Miray
RAM Drive

Manual

Miray RAM Drive

Manual

Table of Contents

1   Introduction

Thank you for using Miray RAM Drive. This application has been developed with the objective to equip a software, sophisticated and powerful inside, with effortless and intuitive usability.

Nevertheless, if you require any assistance with your Miray RAM Drive, or you feel that it does not fit your needs, our team is here to help; please refer to ▶ 11.7 Manufacturer information.

1.1   Chapter summary

The following chapters of the manual provide guidance, information and assistance with regards to Miray RAM Drive. They are organized as follows:

○ 1 Introduction
  General information about the product and about this manual.

○ 2 Quick start
  A quick guide to using Miray RAM Drive instantly.

○ 3 Installation
  How to set up Miray RAM Drive on your PC.

○ 4 Start the program
  How to start and stop Miray RAM Drive.

○ 5 Program window
  Creating a new RAM drive and turning it on and off.

○ 6 Tray icon
  How to access your Miray RAM Drive once it has been started.

○ 7 Context menu
  Allows you to access the advanced features.

○ 8 Additional functions
  Benefits of the additional functions.

○ 9 Application areas
  Common usage scenarios of Miray RAM Drive.

○ 10 Troubleshooting
  What to do if Miray RAM Drive does not work properly.

○ 11 Help and support

How to access more information and support from Miray.

○ **12 Appendix**
General, legal and other information.

○ **13 Glossary**
Explanations of terms used.

1.2   Terminology used

Some of the terms used in this manual may require further explanation, or an explanation of how they are to be understood in the context of Miray RAM Drive. They can be found in the ▸ **13 Glossary**.

1.3   Explanation of the symbols

In this manual, keys on the keyboard are depicted with an inverted background color, for example `Esc` or `Return`. Some keys are represented by an icon, for example `↑` for the arrow up key. The controls you can see on the screen, in particular the buttons, are depicted in italics and using a line below above, for example $\overline{OK}$, and $\overline{Cancel}$. Display elements, such as window titles or labels, are represented within single quotation marks in bold type, for example ‚**Window Title**'.

1.4   Product description

Miray RAM Drive is the easiest and quickest solution for creating a RAM drive under Windows. A RAM drive is an in-memory virtual drive, which is usually several times faster than hard disks, SSDs and other storage media. Miray RAM Drive can be used by any Windows program just like a normal, physical disk. It is freely adjustable in size from 20 MB to 8 GB (or more, depending on the edition used). There are several editions of Miray RAM Drive, providing extended functionality for special areas of use; they are all described in this manual.

1.4.1   Miray RAM Drive

The Standard Edition offers a quick and easy-to-use RAM drive:

○ Simple 3-click interface

○ Maximum performance and minimum latency

○ RAM drive with up to 8 GB (4 GB on 32-bit Windows)

○ Ready for immediate use due to automatic formatting

1.4.2   Miray RAM Drive Plus

In addition to all of the features of Miray RAM Drive, Plus includes:

- RAM drive with up to 24 GB
- Runs in a standard user account (no admin rights required)
- Autostart function
- Persistence mode (▸ 8.4 Persistence)

Miray RAM Drive Plus is designed for users who require a permanently available RAM drive, or a RAM drive that runs in a standard user account.

1.4.3   Miray RAM Drive Pro

In addition to all of the features of Miray RAM Drive Plus, Pro includes:

- RAM drive with up to 48 GB
- Adjustable physical sector size
- Selectable file system and cluster size
- Flexible partitioning and formatting
- Command line option for program automation

Miray RAM Drive Pro is designed for professional users and developers. It can simulate physical disks in test scenarios or other applications, significantly reducing testing and development time.

1.4.4   Miray RAM Drive Server

In addition to all of the features of Miray RAM Drive Plus, Sever includes:

- Specially designed for Windows Server
- RAM drive with up to 128 GB
- Command line option for program automation

Miray RAM Drive Server is specifically designed for use on servers or on virtual machines.

1.4.5   Editions comparison

The following table shows a comparison of the different editions.

Feature Overview	Std	Plus	Pro	Server
Simple 3-click interface	●	●	●	●
Maximum performance and minimum latency	●	●	●	●
Immediately ready with AutoFormat	●	●	●	●
Autostart function (▶ 7.3 Autostart)	●	●	●	●
InstantOn function (▶ 7.4 InstantOn)	○	●	●	●
Persistence mode (▶ 8.4 Persistence)	○	●	●	●
Runs without administrator rights	○	●	●	●
▶ 8.5 Automation (CLI)	○	○	●	●
Sector size adjustable	○	○	●	○
Selectable file system and cluster size	○	○	●	○
Flexible partitioning and formatting	○	○	●	○
Specially designed for Windows Server	○	○	○	●
Supports virtual machines	○	○	○	●
32-bit: max. RAM drive size (GB)	4	4	4	128
64-bit: max. RAM drive size (GB)	8	24	48	128

1.5   Technical specifications

1.5.1   Supported systems

- Windows XP (32- & 64-bit)
- Windows Vista (32- & 64-bit)
- Windows 7 (32- & 64-bit)
- Windows 8 (32- & 64-bit)
- Windows Server 2003 (32- & 64-bit) - Miray RAM Drive Server only
- Windows Server 2008/2008 R2 (32- & 64-bit) - Miray RAM Drive Server only
- Windows Server 2012/2012 R2 (64-bit) - Miray RAM Drive Server only

Miray RAM Drive supports 64-bit Windows systems only on Intel64-compatible hardware. The Itanium processor platform is not supported.

1.5.2   Minimum requirements

- Windows XP or higher
- At least 50 MB of available RAM (or more for a larger RAM drive)
- 10 MB of available disk space

2   Quick start

Complete the following steps for a quick start of Miray RAM Drive:

1. Start the installation program (SETUP.EXE) and follow the on-screen instructions. Accept the proposed settings.

2. Miray RAM Drive will be started automatically once the installation process is complete. Alternatively, it can be started from the Start Menu.

3. In the program window, use the slider to set the desired capacity of the RAM drive. Once complete, turn on the RAM drive (▶ 5.1.2 Turning on the RAM drive) using the green switch.

4. For further operation, the program's icon will show in the system tray (▶ 6 Tray icon). A standard mouse click on the program icon opens the program window; with a right-click you access the ▶ 7 Context menu, which offers more control options. Press F1 on your keyboard for ▶ 7.1 Help.

3   Installation

3.1   Installation package

Miray RAM Drive for Windows comes in the form of an installation package (SET-UP.EXE). The installation package contains the following components:

- Software files

- Driver

- Windows service (Miray RAM Drive Plus/Pro/Server editions only)

- Windows Help file

- Product Manual (PDF)

3.2   Setup

To install Miray RAM Drive, click on SETUP.EXE. If you received Miray RAM Drive on a disk, the installation may start automatically once the disk has been inserted.

Select your preferred from the first window displayed and follow the on-screen instructions to complete the setup. You can start Miray RAM Drive immediately as soon as the setup is finished.
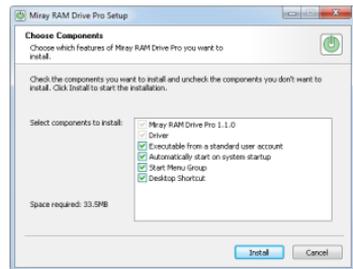
Fig. 1: Miray RAM Drive *setup*

> **Note:** As the setup includes the installation of a driver (▸ 13 Glossary), it is possible that, during that process a windows dialog will appear to inform you of the driver installation; see also ▸ 3.2.4 Other dialogs.

The setup will automatically guide you through each step of the installation. These steps are described in the following subsections.

3.2.1   Components

In the Choose Components dialog (▸ Fig. 1) you can select which of the Miray RAM Drive components you wish to install. The program itself and the driver (▸ 13 Glossary) are always required, and therefore cannot be deselected. The

following are optional components:

- **Executable from a standard user account** (Miray RAM Drive Plus/Pro/Server only)
  Installs a system service (▸ 13 Glossary), which allows Miray RAM Drive to run without administrator rights. This is necessary if you wish to use it from a standard user account

- **Automatically start on system startup** (Miray RAM Drive Plus/Pro/Server only)
  Activates the Autostart function (▸ 7.3 Autostart).

- **Start Menu Group**
  Creates a program group in the Start menu.

- **Desktop Shortcut**
  Creates a shortcut on your desktop.

- **Quick start bar** (Windows XP/Vista and Server 2003 only)
  Creates a shortcut in the Windows quick start bar.

By default, all components are ready selected as they require only minimal resources. Only deselect a component if you are sure you are not going to need it.

3.2.2   Progress bar

The **Installing** dialog shows the installation status using a progress bar. Click *Show details* to see further details of the installation process. The setup automatically enters the final dialog after the installation is complete.

3.2.3   Final steps

The **Finish installation** dialog indicates that the installation was successful. You can use the check box *Run Miray RAM Drive* to start Miray RAM Drive automatically after the installation. Click *Finish* to exit the setup.

3.2.4   Other dialogs

The setup also installs a device driver (**Miray memory controller**), which integrates the RAM drive into the system. Therefore, the **Windows Security** dialog (▸ Fig. 2) will appear during the installation process. Click *Install*, to confirm the installation of the device driver.

Fig. 2: Windows dialog driver installation

In Windows XP, you need to further confirm the **Hardware Installation** popup (▶ **Fig. 3**) by clicking on <u>Continue Anyway</u>. If Windows opens the **Found New Hardware Wizard** (▶ **Fig. 4**), close it by clicking <u>Cancel</u>.

Fig. 3: Windows Hardware installation

Fig. 4: Windows Hardware wizard

3.3   Uninstall

Before beginning the uninstallation, turn off the RAM drive (▶ **5.2.4 Turning off the RAM drive**) and exit Miray RAM Drive (▶ **4.4 Close the program**).

You can uninstall and remove the Miray RAM Drive and all its components at any time you want. To do this, select <u>Uninstall</u> from **Start » Programs » Miray RAM Drive**.

Alternatively, you can use the **Uninstall program** feature on your <u>Control Panel</u> located within the **Programs and Features** dialog. Select Miray RAM Drive and click the <u>Uninstall</u> button, situated at the top of the list.

The program will guide you through the uninstallation process.

3.4   Installing updates/upgrades

If you have Miray RAM Drive already installed and you want to install an update or a different edition, simply run the **SETUP.EXE** of the new version. The installation program uninstalls the existing version for you, ensuring the avoidance a versioning conflict. Your selected program settings are automatically transferred to the new version.

4   Start the program

4.1   Start options

To start Miray RAM Drive, use the program icon created on the desktop during the installation. If you have opted not to create a desktop icon during installation, access the application via the Start Menu. In the program folder Miray RAM Drive (or the name that you have opted to use during setup), click *Run Miray RAM Drive*; the program window will open and the program icon will appear in the system tray (▸ 6 Tray icon).

> **Note:** Miray RAM Drive can be started only once. If attempting to start the program more than once, a popup message will appear to inform you of this. An already active RAM drive will not be affected.

4.2   Autostart

If set the *Autostart* option during the ▸ 3 Installation or using the ▸ 7 Context menu, Miray RAM Drive will be invoked automatically when Windows is started. The program icon can be found in the System Tray (▸ 6 Tray icon).

For more information about the Autostart mode, see ▸ 7.3 Autostart.

4.3   Activity monitor

Once you have started Miray RAM Drive, it can be accessed via the System Tray (▸ 6 Tray icon). Since Miray RAM Drive works in the background, it doesn't have a program icon in the taskbar as other applications do. The program icon instead appears directly in the system tray (▸ Fig. 6) or amongst the hidden icons (▸ Fig. 5). A standard mouse click on the program icon will open the ▸ 5 Program window; you can reach the ▸ 7 Context menu with a right click, to access further control options.

Fig. 5: Hidden icons

Fig. 6: Inactive RAM drive

The application icon also indicated whether or not the RAM drive is currently active. The

brightly colored icon (▸ Fig. 5) shows that the drive is active, whilst the darker shaded icon (▸ Fig. 6) denotes an inactive RAM drive. See ▸ 6 **Tray icon** for more information regarding the system tray.

4.4   Close the program

You can exit the application by clicking *Quit Miray RAM Drive* on the context menu (▸ Fig. 7); this will also remove the application icon from the system tray.

If the RAM drive is still active, you will be asked to confirm your request to quit the application (▸ Fig. 8). This confirmation is required since all stored data is be lost once Miray RAM Drive is closed. This is also the case when the RAM drive is switched off.

Fig. 7: Context menu

Fig. 8: Security query

5   Program window

The Miray RAM Drive program window is displayed at startup and can always be accessed from the system tray (▶ 6 Tray icon). The program window has three layouts (▶ Fig. 9), which correspond to the different states of the RAM drive: Active (▶ 5.2 Active RAM drive), inactive (▶ 5.1 Inactive RAM drive) and inactive in persistence mode (▶ 5.3 Inactive RAM drive (persistence)). The application window is not displayed when it is not needed. You can open it via the system tray (▶ 6 Tray icon).

Fig. 9: Program window states

5.1   Inactive RAM drive

Whilst the RAM drive is inactive, the program window shows a slider (▶ Fig. 11) next to the Miray RAM Drive icon and the On/Off button; the slider can be used to adjust the capacity of the RAM drive.

5.1.1   Adjust the capacity

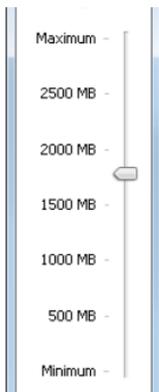The capacity of the RAM drive can be adjusted with the slider (▶ Fig. 11), before the RAM drive is switched on. The value markers on the slider are based on the maximum available memory for the RAM drive, and they adapt automatically to the available space. There are three different ways of setting the desired capacity:
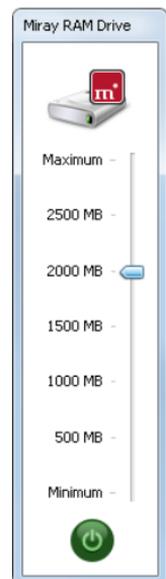

Fig. 10: Inactive

Fig. 11: Slider

- ○ Click on the slider label to select the capacity.

- ○ Click anywhere on the slider to set an arbitrary intermediate value.

- ○ Hold down the arrow button with your mouse and drag it to the desired value. In this case, the arrow shows the exact value, thus allowing a precise setting.

- ○ Miray RAM Drive Plus/Pro/Server editions only: right-clicking on the arrow button opens a small box which enables you to specify the desired size in MB (Plus/Pro/Server) or in sectors (Pro).

Once the desired value is set, you can activate the RAM drive (▶ 5.1.2 Turning on the RAM drive) using the On/Off button.

5.1.2   Turning on the RAM drive

The RAM drive can be turned on using the button located at the bottom of the program window (▶ Fig. 12). Before turning it on, select the desired capacity of the RAM drive, as this cannot be changed afterwards.

Fig. 12: On/Off

When switching on the RAM drive, it will be automatically initialized, partitioned and formatted (▶ 5.2.3 Formatting), so that it is ready for immediate use. Meanwhile, the power button displays an animation, letting you know the initialization is on-going. Once the power button turns green, the RAM drive is active and therefore ready to use.

5.1.3   InstantOn

Miray RAM Drive Plus/Pro/Server editions only

If you have set the option *InstantOn* in the ▶ 7 Context menu, the Miray RAM Drive is turned on immediately after starting the program, with the last selected settings. In combination with ▶ 7.3 Autostart, the RAM drive is available immediately after starting Windows.

See ▶ 7.4 InstantOn for more information regarding this function.

5.2   Active RAM drive

Once the RAM drive is on, formatted and ready to use, the program window changes its display from the slider to a RAM drive status information.

In this state, the bright green power button indicates the active status of the RAM drive.

5.2.1   Status display

When the RAM drive is active, the following information is displayed in the program window:

○ The Windows drive letter of the RAM drive volume.

○ The total capacity of the RAM drive.

○ The free space on the RAM drive, as a value and as a bar graph.
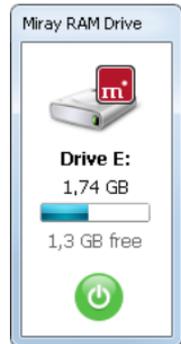
Fig. 13: Active

5.2.2   Opening the RAM drive

Clicking on the Miray RAM Drive icon (▶ Fig. 14) on top of the program window, opens the drive in Windows Explorer.

Fig. 14: Open

5.2.3   Formatting

Switching on the RAM drive triggers its automatic formatting. The entire disk space is reserved in one single partition and formatted with the NTFS file system by default.

> Note: In Miray RAM Drive Pro/Server editions, the RAM drive will be formatted automatically with the file system predetermined in Advanced Settings » Drive Layout (▶ 7.5.2 Drive Layout).

5.2.4   Turning off the RAM drive

To turn off the RAM drive, open the ▶ 5 Program window by clicking the ▶ 6 Tray icon. If the RAM drive is active, the status display and the bright green power button will be shown.

Click the button to turn off the RAM drive.
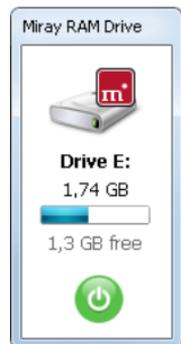
Fig. 15: Active

You will be asked to confirm your request to quit the driver; this is required due to all stored data being lost once it is turned off.

After confirming, a waiting animation will appear on the power button. The symbol then changes to dark green once the RAM drive is turned off and all previously allocated resources are deallocated.

Fig. 16: Security check

The program window now replaces the status display with the slider, again allowing you to adjust the capacity of your RAM drive (▶ 5.1.1 **Adjust the capacity**). You can now turn on the RAM drive again (▶ 5.1.2 **Turning on the RAM drive**) with a different capacity. If you leave the RAM drive turned off, it will only require minimal resources and is accessible via the System Tray.

5.3   Inactive RAM drive (persistence)

Miray RAM Drive Plus/Pro/Server editions only

Using the persistence mode, the content of an existing RAM drive is not lost when exiting Miray RAM Drive or when shutting down the operating system. The RAM drive is thus permanently available (persistent memory), see also ▶ 8.4 **Persistence**.

The capacity of the RAM drive cannot be changed in persistence mode, not even when the drive is turned off; thus, there is another state of the program window (▶ **Fig. 17**). Instead of the usual slider for adjusting the capacity, the window will show the amount of persistent memory defined in the persistence settings (▶ 5.3.1 **Setting the capacity (persistence)**). If the RAM drive is turned on, the keyword 'Persistent' is no longer displayed, and the drive is shown as an ▶ 5.2 **Active RAM drive**.

For more information about persistence, see chapter ▶ 8.4 **Persistence**. To enable the persistence mode, check **Persistence** in the context menu, under **Advanced Settings**, ▶ 7.5.3 **Persistence**.

5.3.1   Setting the capacity (persistence)

Changing the capacity of a persistent RAM drive causes the deletion of that drive and the setting up of a new one with the desired capacity; thus, any data previously saved on the drive is lost. Please follow these steps, if you wish to change the capacity of the drive in persistence mode:

○ Disable the persistence mode (▶ 7.5.3 Persistence).

○ Switch off the RAM drive.

Fig. 17: Persistence settings

○ The program window displays the slider: set the new desired capacity (▶ 5.1.1 Adjust the capacity).

○ Turn on the RAM drive again and reactivate persistence mode; you will be presented with a new blank RAM drive with the new capacity.
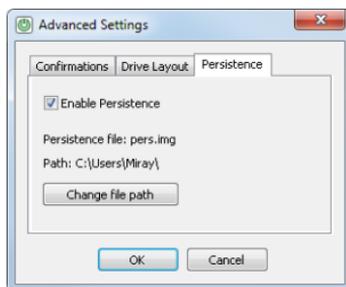
> Note: If required, back up or copy your data before turning off the RAM drive. The data can be restored on the new RAM drive after resizing.

5.3.2   Turning on the RAM drive (persistence)

The program window appears different in persistence mode than without persistence when the RAM drive is inactive. The RAM drive can be turned on using the button from the bottom of the window (▶ Fig. 18).

Fig. 18: On/Off

In persistence mode, Miray RAM Drive automatically loads the data from the persistence file to the RAM drive. After the transfer is complete, the RAM drive is available with the same content it had before being switched off.

6   Tray icon

When the Miray RAM Drive application is started, the program icon appears in the system tray, on the lower right side of the taskbar (▶ Fig. 20).

Note: You may find that the icon has been placed under the arrow icon on the taskbar (▶ Fig. 19). You can store it permanently in the system tray by drag and drop. Since the program window of Miray RAM Drive automatically fades, the icon from the system tray serves as an anchor which allows you to have constant access to the application.

6.1   Activity monitor

The Miray RAM Drive icon within the system tray indicates the status of the RAM drive. If the RAM drive is switched on, the program icon is green with a white background (▶ Fig. 20). If the RAM drive is switched off, the program icon is dark green with a gray background (▶ Fig. 20).

6.2   Open the program window

When Miray RAM Drive is in operation, the ▶ 5 Program window can be opened by clicking on the ▶ 6 Tray icon. Once you click on another window or element, the program window will disappear automatically.

Fig. 19: Hidden icons

Fig. 20: System tray icon

Fig. 21: Inactive RAM drive

Fig. 22: Open the program window

7   Context menu

The basic control functions of Miray RAM Drive, such as setting the capacity and turning it on and off, are performed via the ▶ 5 Program window. Other commands and functions are accessible via the context menu.

The context menu can be opened by right clicking inside the program window or on the application icon in the system tray (▶ Fig. 23 and ▶ 6 Tray icon).

Fig. 23: Context menu

7.1   Help

The Miray RAM Drive program contains a built-in Help section; this is, accessible using the F1 key on your keyboard or via the context menu by clicking *Help*.

7.2   About Miray RAM Drive

This window (▶ Fig. 24) contains information about Miray RAM Drive, detailing the used edition, version and license. It also contains two buttons; one leads you directly to the homepage of Miray RAM Drive and the other is used to check for updates.

Fig. 24: About Miray RAM Drive

7.3   Autostart

The Autostart function automatically starts Miray RAM Drive during system startup. Click *Autostart* in the context menu to enable or disable Autostart.

A check mark next to the menu item indicates that Autostart is active.

7.4   InstantOn

InstantOn switches the RAM drive on immediately after starting the program, including the last setting selected. On the context menu click *InstantOn* to enable

or disable the InstantOn function.

A check mark next to the menu item indicates that InstantOn is active.

7.5   Advanced Settings

This menu item opens the Advanced Settings window; the settings are grouped in tabs, as described in the below subsections.

7.5.1   Confirmations

In the **Confirmations** tab you can activate the security prompts previously deactivated. When turning off the RAM drive, when the program ends (▸ Fig. 26) and when Windows shuts down, the security prompts are displayed, to prevent the unintentional termination of the active RAM drive; this helps to avoid the loss of data stored on the RAM drive.

You can deactivate these questions by choosing the _Do not ask me in the future_ option (▸ Fig. 26). You can activate them again, by checking the respective boxes in the **Confirmations** tab (▸ Fig. 25).

7.5.2   Drive Layout

Miray RAM Drive Pro/Server editions only

This tab allows you to specify format and layout preferences for the RAM drive.

○ **Sector size (Pro edition only)**: Select the desired size for the physical sectors on the RAM drive.

○ **File system**: Specify the file system which will be used to format the RAM drive.

○ **Cluster size (Pro edition only)**: This value determines the size of the logical blocks within the file system.
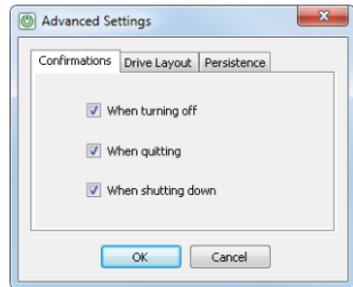

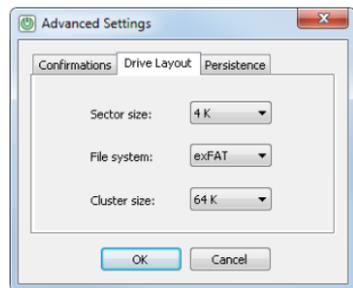_Fig. 25: Confirmations settings_

Fig. 26: Quit Miray RAM Drive

Fig. 27: Drive Layout settings

Note: The sector size, file system and cluster size can influence each other so that not every setting is available for every file system. This is caused by the file system itself. If you do not need a special, personalized setting simply choose the *Auto* option, Miray RAM Drive will then automatically select the appropriate options.

Miray RAM Drive must be restarted in order to apply the changes to format and layout (▸ 5.1.2 Turning on the RAM drive).

See ▸ 8.3 Drive Layout for more information about the drive Layout.

Fig. 28: Apply changes

7.5.3   Persistence

Miray RAM Drive Plus/Pro/Server only

This option is used to activate the persistence mode. You can create a persistence file for saving the current contents of the RAM drive.

○ Enable Persistence: Check this to activate persistence mode.

○ Change file path: Click to change the persistence file.
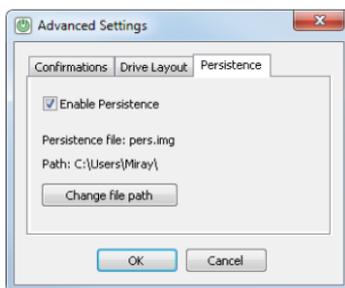
Fig. 29: Persistence settings

Note: Please make sure that there is enough space available on the selected drive (at least as much as the entire size of the RAM drive). In addition, the selected drive should always be available and accessible at system startup; this is especially important when using persistence together with the Autostart function (▸ 4.2 Autostart). If these conditions are not met, persistence mode may not function as expected.

See ▸ 8.4 Persistence for more information.

7.6   Additional Features

Miray RAM Drive Standard edition only

This window displays information about the Miray RAM Drive license. It also links to the product pages of Miray RAM Drive Plus, Pro and Server, which provide additional features.

Fig. 30: Additional Features

8   Additional functions

8.1   Autostart and InstantOn

By combining the ▸ 7.3 Autostart and the ▸ 7.4 InstantOn functions, the RAM drive is turned on automatically at the startup of Windows. This is useful for applications such as caching (▸ 9.3 Cache) or for the dropping of temporary files: after the system starts, a fresh RAM drive is available for temporary data. Data from the previous session is automatically and ultimately deleted.

In combination with ▸ 8.4 Persistence, there is another application: in this case the RAM drive can also be used for non-volatile data (for example, work files, or files that are delivered through a ▸ 9.7 Web server).

Activate the Autostart function as described in ▸ 4.2 Autostart and the InstantOn function as described in ▸ 5.1.3 InstantOn.

8.2   Extended memory

For 32-bit Windows systems, Miray RAM Drive Server can use the upper half of the 4GB limit, too. The size of the usable memory depends on your version of Windows:

- Windows XP   (0,5 – 4 GB)
- Server 2003   (4 – 64 GB)
- Windows Vista (1 – 4 GB)
- Server 2008   (8 – 64 GB)
- Windows 7   (2 – 4 GB)
- Windows 8   (2 – 4 GB)

> **Hint:** A Windows kernel patch that removes the 4 GB limit for 32-bit versions of Windows Vista/7/8 can be found at http://wj32.org/wp/2012/12/26/pae-patch-updated-for-windows-8/.

The 64-bit versions of Windows support 8-4,000 GB of memory. Details on the supported memory are available on the Microsoft website at: http://msdn.microsoft.com/en-us/library/windows/desktop/aa366778.aspx.

For 64-bit Windows systems, Miray RAM Drive can use the memory according to the corresponding edition (see ▸ 1.4.5 Editions comparison).

> **Important:** It may be necessary to manually activate the Windows PAE mechanism on 32-bit Windows systems, in order to use more than 4 GB of memory (▸ 10.4.3 RAM cannot be fully used).

8.3   Drive Layout

Miray RAM Drive Pro/Server only

These settings allow you to set the sector size, cluster size (Pro edition only) and file system manually, making it extremely easy to use different configurations, for example for testing. Being able to set the sector size allows to simulate disks with different sector sizes, making test much easier than with physical drives. In addition, other sector sizes than 512 and 4K can be set (▸ 7.5.2 **Drive Layout**).

Fig. 31: Drive Layout

> **Example:** Different drive layouts, especially the sector size, can be used to test software for compatibility with these layouts; see also ▸ 9.9 **Development and testing**.

8.4   Persistence

Miray RAM Drive Plus/Pro/Server only

Since the RAM drive is located in the PC's memory, it is volatile, meaning it will lose its contents after being switched off. It can however be made persistent for cases in which the content needs to be preserved. Its content is saved the when you turn it off, and will be available again when you turn the RAM drive on. Consequently, the RAM drive is functioning like a permanent storage device. The persistence is enabled using the ▸ 7.5.3 **Persistence** menu.
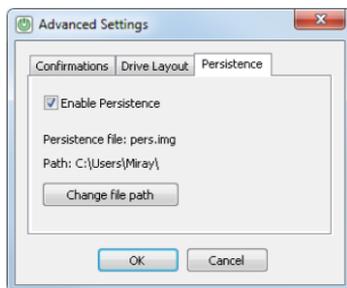
Fig. 32: Persistence

The location of the persistence file can be individually chosen. It needn't be stored on the system drive, but may also be saved on an additional or external disk. However, it should be accessible when switching the RAM drive on and off.

> **Note:** Persistence requires the RAM drive to be switched off regularly. In case of a forced termination of Miray RAM Drive or PC crash, the changes made since turning the RAM drive on will be lost.

8.5   Automation (CLI)

Miray RAM Drive Pro/Server only

The **MRDCLI.EXE** from the program directory, allows you to automatically start Miray RAM Drive or to engage it in automated processes. Start it from the command line or from a script using the following syntax:

mrdcli   <Size (MB | Sectors+"s")> [-f <FileSystem>] [-s <SectorSize>]
          [-c <ClusterSize>] [-force]

Parameter	Meaning
<Size (MB)>	The size of the RAM drive in MB (for example 512)
<Size (Sectors+"s")>	**Pro only:** Size of the RAM drive in sectors ending in 's' (for example, 256000s)
Pro only: -f [<u>NTFS</u> | FAT | ExFAT | RAW] **Server only:** -f [<u>NTFS</u> | ReFS]	*Optional:* The file system the RAM drive will be formatted with (RAW = unformatted).
Pro only: -s [<u>512</u> | 1K | 2K | 4K]	*Optional:* Sector size of the RAM drive.
Pro only: -c [512 | 1K | 2K | <u>4K</u> | ... | 64K]	*Optional:* Cluster size of the file system.
-force	*Optional:* If there is an active RAM drive when calling MRDCLI.EXE, this drive will be automatically switched off. Any unsaved data will be lost.

The following return values are provided by **MRDCLI.EXE** after execution:

Parameter	Meaning
0	RAM drive created successfully.
1	Error when turning on the RAM drive.
2	MRD.EXE could not be started.
3	MRD.EXE was not found.
4	Syntax error in the call parameters.

Note: Settings that are saved automatically by the graphical version of the Miray RAM Drive for the next program start, will not be changed by the command line version.

9   Application areas

9.1   General notes

Miray RAM Drive is designed for universal usage and works even faster than SSDs. The following sections describe some specific scenarios that particularly benefit from the usage of Miray RAM Drive. However, the use of Miray RAM Drive is not limited to these scenarios.

9.2   Temporary files

Some programs or processes create temporary files that are no longer needed after their termination. However, storing these files on a RAM drive can accelerate their execution. When the RAM drive is switched off, the data will be deleted automatically.

> **Note:** For temporary data that is needed over a longer period of time (for example, browser cache ▸ **9.3 Cache**), Miray RAM Drive Plus allows you to create a persistent RAM drive (▸ **8.4 Persistence**).

9.3   Cache

All operating systems have a built-in cache, a memory buffer meant to accelerate the work. The built-in cache is automatic, meaning users are not able to specify the data they would prefer to be cached. This is exactly what you can achieve with a RAM drive. All data stored on the RAM drive benefit from extremely fast access.

9.4   Full RAM usage

Miray RAM Drive Server / 32-bit Windows systems only

For 32-bit systems with more than 2.5 GB of RAM, the upper half of the memory area is not available for programs as linear addressable memory. This limitation can be further decreased to a maximum of 3.5 GB of addressable memory. Miray RAM Drive can use this memory space, and further increase it to more than 4 GB in the Miray RAM Drive Server edition. For example, if your system has 8 GB of RAM, you can use the entire upper half as a RAM drive for caching (▸ **9.3 Cache**), swapping and ▸ **9.2 Temporary files**, thus speeding up the entire system. Server functions can also be accelerated by buffering file data or databases in a RAM drive.

Note: A prerequisite for the support of more than 4 GB of RAM is that the Windows operating system is equipped with the required mechanisms (▶ 8.2 Extended memory).

9.5   Converting data

A RAM drive can optimize the process of converting photos, music or videos into several different formats. Usually, the source data will be read again for every new format generated. Putting them onto a RAM drive first will clearly accelerate the subsequent data processing. This principle is, of course, also applicable for any other types of data.

9.6   Database

You can use Miray RAM Drive to run a file-based database as an in-memory database: copying it to a RAM drive and running them from there can improve access time and transfer rates by a factor of 10-100. Do not forget to activate ▶ 8.4 Persistence mode, in order to save the data.

Note: For servers running a Windows Server operating system, Miray RAM Drive Server is required.

9.7   Web server

Miray RAM Drive can help you speed up your Windows web server and thus increase the number of simultaneous requests. The small latency of the RAM drive is particularly useful when accessing static data or a ▶ 9.6 Database, allowing your web server to utilize its full potential; just ensure to store your data files on a persistent RAM drive.

Note: For servers running a Windows Server operating system, Miray RAM Drive Server is required.

9.8   Data security

Files that are used infrequently (see ▶ 9.2 Temporary files) and should not remain on your computer for security reasons, a RAM drive ensures that these files are not only deleted, but are completely removed after switching off the PC. The files cannot be restored after deletion.

> **Hint:** This also applies to user sessions: if the temporary data of a user session is stored on a RAM drive, all of this data will be permanently deleted at shutdown.

9.9   Development and testing

Miray RAM Drive can accelerate software development and testing, thus saving time. There are three main application areas:

○ **Different sector formats**
A beneficial feature of Miray RAM Drive Pro is the ability to simulate different sector formats. In addition to the standard size (512 bytes), it enables the use of the Advanced Format (AF) with a sector size of 1 KB and 4 KB. Other sector sizes are also supported. Simulating your desired sector format with Miray RAM Drive Pro allows you to test your software (see also ▸ 7.5.3 Persistence). From the internal perspective of the program to be tested, the RAM drive behaves identically to a physical drive with this sector format.

○ **Disk tools and special applications**
For the development and testing of hardware-related software (such as data recovery or file system drivers), you can benefit from using Miray RAM Drive. Since the RAM drive works in the same way as real hardware (but is several times faster), test scenarios can be completed very quickly. The tests themselves require significantly less time to undertake than they would using actual hardware.

○ **Disk-intensive applications and endurance tests**
Miray RAM Drive can also accelerate the development and testing of applications, especially if this involves endurance tests. Simply save the test data onto the RAM drive, and your tests will run much faster.

> **Hint:** Miray RAM Drive is even faster than SSDs. In addition, the RAM drive does not depend on mechanisms such as wear-leveling and is not subject to creeping degeneration.

9.10   Just for fun

Test how fast your computer really is!

The hard disk is often the bottleneck when it comes to the speed of your computer. On top-notch systems, fast processors and chipsets, this even applies to many SSDs. Miray RAM Drive offers you an incredibly fast RAM drive, allowing you to see just how fast your PC really can work!

10 Troubleshooting

There are some instances in which Miray RAM Drive cannot work as expected; in such cases an error message will be displayed. This section details the possible errors and the steps you should take to resolve them.

10.1   Memory problems

10.1.1 Insufficient memory (at startup)

If you receive this message, there is insufficient memory available, even for a small RAM drive (< 20 MB). Miray RAM Drive does not start in this instance; not only because it could run out of memory, but also because the overall ability of the operating system could be adversely affected.

Fig. 33: Insufficient memory

Solution: The following options are available:

○ Quit one or more memory-intensive applications and restart Miray RAM Drive.

○ Expand your computer's memory, as a general measure.

10.1.2 Slider showing too little memory

In the ▸ 5 Program window the slider automatically shows the currently available space for a RAM drive (▸ 5.1.1 Adjust the capacity). Under certain circumstances, this maximum value may be below the actually available memory, as is displayed in the Windows task manager.

Explanation: There are two possible reasons for this:

○ Only actual (real) memory can be used for a RAM drive, that is, no virtual memory such swap space, generated by the operating system in form of swap files. Sometimes, such virtual memory is displayed as RAM.

○ All of the available memory is partitioned into different areas, depending on the operating system and the programs and functions already running; these areas have different sizes
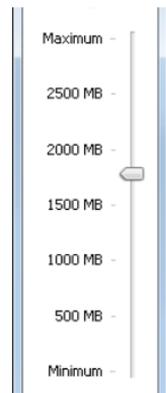
Fig. 34: Slider

and are sometimes very small. For efficiency reasons, Miray RAM Drive will only consider storage areas that have a certain minimum size. Due to this, the memory available for the RAM drive is about 1-5% less than the actually available memory.

10.1.3 Insufficient memory (switching on)

The actually available memory in the system is subject to temporal changes, so that the slider may display a higher value than actually available. In this case, the switching-on command is aborted and an appropriate error message displayed. The slider then updates its values automatically, allowing you to try again.
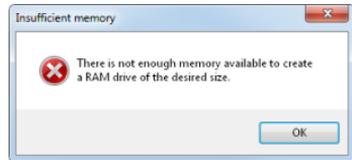
Fig. 35: RAM drive too large

Explanation: The reason for this behavior is a potential change in the actually available memory size between detection and actual reservation by Miray RAM Drive. When Miray RAM Drive determines the maximum available memory, this space is not reserved immediately, but just when turning on the RAM drive; only at this point is the maximum available memory actually known. The fluctuations are usually small, and can be avoided by the Miray RAM Drive's own intelligence and logic. For larger fluctuations, however, the above error message may occur.

10.2   Driver and service problems

10.2.1 Service not started

Explanation: This error message (▶ Fig. 36) occurs when Miray RAM Drive is started from a standard user account (without administrator rights), but the windows service required in this case (the **Miray RAM Drive Service**) is not started.
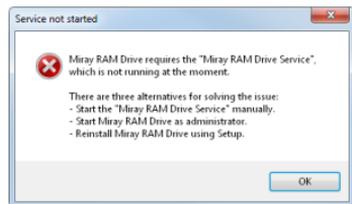
Solution: There are three ways to fix this:

Fig. 36: Service not started

○ If you have previously stopped the service manually, restart it before starting Miray RAM Drive.

○ You can start Miray RAM Drive with administrator privileges (**Elevated Mode**, right-click + *Run as administrator*). This is particularly necessary if you unchecked the **Install service** option during the Miray RAM Drive installation.

○ If you do not know the cause of the problem, or you want to install the service straightaway, simply reinstall Miray RAM Drive (▶ 3.2 Setup).

10.2.2 Driver missing

Explanation: This error message (▶ Fig. 37) indicates a missing **Miray RAM Drive Adapter** driver. It is normally installed automatically during the installation of Miray RAM Drive.

Solution: Reinstall Miray RAM Drive (▶ 3.2 Setup).

Fig. 37: Driver missing

10.2.3 Service not installed

Explanation: This error message (▶ Fig. 38) occurs if Miray RAM Drive was started from a standard user account (without administrator rights), but the required windows service (**Miray RAM Drive Service**) is not installed.

Solution: There are two ways to fix this:

Fig. 38: Service not installed

○ You can start Miray RAM Drive with administrator privileges (**Elevated Mode**, right-click + Run as administrator). This is particularly necessary if you have unchecked the **Install service** option during the Miray RAM Drive installation.

○ If you do not know the cause of the problem, or you want to install the service straightaway, simply reinstall Miray RAM Drive (▶ 3.2 Setup).

10.3   Persistence file problems

10.3.1 Error creating persistence file

Explanation: If persistence mode is active, Miray RAM Drive immediately generates the persistence file to check whether it is possible and if the file is accessible. If it is not possible, this error message will appear (▶ Fig. 39).

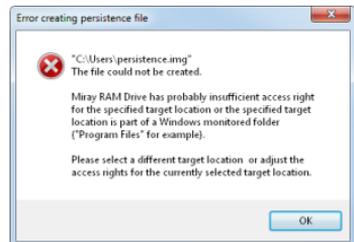Solution: Select a different location for the persistence file, one that is always accessible.

Fig. 39: Error creating persistence file

10.3.2 Insufficient disk space

Explanation: In order to make the RAM drive persistent, its contents will be saved to the persistence file when switching it off. This file has the same size as the RAM drive. If there is not enough free space on the specified drive, this error message will appear (▶ Fig. 40).

Solution: There are two ways to fix this:

○ Create enough free space on the specified drive, for example by deleting files.

Fig. 40: Persistence file too large

○ Change the location of the persistence file to another drive with sufficient free disk space.

10.3.3 Error opening persistence file

Explanation: When the persistence mode is enabled and Miray RAM Drive is started (manually or automatically), it will immediately attempt to open the persistence file in order to initialize the RAM drive. If the persistence file is available, but it cannot be accessed, this error message will appear (▶ Fig. 41).

Fig. 41: Problem opening the file

Solution: The persistence file is likely to have been opened by another application. Make sure that the persistence file is closed and turn on the RAM drive again.

10.3.4 Persistence file damaged

Explanation: If the persistence file is available and accessible, but the data stored within is invalid, for example, because the file has been modified by another program or has become corrupted, this error message will appear (▶ Fig. 42).

Fig. 42: Persistence file damaged

Solution: You have three options:

○ Click *Cancel* to restore the original state of
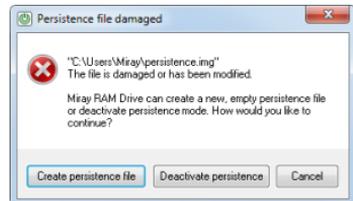
the persistence file and restart the RAM drive.

○ *Create persistence file* will start the RAM drive with a newly created persistence file.

○ To start the RAM drive without persistence, click *Deactivate persistence*.

10.3.5 Persistence file not found

Explanation: This message (▸ Fig. 43) appears when Miray RAM Drive is switched on manually (▸ 5.1.2 Turning on the RAM drive) or automatically (▸ 4.2 Autostart), but the persistence file in the set file path cannot be found; as such, the RAM drive cannot be initialized.
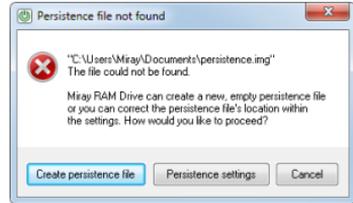
Fig. 43: Persistence file not found

Solution: The persistence file is likely to have been moved, renamed or deleted. You have three options:

○ If the persistence file has been moved or renamed, you can specify the new file path and/or file name using the *Persistence settings* button.

○ Alternatively, select *Cancel*, move the persistence file back to its original location or rename it with its original name, and restart the RAM drive.

○ If the persistence file was deleted, select the *Create persistence file*, button to start the RAM drive with a newly created persistence file.

10.3.6 Error saving the persistence file

Explanation: When quitting Miray RAM Drive in persistence mode, the contents of the RAM drive are saved in the persistence file. If saving fails for any reason, this error message will appear (▸ Fig. 44).

Solution: The persistence file is likely to be opened by another program. You have three options:

Fig. 44: Error saving the persistence file

○ Select *No*, meaning not to switch off the RAM drive. Make sure that the persistence file is not opened by any other program, and retry.

○ Select *No*, meaning not to switch off the RAM drive. Change the persistence
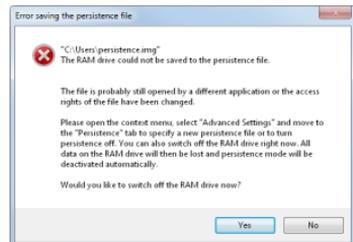
file location or name using the Advanced Settings (▸ 7.5.3 Persistence) and
then retry.

○ Select *Yes* to turn off the RAM drive. The data stored on will then be lost and
the persistence mode will be disabled.

10.4   Other sources of errors

10.4.1 Persistence file stored in the Programs directory

In persistence mode (▸ 8.4 Persistence), the contents of the RAM drive are
saved in the persistence file when turning it off. To set or change the location of
the persistence file, use the Advanced Settings in the context menu, under
▸ 7.5.3 Persistence.

> **Important:** You should not save the persistence file in the folders
> Windows or Programs, because Windows has a protective function
> built in for these folders (see also Virtual Store in ▸ 13 Glossary). This
function prevents Miray RAM Drive from accessing files in these folders. There-
fore, the persistence mode does not work properly if the persistence file is saved
in one of these folders or subfolders.

10.4.2 The RAM drive is slow

Windows XP-64 and Server 2003 (x32 + x64)

Windows XP (64-bit) and Server 2003 (32 and 64 bit) allow, by default, only a
slow access to the RAM drive. Use the official patch KB932755, to install a faster
access method: http://support.microsoft.com/kb/932755/de.

> **Note:** After installing KB932755 you need to reinstall Miray RAM Drive
> (▸ 3.2 Setup). The same applies when uninstalling KB932755.

10.4.3 RAM cannot be fully used

32-bit Windows systems

If you cannot use the full memory, ensure that the Windows PAE mechanism is
activated. Perform the following steps:

Windows XP and Server 2003

○ Make sure that you have administrator rights.

○ Disable the option *Hide protected operating system files (recommended)*

from My Computer » Extras » Options » View.

- ○ Open the system drive (for example C: \) and remove the write protection from the BOOT.INI file by opening right-click » Properties.

- ○ Open BOOT.INI in Notepad and look for lines with this pattern:
multi(0)disk(0)rdisk(0)partition(2)\%systemroot%="Windows XP"

- ○ Change this by appending /PAE to:
multi(0)disk(0)rdisk(0)partition(2)\%systemroot%="Windows XP" /PAE
and save the file. If necessary, you can revert by removing the modification.

- ○ Restart Windows for the change to take effect.

Windows Vista/7/8 & Server 2008

- ○ Open the command shell as administrator. Click on *Start* and type cmd within the search box. Right click on cmd.exe in the search results, and select *Run as administrator* from the context menu.

- ○ Type the command bcdedit /set PAE forceenable. If necessary to revert, use the deactivation command bcdedit /set PAE forcedisable.

- ○ Restart Windows for the changes to take effect.

11 Help and support

When developing Miray RAM Drive, our focus was to produce a program that is both, reliable and easy to use. Nevertheless, should you have questions or encounter any problems, with Miray RAM Drive, the sources listed below will help you find a solution.

11.1 Program help

You can access the program's Help section by pressing `F1` on your keyboard or by selecting _Help_ from the context menu. The Help section includes a brief description of the program's functions and error message troubleshooting.

11.2 Manual

If ▸ **7.1 Help** does not provide the resolution or information required, please refer to this manual for detailed descriptions and additional information on all aspects of the program.

11.3 Online forum

For user or system specific problems that are not described in the Help section or within this manual, you can find useful information our online forum at http://www.miray-software.com/forum/index.php. If you do not find an answer to your problem there, please feel free to post it.

11.4 Technical support

Users of Miray RAM Drive Plus, Pro and Server can access our online support system for individual technical support. Please create a ticket for your problem at http://www.miray-software.com/support/index.html.

11.5 Product inquiries

Please do not hesitate to contact us with any questions you have regarding Miray RAM Drive, purchases or licensing conditions.

○ Questions about the license
   General information about the license terms can be found in ▸ **12.6 License model**. In addition, we are more than happy to provide you with help and advice regarding any specific questions you may have.

○ **Other questions**
  You can find answers to questions regarding the product, application areas, compatibility, technical data, etc. within this manual or online at the Miray RAM Drive product page (miray-software.com/mrd).

If you do not find the answer satisfactory answer or solution to your problem using these sources, please contact us directly:

E-mail   mail@miray.de

Phone   +49 (0) 89 72013-643   (Monday-Friday, 9 am to 5 pm CET / CEST)

11.6   Feedback

We are very keen to receive feedback and welcome both, criticism and appraisal with regards to our product. We would like to know, for example, if you find bugs in the system, if you have any suggestions for improvement and to listen to your experiences with the program, our website and our service. Please send your feedback to:

○ feedback@miray.de or alternatively use our feedback form:

○ http://www.miray-software.com/solutions/customerservice/feedback.html.

11.7   Manufacturer information

Miray RAM Drive is a product of Miray Software AG..

Internet   miray-software.com

E-Mail   mail@miray.de

Postal address Miray Software AG
                    Gaissacher Str. 18
                    81371 Munich
                    Germany

12 Appendix

12.1 Software package

Miray RAM Drive is supplied as an ▶ 3.1 Installation package. You may receive the installation package in one of the following forms:

○ Via download

○ On CD/DVD

○ On USB stick

Please follow the instructions in section ▶ 12.2 Genuine software, to ensure that you use the genuine product.

12.2 Genuine software

There are several ways to ensure that you software package contains genuine software:

○ Download: Please make sure you download the software (Miray RAM Drive Plus/Pro/Server) with your original license key. You should download Miray RAM Drive standard, which is available for free for private users, only from our website (miray-software.com) or from other trusted sites, such as cnet.com, softpedia.com, Download.com or tomsguide.com.

○ CDs/DVDs or USB sticks: An original disk contains a security hologram or an engraved serial number.

If you are unsure whether or not your package contains genuine software, please contact us (▶ 11.7 Manufacturer information). We will verify this for you. In the unlikely event that you do have a counterfeit product, by no fault of your own, we will endeavor to find a suitable solution.

12.3 Updates

Miray RAM Drive will automatically download newer versions if it has access to the Internet. However, you can also manually check for updates (▶ 7.2 About Miray RAM Drive) and follow the steps described in ▶ 3.4 Installing updates/upgrades, for installing the newer version.

12.4   Disclaimer

Although Miray RAM Drive was created with the utmost care and was subject to extensive testing, we do not guarantee the proper functioning of the program, nor are we liable for any damages resulting from its use subject to gross negligence or willful misconduct.

12.5   Security mechanisms

Miray RAM Drive is equipped with a mechanism, to ensure that the software is not used without a proper licensing. We are constantly striving to implement appropriate mechanisms, ensuring that they involve minimal data exchange, work without the exchange of users' personal data, and with the least possible interference of the software. The mechanism requires the exchange of two 24-character strings. This is done automatically when an online connection is available, after confirmation from the user. Without an online connection, the strings can be manually exchanged using another device with an online connection. Please follow the instructions provided by the program.

12.6   License model

Miray RAM Drive is generally licensed on a per installation on a computer or on a virtual machine basis.

12.6.1 Editions and types of use

This table shows both payable and free licenses:

	Private use	Other use*
Miray RAM Drive	*free*	*chargeable*
Miray RAM Drive Plus	*chargeable*	*chargeable*
Miray RAM Drive Pro	*chargeable*	*chargeable*
Miray RAM Drive Server	*chargeable*	*chargeable*

*) any non-private use (for example businesses, companies, institutions etc.)

12.6.2 Available license types

We offer a variety of license types with our standard products. It is possible that not all of them are always available for each of the products. Please contact us (▶ 12.6.3 Counseling) if the product you require is distributed under a license that is not suitable for your needs.

- ○ Single License
  For the installation of the software on one computer only.

- ○ Workplace License
  For the installation of the software on two computers.

- ○ Maintenance license
  For using the software on multiple, arbitrary computers.

- ○ Technician license
  Combines a Workplace License with a Maintenance License.

- ○ Volume license
  Includes a certain volume of Single Licenses.

- ○ Utilization licenses
  Licensed based on duration or frequency of use.

12.6.3 Counseling

We will gladly assist you with any general licensing questions you may have. In addition, if you have any questions about the licensing for a particular scenario, we will help you to find the best and cheapest solution. We will gladly make you an individual offer.

Email   mail@miray.de

Phone   +49 (0) 89 72013-643   (Monday-Friday, 9 am to 5 pm CET / CEST)

13 Glossary

File system
A partition or volume must be formatted with a specific file system (for example, NTFS or FAT) so that the files can be stored on it. In common usage, the file system is often equated with the partition in which it is located (for example, NTFS partition). Technically, however, a partition and file system are two different structures.

Disk
The term 'disk' includes the entire storage medium, as well in case of a removable medium (physical medium, for example CD/DVD) as in case of integrated drives (physical drive, for example hard disks). A disk can contain several partitions. They are accessible through different *drive* letters (for example, C:, D: and E:), although they are located on the same physical drive.

Service
A service is a program that runs in the background and provides certain functions for other (application) programs. As opposed to a driver, a service does not run in the operating system kernel.

Context menu
Selection menu that appears on an item or icon when right clicking.

Drive/Disk
The terms drive or disk have differing meanings in common usage, identifying either a physical storage device or a logical volume (partition).

Partition (Volume)
Partition or volume (logical drive) denotes a contiguous area on a disk. Multiple partitions can be created on a single disk. In Windows, every partition is associated with a drive letter (for example, C:), under which it appears in the system. However, a partition can only be used for storing files when a file system is created on it.

Persistence
The data from the RAM drive is permanently stored, even after the RAM drive is switched off (▸ 8.4 Persistence).

Persistence file
User-defined file in which the data of the RAM drive is stored in persistence mode, whilst the RAM drive is off.

Persistence mode
The mode in which Miray RAM Drive is in when ▶ **8.4 Persistence** is activated.

Program window
A window of the program, from which the program's functions can be controlled.

RAM drive
Designated virtual disk created in memory.

System tray
Area in the Windows taskbar (bottom right), displaying the icons for the programs running in the background and the date and time.

System service
A system service is a service that runs with elevated privileges (on the Windows system account), so that it can access all files, processes, and other resources just like the operating system itself.

Driver
A driver is program code that (under Windows) runs directly in the operating system kernel. A driver handles the connection of hardware devices so that they can be used in the operating system. The driver of Miray RAM Drive reserves the desired amount of memory and interfaces it as a RAM drive in the operating system. This way, the RAM drive behaves exactly like a physical drive, and can be used as such by any program.

Virtual Store
Windows supports the Virtual Store concept, starting with Windows Vista. From the user's perspective, a Virtual Store looks just like a folder in the file system. In contrast to a pure access control, where the access is either allowed or prohibited, read and write operations are monitored by the Windows Virtual Store and automatically redirected to other folders. Examples are the '**Windows**' and '**Program files**' folders: when a normal program attempts to write a file in one of these folders, this file is automatically stored in a different directory, ensuring that no program can directly alter or damage any of the installed programs. Attempts to access C:\WINDOWS\ can be redirected, for example, to: C:\USER\% USERNAME%\APPDATA\LOCAL\VIRTUALSTORE\WINDOWS\ - or similar when accessing other system folders.