Seals Electronics 68 KSC Memory Board

GENERAL INFORMATION

There are several different types of components that will be assembled onto the printed circuit. All are mounted on the same side of the printed circuit, where the location guide is screened onto the board surface. Most are held in place by having their contact leads soldered onto the back side of the board, so the soldering is very important for two reasons; one reason is to hold the component in position on the board and the other is to complete the electrical contact necessary for its operation in the circuit. Always use rosin-core solder only (never use acid-core). Use as little solder and heat as necessary at each connection so that you get a smooth, shiny connection that does not spread out and short the connection to any other adjacent contact point. Excess heat can damage some of the electronic components, so a small low-wattage soldering tool must be used, rather than a large and cumbersome iron that would overheat and damage the components and the board circuits.

The resistors, diodes, and capacitors are all components that are held in position by their two contact leads, soldered to the places where they connect to the foil pattern on the back of the board. Before each of these components is soldered in place, it should be held just off the front surface of the board (about 1/32" should be enough clearance for most, although the disk capacitors may require a little more). After soldering the component in place, test it's security by pressing gently against the mounting and be sure it is secure before proceeding to the next component.

The multi-pin integrated circuit packages have been protected against overheating by adding them into the plug-in sockets after all other parts, including the sockets, have been soldered into position on the board. No further soldering should be required after the integrated circuit packages have been installed.

All of the components, including the printed circuit board, are of the highest quality obtainable. Careful assembly and handling will maintain this quality as you complete the following steps and create the operating circuit that you will appreciate using for a long time to come. Although some of the steps may seem tedious, the extra care and patient procedure that you take to complete each step precisely as described will pay you dividends of long-term useful operation afterward. But a careless mistake could destroy the quality and usefulness that can be yours otherwise.

Scanned and edited by Michael Holley May 2, 2002 swtpc@attbi.com
SEALS Electronics, Inc. Document Circa May 1977

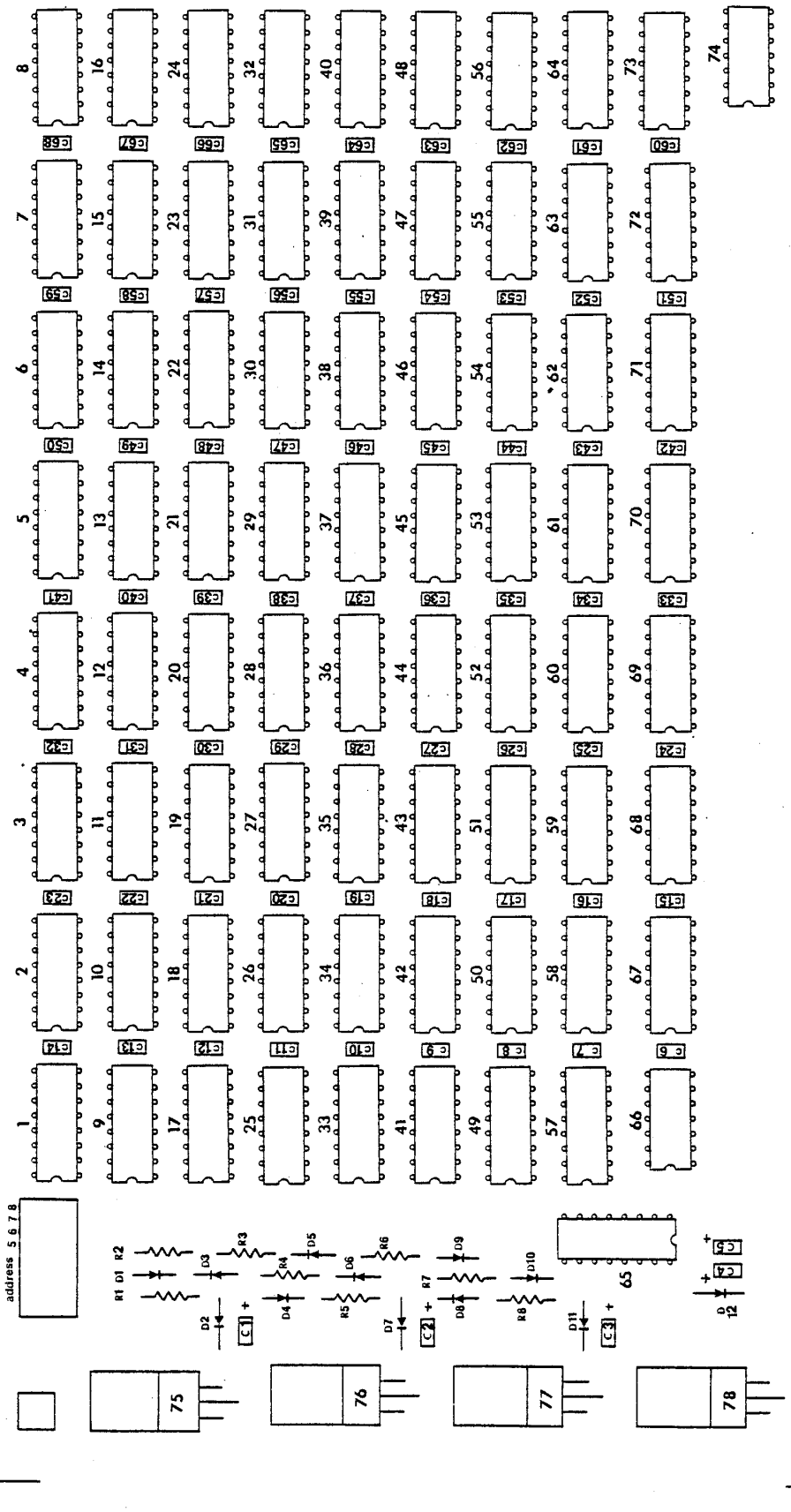

Fig. 1. 68K SC Printed Circuit Screening Layout

68K SC PRINTED CIRCUIT ASSEMBLY

Figure 1 is a layout of the board that is screened onto the component side of the printed circuit. Each integrated circuit location, and also the location for an address switch assembly, are identified with location numbers, 1 through 78. The diode, resistor, and capacitor locations are shown by reference designator numbers (D1 through D12, R1 through R8, and C1 through C68). There may be an error on the screening on your board for the + side of capacitor C4; it is shown correctly on Fig. 1, so please check the marking for this part on your board and observe the proper polarity when you install the part.

The components have been furnished in five numbered bags. The components in bag #1 should all be assembled to the board before those in bag #2, etc. However, it is a good idea to open each bag and check to see that it includes all of the components that are supposed to be included in the shipment. After checking the contents, return all of the parts carefully to each bag to prevent loss, damage, or mixup with those that are in the other bags.

Bag 1 contains:	8 resistors.	Each is 1K 1/8 W and is color-coded brown, black, red, and a 4th band that indicates tolerance.
	12 diodes.	Each is a type 1N4004 and has a band to identify its cathode end.
	4 heat sinks.	Each includes a mounting screw and a nut for assembly.
	4 IC packages.	Each is a type 7805 with a mounting tab on the back and 3 contact leads.
	5 capacitors.	Each is pear-shaped and has a value between 6.8 and 47 uF (value not critical). The polarity is marked.
Bag 2 contains:	1 switch assy.	8 miniature toggle switches in a DIP package.
	2 IC sockets.	14-pin sockets for integrated circuits.
	72 IC sockets.	16-pin sockets for integrated circuits.
Bag 3 contains:	63 capacitors.	Each is 0.1 uF, disk-type.
Bag 4 contains:	5 connectors.	Each is a group of 10 female contacts for the board-edge connector strip.
	1 IC package.	Type 7402, 14-pin.
	1 IC package.	Type 7404, 14-pin.
	4 IC packages.	Type 8T97B, 16-pin.
	2 IC packages.	Type 74S138, 16-pin.
	2 IC packages.	Type 8835, 16-pin.
Bag 5 contains:	64 IC packages.	Type 91L02APC, 16-pin (or equivalent 2102AL-4 or 2102A-4).

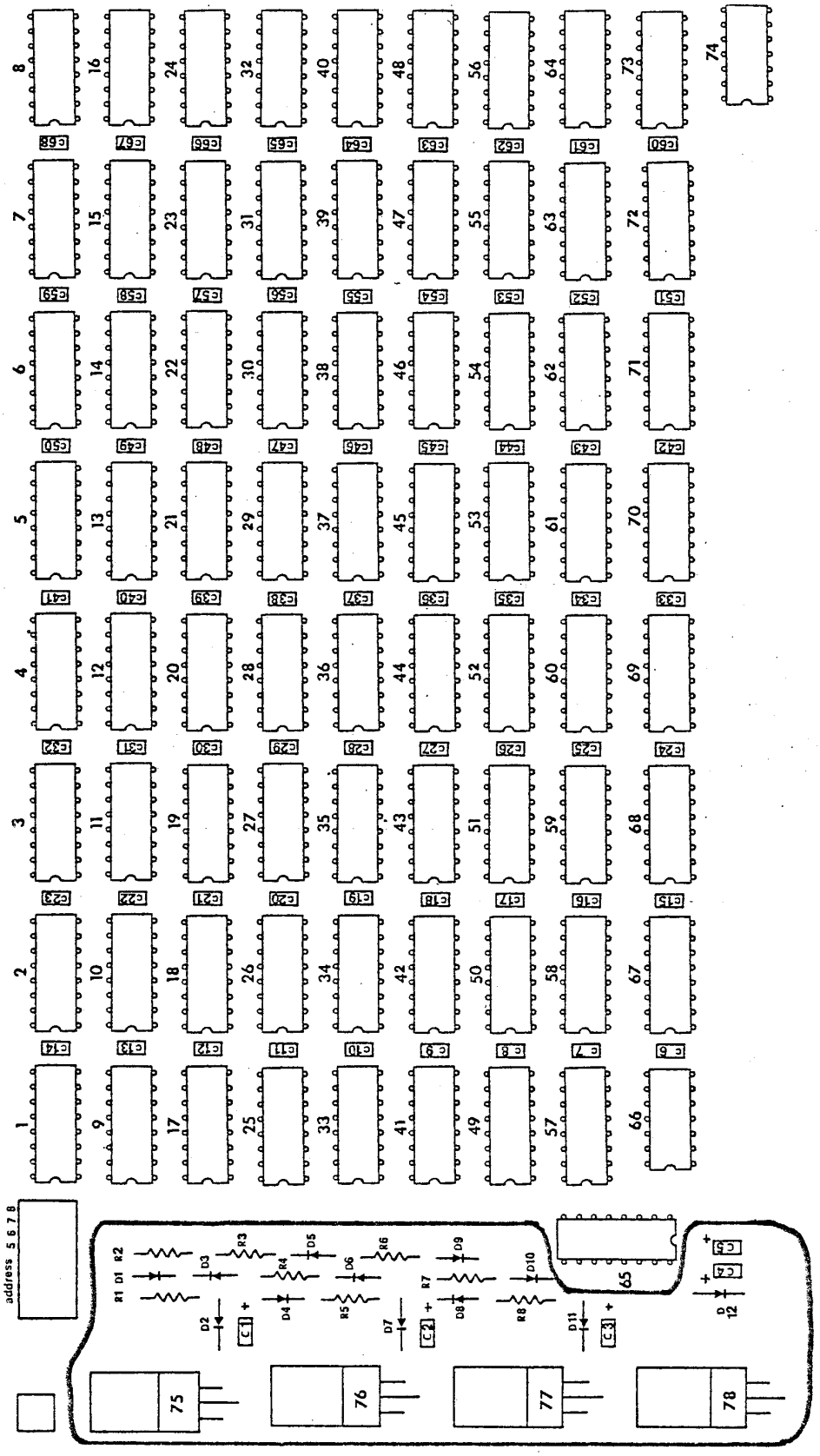

Fig. 2. Locations of Components in Bag #1.

ASSEMBLY OF COMPONENTS IN BAG #1

( ) Resistors Obtain the eight 1K resistors from the bag. Use a needle-nose pliers to bend the leads at right angles to match the hole spacing on the board. Insert each resistor into the correct holes from the screened side of the board and hold it while you turn the board over and bend the leads out at a slight angle; this holds the resistor to the board. Solder both leads to the contact points on the backside of the board. Then clip off any excess lead lengths. Assemble and solder one resistor at a time to ensure that each one is secure both mechanically and electrically.

( ) Diodes Obtain the 12 type 1N4004 diodes from the bag. Use a needle-nose pliers to bend the leads at right angles to match the hole spacing on the board for D1 through D12. Orient each diode according to the markings screened at each diode location; the arrow in the diode symbol points toward the cathode, and the cathode end of each diode is marked with a band around the diode body. Hold it in position while you turn the board over and bend each lead outward slightly to hold it in position on the board. Solder both leads to the contact points on the backside of the board. Then clip off any excess lead lengths. Assemble and solder one diode at a time to ensure that each one is secure both mechanically and electrically.

NOTE: Be sure that each diode is oriented to match the screened guide on the board; failure to observe proper diode orientation can result in permanent damage.

( ) Heat Sinks and Integrated Circuits Select one heat sink, one type 7805 integrated circuit, one screw, and a nut for assembly to the board at each of four locations (75, 76, 77, and 78). Use a needle-nose pliers to bend each of the 3 IC leads at right angles to match the hole spacing on the board; the tab on the side opposite the 3 leads will be attached to the heat sink and the board with the screw (through the top) and fastened with the nut (on the back of the board). Solder all three leads to the contact points on the back of the board. Then clip off any excess lead lengths.

( ) Capacitors Obtain the five capacitors from the bag. The value of each capacitor (between 6.8 and 47 uF) and the positive polarity lead is marked on each of the pear-shaped components. These capacitors must be installed with the proper polarity or they will be damaged when voltage is applied to the board. They will be assembled at component locations C1 through C5 at the left side of the board. The orientation for C1, C2, and C3 is with the + lead toward the right; the orientation for C4 and C5 is with the + lead at the top. For each capacitor, use a needle-nose pliers to bend the leads as necessary to fit the hole spacing on the board. Using the proper orientation, insert the leads through the holes from the screened side of the board and hold the capacitor in position while you bend the leads slightly outward on the back of the board. Then solder each lead to its contact point on the back of the board and clip off any excess lead lengths.

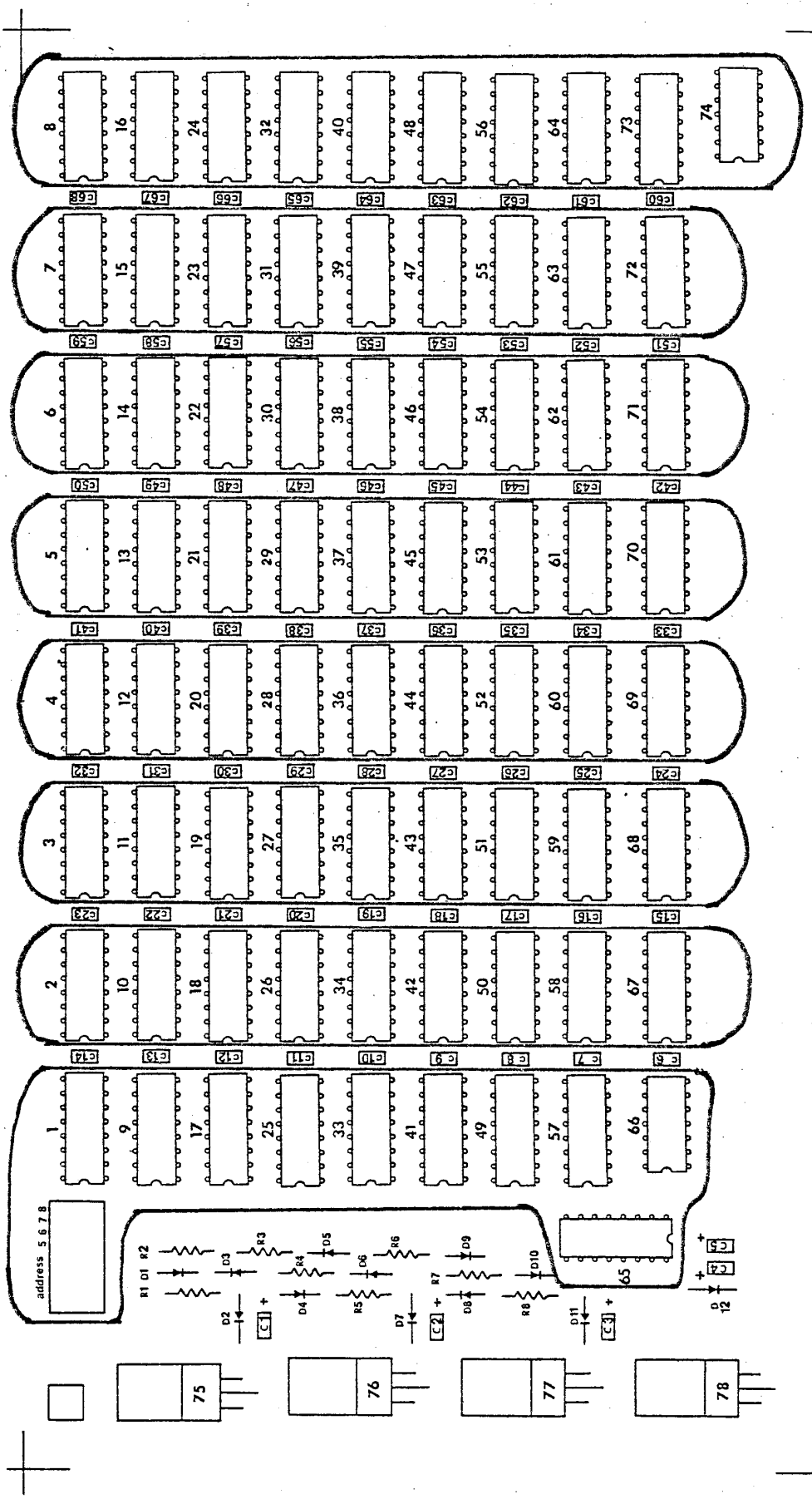

Fig. 3. Locations for Components in Bag #2.

ASSEMBLY OF COMPONENTS IN BAG #2

( ) Switch Assembly The switch assembly includes 8 miniature SPST switches, numbered 1 through 8 at the top and OFF at the bottom. Obtain the assembly from the bag and check the 16 leads (8 across the top and the other 8 across the bottom). Straighten these leads as necessary, using a needle-nose pliers, to install the entire assembly at the marked location in the upper left corner of the board. Orient the assembly so that the switch numbers are across the top. Hold the assembly in position with a short length of masking tape. Turn the board over and solder each of the 16 leads to its contact on the back of the board. Start with the leads across the top of the assembly; practice making solder connections without bridging between the leads while you solder these 8 leads. Then solder each of the 8 leads across the bottom of the assembly, and be careful to prevent shorting between adjacent leads with solder bridges, since these must remain as separate circuits. Remove the masking tape.

( ) 14-pin Integrated Circuit Sockets Obtain the 14-pin sockets from the bag. These will be installed at locations 66 and 74 on the board. Straighten all 14 of the leads as necessary with a needle-nose pliers and insert the socket through the screened side of the board at each location. There is no orientation to be considered for the socket; there will be for the integrated circuit that you plug into it later. If desired, hold the socket in position with a short piece of masking tape while the 14 pins are soldered to their contacts on the back of the board. Be very careful to prevent solder bridges. Remove the masking tape and cut off any excess lead lengths.

( ) 16-pin Integrated Circuit Sockets Each of the remaining 72 IC sockets in the bag is a 16-pin socket that will be installed at one of the remaining locations on the board, 1 through 65 and 67 through 73. Straighten all 16 of its leads as necessary with a needle-nose pliers and insert it through the screened side of the board at one of the designated locations. There is no orientation to be considered for the socket. If desired, hold the socket in position with a short piece of masking tape while the 16 pins are soldered to their contacts on the back of the board. Be very careful to prevent solder bridges. Remove the masking tape and cut off any excess lead length after each socket has been assembled to the board and its leads have been properly soldered.

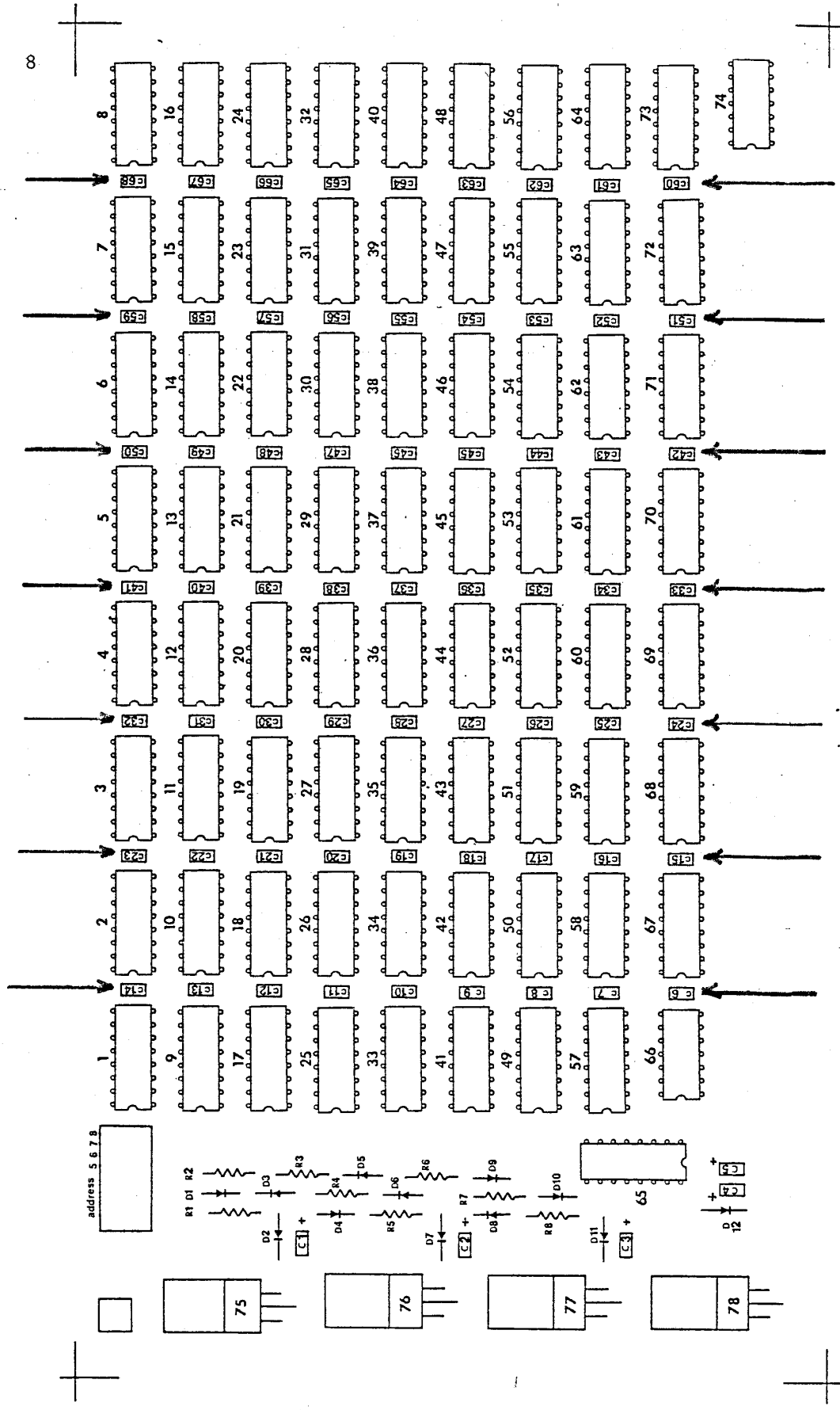

Fig. 4. Locations for Components in Bag #3.

ASSEMBLY OF COMPONENTS IN BAG #3

( ) Capacitors There are 63 capacitors in bag #3 and they all have the same value, 0.1 uF. Their locations are marked C6 through C68 in the 7 vertical rows of 9 capacitors each between the rows of IC sockets. Disk capacitors are not subject to orientation and can be installed by pushing the two leads through the pair of contacts provided at each location on the board. Then bend the leads outward slightly at the back of the board, solder each lead to the contact point, and clip off any excess lead lengths.

On the schematic diagram for the 68K SC board, these 63 capacitors are in a filter circuit for Vcc and all are in parallel electrically. They are shown as two capacitors in the power supply, at the lower left corner of the schematic, and are shown without either part number or value. The collective value is 6.3 uF and their distribution through all circuits in the active matrix filters out any transients that might otherwise cause crosstalk or other erratic responses in the memory circuits.

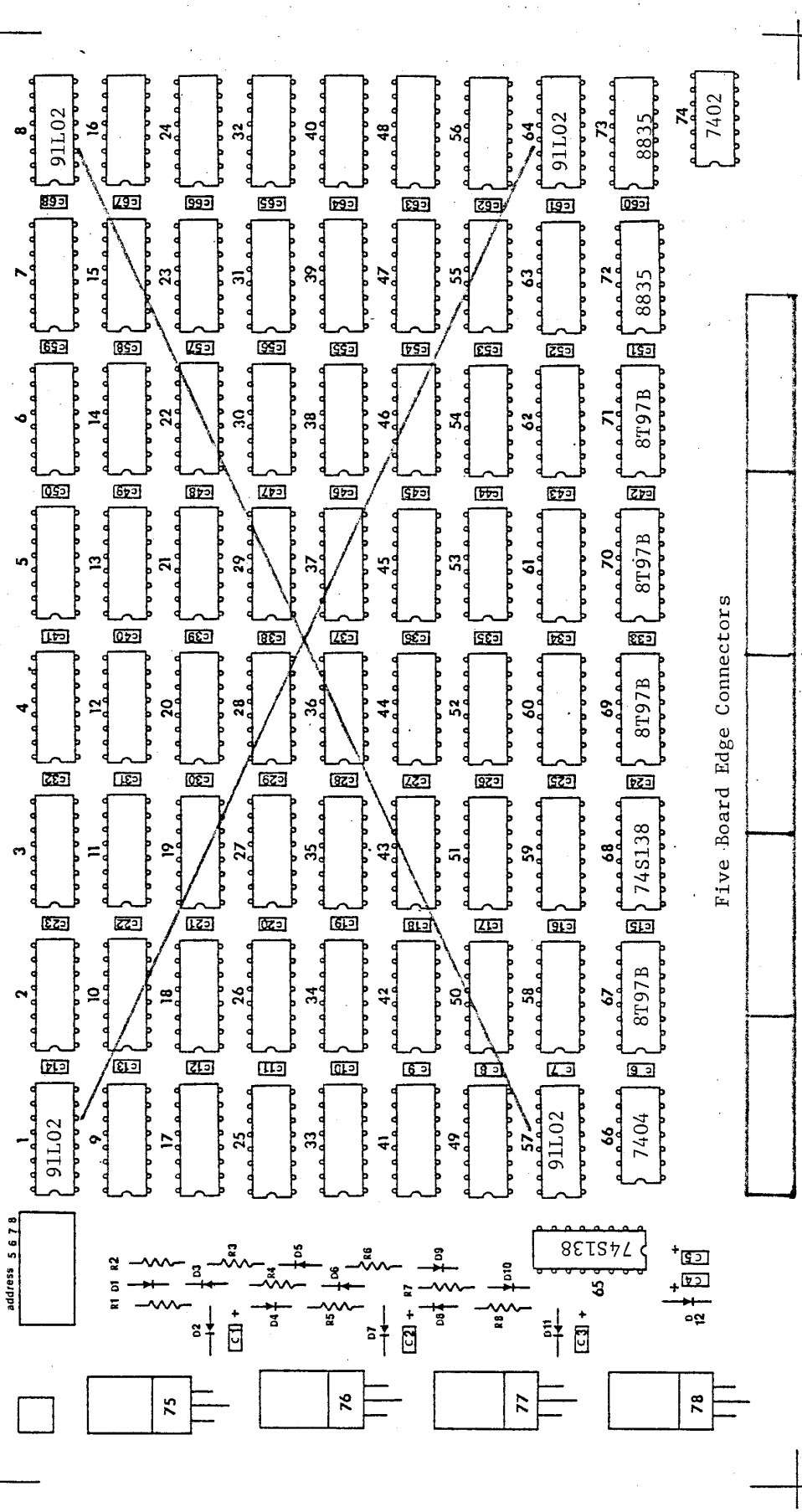

Fig. 5. Locations for Components in Bags #4 and #5.

ASSEMBLY OF COMPONENTS IN BAGS #4 AND #5

( ) Edge Connectors Obtain the five edge connector assemblies from bag 4. Each of these completes the connections between 10 of the 50 contacts on the motherboard and circuits on the printed circuit board. On the back of the assembly, there are three plastic hooks; these clamp the assembly onto the bottom edge of the board. Use a needle-nose pliers to straighten all 10 leads as necessary to fit into the left-most group of 10 contacts across the bottom of the board. With the hooks around the bottom of the board, rotate the assembly to feed all 10 leads through the mating group of 10 board contacts. Then repeat this procedure with each of the remaining four assemblies, filling all of the 50 board contacts from left to right across the bottom of the board. Solder each lead to its mating contact on the back of the board. The slight excessive lead lengths do not need to be removed since they do not project any further from the board than the body of the plastic assembly.

( ) Type 7402 Integrated Circuit Select the type 7402 14-pin integrated circuit from bag 4. Use a needle-nose pliers to straighten all 14 leads as necessary to prepare it for insertion into the socket at location 74. Orient the IC so that its notched end is at the left and its pin 1 is at the lower left as indicated by the screening on the board. With the proper orientation, start the contacts across the top of the IC into the 7 matching holes in the socket but do not push the pins all the way in; align the contacts that are across the bottom of the package with their 7 mating holes in the socket and start them into their holes. Then, when all 14 contacts are started into their proper holes in the socket, press the package down firmly into the socket. This procedure is typical for the proper installation of each IC package into its socket.

( ) Type 7404 Integrated Circuit Select the type 7404 14-pin integrated circuit from bag 4. Use the same procedure as outlined above to insert it into location 66, with the notched end of the package at the left.

( ) Type 8T97B Integrated Circuits Select the type 8T97B 16-pin IC packages from bag 4. Use the same procedure as outlined above to insert them into locations 67, 69, 70, and 71; the notched end of each package is toward the left as marked on the screening.

( ) Type 74S138 Integrated Circuits Select the two type 74S138 16-pin IC packages from bag 4. Use the same procedure as outlined above to insert one into location 65, with the notched end toward the bottom of the board, and the other into location 68, with the notched end toward the left as marked on the screening.

( ) Type 8835 Integrated Circuits Obtain the remaining two type 8835 IC packages from bag 4. Insert them into locations 72 and 73, with the notched end toward the left.

( ) Type 91L02APC Integrated Circuits There are 64 IC packages in bag 5. They are all type 91L02APC or equivalent (2102AL-4 or 2102A-4). Each of these fits into a 16-pin socket at locations 1 through 64, with the notched end of each package toward the left as marked on the board.

WARRANTY

Seals Electronics warrants its equipment for a period of ninety (90) days from the date of shipment to be free from defects in workmanship and materials, provided that the equipment has been used in a proper manner as described in this set of instructions. Seals Electronics cannot be responsible for nor assume any liability for problems that are encountered with methods of installation or with installation results.

After the warranty period, or for any condition that is not covered by the warranty, Seals Electronics will repair or replace, at its option, any part or parts that are found to be defective. This service will be performed within a reasonable time for a service fee of $20.00 per board plus parts. Shipping costs are the responsibility of the purchaser of the board and/or the repair service.

No other warranty is expressed or implied by Seals Electronics.

INSTALLATION

1. This board is designed for installation in a Southwest Technical Products Corporation 6800 Computer. Check to see that a power source of +8 V is furnished through pins 21, 22, and 23 and that ground return is furnished through pins 24, 25, and 26 before plugging the board into the computer.

2. The switches on the address switch assembly in the upper left portion of the board must be set properly to identify the address group that will be used for this board in the computer. This 8K memory group can occupy any one of eight possible address groups and will respond only to the group for which its address switches have been set. See the table of switch settings on Page 14 for further information.

3. Plug the board into the computer at any unused connector on the motherboard. All connections are made in parallel between the boards and have been allocated properly to be compatible with the basic standard interconnections furnished in an SWTPC 6800 Computer.

4. If a battery backup is desired, this can be furnished by connecting a source of +2 to +4 V to the contact points that are identified in a square in the screening that is at the extreme upper left corner on the board. The outboard contact is ground, for the negative input connection, and the inboard contact is for the positive connection. The purpose for a battery backup is to retain the data bit configuration that is stored in the memory during interruptions of power from the Computer power supply.

THEORY OF OPERATION

The SEALS 68K SC Memory is a fast static-type memory card that can be plugged in and used immediately with a Southwest Technical Products 6800 Computer. It includes 8192 memory words of 8 bits each that are fully buffered. The standard access time is limited to less than 500 ns and the memory does not contribute to any wait state because no refresh cycles are required for its operation.

For an installation in which the memory capacity needs to exceed 8192 words (8K = 8192), additional 68K SC cards can be installed in the computer. A convenient DIP switch assembly on each card has 8 toggle switches; these switches must be set according to the following table to select one of eight 8K segments of addresses up to a maximum of 64K. Use the switches according to the following table:

Address Range	Switch Settings							
	1	2	3	4	5	6	7	8
0 to 8K	On	Off	Off	Off	On	Off	Off	On *
8K to 16K	Off	On	Off	Off	On	Off	Off	On *
16K to 24K	Off	Off	On	Off	On	Off	Off	On *
24K to 32K	Off	Off	Off	On	Off	Off	Off	On *
32K to 40K	On	Off	Off	Off	Off	On	On	Off
40K to 48K	Off	On	Off	Off	Off	On	On	Off
48K to 56K	Off	Off	On	Off	Off	On	On	Off
56K to 64K	Off	Off	Off	On	Off	On	On	Off

* Switch 8 is always Off on boards modified for use above 32K.

The schematic, included at the back of these instructions, shows the matrix of 64 memory chip integrated circuits. Only for of the eight rows are drawn; the remaining four rows are connected in an identical manner. These are type 93L02 chips (or their direct equivalent, type 2012AL-4 or 2102A-4), and each has a capacity of one bit at each of 1024 addresses (1K). They are organized, both on the board and in the schematic, so that the top horizontal row of chips serves the first 1K of addresses on the board, the next row serves the second 1K, the third row serves the third 1K, etc. Thus IC's 57 through 64 serve the eighth 1K in the card. Reading from left to right, the first chip in each vertical row serves the first of eight data bits and the last chip serves the eighth data bit. When an address is identified on the input address lines AO through A12, the eight data bits that are stored for that address are furnished through the eight common data bus lines to output buffers in IC72 and IC73, from which they are furnished to the eight common data lines, DO through D7, in the computer, or else they are accepted from the common data lines and stored at the address. The decision on the direction of transfer through IC72 and IC73 is a function of the R/W signal; if the signal line is high, the data are read out of the card; if the signal line is low, the data are stored into the row of memory chips that are enabled. The strobe from the computer that generates either a read or a store response is the combination of VMA and 02, which enables the address decoder, IC65, to identify the address code on the A13 through A15 lines.

The board select circuit uses IC65 and the eight board address switches in the address switch assembly. IC65 decodes address lines A13 and A14 for one of four output lines to switches 1 through 4. The A15 line is routed through switches 5 and 7, which operate in opposition to switches 6 and 8 to provide control to IC65 only if the input address on A15 corresponds to the board address selection. If IC65 is permitted to decode A13 and A14 and the appropriate switch is closed, this enables IC68 to decode address lines A10, All, and A12 to enable a corresponding row of chips in the matrix. IC65 is enabled to decode A13 and A14 only if its pins 4 and 5 are low and its pin 6 is high, so this provides a complete control over board selection from address lines A13, A14, and A15. The board enable (low) signal also enables gate IC74 to determine the direction of buffered transfer of all eight data bits through IC72 and IC73.

The computer can furnish either a high or a low on the R/W line to the board. This signal is normally high, and is driven low to write a bit configuration into an address in the memory that has been selected. The bit configuration is furnished from the D0 through D7 common data lines, through IC72 and IC73, and to pin 11 on each of the chips in the matrix; only the row that has been enabled by the signal from IC68 will respond, and each chip in that row has a signal at pin 3 that is equal to the R/W input (high here to indicate read). The only address bit in each chip that has been selected by this process will be the one that is identified by the address lines A0 through A9. When the R/W signal from the computer is low, the level at pin 3 on each selected chip in the matrix indicates write, and it accepts the bit that is furnished to its pin 12 and stores it at the selected address; the direction of transfer through IC72 and IC73 is from the DO through D7 common data lines to the pin 12 circuits in the matrix.

For low-temperature operation of the power supply, the Vcc for integrated circuits IC1 through IC74 is divided into four groups. One 7805 regulator serves each group according to the legend shown in the lower left portion of the schematic. If a battery backup is furnished, an input level is accepted through the contacts in the upper left corner of the board to maintain the Vcc level at +2 V minimum when the computer power is turned off or is interrupted. This input level is coupled through diodes D2, D7, D11, and D12 into the Vcc lines on the board. As long as the Vcc level remains at a minimum of +2 V, all data bits that have been stored in the 64 memory chips are maintained. If the level drops below +2 V, the data bit configuration will be random when power is applied again.