DIAGNOSTIC MANUAL

1581
VERSION 1.5

JANUARY 1988 **PN-314854-04**

PN-314854-01 — Kit Disk Diagnostic 1581

includes

PN-314854-02 — Diagnostic Progarm Disk 1581 — Version 1.5

PN-314854-03 — Diagnostic Analog Disk 135 TPI

PN-314854-04 — 1581 Diagnostic Manual — Version 1.5

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DIAGNOSTIC DISKETTE INTRODUCTION
VERSION 1.5

This manual was developed to aid you in the use of the Diagnostics available for Repair Troubleshooting of the CBM C128/C128D Consumer Product Line.

The manual is separated into four (4) sections.

SECTION 1: This section contains Diagnostic and Test Programs to assist in troubleshooting of the CBM 1581 Single Disk Drive

SECTION 2: This section contains Diagnostic and Test Programs to assist in troubleshooting the C64 Mode, 80 Column Mode and External RAM Expansion Cartridges of the C128 and C128D Systems.

SECTION 3: This section contains some user friendly Disk Drive Utility Programs which should help you with day to day operations.

SECTION 4: This section contains some of the most used Basic Commands of the C128 and C128D Systems.

The following listing is the directory of the Version 1.5 Diagnostic Diskette and a brief explanation of each Diagnostic Test. More detailed information is contained inside the manual.

Disk Name -- DIAGNOSTIC V 1.5

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PGM  1 -- "1581 MENU.V1.5"    ** 1581   - Diagnostic Test Option Menu
PGM  2 -- "SYSTEM TEST"       ** 1581   - System Test
PGM  3 -- "SOFT ERROR TEST"   ** 1581   - Final MFM Soft Error Test
PGM  4 -- "LOGIC DIAGNOSTIC"  ** 1581   - Logic Diagnostic Test
PGM  5 -- "ALIGNMENT/REPAIR"  ** 1581   - Alignment/Repair Test
PGM  6 -- "C128 80  COLUMN"   ** C128   - 80 Column Mode Test
PGM  7 -- "C128 C64 MODE"     ** C128   - C64 Mode Test
PGM  8 -- "C128 RAM XPANDER"  ** C128   - 1700/1750 RAM Expander Test
PGM  9 -- "128D 80  COLUMN"   ** C128D  - 80 Column Mode Test
PGM 10 -- "128D C64 MODE"     ** C128D  - C64 Mode Test
PGM 11 -- "128D RAM XPANDER"  ** C128D  - 1700/1750 RAM Expander Test
PGM 12 -- "DISK BACKUP"       ** 1581   - Disk Backup Utility
PGM 13 -- "FILE COPY"         ** 1581   - File Copy Utility
PGM 14 -- "DISK FORMATTER"    ** 1581   - Disk Format Utility
PGM 15 -- "FILE SCRATCHER"    ** 1581   - File Scratch Utility
PGM 16 -- "FILE RESTORER"     ** 1581   - Scratched File Restore Utility
PGM 17 -- "1581 SYSTEM.BIN1"  ** 1581   - System Test           - Binary Data
PGM 18 -- "1581 SYSTEM.BIN2"  ** 1581   - System Test           - Binary Data
PGM 19 -- "1581 SYSTEM.BIN3"  ** 1581   - System Test           - Binary Data
PGM 20 -- "1581 SOFT.BIN1"    ** 1581   - Soft Error Test       - Binary Data
PGM 21 -- "1581 SOFT.BIN2"    ** 1581   - Soft Error Test       - Binary Data
PGM 22 -- "1581 SOFT.BIN3"    ** 1581   - Soft Error Test       - Binary Data
PGM 23 -- "1581 LOGIC.BIN1"   ** 1581   - Logic Diagnostic Test - Binary Data
PGM 24 -- "1581 LOGIC.BIN2"   ** 1581   - Logic Diagnostic Test - Binary Data
PGM 25 -- "1581 ALIGN.BIN1"   ** 1581   - Alignment/Repair Test - Binary Data
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VERSION 1.5 DIAGNOSTIC TESTS

1581 DIAGNOSTIC MENU
VERSION 1.5

DESIGNED TO LOAD : 1581 DIAGNOSTIC PROGRAMS

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
40 COLUMN MONITOR OR TV SET
VERSION 1.5 DIAGNOSTIC DISKETTE

The **Diagnostic Menu** is used to Load Diagnostic Tests and Utilities from the Selected Load Drive. Because the Diagnostic Tests use **Binary Files** for correct operation ....

ALL TESTS MUST BE LOADED FROM THIS MENU
DISK DRIVE TESTS WILL FAIL IF DOUBLE SIDED/DOUBLE DENSITY TEST DISKETTES ARE NOT USED

1581 DIAGNOSTIC MENU VERSION 1.5

* Press (+) - Set Load Device Number
* Press (-) - Set Test Device Number
* Press (@) - Set Test Computer Type
* Press (1) - 1581 System Test
* Press (2) - 1581 Soft Error Test
* Press (3) - 1581 Logic Diagnostic
* Press (4) - 1581 Alignment/Repair
* Press (5) - C128/C128D 80 Column Test
* Press (6) - C128/C128D C64 Mode Test
* Press (7) - C128/C128D RAM Expander Test
* Press (0) - Display Utilities Menu

LOAD FROM DEVICE NUMBER >> [8] or [9]
RUN TESTS DEVICE NUMBER >> [8] or [9]
SYSTEM TYPE TO BE TESTED >> 1581

1581 UTILITIES MENU VERSION 1.5

* Press (+) - Set Load Device Number
* Press (-) - Set Test Device Number
* Press (1) - 1581 Disk Backup
  2-DRIVES REQUIRED
* Press (2) - 1581 File Copy
  2-DRIVES REQUIRED
* Press (3) - 1581 Disk Formatter
* Press (4) - 1581 File Scratcher
* Press (5) - 1581 File Restorer
* Press (0) - Display Diagnostic Menu

LOAD FROM DEVICE NUMBER >> [8] or [9]
RUN TESTS DEVICE NUMBER >> [8] or [9]
SYSTEM TYPE TO BE TESTED >> 1581

1581 SYSTEM TEST
VERSION 1.5.1

DESIGNED TO TEST : 1581 SINGLE DISK DRIVE

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
40 COLUMN MONITOR OR TV SET
FORMATTED (WRITE-PROTECTED) DISKETTE
BLANK TEST DISKETTE
VERSION 1.5 DIAGNOSTIC DISKETTE

SYSTEM TEST OPTION MENU

* Press (0) - Select Device Number >> [8] or [9]
* Press (1) - Zero Stop Sensor Test
* Press (2) - Write Protect Sensor Test
* Press (3) - Read/Write Head Bump Test
* Press (4) - Read/Write Test
* Press (A) - All Above Tests
* Press SPACE - Load Diagnostic Menu

SYSTEM TEST OPTION ONE -- SELECT DEVICE NUMBER

* This option allows the System Test to be run on a system set to either Device Number [8] or [9].
  * Selected Device Number is Displayed

SYSTEM TEST OPTION TWO -- ZERO STOP SENSOR TEST

* Insert a Formatted Write-Protected Diskette
  * Write-Protect Tab Must be OPEN
* Press SPACE - Start Testing
  Begins Zero Stop Sensor Test
* Press RETURN - Return to Menu
  Displays System Test Main Menu

The **Zero Stop Sensor Test** checks for proper adjustment of the Zero Stop Sensor by Looping, (5 Times), through the Sensor to Zero Track and Reading a Pre-Written Mark on the Diskette.

FOR MOST ACCURATE TESTING THE FORMATTED DISKETTE BEING USED SHOULD BE FORMATTED ON A KNOWN GOOD DRIVE OTHER THAN THE ONE UNDER TEST

FAILURE - DEFECTIVE, UN-FORMATTED OR UN-WRITE-PROTECTED DISKETTE
MIS-ADJUSTED ZERO STOP SENSOR OR DRIVE ALIGNMENT
DEFECTIVE ZERO STOP SENSOR OR CONTROL LOGIC

* Pass/Fail Status is Displayed

* Press RETURN - Return To Menu
  Displays System Test Main Menu

SYSTEM TEST OPTION THREE - WRITE PROTECT SENSOR TEST

* Insert a **Formatted Write-Protected Diskette**
  * **Write-Protect Tab Must be OPEN**
* Press **SPACE** - Start Testing
  Begins Write-Protect Sensor Test
* Press **RETURN** - Return to Menu
  Displays System Test Main Menu

The **Write Protect Sensor Test** checks for proper operation on the Write Protect Sensor by attempting a Format Operation on the Write-Protected Diskette and Reading the Error Channel.

FOR MOST ACCURATE TESTING THE FORMATTED DISKETTE BEING USED SHOULD BE FORMATTED ON A KNOWN GOOD DRIVE OTHER THAN THE ONE UNDER TEST

FAILURE - DEFECTIVE, UN-FORMATTED OR UN-WRITE-PROTECTED DISKETTE
MIS-ADJUSTED ZERO STOP OR DRIVE ALIGNMENT
DEFECTIVE WRITE-PROTECT SENSOR OR CONTROL LOGIC

* **Pass/Fail Status is Displayed**

* Press **RETURN** - Return To Menu
  Displays System Test Main Menu

SYSTEM TEST OPTION FOUR - ZERO STOP BUMP TEST

* Insert a **Formatted Write-Protected Diskette**
  * **Write-Protect Tab Must be OPEN**
* Press **SPACE** - Start Testing
  Begins Zero Stop Bump Test
* Press **RETURN** - Return to Menu
  Displays System Test Main Menu

The **Zero Stop Bump Test** checks for proper adjustment of the Zero Track Sensor, in **Slow Mode**, by looping the Read/Write Head, (5 Times), through the Zero Stop Sensor and Reading a Pre-Written Mark on the Diskette.

FOR MOST ACCURATE TESTING THE FORMATTED DISKETTE BEING USED SHOULD BE FORMATTED ON A KNOWN GOOD DRIVE OTHER THAN THE ONE UNDER TEST

FAILURE - DEFECTIVE, UN-FORMATTED OR UN-WRITE-PROTECTED DISKETTE
MIS-ADJUSTED ZERO STOP OR DRIVE ALIGNMENT
DEFECTIVE STEPPER MOTOR OR CONTROL LOGIC

* **Pass/Fail Status is Displayed**

* Press **RETURN** - Return To Menu
  Displays System Test Main Menu

SYSTEM TEST OPTION FIVE - READ/WRITE TESTS

* Insert a Blank Test Diskette
  * **Write-Protect Tab Must be CLOSED**
* Press (F) - Test Disk is **Formatted**
* Press (U) - Test Disk is **UnFormatted**

If the (U)nformatted Option is selected .... **(Recommended)**

* The **Format Operation** of the drive is checked by executing a **GCR Format** to all Tracks, (Upper and Lower), with an ID written to all sectors.

* The **GCR Read/Write Operations** are tested by ....

  * Opening a Write File - Writing Data to the File - Closing the File
  * Opening a Read File - Reading and Verifying Data - Closing the File
  * Scratching the File

FAILURE - DEFECTIVE TEST DISKETTE
MIS-ADJUSTED ZERO STOP OR DRIVE ALIGNMENT
DEFECTIVE DRIVE ASSEMBLY
DEFECTIVE READ/WRITE CONTROL LOGIC

* The **GCR Slow Mode** is checked by ....

  * Writing Data to **Tracks 5, 15, 75, 79**
  * Reading and Verifying Data from **Tracks 79, 75, 15, 5**

* The **GCR Fast Mode** is checked by ....

  * Writing Data to **Tracks 5, 10, 76, 79**
  * Reading and Verifying Data from **Tracks 79, 76, 10, 5**

FAILURE - TEST DISKETTE DEFECTIVE OR NOT DOUBLE-SIDED/DOUBLE DENSITY
MIS-ADJUSTED ZERO STOP SENSOR OR ALIGNMENT
DEFECTIVE DRIVE ASSEMBLY
DEFECTIVE READ/WRITE CONTROL LOGIC

* The **MFM Burst Format Operation** is checked by Formatting ....

TRACK	BYTES/SECTOR
01	256
02	512
40	1024
41	256
76	512
79	1024

* The **MFM Burst Read/Write Operations** are checked by ....

  * Writing, Reading and Comparing Data on ....

SIDE	TRACK	BYTES/SECTOR	SIDE	TRACK	BYTES/SECTOR
0	01	256	1	81	256
0	02	512	1	82	512
0	40	1024	1	120	1024
0	41	256	1	121	256
0	76	512	1	156	512
0	79	1024	1	159	1024

FAILURE - TEST DISKETTE DEFECTIVE OR NOT DOUBLE-SIDED/DOUBLE DENSITY
DEFECTIVE DRIVE ASSEMBLY
DEFECTIVE READ/WRITE CONTROL LOGIC

COMPATIBILITY TEST

COMPATIBILITY TEST OPTION MENU

* Press **(8)** - Second Drive Set to Device Number **[8]**
* Press **(9)** - Second Drive Set to Device Number **[9]**
* Press **(S)** - Skip Compatibility Test

COMPATIBILITY TEST OPTION ONE - SECOND DRIVE - DEVICE [8]
COMPATIBILITY TEST OPTION TWO - SECOND DRIVE - DEVICE [9]

These options allow the Data Written during the Read/Write Test to be verified on a second drive which may be set to either Device Number **[8]** or Device Number **[9]**.
* **This helps determine if Data Written on the drive under test can be read by other drives.**

* The **GCR 1581 Slow Mode Compatibility** is checked by ....

  * Reading and Verifying GCR Data, written during the Read/Write Test, from **Tracks 5, 15, 75, 79**

* The **GCR 1581 Fast Mode Compatibility** is checked by ....

  * Reading and Verifying GCR Data, written during the Read/Write Test, from **Tracks 5, 10, 76, 79**

* The **Burst MFM Mode Compatibility** is checked by ....

  * Reading and Verifying MFM Data, written during the Read/Write Test, from ....

SIDE	TRACK	BYTES/SECTOR	SIDE	TRACK	BYTES/SECTOR
0	01	256	1	81	256
0	02	512	1	82	512
0	40	1024	1	120	1024
0	41	256	1	121	256
0	76	512	1	156	512
0	79	1024	1	159	1024

FAILURE - MIS-ADJUSTED ZERO STOP OR ALIGNMENT ON ONE OF THE DRIVES
DEFECTIVE DRIVE ASSEMBLY ON ONE OF THE DRIVES

COMPATIBILITY TEST OPTION THREE - SKIP COMPATIBILITY TEST

This option allows the Compatibility Section of the Read/Write Test to be skipped if a second drive is not available.

SYSTEM TEST RESULTS

* System Test - Pass/Fail Status
* Compatibility - Pass/Fail/Skipped Status
* Press **RETURN** - Return to Menu
  Displays System Test Main Menu

SYSTEM TEST OPTION SIX - ALL ABOVE TESTS

This option executes options (2-5) with a countdown between tests.

SYSTEM TEST OPTION SEVEN - LOAD DIAGNOSTIC MENU

* Insert the Version 1.5 Diagnostic Diskette
* Press **(8)** - Load the Diagnostic Menu from Device Number **[8]**
* Press **(9)** - Load the Diagnostic Menu from Device Number **[9]**
* Press **RETURN** - Return to Menu
  Displays System Test Main Menu

1581 SOFT ERROR TEST
VERSION 1.5.1

DESIGNED TO TEST : 1581 SINGLE DISK DRIVE

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
COMMODORE OR COMPATIBLE PRINTER (OPTIONAL)
40 COLUMN MONITOR OR TV SET
BLANK TEST DISKETTE
VERSION 1.5 DIAGNOSTIC DISKETTE

The **Soft Error Test** does an Extended Read/Write Performance Test on the Disk Drive under test.

THE SOFT ERROR TEST SHOULD BE RUN ON ALL UNITS IN FOR REPAIR

INSERT BLANK TEST DISKETTE
BEFORE SELECTING ANY OPTIONS

SOFT ERROR TEST OPTION MENU

* Press **RETURN** - Start Test >> 50 Pass
* Press **(C)** - Select Device Number >> **[8] or [9]**
* Press **(X)** - Preliminary Test >> 2 Pass
* Press **(M)** - Modified Test
* Press **(0)** - Read Test Results
* Press **SPACE** - Load Diagnostic Menu

NOTE : IF A PRINTER IS CONNECTED
TEST RESULTS WILL BE PRINTED
RATHER THAN DISPLAYED

SOFT ERROR TEST OPTION ONE - START TEST (50 PASS)

This option is used for **Final Soft Error Testing.** At the end of 50 Passes, the test will terminate and the drive will be reset. All Test Results will be stored on the Test Diskette and read at test end using **Soft Error Test** Option Five (Read Test Results).

* **To save Test Time, this option should be run only after the unit has passed the 2 Pass Preliminary Test (Soft Error Test Option Three)**

WHEN DOWNLOADING IS COMPLETE AND THE SOFT ERROR TEST OPTION MENU IS DISPLAYED, THE TEST WILL RUN INTERNAL TO THE DRIVE AND THE C128/C128D NEED NO LONGER BE CONNECTED UNTIL THE TEST IS COMPLETE AND THE TEST RESULTS ARE READ

SOFT ERROR TEST OPTION TWO - SELECT DEVICE NUMBER

This option allows the **Soft Error Test** to be run on a drive which is set to either Device Number **[8] or [9]**

SOFT ERROR TEST OPTION THREE - PRELIMINARY TEST

PRELIMINARY SOFT ERROR TEST OPTION MENU

* Press **RETURN** - Start Test >> 2 Pass
* Press **(A)** - Alter Passes >> 2 Pass
* Press **(0)** - Read Test Results
* Press **(X)** - Return to Menu
  Displays Soft Error Test Main Menu

PRELIMINARY SOFT ERROR TEST OPTION ONE - START TEST 2 PASS

This option is used for **Preliminary Soft Error Testing.** At the end of the designated number of passes, displayed next to Alter Pass Option, the test will terminate and the drive will reset. Test Results are stored on the Test Diskette and read at test end using Option Three. (Read Test Results)

* **If the drive passes this Preliminary Test, the 50 Pass Soft Error Test (Soft Error Test Option One) should be run.**

WHEN DOWNLOADING IS COMPLETE AND THE SOFT ERROR TEST OPTION MENU IS DISPLAYED, THE TEST WILL RUN INTERNAL TO THE DRIVE AND THE C128/C128D NEED NO LONGER BE CONNECTED UNTIL THE TEST IS COMPLETE AND THE TEST RESULTS ARE READ.

PRELIMINARY SOFT ERROR TEST OPTION TWO - ALTER PASSES

This option is used to set the Number of Passes the **Soft Error Test** is to execute.
* **Current Number of Passes is displayed next to option**

PRELIMINARY SOFT ERROR TEST OPTION THREE - READ TEST RESULTS

This option is used to read and display **Soft Error Test Results** once the designated number of passes are complete.
* **Complete Error Reporting as well as Pass/Fail Status is displayed.**

* **Refer to Soft Error Test Result Summary -- Pages 1-9 thru 1-11**

SOFT ERROR TEST OPTION FOUR - MODIFIED TESTS

* Press **(C)** - Create Custom Error Test
* Press **(B)** - **Blink** LED at Test End
* Press **RETURN** - Return to Menu
  Displays Soft Error Test Main Menu

MODIFIED SOFT ERROR TEST OPTION MENU - CREATE CUSTOM ERROR TESTS

This option allows Special Parameters to be selected to create a Custom **Soft Error Test.** The Parameter Options are as follows ....

1. **NEW TEST OR CONTINUATION**
   When **(N)**ew is selected, the Error Log is cleared at the start of the test. When **(C)**ontinuous is selected, the existing Error Log is used as the starting condition and the test will continue from this point.
   * **If the Test Diskette has not previously been used in the Soft Error Test, the (N)ew Option must be selected.**

2. **SPECIFY PASS TYPE**
   The test may be set to **(R)**ead Only, **(W)**rite Only or Read With a Rewrite of Data per the selected Read to Write Pass Ratio.
   * This Ratio Represents The Number Of Read Passes Per Each Write Pass. **Maximum Read To Write Ration = 127**

3. **ENTER NUMBER OF PASSES DESIRED**
   This represents the Number of Passes the **Soft Error Test** will run.
   * If the Test is to Conclude Itself, a Maximum of 500 Passes may be entered. **If (0) is Entered, the Test Will Run Forever.**

4. **WANT FORMATTING (Y/N)**
   If **(Y)**es is selected, the diskette will be formatted by the test.
   If **(N)**o is selected, the test will start without formatting.
   * **If the (N)ew Option was Previously Selected, (Y)es Must be Selected here.**

5. **TRACK SEQUENCE TO BE**
   This Option allows selection of the Track Testing Sequence.
   * If **(A)**lternating is Selected, the Track Testing Sequence will Alternate between Sequential and Random after each pass.
   * If **(S)**equential is Selected, the Tracks are Tested in Sequential Order. **(Tracks 1 thru 160)**
   * If **(R)**andom is Selected, the Tracks are Tested in a Random Fashion, Allowing Complete Exercise of the Stepper Motor.

6. **RESET OR BLINK AT TEST END**
   This option allows the Drive LED Status to be set at Test End and starts execution of the **Soft Error Test** utilizing selected options
   * If **(R)**eset is Selected, the Drive Will be Reset at Test End
     * After Reset, all Disk Activity, including the Flashing Activity LED will cease.
   * If **(B)**link is Selected, the Drive LED will Blink in a Series of (1) Flash Codes at Test End
     * **If (B)link is Selected, the Drive Must be Manually Reset before Test Results can be Read.**
       * Turn Drive Power **OFF** and **ON**

MODIFIED SOFT ERROR TEST OPTION TWO - BLINK/RESET LED AT TEST END

This option allows setting of the Drive LED Status at Test End
* Press (B) - Blink LED at Test End
* Press (R) - Reset LED at Test End

SOFT ERROR TEST OPTION FIVE - READ TEST RESULTS

This option reads and displays the results of the **Soft Error Test.** These results are stored on the Test Diskette and updated at the end of each Completed Pass. Complete Error Reporting along with Pass/Fail Status are displayed as follows ....

IF A PRINTER IS CONNECTED, THE TEST RESULTS WILL BE PRINTED TO HARD COPY -- THIS PRINTOUT SHOULD BE RETURNED TO THE CUSTOMER WITH THE UNIT TO SHOW THE RESULTS OF FINAL TESTING

SOFT ERROR TEST RESULT SUMMARY

1. **NUMBER OF PASSES**
   The Total Number of Passes run.
   * All Tracks on the Diskette are Tested Each Pass
     * **Minimum Number of Passes = One Complete Pass**

2. **COUNTABLE ERRORS**
   The Total Number of encountered errors that required more than one (1) retry to recover.
   * **Countable Errors = Total Errors minus Recovered Errors**
   * **Maximum Countable Errors = Total Passes divided by a Set Value**

3. **TOTAL ERRORS**
   The Total Number of Errors encountered during the test.
   * This Count is Incriminated Only Once for each error regardless of the Number Of Retries Necessary to Recover the Error.
     * If this Count Reaches (1024), the Test Will Terminate
     * **Maximum Errors = Total Passes divided by a Set Value**

4. **PASS/ERROR RATIO**
   The Number of Passes versus the Number of Encountered Errors
   * **Pass/Error Ratio = Number of Passes divided by Countable Errors**
   * **Minimum Pass/Error Ratio = Number of Passes divided by a Set Value**

5. **FIRST PASS RETRIES**
   The Total Number of retries that were successful
   * This Value is a Measure of Diskette Quality as it will show how many Persistent Errors were Encountered
     * If this Value Reaches Five (5), a Defective Diskette is indicated and the test will terminate
   * First Pass Retries are Determined for the First Pass Only
     First Pass Retries = Number of Retries minus First Retries

6. **TRACK, ERRORS, FIRST PASS RETRIES**
   This listing breaks down all Encountered Errors on a Per Track Basis.
   * A Defective Diskette is indicated by Errors Concentrated on the Same Track or Adjacent Tracks
   * **Displayed Only if at Least One Error was encountered**

7. **ERROR TYPE, OPERATION, ERRORS**
   This listing breaks down Total Errors according to Type of Error, Operation Being Performed when the error occurred and Number of Encountered Errors per type as follows ....

   * **HEADER BLOCK NOT FOUND**
     * The Header Block Identifier could not be found

   * **NO SYNC CHARACTER**
     * A Sync Mark, (10 or More Consecutive 1 Bits), on a given track could not be found within a predetermined amount of time and a Time Out has occurred

   * **DATA BLOCK NOT FOUND**
     * A Decoded 8 Bit Byte read from the diskette did not compare to a Present Block Identifier

   * **DATA BLOCK CHECKSUM ERROR**
     * The Calculated Checksum of a 256 Byte Data Block did not match the Actual Checksum Read from the diskette

   * **VERIFY ERROR AFTER WRITE**
     * The Data just Written to a sector of the diskette when Read Back, does not verify with Data Stored in Disk Memory

   * **WRITE PROTECT ERROR**
     * A Write Operation to the diskette cannot be performed due to ....
     * **Write-Protect Tab Open on the Diskette**
     * **Defective Write-Protect Sensor**

   * **HEADER CHECKSUM ERROR**
     * The Header Checksum, Stored in Disk Memory, when EORed with an Independent Checksum does not compare

   * **ID MISMATCH ERROR**
     * The Disk IDs, Read from the Header Block, did not compare with the Disk IDs Stored in Disk Memory.

* **Data Block Checksum Errors are normally caused by Random Electrical Noise and will usually Recover in One (1) Retry**

OPERATION

* **READ** - Data is Read and Verified against Expected Data
* **WRITE** - Data is Written, Stored in Disk Memory, Read Back and Compared to Disk Memory Data
* **SEEK** - The Read/Write Head is moved to a Predetermined Track

8. **ERROR TIME**
   The Total Number of Errors per each 10 Passes
   * **An Increasing Error Rate indicates a Bad Diskette or a Gradually Failing System**

9. **RECOVERY COUNT**
   The Total Number of Retries Required to Recover Encountered Errors
   * A Persistent Error, one Requiring More Than One (1) Retry, or More Than Twenty (20) Errors Recovered in the First Retry is normally a sign of a Defective Drive Mechanism Or Marginal Components
     * **Maximum Retries = Ten (10) before an error is considered a Hard Error in which case the unit will fail the Soft Error Test**

10. **PASS/FAIL**
    The Bottom Line whether or not the unit has Passed the **Soft Error Test** for the Allotted Number of Passes and the Final Status of Test Results

SOFT ERROR TEST OPTION SIX - LOAD DIAGNOSTIC MENU

* Insert the Version 1.5 Diagnostic Diskette
* Press **(8)** - Load the Diagnostic Menu from Device Number **[8]**
* Press **(9)** - Load the Diagnostic Menu from Device Number **[9]**
* Press **RETURN** - Return to Menu
  Displays Soft Error Test Main Menu

1581 LOGIC DIAGNOSTIC
VERSION 1.5.1

DESIGNED TO TEST : 1581 SINGLE DISK DRIVE

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
40 COLUMN MONITOR OR TV SET
VERSION 1.5 DIAGNOSTIC DISKETTE

The **Logic Diagnostic** is designed to test the Main Control Chips of the System Under Test utilizing a Flash Code on the Activity LED.

LOGIC DIAGNOSTIC OPTION MENU

* Press **(0)** - Select Device Number >> **[8] or [9]**
* Press **RETURN** - Start Diagnostic Test
* Press **SPACE** - Load Diagnostic Menu

LOGIC DIAGNOSTIC OPTION ONE - SET DEVICE NUMBER UNDER TEST

This option allows the **Logic Diagnostic** to be run on a System set to either Device Number **[8] or [9]**

LOGIC DIAGNOSTIC OPTION TWO - START DIAGNOSTIC TEST

ROM FAILURES WILL OCCUR IF OUT-DATED ROMS ARE INSTALLED

VALID ROMS -- 1581 - PART NUMBER 312558-02

This option Downloads the Diagnostic Code to the Test System.
* **If the Download is successful the Activity LED should be flashing at a consistent rate.**

* Press **(Y)**es or **(N)**o
  * **If the Activity LED is not flashing at a constant rate after the Download is complete, a Download Failure has occurred and (N)o should be selected.**

* If a Download Failure occurs the drive must be Reset before the Download may again be attempted. Reset the drive by ....
  * **1581** - Turn the Power **OFF** then **ON**

* Press **RETURN** - Retry Download

* A Total of Three (3) Attempts may be made before the System is Determined to Have a Hard Failure

* Press **RETURN** - Return to Menu
  Displays Logic Diagnostic Main Menu

* If (Y)es is selected, the Activity LED Flash Sequence is interpreted using the Error Flash Code Chart

ERROR FLASH CODE CHART		
FLASH CODES	1581 IC FAILURE	1581 IC LOCATION
1 FLASH	SYSTEM OK	NO FAILURE
2 FLASHES	DOS ROM	U2
3 FLASHES	DOS RAM	U3
4 FLASHES	8520 CIA	U5
5 FLASHES	WD1770/1772 FDC	U4
6 FLASHES	ILLEGAL	

ONCE A SUCCESSFUL DOWNLOAD IS COMPLETE THE LOGIC DIAGNOSTIC WILL OPERATE COMPLETELY INTERNAL TO THE DRIVE AND THE C128/C128D NEED NO LONGER BE CONNECTED

* Once the Logic Diagnostic Code has been Downloaded, the Drive Must be Reset before any Disk Access can be accomplished
  * Turn Drive Power OFF and ON

* Press RETURN - Return To Menu
  Displays Logic Diagnostic Main Menu

LOGIC DIAGNOSTIC OPTION THREE - LOAD DIAGNOSTIC MENU

* Insert Version 1.5 Diagnostic Diskette
* Press (8) - Load Diagnostic Menu from Device Number [8]
* Press (9) - Load Diagnostic Menu from Device Number [9]
* Press RETURN -Return To Menu
  Displays Logic Diagnostic Main Menu

1581 ALIGNMENT/REPAIR TEST
VERSION 1.5.1

DESIGNED TO TEST : 1581 SINGLE DISK DRIVE

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
DUAL TRACE SCOPE
VOLT METER (OPTIONAL)
40 COLUMN MONITOR OR TV SET
135 TPI ALIGNMENT DISKETTE (P/N 314854-03)
VERSION 1.5 DIAGNOSTIC DISKETTE

ALIGNMENT REPAIR TEST OPTION MENU

* Press **(0)** - Select Device Number >> **[8] or [9]**
* Press **(1)** - Drive Alignment
* Press **(2)** - Zero Track Test/Adjust
* Press **(3)** - Stepper Motor Slew
* Press **(4)** - Drive Motor Logic
* Press **(5)** - Side Select Logic
* Press **(6)** - Load Diagnostic Menu

ALIGNMENT REPAIR TEST OPTION ONE - SELECT DEVICE NUMBER

This option allows the **Alignment/Repair Test** to be run on a System set to either Device Number **[8] or [9]**

ALIGNMENT REPAIR TEST OPTION TWO - DRIVE ALIGNMENT

* Press **(S)** - Display Scope Settings
* Press **(D)** - Dis-Assembly and Setup
* Press **(A)** - Begin Drive Alignment

* Press **RETURN** - Return to Menu
  Displays Alignment/Repair Test Main Menu

1581 RADIAL ALIGNMENT SCOPE SETTINGS
1. Set Both Channels To AC Scale 2. Set Both Channels To 50 MV/DIV 3. Invert Channel 2 4. Differentially Add Both Channels 5. Set Sweep To 20 MS/DIV 6. Set Trigger To Auto Mode 7. Remove any Diskette Installed in the Drive 8. Make Sure Drive Power Is OFF * Press SPACE - Dis-Assembly & Setup * Press RETURN - Return To Menu Displays Alignment/Repair Test Main Menu

1581 DIS-ASEMBLY AND SET-UP PROCEDURES	
1. DisConnect Power Cable and Serial Cable 2. Remove the Three (3) Screws from the Bottom Case and Remove the Top Case from the unit 3. Remove the Drive FacePlate and Set it Beside the Unit 4. Remove the Four (4) Drive Mounting Screws 5. Remove the Two (2) Shield Screws and Remove the Drive Shield 6. Remove the Drive Assembly and Set it on its Side 7. * Connect Scope Probes As Follows	
Probe 1 -- Pin 1 -- Test Point TP1	Probe 2 -- Pin 3 -- Test Point TP1
8. Connect Power Cable and Serial Cable 9. Turn Drive Power ON 10. Insert 135 TPI Alignment Diskette Commodore Part Number - 314854-03 * Press SPACE - Begin Radial Alignment * Press RETURN - Return to Menu Displays Alignment/Repair Main Menu	

RADIAL ALIGNMENT

```
+-------------------------------------------------------------------------+
|     135 TPI ALIGNMENT DISK -- PART NUMBER 314854-03 MUST BE INSTALLED    |
+-------------------------------------------------------------------------+
```

The Read/Write Head should step to Track 40

FAILURE - DEFECTIVE DRIVE MECHANISM (STEPPER MOTOR)
DEFECTIVE STEPPER MOTOR CONTROL LOGIC

RADIAL ALIGNMENT TEST OPTION MENU

* Press (+) - Step R/W Head - **IN**
* Press (-) - Step R/W Head - **OUT**
* Press (I) - Hysterisis Check - **IN**
* Press (O) - Hysterisis Check - **OUT**
* Press (B) - Restore R/W Head - **BUMP**
* Press (S) - Change Sides
* Press **RETURN** - Return To Menu
  Displays Alignment/Repair Test Main Menu

RADIAL ALIGNMENT TEST OPTION ONE - STEP R/W HEAD - IN

This Option will Step the Read/Write Head IN (Toward The Center)
of the Diskette One Track at a time

RADIAL ALIGNMENT TEST OPTION TWO - STEP R/W HEAD - OUT

This Option will Step the Read/Write Head OUT (Toward The Outside)
of the Diskette One Track at a time

RADIAL ALIGNMENT TEST OPTION THREE - HYSTERISIS CHECK - IN

This Option Steps the Read/Write Head to Track 42 and Back to Track 40
* **When the Head Returns to Track 40 the CAT EYES should be Visible and With-In the Allowed Limits**

RADIAL ALIGNMENT TEST OPTION FOUR - HYSTERISIS CHECK - OUT

This Option Steps the Read/Write Head to Track 38 and Back to Track 40
* **When the Head Returns to Track 40 the CAT EYES should be Visible and With-In the Allowed Limits**

RADIAL ALIGNMENT TEST OPTION FIVE - RESTORE R/W HEAD - BUMP

This Option Steps the Read/Write Head to Track 1 and Back to Track 40
* **When the Head Returns to Track 40 the CAT EYES should be Visible and With-In the Allowed Limits**

RADIAL ALIGNMENT TEST OPTION SIX - CHANGE SIDES

This Option is used to Switch Sides to allow both Read/Write Heads
(**0 = Lower --- 1 = Upper**), to be Aligned

```
+-------------------------------------------------------------------+
|              1581 RADIAL ALIGNMENT CHECK -- LOWER HEAD            |
+-------------------------------------------------------------------+
|    CAT EYES SHOULD BE VISIBLE AND WITHIN 10% AMPLITUDE OF EACH OTHER
|     * The Peak-To-Peak Level MUST be at least 200 MV
|
|  1. CAT EYES ARE NOT VISIBLE
|     * Press (+) - Step the Read/Write Head IN
|     * Press (-) - Step the Read/Write Head OUT
|
|  2. CAT EYES ARE NOT VISIBLE WITHIN TWO (2) STEPS either way
|     * Refer to Upper Head Alignment
|
|  3. CAT EYES ARE VISIBLE BUT NOT WITHIN 10% AMPLITUDE OF EACH OTHER
|     * Refer to Radial Alignment Procedures - Page 1-19
|
|  4. CAT EYES ARE VISIBLE AND WITHIN 10% AMPLITUDE OF EACH OTHER
|     * Press (S) - Change To Side 1 (Upper)
|     * Refer to Upper Head Alignment
+-------------------------------------------------------------------+
```

```
+-------------------------------------------------------------------+
|              1581 RADIAL ALIGNMENT CHECK -- UPPER HEAD            |
+-------------------------------------------------------------------+
|    CAT EYES SHOULD BE VISIBLE AND WITHIN 10% AMPLITUDE OF EACH OTHER
|     * The Peak-To-Peak Level MUST be at least 200 MV
|
|  1. CAT EYES ARE NOT VISIBLE
|     * Press (+) - Step the Read/Write Head IN
|     * Press (-) - Step the Read/Write Head OUT
|
|  2. CAT EYES ARE NOT VISIBLE WITHIN TWO (2) STEPS EITHER WAY
|     BUT WERE VISIBLE ON THE LOWER HEAD ALIGNMENT CHECK
|
|FAILURE - DEFECTIVE DRIVE ASSEMBLY (READ/WRITE HEAD)
|          DEFECTIVE CONTROL OR READ/WRITE LOGIC
|
|  3. CAT EYES ARE NOT VISIBLE WITHIN TWO (2) STEPS EITHER WAY
|     AND WERE NOT VISIBLE ON THE LOWER HEAD ALIGNMENT CHECK
|
|FAILURE - DEFECTIVE ALIGNMENT DISKETTE
|          DEFECTIVE CONTROL OR READ/WRITE LOGIC
|          DEFECTIVE DRIVE MECHANISM (READ/WRITE HEAD)
|
|  4. CAT EYES ARE VISIBLE BUT NOT WITHIN 10% AMPLITUDE OF EACH OTHER
|     * Refer To Radial Alignment Procedures - Page 1-19
|
|  5. CAT EYES ARE VISIBLE AND WITHIN 10% AMPLITUDE OF EACH OTHER
|     * DRIVE ALIGNMENT IS OK !!!  OK !!!  OK !!!  OK !!!  OK !!!
+-------------------------------------------------------------------+
```

1581 RADIAL ALIGNMENT PROCEDURES

CAT EYES SHOULD BE VISIBLE AND WITHIN 10% AMPLITUDE OF EACH OTHER
* The Peak-To-Peak Level MUST be at least 200 MV

1. If the CAT EYES Are Within the 10% Tolerance Refer to Step 4

2. If the CAT EYES Are Not Within 10% Amplitude of each other
   * Loosen the two (2) Stepper Motor Mounting Screws and:
     Turn the Stepper Motor while observing the CAT EYES SIGNAL

3. When the CAT EYES Are Within the 10% tolerance limit ....
   * Hold the Stepper Motor in place and tighten the
     Stepper Motor Mounting Screws
   * If the CAT EYES do not stay the same, the Stepper Motor has moved
     when the Mounting Screws were tightened and must be Re-Adjusted

4. Press (S) - Switch To Side 1 (Upper Head)

5. If the CAT EYES Are Not Within 10% Amplitude of each other
   * Loosen the two (2) Stepper Motor Mounting Screws and:
     Turn the Stepper Motor while observing the CAT EYES Signal

6. When the CAT EYES are the within the 10% tolerance limit ....
   * Hold the Stepper Motor in place and tighten the
     Stepper Motor Mounting Screws
   * If the CAT EYES do not stay the same, the Stepper Motor has moved
     when the Mounting Screws were tightened and must be Re-Adjusted

7. Press (S) - Switch to Side 0 (Lower Head)
   * If the Lower Head Alignment is Off, it may be necessary to adjust
     the Stepper Motor to get the best possible results of both the
     Upper and Lower CAT EYES Signals

8. When Alignment of both heads is complete ....
   ALIGNMENT IS OK !!! ALIGNMENT IS OK !!!

   * Press RETURN - Return to Menu
     Displays Alignment/Repair Main Menu

ALIGNMENT/REPAIR TEST OPTION THREE - ZERO TRACK TEST/ADJUST

ZERO TRACK TEST OPTION MENU

* Press (C) - Check Zero Track Sensor
* Press (D) - Dis-Assembly and Setup
* Press (A) - Adjust Zero Track Sensor
* Press RETURN - Return to Menu
  Displays Alignment/Repair Test Main Menu

ZERO TRACK TEST OPTION ONE - CHECK ZERO TRACK SENSOR

* Insert a Formatted 1581 Diskette
* Press SPACE - Check Zero Stop
* Press RETURN - Return To Menu
  Displays Alignment/Repair Test Main Menu

The Zero Stop Sensor Test checks for proper adjustment of the Zero Stop Sensor by looping, (5 Times), through the sensor to Zero Track and Reading a Pre-Written Mark on the Diskette.

FOR MOST ACCURATE TESTING, THE FORMATTED DISKETTE BEING USED SHOULD BE FOEMATTED ON A KNOWN GOOD DRIVE, OTHER THAN THE ONE UNDER TEST

FAILURE - DEFECTIVE OR UN-FORMATTED DISKETTE
MIS-ADJUSTED ZERO STOP OR ALIGNMENT
DEFECTIVE READ/WRITE OR CONTROL LOGIC

If Zero Stop Test Passes ....
* Press RETURN - Return to Menu
  Displays Alignment/Repair Test Main Menu

If a Failure Occurs on Zero Stop Test ....
* Press (R) - ReTest Zero Stop
  ReTest Zero Stop
* Press (A) - Adjust Zero Stop
* Press RETURN - Return to Menu
  Displays Main Alignment/Repair Test Menu

1581 ZERO STOP DIS-ASEMBLY AND SET-UP PROCEDURES

1. DisConnect Power Cable and Serial Cables
2. Remove the Three (3) Screws from the Bottom Case and Remove the Top Case from the unit
3. Remove the Drive FacePlate and Set it Beside the Unit
4. Remove the Four (4) Drive Mounting Screws
5. Remove the Two (2) Shield Screws and Remove the Drive Shield
6. Remove the Drive Assembly and Set it on its Side
7. Set Scope Channel 1 to DC Scale and 2V/DIV
8. Connect Scope Probe 1 to Test Point 3 (TP3)
9. Connect Power Cable and Serial Cable
10. Turn Drive Power ON
11. Insert a Formatted 1581 Diskette

* Press SPACE - Adjust Zero Stop

DO NOT ADJUST ZERO TRACK UNTIL RADIAL ALIGNMENT IS CORRECT

1581 ZERO TRACK ADJUST

1. Make Sure Current Track Displays 0 - Voltage Level Displays 0.0 VDC
   * The Scope Reading Should also = 0.0 VDC

2. Press (+) - Step IN One Track

ZERO TRACK ADJUSTMENT CHART

VOLTAGE LEVEL	CURRENT TRACK	SCOPE READING	ZERO TRACK STATUS
0.0 VDC	0	0.0 VDC	OK
0.0 VDC	1	0.0 VDC	OK
2.5 VDC	2	2.5 VDC	OK
5.0 VDC	3	5.0 VDC	OK
5.0 VDC	4	5.0 VDC	OK

3. If all Scope Readings Compare to the Zero Track Chart
   * ZERO TRACK ADJUSTMENT IS OK !! OK !! OK !! OK !!
   * Press RETURN - Return To Menu
     Displays Alignment Repair Main Menu

4. If any Scope Readings Do Not Compare to the Zero Track Chart
   * ZERO TRACK MUST BE ADJUSTED !! ADJUSTED !! ADJUSTED !!
   * Refer to Zero Track Adjustment Procedures -- Page 1-22

1581 ZERO TRACK ADJUSTMENT PROCEDURES
DO NOT ADJUST THE STOP UNTIL RADIAL ALIGNMENT IS CORRECT

1. Press (+) or (-) until the Screen Displays
   Voltage Level = 2.5 VDC and Current Track = 2

2. Loosen the Zero Track Screw and Slide the Zero Track Sensor
   Until the Scope Reading = 2.5 VDC

3. Tighten the Zero Track Screw
   * The Scope Reading Must Stay at 2.5 VDC After The Zero Track Screw is Tightened. If the Reading is OFF After the Zero Track Screw is Tightened -- RE-ADJUST ZERO TRACK SENSOR

4. Press SPACE - Re-Check Zero Track
   * If the Zero Track Test Fails ....
     Repeat Steps 1 thru 3 until Adjustment is Correct
   * If the Zero Stop Test Passes ....
     * Press RETURN - Return To Menu
       Displays Alignment/Repair Main Menu

ALIGNMENT/REPAIR TEST OPTION FOUR - STEPPER MOTOR SLEW

STEPPER MOTOR SLEW TEST OPTION MENU

* Press (1) - Step To Track 1
* Press (0) - Step To Track 80
* Press **RETURN** - Return to Menu
  Displays Alignment/Repair Test Main Menu

STEPPER MOTOR SLEW TEST OPTION ONE - STEP HEAD TO TRACK 1
STEPPER MOTOR SLEW TEST OPTION TWO - STEP HEAD TO TRACK 80

The **Stepper Motor Slew Test** checks proper operation of the Stepper Motor by Slewing the Read/Write Head between Track 1 and Track 80, (Inner and Outer Tracks). The Read/Write Head should move smoothly and freely with no sticking or binding of the Stepper Mechanism.

FAILURE - DEFECTIVE DRIVE ASSEMBLY (STEPPER MOTOR)
DEFECTIVE STEPPER MOTOR CONTROL LOGIC

* Press **RETURN** - Return To Menu
  Displays Alignment/Repair Main Menu

ALIGNMENT/REPAIR TEST OPTION FIVE - DRIVE MOTOR LOGIC

The **Drive Motor Logic Test** checks for proper operation of the Drive Motor Control Logic by allowing the Drive Motor to be turned either **OFF** or **ON** and displaying the current status.

Use a Scope or Meter to verify the Measured Signal with the Expected Signal from the Drive Motor Control Logic Chart.

DRIVE MOTOR LOGIC OPTION MENU

* Press (1) - Turn Motor ON
* Press (0) - Turn Motor OFF
* Press **RETURN** - Return to Menu
  Displays Alignment/Repair Main Menu

1581 DRIVE MOTOR CONTROL LOGIC CHART

DRIVE MOTOR DISPLAY	CHECK IC PINS	EXPECTED SIGNAL	SCOPE MODE	INCORRECT SIGNAL PROBABLE FAILURE
OFF	U5 - 4	HIGH	DC	U5 - U11
OFF	U11 - 2	HIGH	DC	U11 - BAD DRIVE
ON	U5 - 4	LOW	DC	U5 - U11
ON	U11 - 2	LOW	DC	U11 - BAD DRIVE

ALIGNMENT/REPAIR TEST OPTION SIX - SIDE SELECT LOGIC

The **Side Select Logic Test** checks for proper operation of the Drive Side Select Logic by turning each Head, (Upper and Lower), on individually.

SIDE SELECT LOGIC OPTION MENU

* Press **(0)** - Select Side **[0] (Lower)**
* Press **(1)** - Select Side **[1] (Upper)**
* Press **RETURN** - Return to Menu
  Displays Alignment/Repair Main Menu

Use a Scope or Meter to verify the Measured Signal with the Expected Signal from the Side Select Control Logic Chart.

1581 SIDE SELECT LOGIC CHART

SIDE SELECTED	CHECK IC PINS	EXPECTED SIGNAL	SCOPE MODE	INCORRECT SIGNAL PROBABLE FAILURE
0	U5 - 2	LOW	DC	U5 - U11
0	U11 - 4	LOW	DC	U11 - BAD DRIVE
1	U5 - 2	HIGH	DC	U5 - U11
1	U11 - 4	HIGH	DC	U11 - BAD DRIVE

ALIGNMENT REPAIR/TEST OPTION SEVEN - LOAD DIAGNOSTIC MENU

* Insert **Version 1.5** Diagnostic Diskette
* Press **(8)** - Load from Device Number **[8]**
* Press **(9)** - Load from Device Number **[9]**
* Press **RETURN** - Return To Menu
  Displays Alignment/Repair Main Menu

C128/C128D 80 COLUMN TEST
VERSION 1.5.1

DESIGNED TO TEST : 80 COLUMN MODE OF THE C128 OR C128D

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
40 COLUMN MONITOR OR TV SET
80 COLUMN RGB MONITOR (OPTIONAL)
VERSION 1.5 DIAGNOSTIC DISKETTE

The **80 Column Test** is used to verify proper operation of the 80 Column Video Controller and Local 80 Column Video RAM of the C128 or C128D

*** All Displays Are In HEX Format**

During Run Time, the tests being run are displayed and can be Interpreted as ....

C128 - Memory Range - 4K Block, (1-4), of RAM Under Test
C128D - Memory Range - 16K Block, (1-4), of RAM Under Test
Address - Current Address in Block Being Tested
Data - Current Data Being Read or Written
R/W - Current Operation (Read/Write) Being Executed

Block Write - Writes Displayed Data to Displayed Address
Block Copy - Copies Data, (Reads/Writes), at Displayed Address

C128 - U22 8563 **Pass/Fail** - Result of 80 Column Video Chip Test
C128D - U22 8568 **Pass/Fail** - Result of 80 Column Video Chip Test

C128 - U23 4416 **Pass/Fail** - Result of 4x16 RAM Chip Test
C128D - U23 4464 **Pass/Fail** - Result of 4x64 RAM Chip Test

C128 - U25 4416 **Pass/Fail** - Result of 4x16 RAM Chip Test
C128D - U25 4464 **Pass/Fail** - Result of 4x64 RAM Chip Test

PASS xxxx - Number of Completed Passes Run
TIME xx:xx:xx - Total Run Time of 80 Column Test

*** Any IC Flagged with a Fail Message must be replaced**

*** If an 80 Column RGB Monitor is connected, the ASCII Character of the Data being executed will be displayed.**

*** The System Must be Powered Down to Exit This Test**

C128/C128D C64 MODE TEST
VERSION 1.5.1

DESIGNED TO TEST : C64 MODE OF THE C128 OR C128D

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
40 COLUMN MONITOR OR TV SET
VERSION 1.5 DIAGNOSTIC DISKETTE

The **C64 Mode Test** is used as Burn-In Diagnostic to verify proper operation of the C64 Mode of the C128 or C128D.

* When **C64 Mode Test** is run, the system under test is switched to the C64 Mode and the test is Auto-Executed.

* The rows of squares displayed during Test Run Time represent ICs with the Numbers Displayed representing IC Locations on the PCB.

* **Defective ICs are Indicated by Blacking Out the Corresponding Locations on the Screen**
* **Testing of the SID IC is done by Audible Tones Only**

* **For more detailed testing, use the C128/C128D Diagnostic Cartridge**

* **The System Must be Powered Down to Exit This Test**

C128/C128D RAM EXPANDER TEST
VERSION 1.5.1

DESIGNED TO TEST : 1700 OR 1750 EXTERNAL RAM EXPANDER

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
MODEL 1700 OR 1750 RAM EXPANSION MODULE
40 COLUMN MONITOR OR TV SET
VERSION 1.5 DIAGNOSTIC DISKETTE

THE 1700/1750 RAM EXPANDER WILL NOT OPERATE PROPERLY WITH THE REV 6 PCB, (C128 ONLY), INSTALLED. IF THIS PROBLEM ARISES, THE PCB MUST BE REPLACED WITH A REV 7 PCB OR HIGHER

THE RAM EXPANSION MODULE MUST BE INSERTED IN THE SYSTEM UNDER TEST BEFORE POWER IS APPLIED AND THE RAM EXPANDER TEST IS LOADED

The **RAM Expander Test** is used to Diagnose Failures of the RAM ICs, any ROM which may be installed and the REC, (RAM Expansion Controller), in the Model 1700, (128K), or 1750, (512K), RAM Expansion Modules

The **RAM Expansion Test** Auto-Executes when loaded and displays a picture of the RAM Expansion Module.

* **If a Failure Occurs during Test Run Time, the IC Location Displays in Reverse Field and a 'BD' (BAD), message is displayed in the Defective IC Location.**

* **If No Failure is detected, an 'OK' is displayed**

* The Number Displayed in the Upper Left Hand Corner of the screen is the Test Version Number and does not effect Diagnostic Testing

* The Size of the Module Under Test, **(1700 - 128K or 1750 - 512K)**, is displayed in the Upper Right Hand Corner of the screen
  * **If Incorrect Size Is Displayed, It May Indicate a Defective REC**

* The Number of Completed Cycles, **`COUNT'**, is displayed in the Lower Left Hand Corner of the screen
  * **Cycle Time is dependant on the Size of the Expansion Module**

* Two (2) Clocks, **(AM and PM)**, are displayed in the Bottom Right Hand Corner of the screen
  * **AM Clock = Internal Time Of Day Clock of 6526 CIA Location U1**
  * **PM Clock = Internal Time Of Day Clock of 6526 CIA Location U4**
    * **CIAs are Located on the Main PCB of the C128 or C128D**
  * **These Two (2) Clocks must display the EXACT SAME TIME during Diagnostic Run Time and Increment as the Test Continues**

TIME-OF-DAY-CLOCK FAILURES

* **Incorrect AM Clock** - Possible 6526 CIA Failure - Location U1
* **Incorrect PM Clock** - Possible 6526 CIA Failure - Location U4
* **Incorrect Both Clocks** - Possible 60 HZ TOD Input Failure

8726 REC (RAM EXPANSION CONTROLLER)

The REC is a DMA Device used to Transfer Blocks of Data between the C128 or C128D and the Expansion RAM.

* The **Verify Option** is tested by Testing Both Verify and Verify Error Conditions with the Interrupts ON.
  * **This Detects the Majority of REC Failures**
  * **If either test Fails, the REC is 'BAD'**
  * **If both Verify Conditions are met the Test Continues**

* The **Swap Option** is tested by Loading the Expansion RAM with a Pre-Selected Random Pattern, Clearing the Host RAM, Swapping RAM and Comparing the Two RAM Areas.
  * **If either RAM Area does not compare to the Pattern, the REC is 'BAD'**
  * **If both RAM Areas Compare to the Pattern, the REC is 'OK'**

Although some REC Failures are not so easily detected, many time they may be determined by the Overall Test Results
* **Example: BAD RAM Patterns for Bank 0 Match Bank 1**

C128 / C128D HOST RAM

The Architecture of the 1700/1750 RAM Expansion Module requires an Area of RAM within the C128 or C128D to be allocated. This RAM is referred to as the Host RAM. Since the Test Data is first placed in this area and Transferred to the RAM Expander for testing and back again, it is necessary to insure that the Host RAM functions properly.
* **The Host RAM is Tested using the C128/C128D Diagnostic Cartridge**
* **A Failure in the Host RAM will cause Incorrect Results to be displayed during the RAM Expansion Test**

RAM EXPANSION TEST

A Test Pattern is placed in the First Memory Location in Host RAM where it is duplicated to fill the remaining area. When this is complete, the Host RAM is Transferred to the RAM Expander. This Transfer Procedure is duplicated until all Banks of the Expansion RAM are filled. After a Set Time, to allow for Refresh, the Data is Transferred back to the Host RAM and Compared to the Test Byte.
* **If Data Read = Data Written - RAM is 'OK'**
* **If Data Read <> Data Written - RAM is 'BAD'**

DYNAMIC RAM

Because the 1700/1750 RAM Expander uses Dynamic RAM, a Refresh Cycle must occur at least every Two (2) MilliSeconds. This is the Time Most RAM Failures Occur.
* **Each Test in the RAM Expansion Diagnostic allows for RAM Refresh**
* **Displayed Failures are Valid Only For The First Pass after which Defective ICs should be Replaced and the Test Re-Started**
  * **Further Testing will Display Incorrect Results**

CUSTOM TEST PATTERN TESTING

The RAM Expansion Test Pattern Table is Located between 2261 and 2274 HEX (Inclusive). This table contains the Bit Patterns used for RAM Expansion Testing.

If a different Test Pattern is desired ....

```
*          Insert Version 1.5 Diagnostic Diskette in Load Drive
* C128  -   Type DLOAD "C128 RAM XPANDER"                  Press RETURN
* C128D -   Type DLOAD "128D RAM XPANDER"                  Press RETURN
*          Type POKE 8801, (Enter Decimal Test Pattern)    Press RETURN
*          Type RUN                                        Press RETURN
```

* **The RAM Expansion Test will now be executed using the Selected Test Pattern.**

EXTERNAL ROM TEST

Although the External ROM, (Location U18 of Expansion PCB), is not currently used, the RAM Expansion Test includes a test to Detect Failures on any ROM which may be used in the future.

The ROM is Tested by adding the contents of each address to a value equal to the sum of the data in all preceding addresses. This is referred to as a **'CHECKSUM'** and the value is displayed, in HEX Format.

* **The Displayed Checksum may change from one Pass to another as only an Empty Slot is being read, however it should be consistent between different RAM Expanders.**
  ** **A Checksum which is Not Consistent between different RAM Expanders may Indicate a Defective PLA on Main PCB of the C128 or C128D.**

* **The System Must be Powered Down to Exit This Test**

1581 DISK BACKUP
VERSION 1.5.1

DESIGNED TO BACKUP: DATA DISKETTES FROM ONE 1581 TO ANOTHER 1581

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
(2) 1581 SINGLE DISK DRIVES
DATA DISKETTE
BLANK DISKETTE
40 COLUMN MONITOR OR TV SET
VERSION 1.5 DIAGNOSTIC DISKETTE

THE DRIVES MUST BE SET TO DIFFERENT DEVICE NUMBERS

The **Disk Backup Program** is the same as the C128 Backup Program on the 1581 Test Demo Diskette.

The Program allows a Data Disk to be Copied from one 1581 Set to Device Number **[8]** to another 1581 Set to Device Number **[9]**

ALL FILES ON THE SOURCE DISKETTE WILL BE COPIED WITH NO FILE SELECTION OPTIONS GIVEN. IF A DISKETTE WITH AN AUTO-BOOT PROGRAM, SUCH AS THE VERSION 1.5 DIAGNOSTIC DISKETTE, IS COPIED, THE NEW DISKETTE WILL ALSO AUTO-BOOT ON POWER-UP

DISK BACKUP OPTIONS

* Insert Source Diskette in Device Number **[8]**
  * **Write-Protect Tab should be Open**
* Insert Blank Diskette in Device Number **[9]**
  * **Write-Protect Tab Must be Closed**
* Press Any Key
  * Begins Disk Backup
    * **[WORKING] will be Displayed**

* **When the Backup is Complete [DONE] will be Displayed**

1581 FILE COPY
VERSION 1.5.1

DESIGNED TO COPY : FILES FROM ONE DRIVE TO ANOTHER

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
(2) 1581 SINGLE DISK DRIVES
DATA DISKETTE
BLANK DISKETTE
40 COLUMN MONITOR OR TV SET
VERSION 1.5 DIAGNOSTIC DISKETTE

THE DRIVES BEING USED MUST BE SET TO DIFFERENT DEVICE NUMBERS

The **File Copy Program** is the same as the Universal Disk-File Copy Program on the 1581 Test Demo Diskette.

The Program allows Disk Files from one drive to be copied to another drive connected VIA the Serial Bus.

FILE COPY OPTIONS

CHANGE DEVICE NUMBER OPTION

* If **(Y)**es is selected ....
  * Input the Original Device Number
  * Input the New Device Number
  * Turn Power **OFF** to all Drives except the one to be changed
  * Press **SPACE** - Change Device Number

* If **(N)**o is selected ....
  * Select Partition Options

PARTITION OPTIONS

THE PARTITION OPTIONS ARE VALID FOR THE 1581 ONLY AND REQUIRES A PARTITION TO PREVIOUSLY HAVE BEEN CREATED

* If **(Y)**es is selected ....
  * Enter Name of Partition to Open
  * Select Read From or Write To Option
    * If **(R)**ead is selected ....
      * Selected Files will be Read from the Partition
    * If **(W)**rite is selected ....
      * Selected Files will be Written to the Partition
  * Select File Transfer Options

* If **(N)**o is selected ....
  * Select File Transfer Options

FILE TRANSFER OPTIONS

* **Input Copy From Unit** (Source Drive Device Number)
  * **Data Diskette Must be Inserted in Source Drive**
* **Input Drive Number** (Always [0] For 1581 or C128D)
* **Input Copy To Unit** (Destination Drive Device Number)
  * **Blank Diskette Must be Inserted in Destination Drive**
    * **Write-Protect Tab Must be Closed**
* **Input Drive Number** (Always [0] For 1581 or C128D)

NAME-SEARCH PATTERN OPTION

* If a File Name is Entered, only that file will be displayed for the File Copy Selection Option
* If Selected Characters are entered followed by an [*] Symbol, only files which begin with these characters will be displayed for the File Copy Selection Option
* If **RETURN** is selected, all files will be displayed for the File Copy Selection Option

FILE COPY SELECTION OPTION

The Selected Files will be displayed as ....

File Size **File Name** **File Type**

* Press **(Y)**es if you wish to copy the displayed file
* Press **(N)**o if you wish to skip the displayed file
* Press **(Y)**es followed by **RETURN** at any file to copy all remaining files
* Press **(N)**o followed by **RETURN** at any file to skip all remaining files

DESTINATION DISK NEW OPTION

If the Destination Diskette is Blank or the Information Contained is no longer required, Select **(Y)**es here

If the Destination Diskette Contains Valid Data and files are to be added, Select **(N)**o here

If **(Y)**es is selected ....
* Enter the Name and ID to be assigned to the Destination Diskette
  * **The Name is limited to (16) Characters, and may be either Alpha or Numeric**
  * **The ID Must be (2) Characters, and may be either Alpha or Numeric but should not be a combination of the two**

When the Format of the Destination Diskette is complete
* Blocks Free is displayed -- **(Blocks Free Should = 1328)**
* File Copy will begin

If (N)o is selected ....
* Blocks Free are Displayed
* File Copy Begins

FILE COPY

The files being copied are displayed as ....
* **Source File Size** - Number of Blocks in Source File
* **Source File Name** - Name of Source File being copied
* **Source File Type** - Type of Source File being copied
  * **SEQ = Sequential REL = Relative PGM = Program USR = User**
* **Destination File Size** - Number of Blocks copied
  * **If Source File Size <> Destination File Size after the file has been copied, an error has occurred during the copy**

ANOTHER COPY OPTION

* If **(Y)es** is selected, **File Copy** ReStarts and you are ready to make another copy
* If **(N)o** is selected, **File Copy** will Terminate

1581 DISK FORMATTER
VERSION 1.5.1

DESIGNED TO FORMAT: A BLANK DISKETTE

REQUIRED EQUIPMENT: C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
BLANK TEST DISKETTE
40 COLUMN MONITOR OR TV SET
Version 1.5 DIAGNOSTIC DISKETTE

The **Disk Formatter Program** is a Disk Utility Program to allow Blank Diskettes to be Formatted under program control.

DISK FORMATTER OPTIONS

* Press (0) - Select Device Number >> **[8] or [9]**
  * This option allows a diskette to be formatted in a Drive set to either Device Number **[8] or [9]**

SELECT FORMAT MODE

* Press (S) - Slow Mode
  * **Formatting will be done in the 1581 Slow Mode**
* Press (F) - Fast Mode
  * **Formatting will be done in the 1581 Fast Mode**
* Press SPACE - Load Diagnostic Menu
  * Insert Version 1.5 Diagnostic Diskette
  * Press (8) - Load From Device # >> **[8]**
    * **Loads Version 1.5 Diagnostic Menu From Device Number [8]**
  * Press (9) - Load From Device # >> **[9]**
    * **Loads Version 1.5 Diagnostic Menu From Device Number [9]**
  * Press Return - Return To Menu
    * **Displays Disk Formatter Main Menu**

FORMAT INFORMATION

* **Disk Name** - Enter Name to be assigned to the diskette
  * **The Disk Name is limited to a maximum of (16) Characters and may be either Alpha or Numeric**
* **Disk ID** - Enter ID to be assigned to the diskette
  * **The ID must be (2) Characters and may be either Alpha or Numeric but not a combination of the two**

* Press (F) - Information is Correct
  * **Begin Formatting Diskette**

WARNING - FORMATTING DESTROYS ALL DATA STORED ON DISKETTE

* Press (A) - Wrong Information Entered
  * **Do Not Format Diskette**

* Press **RETURN** - Return To Menu
  * **Displays Disk Formatter Main Menu**

SCREEN DISPLAY

Disk Name	.....	(Name Assigned to the Diskette
Format Speed	.....	(Fast or Slow)
ID Code	.....	(ID Assigned to the Diskette)
Device Number	.....	(Device Number of Formatting Drive)
Disk Status	.....	(Good / Bad)

* Press **RETURN** - Return To Menu
  Displays Disk Format Main Menu

1581 FILE SCRATCHER
VERSION 1.5.1

DESIGNED TO SCRATCH: FILES FROM A DATA DISKETTE

REQUIRED EQUIPMENT : C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
40 COLUMN MONITOR OR TV SET
DATA DISKETTE
VERSION 1.5 DIAGNOSTIC DISKETTE

The **File Scratcher Program** is a Disk Utility Program to allow Files to be Scratched under Program Control.

FILE SCRATCHER OPTIONS

* Press (0) - Select Device Number >> [8] or [9]
  * This option allows Files to be Scratched from a Device set to either Device Number [8] or [9]
* Press RETURN - Start Scratcher
  Displays Prompts for Input Information
* Press SPACE - Load Diagnostic Menu
  * Insert Version 1.5 Diagnostic Diskette
  * Press (8) - Load From Device # >> [8]
    * Loads Version 1.5 Diagnostic Menu From Device Number [8]
  * Press (9) - Load From Device # >> [9]
    * Loads Version 1.5 Diagnostic Menu From Device Number [9]
  * Press Return - Return To Menu
    Displays File Scratcher Main Menu

FILE SCRATCHER INFORMATION

* **File Name** - Enter Name of File to be Scratched
  * The File must be Entered Exactly as it is Named on the Diskette

* Press (S) - Information is Correct - Scratch The File
* Press (A) - Wrong Information Entered - Do Not Scratch File
* Press RETURN - Return To Menu
  Displays File Scratcher Main Menu

SCREEN DISPLAY

Scratching File ..... (Name Of File Being Scratched)
Device Number ..... (Device Number of Drive)
Disk Status ..... (Good / Bad)

* Press RETURN - Return To Menu
  Displays File Scratcher Main Menu

* If a File has been scratched, the BAM will be updated before the File Scratcher Main Menu is Displayed

1581 FILE RESTORER
VERSION 1.5.1

DESIGNED TO RECOVER: SCRATCHED FILES FROM A DATA DISKETTE

REQUIRED EQUIPMENT : C128 OR C128D COMPUTER
1581 SINGLE DISK DRIVE
40 COLUMN MONITOR OR TV SET
DATA DISKETTE
VERSION 1.5 DIAGNOSTIC DISKETTE

The **File Restorer Program** is a Disk Utility Program to allow Scratched Files to be to be Restored to Usable Condition

IF ANY TYPE OF DISK WRITE OPERATION, SUCH AS SAVING A FILE OR BAM UPDATING, IS DONE AFTER THE FILE IS SCRATCHED, THE FILE MAY NO LONGER BE ABLE TO BE RESTORED

FILE RESTORER OPTIONS

* Disk Unit NR (8-11)
  * **Device Number of the Drive for File Recovery**
* Disk Drive NR (0/1)
  * **Always [0] For 1581/C128D**
* Insert Diskette for File Recovery
  * **Press ANY KEY**

FILE RESTORER INFORMATION

* **File Name** - Enter Name of File to be Recovered
  * If a File Name is entered, the File will be displayed along with Track and Sector where the File is Stored with a Recovery Option
  * If Selected Characters are entered followed by **[*]**, all Scratched Files beginning with these characters will be displayed along with Track and Sector where the File is Stored with a Recovery Option
  * If **RETURN** is Pressed at the **[*]** Prompt, all Scratched Files will be displayed along with Track and Sector where the File is Stored with a Recovery Option

RECOVERY OPTION

* Press **(Y)es** - Restore Displayed File
* Press **(N)o** - Skip Displayed File

* If **(Y)es** is selected ....
  * Enter File Type to be Restored
    * **SEQ = Sequential File PRG = Program File USR = User File**
      REL = Relative File CBM = Boot File

* **Status of Selected File is displayed**

* Press **(Y)es** - Select more files for recovery
* Press **(N)o** - Terminate File Restorer

The following are some of the most common Basic Commands used in the operation of the C128 and C128D Computers. Also listed is a format example of each command.

For more detailed operation commands, please refer to the C128 or C128D System Guide.

COMMAND FUNCTION	COMMAND FORMAT
[FORMAT] or [NEW] a Blank Diskette	HEADER "Disk Name", Dx, ID, Udn * Disk Name = Any Combination of Digits or Letters (Max 16 Characters) * x = Drive Number (Optional) (Always [0] for 1581/C128D) * ID = Any (2) Digits or Numbers (Must be Two Characters) * dn = Device Number of Drive (Optional if Device Number [8])
Example: To FORMAT a Diskette with the Disk Name [COMMODORE] with an ID [BM] in Drive [0] of Device Number [8] HEADER "COMMODORE", D0, IBM - Press RETURN AT THE [ARE YOU SURE] ? PROMPT - Press [Y] - Press RETURN Example: To FORMAT a Diskette with the Disk Name [COMMODORE] with an ID [BM] in Drive [0] of Device Number [9] HEADER "COMMODORE", D0, IBM, U9 - Press RETURN AT THE [ARE YOU SURE] ? PROMPT - Press [Y] - Press RETURN	

COMMAND FUNCTION	COMMAND FORMAT
[SAVE] a Program to a Formatted Diskette	DSAVE "Program Name", Dx, Udn * Program Name = Any Combination of Digits or Letters (Max 16 Characters) * x = Drive Number (Optional) (Always [0] for 1581/C128D) * dn = Device Number of Drive (Optional if Device Number [8])
Example: To SAVE a Program called [COMMODORE] to Drive [0] on Device Number [8] DSAVE "COMMODORE", D0 - Press RETURN Example: To SAVE a Program called [COMMODORE] to Drive [0] on Device Number [9] DSAVE "COMMODORE", D0, U9 - Press RETURN	

COMMAND FUNCTION	COMMAND FORMAT
[LOAD] a Program from a Data Diskette	DLOAD "Program Name", Dx, Udn * Program Name = Name of Program to be Loaded (Spelling Must Be Exact) * x = Drive Number (Optional) (Always [0] for 1581/C128D) * dn = Device Number of Drive (Optional if Device Number [8])

Example: To LOAD a Program called [COMMODORE] from Drive [0] on Device Number [8]

DLOAD "COMMODORE", D0 - Press RETURN

Example: To LOAD a Program called [COMMODORE] from Drive [0] on Device Number [9]

DLOAD "COMMODORE", D0, U9 - Press RETURN

COMMAND FUNCTION	COMMAND FORMAT
[RENAME] a File to Another Name	RENAME Dx, "Old Name" to "New Name", Udn * x = Drive Number (Mandatory) (Always [0] for 1581/C128D) * Old Name = Original Name of File * New Name = New Name of File * dn = Device Number of Drive (Optional if Device Number [8])

Example: To RENAME a File called [COMMODORE] to [CBM] on Drive [0] of Device Number [8]

RENAME D0, "COMMODORE" to "CBM" - Press RETURN

Example: To RENAME a File called [COMMODORE] to [CBM] on Drive [0] of Device Number [9]

RENAME D0, "COMMODORE" to "CBM", u9 - Press RETURN

COMMAND FUNCTION	COMMAND FORMAT
[INITIALIZE] the Disk Drive	OPEN 1, dn, 15: PRINT #1, "Ix" CLOSE 1 * dn = Device Number of Drive (Mandatory) * x = Drive Number (Mandatory) (Always [0] for 1581/C128D)
Example: To INITIALIZE Drive [0] of Device Number [8] OPEN 1,8,15: PRINT #1, "I0" - Press RETURN CLOSE 1 - Press RETURN Example: To INITIALIZE Drive [0] of Device Number [9] OPEN 1,9,15: PRINT #1, "I0" - Press RETURN CLOSE 1 - Press RETURN	

COMMAND FUNCTION	COMMAND FORMAT
[DIRECTORY] Read Directory of the Diskette	DIRECTORY Dx, Udn * x = Drive Number (Optional) (Always [0] for 1581/C128D) * dn = Device Number of Drive (Optional if Device Number [8])
Example: To Read the DIRECTORY from Drive [0] of Device Number [8] DIRECTORY D0 - Press RETURN Example: To Read the DIRECTORY from Drive [0] of Device Number [9] DIRECTORY D0, U9 - Press RETURN	

COMMAND FUNCTION	COMMAND FORMAT
[SCRATCH] a File From a Data Diskette	SCRATCH "File Name", Dx, Udn * File Name = Name of File to be Scratched * x = Drive Number (Optional) (Always [0] for 1581/C128D) * dn = Device Number of Drive = (Optional if Device [8])

Example: To SCRATCH a File named [COMMODORE] from Drive [0] of Device Number [8]

SCRATCH "COMMODORE", D0 - Press RETURN
AT THE [ARE YOU SURE] ? PROMPT - Press [Y] - Press RETURN

Example: To SCRATCH a File named [COMMODORE[from Drive [0] of Device Number [9]

SCRATCH "COMMODORE", D0, U9 - Press RETURN
AT THE [ARE YOU SURE] ? PROMPT - Press [Y] - Press RETURN

To All Service Centers:

Although Extensive Testing was done on the Diagnostic Tests contained on the Version 1.5 Diagnostic Test Diskette, it is still possible that some errors may exist.

If Errors are discovered during Diagnostic Testing .... Please fill out the attached form and return it to ....

COMMODORE BUSINESS MACHINES
ATTN: BRUCE MORTENSON
1200 WILSON DRIVE
WEST CHESTER, PA 19380

All Reported Errors will be validated and if the Program is changed, the Updated Program will be put on the CSIN Network for Downloading.

Please provide as much of the requested information as possible to allow us to provide the Updates to the field as quickly as possible to help all Commodore Service Centers.

Regards

Bruce Mortenson

VERSION 1.5 DIAGNOSTIC
BUG REPORT

Company Name _____

Telephone _____

Technician Name _____

Error Found In ___ Test ___ Manual

Name of Test _____

Test System ___ 1581 ___ C128 ___ C128D

Please give as much information as possible on Bug such as Section of Test, Sequence of Testing etc.