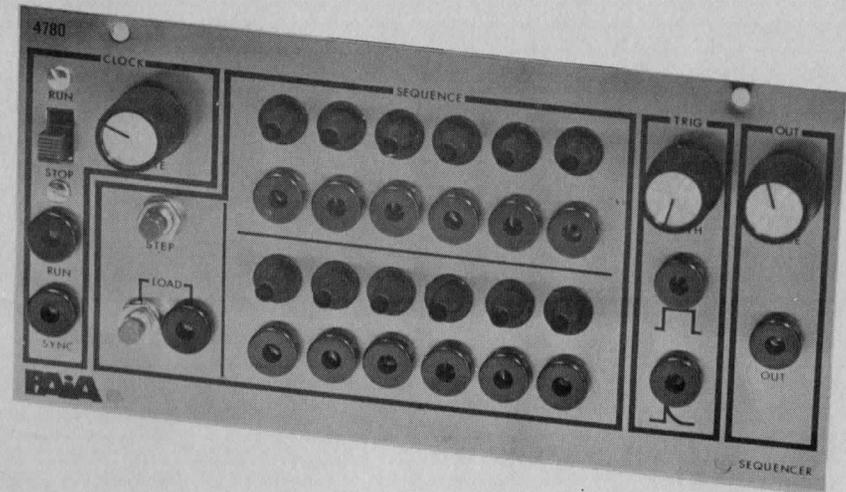


# SEQUENCER

## ASSEMBLY INSTRUCTIONS



In basic terms, a sequencer is simply another control voltage and trigger source. Unlike other controllers, however; it allows the user to pre-program an extended sequence of control voltage variations that can be called up on command and allows the variations to be executed at speeds beyond human capabilities. In addition to their obvious applications in generating fast arpeggios and automatic bass lines, sequencers can also be used as programmable function generators, counters or clock sources.

Considerable time and effort has gone into making the PAIA 4780 as versatile as possible without losing the user in a hopeless tangle of operational details. Many of the internal "housekeeping" functions are automatic yet externally available inputs and controls permit by-passing automatic functions in favor of manual control.

#### SPECIFICATIONS

**Power requirements:** + 18 v. @ 50 ma.  
± 9v. @ 1 ma.

**Clock rate:** 2/sec. to 32/sec.

**Control voltage range:** 0 - 5 v. nominal

**Additional features:** Built in glide  
Light Emitting Diode indicates clock rate  
LED stage status indicators  
Manual and electricly activated controls  
2 to 12 event re-circulating count capabilities.

**SOLDERING**

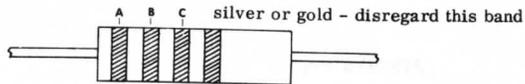
Use care when mounting all components. Use only rosin core solder (acid core solder is never used in electronics work.) A proper solder joint has just enough solder to cover the round soldering pad and about 1/16 inch of the lead passing through it. There are two improper connections to beware of: Using 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 lead from the solder bead. This situation can be cured by re-heating the joint and applying more solder. If too much solder is used there is the danger that a conducting bridge of excess solder will flow between adjacent circuit board conductors forming a short circuit. Unintentional solder 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 smaller "A" 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 value 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. Save the lead clippings for use as jumpers in later steps.



DESIGNATION	VALUE	COLOR CODE A-B-C
R1	150K	brown-green-yellow
R2	150K	brown-green-yellow
R3	150K	brown-green-yellow
R4	150K	brown-green-yellow
R5	150K	brown-green-yellow
R6	150K	brown-green-yellow
R7	1K	brown-black-red
R8	1K	brown-black-red
R9	1K	brown-black-red
R10	1K	brown-black-red
R11	1K	brown-black-red
R12	1K	brown-black-red
R13	680K	blue-grey-yellow
R14	330K	orange-orange-yellow
R15	220K	red-red-yellow
R16	3.9 meg ohm	orange-white-green
R17	1 meg ohm	brown-black-green
R18	2.2 meg ohm	red-red-green
R19	1 meg ohm	brown-black-green
R20	4.7K	yellow-violet-red
R21	15K	brown-green-orange
R22	33K	orange-orange-orange
R23	150K	brown-green-yellow
R24	680	blue-grey-brown
R25	1 meg ohm	brown-black-green
R26	10K	brown-black-orange
R27	100 ohm	brown-black-brown
R28	330K	orange-orange-yellow
R29	15K	brown-green-orange
R30	1K	brown-black-red
R31	150K	brown-green-yellow
R32	22K	red-red-orange
R33	470K	yellow-violet-yellow
R34	1 meg	brown-black-green
R35	33K	orange-orange-orange

DESIGNATION	VALUE	COLOR CODE A-B-C
R36	47K	yellow-violet-orange
R38	1 meg	brown-black-green
R39	1 meg	brown-black-green
R40	6.8K	blue-grey-red
R47	10K	brown-black-orange

Install the ceramic disk capacitors. Without exception the value will be marked on the body of the part.

DESIGNATION	VALUE
C1	.001 mfd. ceramic disk.
C2	100 pf. ceramic disk
C3	.05 mfd. ceramic disk
C6	.05 mfd. ceramic disk



Up to this point all components have been non-polarized and either lead could be placed in either of the holes provided without affecting the operation of the circuit. Electrolytic capacitors are polarized and must be mounted so that the "+" lead of the capacitor goes through the "+" hole in the circuit board. In the event that the "-" lead of the capacitor is marked rather than the "+" lead it is to go through the unmarked hole in the circuit board.

Note that the operating voltage (v.) specified for a capacitor is the minimum acceptable rating. Capacitors supplied with specific kits may have a higher voltage rating than that specified and may be used despite this difference. For instance, a 100 mfd. 25v. capacitor may be used in place of a 100 mfd. 10v. capacitor without affecting the operation of the circuit.

Mount the following electrolytic capacitors and solder them in place. The values, voltage rating and polarization are marked on the body of the part.

DESIGNATION	VALUE
C4	2.2 mfd. 10v. electrolytic
C5	2.2 mfd. 10v. electrolytic

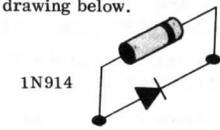
Install the transistors. Orientation of the transistors is keyed by the flat on the side of the case and should be evident from inspection of the parts placement diagram shown in figure 1 and the parts placement designators printed on the circuit board. All semi-conductors are heat sensitive and may be damaged if allowed to get too hot during soldering. To be on the safe side heat sink each transistor lead during the soldering operation by grasping it with a pair of needle-nosed pliers at a point between the circuit board and the body of the transistor. The part type no. is printed on the case.

DESIGNATION	TYPE NO.
Q1	2N5129
Q2	2N5129
Q3	2N5129



Install the diodes. Note that these parts are polarized and must be properly oriented in order to operate correctly. Polarization of the diodes is indicated by a colored band on one end of the case. Install as shown in figure 1. The physical appearance of the device is related to the schematic symbol used on the circuit board parts placement designators in the drawing below.

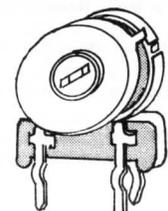
DESIGNATION	TYPE NO.
D1	1N914
D2	1N914



Using the excess resistor leads clipped from resistor installation, form and install the wire jumper indicated by the solid line printed on the circuit board and shown in the parts placement diagram: figure 1.

Install the trimmer potentiometer.

DESIGNATION	VALUE
R37	50K trimmer potentiometer



Install the multi-turn potentiometers R41 through R46. Install the controls by pushing all three pins through the holes provided in the circuit board and then soldering only the pin closest to the edge of the circuit board. Make sure that the control is perpendicular before soldering the rear two pins of each control.

(✓) R41	.....	50K multi-turn
(✓) R42	.....	50K multi-turn
(✓) R43	.....	50K multi-turn
(✓) R44	.....	50K multi-turn
(✓) R45	.....	50K multi-turn
(✓) R46	.....	50K multi-turn

When these controls have been soldered in place, carefully pull the knobs from the shafts. Save the knobs for re-installation in later steps.

Mount the integrated circuit. Note that the orientation of the integrated circuit is keyed by a notch at one end of the case which aligns with the semi-circular key on the designator printed on the circuit board. Use particular care when installing this part, like any other semi-conductor it is heat sensitive and should not be exposed to extraordinarily high soldering temperatures. Make sure that the orientation is correct before soldering, once the unit is in place it cannot be removed without destroying it.

DESIGNATION	TYPE NO.
(✓) IC-1	LM3900 or CA3401E Quad Norton Amplifier

In the following steps wires will be soldered to the circuit board which will later connect to the front panel controls and jacks. At each step prepare the wire by cutting it to the specified length and stripping 1/4 inch of insulation from each end of the wire. "Tin" each end of the wire by twisting the exposed strands tightly together and melting a small amount of solder into the wire.

Using the wire provided make the following connections to the "A" circuit board.

- (✓) A 10 inch length to point "W".
- (✓) A 4-1/2 inch length to point "H".
- (✓) A 5 inch length to point "J".
- (✓) A 4-3/4 inch length to point "K".
- (✓) A 4-1/2 inch length to point "L".
- (✓) A 6-1/2 inch length to point "M".
- (✓) A 4 inch length to point "N".
- (✓) A 6 inch length to point "P".
- (✓) A 6-1/2 inch length to point "R".
- (✓) A 6-3/4 inch length to point "S".
- (✓) A 1-1/4 inch length to point "T".
- (✓) A 6 inch length to point "AB".
- (✓) A 1-1/2 inch length to point "A".
- (✓) A 1-1/2 inch length to point "B".
- (✓) A 1-1/2 inch length to point "C".
- (✓) A 1-1/2 inch length to point "D".
- (✓) A 1-1/2 inch length to point "E".
- (✓) A 1-1/2 inch length to point "F".
- (✓) A 1-3/4 inch length to point "G".

Pass the wires from points A, B, C, D, E and F through the unmarked holes adjacent to each point. This will facilitate their connection to front panel jacks in later steps. See figure 2.

- (✓) Prepare the 2-1/4 inch piece of RG-154/U co-axial cable provided by stripping 1/2 inch of the black outer insulation from each end. Carefully un-braid the shielding to expose the insulated inner conductor. Twist the loosened braid back together and lightly "tin" the end. Remove 1/4 inch of insulation from the inner conductor at each end (see figure 3)
- (✓) At one end of the cable prepared above connect the tinned shield to circuit board point "V" and solder.
- (✓) Connect the inner conductor of the cable prepared above to circuit board point "U".

THIS COMPLETES ASSEMBLY OF THE "A" CIRCUIT BOARD. TEMPORARILY SET THE CIRCUIT BOARD ASIDE AND PROCEED WITH THE ASSEMBLY OF THE 4780 "B" CIRCUIT BOARD.

(✓) Prepare for assembly by thoroughly cleaning the conductor side of the "B" circuit board with a scouring cleanser. Rinse with clear water and dry completely. Following the directions given for resistor installation on the "A" circuit board, install the fixed value resistors on the "B" circuit board as follows. Save the resistor lead clippings for use in later steps. See figure 4.

DESIGNATION	VALUE	COLOR CODE A-B-C
(✓) R48	150K	brown-green-yellow
(✓) R49	150K	brown-green-yellow
(✓) R50	150K	brown-green-yellow
(✓) R51	150K	brown-green-yellow
(✓) R52	150K	brown-green-yellow
(✓) R53	150K	brown-green-yellow
(✓) R54	1K	brown-black-red
(✓) R55	1K	brown-black-red
(✓) R56	1K	brown-black-red
(✓) R57	1K	brown-black-red
(✓) R58	1K	brown-black-red
(✓) R59	1K	brown-black-red
(✓) R60	680	blue-grey-brown
(✓) R61	10K	brown-black-orange
(✓) R62	330K	orange-orange-yellow
(✓) R63	220K	red-red-yellow
(✓) R64	220K	red-red-yellow
(✓) R65	220K	red-red-yellow
(✓) R66	220K	red-red-yellow
(✓) R67	220K	red-red-yellow
(✓) R68	220K	red-red-yellow
(✓) R69	220K	red-red-yellow
(✓) R70	220K	red-red-yellow
(✓) R71	220K	red-red-yellow
(✓) R72	220K	red-red-yellow
(✓) R73	220K	red-red-yellow
(✓) R74	220K	red-red-yellow
(✓) R75	270K	red-violet-yellow
(✓) R76	270K	red-violet-yellow
(✓) R77	270K	red-violet-yellow
(✓) R78	270K	red-violet-yellow
(✓) R79	270K	red-violet-yellow
(✓) R80	270K	red-violet-yellow
(✓) R81	270K	red-violet-yellow
(✓) R82	270K	red-violet-yellow
(✓) R83	270K	red-violet-yellow
(✓) R84	270K	red-violet-yellow
(✓) R85	270K	red-violet-yellow
(✓) R86	270K	red-violet-yellow
(✓) R87	330K	orange-orange-yellow
(✓) R88	330K	orange-orange-yellow
(✓) R89	330K	orange-orange-yellow
(✓) R90	330K	orange-orange-yellow
(✓) R91	330K	orange-orange-yellow
(✓) R92	330K	orange-orange-yellow
(✓) R93	330K	orange-orange-yellow
(✓) R94	330K	orange-orange-yellow
(✓) R95	330K	orange-orange-yellow
(✓) R96	330K	orange-orange-yellow
(✓) R97	330K	orange-orange-yellow
(✓) R98	330K	orange-orange-yellow
(✓) R99	220K	red-red-yellow
(✓) R100	220K	red-red-yellow
(✓) R101	220K	red-red-yellow
(✓) R102	220K	red-red-yellow
(✓) R103	220K	red-red-yellow
(✓) R104	220K	red-red-yellow

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DESIGNATION	VALUE	COLOR CODE A-B-C
R105	220K	red-red-yellow
R106	220K	red-red-yellow
R107	220K	red-red-yellow
R108	220K	red-red-yellow
R109	220K	red-red-yellow
R110	220K	red-red-yellow
R111	100K	brown-black-yellow
R112	100K	brown-black-yellow
R113	100K	brown-black-yellow
R114	100K	brown-black-yellow
R115	100K	brown-black-yellow
R116	100K	brown-black-yellow
R117	100K	brown-black-yellow
R118	100K	brown-black-yellow
R119	100K	brown-black-yellow
R120	100K	brown-black-yellow
R121	100K	brown-black-yellow
R122	2.2 meg ohm	red-red-green
R123	330K	orange-orange-yellow
R130	1K	brown-black-red
R131	1K	brown-black-red
R132	47 ohms	yellow-violet-black
R133	330K	orange-orange-yellow
R134	100K	brown-black-yellow
R140	33K	orange-orange-orange
R141	33K	orange-orange-orange
R142	680	blue-grey-brown
R143	10K	brown-black-orange

Install the ceramic disk capacitors. The values of these capacitors are marked on the body of the part.

C7	.01 mfd. ceramic disk
C8	.005 mfd. ceramic disk
C9	.01 mfd. ceramic disk
C10	.01 mfd. ceramic disk
C11	.01 mfd. ceramic disk
C12	.01 mfd. ceramic disk
C13	.01 mfd. ceramic disk
C14	.01 mfd. ceramic disk
C15	.01 mfd. ceramic disk
C16	.01 mfd. ceramic disk
C17	.01 mfd. ceramic disk
C18	.01 mfd. ceramic disk
C19	.01 mfd. ceramic disk
C20	.01 mfd. ceramic disk
C21	100 pf. ceramic disk
C23	.005 mfd. ceramic disk

Following the directions given for capacitor installation on the "A" circuit board, install the electrolytic capacitors on the "B" circuit board as follows:

DESIGNATION	DESCRIPTION
C22	2.2 mfd. 10v. electrolytic
C24	1000 mfd. 25v. electrolytic
C25	33 mfd. 16v. electrolytic
C26	33 mfd. 16v. electrolytic

Following the instructions given for diode installation on the "A" circuit board, install the diodes on the "B" circuit board as follows:

D3	1N914
D4	5.6v. Zener

Using the excess resistor leads clipped from resistor installation, form and install the 7 wire jumpers indicated by the solid lines printed on the circuit board and shown in the parts placement diagram figure 4.

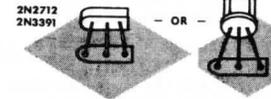
Install the multi-turn potentiometers R124 through R129. Install the controls by pushing all three pins through the holes provided in the circuit board and then soldering only the pin closest to the edge of the circuit board. Make sure that the control is perpendicular before soldering the rear two pins of each control.

R124	50K multi-turn
R125	50K multi-turn
R126	50K multi-turn
R127	50K multi-turn
R128	50K multi-turn
R129	50K multi-turn

When these controls have been soldered in place, carefully pull the knobs from the shafts. Save the knobs for re-installation in later steps.

Following the directions given for transistor installation on the "A" circuit board install the transistor on the "B" circuit board.

DESIGNATION	TYPE NO.
Q4	2N3391



Mount the integrated circuits following the directions for integrated circuit installation given for the "A" circuit board. Make sure that orientation is correct before soldering, once the unit is in place it cannot be removed without destroying it.

DESIGNATION	TYPE NO.
IC-2	LM3900 or CA3401E Quad Norton Amplifier
IC-3	LM3900 or CA3401E Quad Norton Amplifier
IC-4	LM3900 or CA3401E Quad Norton Amplifier
IC-5	748 op-amp

Four "flea" clips have been included to facilitate power supply connection. Insert these clips in the holes at the end of the circuit board marked "++", "+", "-", and "⊥". Solder in place.

In the following steps wires will be soldered to the "B" circuit board which will later connect with front panel controls and jacks. At each step strip 1/4 inch of insulation from each end and twist and "tin" the exposed strands.

Using the wire provided make the following connections to the circuit board.

- A 4 inch length to point "GG".
- A 3-3/4 inch length to point "HH".
- A 3-1/2 inch length to point "JJ".
- A 3 inch length to point "KK".
- A 5 inch length to point "LL".
- A 5-3/4 inch length to point "MM".
- A 1-1/2 inch length to point "NN".
- A 1-1/2 inch length to point "PP".
- A 1-1/2 inch length to point "RR".
- A 1-1/2 inch length to point "SS".
- A 1-1/2 inch length to point "TT".
- A 1-1/2 inch length to point "UU".
- Pass the short wires installed in circuit board points "NN" through "UU" through the unmarked holes in the circuit board as shown in figure 2.
- A 1-1/2 inch length to point "VV".
- A 1-1/2 inch length to point "WW".
- Pass the wire just installed through the unmarked hole just to the right of circuit board point "WW".
- A 1 inch length to point "XX".
- A 1 inch length to point "YY".
- Pass the wire just installed in circuit board point "YY" and the wire previously installed at point "VV" through the unmarked 1/8 inch hole in the circuit board just to the right of point "YY".

A 9-1/2 inch length to point "ZZ".

A 1-1/2 inch length to point "AE".

Pass the wire just installed through the unmarked hole directly above circuit board point "AE".

A 3 inch length to point "AF".

A 2-1/2 inch length to point "AG".

A 1-1/2 inch length to point "AU".

A 4-1/2 inch length to point "AX".

A 3-3/4 inch length to point "AW".

Prepare a 2-3/4 inch length of the co-axial cable provided by stripping 1/2 inch of insulation from one end and un-braiding the exposed shield wires. Twist the shield wires tightly together and tin by melting a small amount of solder into the wires. Remove 1/4 inch of insulation from the end of the exposed center conductor. Connect the shield to circuit board point "AK" and the inner conductor to point "AJ".

Strip 1/2 inch of the outer insulation from the free end of the previously installed cable. Cut the braided shield flush with the outer insulation before stripping 1/4 inch of insulation from the exposed inner conductor. Connect the inner conductor to circuit board point "AL".

Make the following interconnections between points on the "B" circuit board.

Connect the wire from point "GG" to point "AT".

Connect the wire from point "HH" to point "AS".

Connect the wire from point "JJ" to point "AP".

Connect the wire from point "KK" to point "AR".

Connect the wire from point "LL" to point "AN".

Connect the wire from point "MM" to point "AM".

"Dress" the wires installed above so that they all lie flat against the circuit board. The wires may be held in place by pressing them down between conveniently placed resistors on the circuit board.

This completes assembly of the 4780 "B" circuit board. Temporarily set this circuit board aside. You are now ready to put together the light emitting diode assemblies using the small 4780/C circuit boards. This will be a delicate assembly and the instructions should be followed EXACTLY to assure success.

Thoroughly scour the conductor side of the "C" circuit boards until they are bright and shiny. Perform this step only when ready to proceed with the assembly to prevent oxidation on the circuit boards. Oxidized circuit boards will require soldering temperatures that are higher than can be tolerated by the parts that are to be mounted. Rinse the boards with clear water and dry completely.

Cut twelve 3/4 inch lengths of the bare wire provided. Lay the boards face down on the work surface with the conductor sides up. Insert one of the twelve 3/4 inch length of bare wire into the hole in each of the twelve soldering pads and solder in place following detail drawing figure 5.

The boards should now have the wires protruding out the conductor side with none of the wire protruding from the component side of the circuit board. If there is a small bit of wire showing on the component side, clip it off flush with the circuit board.

You are now ready to mount the Light Emitting Diodes (LEDs). First examine this part carefully and note that one of the leads is marked with a green band. This marks the cathode of the LED. Observe that the rear side of the case is flat, while the front side is roughly dome shaped. In a later step the dome shaped front of the package will mate with a hole in the front panel.

Bend the leads of the LED loosely back. DO NOT use pliers to form a right angle bend in the leads. Make sure that the green band goes through the hole that is part of the common strip marked "com" on the conductor side of the board. Insert the LEDs on the component side of the circuit board and fold the leads tightly against the solder pads. DO NOT SOLDER YET.

It is imperative that the LEDs not be subjected to excessive soldering temperatures. Before each LED is soldered in place, carefully scrape the back of its lead with a razor blade or sharp knife to remove any oxidation that may have formed. (NOTE: the green cathode band is on the front of the lead.)

As each lead is scraped clean lightly solder it to the circuit board pads. Clip off each lead as short as possible after it is soldered.

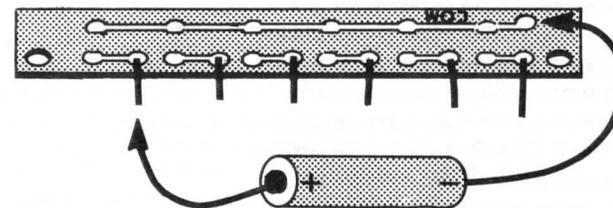
LED-1	MV-54
LED-2	MV-54
LED-3	MV-54
LED-4	MV-54
LED-5	MV-54
LED-6	MV-54
LED-7	MV-54
LED-8	MV-54
LED-9	MV-54
LED-10	MV-54
LED-11	MV-54
LED-12	MV-54

Prepare a 2-1/2 inch length of insulated wire by removing 1/4 inch of insulation from each end and tinning the exposed wire.

Install the wire prepared above in the pad marked "com" from the conductor side of the "C" circuit boards. Solder. Cut away any wire that protrudes from the component side of the circuit board. This circuit board will become the top LED board and should now look like the board shown in figure 6.

#### STOP

When this module is fully assembled the Light Emitting Diode Boards will be difficult to service. At this point test the 4780/C boards using any size 1.5 volt flashlight battery as shown below. Make sure that the negative (-) terminal of the battery connects to the "com" pad of the 4780/C board. Check polarity and soldering connections of any LED that does not light.



Touch "+" of battery to each LED lead in turn.

You are now ready to connect the smaller "C" circuit boards to the "A" and "B" boards. Note that the larger boards have holes under the multi-turn potentiometers marked 1 through 6. The LED boards have their pads numbered 1 through 6 also.

Using the LED board with the wire installed in the "COM" pad, insert the bare wires coming from points labeled 1 through 6 into the holes labeled 1 through 6 on the "A" circuit board. NOTE: These wires are to be inserted from the component side of the "A" circuit board. In a subsequent step this LED board will bend around so that it is in front of the "A" board. This will require that there be approximately 1/2 inch of the bare wire between the two boards. The spacing will be correct if the "C" board is just slightly above the top of the multi-turn trimmers as shown in figure 7 when the leads are soldered in place.

In a similar manner mount the remaining LED circuit board to the "B" circuit board.

Fasten the two "L" brackets to the "A" circuit board using one 4-40 X 1/2 inch machine screw, one 1/4 inch spacer, one lockwasher and one 4-40 nut on each bracket as shown in figure 8. Note that the unthreaded hole in the "L" bracket is used in this step.

In a similar manner fasten two "L" brackets to the "B" circuit board.

Position the mounting holes on the LED boards so that they are in line with the threaded holes in the "L" bracket. In a later step, screws will pass through the front panel and through the LED board into the threaded holes in the "L" brackets.

One Light Emitting Diode remains to be mounted on the "B" board. Just to the right of the circuit board point "WW" are two holes marked "LED" (left side of board). Solder two of the "flea clips" provided into these holes. Note that when properly installed the upright portions of the "U" shape of this clip will be pointed toward the closest edge of the circuit board. (see figure 9)

Install the two LED supporting flea clips.

Bend the leads of the LED loosely back and slip them into the clips such that they are roughly parallel with the surface of the circuit board. The ends of the LED should be even with the rear edges of the clips. Make sure that the unmarked lead goes into the clip that connects to R60.

Lightly solder the LED leads to the clips.

Place the front panel face down on a soft rag to prevent marring the finish.

Place a black pin jack (J1) in the hole provided as shown in figure 10. Fasten in place with a tinnerman nut as shown in figure 11. Press the tinnerman nut down firmly. NOTE that all tinnerman nuts must be mounted vertically as shown in figure 10.

In a similar manner mount black pin jack (J2) as shown in figure 10.

In a similar manner mount black pin jack J3.

In a similar manner mount red pin jack J4.

In a similar manner mount red pin jack J5.

In a similar manner mount red pin jack J6.

In a similar manner mount red pin jack J7.

In a similar manner mount red pin jack J8.

In a similar manner mount red pin jack J9.

In a similar manner mount red pin jack J10.

In a similar manner mount red pin jack J11.

In a similar manner mount red pin jack J12.

In a similar manner mount red pin jack J13.

In a similar manner mount red pin jack J14.

In a similar manner mount red pin jack J15.

In a similar manner mount red pin jack J16.

In a similar manner mount red pin jack J17.

In a similar manner mount red pin jack J18.

Using two 4-40 X 1/4 inch screws, two 4-40 nuts and two lock nuts, mount Slide switch S1 in the position shown in figure 10. Make sure that the points of the 4-40 nuts do not interfere with the travel of the slide inside the switch.

Mount the SPST push button switch S2 in the position shown in figure 10. Use the lockwasher between the rear surface of the front panel and the body of the switch.

In a similar manner mount pushbutton switch S3.

Mount 500K potentiometer R135 in the location shown in figure 10. Use two 3/8 inch nuts, one behind the front panel as a spacer and the second on the front side of the panel to secure the potentiometer. Adjust the rear nut so that none of the threaded shaft of the control is exposed when the front nut is tightened down. This will allow the control knob which will be mounted in a later step to seat as closely as possible to the front panel. Orient as illustrated.

In a similar manner mount 500K potentiometer R136 in the location shown in figure 10. Orient as illustrated.

In a similar manner mount 75K potentiometer R137. Orient as illustrated.

In the following steps interconnection wiring will be done on the front panel controls. At each step cut the wire to the specified length and strip 1/4 inch of insulation from each end. Twist the exposed strands and tin by melting a small amount of solder into the wire. (see figure 12)

Prepare a 1-1/2 inch length of insulated wire and connect lug #2 of S1 and lug #3 of R135. Solder the connection at S1 but do not solder the connection at R135 at this time.

Cut one lead of 100K resistor R139 (brown-black-yellow) to a length of 1/2 inch and the other lead to a length of 1 inch.

Pass the 1 inch lead of the previously prepared resistor through lug #3 of R137 to lug #2 of R137. Pass the 1/2 inch lead of this resistor through lug #1 of R137. Solder the connection at lug #2 of R137 but do not solder the connections at lug #1 and lug #3 at this time.

Cut both leads of 4.7K resistor R138 (yellow-violet-red) to a length of 3/8 inch.

Connect one lead of the previously prepared resistor to lug #1 of R136 and the other lead to lug #3 of R136. Do not solder either connection.

Prepare a 2 inch length of insulated wire and connect lug #1 of S2 to lug #2 of S3. Solder the connection at S3 but do not solder the connection at S2 at this time.

Prepare a 1N914 diode D5 by passing a 3/4 inch length of the plastic tubing provided over each lead. Clip the leads of the diode off 1/4 inch beyond the end of the tubing.

Connect the lead coming from the end of D5 that is marked with a colored band to lug #1 of S3. NOTE: Correct orientation of this diode is necessary for operation of the unit. Solder this connection.

Connect the remaining lead of D5 to J1. DO NOT SOLDER.

Peel the cardboard backing from the black "dots" provided. Mount the dots over the LED holes on the back of the front panel as shown in detail figure 10.

THE CIRCUIT BOARDS MAY NOW BE BOLTED TO THE FRONT PANEL AS FOLLOWS:

Using two each 4-40 X 1/4 inch screws and 6 lockwashers, mount the smaller "A" circuit board to the front panel as shown in figure 8. Note that the "A" circuit board will be the top board of the two board stack and mounts approximately on an imaginary line between R135 and R136. When mounting the board make sure that the shafts of the multi-turn trimmers R41 through R46 align with the top-most row of large holes in the front panel. Also make sure that the Light Emitting Diodes align with the row of smaller holes.

MAKE THE FOLLOWING CONNECTIONS BETWEEN THE "A" CIRCUIT BOARD AND THE FRONT PANEL CONTROLS USING THE WIRES PREVIOUSLY INSTALLED ON THE CIRCUIT BOARD. (see figure 13) Dress the wires against the front panel wherever possible.

Point "J" to pin jack J1 (solder 2 wires at this point).

Point "K" to lug #2 of R136 (solder).

Point "M" to lug #3 of S1 (solder).

Point "P" to pin jack J16 (DO NOT SOLDER).

Point "R" to lug #2 of S2 (solder).

Point "S" to lug #2 of R135 (solder).

Point "T" to lug #3 of R136 (solder two wires).

Point "W" to pin jack J2 (solder).

Point "G" to lug #3 of R135 (solder two wires).

The remaining wires coming from the component side of the "A" circuit board will connect to the "B" circuit board in the following steps.

Connect the six wires that pass through the circuit board from points "A" through "F" to pin jacks J4 through J9 respectively. DO NOT SOLDER any of these connections at this time.

BEFORE MOUNTING THE "B" CIRCUIT BOARD THERE ARE SEVEN CONNECTIONS WHICH MUST BE MADE TO PIN JACKS J4 THROUGH J9. In later steps these wires will connect to points on the "B" circuit board. Prepare each wire prior to installation by stripping 1/4 inch of insulation from each end and twisting and tinning the exposed strands.

A 5-1/2 inch length to J4 (DO NOT SOLDER).

An 8 inch length to J4 (Solder three wires).

An 8 inch length to J5 (Solder two wires).

A 6-1/2 inch length to J6 (Solder two wires).

A 5 inch length to J7 (Solder two wires).

A 4 inch length to J8 (Solder two wires).

A 4-1/2 inch length to J9 (Solder two wires).

Following the same procedure that was used while mounting the "A" circuit board, fasten the "B" board in place using two each 4-40 X 1/4 inch machine screws and 6 lockwashers. Note that diode D5 as well as the wires to S3 and J2 will be between the front panel and the front edge of the "B" circuit board. Make sure that all seven of the LED's associated with this circuit board align with the front panel holes provided for them.

Using the wires previously connected to pin jacks J4 through J9 make the following connections to the "B" circuit board. Solder each connection as it is made. (see figure 14)

- ✓ The shorter of the two leads from J4 to "B" circuit board point "AH".
- ✓ The longer of the two leads from J4 to point "BB".
- ✓ The lead from J5 to point "AA".
- ✓ The lead from J6 to point "CC".
- ✓ The lead from J7 to point "DD".
- ✓ The lead from J8 to point "FF".
- ✓ The lead from J9 to point "EE".

MAKE THE FOLLOWING CONNECTIONS BETWEEN THE "A" and "B" CIRCUIT BOARDS. Solder each connection as it is made. (see figure 15)

- | from "A" board  | to "B" board |
|---|--------------|
| ✓ Point "H" .....   | point "X".   |
| ✓ Point "L" .....   | point "Y"    |
| ✓ Point "N" .....   | point "Z"    |
| ✓ Point "AB" .....  | point "AB"   |
| ✓ Point "U" (Center conductor of co-ax) .....   | point "U"    |
| ✓ Point "V" (shield of co-ax) .....   | point "V"    |
| ✓ Connect the short piece of insulated wire previously soldered to the "com" terminal of the upper LED board (4780/C) to point "AD" of the "B" circuit board. |              |

MAKE THE FOLLOWING CONNECTIONS TO THE FRONT PANEL CONTROLS USING THE WIRES PREVIOUSLY INSTALLED ON THE 4780/B CIRCUIT BOARD. (see figure 14)

- ✓ from point "AG" to lug #1 of pushbutton S2 (solder two wires).
- ✓ from point "AU" to pin jack J18 (solder).
- ✓ from point "AF" to lug #1 of R136 (solder two wires).
- ✓ from point "XX" to pin jack J16 (solder two wires).
- ✓ from point "AX" to lug #1 of R137 (solder two wires).
- ✓ from point "AW" to lug #3 of R137 (solder two wires).
- ✓ Feed the wire originating at "B" circuit board point "ZZ" between the front panel and the wires connecting to pin jacks J4 through J9 and connect to lug #1 of S1 (solder).

FLIP THE MODULE OVER AND MAKE THE FOLLOWING CONNECTIONS USING THE WIRES PREVIOUSLY PASSED THROUGH THE CIRCUIT BOARD. (see figure 16)

- ✓ Connect the wire originating at circuit board point "WW" to pin jack J17 (solder).
- ✓ Connect the wire originating at circuit board point "AE" to the "com" pad of the 4780/C board. NOTE: Do not pass this wire through the hole in the "com" pad as this presents the danger of a short circuit to the front panel. Simply lay the wire against the pad and solder in place.
- ✓ Connect the wire from circuit board point "UU" to J15 (solder).
- ✓ Connect the wire from circuit board point "TT" to J14 (solder).
- ✓ Connect the wire from circuit board point "SS" to J13 (solder).
- ✓ Connect the wire from circuit board point "RR" to J12 (solder).
- ✓ Connect the wire from circuit board point "PP" to J11 (solder).
- ✓ Connect the wire from circuit board point "NN" to J10 (solder).
- ✓ Connect the wire from circuit board point "VV" to J3 (solder). NOTE: Exercise caution at this connection that the two wires coming through the single hole in the circuit board are not confused.
- ✓ Connect the wire coming from circuit board point "YY" to lug #1 of S3 (solder 2 wires).

THIS COMPLETES ELECTRICAL ASSEMBLY OF THE 4780 SEQUENCER. Turn the module over and install the 12 pitch control knobs on the shafts of the multi-turn trimmers accessible through the holes in the front panel. Rotate the three potentiometer shafts (R135, R136 and R137) fully counter-clockwise before pressing on the three control knobs provided. Make sure that the pointer of each knob points to the "7 O'clock" position of an imaginary clock face before pressing it in place.

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