TANDY®

Technician Series
Diagnostics Software

MEMTST

Memory Diagnostic
for
MS-DOS™ Computers

01-0220 Computer Technical Services

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MEMTST - MS-DOS MEMORY DIAGNOSTIC

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GENERAL DESCRIPTION

MEMTST is a memory diagnostic designed for the Tandy Model 1000, Model 1200, Model 2000, Model 3000, Model 4000, and Model 5000. It also tests the RAM in the Graphics Master and Graphics Tender boards. The Model 1200 version is also available in a ROM.

FEATURES

MEMTST is designed to be user friendly with no "hidden" commands. All options appear on the screen. It can be configured to test all RAM areas in blocks of 64K. Checksums for the BIOS ROMs and any expansion ROMs present in the system appear on the main menu.

In the Model 1200 version, if both the monochrome video and color video are available, the video used to display results may be toggled from one to the other as the video display whose RAM is being tested will be overwritten with the test pattern. The video display is always present in the remaining models.

If any errors occur during testing, the test is halted at the end of the segment under test. This permits running the test unattended.

EQUIPMENT REQUIRED

Machine For Testing	Memory Test
Tandy 1000	MEM1000
Tandy 1000EX	MEMEX
Tandy 1000HX	MEMHX
Tandy 1000SL,SL/2,TL,TL/2	MEMSLTL
Tandy 1000TX	MEMTX
Tandy 1200	MEM1200
Tandy 1400	MEM1400
Tandy 2000	MEMTST
Tandy 3000/FAST/NL/HL	MEM3000
Tandy 4000/LX/SX	MEM4000
Tandy 5000	MEM5000

LOADING MEMTST

There are two ways of accessing the memory diagnostic. The first is through the main menu of the diagnostic disk. The key corresponding to the memory test is pressed to load the memory program. The second way to access the memory diagnostic is directly from MS-DOS. The name of the memory diagnostic for the particular model in which the test is to be run is typed in at the MS-DOS prompt:

A:\>MEM4000<ENTER>

The memory diagnostic menu will then appear on the screen.

DISPLAY DESCRIPTION

Upon initialization, the main menu is displayed along with the checksums of the boot ROMs and other expansion ROMs, if applicable. Two modes of operation are available, single and continuous. The default mode is single. Below the mode are the options for testing. Below the menu options are keys that may be used during testing. The Model 2000 uses keys F1 through F4 versus the other models which use keys 1 through 4 to select the first four test options.

The test display shows the current segment under test (upper right hand corner), the mode (single or continuous), the type of test (checkerboard or modified address) and the pass count in the display header.

The following screen in displayed after execution of the loading instructions with the exception of MEM2000.

```
                Tandy XXXX  Memory Diagnostic
                XXXX XX, XXXX       Version X.XX
          Copyright (c) 1989 Tandy Corp.   All rights reserved.
```

TEST MODE	BIOS ROM CHECKSUM	EXPANSION ROM CHECKSUM
	Even ROM: Odd ROM:	

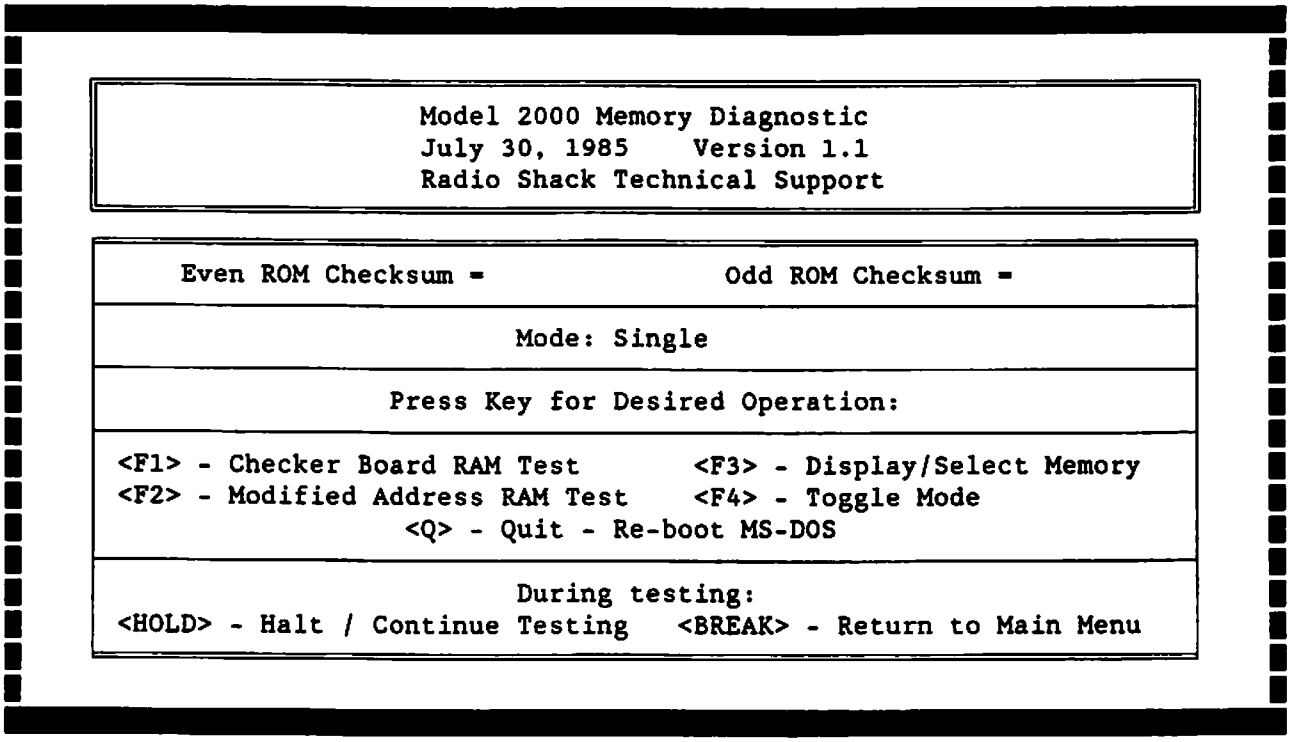
```
     MAIN MENU OPTIONS                    OPTIONS WHILE TESTING

<1> - Checker Board RAM Test              <H>  - Pause / Continue
<2> - Modified Address RAM Test           <ESC> - Return To Main Menu
<3> - Display / Select Memory
<4> - Toggle Test Mode

<Q> - Quit, Re-boot DOS

       Select Option: _
```

MEM2000 will initially display a copyright screen. After the <ENTER> key is pressed the following screen will be displayed.



OPERATING MEMTST

Keys <1> - <4> are used for selecting an option on all tests except for the Model 2000 test which uses keys <F1> - <F4>.

<1>/<F1> - Checker Board RAM Test
This test checks RAM with alternating 55h and AAh patterns.

<2>/<F2> - Modified Address RAM Test
This test checks RAM with an incrementing pattern xor'ed with the address.

<3>/<F3> - Display/Select Memory
This option displays the current segments of memory selected for testing and allows for reconfiguration.

<4>/<F4> - Toggle Mode
This option toggles test mode between SINGLE and CONTINUOUS.

<Q> - Quit Re-boot MS-DOS
Pressing <Q> causes a prompt for exiting to MS-DOS to appear.

<H>/<HOLD> - Halt / Continue Testing
If errors are encountered, pressing <HOLD> on the Model 1000 and Model 2000 or <H> on the Model 1200, Model 3000, Model 4000, and Model 5000 will cause the display to halt until <HOLD> or <H> is pressed again.

<ESC> - Return to Main Menu
Pressing <ESC> at any point will cause the program to return to the main menu.

TEST DESCRIPTIONS

Checker Board Test

The checker board test uses an alternating pattern of 55h and AAh. First the even numbered memory locations are written with a 55h and odd locations with an AAh. These patterns are read back and verified. The even locations are then written with an AAh and the odd locations with a 55h. These patterns are also read back and verified. This is particularly useful in detecting shorted bits in adjacent memory locations. Press **<1>/<F1>** at the main menu to execute this test.

NOTE: This test is useless for detecting parity errors as the patterns written always have even parity. To check parity, the Modified Address test must be used.

Modified Address Test

The modified address test writes multiple patterns to each address. The patterns are derived from the exclusive OR of the address with an incrementing pattern. The incrementing pattern begins with 01h and continues to FFh. The first pass through a 64k block exclusive OR's each address with 01h. These patterns are read back and verified. The pattern is then incremented to 02h and exclusive OR'ed with each address. Again the pattern is verified. This process continues until the pattern reaches FFh. For example, if the pattern is 16h and the address is 1005h the most significant byte of this address is XOR'ed with the pattern (10h XOR 16h). This is followed by a XOR of the least significant byte of the address with the result of the first XOR (05h XOR 06h) giving 03h for the value to be stored at that address. This test is particularly useful for detecting shorted address lines. Press **<2>/<F2>** at the main menu to execute this test.

NOTE: Use this test to detect parity errors.

Display/Select Memory

The Display/Select Memory option is used for viewing the current configuration for testing and to alter that configuration. The memory is laid out in segments of 64k bytes. A segment is enabled/disabled by pressing the letter that corresponds to the desired segment. A segment is enabled when a large graphics block appears in the box corresponding to that segment. Pressing the letter will alternately enable and disable that segment.

Model 1000 version:

The last two segments ('I' at 576k and 'J' at 640k) are located on the main logic board. The main logic board RAM is always the last 128k of RAM in the machine. When additional RAM is present, the main logic board RAM will be mapped above the expansion RAM. To avoid having to remap these segments whenever additional blocks of RAM are added or deleted, this test always maps them at the highest location.

Model 1200 version:

Blocks "K" thru "M" are video RAM. The Graphics Master RAM is represented by "K", the monochrome video RAM by "L" and the graphics tender RAM by "M".

If both the color video and monochrome video are available, the <V> option will be listed. This option allows for switching the video display from one video to another.

Model 2000 version:

All the displayed RAM segments are contiguous. The only other RAM in the Model 2000 is the character generator RAM. This RAM is tested upon entry into the program. If any errors occur, they are displayed before the main menu appears.

Model 3000 version:

The last three segments represent video RAM to be tested. Block "K" selects the Graphics Master RAM, block "L" selects monochrome video RAM, and block "M" selects color video RAM.

Model 4000 version:

All the displayed RAM segments are contiguous. With all blocks selected one megabyte of RAM is tested. No video RAM is tested.

Model 5000 version:

The "K" segment selects cache memory. With all blocks selected 640k system memory is tested along with the cache memory.

Toggle Mode

Two modes of testing are available - SINGLE and CONTINUOUS. Pressing <4>/<F4> in the main menu toggles from one mode to another. SINGLE mode makes just one pass through all the enabled segments. CONTINUOUS mode will start over with the first enabled segment at the end of each pass. This allows for "burning in" the memory for an extended period of time.

Quit - Reboot MS-DOS

Pressing <Q> at the main menu causes the prompt for exiting to MS-DOS to appear. Pressing <ENTER> will cause the system to reboot. Pressing <ESC> at this point will abort the exit routine and return to the main menu. If the ROM version for the 1200 is being used it will restart when <Q> is pressed.

IN-TEST OPTIONS

When errors are encountered during testing, information concerning the errors will scroll on the screen. To halt the scrolling, press <HOLD> or <H> as indicated on the menu. To resume, press <HOLD>/<H> again. To return to the main menu, press <ESC>.

APPENDIX

Error Messages

Below the status lines are the columns for errors. When an error is encountered, its absolute address is displayed in the left-most column and the segment and offset is displayed in the next column. The byte that was written to the location is displayed in the column labeled "Written", the actual value that was read is displayed in the column labeled "Read" and the pass in which the error occurred is displayed in the column labeled "Pass".

In the case of a parity error, a special message is displayed on the screen indicating the segment and offset at which the first parity error was detected. If the segment and offset could not be determined, question marks are displayed to show that a parity error occurred but the address could not be determined.

Model 1000

Parity errors are not checked in the 1000 family memory tests.

Model 1200

When testing graphics RAM with a Captain board, a bank indication (Bk) is added to the segment column header. In this situation bank refers to one of two 64k segments of RAM that are switched in and out. The bank causing the error to occur will be displayed below the bank column header.

Model 2000

When testing graphics RAM, a bank indication (Bk) is added to the segment column header. In this situation bank refers to a 'plane' of graphics RAM. The 'plane' causing the error to occur will be displayed below the bank column header.

Model 3000

When testing Graphics Master RAM, a bank indication (Bk) is added to the segment column header. In this situation bank refers to one of two 64k segments of RAM that are switched in and out. The bank causing the error to occur will be displayed below the bank column header.

Model 5000

When an error occurs in cache memory the absolute address column will display a "C" before the absolute address, the segment column will display the word "CACHE", and the offset will display the offset into cache memory where the error occurred.

ADDENDUM TO MEMTST MANUAL

The memory diagnostic for the 1000SL, SL/2, TL, and TL/2 (MEMSLTL) has been updated. The following is a list of the changes made to the memory test.

PAUSE/CONTINUE KEY:

The Pause/Continue key has been changed to the P. When running a test, pressing the P key once pauses the test and pressing it again resumes testing.

MODIFIED ADDRESS TESTS:

A second modified address test has been added. To access this, a second menu has been added listing two modified address tests. The first test listed is the new one and it is called the "Long Modified Address Test". This test will write a pattern, delay, then read the pattern back. This can be helpful in detecting refresh and intermittent memory problems. The second test is the original modified address test and it is called the "Short Modified Address Test".

NOTE: It is recommended that the Checker Board Test be run before either modified address test. This will ensure that data errors will not be mistaken as address line problems.

DISPLAY/SELECT MEMORY:

On these machines, system RAM detected at boot-up is the only system RAM the CPU will access because of the way the memory controller is programmed. For this reason you can no longer select memory beyond what is detected at boot-up.

The segment number is now used to select or de-select a 64K RAM segment.

ERROR MESSAGES:

A new error message has been added. This message corresponds to a quick address line test. The error message will display the absolute address in the left-hand column, and the next column will say "ADDRESS LINE ERROR:". The "WRITTEN" column will show the byte written as usual, but the "READ" column will display the byte read and also which address line has failed. This will help in determining where stuck address lines are.

As an example, let's say the following error message appears:

40000 ADDRESS LINE ERROR: Written: 00 Read: 10,Line 00

This would tell you that there may be a problem in the fourth memory segment, even addresses, upper nibble, and address line zero.

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U.S.A.: FORT WORTH, TEXAS 76102
CANADA: BARRIE, ONTARIO L4M 4W5

TANDY CORPORATION

AUSTRALIA	BELGIUM	FRANCE	U. K.
91 Kurrajong Avenue Mount Druitt, N.S.W. 2770	Rue des Pieds d'Alouette, 39 5140 Naninne (Namur)	Centre Commercial des 3 Fontaines B.P. 147 95022 Cergy Pontoise Cedex	Bilston Road Wednesbury West Midlands WS10 7JN