

THE DIGI DESIGNER

INSTRUCTION
MANUAL



EL INSTRUMENTS, INCORPORATED

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INTRODUCTION

The E & L Instrument DD1-K is a complete circuit design instrument in kit form.

Included in the DD1-K are a regulated 5VDC supply, a selectable frequency clock (pulse generator), dual bounce-free pushbuttons (pulsers), four (4) switches for applying voltage or ground as required and four (4) logic lamp monitors.

The unique EL SK-10 Universal Component Socket completes this kit to produce a design instrument of great capability.

I. General

- A. The material has been prepacked in plastic bags in general categories for ease of assembly. Check the contents of the bags to make certain all the correct parts are there. Inspect packing material for any loose parts before discarding.

Notify all shortages or discrepancies to the immediate attention of E & L Instruments.

- B. Certain features of construction/instruction are followed throughout the building of this kit as outlined below:

1. When a wire is brought to a location, the designation "connect" is used; when it is followed by an (S), this indicates it is immediately soldered in place; if no (S) appears, do not solder at that time - other wires will be brought to that point and if solder is applied too early, the assembly will be much more difficult.
2. The integrated circuit sockets are composed of 4 parts - 2 sets of springs and 2 plastic holders. The technique for assembly is as follows:
 - a. Insert one set of springs in each plastic holder.
 - b. The exposed pins are then inserted in the printed circuit board and soldered.
 - c. Then and only then, break off the tab leaving the socket ready to accept the IC.
3. When soldering diodes and transistors, it is most important that the heat used is minimal - a 35W. soldering iron is quite adequate for all of the assembly and a large wattage iron should not be used.
4. Terminal #1 on IC is either a dot or an indentation. The Dark band on the diodes denotes the cathode end.
5. The instructions are given line by line with two "Check-off" columns. The first is for checking off as you actually do that step; the second is for rechecking if a problem is encountered.
6. Use rosin core solder only. The use of corrosive (acid core) solder or paste fluxes voids any and all warranties on the unit.
7. This manual uses the new IEEE (Institute of Electrical and Electronic Engineers) international standard term "hertz"

as the basic unit of frequency. The terms are used as follows:

- Hz (hertz) = cps (cycles per second)
 KHz (kilohertz) = kc (kilocycles per second)
 MHz (megahertz) = mc (megacycles per second)

II. Bill of Materials

CATAGORY	ITEM	DESIGNATION	NAME/DESCRIPTION	QUANTITY	CHECK
Hardware	1	MB	Mounting Brackets	3	_____
	2	SC1	6-32-1/4" Panhead Screws	8	_____
	3	SC2	4-40-1/4" Panhead Screws	12	_____
	4	SC3	4-40-5/8" Flathead Screws	6	_____
	5	N1	4-40 Hex Nuts	15	_____
	6	N2	6-32 Hex Nuts	2	_____
	7	LW1	#4 Lockwashers	18	_____
	8	LW2	#6 Lockwashers	2	_____
Switches	9	S1	7-Position Rotary Switch	1	_____
	10	S2 & S3	SPDT Pushbutton Switches	2	_____
	11	S4	On-Off Toggle Switch	1	_____
	12	S5 - S8	SPDT Switches	4	_____
Connectors	13	J1 - J29	EL Breadboarding Pins (BP-22)	29*	_____
	14	J30 & J34	Black 5-way Binding Posts	2	_____
	15	J31 & J33	Red 5-way Binding Posts	2	_____
	16	J32	BNC (UG1094) and Ground Lug	1	_____
	17	J35	EL SK-10 Socket	1	_____
	18	J36 - J37	Component Sockets (in 4 pieces/socket)	2	_____

*Factory Installed in panel

ASSEMBLY INSTRUCTIONS - DD1-K (continued)

CATAGORY	ITEM	DESIGNATION	NAME/DESCRIPTION	QUANTITY	CHECK
Resistors	19	R1 - R10	1K Ω + 5% 1/4W (Brown,Black,Red,Gold)	10	_____
	20	R11 & R13	100 Ω + 5% 1/4W (Brown,Black,Brown,Gold)	2	_____
	21	R12	100 Ω Trimpot	1	_____
	22	R14	150 Ω + 5% 1/4W (Brown,Green,Brown,Gold)	1	_____
	23	R15	220 Ω + 5% 1/4W (Red,Red,Brown,Gold)	1	_____
	24	R16 - R19	22K Ω + 5% 1/4W (Red,Red,Orange,Gold)	4	_____
	25	R20	100K Ω + 5% 1/4W (Brown,Black,Yellow,Gold)	1	_____
Capacitors	(All capacitors have values marked on them)voltage values may vary				
	26	C1	330 6.3V Axial Electrolytic	1	_____
	27	C2	33 6.3V " " "	1	_____
	28	C3	3.3 6.3V " " "	1	_____
	29	C4	.33 12V Ceramic Disc Cap.	1	_____
	30	C5	.03 50V " " " " "	1	_____
	31	C6	.003 50V " " " " "	1	_____
	32	C7	3300 10V Axial Electrolytic	1	_____
	33	C8 - C11	.01 50V Ceramic Disc Cap.	4	_____
Conductors	34	Q1,Q2,Q4-Q12	2N3643	11	_____
	35	Q3	TIP3055 including washer and bushing	1	_____
	36	IC1	SN7405	1	_____
	37	IC2	SN7400	1	_____
	38	D1 - D3	1N914	3	_____
	39	Rect.	Full wave bridge rectifier PF05	1	_____

ASSEMBLY INSTRUCTIONS - DD1-K (continued)

CATAGORY	ITEM	DESIGNATION	NAME/DESCRIPTION	QUANTITY	CHECK
Miscellaneous	40	T1	Transformer - PRI - 115V SEC - 6.3V @ 1.0 Amp	1	_____
	41	LM1 - LM4	Cartridge Lamps 50ma @ 6.0V	4	_____
	42	L1	NE2E Bulb	1	_____
	43	RL	Red Lens	1	_____
	44	FH	Fuse Holder - HTA	1	_____
	45	F1	Fuse - 1/4 Amp	1	_____
	46	TS	Terminal Strip	1	_____
	47	K1	Molded Plastic Knob	1	_____
	48	SR	Strain Relief	1	_____
	49	LC	Line Cord with Molded Plug	1	_____
	50	PC1	Main PC Board (10904/10903)1 (Power Supply & Clock)	1	_____
	51	PC2	Lamp Monitor Board (10906/10905)	1	_____
	52	PC3	Pulser Board (10912/10911)	1	_____
	53	P1	Panel W/Items 13 Installed	1	_____
	54	H1	Housing	1	_____
	55		Buss Wire #22 Gauge	7-1/2'	_____
	56		Hook-up Wire, Stranded #22 Gauge	10'	_____
57		Sleeving #22 Gauge	5'	_____	

III. Mechanical Assembly - Panel

A. Follow this sequence exactly or difficulties may be encountered.

B. Mount in order (See Figures 1 and 6 for proper orientation and location of components.)

	<u>Construction</u>	<u>Check</u>
1. The 4 Lamp Monitors (LM1 - LM4)	_____	_____
2. The Fuse Holder (FH)	_____	_____
3. The Red Lens (RL) - Mount with fastener supplied, per drawing	_____	_____
4. The Terminal Strip (TS) - Mount with 4-40 x 1/4" Screw, lockwasher and nut	_____	_____
5. The On-Off Toggle Switch (S4)	_____	_____
6. The 4 Binding Posts (J30, J31, J33, J34) (make certain that they seat correctly in the "D" holes)	_____	_____
7. The BNC Connector (J32) - note the ground lug on the rear must go under the NUT	_____	_____
8. The Rotary Switch (S1) - use lockwasher on the rear of the panel and hex nut on front	_____	_____
9. The two Pushbutton Switches (S2 & S3) - use flatwasher and nut on the panel front - watch orientation - the common terminal is toward the bottom of the panel	_____	_____
10. The 4 Slide Switches (S5 - S8) - use 4-40 Panhead Screws, lockwasher and nuts	_____	_____
11. Mount the SK-10 Socket (J35) on the panel - use 4-40 x 5/8" Flathead Screws, lockwashers and nuts - do <u>not</u> tighten the nuts down beyond finger tight at this time. DO NOT REMOVE INSULATING BACKING ON SOCKET.	_____	_____
12. Prepare the line cord as follows:		
a. Expose the inner conductors for approximately 3" being careful not to nick the wires	_____	_____
b. Strip the ends of green and white wires 1/4"	_____	_____
c. Cut the black wire leaving 1-1/2" exposed; strip 1/4"	_____	_____

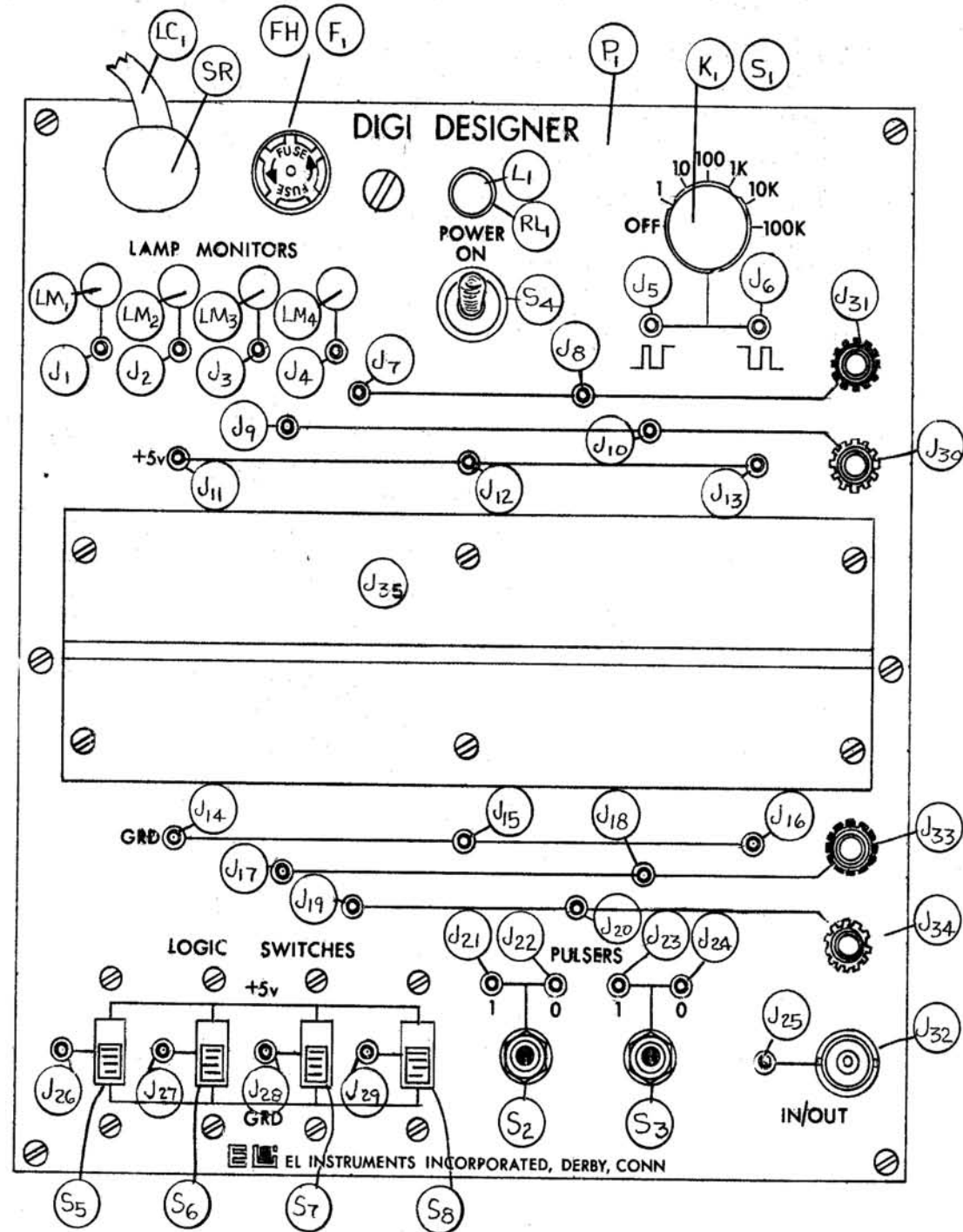
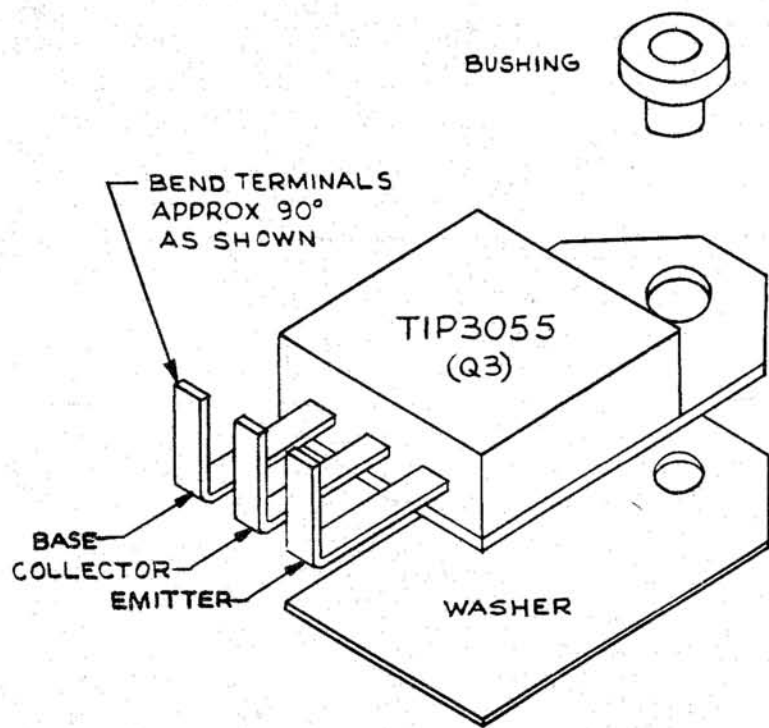


FIGURE 1

ASSEMBLY INSTRUCTIONS - DD1-K (continued)

- d. Capture unexposed portion of cord with Strain Relief so approximately 1/4" to 1/2" comes through on inside of panel
 - e. Using long-nose pliers compress the Strain Relief and force into proper hole
13. Mount Q3 (TIP3055) to the Panel. The transistor is held to the Panel using the center upper screw holding the SK-10 Socket - use the insulated bushing and washer (See Figure 2) The Metal Tab must not contact the Panel directly

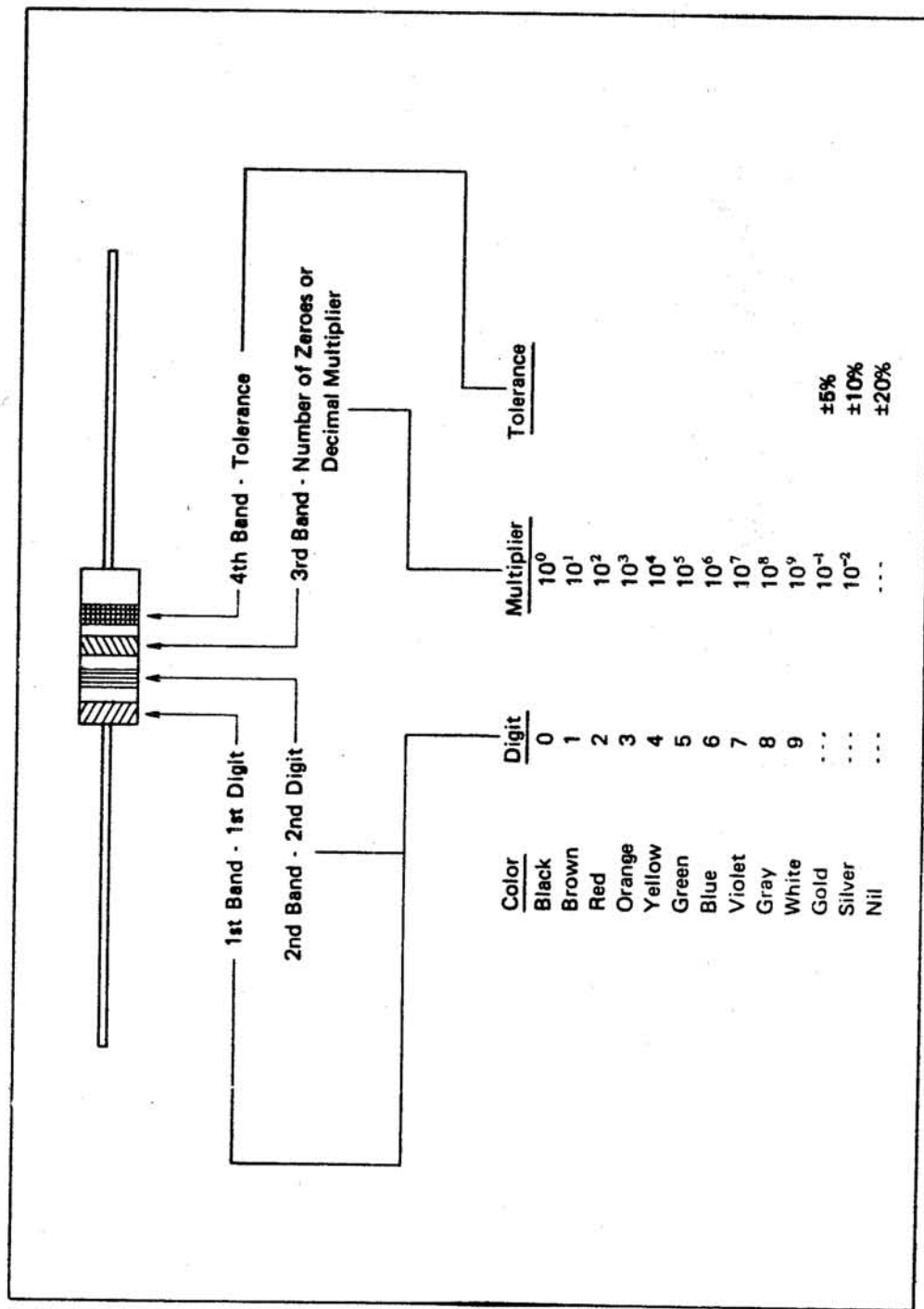


TIP3055 (Q3) MODIFICATION AND ASSEMBLY

FIGURE 2

Standard Color Code

Resistors are symbolized on the body by the color code system described. The symbolization shown has been adopted as the standard EIA color code method of identification.

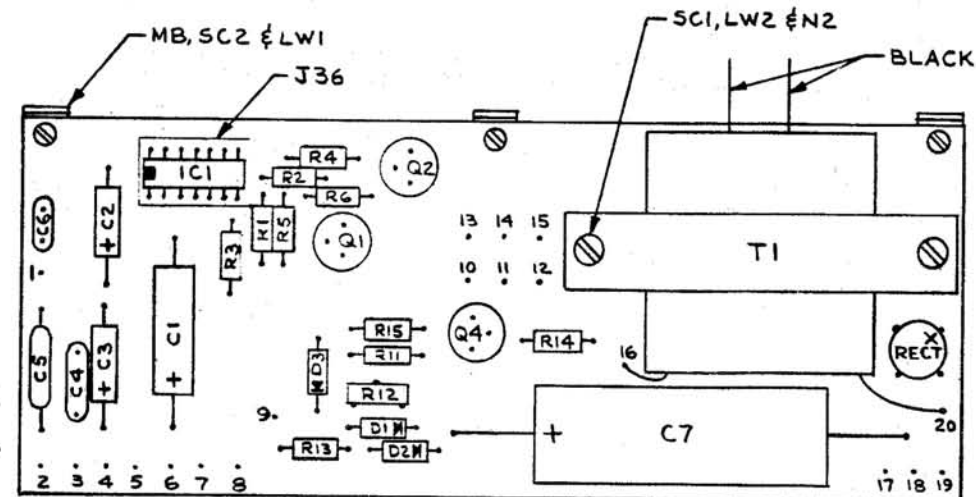


ASSEMBLY INSTRUCTIONS - DD1-K (continued)

V. Printed Circuit Board Assembly

A. Main PC Board (10904/10903) (See Figure 3)

1. Mount IC Socket per IB2 instructions in appropriate holes (S) _____
2. Mount Transformer using 6-32 x 1/4" screws, nuts and lockwashers - note that the black wires go to the outside of the board. Connect one green wire to hole #16 and the other to hole #20. (S) _____
3. Mount the 1/4W Resistors (S) _____
4. Mount the Trimpot (R12) (S) _____
5. Mount all the capacitors. Observe that polarity (+) signs conform to those on the Circuit Board (S) _____
6. Mount all the Semiconductors (Transistors, Diodes, and Rectifier Bridge) - use minimal heat. Observe that polarity (M) signs conform to those on the Circuit Board (S) _____
7. Insert IC1 (SN7405) into the Socket with the indented portion properly oriented _____
8. Mount the 3 Brackets to the Board; use 4-40 x 1/4" screws and lockwashers; make certain they are mounted per Figure 3 (with the tab toward the components) _____



COMPONENTS USED ON THIS BOARD

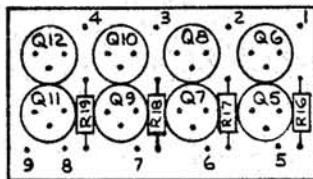
- PC1 - Main PC Board (10904/10903)
- J36 - IC Socket
- IC1 - SN7405 (Observe Polarity)
- C1 - 330 mfd. (Observe Polarity)
- C2 - 33 mfd. (Observe Polarity)
- C3 - 3.3 mfd. (Observe Polarity)
- C4 - .33 mfd.
- C5 - .03 mfd.
- C6 - .003 mfd.
- C7 - 3300 mfd. (Observe Polarity)
- D1, D2, D3 - 1N914 (Observe Polarity)
- Q1, Q2, Q4 - 2N3643 (Observe Rotation)
- Rect. - PF05 (Observe Polarity)
- R1 - 1K \sim
- R2 - 1K \sim
- R3 - 1K \sim
- R4 - 1K \sim
- R5 - 1K \sim
- R6 - 1K \sim
- R11 - 100 \sim
- R12 - 100 \sim Trimpot
- R13 - 100 \sim
- R14 - 150 \sim
- R15 - 220 \sim
- T1 - Transformer (Observe Rotation)
- SC1 - 6-32 - 1/4" Panhead Screws - 2 req'd
- LW2 - #6 Lockwashers - 2 req'd
- SC2 - 4-40 - 1/4" Panhead Screws - 3 req'd
- N2 - 6-32 Hex Nuts - 2 req'd
- MB - Mounting Brackets - 3 req'd

BOARD ASSEMBLY, MAIN PC BOARD

ASSEMBLY INSTRUCTIONS - DD1-K (continued)

D. Lamp Monitor Board (10906/10905) (See Figure 4)

1. Mount the 1/4W Resistors (S). _____
2. Mount the Transistors (S) _____
3. Connect buss wires approximately 3/4" long to holes #1, 2, 3, 4 (S) _____
4. Connect buss wires approximately 1/2" long to holes #5, 6, 7, 8 (S) _____
5. Connect a stranded wire 7" long to hole #9 (S) _____



COMPONENTS USED ON THIS BOARD

PC2 - Lamp Monitor Board (10906/10905)
 Q5 thru Q12 - 2N3643 (Observe Rotation)
 R16 thru R19 - 22 K

BOARD ASSEMBLY, LAMP MONITOR BOARD

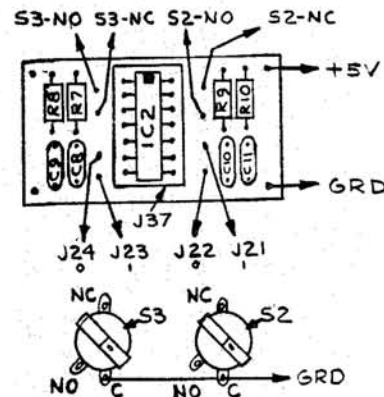
FIGURE 4

ASSEMBLY INSTRUCTIONS - DD1-K (continued)

C. The Pulser Board (10912/10911) (See Figure 5)

NOTE: Capacitors (.01 - 50 V have been added to the circuit for additional stability.

1. Mount the IC Socket per IB2 (S) _____
2. Mount the 1/4W Resistors (S) _____
3. Mount the .01 Capacitors (S) _____
4. Insert IC2 (SN7400) into the Socket with the indented portion properly oriented _____
5. Connect buss wire approximately 1-1/4" long to the appropriate holes on the Board (S) _____



NOTE: Orient Board so "+" symbol is on upper left corner (clad side).

COMPONENTS USED ON THIS BOARD

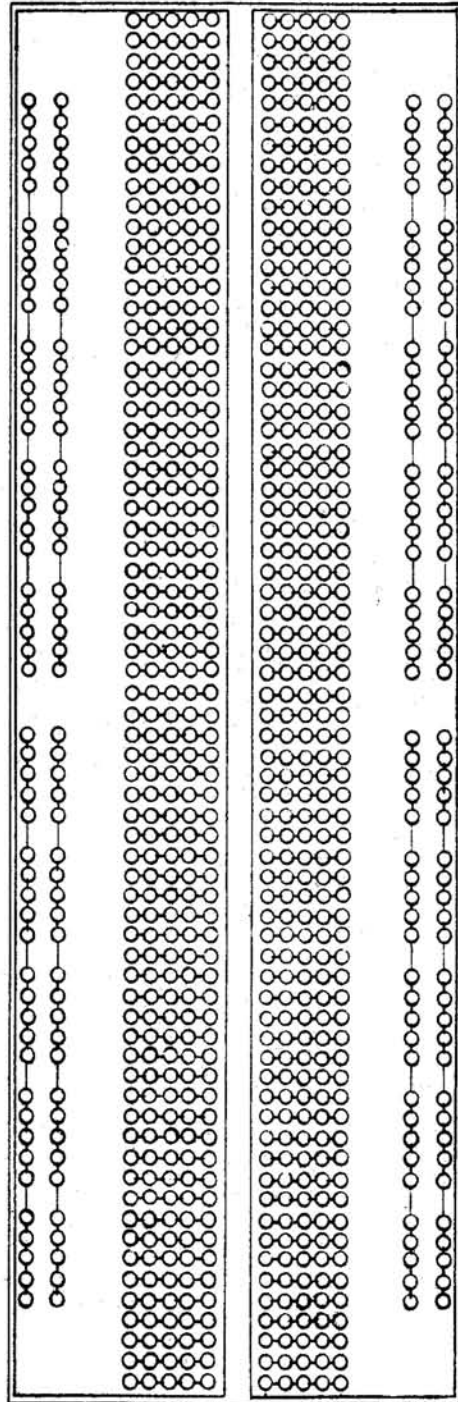
PC3 - Pulser Board (10912/10911)
 J37 - IC Socket
 IC2 - SN7400 (Observe Polarity)
 C8 thru C11 - .01 50V Capacitor
 R7 thru R10 - 1K Resistor

(S2 & S3 SHOWN FOR WIRING PURPOSES)

BOARD ASSEMBLY & WIRING, PULSER BOARD

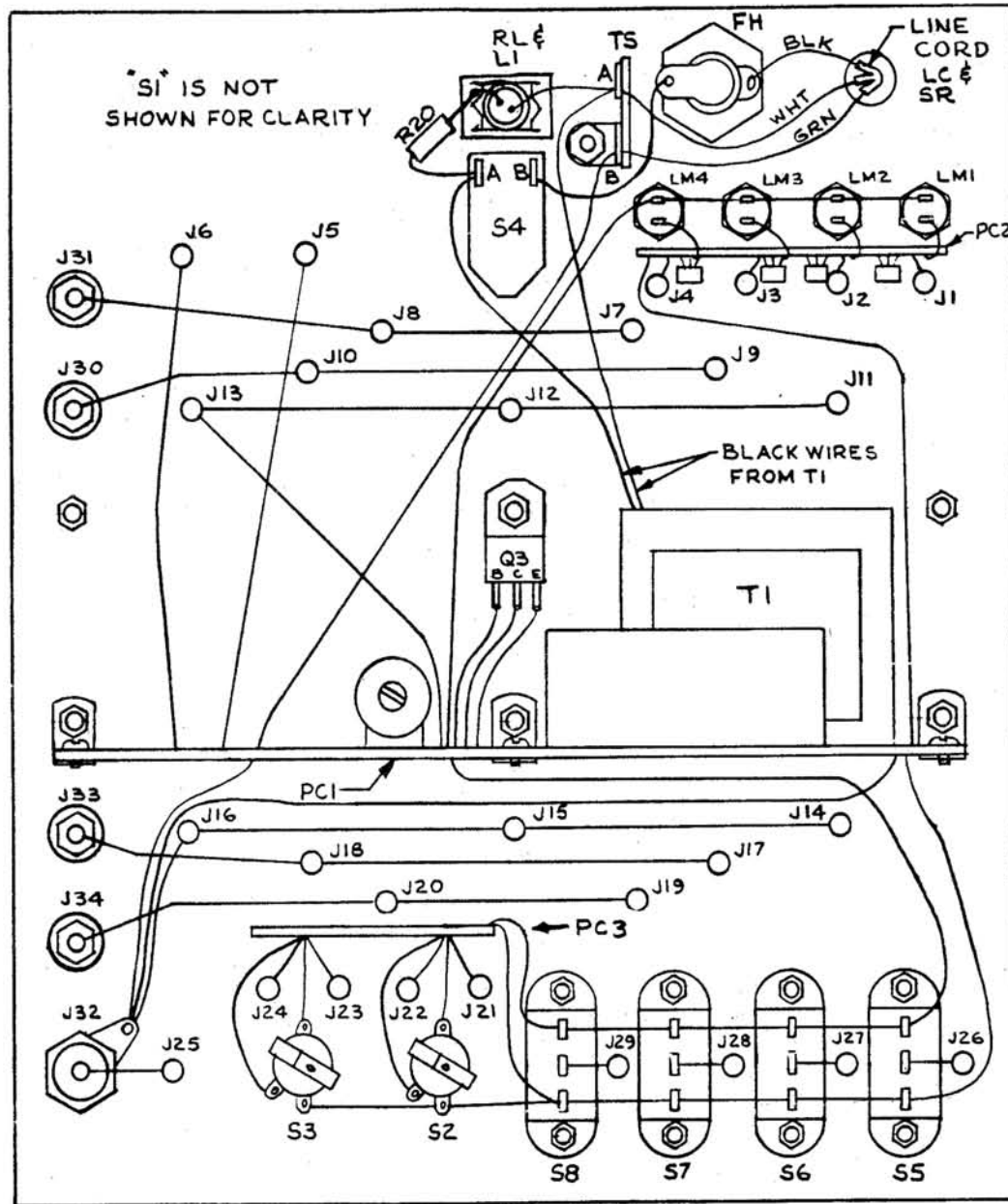
FIGURE 5

SK-10 SOCKET MATRIX CONFIGURATION



V. Panel Assembly/Wiring (See Figure 6)

1. Mount the Main Printed Circuit Board to the Panel by removing the lower set of nuts and lockwashers used to hold SK-10 Socket; put the Board in position per the diagram, now replace the lockwashers and nuts and tighten securely
2. Connect the Ground Breadboarding Pins (J14, J15, J16 and ground lug of J32) using buss wire. Solder Pins J14, J15, and J16 only.
3. Connect buss wire from the center terminals of the Logic Switches (S5 - S8) to the proper Breadboarding Pins (J26, J27, J28, J29) (S)
4. Feed through a buss wire and interconnect the upper row of terminals on the Logic Switches (S5 - S8) Solder S6 & S7 only.
5. Feed through a buss wire and interconnect the lower row of terminals on the Logic Switches (S5 - S8) and to the common terminals of S2 & S3. Solder S6 & S7 only.
6. Connect a buss wire from the center contact of J32 to Breadboarding Pin J25 (S)
7. Interconnect the +5V Breadboarding Pins (J11, J12, J13) but leave an excess of 5" of wire free from the left end (S)
8. Slip a piece of Sleeving over this free end; bring it to the Main PC Board, hole #13 (S)
9. Connect buss wire from the Binding Posts to the proper Breadboarding Pins (J30 to J10 & J9; J31 to J8 & J7; J33 to J18 & J17; J34 to J20 & J19); insulate the portion between the Binding Posts and the first Breadboarding Pins with Sleeving per Figure (S)
10. Connect a buss wire across the upper row of contacts on the Lamp Monitor (LM1, LM2, LM3, LM4) leaving 6" of bare wire on left (S)
11. This free portion is covered with Sleeving and connected to hole #14 on the Main PC Board (S)
12. The black leads from the Transformer are connected as follows:



PANEL ASSEMBLY, REAR VIEW

(AFTER COMPLETION OF STEP V33 THE ASSEMBLY AND WIRING SHOULD LOOK LIKE THIS)

FIGURE 6

- a. One (either one) goes to TS Terminal designated as "A" (See Figure 6) (The Ungrounded Lug)
 - b. The other goes to the On-Off Switch (S4) designated as "A"
13. The Power Cord is wired as follows:
 - a. White lead is connected to TS Terminal designated as "A" (The Insulated Terminal)
 - b. The green lead is connected to TS Terminal designated as "B" (The Grounded Lug)
 - c. The black lead goes to the lower Terminal on the Fuse Holder (S)
 14. Connect a jumper (#22 stranded wire) between the upper Terminal on the Fuse Holder and the On-Off Switch (S4), Terminal designated as "B" (S)
 15. A 100K Resistor (R20) is connected to Terminal designated as "A" of On-Off Switch (S4) and brought towards the top of the panel. Make the connection as short as possible (S)
 16. Insert the Neon Bulb NE2E (L1) into the Lens - it is held in place by compression - make sure the leads are properly spaced apart
 17. One of the leads from NE2E is wrapped around the free end of the Resistor (R20) Keep these wires as short as possible (S)
 18. The other end of the Bulb is brought to TS Terminal designated as "A" (S)
 19. Connect a jumper (#22 stranded wire) from TS Terminal designated as "B" to the ground lug of the BNC Connector (J32) Solder only Terminal designated as "B" (Note: Run wire under Main PC Board)
 20. Connect a jumper (#22 stranded wire) from hole #8 on Main PC Board to "normal" clock output Breadboarding Pin (J5) (S)
 21. Connect a jumper (#22 stranded wire) from hole #9 on Main PC Board to "inverted" clock output Breadboarding Pins (J6) (S)

ASSEMBLY INSTRUCTIONS - DD1-K (continued)

22. Mount the Lamp Monitor Board to the Breadboarding Pins - J1 to hole #5, J2 to hole #6 J3 to hole #7, J4 to hole #8 (S) _____
23. With buss wire, connect the free terminal of LM1 to hole #1, LM2 to hole #2, LM3 to hole #3, LM4 to hole #4 (S) _____
24. Connect the jumper (#22 stranded wire) from hole #9 to hole #19 on the Main PC Board (S) _____
 - a. Connect #22 stranded wire from pin marked number 7 on Switch (S1) (See Figure 7) (S) to Ground Lug of BNC (J32) (See Figure 6) _____
25. Connect a jumper (#22 stranded wire) from hole #17 on Main PC Board to the ground lug of the BNC (J32) (S) _____
26. Connect a jumper (#22 stranded wire) from hole #15 on Main PC Board to the extreme right terminal of the upper row of terminals on the Logic Switches (S) _____
27. Connect a jumper (#22 stranded wire) from hole #18 on Main PC Board to the extreme right terminal of the lower row of terminals on the Logic Switches (S) _____
28. Mount the Pulser Board using Sleeving over the buss wire - Connect to J21, J22, J23, J24 and connect to the Switches S2 & S3 - all per Figure 5 (S) _____
29. Connect +5V from the proper location on the Pulser Board to the extreme left terminal of the upper row of terminals on the Logic Switches (S) _____
30. Connect the ground buss wire from the proper location on the Pulser Board to the extreme left terminal of the lower row of terminals on the Logic Switches (S) _____
31. The TIP3055 (Q3) is connected by three 3" jumpers (#22 stranded wire) to the Main PC Board - use the diagram for terminal designation. Bend the terminals at right angles (See Figure 2). When soldering wires to these terminals, try not to use excessive heat. _____

ASSEMBLY INSTRUCTIONS - DD1-K (continued)

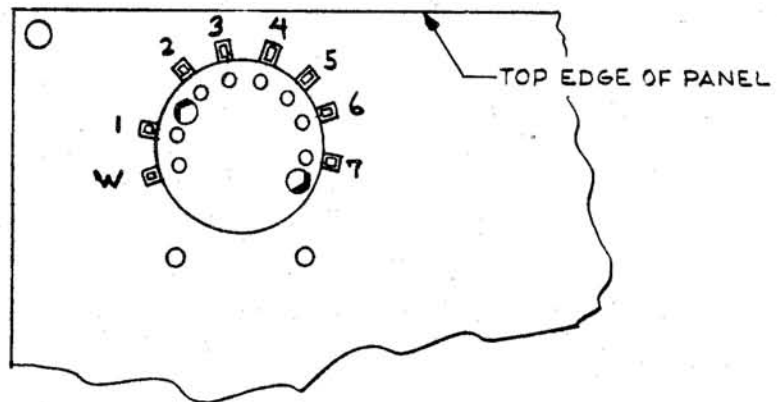
Connect the leads as follows:

- | | | |
|---------------------------|-------|-------|
| Emitter to hole #10 (S) | _____ | _____ |
| Collector to hole #12 (S) | _____ | _____ |
| Base to hole #11 (S) | _____ | _____ |
32. Tighten the other two nuts holding the SK-10 Socket. _____
 33. Using the stranded wire, connect the Clock Frequency Switch (S1) to the Main PC Board as follows (See Figure 7): _____
 - a. From hole #1 to Terminal 1 on Switch _____
 - b. From hole #2 to Terminal 2 on Switch _____
 - c. From hole #3 to Terminal 3 on Switch _____
 - d. From hole #4 to Terminal 4 on Switch _____
 - e. From hole #5 to Terminal 5 on Switch _____
 - f. From hole #6 to Terminal 6 on Switch _____
 - g. From hole #7 to Terminal "W" on Switch _____
 - h. From Terminal #7 on the switch, connect a jumper to Terminal B, the Grounded Lug on the Terminal Strip; this will guarantee no spurious oscillations in the "off" position for the clock switch. _____
 34. Mount the Knob to the Clock Frequency Selector Switch and adjust the pointer to the correct position. _____

NOTE: At this point, inspect the unit for missed solder joints, shorting of wires and loose hardware.

This completes the assembly except for mounting into the case.

After checkout and calibration, mount with six 6-32 x 1/4" screws. It may be necessary to open the mounting holes slightly to avoid a force fit. Use a "rat tail" file.



CLOCK FREQUENCY SWITCH (S1) TERMINAL DESIGNATIONS

FIGURE 7

VI. Checkout/Calibration

- A. Insert the Fuse in the Fuse Holder _____
- B. Plug in and turn on _____
 - 1. Pilot Light should go on _____
 - 2. Using VTVM (or equivalent) measure voltage between +5V and Ground Breadboarding Pins _____
 - 3. Adjust the 100 Trimpot (R12) to read 5.0 volts _____
 - 4. Check function of Lamp Monitors by taking 5V from Breadboarding Pins and connecting it to each Lamp Monitor in turn - the Light should shine brightly _____
 - 5. Check the Pulser as follows: _____
 - a. Run a jumper from "1" to Lamp Monitor _____
 - b. Run another jumper from "0" to another Lamp Monitor _____
 - c. The Lamp Monitor connected to "1" should light, the Lamp Monitor to the "0" should not light _____
 - d. Depressing the Pushbuttons should change state; the "on" light should go "off", the "off" light should go "on" _____
 - e. Both Pushbuttons should be checked in this manner _____
 - 6. The Clock can be checked out directly on the low frequency settings as follows: _____
 - a. Connect a Lamp Monitor to the "normal" output _____
 - b. Connect another Lamp Monitor to the "inverted" output _____
 - c. Set the Clock at 1 Hz. _____
 - d. One Lamp should blink "on/off" with one "on" while the other if "off" _____
 - e. Go to the 10 Hz. position, the Lamps should blink very quickly, but the "on/off" action is still seen _____
 - f. Go to the 100 Hz. position, the blinking should not be visible - the lights will be "on" at a low level _____

7. The Logic Switches can be checked by simply connecting each in turn to the Lamp Monitors - with the Switch "up", the lights should go "on"; with it "down" the lights should go "off"
8. A more thorough check can be accomplished with an oscilloscope to verify the "Bounce Free" nature of the Pulzers and the true frequency of the Clock (the dial setting is nominal - it can vary at least 25%)

If the above checks prove satisfactory, the Digi Designer is now useable for a strong circuit design aid.

VII. Trouble Shooting

- A. General - these circuits are individually quite simple. If a problem develops in either the Pulser or Lamp Monitor, usually substitution of components from good portions of the circuits can localize the problem and replacement parts procured.
- B. The Power Supply is extremely conservatively designed; it can deliver several hundred mils without losing regulation. Do not overload it by drawing more than 500 mils. If a problem occurs in the Supply, it will most likely involve a faulty semiconductor due to overheating.

VIII. Repairs

All repairs on the DDL-K done at the factory, and found due to defective components, will be done on a no charge basis for a period of ninety (90) days after the original shipping date of the kit.

After expiration of warranty period, repairs will be billed at materials cost plus (+) a flat labor charge of \$7.50 per kit.

EL Instruments will return unrepaired, any kit assembled with corrosive solders or fluxes.

IX. Shipping Information

If you should find it necessary to return your kit to the factory for repair, please pack carefully and ship prepaid to:

E & L Instruments, Inc.
61 First Street
Derby, Connecticut 06418
Attn: Kit Repair Dept.

The E & L Instruments, Inc., warrants that the parts supplied in its kits shall be free from defects in materials and workmanship under normal conditions of use and service. The obligation of E & L under this warranty is limited to replacing or repairing any parts upon verification that it is defective in this manner. The obligation is further limited to such defective parts for which E & L is notified of the defect within a period of ninety (90) days from the original date of shipment of the kit.

The foregoing warranty shall be deemed completely void if acid core solder or acid paste flux or other corrosive solders or fluxes have been used in assembling or repairing the kit product.

E & L will not repair any parts of any kit products in which corrosive solder or fluxes have been used.

