

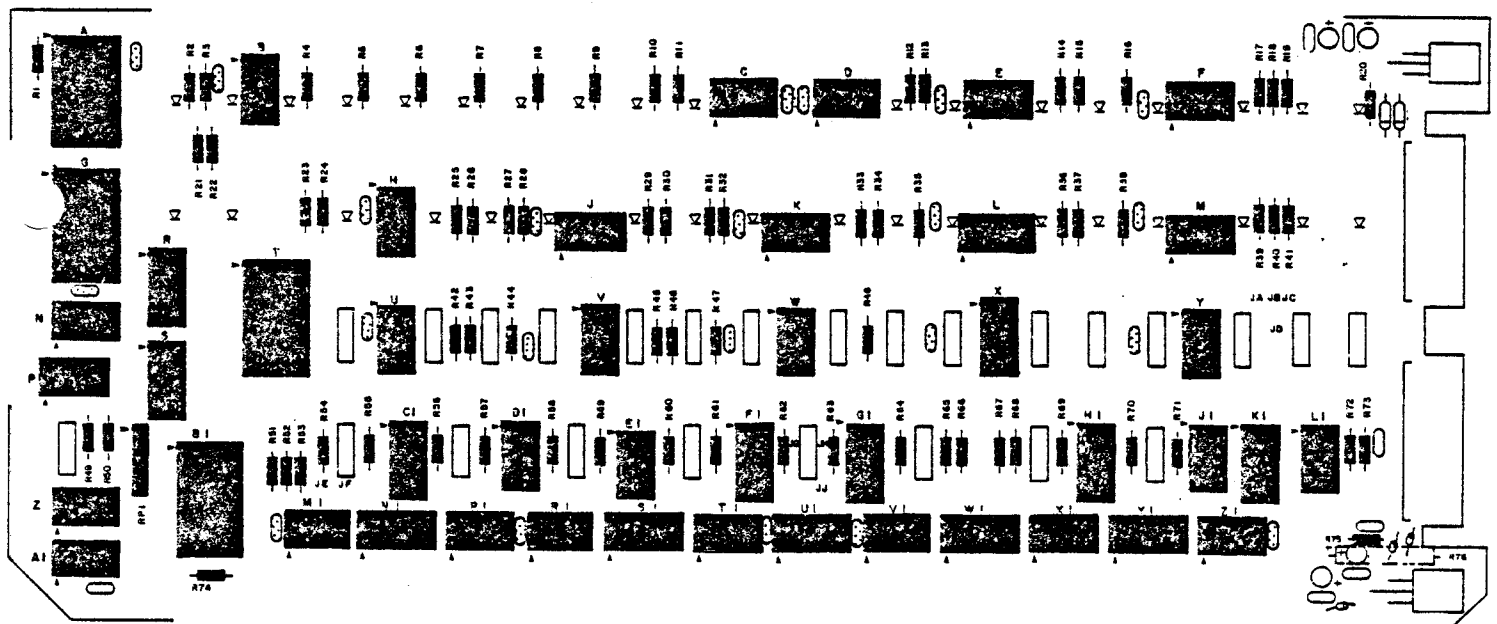
5-25. SUPPRESSOR CAPACITOR INSTALLATION (Figure 5-16)

Install all 22 suppressor capacitors according to the Ceramic Disk Capacitor Installation Instructions given on page 5-7.

There are 22 suppressor capacitors (Bag 6) to be installed on the Display/Control Board. These capacitors are used for noise suppression. They are located next to the ICs on the silkscreen, but they have no individual component designations.

Suppressor Capacitors	Value
() 22 suppressor capacitors	.1uf, 12V

Note that there is not enough space between P1 and R1; T1 and U1; and U1 and V1 for the suppressor capacitors to fit on the top of the board. These three capacitors will, therefore, be installed on the back of the board.



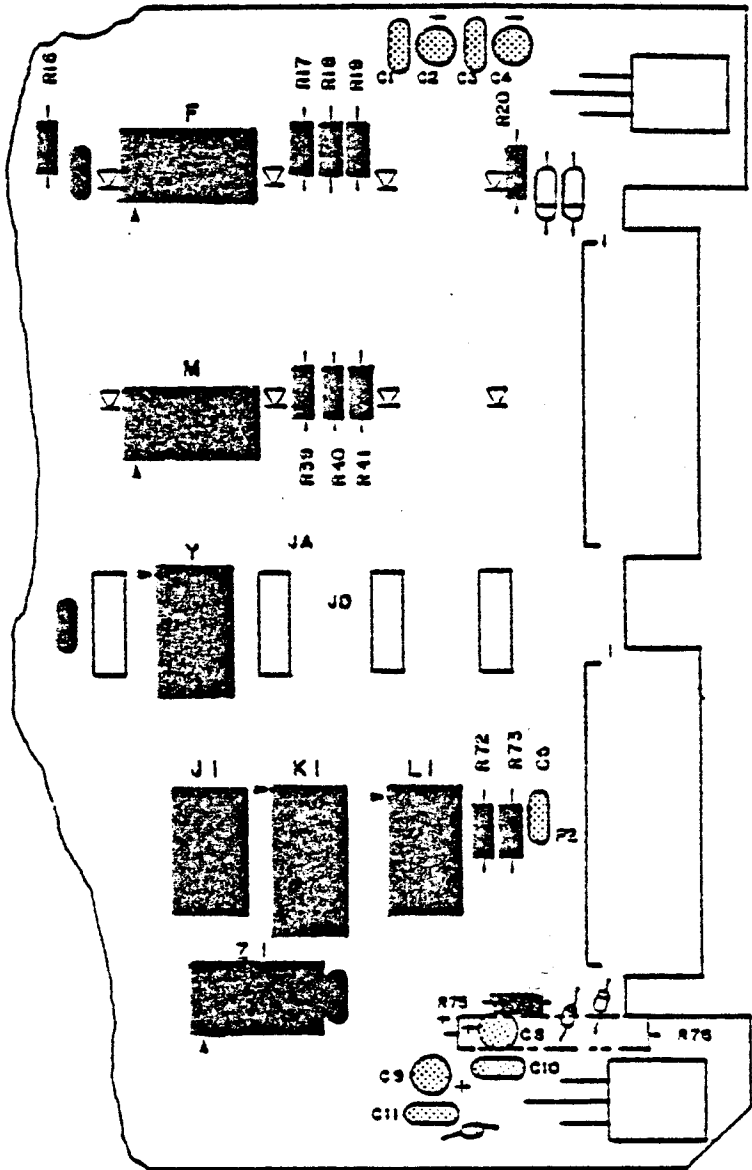
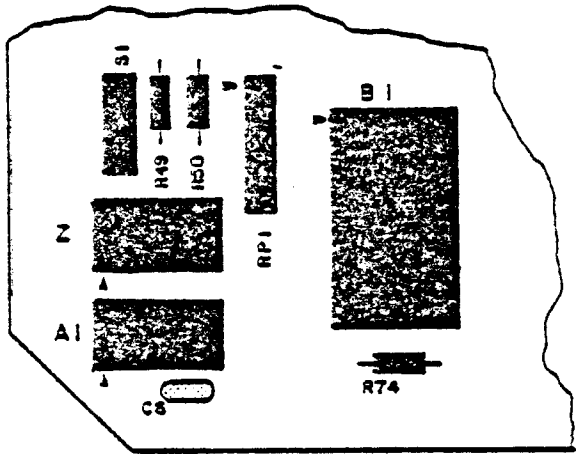
5-16. Display/Control Suppressor Capacitor Installation

5-26. CAPACITOR INSTALLATION
(Figure 5-17)

There are two types of capacitors to be installed on the Display/Control Board. C2, C4, C8, and C9 (Bag 5) are dipped tantalum capacitors. They are marked with a plus sign on the positive side. Be sure to orient this plus sign with the plus sign on the silkscreen before installing each dipped tantalum capacitor. C1, C3, C5, C6, C10, and C11 (Bag 6) are ceramic disk capacitors. They need no polarity orientation. Install the dipped tantalum capacitors according to the Epoxy Dipped Tantalum and Ceramic Disk Capacitor Installation Instructions given on page 5-7.

Capacitor Values	
() C2, C4	22uf, 35V, dipped tantalum
() C8, C9	47uf, 16V, dipped tantalum
() C1, C10, C11	.1uf, 12V or .1uf, 16V
() C3	.1uf, 50V (SK .1m)
() C5, C6,	.001uf

NOTE
There is one .001 μ f capacitor (C7) included with your kit that is not needed. Capacitor C7 should not be installed.



5-17. Display/Control Capacitor Installation

5-27. DIODE INSTALLATION (Figure 5-18)

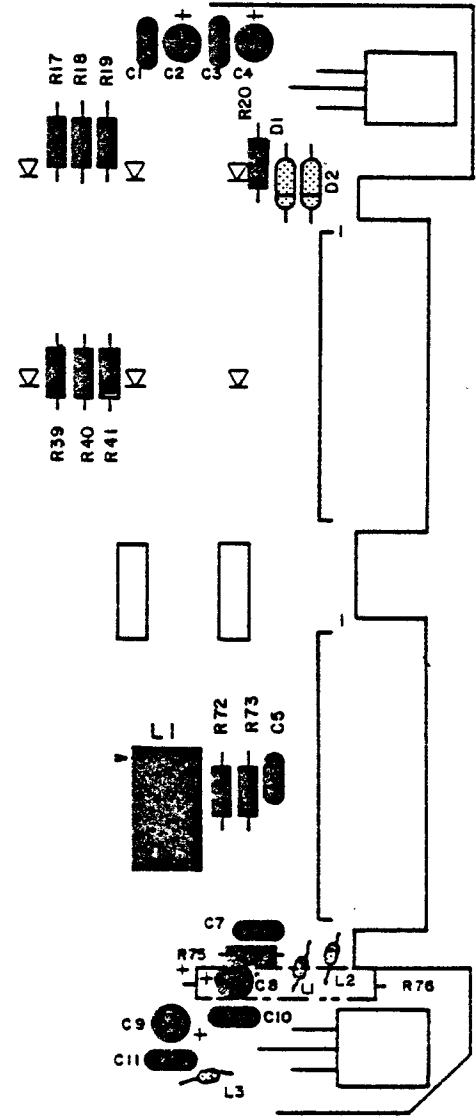
Install the 2 diodes, D1 and D2 (Bag 2), on the Display/Control Board according to the Diode Installation Instructions given on page 5-8.

Diode	Part Number
() D1, D2	IN914

5-28. FERRITE BEAD INSTALLATION (Figure 5-18)

Install the three ferrite beads, L1 through L3 (Bag 2), on the Display/Control Board according to the following instructions.

1. Using the resistor leads saved from Paragraph 5-22, cut three 1-inch lead lengths.
2. Insert the lead through the bead and bend the ends of the lead to conform to the designated holes on the Display/Control Board.
3. Insert the lead into the proper holes from the silk-screened side of the board, and solder to the foil (bottom) side of the board. Be sure not to leave any solder bridges.
4. Clip off any excess lead lengths.



5-18. Display/Control Diode and Ferrite Bead Installation

5-29. VOLTAGE REGULATOR INSTALLATION (Figure 5-19)

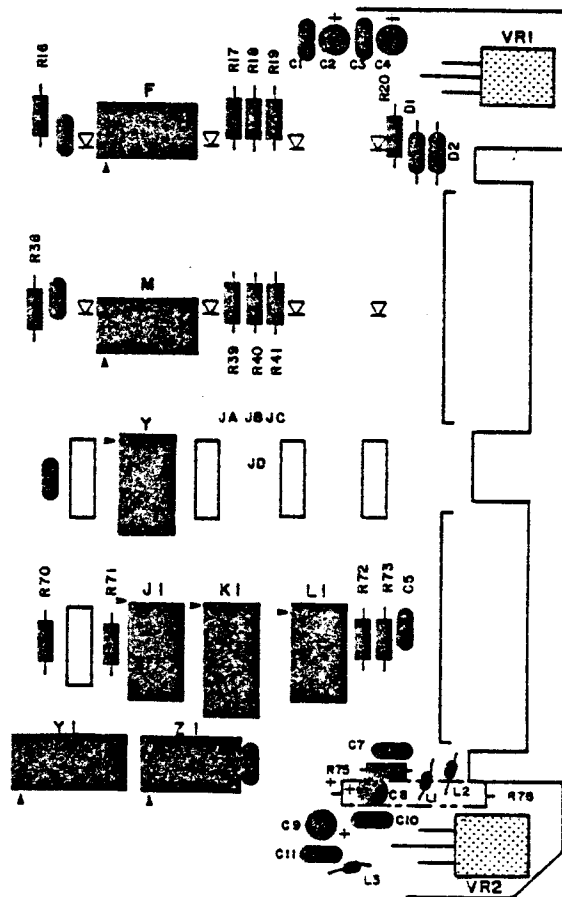
Install the two voltage regulators, VR1 and VR2 (Bag 1), on the Display/Control Board according to the following instructions.

Voltage Regulator	Part Number
() VR1	79M08
() VR2	7805

1. Set the regulator in place on the silk-screened side of the board, aligning the leads with their designated holes.
2. Use needle-nose pliers to bend each of the three leads at a right angle to conform to its proper hole on the board.
3. Prepare a 3" ground strap according to the instructions given in Paragraph 5-72, page 5-71. Secure VR1 in place on the silk-screened side of the board with a #6-32 x 1/4" screw, a #6 lockwasher and a #6-32 nut. Secure VR2 on the silkscreened side of the board and the ground strap on the back of the board with a #6-32 x 1/4" screw and a #6-32 nut. Orient the strap horizontally so that it is pointing away from the board.
4. Solder the three leads to the foil (bottom) side of the board. Be sure not to leave any solder bridges.
5. Clip off any excess lead lengths.

NOTE

Refer to the silkscreen on page 5-24 and install R76 on the back of the board.



5-19. Display/Control Voltage Regulator Installation

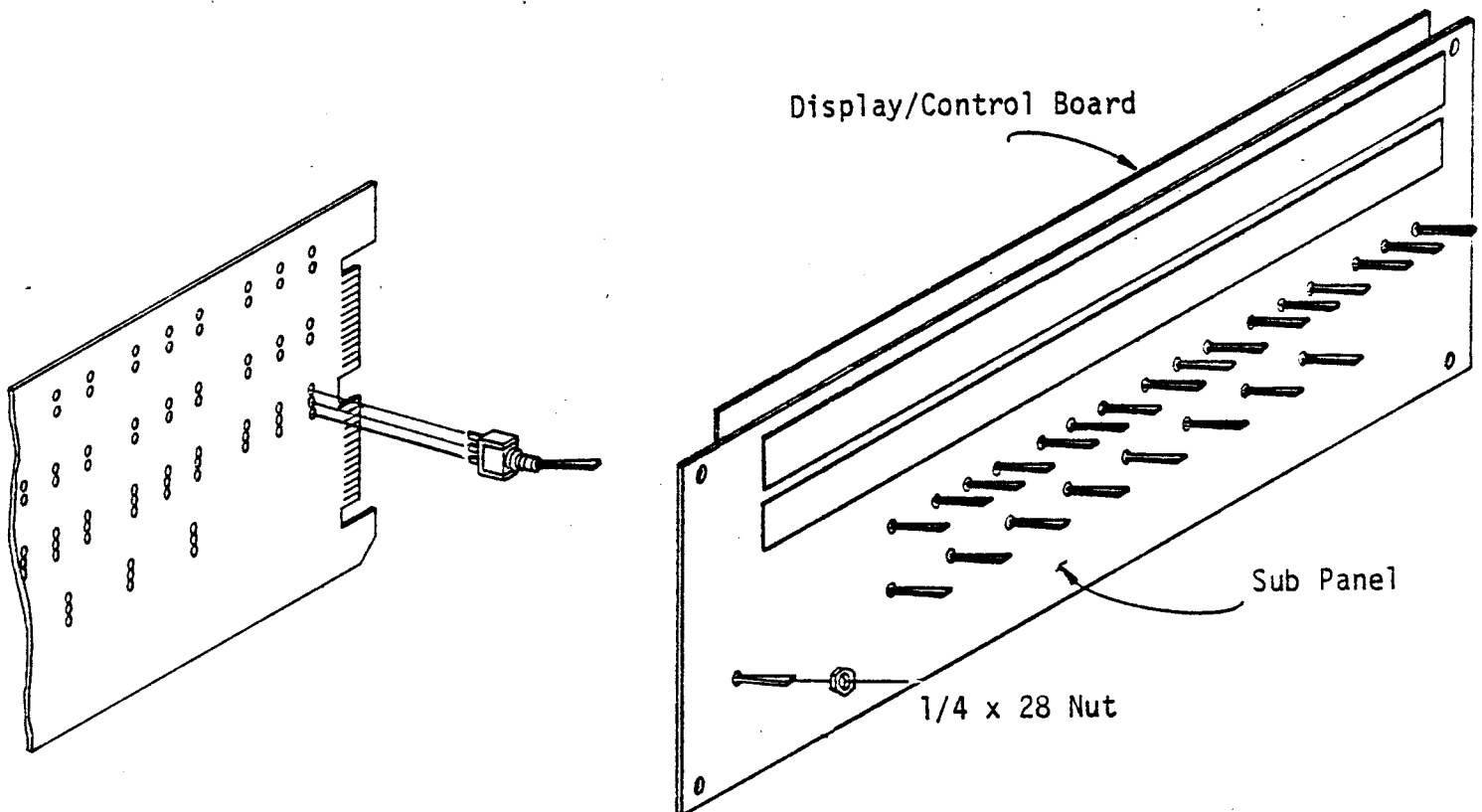
5-30. SWITCH INSTALLATION (Figure 5-20)

There are 25 switches (Bags 7 and 8) to be installed on the Display/Control Board. S2 through S9 are momentary contact switches (i.e. they return to center position automatically when released). SA0 through SA15 and S1 are latching type switches (i.e. they remain in either the up or down position). To insure that all 25 switches are perfectly aligned, the Sub Panel will be temporarily installed at this time. Install the switches according to the following instructions.

NOTE

Set aside 25 of the nuts provided with the switches. The rest of the hardware associated with the switches will not be used.

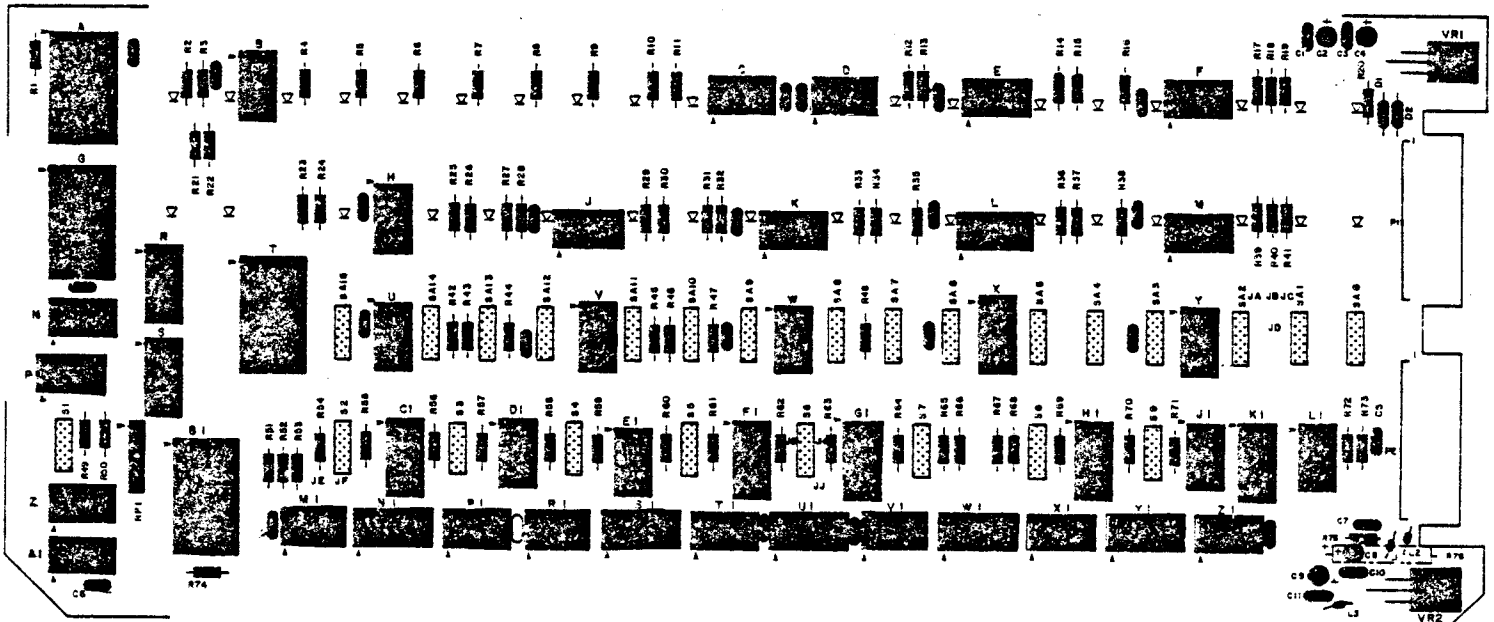
1. Place one nut over each of the 25 switches. Thread the nuts down as far as they will go. With the notched side facing the bottom edge of the board, insert all 25 switches into the silkscreened side of the board as shown in Figure 5-20A. Do not solder the switches at this time.
2. Place the Sub Panel over the Display/Control Board so that the switches come up through the proper switch holes on the Sub Panel. Secure the Sub Panel in place by placing one 1/4 x 28 nut over each switch (Figure 5-20A).



5-20(A). Display/Control Switch Installation

3. Solder all 3 pins of each switch to the foil (bottom) side of the Display/Control Board. Make sure the Display/Control Board is pressed tightly against each switch as it is soldered. If there is any "play" between the switches and the Display/Control Board, the alignment on the final display will not be straight.
4. After all of the switches have been soldered, remove the 25 nuts that were placed on top of the Sub Panel. Set them aside for later use in Paragraph 5-31.
5. Remove the Sub Panel from the Display/Control Board.

Switch	Type
() SA0 through SA15 and S1	latching type
() S2 through S9	momentary contact type

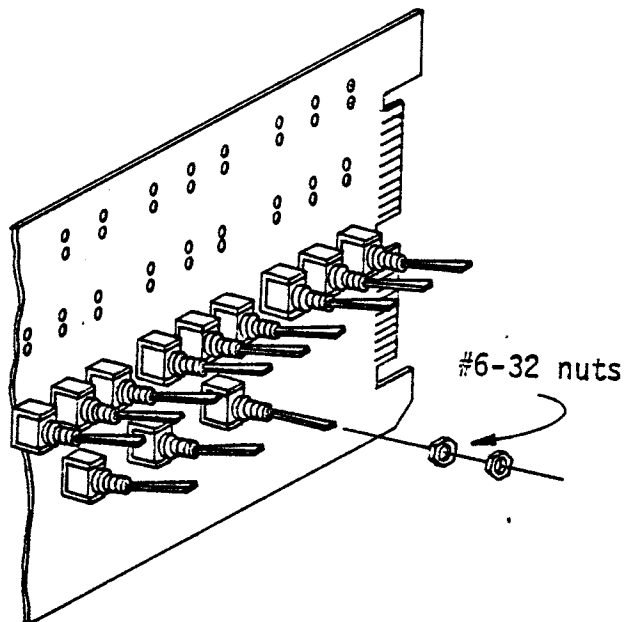


5-20(B). Display/Control Switch Installation

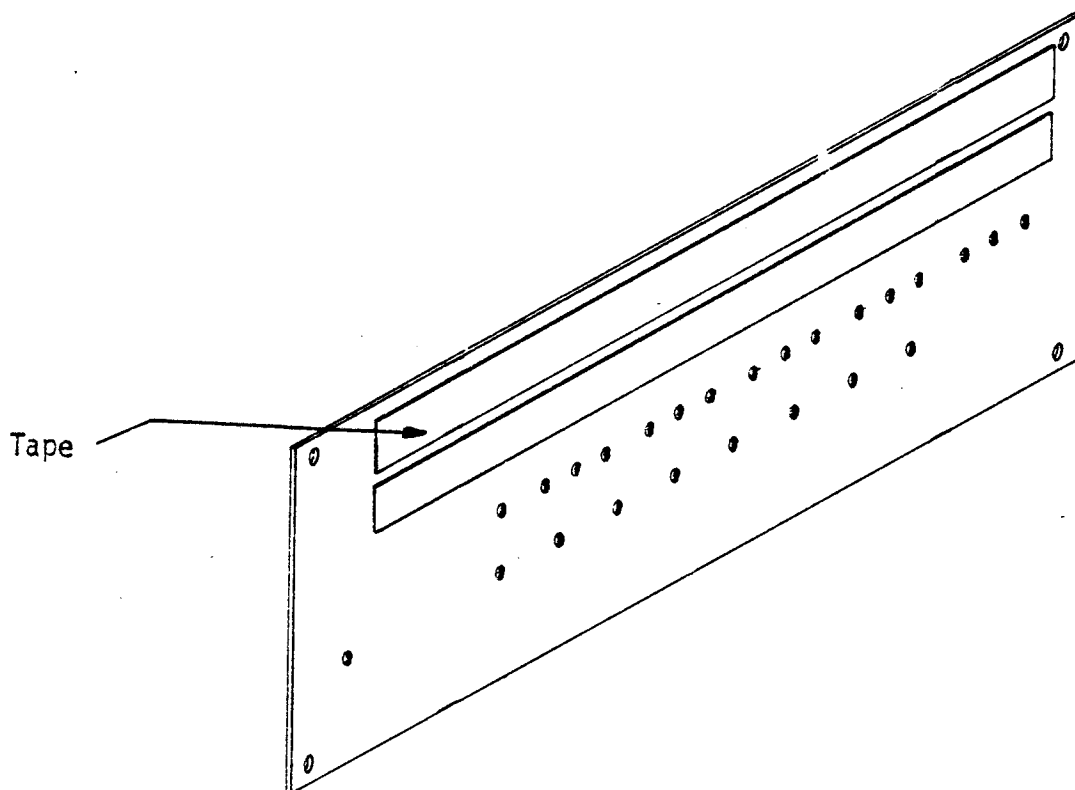
5-31. LED INSTALLATION AND SUB
PANEL INSTALLATION (Figures
5-21 through 5-25)

There are 36 LEDs, RL-21 (Bag 9), to be installed on the Display/Control Board. The Sub Panel will also be installed at this time. Install the LEDs and the Sub Panel according to the following instructions.

1. Place one of the nuts saved from Paragraph 5-30 over each of the following switches: SA0, S9, S1, SA15, S5, as shown in Figure 5-21. There should now be two nuts on each of these switches. Thread the nuts down as far as they will go. Place masking tape over the LED holes on the Sub Panel as shown in Figure 5-22.



5-21. Display/Control Switch Nut Placement



5-22. Covering LED Holes on Sub Panel

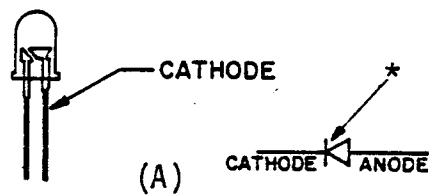
2. With the cathode lead correctly oriented (Figure 5-23A) insert all 36 LEDs into their respective holes from the silk-screened side of the board, as shown in Figure 5-23B.

RL-21

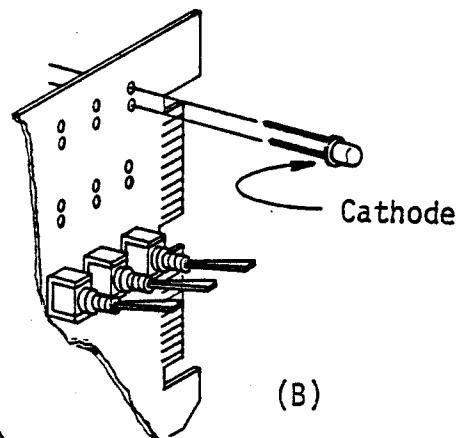
NOTE

Do not solder the LED leads at this time.

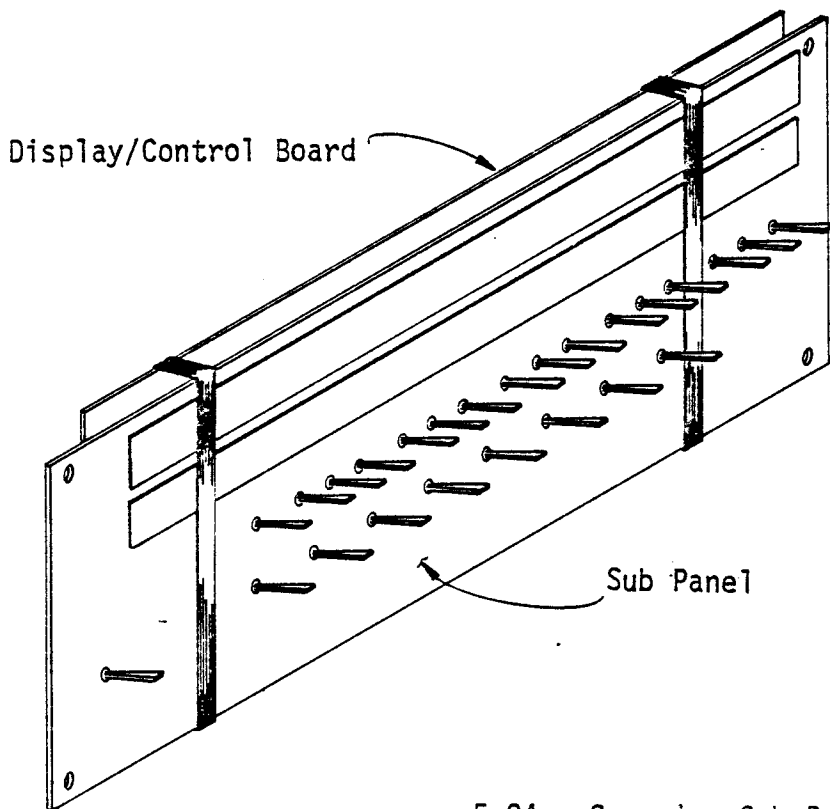
3. Place the Sub Panel over the Display/Control Panel and tape together as shown in Figure 5-24.



*Symbol as shown on board.

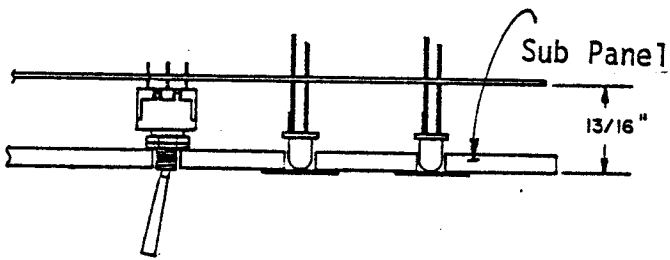


5-23. Display/Control LED Orientation and Installation



5-24. Securing Sub Panel Over Display/Control Board

- Turn the Sub Panel to the bottom and adjust the LEDs until the top of each LED touches the tape as shown in Figure 5-25.



5-25. Display/Control LED Adjustment

- Solder the LED leads to the foil (bottom) side of the Display/Control Board. During this procedure it is advisable to prop the boards from underneath so that the switches are not resting on the work surface.

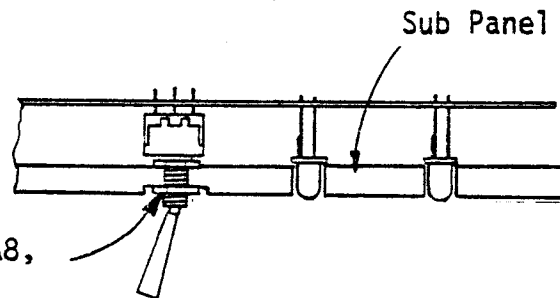
WARNING!

LEDs are heat-sensitive. Use a minimum amount of heat for a minimum length of time when soldering them.

Be sure not to leave any solder bridges, and clip off any excess lead lengths.

- Remove all pieces of masking tape.
- Remove the Sub Panel from the Display/Control Board.
- Remove one nut from SA0, S9, S1, SA15 and S5.
- Place the Sub Panel over the Display/Control Board and secure by placing one nut on the following switches: ON/OFF, RUN/STOP, A15, A8, A0, INPUT/OUTPUT, and DEPOSIT.

Nut for ON/OFF, RUN/STOP, A15, A8, A0, INPUT/OUTPUT and DEPOSIT switches only.



5-25A. Sub Panel Mounting

5-32. CPU BOARD ASSEMBLY

5-33. IC INSTALLATION (Figure 5-26)

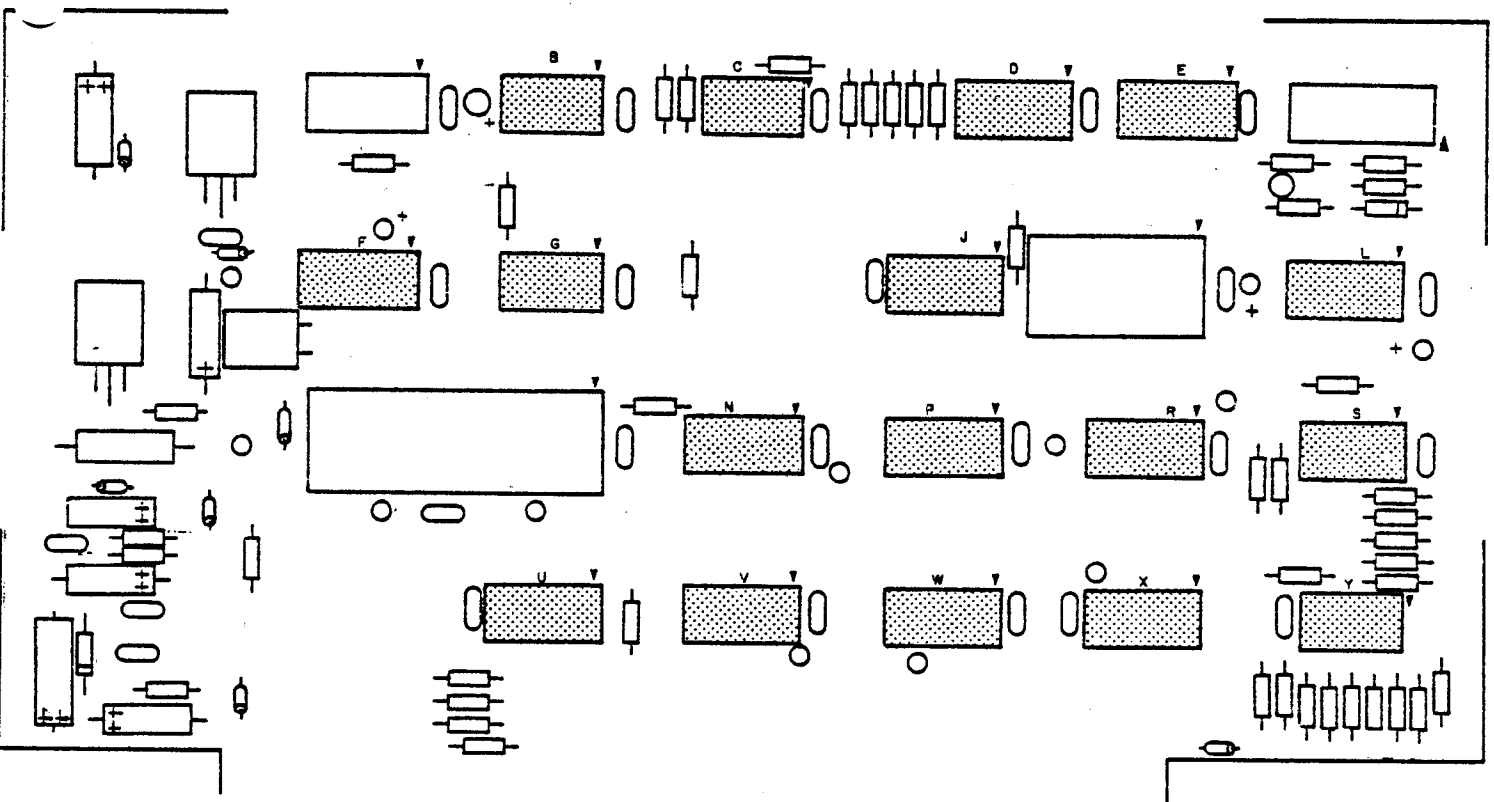
Install the following 17 integrated circuits (Bag 2) on the CPU Board according to the Integrated Circuit Installation Instructions, Section A, given on page 5-10.

NOTE

Do not install ICs A, K, and M at this time. Installation instructions for these ICs are given in Paragraph 5-43.

The following chart lists each integrated circuit, its part number, and acceptable substitutions.

IC Part Numbers	
() D,E	8216
() F	8224
() N,P,R,U, V,W,X	74367
() S,Y	74LS14 or 74LS04
() C	74LS13 or 74LS20
() B,G	74LS04
() L,J	8T98 or 8098 or 74368



5-26. CPU IC Installation

5-34. RESISTOR INSTALLATION
(Figure 5-27)

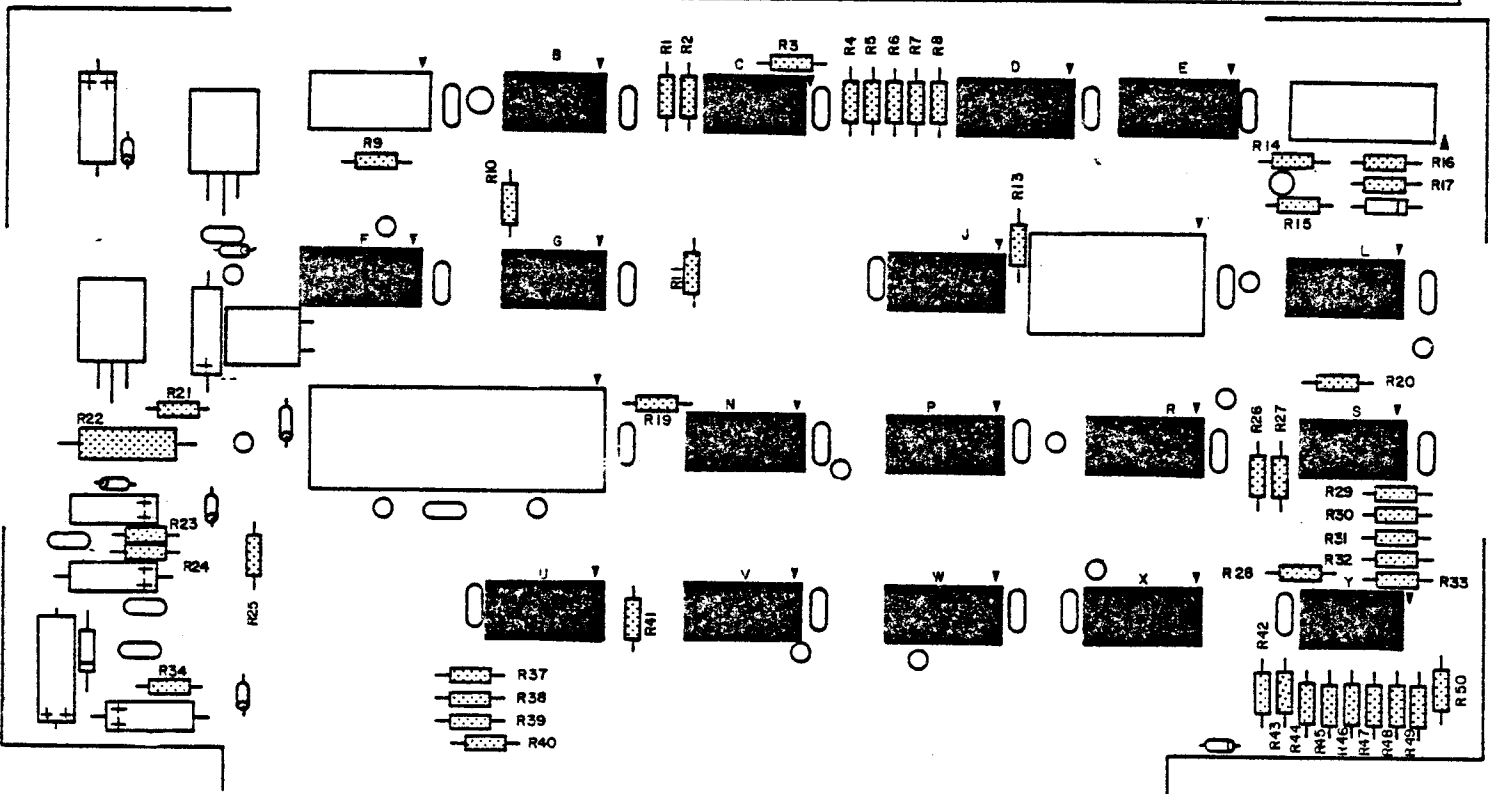
Install the following 46 resistors (Bags 3 and 4) on the CPU Board according to the Resistor Installation Instructions given on page 5-6.

NOTE

Save any excess resistor leads for ferrite bead installation in Paragraph 5-38.

Resistor Values

- | | |
|---|--|
| () R3-R7, R11, R13, R14, R19, R20, R24, R25, R28-R33, R39-R43, R50 | 2.2K ohm (red, red, red) 1/2W or 1/4W |
| () R1, R2, R8, R26, R27, R37, R38, R44-R49 | 3.3K ohm (orange, orange, red) 1/2W or 1/4W |
| () R9 | 15K ohm (brown, green, orange) 1/2W or 1/4W |
| () R16 | 1K ohm (brown, black, red) 1/2W or 1/4W |
| () R34 | 620 ohm (blue, red, brown) 1/2W |
| () R10 | 330 ohm (orange, orange, brown) 1/2W or 1/4W |
| () R21, R23 | 470 ohm (yellow, violet, brown) 1/2W or 1/4W |
| () R17 | 10K ohm (brown, black, orange) 1/2W or 1/4W |
| () R22 | 10 ohm (brown, black, black) 2W |
| () R15 | 100 ohm (brown, black, brown) 1/2W or 1/4W |

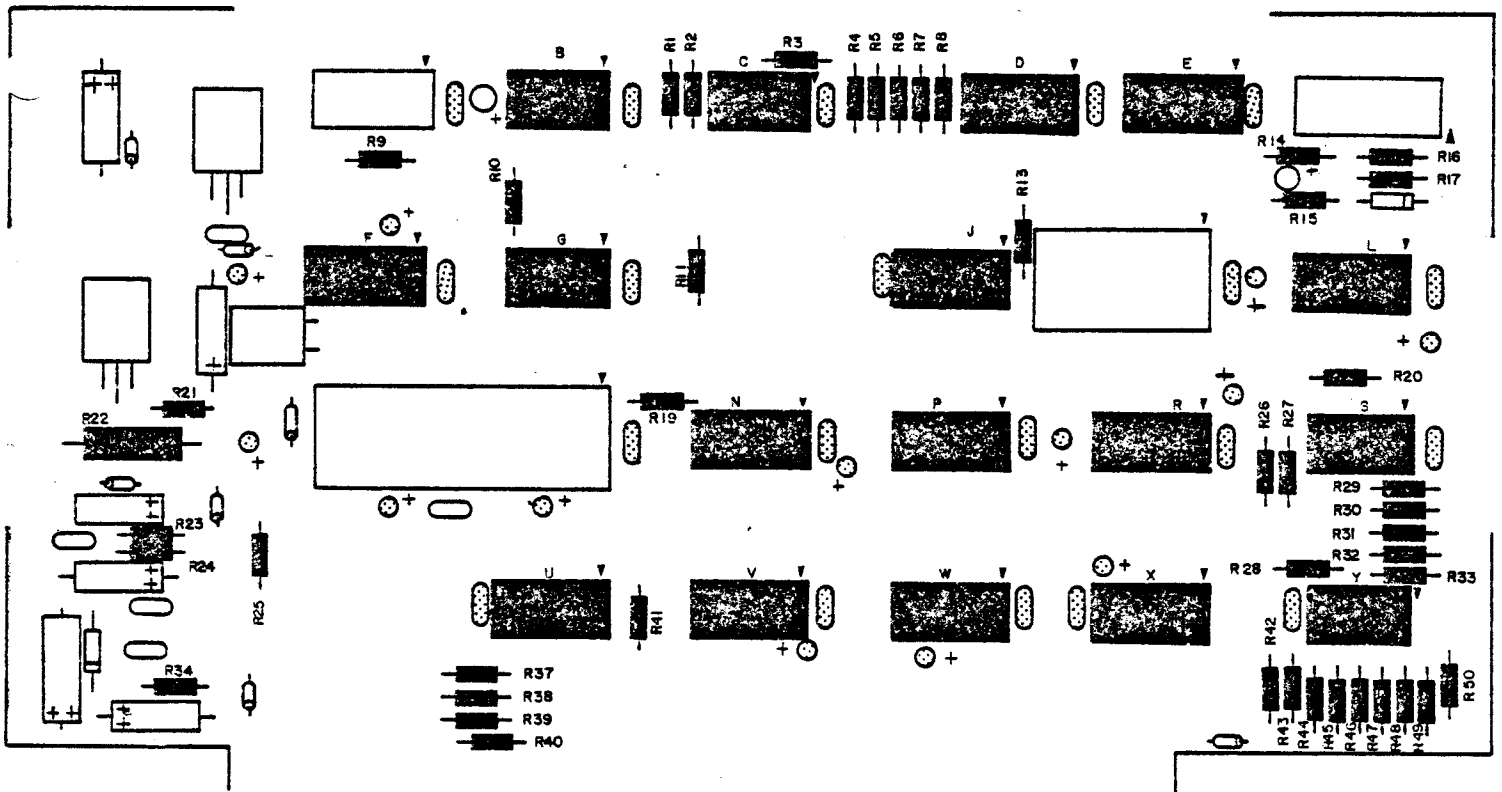


5-35. SUPPRESSOR CAPACITOR INSTALLATION (Figure 5-28)

There are two types of suppressor capacitors to be installed on the CPU Board. The first type, the epoxy dipped tantalum capacitors (Bag 6), are blue on the positive side and are spherical in shape. Be sure to orient the blue side to the "+" sign on the silkscreen before installing each capacitor. The remaining suppressor capacitors are ceramic disk capacitors (Bag 5). They need no polarity orientation. Install both types of capacitors according to the Epoxy Dipped Tantalum and Ceramic Disk Capacitor Installation Instructions given on page 5-7.

Suppressor Capacitor Values

- | | |
|------------------------|-----------|
| () 13 dipped tantalum | 1uf, 35V |
| () 20 ceramic disk | .1uf, 12V |



5-28. CPU Suppressor Capacitor Installation

5-36. CAPACITOR INSTALLATION
(Figure 5-29)

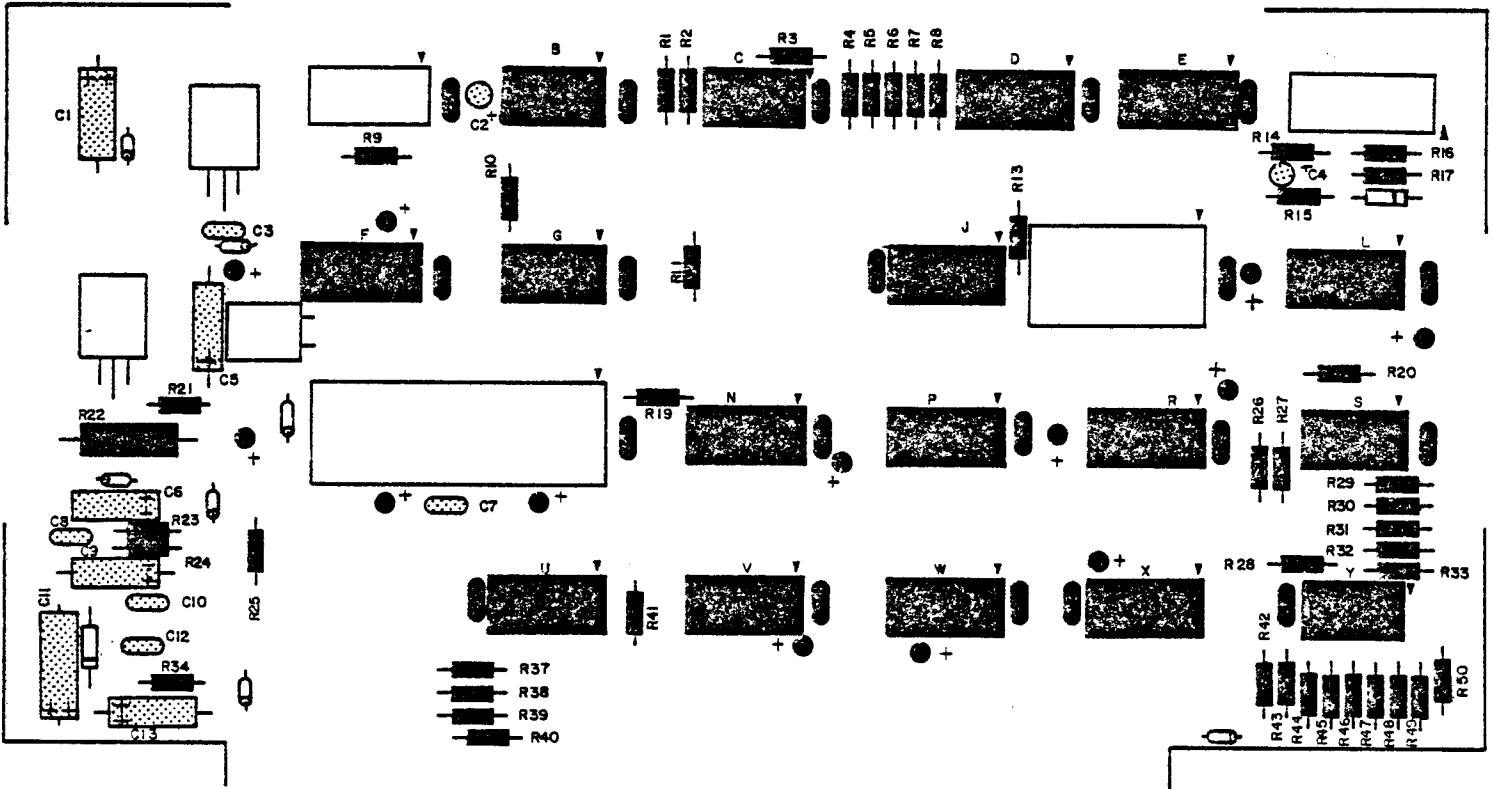
There are 2 dipped tantalum capacitors, 6 electrolytic capacitors, 2 ceramic disk capacitors, and 3 dipped ceramic capacitors (Bag 6) to be installed on the CPU Board. Install each capacitor according to the instructions given on page 5-7.

NOTE

When installing the dipped tantalum and the electrolytic capacitors, be sure the positive lead is installed in the "+" hole on the silkscreen.

Capacitor Values

() C1, C5, C6, C11	33uf, 16V, electrolytic
() C2	22uf, 16V, dipped tantalum
() C3, C7, C10	.1uf, 50V, dipped ceramic
() C4	10uf, 16V, dipped tantalum
() C8, C12	.1uf, 12V - 16V, ceramic disk
() C9, C13	10uf, 25V, electrolytic

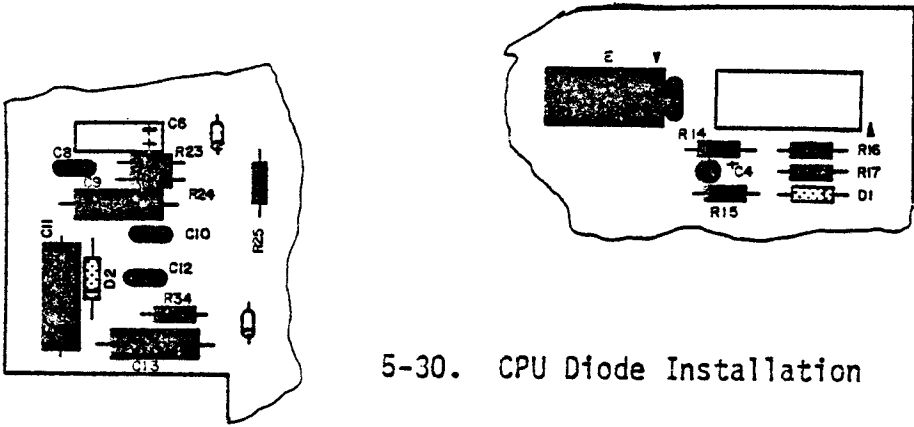


5-29. CPU Capacitor Installation

5-37. DIODE INSTALLATION (Figure 5-30)

Install the two diodes, D1 and D2 (Bag 4), on the CPU Board according to the Diode Installation Instructions given on page 5-8.

Diode Part Numbers	
() D1	1N4730
() D2	1N4733

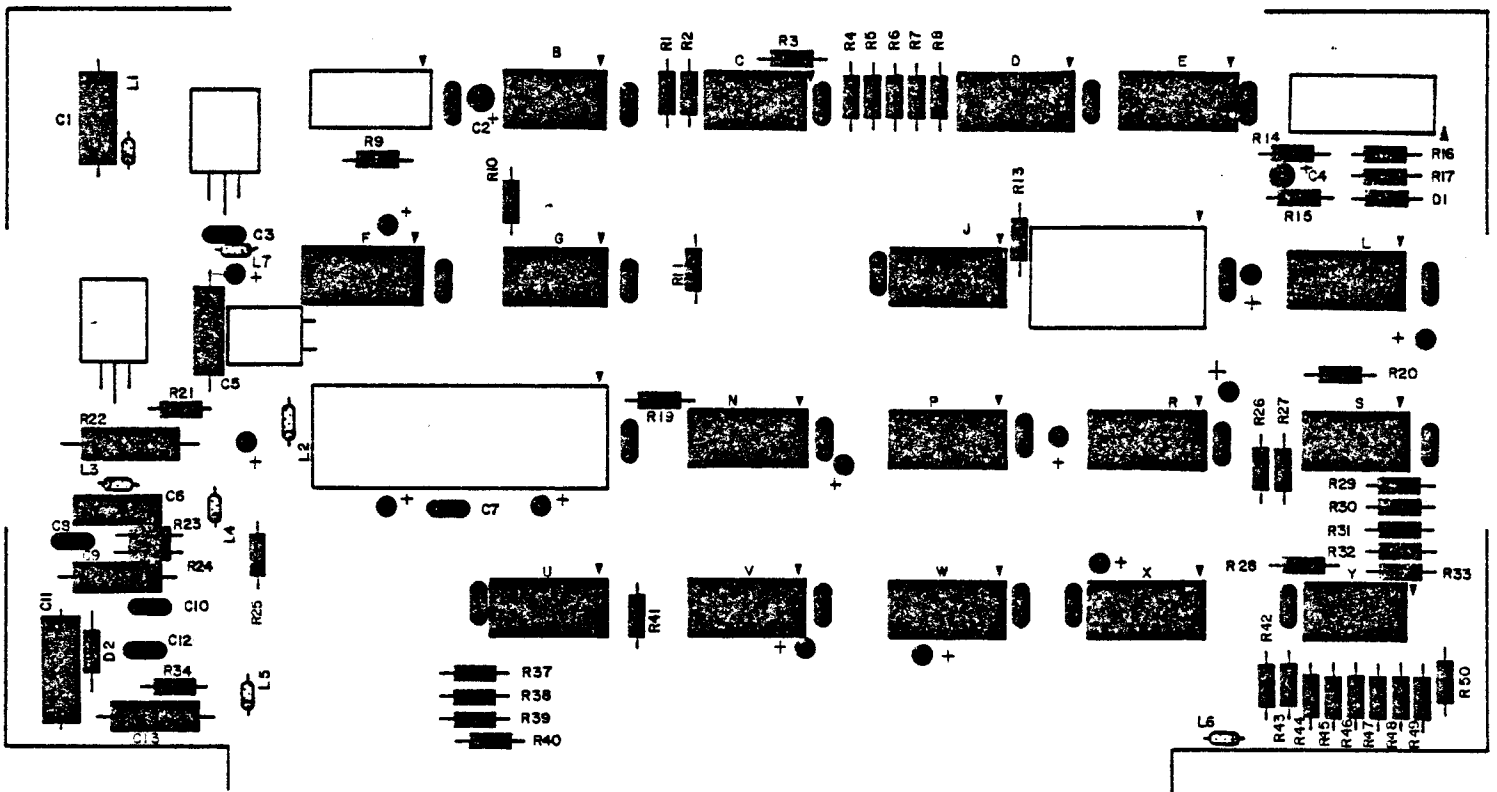


5-30. CPU Diode Installation

5-38. FERRITE BEAD INSTALLATION
(Figure 5-31)

Install the 7 ferrite beads, L1 through L7 (Bag 7), on the CPU Board according to the following instructions.

1. Using the resistor leads saved from Paragraph 5-34, cut seven 1-inch lead lengths.
2. Insert the lead through the bead, and bend the ends so they conform to the designated holes on the CPU Board.
3. Insert the leads into the board, and solder to the foil (bottom) side of the board. Be careful not to leave any solder bridges.
4. Clip off any excess lead lengths.



5-31. CPU Ferrite Bead Installation

5-39. VOLTAGE REGULATOR INSTALLATION (Figure 5-32)

Install the two voltage regulators, VR1 and VR2 (Bag 2), and heat sinks on the CPU Board according to the following instructions.

1. Set the regulator in place on the silk-screened side of the board, aligning the leads with their designated holes.
2. Use needle-nose pliers to bend each of the three leads at a right angle to conform to its proper hole on the board.

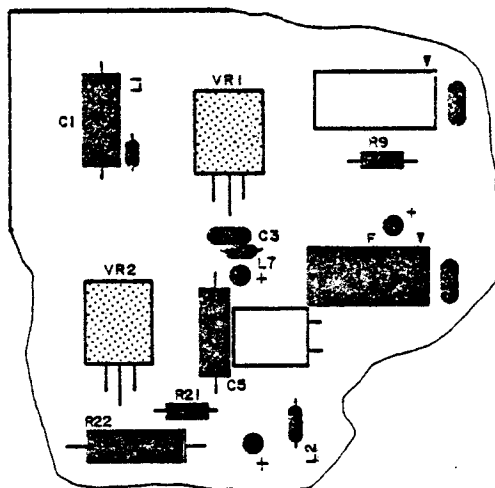
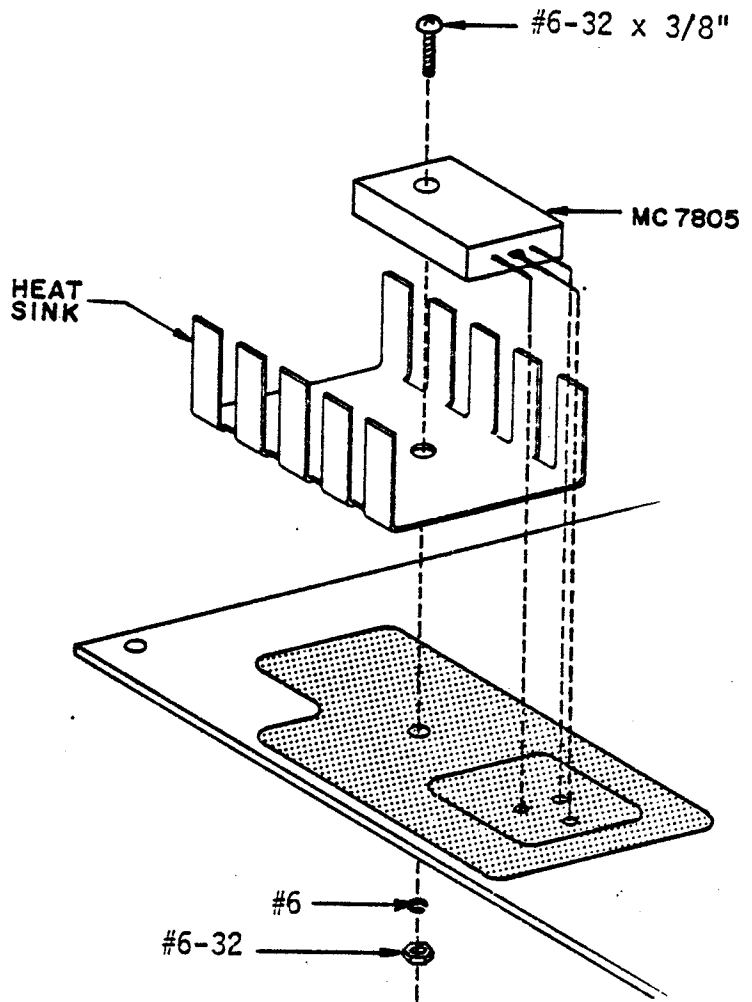
NOTE

Use heat sink grease when installing this component. Apply the grease to all metal surfaces which come in contact with each other.

3. Referring to Figure 5-32, set the regulator and heat sink in place on the silk-screened side of the board. Secure them in place with a #6-32 x 3/8" screw, a #6-32 nut, and a #6 lockwasher.
4. Solder the three leads to the foil (bottom) side of the board. Be sure not to leave any solder bridges.
5. Clip off any excess lead lengths.

Voltage Regulator Part Numbers

() VR1	7805
() VR2	7812



5-32. CPU Voltage Regulator Installation

5-40. TRANSISTOR INSTALLATION
(Figure 5-33)

Install the three transistors, Q1 through Q3 (Bag 4), on the CPU Board according to the Transistor Installation Instructions given on page 5-8.

Transistor Part Numbers	
() Q1, Q2, Q3	2N4410 or CS4410

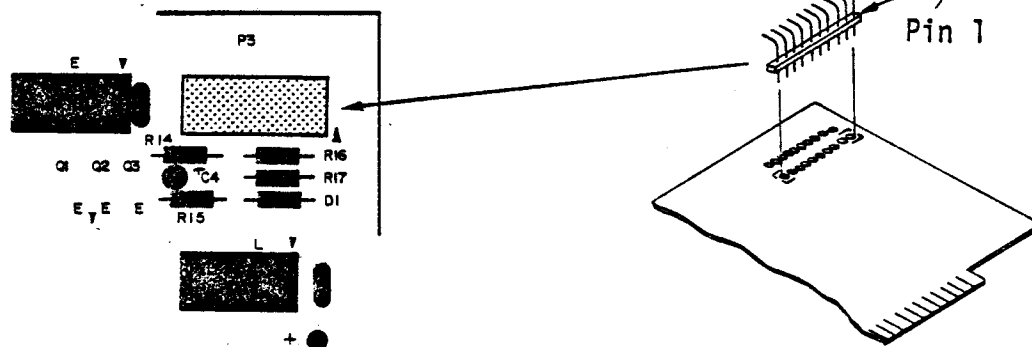
NOTE

The 10-pin Male Connector (P1) may already be installed on the CPU board. If so, disregard the following instructions.

5-41. MALE CONNECTOR INSTALLATION
(Figure 5-33)

Install one 10-pin Male Connector, P1 (Bag 7), on the CPU Board according to the following instructions.

1. Orient the connector as shown in Figure 5-33, with the bent pins pointing toward the top of the board.
2. Insert the short pins into the 10 designated holes on the silk-screened side of the board.
3. Solder each pin to the foil (bottom) side of the board. Be sure not to leave any solder bridges and clip off any excess lead lengths.
4. The arrow on the silkscreen points to Pin #1. After installing the male connector, clip off pin #2 of the connector. This is done for keying purposes. Further keying instructions are given on page 5-75.



5-33. CPU Transistor and Male Connector Installation

5-42. CRYSTAL INSTALLATION (Figure 5-34)

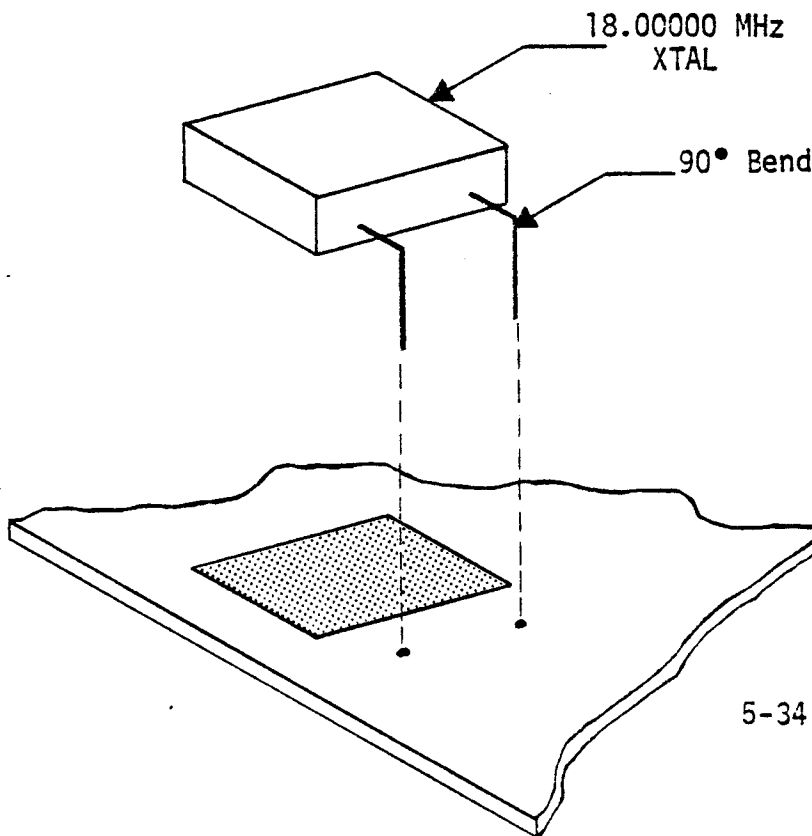
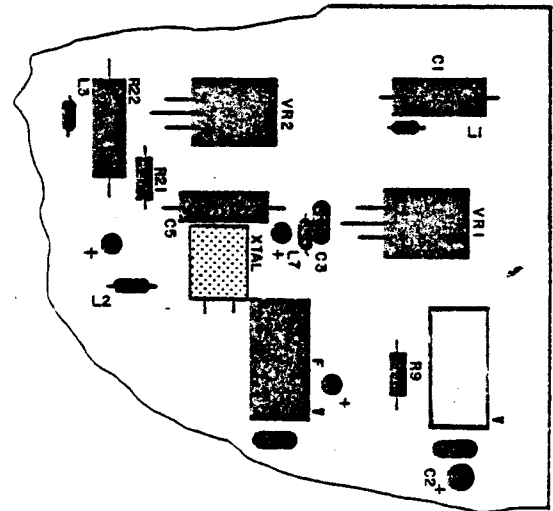
Install one 18.00000 MHz crystal, XTAL (Bag 7), on the CPU Board according to the following instructions.

1. Referring to Figure 5-34, set the crystal in place on the silk-screened side of the CPU board, aligning the two leads with their respective holes.
2. Using needle-nose pliers, bend each lead at a right angle to conform to its respective hole on the board. Insert the leads so that the crystal is resting flat on the board on the square labelled "XTAL".
3. Solder the two leads to the foil (bottom) side of the board. Be sure not to leave any solder bridges.
4. Clip off any excess lead lengths.

CAUTION

Make sure the crystal case does not come in contact with any of the tracks on the CPU Board.

Crystal	Part Number
() XTAL	18.00000MHz



5-34. CPU Crystal Installation

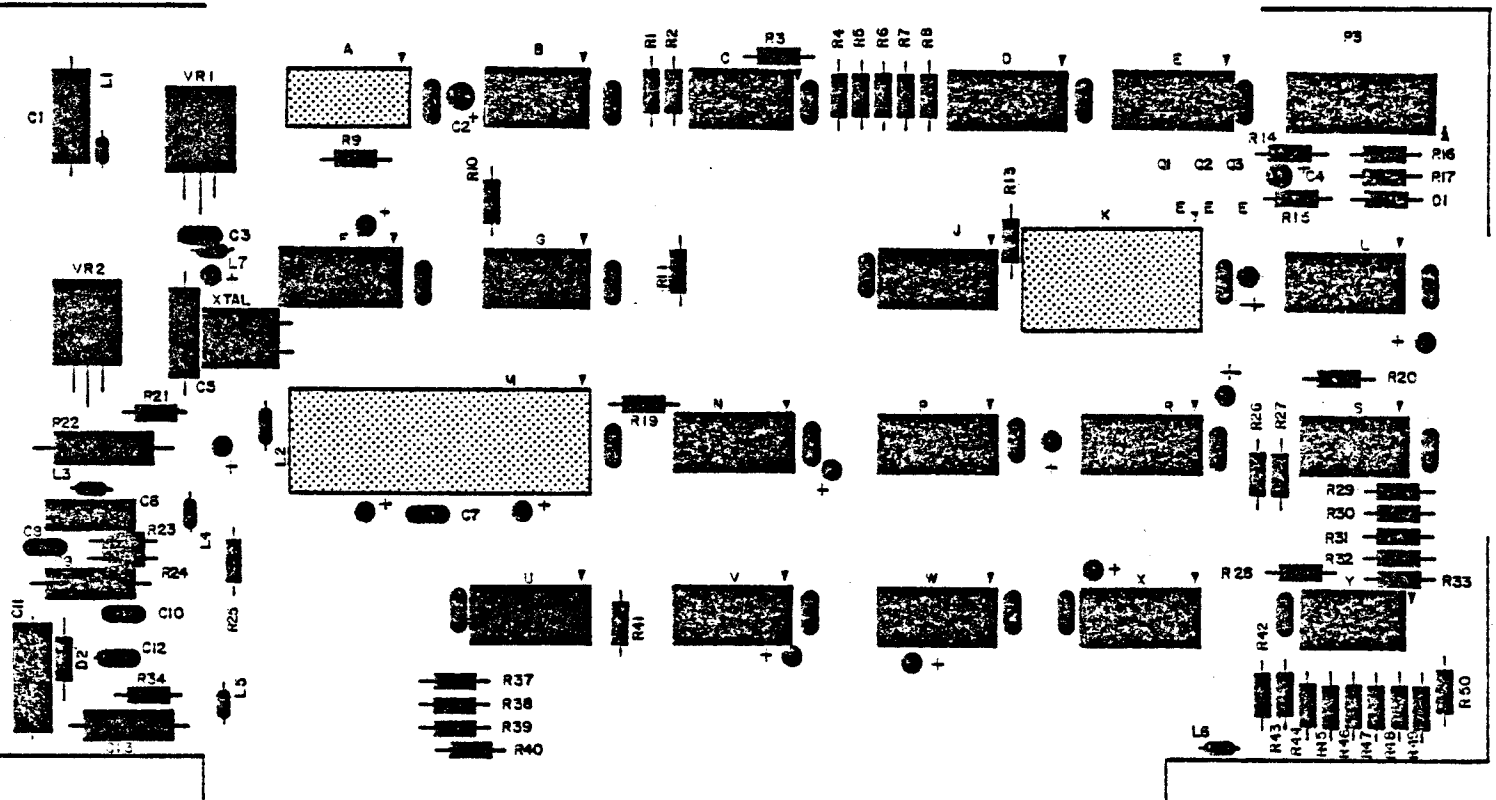
5-43. IC SOCKET AND IC INSTALLATION
(Figure 5-35)

ICs A, K, and M (Bag 1) will be installed at this time. ICs K and M should be installed, with sockets, according to the IC Installation Instructions, Section B, on page 5-10. IC A should be installed (without a socket) according to the IC Installation Instructions, Section A, on page 5-10.

Silkscreen Designation	IC Part Number	Socket Size
() K	8212	24-pin
() M	8080	40-pin
() A	4009	-----

WARNING!

ICs A and M are MOS static-sensitive ICs. See the "MOS IC Special Handling Precautions" on page 5-11 before installing these ICs.



5-35. CPU IC Socket and IC Installation

5-44. POWER SUPPLY BOARD ASSEMBLY

5-45. CAPACITOR INSTALLATION
(Figure 5-36)

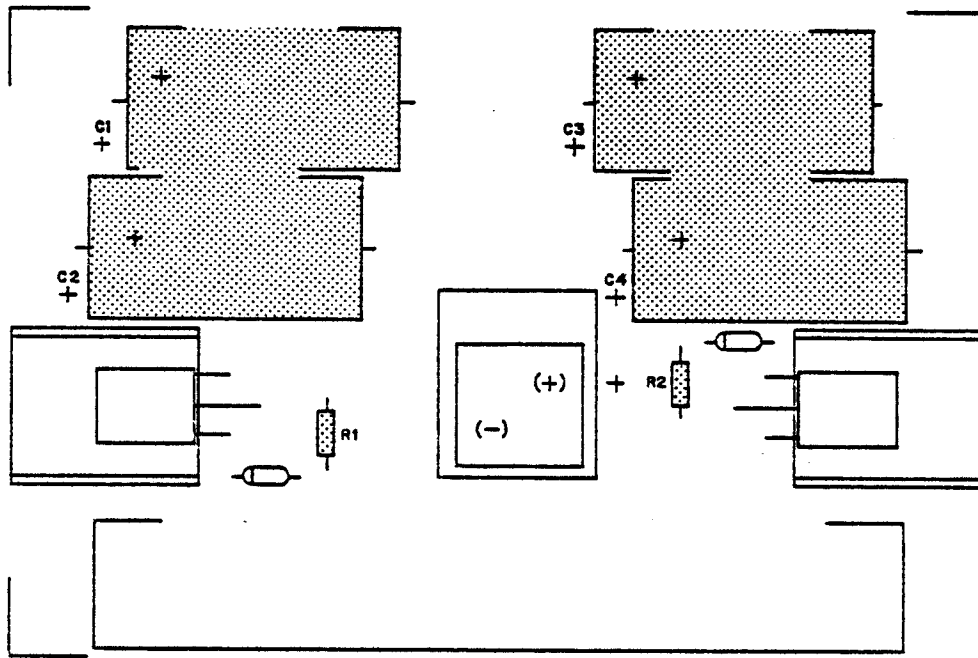
Install the 4 electrolytic capacitors, C1 through C4 (Bag 3), on the Power Supply Board according to the Capacitor Installation Instructions given on page 5-7.

Capacitor Values	
() C1 through C4	2200uf, 25V, electrolytic

5-46. RESISTOR INSTALLATION
(Figure 5-36)

Install the 2 resistors, R1 and R2 (Bag 1), on the Power Supply Board according to the Resistor Installation Instructions given on page 5-6.

Resistor Values	
() R1 and R2	180 ohm (brown, gray, brown) 1/2W

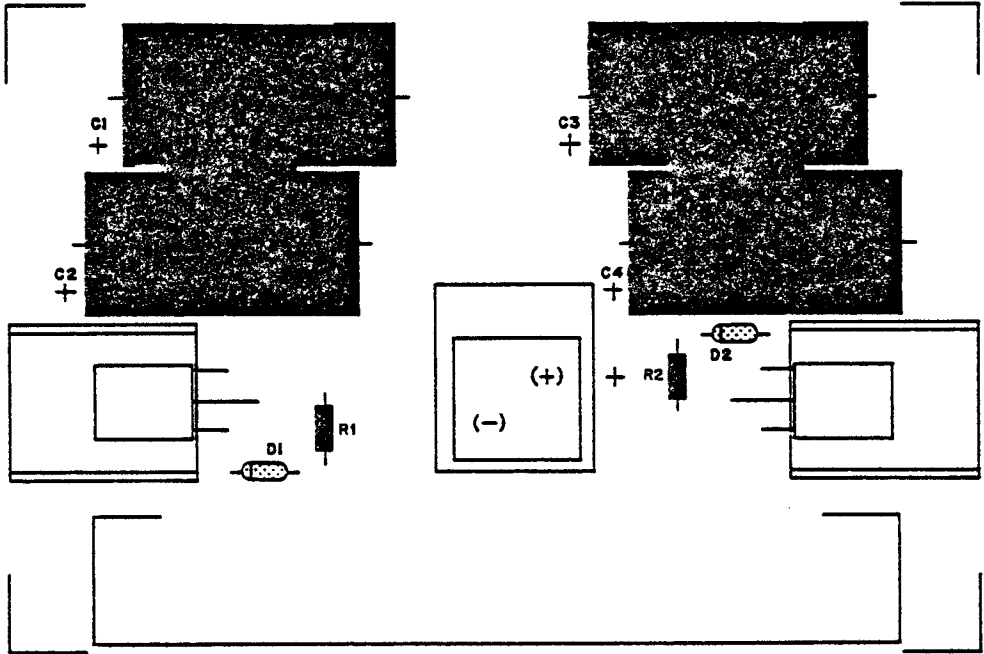


5-36. Power Supply Capacitor and Resistor Installation

5-47. DIODE INSTALLATION (Figure 5-37)

Install the 2 diodes, D1 and D2 (Bag 1), on the Power Supply Board according to the Diode Installation Instructions given on page 5-8.

Diode Part Numbers	
() D1 and D2	IN4746



5-37. Power Supply Diode Installation

5-48. TRANSISTOR INSTALLATION
(Figure 5-38)

Install the two transistors, Q1 and Q2 (Bag 1), mica insulators, and heat sinks on the Power Supply Board according to the following instructions.

1. Set the transistor in place on the silk-screened side of the board, aligning the leads with their designated holes.
2. Use needle-nose pliers to bend each of the three leads at a right angle to conform to its proper hole on the board.

NOTE

Use heat sink grease when installing this component. Apply the grease to all surfaces which come in contact with each other.

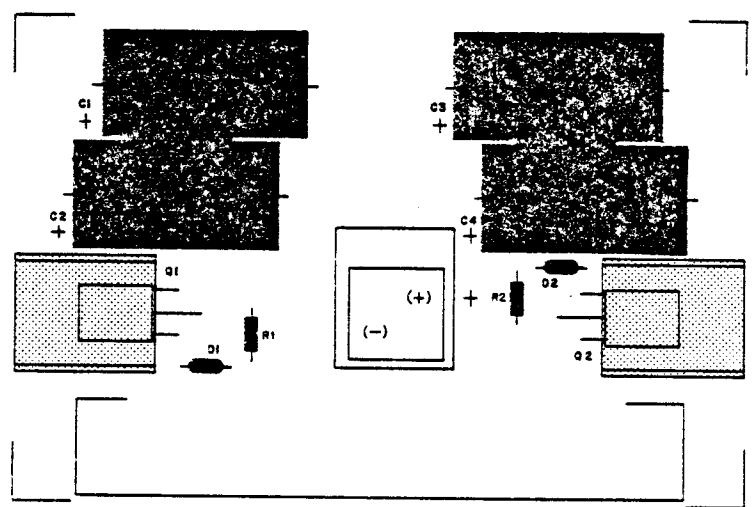
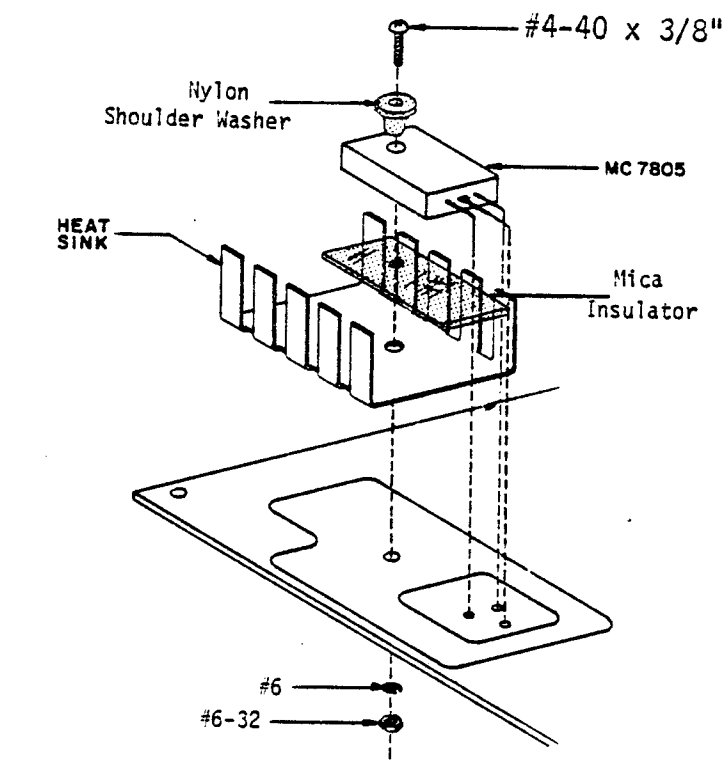
NOTE

According to supply variations, your kit may contain either two #6-32 x 3/8" nylon screws (Bag 5), or two #4-40 x 3/8" metal screws (Bag 5) to be used when installing transistors Q1 and Q2. If your kit contains metal screws, two fiber shoulder washers (Bag 5) must be used along with the screws. To install the fiber shoulder washers, refer to Figure 5-38.

3. Referring to Figure 5-38, set the transistor, mica insulator, and heat sink in place on the silkscreened side of the board. Secure them in place with a #6-32 x 3/8" screw, a #6 lock-washer and a #6-32 nut (Bag 5).

4. Solder the three leads to the foil (bottom) side of the board. Be sure not to leave any solder bridges.
5. Clip off any excess lead lengths.

Transistor Part Numbers	
() Q1	TIP145 or TIP146
() Q2	TIP140 or TIP141



5-38. Power Supply Transistor Installation

5-49. BRIDGE RECTIFIER INSTALLATION (Figure 5-39)

Install one bridge rectifier, BR2 (Bag 1), on the Power Supply Board according to the following instructions.

WARNING!

It is essential that the bridge rectifier be oriented correctly, so that the "+" lead or red dot corresponds with the "+" hole on the Power Supply Board.

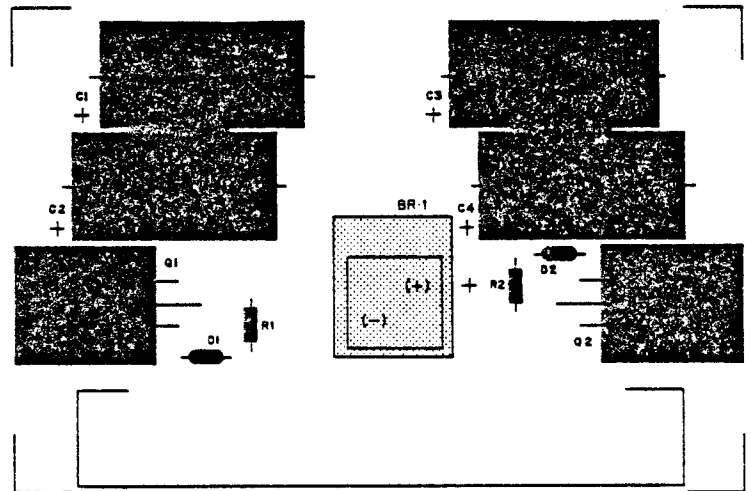
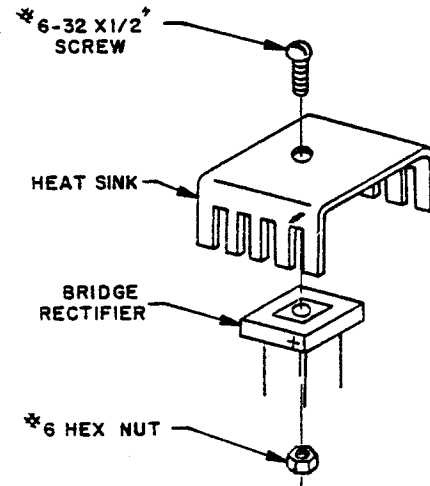
NOTE

Use heat sink grease when installing this component. Apply the grease to the bridge rectifier and the heat sink where they come in contact with each other.

1. Orient the bridge rectifier and the heat sink as shown in Figure 5-39. Note that the mounting hole in the heat sink is not centered, but is closer to one end. Make sure you orient the "+" lead of the rectifier under the wider end of the heat sink, as shown.
2. Attach the heat sink to the bridge rectifier, using a #6-32 x 1/2" screw and a #6 hex nut (Bag 5).
3. Orient the heat sink and rectifier assembly correctly over the board, as shown in Figure 5-39. When you have the proper alignment, the wider end of the heat sink will be pointing toward the right side of the Power Supply Board, and the "+" lead will be going into the "+" hole.

4. Insert the four leads from the bridge rectifier through the proper holes on the Power Supply Board until the legs of the heat sink rest on the board.
5. Holding the heat sink in place, turn the board over and bend the four leads slightly outward. Solder the leads to the foil (bottom) side of the board and clip off any excess lead lengths.

Bridge Rectifier	Part Number
() BR2	KBPC802

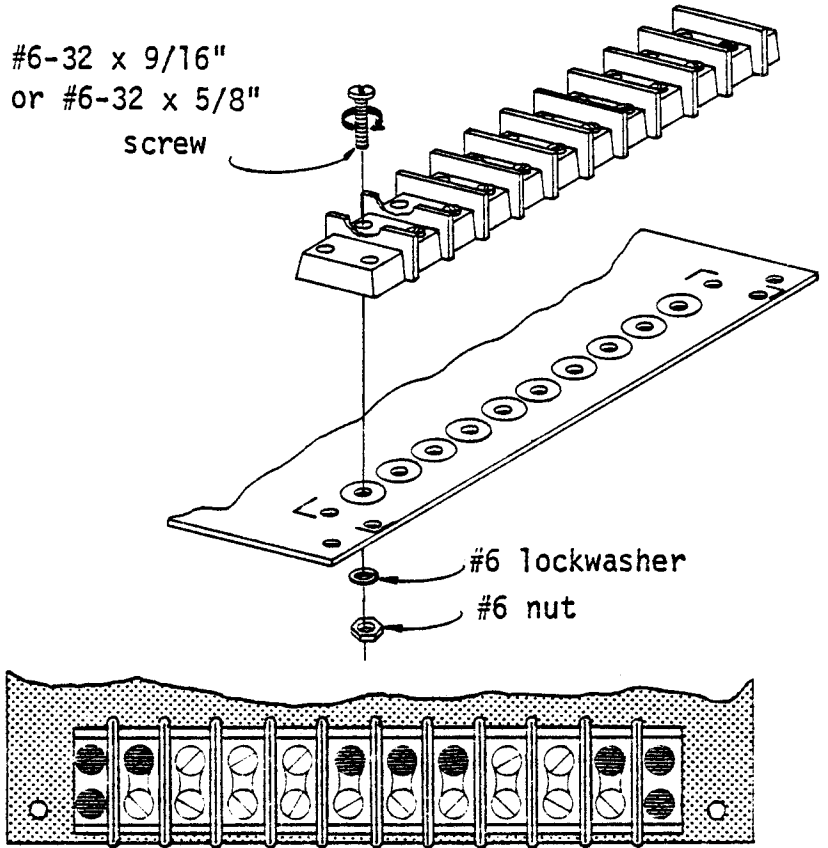


5-39. Power Supply Bridge Rectifier Installation

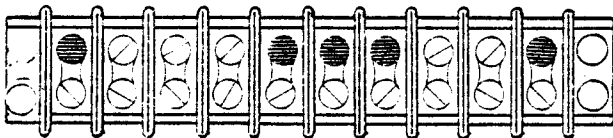
5-50. TERMINAL BLOCK INSTALLATION
(Figures 5-40 through 5-42)

Install the terminal block, TB1 (Bag 2), on the Power Supply Board according to the following instructions.

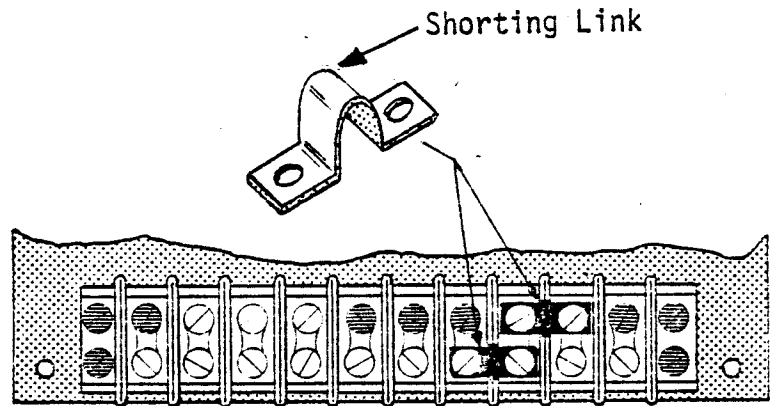
1. Remove the five #6-32 x 1/4" screws shown in Figure 5-40 from the terminal block.
2. Set the terminal block in place on the silk-screened side of the Power Supply Board.
3. Secure the terminal block onto the board by inserting nine #6-32 x 9/16" or #6-32 x 5/8" screws, nine #6 lockwashers, and nine #6 nuts (Bag 5) into the proper holes as shown in Figure 5-41.
4. Insert 1 shorting link (Bag 2) over the lower portion of terminals 7 and 8, and 1 shorting link over the upper portion of terminals 8 and 9. Secure in place with four #6-32 x 1/4" screws (Figure 5-42).



5-41. Power Supply Terminal Block Screw Insertion



5-40. Power Supply Terminal Block Screw Removal



5-42. Power Supply Terminal Block Shorting Link Insertion

5-51. MOUNTING POWER SUPPLY BOARD
ONTO CROSS MEMBER (Figure
5-43)

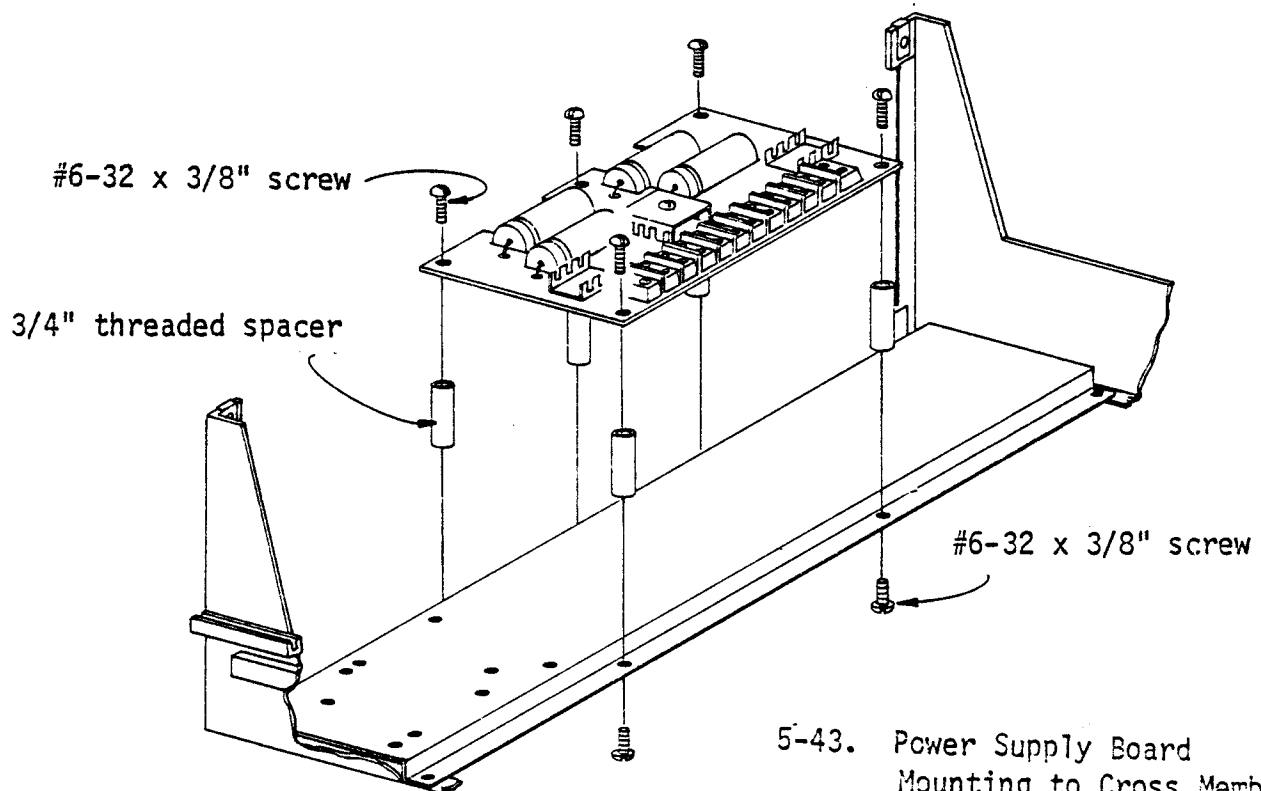
There are four or five holes on the Power Supply Board to be used in mounting the board to the Cross Member at the back of the main frame. Five 3/4" threaded spacers (Bag 5) and ten #6-32 x 3/8" screws (Bag 5) will be used in this procedure. Refer to Figure 5-43 and the following instructions for mounting the board to the Cross Member.

1. Insert one screw into each mounting hole on the board from the silk-screened side.
2. Put a spacer on each screw and tighten it down.
3. Rest the board on the Cross Member so that the spacers are aligned with the mounting holes.

4. Fasten the board into place by inserting another screw into each spacer from underneath the Cross Member.

NOTE

Before mounting the Power Supply Board, make a ground connection between terminal #9 on the terminal block and the lower, right-hand mounting screw on the cross member. Use a 3-inch piece of wire braid with solder lugs at each end. (Instructions for preparing the wire braid are detailed in Paragraph 5-72.



5-43. Power Supply Board
Mounting to Cross Member