Matrox M264

Installation and User Guide

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Digital Video Solutions

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Your notes

1

Introducing Matrox DSX

This chapter provides an overview of Matrox DSX Topology API hardware.

Matrox DSX Topology API overview

Matrox DSX Topology API hardware includes a comprehensive selection of high-density video and audio cards that provide a full range of broadcast-quality I/O. This PC-based hardware is available in various form factors, and offers advanced hardware processing capabilities, such as up/down/cross conversion, video compositing, audio mixing, frame synchronization, and fail-safe capabilities that allow OEMs to build a range of solutions that meet the requirements of diverse markets. For the latest information on available DSX products, see the Matrox Video Developer Products website at www.matrox.com/video/products.

Supported operating systems and development platform

For a list of the supported operating systems and the development platform required for the current DSX release, see your *Matrox DSX Release Notes*.

Remarks

- Matrox M264, M264 S2, and M264 S3 support 64-bit applications only.
- The Matrox M264, M264 S2, and M264 S3 cards can be used in standalone mode or as a co-processor with a Matrox I/O card (such as Matrox X.mio3). When used in standalone mode, a universal clock is available. When used as a co-processor with a Matrox I/O card, the system clock can be derived from the same source as the card that it is being used with. For more information, see "System clock implementation" in the *Matrox DSX Topology API User Guide*.

Validated systems and devices

For an updated list of validated motherboards, systems, and devices for use with Matrox DSX, refer to the Matrox Private Developer Support website at www.matrox.com/video/support/developer/private_support/login.cfm.

DSX system recommendations

For optimal system performance with Matrox DSX hardware, it's recommended that you have at least 1 GB of RAM per core (for example, 16 GB of RAM for a 16-core system). You must also configure your system's power management in your computer's BIOS and in your Windows power options as explained in "Configuring your system's power management" on page 4.

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Preparing for the DSX Installation

This chapter explains how to prepare for installing your DSX hardware.

Before you install your DSX cards

Read the following information carefully before attempting to install DSX cards in your computer system.

Start with a functioning system

Before attempting any DSX installation, you should have a computer with a DSX-supported operating system fully installed and functioning smoothly. This will avoid potential problems later on.

Configuring your system's power management

Before installing DSX hardware, you must configure your system's power management to optimize the performance of your DSX system. Your system's power management is configured in your computer's BIOS and, on a Windows operating system, in your Windows power options.

BIOS power management configuration

Some computers provide advanced power management settings in the BIOS. If these settings are available in your computer's BIOS, you must configure them as follows:

- For **Intel Dynamic power Technology**, set **Enhanced Intel SpeedStep Technology** to **Disable**.
- For **System Power Options**, set **PCIe ASPM Support** to **Disable**.

For details on how to configure your computer's BIOS settings, see your computer's documentation.

Windows power management configuration

The procedure for configuring your Windows power management settings depends on your version of Windows as explained below.

⇨ **On Windows 10, 8, 7, Server 2012, or Server 2008:**

1 In **Control Panel**,

– On Windows 10, 8, or 7, choose **Hardware and Sound** or **System and Security > Power Options**.

– On Windows Server 2012 or 2008, choose **Hardware > Power Options**.

Note On Windows 10, 8, or 7, **Hardware and Sound** and **System and Security** appear if you are in the default **Category** view. Otherwise, only **Power Options** appears.

2 Select **High performance** as the power plan, and click **Change plan settings**.

3 Click **Change advanced power settings**, and customize the settings (if available) as follows:

– For **Hard disk**, set **Turn off hard disk after** to **Never**.

– For **USB settings**, set **USB selective suspend setting** to **Disabled**.

- For **PCI Express**, set **Link State Power Management** to **Off**.
- For **Processor power management**, set **Minimum processor state** and **Maximum processor state** to **100%.**

4 Click **Apply** to save your settings, then click **OK**.

For details on how to configure your Windows power management settings, see your Windows documentation.

Linux power management configuration

The procedure for configuring your Linux power management settings depends on your Linux operating system as explained below.

⇨ **On Ubuntu 14.10 or earlier:**

- Type the following:

```
$ sudo update-rc.d ondemand disable
```

⇨ **On CentOS 7:**

- In */etc/tuned/active_profile*, replace *balanced* by *throughput-performance* and save the file.

Avoid costly damage

Static electricity from your body can damage your DSX cards or your computer. Although you may not notice it, static electricity is generated every time you move. It's often too small to cause a spark, but it can still cause damage to sensitive electronic components or at least reduce their lifespan.

To avoid damage, please observe the following precautions:

- Do not remove DSX cards from their antistatic bags until you're ready to install them. Before removing the cards, place the packages within easy reach of the area where you intend to perform the installation.
- You should avoid touching the chips and other components on the circuit boards. Try to handle the cards by their edges.
- Try to work in an area where the relative humidity is at least 50%.
- Do not wear wool or synthetic clothing. These fabrics tend to generate more static electricity than cotton, which is best for this kind of work.
- Turn off the power switches on your computer and its connected components.

Once you've opened your computer, drain static electricity from your body by touching a bare metal surface on your computer chassis before you install or remove any parts of your system. If you have a grounding wrist strap, use it while handling and installing any components in your computer.

Plan for adequate ventilation

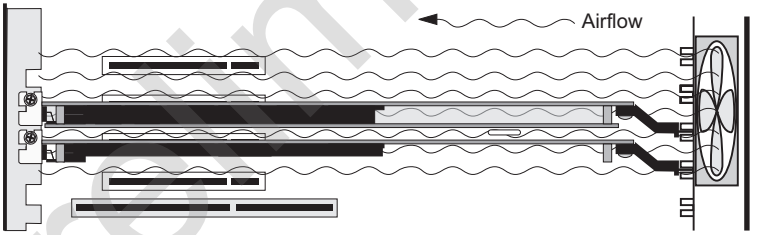
Before using your DSX-equipped system, you must ensure adequate ventilation in your computer. Because your DSX components are positioned closely together, they produce a significant amount of heat. Forced air ventilation is therefore extremely important. Inadequate ventilation may result in erratic operating behavior.

Your DSX system is equipped with numerous temperature sensors to let you monitor the operating temperature of your various DSX hardware components. These temperatures are displayed in the Matrox X.info program on a Windows operating system (see Chapter 8, “Monitoring Your DSX System in Windows” for more information) and in the Matrox mveXinfo program on a Linux operating system (see Chapter 9, “Monitoring Your DSX System in Linux).

The best solution is to provide as much airflow as possible between the cards. We recommend that you install a fan, as explained below:

- Position a fan directly facing the end of the DSX cards, as shown in the illustration below. You should make sure that the fan directs air between the various circuit boards. When installed, this fan works in conjunction with your PC exhaust fan (located at the back of the PC case) to evacuate warmed air away from your DSX cards.

Note The illustration below does not represent a specific Matrox card. It is only used to show proper fan positioning.



- Choose a fan that has a minimum rating of 60 to 80 CFM (CFM stands for cubic feet of air displaced per minute and is a measurement standard for fans).

Note It is mandatory to provide sufficient airflow so that the temperature sensors on your DSX hardware remain within acceptable levels at all times. To determine the amount of airflow to provide, monitor the temperature sensors while all the system processing is maximized on your DSX system at the maximum expected ambient temperature, and adjust the airflow, as required.

- Some computers may require you to increase the speed of your cooling fan by configuring the computer’s BIOS settings. For details about configuring your computer’s BIOS settings, see your computer’s documentation.
- Make sure to mount the fan as close to the cards as possible. In most systems, you should be able to place the fan directly behind the card guide slots.

- Make sure to close your computer's cover once you've finished installing your hardware. This ensures that the airflow generated by the fan is directed through the cards and does not escape through the top of your system.

Caution Fan installation should be done by a qualified technician. Improper installation procedures can result in damage to your DSX components and/or your computer system. Matrox Electronic Systems Ltd. is not responsible for any damage caused by faulty installation.

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Installing Your Matrox M264 Hardware

This chapter explains how to install the hardware for a Matrox M264 system.

Installing your Matrox M264, Matrox M264 S2, or Matrox M264 S3 card

Matrox M264 is a half-length card which can operate in a PCI Express (PCIe) Gen2 x8 or x6 slot, wired electrically with 8 or 4 lanes (8 lanes are recommended for optimal performance).

Matrox M264 S2 is a three-quarter-length card which can operate in a PCIe Gen3 x8 slot, wired electrically with 8 lanes.

Matrox M264 S3 is a three-quarter-length card which can operate in a PCIe Gen3 x16 slot, wired electrically with 16 lanes.

If the slot in which you'll be installing your Matrox M264 card contains another card, either move it to an unused slot or remove it completely.

⇨ **To install your Matrox card:**

1. Remove the metal plate located at the back of the slot you'll be using for your Matrox card.
2. Position your Matrox card over the slot that you've chosen and push it in firmly and evenly until it is fully seated in the slot.

   Remarks

   – To avoid overheating issues, don't install the Matrox card close to another card that generates heat, such as a display card.

– To allow sufficient airflow to the Matrox card's fan, provide sufficient clearance between the Matrox card's fan and the adjacent card.

3 Secure the Matrox card to the computer frame.

Changing the PCI MMIO space size

Some computers may not boot after another Matrox M264 family (M264, M264 S2, or M264 S3) card is installed in the system. If this occurs, the PCI Memory Mapped Input Output (MMIO) space size in the BIOS must be changed as follows:

1 Power off the system, and remove the additional Matrox M264 family card.

2 Power on the system, and press the appropriate key (such as **F2** or **F12**) to enter the BIOS.

3 In **System Configuration**, select **PCI MMIO Space Size**, and change the setting to **Large**.

4 Click **Apply** to apply the change, and click **Exit** to exit the BIOS.

Once the BIOS setting has been changed, you can reinstall the additional Matrox M264 family card.

Before restarting your computer

Once you've finished installing all your DSX hardware, replace your computer's cover before restarting your computer. You can now install the Matrox DSX software as explained in Chapter 5, "Installing Your DSX Software for Windows," on page 29 or Chapter 6, "Installing Your DSX Software for Linux," on page 37.

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Installing Your DSX Software for Windows

This chapter explains how to install the Matrox DSX software, and update the Matrox DSX firmware for Windows.

Installing the Matrox software

Once you've installed your Matrox DSX hardware and properly connected your devices, you can proceed with the software installation.

Remarks

- Refer to the *Matrox DSX Release Notes* for supported operating systems and other important information.
- To install the DSX software, you must log onto an account on your Windows system that has Administrator privileges.
- To help ensure proper functionality of all Matrox cards, it is recommended to disable **Sleep** and **Hibernate** modes (e.g. fast startup) in Windows. For more information on how to do this, see "Disabling Sleep and Hibernate modes in Windows 10, 8, and 7" on page 17.
- When you first start Windows after installing DSX hardware, the "Found New Hardware Wizard" appears. Press **ESC** or click **Cancel** to close the wizard. The installation program installs all the required drivers. For more information, see "Ignoring the Found New Hardware Wizard" on page 17.
- During installation, the Windows notification area may display messages indicating that your devices are ready to use, or that the device driver software was not successfully installed. Ignore these messages and allow the Setup program to complete the entire installation. For more information, see "Windows notification area error messages" on page 18.

⇨ To install the Matrox software:

1. Run *DSX.utils.exe*.
2. Follow the onscreen instructions to install the software on your computer.
   - A **Windows Security** dialog box may appear asking if you want to install the device software. If you want to skip this step for future installation of Matrox software, select **Always trust software from "Matrox Electronic Systems"**, and then click **Install** to continue the Matrox software installation.
   - On certain Windows systems, Windows will check the Microsoft Windows Update website for the latest device drivers, which will slow down the installation. To prevent this, click the status message that appears in the Windows notification area during the driver installation, and in the displayed dialog box, click **Skip obtaining driver software from Windows Update**.
3. If necessary, the Setup program will restart your computer at the end of the installation when you click **OK**.

The Matrox software is installed.

Installing the Matrox software in silent mode

When launched with the */silent* command line switch, the only thing displayed to the user during the installation is the progress bar. All prompts and messages are bypassed. If needed, your system is automatically restarted when the installation is complete. Silent mode is useful when you do not have a user present to confirm the various prompts that appear during a standard installation. For example, you can use silent mode to install the Matrox software on multiple systems over a network.

Remarks

- On certain Windows systems, you must disable User Account Control before attempting silent mode installation.
- A **Windows Security** dialog box may appear asking if you want to install the Matrox device software. In this case, you will need to select **Always trust software from "Matrox Electronic Systems"**, and then click **Install** to continue the Matrox software installation.
- Although the Matrox DSX License Agreement is only displayed during a standard installation, acceptance of the agreement is implied when installing in silent mode.

Installing the Matrox SDK

In order to install the *Matrox Programming Reference Library* and *Matrox DSX Topology API Programming Reference Library* online Help, and the compiled source code for the DSX sample applications included in the Matrox SDK installation, you must have Microsoft Visual Studio installed on your computer.

1. Run *DSX.sdk.exe*.
2. Follow the onscreen instructions to complete the installation of the Matrox SDK on your computer.

Uninstalling the Matrox software

You can remove the various Matrox software components (software or SDK) by choosing the "Uninstall" option that is available for each component, such as **Uninstall Matrox DSX.utils**.

Note Make sure to close all running applications, especially Google Chrome, before uninstalling the Matrox software, otherwise you will be forced to reboot your system.

On a Windows 10, Windows 8.1, or Windows Server 2012 system, the tiles for uninstalling Matrox DSX.sdk and Matrox DSX.utils may not be added to the Apps view. If this occurs, you can uninstall Matrox DSX.sdk or Matrox DSX.utils as follows:

1. In **Control Panel**, switch to **Small icons view**, then choose **Program and Features**.
2. Choose **Matrox DSX.sdk** or **Matrox DSX.utils**.
3. Click **Uninstall**, then click **Next**.

   After Matrox DSX.sdk or Matrox DSX.utils has been successfully removed from your computer, click **OK**.

Updating the Matrox Firmware

All Matrox DSX cards run firmware (onboard software) that is stored in their permanent memory. When a Matrox DSX card receives power, its firmware will execute. The firmware version installed on the card must match the Matrox DSX.utils version installed on the computer system. For the M264 family (M264, M264 S2, or M264 S3), the Matrox Firmware Updater is used by the Matrox Setup program to update the Matrox M264 firmware automatically if the firmware version installed on the card does not match the Matrox DSX.utils version installed on the computer system.

Typical uses for the Matrox Firmware Updater are as follows:

Basic setup During the DSX.utils installation, the Setup program launches *mvM264HmcUpader.exe* to update the firmware, if needed.

Basic setup after installing a new M264 family card After a new card is installed, you must reinstall DSX.utils to update the Matrox M264 firmware.

Replacing Matrox DSX cards Care must be taken when replacing a Matrox DSX card in a system. If the existing Matrox DSX card is replaced by another card because of a malfunction or in order to use a different variation of the card, the firmware installed on the new card might not match the installed DSX.utils software. If an M264 family card is replaced by another M264 family card, you must reinstall DSX.utils to update the Matrox M264 firmware.

System clones When installing multiple systems it might be useful to clone each system's hard disk. Doing so is enough to ensure that the same software is installed on all systems. However, this does not update the firmware of every Matrox DSX card. In this case, you must reinstall DSX.utils to update the Matrox M264 firmware.

Additional installation information

This section includes supporting information that is related to installing the DSX software.

Ignoring the Found New Hardware Wizard

Turn on your computer. Once Windows starts, your DSX hardware will be detected. If the "Found New Hardware Wizard" appears, press **ESC** or click **Cancel** to close the wizard because the Matrox DSX.utils Setup program will automatically detect your devices and install the appropriate drivers. The wizard only appears the first time you start your computer after installing your DSX hardware.

If Windows launches the "Found New Hardware Wizard," it will appear for each of your DSX hardware components. Close the wizard each time it appears. To ensure a smooth DSX software installation, it is essential that you do not let the wizard try to install any drivers.

Disabling Sleep and Hibernate modes in Windows 10, 8, and 7

On a Windows operating system, sleep or hibernate modes can be used as alternatives to a full shutdown of your system. On a system with Matrox DSX installed, these alternative shutdown states can cause your system to become unstable and must be disabled.

You can disable Sleep and Hibernate modes from the Windows Control Panel.

1. In **Control Panel**, choose **Hardware and Sound** or **System and Security > Power Options**.

Note On Windows 10, 8, or 7, **Hardware and Sound** and **System and Security** appear if you are in the default **Category** view. Otherwise, only **Power Options** appears.

2. Under your selected power plan, click **Change plan settings**, then click **Change advanced power settings**.
3. Under **Sleep**, set **Sleep after** and **Hibernate after** to **Never**.
4. Under **Power buttons and lid**, set all the options to either **Shut down** or **Do nothing**.
5. Click **Apply** to save your settings, then click **OK**.
6. On a Windows 10 or 8 system, click **Choose what the power button does**.
   a. Click **Change settings that are currently unavailable**.
   b. Under **Shutdown settings**, clear **Turn on fast startup (recommended)**.
   c. Click **Save changes**.

Windows notification area error messages

The DSX.utils setup program is designed to delete any previously-installed Matrox device drivers found on your system before installing new drivers. When the setup program deletes the old drivers, Windows detects the change, mistakenly assumes it is an error, and displays an error message.

Since the old drivers are deleted intentionally as part of the installation, it is recommended that you ignore the Windows error message, and allow the setup program to finish installing the new Matrox drivers. If you choose to click the error message for details, you will see a list of drivers in the process of being installed.

Your DSX card appears as either **PCI Device** or **Multimedia Controller**, and its status is shown as "No driver found". This status will not change even after the installation is successful, as Windows verifies driver status sequentially, and the drivers had already been deleted when the status was updated. Rest assured that all the required drivers are installed, and your Matrox device will function normally if you allow the setup program to complete the installation.

Installing the Matrox VFW software codecs on a system without DSX hardware

The Matrox VFW software codecs let you render and play back Matrox *.avi* files in your Video for Windows programs without having to install Matrox DSX.utils and DSX hardware.

Note If you've installed Matrox DSX.utils, you do not need to install the Matrox VFW software codecs because all the Matrox codecs are automatically installed on your system during the installation.

The Matrox VFW software codecs are available for download in the "Downloads" section of the Matrox Support website at www.matrox.com/video/support.

5

Installing Your DSX Software for Linux

This chapter explains how to install the Matrox DSX software, and update the Matrox DSX firmware for Linux.

Installing the Matrox software

Once you've installed your Matrox DSX hardware and properly connected your devices, you can proceed with the software installation as explained in the following sections.

Note Refer to the *Matrox DSX Release Notes* for supported operating systems and other important information.

Installing libdispatch

Before installing the software installation package (*DSX-TopologyUtils.run*), libdispatch must be installed.

Note Follow the appropriate procedure for your operating system when installing libdispatch.

To install libdispatch for Ubuntu:

1. If required, uninstall any previously installed version, such as libdispatch0 or libdispatch-dev.

   ```
   $ sudo apt-get purge libdispatch0 libdispatch-dev
   $ sudo apt-get autoremove
   ```

2. Install the libdispatch prerequisites listed at https://github.com/nickhutchinson/libdispatch.

   ```
   $ sudo apt-get install libblocksruntime-dev libkqueue-dev
   libpthread-workqueue-dev
   ```

3. If you have Ubuntu version 12.04, install the Clang compiler version 3.4 available at http://www.llvm.org/. For different Ubuntu versions, go to step 4.

   a. Update the repository of apt-get by adding the following lines at the end of the */etc/apt/sources.list* file:

   ```
   $ deb http://llvm.org/apt/unstable/llvm-toolchain-3.6 main
   $ deb-src http://llvm.org/apt/unstable/ llvm-toolchain-3.6
   main
   ```

   b. Install Clang 3.4 with the following commands:

   ```
   $ sudo apt-get update
   $ sudo apt-get install clang-3.4
   ```

   The compiler should now be installed in */usr/lib*.

   c. Create two symbolic links to use Clang properly:

   ```
   $ sudo ln -s /usr/bin/clang-3.4 /usr/bin/clang
   $ sudo ln -s /usr/bin/clang++-3.4 /usr/bin/clang++
   ```

   d. Verify that everything works by calling the compiler to get its version using the following commands:

   ```
   $ cd
   ```

```
$ clang -v
$ clang++ -v
```

4 If you have an Ubuntu version other than 12.04, install the Clang compiler available at http://www.llvm.org/ with the following command:

```
$ sudo apt-get install clang
```

5 Install CMake version 2.8.8 or later available at http://www.cmake.org/.

– For Ubuntu 12.10 or later:

```
$ sudo apt-get install cmake
```

– For versions earlier than Ubuntu 12.10:

i If required, uninstall any previously installed version of CMake.

```
$ sudo apt-get purge cmake
```

ii Download the latest version of CMake and extract the sources to a local folder. For example, if you are installing CMake version 3.0.1, type the following:

```
$ tar xvf cmake-3.0.1.tar.gz
$ cd cmake-3.0.1
$ ./bootstrap
$ make
$ sudo make install
```

Note To access the newly installed CMake, you must first close your Terminal.

6 Download *libdispatch-0.1.3.1.zip* available at https://github.com/nickhutchinson/libdispatch/releases/tag/v0.1.3.1, then build and install libdispatch as follows:

```
$ unzip libdispatch-0.1.3.1.zip
$ mkdir libdispatch-0.1.3.1-build && cd
libdispatch-0.1.3.1-build
$ ../libdispatch-0.1.3.1/configure
$ make
$ sudo make install
```

To install libdispatch for CentOS 7 or openSUSE 13.1:

1 Install the following:

– For CentOS 7:

```
$ sudo -E yum install epel-release
$ sudo -E yum install clang
$ sudo -E yum install cmake
```

– For openSUSE 13.1:

```
$ sudo zypper install clang
$ sudo zypper install cmake
```

```
$ sudo zypper install gcc
```

2. Download *libblocksruntime-0.4.1.tar.gz* available at https://github.com/mheily/blocks-runtime/releases, then build and install it as follows:

```
$ tar xvf libblocksruntime-0.4.1.tar.gz
$ cd libblocksruntime-0.4.1
$ ./configure
$ make
$ sudo make install
```

3. Download *libpthread_workqueue-0.9.1.tar.gz* available at https://github.com/mheily/libpwq/releases, then build and install it as follows:

```
$ tar xvf libpthread_workqueue-0.9.1.tar.gz
$ cd libpthread_workqueue-0.9.1
$ ./configure
$ make
$ sudo make install
```

4. Download *libkqueue-2.0.3.tar.gz* available at https://github.com/mheily/libkqueue/releases, then build and install it as follows:

```
$ tar xvf libkqueue-2.0.3.tar.gz
$ cd libkqueue-2.0.3
$ ./configure
$ make
$ sudo make install
```

5. In */etc/ld.so.conf.d*, create a *local.conf* file with the text */usr/local/lib*, then run **sudo ldconfig**.

6. Download *libdispatch-0.1.3.1.zip* available at https://github.com/nickhutchinson/libdispatch/releases/tag/v0.1.3.1.

7. Build and install libdispatch as follows:

```
$ unzip libdispatch-0.1.3.1.zip
$ mkdir libdispatch-0.1.3.1-build && cd
libdispatch-0.1.3.1-build
$ ../libdispatch-0.1.3.1/configure
$ make
$ sudo make install
```

Installing the Matrox software installation package

The software installation package (*DSX-TopologyUtils.run*) will be installed in */opt/MatroxVideo/DSX.utils* and contains the Matrox DSX drivers. Any missing dependencies will be reported to you before performing the install. Please install any missing packages to continue.

Note You must install libdispatch, before installing the software installation package. For more details, see "Installing libdispatch" on page 20.

To install the software installation package:

1. Before installing the software installation package, you must copy the *.run* file locally to your computer.
2. After copying the *.run* file, make sure that the software installation package is executable by checking that the execute bit is on using your graphical file manager or setting it on the Terminal (`chmod +x <filename>`).
3. To install the software installation package, do one of the following:
   a. For a typical installation, run the installer with sudo (for example, **`sudo ./DSX-TopologyUtils.run`**), or run it while logged in as the root user.
   b. For a silent mode installation, run the installer with sudo or while logged in as the root user, and add the suffix **`-- -quiet`** or **`-- -q`** (for example, **`sudo ./DSX-TopologyUtils.run -- -quiet`**). All prompts and messages are bypassed, and your system is automatically restarted if needed. Log messages, including errors about dependencies, will appear in the execution trace.
   c. For a trial run installation that will exit before the actual installation begins (or if errors are found), run the installer with the suffix **`-- -validate`** or **`-- -v`** (for example, **`sudo ./DSX-TopologyUtils.run -- -validate`**).

   This trial run allows you to validate the installation package without installing the software. You may see warning and/or error messages in the execution log.

   To validate the trial run installation in silent mode (that is, without prompts or messages), use the following command:

   `sudo ./DSX-TopologyUtils.run --noprogress -- -quiet -v`

Remarks

- If you update your Linux kernel, you must reinstall *DSX-TopologyUtils* in order to rebuild the Matrox kernel drivers with the newer OS kernel distribution.
- In order to update your software installation software to a later version, you must first uninstall the old version as explained in "Uninstalling the Matrox software."

Installing the Matrox SDK

The Matrox SDK contains all the header and DSX library files required to develop applications that use the Matrox DSX hardware, and includes available sample applications. The Matrox SDK (*DSX-TopologySdk.run*) will be installed in */opt/MatroxVideo/DSX.sdk*.

To install the Matrox SDK:

1. Before installing the Matrox SDK, you must copy the *.run* file locally to your computer.
2. After copying the *.run* file, make sure that the Matrox SDK is executable by checking that the execute bit is on using your graphical file manager or setting it on the Terminal (`chmod +x <filename>`).
3. To install the Matrox SDK, run the installer with sudo (for example, **`sudo ./DSX-TopologySdk.run`**), or run it while logged in as the root user.

Note In order to update your Matrox SDK to a later version, you must first uninstall the old version as explained in "Uninstalling the Matrox software."

Uninstalling the Matrox software

You can uninstall the DSX software as follows:

- To uninstall the DSX-TopologyUtils package, run the shell script at */opt/MatroxVideo/DSX.utils/uninstall.sh* as root user (or with sudo).
- To uninstall the DSX-TopologySdk package, run the shell script at */opt/MatroxVideo/DSX.sdk/uninstall.sh* as root user (or with sudo).

Updating the Matrox Firmware

All Matrox DSX cards run firmware (onboard software) that is stored in their permanent memory. When a Matrox DSX card receives power, its firmware will execute. The firmware version installed on the card must match the Matrox DSX-TopologyUtils version installed on the computer system. For the M264 family (M264, M264 S2, or M264 S3), the Matrox Firmware Updater is used by the Matrox Setup program to update the Matrox M264 firmware automatically if the firmware version installed on the card does not match the Matrox DSX-TopologyUtils version installed on the computer system.

Typical uses for the Matrox Firmware Updater are as follows:

Basic setup During the DSX-TopologyUtils installation, the Setup program launches *mvM264HmcUpader.exe* to update the firmware, if needed.

Basic setup after installing a new M264 family card After a new card is installed, you must reinstall DSX-TopologyUtils to update the Matrox M264 firmware.

Replacing Matrox DSX cards Care must be taken when replacing a Matrox DSX card in a system. If the existing Matrox DSX card is replaced by another card because of a malfunction or in order to use a different variation of the card, the firmware installed on the new card might not match the installed DSX-TopologyUtils software. If an M264 family card is replaced by another M264 family card, you must reinstall DSX-TopologyUtils to update the Matrox M264 firmware.

System clones When installing multiple systems it might be useful to clone each system's hard disk. Doing so is enough to ensure that the same software is installed on all systems. However, this does not update the firmware of every Matrox DSX card. In this case, you must reinstall DSX-TopologyUtils to update the Matrox M264 firmware.

Additional installation information

This section includes supporting information that is related to installing the DSX software.

Disabling suspend mode

On a Linux operating system, suspend mode can be used as an alternative to a full shutdown of your system. On a system with Matrox DSX installed, this alternative shutdown state can cause your system to become unstable and must be disabled.

You can disable Suspend mode in Linux as follows:

1. Add the kernel options "**`acpi=off apm=off`**" to the **`GRUB_CMDLINE_LINUX_DEFAULT`** line in the */etc/default/grub* file as root user or with sudo.
2. In a shell, run the command **`update-grub`** as root user or with sudo.

6

Using the Matrox M264 Hardware Codecs

This chapter provides an overview of the codecs that can be used with the Matrox M264 hardware and provides details on how to configure your Matrox M264 hardware encoder and your Matrox M264 hardware decoder.

Overview of the Matrox M264 codecs

In order to use the Matrox M264 hardware codecs, you must have a Matrox M264 family (M264, M264 S2, or M264 S3) card. The codecs enable you to encode, decode, de-interlace, and scale 8- and 10-bit, 4:2:0 and 4:2:2 H.264/AVC multi-stream data. The Matrox M264 codecs support YUV 4:2:2 (8- and 10-bit) and v210 YUV uncompressed formats.You can use a Matrox M264 hardware encoder for compression, de-interlacing, and scaling and a Matrox M264 hardware decoder for decompression with resolutions ranging from proxy to UHD. However, this requires that you access and control the codecs that you would like to use. For information on how to access and control the Matrox M264 encoder, see "About the Matrox M264 hardware encoder" on page 29. For information on how to access and control the Matrox M264 decoder, see "About the Matrox M264 hardware decoder" on page 34.

Note On the Matrox M264/420 card, it is not possible to encode or decode 4:2:2 H.264/AVC content.

General characteristics

The following applies to compression and decompression operations:

- Although multiple instances of the encoder or decoder can be created, only one compression or decompression stream can be opened on any instance.
- Up to 32 processes can be created at the same time.

About the Matrox M264 hardware encoder

The Matrox M264 hardware encoder is an H.264/AVC hardware encoder. It can be used to capture generic H.264 or the following Sony XAVC compressed data.

Sony XAVC format	Resolution	Frame rate (fps)
Intra Class 100 (4:2:2, 10-bit) with CBG compression	720p	50 and 59.94
	1080i	25 and 29.97
	1080p	23.98, 25, 29.97, 50, and 59.94
Intra Class 300 and 480 (4:2:2, 10-bit) with CBG compression	2160p	23.98, 25, 29.97, 50, and 59.94
Intra Class 300 and 480 (4:2:2, 10-bit) with VBR compression	2160p	23.98, 25, 29.97, 50, and 59.94
Long GOP 25 (4:2:2, 10-bit)	1080i	25 and 29.97
	1080p	23.98, 25, and 29.97
Long GOP 35 (4:2:2, 10-bit)	1080i	25 and 29.97
	1080p	23.98, 25, 29.97, 50, and 59.94
Long GOP 50 (4:2:2, 10-bit)	720p	50 and 59.94
	1080i	25 and 29.97
	1080p	23.98, 25, 29.97, 50, and 59.94

The Matrox M264 hardware encoder can be controlled using the **IMvEncoderVideo** interface or the **IMvEncoderStream** interface. If you would like to encode buffers at any speed, such as for faster than real time processing, use the **IMvEncoderVideo** interface. For more information, see "Using the Matrox M264 hardware encoder with buffers" on page 30. Instead, if you would like to encode in topology-based workflows, such as for real time processing, use the **IMvEncoderStream** interface. For more information, see "Using the Matrox M264 hardware encoder in topology-based workflows" on page 33.

Using the Matrox M264 hardware encoder with buffers

The Matrox M264 hardware encoder can be used to encode buffers at any speed, such as for faster than real time processing. In this case, you must use the **IMvEncoderVideo** interface to control and instantiate the Matrox M264 encoder. The codec GUID to use for the Matrox M264 hardware encoder is *CLSID_MvM264Encoder*.

General characteristics

The general characteristics of the Matrox M264 hardware encoder when used to encode buffers with the **IMvEncoderVideo** interface are as follows:

- The compression operations ***Close()***, ***PutUncompressedVideoAndVANC()***, and ***GetCompressedSurface()*** are asynchronous calls, whereas ***Open()***, ***SetOption()***, and ***GetOption()*** are synchronous calls.
- When a notification callback is called, the surface returns additional information provided by ***IMvSurface::GetGroupOfPicturesFrameInfos()*** and ***IMvSurface::GetGroupOfPicturesInfos()***. The parameter *ulBufferSizeInBytes* in the **SMvSurfaceDescription** structure also updates the size of the surface to what is actually required to contain the data.

Sample application

The *mvsVideoEncoderTester* sample application demonstrates how to instantiate and use the **IMvEncoderVideo** interface for encoding YUV frames into H.264 video streams using a Matrox M264 family card. For more information on this sample application, see the *DSXTopologyAPISampleApplications.txt* or *DSX.sdkSampleApplications.txt* file.

Compression operation

The following steps explain how to control the Matrox M264 hardware encoder using the **IMvEncoderVideo** interface.

1. Instantiate the Matrox M264 encoder codec GUID, *CLSID_MvM264Encoder*, using the ***CreateCodecEx()*** method of the **IMvFlexEngine** interface.

   For more information on the **IMvFlexEngine** interface, see "Overview of the Flex Engine" in the *Matrox DSX.sdk User Guide* or "Obtaining a Flex Engine for processing buffers using the card configuration interface" in the *Matrox DSX Topology API User Guide.*

2. Allocate uncompressed Flex host buffers (YUV 4:2:2 8-bit, YUV 4:2:2 10-bit, or v210 4:2:2 10-bit) that will receive the images to be compressed.

Note Due to hardware constraints, the address of the input surfaces must be aligned to 4 kibibytes.

For information on allocating buffers, see “Audio/video surface allocation and management” in the *Matrox DSX.sdk User Guide* or “Using buffers to update a card node” in the *Matrox DSX Topology API User Guide*.

3 Allocate Flex user buffers that will receive the compressed data.

Note For optimal performance, the address of the output buffers should be 32-byte aligned.

4 Call ***IMvEncoderVideo::Open()*** to open a stream for compression.

Remarks

– To capture generic H.264 footage, use the **SMvM264GenericCompressionOptions** structure.

– To capture Sony XAVC footage, use the **SMvM264XAVCCompressionOptions** structure.

5 The user application must implement the completion callback interface using ***IMvCompletionCallback::Notify()*** and set a notification callback by calling ***IMvEncoderVideo::SetOption()*** with the `keMvCodecOptionCompletionCallback_pI` parameter.

Note The notification callback will be called for each frame that is encoded. In addition, the notification callback will be called with a `NULL` parameter to let the user application know when the encoder has finished encoding.

6 The user application must implement the error notification callback interface using ***IMvErrorNotificationCallback::Notify()*** and set an asynchronous error notification callback by calling ***IMvEncoderVideo::SetOption()*** with the `keMvCodecOptionAsynchErrorCallback_pI` parameter.

Note This allows the user application to handle encoder errors.

7 Call ***IMvEncoderVideo::GetOption()*** with the `keMvCodecOptionMaxCompressedFrameSizeByBytes_ui32` parameter to retrieve the maximum possible size of any compressed frame.

Remarks

– If you are generating fields instead of frames, this call will return the maximum possible size of the compressed field.

– To ensure a valid frame or field size, the ***IMvEncoderVideo::Open()*** method must be called prior to calling ***IMvEncoderVideo::GetOption()***.

8 Allocate a sufficient amount of memory to hold the compressed data, and then call ***IMvSurface::AssignUserBufferReference()*** to assign the memory to the buffers created in step 3. Use a surface description that matches the encoder output resolution and the `keMvSurfaceFormatAVC` parameter as the surface format.

Note For optimal performance, the allocated memory should be 32-byte aligned.

9 Set up the **IMvAVContent** interface of these buffers with correct read and write counts and time stamps.

For information on working with buffers, see "Synchronizing surface operations" in the *Matrox DSX.sdk User Guide* or "Working with buffers" in the *Matrox DSX Topology API User Guide*.

10 Fill the memory allocated in step 2 with the uncompressed data.

11 Call the ***IMvEncoderVideo::PutUncompressedVideoAndVANC()*** method for each frame or field that you would like to compress. Each ***PutUncompressedVideoAndVANC()*** operation must contain an uncompressed frame or field.

Remarks

- If you do not have VANC surfaces or do not want to capture VANC surfaces, set VANC surfaces to `NULL`.
- If you call ***IMvEncoderVideo::PutUncompressedVideoAndVANC()*** too many times, the method may fail with the error code MV_E_MODULE_BUSY. If this occurs, it means that the hardware device is busy and unable to take commands at this time, the surface must be resent. You can try resending the surface after you receive a notification callback with the `in_pIAVContent` parameter. Make sure that the read count is incremented accordingly.

12 Call ***IMvEncoderVideo::GetCompressedSurface()*** for every corresponding ***IMvEncoderVideo::PutUncompressedVideoAndVANC()*** frame operation or every two corresponding ***IMvEncoderVideo::PutUncompressedVideoAndVANC()*** field operations performed in step 11.

Remarks

- For interlaced video, to determine whether the codec returns fields or frames, call ***IMvEncoderVideo::GetOption()*** with the `keMvCodecOptionCodecReturnsCompressedField_b` parameter.
- If you call ***IMvEncoderVideo::GetCompressedSurface()*** too many times, the method may fail with the error code MV_E_MODULE_BUSY. If this occurs, it means that the hardware device is busy and unable to take commands at this time, the surface must be resent. You can try resending the surface after you receive a notification callback with the `in_pIAVContent` parameter. Make sure that the write count is incremented accordingly.

13 Continue the ***IMvEncoderVideo::PutUncompressedVideoAndVANC()*** and ***IMvEncoderVideo::GetCompressedSurface()*** loop until all uncompressed frames have been sent to the encoder. For each compression operation, a notification callback is received with the `in_pIAVContent` parameter of the compressed surface.

14 Call ***IMvEncoderVideo::Close()*** to close the stream when finished. The notification callback will be called with a *in_pIAVContent == NULL* parameter to let the user application know when the codec is closed.

Note After calling this method, you can still call ***IMvEncoderVideo::GetCompressedSurface()*** up until you reach the expected number of ***IMvEncoderVideo::PutUncompressedVideoAndVANC()*** calls.

15 When *NULL* is returned, release the two notification callbacks by calling ***IMvEncoderVideo::SetOption()*** with the *keMvCodecOptionCompletionCallback_pI* parameter and the *keMvCodecOptionAsynchErrorCallback_pI* parameter.

Using the Matrox M264 hardware encoder in topology-based workflows

The Matrox M264 hardware encoder can be used to encode in topology-based workflows, such as for real time processing. In this case, you must use the **IMvEncoderStream** interface to control the Matrox M264 family card. The GUID to use for the Matrox M264 hardware encoder is *CLSID_ENCODER_M264*. The Matrox M264 hardware encoder is instantiated with the **IMvEncoderStream** interface. For information on how to use the **IMvEncoderStream** interface for controlling the Matrox M264 hardware encoder, see "Encoder Streams" in the *Matrox DSX Topology API User Guide*.

Using the Matrox M264 hardware encoder for de-interlacing and scaling

The Matrox M264 hardware encoder can be used to automatically de-interlace and downscale. To de-interlace, set the input resolution to interlaced and the output resolution to progressive. To downscale, set an output resolution that is smaller than the input resolution for the encoder settings. However, the input and output frame rate must be the same, and the scaling must always fill the output. This means that letterbox or pillarbox cannot be applied to preserve the aspect ratio.

Encoding closed caption information

The Matrox M264 hardware encoder supports embedding closed caption information from Vertical Ancillary Data Space (VANC) data (or Vertical Blanking Interval (VBI) line 21 in NTSC) into SEI (Supplemental Enhancement Information) messages as described in ANSI/SCTE 128.

Note Encoding other VANC data packets and time code information is not currently supported.

About the Matrox M264 hardware decoder

The Matrox M264 hardware decoder is an H.264/AVC hardware decoder. It can be used to decompress generic H.264 or Sony XAVC compressed data.

Note Decoding VBI (Vertical Blanking Interval) or VANC (Vertical Ancillary Data Space) data packets and time code information is not currently supported.

Using the Matrox M264 hardware decoder with buffers

The Matrox M264 hardware decoder can be used to decode buffers at any speed, such as for faster than real time processing. To do so, you must use the **IMvDecoderVideo** interface to control and instantiate the Matrox M264 decoder. The codec GUID to use for the Matrox M264 hardware decoder is *CLSID_MvM264Decoder*.

General characteristic

The Matrox M264 hardware decoder when used to decode buffers with the **IMvDecoderVideo** interface has the following general characteristic:

- The decompression operations ***PutCompressedSurface()***, ***GetUncompressedVideoAndVANCSurface()***, and ***Flush()*** are asynchronous calls, whereas ***Open()***, ***Close()***, ***SetOption()***, and ***GetOption()*** are synchronous calls.

Modes of operation

The Matrox M264 hardware decoder can be instantiated using blob mode or access unit mode. If the *bAccessUnitAlignedInput* parameter in **SMvM264DecompressionOptions** is set to true, the M264 hardware decoder will be instantiated in access unit mode. Otherwise, it will be instantiated in blob mode.

In access unit mode, the user application provides data that is aligned on an access unit (that is, the compressed data is a full field or frame). In this case, the *ulDisplayPosition* parameter in **SMvGroupOfPicturesFrame** must be initialized properly for the input surface. Use this mode if you want to synchronize uncompressed video with audio.

Note If the surfaces are obtained from the Matrox MPEG2 TS Demuxer, the *ulDisplayPosition* parameter will already be set.

In blob mode, the decoder is able to receive any type of data, including data that is field or frame aligned. In this mode, the user application does not extract or provide details about the data.

Note If the user application sends too many small blobs, the decoder's performance may not be optimal.

Sample application

The *mvsVideoDecoderTester* sample application demonstrates how to instantiate the Matrox M264 hardware decoder and use the **IMvDecoderVideo** interface for decoding compressed H.264 video streams into YUV frames using a Matrox M264 family card. For more information on this sample application, see the *DSXTopologyAPISampleApplications.txt* or *DSX.sdkSampleApplications.txt* file.

Decompression operation

The following steps explain how to control the Matrox M264 hardware decoder using the **IMvDecoderVideo** interface.

1. Instantiate the Matrox M264 decoder codec GUID, `CLSID_MvM264Decoder`, using the ***CreateCodecEx()*** method of the **IMvFlexEngine** interface.

   For more information on the **IMvFlexEngine** interface, see "Overview of the Flex Engine" in the *Matrox DSX.sdk User Guide* or "Obtaining a Flex Engine for processing buffers using the card configuration interface" in the *Matrox DSX Topology API User Guide.*

2. Allocate a pool of Flex user buffers that will be used for the compressed data.

   For information on allocating buffers, see "Audio/video surface allocation and management" in the *Matrox DSX.sdk User Guide* or "Using buffers to update a card node" in the *Matrox DSX Topology API User Guide*.

3. Allocate a pool of uncompressed Flex host buffers (YUV 4:2:2 8-bit, YUV 4:2:2 10-bit, or v210 4:2:2 10-bit) that will receive the uncompressed images.

Note Due to hardware constraints, the address of the input surfaces must be aligned to 4 kibibytes.

4. Call ***IMvDecoderVideo::Open()*** to open a stream for decoding and pass a pointer to the **SMvM264DecompressionOptions** structure.

Note To use the Matrox M264 decoder in access unit mode, set `bAccessUnitAlignedInput` to true in **SMvM264DecompressionOptions**.

5 The user application must implement the completion observer interface using ***IMvCompletionObserver::NotifyCompletion()*** and set a notification callback by calling ***IMvDecoderVideo::SetOption()*** with the *keMvCodecOptionFlushObserver_pI* parameter.

Note The notification will be called once the codec is finished decoding all the data and after ***IMvDecoderVideo::Flush()*** is called. The user application calls ***IMvDecoderVideo::Flush()*** when it is finished passing all the compressed data to the codec.

6 The user application must implement the error notification callback interface using ***IMvErrorNotificationCallback::Notify()*** and set an asynchronous error notification callback by calling ***IMvDecoderVideo::SetOption()*** with the *keMvCodecOptionAsynchErrorCallback_pI* parameter.

Note This allows the user application to handle decoder errors.

7 Allocate a sufficient amount of memory to hold the compressed data, and then call ***IMvSurface::AssignUserBufferReference()*** to assign the memory to the user buffer surfaces created in step 2. Use a surface description that matches the decoder input resolution and the *keMvSurfaceFormatAVC* parameter as the surface format.

Remarks

- If the size of each compressed frame is known, the user buffer surface can reference that size.
- If the bit rate is not known, allocating 512 KB is sufficient.
- If the bit rate is known, it can be used to estimate the average size of one frame of compressed data.

8 Set up the **IMvAVContent** interface of these compressed buffers with correct read and write counts. Once the write operation is finished, call ***IMvAVContent::SignalWriteCompletion()*** to signal that the surface is ready to be used by the decoder.

For information on working with buffers, see “Synchronizing surface operations” in the *Matrox DSX.sdk User Guide* or “Working with buffers” in the *Matrox DSX Topology API User Guide*.

9 Call ***IMvDecoderVideo::PutCompressedSurface()*** for each prepared user buffer in the order that they were read.

Note To use the Matrox M264 decoder in access unit mode, initialize the *ulDisplayPosition* parameter in **SMvGroupOfPicturesFrame** to the frame’s relative position. Then call ***IMvSurface::SetGroupOfPicturesInfos()*** and ***IMvSurface::SetGroupOfPicturesFrameInfos()***.

10 Set up the **IMvAVContent** interface for the buffers created in step 3 and call ***IMvDecoderVideo::GetUncompressedVideoAndVANCSurface()*** with these buffers.

Remarks

- Because VANC surfaces are not supported yet, set VANC surfaces to *NULL*.
- ***IMvDecoderVideo::GetUncompressedVideoAndVANCSurface()*** can be called until all the buffers from the pool are sent to the decoder and as buffers are returned to the pool.
- To ensure that the decoder is not slowed down because it does not have buffers at the input or output, provide the decoder a steady supply of buffers available from the pool.

11 Continue the ***IMvDecoderVideo::PutCompressedSurface()*** and ***IMvDecoderVideo::GetUncompressedVideoAndVANCSurface()*** loop until all compressed data has been sent to the decoder.

12 If the decoded data needs to be processed, each surface sent to the decoder using ***IMvDecoderVideo::GetUncompressedVideoAndVANCSurface()*** must be kept by the user application. To do this, the user application must wait for the write completion event of the surface to be signaled. The decoder will signal the write completion event of the surface once it has finished decompressing a frame into the surface. When a write completion event is signaled, the user application can process the video data referenced by the surface.

Note If the user application does not need to process the decoded data, it can be sent to another Flex module.

13 After all the compressed data has been sent to the decoder, call ***IMvDecoder::Flush()*** to notify the decoder that no more compressed data will be sent.

Remarks

- The user application will be notified by the notification callback when the decoder has decompressed all the compressed data.
- Continue calling ***IMvDecoderVideo::GetUncompressedVideoAndVANCSurface()*** until the notification callback is called.
- After calling ***IMvDecoder::Flush()***, you can no longer call ***IMvDecoderVideo::PutCompressedSurface()***.

14 When *NULL* is returned, release the two notification callbacks by calling ***IMvDecoderVideo::SetOption()*** with the *keMvCodecOptionCompletionCallback_pI* parameter and the *keMvCodecOptionAsynchErrorCallback_pI* parameter.

15 Call ***IMvDecoderVideo::Close()*** to close the codec when finished.

Note After calling this method, no additional calls to ***IMvDecoderVideo::PutCompressedSurface()*** and ***IMvDecoderVideo::GetUncompressedVideoAndVANCSurface()*** can be sent. The decoder will decompress and return all compressed data, as long as enough uncompressed surfaces are provided. Any additional uncompressed surfaces will be cancelled.

Handling corrupted streams

If the *keMvCodecOptionAsynchErrorCallback_pI* parameter is used to set an asynchronous error notification callback with the ***IMvDecoderVideo::SetOption()*** method, the Matrox M264 hardware decoder will asynchronously notify the user application with a warning when it detects corruption in the stream.

When corruption is detected, the decoder may not be able to decompress one or more pictures. Depending on the mode that was set (for more information, see "Modes of operation" on page 34), one of the following occurs:

- In blob mode, the decoder will signal the surface that was provided to ***IMvDecoderVideo::GetUncompressedVideoAndVANCSurface()*** at the time the corruption was detected with the MV_W_CORRUPTION_DATA_IN_STREAM warning.

Note If the file does not start with an IDR frame, the decoder will generate black frames with a MV_W_CODEC_ACCESS_UNIT_SKIPPED warning until it reaches the first IDR frame. After this, if the corruption caused one or more pictures to be lost, the decoder will not be able to generate a black frame. As a result, synchronizing video and audio cannot be guaranteed in this mode.

- In access unit mode, the decoder can properly detect the number of missing pictures based on the information provided by the *ulDisplayField* parameter in the **SMvGroupOfPicturesFrame** structure.
  - If there was corrupted data in the surface, but the decoder was able to decompress it, the uncompressed surface will have a MV_W_CORRUPTION_DATA_IN_STREAM warning on the surface.
  - If frames were skipped as a result of corruption in the compressed data, the skipped frames will have a MV_W_CODEC_ACCESS_UNIT_SKIPPED warning on the uncompressed surface and the surface will be cleared to black.

Using the Matrox M264 hardware decoder for de-interlacing and scaling

The Matrox M264 hardware decoder can be used to automatically de-interlace and downscale. To de-interlace, set the input resolution to interlaced and the output resolution to progressive. To downscale, set an output resolution that is smaller than the input resolution for the decoder settings. However, the output frame rate must be the same as or double the input frame rate, and the scaling must always fill the output. This means that letterbox or pillarbox cannot be applied to preserve the aspect ratio.

Your notes

7

Using Your Matrox M264 Hardware

This chapter provides an overview of how to get started with M264 development. It explains which sample applications you can use with your M264, and includes sample workflows that you can create in mvTopologyBuilder.

Overview

After installing your Matrox M264 hardware and your DSX software, you are ready to start working with your Matrox M264 family (M264, M264 S2, or M264 S3) card.

The following sections will guide you through the initial process of using the card, but you will need to refer to other supporting documentation for more specific information. For example, to create a sample workflow in mvTopologyBuilder, you will need to refer to the *Matrox mvTopologyBuilder User Guide* for detailed instructions on how to use mvTopologyBuilder.

Using the Matrox M264 family card for encoding and decoding using buffers

The Matrox M264 family card can be used to encode and decode at any speed using buffers. For example, it can be used to perform faster than real time processing, such as transcoding. To become familiar with encoding and decoding buffers using a Matrox M264 family card, run the following sample applications.

- ***mvsVideoEncoderTester*** This sample application is supported only on 64-bit applications in Windows and Linux, and demonstrates how to instantiate and use the **IMvEncoderVideo** interface for encoding YUV frames into H.264 video streams using a Matrox M264 family card. It also displays statistics, which can be used to indicate hardware performance.
- ***mvsVideoDecoderTester*** This sample application is supported only on 64-bit applications in Windows and Linux, and demonstrates how to instantiate and use the **IMvDecoderVideo** interface for decoding compressed H.264 video streams in blob mode into YUV frames using a Matrox M264 family card. It also displays statistics, which can be used to indicate hardware performance.

For more information on where to find these sample applications, see "Where to find the Matrox DSX sample applications" on page 47. For more information on the **IMvEncoderVideo** and **IMvDecoderVideo** interfaces, see the "Using the Matrox M264 hardware encoder with buffers" on page 30, "Using the Matrox M264 hardware decoder with buffers" on page 34, the *Matrox DSX Topology API Programming Reference Library*, or the *Matrox DSX.sdk Programming Reference Library*.

Using the Matrox M264 family card in topology-based workflows

The Matrox M264 family card can be used to encode video data from a host node using an encoder stream. For more information on encoder streams, see the *Matrox DSX Topology API User Guide*.

To become familiar with using the Matrox M264 family card to encode data with the Matrox DSX Topology API, create the following topologies in mvTopologyBuilder.

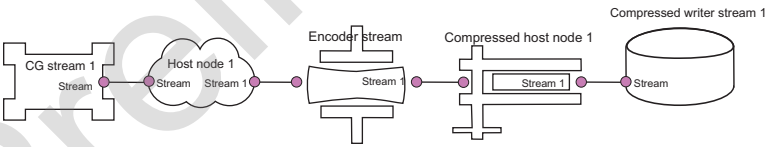
Creating a simple capture topology in mvTopologyBuilder

In mvTopologyBuilder, you can create a basic real time capture topology for the Matrox M264 family card that uses an encoder stream as follows:

1. Open mvTopologyBuilder.
2. Create a universal clock.
3. Create a new topology with the following settings:
   - Card profile: M264.
   - Usable clock: Universal clock.
   - Destroy on close.
4. Create a host node with the following settings:
   - Node name: Host node 1.
   - Content: Video.
   - Write-to-read delay: 1 frame.
   - Depth: 8 frames.
   - Video resolution: 1080i.
   - Video surface format: YUYV 422.
   - Video colorimetry: ITUR BT 709.
   - Any VANC format.

5 Create a compressed host node with the following settings:
   - Node name: Compressed host node 1.
   - Content: Video.
   - Video resolution: same as the host node in step 4.
6 Create an encoder stream with the following settings:
   - Input node: Host node 1.
   - Output node: Compressed host node 1.
   - Clear Process VANC.
   - Advanced delay: 0.
   - Compression type: M264 HW.
7 Create a CG stream with the following settings:
   - Stream name: CG stream 1
   - Video image: Any 1080i file.
   - Output node: Host node 1.
8 Create a compressed writer stream with the following settings:
   - Name: Compressed writer stream 1.
   - Compressed writer type: 264.
   - Compressed video: Compressed host node 1.
   - Filename: Location and *.264* file name of your choice.

   A simple capture topology is created as shown in the following figure.



9 To encode the stream, click the encoder stream and click **Play**.

For more information on how to create the items in mvTopologyBuilder, see the *Matrox mvTopologyBuilder User Guide*.

For a complete list of the supporting documents for using the Matrox M264 family card see, "Other supporting documentation" on page 48.

Creating a capture topology using the inputs of another card in mvTopologyBuilder

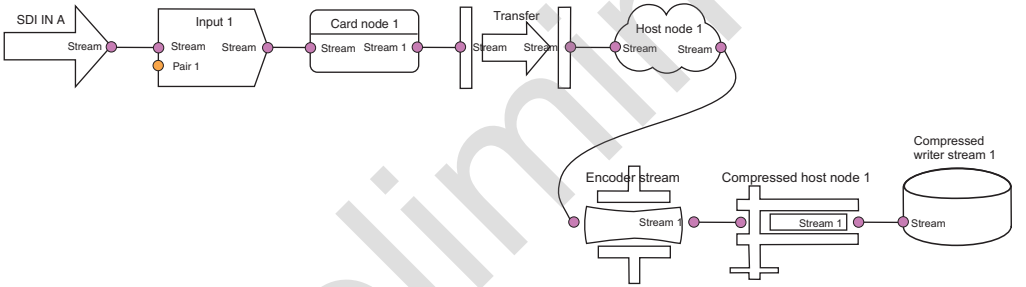
In mvTopologyBuilder, you can create a real time topology workflow for the Matrox M264 family card that captures the SDI inputs of a Matrox I/O card as follows:

1. Open mvTopologyBuilder.
2. Select the genlock settings.
3. Create a new topology with the following settings:
   - Card profile: Matrox card whose SDI inputs you would like to capture.
   - Usable clock: Genlock clock on the Matrox card.
   - Destroy on close.
4. Create a card node with the following settings:
   - Node name: Card node 1.
   - Content: Video.
   - Write-to-read delay: 1 frame.
   - Depth: 8 frames.
   - Video resolution: 1080i.
   - Video surface format: YUYV 422.
   - Video colorimetry: ITUR BT 709.
   - Any VANC format.
5. Create an input stream with the following settings:
   - Output node: Card node 1.
   - Input connector: SDI IN A.
6. Create a host node (Node name: Host node 1) with the same settings as the card node in step 4.
7. Create a transfer stream between the card node and the host node in which the transfer direction is from card node to host node.
8. Create a compressed host node with the following settings:
   - Node name: Compressed host node 1.
   - Content: Video.
   - Video resolution: same as the host node in step 6.

9 Create an encoder stream with the following settings:
- Input node: Host node 1.
- Output node: Compressed host node 1.
- Clear Process VANC.
- Advanced delay: 0.
- Compression type: M264 HW.

10 Create a Compressed writer stream with the following settings:
- Name: Compressed writer stream 1.
- Compressed writer type: 264.
- Compressed video: Compressed host node 1.
- Filename: Location and *.264* file name of your choice.

A topology workflow for the Matrox M264 family card that captures the SDI inputs of a Matrox I/O card is created as shown in the following figure.



11 To encode the stream, click the encoder stream and click **Play**.

For more information on how to create the items in mvTopologyBuilder, see the *Matrox mvTopologyBuilder User Guide*.

For a complete list of the supporting documents for using the Matrox M264 family card see, "Other supporting documentation" on page 48.

Where to find the Matrox DSX sample applications

After you have installed the Matrox SDK, the following sample application material is available to you:

1. Documents that provide an overview of all the sample applications available for Windows and Linux systems.

   They are on your machine at the default location *C:\Program Files (x86)\Matrox DSX.sdk\Documentation* in Windows and */opt/MatroxVideo/DSX.sdk/Documentation* in Linux.

2. The executables for the sample applications, if applicable.

   Not all the sample applications have been compiled into executables (some only have source code). The executables are located at:

   - In Windows:
     - **64-bit:** *C:\Program Files (x86)\Matrox DSX.sdk\Bin\VS2010\64\Release* and *C:\Program Files (x86)\Matrox DSX.sdk\Bin\VS2013\64\Release*.
     - **Java:** *C:\Program Files (x86)\Matrox DSX.sdk\Bin\java*.
   - In Linux:
     - **64-bit:** */opt/MatroxVideo/DSX.sdk/Bin*

3. The source code for the sample applications. The code is located at *C:\Program Files (x86)\Matrox DSX.sdk\SampleApps\Sources* in Windows and */opt/MatroxVideo/DSX.sdk/Samples* in Linux.

Other supporting documentation

For more details on how to use the Matrox M264 family card, refer to the following documentation:

- *DSX Release Notes* Contains a list of new features, operational limitations, and other important information applicable to the current Matrox DSX release.
- *Matrox mvTopologyBuilder User Guide.* Provides information on how to use the mvTopologyBuilder application to create topologies.
- *Matrox DSX Topology API User Guide.* Provides information on how to use the DSX Topology API for application development.
- *Matrox DSX Topology API Programming Reference Library* This is an online help collection available from within Microsoft Visual Studio in Windows and in CHM and *pdf* format in Linux. It provides reference information for the Matrox DSX Topology API interfaces, classes, enumerations, and structures.
- *Matrox DSX.sdk Programming Reference Library* This is an online help collection available from within Microsoft Visual Studio. It provides reference information for the Matrox DSX.sdk interfaces, classes, enumerations, and structures.

The Matrox DSX documentation is in PDF format (get Adobe Reader here), and is available in the following places:

- In the "Documentation" folder on the FTP site where you download the DSX drivers and installation programs. The documents available on the FTP site are a portion of the complete set of documents available to you when you install the SDK. We have included on the FTP site only the documents you'll need to get started.
- In Windows, after you install the DSX.sdk or the DSX-TopologySdk, additional DSX documentation is available on your machine at the default location *C:\Program Files (x86)\Matrox DSX.sdk\Documentation* or *C:\Program Files\Matrox DSX-TopologySdk\Documentation*.
- In Linux, after you install the DSX-TopologySdk, additional DSX documentation is available on your machine at the default location */opt/MatroxVideo/DSX.sdk/Documentation.*
- You have access to the *Matrox DSX.sdk Programming Reference Library* and *Matrox DSX Topology API Programming Reference Library* online help from within Visual Studio.

8

Monitoring Your DSX System in Windows

This chapter explains how to use X.info to display important details about your DSX system and installed hardware in Windows.

Overview

Matrox X.info lets you display information about your Matrox DSX system and installed hardware in Windows, and provides warnings when certain problems arise (for example, when the temperature of one of your DSX cards exceeds the maximum operating temperature).

Using X.info to display DSX information

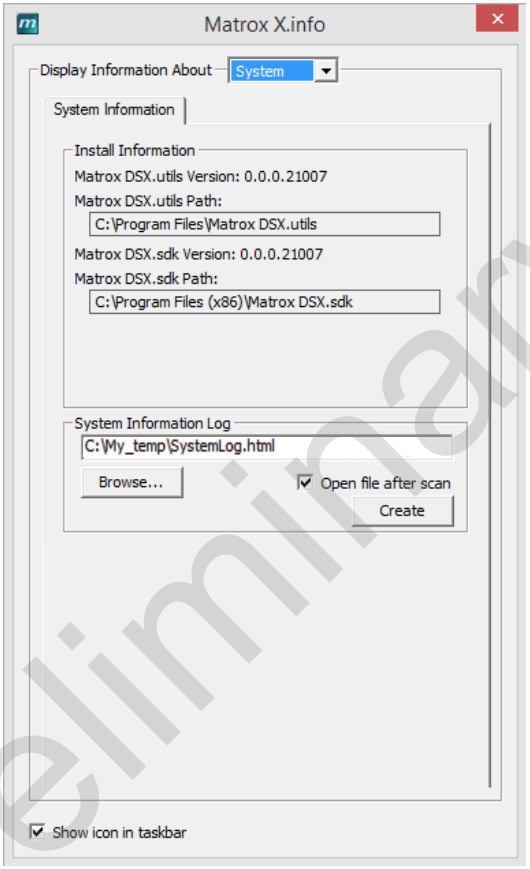
Matrox X.info runs continuously to monitor your system, whenever your computer is turned on. You can open Matrox X.info to display monitoring details by double-clicking the  icon on your Windows taskbar or clicking the  icon on your Windows taskbar and selecting **Open X.info**.

Note If you do not see the icon, check your taskbar properties and make sure that you're showing the icon for Matrox X.info.

Displaying system information

To display information about your Matrox DSX system, select **System** from the **Display Information About** list. On this page, you can see **Install Information**, such as the install path and version of DSX.utils. You can also create an HTML log file of your system information, which can be useful for troubleshooting. To create this log, use the **Browse** button under **System Information Log** to select the path

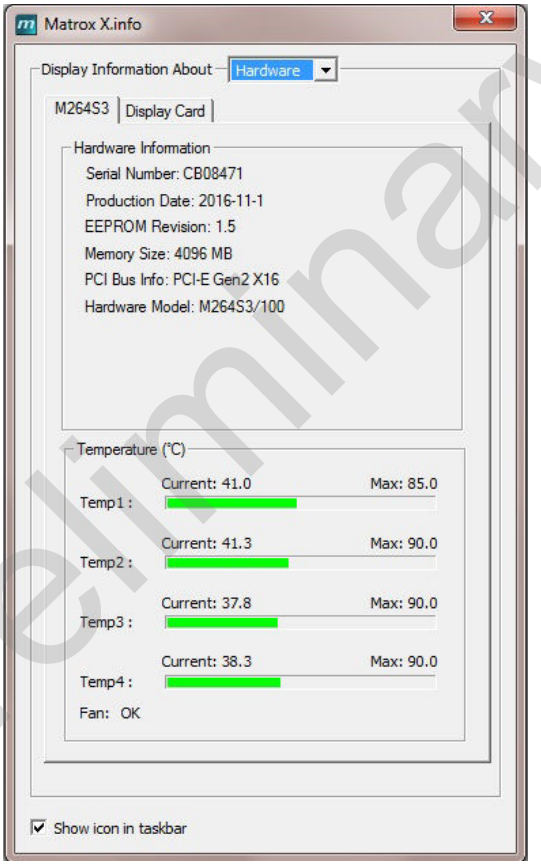
and name of the log, then click **Create**. If **Open file after scan** is selected, the HTML system log opens after it is created.



Displaying hardware information

To display information about all of the Matrox DSX hardware installed in your system, select **Hardware** from the **Display Information About** list. Each DSX card is represented by a tab.

Click the card's tab to display a page with hardware information (for example, serial number and production date). You can also monitor the current and maximum temperature for each hardware component.



Important Whether or not you have opened Matrox X.info, if one or more of your DSX hardware components exceeds the maximum operating temperature, you'll receive a warning message with further instructions (see "Error notification" on page 53).

Monitoring your DSX hardware operating temperatures

As shown in the X.info **Hardware** section, the current and maximum temperatures for your DSX hardware components are displayed. To avoid damage to your DSX components and/or computer system, make sure that you don't operate your DSX components at or near the maximum temperature for a prolonged period of time. You should target your DSX hardware to operate at least 20°C below the maximum operating temperature.

You should monitor the temperature of your DSX hardware components periodically and take measures as needed to lower the room temperature and/or improve the ventilation in your DSX system. For details on how to ensure that your system is properly ventilated, see "Plan for adequate ventilation" on page 6.

Error notification

X.info provides temperature warnings and warnings for other possible hardware problems. Once X.info has detected a hardware problem, the **Matrox X.info Notification** dialog box will be displayed to give you details of the problem and further instructions. You will not be able to close this dialog box until the problem has been resolved.

Your notes

9

Monitoring Your DSX System in Linux

This chapter explains how to use mveXinfo to display important details about your DSX system and installed hardware in Linux.

Overview

The Matrox mveXinfo program lets you display information about your Matrox DSX system and installed hardware in Linux. It also displays warnings when certain problems arise (for example, when the temperature of one of your DSX cards exceeds the maximum operating temperature).

Using mveXinfo to display DSX information

The Matrox mveXinfo program is located at */opt/MatroxVideo/DSX.utils/bin/mveXinfo.exe* and can be called anytime to display system information, hardware information, and your DSX hardware operating temperatures as shown in the following example output:

```
Install information
--------------------

Matrox DSX.utils Version: 9.8.0.22009
Matrox DSX.utils Path: /opt/MatroxVideo/DSX.utils
Matrox DSX.sdk Version: 9.8.0.22009
Matrox DSX.sdk Path: /opt/MatroxVideo/DSX.sdk

M264S3
--------------------

Serial Number: CB08471
Production Date: 2016-11-1
EEPROM Revision: 1.5
Memory Size: 4096 MB
PCI Bus Info: PCI-E Gen3 X16
Hardware Model: M264S3/100

Temperature:
Temp1: 41.0°C (105.8°F), Max 85.0°C (185.0°F)
Temp2: 41.3 C (106.3 F), Max 90.0 C (194.0 F)
Temp3: 37.8 C (100.0 F), Max 90.0 C (194.0 F)
Temp4: 38.3 C (100.9 F), Max 90.0 C (194.0 F)
Fan: OK
```

The Matrox mveXinfo program does not run in the background and must be called to display the current information. You can create an HTML report of your DSX system, which can be useful for troubleshooting, by typing the following on the command line:

```
$ ./mveXinfo.exe [-g[FILE]]
```

Where:

```
[-g]    Generates the DSX system report.

[FILE]  Filename of the DSX system report. The default filename
        is ./dsxSystemInfo.html.
```

If you would like to view a list of all the possible arguments, type the following on the command line:

```
$ ./mveXinfo.exe -h
```

Monitoring your DSX hardware operating temperatures

To avoid damage to your DSX components and/or computer system, make sure that you don't operate your DSX components at or near the maximum temperature for a prolonged period of time. You should target your DSX hardware to operate at least 20°C below the maximum operating temperature.

You should monitor the temperature of your DSX hardware components periodically and take measures as needed to lower the room temperature and/or improve the ventilation in your DSX system. For details on how to ensure that your system is properly ventilated, see "Plan for adequate ventilation" on page 6.

Error notification

For error notifications in Linux, refer to the Matrox DSX Topology API for information on how to implement the code in your application to receive notifications.

Your notes

A

DSX Specifications

This appendix provides specifications for DSX hardware.

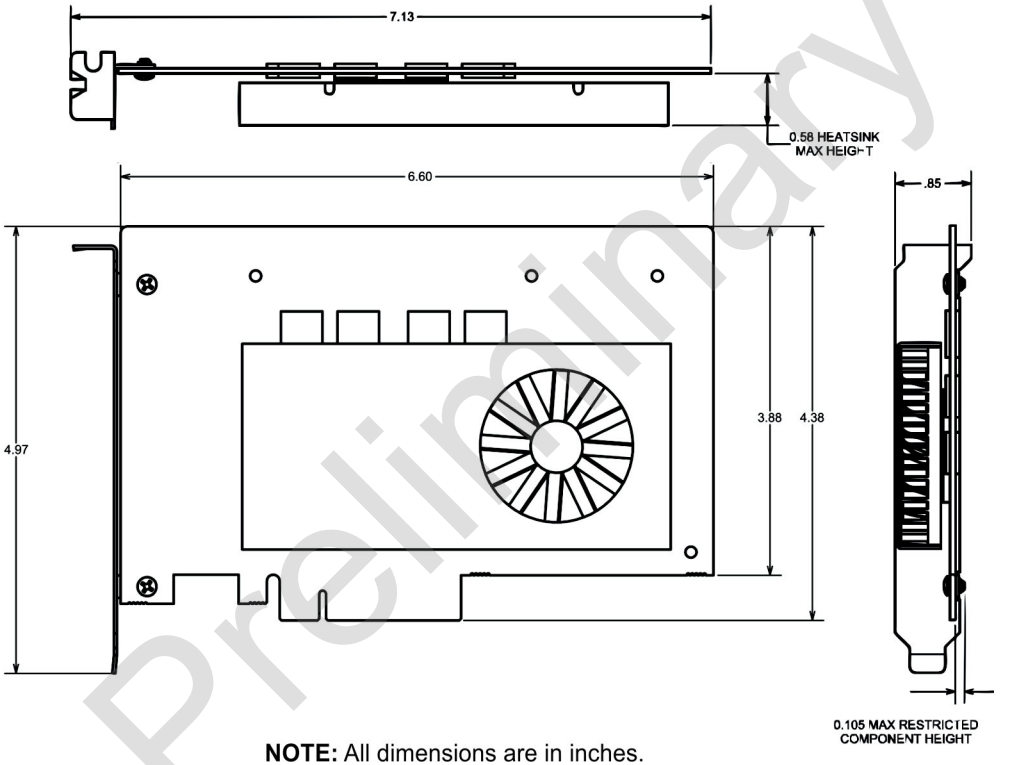
M264 card

General

PCI interface	½-length, full-height PCI Express Gen2 x8 card
Regulatory compliance	FCC Class B, CE Class B, RCM Class B, RoHS

Dimensions

The dimensions for the Matrox M264 card are as shown in the following illustration:



NOTE: All dimensions are in inches.

Typical operating voltages and current consumption

Voltage	+12 V
Current	1.55 A

Total power consumption: 18.6 watts (may vary depending on the resolution, video format, and the number of streams being processed).

Environmental specifications

- Minimum/maximum ambient operating temperature[1]: 0 to 55º C
- Minimum/maximum storage temperature: –40 to 75º C
- Maximum altitude for operation: 3,000 meters
- Maximum altitude for transport: 12,000 meters
- Operating humidity: 20 to 80% relative humidity (non-condensing)
- Storage humidity: 5 to 95% relative humidity (non-condensing)

Important To avoid damage to your DSX components and/or computer system, make sure that you don't operate your M264 card at or near the maximum operating temperature for a prolonged period of time (see "Monitoring your DSX hardware operating temperatures" on page 53 or page 57 for more information).

[1] This temperature range assumes that the hardware components on the card don't exceed the maximum operating temperature as explained in "Monitoring your DSX hardware operating temperatures" on page 53 or page 57.

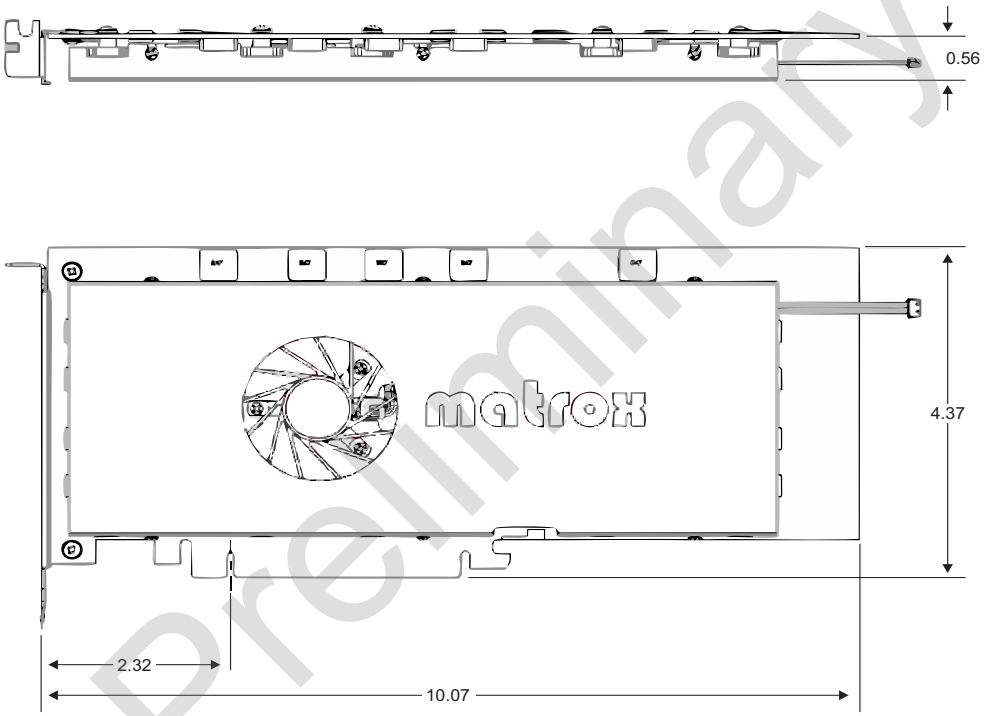
M264 S2 card

General

PCI interface	¾-length, full-height PCI Express Gen3 x8 (x16 mechanical)
Regulatory compliance	FCC Class B, CE Class B, RCM Class B, RoHS

Dimensions

The dimensions for the Matrox M264 S2 card are as shown in the following illustration:



NOTE: All dimensions are in inches.

Typical operating voltages and current consumption

Voltage	+3.3 V	+12 V
Current	1.16 A	3.79 A

Total power consumption: 49.3 watts (may vary depending on the resolution, video format, and the number of streams being processed).

Environmental specifications

- Minimum/maximum ambient operating temperature[1]: 0 to 55º C
- Minimum/maximum storage temperature: –40 to 75º C
- Maximum altitude for operation: 3,000 meters
- Maximum altitude for transport: 12,000 meters
- Operating humidity: 20 to 80% relative humidity (non-condensing)
- Storage humidity: 5 to 95% relative humidity (non-condensing)

Important To avoid damage to your DSX components and/or computer system, make sure that you don't operate your M264 S2 card at or near the maximum operating temperature for a prolonged period of time (see "Monitoring your DSX hardware operating temperatures" on page 53 or page 57 for more information).

[1] This temperature range assumes that the hardware components on the card don't exceed the maximum operating temperature as explained in "Monitoring your DSX hardware operating temperatures" on page 53 or page 57.

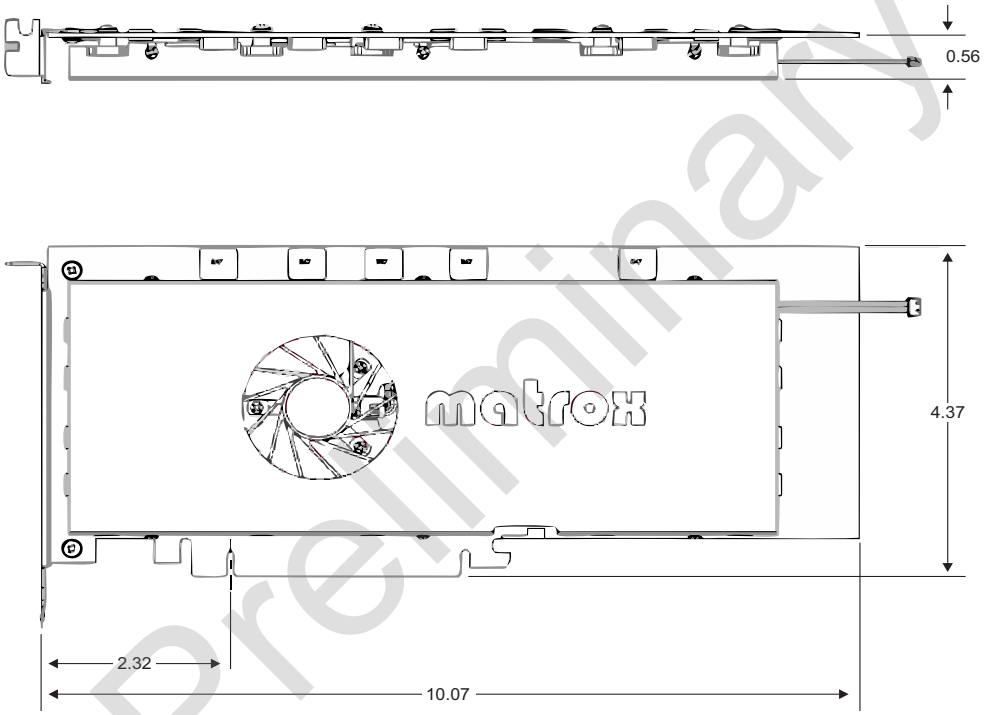
M264 S3 card

General

PCI interface	¾-length, full-height PCI Express Gen3 x16
Regulatory compliance	FCC Class B, CE Class B, RCM Class B, RoHS

Dimensions

The dimensions for the Matrox M264 S3 card are as shown in the following illustration:



NOTE: All dimensions are in inches.

Typical operating voltages and current consumption

Voltage	+3.3 V	+12 V
Current	1.58 A	5.5 A

Total power consumption: 71.2 watts (may vary depending on the resolution, video format, and the number of streams being processed).

Environmental specifications

- Minimum/maximum ambient operating temperature[1]: 0 to 55º C
- Minimum/maximum storage temperature: –40 to 75º C
- Maximum altitude for operation: 3,000 meters
- Maximum altitude for transport: 12,000 meters
- Operating humidity: 20 to 80% relative humidity (non-condensing)
- Storage humidity: 5 to 95% relative humidity (non-condensing)

Important To avoid damage to your DSX components and/or computer system, make sure that you don't operate your M264 S3 card at or near the maximum operating temperature for a prolonged period of time (see "Monitoring your DSX hardware operating temperatures" on page 53 or page 57 for more information).

[1] This temperature range assumes that the hardware components on the card don't exceed the maximum operating temperature as explained in "Monitoring your DSX hardware operating temperatures" on page 53 or page 57.

Your notes

B

DSX Technical Support

This appendix explains how you can register your DSX product and obtain technical support.

Registration

You can register your Matrox DSX product on our web site at www.matrox.com/video.

Important Only registered users are entitled to technical support, software updates, access to our user forums, and special promotional offers.

DSX OEM technical support

As a Matrox DSX user, you have several sources for technical support.

DSX applications engineering

If you have a problem or question that you're unable to solve by referring to your DSX documentation, please contact your Matrox DSX representative. He or she should be able to help you correct any installation or system configuration problem.

If your representative is unable to solve your problem, contact our Matrox applications engineering department for further information and assistance.

Contacting us by telephone

Telephone Worldwide ..... (514) 685-7230 ext. 2841

Matrox Video Products Developer Forum

The Matrox Video Products Developer Forum at http://forum.matrox.com/videodev is an online forum that provides users of Matrox video products with access to product release information, software updates, and technical support. It also gives participants an opportunity to exchange information and share technical expertise with other Matrox developers.

Important Only registered users are allowed on this forum.

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Compliance Statements

USA

FCC Compliance Statement

Remark for the Matrox hardware products supported by this guide These devices have been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: • Reorient or relocate the receiving antenna • Increase the separation between the equipment and receiver • Connect the equipment into an outlet on a circuit different from that to which the receiver is connected • Consult the dealer or an experienced radio/TV technician for help.

WARNING Changes or modifications to this unit not expressly approved by the party responsible for the compliance could void the user's authority to operate this equipment. The use of shielded cables for connection of equipment and other peripherals to the card is required to meet FCC requirements.

Declaration of conformity of a Class B digital device according to the FCC rules

We, the Responsible Party Matrox, 625 State Route 3, Unit B, Plattsburgh, NY 12901-6530 • Telephone: (514) 822-6000 (ext. 2026) • Attention: Conformity Group

Declaration The Matrox hardware products supported by this guide comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) these devices may not cause harmful interference, and (2) these devices must accept any interference received, including interference that may cause undesired operation. Any question regarding this declaration should be forwarded to the above coordinates.

Canada

(English) Industry Canada Compliance Statement

CAN ICES-3 (B)/NMB-3 (B)

Remark for the Matrox hardware products supported by this guide These digital devices do not exceed the Class B limits for radio noise emission from digital apparatus

(Français) Conformité avec les exigences du ministère de l'Industrie Canada

CAN ICES-3 (B)/NMB-3 (B)

Remarque sur les produits matériels Matrox couverts par ce guide Ces appareils numériques n'émettent aucun bruit radioélectrique dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le Règlement sur le brouillage radioélectrique édicté par Industrie Canada.

Japan

VCCI Compliance Statement

Remark for the Matrox hardware products supported by this guide These are Class B products based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If these are used near a radio or television receiver in a domestic environment, they may cause radio interference. Install and use the equipment according to instructions in the manual.

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラス B 情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。

Europe

(English) European user's information – Declaration of Conformity

Remark for the Matrox hardware products supported by this guide These devices comply with EC Directive 2006/95/EC for a Class B digital device. They have been tested and found to comply with EN55022/CISPR22 and EN55024/CISPR24. In a domestic environment these products may cause radio interference in which case the user may be required to take adequate measures.To meet EC requirements, shielded cables must be used to connect equipment and other peripherals to the card. These products have been tested in a typical class B compliant host system. It is assumed that these products will also achieve compliance in any class B compliant system.

(Français) Informations aux utilisateurs Européens – Déclaration de conformité

Remarque sur les produits matériels Matrox couverts par ce guide Ces unités sont conformes à la directive communautaire 2006/95/EC pour les unités numériques de classe B. Les tests effectués ont prouvé qu'elles sont conformes aux normes EN55022/CISPR22 et EN55024/CISPR24. Le fonctionnement de ces produits dans un environnement résidentiel peut causer des interférences radio, dans ce cas l'utilisateur peut être amené à prendre les mesures appropriées. Pour respecter les impératifs communautaires, les câbles de connexion entre l'équipement ou autres périphériques et la carte doivent être blindés. Ces produits ont été testés dans un système hôte typique compatible classe B. On suppose qu'ils présenteront la même compatibilité dans tout système compatible classe B.

(Deutsch) Information für europäische Anwender – Konformitätserklärung

Anmerkung für die Matrox Hardware-Produktunterstützung durch dieses Handbuch Diese Geräte entsprechen EC Direktive 2006/95/EC für ein digitales Gerät Klasse B. Sie wurden getestet und entsprechen demnach EN55022/CISPR22 und EN55024/CISPR24. In einer Wohnumgebung können diese Produkte Funkinterferenzen erzeugen, und der Benutzer kann genötigt sein, entsprechende Maßnahmen zu ergreifen. Um EG-Anforderungen zu entsprechen, müssen zum Anschließen des ausrüstung und anderer Peripheriegeräte an die Karte abgeschirmte Kabel verwendet werden. Diese Produkt wurden in einem typischen, der Klasse B entsprechenden, Host-System getestet. Es wird davon ausgegangen, daß diese Produkte auch in jedem Klasse B entsprechenden System entsprechend funktionieren.

(Italiano) Informazioni per gli utenti europei – Dichiarazione di conformità

Nota per i prodotti hardware Matrox supportati da questa guida Questi dispositivi sono conformi alla direttiva CEE 2006/95/EC relativamente ai dispositivi digitali di Classe B. Sono stati provati e sono risultati conformi alle norme EN55022/CISPR22 e EN55024/CISPR24. In un ambiente domestico, questi prodotti possono causare radiointerferenze, nel qual caso all'utente potrebbe venire richiesto di prendere le misure adeguate. Per soddisfare i requisiti CEE, l'apparecchiatura e le altre periferiche vanno collegati alla scheda grafica con cavi schermati. Questi prodotti sono stati provati in un tipico sistema host conforme alla classe B. Inoltre, si dà per scontato che questi prodotti acquisiranno la conformità in qualsiasi sistema conforme alla classe B.

(Español) Información para usuarios europeos – Declaración de conformidad

Observación referente a los productos de hardware de Matrox apoyados por este manual Estos dispositivos cumplen con la directiva de la CE 2006/95/EC para dispositivos digitales de Clase B. Dichos dispositivos han sido sometidos a prueba y se ha comprobado que cumplen con las normas EN55022/CISPR22 y EN55024/CISPR24. En entornos residenciales, estos productos pueden causar interferencias en las comunicaciones por radio; en tal caso el usuario deberá adoptar las medidas adecuadas. Para satisfacer las disposiciones de la CE, deberán utilizarse cables apantallados para conectar el equipo y demás periféricos a la tarjeta. Estos productos han sido sometidos a prueba en un típico sistema anfitrión que responde a los requisitos de la clase B. Se supone que estos productos cumplirán también con las normas en cualquier sistema que responda a los requisitos de la clase B.

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