

# DD-1 DIGI-DESIGNER

## INSTRUCTION MANUAL

**FCC**

801-0002

3-30

REV. K



E & L INSTRUMENTS, INCORPORATED  
61 FIRST ST. — DERBY, CT. 06418

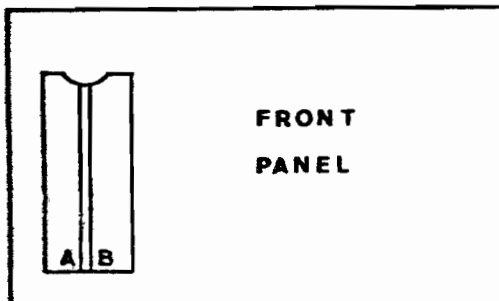
A D D E N D U M

8 Jan 82

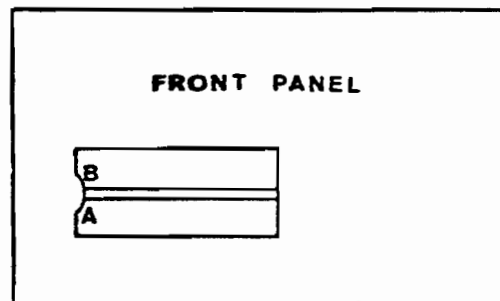
We have changed the value of C9 from 1 mfd to 10 mfd  
(E&L part # 524-0033)

E & L Instruments is now supplying two styles of SK-10 Solderless Breadboarding Sockets- notched and non-notched.

While the non-notched SK-10 socket can be mounted with any orientation, it's helpful to mount the notched socket as shown below. On instruments that have a vertical mount, the socket should be attached with the notch up, however, in a horizontal mount, the socket should be attached with the notch on the left. This arrangement allows for convenient use of the sequentially numbered socket rows A and B when making preliminary circuit diagrams or when recording a circuit's configuration for future reference.



VERTICAL MOUNT



HORIZONTAL MOUNT

As always, all E & L Instruments SK-10 Solderless Breadboarding Sockets carry a Lifetime Guarantee. No questions asked.

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## I. INTRODUCTION

- A. The E & L Instruments Digi-Designer (DD-1) is a complete digital circuit design instrument that will meet all of your requirements for digital circuit work. It will handle both IC and discrete components without soldering; connections are made using any solid 22 gage insulated wire. The unit includes a regulated 5 V DC power supply, a selectable frequency clock (pulse generator), dual bounce free pushbuttons (pulsers), four switches for applying voltage or ground as required, four L.E.D. logic lamp monitors, and E & L's unique SK10 universal component socket.
- B. The SK10 socket is basically a matrix of 64 pairs of common contacts (5 per strip) arranged symmetrically; combined with 8 buss strips running along the length of the socket (40 contacts per strip). On the last page of this manual there is a print of the SK10 socket for your reference and/or preliminary sketching. The socket allows the user to insert all electronic components with lead diameters up to 20 gage wire. For very large components, we recommend the use of E & L's BP24 Adapter Pins, which accept leads up to 16 gage wire. When inserting DIP IC's, be certain to preset the leads at the correct spacing. Insert one side partially in, then roll the second set of leads into the other side, then press squarely down seating the IC properly.
- C. The major portion of this manual is dedicated to the actual assembly instructions, for those of you who have purchased the DD-1 in kit form. Whether in kit form or factory assembled, you will find the suggested uses in the back of this manual to be very helpful in making use of your Digi-Designer to conveniently design, assemble, and test relatively complex digital circuits, even a small computer, WITHOUT SOLDERING, and in only a few minutes.

II. SPECIFICATIONS:

A. Line Voltage 105 to 125 VAC or 210 to 250 VAC.

B. Power Supply:

Output - 5 volt DC ( $\pm 5\%$ )  
1/2 amp external

C. Clock:

Six frequencies - nominal outputs, 1, 10, 100, 1K, 10K,  
and 100K Hz.

Outputs - normal and inverted TTL compatible

D. Switches:

2 debounced pushbutton (logic 0/logic 1)  
4 SPDT Slide Switches to apply ground or 5 volts to the circuit  
1 SPST Power Switch w/integral light

E. 4 Logic Lamps:

On - greater than 2.5V  
Off - less than .5V  
Input Impedance - 6K ohms

F. Connectors:

One SK10 socket (will accept up to 8-14 pin DIP IC's)  
Four - 5 way binding posts/2 uncommitted  
Twenty-Two BP-22 solderless breadboarding pins  
Two IN/OUT BNC Connectors

G. Physical:

3.5" h (8,9cm) x 7.6" w (19,3cm) x 9" L (22,9cm)  
5 pounds (2,27 kg)  
slope - 17°

### III. ASSEMBLY INSTRUCTIONS, GENERAL

- A. The material has been preppacked 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.

Bring 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 this time - other wires will be brought to that point and if solder is applied too early, the assembly will be much more difficult.
2. 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 larger wattage iron should not be used.
3. 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.
4. Use rosin core solder only. The use of corrosive (acid core) solder or paste fluxes voids any and all warranties on the unit.
5. 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)
6. Terminal #1 on an IC is either a dot or an indentation. The dark band on a diode denotes the cathode end. On an L.E.D. the cathode (negative) lead is indicated by a flat or a notch on the flange.

#### IV. REPLACEMENT PARTS LIST

PACKING BAG	MANUAL DESIG.	DESCRIPTION	QTY	P/N	CHECK
HARDWARE BAG	SC1	4-40x5/8" Flat Hd. Screw	6	605-0033	
	SC2	4-40x1/4" Pan Hd. Screw	12	605-0025	
	-	6-32x1/2" Pan Hd. Screw	2	605-0007	
	-	*** 6-32x5/16" Self-Tap Screw	4	605-0038	
	N1	4-40 Hex Nut	10	606-0006	
	-	6-32 Hex Nut	2	606-0012	
	L1	#4 Lockwasher	14	607-0001	
	-	#6 Lockwasher	2	607-0002	
-	Standoff	4	615-0023		

\*\*\* Not part of Bag - Used to hold down panel

SWITCH BAG	S1	SPST Paddle Switch w/integral light	1	570-0019	
	S2	7 Pos. Rotary Switch w/hex nut and washer	1	573-0002	
	S3-S6	SPDT Slide Switch	4	571-0005	
	S7, S8	SPDT Pushbutton Switch	2	572-0002	

CONNECTOR BAG	* J1-J22	BP-22 Breadboarding Pins	22	544-0001	
	J23-J24	BNC Connectors w/hex nut and washer	2	549-0001	
	J25	Red Binding Post w/hex nut	1	543-0007	
	J26	Black Binding Post w/hex nut	1	543-0008	
	J27	White Binding Post w/hex nut	1	543-0011	
	J28	Blue Binding Post w/hex nut	1	543-0009	
	J29	SK10-PL Univ. Comp. Socket	1	415-0001	
	J30, J31	Ground Lug for BNC	2	545-0017	
	** J32, J33	14 Pin IC Socket	2	542-0005	
-	5 Lug Terminal Strip	1	545-0007		

\*Pins are factory installed in the panel, not part of bag.

\*\*Assembled units will not include J32 and J33.

RESISTOR BAG	R1	470 $\Omega$ (Yel, Vio, Brn, Gold)	1	511-0031	
	R2, 4, 6, 8, 11, 13, 14	1K (Brn, Blk, Red, Gold)	7	511-0039	
	R3, 5, 7, 9	150 $\Omega$ (Brn, Grn, Brn, Gold)	4	511-0019	
	R10	4.7K (Yel, Vio, Red, Gold)	1	511-0054	
	R12	15 $\Omega$ (Brn, Grn, Blk, Gold)	1	511-0134	

Note: All resistors are 1/4 w  $\pm$  5%

CAPACITOR BAG	C1	330 mfd. Electrolytic	1	523-0033	
	C2	33 mfd. Electrolytic	1	523-0019	
	C3	3.3 mfd. Electrolytic	1	523-0003	
	C4	.33 mfd. Ceramic Disc	1	520-0018	
	C5	.03 mfd. Ceramic Disc	1	520-0015	
	C6	.003 mfd. Ceramic Disc	1	520-0009	
	C7, C8	2200 Electrolytic	2	523-0044	
	C9, C12, C13	1 mfd. Tantalum	3	524-0009	
	C10, C11	.01 mfd. Ceramic Disc	2	520-0008	



REPLACEMENT PARTS LIST (contd.)

PACKING BAG	MANUAL DESIG.	DESCRIPTION	QTY	P/N	CHECK
WIRE BAG	-	18 Gauge Stranded, Insul Green	1'	580-0011	
	-	18 Gage Stranded, Insul. Black	2'	580-0004	
	-	18 Gage Stranded, Insul. White	1'	580-0005	
	-	22 Gage Buss Wire	2'	582-0001	
	-	22 Gage Stranded, Insul. Wire	30'	580-0001	

SEMI-CONDUCTOR BAG	Q1-Q7	2N5134 Transistor	7	500-0018	
	IC1	7414 Integrated Circuit	1	503-0075	
	IC2	7474 Integrated Circuit	1	503-0044	
	VR1	LM340T-5/7805 5 volt Reg.	1	504-0005	
	CR2,CR3	1N4003 Rectifier	2	501-0009	
	CR5-CR8	Red L.E.D. w/snap ring, bushing	4	551-0003	

Note: CR4 is a Missing Designation.

MISCELL-ANEOUS	FH	Fuse Holder	1	563-0019	
	F	Fuse - 1/4 amp	1	563-0014	
	K	Knob	1	613-0010	
	SR	Strain Relief	1	617-0002	
	AB	Adapter Bushing	4	608-0001	

FINAL	ΔT1	Transformer PR1-115V/Sec. -6.3V @ 1	1	531-0008	
	ΔLC	LineCord w/molded plug	1	567-0002	
	P	Panel	1	621-0001	
	H	Housing	1	620-0001	
	RF	Rubber Feet	4	611-0001	
	PC	P.C. Board	1	711-0172	
	-	Heatshrink Tubing	6"	583-0004	

ΔFor 230 Vac. Operation, use the following parts:

T1 becomes P/N 531-0013

LC becomes P/N 567-0004

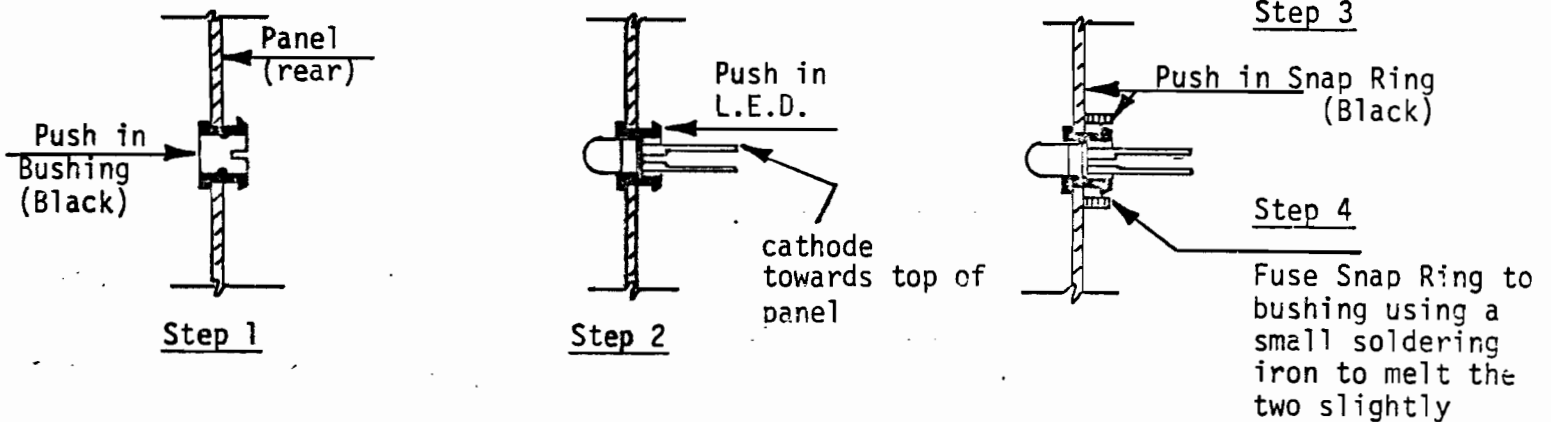
V. MECHANICAL ASSEMBLY - PANEL (see illustrations 1 and 2)

Follow sequence exactly or difficulties may be encountered. Pay special attention to orientation instructions and insertion diagrams.

Mount in Order

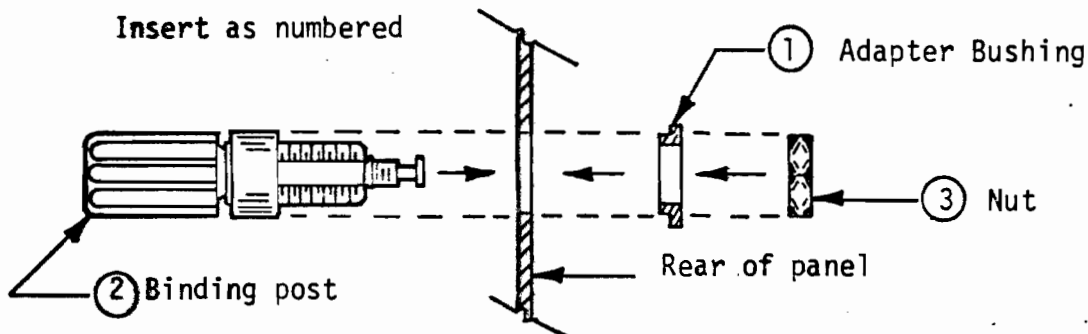
- A. The four lamp monitors (CR5-CR8). Mount these using the snap ring and bushing supplied. Take note of the polarity. The cathode is the lead nearest the flat. After you insert the L.E.D. into the bushing you cannot see the flat, so, take note of the cathode before inserting it.

<u>CONST.</u>	<u>CHECK</u>
_____	_____



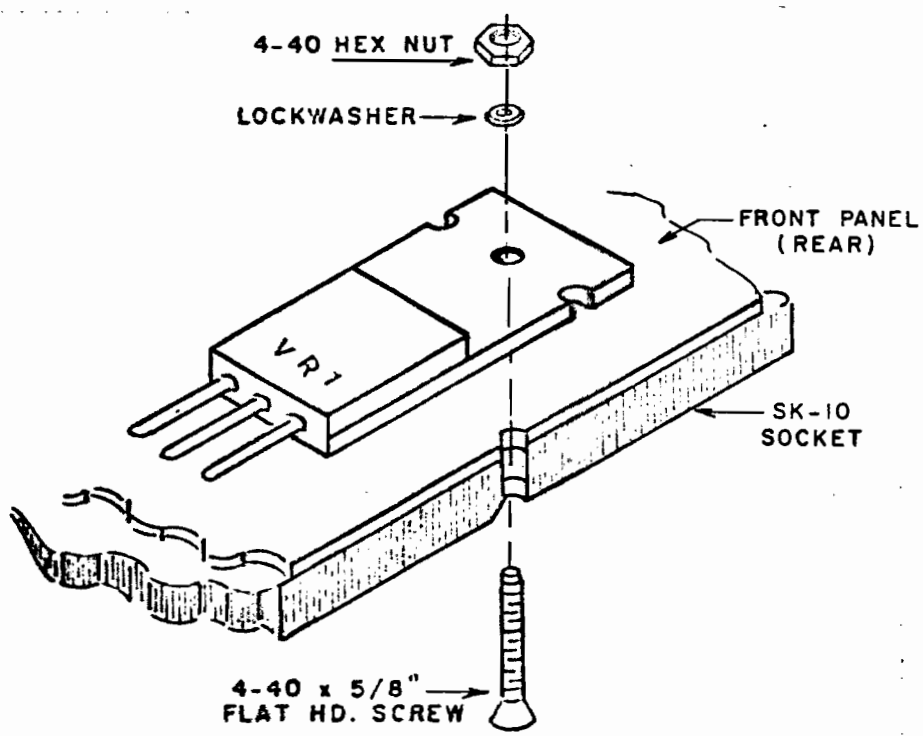
- B. The fuse holder (FH). It will snap into place, the side that reads TOP should be towards the top of the panel.
- C. The on/off power switch (S1). The light should be towards the bottom of the panel, the switch will snap into place. The "on" position is up.
- D. The four binding posts (J25-J28). Mount these using the adapter bushing supplied, (as shown below), the red binding post (J25) should be under "+5V" and the black binding post should be above "GND." On the right side of the panel, the white binding post should be above the blue.

_____	_____
_____	_____
_____	_____



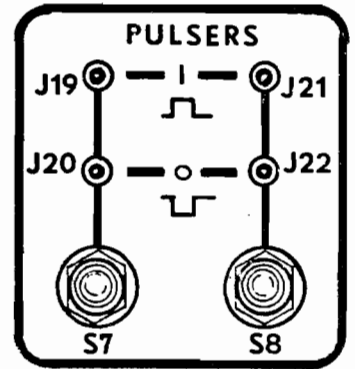
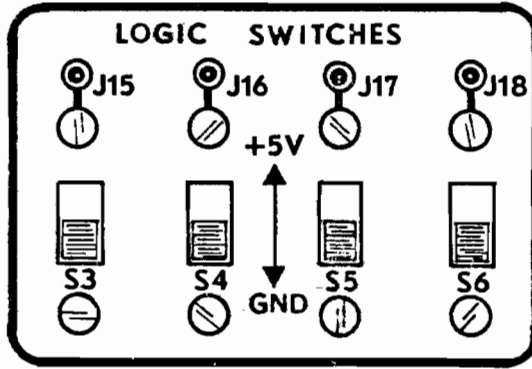
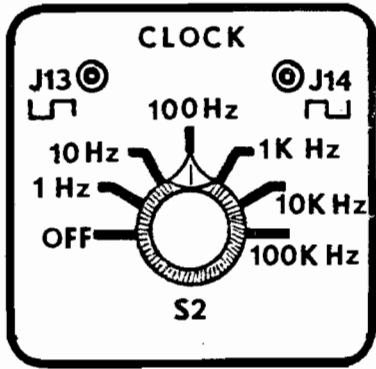
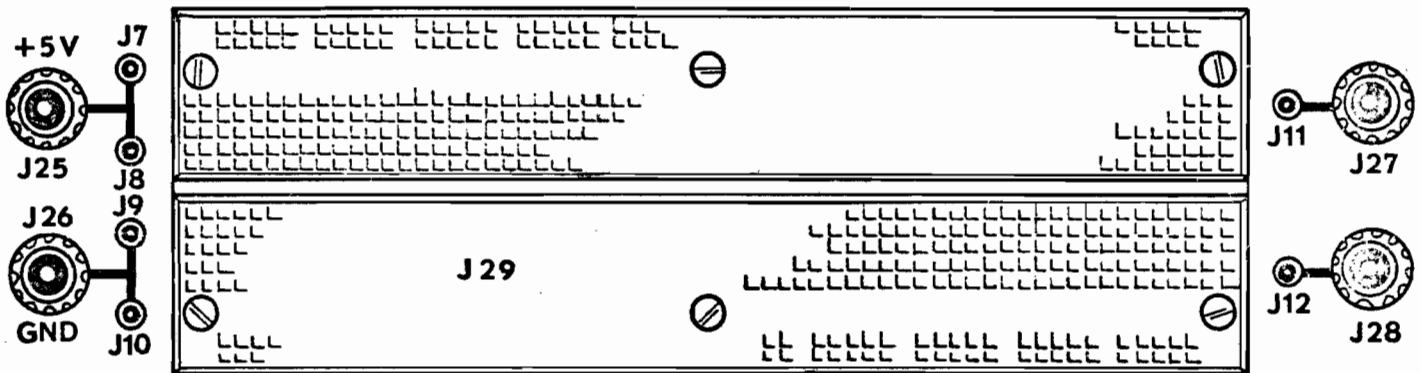
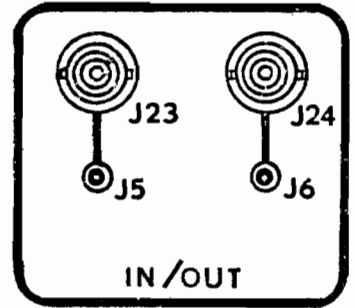
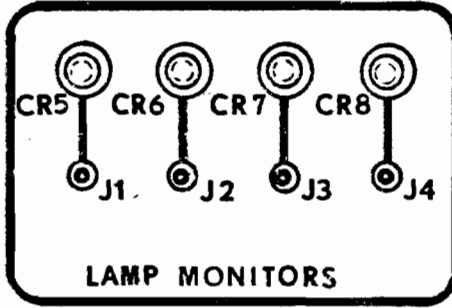
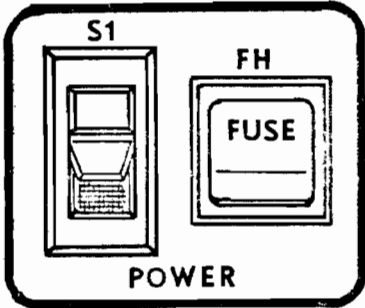
- E. The two BNC Connectors (J23, J24). Mount these using the ground lugs (J30, J31) supplied. The ground lugs must go on before the nut, note orientation of the lugs.
- F. The seven position clock switch (S2). Mount this using the lock-washer on the rear of the panel and the hex nut on the front. Make sure the pointer on the knob is lined up properly before securing the switch to the panel.
- G. The two pulser switches (S7, S8). Mount these using the flatwasher and nut supplied. Both the washer and nut should be on the front of the panel. Observe orientation—the common lug should be towards the bottom of the panel.
- H. The four logic switches (S3-S6). Mount these using 4-40 x 1/4" pan head screws (SC2), 4-40 hex nuts (N1) and lockwashers (L1).
- I. The SK-10 Socket (J29). Do not remove the paper backing from the socket! Install the upper center 4-40 x 5/8" (SC1) flat head screw, 4-40 nut and lockwasher first. Next, install the four corner 4-40 x 5/8" (SC1) flat head screws, lockwashers and 4-40 x 1/2" hex threaded standoffs. Tighten securely.
- J. The 5 volt regulator (VR1). Insert a 4-40 x 5/8" flat head screw into the lower center hole of the socket. Place VR1 on panel with metal tab flush to panel and leads pointing toward bottom of panel. Secure with 4-40 hex nut and lockwasher.

	<u>CONST.</u>	<u>CHECK</u>
E.	_____	_____
F.	_____	_____
G.	_____	_____
H.	_____	_____
I.	_____	_____
J.	_____	_____



# DIGI DESIGNER

# DD-I



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ILLUSTRATION #1

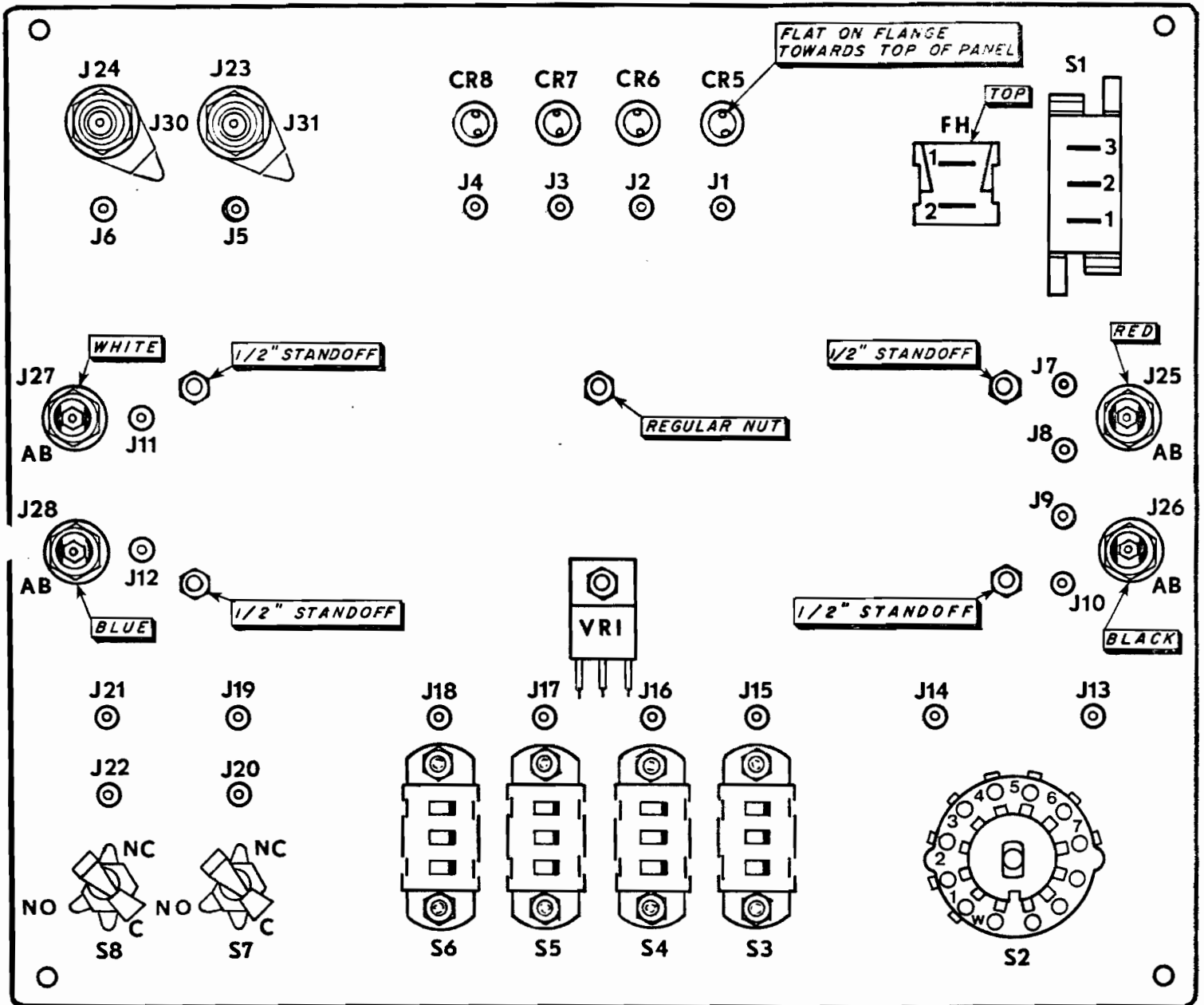


ILLUSTRATION #2

VI. CASE ASSEMBLY

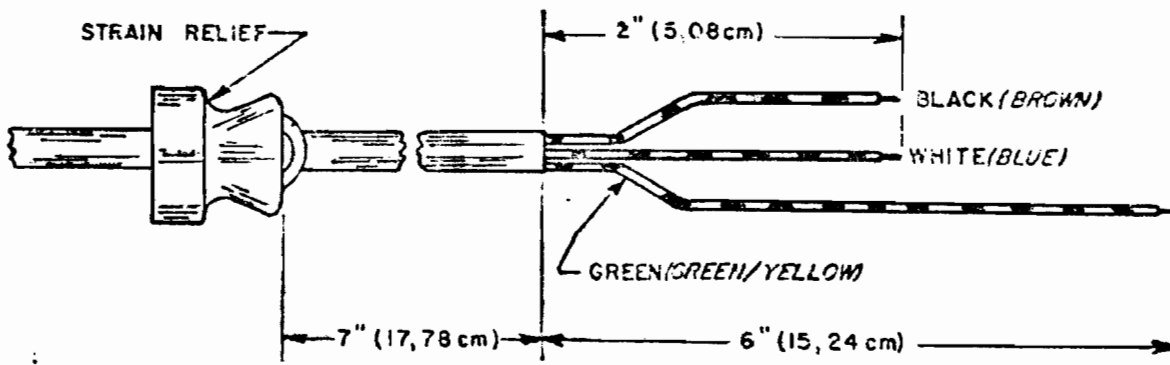
CONST.

CHECK

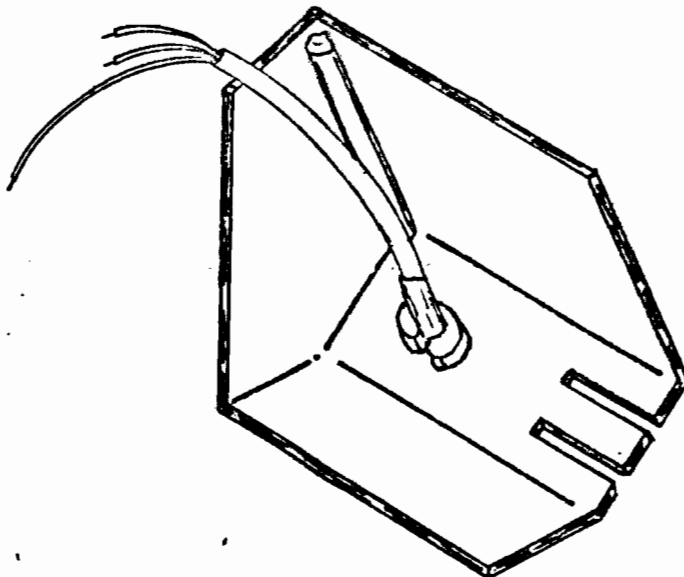
*Since the color coding for the line cord used in the 230 VAC operational unit differs from that of the 115 VAC operational unit the 230 VAC colors are given in italics.*

A. Line Cord Attachment:

Prepare the line cord, as shown below.  
Strip and tin the leads  $\frac{1}{2}$ " (0,6cm)



Compress the strain relief and insert the line cord through the rear of the case, as shown below.

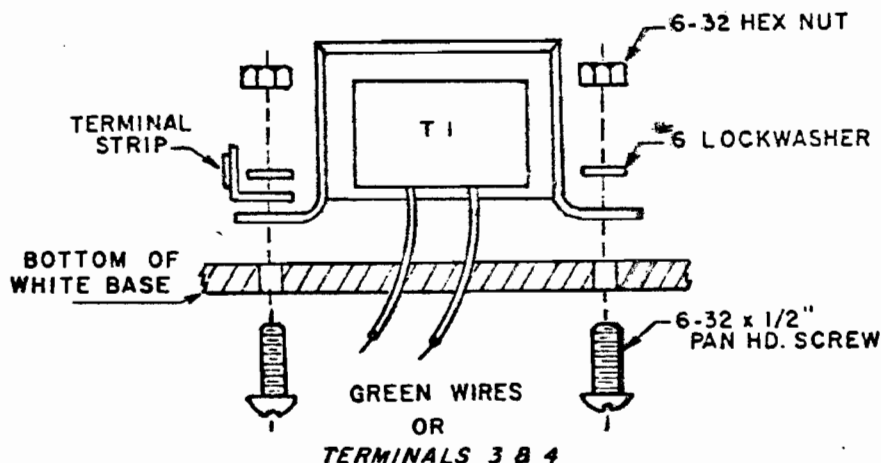


## B. TRANSFORMER INSTALLATION

CONST.

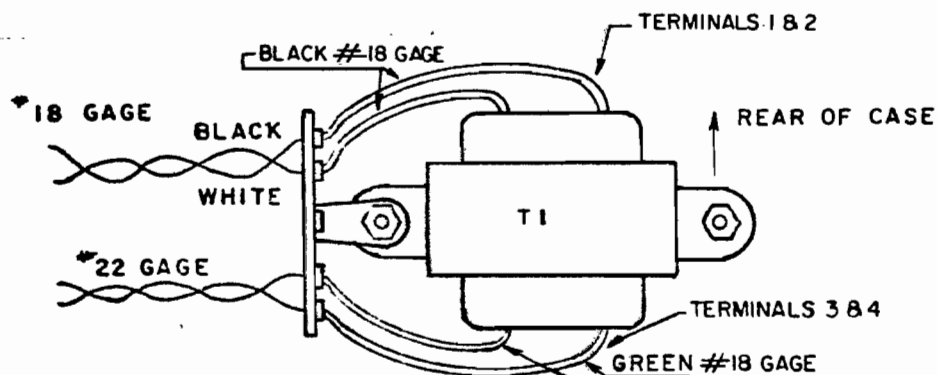
CHECK

Mount the transformer and 5-lug terminal strip in the case with the black wires facing the rear of case, or with terminals 1 and 2 toward rear of case. Attach with pan head screws, lockwashers and hex nuts as shown below.



## C. TRANSFORMER WIRING

- 1) Cut two wires #18 gauge (one black, one white) 8" (20,32cm) long.
- 2) Cut two wires #22 gauge 12" (30,48cm) long.
- 3) For 230 volt wiring cut 2 #18 gauge wires 3" (7,62cm) long and 2 #22 gauge wires 3" (7,62cm) long.
- 4) Strip and tin all leads 1/4" (0,6cm).
- 5) Twist the white and black wires together (3 twists per in). Twist the #22 gauge wires together (3 twists per in).
- 6) Wire as shown below and solder in place.



- 7) If transformer T1 is supplied with terminals, cut two black #18 gauge wires 4" (10,16 cm) long, and two green #18 gauge wires 4" (10,15 cm) long. Strip and tin all leads 1/4" (0,6 cm). Install as shown per illustration

VII. PRINTED CIRCUIT BOARD ASSEMBLY (see illustration 3 )

CONST.

CHECK

A. Component Installation

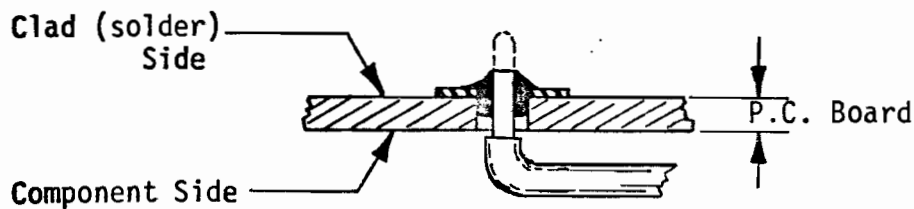
1. Install resistors R1 thru R14 using the color code chart on page 26 to determine component value(s).
2. Install diodes CR2 and CR3 (observe polarity) (s).
3. Install transistors Q1 thru Q7 (s).
4. Install the two jumper wires (JW) using 22 gage insulated wire.
5. Install the two IC sockets J32 and J33 (s).
6. Install capacitors C1 thru C13 (observe polarity) (s).
7. Clip all component leads close to PC clad to prevent them from shorting to the panel when the board is mounted.

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B. Wire the P.C. Board (illustration 3 )

The most convenient way to wire the unit is to put all the wires on the board before mounting it to the panel. All wires should be cut to the lengths shown in illustration 3. Each end is then stripped back 1/4" and tinned. Install the wires from the component side of the board and solder on the clad side (see illustration below) Use stranded #22 gauge insulated wire for this step.





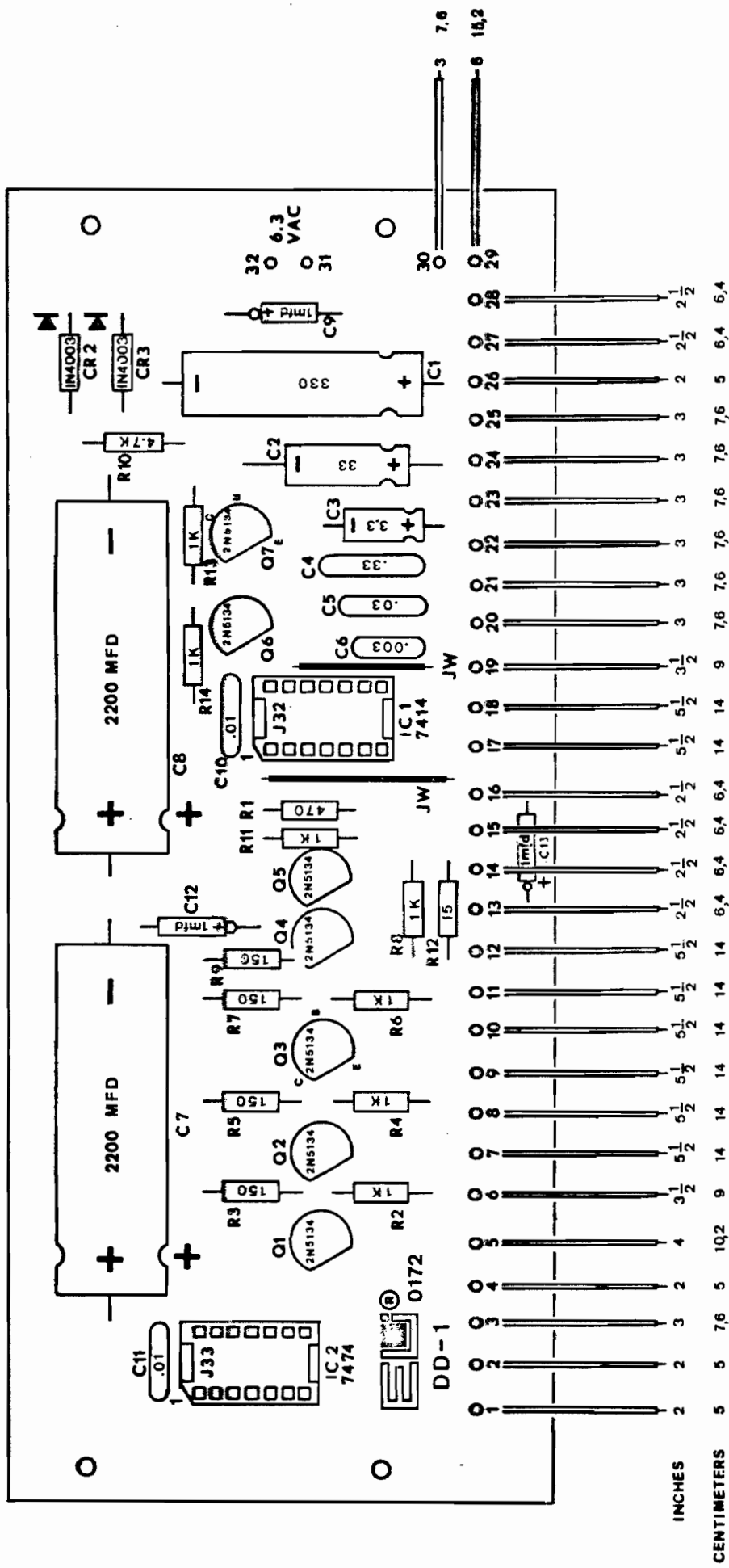


ILLUSTRATION #3

VIII. PANEL PRE-WIRING (see illustration 4)

A. Connect bare buss wire in the following sequence paying strict attention to soldered (s) and NOT soldered wires in each step.

	<u>CONST.</u>	<u>CHECK</u>
1. From J23 (s) to J5 (s).	_____	_____
2. From J24 (s) to J6 (s).	_____	_____
3. From J27 (s) to J11 (s).	_____	_____
4. From J28 (s) to J12 (s).	_____	_____
5. From the common of S8 to the common of S7.	_____	_____
6. From S7 (s) to S6-3.	_____	_____
7. From S6-3 thru S5-3 thru S4-3 thru S3-3.	_____	_____
8. S6-3 (s), S5-3 (s), S4-3 (s).	_____	_____
9. From S6-1 thru S5-1 thru S4-1 to S3-1 (s).	_____	_____
10. S5-1 (s), S4-1 (s).	_____	_____
11. From J26 to J9 (s) to J10.	_____	_____
12. From J25 (s) to J7 (s) to J8.	_____	_____
13. From CR5 to CR6 (s) to CR7 (s) to CR8 (s).	_____	_____

B. Connect insulated #22 gauge wire in the following sequence paying strict attention to soldered (s) and NOT soldered wires in each step. All wires should be cut to the lengths indicated in the following steps with each end stripped back 1/4" and tinned.

1. Connect a 1 1/2" (3,8cm) lead from J31 to J30.	_____	_____
2. Connect a 6 1/2" (16,5cm) lead from J30 (s) to S8 (s).	_____	_____
3. Connect a 2" (5,1cm) lead from S6-2 (s) to J18 (s).	_____	_____
4. Connect a 2" (5,1cm) lead from S5-2 (s) to J17 (s).	_____	_____
5. Connect a 2" (5,1cm) lead from S4-2 (s) to J16 (s).	_____	_____
6. Connect a 2" (5,1cm) lead from S3-2 (s) to J15 (s).	_____	_____
7. Connect a 4" (10,2cm) lead from S3-3 (s) to S2-7.	_____	_____
8. Connect a 3" (7,6cm) lead from S2-7 (s) to J26 (s).	_____	_____
9. Connect a 2" (5,1cm) lead from FH-1 (s) to S1-2 (s).	_____	_____

IX. FINAL WIRING (see illustration 4)

A. FINAL PANEL TO CASE WIRING

CONST.

CHECK

1. Place the front panel, face down, in front of you with selector switch S2 toward you. Place the case assembly to the right of the panel.
2. Connect the white wire of the twisted pair from the case assembly to S1-3.
3. Connect the black wire of the twisted pair from the case assembly to S1-1 (s).
4. Connect the white (blue) wire of the power cord to S1-3 (s).
5. Connect the black (brown) wire of the power cord to FH-2 (s).
6. Connect the green (green/yellow) wire of the power cord to J31 (s).

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B. PC BOARD TO PANEL WIRING

1. Cut three pieces of heatshrink tubing 1" (2,54 cm) long.
2. Slide these over the three wires on pads 14, 15, and 16 until they contact the PC board.
3. Tin the three legs of the regulator VR1, and bend up from the panel slightly.
4. Attach the three wires to the regulator as shown below. Do not crimp or wrap wires. Solder flush as shown.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

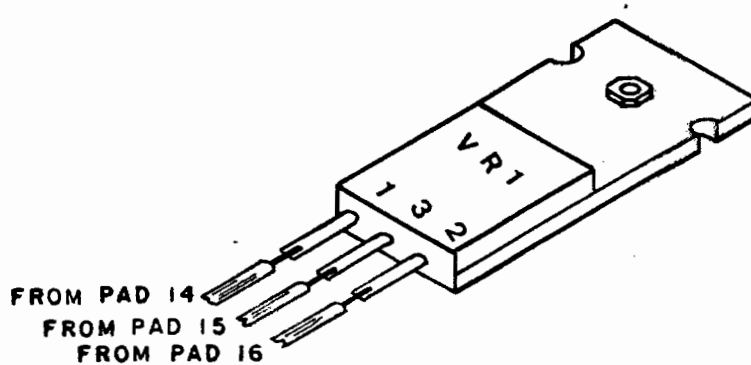
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5. Slide the heatshrink tubing down the wires and up flush to the regulator body. Heat gently with a match to shrink in place. Wipe away excess carbon caused by flame.
6. Connect the two #22 gage wire from the terminal strip Pads 31 and 32, solder.
7. Mount PC board to standoffs on panel, using four 4-40 x 1/4" pan head screws.

\_\_\_\_\_

\_\_\_\_\_

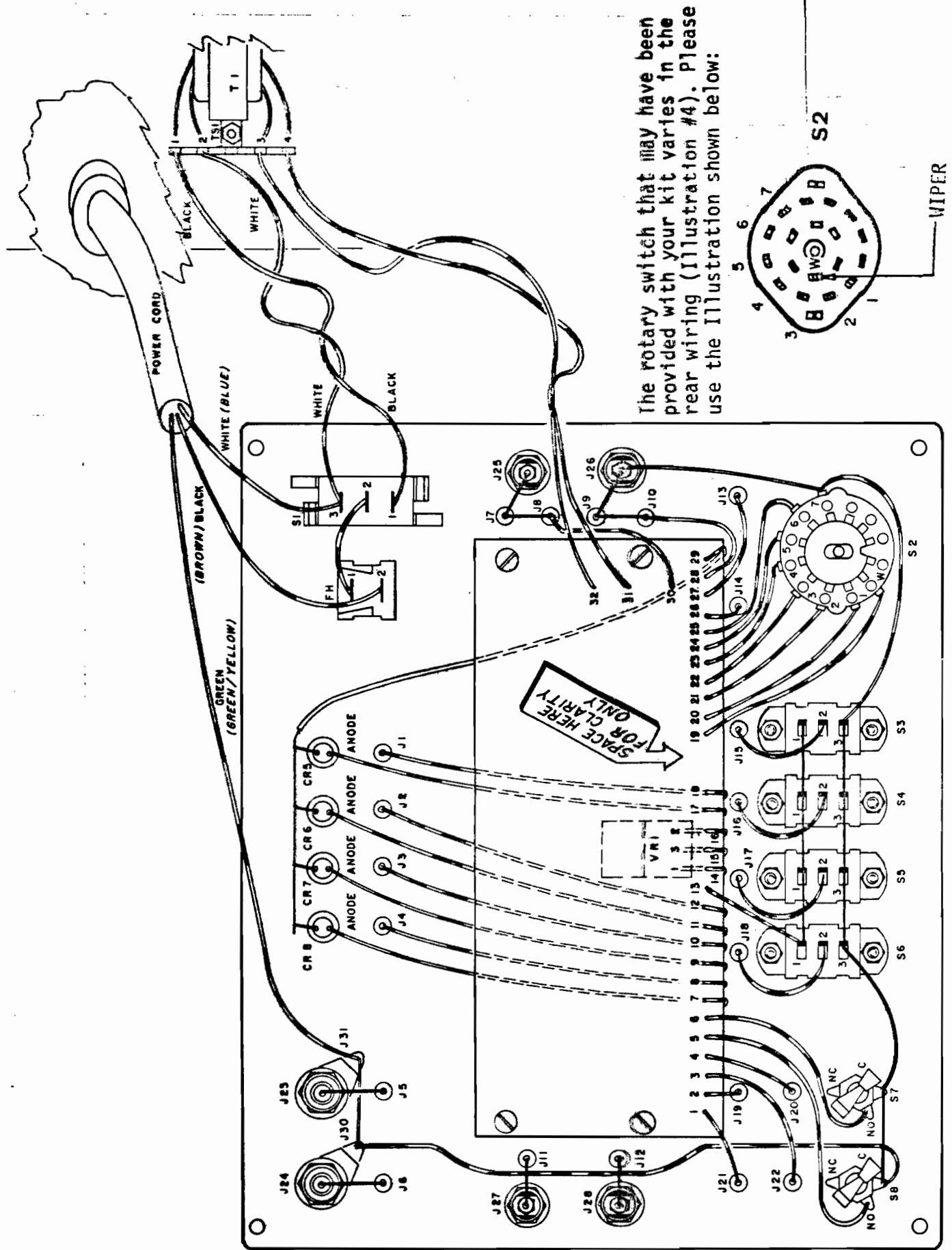
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\_\_\_\_\_

\_\_\_\_\_

	<u>CONST.</u>	<u>CHECK</u>
6. Connect the remaining wires in the following sequence:		
PAD 1 to J21 (s).	_____	_____
PAD 2 to J19 (s).	_____	_____
PAD 3 to J22 (s).	_____	_____
PAD 4 to J20 (s).	_____	_____
PAD 5 to S8 N.O. Terminal (s).	_____	_____
PAD 6 to S7 N.O. Terminal (s).	_____	_____
9. Dress the following leads under the PC board as they are connected:		
PAD 7 to CR 8 ANODE (s).	_____	_____
PAD 8 to J4 (s).	_____	_____
PAD 9 to CR 7 ANODE (s).	_____	_____
PAD 10 to J3 (s).	_____	_____
PAD 11 to CR6 ANODE (s).	_____	_____
PAD 12 to J2 (s).	_____	_____
PAD 17 to CR5 ANODE (s).	_____	_____
PAD 18 to J1 (s).	_____	_____
10. The remaining wires are connected directly to the following points:		
PAD 13 to S6-1 (s).	_____	_____
PAD 19 to S2-W (s).	_____	_____
PAD 20 to S2-1 (s).	_____	_____
PAD 21 to S2-2 (s).	_____	_____
PAD 22 to S2-3 (s).	_____	_____
PAD 23 to S2-4 (s).	_____	_____
PAD 24 to S2-5 (s).	_____	_____
PAD 25 to S2-6 (s).	_____	_____
PAD 26 to J14 (s).	_____	_____
PAD 27 to J13 (s).	_____	_____
PAD 28 to J10 (s).	_____	_____
PAD 29 to Cathode of CR5 (s). (under board)	_____	_____
PAD 30 to J8 (s).	_____	_____
Clip excess lead length from CR5 thru CR8.	_____	_____
The wiring of the unit is now complete.	_____	_____



X. FINAL ASSEMBLY

CONST.

CHECK

1. Inspect the unit for cold or missed solder joints and loose hardware.
2. Remove any wire scraps from case or panel assembly.
3. Install IC1, A 7414, into J32 and IC2, A 7474, into J33. Refer to illustration 3 for location and below for general information.

\_\_\_\_\_

\_\_\_\_\_

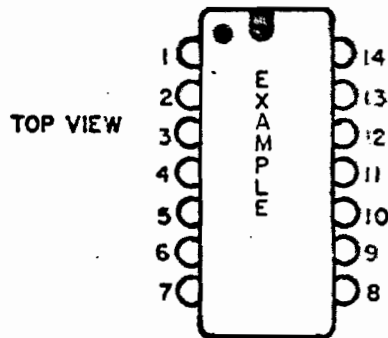
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Integrated Circuit Pin Identification



Pin designation on any size IC is always the same: a "U" shaped indentation, a circular indentation, or both indicates where pin #1 is, when viewed from the top.

4. Install front panel to case using four 6-32 self-tapping screws.
5. Install fuse into fuse holder.
6. Install the four rubber feet, by peeling off protective backing paper and pressing firmly into depressions on bottom of case.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



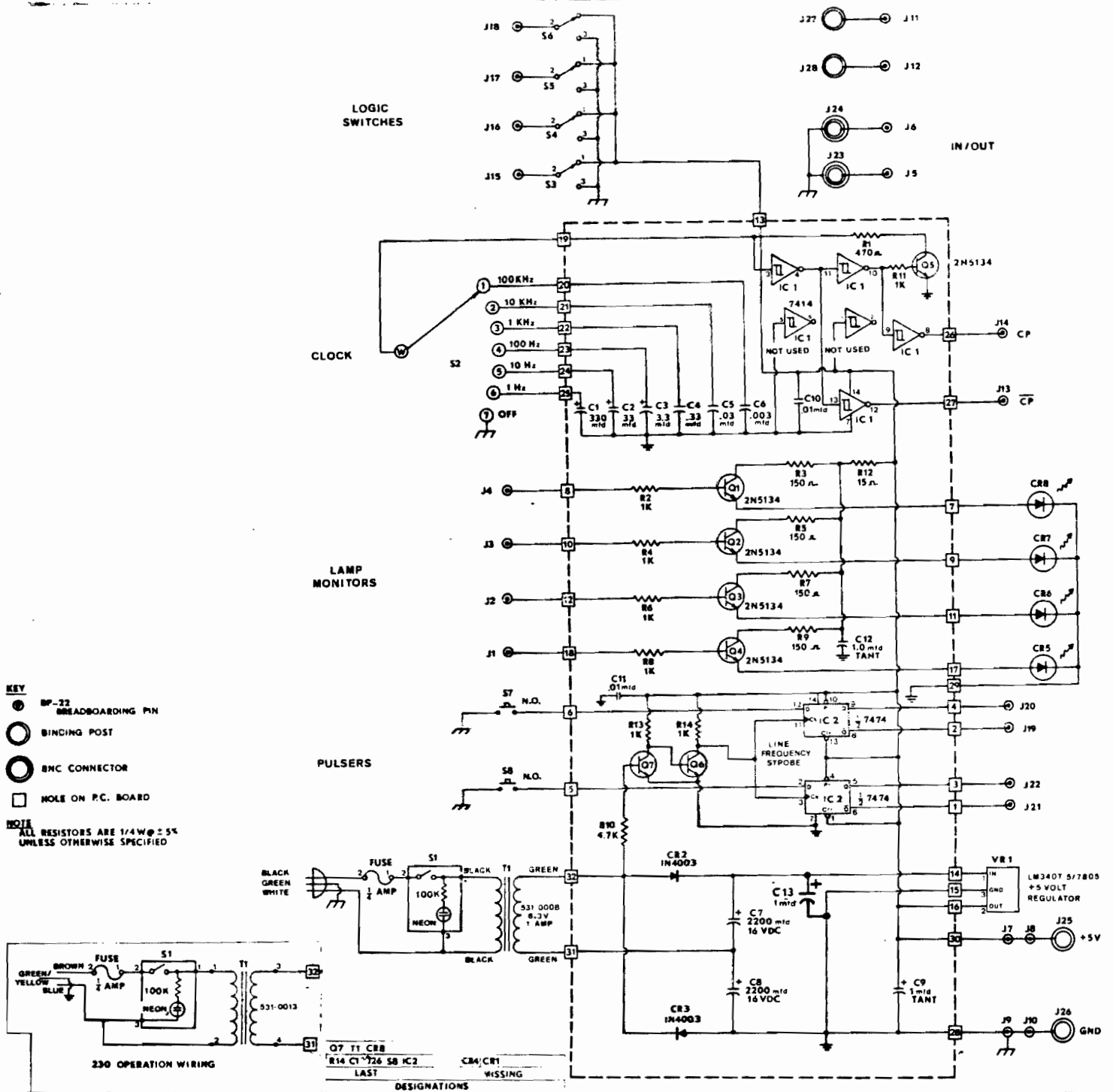


ILLUSTRATION #5



XI. CHECKOUT

Check

Plug in and turn on:

1. The pilot light should glow. \_\_\_\_\_
2. Using a VTVM (or equivalent) measure voltage between the +5V and Ground Breadboarding pins. It should be from +4.75 to +5.25 volts DC. \_\_\_\_\_
3. Check the function of the Lamp Monitors by taking 5V and connecting it to each Lamp Monitor in turn - the light should shine brightly. \_\_\_\_\_
4. Check the pulsers as follows:
  - a. Run a jumper from the active high "1" output to a Lamp Monitor. \_\_\_\_\_
  - b. Run another jumper from the active low "0" output to another Lamp Monitor. \_\_\_\_\_
  - c. The Lamp Monitor connected to "0" should light, the Lamp Monitor to the "1" should not light. \_\_\_\_\_
  - d. Depressing the Pushbutton should cause a change of state; the "on" light should go "off," the "off" light should come "on." \_\_\_\_\_
5. Check the Clock as follows:
  - a. Connect a Lamp Monitor to the "normal" output, (J14). \_\_\_\_\_
  - b. Connect another Lamp Monitor to the "inverted" output, (J13). \_\_\_\_\_
  - c. Set the Clock at 1 Hz. \_\_\_\_\_
  - d. Both monitors should blink, one will be "on" while the other is "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 100Hz, 1KHz, 10KHz and 100KHz positions. Both monitors will be on in these positions. \_\_\_\_\_
6. The Logic Switches can be checked by simply connecting each in turn to a Lamp Monitor - with the Switch "Up," the light should come "on," with it "down," the light should go "off." \_\_\_\_\_

Check

7. A more thorough check can be accomplished with an oscilloscope to verify the "Bounce Free" nature of the Pulser and the true frequency of the Clock (the dial setting is nominal - (it can vary at least 25%).

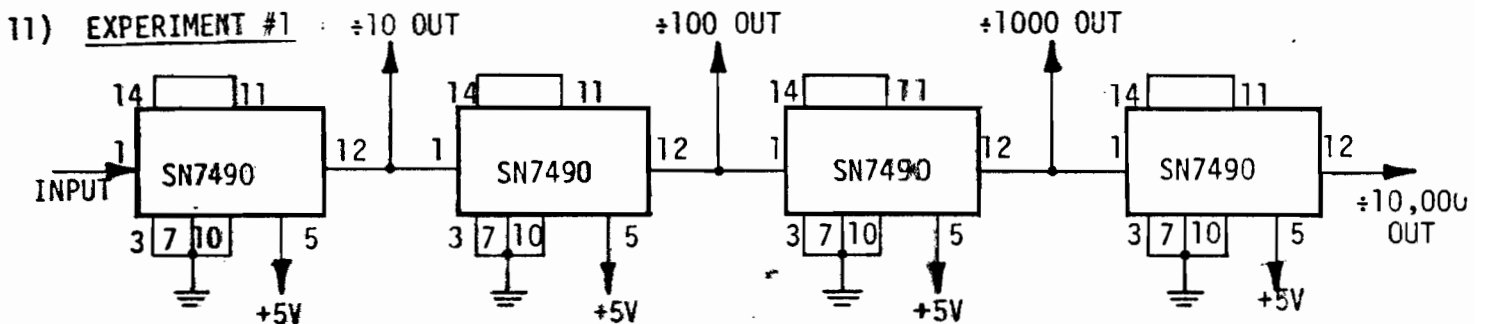
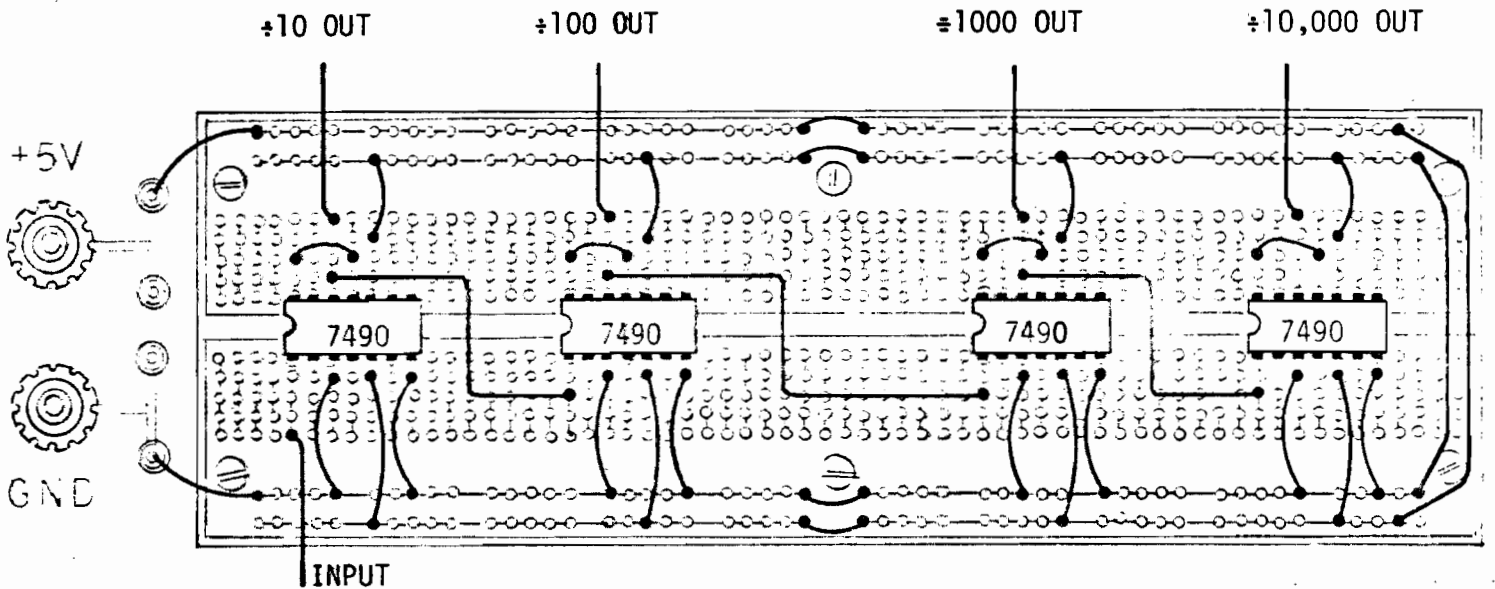
This completes the checkout of your Digi Designer.

XII SUGGESTED USES FOR THE DIGI DESIGNER

Although circuit diagrams are included to indicate typical applications of E&L's products, only components listed in the Replacement Parts List are included in the unit. The application circuits information is not necessarily complete insofar as component manufacturers often make changes in parts that can and do affect the operation of the circuits. E&L believes the circuits to be accurate and has checked some but can assume no responsibility for inaccuracies. Furthermore, the publishing of such circuit diagrams does not convey to the purchaser of E&L's devices, any right or license to manufacture such end items as may be described in the diagrams. E&L reserves the right to make changes in its specifications without notice.

EXPERIMENT #1 (Four-Decade Scaler) ILLUSTRATION #6

Plug four SN7490 integrated circuits into the SK-10 socket as shown below. Here, as in most cases, several 5 volt and ground connections are involved. It's convenient to set up long strips of tie points for this. It should take only a few minutes to hook up the scaler circuit shown in the schematic; one possible physical arrangement is shown. Connections to the input and the four outputs are determined by the end use to which the scaler will be applied. You might try connecting the input to the CLOCK or to the PULSER button, and the outputs to the lamp monitors or to a scope to observe the various input/output relationships for the four scaler stages. Thus, we have built, in a few minutes, an extremely accurate frequency scaler for use in digital division applications, such as digital clocks, calculators, digital measuring instruments, etc. Additional decade can be included by moving the IC's closer together.



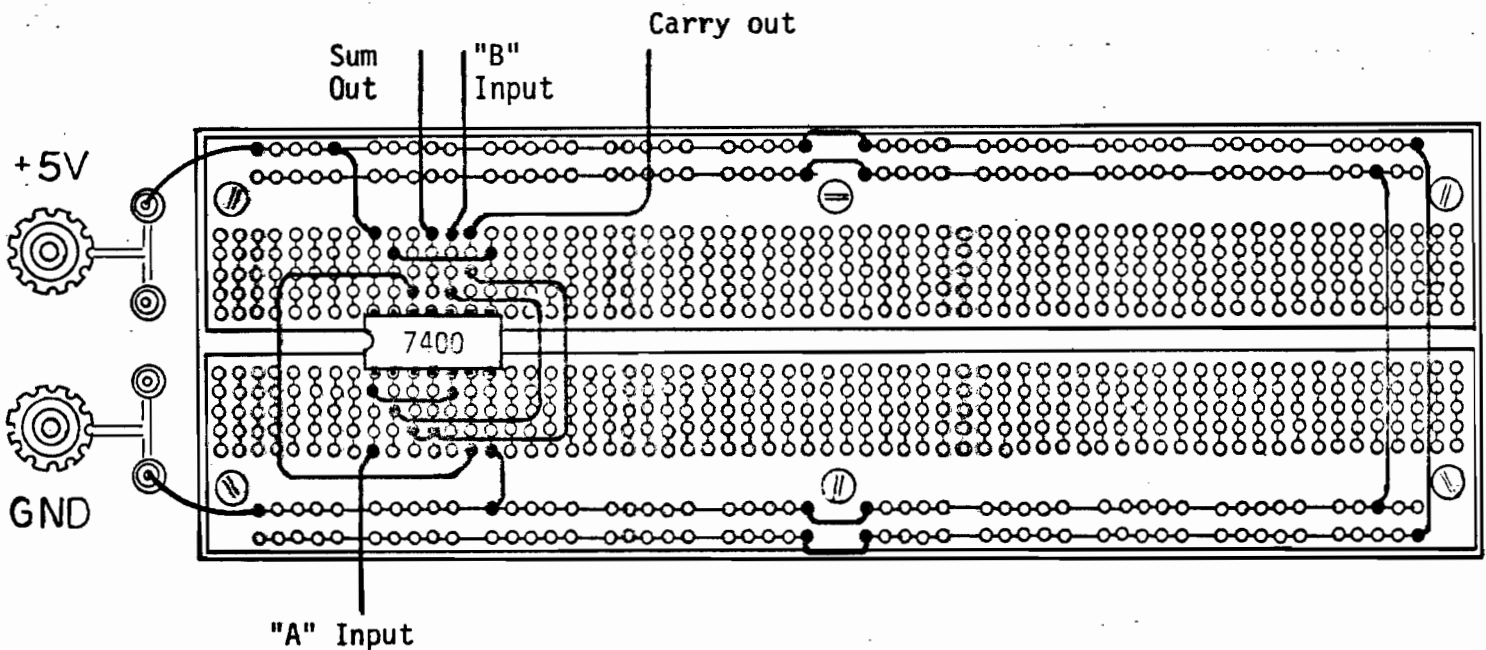
NOTE: Remember, all you have to do to make a connection is to push the stripped ends of wires, or the bare ends of component leads into the holes in the SK-10 socket. External pieces of equipment (scope, meter, power supplies, etc.) are plugged into a mating external connector, with BP-22 pins serving as breadboarding tie points.

EXPERIMENT #2 (Digital Binary Adder Circuit) ILLUSTRATION #7

In many computers, addition and subtraction are the only functions performed. Multiplication, division, exponentiation; are carried out by multiple additions and/or subtractions. The binary adder described here represents the basic arithmetic building block of such a computer. In actual use, numbers consisting of more than a single bit (as is generally the case) are either of two ways:

1. Have a "full adder" to handle each bit simultaneously.
2. Feed the bits, one at a time, to a single, high speed full adder.

Wire the half adder as shown below and note the states of the SUM and CARRY outputs that result from various combinations of A and B inputs. Now, build two Half-Adders and connect them together as shown in the schematic, to form a single-bit full-adder. Again compare input/output relationships. This time, a carry Input is provided. This input accepts the carry Output from a previous stage



12) EXPERIMENT #2

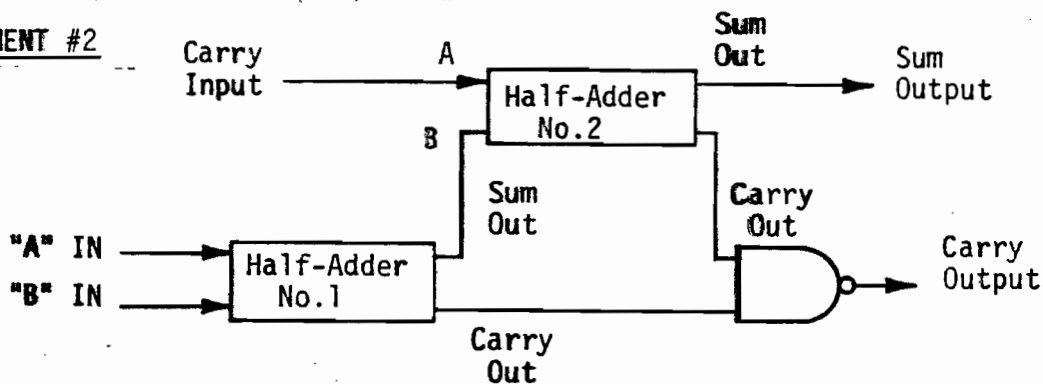
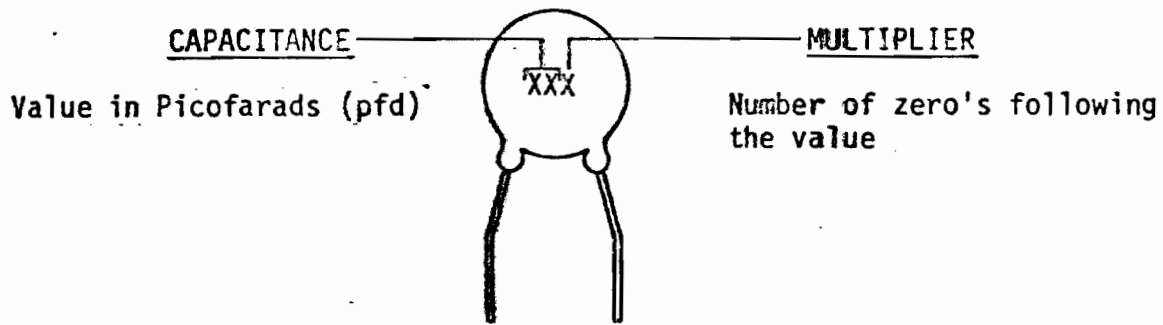


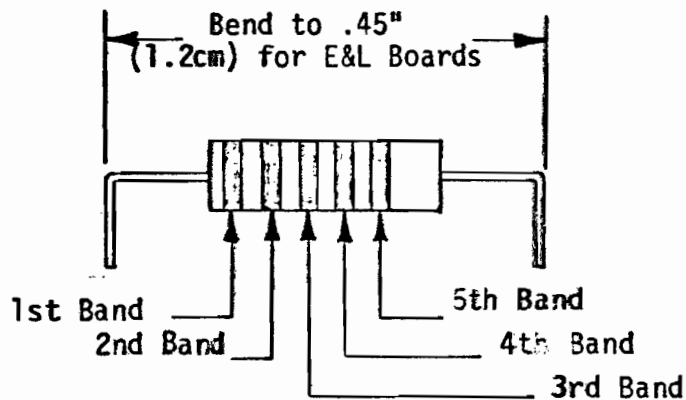
ILLUSTRATION #8

General Ceramic Capacitor Identification



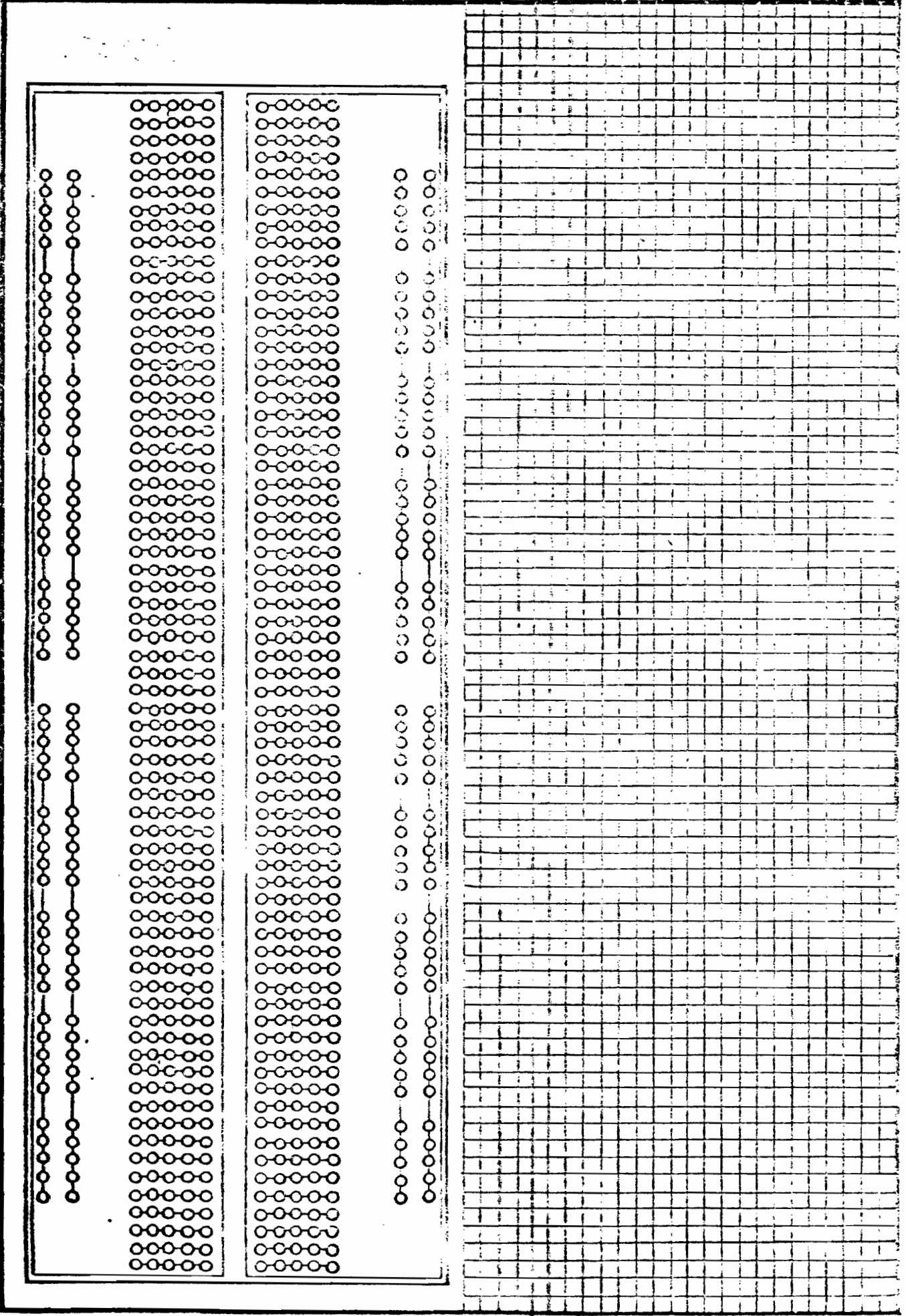
EXAMPLES: 103 = 10,000 pfd or .01 mfd  
 302 = 3,000 pfd or .003 mfd  
 676 = 67,000,000 pfd or 67 mfd

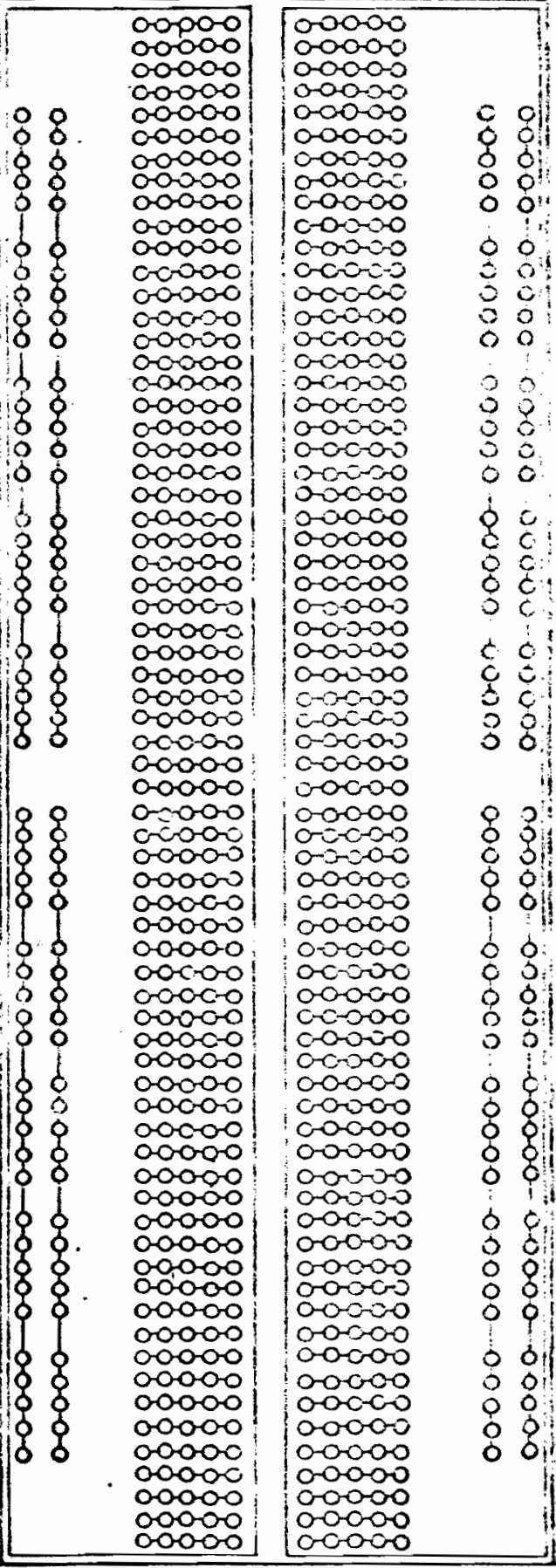
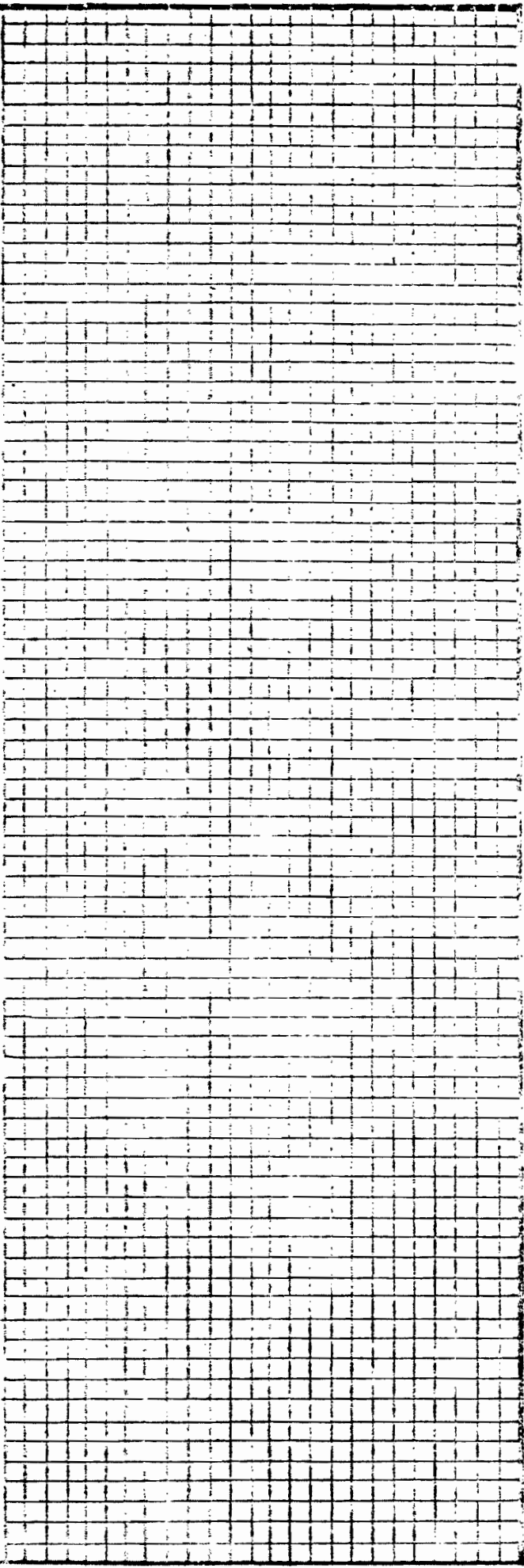
Resistor Color Code Chart



COLOR	BANDS				
	1st	2nd	3rd	4th	5th
Black	0	0	x1.0	-	RC=MIL-R-39008 ↓ RC=MIL-R-11
Brown	1	1	x10	-	
Red	2	2	x100	-	
Orange	3	3	x1000	-	
Yellow	4	4	x10000	-	
Green	5	5	x100,000	-	
Blue	6	6	x1000,000	-	
Purple	7	7	-	-	
Grey	8	8	-	-	
White	9	9	-	-	
Gold	-	-	±10	±5%	
Silver	-	-	±100	±10%	
-----	-	-	-	±20%	

CUT HERE







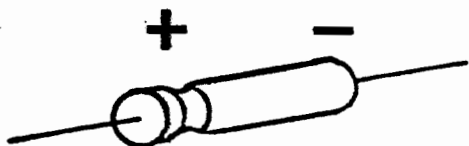


## ENGINEERING NOTICE

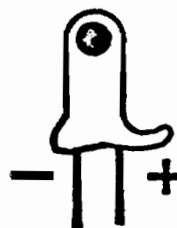
Due to manufacturers availability, the following capacitors may have been substituted in your kit:

<u>Part Number:</u> 524-0005	10 mfd @ 20 V
524-0009	1 mfd @ 35 V
524-0010	22 mfd @ 15 V
524-0032	5 mfd @ 15 V

The substitution on the above parts is not a value substitution but a case style substitution.



OR



PLUS IS ALWAYS  
TO THE RIGHT  
OF THE DOT.