Matrox Design Assistant X

Intuitive, versatile, and extendable integrated development environment for machine vision applications
Flowchart-based vision software
Matrox Design Assistant® X is an integrated development environment (IDE) for Microsoft® Windows® where vision applications are created by constructing an intuitive flowchart instead of writing traditional program code. In addition to building a flowchart, the IDE enables users to design a graphical web-based operator interface for the application.

Matrox Design Assistant X can operate independent of hardware, allowing users to choose any computer with CoaXPress®, GigE Vision®, or USB3 Vision® cameras and get the processing power needed. Image capture from CoaXPress cameras requires the use of a Matrox Rapixo CXP frame grabber. Matrox Design Assistant X works with multiple cameras all within the same project, or per project running concurrently and independently from one another, platform permitting. This field-proven software is also a perfect match for a Matrox Imaging vision controller or smart camera. Matrox Design Assistant X offers the freedom to choose the ideal platform for any vision project.

Application design
Flowchart and operator interface design are done within the Matrox Design Assistant X IDE hosted on a computer running 64-bit Windows. A flowchart is put together using a step-by-step approach, where each step is taken from an existing toolbox and is configured interactively. The toolbox includes steps for image analysis and processing, communication, flow-control, and I/O. Outputs from one step—which can be images and/or alphanumeric results—are easily linked to the appropriate inputs of any other step. Decision-making is performed using a conditional step, where the logical expression is described interactively. Results from image analysis and processing steps are immediately displayed to permit the quick tuning of parameters. A contextual guide provides assistance for every step in the flowchart. Flowchart legibility is maintained by grouping steps into sub-flowcharts.

In addition to flowchart design, Matrox Design Assistant X enables the creation of a custom, web-based operator interface to the application through an integrated HTML visual editor. Users alter an existing template using a choice of annotations (graphics and text), inputs (edit boxes, control buttons, and image markers), and outputs (original or derived results, and status indicators). A filmstrip view is also available to keep track of and navigate to previously analyzed images. The operator interface can be further customized using a third-party HTML editor.

Why a flowchart?
The flowchart is a universally accessible, recognized, and understood method of describing the sequence of operations in a process. Manufacturing engineers and technicians in particular have all been exposed to the intuitive, logical, and visual nature of the flowchart.
Create custom flowchart steps
Users have the ability to extend the capabilities of Matrox Design Assistant X by way of the included Custom Step software development kit (SDK). The SDK, in combination with Microsoft Visual Studio® 2017, enables the creation of custom flowchart steps using the C# programming language. These steps can implement proprietary image analysis and processing, as well as proprietary communication protocols. The SDK comes with numerous project samples to accelerate development.

Application deployment
Once development is complete, the project—with flowchart and operator interface—is deployed either locally or remotely. Local deployment is to the same computer or Matrox Imaging vision controller as was used for development. Remote deployment is to a different computer, including Matrox Imaging vision controllers, or a Matrox Imaging smart camera.

Latest key additions and enhancements
- Capture images from one or more CoaXPress cameras by way of Matrox Rapixo CXP frame grabbers
- Interface to Matrox AltiZ and additional third-party 3D sensors to process and analyze their depth map
- Image classification coarse segmentation that leverages deep learning to detect defects in highly textured materials
- CC-Link IE Field Basic communication to connect directly to Mitsubishi Electric® PLCs
- PLC interface emulator to test communication with a PLC without needing one
- Extract profiles from a point cloud or depth map for individual analysis
Overview (cont.)

Project templates for quicker start-up
Matrox Design Assistant X includes a series of project templates and video tutorials to help new developers get up and running quickly.

These templates serve as either functional applications or application frameworks intended as a foundation for a target application. Templates also permit dynamic modifications, allowing users to tweak functionality at run-time and immediately see the outcome of any adjustments. The project templates address typical application areas, with examples for:

- Barcode and 2D code reading
- Measurement
- Presences/absence
- Recipes
- Robot guidance (Pick-and-Place)
- Dot-matrix text reading [SureDotOCR®]
- Color checking

More information on templates can be found on the Quick Start page of Matrox Design Assistant X software.
Integrated Development Environment

Customizable developer interface
The Matrox Design Assistant X user interface can be tailored by each developer. The workspace can be rearranged, even across multiple monitors, to suit individual preferences and further enhance productivity.

Select the action to perform from a context-based list
Conveniently switch between the flowchart and image, or operator views
Get quick access to context sensitive help

View results for features within the image

Configure each step without losing sight of flowchart and image
Instantly view results after each step
Track and navigate the flowchart execution history without losing sight of the image
Operator View

Operator interface viewable anywhere
The web-based operator interface, or Operator View, can be accessed locally or remotely through a HTML-5-capable web browser such as Google Chrome™ and Chromium, Mozilla Firefox®, and Microsoft Internet Explorer® and new Edge. Local viewing is done on the same computer or Matrox Imaging vision controller as was used for development. Local viewing is also available with a Matrox Imaging smart camera through a simple touch screen connected to its video output and USB interface, which eliminates the need for an additional computer. Remote viewing is done from any computer, including dedicated Human Machine Interface (HMI) or touch-panel PCs.

A stand-alone HMI application can be created using Microsoft Visual Studio to run on the local or a remote computer as an alternative to the web-based operator interface.

Security features
Access to specific Operator Views can be made to require user authentication (i.e., username and password) so only authorized personnel can modify key parameters of a running project. A project can be locked to a specific Matrox Imaging smart camera or vision controller when deployed, preventing it from running on an unauthorized platform. A project can also be encrypted during deployment to a platform, insuring that the project cannot be read or changed by unauthorized users. Projects locked to a platform are automatically encrypted.
Field-Proven Vision Tools

Image analysis and processing
Central to Matrox Design Assistant X are flowchart steps for calibrating, enhancing, and transforming images; locating objects; extracting and measuring features; reading character strings; and decoding and verifying identification marks. These steps are designed to provide optimum performance and reliability.

Pattern recognition steps
Matrox Design Assistant X includes two steps for performing pattern recognition: PatternMatching and ModelFinder. These steps are primarily used to locate complex objects for guiding a gantry, stage, or robot, or for directing subsequent measurement steps.

The PatternMatching step finds a pattern by looking for a similar spatial distribution of intensity. The step employs a smart search strategy to quickly locate multiple patterns, including multiple occurrences, which are translated and slightly rotated. The step performs well when scene lighting changes uniformly, which is useful for dealing with attenuating illumination. A pattern can be trained manually or determined automatically for alignment. Search parameters can be manually adjusted and patterns can be manually edited to tailor performance.

The ModelFinder step employs an advanced technique to locate an object using geometric features (e.g., contours). The step finds multiple models, including multiple occurrences that are translated, rotated, and scaled. Model Finder locates an object that is partially missing and continues to perform when a scene is subject to uneven changes in illumination, thus relaxing lighting requirements. A model is manually trained from an image and search parameters can be manually adjusted and models can be manually edited to tailor performance.
Field-Proven Vision Tools (cont.)

**Shape finding steps**
Matrox Design Assistant X includes dedicated steps for finding circles, ellipses, rectangles, and line segments. Circle finding is defined by the anticipated radius, the possible scale range, and the number of expected occurrences. Ellipse and rectangle finding are defined by the anticipated width and height, the possible scale and aspect ratio ranges, and the number of expected occurrences. Line segment finding is defined by the anticipated length and the number of expected occurrences. Continuous and broken edges lying within an adjustable variation tolerance produce the requested shape.

The shape-finding step computes the total number of found occurrences; for each occurrence, the tool can provide the center position and score relative to the reference. It can also give the radius and scale for circles; the angle, aspect ratio, width, and scale for ellipses and rectangles; and the start and end positions as well as the length for line segments. These specialized modes are generally faster and more robust at finding the specific shapes than generic pattern recognition.
Feature extraction and analysis step
The BlobAnalysis step in Matrox Design Assistant X is used to identify, count, locate, and measure basic features and objects (i.e., blobs) to determine presence and position, and enable further inspection. The step works by segmenting images where blobs are separated from the background and one another before quickly identifying the blobs. Over 50 characteristics can be measured and these measurements can be used to eliminate or keep certain blobs.
Field-Proven Vision Tools (cont.)

Classification steps
Matrox Design Assistant X includes classification steps for automatically categorizing image content using machine learning. These steps make use of deep learning—specifically convolutional neural network (CNN)—technology in two distinct approaches.

The first approach—implemented by the CNNClassIndex step—assigns images or image regions to pre-established classes. Results for each image or image region consist of the most likely class and a score for each class. The second approach—implemented by the CNNClassMap step—generates maps indicating the pre-established class and score for all image neighborhoods. These classification steps are particularly well suited for analyzing images of highly textured, naturally varying, and acceptably deformed goods.

Users can train a CNN on their own—using the MIL CoPilot interactive environment available separately as part of Matrox Imaging Library (MIL) X software—or commission Matrox Imaging to do so using previously-collected images that are both adequate in number and representative of the expected application conditions. Different types of training, such as transfer learning and fine-tuning, are supported, all starting from one of the supplied pre-defined CNN architectures. MIL CoPilot provides what is needed to build the required training dataset, including the labeling of images and augmenting the dataset with synthesized images, as well as to monitor and analyze the training process. Training is accomplished using a NIVDIA GPU or x64-based CPU while inference is performed on a CPU in a Matrox Imaging vision controller, smart camera, or third-party computer, avoiding the need for specialized GPU hardware.
Field-Proven Vision Tools (cont.)

1D and 2D measurement steps
Matrox Design Assistant X includes three steps for measuring: Measurement, BeadInspection, and Metrology. These tools are predominantly used to assess manufacturing quality.

The Measurement step uses the projection of image intensity to very quickly locate and measure straight edges or stripes within a carefully defined rectangular region. The tool can make several 1D measurements on edges and stripes, as well as between edges or stripes.

The BeadInspection step is for inspecting material that is applied as a continuous sinuous bead, such as adhesives and sealants, or its retaining channel. The step identifies discrepancies in length, placement, and width, as well as discontinuities. The BeadInspection step works by accepting a user-defined coarse path as a list of points on a reference bead and then automatically and optimally placing search boxes to form a template. The size and spacing of these search boxes can be modified to change the sampling resolution. The allowable bead width, offset, gap, and overall acceptance measure can be adjusted to meet specific inspection criteria.

The Metrology step is intended for 2D geometric dimensioning and tolerancing applications. The step extracts edges within defined regions to best fit geometric features. It also supports the construction of geometric features derived from measured ones or defined mathematically. Geometric features include arcs, circles, points, and segments. The step validates tolerances based on the dimensions, positions, and shapes of geometric features. The Metrology step can also analyze profiles extracted from point clouds and depth maps.

The Metrology step’s effectiveness is maintained when subject to uneven changes in scene illumination, which relaxes lighting requirements. The expected measured and constructed geometric features, along with the tolerances, are kept together in a template which is easily repositioned using the results of other locating steps.
Field-Proven Vision Tools (cont.)

**Color analysis steps**

Matrox Design Assistant X includes a set of tools to identify parts, products, and items using color, assess quality from color, and isolate features using color.

The ColorMatcher step determines the best matching color from a collection of samples for each region of interest within an image. A color sample can be specified either interactively from an image—with the ability to mask out undesired colors—or using numerical values. A color sample can be a single color or a distribution of colors (i.e., a histogram). The color matching method and the interpretation of color differences can be manually adjusted to suit particular application requirements. The ColorMatcher step can also match each image pixel to color samples to segment the image into appropriate elements for further analysis using other steps such as BlobAnalysis.

The ImageProcessing step includes operations to calculate the color distance and perform color projection. The distance operation reveals the extent of color differences within and between images, while the projection operation enhances color to grayscale image conversion for analysis using other grayscale processing steps.
Field-Proven Vision Tools (cont.)

Character recognition steps
Matrox Design Assistant X provides two steps for character recognition: SureDotOCR and StringReader. These steps combine to read text that is engraved, etched, marked, printed, punched, or stamped on surfaces.

The SureDotOCR step is uniquely designed for the specific challenge of reading dot-matrix text produced by inkjet printers. Its use is straightforward, just needing to specify the dot size, the number of characters in a text string, and the dimension—but not the location—of the text region. The step reads strings located at any angle, with varying contrast, and on an uneven background. It interprets distorted characters and handles some variability to character scale. The step recognizes punctuation marks and blank spaces. It includes pre-defined fonts that can be edited. The step automatically reads multiple lines of text where each line can be in a different font. It supports user-defined constraints, overall and at specific character positions, to further enhance recognition rates. The SureDotOCR step provides greater robustness and flexibility than case-specific techniques that convert dot-matrix characters into solid ones for reading with traditional character recognition tools.

The StringReader step is based on a sophisticated technique that uses geometric features to quickly locate and read text made up of solid characters in images where these characters are well separated from the background and from one another. It handles text strings with a known or unknown number of evenly or proportionally spaced characters. The step accommodates changes in character angle with respect to the string, aspect ratio, scale, and skew, as well as contrast reversal. It accepts strings located across multiple lines and at a slight angle. The step reads from multiple pre-defined or user-defined Latin-based fonts. It supports user-defined constraints, overall and at specific character positions, to further increase recognition rates.
1D and 2D code reading and verification steps

The CodeReader step in Matrox Design Assistant X locates and reads 1D, 2D, and composite identification marks. The step handles rotated, scaled, and degraded codes in tough lighting conditions. The step can provide the orientation, position, and size of a code.

In addition, the CodeGrade step verifies the quality of a code based on the ANSI/AIM and ISO/IEC grading standards.
Photometric stereo step
A Photometric Stereo step in Matrox Design Assistant X produces an image that emphasizes surface irregularities, such as embossed or engraved features, scratches, or indentations. The image is produced from a series of images of the same scene taken with directional illumination as driven by a Quad (X2) Controller from Advanced Illumination (Ai), a Light Sequence Switch (LSS) from CCS, a LED Light Manager (LLM) from Smart Vision Lights, or similar light controller.

2D calibration utility
Calibration is a routine requirement for machine vision. Matrox Design Assistant X includes 2D calibration capabilities to convert results (i.e., positions and measurements) from pixel to real-world units and vice-versa. The capability can compensate results and even an image itself for camera lens and perspective distortions.

Calibration is achieved using an image of a grid or just a list of known points and is performed through a utility project accessed from the Matrox Design Assistant X configuration portal.
Basic image processing steps
Matrox Design Assistant X includes the ImageProcessing step for enhancing and transforming images in preparation for subsequent analysis. Supported operations include arithmetic, color space conversions, color distance and projection (refer to Color analysis section for details), filtering, geometric transformations, logic, LUT mapping, morphology, and thresholding.

Matrox Design Assistant X also includes EdgeLocator and IntensityChecker steps. The EdgeLocator step finds objects by locating straight edges and the IntensityChecker step is used to analyze an object using image intensity.
Field-Proven Vision Tools (cont.)

3D acquisition and analysis
Matrox Design Assistant X provides an interface to a range of 3D sensors. These include Matrox AltiZ 3D profile sensors, as well as third-party 3D sensors like Automation Technologies CS-CS series; LMI Gocator® series; Photoneo® PhoXi® series; Wenglor weCat3D and ShapeDrive series; SmartRay Ecco series; Lucid Helios Time of Flight (ToF) camera; and Zivid One+ 3D camera through their SDK or the interface standard they support. Contact Matrox Imaging for interfaces to other third-party 3D sensors.

Matrox Design Assistant X is able to inspect the depth map produced by these 3D sensors using the image analysis and processing steps. Depth maps can be re-aligned using a reference surface to remove prospective distortion using the AlignPlane step. Profiles can be extracted from a point cloud or a depth map using the ExtractProfile step and then individually analysed using the Metrology step. Matrox Design Assistant X also provides additional functionality to fill gaps in a depth map, remapping a depth map for optimal use including visualization, and presenting the depth data in the world units given by the 3D sensor.
Utilities

Matrox Profiler
Matrox Design Assistant X includes Matrox Profiler, a separate utility to post-analyze the execution of a vision project for performance bottlenecks and timing issues. It presents the flowchart steps executed over time on a navigable timeline. Matrox Profiler permits searching for and selecting specific steps and their execution times for analysis. It computes statistics on execution times and presents these on a per-step basis.

Matrox Capture Assistant
Matrox Capture Assistant is another separate utility included with Matrox Design Assistant X to verify the connection to one or more GigE Vision or USB3 Vision cameras and testing video acquisition. It can obtain GigE Vision and USB3 Vision device information, collect and present acquisition statistics, and provide access to acquisition (GenICam™) properties. The gathering and display of statistics can be performed when acquiring within or outside of Matrox Capture Assistant. Matrox Capture Assistant also allows the adjustment of GigE Vision driver settings and provides the means to troubleshoot connectivity issues.
Utilities (cont.)

Project Change Validator
Project Change Validator is a utility employing a client-server architecture for ensuring that changes made to a deployed project are not detrimental to the functioning of that project. It provides the ability to record reference images—along with the associated inspection settings and results— for a given project.

This archived reference data is then used to validate changes made to the project. Changes are validated by running the modified project with the reference data and comparing the projects’ operation against this data. Validation is performed by the server—typically running on a separate computer—which is reachable over a network.

The Matrox Design Assistant X portal provides access to the validation data for management as well as the validation results. Validation requests are made on demand from the Matrox Design Assistant X portal, an automation controller, or an HMI panel.
Utilities (cont.)

**PLC interface emulation**
While developing a project in Matrox Design Assistant X, the PLC interface emulator is to be used to test communication in instances when a physical one is not connected. Values can be changed and viewed dynamically to test the communication between the project and the PLC. The PLC interface emulator supports CC-Link IE Field Basic, EtherNet/IP, MODBUS over TCP/IP, and PROFINET protocols for communication; these can be activated and controlled from the portal pages.
Connectivity

Connect to devices and networks
Matrox Design Assistant X can capture images from any CoaXPress, GigE Vision, or USB3 Vision compliant camera. Image capture from CoaXPress cameras requires the use of a Matrox Rapixo CXP frame grabber. The software can communicate over Ethernet networks using the TCP/IP as well as the CC-Link IE Field Basic, EtherNet/IP; Modbus over TCP/IP, and PROFINET protocols, enabling interaction with programmable logic/automation controllers. Its QuickComm facility provides ready-to-go communication with these controllers. Matrox Design Assistant X supports direct communication with select robot controllers for 2D vision-guided robotic applications. Supported robot-controller makes and models currently include the ABB IRC5; DENSO RC8; Epson RC420+ and RCS20+; Fanuc LRMate200iC and LRMate200iD; KUKA KR C2; and Stäubli CS8, CS8C HP, and CS9 controllers.

Matrox Design Assistant X can be configured to interact with automation devices through a computer’s COM ports. Matrox Design Assistant X can also directly interact with the I/Os built into a Matrox Imaging vision controller, smart camera, and I/O card as well as the I/O available on a GigE Vision or USB3 Vision camera.

Supported Environments

For Windows
• 64-bit Windows 7 with SP1 and Windows 10 (versions 1607 to 2004)
Training and Support

Matrox Vision Academy
Matrox Vision Academy provides all the expertise of live classroom training, with the convenience of on-demand instructional videos outlining how to get the most out of Matrox Design Assistant X vision software. Available to customers with valid Matrox Design Assistant X maintenance subscriptions, as well as those evaluating the software, users can seek out training on specific topics of interest, where and when needed. Regularly scheduled live classroom training is also offered at Matrox Imaging Headquarters.

Matrox Vision Academy aims to help users increase productivity, reduce development costs, and bring applications to market sooner. For more information, contact Matrox Vision Academy.

Matrox Professional Services
Matrox Professional Services delivers deep technical assistance and customized trainings to help customers develop their particular applications. These professional services comprise personalized training; assessing application or project feasibility (e.g., illumination, image acquisition, and vision algorithms); demo and prototype applications and/or projects; troubleshooting, including remote debugging; and video and camera interfacing.

Backed by the Matrox Vision Squad—a team of high-level vision professionals—Matrox Professional Services offer more in-depth support, recommending best methods with the aim of helping customers save valuable development time and deploy solutions more quickly. For more information on pricing and scheduling, contact Matrox Sales.

Matrox Design Assistant X maintenance program
Matrox Design Assistant X users have access to a Maintenance Program, renewable on a yearly basis. This maintenance program entitles registered users to free software updates and entry-level technical support from Matrox Imaging, as well as access to Matrox Vision Academy.

For more information, please refer to the Matrox Imaging Software Maintenance Programs.
## Ordering Information

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<td><strong>Matrox Design Assistant X Development Package</strong></td>
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<tr>
<td>DAXWINPU</td>
<td>Matrox Design Assistant X development package for Windows. Contains installation media (USB flash disk), a single-user USB hardware license key, and Matrox Design Assistant X maintenance registration number. Note: 75% discount for DAXWINPU if purchased with a MIL X development package (i.e., MILXWINPU) for the same user with their name as proof or for a MIL X user with valid maintenance with the registration number as proof. 50% educational discount for DAXWINPU with proof of affiliation with an academic institution. Discounts cannot be combined.</td>
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| **Matrox Design Assistant X Maintenance Program** |
| DAMAINTENANCE | One-year extension to the Matrox Design Assistant X maintenance program per developer. Note: 50% educational discount for DAMAINTENANCE with proof of affiliation with an academic institution. Included in the original purchase price of the Matrox Design Assistant X development package, registered users are entitled to one year of technical support, access to updates, and Matrox Vision Academy online training website. |

| **Matrox Vision Academy Online Training** |
| Included with Matrox Design Assistant X Maintenance Program | Matrox Vision Academy Online provides a range of categorized instructional videos on how to use the software to create applications. Matrox Vision Academy Online is available to customers with current Matrox Design Assistant X maintenance subscriptions, as well as those evaluating the software. Visit [www.matrox.com/imaging/en/vision_academy/](http://www.matrox.com/imaging/en/vision_academy/) for more information. |

| **Matrox Vision Academy On-Premises Training** |
| DATRAIN | Introduction to Matrox Design Assistant: Three-day instructor-led training on developing machine vision applications using the Matrox Design Assistant IDE. Key topics: Developing a vision or inspection system using flowcharts instead of coding; setting up an operator view; choosing analysis and processing tools; interfacing to automation controllers. Visit [www.matrox.com/imaging/en/vision_academy/on_premises/](http://www.matrox.com/imaging/en/vision_academy/on_premises/) for more information. |

| **Matrox Design Assistant X Run-Time/Supplemental License Software Keys** |
| | Refer to [MIL X datasheet – MIL X/MIL-Lite X Run-Time/Supplemental Licenses section](#). Note: Distributed MIL package license is required on a third-party PC in order to connect to it remotely from the design-time environment. Contact Matrox Imaging or a local representative for more information. |

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**Endnotes:**
1. The software may be protected by one or more patents; see [www.matrox.com/patents](http://www.matrox.com/patents) for more information.
2. Certification pending.
The Matrox Imaging advantage

**Assured quality & longevity**
Adhering to industry best practices in all hardware manufacturing and software development, product designs pay careful attention to component selection to secure consistent long-term availability. Matrox Imaging is able to meet Copy Exact and Revision Change Control procurement requirements in particular circumstances, backed by a dedicated team of QA specialists.

**Trusted industry standards**
Matrox Imaging champions industry standards in its design and production. Leveraging these standards to deliver quality compatible products, Matrox Imaging protects its customers’ best interests by ensuring hardware and software components work with as many third-party products as possible.

**Comprehensive customer support**
Devoted front-line support and applications teams are on call to offer timely product installation, usage, and integration assistance. Matrox Professional Services delivers deep technical assistance to help customers develop their particular applications in a timely fashion. Services include personalized training and device interfacing as well as application feasibility, prototyping, troubleshooting, and debugging.

**Tailored customer training**
Matrox Vision Academy comprises online and on-premises training for Matrox Imaging vision software tools. On-premises intensive training courses are regularly held at Matrox headquarters, and can also be customized for onsite delivery. The Matrox Vision Academy online training platform hosts a comprehensive set of on-demand videos available when and where needed.

**Long-standing global network**
Matrox Imaging customers benefit from a global network of distributors who offer complementary products and support, and integrators who build customized vision systems. These relationships are built on years of mutual trust and span the globe, ensuring customer access to only the best assistance in the industry.

About Matrox Imaging
Founded in 1976, Matrox is a privately held company based in Montreal, Canada. Imaging, Graphics, and Video divisions provide leading component-level solutions, leveraging the others’ expertise and industry relations to provide innovative, timely products.

Matrox Imaging is an established and trusted supplier to top OEMs and integrators involved in machine vision, image analysis, and medical imaging industries. The components consist of smart cameras, 3D sensors, vision controllers, I/O cards, and frame grabbers, all designed to provide optimum price-performance within a common software environment.

Industries served
Matrox Design Assistant is used to put together solutions for the aerospace, agricultural, automotive, beverage, cosmetic, construction material, consumer, electronic, energy, flat panel display, food, freight, machining, medical device, packaging, paper, pharmaceutical, printing, resource, robotics, semiconductor, shipping, textile, and transportation industries.

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www.matrox.com/imaging

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