

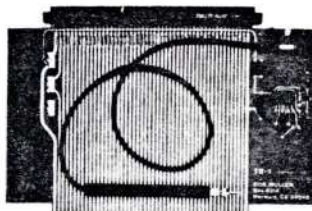
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ALTAIR/IMSAI

**NEW FOR TROUBLESHOOTING
AND DEVELOPMENT: A SUPER
EXTENDER BOARD FOR THE
S-100 BUSS.**

- Built in, 3 LED TTL logic probe
- Jumper links in power lines for easy current measurement and fusing
- Edge connector label identifies all pins
- Outstanding instructions
- Full width card; gold connector teeth

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Assembly Instructions - Controller Board Kit

It should take you less than 2 hours to assemble this kit. We recommend that you start when you will be able to complete it without interruption. Mark each check box as you do each step, to insure that no steps are missed.

1. For this kit you need the following tools: a soldering iron (20 watt max.), ROSIN CORE solder, a damp sponge, needle nose pliers, wire cutters, and a screwdriver.
2. Check the parts received against the "PARTS LIST" (pg. 5). Carefully identify all parts.
3. Read the "Construction and Soldering Tips" (pgs. 9 & 10).

● ● ● ● ● USE SAFETY GLASSES FOR EYE PROTECTION

● ● ● ● ● WHILE SOLDERING OR CUTTING WIRES ● ● ● ● ●

4. Put (pg. 8), "PARTS PLACEMENT DIAGRAM" in front of you, and refer to it as you work. The order of parts insertion was selected to begin with the lowest profile parts. This allows the weight of the board to hold the parts in place while you solder them. Take hold of each wire lead and clip off as you complete soldering each group of parts.
5. Begin assembly by placing the PC board component side up with the edge connector toward you. Select the 8 diodes, (1N4148). Cut apart, bend leads on .4" centers, insert and solder. Diodes are polarized and can be inserted backwards, (see figure below for correct polarity). Several can be soldered at one time.



6. Use the color code bands to identify the resistors. The resistors are not polarized and can be inserted either way. Bend the leads (R₀-R₈ are on .4" centers and R₉-R₁₉ on .5"). Recheck the position as you insert R₈.

R₀ - R₇ are 15KΩ ½ watt (brown-green-orange)
R₈ - R₁₉ are 2KΩ ½ watt (red-black-red)

7. □ There are 3 different low profile sockets: 20-pin, 14-pin, and 8-pin. The #1 position is indicated on the socket by a triangle (see figure below).

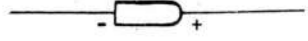


Select the (2) 20-pin sockets, orient them with the #1 pin in the upper right corner, close to the (.) on the board. Insert and solder. Repeat with the (5) 14-pin sockets and the (8) 8-pin ones.

●●● DON'T INSERT ANY ICs until ALL SOLDERING on the board is done.

8. □ Select the voltage regulator and the #6 machine screw, washer and nut. Correctly bending the leads is difficult. I suggest that you align the regulator over the screw hole and mark the leads with a felt-tip pen. Bend the middle lead first and recheck the alignment before bending the others. Insert the screw with washer from the back of the board into the nut on top of the regulator, tighten with a screwdriver. Solder leads.

9. □ Observing the polarity, bend leads to .8" centers, insert and solder the 39µF 10 volt capacitors, (C7 - C8). The rounded end is the positive end. (see figure below)

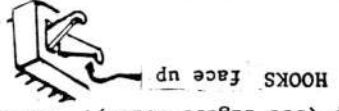


10. □ The (2) cable connector sockets have 16-pins. Locate, insert, with the notched corner in the upper right and solder. The notch indicates the #1 pin position.

11. □ Find, insert and solder the (8) relays. (If you want relay drive and not relay contact, see notes on page 4).

12. □ The .01 µF disk capacitors, (C1 - C6), are not polarized and can be inserted either way. Insert and solder.

13. □ Orient the port address selector switches so that the hooks face up (see figure below). Insert and solder.



14. □ All soldering should now be done. Clean off excess flux with flux remover. Check to see that all leads are firmly soldered, and all excess leads clipped off.

When programming for output, always save the output word in a memory location because there is no other way to determine the status of the relays. After a RESET output of this word will restore the previous condition. To control a single relay without changing the others, OR a '1' in the correct position with the saved output word to close the relay.

Examples: Close relay 2

00001010	-	Saved output word
00000100	-	'1' in position 2
00001110	-	Result of 'OR', output word, and new saved word

To open a single relay without changing the others, AND the complement of a '1' in the correct position with the saved word.

Example: Open relay 2

00001110	-	Saved output word
11111011	-	Complement of '1' in position 2
00001010	-	Result of 'AND', output word, and new saved word

To change the position of a single relay 'XOR' (exclusive OR) a '1' in the correct position with the saved word.

Examples: Reverse relay 2

00001010	-	Saved output word
00000100	-	'1' in position 2
00001110	-	Result of 'XOR', output word, and new saved word

Reverse relay 2 again

00001110	-	Saved output word
00000100	-	'1' in position 2
00001010	-	Result of 'XOR', output word, and new saved word

To determine the status of any input position 'AND' the input word and a '1' in the correct position, and test the result for zero/non-zero.

Examples: Test position 0

00001011	-	Input word
00000001	-	'1' in position 0
00000001	-	Result of 'AND', non-zero = on

Test position 2

00001011	-	Input word
00000100	-	'1' in position 2
00000000	-	Result of 'AND', zero = off

By saving the input word in a memory location, multiple conditions can be tested and any change can be detected. To detect changes 'XOR' the saved input word and the new input word, and test for zero/non-zero.

Examples: Look for change

01010110	-	Saved input word
01010110	-	New input word
00000000	-	Result of 'XOR', zero = no change

Look again

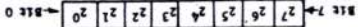
01010110	-	Saved last input word
01010110	-	New input word
00000100	-	Result of 'XOR', non-zero = change

And again

01010110	-	Saved last input word
01010110	-	New input word
00000100	-	Result of 'XOR', non-zero = change

HOW TO USE IT

The I/O address, the input word, and the output word are all 8 bit binary words.

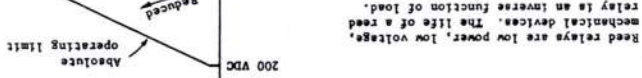


The bits are numbered the same as the power of 2 in that position. The address switch up is a '1', down '0'. An output bit of '1' closes the

corresponding relay contacts, a '0' opens the contacts. Loss of power or a

RSTI opens all the relay contacts. An input bit of '1' indicates current

through the opto-isolator, a '0' indicates no (or too little) current.



Read relays are low power, low voltage, mechanical devices. The life of a read

relay is an inverse function of load.

In general a read relay should be used for low voltage DC or low current audio

signals. In applications where a simple read relay is not sufficient (Kampers!

power switching, zero voltage AC switching, and simple indicators), the relay

can be replaced with two jumper wires plus external devices. Using jumpers

converts the relay contacts into relay current drive. The maximum current

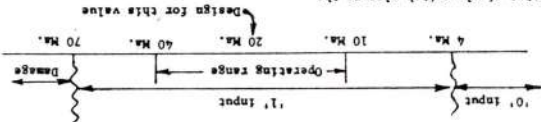
available from the relay drivers is 40 Ma. Several jumper wires are included

with the kit.



Installing the jumpers as shown will keep the polarity of the output cable the same as the input cable (ie. left-positive, right-negative). The red edge of the cable is lead number one, and should be on the right. REPLACING THE RELAYS WITH JUMPERS GIVES UP THE ISOLATION, THE CABLE IS THEN ELECTRICALLY CONNECTED TO THE COMPUTER.

The opto-isolators produce a '1' in the corresponding bit in the input word when the current is above about 4 Ma. No current (or not enough) will produce a '0'. Excess current will damage the opto-isolator.



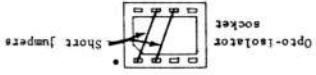
To detect a simple switch closure the opto-isolators can be replaced with

two jumpers. With the jumpers in place

the input bit will be a '1' when the

corresponding cable pair are connected

together, and '0' when not connected.



Opto-isolator socket

Design for this value

REPLACING THE OPTO-ISOLATORS WITH JUMPERS GIVES UP THE ISOLATION, THE CABLE IS THEN ELECTRICALLY CONNECTED TO THE COMPUTER.

Continued on page 11.

CONSTRUCTIONS AND SOLDERING TIPS

1. Choose a well-lit work space with enough room to

layout tools, parts, and instructions. Two light

sources help to eliminate shadows which interfere

with seeing your work.

2. Tools needed for each individual kit will be

listed in the assembly instructions. However, a

basic set will include, a low wattage soldering

iron, 20 watts or less, and a holder which keeps

you from accidentally touching the hot tip. Help-

full are a pair of wire cutters and needle nosed

pliers. A damp sponge to wipe the hot iron's tip

and a magnifying glass to examine details are use-

ful aides.

3. Soldering has the potential of causing several

different kinds of problems in kit building. Heat

can damage the PC board, and the components, or

cause to form unwanted electrical connections.

Using the right soldering iron, the right solder

(rosin core), and a little practice to develop an

efficient technique will eliminate most problems.

Parts are inserted on the component side of the

board and almost always soldered on the back side.

USE EYE PROTECTION WHEN SOLDERING

4. If you plan to build many kits and have the extra

dollars, buy a quality (temperature controlled

tip) soldering iron.

5. Use only ROSIN CORE SOLDER when constructing our

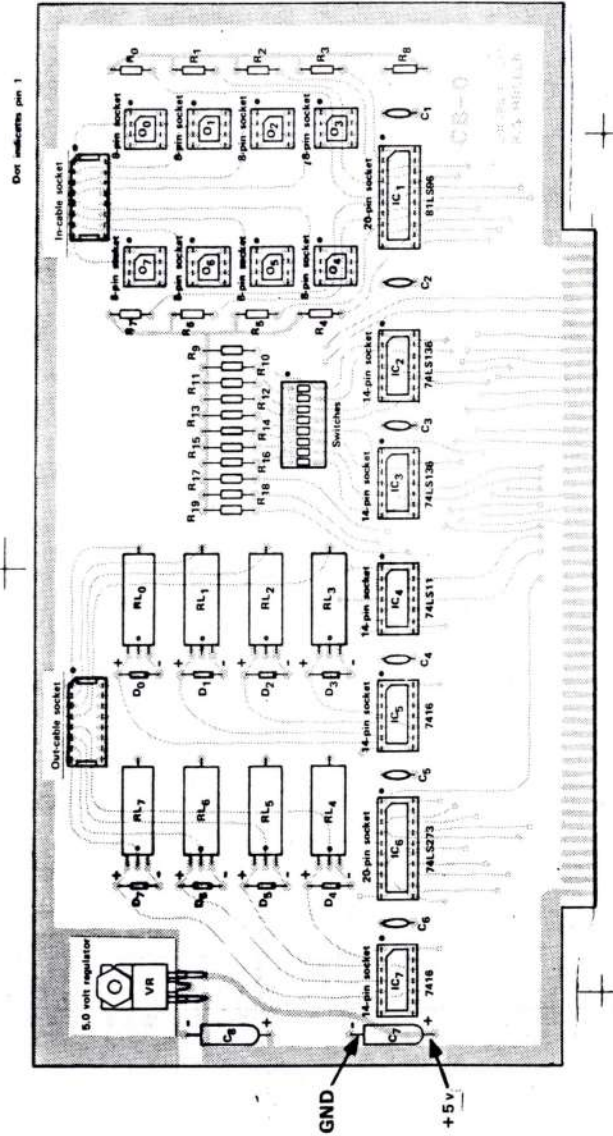
kits. A solder with a high ratio of tin to lead

is important, 63/37 tin/lead, is excellent, and

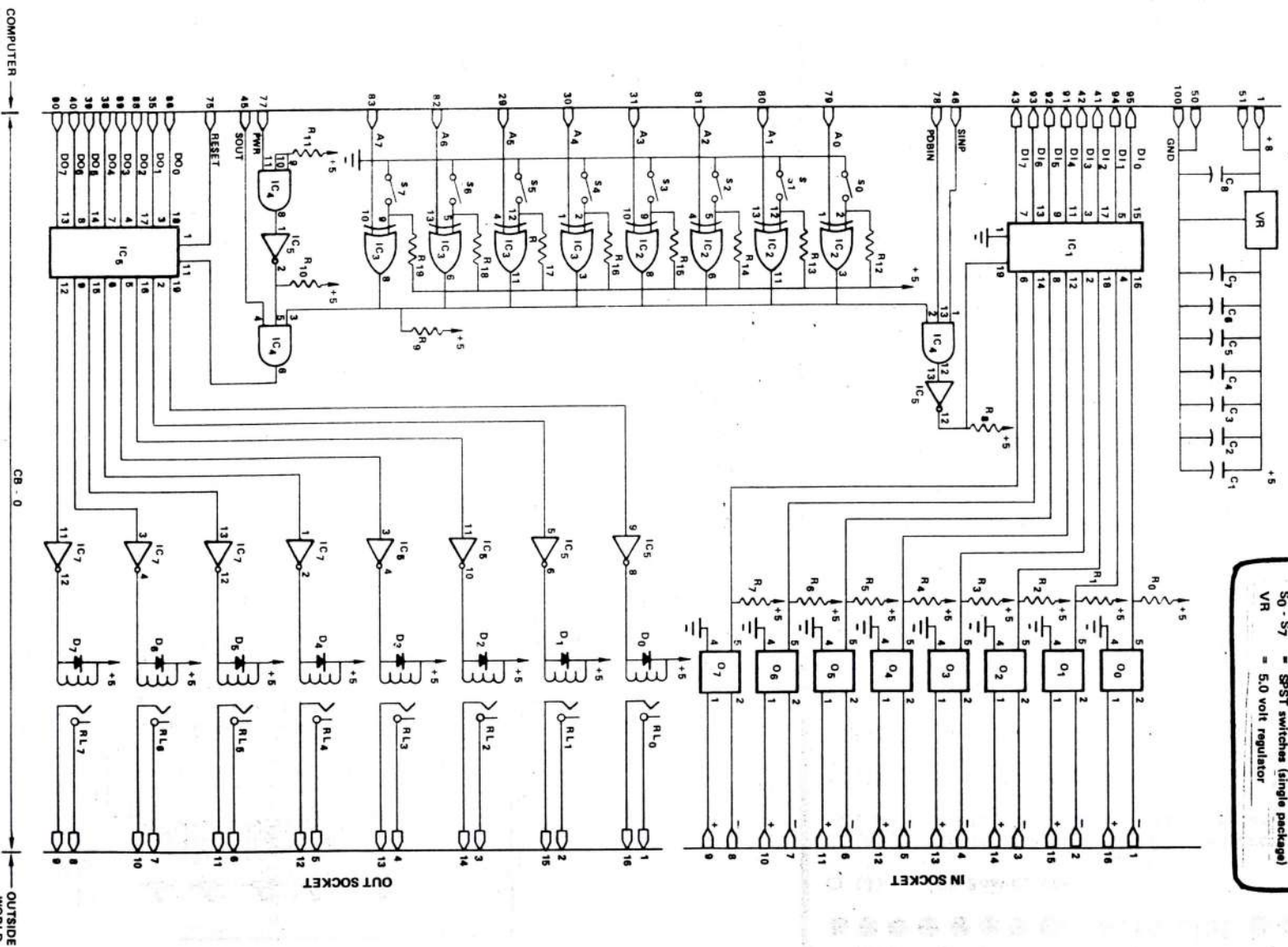
60/40 is good.

6. Solder with a well tinned tip. Tinning is a thin

film of solder coating the surface of the iron's



Controller Board



- C1 - C6 = .01 μ F disc capacitors
 C7 - C8 = 39 μ F electrolytic capacitors
 D0 - D7 = 1N4148 diodes
 IC1 = 81LS96
 IC2, IC3 = 74LS136
 IC4 = 74LS11
 IC5, IC7 = 7416 or 7406
 IC6 = 74LS273
 O0 - O7 = MCT-2, MCB-2 or equivalent
 R0 - R7 = 15 K Ω watt resistor
 R8 - R19 = 2 K Ω watt resistor
 S0 - S7 = SPST switches (single package)
 VR = 5.0 volt regulator

COMPUTER

CB - 0

OUTSIDE
WORLD