Western Digital Corporation

WD 1007 - WA 2

INSTALLATION NOTES

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WD1007A-WA2
User Guide

The WD1007A-WA2 controller is designed to interface with up to two ESDI compatible hard disk drives in an IBM PC AT or compatible system and up two 5-1/4 inch or 3-1/2 inch floppy disk drives.

The ESDI drives used with this controller generally have two modes of operation, soft sector and hard sector. At this time, the WD1007A-WA2 offers only the hard sector mode of operation.

There are two versions of the WD1007A-WA2 available. Feature 1 (F001) has the WD1007A BIOS which will allow low level formatting of ESDI type drives using DOS. The Feature 0 (F000) does not have the BIOS and will work with AT type systems which have ESDI parameters in the system BIOS or for use with the Novell operating system.

NOTE
DO NOT USE THE WD1007A-WA2 WITH MFM TYPE HARD DISK DRIVES
USE ONLY WITH ESDI HARD DISK DRIVES

Installation of the controller requires three steps: 1) verifying jumper settings; 2) installing into the host computer; 3) formatting the hard disk drives. To complete installation, you will need the following:

Two hard disk cables (3 if using 2 hard disk drives); ESDI hard disk drive; floppy drive cable (daisy-chain type cable if using two floppy drives);screwdriver; MSDOS Version 3.3 or later; WD1007A BIOS or WDFMT 2.10 formatting utility; FDISK (normally included with MSDOS).

Preparation of Controller

WARNING
HANDLE THE CONTROLLER BY THE ENDS OF THE BOARD
SOME OF THE CHIPS ARE STATIC SENSITIVE AND DAMAGE
MAY OCCUR IF THE BOARD IS INCORRECTLY HANDLED

Before you can install your WD1007A-WA2, you will need to be certain that the jumpers (small shorting plugs) are correctly set. Refer to Table 1 for correct jumper settings. Modification of factory jumper settings is rarely necessary. Modify jumpers only under the direction of a qualified individual; i.e. your dealer.

J U M P E R S E T T I N G S
Table 1

Jumper	Position	Function
W1	2-3	Standard: BIOS Address Select (C8000-09FFF)
W2	2-3	
W3	Jumper	Enables BIOS
W1	2-3	BIOS Address Select (CA000-CBFFF)
W2	1-2	
W3	Jumper	Enables BIOS
W1	1-2	BIOS Address Select (CC000-CDFFF)
W2	2-3	
W3	Jumper	Enables BIOS
W1	1-2	BIOS Address Select (CE000-CFFFF)
W2	1-2	
W3	Jumper	Enables BIOS
W4	No Jumper	Standard: Floppy Controller Enabled
W5	No Jumper	Standard: Single Spindle Speed Floppy Drive Selected (125 nanoseconds precompensation).
W5	Jumper	Dual Spindle Speed Floppy Drive Operation
W6	2-3	Standard: Floppy Address Select (3FX)
W6	1-2	Floppy Address Select (37X)
W7	1-2	Floppy Drive Select
W8	No Jumper	Standard: WD1007 Mode. Firmware forces a 10 MHz ESDI drive to 35 sectors per track when using the Set Unformatted Bytes per Sector command. This mode supports a 1:1 interleave.
W8	Jumper	Allows the WD1007A-WA2 to be used as a replacement board for the WD1005-WAH without reformatting the drive. The controller reads the Unformatted Bytes Per Sector from the drive.
W9	No Jumper	Standard: Chassis Ground Disconnected
W10	No Jumper	Standard: Digital Input Register Unlatched
W11	Jumper	Standard: Diskette Change Enable w/FDC Option

W12	No Jumper	Standard: Secondary Address Select (1FX)
W13	Uncut	Floppy Controller Enabled (Etch)
W14	No Jumper	Standard: Sector Translation Enabled Provides physical to logical translation**
W14	Jumper	Physical to logical translation disabled.
W15	No Jumper	Standard: 4 Bytes ECC
W15	Jumper	7 Bytes ECC

**Because some of the older operating systems can only recognize 17 sectors per track or a maximum of 1048 cylinders per drive, the WD1007A-WA2 provides a translation scheme so that ESDI hard disk drives with 34-36 sector mode operation can be fully utilized in a PC AT.

Hardware Installation

WARNING
MAKE SURE COMPUTER IS TURNED OFF
AND POWER IS DISCONNECTED

1. Verify that your host computer has a 200 watt power supply. If the disk drive(s) is(are) being installed internally, it is best to locate the controller in the nearest available expansion slot to the drive.

2. Remove the blank expansion slot bracket. Put the bracket away and save it for possible future use. The screw will be used to hold the new controller in place.

3. The terminating resistor must be present only on the last hard disk drive connected. If there are two drives, the terminating resistor must be present on the second drive. Verify proper setting of drive select switches for drive select 1 or 2. Refer to your system owner's manual for information about proper drive termination and select switches. Do not use the Radial Select Option on your drive.

4. Remove or disable any other floppy controller in your system when installing the WD1007A-WA2 controller card.

5. Attach 34-pin control connector pin 1 to J1 on the controller board. Make sure that Pin 1 of the cable connector goes to Pin 1 on the controller board. Pin 1 of the cable connector is typically located on the color coded side of the cable.

6. Connect control cable to drive (s).

7. Attach 20-pin data connector to J2 (Drive C or 0).

8. Attach 20-pin data connector to J3 (Drive D or 1).

9. Connect data cables to drives.

10. Attach the 34-pin daisy-chain cable to J4 Connector.

11. Connect the cable to the floppy drive(s).

12. Attach Winchester activity LED connector to J5.

13. Install controller board into the expansion slot. Make sure that the board is seated properly by pressing down on both ends of the board. Secure the board with the bracket screw.

CAUTION

WHEN ROUTING CABLES, BE CAREFUL NOT TO PINCH THEM. CABLES MUST NOT GET CAUGHT BETWEEN THE COVER AND THE BOARDS, NOR SHOULD THEY OBSTRUCT ANY AIR FLOW PATH FROM FANS OR VENTS.

WD1007A-WA2

CONFIGURING YOUR DRIVE

In order to use an ESDI drive in any system, you must perform the following three steps: Low-level formatting the drive using WDFMT, a third party software, or the WD1007A BIOS; perform active drive partitioning, using MSDOS 3.3 (FDISK) or other operating systems that allow partitioning, such as SCO XENIX; and, high-level formatting using the operating system's normal "Format C: (or D:)/S" command.

1. BIOS: There are two types of BIOS ROMs which may be used to configure ESDI drives using the WD1007A-WA2. The system BIOS refers to the BIOS on the computer motherboard. The system BIOS may only be used if it contains the exact physical drive parameters of your drive. Most of the older model system BIOS ROMs do not contain ESDI drive parameters. The best way to determine whether your particular system BIOS will support your ESDI drive is to contact your system manufacturer. If you determine that your system BIOS does support your ESDI drive, you may proceed to performing a low level format by using your operating system or the WDFORMAT utility.

The WD1007A-WA2 BIOS includes the drive parameters of most ESDI type drives. If you are using the WD1007A-WA2 BIOS, you may proceed to the low level formatting routine. You may elect to low level format with the WD1007A-WA2 BIOS or use the WDFORMAT utility. Both of these options are included under the System Installation.

System Installation

...WARNING.....WARNING.....WARNING...

THE FOLLOWING LOW-LEVEL FORMAT PROCEDURE
WILL DESTROY ALL DATA ON YOUR HARD DRIVE
BACK-UP THE DATA ON YOUR DRIVE BEFORE
CONTINUING WITH LOW LEVEL FORMAT ROUTINE

Before you can complete the low level formatting routine, you will need to know the parameters of your hard disk drives. As a convenience to you, we have included a list of the most common hard disk drives and their parameters. To access this list, return to the Storage Controller menu. If your drive is not listed, contact your drive manufacturer or consult your drive manual to determine drive type and parameters.

USING THE WD1007A-WA2 BIOS

1. Before using the BIOS, make sure the proper address range is selected on W1 and W2. Confirm that the BIOS is enabled (jumper on W3).

2. Enter the BIOS routine through the DOS DEBUG utility. Execute the DEBUG utility and at the program prompt "-" type:

G=C800:5 <CR>

Depending upon the settings of W1 and W2, this causes the system to execute proram code stored at location 5 in ROM. The BIOS then tries to read the parameter tables from the drive and store them in the shadow RAM. If the drive has not been formatted, the BIOS will return a message of "drive not initialized". You will see the following screen:

Western Digital 1007A-WA2 Initialization Utilities, Rev. 1.0

PRESENT DRIVE SETUP...+ or - to change. <ENTER for selection

DRIVE 0 CYLINDERS XXX HEADS XX PRECOMP CYLINDER XXX SPT XX

DRIVE 1 CYLINDERS XXX HEADS XX PRECOMP CYLINDER XXX SPT XX

```
Change Drive Types  --->1
Low Level Format    --->2
Surface Analysis    --->3
Verify Drive        --->4
Enter Defect List   --->5
Exit and Reboot     ---6
Enter Choice (1-6)  --->
```

3. To execute a function, simply enter the number of the desired routine. The BIOS wil execute that routine and then prompt you to press a key to return to the main menu. NOTE THAT ALL CHANGES MADE WHILE IN THE BIOS WILL ONLY BE FINALIZED AFTER A PROPER EXIT THROUGH FUNCTION 6.

a. Drive type routine

The drive types can be changed by using the "+" and "-" keys. Assuming that all the ESDI drives in question are specified at 34 sectors per track (SPT), there are four possible choices that can be implemented for a drive:

No drive present. The BIOS automatically selects a drive type 0 if there is no drive present. You will see the message "***NONE selected or no drive present!***" next to the drive number.

A selection with 17 sectors per track. Use this feature when the drive is being used in a system that does not recognize drives with sectors per track values other than 17 sectors per track. The low-level format will be at 35 sectors per track, while the parameter tables created will show 17 sectors per track (with translation enabled).

A selection with 34 sectors per track. Use this feature if the system recognizes the standard 34 sectors per track drive.

A selection with 63 sectors per track. Use this feature only when the drive in question has more than 1024 cylinders. Translation should always be enabled when such a condition exists. Translation provides full use of all the cylinders of the drive, even though most types of AT BIOS recognize only a maximum of 1024 cylinders.

b. Low Level Format Routine

Formatting routines are present to do the low-level initialization of the disk surface. The drive is formatted at 35 sectors per track. Transparent to the user, the routine formats with a sector skew and also formats a spare sector on each track. The surface analysis routines use the spare sector when reallocating a bad sector on a track. It is also used to store the parameter information generated by the BIOS. This information is written to the spare sector on the cylinder 0, head 0. The sector skew, which is fixed at two, allows the controller to maintain a 1:1 interleave across all head boundaries. Sector skewing is a method of formatting in which the sector numbers are rotated in the interleave table for each track.

c. Surface Analysis Routine

The surface analysis routine identifies bad tracks on the drive and, in the event that there is only one bad sector on the track (and it is NOT sector zero), it uses the alternate sector when reformatting the track. This prevents the controller from identifying the track as "bad", providing that you have entered the manufacturer's list of "bad tracks" prior to performing this routine.

d. Verify Drive Routine

The verify routine identifies all the bad tracks on the drive and lists them by head and cylinder number. Use the FDISK and FORMAT utilities to prepare the drive.

e. Enter Defect List Routine

This routine allows you to enter the list of bad tracks as listed by the drive manufacturer on the drive.

4. If using a 5 Mbit per second ESDI drive, disable the 1007A translation feature (install jumper W8 and W14). This type of ESDI drive is always configured at 17 sectors per track.

6. Partition your hard disk drives by following the partitioning instructions with your operating system.

7. Complete high-level format routine using the "Format C: (or D:)/S" command in your operating system.

LOW LEVEL FORMAT

USING WDFMT UTILITY

Western Digital provides a low-level format utility that allows you to prepare the drive for use by the system. You may elect to use this utility to perform the low-level formatting routine, if your system BIOS supports ESDI type drives. The program includes routines for low-level formatting, disk verify, surface analysis and bad track entry. When using the 1007A board, use a 1:1 interleave, a skew of 2, and format the drive at 35 sectors per track with an alternate sector. WDFMT 2.10 presents the following display:

```
***Western Digital Corporation***
AT Disk Format Utility
Rev. 2.10

Current drive parameters are:

Drive (0/1)      :    0
Cylinders        :    615
Heads            :    4
Sectors          :    17
Interleave       :    3
Precomp          :    306
Skew             :    0
Alt Sector       :    No

ENTER MENU CHOICE

Format disk   CAUTION this will destroy all data on drive!
Verify disk
Bad sector entry
Surface test  CAUTION this will destroy all data on drive!
Quit
```

SECTOR SKEWING

Sector skewing is a method of formatting a drive by which sector numbers are rotated in the interleave table each time a new head on a cylinder is formatted. Selecting a skew of 2 causes the first sector after index on Head 0 to be identified as Sector 1. The sector identified as Sector 1 on Head 1 is the third physical sector from index as shown in the following example:
Ten sectors per track with a skew of 2 and 1:1 interleave:

Head	Sector Numbers									
0	1	2	3	4	5	6	7	8	9	10
1	9	10	1	2	3	4	5	6	7	8
2	7	8	9	10	1	2	3	4	5	6

This formatting procedure allows the controller to maintain 1:1 interleave when reading across the head boundary. This becomes critical when the number of sectors per track increases and the time allowed for completion of overhead functions decreases. By changing the sector numbers, the controller has enough time to complete needed tasks and be ready to read the ID field of the first sector on the next head.

The minimum sector skew factor for proper performance of the WD1007A is 2. Different applications may require different skew factors to optimize performance.

SPARE SECTOR

WDFMT 2.10 also provides the ability to format a spare sector on the track. This spare sector is identified as Sector 0, making it invisible to the system BIOS which expects sector numbers starting at 1. This sector is always formatted as the last physical sector on the track. The surface analysis portion of WDFMT uses the spare sector if an error is encountered with any sector on a track. The program reformats the track, numbering the bad sector as zero and shifting the following sectors one to the right. If more than one sector is bad, the entire track is marked as bad when reformatted.

This feature is useful since many sustem BIOS ROMs support ESDI drives that have 34 sectors per track. The spare sector option causes the drive to look like it has only 34 sectors while providing a spare sector for bad sector reassignment. Software drivers can also make it possible to utilize the spare sector for storing custom data.

Partition your hard disk drives by following the partitioning instructions with your operating system. Complete high-level format routine using the "Format C: (or D:)/S" command in your operating system.

Troubleshooting

Problem: 1790 Disk 0 Error.

Cause: No low level format on hard disk.
Wrong drive type selected.
Not enough drive power.
Bad cables.
Improper drive selection or termination.

Problem: Drive does not partition.

Cause: Check drive types. Note that drive types for the AT and AT-compatibles differ.

Problem: "Error Reading Fixed Disk" appears when booting from hard drive.

Cause: DOS partition not active.

Problem: Winchester activity LED continuously lit.

Cause: No problem. Drive LED selected for latched mode.

Problem: For systems with two drives, both Winchester activity LEDs light at the same time.

Cause: Improper drive selection or termination. Inspect the drive cables. If the data cables are straight, then set drive C's drive select switches for drive select 1 and drive D's drive select switches for drive select 2. If the data cables have a twist, set both drives' select switches for drive select 2. Consult your drive manuals or dealer for drive switch settings. Finally, under no circumstances, use twisted floppy cables for the Winchester drive. Floppy and Winchester drive interface connections differ significantly.

Problem: Slow and inefficient operation.

Cause: The typical cause for this problem is an incorrect interleave factor. Therefore, some experimentation with the interleave factor may be necessary. (Refer to the format instructions for setting interleave factor). Interleave factors are very dependent on the host operating system and application.