Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

LD-1

PENCILBOX™

LOGIC DESIGNER

INSTRUCTION MANUAL

80-01-0207
4/90

E&L Instruments
An Interplex Electronics Company
1486 Highland Avenue, Unit 2
Cheshire, CT 06410
(203)272-3285 FAX: (203)272-4330

By

E&L Instruments
An Interplex Electronics Company
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Cheshire, CT 06410
(203)272-3285 FAX: (203)272-4330

Printed in the United States of America

WARNING

FEDERAL REGULATION (PART 15 OF FCC RULES) PROHIBITS THE USE OF COMPUTING EQUIPMENT WHICH CREATES RADIO OR TV INTERFERENCE

Interplex Electronics specifically warns the user of this instrument that it is intended for use in a classroom or laboratory environment for the purpose of learning and experimentation. When building experimental circuits, it may emit interference that will effect radio and television reception and the user may be required to stop operation until the interference problem is corrected. Home use of this equipment is discouraged since the likelihood of interference is increased by the close proximity of neighbors.

CORRECTIVE MEASURES:

Interference can be reduced by the following practices.

1) Install a commercially built RFI power filter in the power line at the point where the cord enters the unit.

2) Avoid long wires. They act as antennas.

3) If long wires must be used, use shielded cables or twisted pairs which are properly grounded and terminated.

TABLE OF CONTENTS

INTRODUCTION

The E & L Instruments Pencil Box Logic Designer is a complete digital circuit design instrument. It can fullfill modest requirements for the design and study of gates, counters, multiplexers and can even interface directly to a microprocessor.

The unit contains 8 LED logic indicators, 8 logic switches, a clock and two debounced pushbuttons. The logic indicators are a "transparent latch" and thus serve the dual function of 8 independent logic probes or two four bit output ports which can be connected to a microcomputer. Similarly, the eight logic switches can serve the dual function of logic switches or two four bit input ports for interfacing to a microcomputer. The clock is fixed at approximately 1KHZ but can be varied by adding an external capacitor. *See Application notes

All of these functions are internally connected to a solderless interconnect socket with 5 tie points for each signal, In addition, an E & L instrument "SK-10 Solderless Breadboarding Socket" is permanently attached to the unit, thus providing a convenient work area for the circuitry being designed or studied. Both sockets allow insertion of components or wires up to 20 gauge. For components with larger diameter leads use E & L's BP24 adapter pins which can accept wire leads up to 16 gauge.

Power is supplied either internally by batteries, externally by an optional battery eliminator, or by an external 5 volt regulated supply.

The unit is housed in a durable and attractive plastic box with a hinged protective cover thus making it portable and stackable for storage purposes.

SPECIFICATIONS

A. POWER (1) 4 "C" batteries (not included)

(2) Optional 6VDC battery adapter, 300ma, unregulated

(3) User supplied 5VDC regulated supply, $\pm$ 5%, 300ma

B. CLOCK 1 khz $\pm$ 50% user variable with external capacitor

Logic "1" output current 1.2 ma @ 3.25V

Logic "0" output current 1.2 ma @ 0.25V

C. PULSERS Two fully debounced pushbuttons with logic true and complementary outputs

Logic "1" output current 400 microamps @ 2.4V min

Logic "0" output current 16 ma max @ 0.4V max

D. LOGIC SWITCHES (INPUT PORTS) Dual function: 8 switches buffered by two 4 bit tri-state buffers with separate enables

Logic "1" output current 2.6 ma max @ 2.4V min

Logic "0" output current 24 ma max @ 0.5V max

Enables

Logic "1" input current 400 microamps @ 5 volts

Logic "0" input current 20 microamps @ 0.2 volts

E. LOGIC INDICATORS (OUTPUT PORTS) (LAMP MONITORS) Dual function: 8 LEDs driven by two 4 bit latches with separate enables

Logic "1" input current 50 microamps @ 5 volts

Logic "0" input current none required

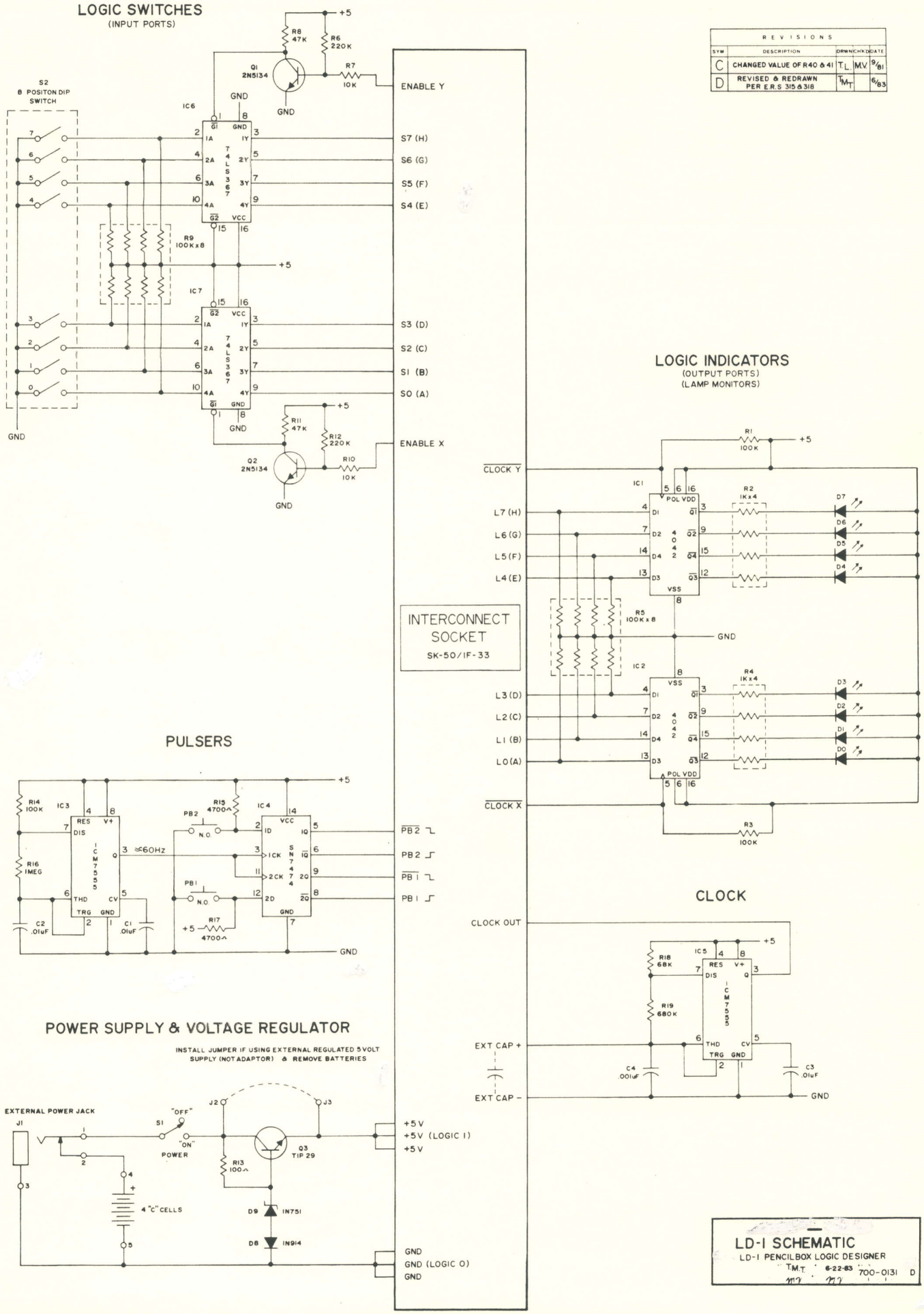
F. CONNECTORS All functions are permanently connected to a solderless tie point connector. Each tie point has five solderless connection points. Power and ground have 15 connection points each. All tie points are labeled.

G. BREADBOARDING One E&L Instruments SK-10 solderless breadboarding socket is permanently attached to the unit. The SK-10 can accommodate up to eight 14 pin DIP ICs with 4 tie points per pin plus 8 power rails with 25 tie points each.

H. PHYSICAL

Length	10 in	25.4 cm
Width	7.5 in	19.05 cm
Height	2.562 in	6.51 cm

I. Weight (less batteries and adaptor) 1 lb 6 oz


LOGIC SWITCHES
(INPUT PORTS)
S2
8 POSITON DIP SWITCH
Q1 2N5134
R8 47K
R6 220K
R7 10K
ENABLE Y
IC6
74LS367
S7 (H)
S6 (G)
S5 (F)
S4 (E)
R9 100K x 8
IC7
74LS367
S3 (D)
S2 (C)
S1 (B)
S0 (A)
Q2 2N5134
R11 47K
R12 220K
R10 10K
ENABLE X
GND
+5
REVISIONS
SYM DESCRIPTION DRWN CHK DATE
C CHANGED VALUE OF R40 & 41 TL MV 9/81
D REVISED & REDRAWN PER E.R.S 315 & 318 TMT 6/83
LOGIC INDICATORS
(OUTPUT PORTS)
(LAMP MONITORS)
R1 100K
CLOCK Y
IC1
4042
R2 1K x 4
D7
D6
D5
D4
L7 (H)
L6 (G)
L5 (F)
L4 (E)
R5 100K x 8
INTERCONNECT SOCKET
SK-50/1F-33
IC2
4042
R4 1K x 4
D3
D2
D1
D0
L3 (D)
L2 (C)
L1 (B)
L0 (A)
CLOCK X
R3 100K
PULSERS
R14 100K
R16 1MEG
C2 .01uF
C1 .01uF
IC3
ICM7555
≈60HZ
R15 4700Ω
R17 4700Ω
PB2
PB1
N.O.
IC4
SN74174
PB2
PB2
PB1
PB1
CLOCK
CLOCK OUT
R18 68K
R19 680K
IC5
ICM7555
EXT CAP +
EXT CAP -
C4 .001uF
C3 .01uF
POWER SUPPLY & VOLTAGE REGULATOR
INSTALL JUMPER IF USING EXTERNAL REGULATED 5 VOLT SUPPLY (NOT ADAPTOR) & REMOVE BATTERIES
EXTERNAL POWER JACK
J1
S1
"OFF"
"ON"
POWER
J2
J3
Q3 TIP 29
R13 100Ω
4 "C" CELLS
D9 IN751
D8 IN914
+5 V
+5 V (LOGIC 1)
+5 V
GND
GND (LOGIC 0)
GND
LD-1 SCHEMATIC
LD-1 PENCILBOX LOGIC DESIGNER
TMT 6-22-83 700-0131 D

GENERAL ASSEMBLY PRACTICES

A. Most of your kit items have been packed in plastic bags. Check the contents of the bags against the BILL OF MATERIAL LISTING to insure that all of the correct parts are in your kit. Inspect packing material for any loose parts before discarding.

Please bring all shortages or discrepancies to the immediate attention of E & L Instruments as this helps us correct errors and make a better kit for the next person.

B. Excessive heat can damage solid state devices. Avoid soldering with guns or irons which exceed 35 watts.

C. Use only rosin core solder. The use of corrosive solders such as acid core or pastes or fluxes voids any and all warranties on your kit.

D. We recommend that you use a yellow high-lighter pen on the CONSTRUCTION FIGURES to mark off items as you assemble the kit. This simple bookkeeping method allows you to put the kit aside and pickup where you left off at another time in an orderly fashion.

E. Electronic devices of similar function often come in different form. Please study the COMPONENT IDENTIFICATION DIAGRAMS to become familiar with the various types of devices which are apt to be supplied in your kit before actual construction.

F. Some Integrated Circuits (ICs) are easily damaged by STATIC ELECTRICITY! These ICs are packed on black conductive foam. Use the following precautions when handling such ICs.

1) Do NOT remove the IC from the conductive foam until you are actually ready to install it into the circuit.
2) Avoid carpeting or other furnishings that promote static build up.
3) Ground soldering tips and test equipment before contacting such ICs.

SOLDERING TIPS

The quality of your unit is going to depend on the quality of your assembly and soldering techniques. We have outlined, below, some standard practices that you should adhere to.

1 There is more to a soldered connection than two or more pieces of metal held together by a "blob" of solder. When molten solder is applied to a metal, the solder actually disolves some of the metal's surface. Thus, metals which have been soldered together are bonded by a solidified solution of solder and parts of the metals which were joined. Soldering is an easy task, but it is a task that must be done correctly. If your soldering techniques are poor you will have a great deal of trouble with the kit that you are about to assemble.

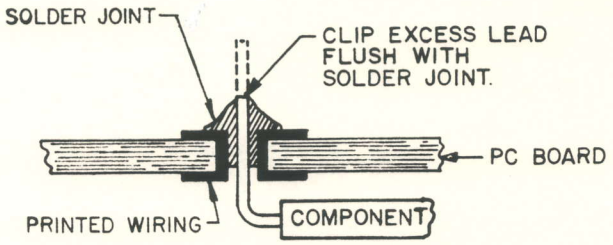
2 In order for molten solder to perform its function of joining metals together, the oxides on the surfaces of the metals must be removed. The oxides are removed by a FLUX. A flux is a material which, when heated, dissolves surface oxides and suspends them away from the surface of the metal. With the surface oxides removed, the molten solder can dissolve some of the surface metal and bond itself tightly to the metal.
We recommend the use of Rosin flux core solder with a mixture of 63% tin and 37% lead. This is the only mixture that goes directly from liquid state to solid state thus, bypassing the plastic state which causes cold solder joints.

3 A good solder connection is made in two steps: The first step is to make the mechanical connection. Then the molten solder is applied to the connection. After you have stripped a wire, always check to see that the wire is clean and free from heavy oxidation, grease or oil. Oxidation can be scraped off, and oil or grease can be removed with a rag. Steel wool or sandpaper is excellent for cleaning badly oxidized wires. Stranded wire should be tinned (covered with solder) to prevent the bare ends from fraying and possibly causing a short circuit.

The next step in making a solder connection is to secure the wire or wires to the terminal or lug. The wire should make sufficient contact with the terminal or lug, but should not be tightly fastened. The solder will provide both mechanical strength and a low resistance junction.

After the mechanical connections are complete, the next step is to apply the solder. First heat the mechanical connection, with the iron, to allow the solder to flow on the hot metal. Apply the solder to the point where the iron meets the contact to be soldered. The flux should melt and flow freely over the contact, dissolving all oxides, and aiding heat transfer from tip to connection. The solder should then melt and flow freely, covering the area to be soldered. Make sure you apply enough solder to cover the contact.

4 To prepare p.c. boards for soldering, clean the area to be soldered on the printed wiring by rubbing with a pencil eraser, and clean the component leads with a piece of steel wool. Place the component on the board, on the side with the nomenclature printed on it, with the leads extending through the holes indicated for the component. Flip the board over and solder the leads. The same general rule for soldering conventional circuitry should be adhered to.

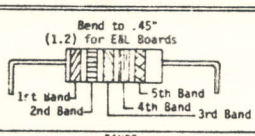


807-0021-2

RESISTOR IDENTITICATION

Resistor Color Code Chart #1

3 significant figures (1%)



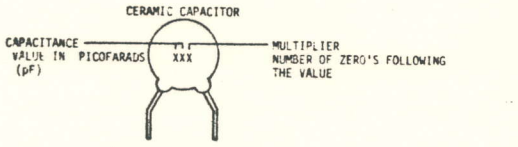
Color	BANDS				
	1st	2nd	3rd	4th	5th
Black	0	0	0	X 1.0	
Brown	1	1	1	X 10	1%
Red	2	2	2	X 100	.1%
Orange	3	3	3	X 1000	.01
Yellow	4	4	4	X 10000	.001%
Green	5	5	5	X 100000	
Blue	6	6	6	X 1000000	
Purple	7	7	7	--	
Grey	8	8	8	--	
White	9	9	9	--	
Gold	-	-	-	÷ 10	
Silver	-	-	-	÷ 100	
-----	-	-	-		

Resistor Color Code Chart #2

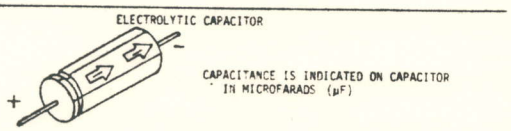
Color	BANDS				
	1st	2nd	3rd	4th	5th
Black	0	0	X 1.0	-	
Brown	1	1	X 10	-	
Red	2	2	X 100	-	
Orange	3	3	X 1000	-	
Yellow	4	4	X 10000	-	
Green	5	5	X 100,000	-	
Blue	6	6	X 1000,000	-	RC=MIL-R-39008
Purple	7	7	--	-	
Grey	8	8	--	-	
White	9	9	--	-	
Gold	-	-	÷ 10	-÷ 5	
Silver	-	-	÷ 100	-÷ 10	
-----	-	-	-	-÷ 20	RC=MIL-R-11

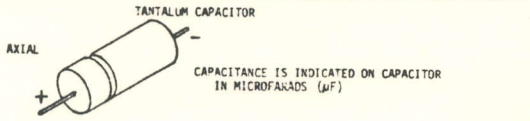
807-0001

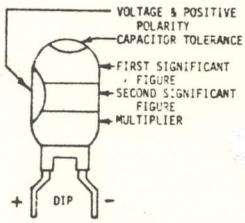
CAPACITOR IDENTIFICATION



EXAMPLES: 103 = 10000 pF OR .01 µF
302 = 3000 pF OR .003 µF
676 = 67000000 pF OR 67 µF





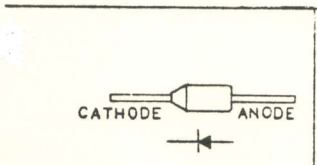


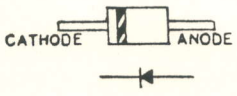
COLOR	VOLTAGE	VALUE	MULTIPLIER
BLACK	4	0	
BROWN	6	1	
RED	10	2	
ORANGE	15	3	
YELLOW	20	4	10000
GREEN	25	5	100000
BLUE	35	6	1000000
VIOLET	50	7	10000000
GRAY	———	8	———
WHITE	———	9	———

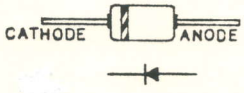
CAPACITANCE MAY BE MARKED ON CAPACITOR IN MICROFARADS (µF) OR BY COLOR CODE IN PICOFAPADS (pF)

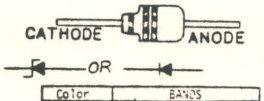
807-0005

DIODE & LED IDENTIFICATION

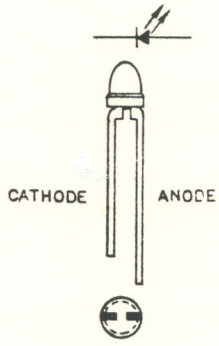


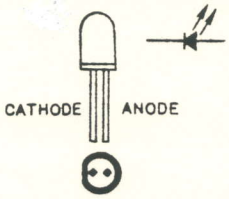






Color	BANDS		
	1st	2nd	3rd
Black	0	0	0
Brown	1	1	1
Red	2	2	2
Orange	3	3	3
Yellow	4	4	4
Green	5	5	5
Blue	6	6	6
Purple	7	7	7
Grey	8	8	8
White	9	9	9

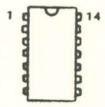




807-0010

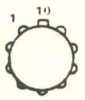
IC IDENTIFICATION

TOP VIEW



14 PIN DIP

8 PIN CAN

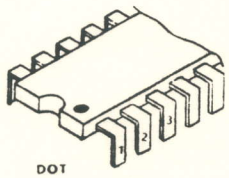


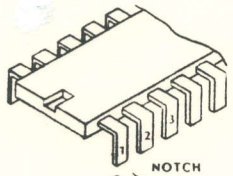
10 PIN CAN

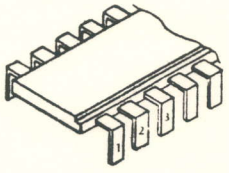
PIN COUNT IS SEQUENTIAL IN A COUNTERCLOCKWISE FASHION

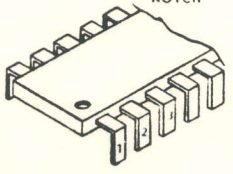
PIN 1 LOCATION

CAN STYLE TAB IS ALWAYS PLACED ON HIGHEST PIN NUMBER WITH PIN 1 TO THE LEFT SIDE



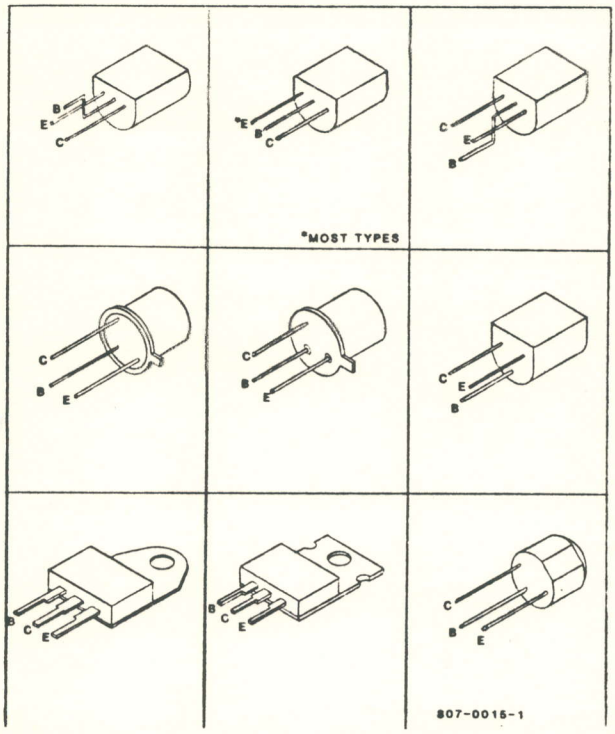


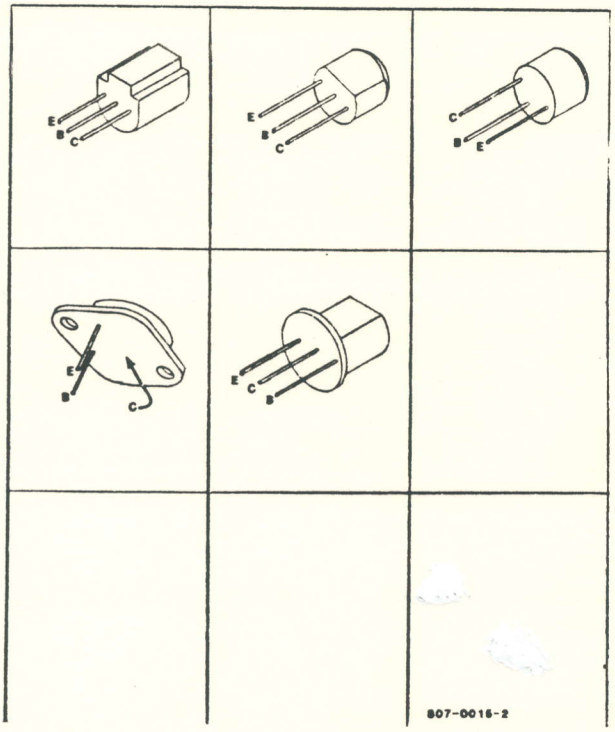




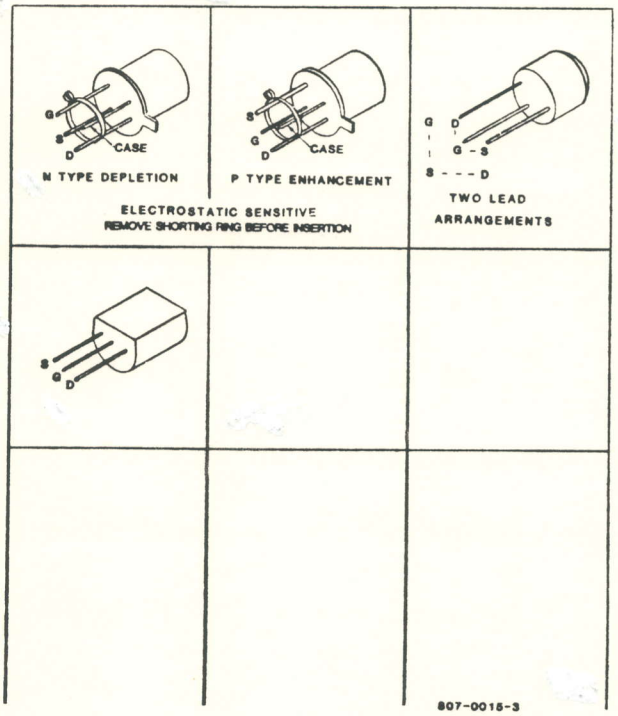
807-0030

TRANSISTOR IDENTIFICATION



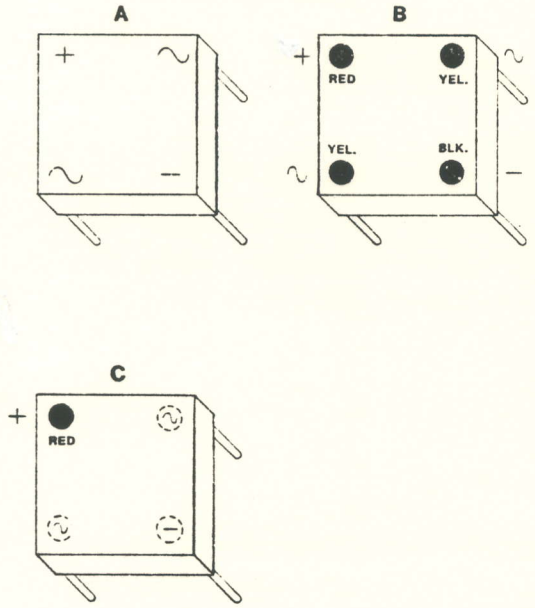


F.E.T. IDENTIFICATION



FULL WAVE BRIDGE RECTIFIER IDENTIFICATION

CASES MAY BE EITHER SQUARE OR ROUND



CONSTRUCTION

Note: For convenience of construction remove figures 1 thru 12 from manual.

A. Assemble PC board as per figures 1 thru 6 as follows:

1. Install all resistors; solder; clip leads flush to board.
2. Install LEDs. Leave 1/8" space between the bottom of the LED and the top of board to prevent damage to LED when soldering. Note polarity; solder; clip.
3. Install remaining diodes; note polarity; solder; clip.
4. Install IC's one at a time; note orientation; solder; clip.
5. Install 8 position DIP switch; note "open" position; solder; clip.
6. Install transistor Q3 (see Fig. 2); solder; clip.
7. Install remaining transistors one at a time; note orientation; solder; clip.
8. Install pushbuttons (PB1 & PB2); solder; clip.
9. Install all capacitors; solder; clip.
10. Install SK-50/IF33 socket carefully. Be certain that ALL pins protrude through the PC board. Secure as shown in Fig. 3; solder; clip.
11. Attach self stick I/O label to SK-50/IF33 as shown in Fig. 4. Carefully align signal names with tie points of SK-50/IF33.
12. Secure SK-10 socket and nylon flex clip as shown in Fig. 5. Make sure clip is perpendicular to front edge of PC board.
13. Install power switch.
14. Install and wire power jack (see Fig. 6).

B. Final Assembly

1. Install 4 rubber feet in plastic housing (see Fig. 7).
2. Install battery holder (see Fig. 8).
3. Attach battery holder wires (see Fig. 9).
4. Attach PC board (see Fig. 10).
5. Affix self stick labels to the top of the plastic housing (see Fig. 11 & 12).

C. Hinge Operation

The front edge of the PC board can be swung up as much as 6 inches for access to batteries and spare parts bag.

1. Raise PC board by pulling it up at the front right corner.
2. Lock PC board by guiding nylon clip under lip of plastic housing with finger.

D. Component Container

Locate the vinyl ziplock bag and the 1x3" piece of conductive foam. Use the ziplock bag to store components for experiments and use the conductive foam to store static sensitive IC's. Place the foam in the bag (so it doesn't get lost) and place the bag in the box under the P.C. board for convenient storage.

CHECKOUT

1. Inspect the unit for missing parts, improper part orientation, cold solder joints etc.. Correct any obvious problems before proceeding.

2. Power Section - Battery Operation
Install four fresh "C" cells in accordance with orientation shown on the battery holder. Turn POWER switch to On and check for +5VDC between "+5" and "GND" on interconnect socket. This voltage may vary with the condition of the batteries but should be in the range of 4.5 to 5.5 volts.

   OPTIONAL - Battery Adaptor Operation
   Plug battery adaptor into JI then in wall outlet. Turn POWER switch to On and check for +5VDC between "+5" and "GND" on interconnect socket. Voltage should be in the range of 4.5 to 5.5 volts.

   OPTIONAL - User Supplied +5
   Remove batteries and battery adaptor. Install jumper between J3 and J2. Connect user power supply to a 1/8" phone plug with +(positive) at tip of plug. User supply should be +5VDC plus or minus 5% (4.75 to 5.25 Volts). Plug user supply into J1. Turn POWER switch to "ON" and check for user voltage between "+5" and "GND" on interconnect socket.

3. Scope CLOCK OUT on interconnect socket.

Frequency	500 to 1500 HZ
Amplitude	4 to 5.5 volts
Duty cycle	40 to 60%

4. LOGIC INDICATORS

   a) All 8 LEDs should be off.
   b) Jumper LO(A) to LOGIC 1 on interconnect socket.
   c) "DO" should lite up, all others should be off.
   d) Move jumper to L1(B).
   e) D1 should lite up, all others should be off.
   f) Test remaining signals - L2(C) thru L7(G) - in like fashion.

5. PULSERS

   a) Jumper LO(A) to PB1
   b) "DO" should light when PB1 is depressed.
   c) Move jumper to $\overline{PB1}$.
   d) "DO" should go out when $\overline{PB1}$ is depressed.
   e) Checkout PB2, $\overline{PB2}$ in like fashion.

6. LOGIC SWITCHES (Note: Do not use GRAPHITE PENCIL TO MOVE SWITCHES!!!)

   a) Jumper LO(A) to SO(A).
   b) Set switch "O" so that "DO" is lit. This is defined as the OPEN position.
   c) Set all 8 switches to OPEN.
   d) Jumper all 8 indicators, LO(A) thru L7(H) to corresponding switches SO(A) thru S7(H). Each LED should light up when it is connected.
   e) Move each switch to not OPEN then to OPEN, noting that only the corresponding LED went out.
   f) Leave wires connected.

7. LATCH TEST

   a) Jumper $\overline{\text{CLOCK}}$ X to PB1.
      Jumper $\overline{\text{CLOCK}}$ Y to PB2.
      All LEDs should be lit.
   b) Set switch "O" thru 3 to not OPEN.
      All LEDs should be lit.
      Press and release PB1; "DO" thru D3 should go out.
   c) Set switch 4 thru 7 to not OPEN.
      D4 thru D7 should still be lit.
      Press and release PB2; D4 thru D7 should go out.
      Remove CLOCK jumpers.

8. INPUT PORT TEST

   a) Jumper ENABLE X to PB1.
      Jumper ENABLE Y to PB2.
      All LEDs should be out.
   b) Set all 8 switches to OPEN.
      All LEDs should still be out.
      Press and hold PB1: "DO" thru D3 should light.
      Release PB1: "DO" thru D3 should go out.
      Press and hold PB2: D4 thru D7 should light.
      Release PB2: D4 thru D7 should go out.

9. Turn POWER switch OFF: Unit should not function.

CHECKOUT COMPLETED

BILL OF MATERIAL LISTING

BOM # 325-4301 LD-1/K PENCIL BOX KT

LINE	COMPONENT	DESCRIPTION	QTY	LVL
1	17-01-0006	BOM REV G		1
2	02-05-0330	SOLID STATE BAG		1
3	05-03-0211	LD-1 PC BD ASSY		2
4	44-01-0059	RCA CD4042AE	2	2
5	44-01-0148	ICM7555IPA	2	2
6	44-01-0130	SN7474	1	2
7	44-01-0097	74LS367	2	2
8	30-01-5134	2N5134 XSTR-NPN	2	2
9	30-01-0004	TIP29 XSTR W/HDW	1	2
10	10-01-4148	IN4148 DIODE	1	2
11	10-01-0751	1N751A 5.2V 5% 400MW	1	2
12	94-03-0067	COMPONENT CONTAINER	1	2
13	15-01-0049	ANTI-STAT FOAM 1.5 X 3	1	2
14	66-00-0131	FOAM IN BAG		2
15	95-01-0203	LD-1 PC BD R/J	1	2
16	10-02-0018	MINI RED LED 100 CENT*	8	2
17	02-05-0322	RESIST AND CAP BAG		1
18	37-01-6845	CCRES 1/4W 680K OHM 5%	1	2
19	37-01-2245	CCRES 1/4W 220K OHM 5%	2	2
20	37-01-1045	CCRES 1/4W 100K OHM 5%	3	2
21	37-01-6835	CCRES 1/4W 68K OHM 5%	1	2
22	37-01-4735	CCRES 1/4W 47K OHM 5%	2	2
23	37-01-1035	CCRES 1/4W 10K OHM 5%	2	2
24	37-01-4725	CCRES 1/4W 4.7K OHM 5%	2	2
25	37-01-1055	CCRES 1/4W 1MEG OHM 5%	1	2
26	37-01-1015	CCRES 1/4W 100 OHM 5%	1	2
27	37-08-0001	1K SERIES SIP 4RES	2	2
28	37-08-0003	100K COM SIP 9 RES	2	2
29	08-04-0103	CER CAP .01 MFD. 50V	3	2
30	08-04-0102	CER CAP .001 MFD 50V	1	2
31	02-05-0325	MISCELLANEOUS BAG		1
32	40-09-0001	8 POSN DIP SWITCH	1	2
33	40-03-0025	SPDT PC SLIDE CUST *	1	2
34	40-04-0025	SPST PC MNT MOM PB MDP	2	2
35	20-03-0119	MINI-JACK (RS274-297)	1	2
36	02-03-0018	SK-50 IF-33 HF SKT R/-	1	2
37	02-03-0001	SK10-PLI UNIV SKT NEW	1	2
38	88-02-0004	NYL FLK CLP	1	2
39	77-01-0162	LD-1 SOCKET LABEL	1	2
40	66-00-0134	LBR HDWR BG LD-1/K R/-	1	1
41	84-01-0001	6-32X5/16SLFTD BLK	2	2
42	84-04-0002	4-40 X 5/8" FL HD. SC	6	2
43	84-03-0008	4-40 X 1/4" PAN HD. SC	1	2
44	86-02-0004	4-40 HEX NUT	7	2
45	85-02-0013	#4 SPLIT LW 1/32	6	2
46	85-01-0033	#4 FLATWASHER	1	2

BILL OF MATERIAL LISTING

BOM # 325-4301 LD-1/K PENCIL BOX KT

LINE	COMPONENT	DESCRIPTION	QTY	LVL
47	02-05-0378	HOUSING BAG		1
48	05-03-0207	LD-1 HOUSING ASSY		2
49	94-03-0088	HSNG AIRMLD RH 2 3/8	1	3
50	86-05-0001	TINRMN FAST C13090-6A	2	3
51	45-01-0005	BATT HLDR PLAS	1	3
52	15-01-0051	DOUBLE SIDE TAPE-INCH	4	3
53	92-01-0009	RBBR BMPRS SMITH #2451	4	3
54	77-01-0161	LD-1 PACKAGE LABEL R/A	1	3
55	77-01-0163	LD-1 BLK DGRM LBL R/C	1	3
56	80-01-0162	WARRANTY & REPAIR INFO	1	3
57	80-01-0207	LD-1 MANUAL R/F	1	3

For Capacitor C4 Installed

External capacitor	Frequency (HZ)
100 picofarad	917
.001 microfarad	505
.01 microfarad	92
.1 microfarad	10
1.0 microfarad	1
10 microfarad	.1

For Capacitor C4 Removed

100 picofarad	10000
.001 microfarad	1000
.01 microfarad	100
.1 microfarad	10
1.0 microfarad	1
10 microfarad	.1

COMPONENT PLACEMENT

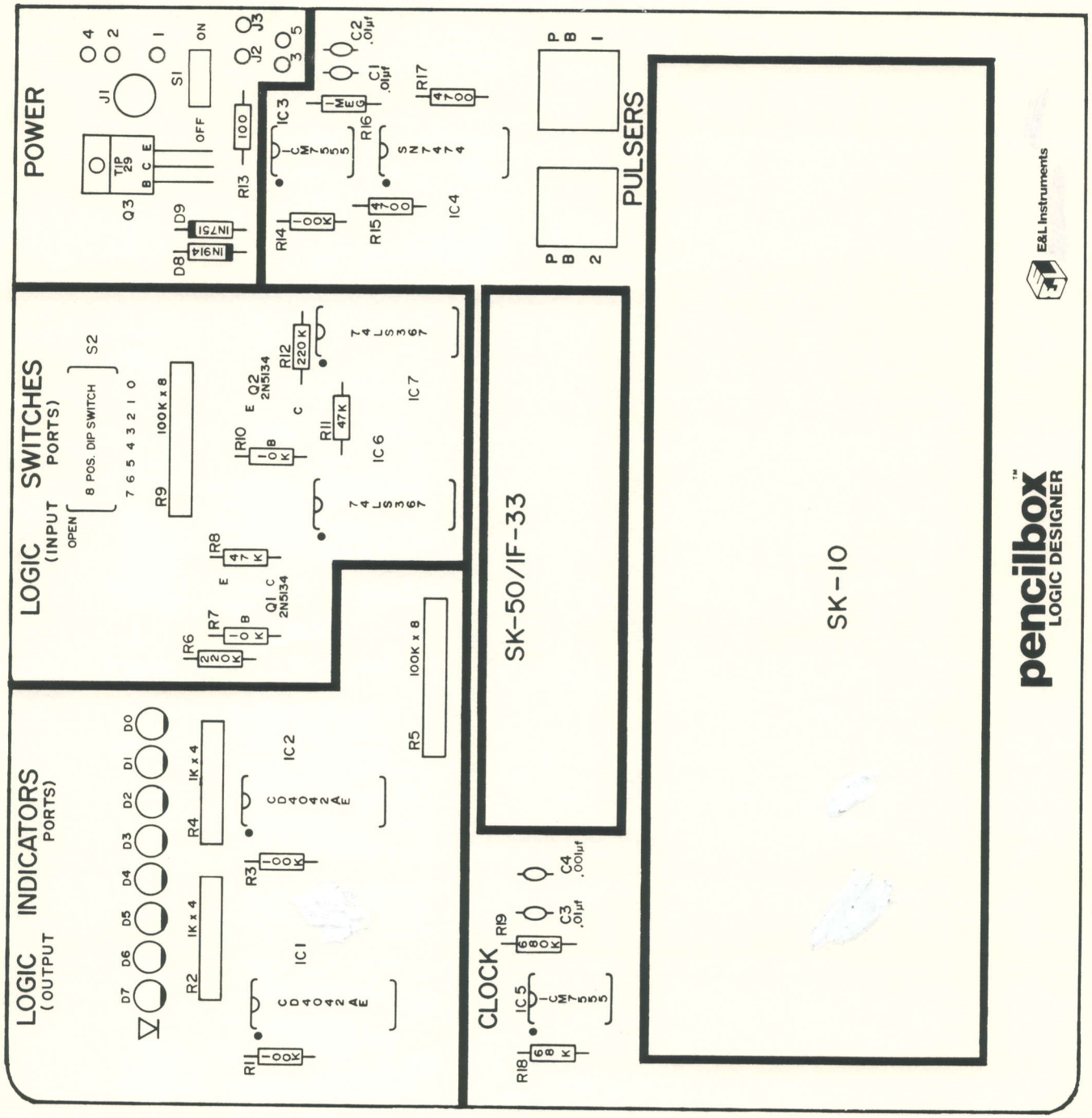


FIG.1

FIG.2

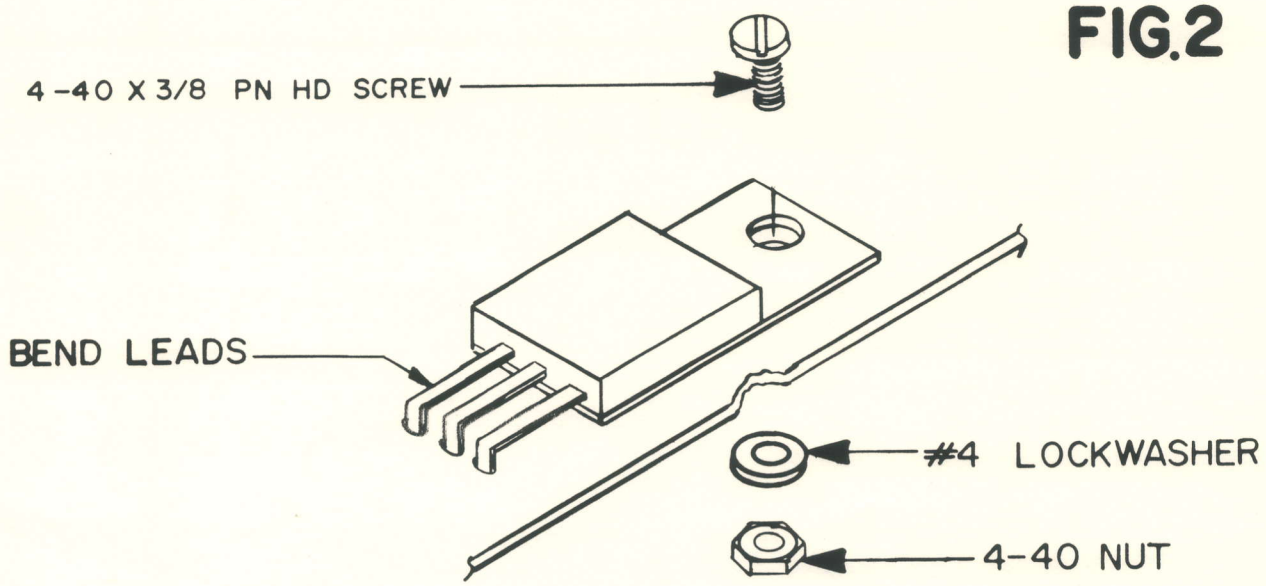


FIG.3

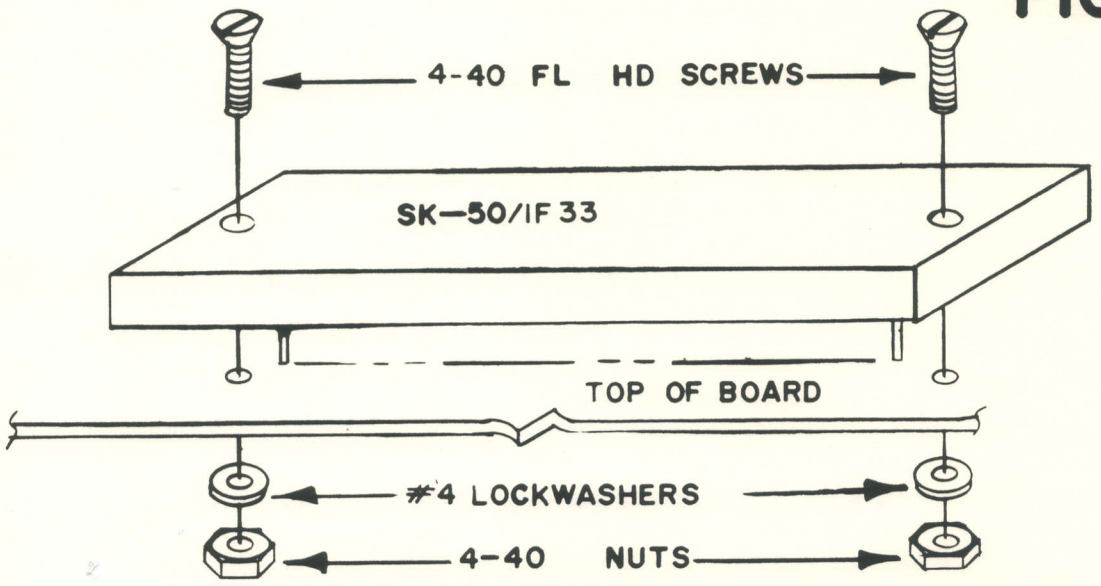


FIG.4