Labs Q81; Tempco	1 K
2	$\frac{1}{4}$ w. carbon film; 5%	1.5 K
1	" " " "	2.2 K
1	" " " "	5.6 K
1	" " " "	7.5 K
2	" " " "	10 K
1	" " " "	12 K
2	" " " "	15 K
3	" " " "	18 K
2	" " " "	20 K
2	" " " "	22 K
7	" " " "	27 K
2	" " " "	33 K
3	" " " "	39 K
8	" " " "	47 K
1	1% metal film; green, yellow, white, red, brown	54.9 K
2	$\frac{1}{4}$ w. carbon film; 5%	68 K
1	1% metal film; white, black, white, red, brown	90.9 K
2	1% metal film; brown, black, black, orange, brown	100 K
12	$\frac{1}{4}$ w. carbon film; 5%	100 K
2	" " " "	150 K
1	1% metal film; red, violet, orange, orange, brown	274 K
3	$\frac{1}{4}$ w. carbon film; 5%	470 K
1	" " " "	560 K
1	" " " "	1 M
1	" " " "	2.2 M
1	" " " "	3.3 M
1	" " " "	22 M
<b>TRIM POTS:</b>		
4	Linear	50K
1	multi-turn cermet (Spectrol 64W103)	10K
1	multi-turn cermet (Spectrol 64W203)	20K
<b>CAPACITORS:</b>		
1	Disc	10pf
1	"	20pf
2	"	50pf
1	"	100pf
1	"	330pf
2	"	1000pf
1	"	0.1uf

## AR-338 PMS VOLTAGE CONTROLLED OSCILLATOR

## PARTS LIST CONT.

QUANTITY	DESCRIPTION	VOLTAGE & RATINGS
1	Mallory SXM 210; Polystyrene cap.	1000pf
1	Mallory SXM 110; " "	10.000pf
2	Tantalum Capacitor	1uf
<b>DIODES:</b>		
5		1N4148
<b>TRANSISTORS:</b>		
2	NPN	2N3393
1	NPN Darlington	MPSA-14
1	PNP	2N3638
<b>I.C.:</b>		
3	Op. Amp.	TL082
2	" "	1458
1	VCO	SSM2030
4	Dual pots; linear	100K
1	" " log	100K
1	Single pots; linear	10K
5 sets	Dual concentric knobs	
1	Single knob	
1	Switch; SPST; on-none-on	
1	Switch; DPDT; on-none-on	
14	Mini jacks	
2	Wire saddle	
4	Nuts; 1/16" thick; 3/8" internal diameter	
1	AR-338 Front panel	
1	AR-338 P.C. Board	
1	Module Frame	
1	Bracket; large	
1	Bracket; small	
3	Screws; Phillips head for module mounting	
4	" #4-40 x 3/8"	
2	" Phillips head, black	
6	Nuts; #4-40	
2	P.C. Card guides	
<b>COLOR CODED WIRE</b>		
4	Black	
6	Brown	
2	Red	
7	Orange	
5	Yellow	
6	Green	
6	Blue	
3	Violet	
4	Grey	
6	White	
20"	24 AWG gauge tinned copper buss wire	



ARIES MODULE AR-339 MULTI-MODE VOLTAGE CONTROLLED FILTER

ASSEMBLY INSTRUCTIONS

(Please refer to the System 300 General Assembly Instructions as a general guide to parts identification and mounting.)

We highly recommend that you:

- (a) Find a place where you can work through completion, without disturbing set-up.
- (b) Use adequate lighting.
- (c) Make sure your hands are free of grease or oil which would interfere with proper soldering.
- (d) Check off each of the following steps, as you proceed.

( ) PREPARATION:

Lay the circuit board down on a sheet of white paper. PLACE METAL FOIL 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 (Electronic grade) SOLDER. Any other type will destroy the connections, and voids the warranty!
- \* Small, diagonal wire cutters
- \* Small wire strippers
- \* Small long-nose pliers
- \* Flat blade screw driver
- \* 1/2" or #16 nut driver
- \* 5/16" or #10 nut driver
- \* 1/4" or #8 nut driver

A pair of regular pliers can substitute for the nut drivers but will not be as easy to use and may scratch the front panel.

( ) 1. First install both jumpers (J1 & J2)

( 2. Resistors: (see general assembly instructions)

Carefully install all resistors on the circuit board. Double check your installation against the P.C. board component layout drawing to be sure that the correct value is in the correct location. To prepare the resistor for insertion hold the body of the resistor between the thumb and index finger of your left hand. With the thumb and index finger of your right hand bend both leads of the resistor at once to form right angles with the body. The resistor will now insert easily into the P.C. board. Once the resistor is inserted, bend the leads on the foil side outward to hold the resistor in place. Solder the resistors to the board and cut the leads about 1/16 of an inch away from the board. For ease in reading the resistor values after they are installed on the P.C. board, install the resistors with the gold band facing either the bottom or the right-hand side of the board.

- A) Mount all 12 100K resistors; R4,13,14,15,16,18,20,21,22,24,33,34, solder & cut leads
- B) " " 8 10K " R1,12,26,30,39,47,48,50, solder & cut leads
- C) " " 5 " " R5, 25, 38, 40, 41, solder & cut leads
- D) " " 4 22 ohm " R28,29,45,46, solder & cut leads
- E) " " 3 47K " R17,27,43, solder & cut leads
- F) " " 3 33K " R11,23,42, solder & cut leads

AR-339 ASSEMBLY INSTRUCTIONS (Cont.)

G) Mount both 22K resistors R3, & 36, solder & cut leads  
 H) " " 150K " R19, & 32, solder & cut leads  
 I) " " 150ohm " R8, & 9, solder & cut leads  
 J) " " 12K " R37 & 44, solder & cut leads  
 K) Mount the 560 ohm resistor; R2, solder & cut leads  
 L) " " 4.7K " R6; solder & cut leads  
 M) " " 68K " R10; solder & cut leads  
 N) " " 330K " R7; solder & cut leads  
 O) " " 1 meg " R25; solder & cut leads  
 P) " " 1.8K " R31; solder & cut leads  
 Q) " " 27K " R41; solder & cut leads  
 R) " " 470K " R51; solder & cut leads

## ( ) 3. DIODES: (see general assembly instructions)

The black band on the component should correspond to the black band on the diode as drawn on the P.C. board layout drawing.

Mount all 5 diodes; CR1,2,3,4,5- solder and cut leads

## ( ) 4. INTEGRATED CIRCUITS: (see general assembly instructions)

Pay particular attention to the orientation of the I.C.'s. The pin indication on the component should correspond with the indication on the P.C. board component layout drawing.

1) Mount the three CA3080; U4,2,5

2) Mount the two TL082CP; U1 & 3

3) Mount the LM301A; U6

## ( ) 5. TRANSISTORS: (see general assembly instructions)

The leads, emitter, collector and base are designated on the P.C. board

1) Mount the 2N3393 NPN transistors-Q1 & 3

2) Mount the 2N3638 PNP transistors-Q2 & 4

## ( ) 6. CAPACITORS: (see general assembly instructions)

Observe the polarity of the three tantalum capacitors. The positive lead is the lead closest to the (+) sign on the component.

1) Mount all 3 lmf tantalum capacitors; C1, 10 11; solder & cut leads

2) Mount both 330pf mica capacitors; C5, 6; solder & cut leads

3) Mount all 3 100pf disc capacitors; C2,7,9; solder & cut leads

4) Mount the 47pf disc capacitor C3; solder & cut leads

5) Mount the 1000pf disc capacitor; C4; solder & cut leads

6) Mount the 150pf disc capacitor; C8; solder & cut leads

## ( ) 7. TRIMPOTS: (see general assembly instructions)

Mount all seven 50K trimpots; T1,2,3,4,5,6,& 7.

THIS COMPLETES THE ASSEMBLY OF THE P.C. BOARD

For the time being, lay it aside and go on to the next section.

AR-339 ASSEMBLY INSTRUCTIONS (cont.)

## FRONT PANEL ASSEMBLY PROCEDURE:

(refer to front panel wiring diagram)

Aries Music face panels are made of anodized aluminum. They will not be scratched in normal operation, but they can be scratched with pliers or a nut driver. When using tools on the front panel, be careful not to scratch it.

- ( ) 1. Mount AUDIO 1 pot and the FREQ pot. Do not yet fully tighten the nuts; they will be later removed for final assembly. If the pots have a small flange which prohibits them from being mounted flush against the face panel, bend the flange outward so the pots can be mounted flush.
- ( ) 2. Mount the remaining 3 single pots, AUDIO 2,3 & 4. Install the additional larger nut onto the bushing and tighten firmly. Now install the pots as usual.
- ( ) 3. Mount the two dual pots. Again install the additional larger nut before mounting.
- ( ) 4. Mount the switch so that the three terminals are in a horizontal line with each other. It makes no difference which terminal is on the right. Screw one nut onto the bushing and against the body of the switch. This is used as a spacer so that when the switch is mounted the threads will protrude from the front of the face panel as far as the jack threads protrude. Place the lock washer between this nut and the back of the face panel. Mount the switch, holding it in place with the second nut.
- ( ) 5. Mount the thirteen jacks orienting them as shown on the wiring diagram. Mount the washer on the front side of the face panel and tighten the nuts.

## PANEL WIRING: (see general assembly instructions before going any further)

The order in which these connections are made has proven to be the easiest and the most convenient method of wiring this module. The color-coded wires will facilitate trouble shooting the module.

USING BLACK WIRE, CONNECT AND SOLDER THE FOLLOWING WIRES. CUT THESE WIRES TO LENGTH AND STRIP THEM. LEAVE AS LITTLE SLACK AS CONVENIENTLY POSSIBLE EXCEPT WHERE INDICATED AT STEP 4 AND 6. When soldering, be careful not to fill up the terminals on the pots and jacks with solder. It will be necessary to connect additional wires to some of the terminals later. All these wires should be just a bit longer than absolutely necessary. They should not be excessively long that they form loops between terminals.

1. The CCW of P8 to the CCW of P9
2. The CCW of P6 to the CCW of P7
3. The CCW of P8 to the CCW of P6
4. The CCW of P6 to the CCW of P5. These wires should be 2" long.
5. The CCW of P5 to the CCW of P1
6. The CCW of P1 to the CCW of P2. This wire should be 2" long.
7. The CCW of P2 to the CCW of P3
8. The CCW of P3 to the CCW of P4
9. Using un-shielded wire, connect the grounds of all 13 jacks together. Do not yet solder the connection to the ground of jack AUD 1.
10. Connect the CCW of P4 to the jack ground of AUD 1.
11. Connect and solder the shunt of jack Q to the ground of jack Q.
12. Connect and solder the shunt of jack FM3 to the ground of jack FM3

AR-339 ASSEMBLY INSTRUCTIONS (cont.)

## USING RED WIRE:

1. Connect the CW of P9 to the CW of P5.

## USING COLOR-CODED WIRE;

1. Connect BROWN wire from CW of P8 to tip of jack Q1
2. Connect BLUE wire from CW of P6 to tip of jack FM1
3. Connect GREY wire from CW of P7 to tip of jack FM2
4. Connect BROWN wire from CW of P1 to tip of jack AUDIO 1
5. Connect ORANGE wire from CW of P2 to tip of jack AUDIO 2
6. Connect YELLOW wire from CW of P3 to tip of jack AUDIO 3
7. Connect GREEN wire from CW of P4 to tip of jack AUDIO 4

## FOR THE FOLLOWING CONNECTIONS, USE 12" LENGTHS OF COLORED WIRE:

1. Connect BROWN wire to the CT of P8
2. Connect GREEN wire to CT of P9
3. Connect BLUE wire to the CT of P6
4. Connect GREY wire to the CT of P7
5. Connect GREY wire to the CT of P5
6. Connect RED wire to the CW of P5
7. Connect BROWN wire to the CT of P1
8. Connect ORANGE wire to the CT of P2
9. Connect YELLOW wire to the CT of P3
10. Connect GREEN wire to the CT of P4
11. Connect ORANGE wire to the terminal 2 of the SWITCH
12. Connect YELLOW wire to the terminal 3 of the SWITCH
13. Connect YELLOW wire to the TIP of jack N/P
14. Connect GREEN wire to the TIP of jack H
15. Connect BLUE wire to the TIP of jack B
16. Connect GREY wire to the TIP of jack L
17. Connect ORANGE wire to the TIP of jack Q2
18. Connect WHITE wire to the TIP of jack FM3
19. Connect BLACK wire to the GROUND of jack AUD 1

## 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 point toward the rear, as shown.
- ( ) 3. Slide the printed circuit board into the frame, holding top and bottom of frame together against the board, so that the board fits snugly in the guides, between the tabs.
- ( ) 4. Using the 4-40 x 3/8" screws and nuts, mount the two angle brackets to the frame as shown. The brackets should be on the component side of the board.
- ( ) 5. Now screw the board to the brackets. Insert the 4-40 x 3/8" screw from foil side of board. DOUBLE CHECK THAT SCREW HEAD DOES NOT TOUCH ANY METAL FOIL!!!
- ( ) 6. Refer again to MODULE ASSEMBLY DRAWING. Mount top of panel to frame, using the two UPPER pots (P1 and P5): Put on lock washers and insert pot shaft through rear of upper holes in front of frame. Bring panel against frame, so these pots also go through matching holes in panel. Tighten nuts on front of panel, with pots oriented in same direction as lower pots.
- ( ) 7. Attach bottom of panel to frame, using remaining 4-40 x 3/8" screws & nuts,

AR-339 ASSEMBLY INSTRUCTIONS (cont.)

CONNECT THE WIRES FROM THE FACE PANEL TO THE BOARD IN THIS ORDER. RUN THE WIRES AROUND THE PERIPHERY OF THE BOARD WHENEVER POSSIBLE. WIRING THE MODULE NEATLY WILL FACILITATE TRIMMING AND TROUBLE-SHOOTING. LEAVE ABOUT 1" SLACK FOR EACH WIRE; CUT THE WIRE, STRIP IT AND SOLDER IT TO THE BOARD.

1. connect RED wire from P5 to board A
2. connect GREEN wire from P9 to board Q INITIAL
3. connect BROWN wire from P8 to board Q MOD 1
4. connect ORANGE wire from jack Q to board Q MOD 2
5. connect BLACK wire from jack 1 AUD to board GROUND
6. connect YELLOW wire from jack N/P to board N/P
7. connect GREY wire from jack L to board L
8. connect BLUE wire from jack B to board B
9. connect GREEN wire from jack H to board H
10. connect ORANGE wire from SWITCH to board S2
11. connect YELLOW wire from SWITCH to board S3
12. connect BROWN wire from P1 to board AUDIO 1
13. connect ORANGE wire from P2 to board AUDIO 2
14. connect YELLOW wire from P3 to board AUDIO 3
15. connect GREEN wire from P4 to board AUDIO 4
16. connect GREY wire from P5 to board FREQ
17. connect BLUE wire from P6 to board FM 1
18. connect GREY wire from P7 to board FM 2
19. connect WHITE wire from jack FM 3 to board FM 3

Turn all pot shafts fully counter-clockwise (to the left) and install the knobs in this order:

1. Audio 4
2. Audio 3
3. Audio 2
4. Audio 1
5. Q-1
6. Initial Q
7. FM 1
8. FM 2
9. FREQ

THIS COMPLETES ASSEMBLY INSTRUCTION OF MODULE AR-339

## AR-339 MULTI-MODE FILTER MODULE

### TRIM PROCEDURE

This procedure should be approached with care and patience in order to obtain maximum performance.

In order to trim your AR-339 you will need:

+ 15 volt dual regulated power supply

DC coupled oscilloscope

DC Voltmeter

Wide range audio oscillator with + 5 volt triangle wave output. (Any of the Aries Music VCOs will do fine.)

1. Refer to the AR-339 PC board component layout drawing. Turn T7 (H.F.Q. trim) fully counter-clockwise. Turn all six other trims T1,2,3,4,5,6 to the center of their rotation.
2. Before turning on the power supply connect the +15 volt output of the supply to pin "A" on the PC board edge connector of the AR-339. Connect power supply GROUND  $\perp$  to pin "M". Connect the -15 volt output to terminal "Z". CAUTION! Improper connections can destroy components!!!
3. Set the voltmeter or oscilloscope on an appropriate range for measuring up to 15 volts D.C. Connect the negative lead to the ground on one of the AR-339 output jacks. Connect the positive lead to the junction of R37 and pin 1 of the #1748 exponential generator module on the PC board. This junction is labelled **[1]** on the PC board component layout drawing.
4. Set the front panel controls as follows: freq. knob fully clockwise. The eight remaining knobs fully counter-clockwise.
5. TURN ON POWER SUPPLY. IMMEDIATELY feel ALL I.C.'s and TRANSISTORS repeatedly, to check for overheating. Slight warming is normal on the I.C.'s, but TURN POWER OFF IMMEDIATELY in the event of any device becoming HOT to the touch! In this case, check your wiring, and check for any shorts, such as metal specks on the board.
6. If all seems well, adjust T1 (frequency trim) for a reading or -1 Volt on the meter. Now, shift the positive meter lead to the junction of R44 and pin 2 of the 1748 exp. generator. This is marked **[2]** on the PC board component layout diagram. The voltage here should be between 0 and -8 volts.
7. Connect the positive lead of the meter to the junction of R6 and the collector of Q4. This is marked **[3]** on the PC board component layout drawing. Adjust T2 ("Q" trim) for a voltage of -11 volts.
8. Reset the following front panel controls: Freq. knob to one o'clock "initial Q" knob to one o'clock. Connect the positive lead to the Band Pass Out at the end of R38 on the PC board. This is labelled "B" on the PC board component layout drawing. The voltage here may be initially any where from +15V to -15V. Adjust T4 ("B" offset trim) for a reading of 0V,  $\pm$  0.1V.
9. Without changing the front panel controller, connect the positive lead to the Low Pass Out at the end of R40 on the PCB. This is labelled "L" on the PCB component layout diagram. Adjust T3 (LH offset HiQ trim) for 0V,  $\pm$  0.1V at the Low Pass Out.

AR-339 TRIM PROCEDURE (Cont.)

10. Set the front panel "initial Q" knob fully counter clockwise. Leave the Freq. knob at 1 o'clock. Keep the positive lead connected to the Low Pass Out. Adjust T5 (LH offset LoQ trim) for 0V, +0.1V at the Low Pass Out.
11. Set the front panel "initial Q" control knob to ten o'clock. Set the front panel "freq." control knob fully counter clockwise. Connect a triangle wave oscillator to the Audio 1 input on the front panel. Connect the oscilloscope positive lead to the junction of R13 and the bottom wire from the center tap of P1. This is labelled Audio 1 on the PC board component layout drawing. Set the Audio 1 front panel control for a 1V peak to peak triangle wave at R13. Set the triangle wave oscillator to a frequency of 16 Hz. Now move the positive lead of the oscilloscope to the Band Pass Out labelled "B". Carefully adjust T1 (freq.trim) for the maximum peak to peak signal at the Band Pass Out.
12. Turn the Freq. control knob fully clockwise. Set the triangle wave oscillator to 16K Hz. Adjust T6 (1V/oct. trim) for the maximum peak to peak signal at the Band Pass Out.
13. Disconnect the triangle wave oscillator. Set the front panel controls as follows: Freq = fully clockwise; initial Q = fully clockwise; the seven remaining knobs fully counter clockwise. Connect +10V DC to the FM1 input. Turn the FM1 input control knob to 12 o'clock. With the oscilloscope, monitor the Band Pass Out. Slowly turn T7 (H.F.Q. trim) clockwise. At some point the Band Pass Out will show high frequency oscillations. Back off the trim pot until the oscillations stop. Remove all connections from the AR-339 and install it in your case.

YOUR AR-339 IS NOW FULLY TRIMMED AND READY TO USE.

## ARIES MUSIC SYNTHESIZER MODULE AR-339

## Multi-Mode VCF

## PARTS LIST

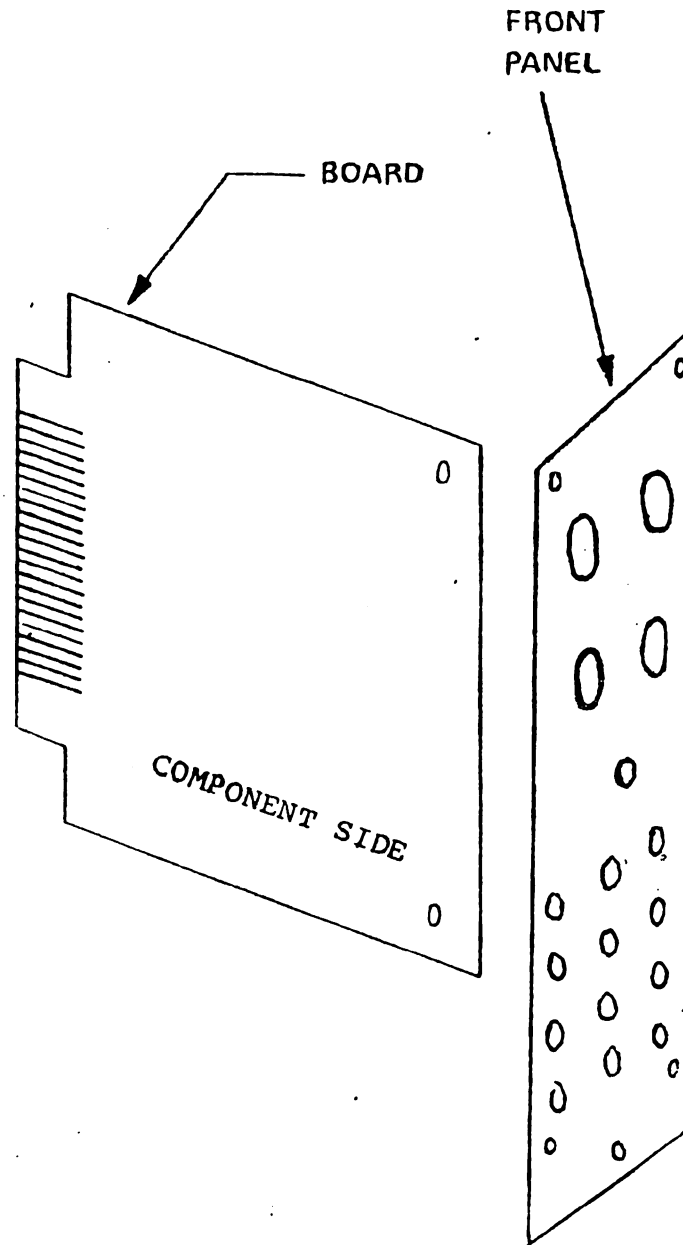
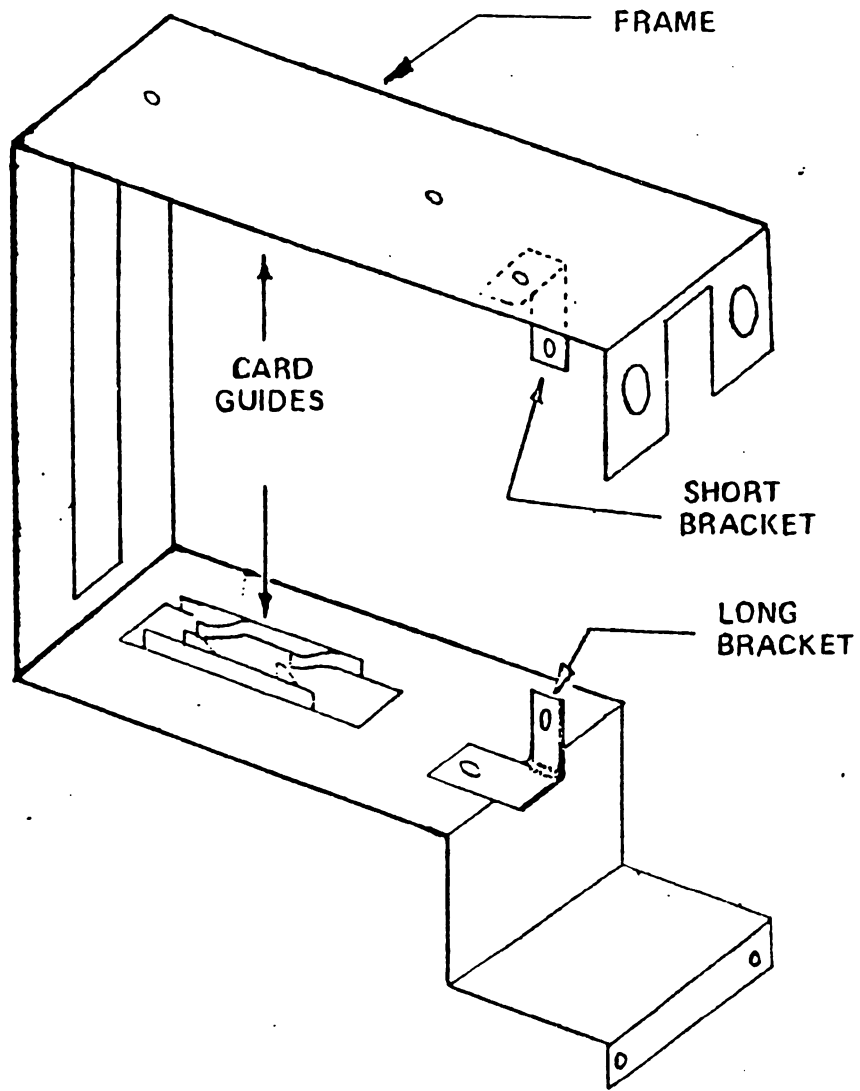
QUANTITY	DESCRIPTION	VALUE & RATING
4	Carbon film resistor; $\frac{1}{4}$ w	22 ohm
2	" " " "	150 ohm
1	" " " "	560 ohm
5	" " " "	1K
1	" " " "	1.8K
1	" " " "	4.7K
7	" " " "	10K
2	" " " "	12K
2	" " " "	22K
1	" " " "	27K
3 -1	" " " "	33K
3	" " " "	47K
1	" " " "	68K
2	" " " "	100K
2	" " " "	<del>130K</del> 150K
1	" " " "	330K
1	" " " "	470K
1 ST	" " " "	1 meg
7	Linear Trim Pots	50K
4	Log pots (single)	100K
1	Linear pots (single)	100K
1	Log pots (dual)	100K
1	Linear Pots (dual)	100K
CAPACITORS:		
3	Tantalum	1 mf ✓
2	mica or film	330 pf -
3	Disc	100 pf ✓
1	"	47 pf ✓
1	"	150 pf ✓
1	"	1000 pf ✓
I.C.		
1	Operational Amplifier	LM301-A
3	Operational Transconductance Amplifier (selected category 1)	CA3080
2	Dual FET input op amp	TL-082CP LM358N
TRANSISTOR:		
2	NPN Transistor	2N-3393
2	PNP "	2N-3638
DIODE:		
5	Diodes	1N-4148
1	SPDT Toggle Switch; on-none-one	
2	P.C. Card Guides	
1	AR-339 P.C. Board	
1	Front Panel	
5	Knobs, single	
2 sets	Knobs, dual concentric	
1	Module Frame	



## AR-339 PARTS LIST, CONT.

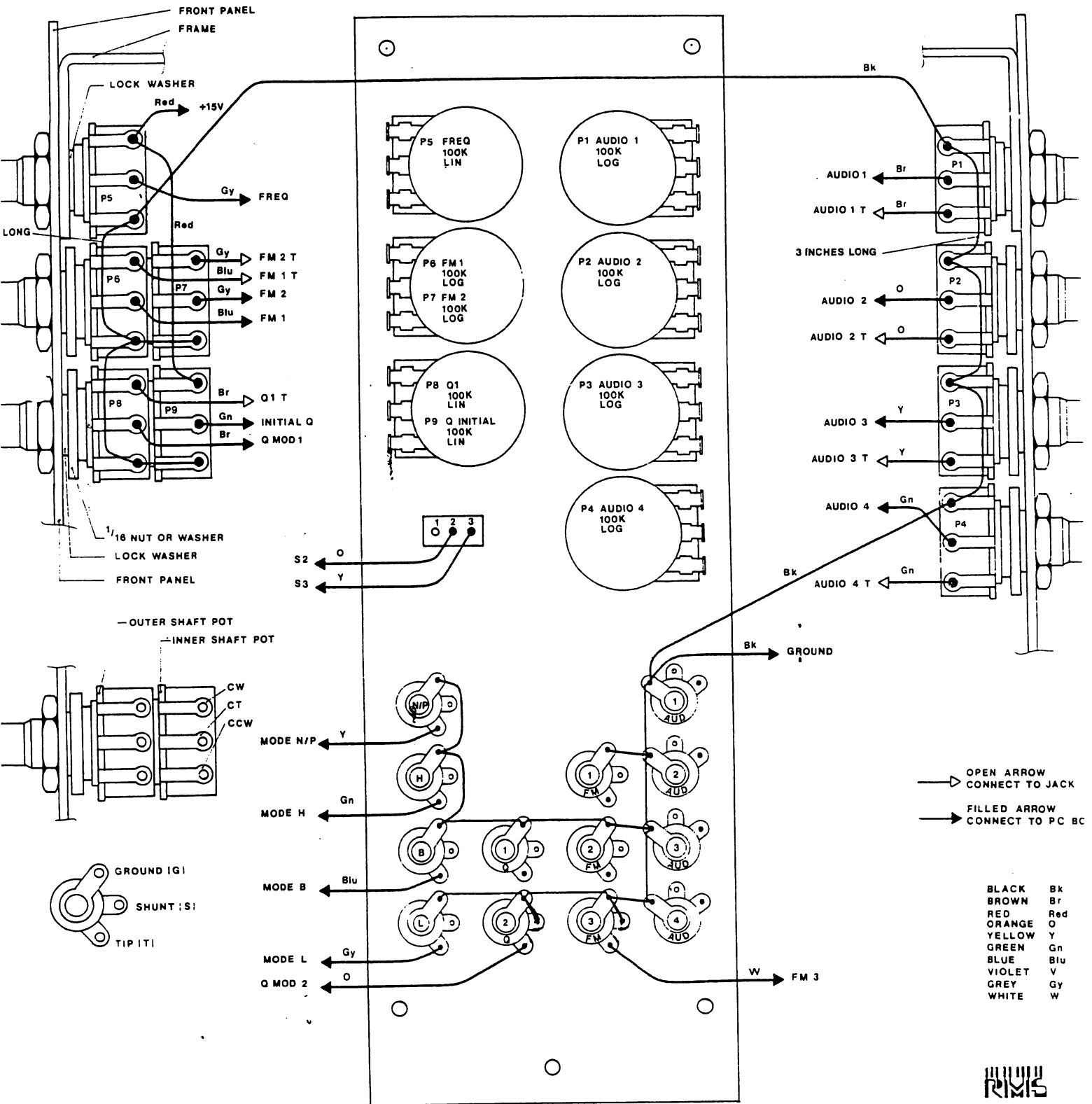
QUANTITY	DESCRIPTION	VALUE & RATING
2	Brackets	
6	Screws; 4-40 x 3/16"	
6	Nuts; 4-40	
13	Mini Jacks	
5	Nuts; 1/16" thick; 3/8" internal diameter	
1*	#1748 Exponential Generator Sub-module	
2	Cable tie	
4	12" black wires	
5	12" brown wires	
3	12" red wires	
5	12" orange wires	
5	12" yellow wires	
5	12" green wires	
4	12" blue wires	
5	12" grey wires	
2	12" white wires	
1	20" 24 gauge AWG bus wire	

\* In many cases, this sub-module will be installed on the board at the factory

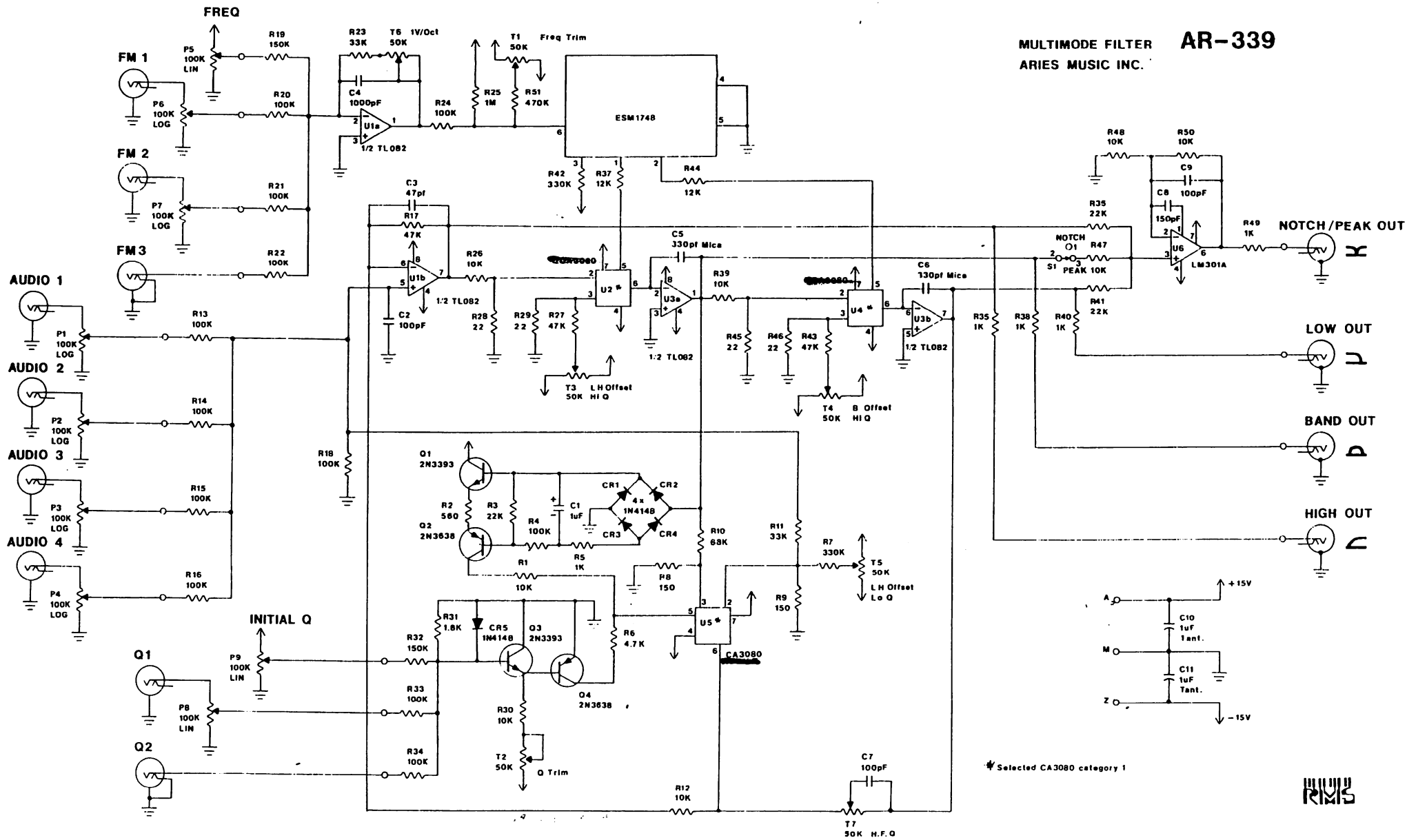


AR-339 MULTIMODE FILTER  
FRONT PANEL WIRING DIAGRAM

ARIES MUSIC INC.



MULTIMODE FILTER AR-339  
ARIES MUSIC INC.



\* Selected CA3080 category 1



## RIVERA MUSIC SERVICES

## MODULE AR-343

## DUAL VC AMPLIFIERS ASSEMBLY INSTRUCTIONS

IT IS RECOMMENDED THAT YOU DO THE FOLLOWING BEFORE YOU PROCEED:

- \* Find a place where you can work through to 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.
- \* Check off each step with a pencil as you proceed

PLEASE ALSO READ THE GENERAL ASSEMBLY INSTRUCTIONS BEFORE BEGINNING THE ASSEMBLY OF THIS MODULE.

## PRINTED CIRCUIT BOARD ASSEMBLY INSTRUCTIONS

## ( ) A. PREPARATION:

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

Place the AR-343 Component Layout Diagram near the board so that it can be viewed during assembly.

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, 25 watt, hot and tinned (solder coated)
- \* Solder; USE ONLY THIN ROSIN-CORE SOLDER! (SN60, 22 AWG)
- \* Small diagonal wire cutters
- \* Small wire strippers
- \* Small long-nose pliers
- \* No. 1 Phillips screw driver.
- \* ½" or #16 nut driver
- \* 5/16" or #10 nut driver
- \* ¼" or # 8 nut driver
- \* 1/16" hex driver

A pair of household pliers can be substituted for the nut drivers but will not be as easy to use and may scratch the front panel.

- ( ) B. Mount all four 50K ohm trimpots as shown on the Component Layout Drawing. Bend the larger leads down so that they touch the circuit board foil. Solder the leads.
- C. Mount the integrated circuits paying particular attention to their orientation. The notch in the IC package and/or the dot in the upper left hand corner should correspond with the indication on the AR-343 Component Layout Drawing.
  - ( ) 1. Mount the four 1458 dual op-amps U3,3,4,4, and solder.
  - ( ) 2. Mount the two TL082 dual op-amps U2,2 and solder.
  - ( ) 3. Mount the SSM 2020 dual VCA U1 and solder.

- D. Carefully install all resistors on the circuit board. Double check your installation against the P.C. board component layout drawing to be sure that the correct value is in the correct location. To prepare the resistor for insertion hold the body of the resistor between the thumb and index finger of your left hand. With the thumb and index finger of your right hand bend both leads of the resistor at once to form right angles with the body. The resistor will now insert easily into the P.C. board. Once the resistor is inserted, bend the leads on the foil side outward to hold the resistor in place. Solder the resistors to the board and cut the leads about 1/16 of an inch away from the board. For ease in reading the resistor values after installation, install the resistors with the gold band facing either the bottom or the right hand side of the board.
- ( ) 1. Mount all twenty 100K resistors, brown black yellow, R7,7,8,8,11,11,12,12,14,14,16,16,21,21,22,22,25,25,27,27. Solder and cut the leads.
  - ( ) 2. Mount all six 270K resistors, red violet yellow, R 4,4,23,23,28,28. (Solder and cut the leads after installing each value.)
  - ( ) 3. Mount all four 1K resistors, brown black red, R 1,1,20,20.
  - ( ) 4. Mount all four 47 K resistors, yellow violet orange, R5,5,2,2.
  - ( ) 5. Mount all four 150K resistors, brown green yellow, R 10,10,13,13.
  - ( ) 6. Mount all four 1M resistors, black brown green, R 3,3,17,17.
  - ( ) 7. Mount both 3.3K resistors, orange orange red, R 6,6.
  - ( ) 8. Mount both 3.9K resistors, orange white red, R 19,19.
  - ( ) 9. Mount both 19.1K 1% resistors, brown white brown red, R 15,15.
  - ( ) 10. Mount both 22K resistors, red red orange, R 24,24.
  - ( ) 11. Mount both 3.3M resistors, orange orange green, R 26,26.
  - ( ) 12. Mount both 10M resistors, brown black blue, R 18,18.
- E. Install both jumpers.
- ( ) 1. Use 1.25 inches of 22 ga. bus wire to install J1. Solder and cut the leads.
  - ( ) 2. Use 1 inch of 22 ga. bus wire to install J2. Solder and cut the leads.
- F. Mount all six diodes. Orient the black band on each diode as shown in the drawing.
- G. Install the capacitors.
- ( ) Mount both 22pf disc capacitors C1,1.
  - ( ) Mount both 5pf disc capacitors C2,2.
  - ( ) Mount both 1uf tantalum capacitors C3,4. Observe the polarity of the two tantalum capacitors when mounting. The positive lead is the lead closest to the red dot or "+".
- ( ) H. Snap both wire saddles into the PC board with the loop on the component side of the board. Orient as shown in the drawing.

This completes the assembly of the printed circuit board. For the time being, lay it aside and go on to the next section.

#### FRONT PANEL ASSEMBLY

- ( ) A. Install the jacks orienting them as shown on the Front Panel Wiring Diagram. Consult the drawing so that the tip and shunt of the jacks are in the correct position. Mount the washers on the front side of the face panel, mount the nuts onto the bushings and tighten the nuts with the #10 nut driver. Be careful to not mar the face panel or the nuts.

- B. Install the jack grounds. First, carefully unfold the bus wire so that no sharp kinks are formed. Then grip one end with pliers and pull the wire through your fingers to smooth and straighten the wire.
- ( ) 1. Insert a 5.5 inch length of 22 gauge bus wire through the ground terminals of jacks X Audio 1, X Audio 2, X AM 1, and X AM 2. Pull the wire through until only 1 inch of wire protrudes beyond the top terminal of jack X Audio 1.
  - ( ) 2. Bend the protruding inch of wire to the left and connect it to the top ground terminal of Y Audio 1.
  - ( ) 3. Bend the lower portion of the bus wire to the left and connect it to the lower ground terminal of Y Out 2. Be sure the bus wire touches the lower ground terminals of jacks X Out 2 and Y AM 2. The wire will later be soldered to the ground terminals of these jacks.
  - ( ) 4. Insert a 3.5 inch length of 22 gauge bus wire through the ground terminals of jacks Y Audio 1 and Y Audio 2; and through the top terminal only of Y AM 1.
  - ( ) 5. Pull the wire almost all the way through and connect the top end of the wire to the top ground terminal of Y Audio 1.
  - ( ) 6. Bend the lower portion of the bus wire to the left and connect it to the top ground terminal of Y Out 1. Be sure the bus wire touches the upper ground terminals of jacks X Out 1 and Y AM 1.
  - ( ) 7. Solder the ground terminal of the jacks as follows. Solder the lower terminals of all the jacks with the exception of these three, Y AM 1, X Out 1, and Y Out 1. On these three jacks solder the upper terminal.
- C. Install the pots. First prepare the pots for installation by bending the pot terminals so they form a 90 degree angle. If the pots have a small flange which prevents them from being mounted flush against the face panel, bend the flange back and forth with pliers until the flange breaks off. Place a thick lockwasher over the shaft of the two single pots before installing them on the panel. Place a thin lockwasher over the shaft of the four lower dual pots. (Consult the Front Panel Wiring Diagram for the correct part numbers of these pots.) The two upper dual pots will not receive a lockwasher. Insert the shafts of the pots through the panel from the rear. Place the nut over the shaft and tighten with a #16 nut driver. Make sure the pot terminals line up as shown in the front panel wiring diagram.
1. Mount the AM1/Amplitude pots for both channels. (100K dual linear, EF 1869) These two pots will be removed later when the panel is assembled to the frame. Tighten the nuts just enough to secure the pots so that they don't rotate when you wire them. The remaining pots should be tightened fully.
  2. Mount the AM2 pots for both channels. (100K linear, FM7922)
  3. Mount the Offset/Lin-Exp pots for both channels. (100K dual linear, EF1869)
  4. Mount the Audio1/Audio2 pots for both channels. (100K dual log, EF1870)
- D. Install the ground jumpers on the dual pots. Cut six 1 inch pieces of 22 gauge bus wire. Using one wire for each pot, make the following connections for both channels.

## Channel X

- ( ) 1. Connect the counter-clockwise terminal of P1, CCW-P1, to the counter-clockwise terminal of P2, CCW-P2. Solder CCW-P1 only.
- ( ) 2. Connect the counter clockwise terminal of P3, CCW-P3, to the center tap of P4, CT-P4. Solder CCW-P3 only.
- ( ) 3. Connect the counter clockwise terminal of P6, CCW-P6, to the counter-clockwise terminal of P7, CCW-P7. Solder CCW-P6 only.

Channel Y (The same connections will be made on the Y channel as on the X.)

- ( ) 4. CCW-P1 to CCW-P2. Solder CCW-P1 only.
- ( ) 5. CCW-P3 to CT-P4. Solder CCW-P3 only.
- ( ) 6. CCW-P6 to CCW-P7. Solder CCW-P6 only.

E. Install the jack to jack jumpers. When connecting insulated wires, strip no more than 3/16 of an inch of insulation from the measured length of wire. Twist the strands of wire together to form a single tight unit. Cut off any excess wire after the connection has been made and soldered. Run each wire straight down to the panel surface and then over to the next terminal to which it is to be connected. After each wire has been connected it should be made to rest flat against the surface of the panel. When soldering to the tip terminals of the jacks, make sure that no solder or solder flux flows down into the jack. If this happens the normaling connections inside the jack could become intermittent at a later date. Either be careful or stand the panel on its side when soldering.

N.B. All specified wire lengths allow for the stripping of up to 1/4 inch of insulation from each end.

- ( ) 1. Connect a 1.5 inch piece of brown wire to the tip of X Audio 1 and then to the shunt of Y Audio 1. Solder only the shunt of Y Audio 1.
- ( ) 2. Connect a 1.5 inch piece of orange wire to the tip of X Audio 2 and then to the shunt of Y Audio 2. Solder only the shunt of Y Audio 2.
- ( ) 3. Connect a 1.25 inch piece of white wire to the tip of Y Out 1 and then to the tip of Y Out 2. Solder only the tip of Y Out 2.
- ( ) 4. Connect a 1.25 inch piece of white wire to the tip of X Out 1 and then to the tip of X Out 2. Solder only the tip of X Out 2.

F. Install pot grounds. For each channel we will thread a single piece of bus wire through all the appropriate terminals to be grounded on each set of pots. When finished the wire should lie exactly as shown on the front panel wiring diagram.

## Channel X

1. Attach a 9.75 inch length of 22 ga. bus wire to the CCW terminal of P7. Crimp and solder. Pass the free end across the back of the pots and through the CCW terminal of P5. Allow about 6.5 inches of wire to protrude beyond the CCW terminal. Bend the wire protruding from the CCW terminal of P5 up and back so it lies across the back of the pots. Crimp the bus wire tightly around the terminal and solder.
2. To connect the next pot, pass the free end of the wire extending from the CCW of P5 across the back of the pots and through the CT terminal of P1. This time allow 4.5 inches to protrude beyond the CT terminal. Bend the wire up and back, and crimp and solder as above.
3. To connect the last pot, Use the same technique to connect the bus wire to the CCW of P2 allowing 3.25 inches to project beyond the terminal. Bend, crimp, and solder as above.
4. Bring the wire from the back of P2 straight down to the face panel, then across and up to the upper ground terminal of the X Audio 1 jack. Crimp but do not solder.



- ( ) 5. Flatten the wire loops against the backs of the pots as shown in the front panel wiring diagram. Be sure that the bus wire is not touching any of the other pot terminals.

#### Channel Y

To connect the pot grounds, attach a 1.75 inch length of 22 ga. bus wire to the CCW of P7 and follow the procedure that was used to wire channel X. the lengths of wire that should protrude beyond the pot terminals are listed below - some lengths are different:

- ( ) 6. CCW-P5        6.5 inches  
 ( ) 7. CT-P4        5.5 inches  
 ( ) 8. CCW-P2       4.0 inches  
 ( ) 9. After making the connection to the CCW terminal of P2, Xconnect the wire to the upper ground terminal of the Y Audio 1 jack. Crimp and solder. As with channel X, bring the wire straight down to the face panel, then over and up to the jack ground terminal. Solder this connection.  
 ( ) 10. Flatten the wire loops against the backs of the pots.
- G. Install the pot to pot connections. N.B All wire lengths are calculated to allow the wire to run flat against the surface of the front panel.
- ( ) 1. Connect a 3.25 inch piece of red wire from the CW-P3(X channel) to the CW-P7(X channel). Solder CW-P3 only.  
 ( ) 2. Connect a 5.75 inch piece of red wire from CW-P7(X channel)to CW-P7 (Y channel). Solder CW-P7(X channel) only.  
 ( ) 3. Connect a 3.25 inch piece of red wire from the CW-P7(Y channel) to the CW-P3(Y channel). Solder CW-P7(Y channel) only.

- H. Install the wires connecting the jacks to the pots. Solder each connection after it's been made.

#### Channel X

- ( ) 1. Connect a 2.5 inch piece of brown wire from the tip of the XAudio 1 jack to the CW terminal of P1.  
 ( ) 2. Connect a 4.25 inch piece of orange wire from the tip of X Audio 2 to the CW terminal of P2.  
 ( ) 3. Connect a 6.5 inch piece of yellow wire from the tip of X AM 1 to the CW terminal of P6.

#### Channel Y

- ( ) 4. Connect a 5 inch piece of brown wire from the tip a Y Audio 1 to the CW terminal of P1.  
 ( ) 5. Connect a 6.25 inch piece of orange wire from the tip of Y Audio 2 to the CW terminal of P2.  
 ( ) 6. Connect an 8.25 inch piece of yellow wire from the tip of Y AM 1 to the CW terminal of P6.

- I. Install the pot to PC board wires. Solder each connection as it is made. Cut off any excess wire.

- ( ) 1. Connect a 7 inch piece of red wire to CT-P7.  
 ( ) 2. " " 7 " " yellow " " CT-P6.  
 ( ) 3. " " 5.5 " " violet " " CT-P5.  
 ( ) 4. " " 4.5 " " violet " " CW-P5.  
 ( ) 5. " " 3.75 " " white " " CCW-P4.  
 ( ) 6. " " 3 " " black " " CW-P4.  
 ( ) 7. " " 4 " " red " " CT-P3.  
 ( ) 8. " " 4.5 " " orange " " CT-P2.

- ( ) 9. Connect a 5 inch piece of brown wire to the CT-P1.

Channel Y

- |     |     |             |                   |             |         |
|-----|-----|-------------|-------------------|-------------|---------|
| ( ) | 1.  | Connect a 6 | inch piece of red | wire to the | CT-P7.  |
| ( ) | 2.  | " "         | 6 " yellow        | " "         | CT-P6.  |
| ( ) | 3.  | " "         | 3.75 " violet     | " "         | CW-P5.  |
| ( ) | 4.  | " "         | 5.75 " violet     | " "         | CT-P5.  |
| ( ) | 5.  | " "         | 4 " black         | " "         | CW-P4.  |
| ( ) | 6.  | " "         | 5 " white         | " "         | CCW-P4. |
| ( ) | 7.  | " "         | 5.75 " red        | " "         | CW-P3.  |
| ( ) | 8.  | " "         | 9.25 " red        | " "         | CT-P3.  |
| ( ) | 9.  | " "         | 6.75 " orange     | " "         | CT-P2.  |
| ( ) | 10. | " "         | 8 " brown         | " "         | CT-P1.  |

J. Install the jack to printed circuit board wires.

(Remember not to let the solder or flux flow down into the jack.)

- |     |    |               |                      |                            |                                 |
|-----|----|---------------|----------------------|----------------------------|---------------------------------|
| ( ) | 1. | Connect a 8.5 | inch piece of black  | wire to the top ground     | terminal of the X Audio 1 jack. |
| ( ) | 2. | Connect a 6.5 | inch piece of yellow | wire to the tip of X AM 1. |                                 |
| ( ) | 3. | " "           | 5 " green            | " "                        | tip " X AM 2.                   |
| ( ) | 4. | " "           | 7 " blue             | " "                        | shunt " Y AM 1.                 |
| ( ) | 5. | " "           | 5.5 " grey           | " "                        | shunt " Y AM 2.                 |
| ( ) | 6. | " "           | 8 " green            | " "                        | tip " Y AM 2.                   |
| ( ) | 7. | " "           | 7 " white            | " "                        | tip " X Out 1.                  |
| ( ) | 8. | " "           | 11 " white           | " "                        | tip " Y Out 1.                  |

K. Install the cable ties.

Channel X

- ( ) Pull all nine wires from the X Channel pots straight back away from the panel. Then, bend them down over the back of the pots toward dual pot P1/P2 (X channel). Also bring the following six jack wires over to dual pot P1/P2 (X channel).

- |     |    |                                 |
|-----|----|---------------------------------|
| ( ) | 1. | Blue wire from jack Y AM 1.     |
| ( ) | 2. | Yellow wire from jack X AM 1.   |
| ( ) | 3. | Grey wire from jack Y AM 2.     |
| ( ) | 4. | Green wire from jack X AM 2.    |
| ( ) | 5. | White wire from jack X Out 1.   |
| ( ) | 6. | Black wire from jack X Audio 1. |

( ) Now bend all 15 wires up 90 degrees from dual pot P1/P2 and attach a cable tie around the wires about  $\frac{1}{2}$  inch above the back of P2. Tighten the tie and clip the excess plastic.

Channel Y

- ( ) Pull all ten wires on the Y channel pots straight back away from the panel and bend them over the backs of the pots toward pot P5 (Y channel). Also bring the green wire from jack Y AM 2 and the white wire from jack Y Out 1 over to pot P5. Bend all 12 wires up 90 degrees from pot P5 and attach a cable tie around the wires about  $\frac{1}{2}$  inch above the back of P5. Tighten the tie and clip the excess plastic.

Make sure the terminals on the pots are still at right angles to the panel. If they are not straighten them so that they are. No portion of the assembly should extend over the edges of the front panel.

This completes the assembly of the front panel. Lay it aside for the time being.

## FINAL ASSEMBLY INSTRUCTIONS

Please refer to the module assembly drawing.

Install the front panel and the printed circuit board onto the frame.

- ( ) 1. Snap the two plastic card guides into the holes in the frame. Be sure that the pairs of tabs point toward the rear as shown.
- ( ) 2. Slide the printed circuit board into the frame, holding top and bottom of the frame together against the board. The board will fit snugly into the card guides between the tabs.
- ( ) 3. Using the 4-40 x 3/8" screws and nuts, mount the two angle brackets to the frame as shown. The brackets should be on the component side of the board. The nuts should be on the inside of the frame against the bracket.
- ( ) 4. Now screw the board to the brackets. Insert the 4-40 x 3/8" screw from the foil side of the board.
- ( ) 5. Mount the top of the front panel to the frame by using the two upper pots as follows. First remove the two upper pots from the front panel. Let them hang by their wires. Insert the pot shafts from behind, insert the two pot shafts through the two large holes at the top of the frame. Now place the front panel against the frame so the pot shafts extend through the two AM 1 / Amplitude holes in the front panel. Replace the nuts over the shafts and tighten firmly. Prevent the pots from rotating as you are tightening them by holding them carefully with your fingers or a pair of large pliers. Make sure the pot terminals remain oriented as shown on the front panel wiring diagram.
- ( ) 6. Attach the bottom of the panel to the frame using the remaining 4-40 x 3/8" screws and nuts.

Wire the front panel to the printed circuit board. Connect the wires from the face panel to the board in the order given below. Strip each wire, pass it through the appropriate wire saddle, and solder the wire to the board. Run the wires around the periphery of the board whenever possible. Wiring the board neatly will facilitate trimming and troubleshooting.

Run these wires through Channel X wire saddle to the X side of the board.

- |     |     |                              |                   |
|-----|-----|------------------------------|-------------------|
| ( ) | 1.  | Connect a black wire from P4 | to board Lin.     |
| ( ) | 2.  | " " violet " " CW-P5         | " " Lin/Exp.      |
| ( ) | 3.  | " " blue " " Jack Y AM 1     | " " Y AM 1 shunt. |
| ( ) | 4.  | " " white " " P4             | " " Exp.          |
| ( ) | 5.  | " " yellow " " jack X AM 1   | " " X AM 1 tip.   |
| ( ) | 6.  | " " grey " " jack Y AM 2     | " " Y AM 2 shunt. |
| ( ) | 7.  | " " green " " jack X AM 2    | " " X AM 2 tip.   |
| ( ) | 8.  | " " red " " P3               | " " Offset.       |
| ( ) | 9.  | " " violet " " CT-P5         | " " AM 2.         |
| ( ) | 10. | " " yellow " " P6            | " " AM 1.         |
| ( ) | 11. | " " red " " P7               | " " AMPL.         |
| ( ) | 12. | " " orange " " P2            | " " AUD 2.        |
| ( ) | 13. | " " brown " " P1             | " " AUD 1.        |
| ( ) | 14. | " " white " " jack X Out 1   | " " OUT X.        |
| ( ) | 15. | " " black " " jack X Audio 1 | " " M GROUND.     |

Run these wires through the channel Y wire saddle to the Y side of the board.

- |     |     |  |
|-----|-----|--|
| ( ) | 1.  | Connect a green wire from jack Y AM 2 to board Y AM 2 tip. |
| ( ) | 2.  | " red " CT-P3 " OFFSET.                                    |
| ( ) | 3.  | " black " P4 " Lin.  |
| ( ) | 4.  | " violet " CW-P5 " Lin/Exp.                                |
| ( ) | 5.  | " white " P4 " Exp.  |
| ( ) | 6.  | " violet " CT-P5 " AM 2.                                   |
| ( ) | 7.  | " yellow " P6 " AM 1.                                      |
| ( ) | 8.  | " red " P7 " AMPL.   |
| ( ) | 9.  | " orange " P2 " AUD 2.                                     |
| ( ) | 10. | " brown " P1 " AUD 1.                                      |
| ( ) | 11. | " white " jack Y Out 1 " OUT Y.                            |
| ( ) | 12. | " red " CW-P3 " +15V at pin A.                             |

- C. Turn all pot shafts fully counter-clockwise and mount the knobs with the pointers at the lower left. Mount the knobs so that there is a very small space between the knob and the panel and each of the dual knobs. This will allow each knob to turn freely on it's shaft without causing the other knob to turn. Install the knobs and tighten the hex nuts in the following order.

Channel X

- |     |    |           |
|-----|----|-----------|
| ( ) | 1. | Audio 1   |
| ( ) | 2. | Audio 2   |
| ( ) | 3. | Offset    |
| ( ) | 4. | Lin-Exp   |
| ( ) | 5. | AM 2      |
| ( ) | 6. | AM 1      |
| ( ) | 7. | Amplitude |

- ( ) Attach the knobs to Channel Y in the same order.

**DOUBLE CHECK ALL OF YOUR WORK TO THIS POINT!**

**THIS COMPLETES ASSEMBLY OF YOUR AR-343 DUAL VCA MODULE. THE MODULE IS NOW READY TO BE CALIBRATED.**

## AR-343 CALIBRATION PROCEDURE

To calibrate the AR-343 you will need the following:

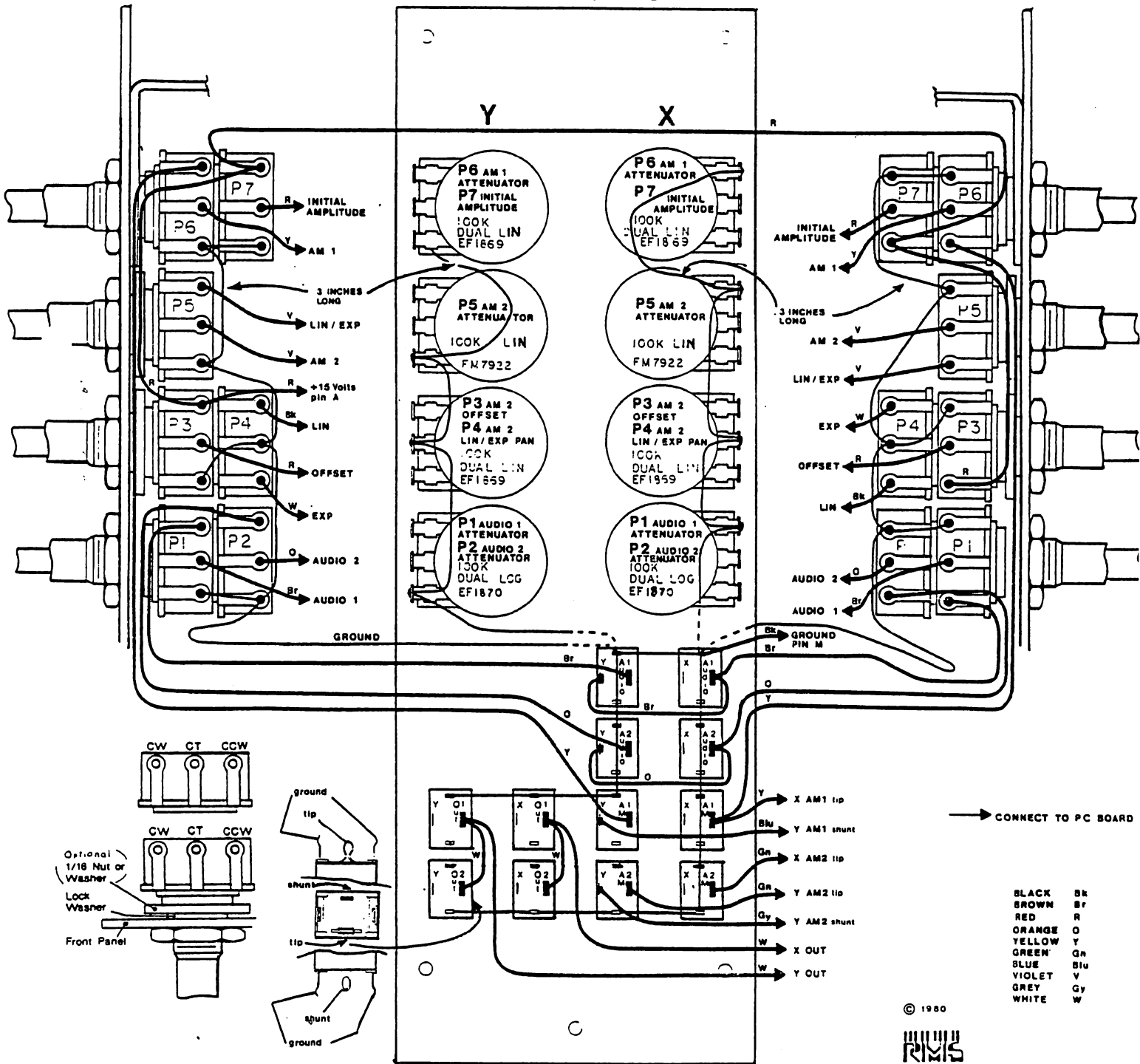
- \* A 10 volt sawtooth such as that available from the AR317,338, or 341.
- \* A method of monitoring the output of the VCA. Either of the following will do:
  - \* a DC coupled oscilloscope
  - \* a low noise audio amplifier and speaker
- \* A power supply for the AR-343. +15v, -15v, and ground.

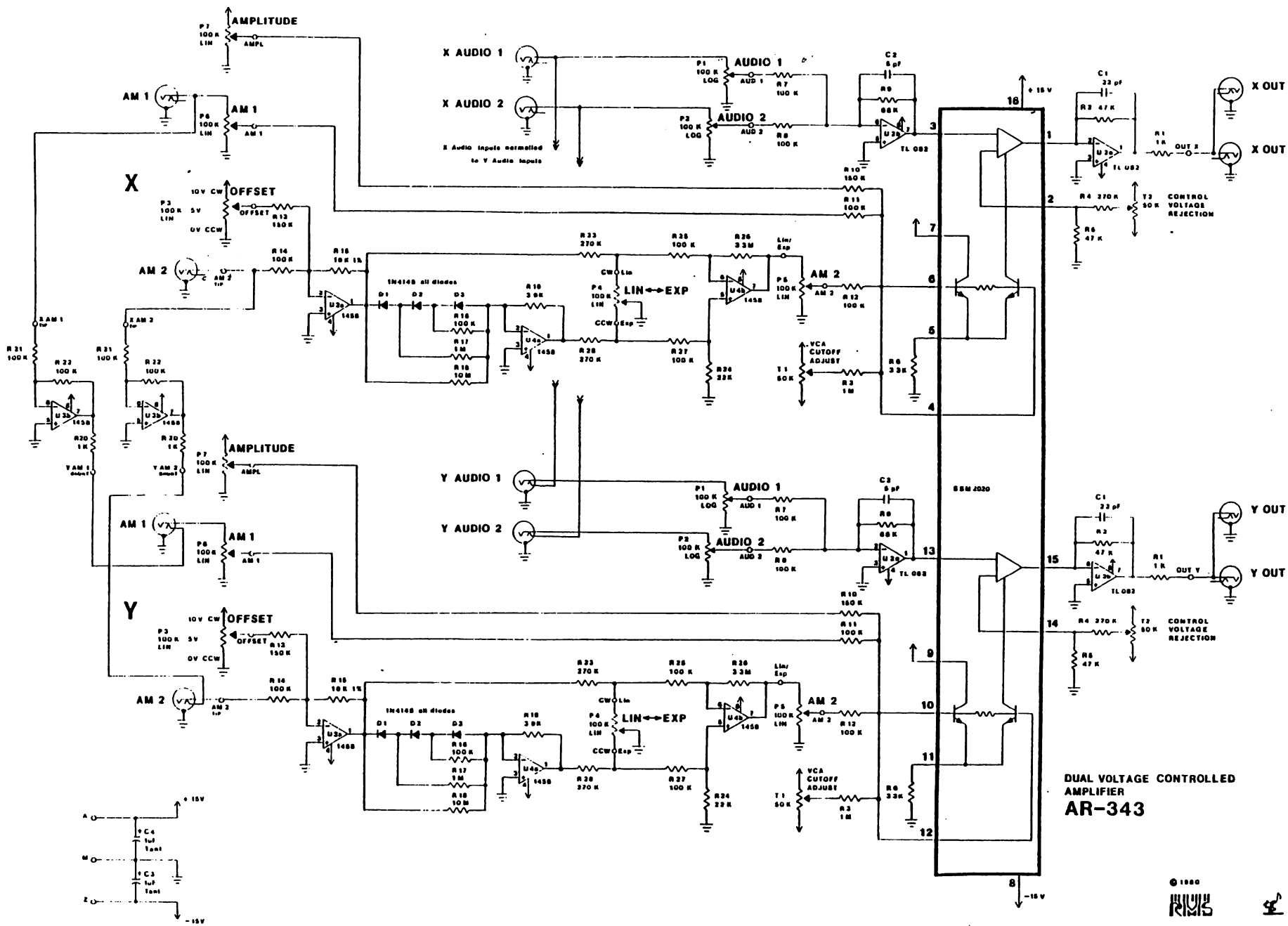
1. Connect the AR-343 to the supply. Do not turn on the supply until all connections have been made. Once the connections have been made turn on the supply. Touch each of the ICs. If they feel hot turn off the supply and check your module for poor connections, solder bridges which may be shorting connections, and misplaced or improperly oriented components. If you find no problems, continue.
2. Turn all knobs on the front panel fully counter-clockwise.
3. Monitor the output from the X OUT jack.
4. Connect a 10 volt audio frequency sawtooth (0 to 10V) to the X Audio 1 jack. Turn the X Audio 1 attenuator knob fully clockwise.
5. Turn trim pot T1 on the X channel until you get a signal at the X OUT 1 jack. Back off T1 until that signal just disappears. Turn up the gain on the audio monitor or oscilloscope to make sure there is no signal.
6. Turn the Audio 1 knob fully counter-clockwise. T1 has been trimmed.
7. Continue to monitor the X OUT jack.
8. Remove the 10 volt sawtooth from the X Audio 1 jack and connect it to the X AM 1 jack.
9. Turn the X AM 1 attenuator knob fully clockwise.
10. Turn trim pot T2 CV Rejection on the X channel until the amplitude of the signal at the X OUT 1 jack is at a minimum. Turn up the gain to make sure the signal is at a minimum.
11. To calibrate the Y channel. Disconnect all cables from the X channel. Repeat steps 2 through 10 this time making all connections and adjustments to the Y channel.

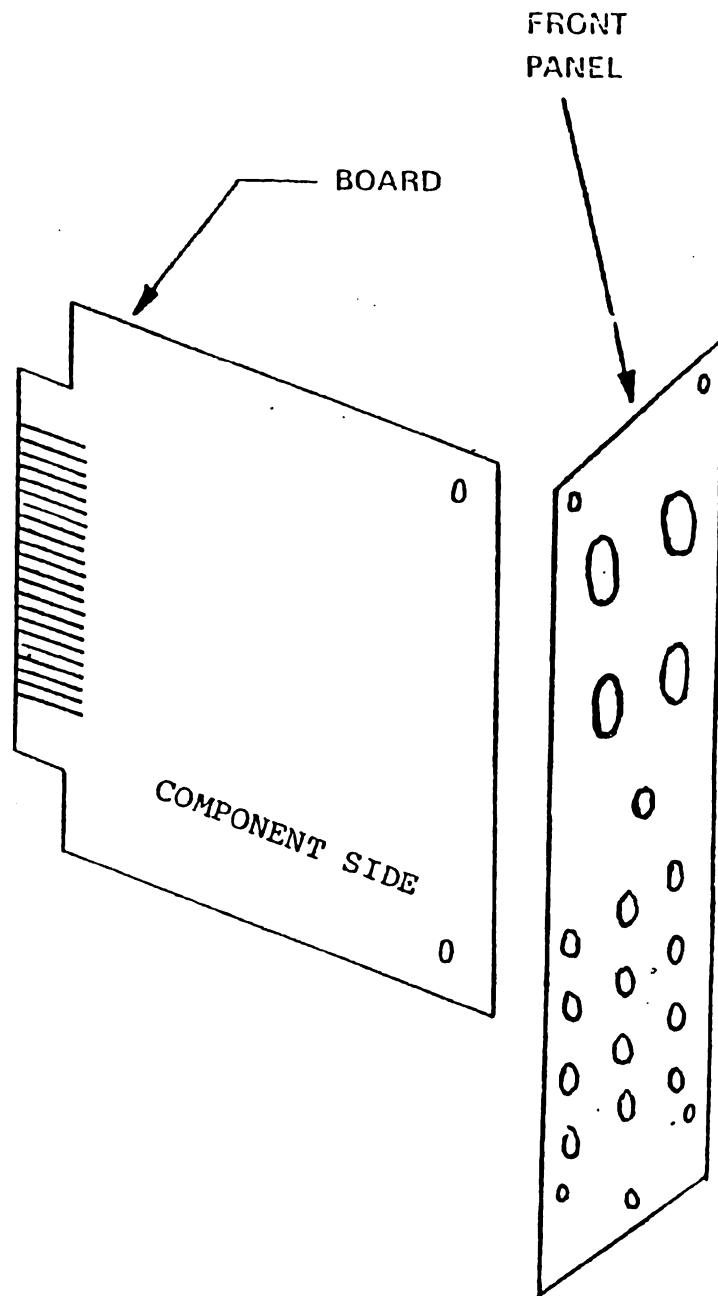
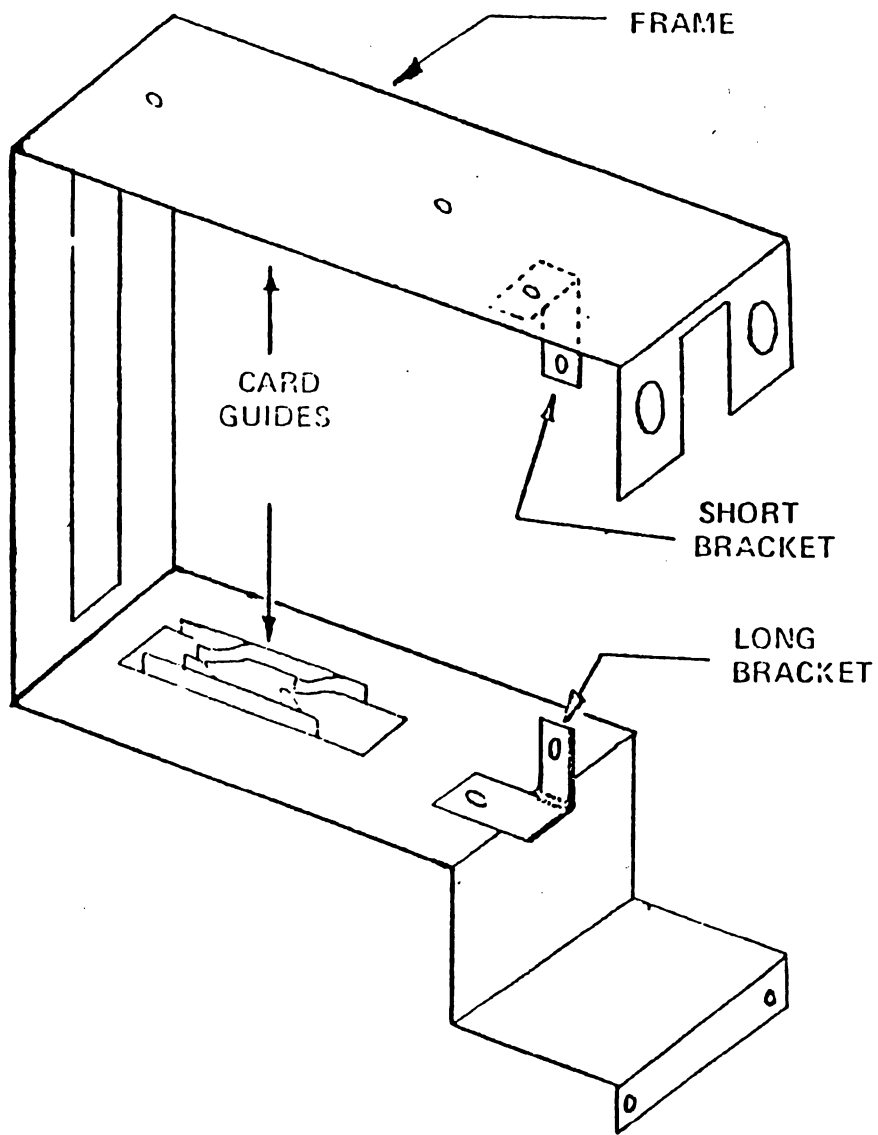
HOORAY!

YOUR AR-343 AMPLIFIERS MODULE IS ASSEMBLED, CALIBRATED, AND READY TO USE.

### AR-343 Dual VC Amplifiers Front Panel Wiring Diagram







AR-343 Amplifiers MODULE ASSEMBLY DRAWING



RIVERA MUSIC SERVICES  
AR-343  
AMPLIFIERS

PARTS LIST

- 2 Dual 100K log pot EF1870
- 4 Dual 100K lin pot EF1869
- 2 100K lin pot FM7922
- 4 50K lin trim pot
  
- 1 SSM 2020 dual vca
- 2 TL082CP or LF353 dual fet op amp
- 4 1458 dual op amp
- 6 1N4148 diodes (selected)
  
- 2 5pf ceramic disc capacitors
- 2 22pf ceramic disc capacitors
- 2 1 uf tantalum 35 volt capacitors
  
- 4 1K 5% carbon film resistor
- 2 3.3K " "
- 2 3.9K " "
- 2 22K " "
- 4 47K " "
- 2 68K " "
- 20 100K " "
- 4 150K " "
- 6 270K " "
- 4 1M " "
- 2 3.3M " "
- 2 10M " "
- 2 19.1K 1% metal film resistor
  
- 1 AR-343 printed circuit board
- 1 AR-343 front panel
- 1 module frame with mounting brackets
- 2 pc board card guides
- 2 wire saddles
  
- 6 4-40 x 3/8" black Phillips mounting screws
- 6 4-40 nuts
- 3 6-32 x 1/4" black Phillips mounting screws
  
- 12 Switchcraft 142A jacks
  
- 6 dual knobs
- 2 single knobs
- 40 inches of 22 gauge tinned copper bus wire
- 2 black 14" lengths of 24 ga. wire 1 green "
- 2 brown " " 1 blue " "
- 4 red " " 2 violet " "
- 2 orange " " 1 grey " "
- 3 yellow " " 3 white "

ARIES MUSIC SYSTEM 300 SYNTHESIZER

MODULE AR-344

DUAL VC ENVELOPE GENERATOR ASSEMBLY INSTRUCTIONS

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.

PLEASE ALSO READ THE GENERAL ASSEMBLY INSTRUCTIONS BEFORE BEGINNING THE ASSEMBLY OF THIS MODULE.

( ) A. PREPARATION:

- Lay the circuit board down on a sheet of white paper. PLACE METAL FOIL SIDE DOWN! Turn board so that connector strip is to the left.
- Lay the assembly drawing near the board.
- Unpack the parts carefully and place in a large box or tray SO THAT 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
- Flat blade screw driver
- ½" or #16 nut driver
- 5/16" or #10 nut driver
- ¼" or #8 nut driver
- A pair of regular pliers can substitute for the nut drivers but will not be as easy to use, and may scratch the front panel.

( ) B. RESISTORS (See general assembly instructions)

- Carefully install all resistors on the circuit board. Double check your installation against the P.C. board component layout drawing to be sure that the correct value is in the correct location. To prepare the resistor for insertion hold the body of the resistor between the thumb and index finger of your left hand. With the thumb and index finger of your right hand bend both leads of the resistor at once to form right angles with the body. The resistor will now insert easily into the P.C. board. Once the resistor is inserted, bend the leads on the foil side outward to hold the resistor in place. Solder the resistors to the board and cut the leads about 1/16 of an inch away from the board. For ease in reading the resistor values after installed on the P.C. board. Install the resistors with the gold band facing either the bottom or the right hand side of the board. Please note the envelope generator ICs labelled with either an "A" or "B", no RTI trim resistors will be installed.

## AR-344 ASSEMBLY CONTINUED

1. Mount all ten 100K resistors R2,2,4,4,6,6,17,17,19,19; Solder & cut leads
2. Mount all six 330K resistors R10,10,11,11,12,12 " " " "
3. Mount all six 180K resistors R1,1,3,3,5,5 " " " "
4. Mount all six 470K resistors R13,13,14,14,15,15 " " " "
5. Mount all four 150K resistors R16,16,18,18 " " " "
6. Mount all four 10K resistors R7,7,8,8 " " " "
7. Mount both 1K resistors R20,20 " " " "
8. Mount both 1 Meg. resistors R9,9 " " " "
9. Mount both 3.9K resistors R24,24 " " " "

## ( ) C. DIODES (see general assembly instructions)

The black band on the component should correspond with the black band on the diode drawn on the P.C. layout drawing.

1. Mount all four diodes C R1,1,2,2 Solder and cut leads

## ( ) D. INTEGRATED CIRCUITS (see general assembly instructions)

The pin indication on the component should coincide with the indication on the P.C. layout drawing

1. Mount both LM-301A op amps. U2,2. Solder
2. Mount both SSM2050 integrated envelope; U1,1 Solder

## ( ) E. TRIM RESISTORS

Mount the additional trim resistors RTI and RTM. Consult the additional trimming resistor chart. Use the correct trim resistors RTI and RTM that correspond to the I.C. letter code on the 14 pin envelope generator I.C. Solder and cut the leads.

## ( ) F. CAPACITORS (see general assembly instructions)

Observe the polarity of the tantalum capacitors. The positive lead is the lead closer to the (+) sign on the component.

1. Mount all four 0.01mf disc capacitors C1,1,2,2; Solder and cut leads.
2. Mount both 33pf disc capacitors; C3,3; " " " "  
(30pf may be substituted)
3. Mount both 0.1mf tantalum capacitors; C5,5; Solder and cut leads.
4. Mount both 1.0mf tantalum capacitors; C6,7; Solder and cut leads.

## ( ) G. TRIM POTS (see general assembly instructions)

1. Mount both 50K trim pots T1,1; solder.

## ( ) H. SNAP WIRE SADDLE INTO PC BOARD WITH THE LOOP ON THE COMPONENT SIDE OF THE BOARD.

THIS COMPLETES THE ASSEMBLY OF THE PC BOARD. FOR THE TIME BEING, LAY IT ASIDE AND GO ON TO THE NEXT SECTION.

*FRONT PANEL ASSEMBLY PROCEDURE (refer to front panel wiring diagram)*

*Aries Music face panels are made of anodized aluminum. They will not be scratched in normal operation, but they can be scratched with pliers or a nut driver. When using tools on the front panel, be very careful not to scratch it.*

- 1. Mount ATTACK 1 and ATTACK 2 pots. Do not yet fully tighten the nuts; they will later be removed for final assembly. If the pots have a flange which prohibits them from mounting flush against the panel, bend the flange outward so the pots can mount flush.*
- 2. Mount remaining 6 pots. First mount the additional larger nut next to the body of the pot. Tighten the nut very firmly. Now mount the pots as shown on the front panel wiring diagram.*
- 3. Mount the 2 SWITCHES orienting the terminals vertically. It makes no difference which terminal is on top. The lock washer should be placed on the back of the face panel. Tighten the nuts.*
- 4. Mount the 14 JACKS orienting them as shown on the wiring diagram. Mount the washer on the front side of the face panel and tighten the nuts.*

*PANEL WIRING AR-344 (see general assembly instructions)*

*The order in which these connections are made has proven to be the easiest and most convenient method of wiring this module. The color-coded wires will facilitate trouble shooting the module.*

*USING BLACK WIRE, CONNECT AND SOLDER THE FOLLOWING WIRES:*

*Cut these wires to length, strip and tin. Leave as little slack as conveniently possible except where indicated at step 9 & 12. When soldering, be careful not to fill up the solder terminals on the pots or jacks with solder. It may be necessary for other wires to be connected to the terminal at a later time.*

- 1. the CCW tap of RELEASE 2 MOD to the CCW tap of RELEASE 2 INITIAL*
- 2. the CCW tap of SUSTAIN 2 MOD to the CCW tap of SUSTAIN 2 INITIAL*
- 3. the CCW tap of DECAY 2 MOD to the CCW tap of DECAY 2 INITIAL*
- 4. the CCW tap of ATTACK 2 MOD to the CCW tap of ATTACK 2 INITIAL*
- 5. the CCW tap of ATTACK 1 MOD to the CCW tap of ATTACK 1 INITIAL*
- 6. the CCW tap of DECAY 1 MOD to the CCW tap of DECAY 1 INITIAL*
- 7. the CCW tap of SUSTAIN 1 MOD to the CCW tap of SUSTAIN 1 INITIAL*
- 8. the CCW tap of RELEASE 1 MOD to the CCW tap of RELEASE 1 INITIAL*
- 9. the CCW tap of ATTACK 2 INITIAL to the CCW tap of DECAY 2 INITIAL*  
*(this wire should be 3" long)*
- 10. the CCW tap of DECAY 2 INITIAL to the CCW tap of SUSTAIN 2 INITIAL*
- 11. the CCW tap of SUSTAIN 2 INITIAL to the CCW tap of RELEASE 2 INITIAL*
- 12. the CCW tap of ATTACK 1 INITIAL to the CCW tap of DECAY 1 INITIAL*  
*(this wire should be 3" long)*
- 13. the CCW tap of DECAY 1 INITIAL to the CCW tap of SUSTAIN 1 INITIAL*
- 14. the CCW tap of SUSTAIN 1 INITIAL to the CCW tap of RELEASE 1 INITIAL*
- 15. Connect the grounds of all 14 jacks together as shown in the diagram. Solder all connections except the wire to jack A2. Use tinned copper bus wire or unshielded wire for easier wiring of the ground connections. Be careful that the wire does not touch any of the other terminals of the jacks.*

16. Connect the CCW tap of *RELEASE 2 INITIAL* to jack A2. Do not yet solder the connection at jack A2.
17. Connect the CCW tap of *RELEASE 1 INITIAL* to jack A2. Do not solder at jack A2.
18. Solder all three wires to the ground of jack A2.

USING RED WIRE, CONNECT AND SOLDER THE FOLLOWING WIRES: Cut these wires to length, strip and tin. Leave as little slack as conveniently possible except where indicated at step 1 and 4.

1. the CW tap of *ATTACK 2 INITIAL* to the CW tap of *DECAY 2 INITIAL* (this wire should be 3" long)
2. the CW tap of *DECAY 2 INITIAL* to the CW tap of *RELEASE 2 INITIAL*
3. the CW tap of *RELEASE 2 INITIAL* to the TOP TERMINAL of *SWITCH 2*
4. the CW tap of *ATTACK 1 INITIAL* to the CW tap of *DECAY 1 INITIAL* (this wire should be 3" long)
5. the CW tap of *DECAY 1 INITIAL* to the CW tap of *RELEASE 1 INITIAL*
6. the CW tap of *RELEASE 1 INITIAL* to the TOP TERMINAL of *SWITCH 1*
7. connect the TOP TERMINALS of both SWITCHES together

USING VIOLET WIRE, CONNECT AND SOLDER THE FOLLOWING WIRE

1. the CW tap of *SUSTAIN 2 INITIAL* to the CW tap of *SUSTAIN 1 INITIAL*

USING COLOR-CODED WIRE CUT TO LENGTH:

1. Connect GREEN wire from CW of *RELEASE 2 MOD*, labelled R2T to TIP of jack R2
2. Connect YELLOW wire from CW of *SUSTAIN 2 MOD*, labelled S2T to TIP of jack S2
3. Connect BLUE wire from CW of *DECAY 2 MOD*, labelled D2T to TIP of jack D2
4. Connect BROWN wire from CW of *ATTACK 2 MOD*, labelled A2T to TIP of jack A2
5. Connect BROWN wire from CW of *ATTACK 1 MOD*, labelled A1T to TIP of jack A1
6. Connect ORANGE wire from CW of *DECAY 1 MOD*, labelled D1T to TIP of jack D1
7. Connect YELLOW wire from CW of *SUSTAIN 1 MOD*, labelled S1T to TIP of jack S1
8. Connect GREEN wire from CW of *RELEASE 1 MOD*, labelled R1T to TIP of jack R1

USING WHITE WIRE, CONNECT AND SOLDER THESE WIRES, LEAVING AS LITTLE SLACK AS CONVENIENTLY POSSIBLE. CUT THE WIRES TO LENGTH AND TIN THE ENDS BEFORE SOLDERING.

1. connect the TIP of *JACK A1* to the SHUNT of *JACK D1*
2. connect the SHUNT of *JACK D1* to the SHUNT of *JACK R1*
3. connect the SHUNT of *JACK A2* to the SHUNT of *JACK D1*
4. connect the SHUNT of *JACK GATE IN 2* to the TIP of *JACK GATE IN 1*

USE GREY WIRE FOR THE FOLLOWING CONNECTIONS

1. connect the TIP of *JACK A2* to the SHUNT of *JACK D2*
2. connect the SHUNT of *JACK D2* to the SHUNT of *JACK R2*

FOR THE FOLLOWING CONNECTIONS, USE 12" LENGTHS OF COLOR-CODED WIRE

1. connect BROWN wire to the CT of *ATTACK 2 MOD*
2. connect GREEN wire to the CT of *ATTACK 2 INITIAL*

3. connect ORANGE wire to the CT of DECAY 2 MOD
4. connect BLUE wire to the CT of DECAY 2 INITIAL
5. connect YELLOW wire to the CT of SUSTAIN 2 MOD
6. connect GREY wire to the CT of SUSTAIN 2 INITIAL
7. connect GREEN wire to the CT of RELEASE 2 MOD
8. connect WHITE wire to the CT of RELEASE 2 INITIAL
9. connect BROWN wire to the CT of ATTACK 1 MOD
10. connect GREEN wire to the CT of ATTACK 1 INITIAL
11. connect ORANGE wire to the CT of DECAY 1 MOD
12. connect BLUE wire to the CT of DECAY 1 INITIAL
13. connect YELLOW wire to the CT of SUSTAIN 1 MOD
14. connect GREY wire to the CT of SUSTAIN 1 INITIAL
15. connect GREEN wire to the CT of RELEASE 1 MOD
16. connect WHITE wire to the CT of RELEASE 1 INITIAL
17. connect RED wire to the CW tap of RELEASE 1 INITIAL
18. connect VIOLET wire to the CW tap of SUSTAIN 1 INITIAL

FOR THE FOLLOWING CONNECTIONS, USE THE 12" LENGTHS OF COLOR-CODED WIRE

1. connect YELLOW wire to the TIP of jack GATE 2 IN
2. connect YELLOW wire to the TIP of jack GATE 1 IN
3. connect BLACK wire to the GROUND of jack A1
4. connect GREEN wire to the SHUNT of jack TRIG 2
5. connect GREEN wire to the SHUNT of jack TRIG 1
6. connect BLUE wire to the TIP of jack TRIG 2 IN
7. connect BLUE wire to the TIP of jack TRIG 1 IN
8. connect WHITE wire to the TIP of jack OUT 2
9. connect WHITE wire to the TIP of jack OUT 1
10. connect ORANGE wire to the BOTTOM TERMINAL of SWITCH 2
11. connect ORANGE wire to the BOTTOM TERMINAL of SWITCH 1
12. take the five wires from SWITCH 1, GATE 1, TRIG 1, TRIG SHUNT 1 and OUT 1 and tie them with a cable tie near the terminal of SWITCH 1.
13. take the five wires from SWITCH 2, GATE 2, TRIG 2, TRIG SHUNT 2 and OUT 2 and tie them with a cable tie near the terminal of SWITCH 2.
14. take all eight wires from the center taps of the channel 2 pots, straighten wires and tie them all together with a cable tie at the back of the RELEASE pot.
15. take all eight wires from the center taps of the channel 1 pots, straighten each wire and tie them all together with a cable tie at the back of the RELEASE pot.

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 point toward the rear, as shown.
- ( ) 3. Slide the printed circuit board into the frame, holding top and bottom of frame together against the board, so that the board fits snugly in the guides, between the tabs.
- ( ) 4. Using the 4-40 x 3/8" screws & nuts, mount the two angle brackets to the frame, as shown. The brackets should be on the component side of the board.
- ( ) 5. Now screw the board to the brackets. Insert the 4-40 x 3/8" screw from foil side of board. DOUBLE CHECK THAT SCREW HEAD DOES NOT TOUCH ANY METAL FOIL!!!
- ( ) 6. Refer again to MODULE ASSEMBLY drawing. Mount top of panel to frame, using the two UPPER pots. Put on lock washers and insert pot shaft through rear of upper holes in front of frame. Bring panel against frame, so these pots also go through matching holes in panel. Tighten nuts on front of panel, with pots oriented in same direction as lower pots.
- ( ) 7. Attach bottom of panel to frame, using remaining 4-40 x 3/8" screws & nuts.

CONNECT WIRES FROM THE JACKS, SWITCHES AND POTS TO THE BOARD IN THIS ORDER.

AS YOU CONNECT EACH GROUP OF WIRES, RUN THEM THROUGH THE WIRE SADDLE. LEAVE ABOUT 1" SLACK FOR EACH WIRE; CUT, STRIP, TIN AND SOLDER AT THE BOARD.

- ( ) A. ENVELOPE 2 (the bottom half of the board) Connect the 8 wires from the center taps of the envelope 2 pots.
1. connect GREY wire from SUSTAIN 2 to board S INITIAL
  2. connect YELLOW wire from SUSTAIN 2 to S MOD
  3. connect WHITE wire from RELEASE 2 to board R INITIAL
  4. connect GREEN wire from RELEASE 2 to board R MOD
  5. connect BLUE wire from DECAY 2 to board D INITIAL
  6. connect ORANGE wire from DECAY 2 to board D MOD
  7. connect GREEN wire from ATTACK 2 to A INITIAL
  8. connect BROWN wire from ATTACK 2 to board A MOD
- ( ) B. ENVELOPE 2 (the bottom half of the board) Connect the five wires from the jacks and switch of envelope 2 and the ground wire.
1. connect WHITE wire from OUT 2 jack to board OUT
  2. connect BLUE wire from TRIG 2 IN jack to board TRIG IN
  3. connect YELLOW wire from GATE 2 IN jack to board GATE IN
  4. connect GREEN wire from SHUNT on the TRIG 2 IN jack to board TRIG SHT
  5. connect ORANGE wire from SWITCH 2 to board SWITCH
- ( ) C. ENVELOPE 1 (the top half of the board) Connect the 8 wires from the center taps of the envelope 2 pots and connect the 2 power supply wires +15V & -15V
1. connect GREY wire from SUSTAIN 1 to board S INITIAL. Run the 2 SUSTAIN wires along the bottom of the frame & then straight up to their terminals in the middle of the board.
  2. connect YELLOW wire from SUSTAIN 1 to board S MOD
  3. connect WHITE wire from RELEASE 1 to board R INITIAL
  4. connect GREEN wire from RELEASE 1 to board R MOD
  5. connect BLUE wire from DECAY 1 to board D INITIAL
  6. connect ORANGE wire from DECAY 1 to board D MOD
  7. connect GREEN wire from ATTACK 1 to board A INITIAL
  8. connect BROWN wire from ATTACK 1 to board A MOD
  9. connect RED wire from RELEASE 1 to board +15
  10. connect VIOLET wire from SUSTAIN 1 to board -15
- At the bottom of the P.C. board, just below U1, tie the 4 SUSTAIN wires & the 3 power supply wires together with a cable tie.
- ( ) D. ENVELOPE 1 (the top half of the board)
1. connect WHITE wire from OUT 1 jack to board OUT
  2. connect ORANGE wire from SWITCH 1 to board SWITCH
  3. connect GREEN wire from SHUNT on the TRIG 1 IN jack to board TRIG SHT
  4. connect YELLOW wire from GATE IN 1 jack to board GATE IN
  5. connect BLUE wire from TRIG IN 1 jack to board TRIG IN

TURN ALL POTS SHAFTS FULLY COUNTER-CLOCKWISE AND MOUNT THE KNOBS WITH THE POINTERS AT THE LOWER LEFT. MOUNT THE KNOBS AND TIGHTEN THE KNOB SCREWS IN THIS ORDER

#1 Envelope: RELEASE, SUSTAIN, DECAY, ATTACK

#2 Envelope: RELEASE, SUSTAIN, DECAY, ATTACK

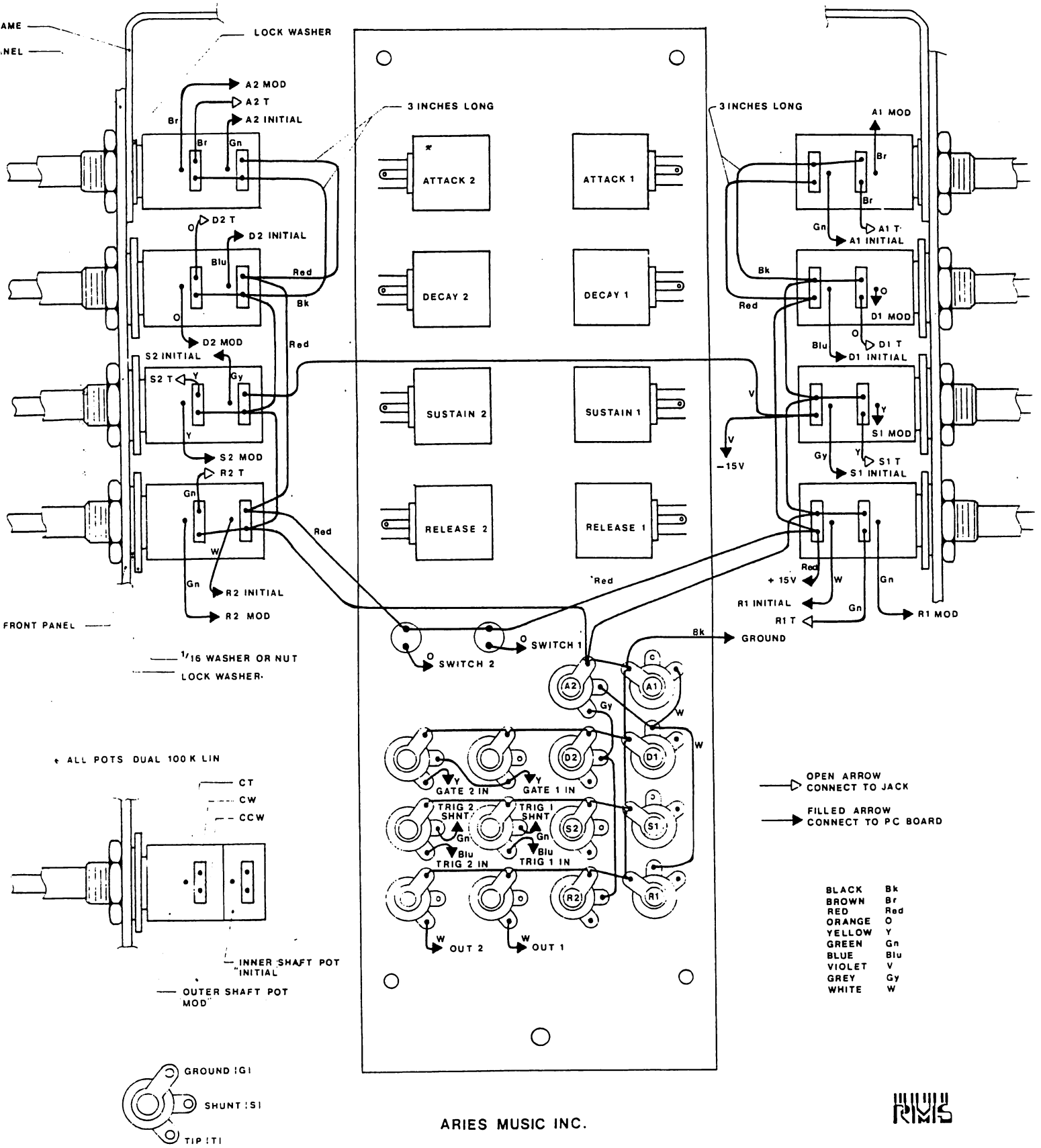
THIS COMPLETES ASSEMBLY OF YOUR AR-344 ENVELOPES MODULE. THE MODULE IS NOW READY TO BE CALIBRATED.

TRIM PROCEDURE AR-344 & AR-345

Patch a LF 50% pulse with a frequency of about 1 Hz into the gate input of the first envelope generator. Connect the envelope output to a direct coupled oscilloscope. Set the time base of the scope to display 2ms per horizontal division and set the scope so that it triggers on the positive slope. Turn all the pots of envelope #1 counter-clockwise so they are at minimum value. While monitoring the envelope output on the scope, adjust T1 (the trim closer to the edge connector) so that the minimum attack time is equal to 2ms (one horizontal division). If you have an AR-345, this completes the trim; if you have an AR-344, repeat this procedure for the second envelope.



# AR 344 ENVELOPES FRONT PANEL WIRING DIAGRAM



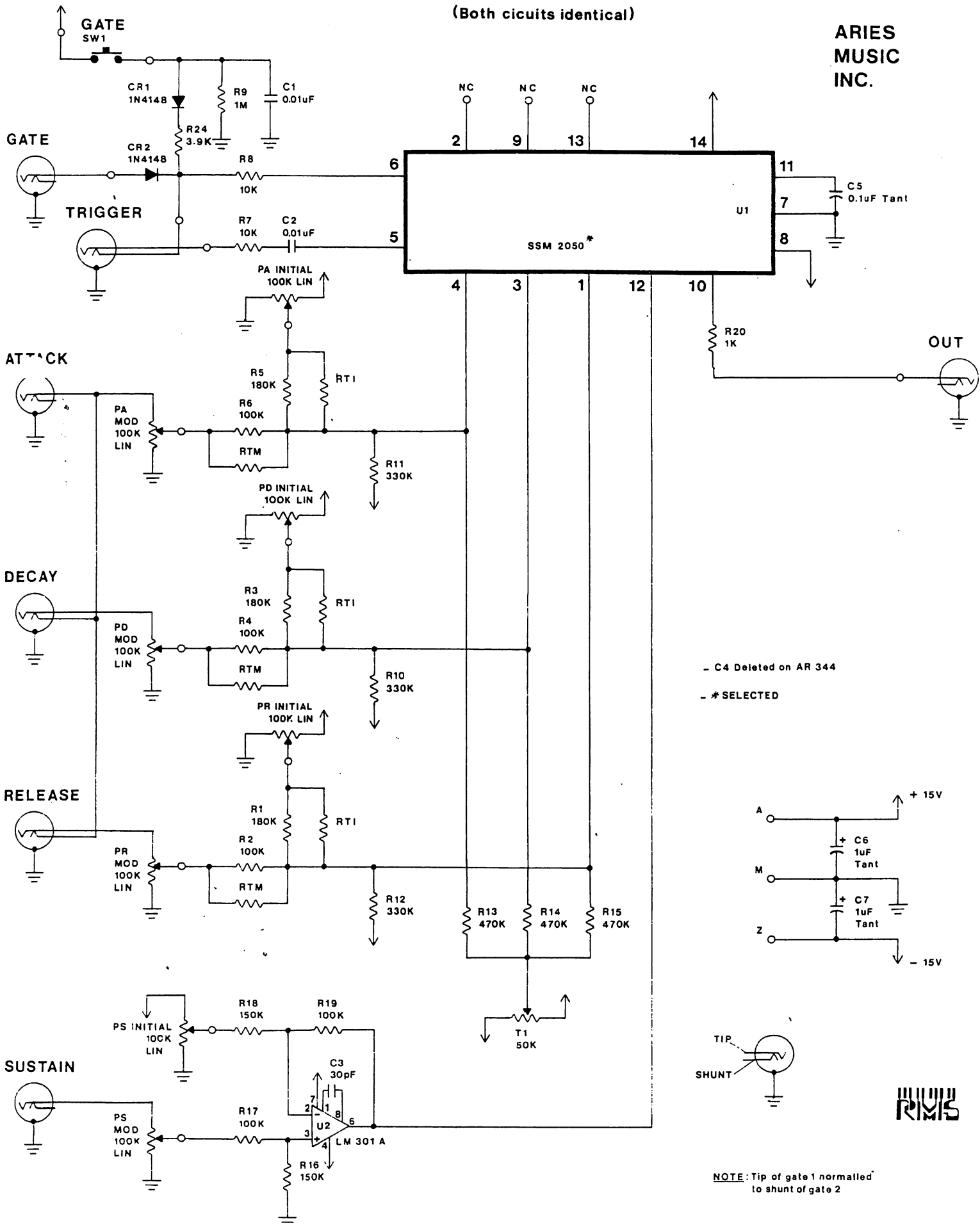
ARIES MUSIC INC.



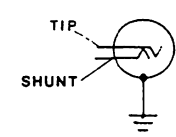
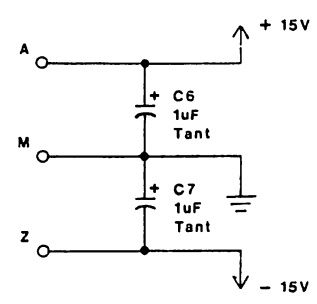
# AR-344 ENVELOPES

(Both circuits identical)

ARIES  
MUSIC  
INC.

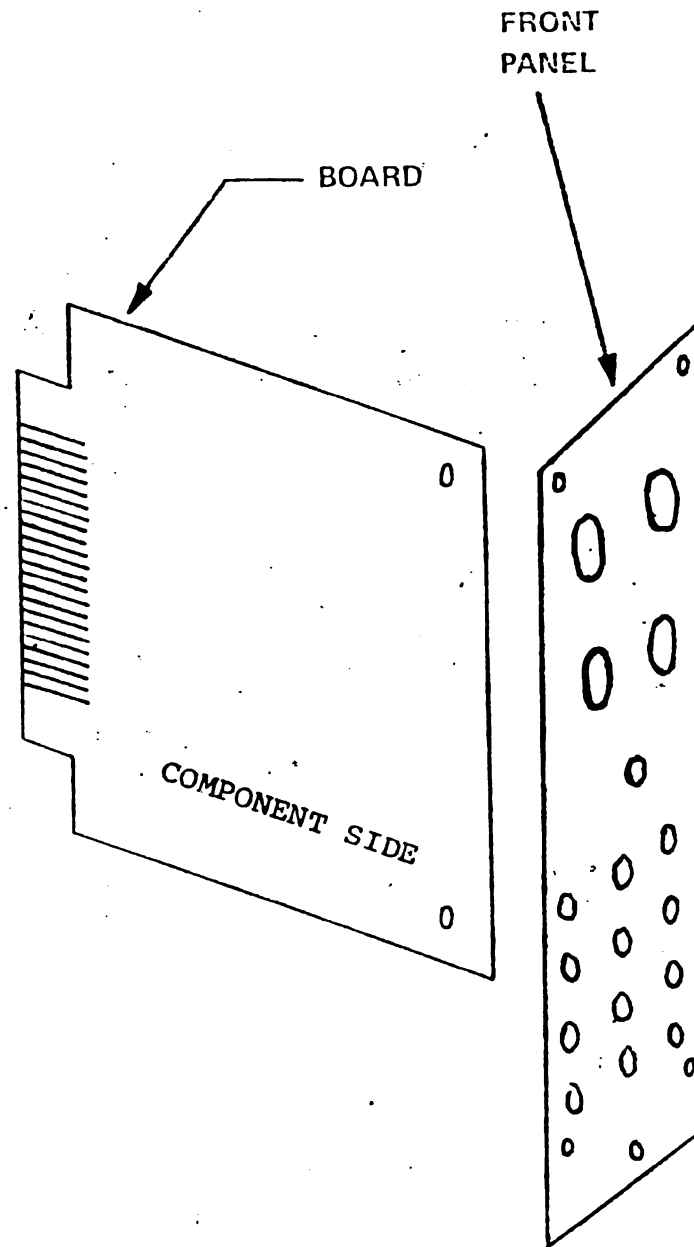
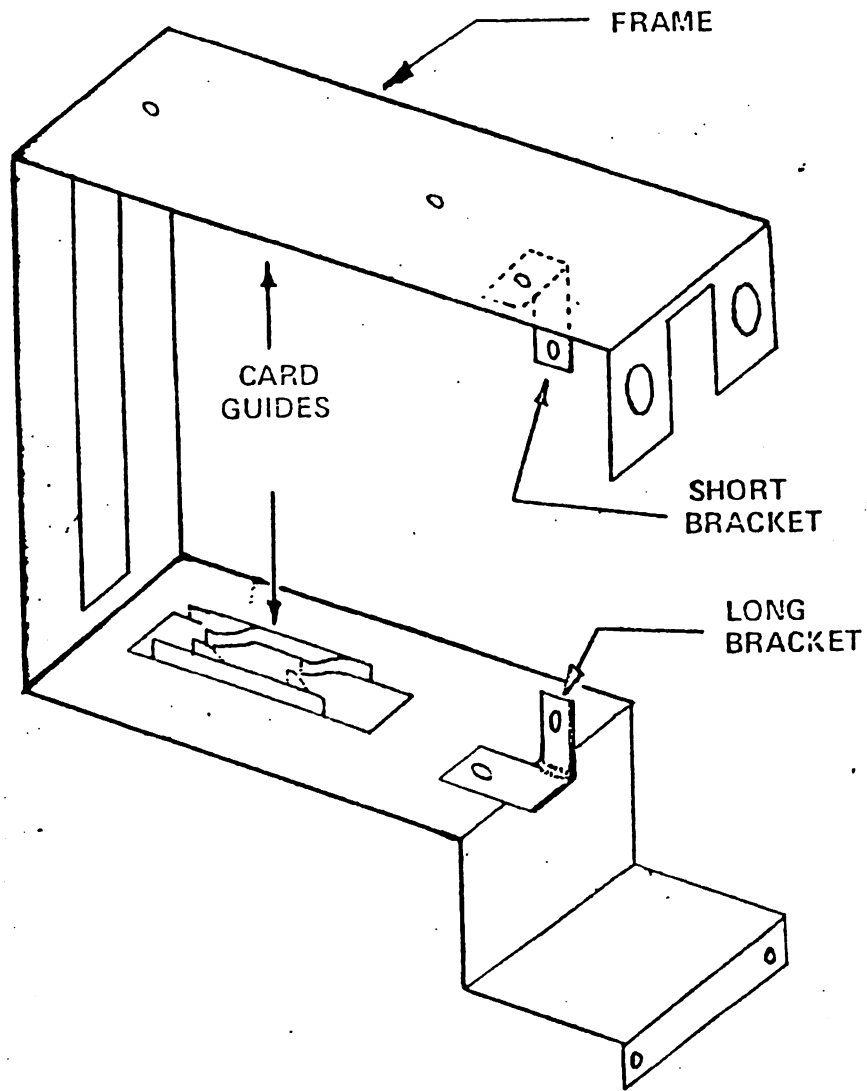


- C4 Deleted on AR 344  
- \* SELECTED



NOTE: Tip of gate 1 normalled  
to shunt of gate 2





## ARIES MUSIC SYSTEM 300

## SYNTHESIZER

## PARTS LIST \* AR-344 \* DUAL VC ENEVELOPE

QUANTITY	DESCRIPTION	VOLTAGE & RATING
2	1/4 watt carbon film resistor	1K
2	" " " "	3.9K
4	" " " "	10K
10	" " " "	100K
4	" " " "	150K
6	" " " "	180K
6	" " " "	330K
6	" " " "	470K
2	" " " "	1 Meg
FOR EVELOPE I } 3	resistor; trim modulation 5% carbon film; 1/4 watt	RTM
3	resistor; trim initial; 5% carbon film; 1/4 watt	RTI
FOR EVELOPE II } 3	resistor; trim modulation; 5% carbon film; 1/4 watt	RTM
3	resistor; trim initial; 5% carbon film; 1/4 watt	RTI
8	100K linear dual pots	
4	Diodes	1N4148
4	Disc capacitor	0.01uf
2	" "	33pf (or 30pf)
2	Tantalum Capacitor	0.1uf
2	" "	1.0uf
2	Op-amp I.C.	LM-301-A
2	Selected env. gen. I.C.	SSM-2050
2	Switches; momentary N.O. push	
14	mini jacks	
8 sets	Knobs; dual concentric	
1	wire saddle	
6	Nuts; 1/16 thick; 3/8* diameter	
1	AR-344 Front Panel	
1	AR-344 P.C. Board	
1	Module Frame	
1	Bracket; large	
1	Bracket; small	
3	Screws; Phillips-head for module mounting	
4	Screws; #4-40 x 3/8"	
2	Screws; Phillips-head, black	
6	Nuts; #4-40	
2	P.C. Card guides	
5	Cable Ties	
2	Trim Pots	50K

## AR-344 DUAL VC ENVELOPE

## PARTS LIST CONT.

QUANTITY	DESCRIPTION	VOLTAGE & RATING
<i>12" LENGTHS OF COLOR-CODED WIRE:</i>		
5	BLACK	
7	GREEN	
5	BROWN	
4	BLUE	
4	RED	
2	VIOLET	
5	ORANGE	
3	GREY	
5	YELLOW	
5	WHITE	
24"	24 gauge tinned copper bus wire	

## INPUT TRIM RESISTORS:

Note that each of the two 14 pin I.C.'s has been especially marked with a letter. Depending upon the letter, you have been given 3 to 6 additional resistors for each I.C. For each I.C., three of the resistors are of one value and three are of another value. These resistors are additional trimming resistors selected especially for your I.C.s. RTI is "resistor trim initial" and RTM is "resistor trim modulation". These resistors are indicated on the schematic and on the PC board layout drawing. Consult the table below to determine the correct values of your trimming resistors based on the letter designation of your particular chips.

IC LETTER CODE	RTI	RTM
A	none used	2.7M
B	none used	2.2M
C	12M	1.8M
D	3.6M	1.1M
E	1.3M	560K
F	910K	390K
G	680K	330K
H	560K	240K
I	430K	200K
K	360K	180K
L	300K	150K
M	240K	120K

Note: The AR-344 Envelope Generator is a dual module and the circuits of both envelopes are identical. The components numbering system on the schematic drawing, the P.C. layout drawing and these instructions reflect this. Each envelope circuit has, for example, a resistor labeled "R-1"; therefore there are two "R-1" resistors. You should install these on the P.C. Board at the two places indicated.

## ARIES MUSIC SYSTEM 300 SYNTHESIZER

## MODULE AR-345

## VC ENVELOPE GENERATOR ASSEMBLY INSTRUCTIONS

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.

( ) 1. PREPARATION:

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

Lay the assembly drawing near the board.

Unpack the parts carefully and place in a large box or tray SO THEY WON'T GET LOST. PLEASE READ THE GENERAL ASSEMBLY INSTRUCTIONS BEFORE BEGINNING ASSEMBLY.

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

Flat blade screw driver

½" or #16 nut driver

5/16" or #10 nut driver

¼" or #8 nut driver

A pair of regular pliers can substitute for the nut drivers but will not be as easy to use.

( ) 2. RESISTORS (See general assembly instructions)

Carefully install all resistors on the circuit board in the following sequence. Double check your installation against the P.C. board component layout drawing to be sure that the correct value is in the correct location. To prepare the resistor for insertion hold the body of the resistor between the thumb and index finger of your left hand. With the thumb and index finger of your right hand bend both leads of the resistor at once to form right angles with the body. The resistor will now insert easily into the P.C. board. Once the resistor is inserted, bend the leads on the foil side outward to hold the resistor in place. Solder the resistors to the board and cut the leads about 1/16 of an inch away from the board. For ease in reading the resistor values once they are installed, install the resistors with the gold band facing either the bottom or the right hand side of the board. For envelope generator I.C.'s labelled with an "A" or "B" no RTI trim resistors will be installed.

a.	Mount all seven 100K resistors.	R2,4,6,17,19,21,22.	Solder & cut leads
b.	" " three 180K	" R1,3,5	" " " "
c.	" " three 330K	" R10,11,12	" " " "
d.	" " three 470K	" R13,14,15	" " " "
e.	" both 10K	" R7,8	" " " "
f.	" both 1K	" R20, 23	" " " "
g.	" both 150K	" R16,18	" " " "

- h. Mount the 1Meg resistor. R-9 Solder & cut leads
- i. " " 3.9K " R-24 " " " "
- j. " additional trimming resistors TRI and RTM. Solder & cut leads.

- ( ) 3. DIODES (see general assembly instructions)  
The black band on the component should correspond with the black band on the diode drawn on the PC board layout drawing.  
Mount both diodes; C-1 & 2. Solder and cut leads
- ( ) 4. INTEGRATED CIRCUITS (see general assembly instructions)  
The pin indication on the component should coincide with the indication drawn on the PC layout drawing.  
Mount both LM-301-A op-amps; U-2 & U-3. Solder  
Mount the SSM 2050 envelope generator IC, U-1. Solder
- ( ) 5. CAPACITOR (see general assembly instructions)  
Observe the polarity of the tantalum capacitors. The positive lead is the lead closer to the (+) sign on the component.
  - a. Install both 0.01uf ceramic disc capacitors. C1, 2. Solder & cut leads
  - b. Install both 33pf ceramic disc capacitors. C3, 4. Solder & cut leads
  - c. Install both 1uf tantalum capacitors. C6, 7. Solder & cut leads.
  - d. Install the 0.1uf tantalum capacitor. C5. Solder & cut leads.
- ( ) 6. TRIM POTS (see general assembly instructions)  
Mount the trim pot T1. Solder.
- ( ) 7. Snap wire saddle into PC board with the loop on the component side of the board.

THIS COMPLETES THE ASSEMBLY OF THE PC BOARD. FOR THE TIME BEING, LAY IT ASIDE AND GO ON TO THE NEXT SECTION.

#### FRONT PANEL ASSEMBLY PROCEDURE (refer to front panel wiring diagram)

Aries Music face panels are made of anodized aluminum. They will not be scratched in normal operation, but they can be scratched with pliers or a nut driver. When using tools on the front panel, be very careful not to scratch it.

- 1. Mount ATTACK INITIAL and ATTACK MOD pots. Do not yet fully tighten the nuts because they will be later removed for final assembly. If pots have a flange which prohibits them from mounting flush against the face panel, bend the flange outwards so the pots will mount flush.
- 2. Mount the remaining 6 pots being sure to include the additional larger 1/16" thick nut between the body of the pot and the lock washer. Tighten the nut firmly against the body of the pot. Mount these pots putting smaller nut on front of face panel.
- 3. Mount the SWITCH orienting the terminals horizontally. It makes no difference which terminal is on the right. The washer should be placed on the back of the face panel.
- 4. Mount the 10 JACKS orienting them as shown on the wiring diagram. Mount the washer on the front side on the face panel and tighten the nuts.

PANEL WIRING AR-345

PLEASE REFER TO THE GENERAL ASSEMBLY INSTRUCTIONS BEFORE GOING ANY FURTHER

The order in which these connections are made has proven to be the easiest and most convenient method of wiring this module. The color-coded wires will facilitate trouble shooting the module.

USING BLACK WIRE, CONNECT AND SOLDER THE FOLLOWING WIRES.  
CUT THESE WIRES TO LENGTH, STRIP AND TIN. LEAVE AS LITTLE  
SLACK AS CONVENIENTLY POSSIBLE EXCEPT WHERE SPECIFICALLY  
INDICATED AT STEPS 1 AND 4.

NOTE: When soldering, be careful not to fill up the solder terminals on the pots or jacks with solder. It may be necessary for other wires to be connected to the terminal at a later time.

1. the CCW tap of PA INITIAL to the CCW tap of PD INITIAL. This wire should be 3" long
2. the CCW tap of PD INITIAL to the CCW tap of PS INITIAL
3. the CCW tap of PS INITIAL to the CCW tap of PR INITIAL
4. the CCW tap of PA MOD to the CCW tap of PD Mod. This wire should be 3" long
5. the CCW tap of PD MOD to the CCW tap of PS MOD
6. the CCW tap of PS MOD to the CCW tap of PR MOD
7. the CCW tap of PR INITIAL to the GROUND of JACK A. (Do not yet solder this wire to the jack)
8. the CCW tap of PR MOD to GROUND of JACK A. (Do not yet solder this wire to the jack)
9. Using un-shielded wire or tinned copper bus wire, connect the GROUNDS of all 10 JACKS together. Solder all three wires to JACK A.

USING RED WIRE, CONNECT AND SOLDER THE FOLLOWING WIRES. CUT THESE WIRES TO LENGTH, STRIP AND TIN. LEAVE AS LITTLE SLACK AS CONVENIENTLY POSSIBLE EXCEPT WHERE SPECIFICALLY INDICATED AT STEP 1.

1. the CW tap of PA INITIAL to the CW tap of PD INITIAL. This wire should be 3" long
2. the CW tap of PD INITIAL to the CW tap of PR INITIAL.
3. the CW tap of PR INITIAL to the LEFT TERMINAL of the SWITCH. Do not solder the left terminal of the SWITCH

USING WHITE WIRE, CONNECT AND SOLDER THE FOLLOWING WIRES. CUT THESE WIRES TO LENGTH, STRIP AND TIN. LEAVE AS LITTLE SLACK AS CONVENIENTLY POSSIBLE.

1. the SHUNT of JACK R to the SHUNT of JACK D
2. the SHUNT of JACK D to the TIP of JACK A
3. the TIP of JACK OUT to the TIP of JACK OUT 2. Do not yet solder the tip of JACK OUT 2.
4. the TIP of JACK OUT INV 1 to the TIP of JACK OUT INV 2. Do not yet solder the tip of JACK OUT INV 1.



USING THE COLOR CODED WIRE, CONNECT AND SOLDER THE FOLLOWING WIRES. CUT THE WIRES TO LENGTH, STRIP AND TIN. LEAVE AS LITTLE SLACK AS CONVENIENTLY POSSIBLE.

1. connect BROWN wire from CW tap of PA MOD to the TIP of JACK A
2. connect ORANGE wire from CW tap of PD MOD to the TIP of JACK D
3. connect YELLOW wire from CW tap of PS MOD to the TIP of JACK S
4. connect GREEN wire from CW tap of PR MOD to the TIP of JACK R

FOR THE FOLLOWING CONNECTIONS, USE 12" LENGTHS OF COLOR CODED WIRE.

1. connect BLUE wire to CT of PA INITIAL
2. connect GREY wire to CT of PD INITIAL
3. connect WHITE wire to CT of PS INITIAL
4. connect VIOLET wire to CW tap of PS INITIAL
5. connect BROWN wire to CT of PR INITIAL
6. connect BROWN wire to CT of PA MOD
7. connect ORANGE wire to CT of PD MOD
8. connect YELLOW wire to CT of PS MOD
9. connect GREEN wire to CT of PR MOD
10. connect BLACK wire to CCW tap of PR MOD
11. connect RED wire to LEFT terminal of SWITCH & solder wire from PR INITIAL
12. connect ORANGE wire to RIGHT terminal of SWITCH
13. connect GREY wire to the TIP of JACK OUT 2; solder white wire to JACK OUT 2
14. connect WHITE wire to the TIP of JACK OUT INV 1, solder short wire from OUT INV 2 to OUT INV 1.
15. connect GREEN wire to the SHUNT of JACK TRIG
16. connect BLUE wire to the TIP of JACK TRIG
17. connect YELLOW wire to the TIP of JACK GATE

THIS COMPLETES THE FRONT PANEL WIRING FOR THE AR-345.  
PLEASE GO BACK AND CHECK ALL CONNECTIONS.

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 point toward the rear, as shown.
- ( ) 3. Slide the printed circuit board into the frame, holding top and bottom of frame together against the board, so that the board fits snugly in the guides, between the tabs.
- ( ) 4. Using the 4-40 x 3/8" screws and nuts, mount the two angle brackets to the frame, as shown. The brackets should be on the component side of the board.
- ( ) 5. Now screw the board to the brackets. Insert the 4-40 x 3/8" screw from foil side of board. DOUBLE CHECK THAT SCREW HEAD DOES NOT TOUCH ANY METAL FOIL!!!
- ( ) 6. Refer again to MODULE ASSEMBLY DRAWING. Mount top of panel to frame, using the two UPPER pots. Put on lock washers and insert pot shaft through rear of upper holes in front of frame. Bring panel against frame, so these pots also go through matching holes in panel. Tighten nuts on front of panel, with pots oriented in same direction as lower pots.
- ( ) 7. Attach bottom of panel to frame, using remaining 4-40 x 3/8" screws & nuts.

WIRING OF THE FRONT PANEL TO THE PC BOARD

CONNECT WIRES FROM JACKS, SWITCHES AND POTS TO THE BOARD IN THIS ORDER.  
RUN ALL WIRES THROUGH THE WIRE SADDLE. LEAVE ABOUT 1" SLACK FOR EACH WIRE;  
CUT, STRIP AND TIN AND SOLDER AT THE BOARD.

1. connect VIOLET wire from PS INITIAL to board -15v at pin Z on the edge conn.
2. connect BLACK wire from PR MOD to board GROUND at pin M on the edge connector
3. connect RED wire from SWITCH to board +15v at pin A on the edge connector
4. connect WHITE wire from JACK OUT INV 1 to board OUT INV
5. connect GREY wire from JACK OUT 2 to board OUT
6. connect ORANGE wire from SWITCH to board SWITCH
7. connect GREEN wire from JACK TRIG to board TRIG SHT
8. connect YELLOW wire from JACK GATE to board GATE IN
9. connect BLUE wire from JACK TRIG to board TRIG IN
10. connect BROWN wire from PA MOD to board A MOD
11. connect BLUE wire from PA INITIAL to board A INITIAL
12. connect ORANGE wire from PD MOD to board D MOD
13. connect GREY wire from PD INITIAL to board D INITIAL
14. connect GREEN wire from PR MOD to board R MOD
15. connect BROWN wire from PR INITIAL to board R INITIAL
16. connect WHITE wire from PS INITIAL to board INITIAL S
17. connect YELLOW wire from PS MOD to board MOD S

DOUBLE CHECK EACH CONNECTION

18. use one cable tie to tie the wires into a bunch at a point near the front panel  
use the other cable tie to tie the five wires extending across the board at a  
point right below the envelope generator IC
19. turn all pot shafts fully counter-clockwise. Mount knobs so that the pointer is  
pointing to the lower left. Tighten knob screws. Mount knobs in this order.  
Release Mod  
Sustain Mod  
Decay Mod  
Attack Mod  
Release Initial  
Sustain Initial  
Decay Initial  
Attack Initial

THIS COMPLETES THE ASSEMBLY OF THE AR-345 ENVELOPE MODULE

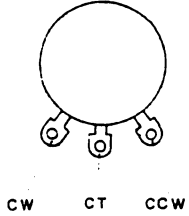
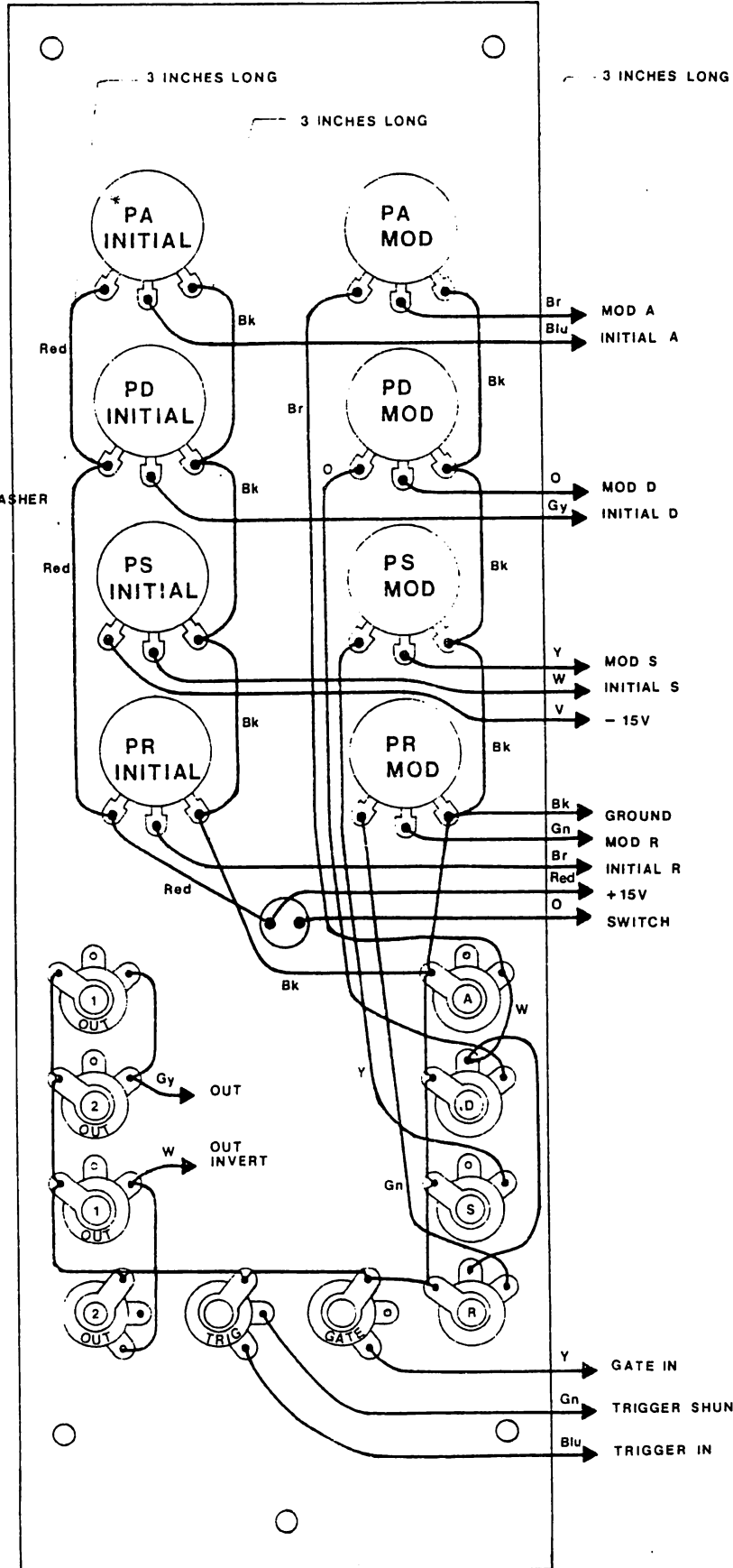
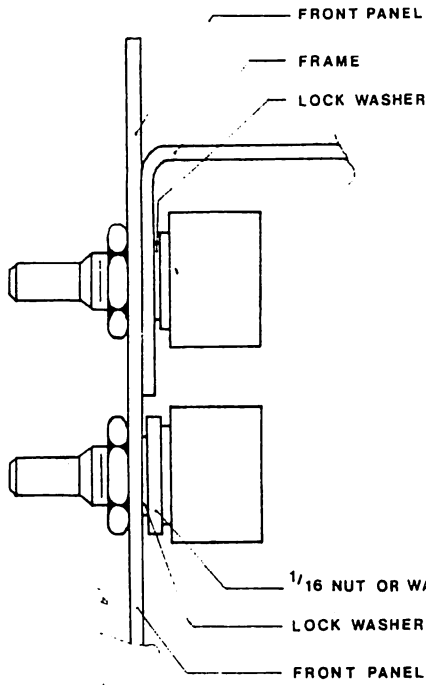
PLEASE GO BACK AND DOUBLE CHECK THE LAST ASSEMBLY STEPS. THE AR-345 IS  
NOW READY TO CALIBRATE.

**TRIM PROCEDURE AR-344 & AR-345**

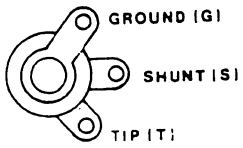
Patch a LF 50% pulse with a frequency of about 1 Hz into the gate input of the first envelope generator. Connect the envelope output to a direct coupled oscilloscope. Set the time base of the scope to display 2ms per horizontal division and set the scope so that it triggers on the positive slope. Turn all the pots of envelope #1 counter-clockwise so they are at minimum value. While monitoring the envelope output on the scope, adjust T1 (the trim closer to the edge connector) so that the minimum attack time is equal to 2ms (one horizontal division). If you have an AR-345, this completes the trim; if you have an AR-344, repeat this procedure for the second envelope.

AR-345 ENVELOPE  
FRONT PANEL WIRING DIAGRAM

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ALL POTS 100K LIN



OPEN ARROW  
CONNECT TO JACK

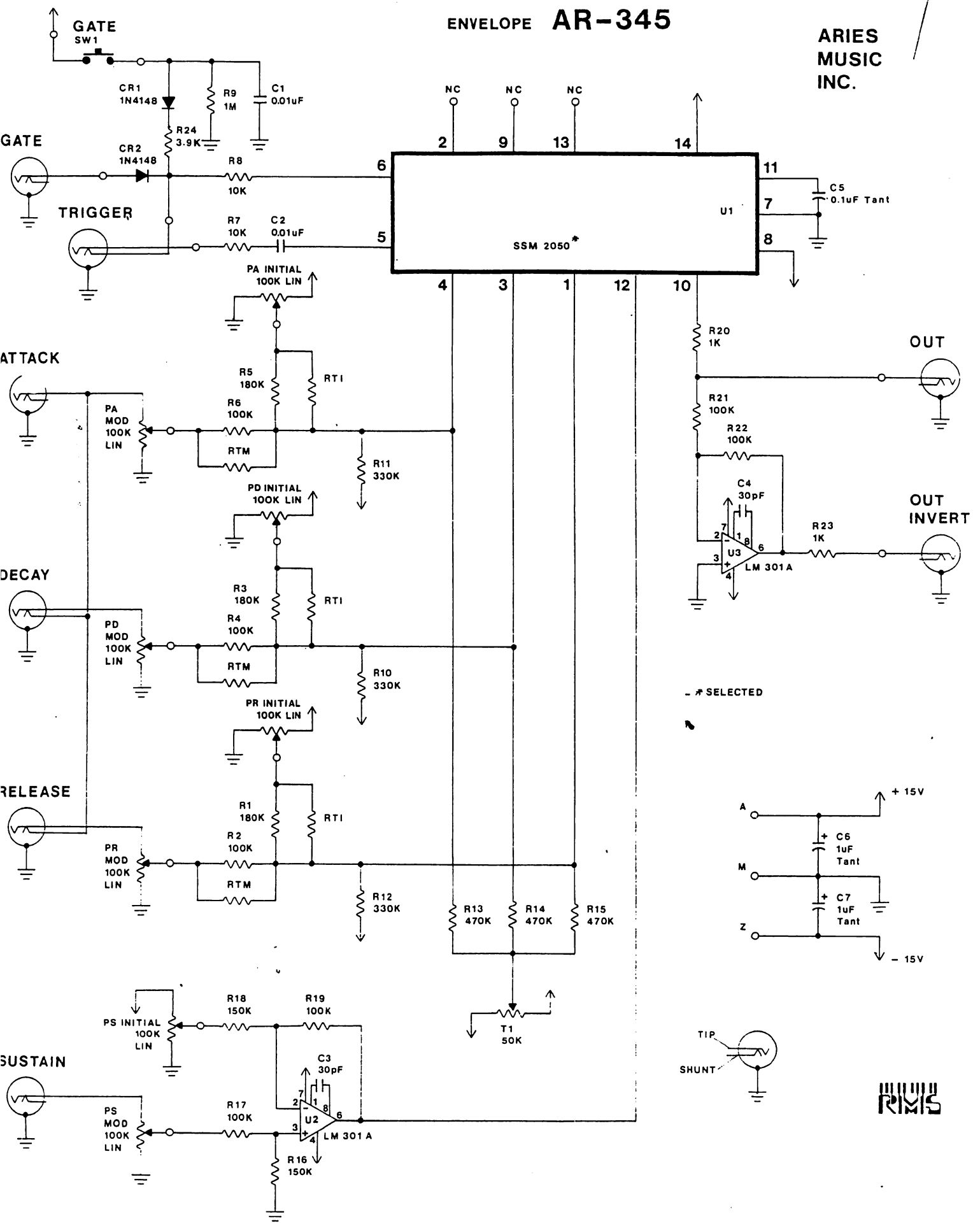
FILLED ARROW  
CONNECT TO PC BOARD

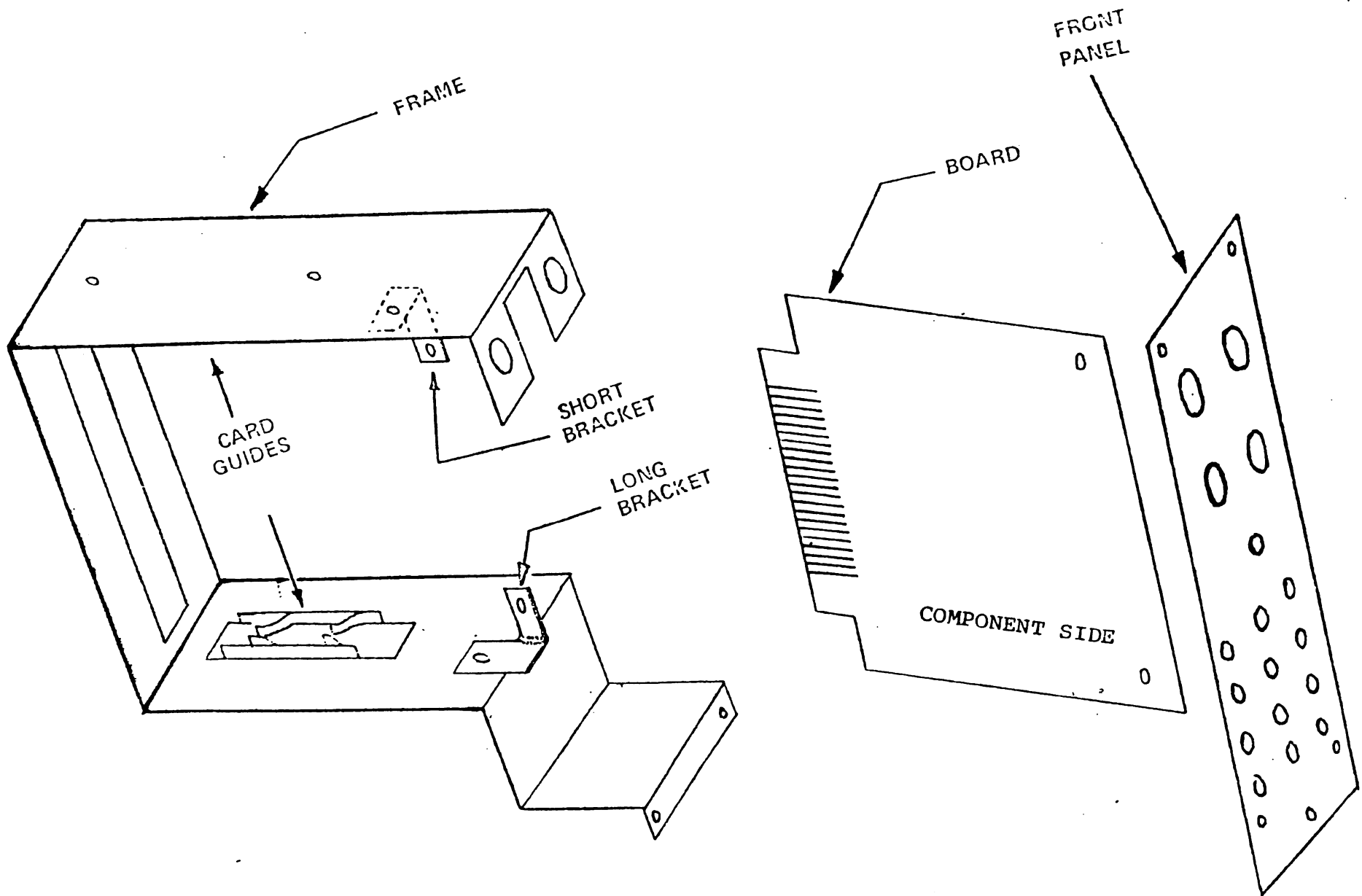
BLACK	Bk
BROWN	Br
RED	Red
ORANGE	O
YELLOW	Y
GREEN	Gn
BLUE	Blu
VIOLET	V
GREY	Gy
WHITE	W



# ENVELOPE AR-345

ARIES  
MUSIC  
INC.





## ARIES MUSIC SYSTEM 300

## ●SYNTHESIZER

## PARTS LIST \* AR-345 \* VC ENVELOPE GENERATOR

QUANTITY	DESCRIPTION	VOLTAGE & RATING
2	½ watt carbon film resistor	1K
1	" " " "	3.9K
2	" " " "	10K
7	" " " "	100K
2	" " " "	150K
3	" " " "	180K
3	" " " "	330K
3	" " " "	470K
1	" " " "	1M
3	Resistor; Trim mod. 5% CF ½w	RTM
3	" Trim Initial 5% CF ½w	RTI
1	Trim Pot	50K
8	Pots, lin.	100K
2	Diodes	1N4148
2	Ceramic Disc Caps	0.01uf
2	" " "	33pf (or 30pf)
1	Tantalum Capacitor	0.1uf
2	" "	1uf
1	Selected Env. Generator I.C.	SSM2050
2	Op Amps	LM-301-A
1	Switch; Momentary; Normally open push	
10	Jacks; mini Switchcraft 42-A	
8	Knobs	
1	Wire saddle	
6	Nut; 1/16 thick, same internal diameter as pot bushing	
1	AR-345 Front Panel	
1	P.C. Board	
1	Module Frame	
1	Bracket, large	
1	Bracket, small	
3	Screw; 6-32 x 3/8" Phillips-head for module mounting	
4	Screw; 4-40 x 3/8"	
2	Screw; Phillips-head, black	
6	Nuts; #4-40	
2	P.C. Card guides	
5	12" BLACK wire	
3	12" BROWN "	
3	12" RED "	
3	12" ORANGE wire	
3	12" YELLOW "	
3	12" GREEN wire	

## AR-345 VC ENVELOPE GENERATOR

## PARTS LIST CONT.

QUANTITY	DESCRIPTION	VOLTAGE & RATING
3	12" BLUE Wire	
2	12" VIOLET Wire	
3	12" GREY wire	
4	12" WHITE Wire	

1 24 gauge tinned copper bus wire; 16"

2 Cable Ties

## ADDITIONAL TRIMMING RESISTORS

Note that the 14 pin envelope generator IC has been especially marked with a letter. Depending upon the letter, you have been given 3 or 6 additional resistors. Three of the resistors are of one value and the other three of another value. These resistors are used when necessary, to trim the initial and modulation inputs to the input sensitivity of the I.C. RTI is "resistor trim initial" and RTM is "resistor trim modulation". These resistors are indicated on the schematic and the P.C. layout drawing. Consult the table below to determine the values of your trimming resistors based on the letter designation of your chip.

IC LETTER CODE	RTI	RTM
A	None used	2.7M
B	" "	2.2M
C	12M	1.8M
D	3.6M	1.1M
E	1.3M	560K
F	910K	390K
G	680K	330K
H	560K	240K
I	430K	200K
K	360K	180K
L	300K	150K
M	240K	120K



ARIES SYSTEM 300 MUSIC SYNTHESIZER  
Model AR-347  
PATCH BAY ASSEMBLY INSTRUCTIONS

PARTS LIST

<u>QUANTITY</u>	<u>DESCRIPTION</u>
44	Switchcraft 142-A Mini-jacks
1	AR-347 Front Panel
9'	Buss Wire

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

Use adequate lighting

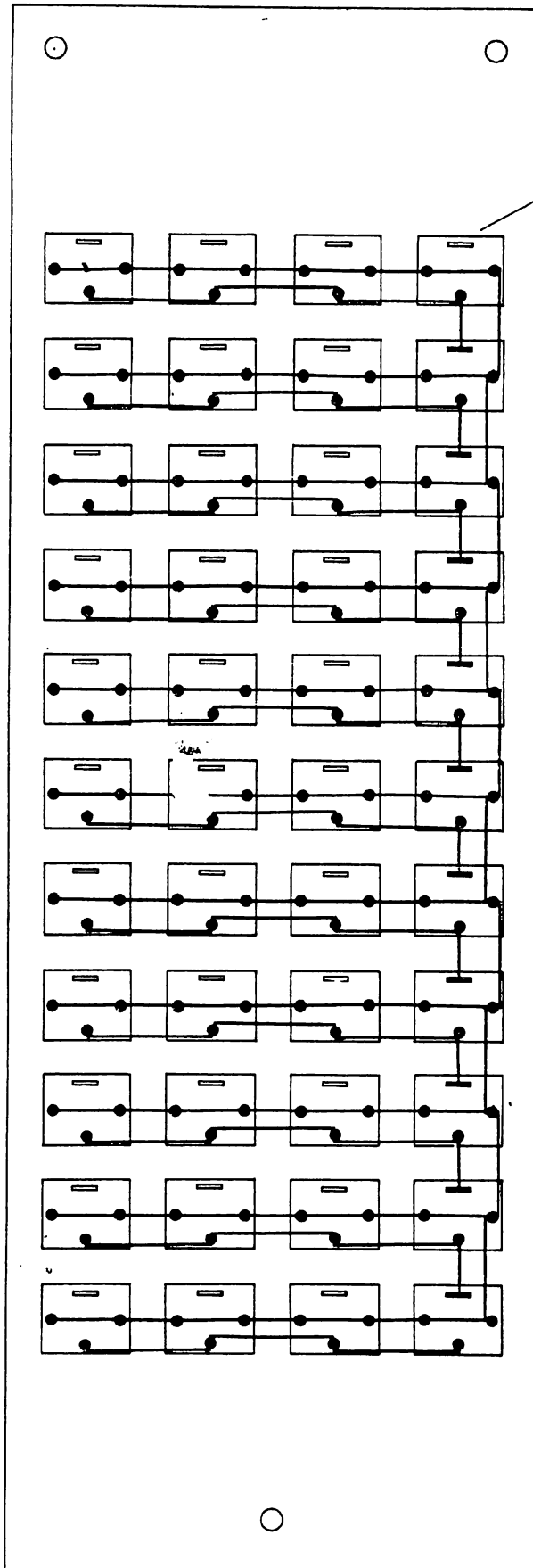
Wash hands before starting. This removes contaminating oils and perspiration and makes assembly more comfortable.

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

1. ( ) Mount all 44 jacks orienting them as shown on the wiring diagram.  
USING 24 AWG gauge tinned copper buss wire  
(see section 1, item 5-C)
2. ( ) Connect a wire completely through all shunts and tips of the right vertical column of jacks. Do not solder this wire. (This is an intermediate step and portions of this wire will be later cut away.) Instead, crimp the wire around the tip of the topmost jack and the shunt of the bottom-most jack to hold the wire in place.
3. ( ) Connect the tips of each horizontal row of jacks together. Crimp the wire on the tip of each jack in the left vertical column; weave the wire through alternate sides of the tips of the jacks in the middle two columns finally crimping the wire to the tip of the jack in the right vertical column. Refer to the wiring diagram. Before soldering any connections, place this module in a vertical position. You may clamp it in a vise (but be careful not to scratch the front panel) or mount it backwards (i.e. the jacks facing outward) in your Aries cabinet. This is done to prevent any solder or flux flowing into the jack mechanism and destroying the mechanical "normalling" connection.
4. ( ) Solder the horizontal wires to the tips of all jacks in each horizontal row. At this time solder the tip of the right-most jack where the horizontal tip wire intersects the vertical wire running through the tips and shunts of the right hand jacks.
5. ( ) With diagonal cutters, cut the tip/shunt wire just above every tip in the right vertical column of jacks. Next crimp this wire around every shunt on the jacks in this column. Solder this wire to the shunts. The purpose of this wire is to connect the tip of one jack to the shunt of the jack just below it. Please refer to the wiring diagram if further clarification is needed.
6. ( ) Connect the right-side ground of all jacks in the right vertical column together. Weave the wire through the ground terminals in alternate directions as shown in the diagram. Do not yet solder the wire to the jack ground terminals. You need not crimp the wire around each ground terminal. Crimp only the ground terminals at the top and bottom jack.
7. ( ) Connect all grounds of each horizontal row of jacks together. Run the wire directly through the center of the ground terminals. Crimp the wire to the left ground terminal of each jack in the left column and to the right ground terminal of each jack in the right column. Solder the grounds on each jack. Where this wire intersects the vertical ground wire, solder both ground wires to the terminal. This completes the assembly of your AR-347 module.

AR-347 PATCH BAY  
FRONT PANEL WIRING DIAGRAM

ARIES  
MUSIC  
INC.

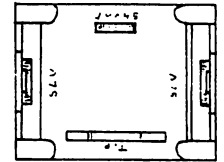


RIGHT VERTICAL COLUMN

SLV GROUND

TIP

SLV GROUND



SLV GROUND

SHUNT

SLV GROUND

