PAIA Electronics
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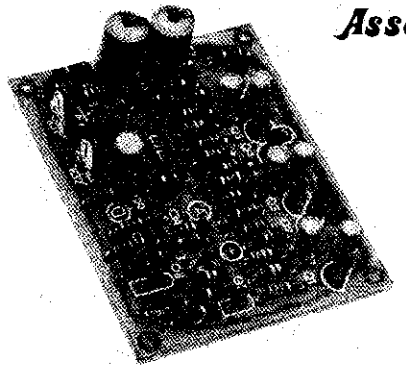
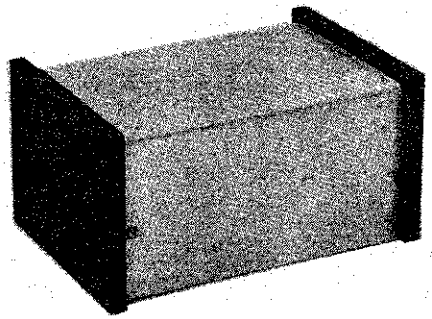
The Wind
Assembly Instructions





The term "Noise" makes most people think of jack-hammers or trash cans being knocked together at 5 AM, but to the electronics buff noise has such a totally different meaning that it even comes in colors. White noise describes a signal which contains all possible frequencies from sub-audio up through radio and microwave to gamma rays and beyond.

Pink noise differs from white noise in that the probability that the signal contains a frequency outside the audio spectrum (or even a limited band of the audio spectrum) is very low.

Pink noise should be particularly interesting to the audio experimenter because there are a lot of sounds that can only be produced using a noise source. In speech synthesis sibilants and frictives can't be produced without noise. In music, snare drums and cymbals are only two examples of noise based sounds. Finally, many natural phenomena such as the sound of the surf or The Wind are relatively easy to produce using noise that has its frequency content and/or amplitude varied randomly.

SOLDERING

Use care when mounting all components. Use only rosin core solder (acid core solder is never used in electronics work). A proper solder joint has just enough solder to cover the round soldering pad and about 1/16 inch of the lead passing through it. There are two improper connections to beware of: Using too little solder will sometimes result in a connection which appears to be soldered but actually there is a layer of flux insulating the component from the solder bead. This situation can be cured by re-heating the joint and applying more solder. If too much solder is used on a joint there is the danger that a conducting bridge of excess solder will flow between adjacent circuit board conductors forming a short circuit. Unintentional bridges can be cleaned off by holding the board up-side down and flowing the excess solder off onto a clean, hot soldering iron.

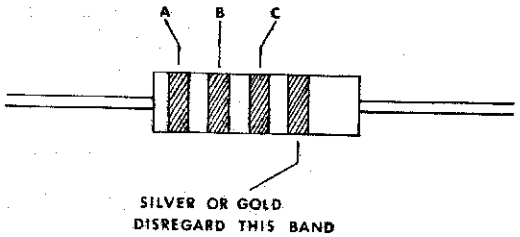
Select a soldering iron with a small tip and a power rating not more than 35 watts. Soldering guns are completely unacceptable for assembling transistorized equipment because the large magnetic field they generate can damage solid state components.

CIRCUIT BOARD ASSEMBLY

( ) Prepare for assembly by thoroughly cleaning the conductor side of the 3721A circuit board with a scouring cleanser. Rinse the board with clear water and dry completely.

Solder each of the fixed resistors in place following the parts placement designators printed on the circuit board and the assembly drawing figure 1. Note that the fixed resistors are non-polarized and may be mounted with either of their two leads in either of the holes provided. Cinch the resistors in place prior to soldering by putting their leads through the holes and pushing them firmly against the board; on the conductor side of the board bend the leads outward to about a 45° angle. Clip off each lead flush with the solder joint as the joint is made.

	DESIGNATION	VALUE	COLOR CODE A-B-C
( )	R1	6800	blue-grey-red
( )	R2	100K	brown-black-yellow
( )	R3	330K	orange-orange-yellow
( )	R4	6800	blue-grey-red
( )	R5	6800	blue-grey-red
( )	R6	220K	red-red-yellow
( )	R7	47K	yellow-violet-orange
( )	R8	6800	blue-grey-red
( )	R9	6800	blue-grey-red
( )	R10	100K	brown-black-yellow
( )	R11	68K	blue-grey-orange
( )	R12	6800	blue-grey-red
( )	R13	22K	red-red-orange
( )	R14	33K	orange-orange-orange
( )	R15	10K	brown-black-orange
( )	R16	4700	yellow-violet-red
( )	R17	22K	red-red-orange
( )	R18	68K	blue-grey-orange
( )	R19	1 megohm	brown-black-green
( )	R20	1 megohm	brown-black-green
( )	R21	100K	brown-black-yellow
( )	R22	6800	blue-grey-red
( )	R23	47K	yellow-violet-orange
( )	R24	150K	brown-green-yellow
( )	R25	27K	red-violet-orange
( )	R26	2200	red-red-red
( )	R27	6800	blue-grey-red
( )	R28	47K	yellow-violet-orange
( )	R29	47K	yellow-violet-orange
( )	R30	47K	yellow-violet-orange
( )	R33	680	blue-grey-brown
( )	R34	10K	brown-black-orange



Mount the ceramic disc and mylar capacitors as follows. Note that these parts are non-polarized and either lead may go in either of the holes provided. The values of these components are printed on the body of the part.

	DESIGNATION	VALUE
( )	C8	.05 mfd. disc
( )	C9	.05 mfd. disc
( )	C11	.05 mfd. disc

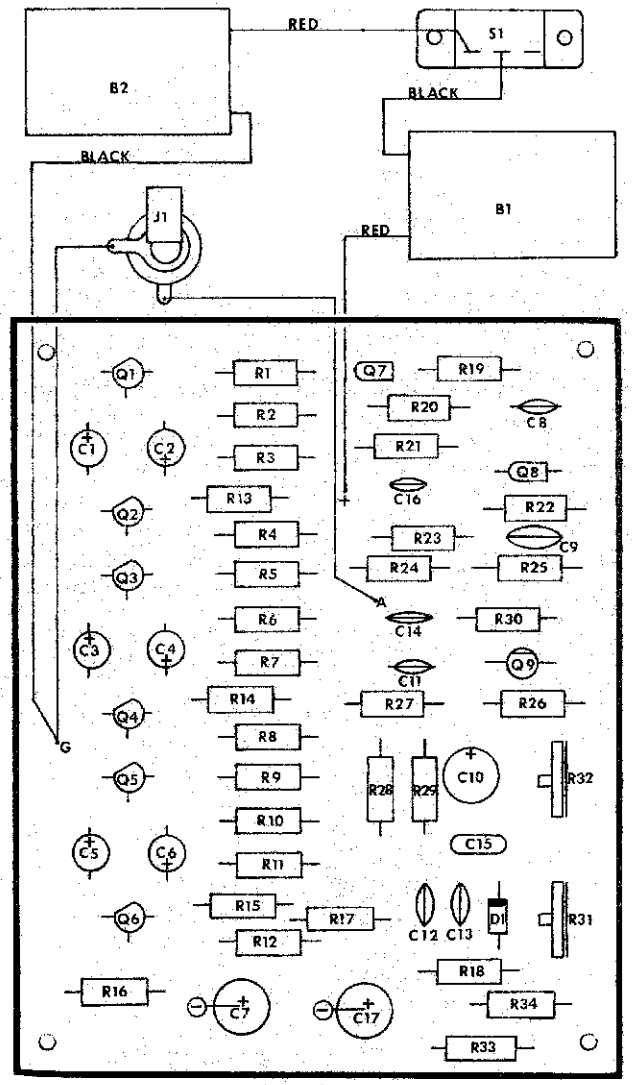


Figure 1

( )	C12	.001 mfd. disc
( )	C13	.001 mfd. disc
( )	C14	.01 mfd. disc
( )	C15	.1 mfd. mylar
( )	C16	.01 mfd. disc

Mount the electrolytic capacitors as follows. Note that these capacitors are polarized and the " + " and " - " leads must go in the proper holes. The " + " hole will always be marked on the circuit board, but the capacitor may have either the " + " or " - " lead marked. Note also that C7 and C17 are axial lead components and are mounted with the " + " lead butted against the circuit board and the " - " lead folded over and down through the remaining hole.

	DESIGNATION	VALUE/MINIMUM RATING
( )	C1	30 mfd. / 10v.
( )	C2	30 mfd. / 10v.
( )	C3	30 mfd. / 10v.
( )	C4	30 mfd. / 10v.
( )	C5	30 mfd. / 10v.
( )	C6	30 mfd. / 10v.
( )	C7	250 mfd. / 10v.
( )	C10	30 mfd. / 10v.
( )	C17	250 mfd. / 15v.

Mount the two trimmer potentiometers as follows. Note that these trimmers are two different values and are not necessarily identical in appearance. The value will be indicated on the part.

	DESIGNATION	VALUE
( )	R31	50K ohm trimmer potentiometer
( )	R32	100 ohm trimmer potentiometer

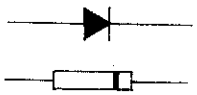
Complete the circuit board by installing the diode and transistors. Note that the parts placement designators printed on the circuit board are shown as the transistors will appear as you look down on the board from the component side. Orientation should be apparent from inspection.

Transistors and diodes are heat sensitive and must be protected from temperature damage. While soldering them in place grip the lead being soldered with a pair of needle nose pliers between the body of the component and the point being soldered.

Note that one of the 2N2712's has been pre-tested and selected for its noise characteristics. The middle lead (collector) of this device has been clipped short and this unit is intended for use as Q7.

	DESIGNATION	TYPE NO.
( )	Q1	2N5129
( )	Q2	2N5129
( )	Q3	2N5129
( )	Q4	2N5129
( )	Q5	2N5129
( )	Q6	2N5129
( )	Q7	2N2712 selected for noise (see above)
( )	Q8	2N2712
( )	Q9	2N3391
( )	D1	1N914

The schematic representation of the diode is related to the physical appearance of the device in the drawing to the right.....



1N914

THIS COMPLETES CIRCUIT BOARD ASSEMBLY

( ) Insert the red lead of one of the battery connectors to the " + " hole in the circuit board and solder.

( ) Connect the black lead of this connector to the center terminal of slide switch S1 and solder.

( ) Connect the red lead of the remaining battery connector to one of the outside terminals of slide switch S1.

( ) Strip 1/4 inch of insulation from both ends of a 4 inch length of #24 stranded wire and connect between the output jack and circuit board point "A" as shown in figure 1. Solder both connections.

( ) Strip 1/4 inch of insulation from both ends of a 3 inch length of #24 stranded wire and connect between the output jack and circuit board point "G" as shown in Figure 1 DO NOT SOLDER THE CONNECTION AT POINT "G". Solder the connection at the output jack.

( ) Connect the remaining black lead from the battery connectors to circuit board point "G". Solder this lead and the lead from the previous step.

TESTING AND OPERATION

The unit is now ready to test. Check over all connections to make sure there are no solder bridges or cold solder joints. Re-check the installation of diode D1 and all transistors. Re-check the polarity of all electrolytic capacitors. When you are sure that all components are properly installed snap two fresh 9v. batteries into the battery connectors.

Jumper the output of The Wind into one of the high level auxilliary inputs of a hi-fi or instrument amplifier and turn both the wind and the amp on. With R32 and R31 set to approximately the center of their rotation you should hear a wind-like sound from the amplifier.

The two trimmers (R31 and R32) are both set according to personal preference but a few general comments will get you started. R31 controls the amount of random voltage applied to the tuning input of the voltage controlled filter. As this control is rotated clockwise the variability of The Wind is increased. R32 controls the gain of the amplifier used in the band-pass filter and consequently the "Q" of the filter. Rotating R32 clockwise produces a shriller sound.

CASE MOUNTING

If you are mounting your unit in a 3711C case proceed as follows.

Using epoxy cement attach the battery clips to the inside top of the case as shown in the photograph figure 2. Roughen mating surfaces with emery paper prior to gluing and allow the epoxy to set completely.

Install the output jack in the large round hole provided in the rear of the case. Note that the washer supplied with the output jack should go on the outside between the case and the mounting nut.

Mount the power switch to the case using the 4-40 X 1/4 inch bolts and 4-40 nuts provided. Note that the switch should be positioned so that the lug that has the red battery connector lead attached to it is closest to the top of the case.

Mount the circuit board to the base plate using the 4-40 X 1/2 inch bolts, 1/4 inch spacers and 4-40 nuts. Note that the bolt goes through the base plate, through the spacer, through the circuit board and is secured with the nut.

Slide the wood ends into the top of the case and secure with #4 wood screws. If at all possible pre-drill the holes with a 1/16 inch drill. Make sure that the aluminum is snug against the wood and note that the most shallow cut on the blocks will go on the bottom. Snap the batteries into the battery clips.

Complete assembly by fitting the base and circuit board to the case. Pre-drill the wood ends for the screws and note that the #4 screws which hold the base plate in place also mount the 4 rubber feet.

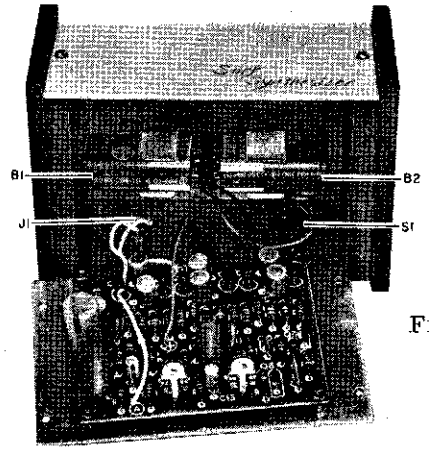


Figure 2

The above photograph indicates battery placement in the 3711C case. Although the Surf Synthesizer is pictured, The Wind mounts in the same manner.

DESIGN ANALYSIS

A complete schematic of The Wind is shown in figure 4 but it is convenient to break the unit down into a noise source, voltage controlled band pass filter (VCF) and a random voltage generator as shown in block diagram figure 3. These sections may be analyzed one at a time.

The noise source is built around a reverse biased p-n junction operating above its breakdown potential. The shot noise resulting from the avalanche breakdown mechanism of the reverse biased base-emitter junction of Q7 is amplified by Q8 and passed on to the VCF circuit for voicing.

Control voltages for the VCF originate in the random voltage generator which consists of three astable multi-vibrators (Q1 - Q6) running at different rates with different duty factors. The outputs of the three astables are summed with resistors R13, R14 and R15 and appear across R16. While the voltage appearing at this summing junction is to a certain extent random it is weighted by the different values of the summing resistors and the different periods and duty factors of the astables to approximate the blowing of the wind. After being smoothed by the integrating action of the summing resistors and C7 the output of the random voltage generator is applied to the VCF.

The Voltage Controlled band-pass Filter consists of a single transistor gain stage (Q9) with a parallel T notch filter in the feed-back loop. For signals outside the notch frequency, insertion loss is very low so that these signals pass from the output of the amplifier back to the input with little attenuation. However; since the output of the gain stage is 180° out of phase with respect to the input the overall effect is one of negative feed-back resulting in the cancellation of the two signals. Signals that are within the notch frequency are attenuated by the filter so they produce no negative feed-back and the amplifier passes them. R32 varies the amount of amplification provided by the gain stage and thereby controls the "Q" of the filter.

The non-linear V-I characteristics of diode D1 are used as a variable resistor to vary the center frequency of the notch filter. As the control voltage rises it applies a greater forward bias to D1 causing the diode's equivalent impedance to decrease. As the equivalent impedance at the junction of C12 and C13 increases the center frequency of the notch filter gets higher.

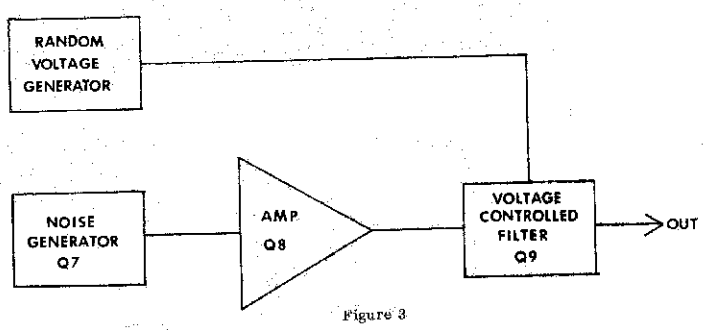


Figure 3

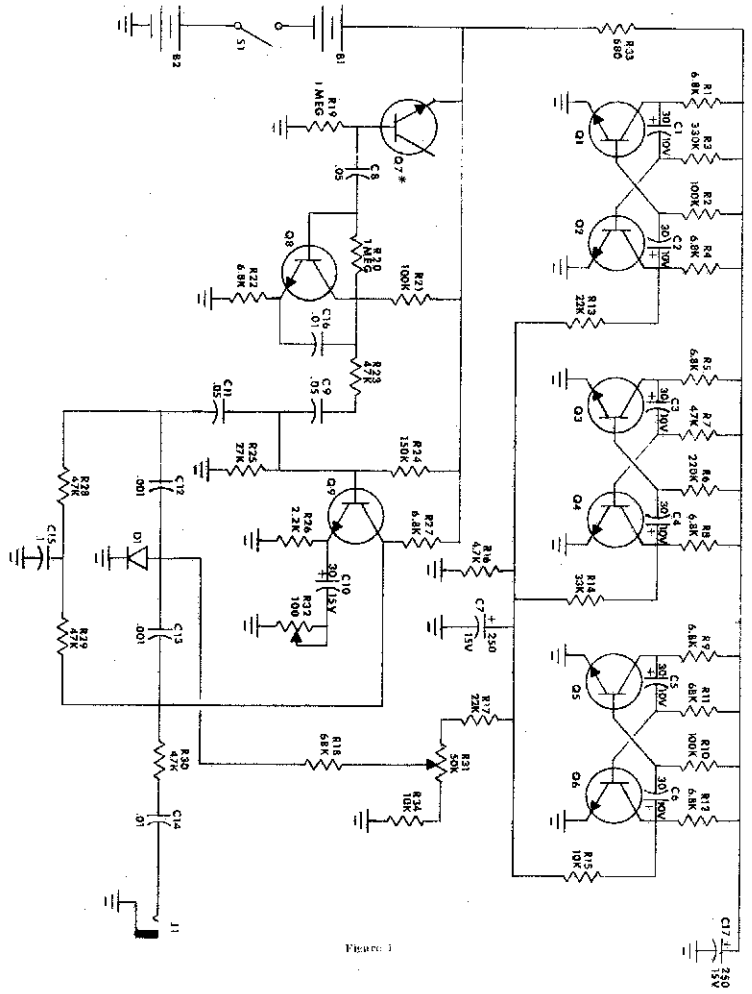


Figure 4

IN CASE OF DIFFICULTY

Recheck the wiring with the parts placement diagrams, wiring diagram and, if applicable case wiring diagram. Check the value of the parts to make sure that the proper part has been installed in each position. Check polarity of diode, capacitors and transistors. Many kits which are returned for repair are malfunctioning due to poor solder connections. Look over all solder connections to see that they are as described in the assembly section of this manual. Finally check for solder bridges, wire bits or other foreign matter which may be lodged in the wiring or across conductors on the circuit board.

A repair service is available should you be unable to determine the difficulty. Before sending a unit in for repair please write:

PAIA Electronics, Inc.
Service Department
P. O. Box 14359
Oklahoma City, OK 73114

.....Give as full a description of the malfunction as possible. It is possible that some malfunctions can be diagnosed by mail but if no diagnosis can be made you will be supplied with a repair address and shipping instructions. Repairs are charged at the rate of $4.00/hr. plus parts and shipping. Repairs ordinarily take about one hour but repair times in specific cases cannot be estimated in advance.