



ENTERPRISES  
INCORPORATED

(602)265-7564

2967 W. Fairmount Avenue  
Phoenix AZ. 85017.

VAK-2/VAK-4 USER MANUAL  
PRELIMARY

December 2, 1978

*THE EXCLUSIVE ALTERNATIVE FOR QUALITY*

## General

The RNB VAK-2 is an 8K byte static RAM designed as a memory expansion for KIM, SYM, and AIM65 microcomputer systems. The VAK-3 is a "plug in" option kit of IC's to expand the VAK-2 memory board to a dual 8K memory board. The VAK-4 is a complete dual 8K memory board.

The board is called a dual 8K memory board instead of a 16K memory board because each 8K section is completely separate. That is: separate address control and separate write protect. This gives the user much greater versatility than he would have with a single 16K memory board.

A single board may be wired to your microcomputer board directly. If more than one board is desired, the VAK-1 motherboard can be used. It has slots for 8 accessory cards.

The VAK-2 and VAK-4 memory boards require only a single 5 volt regulated power supply. Etched circuitry on the board allows easy addition of on-board regulators to provide compatibility with older KIM modules. When the regulators are installed, the VAK-2 and VAK-4 boards are completely interchangeable with older KIM-3 memory boards. One VAK-4 will replace two KIM-3 memory expansion modules.

The VAK-2 and VAK-4 memory boards are covered by a 90 day factory warranty. Service is available at standard rates from the factory after your warranty expires.

## Theory of Operation

The VAK-2 and VAK-4 memory boards buffer the incoming address buss using 3 - 74LS365 non-inverting hex buffers (UA20, UA11, UA12). For each 8K memory, a separate 7485 address comparator IC (UC12, UC11) is used to select the address range of the memory. The range is set by comparing address bits A15, A14, and A13 with the address switch S1.

If the high order address bits match the S1 switch settings and if the respective SEL switch (S1-2 or S1-7) is open, a high logic level appears on the output (PIN6) of the comparator (UC12, UC11). This output enables the 74S138 decoder chip which, in turn, decodes address bits A12, A11, A10 into a one-out-of-eight negative logic signal. This low logic signal is used to select two 2114 RAM chips. One chip is used for data bits 0, 1, 2, 3; the other for data bits 4, 5, 6, 7. Each chip has 1024 4 bit memory cells inside - when it is selected, address bits A9-A0 are decoded internally to select a particular four (4) bit memory location. If the Read/Write line is high, the contents of the selected memory cell are placed on the data bus. If the R/W line is low, the logic state of data bus is written into the selected cell.

The data bus is buffered via a 74LS245 bi-directional bus driver (UB1, UC1). One driver is used for each 8K memory bank to minimize capacitive loading

within the board. The driver is enabled by inverting the same logic signal that enables the 74S138 decoder. The driver IC is UB10, a 74S04.

The write line from the processor bus is buffered via UA11 and UB11 (74S00). UB11 also "ands" the write line with the processor  $\phi 2$  clock to prevent false writes. Switch S1-1 and S1-6 disconnect the write signal from each 8K RAM memory respectively. The write signal is also fed to the direction control pin of the bus drivers (UB1, UC1).

If either 8K memory is selected, a high level will appear on the output of UB11-3. This logic level is normally connected to the board edge pin 16. This signal is used to tell the mother board that a card has been selected. It is used to control the data bus driver on the mother board. This signal can be inverted if needed for other systems by changing the board strap D-E to D-F.

When only a single memory is used (VAK-2) a strap J-H is inserted to simulate a No-select logic state from the missing comparator, UC11.

#### Installing the VAK-2 or VAK-4

Installing the VAK memory board in a mother board is quite simple. When using a VAK-1 mother board, plug the card in so the components (IC's) face the power connector. If one of the older KIM-4 mother boards is used, plug the card in so that the component side of the board faces away from the microcomputer board. In either case, make sure the VAK memory board is wired for the voltage available: +8 or +5. In order to operate from +8 VDC regulators must be installed on the VAK memory boards.

#### Control Switches

Ten control switches are located at the top board edge. Three switches are used to set the memory address range for each 8K memory. In addition, each 8K memory has a write enable switch and a logic select (SEL) switch. In order to use the memory, the address range must be selected and the logic select (SEL) must be OPEN. In order to write, the write enable (WRT) switch must be closed. VAK-2 uses only switches 1 through 5 for its 8K memory. VAK-4 uses all 10 switches.

## Address Switches

A15	A14	A13	Address range
CL	CL	CL	0000 - 1FFF (1,2,3)
CL	CL	0	2000 - 3FFF
CL	0	CL	4000 - 5FFF
CL	0	0	6000 - 7FFF
0	CL	CL	8000 - 9FFF (4)
0	CL	0	A000 - BFFF (5,6,7)
0	0	CL	C000 - DFFF (8,9)
0	0	0	E000 - FFFF (10,11,12)

0 = OPEN      CL = CLOSED

### Notes:

1. Conflicts with KIM-1 on-board RAM and ROM monitor
2. Conflicts with SYM-1 on-board RAM
3. Conflicts with AIM-65 on-board RAM (0000-0FFF)
4. Conflicts with SYM-1 on-board ROM monitor
5. Conflicts with SYM-1 on-board I/O
6. Conflicts with AIM-65 on-board I/O
7. Conflicts with AIM-65 8K Basic ROM option (B000-CFFF)\*
8. Conflicts with SYM-1 8K basic ROM option (C000-DFFF)\*
9. Conflicts with AIM-65 Assembler/Editor ROM option (D000-DFFF)\*
10. Conflicts with SYM-1 Assembler/Editor ROM option (E000-FF80)\*
11. Conflicts with SYM-1 on-board RAM ECHO (FF80-FFFF)
12. Conflicts with AIM-65 on-board ROM monitor

\*These are conflicts, if the ROM options are implemented.

### Installing VAK-3 Expansion Kit

The VAK-3 expansion kit converts at VAK-2 8K memory board into a VAK-4 dual 8K memory board.

1. Plug in 8-2114 RAM IC's in Row C.
2. Plug in 8-2114 RAM IC's in Row D.
3. Plug in 1-74LS245 bus driver in location C-1.
4. Plug in 1-74S138 decoder in location D-10.
5. Plug in 1-7485 comparitor in location C-11.
6. Remove Jumper J-K (on Rev C or later) or the wire behind chip location D-10 (on solder side of board).
7. Set control switches and test.

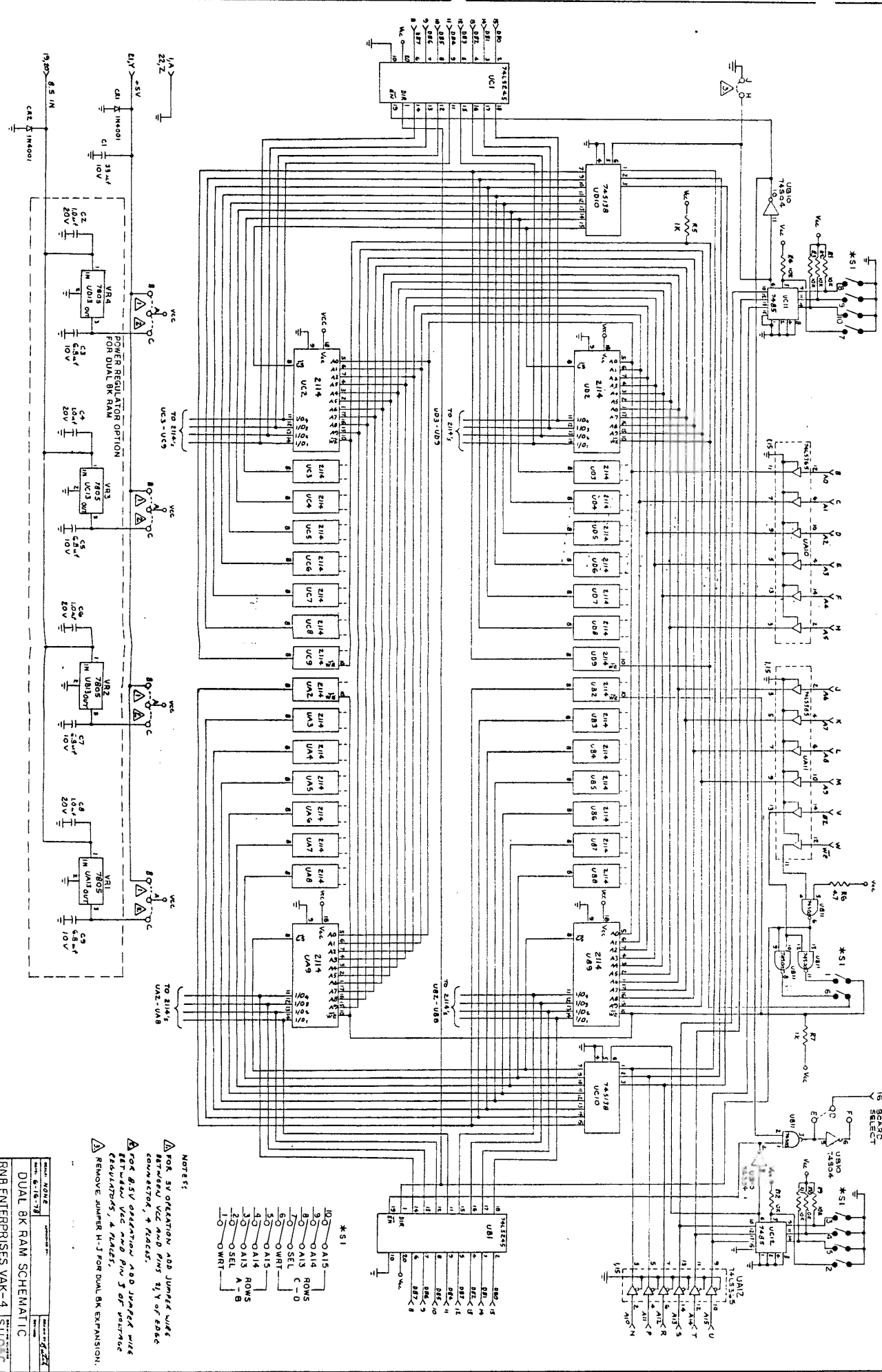
### Adding Voltage Regulators

Etched circuitry is provided for regulators so that the VAK-2 and VAK-4 memory boards can be operated from unregulated 8 VDC. At the end of each row, add a 7805 or LM340-5 plastic regulator. A thermalloy THM6030 (or equivalent) heatsink should be inserted between the regulator and the printed circuit board. A thin coating of thermal compound should be wiped on the conducting surface of the IC regulators. A 6-32x3/8" screw and nut will hold the regulator and heatsink in place.

To prevent oscillation, a 1 $\mu$ f 20V tantalum capacitor should be added to the input of each regulator. A 6.8 $\mu$ f 10V tantalum capacitor should bypass the output of each regulator to reduce the high frequency impedance of the voltage bus.

On the VAK-2, two regulators must be added. Rows A and B are used. The VAK-4 requires four regulators; rows A, B, C, and D.

The voltage strips at the end of each row must be changed from A→B to A→C.



NOTES:  
 ⚠ FOR 3V REGULATION, ADD JUMPER WIRE BETWEEN VCC AND PINS 11, Y OF 7805 CONNECTION, 4 PACKETS.  
 ⚠ FOR 65V OPERATION, ADD JUMPER WIRE BETWEEN VCC AND PIN 5 OF 7805 REGULATORS, 4 PACKETS.  
 ⚠ REMOVE JUMPER H-3 FOR DUAL 8K EXPANSION.

MODEL	MANUFACTURER	REVISION	DATE
7805	MONTELEC	1	6-16-78
74S138	MONTELEC	1	6-16-78
74S178	MONTELEC	1	6-16-78

DUAL 8K RAM SCHEMATIC  
 RNB ENTERPRISES VAK-4 51002C  
 6-16-78

\*S1

10	Q15	ROWS
9	Q14	ROWS
8	Q13	C - D
7	SEL	SEL
6	OWRT	OWRT
5	Q15	ROWS
4	Q14	ROWS
3	Q13	ROWS
2	Q12	A - B
1	OWRT	OWRT

\*S1

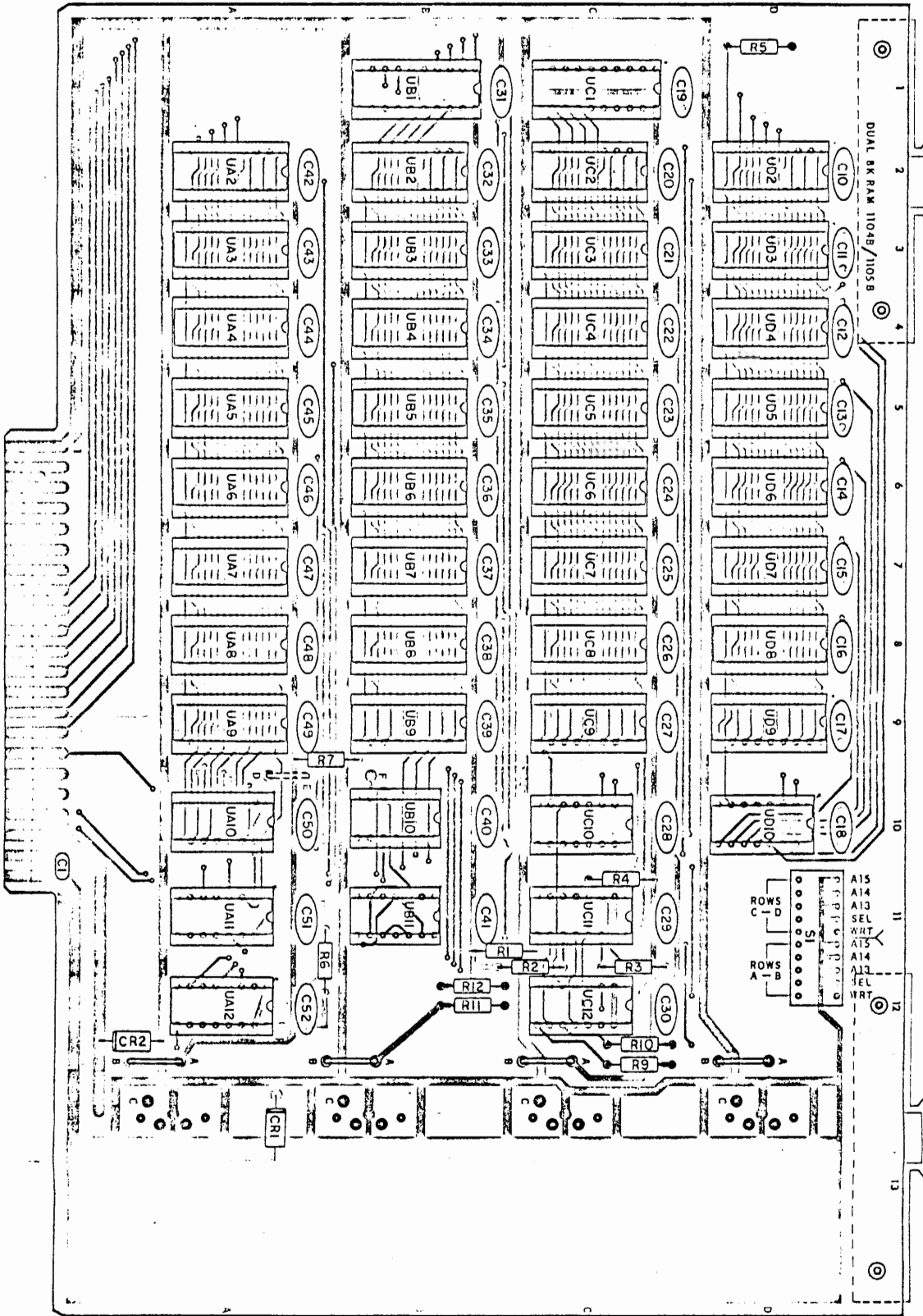
10	Q15	ROWS
9	Q14	ROWS
8	Q13	ROWS
7	Q12	ROWS
6	Q11	ROWS
5	Q10	ROWS
4	Q9	ROWS
3	Q8	ROWS
2	Q7	ROWS
1	Q6	ROWS

\*S1

10	Q15	ROWS
9	Q14	ROWS
8	Q13	ROWS
7	Q12	ROWS
6	Q11	ROWS
5	Q10	ROWS
4	Q9	ROWS
3	Q8	ROWS
2	Q7	ROWS
1	Q6	ROWS

\*S1

10	Q15	ROWS
9	Q14	ROWS
8	Q13	ROWS
7	Q12	ROWS
6	Q11	ROWS
5	Q10	ROWS
4	Q9	ROWS
3	Q8	ROWS
2	Q7	ROWS
1	Q6	ROWS



REV. 2/1  
 DATE: 17 OCT 78  
 APPROVED BY: [Signature]  
 DUAL 8K RAM ASSEMBLY  
 RNB ENTERPRISES VAK-4  
 PART NO. AI105B/C