

altair 680b

II. MAIN PC BOARD ASSEMBLY

- IC Socket and IC Installation
- Capacitor Installation
- Resistor Installation
- Transistor Installation
- Diode and Crystal Installation
- Voltage Regulator Installation
- Bridge Rectifier Installation
- Connector Installation
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IC Socket Installation

There are 15 IC sockets to be installed on the 680b Main PC Board.

Install the IC sockets according to the instructions given on page 7, section B. The size for each socket is listed below.

IC Designation	Socket Size
() C, D, E, F, G, H, J, K, and Z	16 pin
() T, U, V, W, and JJ	24 pin
() NN	40 pin

The ICs that are to be installed into these sockets are all static-sensitive MOS ICs. (see page 6)

Install only the sockets at this time. DO NOT install the ICs in the sockets until the Main PC Board has been completely assembled.

IC Installation

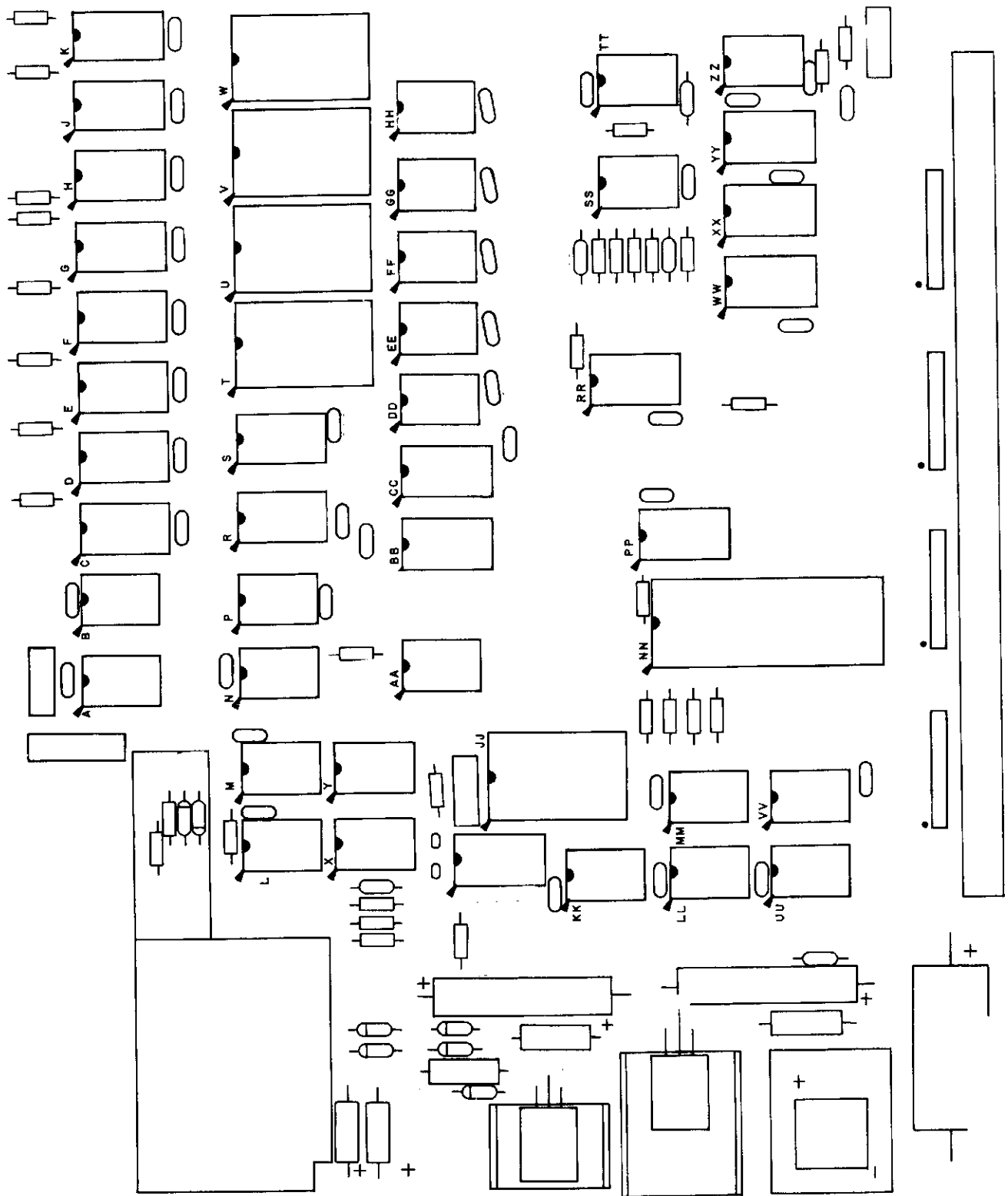
There are 31 ICs to be installed (without sockets) onto the 680b Main PC Board.

Install these ICs according to the instructions on page 7, section A. The correct part numbers for the ICs are listed below.

IC Designation	Part Number
() A, B, X, HH, MM, VV, and ZZ	74LS04
() L (Baudot only)*	74LS74
() M	74LS10
() N and P	74LS01
() R, S, CC, and PP	4050**
() Y	74LS00
() AA, KK, LL, and UU	74LS30
() BB	4449**
() DD, EE, and FF	74LS20
() GG and SS	74LS02
() TT	74LS73
() RR, WW, XX, and YY	74367 (or 8T97)

*NOTE: Install IC L ONLY if a Baudot terminal is to be interfaced to the 680b.

**Static-Sensitive MOS ICs.
See page 6 before installing.



IC and IC Socket Installation

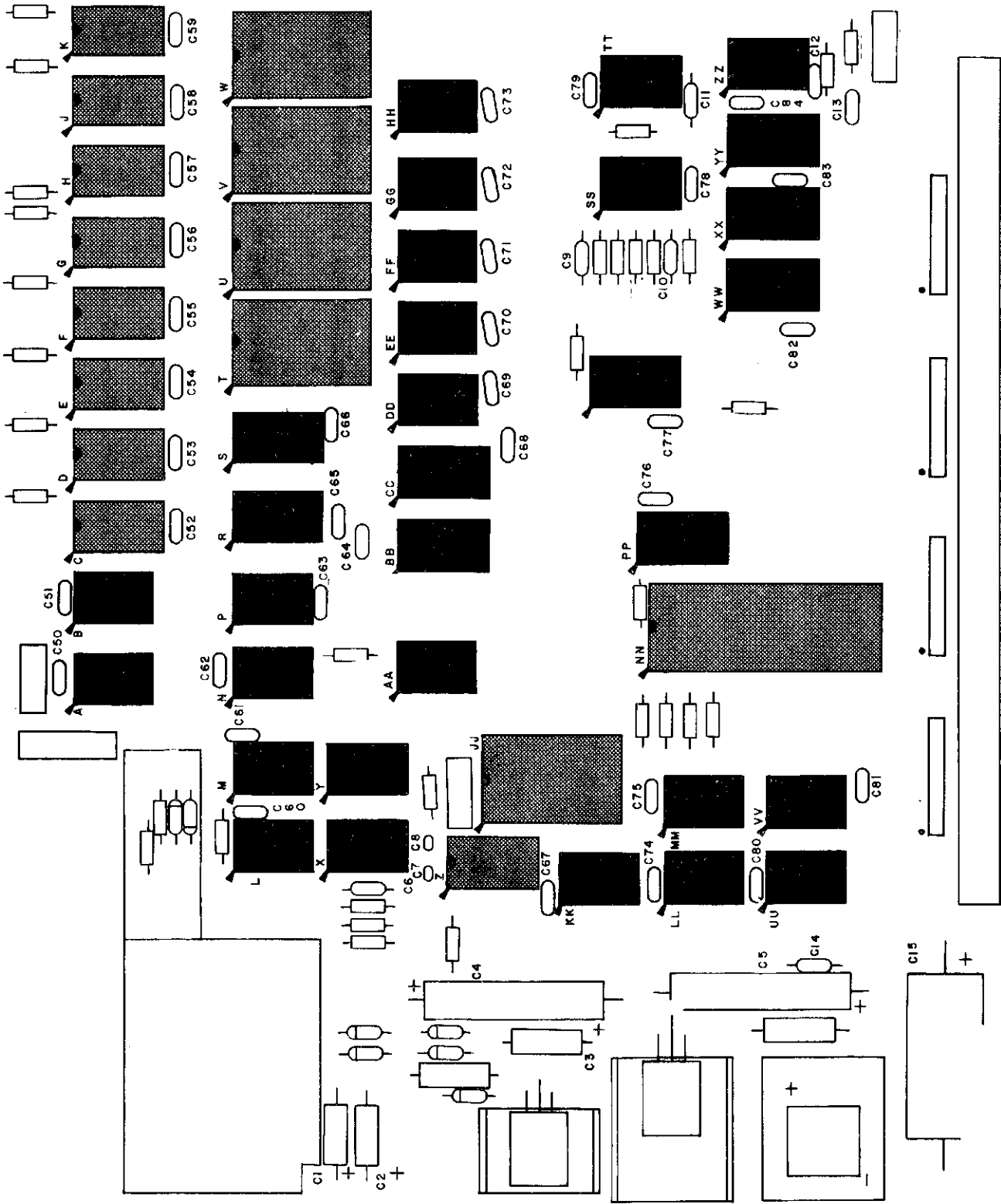
Capacitor Installation

There are 6 electrolytic capacitors (C1, C2, C3, C4, C5, and C15), 1 tantalum capacitor (C6), and 43 ceramic disk capacitors (C7 through C14 and C50 through C84) to be installed on the Main PC Board. Install the electrolytic capacitors and the tantalum capacitor according to the instructions given on page 9, Section A. Install the ceramic disk capacitors according to the instructions on page 9, Section B.

The values for all 50 capacitors are listed below.

Capacitor Values	
() C1, C2, C3	35 uf
() C4, C5	100 uf
() C6	1 uf
() C7, C8	56 pf
() C9, C10	430 pf
() C11	.001 uf
() C12	50 pf
() C13	.01 uf
*() C14, C50 through C84	.1 uf
() C15	3300 uf

*NOTE: Save the extra capacitor leads clipped from C50 through C84 for later use.



Capacitor Installation

Resistor Installation

Install the following 37 resistors on the Main PC Board. Use the instructions listed on page 8.

NOTE: All of the resistors on the Main PC Board are either 1/4 watt or 1/2 watt, except R21, which is a 2-watt resistor.

Resistor Values and Color Codes

() R1 through R9, R15, R30	4.7K ohm, yellow, violet, red
() R10, R11, R13, R17, R18	10K ohm, brown, black, orange
() R12	33K ohm, orange, orange, orange
() R14	330 ohm, orange, orange, brown
() R16	10M ohm, brown, black, blue
() R19, R20	3.3K ohm, orange, orange, red
() R21	15 ohm (2 watt), brown, green, black
() R22	1K ohm, brown, black, red
() R23, R28	47 ohm, yellow, violet, black
() R24, R25, R26, R27, R31, R32	470 ohm, yellow, violet, brown
() R29	100 ohm, brown, black, brown

Resistor Pack Installation

After installing all 37 resistors, the 4 resistor packs (RP1 through RP4) must be installed. The resistors within these packs each have a value of 4.7K ohms. Each pack has a small dot printed at one end. This dot must correspond with the dot printed on the PC Board. Use the following instructions to install each resistor pack.

1. Install the resistor pack at a perpendicular angle to the silk-screened side of the board. Make sure the dot on the resistor pack is aligned with the dot printed on the PC Board.

2. Tape the resistor pack in place and turn the board over. Before soldering, check that the resistor pack is still perpendicular to the board. Carefully solder each pin of the resistor pack to the foil pattern on the back of the board.*
3. Turn the board over again and remove the tape.

() RP1 through RP4 are 4.7K ohm resistor packs

*NOTE: The foil pattern on the back of the board is partially covered by a solder mask. The solder mask helps prevent solder bridges across lands.

Special Insert Page

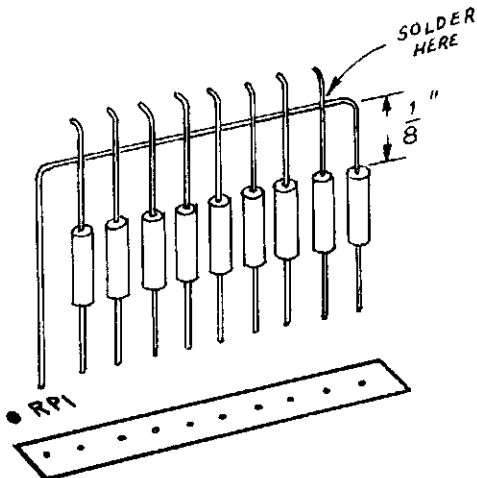
RESISTOR PACK SUBSTITUTIONS

ALTAIR 680b MAIN PC BOARD

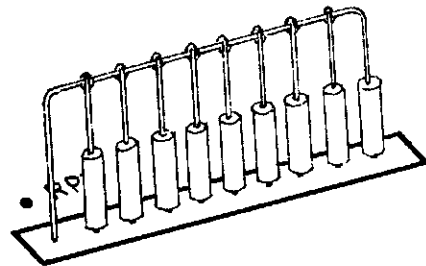
Due to supply shortages, your 680b kit has been shipped to you without the four 4.7K ohm Resistor Packs (RP1-RP4) called for on page 20 of the Assembly Manual. Nine 4.7K ohm, 1/4 watt resistors have been substituted for each pack. These substitute resistors must be installed according to the directions outlined below.

Substitute Resistors, RP1-RP4 Installation Procedure

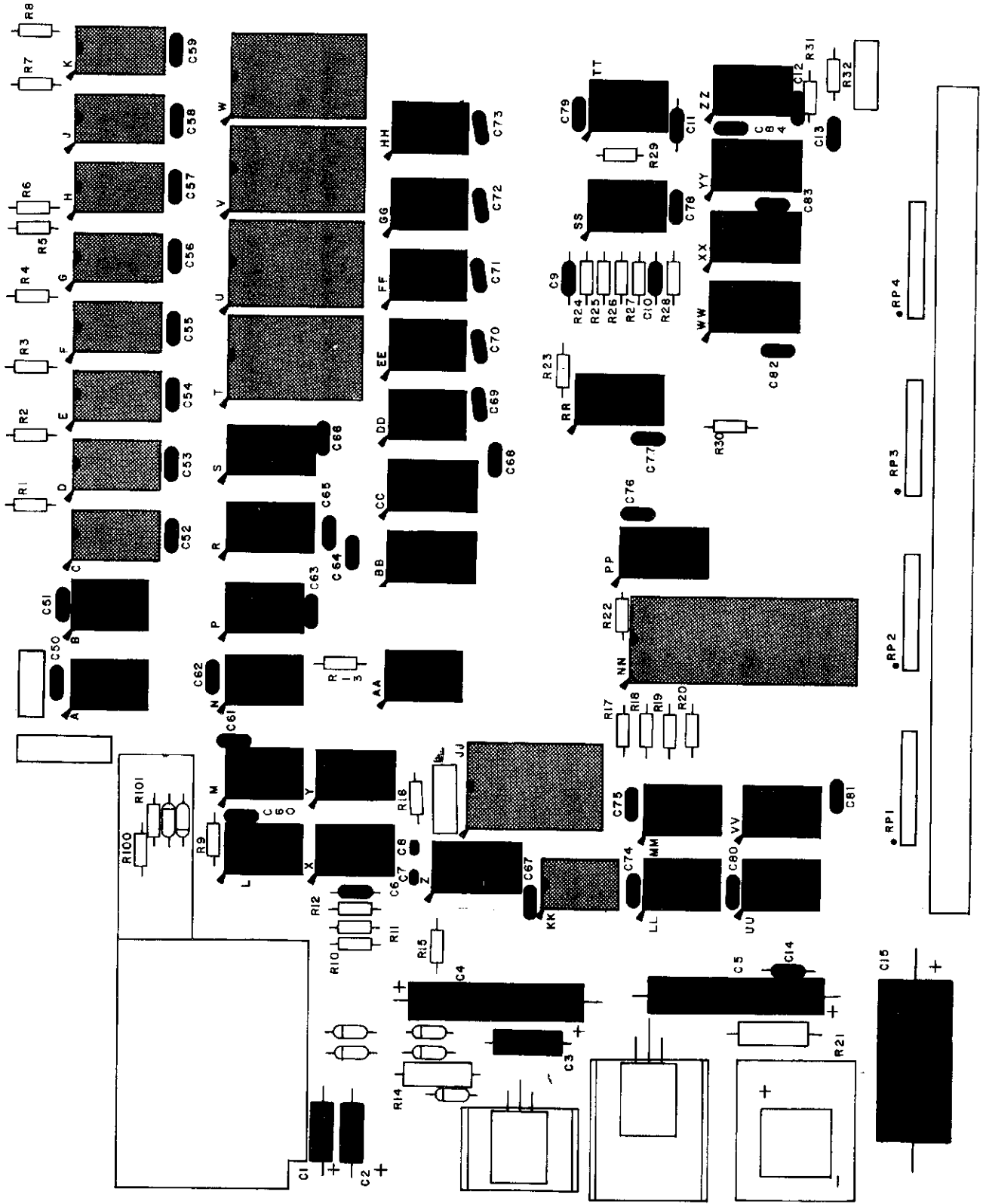
1. Note that each resistor pack designation on the silk screen has 10 holes. The left-most hole is marked on the silk screen with a dot.
2. Beginning with the box labeled RP1, insert one 4.7K ohm, 1/4 watt (yellow-violet-red) resistor vertically into the right-most hole in the box. Bend the top lead at two right angles, as shown in the diagram, so that the end of the free lead may be inserted into the hole marked with a dot. Solder the two inserted leads to the foil pattern on the back of the board.
3. Insert the remaining eight 4.7K ohm, 1/4 watt resistors vertically into the remaining eight holes. Solder each of the top leads to the common horizontal lead of the first resistor. It may be helpful to bend the top leads against the horizontal lead for better contact before soldering.
4. Solder the inserted leads of the eight resistors to the foil pattern on the back of the board. Clip all excess leads from the top and bottom of the resistors.
5. Repeat this procedure for RP2, RP3 and RP4.



Resistor Installation



Completed Resistor Assembly



Resistor Installation

Transistor Installation

There are five transistors to be installed on the Main PC Board. Q2, Q3, Q4, and Q5 should be installed first. To install these 4 transistors, follow the instructions given on page 10. MAKE SURE YOU INSTALL THE EMITTER LEAD INTO THE HOLE LABELLED "E" ON THE BOARD. See the Transistor Identification Chart on page 11 for identification of the emitter lead.

Install transistor Q1 next. Q1 is a TIP-30 power transistor that will be installed with a small heat sink. Use the instructions and diagram below to install Q1.

WARNING: The TIP-30 is very similar in appearance to the MC7805 voltage regulator (VR1). When installing Q1, make sure you have selected the part labeled TIP-30.

1. Set the TIP-30 in place on the board and align the mounting holes. Use a pencil to mark the point on each of the three leads where they line up with their respective holes on the board.
2. Use needle-nose pliers to bend each of the three leads at a right angle on the points where you made the pencil marks.

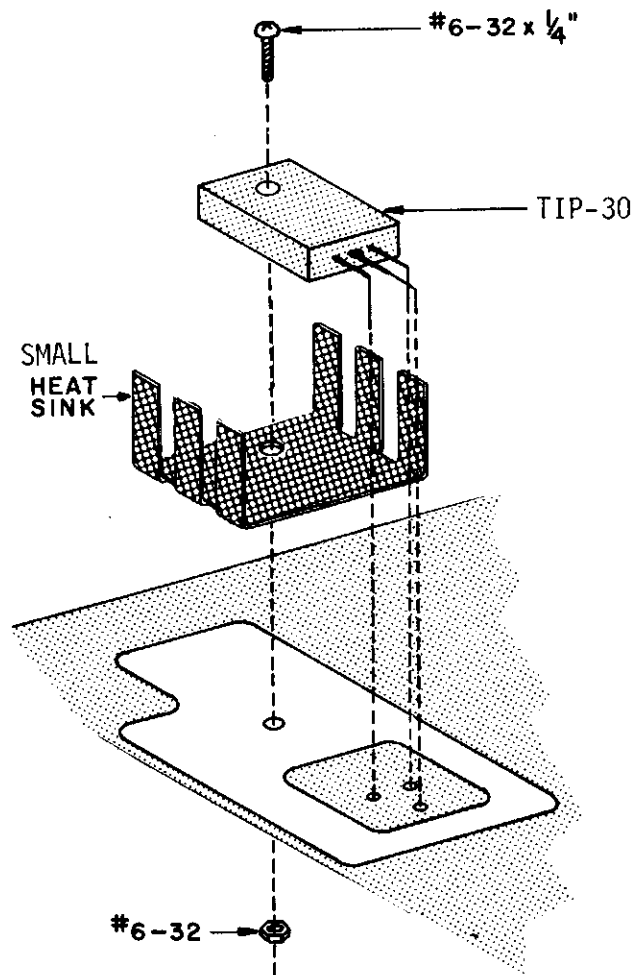
NOTE: Use heat-sink grease when installing this component. Apply the grease to all surfaces which come in contact with each other.

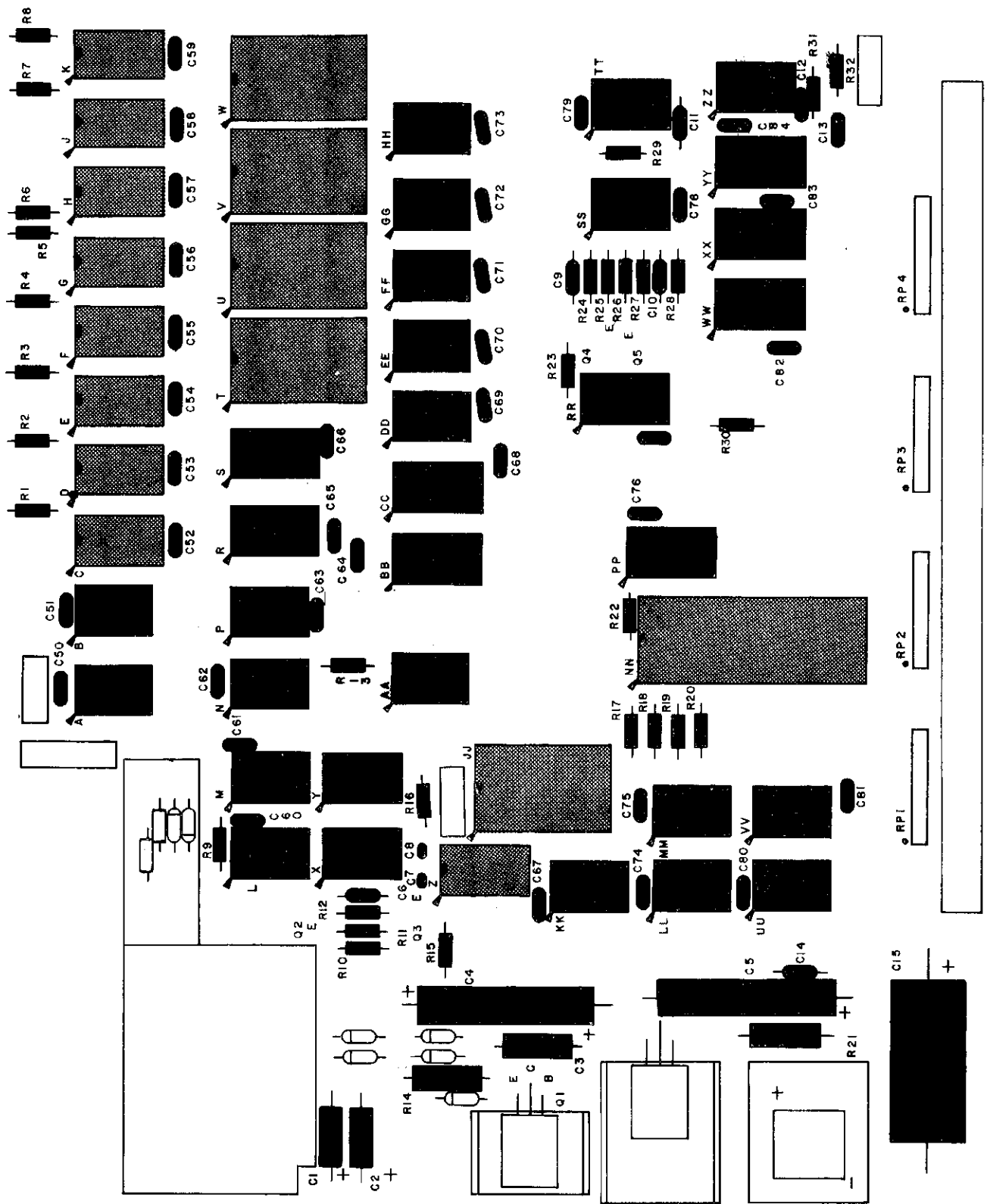
3. Referring to the drawing, set the transistor and heat sink in place on the silk-screened side of the board. Secure them to the board using a #6-32 nut. Hold the transistor in place as you tighten the nut to keep from twisting the leads.

4. Turn the board over and solder the three leads to the foil pattern on the back side of the board. Be sure not to leave any solder bridges.
5. Clip off any excess lead lengths.

Part numbers for the five transistors are given below.

Transistor Part Numbers	
() Q1	TIP-30
() Q2, Q3	CCS-4438
() Q4, Q5	2N-2907





Transistor Installation

Diode Installation

There are five diodes (D1, D2, D3, D4, and D5) to be installed on the Main PC Board. To install these diodes, follow the instructions given on page 10.

Part numbers for the five diodes are listed below.

Diode Part Numbers	
<input type="checkbox"/> D1, D2, D3, D5	IN4004
<input type="checkbox"/> D4	10.0 volt zener

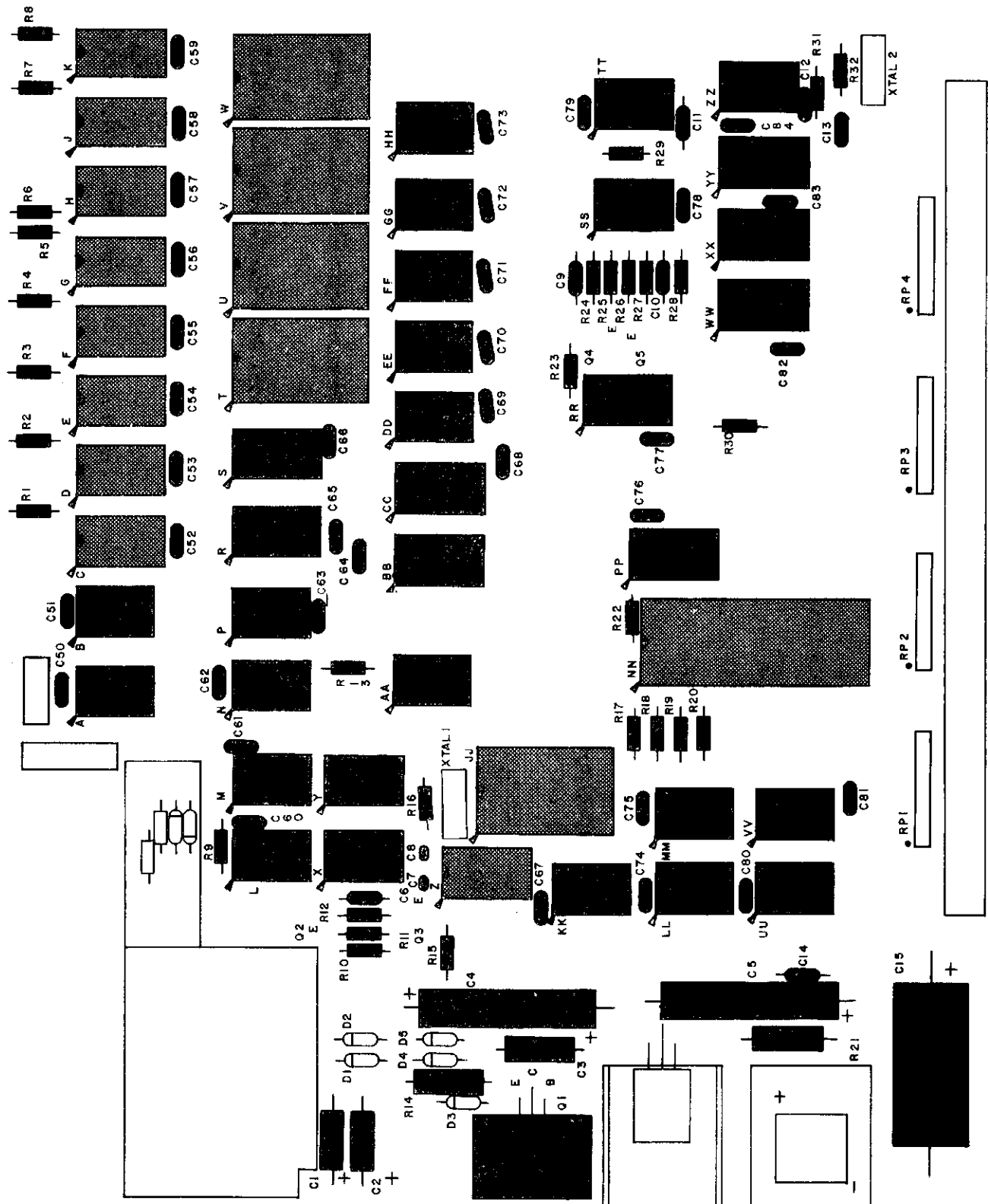
Crystal Installation

There are two crystals to be installed on the 680 Main PC Board. XTAL 1 is a 2.4576 MHz crystal and XTAL 2 is a 2.000 MHz crystal.

Follow the instructions below for installation of each crystal.

1. Use needle nose pliers to straighten the leads on the crystal.
2. Insert the leads into the correct holes until the crystal case stands 1/8" off the surface of the board. (Do not allow the metal crystal case to come into contact with any of the lands on the board.)
3. Holding the crystal in place, turn the board over and bend the leads slightly outward.
4. Solder the leads to the foil pattern and clip off any excess lead lengths.

<input type="checkbox"/> XTAL 1	2.4576 MHz
<input type="checkbox"/> XTAL 2	2.000 MHz



Voltage Regulator Installation

There is one 7805 5-volt regulator (VR1) to be installed on the 680b Main PC Board.

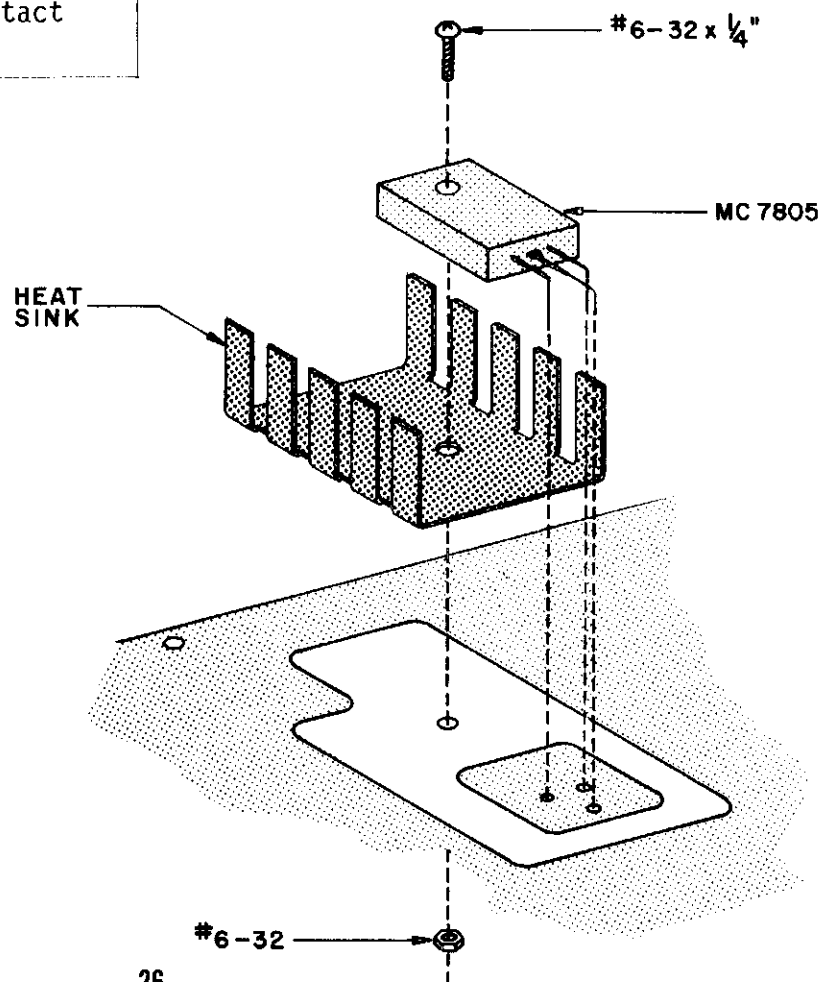
Use the following instructions and the diagram below to install the voltage regulator.

1. Set the 7805 in place on the board and align the mounting holes. Use a pencil to mark the point on each of the three leads where they line up with their respective holes on the board.
2. Use needle-nose pliers to bend each of the three leads at a right angle on the points where you made the pencil marks.

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

3. Referring to the drawing, set the regulator and heat sink in place on the silk-screened side of the board. Secure them to the board using a #6-32 nut. Hold the regulator in place as you tighten the nut to keep from twisting the leads.
4. Turn the board over and solder the three leads to the foil pattern on the back side of the board. Be sure not to leave any solder bridges.
5. Clip off any excess lead lengths.

() VR1 is part number 7805.



Bridge Rectifier Installation

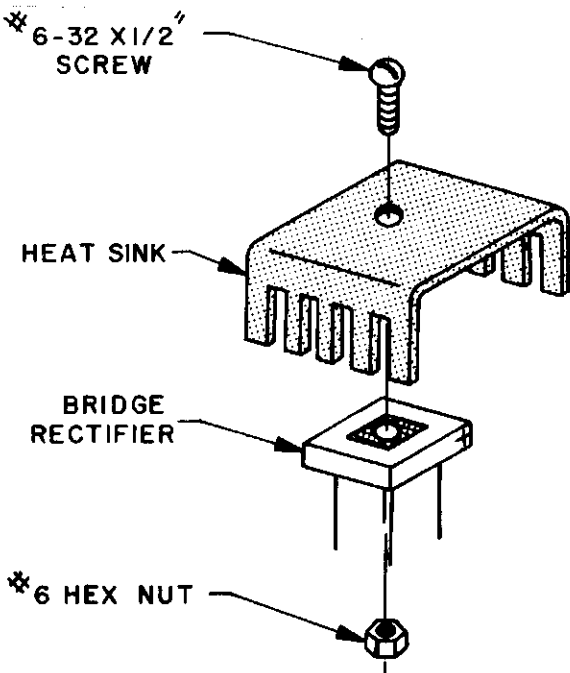
There is one VJ048 bridge rectifier (BR1) to be installed on the 680 Main PC Board. It will be installed with one of the large heat sinks over it.

WARNING! It is absolutely essential that the bridge rectifier be oriented correctly, so that the "+" lead corresponds with the "+" hole on the PC board. Failure to orient the bridge rectifier properly will result in permanent damage to your unit.

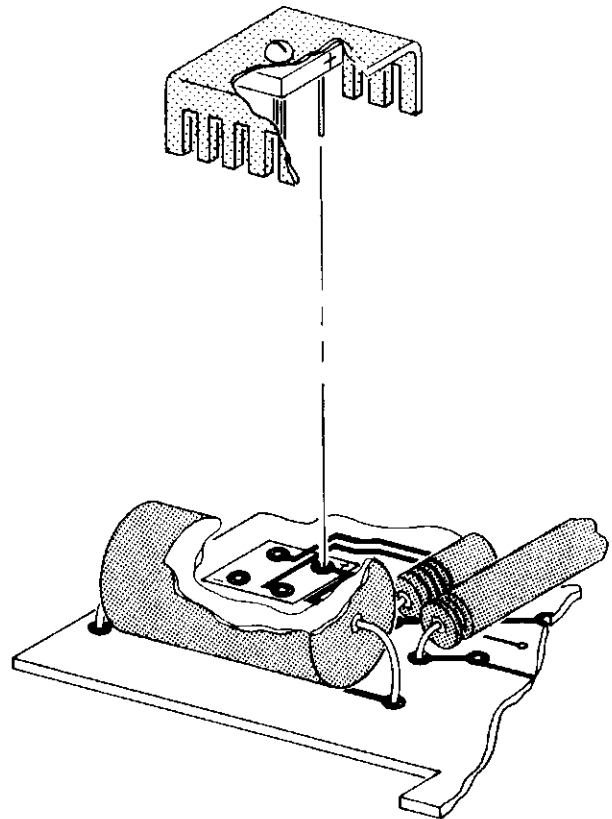
Examine the diagrams shown below and use the following instructions to install BR1.

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

1. Orient the bridge rectifier and the heat sink as shown in the illustration below. 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 inch screw and a #6 hex nut.



3. Orient the heat sink and rectifier assembly correctly over the board, as shown in the next illustration. When you have the proper alignment, the wider end of the heat sink will be pointing towards the right side of the PC board, and the "+" lead will be going into the "+" hole.
4. Put the four leads from the bridge rectifier through the proper holes on the PC board until the prongs of the heat sink rest on the board. If necessary, bend the prongs of the heat sink outward slightly so that they do not contact any lands when mounted to 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 pattern on the back of the board and clip off any excess lead lengths.



() BR1 is part number VJ048

Connector Installation

There are three silk-screen designations for connectors on the 680b Main PC Board: J1, J2 and J3.

J1

J1 is not included with your kit and is not to be installed at this time. The designation J1 is for a 100-pin edge connector that will be used for future memory and I/O expansion. The connector itself is included with the purchase of an expander card.

J2

J2 is a 5-pin male molex connector. Install J2 onto the Main PC Board according to the following instructions.

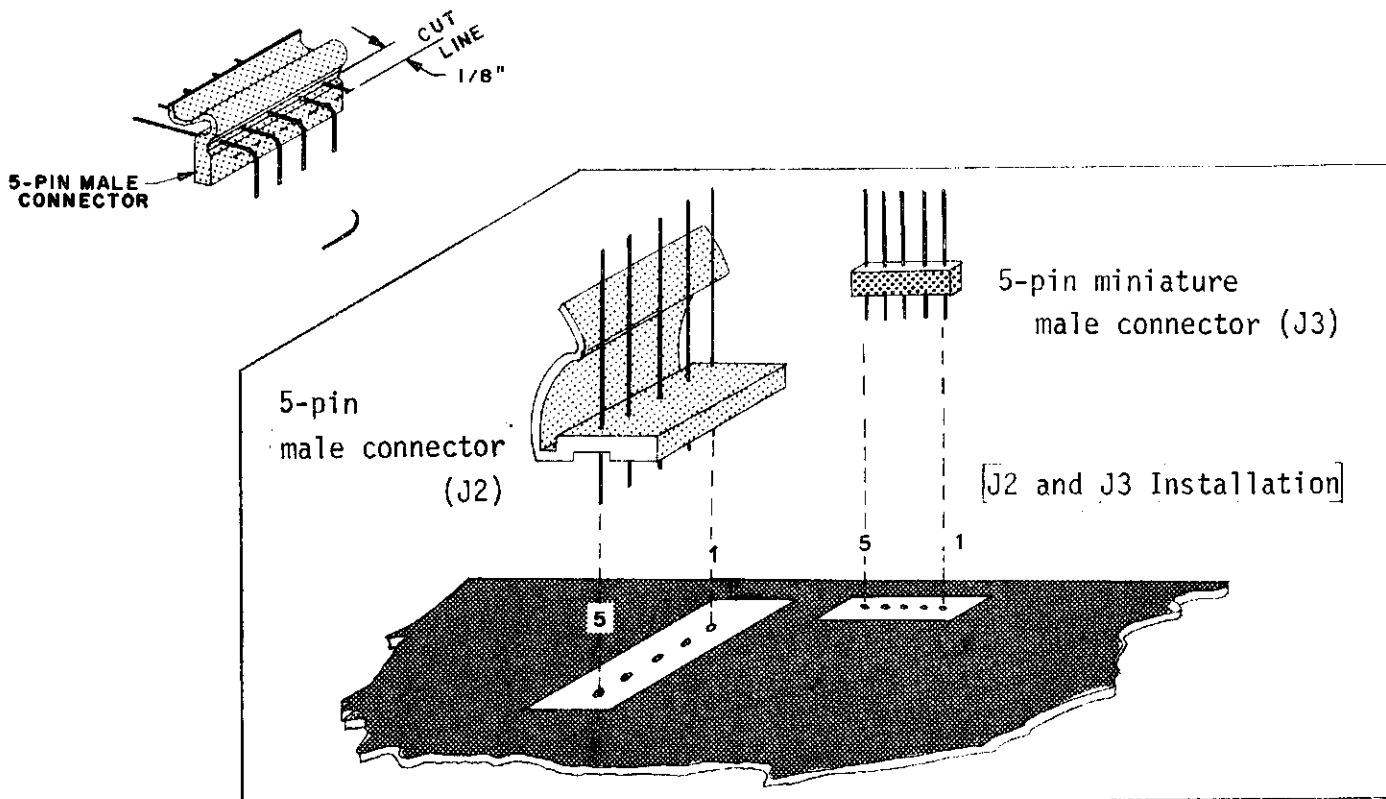
1. Cut the bent pins off 1/8" from the body of the connector, as shown. This modification is necessary before the connector will fit properly on the PC board.
NOTE: Disregard this step if the bent pins have been pre-cut at the factory.

2. Orient the connector J2 as shown below, with the closed side facing the left hand side of the board. Insert the 1/8" pins into the five holes on the silk screened side of the board.
3. Holding the connector in place, turn the board over and solder the five pins to the foil pattern on the back side of the board.

J3

J3 is a 5-pin miniature male molex connector. Install J3 onto the Main PC Board according to the following instructions.

1. Insert the short pins into the five holes on the silk screened side of the Main PC Board, as shown below.
2. Holding the connector in place, turn the board over and solder the five pins to the foil pattern on the back side of the board.



Input/Output Configurations

In the upper left-hand corner of the Main PC Board, a portion of the foil pattern has been boxed off and labeled "I/O."

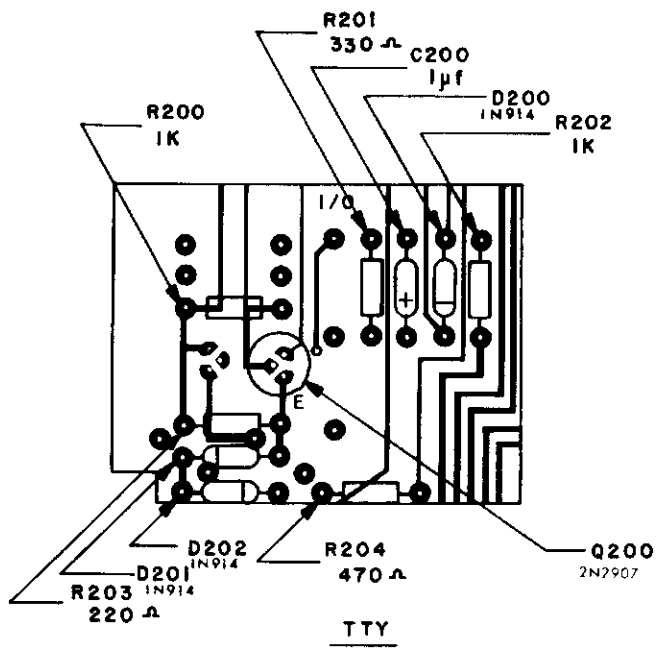
The components in this box may be configured in one of three different ways, depending on the interface level desired.

- A. ASR33/KSR33 Teletype Interface (20 ma current loop)
- B. Standard RS-232 Interface
- C. Baudot Interface

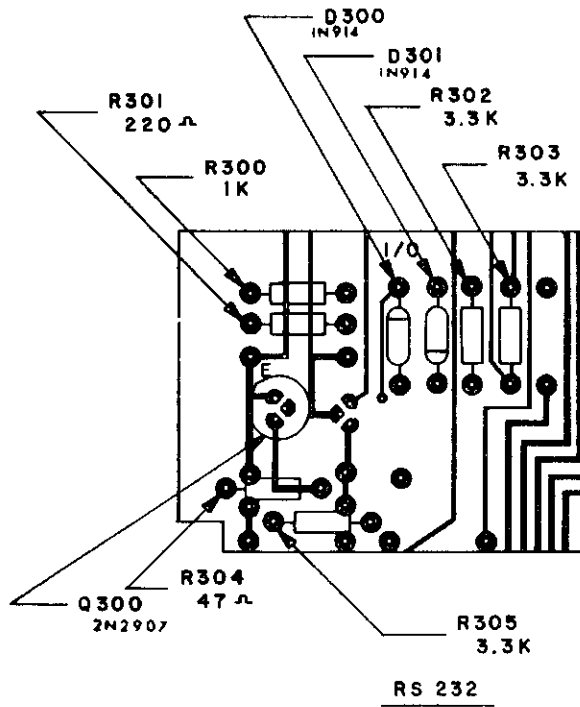
The component configuration for each of the three interface levels is diagrammed below. The correct part numbers and values appear on the diagrams.

Install these components onto the "I/O" section of the Main PC Board according to the interface level you are planning to use.

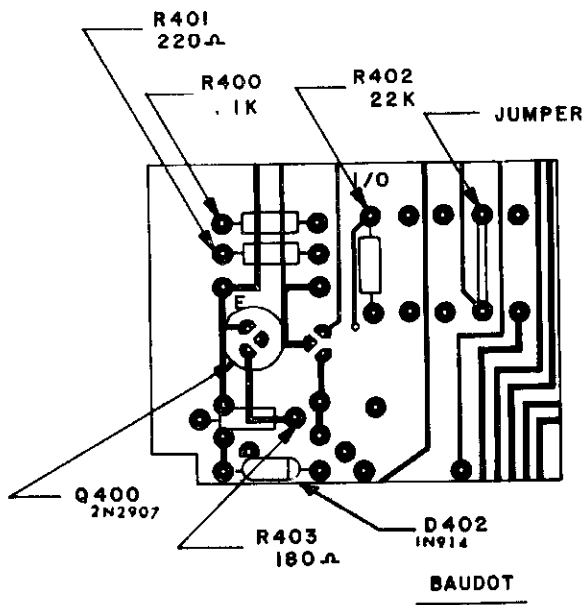
A. ASR33/KSR33 Teletype Interface (20 ma current loop)



B. Standard RS-232 Interface



C. Baudot Interface*



*This component configuration alone does not provide a Baudot level interface for the 680b. It is also necessary to include a level converting and isolation circuit (either a read relay or an optical isolation circuit will suffice). A suggested isolation circuit is shown in the Altair 680b Operator's Manual.

Jumper Wire Connections

On the 680b Main PC Board, the following three areas require jumper wire connections:

- A. Baud Rate Generator (pads 0-3, to the left of IC Z)
- B. RAM Starting Address (pads 1-6 and 10- $\overline{15}$, between ICs AA & BB)
- C. Hardware Programmable Bits (pads 1-5, to the left of IC WW)

Use the capacitor leads saved earlier to make the jumper connections. Cut the leads to size and insert the ends into the proper holes from the silk screened side of the board. Solder the ends to the foil pattern. Make sure the wire is raised 1/4" or so above the board so that none of the lands underneath are shorted.

A. BAUD RATE GENERATOR

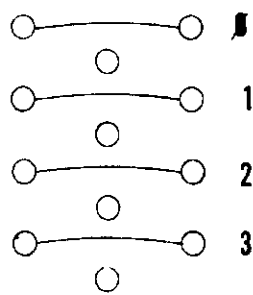
Moving to the left from IC Z there is: 1) a column of four holes labeled 0 through 3; 2) a column of four holes (not labeled) representing the ground (LOW) plane; 3) a column of four holes (not labeled) representing the +5 volt (HIGH) plane.

The baud rate for the 680b computer is user selectable according to the jumper connections placed across these holes. The configurations of the jumper wires for the various baud rates are listed in the chart on the next page.

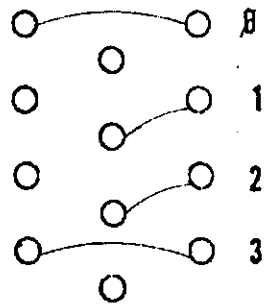
0	1	2	3	OUTPUT RATE Z(pin 10)
L	H	L	L	50 Baud
H	H	L	L	75 Baud
L	L	H	L	134.5 Baud
H	L	H	L	200 Baud
L	H	H	L	600 Baud
H	H	H	L	2400 Baud
L	L	L	H	9600 Baud
H	L	L	H	4800 Baud
L	H	L	H	1800 Baud
H	H	L	H	1200 Baud
L	L	H	H	2400 Baud
H	L	H	H	300 Baud
L	H	H	H	150 Baud
H	H	H	H	110 Baud

TRUTH TABLE FOR
RATE SELECT INPUTS

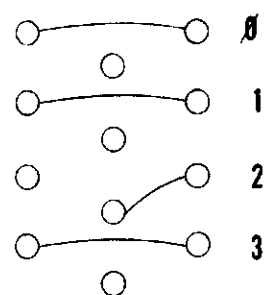
Examples are shown below of the jumper wire configurations for 110 baud, 4800 baud and 1200 baud.



110 Baud



4800 Baud

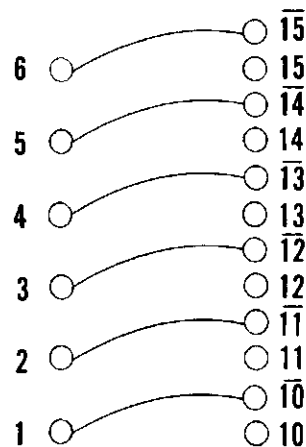


1200 Baud

B. RAM STARTING ADDRESS

The Altair 680b comes equipped with 1K of Random Access Memory (RAM). The starting address for this block of memory is determined by the configuration of the jumper wires across pads 1 through 6 and 10 through $\overline{15}$ (between ICs AA and BB).

As long as the unit is equipped only with the original 1K of RAM, you will probably want to configure the jumper wires for starting address 0000. This is accomplished by jumpering the following locations:



As more memory is added to the unit, you may wish to change the RAM starting address. Details on how to wire the board for various starting addresses are given in the 680b Operator's Manual.

C. HARDWARE PROGRAMMABLE BITS

Moving to the left from IC WW there is: 1) a column of five holes labeled 1 through 5; 2) a column of five holes (not labeled) representing the ground (LOW) plane; 3) a column of five holes (not labeled) representing the +5 volt (HIGH) plane.

The following three conditions are to be hardware programmed by placing jumper connections across these holes:

1. Baudot Interface Bit

Jumper hole #1 HIGH if a Baudot interface is to be used.

Jumper hole #1 LOW if no Baudot interface is to be used.

2. Number of Stop Bits Bit

Jumper hole #2 HIGH for 1 stop bit.

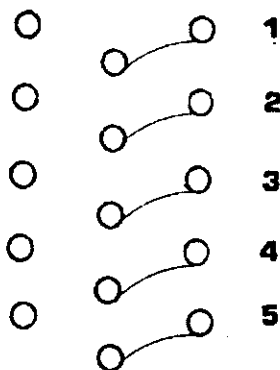
Jumper hole #2 LOW for 2 stop bits.

3. Terminal/No Terminal Bit

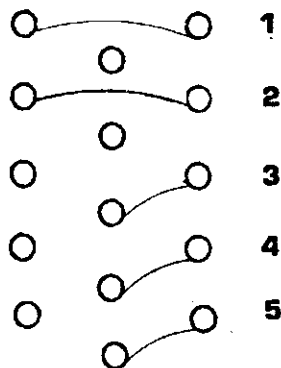
Jumper hole #5 HIGH if no terminal is to be interfaced (i.e. programming to be done via the front panel).

Jumper hole #5 LOW if a terminal is to be interfaced (i.e. programming to be done via Teletype, CRT terminal, etc.).

The remaining two holes (#3 and #4) are reserved for future system expansion and are not used at this time. They should be jumpered to the LOW plane to insure noise immunity on the bus.



Programmed for:
1. no Baudot
2. 2 stop bits
3. terminal



Programmed for:
1. Baudot
2. 1 stop bit
3. terminal

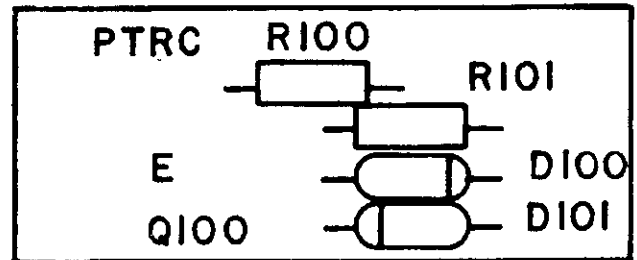
Paper Tape Reader Control

In the upper left-hand corner of the Main PC Board there is a block of components labeled "PTRC" (Paper Tape Reader Control).

These components are to be installed only if the Altair 680b is to be interfaced to a Teletype equipped with a Call/Control Unit (controllable reader).

The part numbers for the components are listed in the chart below.

Silk Screen Designation	Part Number
R100	1K ohm brown-black-red
R101	220 ohm red-red-brown
D100 & D101	IN914
Q100	2N2907



If you are not using a controllable reader, it is not necessary to mount these components onto the board.

MOS IC Installation

The assembly of the Main PC Board is now complete except for the installation of the Static-Sensitive MOS ICs into their respective sockets.

Before installing these ICs, review the "MOS IC Special Handling Precautions" given on page 6.

Install the ICs according to the instructions given on page 7, section B.

The correct part numbers are listed in the chart below.

ACIA PROM Monitor

Insert the 1702-A chip (labeled "A" or "680A") into the the IC socket labeled T. This IC contains the PROM monitor for use with any of the ACIA interfaces (TTY or RS-232).

Baudot PROM Monitor

The Baudot PROM monitor is contained within two ICs labeled "680B1" and "680B2." Insert 680B1 into IC socket T and 680B2 into IC socket U. These two ICs are supplied only to customers who specified the Baudot option when ordering their kit.

Silk Screen Designation	IC Part Number
() C, D, E, F, G, H, J, and K	2102
() Z	34702
() JJ*	6850
() NN	6800

*NOTE: DO NOT INSTALL IC JJ if a Baudot terminal is to be interfaced to the 680b.