MODULAR CIRCUIT TECHNOLOGY™

USER'S GUIDE

MOD-MIC

IC TESTER MODULE

The MOD-MIC IC Tester Module is a diagnostic device designed to test TTL, CMOS and memory chips with 14 to 24 pins. In addition to automatically testing the more commonly used logic and memory chips, the MOD-MIC allows the user to enter and edit a customized test pattern. This feature enables the user to test chips not shown in the selection menus.

The software packaged with the MOD-MIC combines all the programming commands in one easy-to-use menu driven program. Function execution and chip selection are done by pressing the appropriate key on the keyboard. In addition to being able to edit your own test pattern, the software will execute your test patterns set by set, allowing you to determine which set is not functional.

The MCT-MOD is fully IBM compatible and will work with DOS version 3.0 or later versions. With the MOD-MAC, the MOD-MIC is capable of working with systems operating at different microprocessor speeds and can be configured for different I/O addresses.

The ability to test a wide variety of chips, menu driven software, and compatibility make the MOD-MIC a highly versatile tester. Thank you for purchasing the MOD-MIC IC Tester.

CUSTOMER SUPPORT

The MOD-MIC Tester Module should perform well for you. If it does not, please contact your dealer or call the Customer Support Department at JDR Microdevices. The toll free number is **800-538-5000**. Please include a daytime phone number when writing.

PARTS LIST

Your MOD-MIC Tester Module package includes the following:

one User's Manual
one IC ZIF Socket:
one 5 1/4" Utility Diskette

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MANUAL OVERVIEW

The following chapter summaries will help you identify the chapters you need to read. For best results, however, you should read the entire manual before using the MOD-MIC.

1 INTRODUCTION

Summarizes manual content and arrangement. Lists requirements for installation and operation.

2 INSTALLATION

Contains step-by-step instructions on installing the tester.

3 USING THE TESTER

Provides detailed instructions for testing ICs.

4 QUICK-REFERENCE GUIDE

Describes each of the menu commands.

5 TROUBLESHOOTING GUIDE

Provides solutions to common tester problems.

1 INTRODUCTION

MANUAL ARRANGEMENT

This manual is divided into five parts:

(1) Introduction
(2) Installation
(3) Using the Tester
(4) Quick-Reference Guide
(5) Troubleshooting Guide

ITEMS REQUIRED FOR INSTALLATION

TOOLS

A Phillips or a flatblade screwdriver may be required to remove the computer case and slot cover.

COMPUTER SYSTEM

The MOD-MIC is designed for the PC/XT/AT and compatibles. At least 384K of RAM must be installed. The MOD-MIC can be configured for different CPU speeds.

DOS

The MOD-MIC will run under MS-DOS or IBM's PC-DOS (versions 3.0 or greater).

ADAPTER CARD

The MOD-MIC requires the MOD-MAC adapter.

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2 INSTALLATION

Installation of an MOD-MIC tester consists of two parts: (1) installing the required hardware and, (2) installing the MIC **software**.

HARDWARE INSTALLATION

The MOD-MIC requires the MOD-MAC adapter card (sold separately). To install the MOD-MAC, follow the procedure described below in steps 1 - 5. If an MOD-MAC is already installed in your system, ignore these steps and proceed with the software installation.

INSTALLATION OVERVIEW

Hardware installation consists of the following five steps:

(1) Remove the computer case cover
(2) Check the MOD-MAC card jumper pins
(3) Insert the MOD-MAC card
(4) Replace computer case cover
(5) Connect the ZIF socket cable

Caution: do not connect your printer or any other parallel device to the MAC card! Printers and other parallel devices may be damaged by the MAC card.

MEMORY CHIPS

The MOD-MIC tests the following memory chips:

4164 - 64K x 1	6264 - 8K x 8
4256 - 256K x 1	6116 - 2K x 8
2114 - 1K x 4	

IC CHIPS

The MOD-MIC works with chips in the 74xx series, the 74LSxx, the 74Sxx, the 74Lxx, the 74Hxx, and the 74HCxx series. It will test the ICs listed in the table below.

--TTL

00	16	40	92	139	165	243	279	373
01	17	42	93	140	166	244	280	374
02	18	45	95	145	170	245	283	375
03	19	46	96	147	173	246	289	377
04	20	47	107	148	174	247	290	378
05	21	48	109	151	175	248	293	386
06	22	49	112	152	183	249	295	390
07	24	51	113	153	189	251	298	399
07	25	54	114	155	190	253	299	425
08	26	55	125	156	191	257	323	426
09	27	74	126	157	192	258	348	490
10	28	75	128	158	193	259	352	572
11	30	83	132	160	194	260	353	640
12	32	85	133	161	195	261	365	645
13	33	86	136	162	240	266	366	668
14	37	89	137	163	241	273	367	669
15	38	90	138	164	242	276	368	670

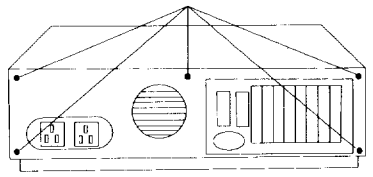
--CMOS

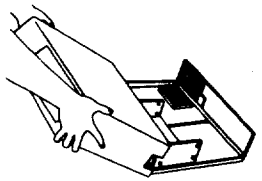
4000	4020	4044	4072	4506	4584
4001	4022	4049	4073	4510	
4002	4023	4050	4075	4512	
4009	4025	4051	4076	4516	
4010	4027	4052	4077	4518	
4011	4028	4053	4078	4519	
4012	4030	4066	4081	4529	
4013	4035	4068	4082	4532	
4015	4040	4069	4501	4555	
4016	4041	4070	4502	4558	
4017	4043	4071	4503	4572	

STEP 1: REMOVE THE CASE COVER

First, turn off the computer. Then, **if you have a flip-top case**, press the buttons on the flip-top and lift up. **If you have a slide case**, remove the Phillips screws at the rear of the case and slide the cover forward (figure 1).

REMOVE THE SCREWS ON THE BACK OF THE CASE

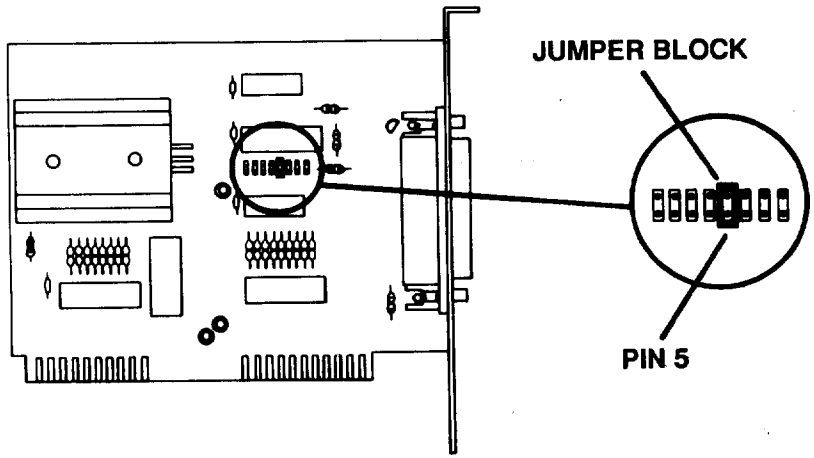




STEP 2: CHECK THE JUMPER PINS

Before inserting the MOD-MAC card, check the JP1 jumper pins on the programmer card. There should be a jumper block on pin 5 (refer to figure 2).

FIGURE 2



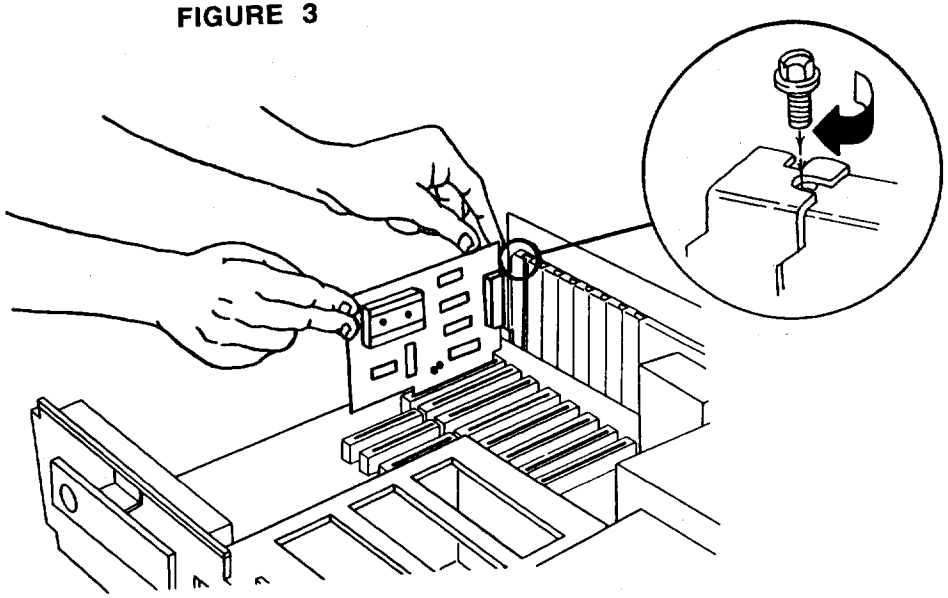
Note: The MOD-MAC is preset for the address 280H. If it conflicts with other cards in your system, you can change the address by following the procedure described on page 14.

STEP 3: INSERT THE MOD-MAC CARD

Next, select a slot for the MOD-MAC and remove the slot cover. Then, gently press the MOD-MAC all the way down into the slot (figure 3). Finally, fasten the card to the PC frame with the slot cover screw.

Caution: the MOD-MAC can be damaged if it is not inserted all the way down into the slot!

FIGURE 3



SOFTWARE INSTALLATION

STEP 1: COPY FILES

Caution: Do not use the original MOD-MIC diskette as a work-copy! Instead, make and use a copy of the original diskette.

To make a work copy, insert your DOS diskette into Drive A. Then, insert a blank diskette into your B drive, and type the command **FORMAT B:/S** to format the diskette and copy the operating system onto the blank diskette. Next, copy the DEBUG.COM file from your DOS Utilities diskette onto the work diskette. Finally, copy all files from the MOD-MIC utility diskette onto the formatted work diskette by inserting the MOD-MIC utility diskette and using the DOS **COPY A:*.* B:** command.

After copying these files, the work diskette can be used to boot up your computer system.

Note: if your system has a hard disk, you must first create a separate directory. Then, copy all of the files from the MOD-MIC utility diskette into the new directory.

STEP 4: REPLACE THE CASE COVER

Next, slide the computer cover into place and fasten it with the Phillips screws.

STEP 5: CONNECT THE CABLE

Caution: do not connect the ZIF socket module to the MAC card while the computer is turned on. Such an installation can put the module in an "unknown" state, resulting in damage to the test chip and/or the module.

Finally, connect the ZIF socket to the MOD-MAC card using the included cable. The male cable end must be inserted into the MOD-MAC card; the female end must be connected to the ZIF socket module (figure 4).

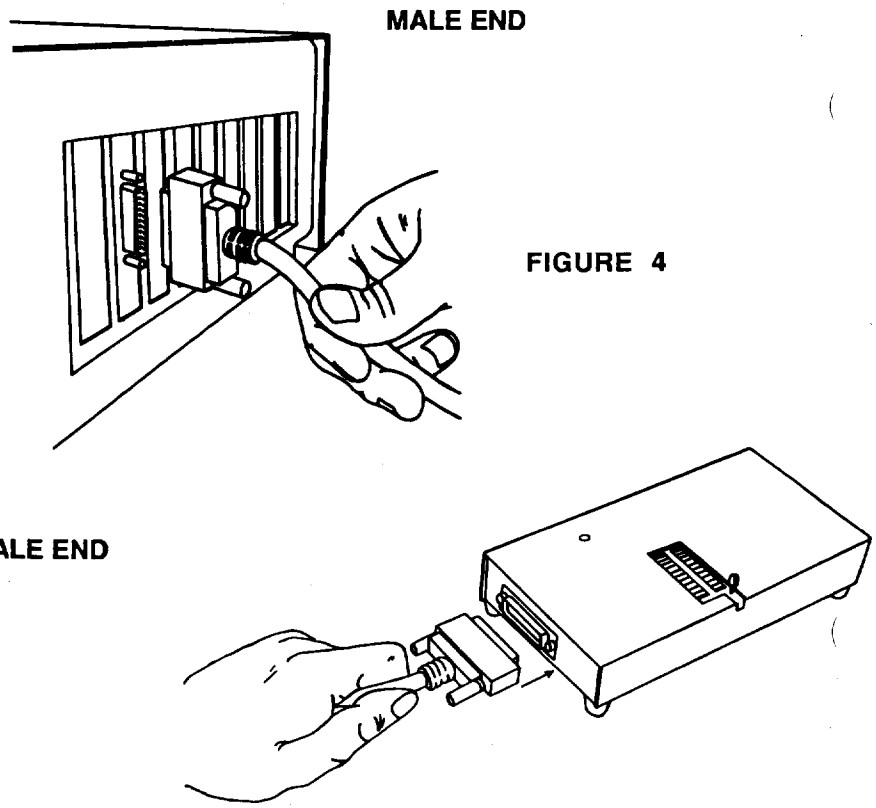


FIGURE 4

Now, press **<1>** if you have placed a jumper block on the #1 pins on the MAC card, press **<2>** if the jumper block is placed on the #2 pins, press **<3>** if the jumper block is placed on the #3 pins, and so on. The addresses corresponding to these jumper block settings are:

JUMPER BLOCK	ADDRESS
PIN 1	200H
PIN 2	220H
PIN 3	240H
PIN 4	260H
PIN 5	280H
PIN 6	2A0H
PIN 7	2C0H
PIN 8	2E0H

Next, check the OSC frequency listed on the menu: this must match the CPU speed setting of your computer. If the frequency listed does not match that of your system, press **<F>**. The following menu will appear:

```
        SETUP PROGRAM
by Modular Circuit Technology
- - - - - - - - - - - - - - - - - - - - - -
CURRENT I/O ADDRESS IS    : 280H PIN 5
PC TYPE & SPEED IS        : 8M

        (A) CHANGE I/O ADDRESS.
        (F) CHANGE OSC FREQUENCY.
              <ESC> EXIT
            CHANGE OSC FREQ
1.XT/4.77M   2.XT/6M    3.XT/8M    4.XT/10M
5.AT./6M     6.AT/8M    7.AT/10M   8.AT/12M
                              SELECT:
```

Thus, for example, if your computer is an XT operating at 8Mhz, press **<3>**; if it is an AT operating at 10Mhz, press **<4>**.

STEP 2: CONFIGURE THE MOD-MAC

Next, configure the adapter card by running the SETUP program. To do this, simply type **SETUP** and press the **ENTER** key. The following menu will appear:

```
        SETUP PROGRAM
by Modular Circuit Technology
- - - - - - - - - - - - - - - - - - - - - -
CURRENT I/O ADDRESS IS    : 280H PIN 5
PC TYPE & SPEED IS        : 8M

        (A) CHANGE I/O ADDRESS.
        (F) CHANGE OSC FREQUENCY.
              <ESC> EXIT
```

Check the current I/O address listed on the menu: it should be 280H, matching the address setting on the MAC card. (The MAC card is shipped with a jumper block on the # 5 pins, which is address 280H). If the address of the card does not match the address listed on the menu, you can change the menu setting by pressing **<A>**. The monitor will then display the following:

```
        SETUP PROGRAM
by Modular Circuit Technology
- - - - - - - - - - - - - - - - - - - - - -
CURRENT I/O ADDRESS IS    : 280H PIN 5
PC TYPE & SPEED IS        : 8M

        (A) CHANGE I/O ADDRESS.
        (F) CHANGE OSC FREQUENCY.
              <ESC> EXIT
          CHANGE I/O ADDRESS
    JUMPER IN WHICH POSITION (1-8):
```

3 USING THE TESTER

Note: if you have a test pattern saved on disk or would like to create one, refer to the appendix at the end of the manual.

STEP 1: STARTUP

The file DMT-01.EXE is the central program of the MOD-MIC. Enter the program by typing DMT-01 and pressing ENTER. The screen should display:

```
MCT DIGITAL & MEMORY TESTER V1.0
MODEL : MOD-MIC   (C) SEP 1988
By Modular Circuit Technology
        Main Menu
=========================
1. DIR
2. LOAD TEST PATTERN & TESTING
3. SAVE TEST PATTERN
4. EDIT TEST PATTERN
5. DEBUG TEST PATTERN
T. TTL TESTER
C. CMOS TESTER
M. MEMORY TESTER
Q. QUIT
```


STEP 2: PLACE CHIP IN SOCKET

Once the main menu is displayed, place the test chip in the ZIF socket by moving the socket lever to the up position and inserting the chip in the socket. The chip notch must be located at that socket end which is opposite the lever; the chip's ground pin must be inserted in the slot labelled GND (refer to figure 5). Lower the lever until it locks in place.. (**Do not insert or remove chips while the "Busy" LED is on**!)

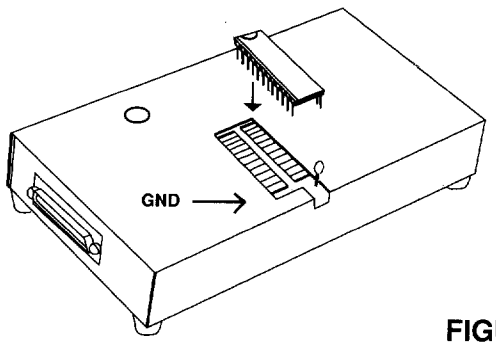


FIGURE 5

STEP 3: SELECT CHIP TYPE

Select the chip type by pressing T for a TTL chip, C for a CMOS chip, or M for a memory chip. Thus, if a 74LS00 were to be tested, you would press T: the screen would display:

```
TTL TESTER :

IC NUMBER : 224

<C>: change number
<A>: auto search IC number
<SPACE>: testing
<ESC>: return to main menu

Which one (C/A/<SPACE>/<ESC>) ?
```

4 QUICK REFERENCE GUIDE

The following reference guide describes each of the commands found in the main menu. The commands will be described in the order in which they are listed in the menu:

```
MCT DIGITAL & MEMORY TESTER V1.0
MODEL : MOD-MIC   (C) SEP 1988
By Modular Circuit Technology
        Main Menu
======================
1. DIR
2. LOAD TEST PATTERN & TESTING
3. SAVE TEST PATTERN
4. EDIT TEST PATTERN
5. DEBUG TEST PATTERN
T. TTL TESTER
C. CMOS TESTER
M. MEMORY TESTER
Q. QUIT
```

1. DIR

Press 1 to list the files in a specified directory or disk. After pressing 1, the screen will display:

```
DIR command format is:
      [d:][path][filename][.ext][/P][/W]
      or press <ESC> to return to main menu
```


STEP 4: SELECT CHIP NUMBER

To select the chip number, press C and enter the last 3 digits of the IC number. (If you are unsure of the chip number, refer to page 24 for a description of the AUTO SEARCH function.) Thus, if you were using a 74LS00 chip, you would press C, then enter 00:

```
TTL TESTER :
   IC NUMBER : 00

<C>: change number
<A>: auto search IC number
<SPACE>: testing
<ESC>: return to main menu

Which one (C/A/<SPACE>/<ESC>) ?
```

STEP 5: TEST THE CHIP

To test the chip, press the SPACE BAR. If the chip is good, the monitor will display the following message:

```
RESULT : GOOD
```

If the chip is bad, the monitor will display:

```
RESULT : ERROR
```

If you have other chips to test, wait for the "Busy" LED to shut off, replace the chip and press the SPACE BAR again. When you are finished, press ESC to return to the main menu.

```
SAVE :

Enter file name to be saved :
B:EXAMPLE

Saving now . . .
OK !

        Press any key to continue.
```

Press any key to return to the main menu.

4. EDIT TEST PATTERN

Press 4 to edit a test pattern. This function calls the DOS DEBUG.COM file. Make sure you have a copy of this file on your work copy of the MCT-MIC Utility diskette. After 4 is pressed, the screen will display:

```
Memory buffer starting address at XXXX:YYYY
```

Now, type RDS, then press ENTER. The screen will display:

```
Memory buffer starting address at XXXX:YYYY

-RDS
DS ZZZZ
```

Next, type in the first four digits of the memory buffer starting address given in the first line.

Type in the pathname or the drive letter of the directory, and press ENTER. Press ESC to return to the main menu.

2. LOAD TEST PATTERN & TESTING

Press 2 to load a test pattern from a disk file into the memory buffer. When prompted, type in the complete name of the file, including the drive letter and any path names, then, press ENTER. The file must conform to the test pattern reserved addresses as outlined in the APPENDIX. The screen will then display:

```
LOAD :
Enter file name to be loaded :
B:EXAMPLE

Loading now . . .
OK !

        Press any key to test,
                or <ESC> to quit.
```

At this point, you can insert a chip into the ZIF socket and press any key to test. Otherwise press ESC to return to the main menu.

3. SAVE TEST PATTERN

Press 3 to save a test pattern from the memory buffer to a disk file. When prompted, type in the complete name under which you want the file to be saved, including drive letter and any pathnames, then press ENTER; the screen will display:

```
1: pattern write      port (A)=48    port (B)=49
          read        port (A)=48    port (B)=49
2: pattern write      port (A)=5A    port (B)=5B
          read        port (A)=5A    port (B)=5B
3: pattern write      port (A)=6C    port (B)=6D
          read        port (A)=FF    port (B)=6D — ERROR
4: pattern write      port (A)=36    port (B)=76
          read        port (A)=36    port (B)=76

******** END    Press any key to continue.
```

T. TTL TESTER

Press T to test a TTL chip. After pressing T, the screen will display:

```
TTL TESTER :

IC NUMBER : 244

<C>: change number
<A>: auto search IC number
<SPACE>: testing
<ESC>: return to main menu
Which one (C/A/<SPACE>/<ESC>) ?
```

Type C to change the IC number. Then, type in the last digits (maximum of three digitals) of the IC number and press ENTER. For example:

IC NUMBER	ENTER
74LS138	138
74S00	00
5407	07


```
Memory buffer starting address at
XXXX:YYYY

-RDS
DS ZZZZ
: XXXX
```

You may now proceed with the editing of a test pattern. Refer to the APPENDIX for more information on test patterns and refer to your DOS reference manual for more information on using the DEBUG program.

5. DEBUG TEST PATTERN

Press 5 to test a chip after editing or loading a test pattern. After 5 is pressed, the following chip information will be displayed:

```
1: Total pattern sets : 4
2: VCC & GND code : 00
3: port (A) in/out code : 37
4: port (B) in/out code : B6

Put IC on socket, then press any key to test by step,
or press <ESC> to quit.
```

With a chip placed in the socket, press any key; the MCT-MIC will begin testing the chip, displaying each test pattern set as it tests. Press ENTER to proceed to the next test pattern set. An error message will be displayed with each set that the chip does not pass. An example of a test pattern debug is shown below:

C. CMOS TESTER

Press C to test a CMOS chip. After C is pressed, the screen will display:

```
CMOS TESTER :

IC NUMBER : 244

<C>: change number
<A>: auto search IC number
<SPACE>: testing
<ESC>: return to main menu
Which one (C/A/<SPACE>/<ESC>) ?
```

Type C to change the IC number. Then, type in the last digits (maximum of five digitals) of the IC number and press ENTER. For example:

IC NUMBER	ENTER
CD4051	4051
CD4512	4512
CD40174	40174

If you do not know the chip number, or are unsure of the number, use the auto search function described on page 24.

Finally, after you enter the chip number, insert the chip in the ZIF socket and press the SPACE BAR to start the test. If the chip functions, the screen will display the message: "GOOD." Otherwise, the screen will display the "ERROR" message.

If you do not know, or are unsure of the IC number, insert a chip into the ZIF socket and press A. The program will **automatically** determine the chip number and display compatible chip numbers at the bottom of the submenu. For a 74LS04, the screen will display:

```
TTL TESTER :

IC NUMBER : 244

<C>: change number
<A>: auto search IC number
<SPACE>: testing
<ESC>: return to main menu

Which one (C/A/<SPACE>/<ESC>) ? A

Result : 04, 14, 19, 4096, 4584
            *** END
```

After the **Auto-search**, press C and type in any of the given chip numbers and press ENTER. Then, insert the chip in the ZIF socket and press the SPACE BAR to start the test. If the chip is good, the screen will display the following message:

```
RESULT:          GOOD
```

Otherwise, the screen will display:

```
RESULT:          ERROR
```

Press ESC to return to the main menu.

Q. QUIT

Press Q to exit the main menu and return to DOS. If you are in one of the submenus, you must first exit that submenu and return to the main menu; then press Q to exit.

M. MEMORY TESTER

Press M to test a memory chip. The screen will display:

```
MEMORY TESTER :
IC NUMBER  : 4164 - 64K*1

1. 4164 -64K*1 2. 4256 -256K*1
3. 2114 -1K*4  4. 6116 -2K*8
5. 6264 -8K*K
<C>: change number
<SPACE>: testing
<ESC>: return to main menu
Which one (C/<SPACE>/<ESC>)?
```

Next, type C to select the chip number. Then, type the menu number which corresponds to your chip number. For example:

If chip number is **2114**	type **3**
If chip number is **4164**	type **1**

After the chip number is entered, insert the chip in the ZIF socket and press the SPACE BAR to start the test. If the chip is good, the screen will display the following message:

```
RESULT:          GOOD
```

If the chip is bad, the screen will display:

```
RESULT:          ERROR
```

Finally, press ESC to return to the main menu.

5 TROUBLESHOOTING

We have provided the following troubleshooting guide to help you overcome some of the more commonly experienced installation/setup problems. This trouble-shooting guide, however, is not intended to be a repair manual. If you encounter problems other than those described here, please contact you dealer or the Customer Support Department at JDR Microdevices. The toll free number is **800-538-5000**.

INSTALLATION PROBLEMS

PROBLEM:

When the computer is turned on, nothing happens; the power supply fan does not turn and nothing appears on the monitor screen.

SOLUTION:

Check the power cord. Make sure that one end of the cord is securely inserted into a power outlet and the other end is pressed firmly into the power supply. If you have a surge protector, make sure that it is switched on.

PROBLEM:

When the computer is turned on, the power supply fan spins and there is a clicking sound from the power supply.

SOLUTION:

The programmer card may be improperly installed or may have a short circuit. Switch the computer off and push the card into the slot to make sure it is firmly seated. Then, turn on the computer. If the problem persists, switch the computer off, remove the programmer card from the motherboard, and turn on the computer again. If there is no longer any clicking sound when the card is removed, there might be a problem in the card. Contact your dealer or call the Customer Support Department at JDR Microdevices for further assistance.

GENERAL TROUBLESHOOTING CHECKLIST

If your problem is not described above, check the following:

1. The MOD-MAC adapter card is fully seated in its slot.
2. All cable connections are securely fastened.
3. The MAC jumper setting matches the I/O address displayed by the programmer software.
4. No other card on the bus has the same I/O address as the adapter card.

(2) SET PORT DIRECTION

Each slot of the tester socket is matched with a chip pin which has a given function. Each chip pin function is assigned a code. The possible functions and the corresponding codes are given in the table below.

FUNCTION	CODE
Vcc	0
GND	0
INPUT	1
OUTPUT	0
DON'T CARE	1

The direction code is determined by examining one port at a time. You must determine the chip pin function for each port slot. Next, use the table above to determine the code. Then, using the port slots as bits, form a binary number with PA0 as the least significant bit and PA7 as the most significant bit. Finally convert the resulting binary number to hexadecimal. For example, to set the direction of port A:

PORT A:	PA7	PA6	PA5	PA4	PA3	PA2	PA1	PA0
	GND	OUT	IN	IN	OUT	IN	IN	X
	0	0	1	1	0	1	1	1

=37HEX

DIR A = 37

APPENDIX

CREATING A TEST PATTERN

The MOD-MIC allows you to customize the test pattern to determine the signal input to each pin, as well as the output of each pin. Although a complete and accurate test can be conducted by writing and reading values according to the chip's spec sheet, you can save time by testing only certain functions or addresses. The tester socket slots are grouped into 3 bidirectional I/O ports: PA, PB, and PC, through which the input and output values are read and written.. To create a test pattern, you must do the following:

(1) Select Vcc and GND code.
(2) Set port directions.
(3) Set port test patterns.
(4) Determine total sets of test patterns.
(5) Load test pattern into buffer.
(6) Test the chip.

(1) SELECT Vcc AND GND CODE

Vcc and GND codes are determined by number of pins the chip has. The table below gives the pin numbers and the corresponding code.

CHIP	CODE
14 - pin	00
16 - pin	01
18 - pin	02
20 - pin	03
22 - pin	04
24 - pin	05

PORT A:

	PA7 GND	PA6 OUT	PA5 IN	PA4 IN	PA3 OUT	PA2 IN	PA1 IN	PA0 X
input			0	0		0	0	
output		1			1			
COMB.	0	1	0	0	1	0	0	0

= 48HEX

Repeat this process for all desired combinations.

PORT A:

	PA7 GND	PA6 OUT	PA5 IN	PA4 IN	PA3 OUT	PA2 IN	PA1 IN	PA0 X
input			0	1		0	1	
output		1			1			
COMB.	0	1	0	1	1	0	1	0

= 5AHEX

PORT A:

	PA7 GND	PA6 OUT	PA5 IN	PA4 IN	PA3 OUT	PA2 IN	PA1 IN	PA0 X
input			1	0		1	0	
output		1			1			
COMB.	0	1	1	0	1	1	0	0

= 6CHEX

PORT A:

	PA7 GND	PA6 OUT	PA5 IN	PA4 IN	PA3 OUT	PA2 IN	PA1 IN	PA0 X
input			1	1		1	1	
output		0			0			
COMB.	0	0	1	1	0	1	1	0

= 36HEX

The complete test pattern for this port consists of a combination of the sets of derived test patterns. The above example has a total of four sets: TPA = 48 5A 6C 36. Following the above example, repeat the procedure for all the other ports:

Follow the same procedure for each of the other ports:

PORT B:	PB7	PB6	PB5	PB4	PB3	PB2	PB1	PB0
	X	Vcc	IN	IN	OUT	IN	IN	OUT
	1	0	1	1	0	1	1	0

=B6HEX

DIR B = B6

Port C is not used in this example.

(3) SET PORT TEST PATTERNS

The next step is to determine combinations of inputs and the desired ouputs. The following table shows the codes for the possible states.

STATE	CODE
HIGH LEVEL	1
LOW LEVEL	0
GND	0
VCC	1
DON'T CARE (X)	0

Again, examine one port at a time. For each slot designated earlier as an input, enter a combination of HIGH and LOW signals. Then, at the sockets designated as outputs, enter the expected output. Next, determine the codes for the pins designated as GND, Vcc, or DON'T CARE (x). Form a binary number as in the determination of the direction code, and convert to HEX to get a test pattern set. An example test pattern set is shown below.

(4) DETERMINE TOTAL SETS OF PATTERNS

The total sets of test patterns is the number of input combinations used. In the examples given above, four input combinations were used.

At this point you should have the following codes and patterns derived:

Vcc (Vcc & GND code) = 00
DIRA (direction of PA = 37
DIRB (direction of PB = B6
DIRC (direction of PC) = DON'T CARE
TPA (test pattern of PA) = 48 5A 6C 36
TPB (test pattern of PB) = 49 5B 6D 76
TPC (test pattern of PC = DON'T CARE
NO. (**total sets of test patterns**) = 4

(5) ENTER TEST PATTERN INTO BUFFER

After determining test pattern codes, the next step is to load these codes into the memory buffer. The table below shows the buffer address assignments for the different codes and patterns.

BUFFER ADDRESS	ASSIGNMENT
0 - 7F	TPA
80 - FF	TPB
100 - 17F	TPC
180	DIRA
181	DIRB
182	DIRC
183	VCC
184	NO.

From the main menu, type **4** to enter the DEBUG program. Refer to your DOS manual for instructions on how to use the DEBUG program and enter the codes and patterns at the addresses assigned in the table above.

PORT B:

	PB7 X	PB6 Vcc	PB5 IN	PB4 IN	PB3 OUT	PB2 IN	PB1 IN	PB0 OUT
input			0	0		0	0	
output					1			1
COMB.	0	1	0	0	1	0	0	1

= 49HEX

PORT B:

	PB7 X	PB6 Vcc	PB5 IN	PB4 IN	PB3 OUT	PB2 IN	PB1 IN	PB0 OUT
input			0	1		0	1	
output					1			1
COMB.	0	1	0	1	1	0	1	1

= 5BHEX

PORT B:

	PB7 X	PB6 Vcc	PB5 IN	PB4 IN	PB3 OUT	PB2 IN	PB1 IN	PB0 OUT
input			1	0		1	0	
output					1			1
COMB.	0	1	1	0	1	1	0	1

= 6DHEX

PORT B:

	PB7 X	PB6 Vcc	PB5 IN	PB4 IN	PB3 OUT	PB2 IN	PB1 IN	PB0 OUT
input			1	1		1	1	
output					0			0
COMB.	0	1	1	1	0	1	1	0

= 76HEX

TPB = 49 5B 6D 76

No example is given for Port C.

GLOSSARY

AUTOMATIC BOOTING—A computer system with automatic booting is one that loads the operating system and becomes fully functional as soon as power is applied and the DOS inserted into a floppy drive. (Or, if the system has a hard drive, whenever it is turned on.)

BIOS—An abbreviation for Basic Input Output System.

BOOT—The process of loading a computer operating system from a disk to the computer memory.

BUS—A "bus" is a circuit that is used as a path for data or for the transmission of power signals. In microcomputers, busses are used for addressing, data transferral, and control signals.

CLOSE—In electronic terminology, to "close" means to complete a circuit. By "closing" a set of jumper pins, for example, you connect them so that current flows between the pins.

CONFIGURE—The process by which the various components of a computer are integrated with each other. This is usually accomplished by means of jumper pins on the motherboard, expansion cards, or on the peripherals themselves.

CONTROLLER—The computer component that controls hard disk activity. See "hard disk controller".

DEBUG—This is a DOS command that allows you to manipulate registers, memory, and I/O ports. It is used in hard disk setup to summon the preformat and park routines from the disk BIOS ROM on the controller.

(6) TEST THE CHIP

With the test pattern entered into the memory buffer, insert a chip into the ZIF socket and press 5: the program will display the following chip information:

1: Total pattern sets : 4

2: VCC & GND code : 00
3: port (A) in/out code : 37
4: port (B) in/out code : B6

Put IC on socket, then press any key to test by step,
or press <ESC> to quit.

Press any key. The program will start testing the chip, displaying each test pattern set as it tests. Press ENTER to proceed to the next test pattern set. An error message will be displayed with each set that the chip does not pass. An example of a test pattern debug is shown below:

```
1: pattern write      port (A)=48    port (B)=49
           read       port (A)=48    port (B)=49
2: pattern write      port (A)=5A    port (B)=5B
           read       port (A)=5A    port (B)=5B
3: pattern write      port (A)=6C    port (B)=6D
           read       port (A)=FF    port (B)=6D
— ERROR
4: pattern write      port (A)=36    port (B)=76
           read       port (A)=36    port (B)=76

******** END    Press any key to continue.
```

DISK OPERATING SYSTEM (DOS)—The main operating system of a computer. There are several types of operating system— CP/M, Xenix, just to name a few. However, in the PC world, Microsoft's DOS is by far the most commonplace, either in its generic version (MS-DOS), or in its IBM version (PC-DOS).

DRIVE C—The first hard drive in a system. By convention, the #1 floppy drive is called drive A, the second floppy is called drive B, and the #1 hard drive is called drive C. If you were to add another hard drive, it would be called drive D.

DRIVE 0—The first (or only) hard drive in a system. The first hard drive is usually referred to as drive 0 during the initial configuration process (preformat, partition, format), and as drive C during normal operation.

DRIVE 1—The second hard drive installed in a system.

DRIVE SELECT JUMPER—The jumper pins on a disk drive (hard or floppy) that designate the drive as drive 0, or drive 1, or drive 2, or drive 3. The drive number is selected by placing a jumper block over the appropriate pins.

EXPANSION SLOTS—These are the long rectangular receptacles on the motherboard that are designed for the expansion card. During card installation, the edge connector of the expansion card is inserted into one of the expansion slots. The original IBM PC had 5 of these slots (8-bit), the PC/XT has 8 slots.

LOGICAL DRIVE—See "physical drive".

OPEN—In electronic terminology, to "open" means to interfere with or "break" a circuit so that the flow of electric current is stopped. By "opening" a set of jumper pins, for example, you remove any connection between them so that no current flows between the pins.

PHYSICAL DRIVE—A hard disk. A hard disk is called a "physical drive" to distinguish it from the "logical drives" created for split mode operation. In split mode, a large hard disk—the physical drive--is formatted into several partitions, each of which acts as a distinct (logical) drive.

RAM—Abbreviation for Random Access Memory. This is a type of computer memory that allows data to be written (recorded) into it and read from it. RAM is more properly called RWM, or Readable-Writable Memory. (See ROM.)

ROM—Abbreviation for "Read Only Memory". This type of computer memory contains data permanently imbedded in it. This data can be retrieved for use, but cannot be replaced by new data. It can only be "read from"; it cannot be "written to". (See RAM.)

SPLIT MODE—Refers to the process of "dividing" a large hard disk into two or more "logical drives". The reason that people use split mode is that MS-DOS and PC-DOS cannot format hard disks larger than 32 megabytes. To get around this limitation, you must "split" your large drive into several logical drives, each of which must be smaller than 32MB.