ARIES System 300 Music Synthesizer
Module AR 312
ADSR Envelope Generator Assembly Instructions

The previous pages were written as a general guide to familiarize the builder with the componenents. 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:

( ) 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 shawn.

( ) 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.

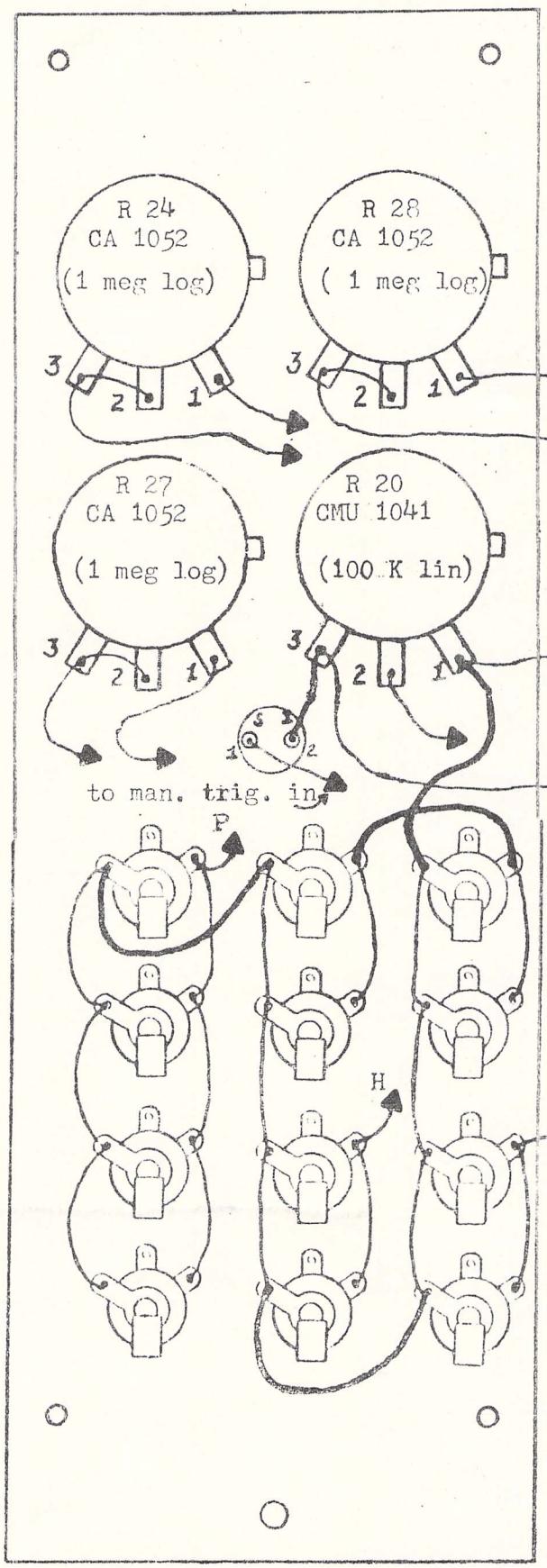
( ) 7. Run a wire between pin 2 and pin 3 of R 27. Do the same for R 24 and R 28.

( ) 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.

NOTE:

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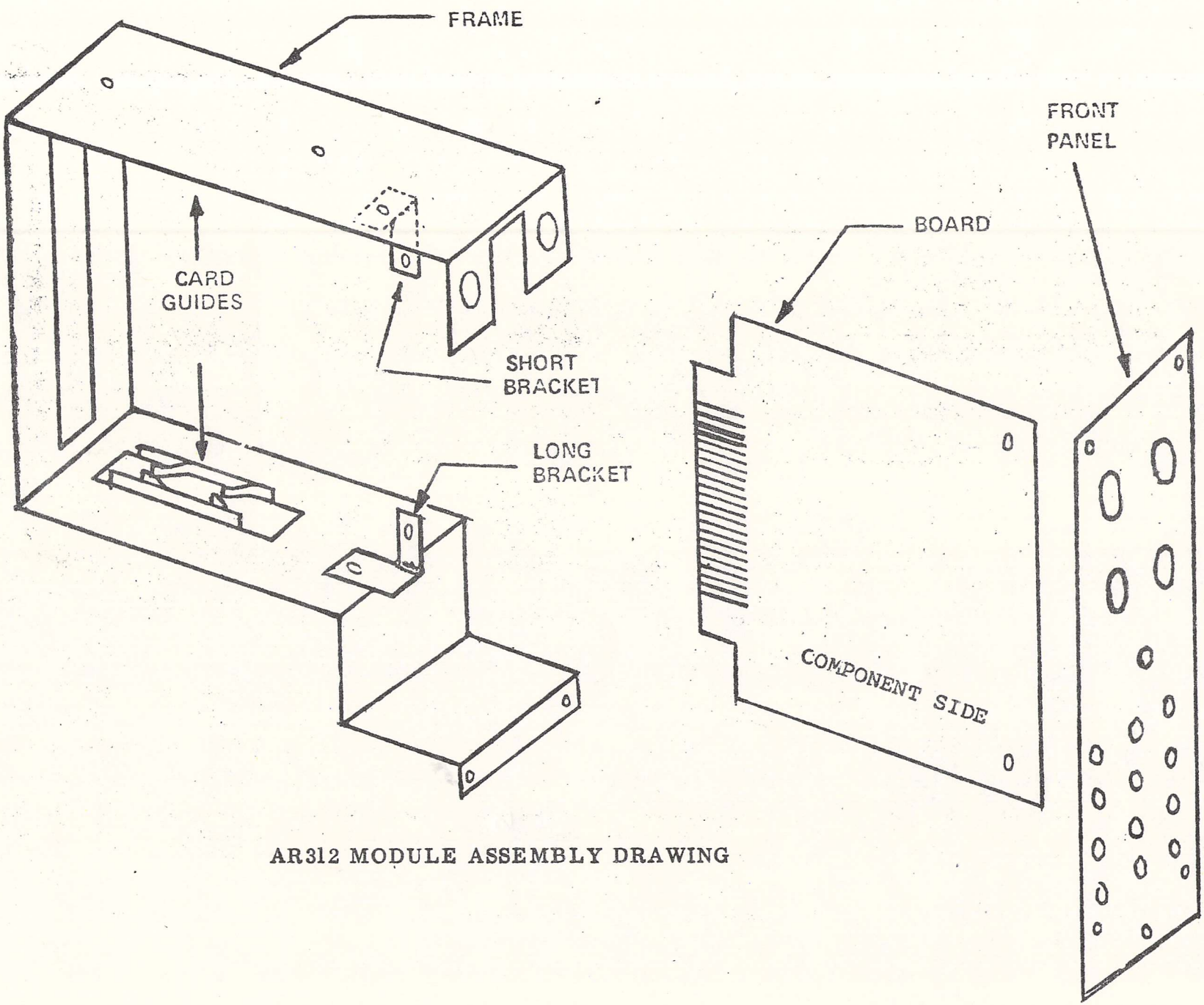

AR312 MODULE ASSEMBLY DRAWING

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 Q 4, 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 R 11 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 R 28, 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.