DIAGNOSTIC MANUAL

C-64
DEAD TEST

JANUARY 1988

PN-314139-02

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Commodore Business Machines, Inc.
1200 Wilson Drive, West Chester, Pennsylvania 19380 U.S.A.

C64/C128/C128D DIAGNOSTIC
DEAD TEST REV 781220

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DEAD TEST DIAGNOSTIC OVERVIEW

The Dead Test Diagnostic Cartridge is designed to test the C64 and C128/C128D, (C64 Mode), Systems that fail to display video information on Power Up even with the C64 or C128/C128D Diagnostic Assembly installed.

The Dead Test is meant only as an extra troubleshooting tool to assist the Technician in repairing Dead PCBs and does not replace the current C64 or C128/C128D Diagnostic Assemblies now being used.

The Dead Test is almost completely dedicated to System RAM testing and does no type of System ROM or Port Testing.

DIAGNOSTIC STARTUP

The Dead Test should [Auto-Boot] on System Power Up and begin executing Diagnostic Tests.

If the screen begins flashing in a series of consistent flash codes on power up, a BAD RAM IC or Stuck Data Line is normally indicated. If this is the case, refer to Section Two of this manual. **[Power Up RAM Test]**

If all RAM ICs can be accessed and the Data Bus seems to be operating, the Diagnostic Screen should be displayed.
*** The Diagnostic Screen should appear approximently 10 to 15 Second after System Power Up.**
The Diagnostic Screen displays the Current Test being executed, Test Status, [OK or BAD], and Probable RAM Failure.

It is possible to have a RAM Failure that is not a consistent or hard failure. It may Pass the Test one time and Fail the next. This is normally due to a Refresh Failure.

If a RAM Failure is detected, a [BAD] message will be displayed in Red next to the failed test and the probable RAM Failure indicated inside the Red Rectangular Box. If the test passes on the next Diagnostic Cycle, the [OK] message is displayed in Red next to the failed test but the probable RAM IC Failure will not be cleared from the box. This is an indication that a failure has occurred at least once during Diagnostic Run Time and the RAM IC should be replaced and the System Retested.

Once the Diagnostic is running it will continue to execute, displaying the Results of the Tests, Count, [Number of Cycles], and Two (2) Time of Day Clocks. A detailed description of these clocks is contained in Section Two of this manual. **[Lower Screen Display]**

BASIC DIAGNOSTIC THEORY

The Dead Test Diagnostic Cartridge resides at Memory Location $E000-$ECA8. When power is applied to the system, the Micro-Processor reads Memory Address $FFFC. This address instructs the system where Diagnostic Routines are to be executed.

The Diagnostic Test exercises the Micro-Processor, System RAM and SID Circuits of the of the C64 or C128/C128D. The current test being executed, status, (OK or BAD), and possible IC Failures are displayed.

Detailed Test Descriptions are included in Section Two of this manual. **[Diagnostic Test Descriptions]**

INSTALLATION

1. Make sure Power is OFF on the Test System

2. Plug the Dead Test Diagnostic Cartridge into the Expansion Port of the Test System.
   *** Make sure the Label is facing UP**

3. Turn the System Power ON

DIAGNOSTIC TEST DESCRIPTIONS

POWER-UP RAM TEST

THE POWER-UP RAM TEST WILL TAKE APPROXIMENTLY TEN SECONDS TO COMPLETE EXECUTION DURING WHICH TIME THE SCREEN WILL REMAIN BLACK

When the Micro-Processor begins executing the Diagnostic Test, RAM Locations $0100 - $1000 are tested. During this test, Preset Data from the RAM Data Table is loaded into these Memory Locations. After a Refresh Cycle this Data is Read back and Compared with the Data Table.

* If DATA READ = DATA STORED, RAM is [OK]
* If DATA READ <> DATA STORED, RAM is [BAD]

RAM TEST DATA TABLE

Binary	Hex	Decimal	Binary	Hex	Decimal
01111111	$7F	127	00100000	$20	032
10111111	$BF	191	00010000	$10	016
11011111	$DF	223	00001000	$08	008
11101111	$EF	239	00000100	$04	004
11110111	$F7	247	00000010	$02	002
11111011	$FB	251	00000001	$01	001
11111101	$FD	253	11111111	$FF	255
11111110	$FE	254	10101010	$AA	170
10000000	$80	128	01010101	$55	085
01000000	$40	064	00000000	$00	000

This test continues until the end of the Data Table is reached or a RAM Error is detected.

A. If the Test is Successful a Character Set is Downloaded into Low RAM and Diagnostic Testing Continues.

If no screen flashing occurs or the Diagnostic Screen is not displayed after a Maximum of Twenty (20) Seconds an Initial Startup Failure has occurred normally indicating ...

1. Defective Power Supply or Power Supply Circuit Failure
2. System Reset or System Clock Circuit Failure
3. Defective MPU Chip or Associated Control Logic Circuits
4. Defective PLA Chip or Associated Control Logic Circuits
5. Defective VIC Chip or Associated Control Logic Circuits

B. If a RAM Error id Detected the screen will begin flashing in a series of flash codes with a pause between each series.

Defective RAM ICs are indicated by the Number of Flash Codes in the series and may be interpreted using the RAM Error Flash Code Chart.

RAM ERROR FLASH CODE CHART

FLASH CODES	C64 REV A/B	C64 REV B-3	C64 REV E	C128 ALL REV	C128D ALL REV	DATA BIT
1	U12	U9	U11	U45/U53	U39/U41	7
2	U24	U9	U11	U44/U52	U39/U41	6
3	U11	U9	U11	U43/U51	U39/U41	5
4	U23	U9	U11	U42/U50	U39/U41	4
5	U10	U10	U10	U41/U49	U38/U40	3
6	U22	U10	U10	U40/U48	U38/U40	2
7	U9	U10	U10	U39/U47	U38/U40	1
8	U21	U10	U10	U38/U46	U38/U40	0

If more than one RAM IC is defective, the Dead Test will execute the Flash Code Sequence for the first RAM detected. When this RAM IC is replaced, a Flash Code Sequence for the next RAM IC will be executed. This will continue until all Defective ICs have been replaced.

SEVERAL DEFECTIVE RAM IC'S MAY INDICATE A DEFECTIVE POWER SUPPLY OR ON/OFF SWITCH

Some RAM Failures may cause the Dead Test to display incorrect results. The majority of these will display a One (1) Flash Code indicating a Defective Data Bit [7]. If the associated RAM is replaced and the results remain the same, the real failure normally turns out to be a Defective RAM IC associated with Data Bits [0 or 1].

Flash Codes are normally an indication of a Data Line being held either high or low. Although this is usually caused by a Defective RAM IC, it is also possible for any IC associated with the Indicated Data Line to be at fault.

The Dead Test Diagnostic will execute the Power-Up RAM Test with all Major ICs removed from the PCB with the exception of the MPU , PLA and VIC Chip, thus allowing all Socketed ICs to be removed eliminating them as the Possible Defective Component.

If the Dead Test executes a Flash Code Sequence and RAM replacement or Socketed IC Removal does not correct the problem, use a scope to verify the defective Data Line. Once this is accomplished, it may be necessary to begin clipping IC pins associated with the Data Line.

1. Clip the pin as close to the PCB as possible and lift the pin away from the PCB
2. ReTest System with the Dead Test
3. If result is the same, Resolder the pin and continue to the next Associated IC
4. Continue with these steps until the Dead Test executes properly
5. If the Dead Test operates properly, Replace the IC associated with the clipped pin and ReTest

NOTE * NOTE * NOTE * NOTE * NOTE * NOTE * NOTE

USING THIS METHOD OF TROUBLESHOOTING MAY VOID PARTIAL OR ALL CREDIT IF THE PCB IS RETURNED TO COMMODORE BUSINESS MACHINES DAMAGED IN ANY WAY

The Dead Test Screen displays RAM Locations which correspond to the C64 Rev A and Rev B PCBs. If the System under test is a C64 with a Rev B-3 or Rev E PCB installed, or a C128 or C128D, the BAD RAM displayed may be interpreted using the System RAM Chart.

SYSTEM RAM CHART

DIAG DISPLAY	C64 RAM REV A/B	C64 RAM REV B-3	C64 RAM REV E	C128 RAM ALL REV	C128D RAM ALL REV
U21	U21	U10	U10	U38	U38
U9	U9	U10	U10	U39	U38
U22	U22	U10	U10	U40	U38
U10	U10	U10	U10	U41	U38
U23	U23	U9	U11	U42	U39
U11	U11	U9	U11	U43	U39
U24	U24	U9	U11	U44	U39
U12	U12	U9	U11	U45	U39

ZERO PAGE RAM TEST

Zero Page Memory resides at Locations $0000 - $00FF. Two of these locations, $0000 and $0001, are reserved for the MPU I/O Port. These two locations cannot be tested.

The Zero Page Test writes data from the data table into locations $0003 - $00FF. This data is then read and compared to Stored Data.

*** IF DATA READ = DATA WRITTEN, ZERO PAGE RAM IS [OK]**
*** IF DATA READ <> DATA WRITTEN, ZERO PAGE RAM IS [BAD]**

If a failure occurs during the Zero Page Test, any indicated RAM IC must be replaced.

If this does not correct the problem, or if more than two RAM ICs are displayed defective, Refer to the RAM Sections of the appropriate Diagnostic and Troubleshooting Manuals.

STACK PAGE RAM TEST

The Stack Page resides at Memory Locations $0100 - $01FF.

The Stack Page Test writes data from the Data Table into each of these locations. The data is then read and compared to Stored Data.

*** IF DATA READ = DATA WRITTEN, STACK PAGE RAM IS [OK]**
*** IF DATA READ <> DATA WRITTEN, STACK PAGE RAM IS [BAD]**

If a failure occurs during the Stack Page Test, any indicated RAM IC must be replaced.

If this does not correct the problem, or if more than two RAM ICs are displayed defective, Refer to the RAM Sections of the appropriate Diagnostic and Troubleshooting Manuals.

SCREEN RAM TEST

The Screen RAM resides at Memory Locations $0400 - $07FF.

The Screen RAM Test writes data from the Data Table into each of these locations. After a short delay, to allow Refresh, the data is read and compared to the written data.

*** IF DATA READ = DATA WRITTEN, SCREEN RAM IS [OK]**
*** IF DATA READ <> DATA WRITTEN, SCREEN RAM IS [BAD]**

If a failure occurs during the Screen RAM Test, any indicated RAM IC must be replaced.

If this does not correct the problem, or if more than two RAM ICs are displayed defective, Refer to the RAM Sections of the appropriate Diagnostic and Troubleshooting Manuals.

COLOR RAM TEST

The Color RAM resides at Memory Locations $D800 - $DC00.

The C64 Color RAM uses the Lower Four (4) Bits to display any color, therefor a revised version of the Data Table is used for Color RAM Testing. This revised Data Table uses the same type of Data Patterns but only with the Lower Four (4) Bits.

The Color RAM Test writes data from the Data Table into each of these locations. After a short delay, to allow Refresh, the data is read and compared to written data.

*** IF DATA READ = DATA WRITTEN, COLOR RAM IS [OK]**
*** IF DATA READ <> DATA WRITTEN, COLOR RAM IS [BAD]**

If a failure occurs during the Color RAM Test, any indicated RAM IC must be replaced.

If this does not correct the problem, or if more than two RAM ICs are displayed defective, Refer to the RAM Sections of the appropriate Diagnostic and Troubleshooting Manuals.

RAM TEST

Because of the configuration of the Dead Test Diagnostic Cartridge, only RAM Locations $0800 - $1000 can be tested.

The RAM Test writes data from the Data Table into each of these locations.

* **As the data is written to these locations the Character Set is replaced and should slowly disappear from the screen.**
* **After approximently 30 Seconds, when the RAM Test is complete, the Screen should Reappear.**

After a short delay to allow Refresh, the data is read and compared to the Data Table.

* **IF DATA READ = DATA WRITTEN, RAM IS [OK]**
* **IF DATA READ <> DATA WRITTEN, RAM IS [BAD]**

If a failure occurs during the RAM Test, any indicated RAM IC must be replaced.

SOUND TEST

When the RAM Test is complete and the Dead Test Screen is Redisplayed, the Sound Test is executed.

The Sound Test is an Audible Test Only and no [OK] or [BAD] message will be displayed. The Sound Test should produce Three (3) Distinctive Voices at Three (3) Volume Levels followed by Three (3) Bursts of Noise.

If any of the Voices, Volume Levels or Noise Bursts are missing, a Defective SID IC is normally indicated.

If replacement of the SID IC does not correct the problem, troubleshooting of the Audio Output Circuitry is necessary.

LOWER SCREEN DISPLAY

During Diagnostic Run Time, the Dead Test Diagnostic displays the Number of Completed Diagnostic Cycles, [COUNT], in the Bottom Left Hand Corner of the screen.

In the Bottom Right Hand Corner of the screen, Two (2) Clocks are displayed. The AM Clock corresponds to the Internal Time-Of-Day Clock of the 6526 CIA, U1. The PM Clock corresponds to the Internal Time-Of-Day Clock of the 6526 CIA, [U2 on C64], [U4 on C128 and C128D].

The Two AM and PM Clocks should display the Exact Same Time during Diagnostic Run Time and increment as the Diagnostic Tests are executing. The increments of the Clocks should compare to the Lower Screen Display Chart.

LOWER SCREEN DISPLAY CHART

Current Test	AM Clock	PM Clock
Zero Page	No Display	No Display
Stack Page	No Display	No Display
Screen RAM	00:00:13	00:00:13
Color RAM	00:00:42	00:00:42
RAM Test [Screen Disappears]	00:00:58	00:00:58
Sound Test [Screen Reappears]	00:01:27	00:01:27
New Cycle [Begin 2nd Cycle]	00:01:27	00:01:27

FAILURE MODES

INCORRECT AM CLOCK	= Possible 6526 CIA Failure
INCORRECT PM CLOCK	= Possible 6526 CIA Failure
INCORRECT BOTH CLOCKS	= Possible 60HZ TOD Input Failure
	Possible 6526 CIA Failure

IF THE DEAD TEST DIAGNOSTIC PASSES ALL TESTS AND THE SYSTEM WILL NOT RUN THE STANDARD DIAGNOSTIC, A BAD ROM OR PLA IS NORMALLY INDICATED.