Matrox Morphis

Installation and Hardware Reference

Manual no. Y10867-101-0400

January 29, 2014

PRINTED IN CANADA

Contents

Chapter

1

Introduction

This chapter outlines the key features of the Matrox Morphis board.

Matrox Morphis

Board overview

The Matrox Morphis family consists of three cost-effective imaging boards capable of acquiring standard, monochrome/color, analog video: Matrox Morphis Dual Matrox Morphis Quad, and Matrox Morphis QxT. This manual discusses Matrox Morphis Dual and Matrox Morphis Quad. Refer to the Matrox Morphis QxT manual for information on Matrox Morphis QxT.

Acquisition with Matrox Morphis Dual

Matrox Morphis Dual is a frame grabber that can simultaneously capture from any two of the up to sixteen connected, supported, asynchronous video sources, using its two independent acquisition paths. In addition, it can switch the capture between any of the connected video sources of the same type with minimum latency (fast switching); if not simultaneously capturing from two video sources, it can perform ultra-fast switching. The acquisition section can acquire video from standard monochrome/color video sources.

There are four factory-configured versions of Matrox Morphis Dual: Matrox Morphis Dual Standard, Matrox Morphis eDual Standard, Matrox Morphis Dual High Density Connector (HDC), and Matrox Morphis Dual PC/104-*Plus*.

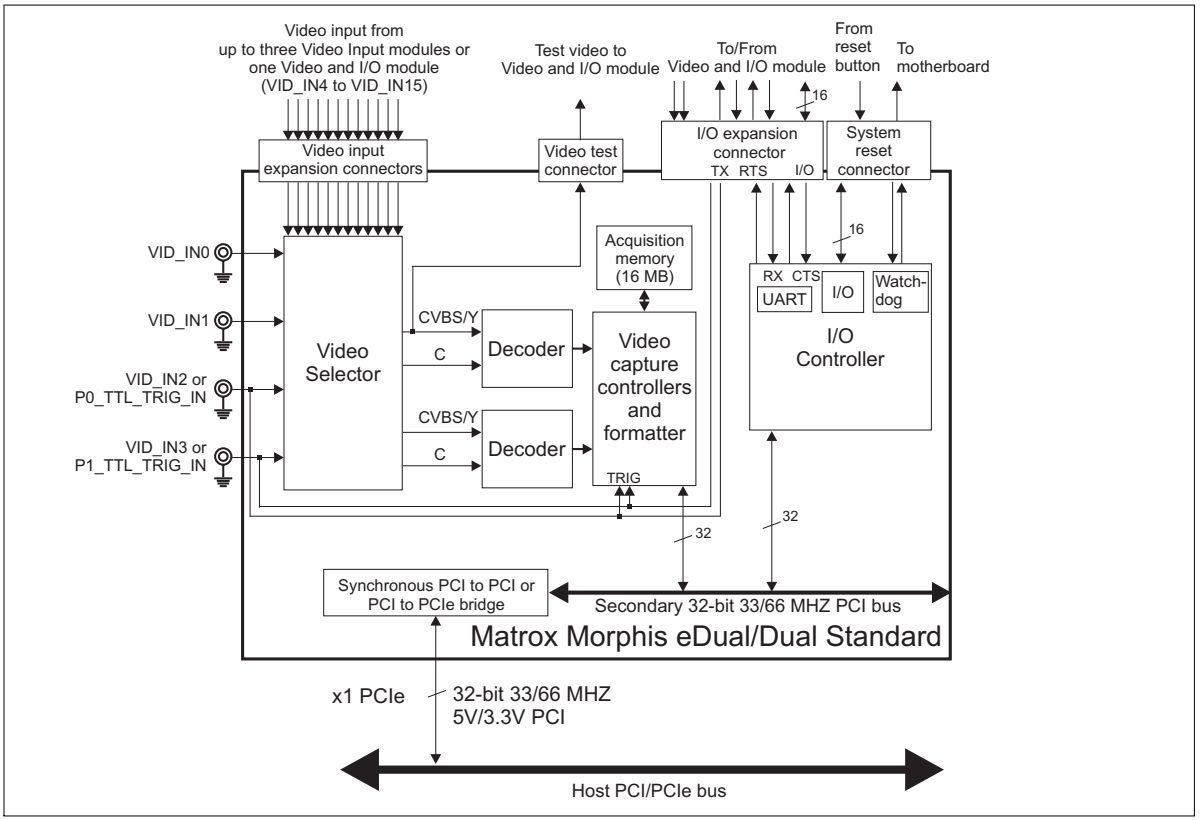
Matrox Morphis eDual Standard provides the same features as Matrox Morphis Dual Standard except that it connects to the Host via a x1 PCIe slot. Therefore, when this manual refers to both versions of the Standard, it will refer to them as Matrox Morphis eDual/Dual Standard.

Matrox Morphis Dual HDC provides the same features as Matrox Morphis Dual Standard, except the HDC version has a high density 44-pin video input connector on its bracket to directly support connection with up to 16 CVBS/monochrome or 8 Y/C video sources, or a combination of both.

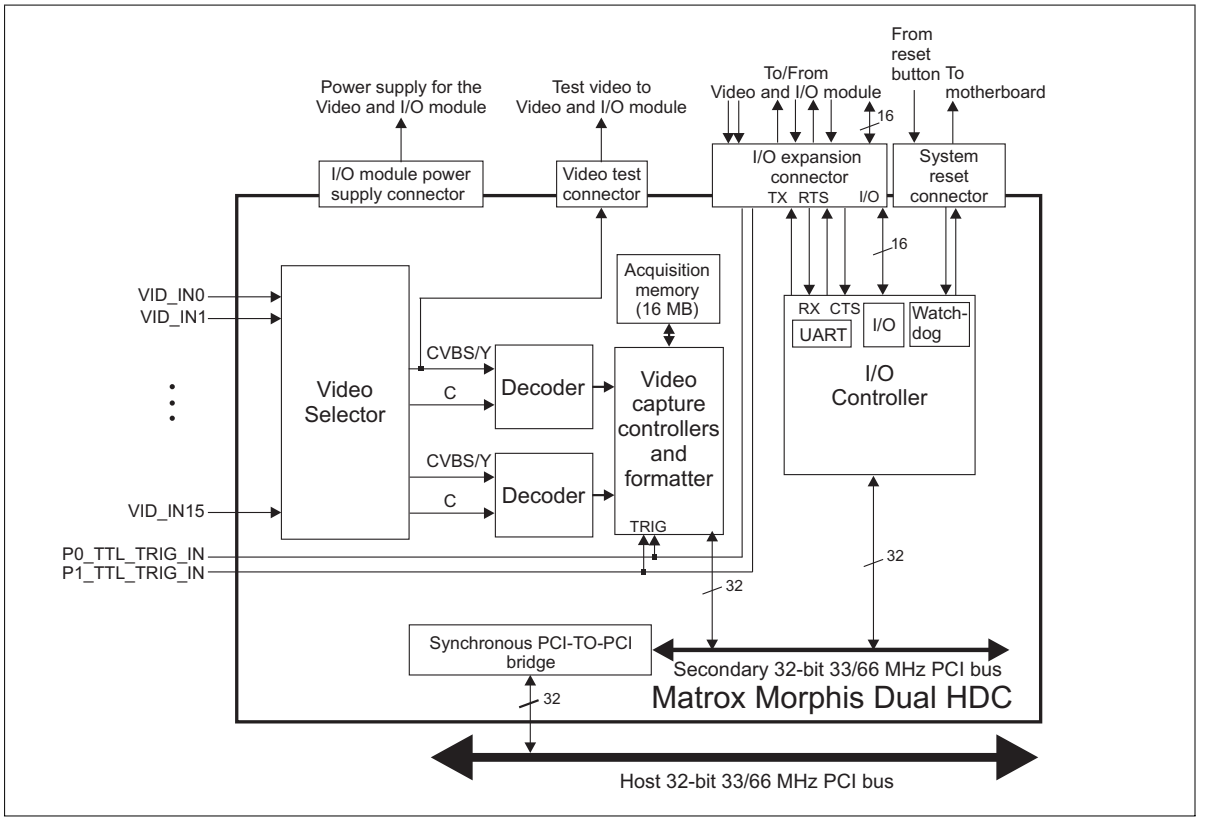
Matrox Morphis Dual PC/104-*Plus* provides similar functionality to Matrox Morphis Dual Standard, except it is in a PC/104-*Plus* form factor and can fit in embedded/compact computers that support the form factor. Furthermore, it does not include an I/O controller.

This manual refers to all Matrox Morphis boards discussed in the manual as Matrox Morphis. When necessary, this manual distinguishes between the boards using their full names.

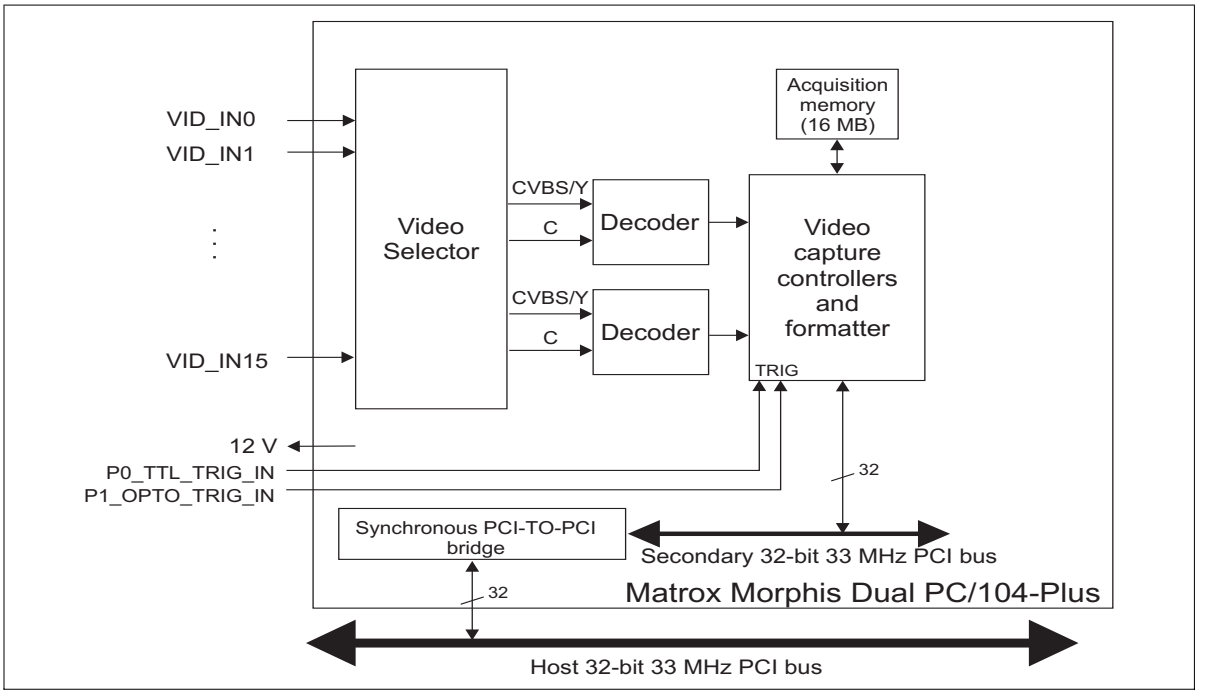
The following diagram illustrates the data flow of the Matrox Morphis eDual/Dual Standard boards.



The following diagram illustrates the data flow of the Matrox Morphis Dual HDC board.



The following diagram illustrates the data flow of the Matrox Morphis Dual PC/104-*Plus* board.

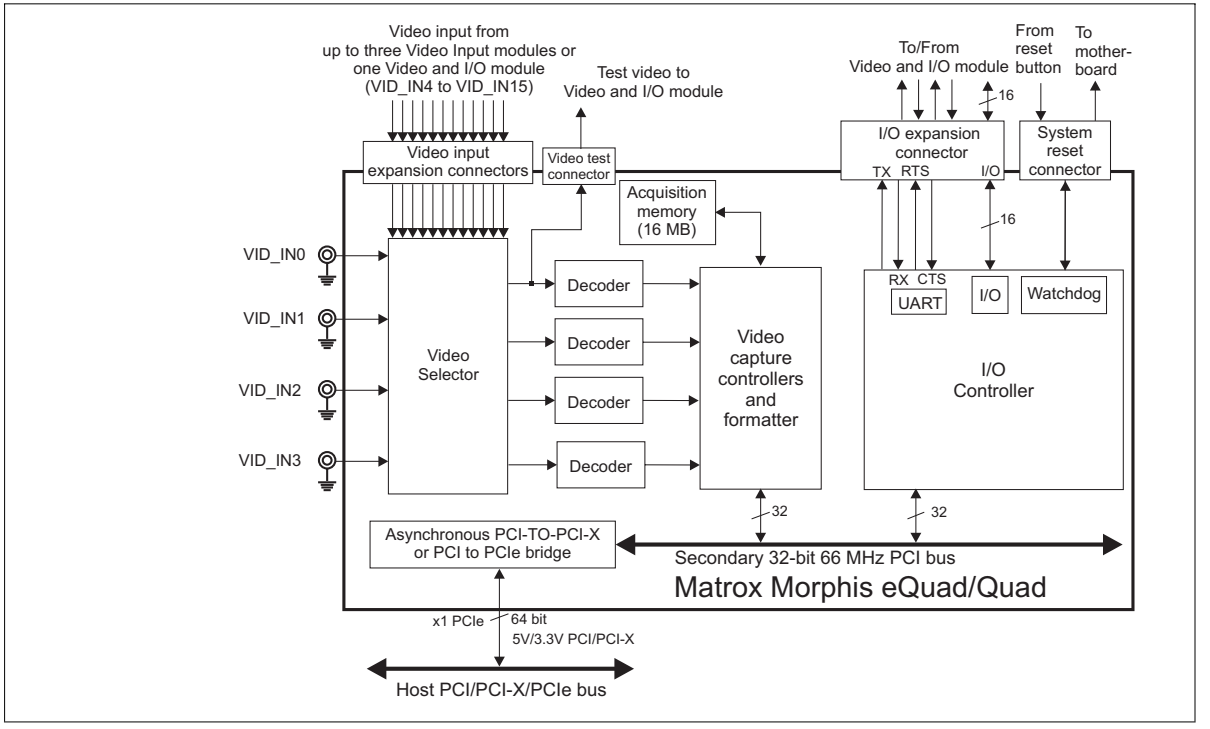


Acquisition with Matrox Morphis Quad

Matrox Morphis Quad is a frame grabber that can simultaneously capture from any four of the up to sixteen connected, supported, asynchronous video sources, using its four independent acquisition paths. In addition, it can switch the capture between any of the connected video sources of the same type with minimum latency (fast switching). If not simultaneously capturing from four video sources, Matrox Morphis Quad can perform ultra-fast switching.

There are two factory configured versions of Matrox Morphis Quad: a PCI-X version and a PCIe version. The PCIe version has the same features as the PCI-X version except that it connects to the Host via a x1 PCIe bus. Therefore, when this manual refers to both versions of the board, it will refer to them as Matrox Morphis eQuad/Quad. It will refer to the PCI-X version as Matrox Morphis Quad and the PCIe version as Matrox Morphis eQuad.

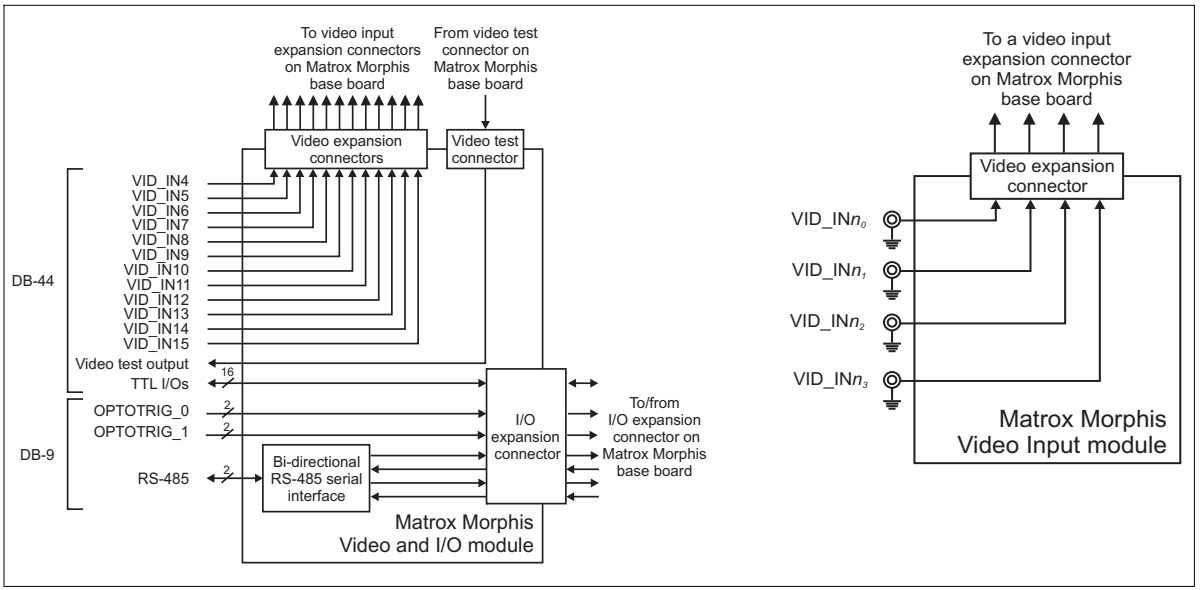
The following diagram illustrates the data flow of the Matrox Morphis eQuad/Quad board.



General acquisition features

The Matrox Morphis video decoders can accept composite (CVBS) and component S-video (Y/C) in NTSC/PAL formats, and monochrome video in RS-170/CCIR. Grabbed data can be converted into the following formats with square pixels: RGB planar, BGR32 packed, YUV16 packed (stored in YUYV format), and 8-bit monochrome.

As a standard feature on Matrox Morphis eDual/Dual Standard and Matrox Morphis eQuad/Quad, you can connect up to 4 CVBS/monochrome or 2 Y/C video sources, or a combination of both. You can extend the number of video sources that can be connected using optional expansion modules. You can use up to three Matrox Morphis Video Input modules, and to each module, connect the same number of video sources as is supported by the base board. Alternatively, you can use a single expansion module, the Matrox Morphis Video and I/O module, and connect an additional 12 CVBS/monochrome or 6 Y/C video sources, or a combination of both.



❖ Note that you can only connect a single Matrox Morphis Video and I/O module to the base board, and that the Matrox Morphis Video and I/O module and the Matrox Morphis Video Input module are mutually exclusive.

Formatting features of Matrox Morphis include cropping (ROI capture), arbitrary downscaling to 1/16th of a field or frame, and vertical/horizontal flipping.

Matrox Morphis eDual/Dual boards accept two external auxiliary trigger inputs, and can operate in next valid frame/field mode when grabbing upon a trigger. From the BNC connectors of the base board, the triggers are received directly in TTL format; whereas from the Matrox Morphis Video and I/O module, the triggers are opto-isolated. Matrox Morphis eQuad/Quad does not accept external trigger inputs.

Matrox Morphis has 16 Mbytes of on-board acquisition memory.

Additional functionality

To simplify overall system integration, Matrox Morphis also offers a variety of additional features. These features include:

Feature	eDual/Dual Standard	Dual HDC	Dual PC/04-*Plus*	eQuad/Quad
Hardware facilities for implementing custom software-based motion detection.	●	●	●	●
Integrated Watchdog capability for automatically recovering from application or system failure.	●	●		●
16 TTL auxiliary I/O integrated signals that can be used to transmit or receive application-specific user output and/or input. These signals can be internally accessed, or accessed externally using the Matrox Morphis Video and I/O module.	●	●		●
An RS-485 serial interface, mapped as a COM port so that the interface can be accessed through the Microsoft Windows API. The serial interface can both receive and transmit signals, but in half-duplex mode. The serial interface can be connected to an RS-485 two-wire multi-drop network.	●	●		●
Video input testing. The CVBS or Y input of decoder 0 can be routed out to the Matrox Morphis Video and I/O module for test purposes.	●	●		●

Data transfer

Matrox Morphis boards can transfer live video to Host memory without the help of the Host CPU. To do so, the boards feature an on-board 32-bit 33/66 MHz PCI bus master. Matrox Morphis Dual Standard and HDC transfer the video over a PCI bus, Matrox Morphis Dual PC/104-*Plus* transfers the video over a PC/104-*Plus* bus, Matrox Morphis Quad transfers the video over a PCI-X bus, and Matrox Morphis eDual Standard and eQuad transfer the video over a x1 PCIe bus. The boards can also generate interrupts for the start and end of a field, frame, and sequence capture.

Software

To operate Matrox Morphis, you can purchase one or more Matrox Imaging software products that support the Matrox Morphis board. These are the Matrox Imaging Library (MIL) and its derivatives (for example, MIL-Lite and Matrox Intellicam). All Matrox software is supported under Windows; MIL is also supported under Linux when using Matrox Morphis. Consult your software manual for supported versions of these operating systems.

MIL

MIL is a high-level programming library with an extensive set of optimized functions for image capture, processing, analysis, transfer, compression, display, and archiving. Image processing operations include point-to-point, statistical, spatial filtering, morphological, geometric transformation, and FFT operations. Analysis operations support calibration, are performed with sub-pixel accuracy, and include pattern recognition (normalized grayscale correlation and Geometric Model Finder), blob analysis, edge extraction and analysis, measurement, metrology, character recognition (template-based and feature-based), code recognition and verification (1D, 2D and composite code types), bead inspection, 3D reconstruction, and color analysis.

MIL applications are easily ported to new Matrox hardware platforms and can be designed to take advantage of multi-processing and multi-threading environments.

MIL-Lite

MIL-Lite is a subset of MIL. It includes all the MIL functions for image acquisition, transfer, display control, and archiving. It also allows you to perform processing operations that are typically useful to pre-process grabbed images.

Matrox Intellicam

Matrox Intellicam is an interactive Windows program that allows for fast video source interfacing and provides interactive access to all the acquisition features of your Matrox board. Matrox Intellicam also has the ability to create custom digitizer configuration format (DCF) file, which MIL and its derivatives use to interface to specific non-standard video sources. Matrox Intellicam is included with all Matrox Imaging software products.

Essentials to get started

To use Matrox Morphis, you must have a computer with at least the following:

- For Matrox Morphis Dual Standard, Dual HDC, and Quad, you need an available conventional 32 or 64-bit PCI or PCI-X slot (bus-master capable). The slot can be either 3.3 or 5 V, running at 33, 66, 100, or 133 MHz.
- For Matrox Morphis Dual PC/104-*Plus*, you need a PC/104-*Plus* connector that supports 3.3 and/or 5 V PCI signalling (depending on how the board has been configured).
- For Matrox Morphis eDual and eQuad, you need an available x1 PCIe slot.
- You also need a free bracket location at the back of the computer chassis for each required Matrox Morphis expansion module (preferably, but not necessarily, a PCI-X or PCI slot to give the installed module increased mechanical stability). This location need not be adjacent to the Matrox Morphis base board.
- Processor with an Intel 32-bit or 64-bit architecture, or equivalent.

Other useful considerations

- A computer with a relatively up-to-date PCIe, PCI-X, or PCI chipset. An up-to-date chipset is recommended because it generally offers better performance in terms of data transfer rates. The list of platforms that are known to be compatible with Matrox Morphis are available on the Matrox website, under the board's PC compatibility list.
- MIL, or one of its derivatives. This should be installed after you install your board.

Inspecting the Matrox Morphis package

When you unpack your Matrox Morphis package, you should check its contents. Note that optional parts might or might not be included, depending on what you ordered. If something is missing or damaged, contact your Matrox representative.

Standard package

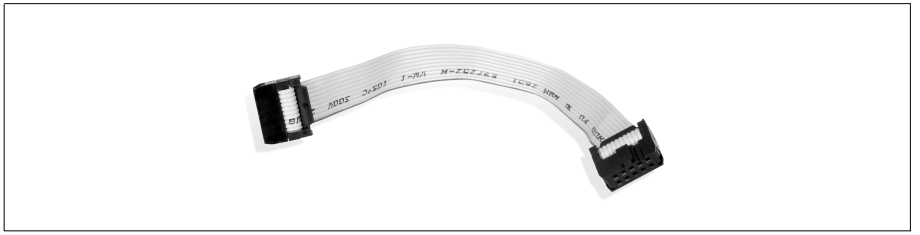
If you ordered Matrox Morphis, you should receive the following items:

- The Matrox Morphis base board.
- An HD-44 video input module, 2 jack screws, and a flat ribbon cable (that has a standard 40-pin female connector at both ends), included with Matrox Morphis Dual PC/104-*Plus*.

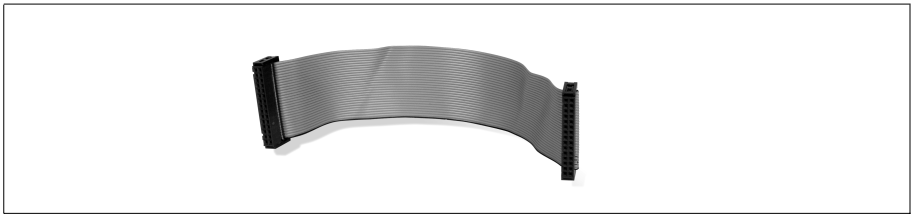
Optional items

You might have also ordered one or more of the following:

- MIL or MIL-Lite. Matrox Intellicam is included with both of these software packages.
- A Matrox Morphis Video Input module, and a flat ribbon cable (that has a standard 10-pin female connector at both ends) to connect the module to the base board.



- A Matrox Morphis Video and I/O module, and four flat ribbon cables to connect the module to the base board. Three of the flat ribbon cables have a standard 10-pin female connector at both ends (same as the previously illustrated cable), and one has a standard 30-pin female connector at both ends.

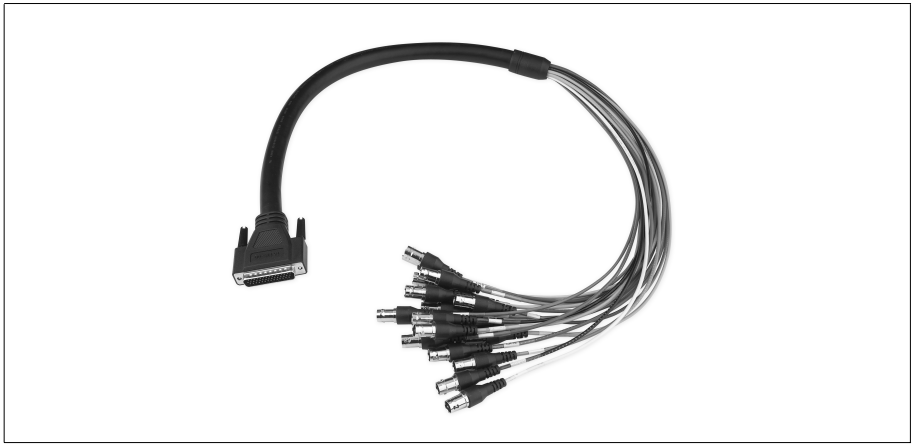


- A DBHD44-TO-13BNC input cable, a 7-foot cable with a high density 44-pin male connector and thirteen BNC male type connectors. Six BNC-TO-SVHS adapter cables for Y/C input are shipped with the DBHD44-TO-13BNC cable.

- A DH44-TO-13BNC/O input cable, a 6-foot cable with a high density 44-pin male connector at one end and both open-ended wires and thirteen BNC male type connectors at the other end. This cable is required if you want to connect to synchronization and control signals. Six BNC-TO-SVHS adapter cables for Y/C input are also shipped with the DH44-TO-13BNC/O cable.

- A BNC-TO-SVHS adapter cable, an 8-inch cable with two BNC female type connectors at one end, and a Y/C connector at the other end. This cable can be attached to two standard BNC to BNC cables for Y/C input.

- An HD-44M-18BNC input cable, a 3-foot cable with a 44-pin male connector at one end and eighteen BNC female type connectors at the other end. This cable is used with Matrox Morphis Dual HDC.



- An HD-44M-18BNC+ input cable, a 3-foot cable with a 44-pin male connector at one end and eighteen BNC female type connectors at the other end. This cable is used with Matrox Morphis Dual PC/104-*Plus*.

Important

Note that the HD-44M-18BNC and the HD-44M-18BNC+ cables are not interchangeable. Although both cables have similar terminations, the pins are wired differently between the two. It is therefore important to always use the correct cable with your Matrox Morphis board.

Handling components

The electronic circuits in your computer and the circuits on Matrox Morphis are sensitive to static electricity and surges. Improper handling can seriously damage the circuits. Be sure to follow these precautions:

- Drain static electricity from your body by touching a metal fixture (or ground) before you touch any electronic component.

- Avoid letting your clothing come in contact with the circuit boards or components.

Caution

Before you add or remove devices from your computer, always **turn off** the power and unplug the power cable of your computer.

Installation overview

The installation procedure consists of the following steps:

1. Complete the hardware installation as described in *Chapter 2: Hardware installation*.

2. Complete the software installation procedure as described in the documentation accompanying your software package.

More information

For information on using multiple Matrox Morphis boards, refer to *Chapter 3: Using multiple Matrox Morphis boards*.

For in-depth hardware information, refer to *Chapter 4: Hardware reference*.

If you want technical information about Matrox Morphis, including specifications and connector pinouts and descriptions, refer to *Appendix B: Technical information*.

Conventions

This manual occasionally makes reference to a MIL-Lite function. However, anything that can be accomplished with MIL-Lite can also be accomplished with MIL.

Note that unless otherwise stated, the information in this manual reflects the most recent versions of the boards available at the time that this manual was written. *Appendix C: Listing of Matrox Morphis boards* lists the major changes that have been made to the boards since they were first introduced.

When the term *Host* is used in this manual, it refers to your computer.

Need help?

If you experience problems during installation or while using this product, refer to the support page on the Matrox Imaging web site: www.matrox.com/imaging/support. This page provides answers to frequently asked questions, as well as offers registered customers additional ways of obtaining support.

If your question is not addressed and you are registered, you can contact technical support. To do so, you should first complete and submit the online Technical Support Request Form, accessible from the above-mentioned page. Once the information is submitted, a Matrox support agent will contact you shortly thereafter by email or phone, depending on the problem.

Chapter

2

Hardware installation

This chapter explains how to install the Matrox Morphis hardware.

Installing Matrox Morphis

Before you install your Matrox Morphis board(s), some precautionary measures must be taken. Turn off the power to your computer and its peripherals, and drain static electricity from your body (by touching a metal part of the computer chassis). Next, follow the steps to install your board(s) according to its form factor: PCIe/PCI/PCI-X or PC/104-*Plus*.

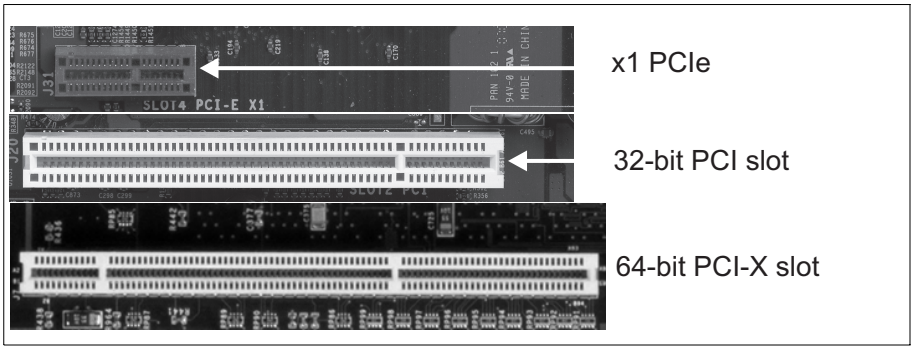
Note that your board(s) should be installed before you install your software.

Installing Matrox Morphis boards except for Matrox Morphis PC/104-*Plus*

Use the following steps to install your Matrox Morphis board(s) that install into a PCIe/PCI/PCI-X slot.

1. Remove the cover from your computer using the instructions from your computer manual.

2. Check that you have an empty PCIe, PCI-X, or PCI slot that can accommodate the Matrox Morphis base board, depending on the version of Matrox Morphis you need to install. Illustrated below are some of the more common PCIe, PCI-X, or PCI slots:



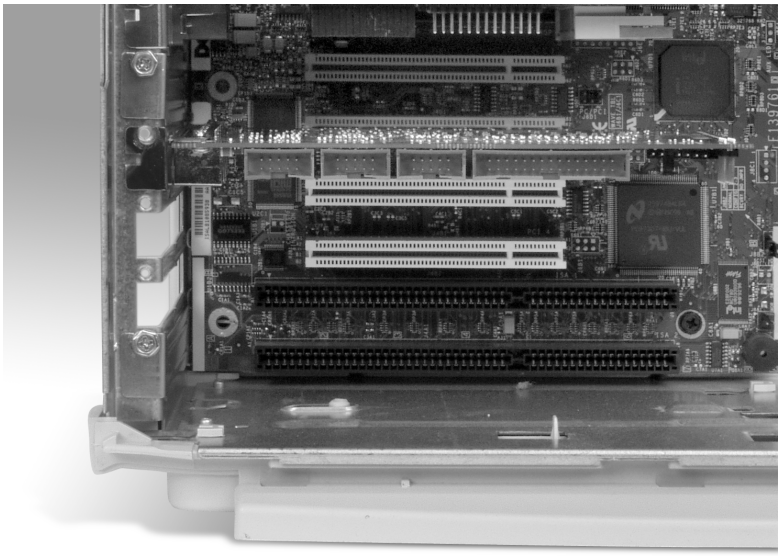
If you are also installing Matrox Morphis expansion modules, an additional slot must be available for each expansion module that you intend to install. This slot need not be adjacent to the base board. In addition, the slot can be of any type because the expansion modules' support tab(s) can be removed; if a PCI-X or PCI slot is selected, the tab(s) will fit into the slot's connector, ensuring that the module does not move.

If necessary, remove boards from your computer to make room for your Matrox Morphis board(s).

3. If present, remove the blank metal plate located at the back of the selected slots. Keep the removed screws; you will need them to fasten the Matrox Morphis boards.

4. If Watchdog functionality is required, install the appropriate cables as described in *Installing the cables for Watchdog functionality* section, later in this chapter.

5. Carefully position the Matrox Morphis base board in one of the selected empty PCIe, PCI-X, or PCI slots. Once perfectly aligned with the slot's connector, press the board firmly but carefully into the connector.



6. Anchor the board by replacing the screw that you removed.

7. If required, install your expansion modules as described in the *Installing the Matrox Morphis Video Input module* section and the *Installing the Matrox Morphis Video and I/O module* section, later in this chapter.

8. Attach your video sources as described in the *Connecting video sources to Matrox Morphis* section, later in this chapter.

9. Turn on your computer.

❖ When you boot your computer under Microsoft Windows, Windows' Plug-and-Play system will detect a new PCI Data Acquisition and Signal Processing Controller and you will be asked to assign it a driver. At this point, you should click on **Cancel** because the driver will be installed during the installation of Matrox Morphis software.

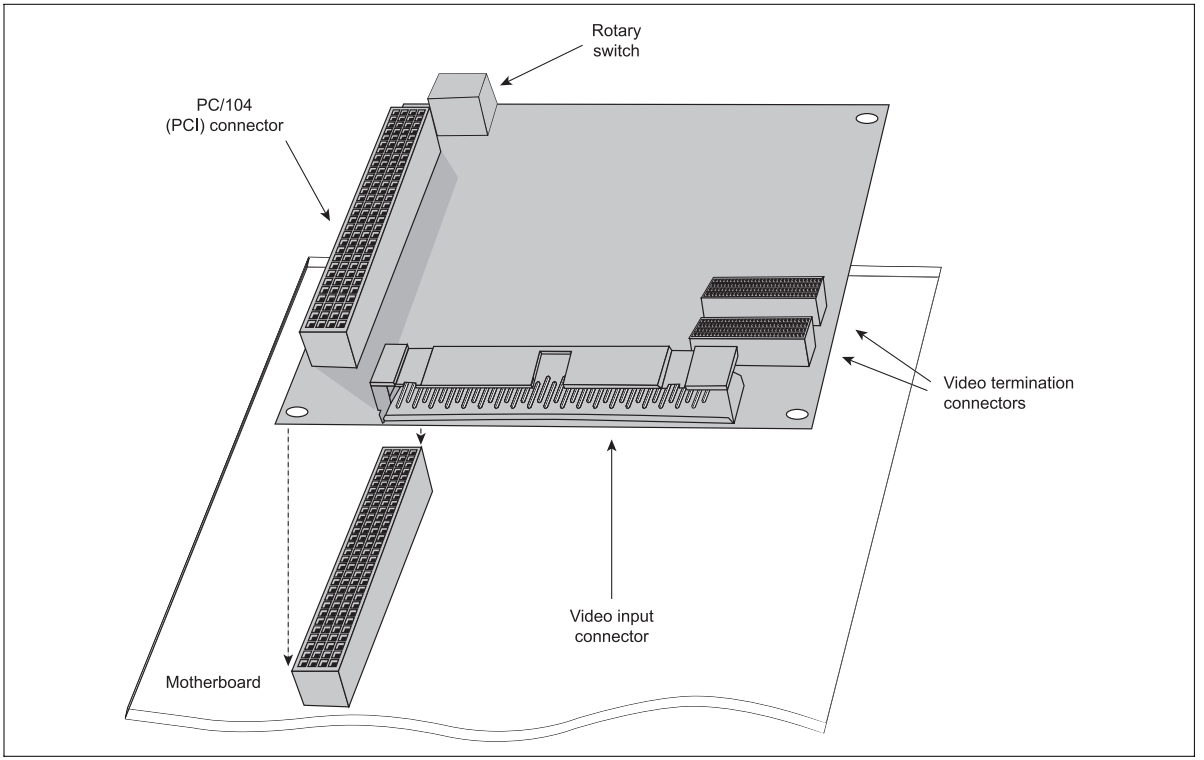
Installing Matrox Morphis Dual PC/104-*Plus*

This section refers to the installation of the Matrox Morphis Dual PC/104-*Plus* board. Use the following steps to install your Matrox Morphis Dual PC/104-*Plus* board:

1. Check that you have an available PC/104-*Plus* (PCI) connector on the motherboard, or verify that your existing stack can support another board.

2. Remove the anchoring screws from the stack. Do not discard them since you will need them to fasten the Matrox Morphis Dual PC/104-*Plus* board.

3. Carefully position Matrox Morphis Dual PC/104-*Plus* over the PC/104-*Plus* connector of the motherboard (or the existing board in the stack) and press the board firmly into place.



4. Set the rotary switch to 0 if installing the first stackable board, or another appropriate setting if not the first.

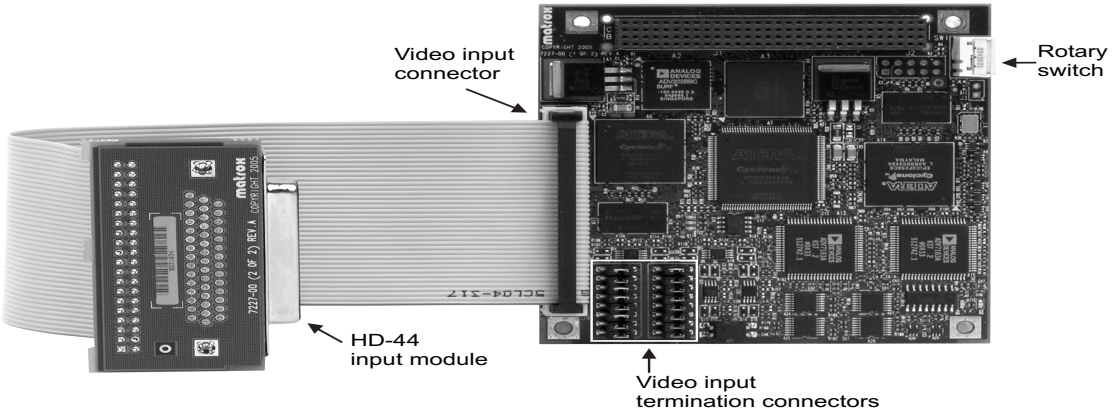
Important

Note that if you are stacking multiple boards, you cannot add a PC/104 (ISA) board on top of a Matrox Morphis Dual PC/104-*Plus* (PCI) board. You should install the Matrox Morphis Dual PC/104-*Plus* (PCI) board(s) on top of PC/104 (ISA) boards. For more information on installing multiple boards, see *Chapter 3: Using multiple Matrox Morphis boards*.

5. Replace the anchoring screws.

6. If you have to attach another board, go to step 3. If not, go to step 7.

7. Interface the video input module to video input connector on the Matrox Morphis Dual PC/104-*Plus* board using the provided 40-pin flat ribbon cable. The cable connector will only latch properly when the red wire of the cable is closest to the board's video input termination connectors.



Matrox Morphis Dual PC/104-Plus

Insert the HD-44 female connector of the video input module into the available I/O aperture of your custom-made chassis, and use the distributed jack screws to attach the connector to the chassis. The jack screws are included in the package for the board; you will need a 3/16" (4.75 mm) hex nut driver to fasten the jack screws.

8. Connect your video sources. For more information, see *Connecting video sources to Matrox Morphis* section later in this chapter.

9. Turn on your computer.

   In some cases, when you boot your computer, Windows' Plug-and-Play system will detect a new PCI card and you will be asked to assign a driver to it. At this point, you should click on **Cancel** because the driver will be installed during the installation of MIL or one of its derivatives.

Installing the cables for Watchdog functionality

Watchdog functionality is available on the Matrox Morphis eDual/Dual Standard, Dual HDC, and eQuad/Quad boards. If Watchdog functionality is required:

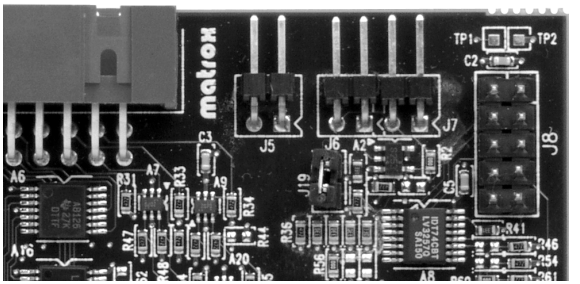
1. Create a custom cable (Cable A) with a standard, 0.1" spacing, 2-pin female connector at one end, and at the other end, a connector that fits into the Reset button connector of the chassis (see the *Video test and system reset connectors* subsection of the *Base board input and output connectors* section, in *Appendix B: Technical information*).

2. Create a second custom cable (Cable B) with a standard, 0.1" spacing, 2-pin female connector at one end, and at the other end, a connector that fits into the motherboard reset connector (see the above-mentioned subsection).

3. Disconnect the end of the Reset button cable currently attached to the Reset button connector of the chassis, and attach Cable A to this connector instead.

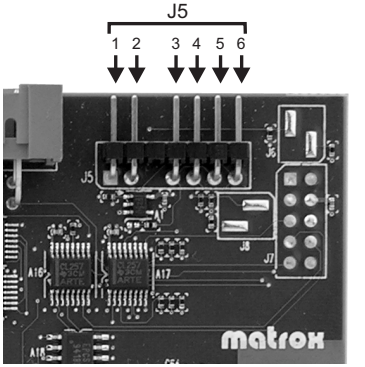
4. Disconnect the end of the Reset button cable currently attached to your motherboard reset connector, and attach Cable B to this connector instead.

5. Connect Cable A to the J7 system reset connector of the Matrox Morphis eDual/Dual Standard and Dual HDC base board (pins 5 and 6 of connector J5 for the Matrox Morphis eQuad/Quad board).

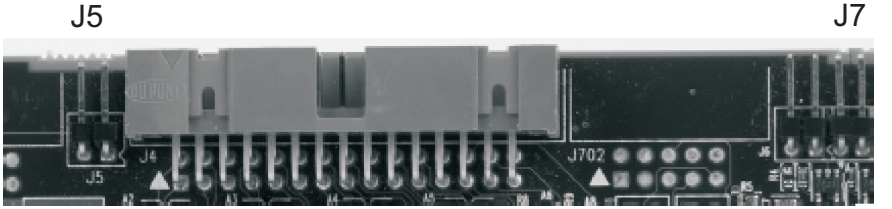


* Note that the location of connectors J5, J6, and J7 differ on Matrox Morphis HDC.

Matrox Morphis Dual/eDual Standard



Matrox Morphis Quad/eQuad



Matrox Morphis Dual HDC

6. Connect Cable B to the J6 system reset connector of the Matrox Morphis eDual/Dual Standard and Dual HDC base board (pins 3 and 4 of connector J5 for the Matrox Morphis eQuad/Quad board).

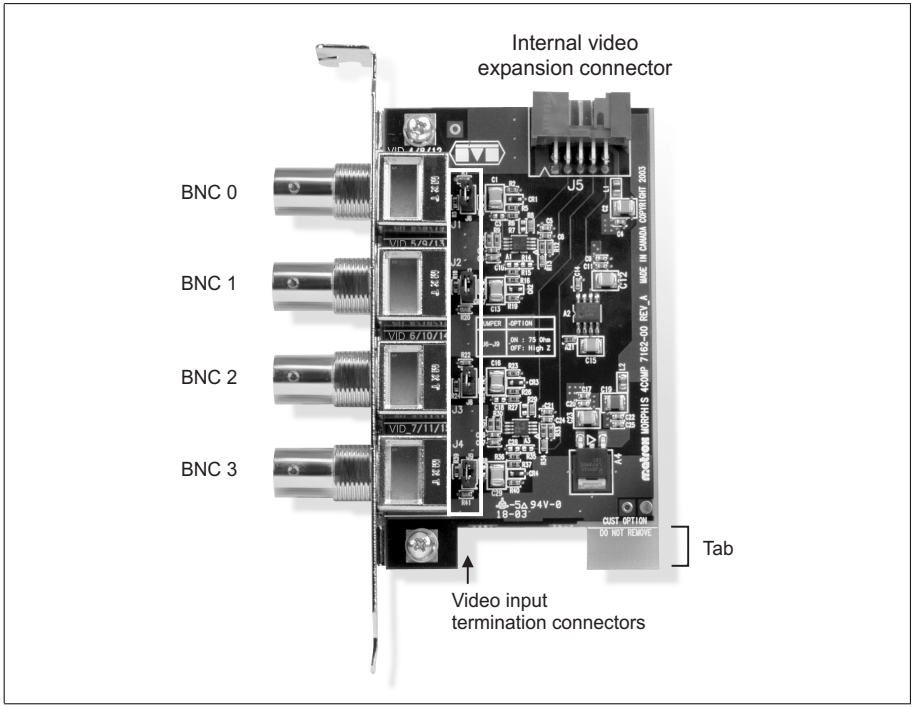
Installing the Matrox Morphis Video Input module

To install a Matrox Morphis Video Input module to the Matrox Morphis eDual/Dual Standard or eQuad/Quad board, proceed with the following steps:

1. Make sure that your Matrox Morphis base board is fastened to the computer chassis.

2. If the slot selected for the module is not a PCI-X or PCI slot, the module's tab might interfere with other components in the computer; if this is the case, you can break off the tab. The tab was added so that if used in a PCI-X or PCI slot, the module would have extra support and be more sturdy.

   To break off the tab, use a set of pliers; there is a groove along the tab so that you can break it off without an excessive amount of force.

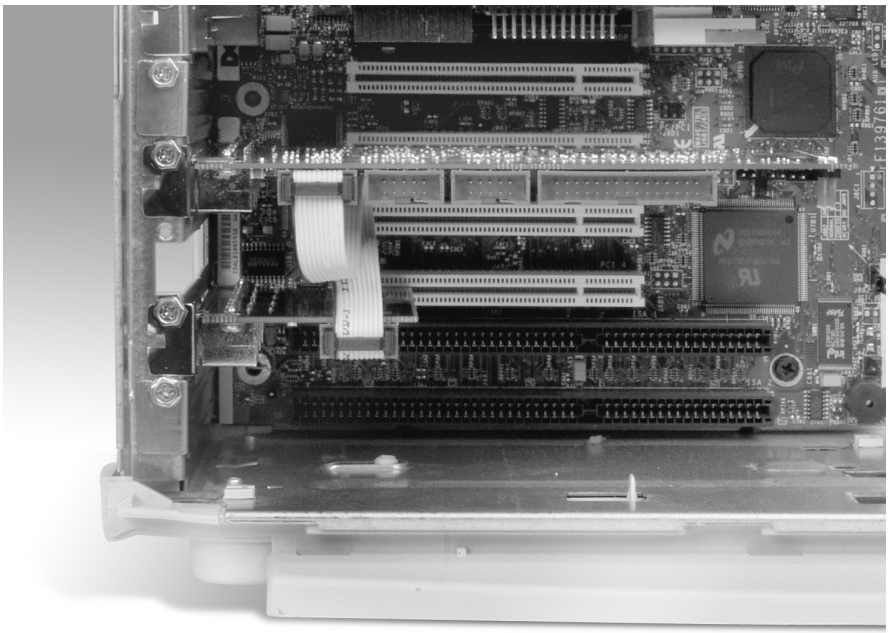


3. If you are installing the module in a PCI-X or PCI slot, align the module's tab with the slot's connector, and then press the module firmly but carefully into the slot's connector. For other types of slots, slide the module's bracket into the opening at the back of the selected slot.

4. Anchor the module's bracket to the chassis using the screw that you removed in the first section.

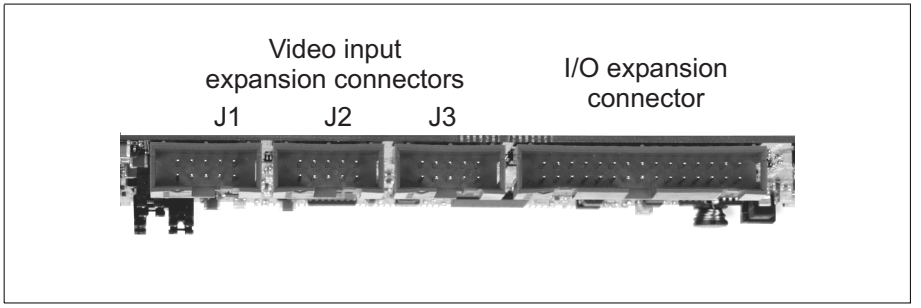
5. Connect the Matrox flat ribbon cable, shipped with the module, to the internal video expansion connector of the module. You can connect either end of the cable to the module; the selected cable connector will latch properly only when the red wire of the cable is closest to the module's bracket.

6. Connect the other end of the Matrox flat ribbon cable to one of the video input expansion connectors on the base board. The cable connector will latch properly only when the red wire of the cable is closest to the module's bracket.



Important

Take note of the base board connector (J1, J2, or J3) to which you attach the cable. Each connector is associated with specific video input signals. When developing your application in software, you will need to know the video input signal that the required video source is driving.



7. Repeat steps 2 through 6 for each Matrox Morphis Video Input module that you need to install. You can install up to 3 Matrox Morphis Video Input modules.

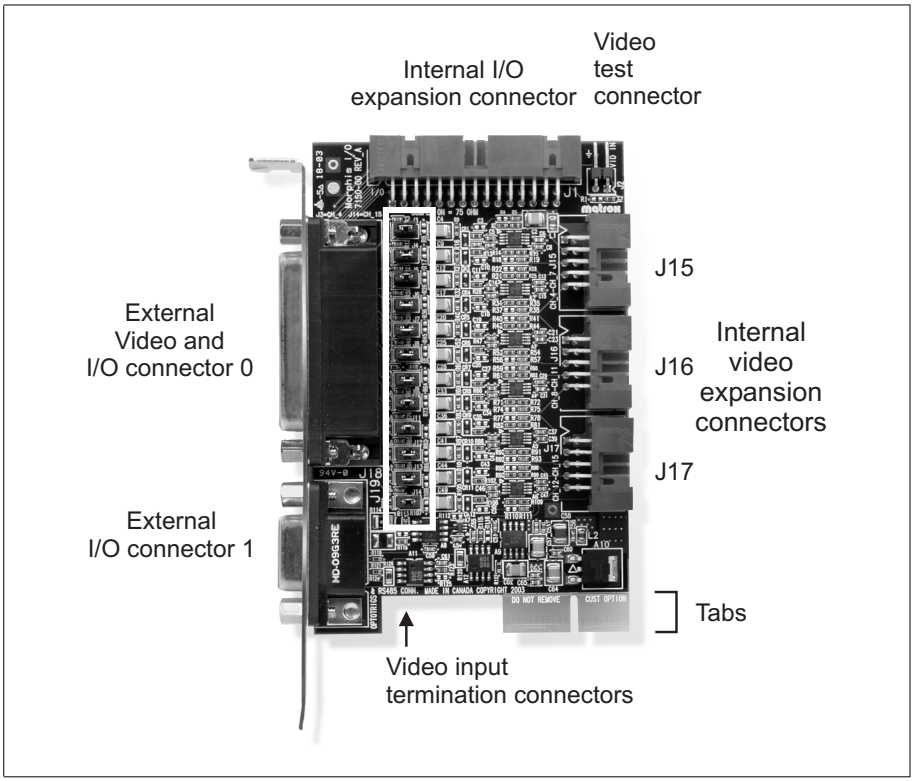
Installing the Matrox Morphis Video and I/O module

To install a Matrox Morphis Video and I/O module to the Matrox Morphis eDual/Dual Standard, Dual HDC, or eQuad/Quad boards, proceed with the following steps:

1. Make sure that your Matrox Morphis base board is fastened to the computer chassis.

2. If the slot selected for the module is not a PCI-X or PCI slot, the module's tabs might interfere with other components in the computer; if this is the case, you can break off the tab. The tabs were added so that if used in a PCI-X or PCI slot, the module would have extra support and be more sturdy.

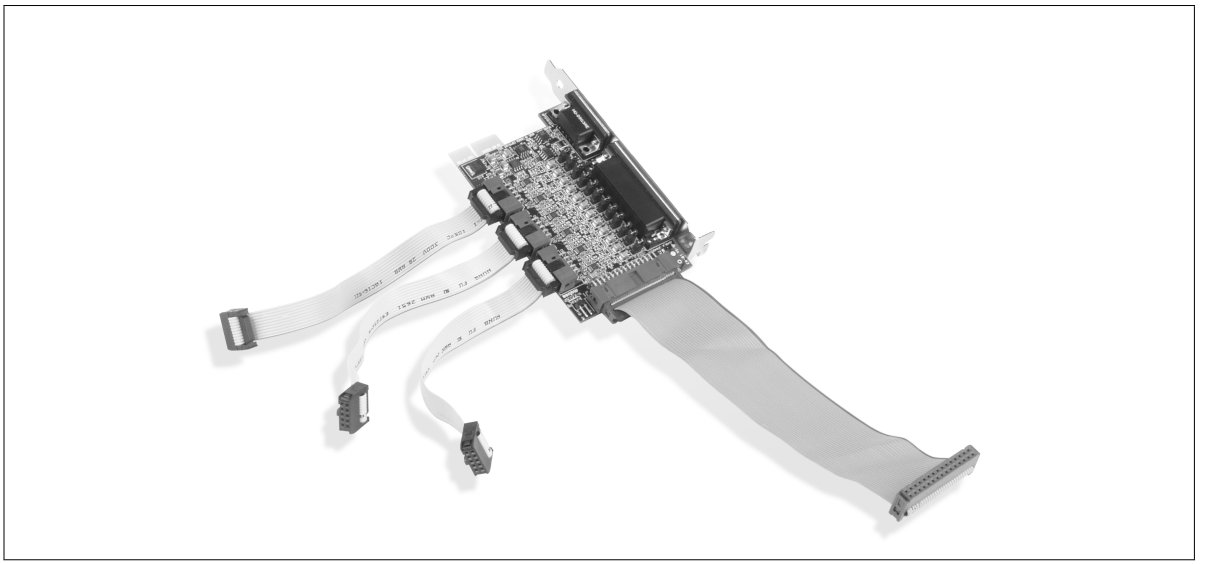
To break off the tabs, use a set of pliers; there is a groove along the tabs so that you can break them off without an excessive amount of force.



3. Connect the Matrox flat ribbon cables, shipped with the module, to the module.

   To the internal I/O expansion connector of the module, connect the accompanying ribbon cable that has a 30-pin female connector at both ends. You can connect either end of the cable to the module; the selected cable connector will latch properly only when the red wire of the cable is closest to the module's bracket.

To each of the internal video expansion connectors of the module, connect one of the other accompanying ribbon cables*. You can connect either end of the cables to the module; the selected cable connector will latch properly only when the red wire of the cable is closest to the module's top edge.



4. If you are installing the module in a PCI-X or PCI slot, align the module's tab with the slot's connector, and then press the module firmly but carefully into the slot's connector. For other types of slots, slide the module's bracket into the opening at the back of the selected slot.

5. Anchor the module's bracket to the chassis using the bolt that you removed in the first section.

6. Connect the other end of the Matrox flat ribbon cables to the base board.

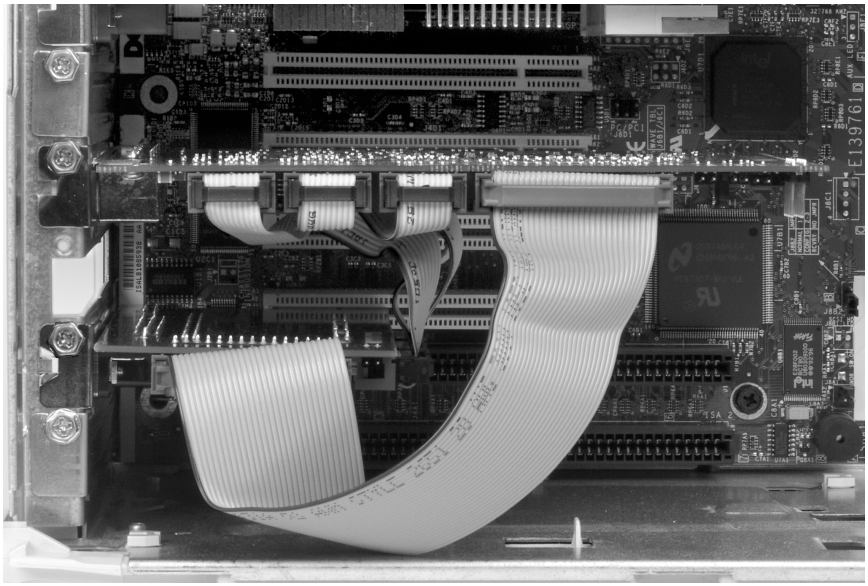
---

*. Note, even if you are not using the module to capture video input, you must still connect an internal video expansion connector to a video input expansion connector on the base board, using one of these cables. The module draws power from the base board using these connectors; the opto-isolated trigger input components and the serial input/output components need to be powered.

To the J1 video input expansion connector (closest to the bracket) on the base board, connect the other end of the ribbon cable attached to the top-most video expansion connector on the module. To the J2 video input expansion connector, connect the other end of the ribbon cable attached to the middle video expansion connector. Then, to the J3 video input expansion connector, connect the other end of the ribbon cable attached to the bottom video expansion connector.

To the I/O expansion connector on the base board, connect the other end of the ribbon cable attached to the I/O expansion connector on the module.

In all cases, the red wire of the ribbon cable attached to the base board will be closest to the bracket.



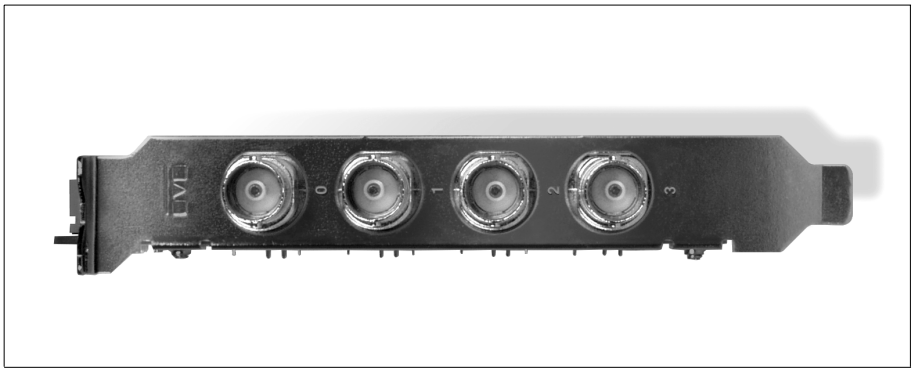
7. If you expect to test the video inputs arriving on the base board, connect the video test connector of the module to the video test connector of the base board using a custom cable. This connection allows you to output any of the CVBS video inputs, or the Y component of any Y/C video inputs, arriving on the base board (those from the Video and I/O module or those directly from the base board).

Connecting video sources to Matrox Morphis

The method of connecting video sources to your Matrox Morphis board depends on the type of board or module to which you are trying to connect. This section is divided based on different types of boards or modules that are interfaced in a similar fashion.

Connecting video to Matrox Morphis eDual/Dual Standard, Matrox Morphis eQuad/Quad, or the Video Input module

The Matrox Morphis eDual/Dual Standard, Matrox Morphis eQuad/Quad, and Video Input module have four BNC connectors on their bracket:



You can use a standard BNC to BNC video cable (available from your local electronic store) to interface a composite color or monochrome video source with one of these connectors. To interface a Y/C video source, you can use a custom cable, or you can use two BNC to BNC cables and a Matrox BNC-TO-SVHS adapter cable.

The video input expansion connector on the base board, to which a module is attached, establishes the video signal number associated with the module's BNC connectors. When developing your application, you will need to know the video input signal that a video source is driving.

BNC Connector #	Base board	Signals of the Video Input modules			Video source to connect and software channel number (MdigControl() with M_CHANNEL)
		Connected to J1	Connected to J2	Connected to J3	
0	VID_IN0	VID_IN4	VID_IN8	VID_IN12	A CVBS video source (channel 0, 4, 8, and 12, respectively), or the Y component of a Y/C video source (channel 0, 2, 4, and 6, respectively).
1	VID_IN1	VID_IN5	VID_IN9	VID_IN13	A CVBS video source (channel 1, 5, 9, and 13, respectively), or the C component of the Y/C video source connected to BNC 0 (channel 0, 2, 4, and 6, respectively).
2	VID_IN2[1]	VID_IN6	VID_IN10	VID_IN14	A CVBS video source (channel 2, 6, 10, and 14, respectively), or the Y component of a Y/C video source (channel 1, 3, 5, and 7, respectively).
3	VID_IN3[2]	VID_IN7	VID_IN11	VID_IN15	A CVBS video source (channel 3, 7, 11, and 15, respectively), or the C component of the Y/C video source connected to BNC 2 (channel 1, 3, 5, and 7, respectively).

1. Note, if configured for TTL trigger input 0 (P0_TTL_TRIG_IN) (jumper on video/trigger selection connector J17 is positioned across pins 2 and 3), you cannot connect a video source to this BNC connector.
2. Note, if configured for TTL trigger input 1 (P1_TTL_TRIG_IN) (jumper on video/trigger selection connector J18 is positioned across pins 2 and 3), you cannot connect a video source to this BNC connector.

Y/C input

Attach your video source to the BNC-TO-SVHS adapter cables, using the following cable information.

Connectors on video source	Wires on the BNC-TO-SVHS adapter cable
Luminance	Blue (Y)
Chrominance	Green (C)

Connecting video to the Matrox Morphis Dual HDC and Matrox Morphis Dual PC/104-*Plus*

Matrox Morphis Dual HDC and Dual PC/104-*Plus* have a high-density DB-44 female connector for video input. The connector is located on the bracket of the Dual HDC board and on a separate video input module for the Dual PC/104-*Plus* board.

To connect video to your Matrox Morphis board, plug the HD-44M-18BNC (for Matrox Morphis Dual HDC) or HD-44M-18BNC+ cable (for Matrox Morphis Dual PC/104-*Plus*) into the DB-44 video input connector.

Important

Note that the HD-44M-18BNC and the HD-44M-18BNC+ cables are not interchangeable. Although both cables have similar terminations, the pins are wired differently between the two. It is therefore important to always use the correct cable with your Matrox Morphis board.

The BNC connectors for the HD-44M-18BNC and the HD-44M-18BNC+ cables are labelled below.

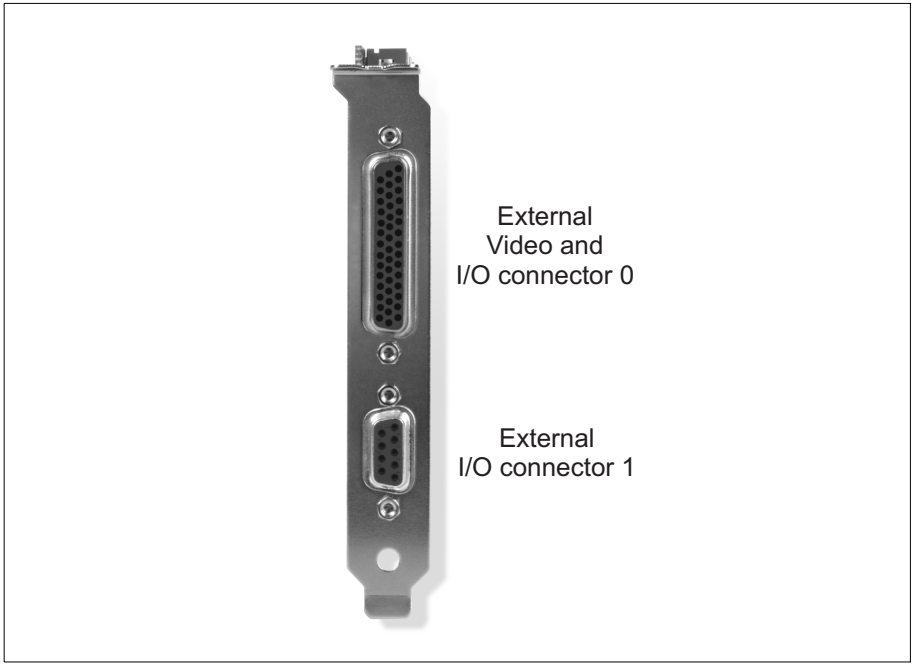
BNC label	Signal	Video device to connect and software channel number (MdigControl() with M_CHANNEL)
CH-0	VID_IN0	A CVBS video source (channel 0), or the Y component of a Y/C video source (channel 0).
CH-1	VID_IN1	A CVBS video source (channel 1), or the C component of the Y/C video source connected to BNC CH-1 (channel 0).
CH-2	VID_IN2	A CVBS video source (channel 2), or the Y component of a Y/C video source (channel 1).
CH-3	VID_IN3	A CVBS video source (channel 3), or the C component of the Y/C video source connected to BNC CH-2 (channel 1).
CH-4	VID_IN4	A CVBS video source (channel 4), or the Y component of a Y/C video source (channel 2).
CH-5	VID_IN5	A CVBS video source (channel 5), or the C component of the Y/C video source connected to BNC CH-4 (channel 2).
CH-6	VID_IN6	A CVBS video source (channel 6), or the Y component of a Y/C video source (channel 3).
CH-7	VID_IN7	A CVBS video source (channel 7), or the C component of the Y/C video source connected to BNC CH-6 (channel 3).
CH-8	VID_IN8	A CVBS video source (channel 8), or the Y component of a Y/C video source (channel 4).
CH-9	VID_IN9	A CVBS video source (channel 9), or the C component of the Y/C video source connected to BNC CH-8 (channel 4).

BNC label	Signal	Video device to connect and software channel number (MdigControl() with M_CHANNEL)
CH-10	VID_IN10	A CVBS video source (channel 10), or the Y component of a Y/C video source (channel 5).
CH-11	VID_IN11	A CVBS video source (channel 11), or the C component of the Y/C video source connected to BNC CH-10 (channel 5).
CH-12	VID_IN12	A CVBS video source (channel 12), or the Y component of a Y/C video source (channel 6).
CH-13	VID_IN13	A CVBS video source (channel 13), or the C component of the Y/C video source connected to BNC CH-12 (channel 6).
CH-14	VID_IN14	A CVBS video source (channel 14), or the Y component of a Y/C video source (channel 7).
CH-15	VID_IN15	A CVBS video source (channel 15), or the C component of the Y/C video source connected to BNC CH-14 (channel 7).
TRIG-0	P0_TTL_TRIG_IN	TTL trigger input for acquisition path 0. Allows image synchronization to be coordinated with an external event.
TRIG-1[1]	P1_TTL_TRIG_IN	TTL trigger input for acquisition path 1. Allows image synchronization to be coordinated with an external event.
OPTOTRIG-1[2]	P1_OPTO_TRIG_IN	Opto-isolated trigger input for acquisition path 1. Allows image synchronization to be coordinated with an external event.

1. Only on HD-44M-18BNC
2. Only on HD-44M-18BNC+

Connecting to the Video and I/O module

The Matrox Morphis Video and I/O module has two connectors on its bracket:



- **External Video and I/O connector 0.** Used to transmit or receive video signals and auxiliary signals (trigger input or user input/output). You can connect up to 12 video sources to this connector.

- **External I/O connector 1.** Used to receive auxiliary signals (trigger input) and connect to an RS-485 two-wire multi-drop network.

Connecting external devices to External Video and I/O connector 0

Using the DBHD44-TO-13BNC or DH44-TO-13BNC/O optional Matrox cable, you can attach video sources to External Video and I/O connector 0 of the module. Both of these cables have thirteen BNC connectors, and a DB-44 plug; the DH44-TO-13BNC/O cable also has open ended wires to access the auxiliary signals.

The wires with the BNC connectors are numbered as follows:

BNC #[1]	Signal	Video device to connect and software channel number (MdigControl() with M_CHANNEL)
1	VID_IN4	A CVBS video source (channel 4), or the Y component of a Y/C video source (channel 2).
2	VID_IN5	A CVBS video source (channel 5), or the C component of the Y/C video source connected to BNC 1 (channel 2).
3	VID_IN6	A CVBS video source (channel 6), or the Y component of a Y/C video source (channel 3).
4	VID_IN7	A CVBS video source (channel 7), or the C component of the Y/C video source connected to BNC 3 (channel 3).
5	VID_IN8	A CVBS video source (channel 8), or the Y component of a Y/C video source (channel 4).
6	VID_IN9	A CVBS video source (channel 9), or the C component of the Y/C video source connected to BNC 5 (channel 4).
7	VID_IN10	A CVBS video source (channel 10), or the Y component of a Y/C video source (channel 5).
8	VID_IN11	A CVBS video source (channel 11), or the C component of the Y/C video source connected to BNC 7 (channel 5).
9	VID_IN12	A CVBS video source (channel 12), or the Y component of a Y/C video source (channel 6).
10	VID_IN13	A CVBS video source (channel 13), or the C component of the Y/C video source connected to BNC 9 (channel 6).
11	VID_IN14	A CVBS video source (channel 14), or the Y component of a Y/C video source (channel 7).
12	VID_IN15	A CVBS video source (channel 15), or the C component of the Y/C video source connected to BNC 11 (channel 7).
13	P0_VID_OUT	A device that accepts the video test output.

1. The wire color associated with each BNC number can be determined using the color code pinout chart included with the DBHD44-TO-13BNC or DH44-TO-13BNC/O cable.

Y/C input

The module supports a maximum of six Y/C inputs. To connect a Y/C video source to Matrox Morphis, connect BNC-TO-SVHS adapter cables to your DBHD44-TO-13BNC or DH44-TO-13BNC/O cable. Then, attach your video source to the BNC-TO-SVHS adapter cables, using the following cable information.

Connectors on video source	Wires on the BNC-TO-SVHS adapter cable
Luminance	Blue (Y)
Chrominance	Green (C)

Chapter

3

Using multiple Matrox Morphis boards

This chapter explains how to use multiple Matrox Morphis boards.

Multiple board installation

This section describes how to use multiple Matrox Morphis boards.

Install each additional Matrox Morphis board as you installed the first board (refer to the *Installing Matrox Morphis Dual PC/104-Plus* section, in *Chapter 2: Hardware installation*).

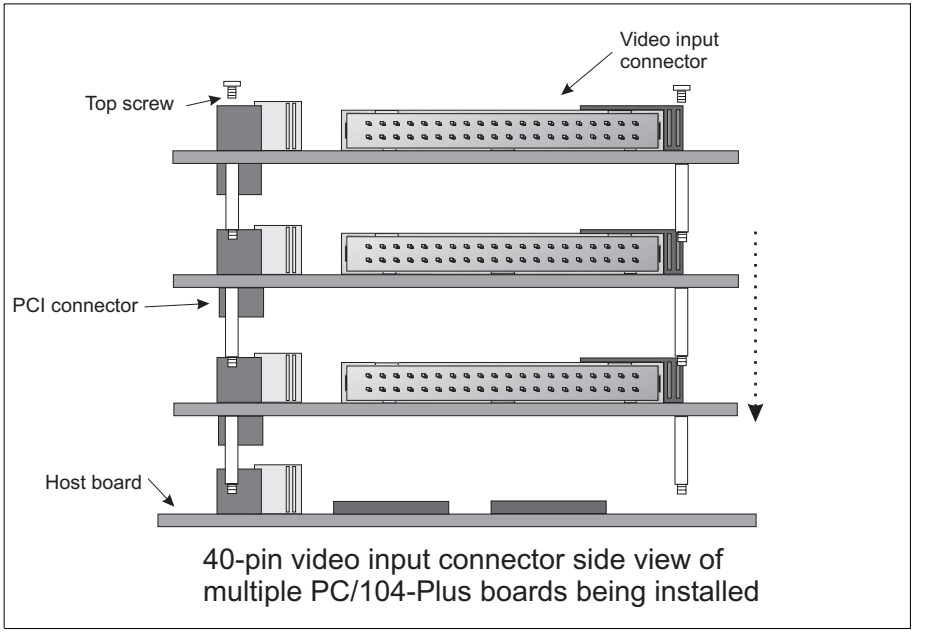
Installing multiple PCIe, PCI-X, or PCI boards

When installing Matrox Morphis eDual/Dual Standard, Matrox Morphis Dual HDC, Matrox Morphis eQuad/Quad, you can theoretically have as many as 16 Matrox Morphis boards installed in your computer at one time. This number is, however, limited by the number of empty slots in your computer and, for simultaneous image capture, by the available bandwidth of your computer (discussed later in this chapter).

Using MIL-Lite, you have to allocate a MIL system for each board and allocate the resources of each MIL system. For more information, see **MsysAlloc**() in the MIL Reference.

Installing multiple Dual PC/104-*Plus* boards

When installing multiple Matrox Morphis Dual PC/104-*Plus* boards, you must stack the boards on top of one another, as shown in the diagram below. The number of Matrox Morphis Dual PC/104-*Plus* boards that you can stack depends on the computer that you are using.



40-pin video input connector side view of multiple PC/104-Plus boards being installed

❖ If you are stacking multiple boards, you cannot add a PC/104 (ISA) board on top of a Matrox Morphis Dual PC/104-*Plus* (PCI) board. You should install the Matrox Morphis Dual PC/104-*Plus* (PCI) board(s) on top of PC/104 (ISA) boards.

In addition, you must set the rotary switch of each PC/104-*Plus* board to a unique setting in the stack. Setting the rotary switch dedicates a group of PCI signals to the board in the stack: clock, request grant, ID select, and interrupt signals. It is recommended that the first board installed (the board closest to the Host CPU

board) be configured to 0, the second to 1, and so on. The table below shows the recommended switch setting for each board, as well as the corresponding settings for the dedicated signals.

Switch position	Board position	Interrupt	Request grant	ID select
0 or 4	1	Interrupt A	0	0
1 or 5	2	Interrupt B	1	1
2 or 6	3	Interrupt C	2	2
3 or 7	4	Interrupt D	2	3

Using MIL-Lite, you have to allocate a MIL system for each board and allocate the resources of each MIL system. For more information, see **MsysAlloc**() in the MIL Reference.

Simultaneous image capture from different boards

You can simultaneously capture images from video sources attached to different Matrox Morphis boards; however, the number of video sources from which you can simultaneously capture images is determined by the available bandwidth of your PCIe, PCI-X, or PCI interface (segment). If there is not enough bandwidth, your board will drop frames.

Matrox Morphis Dual and Quad are susceptible to dropping frames because the PCI/PCI-X bus bandwidth can be shared if you are using multiple boards.

Matrox Morphis eDual and Matrox Morphis eQuad might have a problem with dropped frames if you are capturing large images, or your available bandwidth has been reduced.

The use of a high-performance PCIe, PCI-X, or PCI core-logic chipset is necessary to sustain PCIe, PCI-X, or PCI transfers to Host memory. If a high performance chipset is used, you should not have a problem with dropped frames. The list of platforms that are known to be compatible with Matrox Morphis are available on the Matrox web site, under the board's compatibility list.

You should not have any PCI/PCI-X bandwidth problems capturing the following number of full-sized color images simultaneously from multiple Matrox Morphis boards, assuming you are using a high-performance chipset. Capturing more than this number might result in PCI/PCI-X bandwidth problems.

Transfer mode of full-sized color images	Number of images captured simultaneously without PCI/PCI-X bandwidth problems		
	33 MHz PCI slot	66 MHz PCI slot	133[1] MHz PCI-X slot
RGBX (32-bit) mode	2	4	4
YUV16 mode	4	8	8

1. Note that with two Matrox Morphis Quad boards, the bus will run at 100 MHz, and with three, it will run at 66 MHz.

❖ Note that grabbing images from the same board requires the same amount of PCI/PCI-X bandwidth as grabbing them from two different boards.

As a reference point, capturing one full-sized NTSC or PAL image in real time will require a PCI bandwidth of 35 Mbytes/sec or 42 Mbytes/sec, respectively, when transferring in RGBX (32-bit) mode.

It is recommended that when capturing more than two images simultaneously over a PCI interface, you either use a 66 MHz PCI slot, use a different transfer mode, or reduce the image size to avoid reaching the upper limits of the overall available bandwidth.

Chapter

4

Hardware reference

This chapter explains the architecture of the Matrox Morphis hardware, as well as the available features and modes.

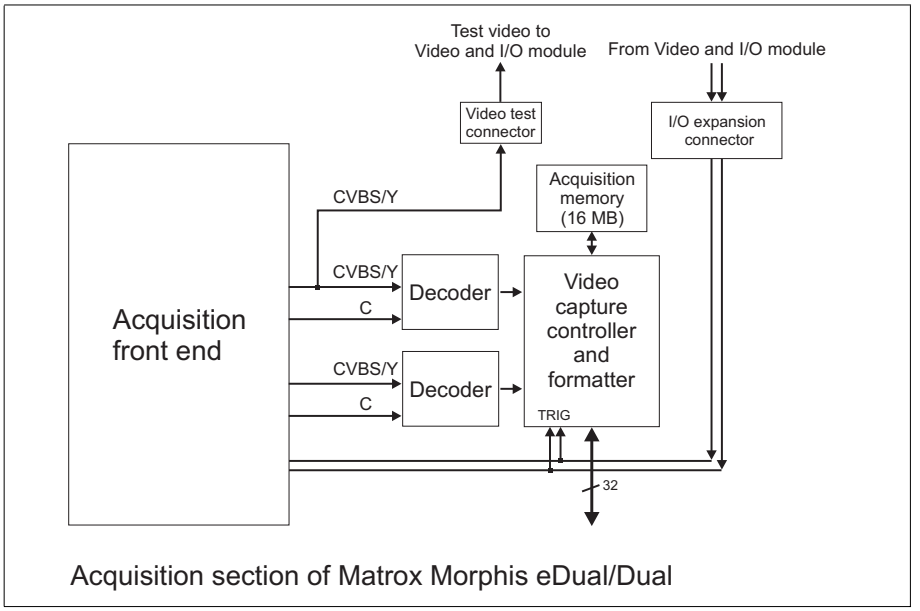
Matrox Morphis hardware reference

This chapter provides information on the architecture, operating modes, and supported features of Matrox Morphis. For a summary of the information given in this chapter and detailed specifications of connectors and pinouts, refer to *Appendix B: Technical information* of this manual.

Acquisition section

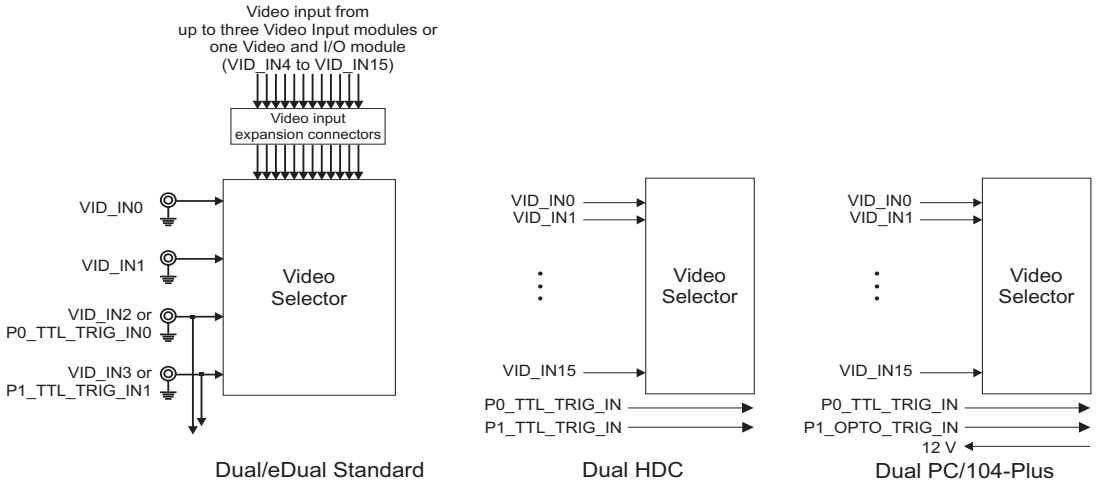
The acquisition section of Matrox Morphis can capture RS-170 /CCIR monochrome video and composite (CVBS) and component (Y/C) video in NTSC /PAL format. The acquisition sections of the Matrox Morphis eDual/Dual Standard, Dual HDC, and Dual PC/104-*Plus* have two independent acquisition paths, whereas the Matrox Morphis eQuad/Quad have four. These independent acquisition paths allow Matrox Morphis to simultaneously capture from any two or four of the up to sixteen connected, supported, synchronous or asynchronous video sources, depending on the board. In addition, all boards can switch the capture between any connected video source of the same type with minimum latency (fast switching). The speed of switching will increase linearly in relation to the number of available decoders.

The following diagram illustrates the main components of the acquisition section of Matrox Morphis eDual/Dual.



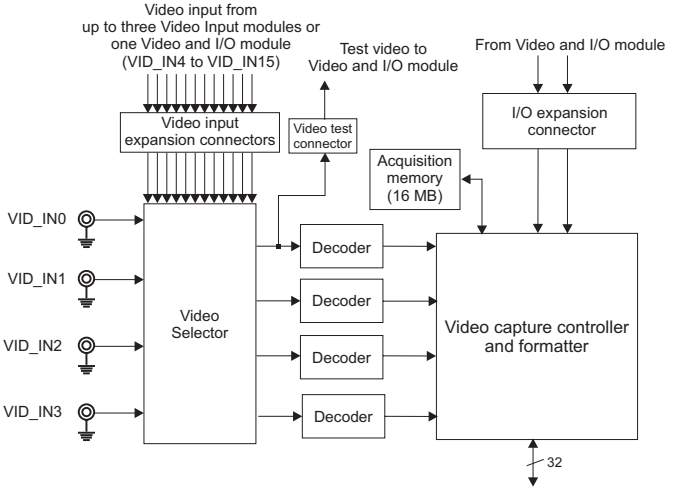
Acquisition section of Matrox Morphis eDual/Dual

The following diagram illustrates the different acquisition front ends of the Matrox Morphis Dual boards.



Acquisition front ends for different Matrox Morphis Dual boards

The following diagram illustrates the main components of the acquisition section of Matrox Morphis eQuad/Quad.



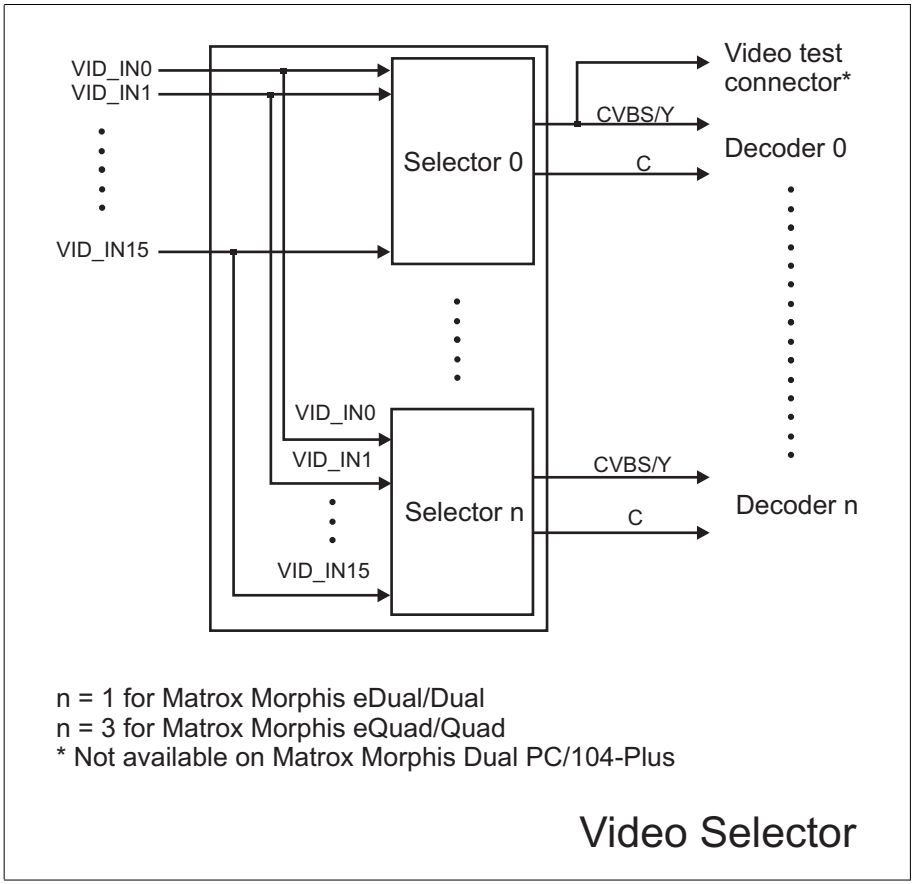
Acquisition section of Matrox Morphis eQuad/Quad

To grab from a video source, allocate a MIL digitizer with a DCF that matches the video source's data type, using the MIL-Lite function **MdigAlloc**(); a MIL digitizer represents the acquisition path(s) with which to grab from one input source of the specified type. Then, using the returned MIL digitizer identifier, call **MdigGrab**().

To grab video data from multiple video sources simultaneously, allocate the appropriate number of digitizers with **MdigAlloc**() and specify different device numbers for each.

Video Selector

The Video Selector is responsible for routing the video inputs to the appropriate decoder, as well as routing decoder 0's input to the video test connector of most Matrox Morphis boards except Matrox Morphis Dual PC/104-Plus.



The Video Selector can, for each decoder, perform fast switching between connected video sources of the same type. In addition, the speed of switching will increase linearly in relation to the number of available decoders. If Matrox Morphis eDual/Dual, for example, is not simultaneously capturing from two video sources, the Video Selector can perform ultra-fast switching between video sources. In this case, the new input is routed to the idle decoder so that while the current capture is in process, the next capture is being set up.

Input channels

For each of the video decoders, the Video Selector can switch between 16 CVBS/monochrome or 8 Y/C video sources, or a combination of both. The video sources can be connected to the base board and/or to one of the Matrox Morphis expansion modules. For fast or ultra-fast channel switching, the video sources must be of the same type.

As a standard feature on the Matrox Morphis eDual/Dual Standard and Matrox Morphis eQuad/Quad, you can connect up to 4 CVBS/monochrome or 2 Y/C video sources, or a combination of both, to the base board. To each of a maximum of three Matrox Morphis Video Input modules, you can connect the same number of video sources as is supported by the base board. To the Matrox Morphis Video and I/O module, you connect 12 CVBS/monochrome or 6 Y/C video sources, or a combination of both.

❖ Note that you can only connect a single Matrox Morphis Video and I/O module to the base board, and that the Matrox Morphis Video and I/O module and the Matrox Morphis Video Input module are mutually exclusive.

To switch between video sources of the same type for each MIL digitizer, use **MdigControl**() with **M_CHANNEL**[*].

Video input testing

With the exception of Matrox Morphis Dual PC/104-Plus, you can test the CVBS/monochrome video input or the Y component of the Y/C video input that is routed to decoder 0. To test the video signal, it can be output to the video test connector. If you have a Matrox Morphis Video and I/O module, this video signal can be sent out through external Video and I/O connector 0 (HD-44). You can connect this output to a monitor to establish, for example, the channel to which a video source is connected. When performing ultra-fast channel switching, this output is not very useful because most monitors cannot synchronize to this output and because every second switch causes the video input to be routed to decoder 1.

*. As of MIL 10.

Video decoders

The acquisition section has either two or four multi-standard video decoders, depending on the board type. These decoders feature internal filtering and automatic gain control, in addition to digitizing video.

Gain

The video decoders feature automatic gain control (AGC). This allows the video signal input range to be optimized before being digitized. You can, however, disable the AGC and set the gain manually, using the **MdigControl**() function, with M_GRAB_AUTOMATIC_INPUT_GAIN set to M_DISABLE and M_GRAB_INPUT_GAIN set to any integer value from 0 to 255.

Digitizing component

The multi-standard video decoders can convert analog composite (CVBS) and component (Y/C) video in NTSC/PAL format, to digitized video in YUV16 (YUYV).

Each decoder supports the following video timing parameters:

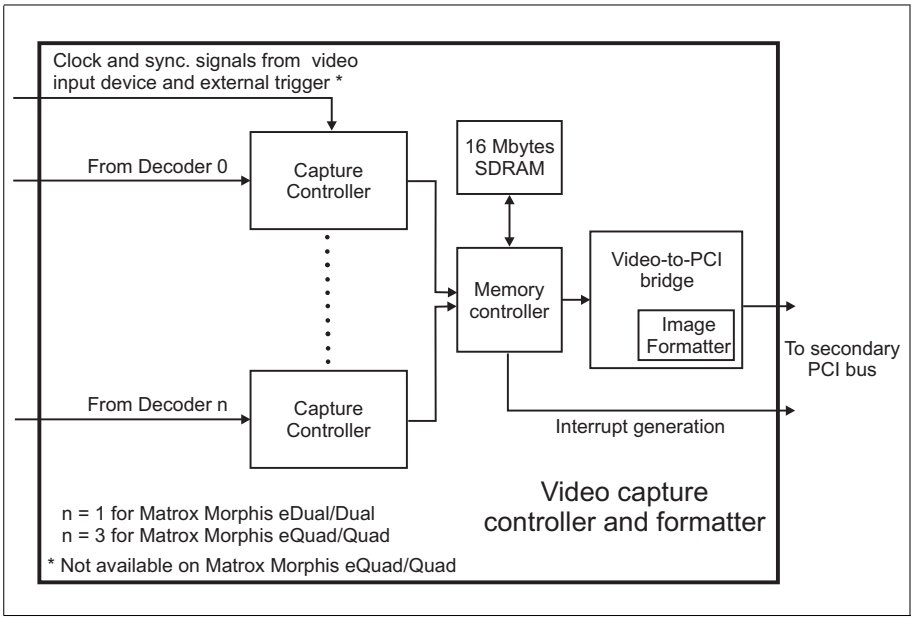
	Square pixel video formats	
	NTSC	**PAL**
Pixel sampling rate (MHz)	12.27	14.75
Y component sampling rate (MHz)	12.27	14.75
U and V components (MHz)	6.14 each	7.38 each
Digitizing component sampling rate (MHz)	24.54	29.5
Field rate (Hz)	60	50
Pixel/line (Pixels)	780	944
Active pixel/line (Pixels)	640	768
Active lines/frame (Lines)	480	576
Line rate (KHz)	15.734	15.625

Video capture controller and formatter

Once the analog video has been converted to digitized video, it enters a component called the *video capture controller and formatter*.

The video capture controller and formatter accepts all data signals provided by the decoders, and formats the digitized video for transfer to Host or graphics controller memory.

The following diagram illustrates the video capture controller and formatter found on Matrox Morphis.



The video capture controller and formatter contains the following elements:

- Capture controller.
- Memory controller.
- Video-to-PCI bridge (which includes an image formatter).

Capture controllers

There are either two or four capture controllers in the video capture controller and formatter. Each capture controller has the following functions:

- Each sets the conditions under which to start and end a grab. Examples of grabbing conditions are whether to grab one or two fields per frame, or whether to start the grab on an odd or even field. Set the capture controller conditions using the MIL/MIL-Lite **MdigControl**() function.

- Each can generate interrupts, based on various grabbing events. You can hook a function to these events using the **MdigHookFunction**() function. The various events that can cause an interrupt are listed in the following table:

Hook Type	Description
M_GRAB_START	Hook to the start of each grab.
M_GRAB_END	Hook to the end of each grab.
M_GRAB_FIELD_END_ODD	Hook to the end of grabbed odd fields.
M_GRAB_FIELD_END_EVEN	Hook to the end of grabbed even fields.
M_FRAME_START[1]	Hook to the start of the incoming signal's frames.
M_FIELD_START_ODD[1]	Hook to the start of the incoming signal's odd fields.
M_FIELD_START_EVEN[1]	Hook to the start of the incoming signal's even fields.

1. These events occur even when a video source is connected but not grabbing.

- Each receives clock and synchronization signals from the video source and, with the exception of Matrox Morphis eQuad/Quad, accepts an external trigger input.

Trigger

With the exception of the capture controllers on Matrox Morphis eQuad/Quad, each capture controller accepts an independent external trigger input, which allows image acquisition to be synchronized with an external event.

From the BNC connectors of the eDual/Dual Standard board, the trigger input is received directly in TTL format; whereas from the Matrox Morphis Video and I/O module, the trigger input is received through an opto-coupler, which isolates the rest of the circuitry from outside surges.

When receiving the trigger through the opto-coupler, the voltage difference across the positive and negative components of the signal must be between 4.05 V and 9.16 V for high level voltage, and between -4.5 V and 0.8 V for low level voltage.

Each capture controller operates in *next valid frame/field* (synchronous) mode. In this mode, the capture controller waits for the next valid frame or field (depending on whether grabbing a frame or a field) before commencing the grab.

Acquisition in next valid frame/field mode is executed in one of two ways:

- **Edge-triggered acquisition.** The capture controller waits for the rising/falling edge of the trigger to capture a frame/field.

- **Level-sensitive acquisition.** The capture controller waits for the level of the trigger to become high/low to capture a frame/field. The polarity of the active and inactive levels of the trigger signal are programmable.

To enable grabbing upon a trigger, use the MIL-Lite function **MdigControl**() with **M_GRAB_TRIGGER_STATE***. To set the signal used to trigger the grab, use **MdigControl**() with **M_GRAB_TRIGGER_SOURCE**.

Memory controller

The memory controller is responsible for toggling between the incoming video data, storing it in the 16 Mbytes of on-board acquisition memory, and upon request, transferring it to the video-to-PCI bridge. After storing the video, an interrupt is generated notifying the Host of the acquired data. The Host is then responsible to request its transfer to the Host memory. Upon receiving the request, the memory controller transfers the data to the video-to-PCI bridge.

Video-to-PCI bridge

The video-to-PCI bridge is capable of high-speed transfers to Host memory. Upon transmitting the video data, the video-to-PCI bridge can format the data with its image formatter.

Image formatter

The image formatter can perform several operations:

- **Image resizing.** Captured data can be cropped (ROI capture) or it can be arbitrarily downscaled to 1/16th of a field or frame. This can be useful to implement custom software-based motion detection because at a reduced scale, image comparison is faster.

- **Vertical/horizontal flipping.** Captured data can be flipped vertically or horizontally, or both.

*. As of MIL 10.

- **Color-space conversion.** Captured data can be converted into the following formats with square pixels: RGB planar, BGR32 packed, YCrCb, and 8-bit monochrome. Alternatively, YUV16 packed (stored in YUYV format) can be passed through. The image formatter can also perform *color kill*, which converts the data to grayscale and then converts it to the appropriate destination format.

  The equations for the conversions are as follows:

Color space conversion	Equations
YUV-to-Y	• Y = Y
YUV-to-RGB	• R = Y + 1.4017 V • G = Y - 0.3437 U - 0.7142 V • B = Y + 1.7722 U
YUV-to-YCrCb	• Y = Y x 220/256 + 16 • Cb = (U - 128) x (113/256) + 128 • Cr = (V - 128) x (113/256) + 128

I/O controller

The I/O controller is responsible for routing auxiliary signals and controlling the RS-485 serial interface of the Video and I/O module. The I/O controller also integrates Watchdog circuitry for automatically recovering from application or system failure.

❖ Note that the RS-485 serial interface and the integrated Watchdog circuitry are only available with Matrox Morphis eDual/Dual Standard, Dual HDC, and eQuad/Quad. They are not available with Matrox Morphis Dual PC/104-*Plus*.

Auxiliary signals

Using the Matrox Morphis Video and I/O module, Matrox Morphis has sixteen TTL auxiliary signals shared between all acquisition paths. These auxiliary signals can be used to transmit or receive application-specific user output and/or input.

If you want to start or stop an external event based on some calculation or analysis, you can manually set the state of any auxiliary output signal (or I/O signal set to output) to high or low. To do so, you set the state (on/off) of a bit in a user settable register (static-user-output register). When the bit is on, its associated auxiliary output signal will be high; when it is off, the associated auxiliary output signal will be low. This bit is referred to as a user-bit. To set the state of a user-bit, use the MIL-Lite function **MsysControl**() with **M_USER_BIT_STATE***.

Your application can also act upon and interpret the state of an auxiliary input signal (or I/O signal set to input). The state of an auxiliary input signal is not associated with a user-bit; you poll the state of the signal directly. To poll the state of an auxiliary input signal, use **MsysInquire**() with **M_IO_STATUS***. The state of an auxiliary input signal can also generate an interrupt; to do so, use **MsysControl**() with **M_IO_INTERRUPT_STATE*** and then use **MsysHookFunction**() with **M_IO_CHANGE*** to hook a function to this event (that is, to set up an event handler).

For information on the electrical specification of auxiliary signals, see the *Electrical specifications* section, in *Appendix B: Technical information*.

RS-485 serial interface

Using the Video and I/O module, Matrox Morphis offers an RS-485 serial interface. It is mapped as a COM port so that the interface can be accessed through the Microsoft Windows API. The serial interface can both receive and transmit signals, but in half-duplex mode. The serial interface can be connected to an RS-485 two-wire multi-drop network.

The interface is controlled by a Universal Asynchronous Receiver-Transmitter (UART)† circuit in the I/O controller. Matrox Morphis integrates a 16450-compatible UART, which features independently programmable baud rates (maximum recommended baud rate = 9600 baud).

The RS-485 interface supports multiple devices, and distances of up to 4000 feet. In addition, with the RS-485 interface, data communication uses differential signaling.

---

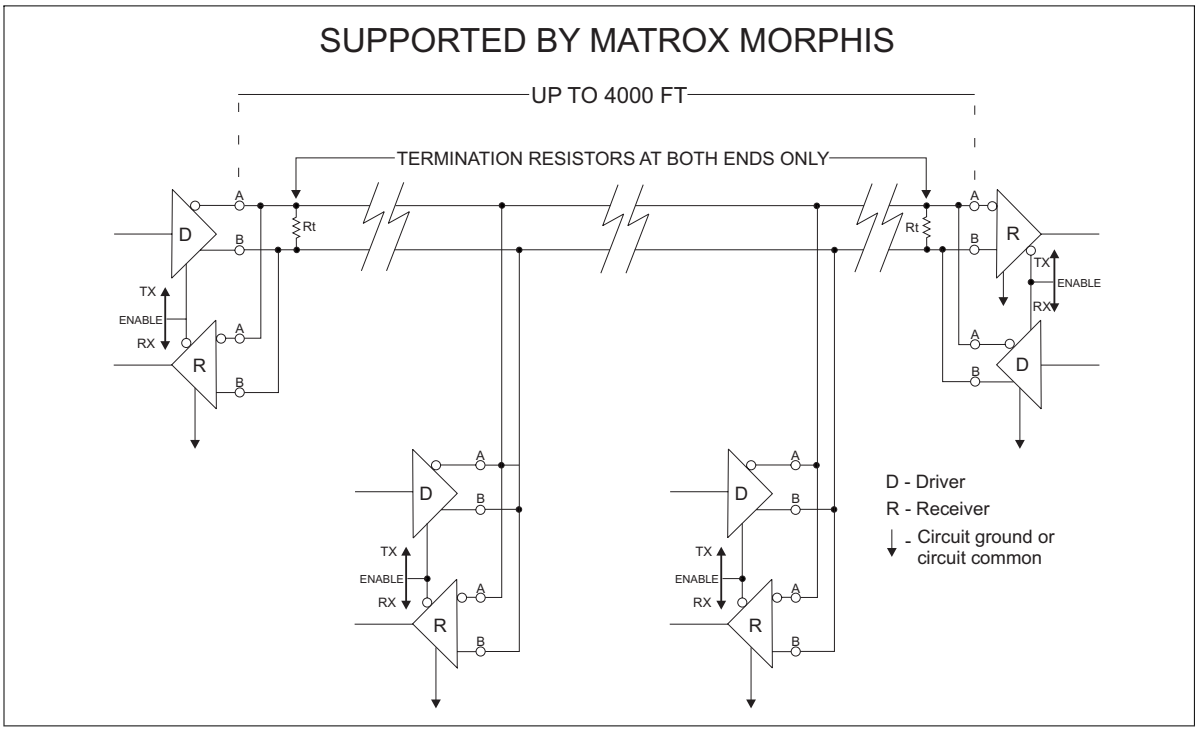
*. As of MIL 10.

†. The UART implementation was derived from a design by Daniel Wallner. Please see *Appendix D: Acknowledgments* for copyright information.

You can use the serial interface to connect Matrox Morphis to a multi-drop network. This allows you to connect Matrox Morphis to multiple devices that are already connected to each other through this network.

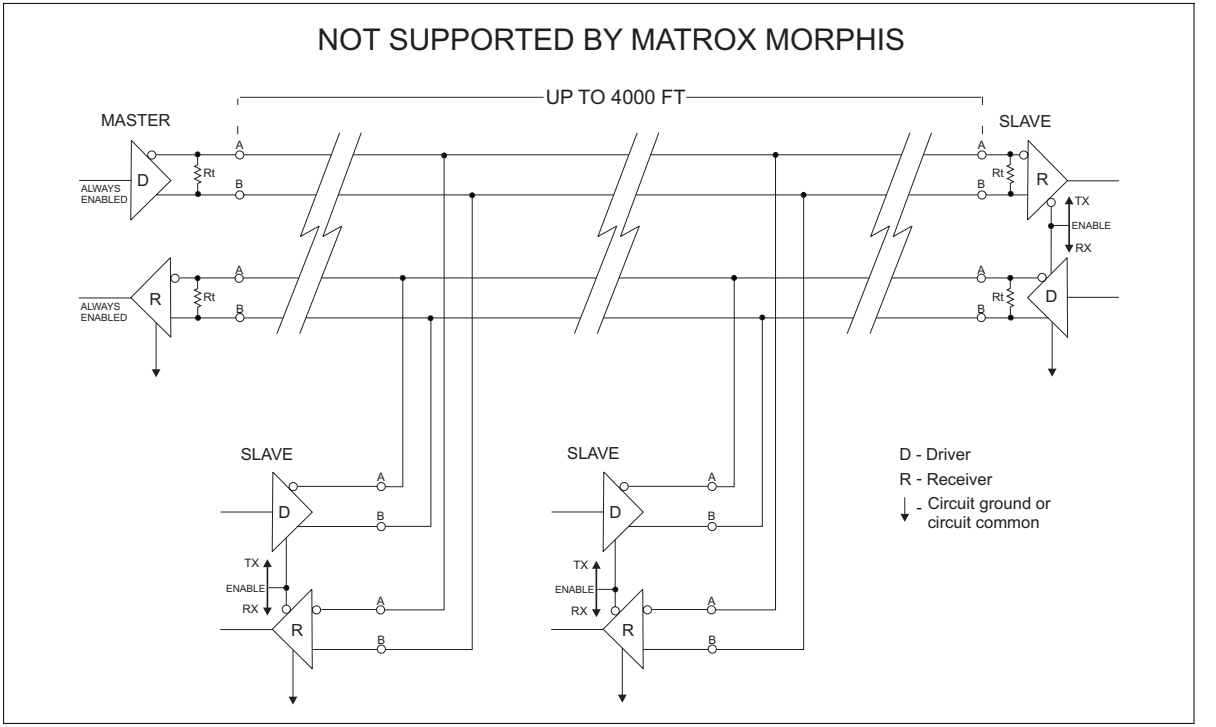
Two-wire multi-drop network

Since, as mentioned earlier in this section, the serial interface can only operate in half-duplex mode, it can only be connected to a RS-485 two-wire multi-drop network shown below. Note that Matrox Morphis does not have a termination resistor nor bias resistors.



Four-wire multi-drop network

Matrox Morphis cannot be connected to a four-wire multi-drop network.



Watchdog circuitry

The I/O controller integrates Watchdog circuitry to automatically recover from application or system failure. The Watchdog circuitry automatically reboots your computer when, for some reason, your computer hangs for longer than a pre-set amount of time.

The Watchdog circuitry works based on several integrated timers. When the Watchdog circuitry is enabled, it must receive a reset signal from the user application within the time specified by a timer. Every time the signal is received, Watchdog resets this timer. If, however, the Watchdog circuitry does not receive a reset signal for a period longer than the time allotted by this timer, it will either send a warning interrupt signal or a hardware signal to reboot the computer, depending on the timer.

There are three main timers that make up the Watchdog circuitry:

- **Warning timer:** If, during the course of regular operations, the Host computer does not reset the warning timer before the specified interval expires, it is assumed to have hung. The Watchdog's warning timer will then generate a warning interrupt.

- **Timeout timer:** If, during the course of regular operation, the Host computer does not reset the timeout timer before the specified interval expires, it is assumed to have hung. The Watchdog's timeout timer will then force the Host computer to reboot.

- **Reboot timer:** If, during a reboot, the Host computer does not start regular operations before the specified interval expires, the Host computer is assumed to have hung. The Watchdog's reboot timer will then force the Host computer to reboot again.

You can enable the Watchdog circuitry and set and reset the Watchdog timers using the MIL-Lite **MsysControl**() function. You can hook an event handler function to the warning interrupt using **MsysHookFunction**().

PCIe, PCI-X, or PCI interface

The Matrox Morphis board allows the transfer of live video to Host memory across either a PCIe, PCI-X, or PCI bus, without the help of the Host CPU.

All Matrox Morphis boards feature an on-board 32-bit 33/66 MHz PCI bus master to reduce CPU usage. The board can also generate interrupts for the start and end of a field, frame, and sequence capture.

Matrox Morphis eDual Standard and eQuad have a x1 PCIe bus interface.

Matrox Morphis Dual Standard and Dual HDC have a 32-bit synchronous PCI bus interface, which is capable of a peak transfer rate of 132 Mbytes/sec when operating at 33 MHz or 264 Mbytes/sec when operating at 66 MHz.

Matrox Morphis Quad has a 64-bit asynchronous PCI-X bus interface, which is capable of a peak transfer rate of 1056 Mbytes/sec when operating at 133 MHz.

Appendix A: Glossary

This appendix defines some of the specialized terms used in this Matrox Morphis document.

Glossary

- **Band**

  One of the surfaces of a buffer. A grayscale image requires just one band. A color image requires three bands, one for each color component.

- **Bandwidth**

  A term describing the capacity to transfer data. Greater bandwidth is needed to sustain a higher transfer rate. Greater bandwidth can be achieved, for example, by using a wider bus.

- **Bus**

  A pathway along which signals are sent, generally in two directions, for communication of data.

- **Color component**

  One of the components that make up a color space. Typically, each component of a color image is stored in a separate band of a multi-band buffer.

- **Color space**

  A color space is a way of representing and describing the complete range of perceived colors. A number of color spaces have been developed. Common color spaces are RGB and HSL. Both describe the same range of perceivable colors.

- **DCF**

  Digitizer Configuration Format. A DCF defines the input data format and among other things, how to accept or generate video timing signals such as horizontal sync, vertical sync, and pixel clock.

- **Field**

  One of the two halves that make up an image. One half consists of the image's odd lines (known as the *odd field*); the other half consists of the image's even lines (known as the *even field*).

- **Frame**

  A single image grabbed from a video camera.

- **Grab**

  To acquire or capture an image from a camera.

- **Horizontal synchronization signal**

  The part of a video signal that indicates the end of a line and the start of a new one.

  See also *vertical synchronization signal*.

- **Host**

  In general, Host refers to the principal CPU in one's computer.

- **Interlaced scanning**

  Describes a transfer of data in which the odd-numbered lines of the source are written to the destination buffer first and then the even-numbered lines (or vice-versa).

  See also *progressive scanning*.

- **PCI**

  Peripheral Component Interconnect. Present day standard expansion bus.

- **Progressive scanning**

  Describes a transfer of data in which the lines of the source input device are written sequentially into the destination buffer.

  Also known as *non-interlaced.* See also *interlaced scanning*.

- **RGB**

  A color space that represents color using the primary colors (red, green and blue) as components.

- **Vertical synchronization signal**

  The part of a video signal that indicates the end of a frame and the start of a new one.

  See also *horizontal synchronization signal*.

Appendix B: Technical information

This appendix contains information that might be useful when installing your Matrox Morphis boards.

Technical information

This appendix contains information that might be useful when installing your Matrox Morphis board.

Global information

- Operating system: See your software manual for supported versions of Microsoft Windows or Linux.

- System requirements: A computer with a PCIe, PCI-X, or PCI bus and an Intel Pentium processor (or equivalent) or better.

  Some older computers use a core logic chipset (interfaces PCI with Host memory) that has limited throughput capabilities. Matrox Morphis might not be able to attain full functionality on such a computer. We recommend a computer with a relatively up-to-date PCIe, PCI-X, or PCI chipset because it generally offers better performance in terms of data transfer rates. To learn more about the most appropriate chipset, refer to the Matrox Imaging website or consult with your local Matrox Imaging representative, local Matrox Imaging sales office, or the Matrox Imaging Customer Support Group at headquarters.

Acquisition features

- Accepts composite (CVBS) and component S-video (Y/C) in NTSC/PAL formats, and monochrome video in RS-170/CCIR format.

- Captured data can be converted into the following formats with square pixels: RGB planar, BGR32 packed, YCrCb, YUV16 packed (stored in YUYV format), and 8-bit monochrome.

- Performs fast switching between multiple video sources. In addition, it can either:

  - Perform ultra-fast switching between multiple video sources.

  - Simultaneously capture images from two or four independent video sources, depending on the board type.

- Supports connection to the following number of video sources:

  - With the Matrox Morphis eDual/Dual Standard or eQuad/Quad base board, up to 4 CVBS/monochrome or 2 Y/C video sources, or a combination of both. With the Matrox Morphis Dual HDC base board or Dual PC/104-*Plus*, up to 16 CVBS/monochrome or 8 Y/C video sources, or a combination of both.

  - With each Matrox Morphis Video Input module, used with Matrox Morphis eDual/Dual Standard or eQuad/Quad, an additional 4 CVBS/monochrome or 2 Y/C video sources, or a combination of both. You can connect up to 3 Matrox Morphis Video Input modules to the eDual/Dual Standard and eQuad/Quad boards.

  - With the Matrox Morphis Video and I/O module, used with Matrox Morphis eDual/Dual Standard, Dual HDC, or eQuad/Quad, an additional 12 CVBS/monochrome or 6 Y/C video sources, or a combination of both. You can only connect a single Matrox Morphis Video and I/O module to the base board.

    ❖ Note that the Matrox Morphis Video and I/O module and the Matrox Morphis Video Input module are mutually exclusive.

- With the exception of Matrox Morphis eQuad/Quad, Matrox Morphis accepts two external trigger inputs that can operate in next valid frame/field mode. From the BNC connectors of the base board, the triggers are received directly in TTL format; whereas from the Matrox Morphis Video and I/O module, the triggers are opto-isolated.

- Controllable automatic gain control (freeze with manual adjust).

- Supports cropping (ROI capture), arbitrary downscaling to 1/16th of a field or frame, and vertical/horizontal flipping.

Additional features

In addition to the video capture functionality, Matrox Morphis incorporates a variety of features to simplify overall system integration. These features include:

Feature	eDual/Dual Standard	Dual HDC	Dual PC/104-*Plus*	eQuad/Quad
Hardware facilities for implementing custom software-based motion detection.	●	●	●	●
Integrated Watchdog capabilities for automatically recovering from application or system failure.	●	●		●
16 TTL auxiliary I/O integrated signals that can be used to transmit or receive application-specific user output and/or input. These signals can be internally accessed, or accessed externally using the Matrox Morphis Video and I/O module.	●	●		●
An RS-485 serial interface, mapped as a COM port so that the interface can be accessed through the Microsoft Windows API. The serial interface can both receive and transmit signals, but in half-duplex mode. The serial interface can be connected to an RS-485 two-wire multi-drop network.	●	●		●
Video input testing. The CVBS or Y input of decoder 0 can be routed out to the Matrox Morphis Video and I/O module for test purposes.	●	●		●

Data transfer features

- Features an on-board 32-bit 33/66 MHz PCI bus master to reduce CPU usage.
- Allows the transfer of live video to Host memory.
- Can generate interrupts for the start and end of a field, frame, and sequence capture.

Electrical specifications

The following tables list the electrical specifications of the different boards under different conditions.

Important

When determining the power requirements for your computer, do not forget to include the power requirements for other peripheral devices. In addition, if combining multiple boards, do not forget to add their total power requirements together.

Typical operating voltage and current for Matrox Morphis eDual Standard with two video decoders and no expansion module (applies to PCB Y7272-01 rev. A VER. 101).		
Voltage	**Current**	**Power**
3.3 V ± 5%	1.3 A	4.3 W
12 V ± 10%	100 mA	1.2 W
Total		5.5 W

Typical operating voltage and current for Matrox Morphis Dual Standard with two video decoders and no expansion module (applies to PCB Y7142-03 rev. A / VER. 300).		
Voltage	**Current**	**Power**
5 V ± 5%	900 mA	4.5 W
3.3 V ± 5%	n/a	
12 V ± 10%	100 mA	1.2 W
Total		5.7 W

Typical operating voltage and current for Matrox Morphis Dual HDC with two video decoders and no expansion module (applies to PCB Y7173-01 rev. A / VER. 100).		
Voltage	**Current**	**Power**
5 V ± 5%	900 mA	4.5 W
3.3 V ± 5%	n/a	
12 V ± 10%	100 mA	1.2 W
Total		5.7 W

Typical operating voltage and current for Matrox Morphis Dual PC/104-*Plus* with two video decoders (applies to PCB Y7227-01 rev. D / VER. 100).		
Voltage	**Current**	**Power**
5 V ± 5%	150 mA	0.75 W
3.3 V ± 5%	650 mA	2.145 W
12 V ± 10%	80 mA	0.96 W
Total		3.855 W

Typical operating voltage and current for Matrox Morphis eQuad (applies to PCB Y7281-00 rev. A VER. 000).		
Voltage	**Current**	**Power**
3.3 V ± 5%	2.02 A	6.7 W
12 V ± 10%	0.21 A	2.5 W
Total		9.2 W

Typical operating voltage and current for Matrox Morphis Quad with four video decoders, and no expansion module (applies to PCB Y7198-01 rev. B / VER. 100).		
Voltage	**Current**	**Power**
5 V ± 5%	1.4 A	7 W
3.3 V ± 5%	n/a	
12 V ± 10%	0.21 A	2.5 W
Total		9.5 W

Typical operating voltage and current for Matrox Morphis video and I/O expansion module (applies to PCB Y7150-00 rev. A / VER. 000).		
Voltage	**Current**	**Power**
5 V ± 5%	150 mA	0.75 W
3.3 V ± 5%	n/a	
12 V ± 10%	100 mA	1.2 W
Total		1.95 W

Typical operating voltage and current for the Matrox Morphis video input expansion module (applies to PCB Y7162-0001 rev. A / VER. 001).		
Voltage	**Current**	**Power**
5 V ± 5%	50 mA	0.25 W
3.3 V ± 5%	n/a	
12 V ± 10%	35 mA	0.42 W
Total		0.67 W

The following table lists the electrical signal specifications of Matrox Morphis eDual/Dual Standard, Dual HDC, and eQuad/Quad.

Signals	Specifications
Video input signals	Termination: 75 Ω with jumper installed, >100 KΩ without jumper.
Input signals in TTL format	No termination. Input current: ± 1 µA max. Input voltage: • Low: 0 V min; 0.8 V max. • High: 2.0 V min; 5 V max.
Output signals in TTL format	No termination. Maximum output current: 24 mA. Output voltage: • Low: 0.55 V max. • High: 2.4 V min; 5 V max.
Opto-coupled input signals	511 Ohm series termination. Input current: • max of low: 250 µA • min of high: 5 mA (6.3 mA min recommended) • max of high: 15 mA (10 mA max recommended) Input voltage (with 511 Ohm series resistor only): • low: 0.8 V max • high: 4.05 V min
Input signal in RS-485 format	No termination. Input voltage: • Differential range: ±12 V. • Sensitivity: ±200 mV • Common mode range: -7 V to 12 V.
Output signal in RS-485 format	Specified for a 27 Ω load. Output voltage: • Differential range: 1.5 V to 5 V. • Common mode range: -1 V to 3 V.

The following table lists the electrical signal specifications of Matrox Morphis Dual PC/104-*Plus*.

Signals	Specifications
Video input signals	Termination: 75 Ω with jumper installed, >100 KΩ without jumper.
Input signals in TTL format	No termination. Input current: ± 1 µA max. Input voltage: • Low: 0 V min; 0.8 V max. • High: 2.0 V min; 5 V max.
Opto-coupled input signals	330 Ohm series termination. Input current: • max of low: 250 µA • min of high: 2 mA (5.0 mA min recommended) • max of high: 40 mA (20 mA max recommended) Input voltage (with 330 Ohm series resistor only): • low: 1.0 V max • high: 4.00 V min

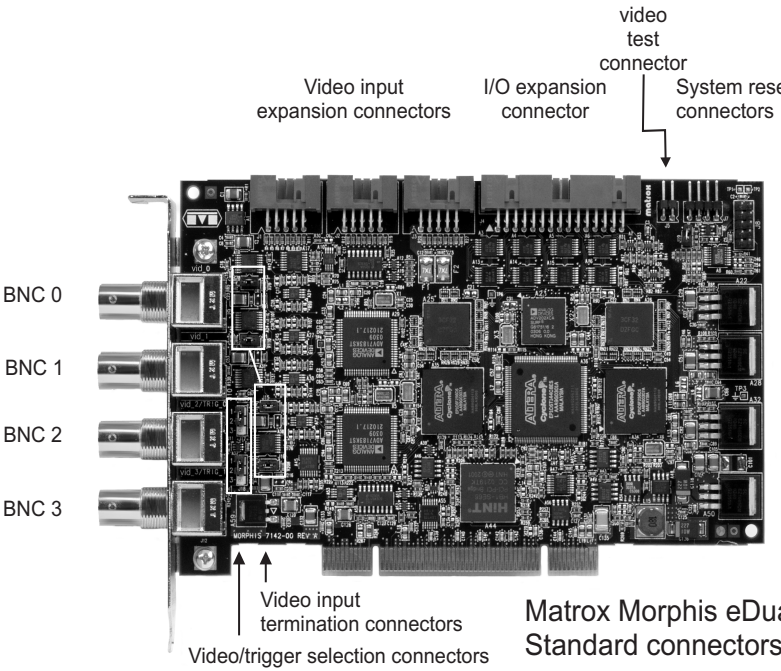
Dimensions and environmental specifications

- Dimensions:
  - Matrox Morphis eDual/Dual Standard, Matrox Morphis Dual HDC, and Matrox Morphis eQuad/Quad boards: 16.7 L x 10.7 H cm (6.6" x 4.2") from bottom edge of goldfinger to top edge of board.
  - Matrox Morphis Dual PC/104-*Plus* board: 9.6 L x 9.0 H cm (3.8" x 3.5").
  - Matrox Morphis Video Input module: 5.6 L x 9.1 H cm (2.2" x 3.6")
  - Matrox Morphis Video and I/O module: 6.9 L x 10.7 H cm (2.7" x 4.2")
- Minimum/maximum ambient operating temperature: 0°C to 55°C.
- Minimum/maximum storage temperature: -25°C to 85°C.
- Operating humidity: 10% - 90% (non-condensing).
- Storage humidity: 10% - 90% (non-condensing).
- Maximum altitude for operation: 3000 meters.
- Maximum altitude for transport: 12000 meters.

Base board input and output connectors

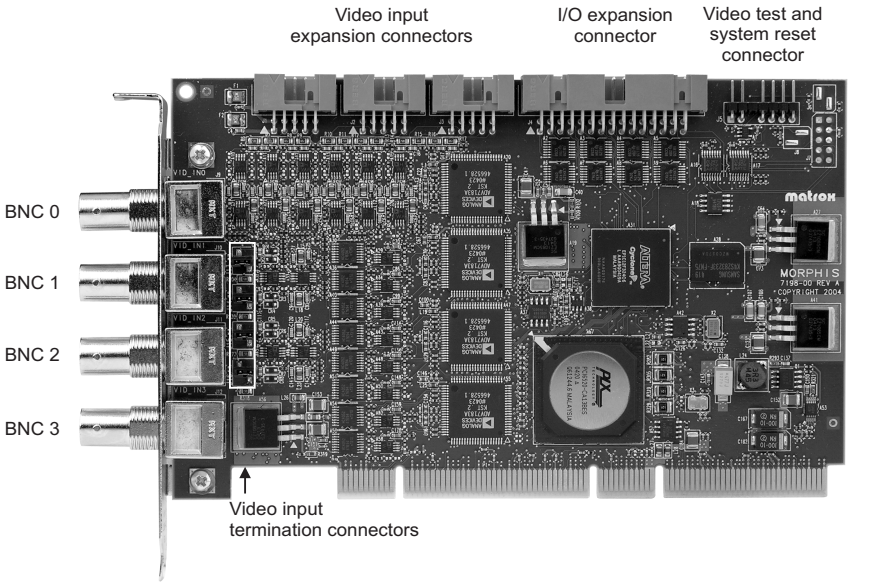
Matrox Morphis eDual/Dual Standard and eQuad/Quad boards

The Matrox Morphis eDual/Dual Standard and eQuad/Quad boards have several interface connectors. On their brackets, they have four BNC connectors for video input. On the top edge of the boards, there are three 10-pin connectors for video input from the Matrox Morphis expansion modules, and one 30-pin connector for I/O from the Matrox Morphis Video and I/O module. In addition, there is a video output connector for test purposes and two system reset connectors. Behind each BNC connector, there is a video input termination connector, which allows you to control the video input termination. In addition, on the Matrox Morphis eDual/Dual Standard, there is a 3-pin video/trigger selection connector behind BNC 2 and BNC 3, which establishes if its respective BNC is used for video input or trigger input.



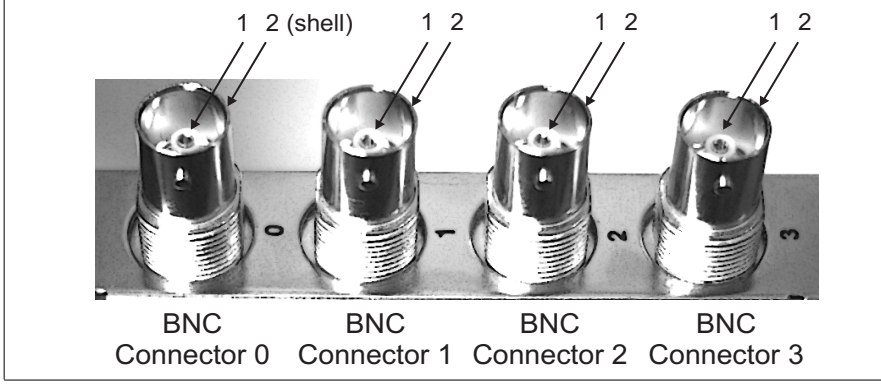
Matrox Morphis eDual/Dual Standard connectors*

*Although this is an image of Matrox Morphis Dual Standard, the connectors are the same for Matrox Morphis eDual Standard.



BNC connectors

The BNC connectors are standard, low profile, 75 Ohm impedance BNC connectors, used to receive CVBS and/or Y/C video input. The connectors' pin assignment is as follows:



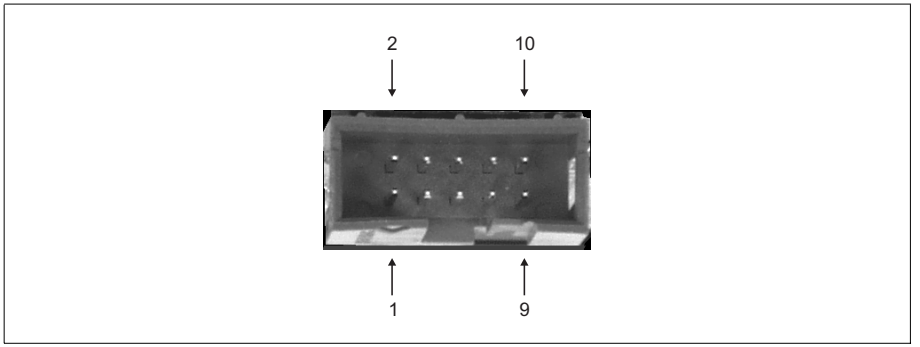
BNC connector	Pin	Hardware signal name	MIL constant for auxiliary signal[1]	Digitizer device number for auxiliary signal	Description
0	1	VID_IN0			CVBS video input 0 or the Y component of Y/C video input 0.
	2 (shell)	GND			Ground.
1	1	VID_IN1			CVBS video input 1 or the C component of Y/C video input 0.
	2 (shell)	GND			Ground.
2	1	VID_IN2 (or P0_TTL_TRIG_IN[2])[3]	M_AUX_IO16	M_DEV0	CVBS video input 2, the Y component of Y/C video input 1, or TTL auxiliary trigger input for acquisition path 0.
	2 (shell)	GND			Ground.
3	1	VID_IN3 (or P1_TTL_TRIG_IN[2])[3]	M_AUX_IO16	M_DEV1	CVBS video input 3, the C component of Y/C video input 1, or TTL auxiliary trigger input for acquisition path 1.
	2 (shell)	GND			Ground.

1. These MIL constants represent the signals as of MIL 10. The signals that were previously represented by M_HARDWARE_PORT0 became represented by M_AUX_IO16. For a complete list of changes between previous MIL versions and MIL 10, see MILMORPHISIOCONVERSIONTABLE within MIL Release Notes.
2. The status of auxiliary input signals exclusively dedicated for triggers cannot be inquired using MsysInquire() with M_IO_STATUS. If an inquire attempt is made, an error will be generated.
3. Trigger input pin should not be used at the same time as the equivalent trigger input pin on the I/O expansion connector.

You can use a standard video cable (available from your local electronic store) to interface with this connector.

Video input expansion connectors

The video input expansion connectors are standard, 0.1" spacing, 10-pin male connectors, used to interface video input from any of the Matrox Morphis expansion modules with the base board. The connector's pin assignment is as follows:



Pin	Signals of video input expansion connectors			Description
	J1	J2	J3	
1	+12V	+12V	+12V	Fused +12 Volt supply for Matrox Morphis modules.
2	+5V	+5V	+5V	Fused +5 Volt supply for Matrox Morphis modules.
3	VID_IN4	VID_IN8	VID_IN12	CVBS video input 4, 8, or 12, respectively, or the Y component of Y/C video input 2, 4, or 6, respectively.
4	GND	GND	GND	Ground.
5	VID_IN5	VID_IN9	VID_IN13	CVBS video input 5, 9, or 13, respectively, or the C component of Y/C video input 2, 4, or 6, respectively.
6	GND	GND	GND	Ground.
7	VID_IN6	VID_IN10	VID_IN14	CVBS video input 6, 10, or 14, respectively, or the Y component of Y/C video input 3, 5, or 7, respectively.
8	GND	GND	GND	Ground.
9	VID_IN7	VID_IN11	VID_IN15	CVBS video input 7, 11, or 15, respectively, or the C component of Y/C video input 3, 5, or 7, respectively.
10	GND	GND	GND	Ground.

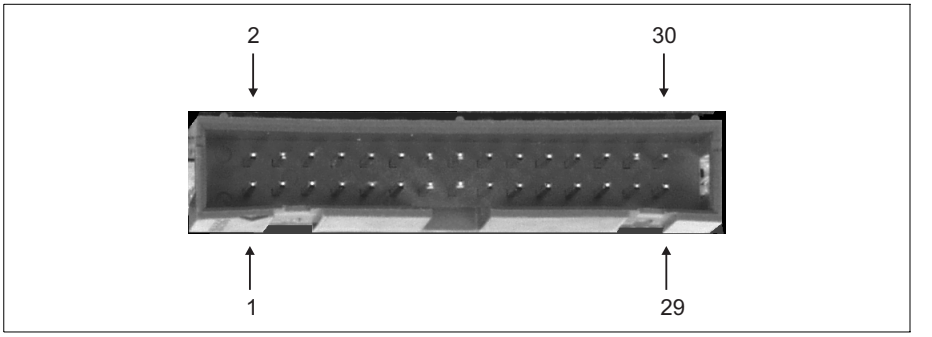
To interface this connector with a Matrox Morphis expansion module, the module includes a Matrox cable that has a standard 10-pin female connector at both ends.

For customers planning to build their own cable to interface with video input from another source, parts can be purchased from:

Manufacturer	3M
IDC Connector	3473-6610
Ribbon cable	3365/10

I/O expansion connector

The I/O expansion connector is a standard, 0.1" spacing, 30-pin male connector, used to transmit or receive auxiliary signals (trigger input or user input/output). It is also used by the UART to send and receive control signals to and from an external device. This connector is typically interfaced with the Matrox Morphis Video and I/O module. The I/O expansion connector's pin assignment is as follows:



Pin	Hardware signal name	MIL constant for auxiliary signal[1]	Digitizer device number for auxiliary signal[2]	Description
1	TTL_USER_IO_0	M_AUX_IO0	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 0 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT0).
2	TTL_USER_IO_1	M_AUX_IO1	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 1 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT1).
3	TTL_USER_IO_2	M_AUX_IO2	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 2 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT2).

Pin	Hardware signal name	MIL constant for auxiliary signal[1]	Digitizer device number for auxiliary signal[2]	Description
4	TTL_USER_IO_3	M_AUX_IO3	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 3 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT3).
5	GND			Ground.
6	GND			Ground.
7	TTL_USER_IO_5	M_AUX_IO5	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 5 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT5).
8	TTL_USER_IO_4	M_AUX_IO4	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 4 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT4).
9	TTL_USER_IO_7	M_AUX_IO7	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 7 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT7).
10	TTL_USER_IO_6	M_AUX_IO6	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 6 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT6).
11	GND			Ground.
12	GND			Ground.
13	TTL_USER_IO_8	M_AUX_IO8	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 8 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT8).
14	TTL_USER_IO_9	M_AUX_IO9	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 9 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT9).
15	TTL_USER_IO_10	M_AUX_IO10	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 10 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT10).
16	TTL_USER_IO_11	M_AUX_IO11	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 11 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT11).
17	GND			Ground.
18	GND			Ground.
19	TTL_USER_IO_13	M_AUX_IO13	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 13 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT13).
20	TTL_USER_IO_12	M_AUX_IO12	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 12 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT12).

Pin	Hardware signal name	MIL constant for auxiliary signal[1]	Digitizer device number for auxiliary signal[2]	Description
21	TTL_USER_IO_15	M_AUX_IO15	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 15 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT15).
22	TTL_USER_IO_14	M_AUX_IO14	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 14 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT14).
23	GND			Ground.
24	GND			Ground.
25	TTL_RxD			UART serial TTL input (receive data).
26	TTL_TxD			UART serial TTL output (transmit data).
27	TTL_CTS			UART CTS input (clear to send).
28	TTL_RTS			UART RTS output (ready to send).
29	P0_TTL_TRIG_IN[3]	M_AUX_IO16	M_DEV0	TTL auxiliary signal (input), for acquisition path 0, which supports trigger input.
30	P1_TTL_TRIG_IN[3]	M_AUX_IO16	M_DEV1	TTL auxiliary signal (input), for acquisition path 1, which supports trigger input.

1. These MIL constants represent the signals as of MIL 10. The signals that were previously represented by user-defined signal #n became represented by M_AUX_IOn (where the value of n remained the same between the constants). For a complete list of changes between previous MIL versions and MIL 10, see MIL-MORPHISIOCONVERSIONTABLE within MIL Release Notes.
2. Devices M_DEV2 and M_DEV3 are only supported on Matrox Morphis eQuad/Quad.
3. Trigger input pin should not be used at the same time as the equivalent trigger input pin on the BNC connectors

To interface this connector with the Matrox Morphis Video and I/O module, the module includes a Matrox cable that has a standard 30-pin female connector at both ends.

For customers planning to build their own cable to interface this connector with a custom board, parts can be purchased from:

Manufacturer	3M
IDC Connector	3419-6630
Ribbon cable	3365/30

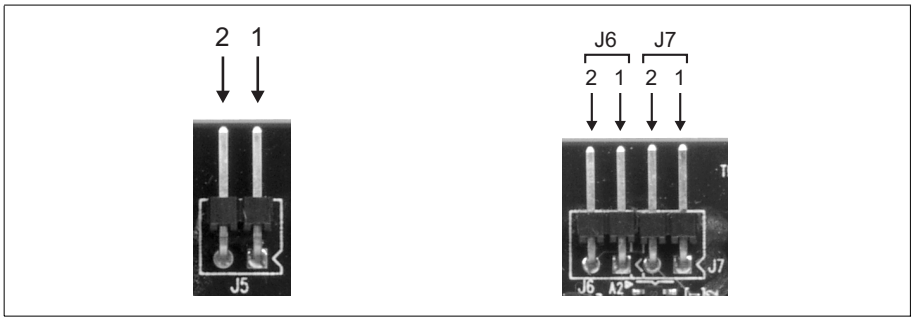
Video test and system reset connectors

Matrox Morphis eDual/Dual Standard has a video test connector and two system reset connectors, while Matrox Morphis eQuad/Quad has a single connector that encompasses this functionality. In both cases, the connectors are standard, right angle, 0.1" spacing, male connectors; you interface with them in the same way.

The video test pins are used to output the CVBS/monochrome video input, or the Y component of the Y/C video input that is routed to decoder 0. You can also interface with these pins through Video and I/O expansion connector 0 (DB-44) of the Matrox Morphis Video and I/O module.

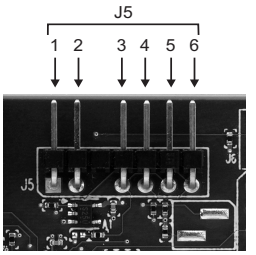
The system reset pins are used to reset the motherboard if the reset button is pressed or the Watchdog circuitry of Matrox Morphis detects abnormal Host inactivity.

The video test and system reset connectors' pin assignment for Matrox Morphis eDual/Dual Standard is as follows:



Connector	Pin	Signal	Description
J5	1	P0_VID_OUT	Video test output for acquisition path 0.
J5	2	GND	Video test ground.
J6	1	RESET_MB	Reset signal output (usually to motherboard).
J6	2	GND_MB	Motherboard active reset level (usually ground).
J7	1	RESET_BUTTON	Reset signal input (usually from Reset button).
J7	2	GND_MB	Motherboard active reset level (usually ground).

The video test and system reset connector's pin assignment for Matrox Morphis eQuad/Quad is as follows:



Connector	Pin	Signal	Description
J5	1	GND	Video test output for acquisition path 0.
J5	2	P0_VID_OUT	Video test ground.
J5	3	GND_MB	Motherboard active reset level (usually ground).
J5	4	RESET_MB	Reset signal output (usually to motherboard).
J5	5	GND_MB	Motherboard active reset level (usually ground).
J5	6	RESET_BUTTON	Reset signal input (usually from Reset button).

To build your own cable for the video test and system reset connectors, parts can be purchased from:

Manufacturer	FCI
Crimp-to-wire receptacle	76357-301 (discrete contact; wire size: 22-30 AWG)
Housing	65039-035 (2 positions) 65039-033 (4 positions)

Video/trigger selection connectors J17 and J18

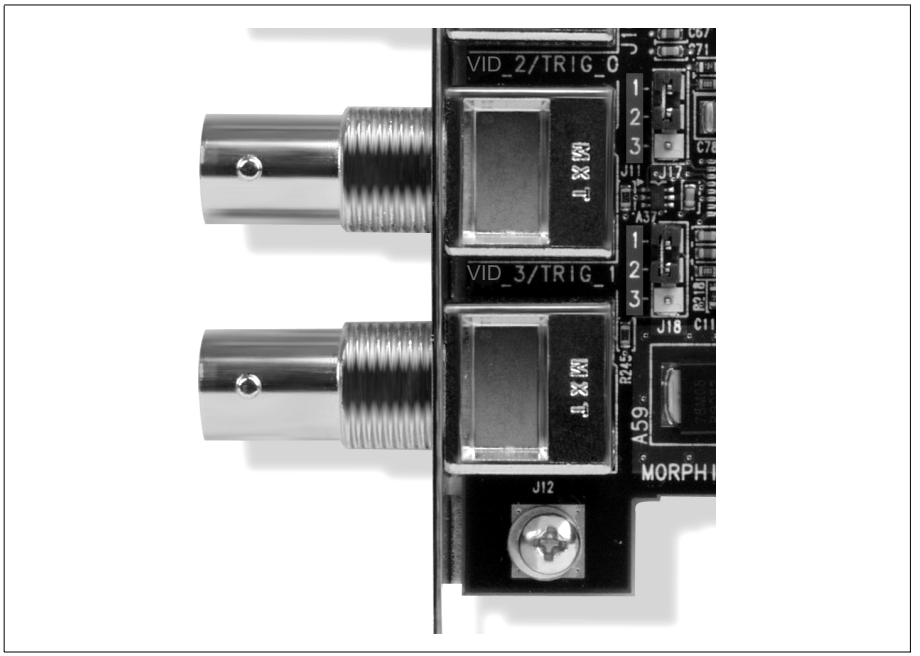
Trigger input through BNC 2 and BNC 3

On the Matrox Morphis eDual/Dual Standard board, BNC 2 and BNC 3 each support a TTL trigger input. The BNC connectors are set for video input data by default, but through the use of jumpers, the connectors can each be configured for trigger input.

Warning

If you connect a trigger input to the BNC connectors without appropriately installing the jumpers, you can cause damage to the board because the trigger operates at +5 V and video input operates at +1 V. Follow the instructions below to correctly install the jumpers.

1. Behind the BNC connector that must be configured to accept a trigger input, locate the 3-pin Video/trigger selection connector (J17 or J18):



2. Remove the jumper that is positioned across pins 1-2, as shown above, and replace it over pins 2-3. The pin numbers are clearly printed on the board itself.

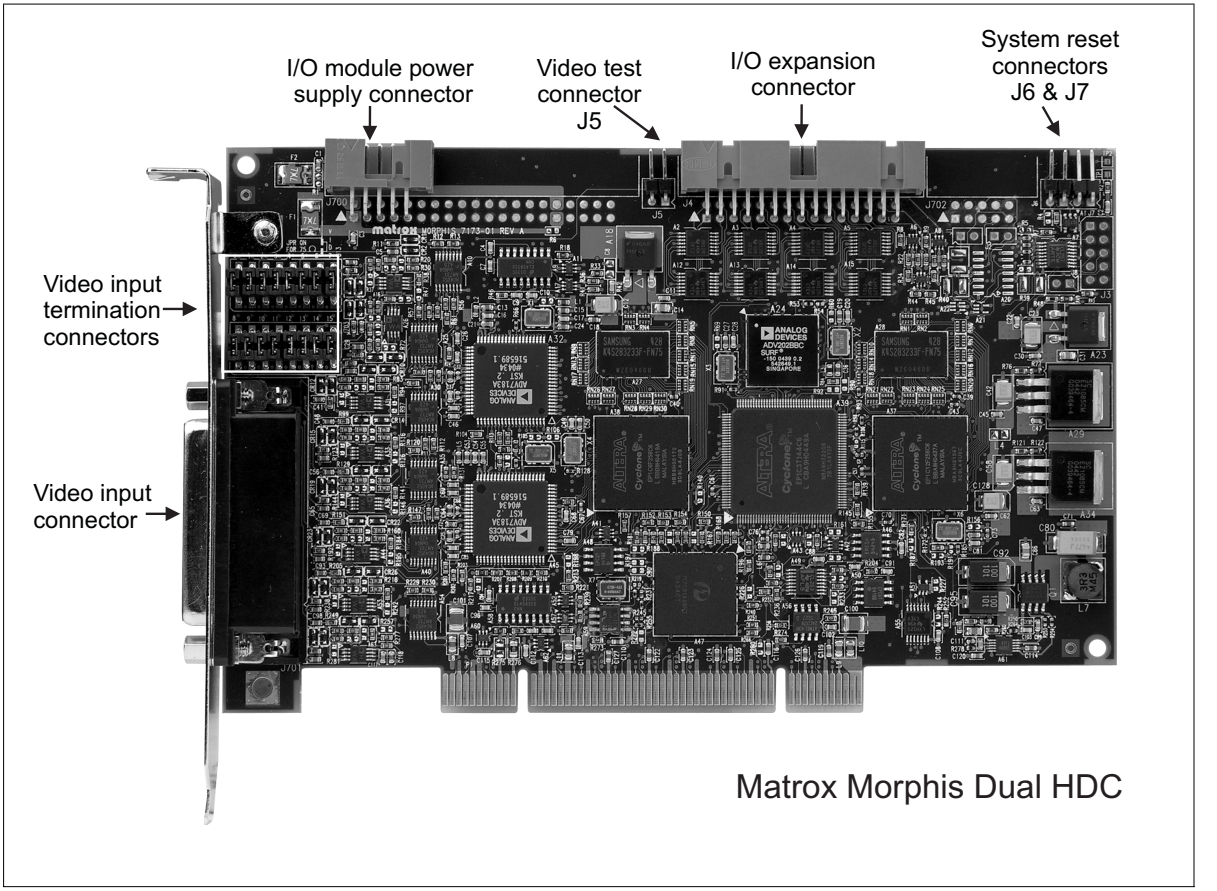
Video termination connectors

The video termination connectors are standard, 0.1" spacing, 2-pin male connectors that allow you to change the termination of their associated video input.

Jumper	Description
Installed	75 Ohm termination.
Not installed	High impedance (> 100 KOhms).

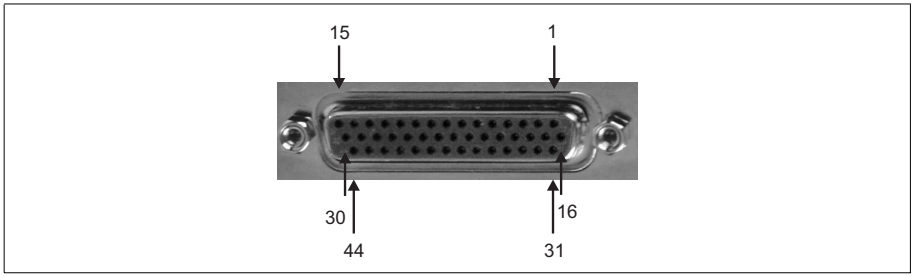
Matrox Morphis Dual HDC board

The Matrox Morphis Dual HDC base board has several interface connectors. On its bracket, it has a DB-44 connector for video input. On the top edge of the board, there is a 30-pin connector for I/O from the Matrox Morphis Video and I/O module and a 10-pin connector to supply power to the Matrox Morphis Video and I/O module if connected. In addition, there is a video output connector for test purposes and two system reset connectors. Adjacent to the video input connector, there is a video input termination connector for each possible video input, allowing control of its termination.



Video input connector

The video input connector is a high-density DB-44 female connector, used to receive video input signals. The connector's pin assignment is as follows.



Pin	Hardware signal name	MIL constant for auxiliary signal[1]	Digitizer device number for auxiliary signal	Description
1	VID_IN15			Analog video input 15 (CVBS15 or C7).
2	VID_IN7			Analog video input 7 (CVBS7 or C3).
3	GND			Ground.
4	GND			Ground.
5	GND			Ground.
6	P0_TTL_TRIG_IN[2]	M_AUX_IO16	M_DEV0	TTL auxiliary signal (input), for acquisition path 0, which supports trigger input.
7	VID_IN14			Analog video input 14 (CVBS14 or Y7).
8	GND			Ground.
9	VID_IN5			Analog video input 5 (CVBS5 or C2).
10	GND			Ground.
11	VID_IN13			Analog video input 13 (CVBS13 or C6).
12	NC			Not connected.
13	VID_IN4			Analog video input 4 (CVBS4 or Y2).
14	GND			Ground.
15	VID_IN12			Analog video input 12 (CVBS12 or Y6).
16	GND			Ground.
17	GND			Ground.
18	GND			Ground.
19	VID_IN0			Analog video input 0 (CVBS0 or Y0).
20	VID_IN1			Analog video input 1 (CVBS1 or C0).
21	GND			Ground.

Pin	Hardware signal name	MIL constant for auxiliary signal[1]	Digitizer device number for auxiliary signal	Description
22	GND			Ground.
23	VID_IN6			Analog video input 6 (CVBS6 or Y3).
24	P1_TTL_TRIG_IN[2]	M_AUX_IO16	M_DEV1	TTL auxiliary signal (input), for acquisition path 1, which supports trigger input.
25	GND			Ground.
26	GND			Ground.
27	GND			Ground.
28	NC			Not connected.
29	GND			Ground.
30	GND			Ground.
31	NC			Not connected.
32	GND			Ground.
33	VID_IN8			Analog video input 8 (CVBS8 or Y4).
34	GND			Ground.
35	VID_IN9			Analog video input 9 (CVBS9 or C4).
36	NC			Not connected.
37	NC			Not connected.
38	NC			Not connected.
39	NC			Not connected.
40	VID_IN2			Analog video input 2 (CVBS2 or Y1).
41	VID_IN3			Analog video input 3 (CVBS3 or C1).
42	GND			Ground.
43	VID_IN10			Analog video input 10 (CVBS10 or Y5).
44	VID_IN11			Analog video input 11 (CVBS11 or C5).

1. These MIL constants represent the signals as of MIL 10. The signals that were previously represented by M_HARDWARE_PORT0 became represented by M_AUX_IO16. For a complete list of changes between previous MIL versions and MIL 10, see MILMORPHISIOCONVERSIONTABLE within MIL Release Notes.
2. The status of auxiliary input signals exclusively dedicated for triggers cannot be inquired using MsysInquire() with M_IO_STATUS. If an inquire attempt is made, an error will be generated.

You can use the optional Matrox HD-44M-18BNC cable to interface with this connector. The cable has a high density D-Subminiature 44-pin male connector at one end, and 18 BNC female type connectors at the other end.

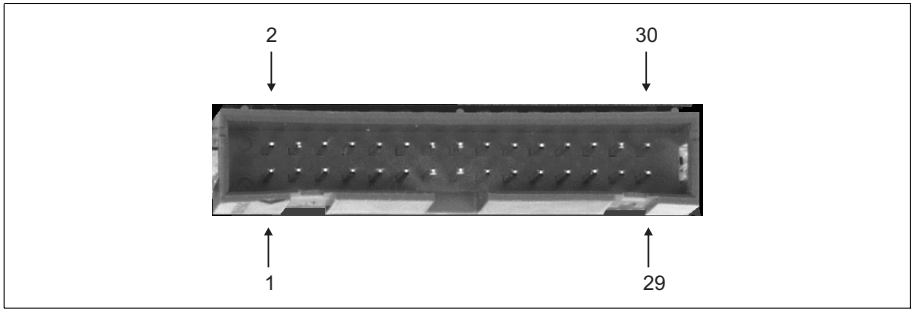
To build your own cable to interface with this connector, you can purchase the following parts:

Manufacturer:	NorComp, Inc.
Connector:	180-044-102-031
Backshell:	970-025-010-011

These parts can be purchased from third parties such as Digi-Key Corporation (www.digikey.com).

I/O expansion connector

The I/O expansion connector is a standard, 0.1" spacing, 30-pin male connector, used to transmit or receive auxiliary signals (trigger input or user input/output). It is also used by the UART to send and receive control signals to and from an external device. This connector is typically interfaced with the Matrox Morphis Video and I/O module. The I/O expansion connector's pin assignment is as follows:



Pin	Signal	MIL constant for auxiliary signal[1]	Digitizer device number for auxiliary signal	Description
1	TTL_USER_IO_0	M_AUX_IO0	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 0, shared between all acquisition paths for user input or user output (M_USER_BIT0).
2	TTL_USER_IO_1	M_AUX_IO1	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 1, shared between all acquisition paths for user input or user output (M_USER_BIT1).
3	TTL_USER_IO_2	M_AUX_IO2	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 2, shared between all acquisition paths for user input or user output (M_USER_BIT2).
4	TTL_USER_IO_3	M_AUX_IO3	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 3, shared between all acquisition paths for user input or user output (M_USER_BIT3).
5	GND			Ground.
6	GND			Ground.
7	TTL_USER_IO_5	M_AUX_IO5	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 5, shared between all acquisition paths for user input or user output (M_USER_BIT5).
8	TTL_USER_IO_4	M_AUX_IO4	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 4, shared between all acquisition paths for user input or user output (M_USER_BIT4).
9	TTL_USER_IO_7	M_AUX_IO7	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 7, shared between all acquisition paths for user input or user output (M_USER_BIT7).
10	TTL_USER_IO_6	M_AUX_IO6	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 6, shared between all acquisition paths for user input or user output (M_USER_BIT6).
11	GND			Ground.
12	GND			Ground.
13	TTL_USER_IO_8	M_AUX_IO8	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 8, shared between all acquisition paths for user input or user output (M_USER_BIT8).
14	TTL_USER_IO_9	M_AUX_IO9	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 9, shared between all acquisition paths for user input or user output (M_USER_BIT9).
15	TTL_USER_IO_10	M_AUX_IO10	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 10, shared between all acquisition paths for user input or user output (M_USER_BIT10).
16	TTL_USER_IO_11	M_AUX_IO11	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 11, shared between all acquisition paths for user input or user output (M_USER_BIT11).
17	GND			Ground.
18	GND			Ground.
19	TTL_USER_IO_13	M_AUX_IO13	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 13, shared between all acquisition paths for user input or user output (M_USER_BIT13).
20	TTL_USER_IO_12	M_AUX_IO12	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 12, shared between all acquisition paths for user input or user output (M_USER_BIT12).
21	TTL_USER_IO_15	M_AUX_IO15	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 15, shared between all acquisition paths for user input or user output (M_USER_BIT15).

Pin	Signal	MIL constant for auxiliary signal[1]	Digitizer device number for auxiliary signal	Description
22	TTL_USER_IO_14	M_AUX_IO14	M_DEV0/M_DEV1/ M_DEV2/M_DEV3	TTL auxiliary signal 14, shared between all acquisition paths for user input or user output (M_USER_BIT14).
23	GND			Ground.
24	GND			Ground.
25	TTL_RxD			UART serial TTL input (receive data).
26	TTL_TxD			UART serial TTL output (transmit data).
27	TTL_CTS			UART CTS input (clear to send).
28	TTL_RTS			UART RTS output (ready to send).
29	P0_TTL_TRIG_IN	M_AUX_IO16	M_DEV0	TTL auxiliary signal (input), for acquisition path 0, which supports trigger input.
30	P1_TTL_TRIG_IN	M_AUX_IO16	M_DEV1	TTL auxiliary signal (input), for acquisition path 1, which supports trigger input.

1. These MIL constants represent the signals as of MIL 10. The signals that were previously represented by user-defined signal #n became represented by M_AUX_IOn (where the value of n remained the same between the constants). For a complete list of changes between previous MIL versions and MIL 10, see MIL-MORPHISIOCONVERSIONTABLE within MIL Release Notes.

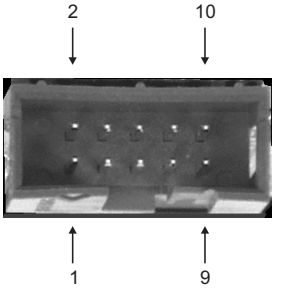
To interface this connector with the Matrox Morphis Video and I/O module, the module includes a Matrox cable that has a standard 30-pin female connector at both ends.

For customers planning to build their own cable to interface this connector with a custom board, parts can be purchased from:

Manufacturer	3M
IDC Connector	3419-6630
Ribbon cable	3365/30

I/O module power supply connector

The I/O module power supply connector is a standard, 0.1" spacing, 10-pin male connector, used to provide power to the Matrox Morphis Video and I/O module if connected. The connector's pin assignment is as follows:



Pin	Signal	Description
1	+12V	+12 Volt supply for Matrox Morphis modules.
2	+5V	+5 Volt supply for Matrox Morphis modules.
3	reserved	Reserved.
4	GND	Ground.
5	reserved	Reserved.
6	GND	Ground.
7	reserved	Reserved.
8	GND	Ground.
9	reserved	Reserved.
10	GND	Ground.

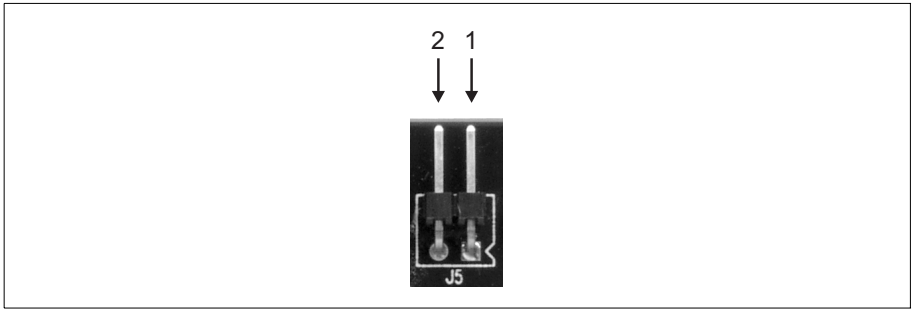
To interface this connector with a Matrox Morphis expansion module, the module includes a Matrox cable that has a standard 10-pin female connector at both ends.

For customers planning to build their own cable to interface with video input from another source, parts can be purchased from:

Manufacturer	3M
IDC Connector	3473-6610
Ribbon cable	3365/10

Video test connector

The video test connector is a standard, right-angle, 0.1" spacing, 2-pin male connector, used to output any of the CVBS video inputs, or the Y component of any Y/C video inputs, for test purposes. You can interface this connector with the Matrox Morphis Video and I/O module and access the video signal from the Video and I/O expansion connector 0 (DB-44). The video test connector's pin assignment is as follows:



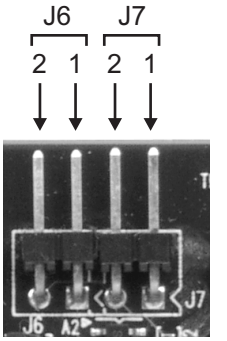
Pin	Signal	Description
1	P0_VID_OUT	Video test output for acquisition path 0.
2	GND	Video test ground.

To build your own cable, parts can be purchased from:

Manufacturer	FCI
Crimp-to-wire receptacle	76357-301 (discrete contact; wire size: 22-30 AWG)
Housing	65039-035

System reset connectors

The two system reset connectors are standard, 0.1" spacing, 2-pin male connectors, used to reset the motherboard if the reset button is pressed or the Watchdog circuitry of Matrox Morphis detects abnormal Host inactivity. The system reset connectors' pin assignment are as follows:



Connector	Pin	Signal	Description
J6	1	RESET_MB	Reset signal output (usually to motherboard).
J6	2	GND_MB	Motherboard active reset level (usually ground).
J7	1	RESET_BUTTON	Reset signal input (usually from Reset button).
J7	2	GND_MB	Motherboard active reset level (usually ground).

To build your own cable, parts can be purchased from:

Manufacturer	FCI
Crimp-to-wire receptacle	76357-301 (discrete contact; wire size: 22-30 AWG)
Housing	65039-035 (2 positions) 65039-033 (4 positions)

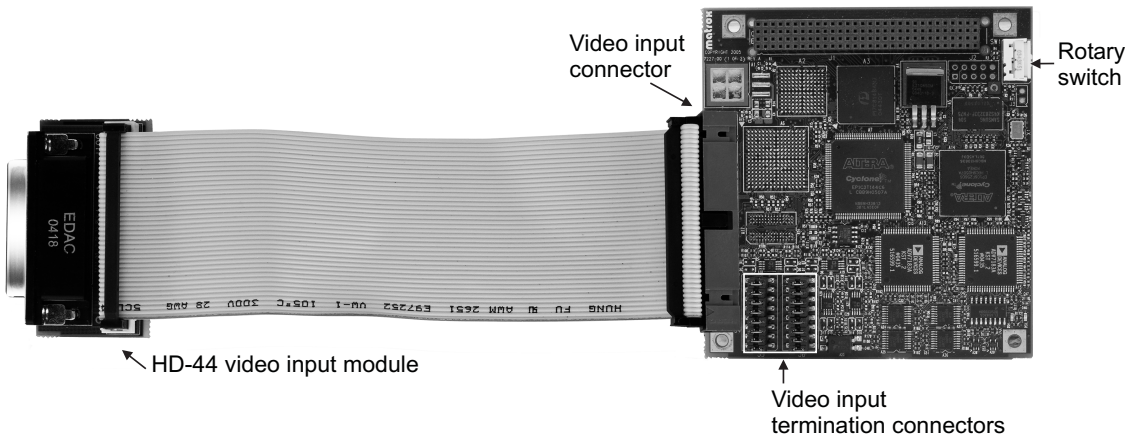
Video termination connectors

The video termination connectors are standard, 0.1" spacing, 2-pin male connectors that allow you to change the termination of their associated video input.

Jumper	Description
Installed	75 Ohm termination.
Not installed	High impedance (> 100 KOhms).

Matrox Morphis Dual PC/104-*Plus* board

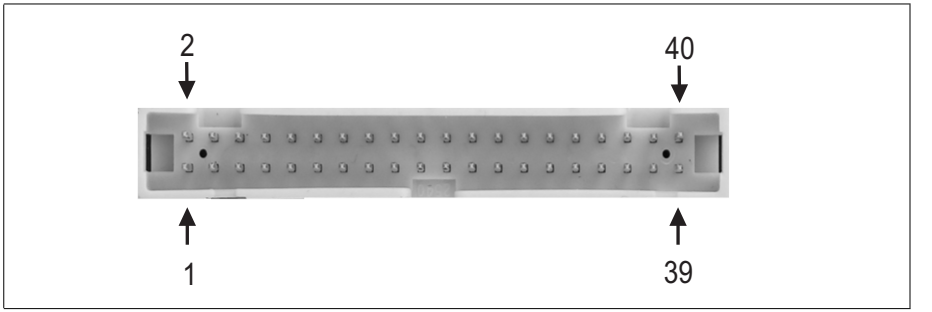
The Matrox Morphis Dual PC/104-*Plus* board has several interface connectors. On the top side of the board, there is a 40-pin video input connector. This input can be connected to the supplied HD-44 video input module with the 40-pin flat ribbon cable. Behind the video input connector, there are sixteen video input termination connectors for each possible video input, allowing control of their termination.



Matrox Morphis Dual PC/104-Plus

Video input connector

The video input connector is a standard, 0.1" spacing, 40-pin male connector, used to receive video input signals. The connector's pin assignment is as follows.



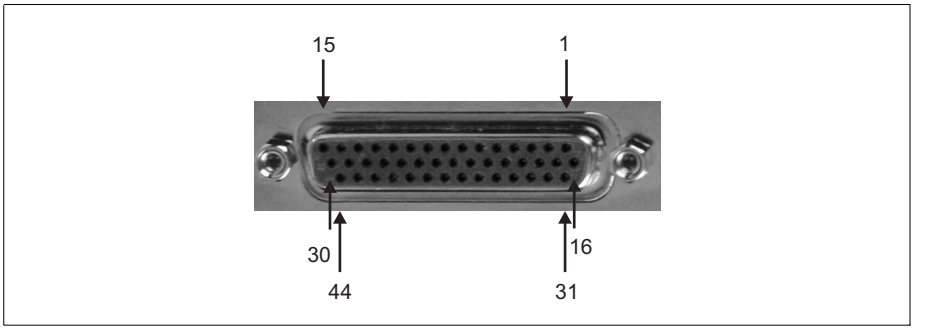
Pin	Signal	MIL constant for auxiliary signal[1]	Digitizer device number for auxilliary signal	Description
1	VID_IN_0			Analog video input 0 (CVBS 0 or Y0).
2	GND			Ground.
3	VID_IN_1			Analog video input 1 (CVBS 1or C0).
4	GND			Ground.
5	VID_IN_2			Analog video input 2 (CVBS 2 or Y1).
6	GND			Ground.
7	VID_IN_3			Analog video input 3 (CVBS 3 or C1).
8	GND			Ground.
9+, 29-	P1_OPTO_TRIG_IN	M_AUX_IO16	M_DEV1	Opto-isolated auxiliary signal (input), for acquisition path 1, which supports trigger input.
10	GND			Ground.
11	VID_IN_4			Analog video input 4 (CVBS 4 or Y2).
12	GND			Ground.
13	VID_IN_5			Analog video input 5 (CVBS 5 or C2).
14	GND			Ground.
15	VID_IN_6			Analog video input 6 (CVBS 6 or Y3).
16	GND			Ground.
17	VID_IN_7			Analog video input 7 (CVBS 7 or C3).
18	GND			Ground.
19	P0_TTL_TRIG_IN	M_AUX_IO16	M_DEV0	TTL auxiliary signal (input), for acquisition path 0, which supports trigger input.

Pin	Signal	MIL constant for auxiliary signal[1]	Digitizer device number for auxilliary signal	Description
20	GND			Ground.
21	VID_IN_8			Analog video input 8 (CVBS 8 or Y4).
22	GND			Ground.
23	VID_IN_9			Analog video input 9 (CVBS 9 or C4).
24	GND			Ground.
25	VID_IN_10			Analog video input 10 (CVBS 10 or Y5).
26	GND			Ground.
27	VID_IN_11			Analog video input 11 (CVBS 11 or C5).
28	GND			Ground.
30	GND			Ground.
31	VID_IN_12			Analog video input 12 (CVBS 12 or Y6).
32	GND			Ground.
33	VID_IN_13			Analog video input 13 (CVBS 13 or C6).
34	GND			Ground.
35	VID_IN_14			Analog video input 14 (CVBS 14 or Y7).
36	GND			Ground.
37	VID_IN_15			Analog video input 15 (CVBS 15 or C15).
38	GND			Ground.
39	12V			+12 volt power, up to 750 mA.
40	GND			Ground.

1. These MIL constants represent the signals as of MIL 10. The signals that were previously represented by M_HARDWARE_PORT0 became represented by M_AUX_IO16. For a complete list of changes between previous MIL versions and MIL 10, see MILMORPHISIOCONVERSIONTABLE within MIL Release Notes.

Video input connector on the HD-44 video input module

The video input connector on the HD-44 video input module is a high-density 44-pin female connector, used to receive video input signals. The connector's pin assignment is as follows.



Pin	Signal	MIL constant for auxiliary signal[1]	Digitizer device number for auxilliary signal	Description
1	12V			+12 volt power, up to 750 mA total with pin 16.
2	VID_IN11			Analog video input 11 (CVBS 11 or C5).
3	GND			Ground.
4	GND			Ground.
5	GND			Ground.
6	NC			No connect.
7	VID_IN13			Analog video input 13 (CVBS 13 or C6).
8	GND			Ground.
9	VID_IN14			Analog video input 14 (CVBS 14 or Y7).
10	GND			Ground.
11	VID_IN4			Analog video input 4 (CVBS 4 or Y2).
12	P0_TTL_TRIG_IN	M_AUX_IO16	M_DEV0	TTL auxiliary signal (input), for acquisition path 0, which supports trigger input.
13	VID_IN2			Analog video input 2 (CVBS 2 or Y1).
14	GND			Ground.
15	VID_IN0			Analog video input 0 (CVBS 0 or Y0).
16	12V			+12 volt power, up to 750 mA total with pin 1.
17	GND			Ground.
18	GND			Ground.
19	VID_IN9			Analog video input 9 (CVBS 9 or C4).

Pin	Signal	MIL constant for auxiliary signal[1]	Digitizer device number for auxilliary signal	Description
20	VID_IN8			Analog video input 8 (CVBS 8 or Y4).
21	NC			No connect.
22	NC			No connect.
23	VID_IN7			Analog video input 7 (CVBS 7 or C3).
24	GND			Ground.
25	GND			Ground.
26	GND			Ground.
27	GND			Ground.
28	GND			Ground.
29	GND			Ground.
30	GND			Ground.
31	GND			Ground.
32	VID_IN15			Analog video input 15 (CVBS 15 or C15).
33	VID_IN10			Analog video input 10 (CVBS 10 or Y5).
34	GND			Ground.
35	P1_OPTO_TRIG_IN	M_AUX_IO16	M_DEV1	Opto-isolated auxiliary signal (input), for acquisition path 1, which supports trigger input.
36	NC			No connect.
37	NC			No connect.
38	VID_IN12			Analog video input 12 (CVBS 12 or Y6).
39	NC			No connect.
40	VID_IN6			Analog video input 6 (CVBS 6 or Y3).
41	VID_IN5			Analog video input 5 (CVBS 5 or C2).
42	GND			Ground.
43	VID_IN3			Analog video input 3 (CVBS 3 or C1).
44	VID_IN1			Analog video input 1 (CVBS 1or C0).

1. These MIL constants represent the signals as of MIL 10. The signals that were previously represented by M_HARDWARE_PORT0 became represented by M_AUX_IO16. For a complete list of changes between previous MIL versions and MIL 10, see MILMORPHISIOCONVERSIONTABLE within MIL Release Notes.

You can use the optional Matrox HD-44M-18BNC+ cable to interface with this connector. The cable has a high density D-Subminiature 44-pin male connector at one end, and 18 BNC female type connectors at the other end.

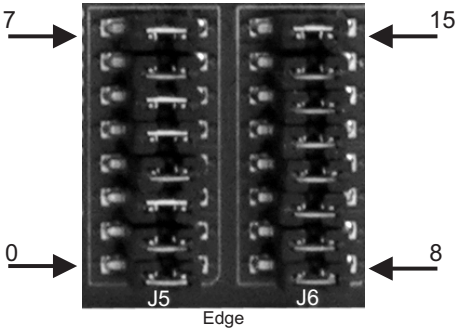
To build your own cable, you can purchase the following part:

Manufacturer:	NorComp, Inc.
Connector:	180-044-102-031
Backshell:	970-025-010-011

This part can be purchased from third parties such as Digi-Key corporation (www.digikey.com).

Video termination connectors

The video termination connectors are standard, 0.1" spacing, 2-pin male connectors that allow you to change the termination of their associated video input.



Termination	Signal	Description
0	CH_0	Termination connector for channel 0.
1	CH_1	Termination connector for channel 1.
2	CH_2	Termination connector for channel 2.
3	CH_3	Termination connector for channel 3.
4	CH_4	Termination connector for channel 4.
5	CH_5	Termination connector for channel 5.
6	CH_6	Termination connector for channel 6.
7	CH_7	Termination connector for channel 7.
8	CH_8	Termination connector for channel 8.
9	CH_9	Termination connector for channel 9.
10	CH_10	Termination connector for channel 10.

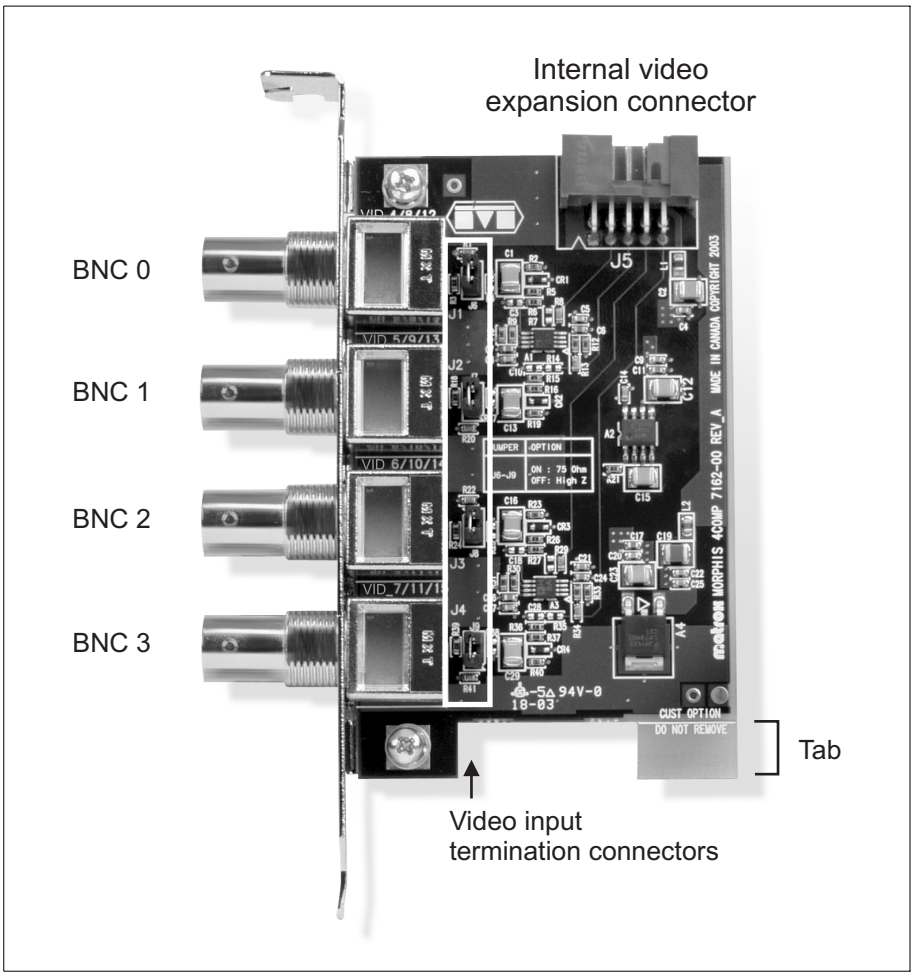
Termination	Signal	Description
11	CH_11	Termination connector for channel 11.
12	CH_12	Termination connector for channel 12.
13	CH_13	Termination connector for channel 13.
14	CH_14	Termination connector for channel 14.
15	CH_15	Termination connector for channel 15.

Jumper	Description
Installed	75 Ohm termination.
Not installed	High impedance (> 100 KOhms).

Connectors of the expansion modules

Matrox Morphis Video Input module

The Matrox Morphis Video Input modules have four BNC connectors on their bracket to receive CVBS and/or Y/C video input; these connectors are the same as those used on the base board. The module also has an internal video expansion connector, which interfaces with a video input expansion connector on the base board. In addition, behind each BNC connector, there is a video input termination connector, which allows you to control the video input termination.



BNC connectors

The BNC connectors are the same as those on the base board. The BNC connectors are used to receive CVBS and/or Y/C video input. Their pin assignment depends on the video input expansion connector on the base board to which the module is connected. The connectors' pin assignment is as follows:

BNC connector	Pin	Signals of the Video Input modules			Description
		Connected to J1	Connected to J2	Connected to J3	
0	1	VID_IN4	VID_IN8	VID_IN12	CVBS video input 4, 8, or 12, respectively, or the Y component of Y/C video input 2, 4, or 6, respectively.
	2 (shell)	GND	GND	GND	Ground.
1	1	VID_IN5	VID_IN9	VID_IN13	CVBS video input 5, 9, or 13, respectively, or the C component of Y/C video input 2, 4, or 6, respectively.
	2 (shell)	GND	GND	GND	Ground.
2	1	VID_IN6	VID_IN10	VID_IN14	CVBS video input 6, 10, or 14, respectively, or the Y component of Y/C video input 3, 5, or 7, respectively.
	2 (shell)	GND	GND	GND	Ground.
3	1	VID_IN7	VID_IN11	VID_IN15	CVBS video input 7, 11, or 15, respectively, or the C component of Y/C video input 3, 5, or 7, respectively.
	2 (shell)	GND	GND	GND	Ground.

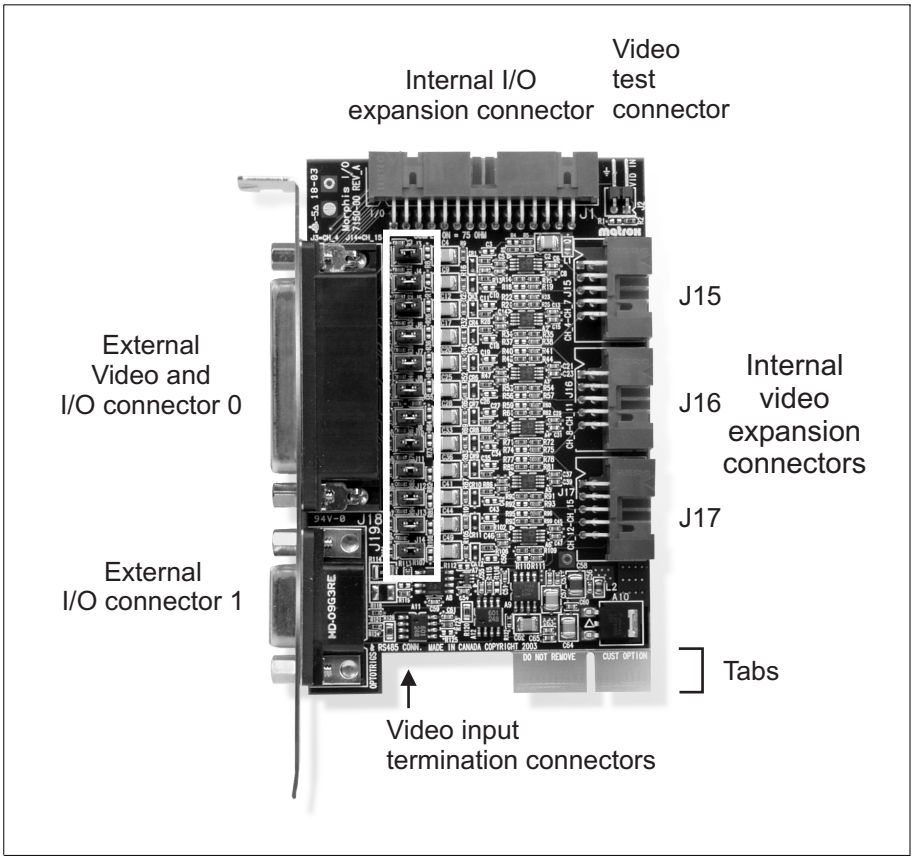
Video termination connectors

The video termination connectors are standard, 0.1" spacing, 2-pin male connectors that allow you to change the termination of their associated video input.

Jumper	Description
Installed	75 Ohm termination.
Not installed	High impedance (> 100 KOhms).

Matrox Morphis Video and I/O module

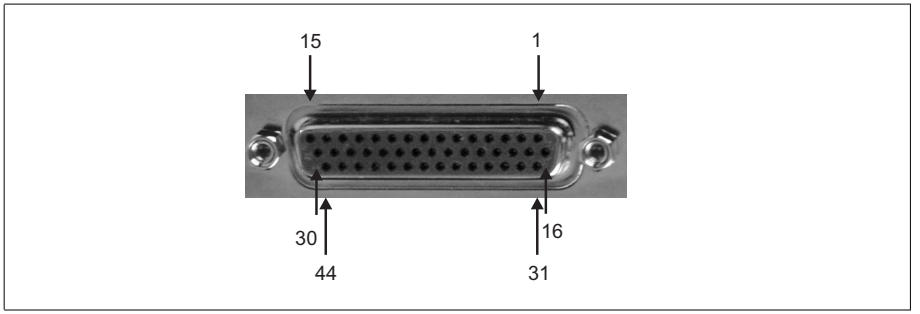
The Matrox Morphis Video and I/O module has two connectors on its bracket: external Video and I/O connector 0 (HD-44) and external I/O connector 1 (DB-9*). The module also has five internal connectors: 3 video expansion connectors (which interface with the video input expansion connectors on the base board), an I/O expansion connector (which interfaces with the I/O expansion connector on the base board), and a video test connector (which interfaces with the video test connector on the base board). In addition, behind Video and I/O connector 0, there is a video input termination connector for each possible video input, allowing control of its termination.



*. More accurately known as DE-9.

External Video and I/O connector 0

External Video and I/O connector 0 is a high-density DB-44 female connector, used to receive video signals, transmit video test output (acquisition path 0 only), and transmit or receive auxiliary signals (trigger input and user input/output). The connector's pin assignment is as follows:



Pin	Hardware signal name	MIL constant for auxiliary signal[1]	Description
1	TTL_USER_IO_15	M_AUX_IO15	TTL auxiliary signal 15 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT15).
2	VID_IN15		Analog video input 15 (CVBS15 or C7).
3	GND		Ground.
4	GND		Ground.
5	GND		Ground.
6	TTL_USER_IO_9	M_AUX_IO9	TTL auxiliary signal 9 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT9).
7	TTL_USER_IO_8	M_AUX_IO8	TTL auxiliary signal 8 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT8).
8	TTL_USER_IO_5	M_AUX_IO5	TTL auxiliary signal 5 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT5).
9	TTL_USER_IO_2	M_AUX_IO2	TTL auxiliary signal 2 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT2).
10	GND		Ground.
11	VID_IN8		Analog video input 8 (CVBS8 or Y4).
12	TTL_USER_IO_0	M_AUX_IO0	TTL auxiliary signal 0 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT0).
13	VID_IN6		Analog video input 6 (CVBS6 or Y3).
14	GND		Ground.
15	VID_IN4		Analog video input 4 (CVBS4 or Y2).

Pin	Hardware signal name	MIL constant for auxiliary signal[1]	Description
16	TTL_USER_IO_14	M_AUX_IO14	TTL auxiliary signal 14 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT14).
17	GND		Ground.
18	GND		Ground.
19	VID_IN13		Analog video input 13 (CVBS13 or C6).
20	VID_IN12		Analog video input 12 (CVBS12 or Y6).
21	TTL_USER_IO_13	M_AUX_IO13	TTL auxiliary signal 13 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT13).
22	TTL_USER_IO_10	M_AUX_IO10	TTL auxiliary signal 10 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT10).
23	VID_IN11		Analog video input 11 (CVBS11 or C5).
24	TTL_USER_IO_4	M_AUX_IO4	TTL auxiliary signal 4 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT4).
25	GND		Ground.
26	GND		Ground.
27	GND		Ground.
28	TTL_USER_IO_1	M_AUX_IO1	TTL auxiliary signal 1 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT1).
29	GND		Ground.
30	GND		Ground.
31	TTL_USER_IO_12	M_AUX_IO12	TTL auxiliary signal 12 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT12).
32	TTL_USER_IO_11	M_AUX_IO11	TTL auxiliary signal 11 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT11).
33	VID_IN14		Analog video input 14 (CVBS14 or Y7).
34	GND		Ground.
35	P0_VID_OUT		Video test output for acquisition path 0.
36	GND		Ground.
37	TTL_USER_IO_7	M_AUX_IO7	TTL auxiliary signal 7 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT7).
38	TTL_USER_IO_6	M_AUX_IO6	TTL auxiliary signal 6 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT6).
39	TTL_USER_IO_3	M_AUX_IO3	TTL auxiliary signal 3 (input/output), shared between all acquisition paths for user input or user output (M_USER_BIT3).
40	VID_IN10		Analog video input 10 (CVBS10 or Y5).
41	VID_IN9		Analog video input 9 (CVBS9 or C4).

Pin	Hardware signal name	MIL constant for auxiliary signal[1]	Description
42	GND		Ground.
43	VID_IN7		Analog video input 7 (CVBS7 or C3).
44	VID_IN5		Analog video input 5 (CVBS5 or C2).

1. These MIL constants represent the signals as of MIL 10. The signals that were previously represented using user-defined signal #n became represented by M_AUX_IOn (where the value of n remained the same between the constants). For a complete list of changes between previous MIL versions and MIL 10, see MIL-MORPHISIOCONVERSIONTABLE within MIL Release Notes.

You can use the optional Matrox cable DH44-TO-13BNC/O to interface with this connector. The cable has a high density D-Subminiature 44-pin male connector at one end, and 13 BNC male type connectors and 18 open-ended wires at the other end.

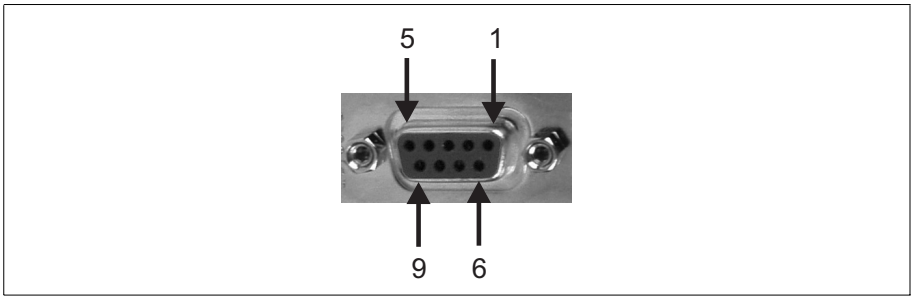
To build your own cable, you can purchase the following part:

Manufacturer:	NorComp, Inc.
Connector:	180-044-102-031
Backshell:	970-025-010-011

This part can be purchased from third parties such as Digi-Key Corporation (www.digikey.com).

External I/O connector 1

External I/O connector 1 is a standard DB-9 female connector, used to receive auxiliary signals (trigger input) and connect to an RS-485 two-wire multi-drop network. The connector's pin assignment is as follows:



Pin	Hardware signal name	MIL constant for auxiliary signal[1]	Digitizer device number for auxiliary signal	Description
1+,2-	P1_OPTO_TRIG_IN[2]	M_AUX_IO16	M_DEV1	Opto-isolated auxiliary signal (input), for acquisition path 1, which supports trigger input.
3+,7-	P0_OPTO_TRIG_IN[2]	M_AUX_IO16	M_DEV0	Opto-isolated auxiliary signal (input), for acquisition path 0, which supports trigger input.
4	RS485_TRxD+			RS-485 bi-directional serial port (non-inverting terminal).
5	RS485_GNDREF			RS-485 ground reference.
6	GND			Ground.
8	GND			Ground.
9	RS485_TRxD-			RS-485 bi-directional serial port (inverting terminal).

1. These MIL constants represent the signals as of MIL 10. The signals that were previously represented by M_HARDWARE_PORT0 became represented by M_AUX_IO16. For a complete list of changes between previous MIL versions and MIL 10, see MILMORPHISIOCONVERSIONTABLE within MIL Release Notes.
2. The status of auxiliary input signals exclusively dedicated for triggers cannot be inquired using MsysInquire() with M_IO_STATUS. If an inquire attempt is made, an error will be generated.

To build your own cable, you can purchase the following part:

Manufacturer:	NorComp, Inc.
Connector:	172-E09-102-031
Backshell:	970-009-010-011

This part can be purchased from third parties such as Digi-Key Corporation (www.digikey.com).

Video termination connectors

The video termination connectors are standard, 0.1" spacing, 2-pin male connectors that allow you to change the termination of their associated video input.

Jumper	Description
Installed	75 Ohm termination.
Not installed	High impedance (> 100 KOhms).

Appendix C: Listing of Matrox Morphis boards

This appendix lists specific versions and revisions of the Matrox Morphis boards.

Major revisions of Matrox Morphis

Board	PCB#/ VER.	*Description*
Matrox Morphis Dual Standard board (MOR/2VD/84*)	7142-00 rev. A	• Original version.
	7142-01 rev. A	• Added support for Y/C video format. • Added EOC flag for JPEG2000 compression.
	7142-02 rev. A	• Added video signal clamping on 16 channels. • Faster JPEG2000 CODEC. • Installed low power video decoder.
	7142-0201 rev. A	• Fixed BNC connectors soldering issue.
	7142-03 rev. A/302	• Separated JPEG2000 CODEC core voltage from global voltage supply for increased reliability. • Applied assembly optimizations.
	Y7142-03 rev. A/300	• Separated JPEG2000 CODEC core voltage from global voltage supply for increased reliability. • Applied assembly optimizations. • RoHS compliant.
Matrox Morphis Dual HDC board (MOR/2VD/HD/84*)	7173-00 rev. A	• Original version.
	7173-00 rev. B	• Modified copper plane to avoid possible short-circuit between ground and analog power planes when installing PCI bracket.
	7173-01 rev. A/101	• Added video signal clamping on 16 channels. • Added EOC flag for JPEG2000 compression. • Faster JPEG2000 CODEC. • Separated JPEG2000 CODEC core voltage from global voltage supply for increased reliability. • Installed low-power video decoder. • Applied assembly optimizations.

Board	PCB#/ VER.	*Description*
	Y7173-01 rev. A/100	• Added video signal clamping on 16 channels. • Added EOC flag for JPEG2000 compression. • Faster JPEG2000 CODEC. • Separated JPEG2000 CODEC core voltage from global voltage supply for increased reliability. • Installed low-power video decoder. • Applied assembly optimizations. • RoHS compliant.
Matrox Morphis Dual PC/104-*Plus* board (MOR+/2VD/84*)	7227-00 rev. A/000	• Original version.
	Y7227-00 rev. A/001	• Original version. RoHS compliant.
	Y7227-01 rev. D/100	• Applied assembly optimizations relative to press-fit connector and to D-Subminiature 44-pin connector.
Matrox Morphis eDual board (MOR2VDE/84*)	Y7272-01 rev. A/101	• Original version. RoHS compliant.
Matrox Morphis Quad board (MOR/4VD/84*)	7198-00 rev. A	• Original version.
	7198-01 rev. A/103	• Increased soldering pad area on PCB for surface-mount 75-Ohm jumpers
	Y7198-01 rev. A/100	• Original version. RoHS compliant.
	Y7198-01 rev. B/100	• Corrected PCB drawing dimensioning.
Matrox Morphis eQuad board (MOR4VDE/84*)	Y7281-00 rev. A/000	• Original version. RoHS compliant.
Matrox Morphis Video and I/O module (MOR-IO*)	7150-00 rev. A/001	• Original version.
	Y7150-00 rev. A/000	• Original version. RoHS compliant.
Matrox Morphis Video Input module (MOR-4COMP*)	7162-00 rev. A/000	• Original version.
	Y7162-00 rev. A/000	• Original version. RoHS compliant.
	Y7162-0001 rev.A/001	• Increased clearence between PCI metal bracket and PCB copper plane.

Appendix D: Acknowledgments

This appendix lists the copyright information regarding third-party material used to implement components on the Matrox Morphis board.

UART copyright information

The following is the copyright notice for the UART design used on the Matrox Morphis boards.

Index

H

I

J

M

N

O

P

R

S

T

U

V

W

Regulatory compliance for Matrox Morphis Dual PC/104-Plus

FCC Compliance Statement

Warning

Changes or modifications to these units 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 connections of these devices to other peripherals is required to meet the regulatory requirements.

Note

These devices comply with Part 15 of 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.

This equipment has been tested and found to comply with the limits for Class A digital devices, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of these devices in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

Industry Canada Compliance Statement

These digital apparatuses do not exceed the Class A limits for radio noise emission from digital apparatuses set out in the Radio Interference Regulations of Industry Canada.

Ces appareils numériques n'émettent pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par Industrie Canada.

EU Notice (European Union)

WARNING: These are class A products. In a domestic environment these products may cause radio interference in which case the user may be required to take adequate measures.

AVERTISSEMENT: Ces appareils sont des produits informatiques de Classe A. Lorsque ces appareils sont utilisent dans un environnement résidentiel, ces produits peuvent entraîner des interférences radioélectriques. Dans ce cas, l'usager peut être prié de prendre des mesures correctives appropriées.

This device complies with EC Directive 89/336/EEC for Class A digital devices. They have been tested and found to comply with EN55022/CISPR22 and EN55024/CISPR24 when installed in a typical class A compliant host system. It is assumed that these devices will also achieve compliance in any Class A compliant system.

Ces unités sont conformes à la Directive communautaire 89/336/EEC pour les unités numériques de Classe A. Les tests effectués one prouvé qu'elles sont conformes aux normes EN55022/CISPR22 et EN55024/CISPR24 lorsqu'elles sont installées dans un système hôte typique de la Classe A. On suppose qu'ils présenteront la même compatibilité dans tout système compatible de la Classe A.

Regulatory compliance for Matrox Morphis eDual/Dual Standard, Dual HDC, and eQuad/Quad

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 the monitor 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 International Corporation, 625 State Route 3, Unit B, Plattsburg, NY 12901-6530
Telephone: (514) 822-6000 (x2026) • 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.

(English) Industry Canada Compliance Statement

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 devices set out in the Radio Interference Regulation of Industry Canada.

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

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.

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

Remark for the Matrox hardware products supported by this guide

These devices comply with EC Directive 89/336/EEC 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 the monitor 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 89/336/EEC 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 le moniteur 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 89/336/EEC 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 Monitors 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 89/336/EEC 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, il monitor 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 89/336/EEC 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 monitor 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.

Directive on Waste Electrical and Electronic Equipment (WEEE)

Europe

(English) European user's information – Directive on Waste Electrical and Electronic Equipment (WEEE)

Please refer to the Matrox Web site (**www.matrox.com/environment/weee**) for recycling information.

(Français) Informations aux utilisateurs Européens – Règlementation des déchets d'équipements électriques et électroniques (DEEE)

Se référer au site Web de Matrox (**www.matrox.com/environment/weee**) pour l'information concernant le recyclage.

(Deutsch) Information für europäische Anwender – Europäische Regelungen zu Elektro- und Elektronikaltgeräten (WEEE)

Bitte wenden Sie sich an dem Matrox-Website (**www.matrox.com/environment/weee**) für Recycling Informationen.

(Italiano) Informazioni per gli utenti europei – Direttiva sui rifiuti di apparecchiature elettriche ed elettroniche (RAEE)

Si prega di riferirsi al sito Web Matrox (**www.matrox.com/environment/weee**) per le informazioni di riciclaggio.

Limited Warranty

Refer to the warranty statement that came with your product.