HDClone 4.3

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Manual

HDClone 4.3

User's Manual

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1   Introduction

Thank you very much for choosing HDClone. It is our expressed goal to offer a product, that fully meets your requirements and expectations. In case of having suggestions or not being satisfied with the software, we kindly ask you send your suggestions and criticism to feedback@miray.de.

1.1   Chapter overview

1 Introduction: Offers general information about this manual and the program. Particularly, it contains an overview of the available editions and their abilities.

2 Fields of application: By supporting physical copies, HDClone is suitable for many different areas of application. Here you find descriptions and hints for the most common areas of application of the program.

3 Supported hardware: In this chapter, you find a list of supported controllers and media as well as information about which aspects to consider when using certain types of controllers or media.

4 Installation: For using HDClone, you can install it as a normal Windows program and/or create a bootable medium This chapter describes how this can be done within few minutes, using the installation package.

5 Program instructions: This chapter contains the actual manual for operating HDClone. It is a step-by-step description of how to operate the program for creating a copy with HDClone.

6 Operating principles: Here you find useful descriptions and hints for gaining optimal performance when using HDClone with different types of media as each media type can have its very own characteristics.

7 Troubleshooting: In case you encounter any problems when using HDClone, you find detailed descriptions and support here. By means of these information you will be able to solve or bypass occurring problems in most cases.

8 Miray Virtual Disk: The HDClone software package includes the Miray Virtual Disk application. With this software you can mount file images as virtual drives.

9 Miscellaneous: In the last chapter you find miscellaneous information, particularly regarding our support and HDClone licensing terms.

1.2   Character conventions

In this manual, keys on the keyboard are printed with a gray background, for example **Esc** for the escape key or **Return** for the return key. Some keys are represented by a corresponding symbol, e.g. **t** for the 'up'-key. Visual controls on the screen, particularly buttons are represented by brackets ([and]) and semi-bold type, e.g. [next], [back].

1.3   Features

HDClone lets you make physical and logical 1:1 copies (clones) as well as physical and logical file images of hard disks and partitions. Physical 1:1 copies ensure, that the copy is sector-by-sector 100% identical with the source. This allows HDClone to create copies or file images of hard disks regardless of the respective partitioning scheme, the used file system and the installed operating system(s). Thus HDClone is especially suitable for the tasks described in ▸ 2 **Fields of application** as well as for many other tasks.

> **Note:** The physical copying process of HDClone for exact (bit-wise) 1:1 copies and 1:1 images makes it suitable for many areas of application. HDClone's features make it a valuable tool, even in special and extraordinary scenarios.

1.4   Edition overview

There are different editions of HDClone. They differ from each other by the amount of features they offer, particularly supported device types, performance and special options. The following table offers you a comparative overview of the editions and their features. Subsequent, there are short explanations referring to some of the topics listed in the table.

> **Note:** Within the table the following abbreviations are used to identify the different editions: **FE** = Free | **BE** = Basic | **SE** = Standard | **PE** = Professional | **EE** = Enterprise

	FE	BE	SE	PE	EE
Device support					
IDE/ATA/SATA hard disks [1]	●	●	●	●	●
AHCI (SATA II)	●	●	●	●	●
USB (UHCI, OHCI, EHCI)	●	●	●	●	●
Hard disks > 2048 GB (2 TB) [2]	○	●	●	●	●

	FE	BE	SE	PE	EE
USB 3.0 (XHCI)	○	○	●	●	●
Firewire / IEEE1394 (OHCI)	○	○	○	●	●
SCSI hard disks [3]	○	○	○	●	●
Copy modes [4]					
Drive copy	●	●	●	●	●
Partition copy	○	●	●	●	●
SmartCopy	○	○	●	●	●
PartitionSelect	○	○	●	●	●
MultiCopy (4x, 8x, 16x)	○	○	○	○	●
File images					
Physical images	●	●	●	●	●
Logical images (SmartImage)	○	○	●	●	●
Compressed images	○	○	●	●	●
Password protected images	○	○	●	●	●
Securely encrypted images	○	○	○	●	●
QuickCompress, StrongCompress	○	○	○	●	●
RAW images	○	○	○	●	●
Dynamic VMDK & VHD images	○	○	○	●	●
Special modes [5]					
HotCopy	●	●	●	●	●
Up-sizing (NTFS, FAT, ext2-ext4)	●	●	●	●	●
Down-sizing (NTFS, FAT)	○	●	●	●	●
LiveImage	○	●	●	●	●
SafeRescue mode	○	●	●	●	●
Defragmentation (NTFS, FAT)	○	○	●	●	●
Verification mode	○	○	●	●	●
Advanced Format / 4K conversion	○	○	○	●	●
Command line interface	○	○	○	●	●
FastCopy mode	○	○	○	●	●
Storing a clone report	○	○	○	●	●
Copying speed [6]					
Maximum speed in MB per sec.	30	50	60	100+	1000+
Miray Virtual Disk					
Virtual volumes	○	1	1	7	7
File image management	○	1	1	●	●
Persistent virtual disks	○	○	○	●	●

	FE	BE	SE	PE	EE
Virtual volumes @ TrueSpeed [7]	○	○	○	●	●
Mounting VMDK & VHD images	○	○	○	●	●
License scope [8]					
Private use	●	●	●	●	●
Professionals/corporations	○	○	●	●	●
Technician license	○	○	○	●	●

[1] **SATA hard disks:** Have to be connected to a SATA controller supported by HDClone and the controller has to be configured correspondingly (▶ 3.3.2 SATA/SATA-II controllers).

[2] **Hard disks > 2048 GB:** HDClone supports hard disks above 2048 GB (2 Terabytes) from the Professional Edition on.

[3] **SCSI hard disks:** Have to be connected to one of the SCSI host adapters supported by HDClone (▶ 3.4 SCSI).

[4] **Copying modes:** You find further information regarding the different modes in chapter ▶ 6 Operating principles.
  • **Drive copy:** Allows to make a copy of entire drives.
  • **Partition copy:** Allows to make a copy of single partitions.
  • **SmartCopy:** Creates a logical 1:1 copy, usually faster by a multiple (▶ 6.1.2 SmartCopy).
  • **MultiCopy:** Mass-copying to up to 4/8/16 targets at a time, multiplying transfer ratio according to the Enterprise Edition used (4x/8x/16x) (▶ 6.5 MultiCopy).

[5] **Special modes:** Increased copying speed (FastCopy), data integrity and safety (verification, SafeRescue), use within Windows at runtime (HotCopy, LiveImage). Further information to be found in chapter ▶ 5.8 Selecting the options.

[6] **Copying speed:** Due to technical differences between the individual editions, there is an upper limit for the actually achievable copy speed of each edition.
  > 100 MB/sec: Up to 133 MB/sec. using Ultra-DMA 6, up to 300 MB/sec. using SATA II.
  > 1000 MB/sec: Mass-copying to up to 16 targets at a time.

[7] **Virtual volumes @ TrueSpeed:** Use of RAW images at almost hardware speed.

[8] **License scope:** See also chapter ▶ 9.1 Terms of license.

2   Fields of application

HDClone is specialized on creating physical copies. Therefore HDClone offers particular advantages for copying resp. rescuing defective media (▸ 2.2 **Data rescue**). In addition, HDClone is able to work independent from partitioning scheme, file system and operating system. This allows to copy entire operating system installations (▸ 2.1 **Upgrading hard disks & migrating an OS**) or to be able to create an exact copy in case of unknown/proprietary file systems (▸ 2.6 **Proprietary hard disk formats**). Altogether, HDClone covers a wide spectrum of possible applications by its universal copying technology. In the following you find descriptions of the most common areas of application of HDClone. The individual chapters contain instructions as well as further advice regarding accomplishment of the respective application.

> **Hint:** HDClone allows you to copy data arbitrarily between all types of media recognized, particularly between different types of drives.

2.1   Upgrading hard disks & migrating an OS

Since HDClone works independent of file system formats and operating systems, you can use it to migrate entire installations, including the installed operating system, to another hard disk. This is especially useful if you want to migrate an existing installation to a new hard disk without having to install the operating system and applications again. For this type of application, the ▸ 6.1.3 **Drive-to-drive** mode is most suitable. Use the **PartitionSelect** feature (▸ 6.6 **PartitionSelect**) to choose individual partitions to be cloned.

> **Note:** Please take care to have only one hard disk connected after completing the copy and before starting the operating system. It should be plugged to the same channel as the original. Hence, either remove the copy or connect it instead of the original medium.

2.1.1   Unused disk space

Free disk space on the target medium can be converted into a partition and used as an additional drive from within Windows by using the **fdisk** tool or the Windows Computer Management (**C:\WINDOWS\system32\compmgmt.msc**).

2.1.2 Smaller target medium

In general, you can also copy from a larger to a smaller medium. For NTFS and FAT file systems, HDClone can perform downsizing automatically. For other file systems, you may downsize the partitions on the source medium before cloning, using appropriate third-party tools before cloning.

2.2   Data rescue

In case of hard disks with defective areas it is especially important, that they are being rescued to an intact medium before starting any recovery attempts. Otherwise, depending on the kind of defect, the recovery procedure may cause further defects resulting from the inherent exposure of this procedure. Of course, using HDClone also cases exposure for the hard disk. But the physical copying causes much less exposure than any other usage due to its linear operation, i.e. only continuous movement of the disk's heads. Furthermore, the option SafeRescue (▸ 5.8.8 Advanced options) is able to reduce exposure to an absolute minimum. In very critical cases, you can also just copy single partitions to reduce exposure for the medium even more (▸ 6.1.4 Partition-to-partition). After having rescued the data from the defective hard disk, you can perform a recovery on the (functional) target medium without having to fear any further damages.

> **Note:** Only a physical copy allows to rescue all of the data (except irrecoverable areas), even if there are logical errors resulting from defective areas. For this reason, **never** use SmartCopy mode (▸ 6.1.2 SmartCopy) for rescuing data.

> **Hint:** Alternatively, you may create a RAW image or a physical image. You then can restore the image to another hard disk later or perform the recovery directly on the image by mounting it as a virtual drive using Miray Virtual Disk (▸ 8 Miray Virtual Disk).

2.3   Installation backup

HDClone can also create a local backup of an entire system installation. If required, a simple restore from the backup partition brings the system installation back into its original state – without any dead freight, faulty program installations, viruses etc. For this purpose, create an unused partition in addition to the system partition of at least the same size to serve as a backup partition. Then create a file image and restore the original system from that image when needed.

> **Note:** Before restoring from the backup partition, save your work files and other data from the system partition or store them somewhere else, since they otherwise will be overwritten.

2.4   Mass copying

HDClone Enterprise Edition is specially designed for creating up to 16 copies at a time. This makes it especially suitable for industrial duplication of pre-installed software (e.g. on hard disks or on CompactFlash media etc.) or for creating several identical operating system installations (▸ 2.5 Master installations)

2.5   Master installations

HDClone is also suitable for duplicating (deployment) system installations (▸ 2.4 Mass copying). Copy an entire master hard disk or master partition to the target medium to create a complete installation there and to have it ready for action.

> **Note:** When duplicating Windows XP, we recommend to run **sysprep** (included in Windows) before cloning. Further information is to be found at Microsoft at http://www.microsoft.com, search for ‚sysprep'.

2.6   Proprietary hard disk formats

HDClone is capable of copying arbitrary hard disk formats. Especially for hard disks installed in proprietary systems (e.g. studio technology, medical technology etc.) there are often no programs besides system software, which can read the data on these media. HDClone can rescue this data or moving it to a new medium without any problem. The best way is to copy the original medium to a target medium of the same or larger size. A target medium smaller than the original medium should not be used, as it cannot be assured, that all relevant user data will be transferred in this case.

> **Note:** In case of unknown or proprietary (non-standardized) formats, always copy the entire original medium. You should only use the mode ▸ 6.1.4 Partition-to-partition if you know for sure that the partitions are reported correctly.

2.7   Forensic data safekeeping

HDClone is also very suitable for safekeeping data for forensic purposes, as really all data from a hard disk is copied, including data, that has possibly been hidden or deleted. This data cannot be reached any more via the usual file system mechanisms. Therefore it will be useful to create a copy in drive-to-drive mode (▸ 6.1.3 Drive-to-drive) or a RAW image (▸ 6.2 Size differences) before performing a detailed forensic analysis of secured media. This allows you to make changes to the copy during analysis without altering and thus endangering the original content of the medium.

> **Note:** When backing up data for forensic safekeeping, hidden and deleted files can be located anywhere on the medium, it is always required to create a copy of the entire medium to a target medium of the same or larger size. **Never** use SmartCopy mode (▸ 6.1.2 SmartCopy) for this type of application.

2.8   Image files

In HDClone, working with physical and logical images follows the same basic logic as physical and logical copies, which are performed directly from medium to medium. File images offer the following advantages:

- Simple storing and managing in your file system
- Optional compression for minimum space required
- Password protection and AES encryption to protect data
- Distributing without physical media via networks and the Internet
- Accessing individual files via virtual drives (▸ 8 Miray Virtual Disk)
- Use with virtual machines (▸ 6.7.4 Dynamic VMDK and VHD images)

> **Example:** To rescue a defective hard disk, you may create a physical (!) image (▸ 6.1.3 Drive-to-drive) instead of a physical 1:1 copy (▸ 6.2 Size differences). In both cases, a bit-wise identical clone of the master hard disk will be created.

2.9   HotCopy & LiveImage

HDClone supports creating clones or images of a Windows drive while Windows is working - even of the Windows system partition itself. To use this feature, it is not necessary to take certain steps. When using HDClone/W, the appropriate mechanisms for using HotCopy and LiveImage will be activated automatically.

3   Supported hardware

This section contains detailed information about the hardware and hardware standards supported by HDClone. Furthermore, there are special references to be found regarding the usage of certain device types.

3.1   Overview

Subsequent, you find a listing of the hardware requirements concerning the hardware used to run HDClone as well as additionally supported devices.

> **Note:** The devices listed below represents the entire spectrum of hardware supported by HDClone. Which of them can be used with a certain edition is listed in ▶ **1.4 Edition overview**.

3.1.1   Hardware requirements

○ PC 80586 or higher, 500 MHz, 128 MB RAM, VGA (optimal: VESA support)

○ Keyboard & mouse: PS/2 or USB

○ Bootable floppy or CD drive or bootable USB medium

3.1.2   Supported media

○ Under Windows (HDClone/W):
   any mass storage media supported by Windows

○ DE/ATA hard disks, CompactFlash via IDE [1]

○ SATA hard disks (internal & external)

○ SCSI hard disks (internal & external)

○ USB hard disks (internal & external)

○ Firewire hard disks (internal & external)

○ USB keys [2], CompactFlash I [3], CompactFlash II [3], MicroDrive [3], SD/MMC [3]

○ xD-Picture Card [3], Memory Stick [3], Memory Stick PRO [3], Memory Stick DUO [3]

[1] CompactFlash media with TrueIDE support
[2] Must support the USB-Mass-Storage-Class protocol
[3] Via an appropriate USB card reader

3.1.3   Supported controllers

○ **Under Windows (HDClone/W):** any controller supported by Windows

○ PCI-IDE controller and Bus Master IDE controller

○ PCI-SCSI host adapter (▸ 3.4.2 Compatibility)

○ SATA controller with IDE interface (▸ 3.3.2 SATA/SATA-II controllers)

○ SATA-II controller with AHCI interface (▸ 3.3.2 SATA/SATA-II controllers)

○ USB UHCI & OHCI controller (USB 1.1)

○ USB EHCI controller (USB 2.0)

○ USB XHCI controller (USB 3.0)

○ IEEE1394 OHCI controller (Firewire)

3.2   Compatibility

HDClone has been developed for the hardware listed in ▸ 3.1 Overview and tested on a large number of devices. HDClone also works well with many other devices. Please use the HDClone Free Edition to easily check out in advance and for free whether the device in question is supported (▸ 3.2.1 Compatibility test).

3.2.1   Compatibility test

You can use the Free Edition of HDClone to find out easily if your hard disks, other media as well as the associated controllers are supported properly, even if a higher edition is required to use them with HDClone. For this purpose, simply start HDClone Free Edition on the respective PC, chose a drive-to-drive copy and click on [Next]. All drives displayed there as well as the associated controllers have been recognized by HDClone and are supported by one of the available editions. Which edition will be necessary to utilize a certain device type can be seen from the info box at the right side of the list box when you select the regarding drive (▸ 5.7.4 Drive information).

> **Note:** Please ensure that you connect the needed USB devices before starting the program to ensure that they are recognized correctly (▸ 5.1 Preliminary steps).

3.2.2   Standards

To be able to support as many devices as possible, HDClone implements the effective standards for the appropriate device types. Device support in HDClone primarily refers to the standards applicable to the appropriate device type. In

addition, we perform extensive tests with each device type. Those test also reveal that there is a number of devices, which themselves implement their respective standard only insufficiently or even inaccurately. Furthermore, it is possible that some problems occur in certain hardware configurations, usually in certain combinations of controller and device. If possible, HDClone tries to support even such devices and to bypass the any hardware deficiencies. However, these kinds of problems can not always be bypassed. Hence even extensive tests cannot completely prevent that a problem appears in your special hardware configuration. In most cases this can be solved by setting the options appropriately (▶ 5.8 Selecting the options and ▶ 7 Troubleshooting). In case of even this does not work, our support team (▶ 9.5 Support) will be there to assist you with solving the problem.

3.3   IDE/ATA/SATA

Generally, HDClone supports IDE/ATA/SATA hard disks. A necessary precondition is to have them connected to one of the IDE/ATA/SATA controllers supported by HDClone (▶ 3.3.1 IDE/ATA controllers and ▶ 3.3.2 SATA/SATA-II controllers).

3.3.1   IDE/ATA controllers

HDClone supports standard IDE controller (ISA) and PCI IDE controller. These may be (internal) onboard controllers as well as (external) PCI/ISA adapter cards. In case of ISA/Standard IDE controllers, the first two channels are scanned for hard disks. HDClone recognizes available PCI IDE controllers automatically and scans them for connected hard disks.

> **Note:** If there are one or more PCI IDE controllers available in the system, ISA controllers that are possibly present, too, will not be taken into account and drives connected to them will not be listed.

HDClone supporting PCI IDE controllers refers to a standardized programming interface, which is supported by a large majority of IDE controllers. See ▶ 3.2.1 Compatibility test about how to check if your PCI controller complies with PCI IDE standard.

3.3.2   SATA/SATA-II controllers

Precondition for the support of SATA drives is an SATA controller with IDE interface or an SATA II controller with AHCI interface. All popular chipsets from Intel with ICH-5/-6/-7 incorporate such an IDE-compatible SATA controller. Regrettably, many other SATA controllers only offer a proprietary programming interface. Nevertheless, it may be possible in case of onboard SATA controllers to activate

a compatibility mode in BIOS setup, which would allow HDClone to access the SATA controller. As for SATA II controllers, many models already implement the AHCI interface supported by HDClone.

> **Hint:** With HDClone Free Edition you can easily check out if your SATA or SATA-II controller is supported (▶ 3.2.1 Compatibility test). Connect at least one SATA drive and start HDClone. If the SATA drive is recognized, HDClone also supports the associated SATA/SATA-II controller.

> **Note:** It might be necessary to adjust the SATA settings in BIOS. As mode of operation, IDE, ATA, compatible or AHCI should be chosen, but in no case RAID or SATA. Additionally it may be necessary to set the controller configuration to combined, especially for allowing simultaneous use of IDE and SATA hard disks. In this case there are only ports 0 and 2 or 1 and 3 available for SATA. Please connect the SATA hard disks correspondingly in this case.

3.3.3   Multiword DMA and Ultra-DMA

HDClone automatically recognizes and uses bus master IDE controllers, which allow data rates up to 133 MB/sec resp. 7.8 GB/min. Hereby, Multiword DMA (up to 16.7 MB/sec) as well as Ultra-DMA (UDMA) are supported. This can increase achievable data transmission rates by a multiple higher of the rates that can be achieved without DMA (in PIO mode). HDClone recognizes automatically whether controller and hard disk support DMA and then automatically selects the fastest usable mode (Multiword DMA or Ultra-DMA 33/66/100/133).

> **Note:** Please take into account that both, hard disk and IDE controller have to support a certain DMA mode. If the actual speed does not match the technical data of a hard disk, the reason may be that the IDE controller only supports lower modes. Furthermore, the achievable values also depend on the physical abilities of the hard disk, i.e. a hard disk with UDMA-6 (theoretically 133 MB/sec.) currently achieves an actual transfer rate of about 90 MB/sec.

3.3.4   Bus master IDE controllers

Precondition for using DMA mode is that the attached PCI IDE controller also supports the Bus master IDE standard. Whether your PCI IDE controller supports Bus master IDE can be determined by means of the program PCISniffer, which can be downloaded for free at http://www.miray.de/download/sat.pcisniffer.html. The field ‚Classcode' in PCISniffer has to contain the value 01018x (x = arbitrary) for the respective PCI IDE controller.

Note: For using Bus master IDE, the settings and initializations made in and by the PC's system BIOS play a major role. In case of problems with utilizing DMA, it is likely that certain BIOS settings have to be accommodated correspondingly (▸ **7.4.3 Problems with DMA**).

3.3.5   Speed

The speed DMA can achieve always depends on the physical abilities of a hard disk. The rough classification below shows the approximate speed to be expected from a certain drive type:

Type	Age	Speed
Older drives	About 5-10 years	About 5-30 MB/sec
Newer drives	About 2-5 years	About 30-60 MB/sec.
Top models	About 0-2 years	About 60-120 MB/sec and more
SSDs	About 0-2 years	About 90-200 MB/sec and more

3.4   SCSI

If your edition of HDClone supports SCSI hard disks, the following chapters provide important information on utilizing and compatibility of SCSI devices.

Note: Since HDClone embeds original driver code of the hardware manufacturers, there no influence on actual compatibility. The following information is based on specifications of the manufacturer.

3.4.1   Utilization

You can use HDClone with SCSI hard disk in the same way as with any other media. HDClone automatically recognizes supported SCSI controllers and connected SCSI hard disks at program start and displays them, along with other recognized media, in the respective selection lists.

Note: You can copy data from SCSI hard disks to other media types (▸ **2 Fields of application**). This is important for the purpose of data rescue or if there is no SCSI target medium at hand, as any arbitrary medium can be used for (temporarily) storing the regarding data.

3.4.2   Compatibility

Generally, HDClone supports SCSI hard disk drives. As a precondition, they have to be connected to a SCSI controller HDClone supports. Currently, HDClone supports Narrow-, Wide-, Ultra- and Ultra-Wide-SCSI controllers from Adaptec.

Hint: Use the Free Edition to determine whether your SCSI controller is supported (▸ 3.2.1 Compatibility test). If HDClone recognizes the SCSI drive, HDClone will also support the SCSI controller.

3.4.3   Manufacturer information

The drivers integrated in HDClone support the following SCSI adapters:

AHA-2930U   AHA-2940 Ultra   AHA-2940UW   AHA-2940AU
AHA-2944UW   ASC-19160   ASC-29160   ASC-29160LP
ASC-29160N   ASC-39160

3.4.4   Driver information

HDClone supports even more controllers, either as onboard chipset (AIC) or as addon card (AHA, ASC). They are determinable by their respective vendor and device IDs which are listed in the following table.

Vendor	Model	Device	Vendor	Model	Device
9004h	AHA-2930U	3860h	"	AHA-4944UW	8678h
"	AHA-2930CVAR	3868h	"	AIC-7887	8778h
"	"	3869h	"	AIC-7888	8878h
"	AHA-4944(U)W	3B78h	"	AHA-4944(U)W	EC78h
"	AIC-755x	5x75h	9005h	AHA-2940/50U2W	0010h
"	AIC-785x	5x78h	"	AIC-789x	001xh
"	AIC-7560	6075h	"	"	002xh
"	AIC-786x	6x78h	"	"	003xh
"	AIC-7870	7078h	"	AHA-3940/50U2x	0050h
"	AHA-2940(W)	7178h	"	AHA-3950 U2x	0051h
"	AHA-3940(W)	7278h	"	AIC-7896/7 U2	005Fh
"	AHA-2944	7478h	"	AIC-789x	006xh
"	AHA-3944(W)	7578h	"	"	007xh
"	AHA-4944(U)W	7678h	"	AIC-7892(A|B)U160	008xh
"	AIC-7877	7778h	"	AIC-789x	009xh
"	AIC-7860	7860h	"	"	00Axh
"	AIC-7895	7895h	"	"	00Bxh
"	AIC-7880	8078h	"	AIC-7899(A) U160	00Cxh
"	AHA-2940U(W)	8178h	"	AIC-789x	00Dxh
"	AHA-3940U(W)(D)	8278h	"	"	00Exh
"	AHA-2944UW	8478h	"	"	00Fxh
"	AHA-3944U(WD)	8578h	"	AHA-2930U2	0180h

The IDs of your controller can be determined by PCISniffer. It can be downloaded for free at http://www.miray.de/download/sat.pcisniffer.html. For the SCSI controller in question, the values displayed by PCISniffer for the fields Vendor ID and Device ID have to match the values specified above for your SCSI controller.

3.5   USB

The following chapters contain information regarding utilization and compatibility of USB storage media and controllers.

> **Note:** Please take care to connect USB devices already before starting HDClone (▶ 5.1 Preliminary steps) and if possible directly to the PC or to the USB controller addon card (▶ 3.5.4 Hubs).

3.5.1   Mass-Storage-Class

USB storage media to be used with HDClone has to support the USB-Mass-Storage-Class protocol, an official standard supported by almost all current USB sticks, card readers, hard disks etc. If you are not sure if a certain USB storage medium is supported, proof it using the Free Edition (▶ 3.2.1 Compatibility test).

3.5.2   UHCI, OHCI and EHCI

In case of USB devices, it is crucial that HDClone supports the USB controller used. HDClone is capable of all three common USB standards, UHCI and OHCI for USB 1.0/1.1, EHCI for USB 2.0 as well as XHCI for USB 3.0. In the area of standard PCs, all current USB controllers, onboard controllers as well as adapter cards, offer one of these three interface standards. In case you are not sure though, you can use HDClone Free Edition to check (▶ 3.2.1 Compatibility test).

3.5.3   XHCI

HDClone also supports the new XHCI standard. Therefore it is able to use fast, USB 3.0 SuperSpeed technology mass storage media of the latest generation.

3.5.4   Hubs

USB devices are sometimes connected via a USB hub. For achieving the highest possible transfer rate, you should connect USB disks directly to the PC's USB port.

3.6   Firewire (IEEE1394)

If your edition of HDClone supports Firewire, you can connect arbitrary Firewire drives or card readers. Connected devices must support the Serial-Bus-Protocol (SBP) in order to be recognized and operated correctly by HDClone.

> **Note:** Please take care to connect Firewire devices already before starting HDClone (▶ 5.1 Preliminary steps) and if possible directly to the PC or to the Firewire controller.

4   Installation

4.1   Introduction

HDClone can be started without an installation directly in Windows or without the presence of an operating system as a self-booting application from CD, floppy disk or USB key (▶ **4.1.1 Bootable medium**). Additionally, there is a setup program for installing HDClone in Windows (▶ **4.2.1 HDClone Setup**).

4.1.1   Bootable medium

In case you have HDClone already available on a bootable medium, you can start and use the program immediately on any PC and without any preceding installation, as described in chapter ▶ **5.2 Starting the program**.

> **Note:** It is possible that, although you have HDClone on a physical medium, it may not be in form of a bootable medium but rather as an installation package. Create a bootable medium at first, according to the following description (▶ **4.1.2 Software package**).

4.1.2   Software package

As far as you do not receive HDClone on a bootable medium, you can create one by yourself. The software package contains the required files. The following chapters describe how to create a bootable medium. It then can be used to start HDClone on any PC without any further installation (▶ **5.2 Starting the program**).

4.1.3   Miray Virtual Disk

Some editions of HDClone also contain the software ▶ **8 Miray Virtual Disk** an application to mount file images as virtual Windows drives. Miray Virtual Disk will be installed automatically during HDClone setup. In case you do not want to have it installed, please deselect it in the first installation screen (▶ fig. 1).
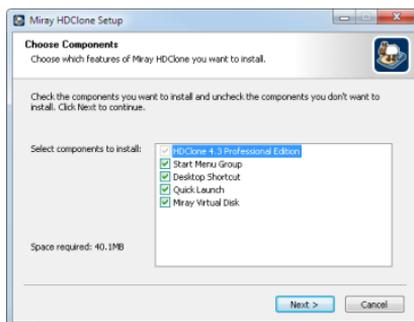
fig. 1: HDClone setup start screen

4.2   Installation in Windows

The HDClone software package contains a setup program (**setup.exe**), allowing you to install HDClone directly on Windows into a program folder. This will – by choice of the user – also create an Start menu folder as well as links on your desktop and in the Quickstart bar (▶ **4.2.1 HDClone Setup**).

The HDClone software package also contains an installation program for creating a bootable floppy disk or CD/DVD with only few mouse clicks (▶ **4.2.2 Boot-Setup & boot media**). To use the boot setup program, please run **setup.exe** first. Then start **[All Programs]** ▶ **[HDClone]** ▶ **[Create bootable medium]** in the Windows Start menu.

> **Note:** Alternatively, in case you have a software package in the ZIP file format, you may extract all files to an empty folder. Then execute the file **setup.exe** from there.

4.2.1   HDClone Setup

Start **setup.exe** (▶ fig. **1**) and select the desired options on the first screen. Then follow the instructions displayed to install HDClone on your Windows PC. After setup has finished, you are asked in the final screen to choose whether to start HDClone directly.

> **Note:** HDClone Setup also will install the software **Miray Virtual Disk**, as far as you did not deselect it on the first screen. This will also include a software driver to be installed. For this reason, a Windows dialog window regarding driver installation (▶ fig. **2**) may appear during setup. Confirm it with **[Continue Anyway]**. In case Windows will display the Found New Hardware Wizard (▶ fig. **3**), close it with **[Cancel]**.

fig. 2: Hardware Installation dialog

fig. 3: Hardware Wizard dialog

> **Note:** If you received HDClone on a physical medium, you may addition-
> ally use **setup.exe** to install HDClone on Windows. A software package in
> the ZIP file format has to be un-zipped first. In case you have download-
> ed the **setup.exe** file (selfextracting), please start it directly.

4.2.2   Boot-Setup & boot media

When starting the Boot-Setup program, the main window appears (▸ **fig. 4**).

○ If you want to create a bootable floppy, choose the drive at **Floppy drive** and click on **[Create floppy]**.

○ For a bootable CD/DVD, select the desired drive under **CD/DVD writer** and click on **[Create CD/DVD]**.

○ To create a bootable USB key, choose the desired drive at **USB me-dium** and click on **[Make bootable]**.

Follow the instructions and wait until the has finished. Then click on **[Exit]**. Continue at ▸ **5 Program instructions**.

fig. 4: HDClone boot setup

> **Note:** When creating a CD/DVD, please always use a new, empty
> writeable CD/DVD. Otherwise there may be problems when starting
> HDClone.

4.2.2.1   CD/DVD writer not selectable

In few cases, no drive is offered for selection at **CD/DVD writer** although a CD/DVD writer is available on the system. Usually, this results from already installed software for the CD/DVD writer (e.g. drivers for direct access to the CD/DVD writer with Windows Explorer). It reserves the drive in a way that the installation program cannot access it. If possible, deactivate or uninstall the CD/DVD writer software. Or create a bootable CD/DVD from that ISO image, which is also con-tained in the software package (▸ **4.3.2 Creating a bootable CD/DVD**).

4.2.3   Bootable Windows XP CD

When using HDClone with storage devices or controllers, which require special

Windows drivers, it has to be used directly on Windows. If there is no Windows installation available, you can create a bootable Windows XP CD which includes the drivers needed. It just requires PE Builder and a Windows XP installation CD.

Please download PE Builder from the Internet at http://www.nu2.nu/pebuilder/. The downloaded package allows you to create a specially configured Windows XP system, which can be started right off a CD. A plug-in is used to integrate HDClone into the PE system. A corresponding plug-in is to be found at http://www.miray.de/public/support/HDClone-BartPE-Plugin.en.zip. Please install PE Builder on your system and unpack the plug-in to the folder pebuilder3110a\plugin. This location

fig. 5: PE Builder configuration dialog

then should contain the new folder HDClone. Now copy hdclone.exe from the installation package to pebuilder3110a\plugin\HDClone\files. In case the mass storage devices and controller on your target system will require special drivers, please copy the driver files to pebuilder3110a\drivers\SCSIAdapter.

Then start pebuilder.exe from the folder pebuilder3110a. After few seconds, a dialog window appears (▶ fig. 5). Please enter the path to the Windows XP installation files in the input field on top. They are to be found on your Windows XP installation CD. Hence, this field usually contains the drive letter of your CD/DVD drive – except you have copied the installation files to another location. You can now choose a name and a location for the boot image by clicking on Create ISO image in the box Media output. If another CD/DVD writer is available, you can immediately create a CD by clicking on Burn to CD/DVD. Otherwise, please create an ISO image first.

After clicking on Start PE Builder creates the CD. Depending on your system, this may take a few minutes. If you did not select Burn to CD/DVD in the previous step, it is necessary to write the newly created ISO image to CD with your recording software. Please note that the file has to be written to CD directly as an image. Normal writing will not be sufficient in this case. Instead, please start your recording software and choose Create from image file (or similar description, depending on the recording software used).

Start your PC from the CD created. HDClone is to be found at Go ▶ Programs.

4.3   Installation with other operating systems

4.3.1   Creating a bootable floppy disk

You can also create a bootable HDClone floppy disk without the installation program with any operating system. For this purpose, the HDClone software package contains a floppy disk image in the file hdclone.img. You can create a bootable 3.5"/1.44MB floppy disk from this image with any appropriate disk imaging program. After having created a bootable floppy disk, you can start HDClone on any PC as described in chapter ▸ 5.2 Starting the program.

> Hint: Under UNIX and Linux you may use the tool dd, which is available on these systems, with the following syntax:
> dd if=hdclone.img of=/dev/fd0.

4.3.2   Creating a bootable CD/DVD

The HDClone software package contains an ISO image (hdclone.iso). It can be used to create a bootable HDClone-CD in any operating system and with any software supporting creation of CDs/DVDs from ISO images. Further information can be found in the manual of your CD/DVD authoring software.

○ Extract the file hdclone.iso from the HDClone software package.

○ Start your CD writing software and choose Create CD from image file (or similar caption, according to the respective CD writing software).

○ Specify the file hdclone.iso as image file.

○ Insert a blank CD into the drive and write the CD.

> Hint: The easiest way of creating a bootable HDClone CD under Linux is using the software tool cdrecord with the following syntax: cdrecord hdclone.iso.

After having accomplished these steps you have created a bootable HDClone CD. From this CD you can start HDClone directly on any PC with a bootable CD/DVD drive as described in ▸ 5.2 Starting the program.

> Note: CD/DVD writing software may refuse writing an ISO image to a DVD. The HDClone installation program writes DVDs without any problem. Booting from a DVD created this way also works smoothly.

4.4   Booting from USB key

To start HDClone from a USB key, the PC has to be able to boot from USB media.

Usually the easiest way is to enter the BIOS-Boot-Selector (BBS) and select the USB key to start from. The PC then boots directly from the USB key instead of the installed operating system. Depending on the regarding BIOS of the PC, the USB key is displayed in the BBS menu under its name (e.g. Miray USB), as USB medium, USB-HDD, Removable Device, or a similar caption.

If the USB key is not listed in the BBS menu at all, it is required to activate support for USB boot media in the BIOS setup first. This setting is to be found under different captions and menu items, depending on the regarding BIOS. In most cases they are to be found under captions like USB, Boot and Legacy. In BIOS setup you can also preset booting from USB firmly, usually under the menu item Boot.

Hint: You can enter the BBS menu directly when starting the PC with a certain key on the keyboard, depending on the BIOS. In most cases the startup screen shows which key to press. For the BBS menu it is F8 or F12 in most cases, rarely F11. BIOS setup usually is called with the F2 or the Del key.

5   Program instructions

The following chapters provide a detailed description on how to operate HDClone, from the start to the end.

> **Note:** Depending on the edition you use, there may be differences in the features described in this and the following chapters. Please check ▶ 1.4 **Edition overview** for the features your edition supports.

5.1   Preliminary steps

If you want to use USB devices for the following copying process, connect the devices before starting HDClone and leave them connected until the copying process is finished. Otherwise it is not guaranteed that HDClone recognizes them correctly. Do not use a USB hub to connect USB storage devices, always connect the USB storage devices directly to the USB controller or the PC case.

> **Note:** HDClone can be started directly as a Windows application (▶ 5.2.2 **Windows program**) or as a self-booting application (▶ 5.2.1 **Self-booting program**). To start the self-booting HDClone, you need a bootable HDClone CD or floppy disk. You can create it as described in chapter ▶ 4.2.2 **Boot-Setup & boot media**.

5.2   Starting the program

5.2.1   Self-booting program

Insert the bootable HDClone CD, floppy disk into the corresponding drive or plug the bootable USB key to your PC. Switch on the computer or reboot it. Make sure that the BIOS boots from the respective drive or USB key (▶ 4.4 **Booting from USB key**). HDClone will then start automatically from the bootable medium and the program screen appears.

> **Note:** In case your PC does not boot from the HDClone boot medium, press **F8**, **F11** or **F12** (BIOS dependent) immediately after turning on the PC to enter the boot menu and select the HDClone boot device. Or press **F2**, **F10** or **Del** (BIOS dependent) to enter BIOS setup and set the required boot device order there.

5.2.2   Windows program

Start HDClone from the Windows start menu at [Programme] ▶ [HDClone] ▶ [Start HDClone] or by starting the executable file hdclone.exe from the genuine HDClone medium or directly from your software package.

5.2.3   Command line program

You may include HDClone in automated workflows like shell scripts or time-triggered tasks. For this kind of usage, there is a command line version of HDClone (hdclone-cl.exe), to be found in the program folder of HDClone. It is especially suitable for the following fields of application:

○ Calling it from shell scripts or batch files.

○ Creating a permanent link on the Desktop or in the Start menu.

○ Creating time triggered tasks by calling HDClone through the Task Scheduler.

This allows to integrate HDClone seamless into existing scripts or batch processes. You can also create Desktop links for frequently used cloning configurations to call them easy manually or automatically on demand. Usage of hdclone-cl.exe is described in detail in ▶ 6.9 Command line interface.

5.3   Program screen
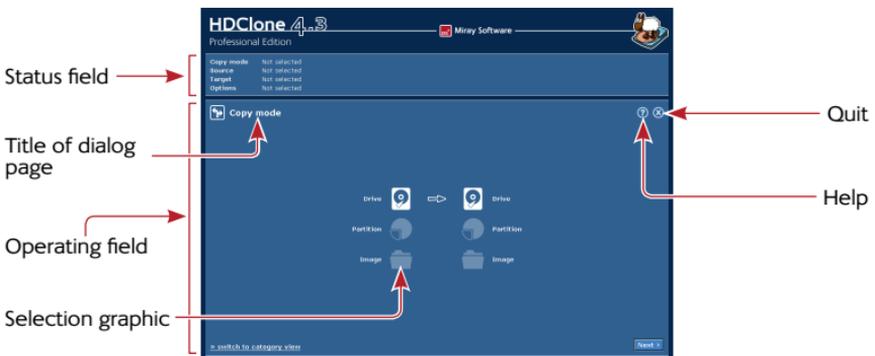
fig. 6: Program screen

The HDClone program screen (▶ fig. 6) contains two fields in a lighter blue. They are the 'active' area of the program; where all information is shown and all operation steps are executed.

5.3.1   Status field

The upper field is the status field (▶ fig. 6). It shows the parameters selected for the copying process (Copying mode, Source, Target and Options). Thus you at any point of the program, which parameters you have already selected. Furthermore, the right side of the status field also shows license information.

5.3.2   Operating field

The lower field is the operating field (▶ fig. 6). In the upper left of the operating field is the title of the currently shown dialog page together with a corresponding symbol. In the upper right are two general operating elements: with the help button [?] you can call up the interactive help at any point of the program (▶ 5.5 Help). With the quit button [X] you can quit the program at any time (▶ 5.11 Closing the program). At the bottom of the operating field, you find the buttons [Next] and [Back], for navigating to the next or previous dialog page.

5.4   Operation

To create a copy, you are led through five consecutive dialog pages, where you can select the individual parameters for the copy and start and control the copying process. These five dialog pages are shown in the operating field.

5.4.1   Graphical control elements

To control the program, HDClone offers different graphical control elements (▶ fig. 7 and fig. 8). The names, used within this manual to designate the different elements, are listed and illustrated by examples in the following illustrations.
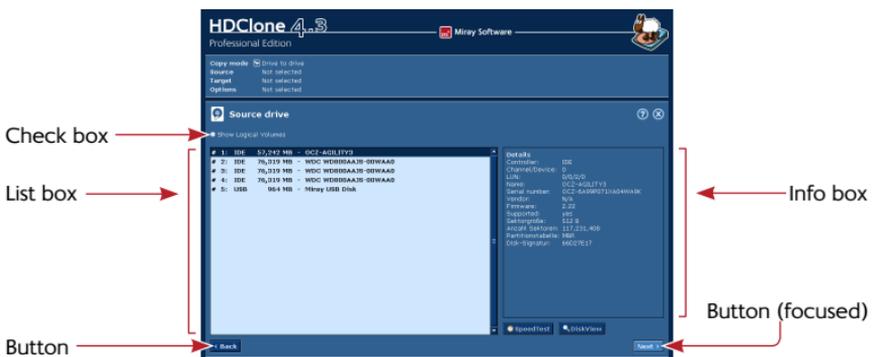
fig. 7: Graphical control elements (1)
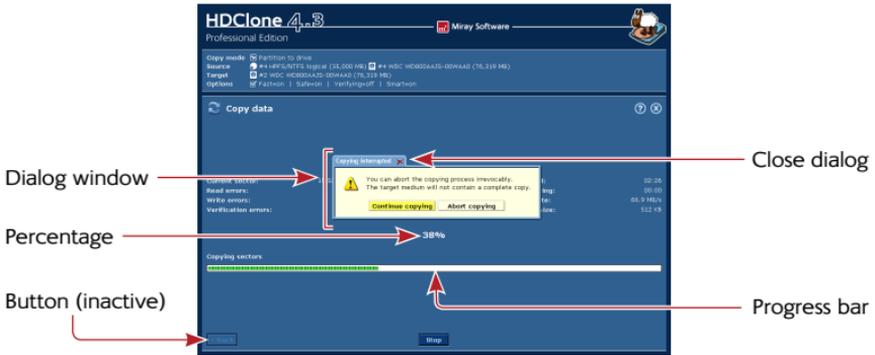
fig. 8: Graphical control elements (2)

5.4.2   Operation with keyboard and mouse

HDClone is operated by keyboard and mouse. It is also possible to operate the program exclusively by keyboard or exclusively by mouse.

5.4.2.1   Keyboard operation

Keyboard operation always refers to the currently focused graphical element. This element is highlighted by color, brightness, or an additional frame. With the tabulator key you can switch the focus in turn to the other operating elements. The following control keys have a function when operating the keyboard:

Key	Control element	Function
Tab	(All)	Switch to the next element
Arrow keys	List field	Select list element
↑ ↓ ...	Selection graphic	Highlight element
Space	Button	Press button
	Selection graphic	Select highlighted element
	Link	Show link target
Return	Button	Press button (in dialog windows only)
	Link	Show link target
Esc	Window	Close window (only windows with ✗ in the title bar)
	(Operating field)	Quit HDClone

5.4.2.2   Mouse operation

Operating HDClone with the help of a mouse is done according to the point-and-click principle. The right mouse key has no special function. HDClone does not use drag-and-drop.

5.5   Help

You can open a context-related help window at any point of the program by pressing the key **F1** or the [?] symbol in the upper right corner of the operating field (▶ fig. 6). The help gives you useful hints on the current program screen. The underlined text links in the help window enable you to jump to other help topics at any time.

> **Note:** The program help is designed to give you useful hints when using the program. Please use this user's manual when encountering problems or requiring more information on a topic.

5.6   Selecting a copy mode

Select the desired copying mode on the first dialog page (▶ fig. 9 and fig. 10). There are two views, basically offering the same options. They differ in how the copying modes are presented. The classic view is focused on functionality, while the category view displays the available copying modes task-oriented.

5.6.1   Category view

The category view (▶ fig. 9) allows you to choose a copying mode matching the desired area of use (backup, restore, and cloning). The upper row of symbols shows the copying modes referring to entire disks (e.g. hard disks). The lower row refers to copying modes for individual partitions. If you select a copying mode by clicking with your mouse, it will be displayed highlighted. If you want to use the selected copying mode, click on [next]. A

fig. 9: Selecting copying mode (categories)

detailed description of the copying modes, their operation and impact can be found in ▶ 6 Operating principles.

5.6.2   Classic view

The classic view (▶ fig. 10) offers you a more functional selection of the available copying modes. You have eight options altogether. This is two more than with the category view, since the classic view also allows for choosing ▶ 2.1.1 Unused disk space and ▶ 6.1.5 Drive-to-Partition. According to your choice, a physical copy, a logical copy, or an image file will be created or restored. You find a detailed description of the copy

fig. 10: Selecting copying mode (classic)

modes and how they work in ▶ 6 Operating principles.

> Note: The copy modes drive-to-partition and partition-to-drive are designed for mutual use. In general, it is not possible to copy a working hard disk installation onto a partition and to use it from there. The installation rather has to be copied back to a hard drive first. We recommended to rather use a file image in this case (▶ 5.6.1 Category view).

After selecting the copy mode, move to the next step by clicking [next] in the lower right corner of the operating field (▶ 5.7 Selecting data source and target).

When selecting the copy mode, HDClone starts its device and drive recognition. A small popup will be displayed before the next dialog page will be shown. This can take one minute or more. The time required depends on the number of drives connected. If it takes more than five minutes, there may be technical problem. In this case you find further information in ▶ 7 Troubleshooting.

5.7   Selecting data source and target

In the two following steps, you select the data source and the target for the copying process. The left half of the operating field shows a selection list. On the right side is an info box containing details on the currently selected element. According to the selected copying mode, you can select either an entire drive or a single partition. The following sub-chapters give you more detailed information. After having selected the data source in the first step, another dialog page appears for the selection of the target. After these two steps, you come to the selection of the options (▶ 5.8 Selecting the options).

5.7.1   Selecting a drive

When selecting a source or target drive (▶ fig. 11) you see the devices recognized by HDClone in the selection list. The info box on the right side shows more details on the selected element (▶ 5.7.4 Drive information).

Select the desired drive and confirm your selection by pressing [Next] in the lower right corner of the operating field and go to the next step.
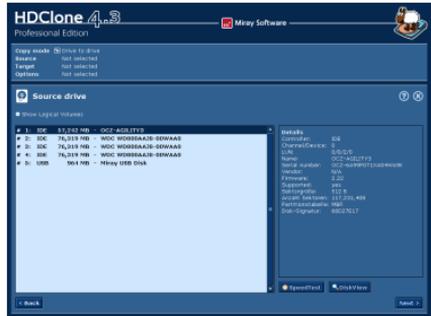
fig. 11: Selecting a drive

5.7.2   Selecting a partition

When selecting a source or target partition (▶ fig. 12), the partitions found are displayed indented under the respective drive, shown in the selection list. The frame on the right side of the selection list shows details for the drive where the currently selected partition is located on.

Select the desired partition and confirm with [Next] to proceed to the next step.

fig. 12: Selecting a partition

5.7.3   Deactivated list entries

There are four cases in which entries in the selection list for source or target are deactivated and therefore cannot be selected:

○ When selecting a source or target partition, the list entries for the corresponding hard disks are always deactivated; only partitions can be selected.

○ Since source and target must not overlap, the already selected source drive or the drive that contains the source partitions is deactivated when selecting a target drive.

○ When selecting a target partition, the already selected source partition or all partitions of the source drive are deactivated.

○ If HDClone recognizes drives which are not supported by the edition used the

partitions are also deactivated. For further information on the different editions, please go to ▶ **1.4 Edition overview** or http://www.hdclone.com.

> **Hint:** Activate **All drives selectable** below the details to see the details of drives which are recognized by HDClone but not supported by your edition (▶ **1.4 Edition overview**).

5.7.4 Drive information

On the right side of the selection list for the source drive/source partition resp. the target drive/target partition, you find a frame containing details on the currently selected drive. When selecting a partition, the data of the corresponding drive is shown here. The following information is available:

Field	Description
Controller	Type (IDE/SCSI) and number (0-15) of the controller
Channel/Device	Channel used by the drive (primary/secondary) and Connection of the drive (master/slave resp. 0-15)
LUN	Logical number of the drive (0-255)
Name	Name of the device (as specified by internal drive data)
Serial number	Device serial number (as specified by internal drive data)
Manufacturer	Name of the manufacturer (as specified by internal drive data)
Firmware	Version of the firmware (as specified by internal drive data)
Supported	Drive type supported by the edition used

> **Note:** Supported will show **Yes** if the edition you use supports the selected drive. Otherwise HDClone indicates here from which edition on that drive is supported.

5.7.5 Selecting a file image

When selecting a file image as source or target (▶ **fig. 14** and **fig. 15**), the recognized partitions are listed. Partitions of a certain drive are listed beneath the drive in indented form. The drives themselves cannot be selected. On the right of the list box, the file image can be selected. The form of the selection slightly varies depending on whether the file image will be the tar-

fig. 13: File image browser
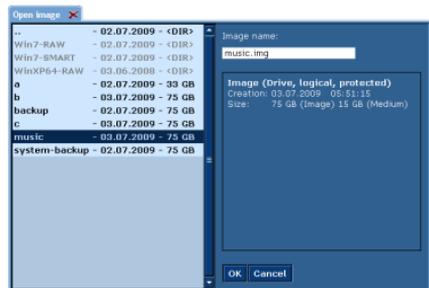
get (▸ 5.7.5.1 File image as a target) or the source (▸ 5.7.5.2 File images as a source). In both cases [Browser] will open the file image browser (▸ fig. 13). It offers a more convenient layout for folder structures. Use [Cancel] to return without any changes and [OK] to use the file image selected in the browser.

> **Note:** If you are running HDClone/W and mapped network drives are not displayed in the selection list, this may probably be solved as described in ▸ 7.7 Mapped network drives.

5.7.5.1   File image as a target

When creating a file image (▸ fig. 14), select the desired partition. In the box on the right, specify the name for the file image and the image format: FullImage, SmartImage, RAW, VMDK, or VHD (▸ 6.7 File images). To store the file image in a different folder than the standard folder, click on [Browser]. Confirm your choice with [Next] in the lower right to proceed to the next step.
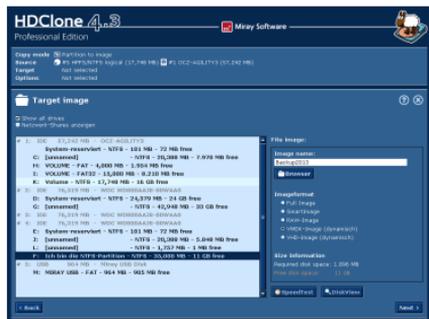
fig. 14: File image as a target

5.7.5.2   File images as a source

For an image restore (▸ fig. 15), select the partition where the file image is located on. Then select the image from the list on the right to display image details on the image below the list: image type, creation date and time, and size. Image type can be an entire drive or a single partition and the image format used: FullImage, SmartImage, RAW, VMDK, or VHD (▸ 6.7 File images). Image size has two values: size of the file image and size of the original medium. Confirm your selection with [Next] to proceed to the next step.

fig. 15: File image as a source

5.7.6   SpeedTest

Use the [SpeedTest] button in the lower right of the operating field to start a speed test for the currently selected medium. Since this is a pure read test, all data will remain unchanged. The test shows the maximum speed that can be achieved for linear reading on the currently selected medium.

> **Note:** If the option MultiCopy (▸ 5.7.7 MultiCopy mode) is selected, the speed test is performed for all selected media at the same time. This determines the maximum possible concurrent total data throughput of these media. This is especially relevant for potential use of the Enterprise Edition, but also represents a performance test of the entire system. The speed, that can be achieved, strongly depends on how the tested media are connected to the system (▸ 6.5.2 Speed).

5.7.7   MultiCopy mode

When selecting the target medium you can use the check box MultiCopy to activate MultiCopy mode (▸ 6.5 MultiCopy) . In this mode it is possible to select up to 16 drives or partitions at the same time. For doing so, click on all desired list entries. The selected entries then will be marked with a dark blue background. To remove a marked list entry from the selection, it simply has to be clicked again. You can then use the ▸ 5.7.6 SpeedTest to measure the data throughput of the selected drives or partitions in parallel operation. Copying to multiple drives in parallel is only possible with the Enterprise Edition. It allows to copy to up to 4, 8 or 16 targets at a time, depending on the stage used (Enterprise Edition 4x, Enterprise Edition 8x or Enterprise Edition 16x).

> **Note:** You can activate the MultiCopy option in all editions of HDClone, even in the Free Edition, to check the achievable speed of the Enterprise Edition on a certain system. Please note that the achievable speed strongly depends on the interfaces used (most suitable: IDE, SATA, and SCSI) and the drive combinations (only use master drives with IDE).

> **Hint:** MultiCopy mode can also be used for restoring from file images to restore the contents of an image file to up to 16 targets at a time (▸ 5.7.5.2 File images as a source).

5.8   Selecting the options

On the dialog page Options, you can set the options with which you want the following copying process to be executed. The individual options are described below. After choosing the required options, click [Next] to proceed to the next dialog page where you can start the copying process (▸ 5.9 Copying data).

5.8.1   Verifying

The option Verifying is an exception to the options described in this chapter
(▶ 5.8.3 General options). This option has no influence on the copying perfor-
mance itself, but offers the possibility to synchronize the data of the source and
target after the copying process. However, the whole process of copying and
verifying then normally takes approximately the double amount of time. Choose
this option according to your needs of copying and your time available.

> Warning: You should not activate verification when you copy hard
> disks containing defects (data rescue). Physical damages on the drive
> could spread faster due to the additional stress. Furthermore, a verifica-
> tion of hard disks with defects has no real expressiveness.

5.8.2   Locked options

The options show different availability and selectability, depending on the copy
mode selected. Locked options cannot be modified, but the displayed setting is
valid. ▶ fig. 16 shows the different states.
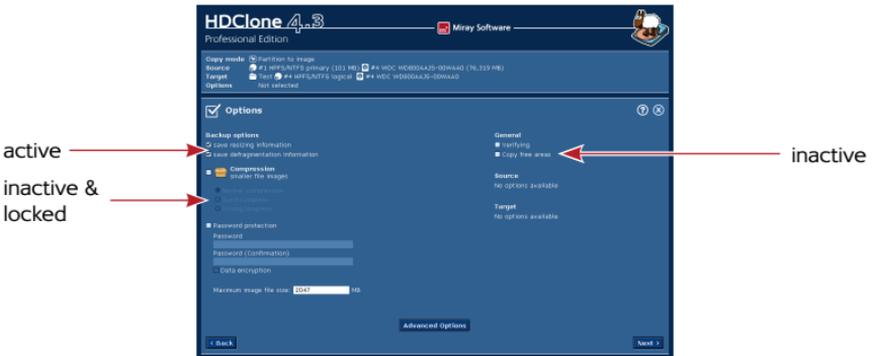
fig. 16: Selecting the options (creating an image)

5.8.3   General options

The column General, contains options that refer to all modes.

Option	Meaning
Verifying	Compares the data of source and target after copying. Not to be used for data rescue, as it yields unnecessary additional stress for a damaged drive (▶ 5.8.1 Verifying).

Option	Meaning
Copy free areas	On a partly partitioned source, HDClone works faster if free areas are not included. In case of special media (for example dynamic disks, RAID) it may be though be required to include free areas, though.

5.8.4 Cloning options

This column only appears in the cloning modes (not when creating an image).

Option	Meaning
SmartCopy	Copying only: Create a logical copy (▸ 6.1.2 SmartCopy).
Defragmentation	Copying only (NTFS+FAT): Reorganizing the file system.

5.8.5 Backup options

These options are only displayed when creating images.

Option	Meaning
Store downsizing info	Store information needed to downsize NTFS and FAT partitions when restoring, otherwise partitions can only be restored at their original size (or larger).
Store defrag info	Store information needed to defragment NTFS and FAT partitions when restoring, otherwise partitions cannot be defragmented during restoring.
Compression	Creates a file image with the selected compression (Normal/Quick/Strong) (▸ 6.7.6 Compressed Images).
Password protection	Use a password to protect your file image (▸ 6.7.7 Password-Protection) and choose to use file image encryption (▸ 6.7.8 Encryption).
Maximum image file size	Defines the maximum size of the file blocks stored within an image. To be compatible with different file systems, the default is 2,047 MB. For burning an image to CD, DVD or BD later, you may specify a different value (CD: 700 MB | DVD: 4.700 MB | BD: 25.000 MB).

5.8.6 Restore options

These options are only displayed when restoring images.

Option	Meaning
Defragmentation	NTFS+FAT only: Reorganize file system during copying.

5.8.7   Options for source and target

These settings refer to the drives selected as source and target.

Option	Meaning
Sector area	Exactly definable copying area (▸ 6.4 Area copy).
4k alignment	Target only: Will align the partitions copied automatically to 4 KB borders on the target medium.
Driver adjustment	Target only: Activate inactive AHCI and IDE drivers.
MediaDirect (Dell)	Target only: Deactivate MediaDirect software.
Error threshold	Target only (MultiCopy): Sector error threshold. Media encountering more than the specified number of errors during copying will be suspended from copying to allow the remaining media to be copied at maximum speed. For example, a good value for practical use is 32,000.

5.8.8   Advanced options

Find more settings via [Advanced options]. This will open a dialog you find more settings. It opens a dialog with more option (▸ fig. 17). The separation into different columns is the same as on the dialog page Options.

fig. 17: Advanced options

5.8.8.1   General

These options refer to the general features of a copying run.

Option	Meaning
FastCopy	Special copy algorithm. May increase the regular copy speed up to the double.
SafeRescue	Special algorithm for data recovery. Tries to recover large areas first. Can also stay turned on for normal copies.
CachedMemory	Use fast intermediate memory.
SharedMemory	Use fast data transfers.
Animation	Switch off copy animation.

Option	Meaning
HotCopy LiveImage	HDClone/W only: This option allows for clones or file images of the system drive or of media, which are used by other programs at the same time.
Avoid exclusive read access	HDClone/W only: In Windows, HDClone usually tries to reserve the source drive for exclusive access at first. If this option is selected, HDClone will try to use HotCopy mode or LiveImage mode first.
Copy swap files	Creating images only: Usually, it is not necessary to store the files pagefile.sys and hiberfil.sys in the file image. For cloning, this option is always activated.

5.8.8.2 Source and target

Specific Options for source and target. They are not available under Windows and therefore are not showing up under HDClone/W.

Option	Meaning
IRQ	In IRQ mode, source and target are optimally synchronized. Only this leads to a maximum copy transfer rate.
DMA	For highest transfer rate and the shortest copying time.
Read cache	Use fast read buffer.
Write cache	Use fast write buffer.
Multi-sector PIO	Increases speed in PIO mode by about 10%.
Recovery via PIO	Optimal recovery of defective sectors.
Cooling phase	Only if problems occur (▶ 7.6.2 Other device problems).

5.9   Copying data

The dialog page Copy data (▶ fig. 18) lets you start the copying process. Check in the status field if copy mode, source, target, and options are selected correctly. If needed, go back with [Back] in the lower left corner and adjust the settings. Click [Start] to start the copying process.
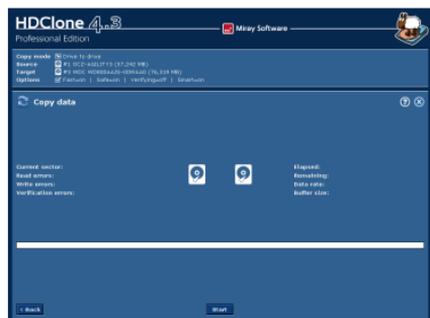
fig. 18: Dialog page 'Copy data'

5.9.1   PartitionSelect

The PartitionSelect dialog (▸ fig. 19) will prompt you to choose the partitions to copy and which to exclude from copying. If the total size of the partitions to be copied exceeds the total capacity of the target, the graphical bar will be marked in red. In this case, exclude partitions you do not require on the target until the remaining partitions fit on the target. Alternatively, you can click on [Cancel] to choose a different combination of source and target for creating the copy.
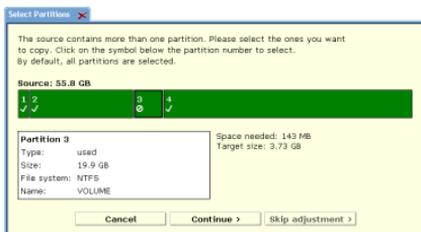
fig. 19: Dialog 'Select Partitions'

The default setting is to have all partitions selected, so you may accept that by just clicking [Continue]. Otherwise select which partitions to exclude from copying by clicking on the check symbol (✔) beneath the partition number. The check symbol will then change to a lock symbol (⊘). It signals that the partition will be excluded from copying. When clicking on the lock symbol, you can activate the partition again and the check symbol appears again. When you have selected all partitions as desired, click on [Continue].

In case you want to copy all partitions and to skip the adjustment step (▸ 5.9.2 Adjusting partitions), use [Skip adjustment]. Any previous partitions selection will then be ignored and all partitions will be copied in their original size and original location as given on the source. For more information, see ▸ 6.6 PartitionSelect.

5.9.2   Adjusting partitions

In case partition sizes can be altered, a dialog window appears, before starting the copying process (▸ fig. 20). It allows you to adjust the size of several or all partitions to fit on the target medium as desired. Positions and sizes of the partitions on the target medium are displayed graphically in a bar. Each partition has a cipher or – from the tenth partition on – a letter assigned to it. If you click on a partition in the bar,

fig. 20: 'Adjust partitions' dialog

the box on the lower left will display additional information on the selected par-

tition. Below each partition number, there is either a double arrow (, the default setting), showing that the partition size can be altered, or a lock-symbol ( ), indicating that the partition size is fixed. By clicking on these symbols, you can toggle between both modes. This allows to keep the original sizes of certain partitions, while changing others or have them adjusted automatically.

> **Example:** Given are system partition (C:) and two data partitions (D: and E:). When migrating to a larger hard disk, only the latter two are to be up-sizead, but not the system partition. First, click on the symbol below the system partition to have it change to the lock-symbol. This will keep the system partitions's size fixed. Then choose Automatic adjustment to have the data partitions resized proportionally to the newly available space. Then click [Continue].

FAT, NTFS, and ext2/ext3/ext4 partitions can be increased, FAT and NTFS partitions can also be decreased in size. Each partition can be shrinked to the minimum amount of space required by the data stored on this partition. Up- and down-sizing can be accomplished either automatically, proportional to the size of the target medium or manually to an arbitrary size. The original size of the partition is displayed in light green, the minimal partition size achievable by downsizing in dark green. The additionally assigned space when enlarging a partition is displayed in striped light green. The size of partitions displayed in black cannot be altered. Free space not assigned to any partition is displayed in white. There are three options for how to handle free space on the target medium (▸ 5.9.2.1 Keep original sizes, 5.9.2.2 Automatic adjustment, 5.9.2.3 Free adjustment). Select the desired option. In case of Free adjustment, make the desired changes. Then click on [Apply adjustments] for having the selected adjustments become effective. If you click on [Continue without adjustment] , the following copying process will transfer the partitions of the source to the target medium without any changes. Clicking [Cancel] will bring you back to the dialog page Copy data, and will cancel any changes made.

> **Note:** To transfer the original partition layout to the target medium, click on [Continue without adjustment]. The option Keep original sizes will keep the original partition sizes, but may alter their absolute positions on the medium by shifting them towards the beginning of the medium for a better utilization of free space.

5.9.2.1   Keep original sizes

The original sizes of partitions on the source will be kept on the target me-

fig. 21: Option 'Keep original sizes'

dium (▸ fig. 21). The partitions themselves will be "shifted together" at the beginning of the target, if possible. This approach is useful since it closes gaps between partitions, gaining additional space, which is made available in one single block at the end of the medium.

5.9.2.2   Automatic adjustment

Free space on the target medium will be apportioned completely to the individual partitions, proportional to their respective size (▸ fig. 22). This increases the partitions' sizes according to their part of the full size of medium. Calculation of the size proportions is handled automatically by HDClone.
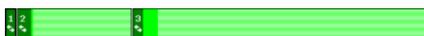
fig. 22: Option 'Automatic adjustment'

5.9.2.3   Free adjustment

You can adjust the apportioning of additional space on the target medium to the individual partitions by yourself

fig. 23: Option 'Free adjustment'

(▸ fig. 23). You can change the size of a certain partition by clicking and dragging the corresponding area on the graphical representation.

5.9.3   Security query

Before the final start of the copying process, a security query (▸ fig. 24), appears where source and target of the copying process as well as corresponding security notes are displayed. Click [Start copying] to start the copying process and [Cancel] to return without starting the copying process.

Start copying process ✕

⚠️ **Source**
Drive: #1 HDS728080PLA380 (78,533 MB)

Target
Drive: #5 Flash Disk (968 MB)

The content of the target area will be overwritten by the copy.
The source area is larger than the target area; approx. 77,565 MB overhang will not be copied.

[**Abort**]   [**Start copying**]

fig. 24: Security query

Warning: Any data in the target area will be irretrievably deleted by starting the copying process. Then even a data recovery software will not be able to retrieve the overwritten data.

5.9.4   Copy animation

In the center of the operating field, there is the copy animation Especially if other indicators only change rarely, for example in case of read or write errors, the copy animation shows that HDClone is still running.

5.9.5   Status indication

On the left and right side of the operating field, you see the status indicators. They contain information on the current status of the copying process.

Status	Meaning
Sectors processed	Absolute number of sectors already copied.
Buffer size	Size of the internally used buffer.
Read errors	Number of the read errors occurred. May decrease if errors can be fixed. When starting the optional verification run, this value is set back to zero.
Write errors	Number of the write errors occurred. May decrease if errors can be fixed. When starting the optional verification run, this value is set back to zero.
Running time	Time passed since the start of the copying process.
Time remaining	Estimated (!) time remaining for the entire copying process (incl. the optional verification run) based on the current copying speed. Note: The rest time can strongly increase in case of occurring read or write errors.
Data rate	Average data rate, which has been attained up to this point of time. The indicated value refers to the amount of copied data. The actual throughput is twice as high (x MB copying = x MB reading + x MB writing).
Verification errors	This indicator is only used if the Verifying option is on.

5.9.6   Percentage indication

The percentage indicator (▶ fig. 8) is located below the copy animation, showing the progress of the current run (▶ 5.9.8 Course of the process) in percent.

5.9.7   Progress bar

The progress bar (▶ fig. 8) below the percentage indication visualizes the progress of the current run. Which run (▶ 5.9.8 Course of the process) is currently processed is shown on the left above the progress bar.

5.9.8   Course of the process

The process consists of up to three runs: the copying process itself, an optional error recovery run (option **SafeRescue** active, ▶ 5.8.3 **General options**), and an optional verification run (option **Verifying** active, ▶ 5.8.3 **General options**).

5.9.9   Interrupting the running process

You can use **[Stop]** at any time to in-terrupt the process (▶ fig. 25 and fig. 26). You may then continue the process (click on **[Continue copying]** or **[Continue verifying]**) or abort it completely (click on **[Abort copying]**

fig. 25: Abort dialog copying process

or **[Abort verifying]**, ▶ 5.10.1 **User abort**). As long as you select neither option, the current copying process remains interrupted.

5.10   Termination of the copying process

5.10.1 User abort

If you interrupt a running copying pro-cess or verification run by clicking **[Stop]** (▶ 5.9.9 **Interrupting the run-ning process**), you can definitively abort the process in the dialog win-dow which then appears (▶ fig. 25 and fig. 26) by clicking **[Abort copy-**

fig. 26: Abort dialog verification run

ing] or **[Abort verifying]**. You then obtain a final report (▶ 5.10.4 **Final dialog**) upon the prematurely terminated process.

> **Note:** Unlike an aborted copying run, an aborted verification run has no influence on the copied data. The copy itself is already finished at that point of time.

5.10.2 Regular termination

After up to three runs (▶ 5.9.8 **Course of the process**) without a premature abort, the copying process is regularly finished. You then obtain a final report upon the complete copying process in a dialog window (▶ 5.10.4 **Final dialog**).

5.10.3 Adjust media parameters

After finishing the copying process, a dialog for adjusting media parameters appears (▸ fig. 27). Since HDClone creates a 1:1 copy, the data from the Master Boot Record (MBR) and of the boot sector(s) are also copied to the target medium. As this characteristic of a 1:1 copy may yield problems in some cases, HDClone offers to adjust media parameters.

HDClone automatically sets parameter values, which are optimal for the respective medium in most cases. They usually just need to be confirmed. A manual change of the preset parameters is only needed in exceptional cases. The parameters refer to the Master Boot Record (=MBR/GPT) and to any known boot sector(s) and are grouped correspondingly.

Adjust target manually

Geometry used
○ Normal ○ Large ● LBA ○ User
C 1   H 255   S 63

Master boot record
☑ Adopt partition ID
   old: 0x7 (HPFS/NTFS), new: 0xB (FAT32)
☑ Adjust partition size
   old: 27,227 MB, new: 2,346 MB
☐ Adjust CHS layout
☐ Change disk signature

Boot sector(s)
☑ Adjust offset
☐ Adjust CHS layout
☑ Patch boot code
☑ Change volume ID
   [**Adjust**] [No changes]

fig. 27: Adjustment dialog

Important: In case you adjust the target medium, it will no longer be an absolute 1:1 copy. Especially in case of forensic analysis, you might want to abstain any adjustment.

Parameter	Meaning
Geometry used	To boot from the medium, the device geometry has to match the geometry set in BIOS.
Adopt partition ID	Use same partition type as on the source medium.
Adjust partition size	Set the space reserved for the target partition to the size needed for the partition copied.
Adjust CHS layout	Use the values set under Geometry used for adjusting the MBR or the boot sector(s).
Reset disk signature	Reset unique media signature.
Adjust offset	Adjust real partition start address in boot sector(s).
Patch boot code	Avoids boot problems on older hardware.
Change volume ID	Create a new ID for the partition. Required when source and target work in the same PC.

When the parameters and options are set as desired, click on [Adjust] to modify the medium or click on [No changes] to leave the medium unchanged.

> **Note:** In case of a copy with several target media (Enterprise Edition only), the dialog appears only once. The selected adjustments are then carried out for all target media.

5.10.4 Final dialog

fig. 28: Final dialog

After termination a final report (▶ fig. 28) with the following information appears:

- A complete copy has been created: The copying process has been finished without an abort (even if the verification run has been aborted).

- The copying process has been aborted: In case the copying run has been aborted before its regular termination.

- The copy has not been verified: No verification run or the copying process has been aborted.

- The copy has been only partly verified: The verification run was aborted.

- The copy has been verified: Verification was terminated without an abort.

Field	Meaning
Source	Source drive/partition of the copying process.
Target	Target drive/partition of the copying process.
Copied sectors	Total number of copied sectors.
Read errors	Total number of read errors occurred (w/o verification).
Write errors	Total number of write errors occurred.
Verification errors	Total number of errors occurred during verification.
Runtime	Time required for the entire process..

You can start another copying process by clicking [Another copy] or end the program by clicking [Quit HDClone] (▶ 5.11.2 Good-bye screen). The [Details] button will open another dialog with more details on each drive.

Use [Store report] to create a detailed cloning report and store it as a text file (▸ 6.10 Store final report). Select the drive you want the report being stored on (▸ fig. 29). Clicking [Create] will store the report to the selected drive in the file hdclone.<x>.txt (<x> = consecutive number), located in the root directory (for example X:\hdclone.1.txt).
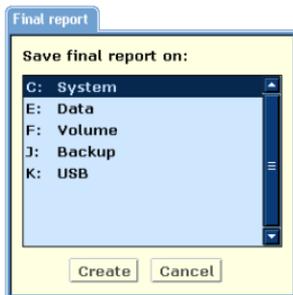
5.11 Closing the program

5.11.1 End dialog

You can end HDClone at any time by clicking the end symbol [X] in the upper right corner of the operating field (▸ fig. 6) or by pressing Esc . The end dialog appears (▸ fig. 30) where you can quit HDClone by clicking [Yes] or return to the program by clicking [No].
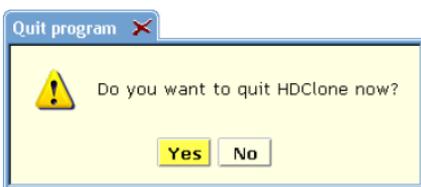
5.11.2 Good-bye screen

After the termination of HDClone, either via the end dialog (▸ 5.11.1 End dialog) or via the dialog window with the final report (▸ 5.10.4 Final dialog), a good-bye screen appears (▸ fig. 31). You can then shut down the computer or reboot it.

fig. 29: Store report

fig. 30: End dialog

fig. 31: Good-bye screen

Note: If you don't want to start HDClone when starting the computer the next time, remove the HDClone boot medium from the boot drive.

6   Operating principles

HDClone can handle entire hard disks as well as individual partitions. Clones can be created directly to target disks or via file images. HDClone offers different modes and options for these use cases.

> **Important:** For data rescue, create a full BitCopy (▸ 6.1.1 BitCopy) or a RAW image (▸ 6.7.3 RAW images) of the entire disk first. You can then try different recovery attempts without putting the original data on risk.

6.1   Copying modes

The copying modes offered by HDClone aim to cover as many use cases as possible. As long as you do not overwrite any areas containing data which is still needed, you can try every copying mode without any risk since the original drive remains unchanged.

6.1.1   BitCopy

BitCopy (physical copy) creates a complete or partial (▸ 6.4 Area copy) clone of a storage medium. This clone is bit by bit identical with the source, since each sector of the source will be copied exactly to the same sector on the target. A BitCopy will always be created automatically, if the **SmartCopy** option (▸ 5.8.4 Cloning options) has not been selected.

> **Important:** For a complete BitCopy of all areas of the source, also select the **Copy free areas** option. This is especially required when performing data rescue or forensic safekeeping of data.

6.1.2   SmartCopy

For cloning disks with **SmartCopy** (▸ fig. 32), activate the **SmartCopy** option (▸ 5.8.4 Cloning options). SmartCopy mode can be applied to entire hard disks or other media as well as to single partitions. SmartCopy cur-

SmartCopy
logical 1:1 copy
accelerated cloning

fig. 32: SmartCopy

rently supports NTFS, FAT, ext2-4 file systems. Partitions with other file systems, will be copied in **BitCopy** mode, even if the SmartCopy option is activated.

With SmartCopy (logical copy) HDClone only takes those areas of a storage medium that are occupied by the operating system and other files. Any unused ar-

eas will not be copied. Since in most cases only a part of the total capacity of storage media is occupied, SmartCopy saves – depending on the amount of data stored – some of the time needed for a BitCopy. For this reason, SmartCopy usually is by a multiple faster than BitCopy.

> **Note:** SmartCopy evaluates file system and depends on file system data being consistent and free of errors. Otherwise the copy may contain errors, too. In case you are not sure, you may check the source with chkdsk /f before cloning.

SmatCopy also creates an exact clone, but in contrast to BitCopy, only copying the used areas of the medium. For many cases of use, this mode is preferable, since it delivers the same result in less time.

> **Hint:** Since it is only a clone, you can always try SmartCopy mode first. If it turns out not to be sufficient for your individual case of use, you can still create a BitCopy.

> **Warning:** Never use **SmartCopy** mode for ▸ **2.2 Data rescue**, for copying defective or inconsistent file systems, or for ▸ **2.7 Forensic data safekeeping**. It is recommended to create a BitCopy in these cases.

6.1.3   Drive-to-drive

Drive-to-Drive creates a direct clone from one medium to another. You can choose between a SmartCopy or a BitCopy, depending on the actual setting of the Smart-Copy option (▸ **5.8.4 Cloning options**). It is recommended to use this mode even for copying individual partitions. You can then use ▸ **6.6 PartitionSelect** to choose the partition(s) to be copied to the target. If source and target have different sizes, you can ▸ **5.9.2 Adjusting partitions** manually or automatically.
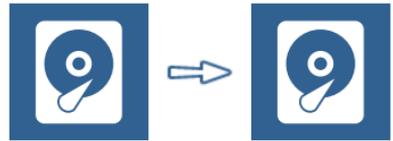
fig. 33: Drive-to-drive

Drive-to-Drive is suitable for the following areas of use:

- Migration of an existing operation system installation
- Data rescue (only in combination with ▸ **6.1.1 BitCopy**)
- Backup and restore
- Rolling-out installations on individual systems (deployment)
- Copying proprietary file systems and data formats
- Safekeeping data for forensic analysis and evaluation

6.1.4   Partition-to-partition

Partition-to-Partition creates a direct clone of an individual partition, either as a Smart-Copy or as a BitCopy, depending on the setting for the SmartCopy option (▶ 5.8.4 Cloning options). Target size can be adjusted manually or automatically before copying (▶ 5.9.2 Adjusting partitions).

fig. 34: Partition-to-partition

Partition-to-Partition is suitable for the following areas of use:

- Relocating a partition
- Rescue of an individual partition (only in combination with ▶ 6.1.1 BitCopy)
- Backup and restore of an individual partition
- Copying of proprietary partitions
- Safekeeping data of individual partitions for forensic analysis and evaluation

> **Note:** In case of doubt, always use Drive-to-Drive mode. It also adjusts the partitioning scheme, yielding the same or even better results in most cases (for example regarding bootability).

6.1.5   Drive-to-Partition

Drive-to-Partition stores the contents of an entire hard disk or any other storage medium on a partition. This mode uses a partition as an intermediate storage for a drive image, which can be restored with Partition-to-Drive at a later point in time.

fig. 35: Drive-to-partition

> **Note:** The data stored on the target partition is usually not accessible directly and the partition will be displayed as unformatted under Windows. For restoring the data, ▶ 6.1.6 Partition-to-Drive is used.

Drive-to-Partition is suitable for the following areas of use:

- Rescue of several storage media onto one single drive
- Backup of several storage media
- Backup of the data from several drives to one single drive
- Temporary or intermediate storage of entire drives

Hint: This copying mode has been introduced prior to file images. In the current version, file images (▶ **6.7 File images**) are the more versatile, preferable, recommendable, and better alternative.

6.1.6   Partition-to-Drive

Partition-to-Drive will overwrite an entire hard disk or other storage medium with the data from a partition. This mode is used to restore drive images , created with ▶ **6.1.5 Drive-to-Partition** before.
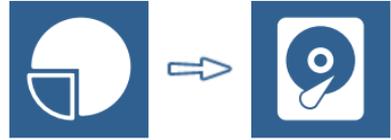
fig. 36: Partition-to-drive

Note: Partition-to-Drive usually only makes sense in combination with ▶ **6.1.5 Drive-to-Partition**. For storing and recovering storage media images, file images (▶ **6.7 File images**) are the more versatile, preferable, recommendable, and better alternative.

6.2   Size differences

To create a real BitCopy, source and target must have exactly the same size. HDClone is also capable to create physical copies if the size of source and target differs. But the result will not be an absolutely identical clone.

Hint: The following subchapters refer to the usage of ▶ **6.1.1 BitCopy**. With ▶ **6.1.2 SmartCopy** the contents of the source can usually be adjusted automatically to the size of the target.

6.2.1   Equal size

If source and target have exactly the same size, ▶ **6.1.3 Drive-to-drive** mode is selected, and a complete BitCopy is set up, HDClone creates an absolutely identical copy. On this clone – provided the process was error-free – all sectors on the target are 100% identical with the source.

6.2.2   Small to large

If the source is smaller than the target, HDClone clones all source data, from the beginning of the source, onto the target medium. The area at the end of the target medium, which is larger than the source, remains unaffected. The unaffected area remains possibly unused during a later usage, such a copy is usually comparable to a real clone as far as the capacity of use is concerned because the target contains entirely all data of the source (in contrast to ▶ **6.2.3 Large to small**).

6.2.3   Large to small

If the source is bigger than the target, HDClone copies only the data which also fits onto the target. This data is copied from the beginning of the source to the beginning of the target medium. The data, which is larger than the target, is not copied and is missing on the target. Generally, such a copy is unusable or only very restrictedly usable because possibly necessary data can be missing. However, if you make sure before copying (e.g. by defragmentation), that all valid or necessary data is in the front part of the source medium and that this area is not larger than the target medium, a copy onto a smaller target medium can also be successfully used. This also applies if you have copied a smaller source onto a larger target (▸ 6.2.2 Small to large) and if you copy back the (unchanged) data onto the original medium or onto a target of the corresponding size.

6.3   Automatic troubleshooting

HDClone tries to troubleshoot occurring sector errors the best possible. If this is not possible, the errors will be counted in a corresponding error statistic.

6.3.1   Intensive reading/writing

In case of read errors, HDClone uses different strategies in order to recover these sectors. The time used for that depends on the type and size of medium used. For each sector, several seconds up to minutes can be needed for the recovery attempts. Therefore, it is recommended to always activate the option SafeRescue (▸ 5.8.3 General options) since handling of defective sectors then will be done after copying all intact areas has been finished. The process can then be aborted if it takes too long without losing the data of the intact areas.

6.3.2   Read errors

During the copying process, read errors can only occur on the source medium. HDClone then tries to read the defective areas immediately after the termination of the copying process (option SafeRescue, ▸ 5.8.3 General options) within a separate error recovery run (▸ 5.9.8 Course of the process). During the error recovery run, the number of the indicated read errors can reduce depending on the areas on the source, which could be recovered.

> **Note:** Read errors occurring during verification are counted as verification errors (▸ 5.9.5 Status indication). Since at verification time, cloning has been finished already, there will be no further error recovery.

6.3.3   Write errors

Write errors can only occur during the copying process and only on the target medium. HDClone then tries to read the defective areas immediately after the termination of the copying process (with the option SafeRescue, ▶ 5.8.3 General options) with the help of special data recovery strategies within a separate error recovery run (▶ 5.9.8 Course of the process). During the error recovery run, the number of the indicated write errors can decrease depending on the recoverable areas on the target.

6.3.4   Verification errors

When the option Verifying (▶ 5.8.1 Verifying) is activated, HDClone executes a verification run (▶ 5.9.8 Course of the process) after the copying process. A verification error is counted if the data of two sectors on source and target do not correspond. Furthermore, read errors, which occur during the verification run in one or both of the areas to be compared, are also counted as verification errors. The number of verification errors gives you absolute information on how exact source and target correspond to each other after cloning.

> **Note:** Verification will only be performed on sectors that have been copied previously. Since SmartCopy only will copy data from used sectors, verification will only compare these sectors.

6.4   Area copy

In case of an area copy, not the entire storage medium (drive/partition) of source or target (or both) will be used, but only a partial area.

6.4.1   Usage

The dialog page Options provides the possibility to specify an exactly definable sector area for source and target (▶ 5.8.7 Options for source and target). To specify a sector area, activate the check box Sector area and enter the starting (from) and the ending (to) sector of the area. These sectors are interpreted as the first and the last sector of the area, i.e. they are included with the area.

> **Note:** Counting starts with '0' (= 1st sector of the medium), so all further sector numbers have to be decreased by 1 (e.g. from = 0, to = 99999 defines the first 100000 sectors on the medium as an area).

> **Warning:** Only use area copy if you are completely aware of its functioning. A sector area, which has not been defined properly, may lead to data loss or render the result unusable.

6.4.2   Functioning

Sector area means a contiguous area of sectors on a storage medium. In case of partitions, it is specified relative to their starting positions. HDClone will then copy the first sector of the source are to the first sector of the target area and so on. Compared to a normal BitCopy, the main difference is that the defined partial area is cloned instead of the entire drive or partition.

> **Example:** Sector area from = 0, to = 31. For drives this defines the (absolute) first 32 sectors. The absolute position of the first 32 sectors of a partition depends on its (absolute) start on the drive.

6.5   MultiCopy

In case of a MultiCopy (mass copy) the contents of the source are copied on multiple targets at the same time. As a result there is a huge benefit regarding time and performance, since the source data only has to be read once and the data can be written on multiple targets at the same time.

6.5.1   Mode of operation

A MultiCopy generally works the same way as a single copy. A soon as the option **MultiCopy** has been selected on the target dialog page (▶ 5.7 Selecting data source and target), two or more targets can be selected in the list. The remaining steps are just the same as for creating a single copy.

> **Note:** When creating a **MultiCopy**, the result on a single medium is identical with the result of a single copy. Even the values for automatic resizing will be calculated separately for each target.

6.5.2   Speed

Mass copying yields an enormous advantage in speed compared to single copies. In case of optimal connected media (▶ 6.5.3 Different media) , speed increases straight proportional with the number of target media. For example, a fourfold copy yields about four times the data throughput of a single copy.

6.5.3   Different media

MultiCopy can be used with an arbitrary combination of drive types. Differences in performance of different media types may have an impact on the total performance. It is recommended to use IDE drives configured as master only.

6.6   PartitionSelect

Partitions on the source are displayed in a graphical bar (▶ fig. 37) and numbered (with letters after the ninth partition). Beneath the partition number, there is a check symbol (✔, default setting), if the partition will be included in, or a blocking-symbol (⊘), if this partition will be excluded from the clone. Click on these symbols, to include or exclude any partition individually. Changes to the total size by selecting and de-selecting partitions will be displayed.
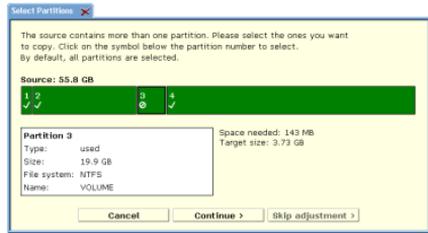
fig. 37: PartitionSelect dialog

PartitionSelect provides a way to transfer only certain partitions and to leave others out. Hence, you can use PartitionSelect to reduce the storage size required for the target.

6.7   File images

Besides direct clones, HDClone is also capable of storing images of a medium into a file. An image contains the same data as a clone. When an image has been restored to another medium, the result is the same as if it had been copied directly from the original source.

6.7.1   FullImage

A FullImage (physical Image) stores – analog to a BitCopy – all sectors of the selected partitions and optionally all sectors in between (Copy free areas, ▶ 5.8.3 General options) in a file image.

6.7.2   SmartImage

A SmartImage (logical Image) stores – analog to a SmartCopy – only those areas of a medium that are occupied with file system data. A SmartImage usually requires much less disk space and time for creation than a FullImage.

6.7.3   RAW images

RAW images are also physical images. They contain the same data like FullImages (including Copy free areas, ▶ 5.8.3 General options). HDClone just uses a special file format for FullImages, which optimally supports HDClone specific fea-

tures (e.g. SafeRescue) . RAW images contain data in the same linear order as it is stored on a medium. This makes it faster and easier to process image files with third party programs, especially when mounting them in ▶ 8 Miray Virtual Disk.

> **Hint:** RAW images created by HDClone automatically contain a VMDK file required to mount them directly as virtual drives in VMware or other virtual machines (▶ 6.7.4 Dynamic VMDK and VHD images).

6.7.4   Dynamic VMDK and VHD images

IOn addition to its own image formats, HDClone is also able to create dynamic VMDK and VHD images. These only contain used areas of the source and therefore are usually much smaller than ▶ 6.7.3 RAW images (analog to ▶ 6.7.2 SmartImage). Due to their technical characteristics, VMDK and VHD images are often a little bit larger than SmartImages. And it is not possible to exactly calculate their final size in advance. During creation, this may lead to a deviation from the predicted size.

> **Note:** Compression and encryption are not available for VMDK and VHD images. In this case, select a SmartImage and the appropriate options instead (▶ 5.8.5 Backup options).

VMDK and VHD images created with HDClone can be used as virtual drives in virtual machines. For further information, please refer to the manual of your version of VMware or VirtualPC. From Windows 7 and Windows Server 2008 on, you can also mount VHD images as virtual drives using the Disk Management tool (diskmgmt.msc).

▶ 8 Miray Virtual Disk can mount both formats under Windows as virtual drives. This allows you to access the files and folders stored in them without opening the image in a virtual machine.

> **Note:** A virtual VMDK or VHD drive mounted with Miray Virtual Disk can be read AND written. But changes are not stored directly in the image. But you can use the virtual drive to create a new image including all changes (▶ 8.7 Copy to other Image formats).

When creating a RAW-Image (▶ 6.7.3 RAW images), a VMDK file will be created automatically. Opening the HDClone file image with **VMware**, you will be displayed a VMDK file of the same name. You then can select and use it. The VMDK files HDClone creates comply with **HWversion=4** and are specified to be used with the following versions of **VMware**:

○ **VMware Player** starting from version 1.x

○ **VMware Workstation** starting from version 5.x

- ○ **VMware Server** starting from version 1.x
- ○ **VMware ESXi** starting from version 3

6.7.5   Usage

When choosing a copying mode (▸ **5.6 Selecting a copy mode**) you can specify **Image** as source (= restore image) or target (= create image). You can create FullImages of any media supported by HDClone. For creating SmartImages, it is required that the source medium is formatted with FAT, NTFS, ext2/ext3. With HDClone/S you can use FAT32 or NTFS formatted media for reading and writing image files. HDClone/W also supports network drives and network shares.

6.7.6   Compressed Images

When creating a file image, the dialog page **Options** (▸ **5.8 Selecting the options**) offers you to create a compressed image. Please choose the option **Compression** to have HDClone compress the file image. You will then be able to choose between **normal compression** (default), **QuickCompress** and **StrongCompress** (▸ **fig. 38**). **QuickCompress** offers a lower compression ratio than **Normal**

fig. 38: QuickCompress

compression, but in run it requires almost no additional runtime. To create back-ups quickly while saving some space, please choose **QuickCompress**. To maxi-mize the amount of saved space, please choose **StrongCompress**, which needs more time for its maximum compression.
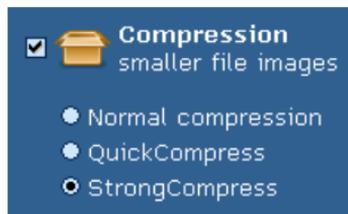
When using file images in HDClone, there is – except file sizes – no difference between compressed and uncompressed file images from the user's point of view. Creating compressed file images will consume more time than decom-pressing file images when restoring. Therefore, transfer speed when restoring compressed file images is usually faster than creating compressed file images.

> **Note:** Activating compression usually leads to a lower copying speed, since compressing data consumes extra time. But in some cases, creat-ing compressed file images may even lead to a higher copying speed. Especially when the medium containing the file image is relatively slow, for example slow USB keys, mass storage media connected via USB 1.1, or slow network drives and when using **QuickCompress**.

6.7.7 Password-Protection

When creating file images, you can protect them with a password (option Password protection, ▶ 5.7.5.1 File image as a target). HDClone will not restore a file image that is password protected unless the correct password is specified. It is also not possible to open or mount a password protected file image with ▶ 8 Miray Virtual Disk without specifying the correct password first.

> **Important:** Password protection is a simple access protection for file image. HDClone and Miray Virtual Disk will deny any access without the correct password. For secure protection of the file image data, choose the Data Encryption option (▶ 5.7.5.1 File image as a target).

6.7.8 Encryption

If you select the Data Encryption option when creating a file image (▶ 5.7.5.1 File image as a target) , the data in the image will be encrypted. HDClone uses a 128 bit AES encryption for this purpose. The image data then cannot be read without the specified password, neither with HDClone or ▶ 8 Miray Virtual Disk not with other software tools.

> **Warning:** Since the data encryption used in HDClone is a secure method without a displacement password, image data created with encryption will be definitely irrecoverable if the password gets lost.

> **Note:** Currently, encrypted file images cannot be opened and mounted as virtual drives with Miray Virtual Disk.

> **Hint:** Encryption will usually increase the time required for creating and restoring file images significantly. Select Data Encryption only if it is required. Otherwise the password protection mechanism may also be sufficient and it will not increase the duration of the process.

6.7.9 Images from CD/DVD

HDClone cannot store file images directly on CD/DVD, but read file images from there for restoring. Insert the CD/DVD into the drive before starting HDClone or when the first screen appears. Choose Image-to-Drive or Image-to-Partition mode and click on [Next]. When selecting the source image, the CD/DVD drive will appear in the list and you can choose a source images from there.

> **Note:** When writing an HDClone image to CD or DVD it is required to use an ISO file system. Please consider the manual of your CD writing software in this case. The CD/DVD media has to contain the entire im-

age. So called ‚spanning' of the file image is not supported by HDClone But you can choose a file block size, matching the capacity of the target medium optimally (▶ 5.8.7 Options for source and target).

6.8   Defragmentation

HDClone can perform a defragmentation for NTFS and FAT file systems during copying. On the Options dialog page (▶ 5.8 Selecting the options), select Defragmentation (▶ fig. 39). Apart from the general advantages of a de-

fig. 39: Defragmentation

fragmentation, in particular the acceleration of file accesses and the boot process, HDClone offers the special advantage of performing the defragmentation process with only little additional time required. Downsizing or defragmenting can also be selected when restoring from file images if it has been created using the options Store downsizing info or Store defrag info (▶ 5.8.3 General options).

> **Important:** Use defragmentation on healthy file systems only, meaning only those file systems declared being flawless by programs like chkdsk. exe (under Windows).

> **Note:** When downsizing partitions, HDClone may also shift data blocks. This shifting aims to reduce the file system's size in as few steps as necessary. For a real defragmentation select the option Defragmentation explicitly even when downsizing a file system.

6.9   Command line interface

To use HDClone for automated processes or time-triggered calls, there is the additional file hdclone-cl.bat for calling HDClone from the Windows command line. This program is destined to be called by shell scripts or program links. It handles user input and output exclusively via the command line and calling parameters.

This allows to use the command line version for areas of application, for which the graphical version is not suitable, like the following examples:

○ **Time-triggered calling:** Scheduled calls of HDClone by the Windows Task Manager to start copying processes automatically, for example backups.

○ **Script integration:** Calling HDClone from scripts for integrating it into automated processes, for example for mass installation (deployment).

○ **Programmed processes:** For recurring copying processes, you can create links in the Start Menu, the Quick Launch bar, or on the Desktop to allow these programmed processes to be called quickly and easily at any time.

> **Hint:** When calling **hdclone-cl -help** or without any parameters, a list of supported parameters in combination with a short description of their usage will be displayed.

The following chapters list and explain the supported parameters. The order of individual parameters when calling **hdclone-cl** is arbitrary.

6.9.1   Start Menu

To facilitate use of the command line version, it has its own Start Menu entry. Under the HDClone entry, you find the sub-folder CLI. It contains two subitems:

○ **HDClone CLI:** Opens a privileged Windows Shell in the program folder, so you can directly start the command line version from here.

○ **Scripting templates:** Opens a folder with templates for batch scripts in the Windows Explorer. You may customize them according to your needs.

> **Important:** Along the scripting templates, there is an **hdclone-cl.bat** file. Use it instead of calling **hdclone.exe cl**, especially in complex scripts, to ensure you obtain the correct result values (▶ 6.9.7 Return values). Replace the call of **hdclone-cl.exe** from earlier versions with **hdclone-cl. bat**.

6.9.2   Program call

The command line version of HDClone expects the following calling syntax:

○ **D2D – Copying an entire drive**
  hdclone-cl -mode:d2d -srcdrv:[source] -dstdrv:[target]

○ **P2P – Copying a single partition**
  hdclone-cl -mode:p2p -srcvol:[source] -dstvol:[target]

○ **D2I – Creating a file image of an entire drive**
  hdclone-cl -mode:d2i -srcdrv:[source] -dstvol:[target] -dstimg:[image]

○ **P2I – Creating a file image of a single partition**
  hdclone-cl -mode:p2i -srcvol:[source] -dstvol:[target] -dstimg:[image]

○ **I2D – Restoring a file image to an entire drive**
  hdclone-cl -mode:i2d -srcvol:[source] -srcimg:[image] -dstdrv:[target]

○ **I2P – Restoring a file image to a single partition**
  hdclone-cl -mode:i2p -srcvol:[source] -srcimg:[image] -dstvol:[target]

> **Note:** When using Enterprise Edition with more than one target, the calling syntax is extended as follows: the parameter combinations

-dstdrv:[target], -dstvol:[target] or -dstvol:[target] -dstimg:[filename] have to be specified iteratively, one for each copying target.

Providing the parameters described above is mandatory. If one of the parameters is missing or has an invalid value, the call will be canceled with an error.

> **Note:** Drive-to-Partition and Partition-to-Drive modes are not available in the command line version. Please use the functions for creating and restoring file images instead.

6.9.3   Drive identification

To allow more areas of use for physical drives (-srcdrv:[source]/-dstdrv:[target]), there are different ways to specify a drive:

○ **Drive by Windows ID:** Physical drives are usually specified by their respective ID, assigned by Windows at run-time. This ID is to be found in the Disk Management of Windows (diskmgmt.msc).

○ **Drive by port:** You can also specify the port that is used to connect the drive (not for USB and Firewire). If you specify the 2nd SATA port for the source, the drive connected to it will be used, regardless of the Windows ID assigned to it.

○ **Drive by name / serial number:** Alternatively, a drive can be selected by its type name and /or serial number, regardless of the Windows ID assigned to it or over which port it is connected. But it has to be unique in the context of the copy to be created (and the Edition used).

> **Hint:** You can use hdclone-cl -list to display a list of the available physical drives and their respective indications: Windows ID, port number, and name/serial number.

In case there are several targets available under the identification provided, HDClone Enterprise Edition will take this specification as unambiguous if the number of drives is smaller than or equal to the maximal number of targets.

> **Example:** If you specify a drive name as target, which matches five drives in the system. HDClone Enterprise Edition 8x will use all five drives as targets, while the Enterprise Edition 4x will refuse cloning due to the ambiguity.

> **Note:** If HDClone cannot make an unambiguous selection for the port or identification specified, HDClone will abort the process with an error.

6.9.4 Folder paths

File images are specified as source or target (▶ 6.9.2 Program call) using the drive name (-srcvol:[source]/-dstvol:[target]) and the image name (-srcimg:[image]/-dstimg:[image]). HDClone then creates or searches for images in the "HDClone Images" folder on the specified drive. A different folder can optionally be specified with -srcdir:[path] or -dstdir:[path].

6.9.5 Network shares

File images can also be created directly on network shares or be recovered from there. Just use -srcvol:[source]/-dstvol:[target] to specify a path for the network share instead of a drive letter. The network path must have the form:

\\[domain|computer]\[share]

For example "\\MyComputer\sharedfolder". Subfolders on network shares can be optionally specified using -srcdir:[path] or -dstdir:[path] (▶ 6.9.4 Folder paths). Otherwise the default folder "\\MyComputer\sharedfolder" will be used for network shares, too.

6.9.6 Optional parameters

There is a number of further, optional parameters, allowing you to enable or disable certain features of HDClone for the copying process. They are provided in the form

-[option]:[on|off].

The following table lists the available options. The values printed in capital letters (ON or OFF) represents the default value for the respective parameter. This value will be used if you do not explicitly provide this parameter. The individual options correspond to the options of the graphical HDClone program.

Option	Meaning
-verify:[on|OFF]	Perform an additional verification (▶ 5.8.1 Verifying).
-smart:[ON|off]	Faster copies by using logical file system information (▶ 6.1.2 SmartCopy).
-freespace:[on|OFF]	Copy unused areas (▶ 5.8.3 General options).
-swapfiles:[on|OFF]	Copy pagefile.sys and hiberfil.sys (▶ 5.8.8 Advanced options).

Option	Meaning
-defrag:[on|OFF]	NTFS+FAT only: Also perform a defragmentation when copying or store defragmentation information when creating a file image (▶ 5.8.3 General options).
-imagetype: [full|SMART|raw| vmdk|vhd]	Image type to be created, according to the available image formats (▶ 6.7 File images).
-timestamp:[ON|off]	Automatically extends the names of image files by a time-stamp. For labeling periodic backups and to avoid identical naming of file images. Without this option, the command line version will cancel the process in case of identical names.
-compression: [on|OFF|quick|strong]	Create a compressed image, on for standard compression, quick for QuickCompress, and strong for Strong-Compress (▶ 6.7.6 Compressed Images).
-resizeinfo:[ON|off]	NTFS+FAT only: Store information for downsizing when creating file images (▶ 5.8.5 Backup options).
-password:<password>	Specify a password to protect the file image.
-encrypt	Encrypt image (only in combination with -password).
-maxsize:<size>	Limit the size of files in the image folder to a maximum. Value for size plus K/M/G/T for magnitude, for example 650M, 4G, default is 2G.
-skip:[pnr]:[pnr]...	Copy and create image only: Numbers of the partitions to be excluded from the copy or not stored if an image is created. Numbering starts with 1, the partition order equals the order listed by the command hdclone-cl -list.
-resize -resize:<size> -resize:fixed -resize:skip -resize:AUTO -resize:[p1]:[p2]:[p3]...	NTFS+FAT+ext with copy and image restore only: Resizing partitions automatically or manually when copying or restoring from a file image (▶ 5.9.2 Adjusting partitions), excluding individual partitions (▶ 6.6 PartitionSelect). <size> = value for size plus K/M/G/T for magnitude, for example 650M, 4G, default is 2G.
-adjust:[ON|off]	Automatic adjustment of disk parameters.
-preferlock	Reserve source for exclusive access, otherwise VSS (▶ 2.9 HotCopy & LiveImage) will be used.
-allowlock	Only use exclusive source access if VSS (▶ 2.9 HotCopy & LiveImage) is not available.
-allowlazy	Use unsecured drive access, if exclusive access or VSS are both not available.

Option	Meaning
-report:[drvletter]	Generate a report and store it to the specified drive (▸ 6.10 Store final report).
-list	Lists all drives and partitions recognized as well as their internal numbering, port number, name, and serial number (▸ 6.9.3 Drive identification).

6.9.7 Return values

The command line version (CLI) of HDClone returns result values in the environment variable ERRORLEVEL. This allows to evaluate and to react to the copying result automatically, for example by using batch files.

Option	Meaning
0	Copying process finished successfully with no errors of any kind or the program was called using parameters -help or -list.
1	Errors in call (missing/duplicate/invalid parameters).
2	Invalid license or license expired.
3	At least one 'resize' parameter (▸ 6.9.6 Optional parameters) is invalid, does not match the target size or contains invalid characters.
4	Could not access source or target properly, for example device or file image not found/access denied.
5	Password not specified or invalid password.
6	User abort (Ctrl + C).
7	Copying finished with verification errors.
8	Copying finished with read/write errors (overrides 7).
9	Some other error occurred. A specific error code, is displayed with the console output of HDClone.

6.9.8 Resizing

In case of copying or restoring, you can use the resize option (▸ 6.9.6 Optional parameters) to specify how to adjust the sizes of individual partitions on the target medium. The resize option without any further parameters will cause all partitions to be resized proportionally to their original size. You can specify one or more additional parameters to specify the resizing for individual partitions in their natural order on the medium. These parameters are:

<size>: Increases or reduces the size of a partition to the size value specified.

The values may be specified in sectors (**S**), bytes (**B**), kilobytes (**K**), megabytes (**M**), gigabytes (**G**), or terabytes (**T**). The desired numeric value has to be specified, immediately followed (without spaces) by one of the unit specifiers above (for example: **10G** = 10 gigabytes or **500M** = 500 megabytes).

fixed: Keeps the partition size without any changes

skip: Skips the partition, meaning it will not be copied (▶ 6.6 PartitionSelect).

auto: Adjusts the partition size automatically and proportionally to its share of the entire medium.

The parameters for resizing (**<size>**, **fixed**, **skip**, **auto**) may be specified repeatedly, separated by a colon. The parameters will be applied to the partitions in the specified order. In case there are more partitions than parameters specified, the default parameter **auto** will be applied to the remaining partitions. If there are more parameters specified than partitions available, the remaining parameters are ignored. This option works equivalent to ▶ 5.9.2 Adjusting partitions.

> **Example:** There are four partitions on the drive, but only two resize-parameters are specified. The first two partitions will be adjusted as specified. The two remaining partitions will be resized automatically, just as if the parameter **auto** was specified for them.

6.9.9   Examples of use

The following examples represent a selection of frequently used scenarios, but they do not cover all possible variations or areas of use.

○ **Copying Disk 1 to Disk 2, physical 1:1 copy (hard disk copy)**
  hdclone-cl -mode:d2d -srcdrv:1 -dstdrv:2 -smart:off -freespace:on

○ **Backup image: store Disk 1 to file on E: (hard disk backup)**
  hdclone-cl -mode:d2i -srcdrv:1 -dstvol:E -dstimg:backup

○ **Restoring a file image from drive E: to Disk 1**
  hdclone-cl -mode:i2d -srcvol:E -srcimg:backup -dstdrv:1

○ **Copying Disks, adjust partitions sizes automatically**
  hdclone-cl -mode:d2d -srcdrv:1 -dstdrv:2 -resize

○ **Copying Disks, keep size of partition 1, resize others automatically**
  hdclone-cl -mode:d2d -srcdrv:1 -dstdrv:2 -resize:fixed

○ **Copying Disks, partitions: 1. keep size, 2. resize to 100 GB, resize others**
  hdclone-cl -mode:d2d -srcdrv:1 -dstdrv:2 -resize:fixed:100G

○ **Copying Disk, adjust partition 1 automatically, keep sizes of others**
  hdclone-cl -mode:d2d -srcdrv:1 -dstdrv:2 -resize:auto:fixed:fixed:fixed

Hint: Call hdclone-cl -list to find out, which drive numbers are assigned to which physical drives. You will be displayed a list of the available physical drives in the system.

Note: These and further examples are to be found in the CLI subfolder of the program path after installing HDClone, or via [Start] ▶ [Programs] ▶ [HDClone...] ▶ [CLI] ▶ [Sample scripts].

6.10   Store final report

After the process has been finished, you can generate and store a detailed final report in a text file to document and analyze cloning processes. The report contains the following Information:

○ Program and license

○ Device data (CPU, memory, etc.)

○ Copying mode

○ Source and target(s) including device details

○ Option settings

○ Duration and result including errors

7   Troubleshooting

This paragraph describes possible problems when using HDClone and offers proposals for solution. If there should be no proposal for solution for a problem, you can gladly contact our ▶ 9.5 Support.

7.1   Load errors

During the start of the program, before HDClone is loaded itself, a message and a progress bar will appear on the boot screen. In case of an error, one of the following error codes will be indicated here.

7.1.1   Error #5002 and 'Disk error'

This error will be displayed if the boot medium is not readable when booting the program. The error is reported by the BIOS of the computer and points to a defective data carrier or a problem with the used boot drive. In many cases, in particular when booting from a floppy disk, an incompatibility between drive and data carrier is the cause. Principally this problem can be fixed. Please try the following steps, at best in the indicated order:

- Try again to boot the program, perhaps with/without cold start.
- Create once again a bootable disk (▶ 4 Installation).
- **Floppy disk:** format the Floppy disk (no quick format) before creating a new one.
- **Floppy disk:** Use another floppy disk.
- Use (if possible) another boot drive.

> **Note:** If you didn't receive HDClone as an installation package but on a bootable disk and if a disk shows this problems also after multiple trials on different devices, please contact our ▶ 9.5 Support and indicate your license number.

7.1.2   Other errors

If other errors in the form of # (number) should occur when loading the program, please contact our ▶ 9.5 Support.

7.2   Keyboard and mouse

HDClone supports keyboards and mice with PS/2 standard or USB connector
(▶ 3 Supported hardware). This also includes many wireless mice, given they are
connected as a true USB device. Input devices connected with Bluetooth are
currently not supported. In this case, please connect a separate USB device. If
keyboard or mouse (or both) do not function with HDClone, this is usually due
to a wrong legacy emulation setting in BIOS setup. On most computers, you can
fix this problem by changing (activating or deactivating, depending on the cur-
rent setting) the emulation for PS/2 devices in BIOS setup. Please consult your
computer manual on how to change this setting since it may be named differ-
ently according to the respective BIOS. In most of the cases, you can find it un-
der the name USB Legacy Support or USB Keyboard Support (often under Inte-
grated Peripherals or Advanced Options).

> **Note:** In some of the cases, problems with PS/2 keyboards or mice oc-
> cur with active emulation for PS/2 devices. If you don't use any USB de-
> vices, please switch off PS/2 emulation in the BIOS setup.

7.3   General problems

7.3.1   Slowed down system

If you think the speed of the total system or the copying speed – also with IDE
and SCSI devices – is too slow, a USB controller can be the cause, even if it is not
used (▶ 7.6.4 Speed loss).

> **Note:** In case the working speed of a copy is significantly below the
> source medium and the technical performance data of the target me-
> dium imply a significantly higher performance, the target medium might
> be a drive with a deviant internal block size. In this case, try to use the
> automatic alignment option (▶ 5.8.7 Options for source and target).

7.3.2   Read, write and verification errors

When HDClone reports errors, this usually means defective areas on the medi-
um. General hardware problems can also cause read and write errors, usually
indicated by a very high number of errors. Try to fix the problem using the trou-
bleshooting instructions for the hardware type (IDE, SCSI, USB). If the problems
cannot be fixed this way, deactivate, step by step, the following options:

○ CachedMemory

○ Read cache and write cache

- ○ FastCopy

- ○ DMA

- ○ SharedMemory

If the problem does not occur any more after having deactivated a certain option, the previously deactivated options can be reactivated as a test.

7.4   IDE/ATA/SATA

7.4.1   Hard disk not recognized

If HDClone does not recognize a hard disk, there can be several reasons. Perhaps the controller, which the disk is connected to, has not been found (▸ 7.4.2 IDE controller not found). A further possible reason can be a non-standardly connected hard disk. This is for example the case if a hard disk is configured as slave and if a CD/DVD drive or no drive at all is connected at the same IDE channel as master. Normally, HDClone can handle that, too.

> Note: If an SATA hard disk is not recognized, this can also be due to the used SATA controller (▸ 3.3.2 SATA/SATA-II controllers).

7.4.2   IDE controller not found

There are the following three reasons why HDClone has not automatically recognized an IDE controller:

- ○ The IDE controller/channel is deactivated, e.g. on an onboard IDE controller. Activate the IDE controller/channel via the BIOS setup.

- ○ Standard IDE controllers (ISA) are not taken into account if PCI IDE controllers are available. Connect the respective hard disk to a PCI IDE controller in this case or deactivate the PCI IDE controller or controllers.

- ○ The used controller does not correspond to the PCI IDE standard. Although most controllers support this standardized programming interface, there are some controllers which have only a proprietary programming interface. More detailed information can be found in ▸ 3.3.1 IDE/ATA controllers. Connect the corresponding drives to another controller (PCI IDE controller).

7.4.3   Problems with DMA

The following principal problems can occur with (Ultra) DMA:

- ○ The achieved speed is too slow despite DMA. Please consider that the achiev-

able speed (▸ 3.3.5 Speed) depends on many factors and that this is not absolutely due to a problem with DMA.

○ DMA mode is not available. When selecting the options (▸ 5.8.7 Options for source and target), the option DMA is deactivated and locked in this case.

○ Read, write or verification errors occur when using DMA.

In all cases, the problems can be due to the same reasons. When having problems with DMA, you can principally use PIO mode at any time. Deactivate the option DMA of the concerned drive when selecting the options (▸ 5.8.7 Options for source and target). Since PIO mode is usually much slower than DMA, we recommend to try first of all the following hints and help instructions to possibly be able to use the DMA mode. Please consider the notes in the subchapter ▸ 7.4.4 BIOS settings.

○ Check if the concerned drive really supports DMA. Some older drives and especially older CompactFlash media do not support DMA.

○ Make sure that from Ultra DMA Mode 3 on an 80-wire data cable is used to connect the drive(s).

○ If two drives are connected via the same cable, the DMA mode of the slower drive is also used for the faster drive. Remove the slower drive temporarily, if possible, or connect the drives via separate channels or cables.

○ Try both connections of the data cable (center connection and connection at the end) in case of a single connected drive to eliminate possible problems with damping (center connection) and reflection (connection at the end).

○ Switch the used UltraDMA mode to a lower value in the BIOS setup (▸ 7.4.4.1 Switch to a lower/higher UltraDMA mode) or deactivate UltraDMA (▸ 7.4.4.2 Activate/deactivate UltraDMA). Multiword DMA mode will be (automatically) still available, which offers about a twice to four times higher speed than PIO mode.

○ On the other hand, you can also try to activate UltraDMA or to switch to a higher UltraDMA mode if the corresponding default settings in your BIOS setup are too low.

> **Note:** Our tests revealed that some chipsets and hard disks do not collaborate optimally. This can lead to UltraDMA mode (putatively correctly) recognized and set in the BIOS is too high.

7.4.4   BIOS settings

In case of problems when using DMA, please refer to the following notes

The following notes refer to settings which you should possibly make in the BIOS setup of your computer if problems occur during the use of DMA. Since the settings in the BIOS setup are manufacturer- and model-specific, these notes can only be given in a general form. Refer to your BIOS manual on how exactly to make these settings and which settings are available at all. You usually find the DMA settings under Integrated Peripherals or Chipset Setup in the BIOS setup.

> Note: Please perform automatic hard disk recognition in BIOS after each modification of the DMA and hard disk settings so that the modifications for the corresponding drives become effective. Make sure to save the modifications via Save and Exit when leaving BIOS setup.

7.4.4.1   Switch to a lower/higher UltraDMA mode

In many BIOS setups the (highest) used UltraDMA mode can be selected manually. If you have problems with DMA, try to switch the used mode step by step to a lower level at the corresponding IDE channel. Only if this does not solve the problem, deactivate UltraDMA completely. The controller then mostly (automatically) uses multi-word DMA, which is at least faster than PIO. You can switch the UltraDMA mode step by step to a higher level, if you think you have not selected the best possible UltraDMA mode.

7.4.4.2   Activate/deactivate UltraDMA

Some BIOS setups do not offer a free selection of the UltraDMA mode but only an automatic recognition or deactivation. If this is the case with your BIOS or if you have already switched to the lowest UltraDMA mode and problems keep occurring, deactivate UltraDMA. Usually, multi-word DMA is (automatically) available then, which is often faster than PIO. Only if this doesn't function either, you should completely switch off the DMA mode in HDClone (▶ 5.8.7 Options for source and target). If UltraDMA is deactivated in your BIOS setup, you can activate it as a test, of course, in order to attain a higher speed, if possible.

7.4.4.3   Deactivate IO caching

If there are problems in the PIO mode as well, you should deactivate IO caches and buffers. In particular the setting Dataport Postwrite, if available, should be switched to Disable if there are problems.

7.4.4.4   Set BIOS defaults

If HDClone should not work as desired despite all the above mentioned instruc-

tions, you can try to set standard values via the option **Load BIOS/Setup Defaults**. This setting tries to avoid possible hardware conflicts.

7.5   SCSI

When using SCSI devices, please make sure that they are correctly configured and connected to the SCSI controller. In particular SCSI controllers with SCSI BIOS must show a hard disk during the system start, so that HDClone can then address this hard disk. Furthermore, HDClone must support the controller you use. You find a list of the supported SCSI controllers in chapter ▶ **3.4.2 Compatibility**.

> **Note:** Even if an SCSI controller shows the desired drives during the system start, this is no guarantee that they are correctly configured or connected. In principle, the BIOS of the SCSI controller works on a lower level than the SCSI drivers used by HDClone and can thus possibly recognize hard disk drives which are not recognized by HDClone itself.

HDClone has been tested on a range of SCSI controllers. Sporadically encountered problems are bypassed by the software as far as possible. The following subchapters contain useful hints on how to solve further random or sporadic problems. These hints should be applied in the described order to minimize the effort, if possible. The following problems occurred during the tests and could be bypassed with the hints from the following subchapters:

- ○ HDClone stops during device recognition (▶ **5.6 Selecting a copy mode**)
- ○ No SCSI hard disks are recognized
- ○ Not all SCSI hard disks are recognized

7.5.1   Restart

If HDClone stops during the startup or does not show the desired SCSI drives, try to restart with a warm boot (reset button). Only if this does not fix the problem, you should try a cold start (switch off the PC and switch it on again after 30 seconds). Both forms of restart may solve signal problems of SCSI controllers.

7.5.2   Deactivate unused controllers

If a restart does not lead to the desired result, you should, if your system disposes of several SCSI controllers, deactivate unused controllers. This is also recommended if a controller is principally used, but the hard disks connected to it are not needed for using HDClone.

7.5.3   Deactivate unused drives

In some cases, SCSI hard disks, which are connected to the same controller, can interfere with each other or even with the controller itself. Deactivate individual hard disks as a test or connect them step by step after one another to find out which hard disk possibly causes an interference. Make sure that the last SCSI device is always terminated also during the tests.

7.5.4   Minimum configuration of the controller

The configuration of the SCSI controller over its BIOS setup or the BIOS setup of the PC, in case of onboard controllers, can also solve the problem. Set the lowest resp. the securest values for the SCSI bus (e.g. transmission in the narrow mode of a wide controller).

7.5.5   Minimum configuration of the systems

Try to connect the SCSI hard disks used in the system in a different way, especially if you use several SCSI controllers. Proceed as follows, if possible: deactivate all SCSI controllers except one. This controller should have one SCSI channel only, if possible, and be part of the controllers listed in ▶ 3.4.3 **Manufacturer information**. Connect then the needed drive or drives only. Apart from defective drives, this strategy mostly allowed us to find a functioning configuration during our tests to execute the planned job.

7.6   USB

Despite the vast support of USB controllers and storage devices (▶ 3.5 **USB**), there are some cases where these controllers and devices do not function as expected. The following subchapters provide you with hints and solutions.

7.6.1   Storage device not recognized

Mostly, there are four possible reasons why a USB storage device supported by HDClone (▶ 3.1 **Overview**) is not recognized:

○ The USB storage device has been connected too late or exchanged afterwards. USB storage devices should be connected to the computer before starting HDClone (▶ 5.1 **Preliminary steps**).

○ The USB storage device is not directly connected to the USB controller but via a hub (e.g. at the monitor). Always connect the USB devices, you wish to use with HDClone, directly to the USB controller or to the computer.

○ The used device is no standard-conform USB mass storage device and does

there-fore not belong to the supported devices (▸ 3.5.1 Mass-Storage-Class).

○ The USB storage device is defective or works faultily. You should then test its functionality by using it with another PC or another operating system.

> **Note:** If no USB storage device is recognized and if the above mentioned possibilities are excluded, the corresponding USB controller has probably not been recognized (▸ 7.6.3 Controller not found).

7.6.2   Other device problems

Some devices, especially USB sticks, can show malfunctions in case of temperature rise or continuous operation, i.e. in case of continuous reading or writing big amounts of data. With HDClone, these problems manifest in read or write errors on the respective USB storage device, which do not always occur at the same location but after a certain operating time. Sometimes these hardware problems also lead to very long breaks during the copying process, which can be up to several minutes. When selecting the options (▸ 5.8.3 General options) , try to deactivate the option FastCopy in this case. Only if the problem persists, activate additionally the option Cooling off break for the concerned device. Thus, the copying process takes a bit longer, but usually the data transfer works better.

> **Note:** The described problems are mostly due to deficient hardware and also occur under other operating systems. We recommend you to have the concerned device replaced by your vendor.

7.6.3   Controller not found

HDClone should recognize all current USB controllers which offer one of the USB standard interfaces (▸ 3.5.2 UHCI, OHCI and EHCI). If HDClone recognizes USB devices on one PC but not on another PC or on another controller, the USB controller can have one of the following problem:

○ The USB controller does not meet to the UHCI, OHCI or EHCI standard. In this case, use another compatible (▸ 3.5.2 UHCI, OHCI and EHCI) USB controller.

○ The USB controller is deactivated, e.g. in case of an onboard USB controller. Activate the USB controller via the BIOS setup.

○ The USB controller does not function correctly or is defective. Use another USB controller or another PC for the copying process.

7.6.4   Speed loss

USB controllers can have a negative effect on the speed of the whole system. This particularly affects the copying speed of **all** device types (also IDE and SCSI),

even if no USB storage device is connected. Remove the corresponding USB controller if it is not needed during the use of HDClone. Otherwise, there a no negative effects apart from the speed loss.

> **Note:** In our tests, this problem showed up with only one USB controller (VIA VT6212) and also persisted on other computers and operating systems with this controller. The measured speed loss on the PCI bus was at about 40% (!).

7.6.5   Other controller problems

Another problem is an incompatibility with certain USB storage devices caused by the USB controller. Especially older USB devices do not function flawlessly in such USB controllers. Use another USB controller, if possible.

> **Note:** In our tests, this problem showed up with only one USB controller (Acer ALi M5273) and was also reproducible on other computers and operating systems.

7.7   Mapped network drives

When using mapped drives in Windows, HDClone may not find the mapped drives in some cases, since HDClone is running in administrator mode. To use the established mapped drives, a small change to the Windows Registry is required. Usually, ▶ 4.2.1 HDClone Setup will handle this automatically. But you can also make the change manually, as described below:

○ Open the registry editor (regedit.exe)

○ Move to the following registry key in the tree structure
   HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\
   Policies\System

○ Create the DWORD value EnableLinkedConnections

○ Set its value data to 1 and restart your computer

> **Note:** To undo the changes, simply delete the registry value.

8   Miray Virtual Disk

HDClone contain the software **Miray Virtual Disk**, which allows to mount file images created with HDClone – even VMDK and VHD images – as virtual drives under Windows. You then can access files and folders stored within a file image directly. **Miray Virtual Disk** can be started on demand or automatically at system start-up. File images may be mounted either just on demand or persistently.

> **Note:** You can also open and mount file images as virtual drives directly, from the network, using network drives or network shares.

8.1   Installation

Miray Virtual Disk is included with the ▶ 4.2.1 **HDClone Setup**. During setup, you can choose to install ▶ 4.1.3 **Miray Virtual Disk**. It will be installed to a separate location in the **Program Files** directory.

8.2   Program startup

You find **Miray Virtual Disk** in the Windows Start menu in the HDClone folder. At startup, the program window will appear (▶ **fig. 40**). Since **Miray Virtual Disk** works in the background, the program icon will appear in the System Tray. **Miray Virtual Disk** will remain active in the background, even if you close the program window. You can open the program window again using the **System Tray** icon.

8.2.1   Program window

Use the program window (▶ **fig. 40**), to open file images and create virtual drives. It contains three major elements: menu bar, ▶ 8.2.2 **Image list**, and control buttons at the bottom. You may also control **Miray Virtual Disk** using the Context Menu (right click on the image list) or keyboard shortcuts (hotkeys) (▶ 8.3 **Operation**).

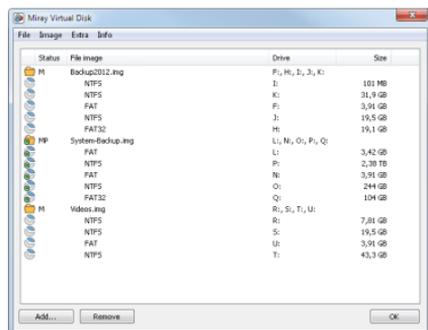You can use the control buttons to add an Image ([**Add...**], see ▶ 8.3.1

fig. 40: Program window

Adding an image) to or to remove an Image ([Remove], see ▶ 8.3.2 Removing an image) from the image list. Press [OK] to close the program window. Miray Virtual Disk will though stay active in the background (▶ 8.2.3 Tray icon).

> **Note:** Adding an image to the image list does not automatically create a virtual drive. The image list shows the partitions an image contains, so you can mount them separately (▶ 8.3.4 Mounting an image).

> **Hint:** If you have several images in the list, you may want to resize the program window freely by clicking and dragging the lower right corner.

8.2.2   Image list

The image list serves to manage the images added before and offers an overview of the partitions they may contain. Partitions are always displayed right below the image they belong to. To distinguish the individual entries in the image list, there are different symbols as listed below:

File image
Image is not mounted

File image
Image could not be found

File image
Image is mounted

File image
Image is mounted permanently

SuperFloppy (no MBR)
Volume is not mounted

Partition
Partition is not mounted

SuperFloppy (no MBR)
Volume is mounted

Partition
Partition is mounted

SuperFloppy (no MBR)
Volume is mounted permanently

Partition
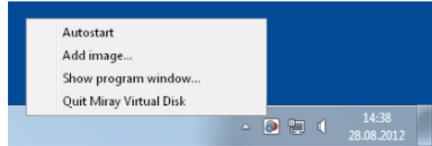Partition is mounted permanently

> **Note:** In addition to the symbols listed above, there is a column Status, where a mounted image or volume will be marked with letter M or - if permanently mounted - with MP.

> **Hint:** You can directly open mounted partitions in Windows Explorer by double-clicking in the **File image** column. This may be especially useful, if there is no drive letter available to be assigned to the partition.

8.2.3   Tray icon

You can see whether **Miray Virtual Disk** is active or not from the program icon appearing in the System Tray (Tray icon). You can open the program window by double-clicking the Tray icon. Right-clicking the Tray icon opens the context menu (▶ fig. 41) which

fig. 41: Tray icon and context menu

gives you direct access to the following four functions:

- ○ **[Autostart]:** Same functions as ▶ 8.3.7 Autostart.

- ○ **[Add image]:** Same functions as ▶ 8.3.1 Adding an image.

- ○ **[Open program window]:** Opens the program window or brings it to the front.

- ○ **[Quit Miray Virtual Disk]:** Same functions as ▶ 8.3.9 Quit program.

> **Hint:** If you want to open the program window, double-click the Tray icon. If the Tray icon is not visible, Miray Virtual Disk is not active and there are no virtual drives available.

8.3   Operation

You can operate **Miray Virtual Disk** using the menu bar on the top of the window, the control buttons on the bottom of the window or the context menu (▶ 8.2.1 Program window).The context menu opens by right-clicking on entries or on the free area of the image list. You open the tray context menu by a right-click on the program icon in the System Tray.

8.3.1   Adding an image

At first, you can add a file image to the image list of the program window. There are five ways to achieve this:

- ○ Control button **[Add...]**
- ○ Menu bar **[File] ▶ [Add image...]**
- ○ Context menu **[Add image...]**
- ○ Tray context menu **[Add image...]**

○ Hotkey F2

○ Drag-and-drop from any Explorer window

The image list also displays information on the partitions and file systems of each file image in the list (▶ fig. 40).

> **Note:** Depending on the version of the program, you will be allowed to add one or more images. When you quit the program, **Miray Virtual Disk** will memorize these images for the next program startup.

8.3.2   Removing an image

Select one or more file images, you want to remove from the image list. There are four ways to remove them:

○ Control button [Remove]

○ Menu bar [File] ▶ [Remove image]

○ Context menu [Remove image]

○ Hotkey Shift + F2

> **Note:** If images or individual partitions you want to remove are still mounted as virtual drives, the file image cannot be removed. A corresponding message will appear.

8.3.3   Empty image list

There are three ways to remove all images from the image list:

○ Menu bar [File] ▶ [Empty image list]

○ Context menu [Empty image list]

○ Hotkey Ctrl + Shift + F2

> **Note:** If one or more file images to be removed from the image list (or individual partitions thereof) are still mounted as virtual drives, the image list cannot be emptied.

8.3.4   Mounting an image

You can mount previously added file images or individual data areas (volumes) as Windows drives. When mounting an image, it will be made available as a Windows disk and will behave just like a physical disk. When mounting an entire file image which contains several partitions, you obtain several drive letters, one for each partition containing a file system Windows is able to access. When mount-

ing an individual partition, you may obtain one drive letter for this partition if Windows supports the file system it contains.

There are three ways to mount an entire file image or an individual partition. Select one or more images or partitions first:

○ Menu bar [Image] ▶ [Mount]

○ Context menu [Mount image]

○ Hotkey F8

As soon as an image or a partition has been mounted successfully, this will be displayed in the image list as follows:

○ The icon of the image or partition mounted will be displayed in color.

○ The capital **M** is displayed in the column next to the icon.

○ The drive letter(s) assigned to the virtual drives will be displayed in the row of the mounted image or partition.

> **Note:** The capital **M** always appears in the row of the object which has actually been mounted. For example, mounting an image containing two partitions, **M** will appear in the row of the image. If mounting both partitions individually, the capital **M** appears in both partition rows.

8.3.5   Persistent mounting

You can make mounted virtual drives persistent. This means that these virtual drivers will be mounted automatically with any start of **Miray Virtual Disk**. They will remain mounted as long as the program is active. In case this feature is used in combination with the option ▶ 8.3.7 Autostart, the respective virtual drives will be available at any time while Windows is running.

> **Note:** Password protected images cannot be mounted permanently, since the password would have to be stored. This would compromise password security and therefor is not supported.

If you want to mount images or partitions thereof permanently, there are three ways to achieve this. Select one or more images or partitions first:

○ Menu bar [Image] ▶ [Mount permanently]

○ Context menu [Mount image permanently] / [Mount volume permanently] (right-click on the desired image or partition in the image list)

○ Hotkey Ctrl + F8

Persistent mounting can be applied to mounted *and* unmounted images or parti-

tions. As soon as an image or a partition has been successfully mounted persistently, this will be displayed in the image list as follows:

○ A mall green point ⬤ appears in the icon of the mounted image/partition.

○ The capitals MP are displayed in the column next to the icon

> **Note:** To cancel persistent mounting, mount the regarding image or partition normally (▶ 8.3.4 Mounting an image) or unmount it completely (▶ 8.3.6 Drive unmounting).

8.3.6   Drive unmounting

There are three ways mounted images and partitions and the regarding virtual drives can be unmounted. Select one or more images or partitions first:

○ Menu bar [Image] ▶ [Unmount]

○ Context menu [Unmount image] / [Unmount volume]

○ Hotkey Shift + F8

As soon as an image or an individual partition have been unmounted, the respective icon in the image list will be displayed in gray and the capitals M or MP in the column next to the icon as well as the related drive letters will disappear.

8.3.7   Autostart

You can select to start Miray Virtual Disk automatically at system startup (Autostart). This allows to have persistently mounted drives permanently available without having to start Miray Virtual Disk manually.

There are two ways to switch the Autostart function on or off:

○ Menu bar [Image] ▶ [Autostart]

○ Tray context menu [Autostart]

The menu item indicates whether the Autostart function is currently active. If the menu item [Autostart] is displayed with a leading check mark, the Autostart function is already activated. Without a check mark, the Autostart function is not active.

> **Note:** If Miray Virtual Disk is started automatically at system startup, only the ▶ 8.2.3 Tray icon will appear. Double-click it to open the program window.

8.3.8   Close program window

You can close the program window at any time. **Miray Virtual Disk** will though stay active in the background. There are two ways to close the window:

○ Menu bar [File] ▶ [Close window]

○ Hotkey Ctrl + W

8.3.9   Quit program

To quit **Miray Virtual Disk** completely, there are three ways:

○ Menu bar [File] ▶ [Quit Miray Virtual Disk]

○ Tray context menu [Quit Miray Virtual Disk]

○ Hotkey Ctrl + Q

> **Note:** When quitting Miray Virtual Disk, all active virtual drives will be unmounted, after a corresponding dialog has been confirmed. They will be unavailable until next program startup.

8.4   Drive not visible

If there are no drive letters or less drive letters than partitions displayed after mounting an image, there may be several reasons:

○ Windows drive recognition of one or more virtual drives has been delayed. In this case, they have a drive letter assigned, but **Miray Virtual Disk** does not display it yet. Press the F5 key or select [Image] ▶ [Refresh list] from the main menu to update the image list.

○ One or more partitions contain file systems Windows is unable to use (e.g. Linux file systems). In this case, the behavior is normal, since Windows is not able to use these file systems.

○ There are no more Windows drive letters available. Windows recognizes the mounted partitions, but cannot assign drive letters to them. In this case, free one or more of the drive letters currently in use.

○ If there is a drive letter displayed, but the drive has no content or Windows prompts to format that drive, the file system is damaged. The image may have been created from an inconsistent or damaged file system.

8.5   Modes of operation

There are three different ways to mount file images in Miray Virtual Disk:

○ Write-protected: Menu bar [Image] ▸ [Advanced] ▸ [Mount (R/O)]

○ Writeable with undo option: Menu bar [Image] ▸ [Mount]

○ Direct reading & writing: Menu bar [Image] ▸ [Advanced] ▸ [Mount (R/W)]

8.5.1 Write-protected access

In this mode, virtual drives can only be read. In previous versions of Miray Virtual Disk, this was the only mode available. In this mode, no changes are made to the mounted images and no changes can be made to the file system on the virtual drive. For example, it is not possible to change file names or access rights in this mode.

8.5.2 Read/write access (default)

This mode is the default mode when mounting file images. It allows to read from and write to file images. The data written will be stored separately in this mode. This means that the data of the original file image remains unaltered, even when writing to the virtual drive. To make changes available in the original image, some Editions of HDClone allow to create a new image of the desired type from the virtual drive (▸ 8.7 Copy to other Image formats)

> **Note:** This mode works with any kind of file image. For high performant access, it is recommended to use RAW images (▸ 8.6 Converting to RAW image) in R/W mode (▸ 8.5.3 Direct read/write access).

To undo changes to an original image, resulting from write access to it, select the image in the list and unmount it. Then click on [Extras] ▸ [Delete overlay data]. The file image then has been reverted to its original state. Any changes made to the virtual drive are then made undone.

> **Hint:** To delete overlay data created with Miray Virtual Disk 3.x and earlier, double-click the file image in Windows Explorer and delete any files with the .ovl extension there.

8.5.3 Direct read/write access

In this mode Miray Virtual Disk writes or reads directly from a RAW image. It offers the fastest possible access – comparable to physical media access. This mode will immediately and irrevocably change the RAW image – in contrast to normal read/write access (▸ 8.5.2 Read/write access (default)). Therefore you may consider creating a copy of the original RAW image before using direct read/write access.

> **Note:** This mode can only be applied to RAW images. If required, you can convert other image types into RAW images (▸ 8.6 Converting to RAW image).

8.6   Converting to RAW image

One main advantage of SmartImages is the strongly reduced size they require for storing. When using Miray Virtual Disk, RAW images offer a clearly higher access performance of the virtual drive. If required, you can convert a SmartImage to a RAW image via [Extra] ▸ [Create RAM image...].

8.7   Copy to other Image formats

Use HDClone to create a copy of a virtual drive into a new image of any format required (Full, Smart, RAW, VMDK, VHD), independent of the original image format the virtual drive is based on.

Especially in cases where an image has been mounted with ▸ 8.5.2 Read/write access (default), the changes made on the virtual drive are not stored in the original image. In this case, you can use such a copy to create a new image of the desired type, which will then contain all changes made to the virtual drive.

9   Miscellaneous

9.1   Terms of license

HDClone is designed to offer you the highest possible technical flexibility, and also the HDClone license conditions are designed not to limit your flexibility when using HDClone. Since you usually don't know at the beginning on how many computers and how often you will use the software, we offer you a very simple and cost-effective license model, which restricts you the least possible.

9.1.1   License model

The following table shows you the minimum number of licenses necessary for the respective area of use.

Edition	Private users	Companies/Institutions	Professionals
Free	Sufficient	Insufficient	Insufficient
Basic	1 license	Insufficient	Insufficient
Standard	1 license	1 license per location [1] 1 license per 5 PCs [2]	Insufficient
Professional	1 license	1 license per location [1] 1 license per dedicated PC [4]	
		1 license per 25 PCs [2]	1 license per technician [3]
Enterprise	1 license	1 license per location [1] 1 license per dedicated PC [4]	
		1 license per 100 PCs [2]	1 license per technician [3]

[1] License is taken into account for the respective other indicated criteria.
[2] Existing PC work stations, regardless of actual use of HDClone.
[3] Technicians are all employees who use HDClone simultaneously or for field service.
[4] PC which is exclusively used for HDClone, for example as copy server.

In practice, the use of HDClone can involve a different number of PCs according to the area of use, despite a similar use. Either the program is permanently used on one single or several few computers, which the media to be copied is connected to when needed. Or HDClone is always used directly on the re-

spective computers, which the media to be copied is connected to; mostly with only one usage per computer. To find a fair regulation for all use cases, you can choose between a license per dedicated PC and a license for a lump number of work station PCs where HDClone could be used. Furthermore, you need additional licenses if you use HDClone (potentially) in parallel on several PCs, for example if several service employees use HDClone independently from each other. That is why you need at least one license per branch office because this also represents a (potentially) parallel use.

9.1.2   Examples

The following examples refer to frequently occurring license situations:

○ A company with 50 PC work stations needs two licenses of the Professional Edition, whereof each covers 25 PC work stations.

○ A company with 100 PC work stations needs four licenses of the Professional Edition, one for 25 PCs each.

○ A service provider with two PCs that serve as HDClone copy station needs two licenses of the Professional Edition, one for each copy station.

○ A service provider with two field service employees who use HDClone needs two licenses of the Professional Edition, one for each independently working technician.

9.1.3   Scope

A license is unlimited concerning the number of usages and the period of validity. It can be used as often as desired and without a time limit. However, the license is limited with regard to the (also potentially) parallel use on several computers and the size of the company or the institution concerning the number of existing PC work stations.

9.1.4   Consultancy

If you have questions concerning the license situation in your specific case, please contact us at products@miray.de. We will be pleased to advise you on volume licenses or more complex cases and offers you attractive discounts make you an individual offer.

9.2   Certificate of authenticity

The following notes exclusively refer to the boxed versions of HDClone and not to the versions available as download or via email.

9.2.1   Security hologram

For the protection against bootleg copies, our software is equipped with a security hologram, among others. Each of the original data carriers you received bears a security hologram. Please keep the data carriers with the security hologram in any case because this is your license proof.

9.2.2   Valid product license

The condition to have a valid product license is that the number printed on the security hologram corresponds to the number shown within the program. If this should not be the case for your software package, please email us at products@miray.de. Please indicate the number displayed by the program, the number on the security hologram and where you acquired the software package. If there is no security hologram on the data carriers or if the security hologram is damaged, please contact us as well and indicate the above mentioned data. We will try to find a simple solution so that you obtain a valid license.

> Note: Make sure that each data carrier you received bears its own security hologram with its own registration number and that this number has to correspond to the number of the program which has been started from this data carrier. That means if you start the program from a floppy disk, the displayed number has to correspond to the number of the security hologram on the floppy disk and not to the number of the security hologram on the CD.

9.3   Disclaimer

Parts of this product are based on works licensed under the GNU General Public License (GPL). The appropriate license is to be found at http://www.gnu.org/copyleft/gpl.html. On request to support@miray.de we will send you a copy of the source code.

Although HDClone was programmed with the largest possible caution and was tested on a large scale of different systems, we hope you understand that we cannot assume any liability for the proper functionality of the program and that we are not liable for damages resulting from its usage, subject to gross negligence and intention.

9.4   Feedback

We are highly interested in your feedback. If you encounter any program errors or if you have any improvement ideas, we will always try to fix the errors and implement or integrate your ideas. If you only want to tell us your opinions on this software, we are looking forward to receive such information from you.

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Fax   +49 (0)89 72013-647

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9.5   Support

If you encounter any problems with one of our products, our support team is gladly at your disposal. Please send us your inquiry through our homepage at http://www.miray.de/support/ or email us at support@miray.de. Please note that inquiries sent directly per email and not over our homepage take a bit longer to be answered due to the system.