Z-100 LifeLine
Since 1989

March 2022

#WEB

This article was first published in issue #104, April 2006

DETECT version 4 Documentation

by Steven Vagts
Editor, "Z-100 LifeLine"

Z-DOS v4 DETECT

The Utility that Locates and Isolates New Bad Sectors on your Hard Disk

The DETECT Version 4 utility examines your hard disk drive for any bad sectors (media imperfections) that have occurred since PREP was last used. DETECT then adds the addresses of these bad sectors that it finds to a list of bad sectors that had been recorded in the Reserved Winchester Area of the disk when PREP was run. This list is called the Bad Sector Table.

NOTES:

* DETECT Version 4 requires a Heath/Zenith H/Z-100 series computer using Z-DOS v4.x and monitor ROM v4.x.
* For users running older versions of DOS, use their respective DETECT program (Early DOS versions used a program called VERIFY).
* PC-DOS v4 replaced the DETECT program with DSKSCAN, but Z-DOS v4 continues to use DETECT.
* VERIFY and DETECT will work ONLY with MFM hard drives and MFM controllers such as the Zenith Z-217 or CDR 317 hard drive controllers.
* The bad sectors found by VERIFY or DETECT will not be locked out by MS-DOS until the partition has been formatted with the FORMAT command.

Recent Changes to DETECT

+ To provide more control to users, command line switches have been added.

+ The method of screen output has been changed to accommodate the {CTRL-P} (^P -- echo to printer) DOS command. The solution was not trivial. The trick lies in the different way DOS processes its output character functions 9 (string) and 3Fh (handle) routines. Function 9 will always echo to the printer if <^P> has been activated, while function 3Fh will ONLY echo to the printer if the standard output device is in "ASCII/ cooked" mode. (You can change between "cooked" and "raw/BINARY" modes with DOS function 44H sub function 1.) Most of the problems arise when a program wants to use "cursor positioning" to control the output.

+ A NO_INF_LOOP option was added to prevent an infinite loop problem that was found. There are two cases that might TIME OUT, each has its own error message. First we will wait a short time for the STATUS to show ready. Then we wait for a long time for the command to complete. However, these new sections of code have not been fully tested because not all controller cards show the problem.

Generic DETECT Background Information

BAD SECTORS AND HARD ERROR MESSAGES

Bad sectors are media imperfections that can cause hard errors during hard drive disk access operations. Hard errors are conditions under which an operation has failed after a number of repeated attempts. Recovery from a hard error usually brings an abrupt end to the operation that was being performed when the error occurred.

If you encounter hard errors that are caused by bad sectors, DETECT enables you to prevent the hard errors from recurring in the future. When you run DETECT, any bad sectors are added to the disk's bad sector table. After the affected partition(s) are reformatted, the bad sectors will no longer be accessed by the system. However, the maximum number of bad sectors in the bad sector table is 169. If more than 169 bad sectors are found, an error message will appear.

The bad sector table was initially prepared by the **PREP** utility, which initialized the hard drive disk and is the first of all hard drive utilities to be run on a new drive.

When you use **FORMAT** on a partition that has been examined by DETECT, FORMAT will mark the Cluster associated with a bad sector table entry as "bad" in the FAT, forcing DOS to skip that unusable portion of the partition. If the location of the bad sector is in the boot sectors, FAT's or the root directory, **PART** must be used to relocate the beginning of the partition.

When bad sectors are encountered during hard drive disk access operations, MS-DOS displays a hard error message that is slightly different from the floppy disk hard error message. The hard drive message appears in the form:

```
<type> error <action> drive <d>
Sector address of error is <nnnn>
Abort, Retry, Ignore?_
```

Where:

<type> indicates the type of problem that caused the error condition and can be any of the following:

```
WRITE PROTECT
SEEK
DATA
SECTOR NOT FOUND
WRITE FAULT
DISK
```

<action> identifies the operation that was being performed when the error occurred - whether the disk was reading or writing.

<d> is the drive name assigned to the partition in use at the time the error occurred; and

<nnnn> is the logical hexadecimal address of the sector on which the hard error occurred. Logical sector addresses begin with the first sector on the entire hard drive disk, which is sector 0000.

Whenever a hard error message appears, you need to record the sector address of the error, the partition name, and the operating system name of the partition on which the error occurred. With this information, you will be ready to respond to the utility prompts when you run DETECT.

OTHER CAUSES OF HARD ERRORS

Hard errors are not always caused by bad sectors. You might also obtain hard errors during hard drive disk access due to the following problems:

* excessive physical shock exerted on the disk drive unit (more than 5 G's for a period of time greater than 5 milli-seconds),
* entry of foreign material (such as smoke) into the sealed hard drive disk chamber,
* malfunction of the hard drive controller board, and/or
* temporary loss of power to the hard drive.

If one of these problems causes a hard error, the disk might not actually have any bad sectors for DETECT to find. In such a case, you should back up the files from your hard drive disk and run the PREP utility.

DETECT does not destroy any data stored on the hard drive disk. However, it is recommended that after running DETECT, you run BACKUP to copy all files from the partition(s) on which the bad sectors occurred, FORMAT the affected partition(s), and use RESTORE to replace the files on the partition.

DETECT Version 4 Operation

1 Invoking DETECT Help

DETECT v4, as with most Z-DOS v4 utilities, has a help screen that can be invoked by typing either of the following commands:

```
DETECT ?
DETECT /?
```

This displays the help screen of Figure 1.

~~~~~~

```
   The DETECT utility helps you to:

      * Locate sectors that have failed since you last ran PREP, and
        update the "BAD SECTOR TABLE" used by FORMAT to create the FAT.
      * You may optionally list the sectors to automatically mark as bad
        in the "BAD SECTOR TABLE".
      * Existing data on the DRIVE is retained until the next "format".
      * "BREAK" must be set to ON for <^C> termination.

              Usage: [d:\][pathname\]DETECT [?][/x]
Where:
   d:\         - Is the optional drive with transient command file.
   pathname\   - Is the optional path to transient command file.
   ?           - Prints this message.
   /x          - Is any combination of the following switches:
        /Ca    - Specifies Z217 controller CARD "A" or "B".
        /L     - Use LOGICAL instead of Physical Access for sector reads.
        /N     - Do NOT update the "BAD SECTOR TABLE" after detection.
        /R     - Repeated TEST on ONE CYLINDER.
        /S     - SKIP the surface testing of the drive.
        /Un    - Specifies UNIT number of the drive (0-3).
        /Z     - ZERO the "BAD SECTOR TABLE"(discard previous sectors).
```

Figure 1
DETECT HELP SCREEN

~~~~~~

```
                          DETECT version 4.06
            Copyright (C) 1984, Zenith Data Systems Corporation

        Type "DETECT ?" for command line switches

        Do you wish to proceed with DETECT (Y/N)?
```

Figure 2.
DETECT Opening Screen

~~~~~~

NOTE: As you may recall, earlier versons of DETECT had no switches, so let's look closer at each of the switches:

/Ca Controller Card - specifies Z-217 controller card "A" or "B". Unlike the Z-207 Floppy Disk Controller Card which has jumpers that can change the card's address, the Z-217 Winchester Controller Card's address can only be changed by the firmware in a PROM on the card. Nevertheless, DETECT has the capability to recognize a second card if someone ever goes through the trouble to program one.

/L Logical Access - uses LOGICAL Read Access instead of the default Physical Access. Physical was left as the default because it is necessary for the hard drive Z-217 controller to access sectors above 64 Megabytes.

DETECT4 does not check to see if it is better to do Logical or Physical, this is left up to the user. (At this point we do not know what the exact limitations are for either the CDR 317 card or the UCI Win card.)

/N No Update - does NOT update the "BAD SECTOR TABLE" after detection. This permits us to run DETECT without disturbing the existing Bad Sector Table.

/R Run Continuous - repeatedly tests a specified cylinder.

/S Skip Surface Test - skips the surface testing of the drive.

/Un Unit - specifies the UNIT number (0-3) of the drive. If not used, the program will question the operator for the device unit number.

/Z Zero BST - zeroes the "BAD SECTOR TABLE" to provide a fresh test of the hard drive's disk. While not normally recommended, this has been found particularly useful if you have changed the drive's circuit board or some component thereon.
~~~~~~

2 Invoking DETECT

Invoke DETECT by entering the following command at the Z-DOS system prompt:

```
DETECT [/x]
```

Where /x is one of the optional switches discussed earlier. If DETECT is not on the default disk and/or in the current directory precede the command name with the appropriate drive and/or path name.

When you invoke DETECT, the display of Figure 2 appears.

Pressing any key other than {**Y**} at this prompt ends the DETECT utility without examining any part of the hard drive disk and returns you to the system prompt.

If you want to continue with DETECT, press {**Y**} at the prompt. DETECT then prompts:

Winchester drive unit number (0-3): _

At this prompt, enter the unit number of the hard disk drive that you want DETECT to access. Up to four hard drives can be used and they are identified by unit numbers 0-3. Most hardware systems are configured so that a single hard disk drive is drive unit 0.

If you should enter a number for a nonexistent drive, the computer will display an error and return you to the system prompt:

Error - Drive not Ready.

After you have specified a valid unit number, DETECT will display the existing bad sector table and then gives you the opportunity to enter a bad sector manually.

```
Existing BAD SECTOR TABLE
 xxxxx(xxxxh) xxxxx(xxxxh) xxxxx(xxxxh)
Enter bad sector in HEX (CR to end):
```

At this prompt, enter either the correct hexadecimal address (nnnn) of a logical sector at which errors occurred or press {RETURN} to begin media verification. DETECT will not actually begin media verification until you enter a {RETURN} at this prompt.

~~~~~~

```
Existing BAD SECTOR TABLE
 1822(071Eh) 9783(2637h) 10629(2985h)
Enter bad sector in HEX (CR to end): 1155
Enter bad sector in HEX (CR to end): 1166
Enter bad sector in HEX (CR to end): 10282
Invalid Sector Number!!!!
Enter bad sector in HEX (CR to end): 282A
Enter bad sector in HEX (CR to end): {RETURN}
Total CYLINDERS 305(0131h)
```

Figure 3.
Entering Bad Sectors

~~~~~~

If you enter a valid bad sector address and press {RETURN}, the computer will repeat the prompt on the next line, ready for the next address. If you should provide an invalid bad sector address, the computer will respond with:

```
Invalid Sector Number!!!!
Enter bad sector in HEX (CR to end):
```

When you have finished entering the addresses of bad sectors, enter {RETURN} at the prompt to begin the DETECT operation.

An example of the display at this point is shown in Figure 3.

3 DETECT Operation

3.1 Normal Operation

When you enter a {RETURN} at the last DETECT prompt, DETECT begins to search for bad sectors on the hard disk. During this phase of operation (known as media verification), the screen displays:

CYLINDER xxxxx(xxxxh)

Where xxxxx(xxxxh) represents each increasing cylinder number.

If a bad sector is detected, the displayed line becomes:

```
CYLINDER xxxxx(xxxxh) HEAD xx(xxh) SECTOR
   xx(xxh)
- Sector xxxx(xxxxh) BAD!
```

And the CYLINDER display continues on the next line.

When DETECT is finished verifying the disk and no new bad sectors were found, the screen displays:

Completed
xxx Bad sectors in Table, xxx Available slots
No NEW bad sectors located.

You can assume that the hard errors you encountered were not due to bad sectors.

If DETECT found a reasonable number (from 1-169) of bad sectors during verification, DETECT displays:

Completed
xxx Bad sectors in Table, xxx Available slots
Bad sectors located. Tables modified.

Note: The words "Tables modified" will NOT appear in this message if DETECT is unsuccessful in appending the new bad sector information to the end of the bad sector table.

If DETECT found more than 169 bad sectors on the Winchester disk, the following message will appear at the end of the verification:

Bad sector count exceeded for this drive.
Must format with "/V".

3.2 Special Operations

3.2.1 Run Continuous

When DETECT is invoked with the /R switch, the computer will display the opening screen, ask to proceed with DETECT, ask for the unit number, and then display the bad sector table, as usual. Finally, it will display:

Enter CYLINDER for repeated test in HEX:

Enter the desired cylinder number in HEX and press {RETURN}. If the cylinder number you entered is invalid, the computer will display:

INVALID CYLINDER NUMBER!!

And you are returned to the DOS prompt. Remember to use a CYLINDER number, not a sector number from the bad sector table just displayed!

Once a valid cylinder number has been added, the computer will display:

Press {ESC} to STOP repeating the cylinder test.

Total CYLINDERS xxx(xxxxh)
CYLINDER xxx(xxxxh)

Where xxx is the cylinder number you requested.

If there are no bad sectors detected and you finally press {ESC}, the computer will respond with:

Completed
xxx Bad sectors in Table, xxx Available slots
No NEW bad sectors located.

And you are returned to the system prompt.

If bad sectors are detected, they are displayed on separate lines as shown earlier, and will be repeated if they are detected on each pass. The display will not stop until you press {ESC}, at which time the computer will display:

Completed
xxx Bad sectors in Table, xxx Available slots
No NEW bad sectors located.

or

Completed
xxx Bad sectors in Table, xxx Available slots
Bad sectors located. Tables modified.

Again, you are returned to the system prompt.

3.2.2 Control-C to Abort DETECT

You can exit from DETECT at any time by pressing {CTRL-C}. The computer will display:

User ABORT, Bad Sector Table not updated.

And you are returned to the system prompt.

3.2.3 Maximum Bad Sector Count Exceeded

If during the detection process, the number of bad sectors exceeds the capacity of the bad sector table, the computer will display:

Bad sector count exceeded for this drive.
Must format with "/V".
Continue with DETECT?

This gives you the option to continue DETECT, knowing that no additional bad sectors can be added to the table. Pressing {Y} will continue DETECT where it had left off; pressing {N} will cause the operation to stop and the computer will return you to the DOS prompt after displaying:

ABORTING DETECT!

NOTE: Upon completion of DETECT, FORMAT the affected partition(s) with the /v switch to lock out these additional bad sectors.

4 DETECT Followup Activities

After you use DETECT, the data stored on your hard disk will be intact, except for the data which was recorded over bad sectors. The bad sectors that DETECT found will not be made inaccessable until FORMAT is used on the partition(s) that contain the bad sectors.

When you use FORMAT on a partition that has been examined by DETECT, FORMAT will mark the Cluster associated with a bad sector table entry as "bad" in the FAT, forcing DOS to skip that unusable portion of the partition.

To ensure the safety of the data you have stored on your hard disk, perform the following sequence of activities as soon as possible after running DETECT:

1. Reset your computer and reboot using a floppy disk or hard disk partition other than the one just verified. (No partition will be accessible until you do.)

2. Use BACKUP to copy all files from the verified partition(s) onto floppy disks.

3. After you have backed up your files, execute FORMAT once for each partition on which bad sectors occurred.

4. After formatting, use RESTORE to return all backed up files to their appropriate partition(s).

See your MS-DOS documentation for information on BACKUP, FORMAT, and RESTORE commands.

5 DETECT Error Messages

In addition to the usual errors, such as "Drive Not Ready", others need additional explanation:

Bad sector count exceeded for this drive. Must format with "/V".

Cause: This message appears when the upper bound limit of 169 bad sectors has been exceeded. This could indicate a hardware malfunction, particularly if it occurs relatively quickly. The problem may be failure of the drive, controller card or data separator board. Also, recheck all cable connections and try reseating the controller card in its S-100 socket.

Cure: If this message appears, run DETECT again. If the error still occurs, BACKUP the files from all the Winchester's partitions and run PREP. If the error recurs after PREP is run, try replacing the drive, controller, and/or data separator board.

Bad command line switch. "DETECT ?" for valid switches.

Cause: You attempted to run DETECT with an invalid command line switch.

Cure: Invoke the Help screen to obtain the valid switch to use.

DETECT only runs on a Zenith Z-100 Machine!

Cause: You attempted to run DETECT on something other than an H/Z-100.

DOS/BIOS version ERROR.
You must use BIOS version 4.06, and DOS version 4.00.
The versions are displayed at boot time and with the VER command.

Cause: You attempted to run DETECT with an older version of DOS.

Cure: Make a new Z-DOS v4.06 Hard Drive Utilities floppy disk. Ensure all previous superceded software is removed from this working floppy disk.

Error - Can not read superblock A.

Cause: This message appears when a bad sector error has occurred in Superblock A in the Reserved Winchester Area.

Cure: This condition is self-correcting, in that if Superblock A is unusable, the backup copy of the superblock (Superblock B) will be used. It is advised, however, that you back up all files on the Winchester disk as soon as possible and then run PREP and PART again. Otherwise, if Superblock B becomes unreadable, all data on the hard disk drive will be inaccessible.

Error - Cannot Re-Direct DETECT to a file.

Cause: DETECT output is only sent to the display.

Error reading Software Boot Code on first Sectors.

Cause: This message appears when the boot code is not present on the specified partition or if the partition boot code has developed a bad sector.

Cure: When this message appears, boot up from another drive and run DETECT, BACKUP, FORMAT, and RESTORE on the affected partition. If the partition is completely inaccessible, you may need to run PREP.

Fatal Error - Can not read superblock B.

Cause: This message appears when a bad sector error has occurred in the backup copy of the superblock (Superblock B). Superblock A is also bad.

Cure: Run DETECT again. If the error recurs, you may have to run PREP.

Invalid HEX value, Try again:

Cause: This message appears when the bad sector address you entered was not a valid hexadecimal number or was out of the valid range of sector addresses.

Cure: Make certain you know the appropriate hexadecimal address and enter the correct value. Track 0 contains bad sector(s).

Drive probably Non-Bootable!

Cause: This message appears when a bad sector error has occurred in the Reserved Winchester Area of the disk. This could indicate a hardware malfunction.

Cure: If this error occurs, check all cable connections and try reseating the controller card in its S-100 socket. Run DETECT again. If the error still occurs, attempt to BACKUP the files from all the hard drive's partitions and run PREP.

Unable to communicate with the Z217 controller.

Cause: This message appears when DETECT is unable to locate the Z-217 Winchester Controller. This could indicate that the controller board is not firmly plugged into the S-100 bus, that the drive cable connectors are not securely fastened, or that there is a hardware malfunction on the controller board.

Cure: If this message appears, make sure that the controller card and all cable connectors are secure, and run DETECT again. If the error still occurs, then run PREP.

User ABORT, Bad Sector Table not updated.

Cause: The user has aborted DETECT using {CTRL-C}.

Z217 controller error on Set Drive Parameters command.

Cause: For some reason, one or more responses to the six drive characteristic questions in PREP are no longer valid for the particular drive connected or there is a malfunction of your hard drive.

Cure: After checking for a malfunctioning hard drive, run PREP and PART in sequence.

Z217 controller error, TIME OUT on EXECUTE command.
Z217 controller error, TIME OUT on STATUS command.

Cause: The Z-217 Winchester hard disk controller is reporting an error or there is a malfunction in the hard drive.

Cure: Recheck cable connections, reseat the hard drive controller, or try running the Winchester module of the disk-based diagnostics DIAG.

If you have any questions or comments, please email me at:
z100lifeline@swvagts.com

Cheers,

Steven W. Vagts