HPT370 RAID Controller Guide

Index

MN-171-2K0-39
Rev. 2.00

1. Introduction of RAID

Thank you for purchasing ABIT's latest motherboard with RAID function. Please read this guide as a reference for setting up the RAID BIOS and installing the driver software of this motherboard. This motherboard uses the HighPoint 370 controller which allows for RAID.

1-1. What is RAID?

RAID (Redundant Array of Inexpensive/Independent Disks) technology was developed to offer a combination of outstanding data availability, excellent performance, and high capacity that one single disk drive can not meet up with. A RAID array is defined as two or more disks grouped together to appear as one single device to the host system, which can tolerate the failure of a drive without losing data, and which can operate independently from each other.

To manage MTBF (Mean Time Between Failures) and prevent any single drive failure causing data loss within an array, UC Berkeley scientists proposed five types of redundant array architectures, defining them as RAID levels 1 through 5. Each RAID level has its own strengths and weaknesses, and is well

suited for certain types of applications and computing environments. RAID 1, RAID 3 and RAID 5 of these five types are commonly used. RAID 2 and RAID 4 do not offer any significant advantages over these other types. RAID 3 is designed for single-user or data-intensive environments, such as imaging or data acquisition that access extremely large sequential records. This leaves RAID 1 and RAID 5 as the RAID levels is applicable for networked and transaction processing-based environments utilizing NetWare, Windows NT, Unix, and OS/2.

In addition to these five redundant array architectures, it has become popular to refer to a non-redundant array of disk drives as RAID 0 array.

1-2. Why RAID?

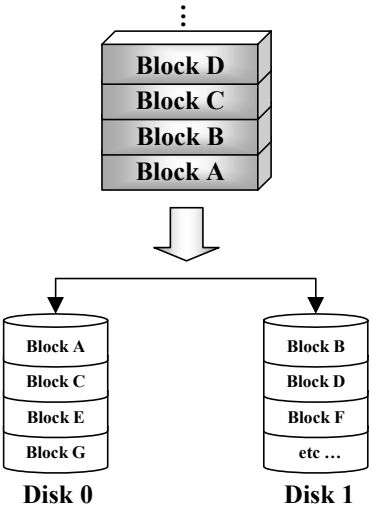
Data security is a very important issue for system administrators. They have to adopt efficient methods of data protection to guard against potential losses due to drive failures. Tape-based backups are used to be one solution for data security, but this method is becoming a task more difficult. Slow, cumbersome tape backup solutions lose their effectiveness for servers and workstations.

RAID technology is another solution for data security. There are a number of factors responsible for the growing adoption of arrays for critical network storage. Because today's applications create larger files, the need for network storage has proportionately increased. To accommodate expanding storage requirements, users are adding disk drives --- raising the probability of drive failures. In addition, the development of CPU speed has exceeded data transfer rates to storage media, causing I/O bottlenecks for networking application.

RAID technology overcomes these challenges by providing a combination of outstanding data availability, extraordinary and highly scalable performance, as well as high capacity. RAID provides real-time data rebuild when a disk drive fails, increasing system uptime and network availability, while protecting against the loss of data. Multiple drives working together also increases system performance.

1-3. The RAID levels

RAID Level 0:

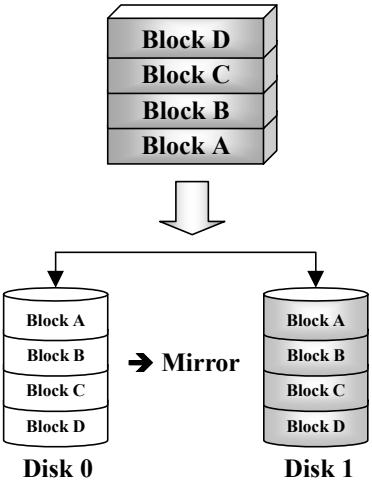


Striped Disk Array without Fault Tolerance

RAID 0 is typically defined as a non-redundant collection of striped disk drives. It doesn't provide data protection but it offers very high data throughput, especially for large files.

RAID 0 does not deliver any fault tolerance. All data is lost if any drive in the array fails. It is intended for non-critical data requiring high performance. Simply put, RAID 0 splits the information in two, with half of the information going to each hard disk. Thus, performance is quickened by this approach.

RAID Level 1



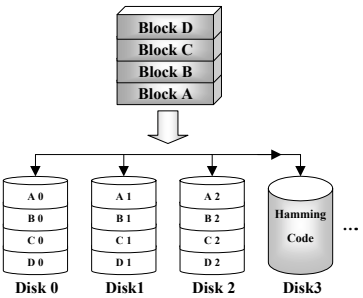
Mirroring and Duplexing

RAID 1 provides 100% redundancy by mirroring one drive to another one. In the event of a disk drive failure, the array controller will automatically switch the read/write activity to another drive.

Each individual drive can execute simultaneous read operations. Mirroring thus doubles the read performance of a single drive and leaves the write performance unchanged.

RAID 1 is a good entry-level redundant system, since only two drives are required. However, the cost of RAID 1 is higher because one drive has to be used to store duplicate data.

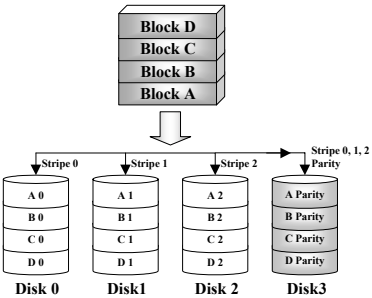
RAID Level 2



Disk Striping with error-correction code (ECC)

RAID 2, which uses Hamming error correction codes, is intended for use with drives which do not have built-in error detection. Because the check method of Hamming code is very complicated, and more than one drive is required to store ECC information, RAID 2 offers no significant advantages over RAID 3.

RAID Level 3

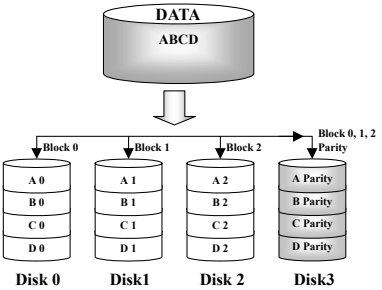


Parallel transfer with parity

RAID 3 uses a separate drive to store parity and stripes data on a byte-by-byte basis across all of the data disks in the array.

Because each I/O accesses all drives in the array, RAID 3 does not support multiple, simultaneous read/write requests. It is optimized for large, sequential data requests.

RAID Level 4

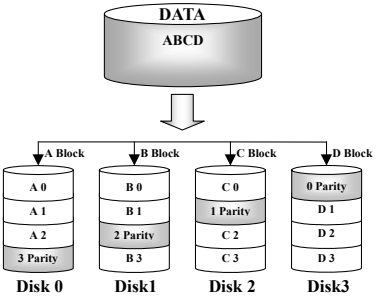


Independent Data disks with shared parity disk

RAID 4 is identical to RAID 3 except the block level stripes are used.

RAID 4 supports multiple simultaneous read requests. However, since all write operations require that parity data to be updated each time, they can not be overlapped. And so the RAID 4 offers no significant advantages over RAID5.

RAID Level 5



Independent Data disks with distributed parity blocks

RAID 5 also stripes data at a block level across several drives. But it distributes parity among the drives, this avoids the write bottleneck caused by the single dedicated parity drive. Each drive takes turns storing parity information for a different series of stripes. RAID 5 can execute read/write to disk drives either in parallel or independently.

1-4. Which RAID level should I use?

Many different disk array configurations are possible, depending on end-user requirements and the goals of the manufacturer. Each controller design has a different functionality to accomplish specific performance and data availability goals. Therefore, no individual RAID level is inherently superior to any other. Each of the five array architectures is well suited for certain types of applications and computing environments. The follow table summarizes the strengths and weaknesses of each RAID level.

RAID Level	Min. No. of Drives	Description	Characteristics / Strengths	Weaknesses
RAID 0	2	• Striped Disk Array without Fault Tolerance	• Highest I/O Performance • Very simple design • Easy to implement	• No redundancy One drive fails, all data is lost
RAID 1	2	• Mirroring and Duplexing	• 100% redundancy of data • Twice the Read transaction rate of a single disk, same Write transaction rate as single a disk • Simplest RAID storage subsystem design	• High redundancy cost overhead

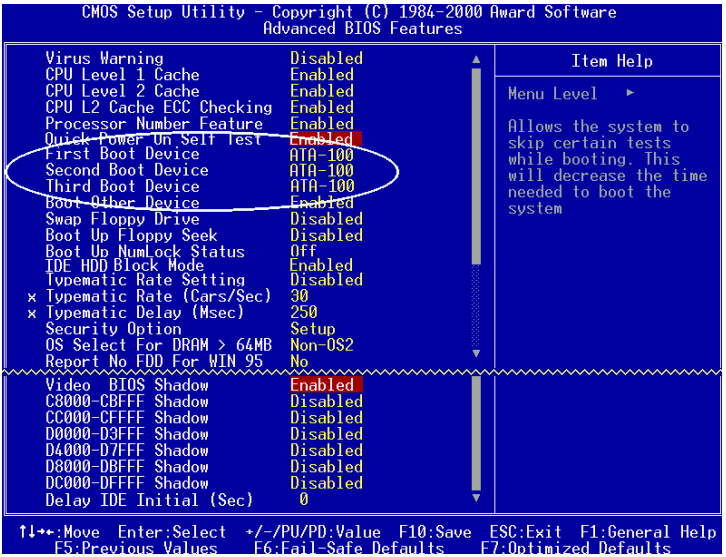
RAID 2	Not used in LAN	• Disk Striping with error-correction code (ECC)	• Previously used for RAM error environments correction (known as Hamming Code) and in disk drives before the use of embedded error correction	• No practical use
RAID 3	3	• Parallel transfer with parity	• Very high Read data transfer rate • Very high Write data transfer rate • Excellent performance for large, sequential data requests • Low ratio of ECC (Parity) disks to data disks means high efficiency	• Doesn't support multiple, simultaneous Read and Write requests • Transaction rate equal to that of a single disk drive at best (if spindles are synchronized)
RAID 4	3	• Independent Data disks with shared parity disk	• Very high Read data transaction rate • High aggregate Read transfer rate • Low ratio of ECC (Parity) disks to data disks means high efficiency	• Worst Write transaction rate and Write aggregate transfer rate •
RAID 5	3	• Independent Data disks with distributed parity blocks	• Highest Read data transaction rate • Medium Write data transaction rate • Best cost/performance for transaction-oriented networks • Supports multiple, simultaneous Read and Write • Low ratio of ECC (Parity) disks to data disks means high efficiency	• Write performance is slower than RAID 0 or RAID1

2. The features of RAID on this motherboard

This motherboard supports Striping (RAID 0), Mirroring (RAID 1), or Striping/Mirroring (RAID 0+1) operation. For the striping operation, the identical drives can read and write data in parallel to increase performance. The Mirroring operation creates a complete backup of your files. Striping with Mirroring operation offers both high read/write performance and fault tolerance although requiring 4 hard disks in order to do so.

2-1. Setting up RAID on this motherboard

Enter Advanced BIOS Features in the BIOS setup. Change the settings of First Boot Device, Second Boot Device and Third Boot Device to read ATA – 100. See the figure below:



2-2. The BIOS setting menu

Reboot your system. Press <CTRL> and <H> key while booting up the system to enter the BIOS setting menu. The main menu of BIOS Setting Utility appears as shown below:

To select the option in the menu, you may:

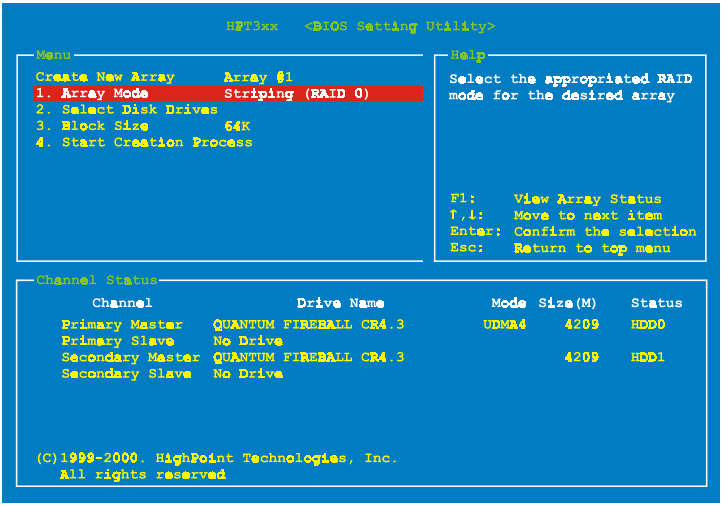
- Press **F1** to view array status.

- Press ↑ ↓ (up, down arrow) to choose the option you want to confirm or to modify.
- Press **Enter** to confirm the selection.
- Press **Esc** to return to top menu.

Create RAID

This item allows you to create a RAID array.

After you had selected the function you want in the main menus, you may press the <Enter> key to enter the sub menu as shown below:



Array Mode:

This item allows you to select the appropriate RAID mode for the desired array. There are four modes to choose.

- ***Striping (RAID 0):*** This item is recommended for high performance usage. Requires at least 2 disks.
- ***Mirror (RAID 1):*** This item is recommended for data security usage. Requires at least 2 disks.
- ***Striping and Mirror (RAID 0+1):*** This item is recommended for data security and high performance usage. Allows Mirroring with a Strip Array.
- ***Span (JBOD):*** This item is recommended for high capacity without redundancy or performance features usage. Requires at least 2 disks.

Select Disk Drives:

This item allows you to select the disk drives to be used with the RAID array.

Block Size:

This item allows you to select the block size of the RAID array. There are five options: 4K, 8K, 16K, 32K, and 64K.

Start Creation Process:

After you have made your selection, choose this item and press <Enter> to start creation.

Delete RAID

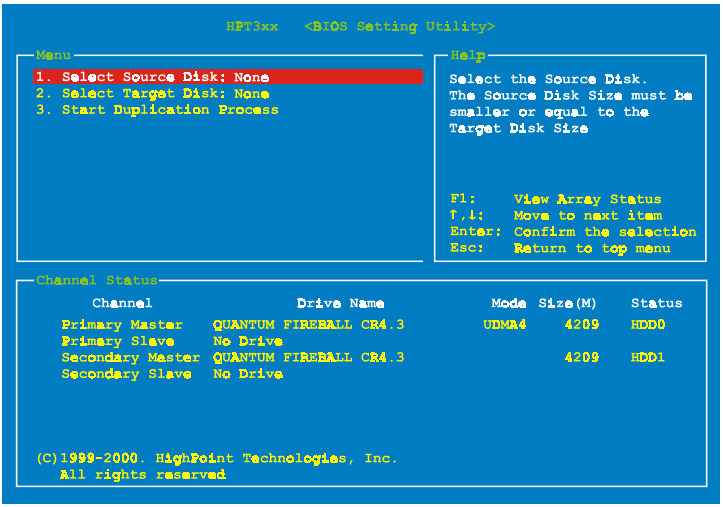
This item allows you to remove a RAID Array.

Note: After you have made and confirmed this selection, all the data stored in the hard disk will be lost!

Duplicate Mirror Disk

This item allows you to select the disk you wish to duplicate in preparation for a "Mirror Disk Array".

After you have selected the function you want in the main menu, you may press the <Enter> key to enter the sub menu as shown below:



- ***Select Source Disk:*** This item is to select the source disk. The size of source disk must be smaller or equal to the one of target disk.
- ***Select Target Disk:*** This item is to select the target disk. The size of target disk must be greater or equal to the one of source disk.
- ***Start Duplicating Process:*** After you had selected this item, the BIOS setting will take up to 30 minutes to run the duplication. Please wait or you may press <Esc> to cancel.

Create Spare Disk

This item allows you to select the disk to be used as a spare for a Mirror Disk Array.

Remove Spare Disk

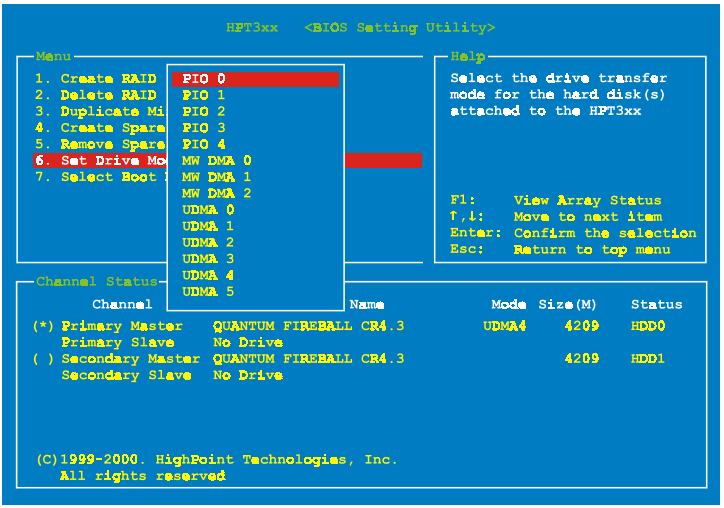
This item allows you to remove the spare disk from a Mirror Disk Array.

Set Drive Mode

This item allows you to select the drive transfer mode for the hard disk(s).

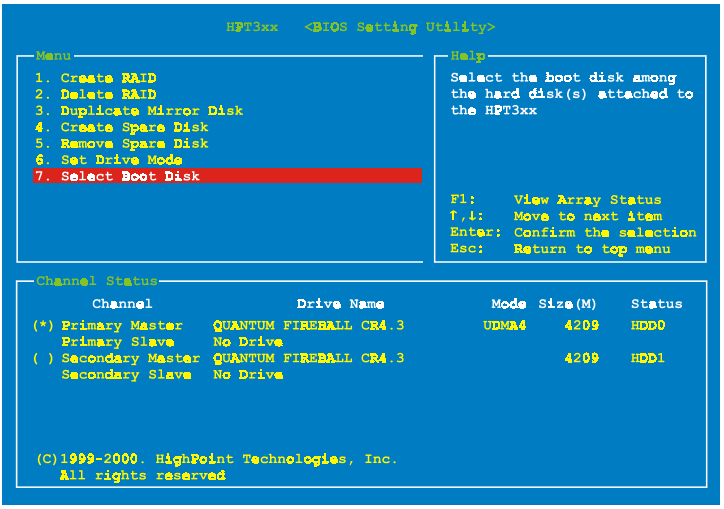
Use the up/down arrow to select the menu option to "Set Drive Mode" and press <Enter>. In the Channel

Status, select the channel you would like to set and press <Enter>, there will comes out an asterisk mark in the parentheses indicating that the channel selection had be done. Choose the mode from the pop-up menu. You can choose from PIO 0 ~ 4, MW DMA 0 ~ 2, and UDMA 0 ~ 5.



Select Boot Disk

This item allows you to select the boot disk among the hard disk(s).



Use the up/down arrow to select the menu option to “Select Boot Disk” and press <Enter>. In the Channel Status, select the channel you would like to set as bootable disk and press <Enter>, there will comes out an asterisk mark in the parentheses indicating that the channel selection had be done.

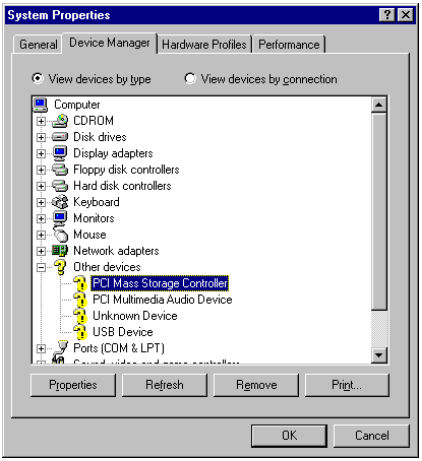
3. Software installation

Here we will show you the driver installation procedure under various operating systems.

3-1. DOS

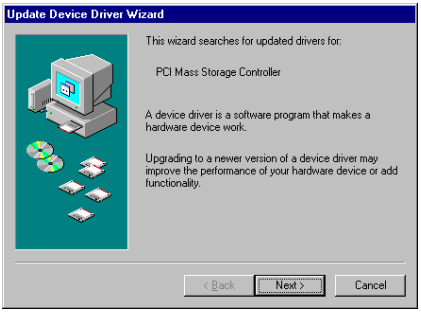
This IDE RAID card BIOS supports DOS 5.x (or above) and Windows 3.1x without the software driver.

3-2. Windows 9x

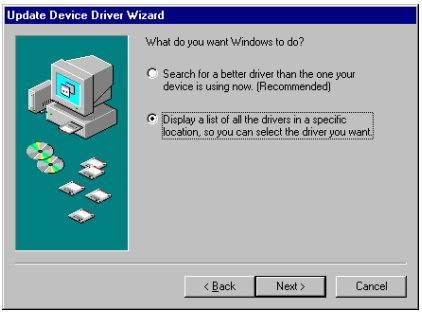


Step 1: After the Windows 9x operating system had been installed and rebooted successfully, go to the "Control Panel" ➔ "System Properties" ➔ "Device Manager". You can see the driver is not yet installed, and there is a device of "? PCI Mass Storage Controller" under "Other devices".

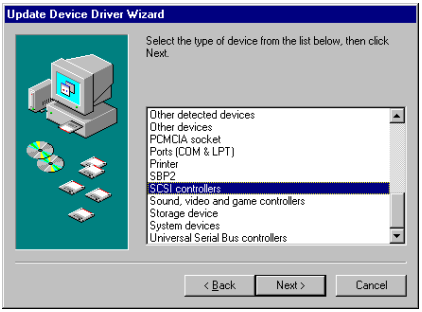
Step 2: Click right button of your mouse on the "? PCI Mass Storage Controller", and then go to "Driver" tab. Click "Update Driver" to go to next step.



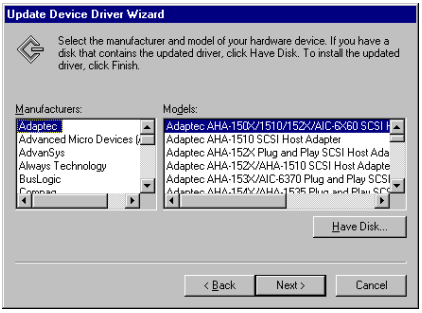
Step 3: The wizard is going to install the PCI Mass Storage Controller. Click "Next >" to go to next step.



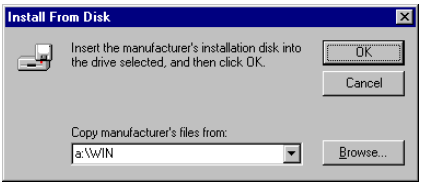
Step 4: Choose "Display a list of all the drivers in a specific location…" and click "Next >" to go on.



Step 5: Choose "SCSI controllers" and click "Next >" to go on.

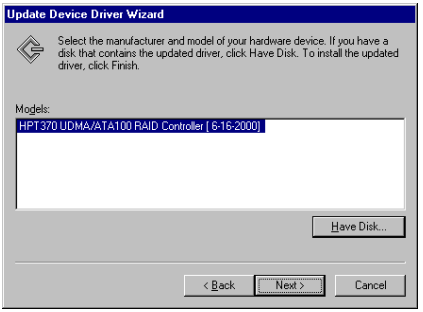


Step 6: Click "Have Disk…" to go on.



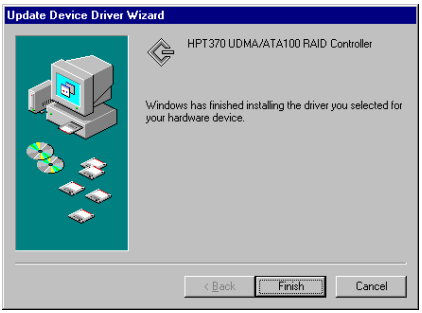
Step 7: Insert the driver disk and type the path in the text box "a:\WIN" ("a:\" is your floppy drive letter), or "E:\Drivers\hpt370\Win9x" (E:\ is your CD-ROM drive letter).

Click "OK" to go on.

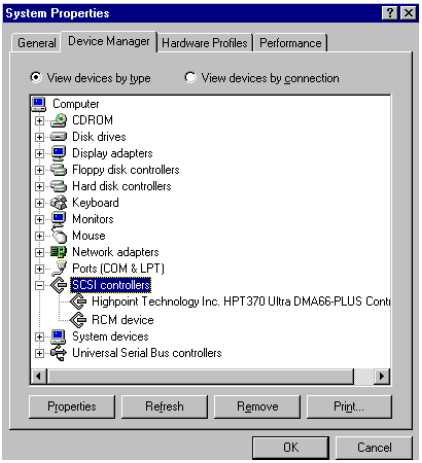


Step 8: Choose "HPT370 UDMA/ATA100 RAID Controller" and click "Next >" to go on.

Step 9: Windows is now ready to install the driver. Click "Next >" to go on.



Step 10: Windows has finished installing the driver. Click "Finish" to end the installation.



Step 11: After rebooting the system, go to the "Control Panel" ➔ "System Properties" ➔ "Device Manager". Now you can see the driver is installed under the item of "SCSI controllers".

3-3. Windows NT 4.0

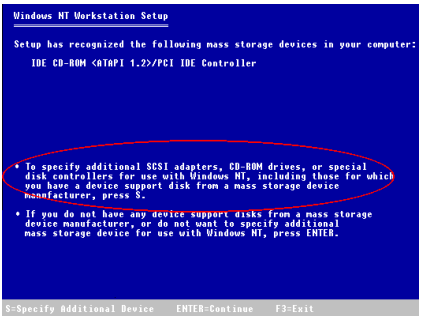
Before you start to install Windows NT 4.0, you have to create a driver disk for the Hot Rod 100 Pro. You can copy the Ultra ATA/100 driver files from the CD-Title that comes with this motherboard. The path for the Ultra DMA/100 driver files is "E:\drivers\hpt370\winnt (E is your CD-ROM drive letter)."

Please note two things before you copy the driver files to diskette. Firstly, the driver files must be copied to the root directory of the diskette. Secondly, you have to set your system to "Show all files". Otherwise you will be unable to copy some important system files to diskette.

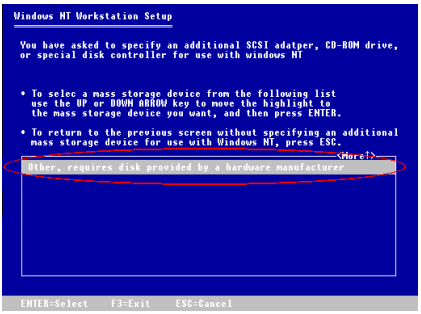
Installing drivers during Windows NT installation:

If the NT 4.0 is first installed on the ATA100 drive, please follow the following installation procedure:

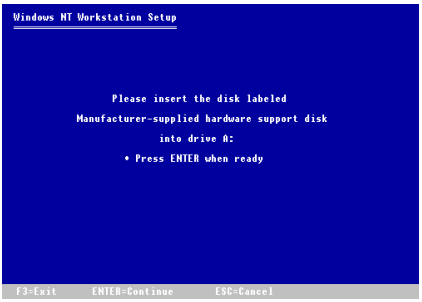
Step 1: Set your system to boot from "**Drive A**" and then insert the Windows NT installation diskette 1/3. Power on your computer.



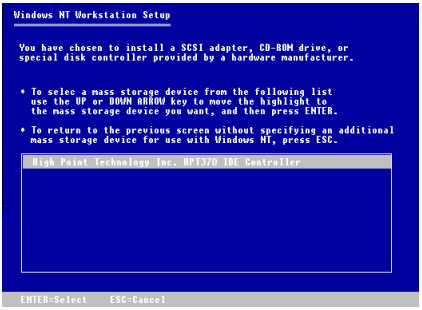
Step 2: The setup program will display a message about installing mass storage devices (see figure left) while you install NT4.0. Please press "**S**" to install the hpt370 driver



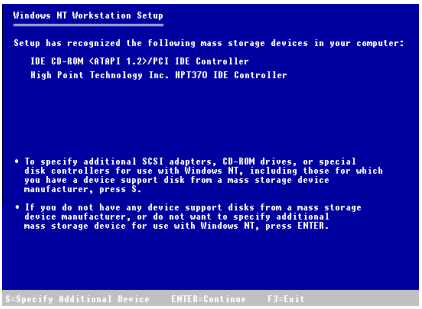
Step 3: Select "Other, requires disk provided by a hardware manufacturer", and then press <ENTER>.



Step 4: Insert the driver disk into drive A and press <ENTER>.

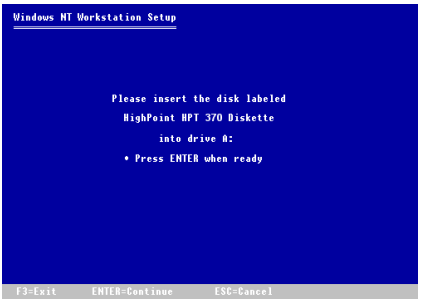


Step 5: Use the UP or DOWN arrow key to move the highlight to the mass storage device you want and press <ENTER> to continue setup.



Step 6: Windows NT setup has recognized this HPT 370 IDE RAID controller

Press <ENTER> to continue setup.

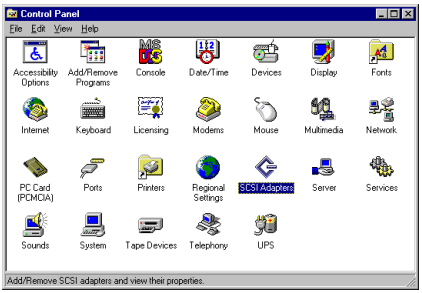


Step 7: After you configure your hard disk and specify the installation path, the NT setup will ask you to insert this HPT 370 IDE RAID controller driver disk into drive A again. Insert the driver disk, and then press <ENTER> to continue setup.

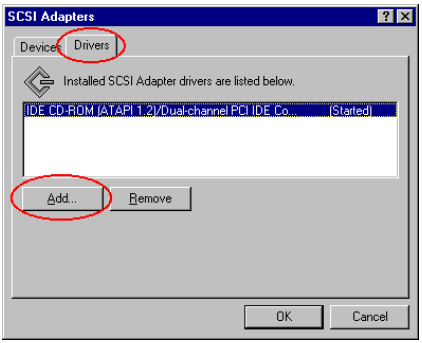
If you have followed the steps described above, you should be finished installing your HPT 370 controller. For the rest of Windows NT installation steps, please follow the instructions displayed in the NT setup program.

Installing drivers with existing Windows NT:

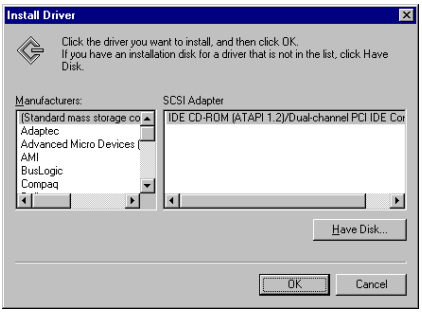
If there is an existing NT 4.0 file system, you can install the HPT 370 IDE RAID controller into the existing system by the following procedure:



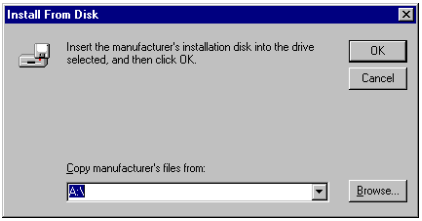
Step 1: Go to “Control Panel”, and then enter “SCSI Adapters”.



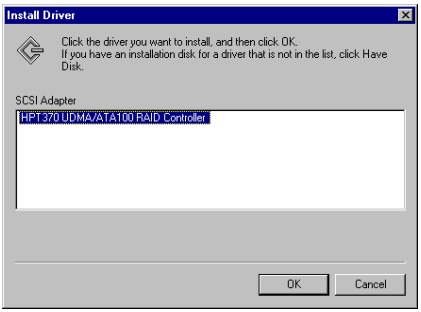
Step 2: Select "Drivers", and then click "Add…".



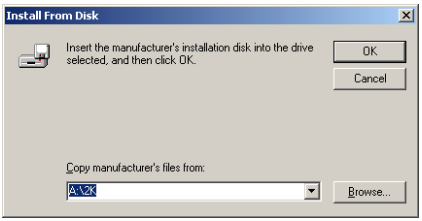
Step 3: Click "Have Disk…" to go on.



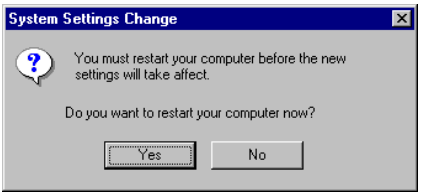
Step 4: Insert this HPT 370 IDE RAID controller driver disk into drive A, and then click "OK."



Step 5: Click "OK" to go on.



Step 6: Insert the driver disk and type the path in the text box "A:\nt" ("a:\" is your floppy drive letter), or "E:\Drivers\hpt370\NT" (E:\ is your CD-ROM drive letter).



Step 7: Click "Yes" to restart your computer.

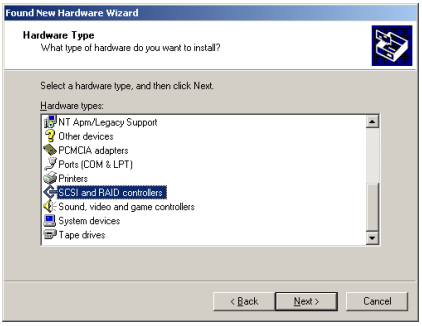
3-4. Windows 2000

If you want to install the Windows 2000 operating system on the hard drive utilizing the HPT 370 controller, please refer to the NT4.0 installation procedure. The following procedure is used only when you don't want to install the Windows 2000 operating system onto the hard drive utilizing the HPT 370 controller.

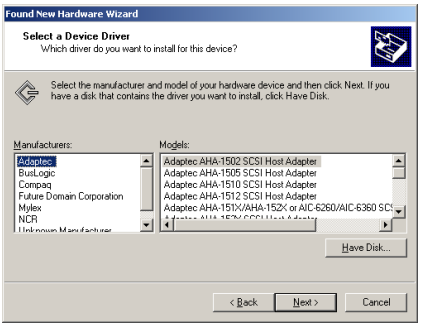
Step 1: Reboot the system. Windows will detect the new hardware automatically.

Click "Next>" to go to the next step.

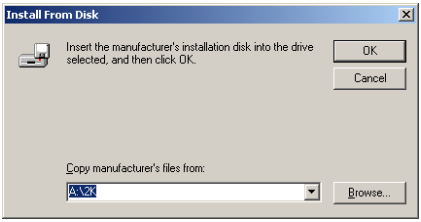
Step 2: Choose "Display a list of all the drivers in a specific location…" and click "Next >" to go on.



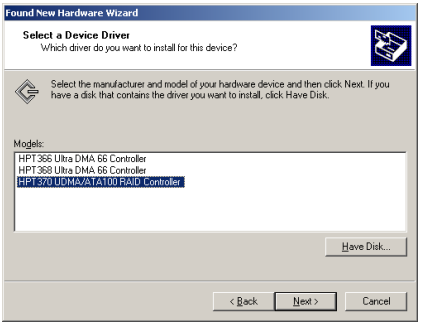
Step 3: Choose "SCSI and RAID controllers" and click "Next >" to go on.



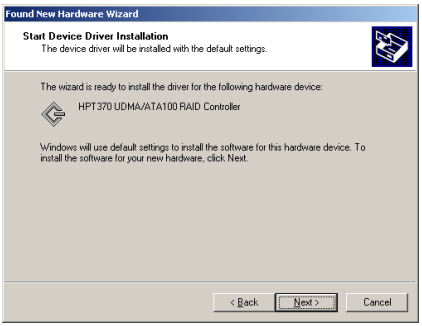
Step 4: Click "Have Disk…" to go on.



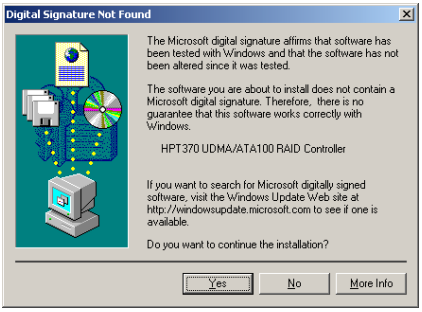
Step 5: Insert the driver disk that comes with the Hot Rod 100 Pro and type the path in the text box "A:\2K" ("a:\" is your floppy drive letter), or "E:\Drivers\hpt370\2k" (E:\ is your CD-ROM drive letter).



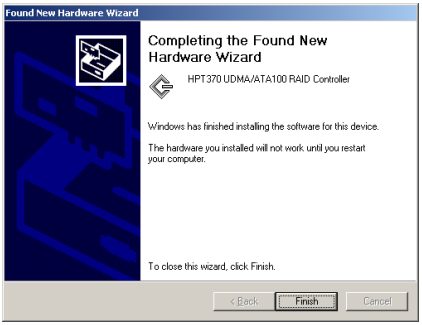
Step 6: Choose "HPT370 UDMA/ATA100 RAID Controller" and click "Next >" to go on.



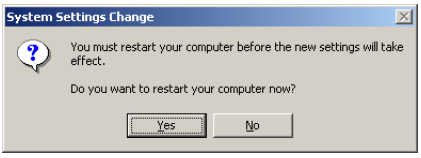
Step 7: Windows is now ready to install the driver. Click "Next >" to go on.



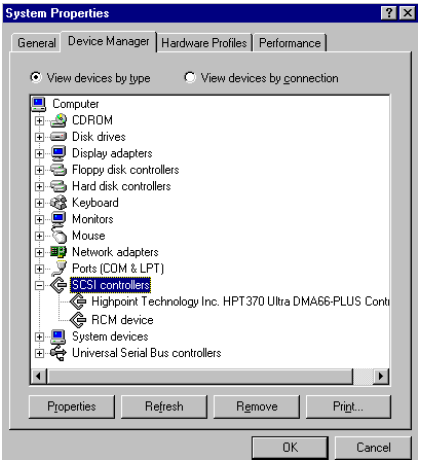
Step 8: Click "Yes >" to go on.



Step 9: Windows has finished installing the driver. Click "Finish" to end the installation.



Step 10: Click "Yes" to restart the system.



Step 11: Go to the "Control Panel" ➔ "System Properties" ➔ "Device Manager". Now you can see the driver is installed under the item of "SCSI and RAID controllers".