SM-WH-88-16

16K Memory Expansion

Service Manual

ZENITH | data systems

ZENITH DATA SYSTEMS
SAINT JOSEPH, MICHIGAN 49085

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SPECIFICATIONS

Memory Expansion from 48K to 56K when used with HDOS.

Memory Expansion from 48K to 64K when used with CP/M.

PROGRAMMING

To program the Computer for the expanded memory,
set the jumpers on the CPU board as follows:

JUMPER	POSITION
JJ504	0
JJ502	1
JJ501	1

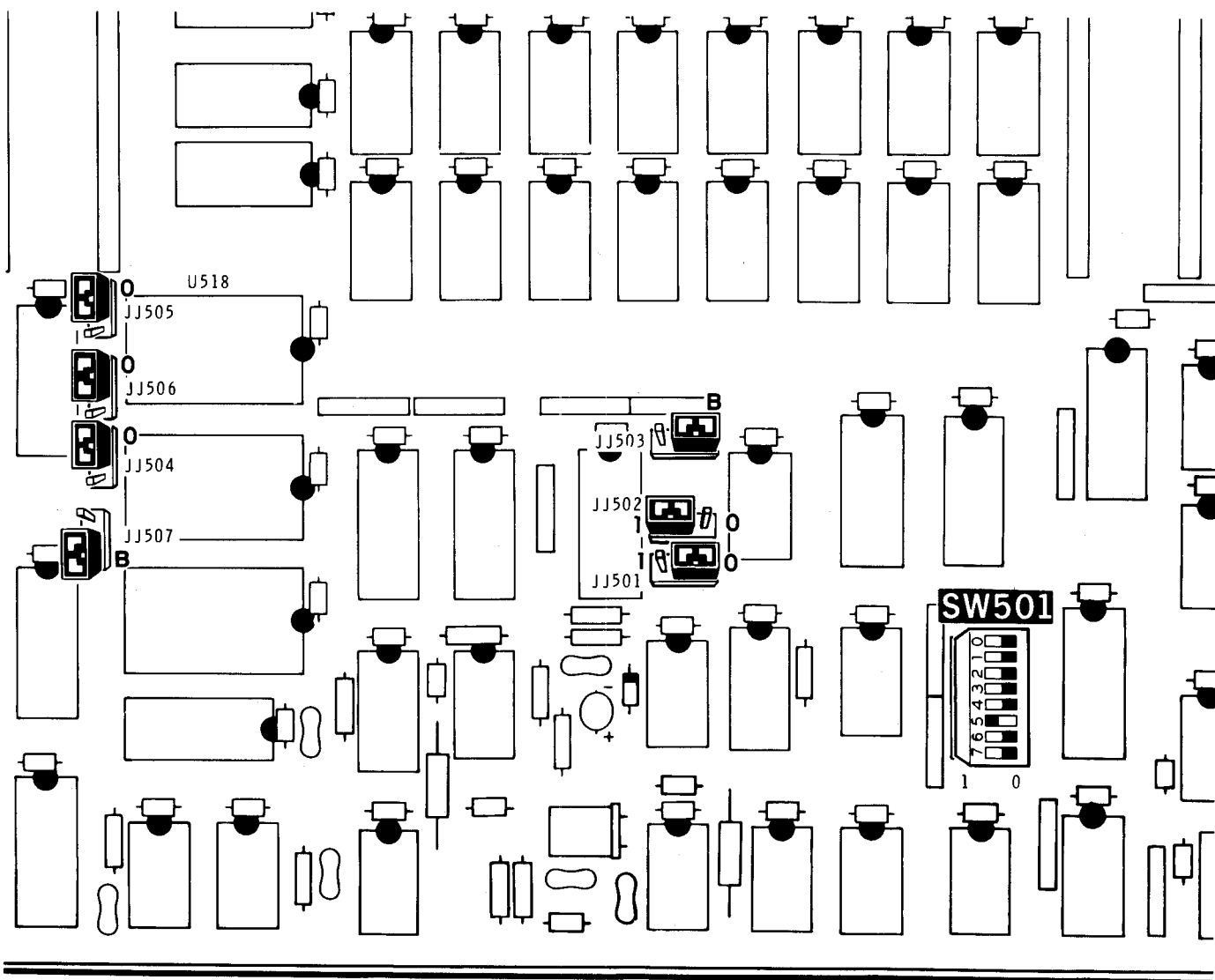Refer to Figure 2-1 for the jumper locations.

Figure 2-1

CPU board.

OPERATION

Figure 3-1 shows how the memory map of the Computer changes after the WH-88-16 16K Memory Expansion Accessory is installed, and how the use of either HDOS or ORG 0 CP/M affects the configuration of the system.
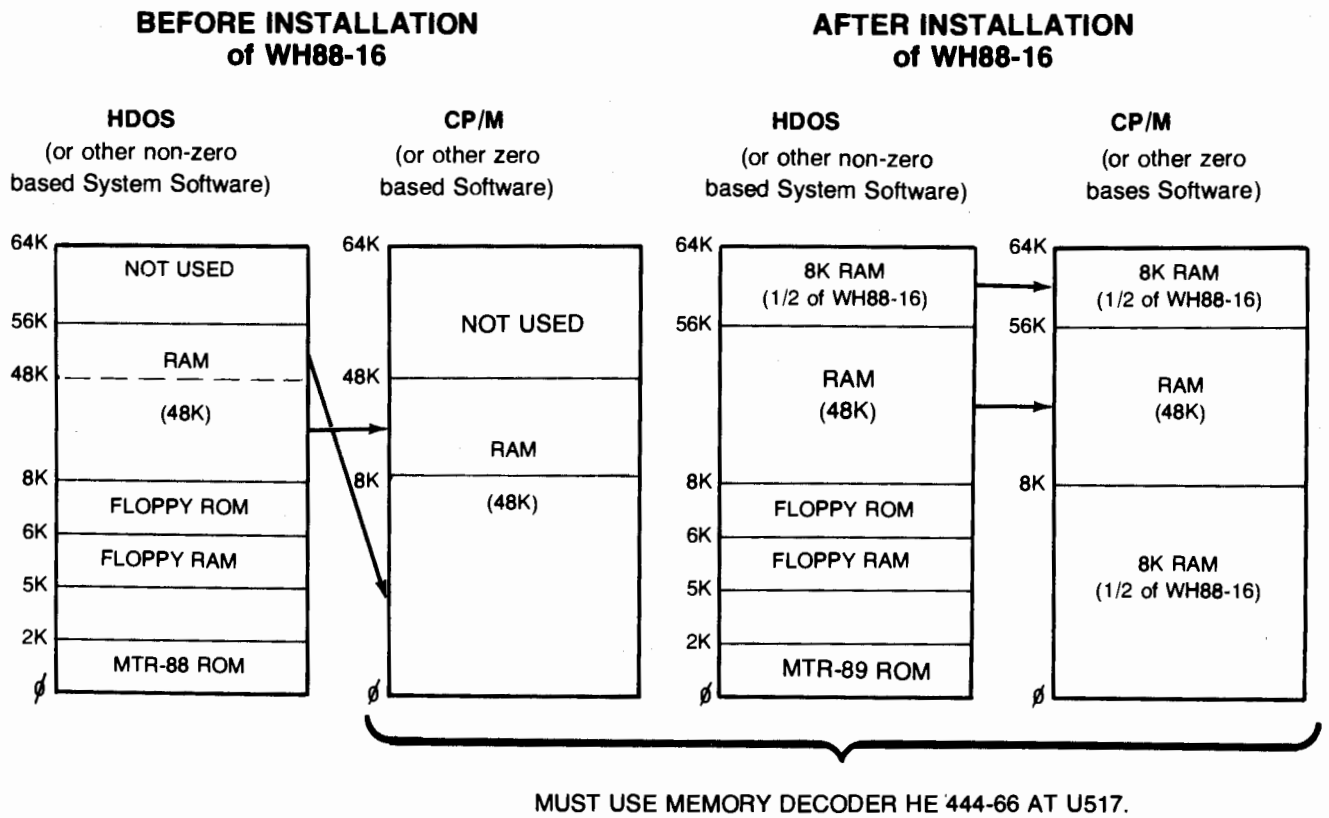
**BEFORE INSTALLATION
of WH88-16**

**AFTER INSTALLATION
of WH88-16**

HDOS
(or other non-zero
based System Software)

CP/M
(or other zero
based Software)

HDOS
(or other non-zero
based System Software)

CP/M
(or other zero
bases Software)

64K	NOT USED
56K	
48K	RAM
	(48K)
8K	FLOPPY ROM
6K	
5K	FLOPPY RAM
2K	
∅	MTR-88 ROM

64K	
	NOT USED
56K	
48K	
	RAM
8K	(48K)
∅	

64K	8K RAM
	(1/2 of WH88-16)
56K	
	RAM
	(48K)
8K	FLOPPY ROM
6K	
	FLOPPY RAM
5K	
2K	
∅	MTR-89 ROM

64K	8K RAM
	(1/2 of WH88-16)
56K	
	RAM
	(48K)
8K	
	8K RAM
	(1/2 of WH88-16)
∅	

MUST USE MEMORY DECODER HE 444-66 AT U517.

Figure 3-1

MEMORY TESTING

It is usually easier to test and locate a bad memory IC using diagnostic programs rather than with test equipment. The system monitor has a built-in memory test you can use to locate a faulty bit.

The memory test uses the Z-80 registers as its scratch pad and will check all user memory from 040000A on up to the top end of the supplied memory. You can start it either by setting section 5 of SW501 to its zero position and resetting the Computer, or by entering:

MTR 89	H: Go 7375 ⏎
MRT 90	H: T or H: Go 7375 ⏎

The Computer will then load 000Q into each byte of memory, go back and compare each location to zero, increment each location until it again reaches the end of memory, and then repeat the operation. It will do this until every bit pattern from 000Q to 377Q has been tested in every memory location. It will then go back to zero and start over.

Due to the way the program is written, the first value to be displayed is as shown below (48K system):

MTR 89	MTR 90
Dynamic RAM test LWA = 337377 Pass = 002	Dynamic RAM test LWA = 377377 Pass = 002

Depending on the amount of RAM installed, the last working address (LWA) will normally indicate one of the following four numbers:

Amount of RAM Installed	LWA (Offset Octal)	LWA (Decimal)
16K	137377	24575 (24K-1)
32K	237377	40959 (40K-1)
48K	337377	57343 (56K-1)
64K	377377	65535 (64K-1)

The *Pass* number indicates the data byte that the program is checking for. If the location being checked were not this value, then an error message similar to the following would occur:

MTR 89	MTR 90
Dynamic RAM test LWA = 337377 Pass = 002 Error @ 040100 = 006	Dynamic RAM test LWA = 377377 Pass = 002 Error @ 040100 = 006

and the speaker will continuously beep. This indicates that the program expected to see a binary 00000010 at address 040100A, but got a binary 00000110 instead. In other words, data bit D_2 is stuck to a logic one.

You can determine which IC has failed by converting the Pass Number and Error Number from their octal form to binary form. Then locate the mismatch in the numbers as in the following example:

MTR 89	MTR 90
Dynamic RAM test LWA = 337377 Pass = 002 Error = 006	Dynamic RAM test LWA = 377377 Pass = 002 Error = 006

$$D_7D_6D_5D_4D_3D_2D_1D_0$$

002 octal = 0 0 0 0 0 0 1 0 binary

006 octal = 0 0 0 0 0 1 1 0 binary

Data bit D_2 is a mismatch. In this case the defective IC is in the top row (48K = top row, 32K = middle row, 16K = bottom row). Since LWA = 337377 is greater than 32K, its location is in the top row. D_2 is the defective IC, so the third IC in the top row is defective.

You can use the table below to cross-reference the address and faulty bit location to the IC causing the failure.

Since the faulty bit was D_2 at address 040100A, then U544 should be replaced. (Refer to the table below.)

MTR 90

	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
64K LWA = 377.377	U5	U6	U4	U7	U3	U8	U2	U9
48K LWA = 337.377		U548	U547	U546	U545	U544	U543	U542
32K LWA = 237.377	U541	U540	U539	U538	U537	U536	U535	U534
16K LWA = 137.377	U533	U532	U531	U530	U529	U528	U527	U526

MTR 89

	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
48K LWA = 337.377	U549	U548	U547	U546	U545	U544	U543	U542
32K LWA = 237.377	U541	U540	U539	U538	U537	U536	U535	U534
16K LWA = 137.377	U533	U532	U531	U530	U529	U528	U527	U526

REPLACEMENT PARTS LIST

(16K memory expansion board, part number HE 181-3386.)

CIRCUIT Comp. No.	PART NUMBER	DESCRIPTION
U1, U9	HE 443-904	MK4116-4 memory IC
U10	HE 442-665	79L05 5 V regulator
U562	HE 443-901	74S132 quad 2-input NAND
C1, C4	HE 25-761	10 μF electrolytic capacitor
C5, C19	HE 21-761	.01 μF glass capacitor
C21, C23	HE 21-761	.01 μF glass capacitor

MISCELLANEOUS PARTS

PART NUMBER	DESCRIPTION
HE 134-1130	Ribbon cable
HE 204-2456	Accessory mounting bracket
HE 266-944	1-3/8" spacer
HE 250-1314	8-32 $\times$ 3/8" hex head screw
HE 250-1264	6-32 $\times$ 3/8" hex head screw
HE 254-2	#8 lock washer

X-RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

A. Find the circuit component number (C1, C10, etc.) on the "X-Ray View."

B. Locate this same number in the "Circuit Component Number" column of the "Replacement Parts List."

C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION, which must be supplied when you order a replacement part.
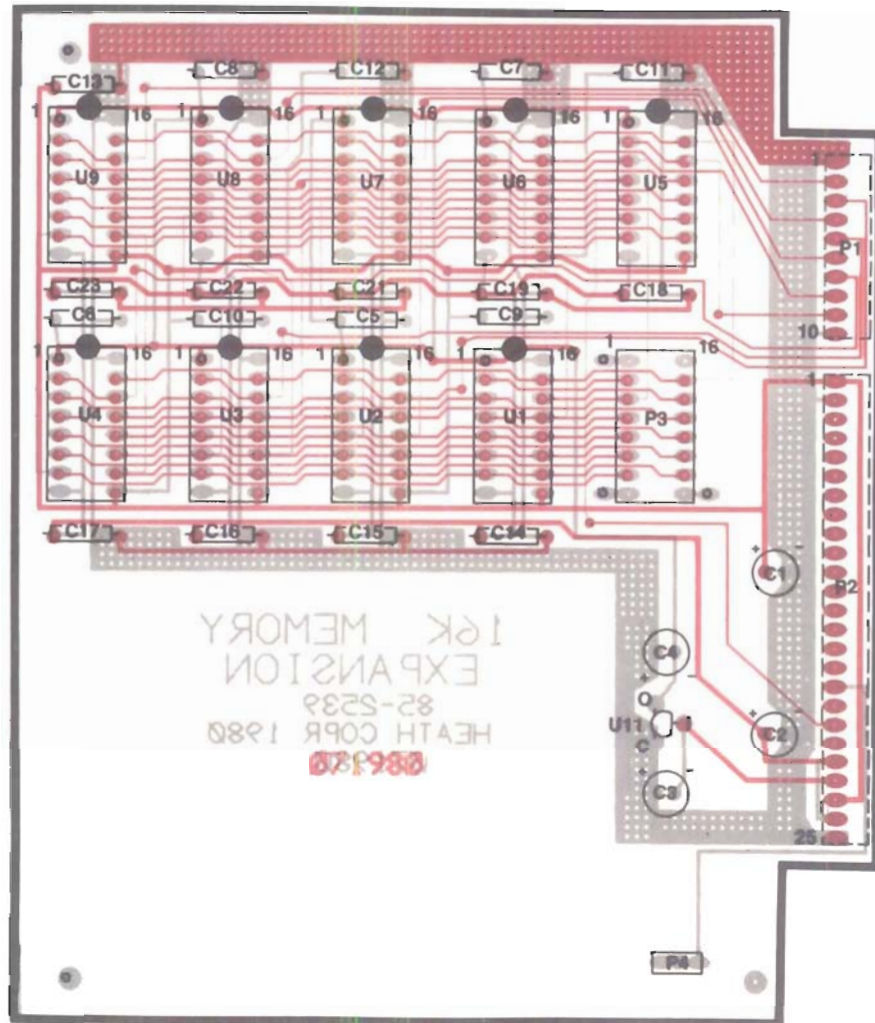
16K MEMORY EXPANSION BOARD

Part number HE 181-3386. Shown from the component side.
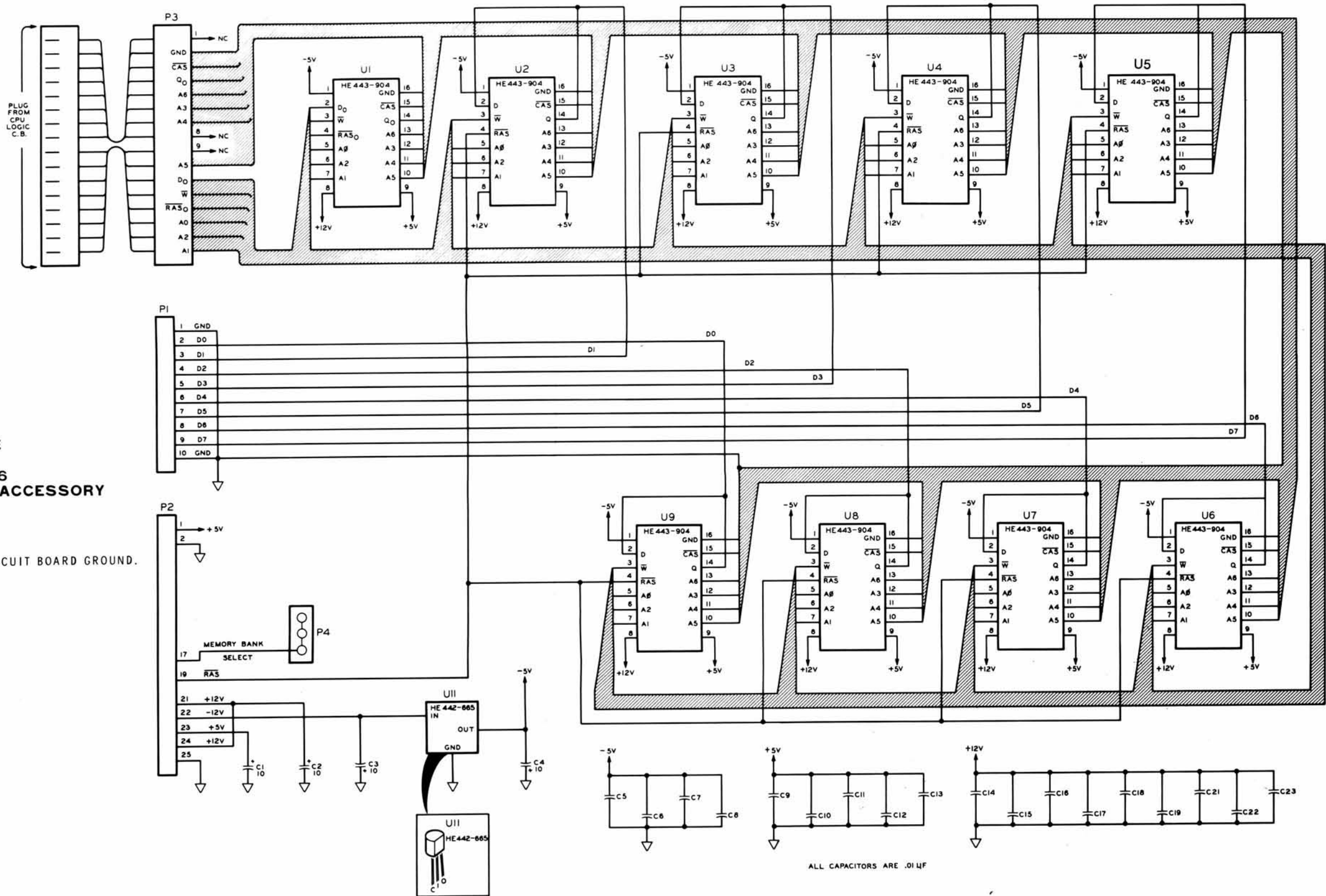
SCHEMATIC OF THE

MODEL WH88-16
16K MEMORY EXPANSION ACCESSORY

NOTES:

1. ALL CAPACITORS ARE IN μF.

2. ▽ THIS SYMBOL INDICATES CIRCUIT BOARD GROUND.

Part of 585-12

ALL CAPACITORS ARE .01 μF