

# Matrox **Design Assistant 5.1** >>

Flowchart-based vision software



An intuitive, versatile, and extendable integrated development environment (IDE) for machine vision applications.



# Overview

## Matrox Design Assistant<sup>1</sup>

Matrox Design Assistant is an IDE for 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. Since Matrox Design Assistant is hardware independent, you can choose any computer with GigE Vision® or USB3 Vision® cameras and get the processing power you need. This field proven software is also a perfect match for the Matrox 4Sight GPM vision controller or the Matrox Iris GTR smart camera. Matrox Design Assistant gives you the freedom to choose the ideal platform for your next vision project.

## Application design

Flowchart and operator interface design are done within the Matrox Design Assistant 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 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.

## Matrox Design Assistant at a glance

**Solve machine vision applications quickly and easily without writing program code** by using an intuitive flowchart-based methodology

**Choose the best platform for the job** within a hardware-independent environment that supports any PC with any GigE Vision or USB3 Vision camera

**Deploy the same project simultaneously** on a rugged and reliable Matrox vision controller and smart camera

**Tackle machine vision applications with utmost confidence** using field-proven tools for analyzing, locating, measuring, reading, and verifying

**Use a single program** for creating both the application logic and operator interface

**Work with multiple cameras** within the same project

**Rely on a common underlying vision library** for the same results with a Matrox smart camera, vision system, or third-party computer

**Maximize productivity** with instant feedback on image analysis and processing operations

**Receive immediate, pertinent assistance** through an integrated contextual guide

**Communicate actions and results to other automation and enterprise equipment** via discrete Matrox I/Os, RS-232, and Ethernet (TCP / IP, EtherNet / IP™<sup>2</sup>, Modbus®, PROFINET®, and native robot interfaces)

**Maintain control and independence** through the ability to create custom flowchart steps

**Increase productivity and reduce development costs** with Matrox Vision Academy online and on-premises training

**Protect against inappropriate changes** with the Project Change Validator tool

# Overview (cont.)

## Create custom flowchart steps

Users have the ability to extend the capabilities of Matrox Design Assistant by way of the included Custom Step software development kit (SDK). The SDK, in combination with Microsoft® Visual Studio® 2013/2015/2017 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 vision controller as was used for development. Remote deployment is to a different computer, including a Matrox vision controller or a Matrox smart camera.

## Project templates for quicker start-up

Matrox Design Assistant 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
- Presence / Absence
- Recipes
- Robot guidance (Pick-and-Place)
- Dot-matrix text reading (SureDotOCR)

More information on templates can be found on the Quick Start Page of Matrox Design Assistant software.

## Release 5.1 highlights

**Project Change Validator** tool guards against detrimental changes to a project

**Image-centric configuration** lets measurements be set up directly on an image instead of through a configuration pane

**QuickComm** provides ready-to-go communication with a programmable logic / automation controller

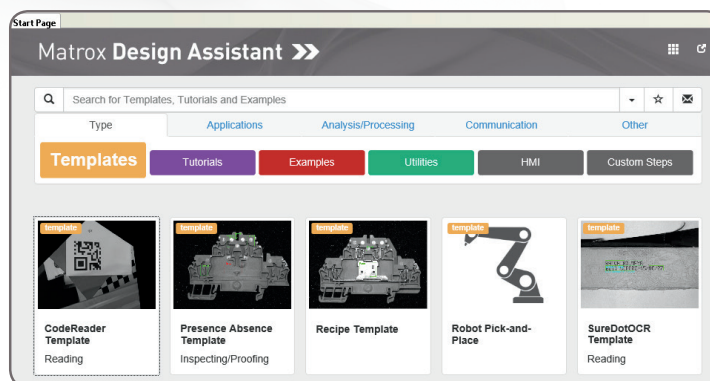
**Events & Actions** put the management of specific events and actions into secondary flowcharts thus simplifying the main flowchart

**Persistent recipes** enable the creation of a simpler flowchart with different settings for inspecting similar object types

**HTML-5-based Operator View** provides access to the operator interface from any HTML-5 capable browser

**SureDotOCR™** step enables the reading of dot-matrix text even when distorted, rotated and on irregular backgrounds

Support for the **Matrox Iris GTR** smart camera and **Matrox Indio** industrial I/O and communication card



Project templates

# IDE

## Customizable developer interface

The Matrox Design Assistant 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.

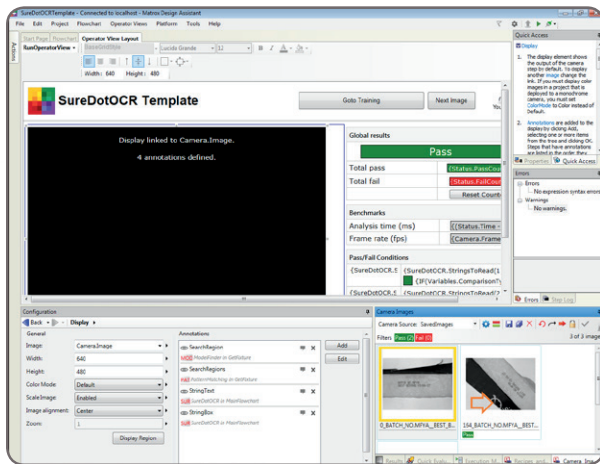
The screenshot displays the Matrox Design Assistant IDE interface, which is divided into several functional areas. Callouts highlight the following features:

- Select the action to perform from a context-based list:** Points to the top toolbar where various actions like 'Run', 'Stop', and 'Debug' are available.
- Conveniently switch between the flowchart and image, or operator views:** Points to the tabs at the top of the main workspace, including 'Flowchart', 'Image', and 'Operator View Layout'.
- Get quick access to context sensitive help:** Points to the 'Quick Access' panel on the right, which provides help for the currently selected step or component.
- View results for features within the image:** Points to a pop-up window showing OCR results for a specific line of text in the image, including the string, formatted string, score, and character occurrences.
- Configure each step without losing sight of flowchart and image:** Points to the 'Configuration' panel at the bottom left, which allows users to adjust settings for the selected step.
- Instantly view results after each step:** Points to the 'Results' panel at the bottom right, which displays a table of results for the entire flowchart execution.
- Track and navigate the flowchart execution history without losing sight of the image:** Points to the 'Execution History' panel at the bottom right, which shows the sequence of steps executed during the process.

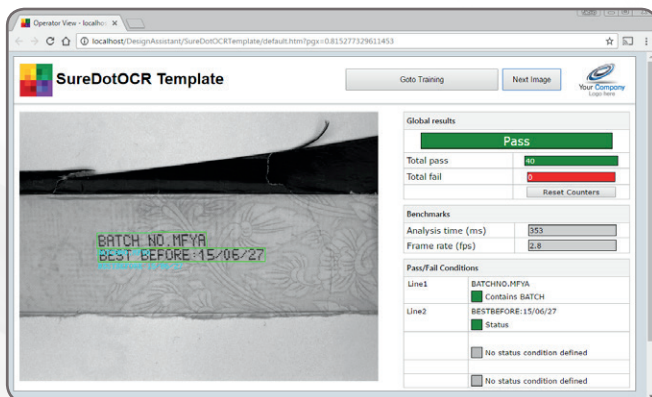
The main workspace shows a flowchart on the left, a live image of a document with text 'BATCH NO. MFYA' and 'BEST BEFORE: 15/06/27' in the center, and various panels on the right and bottom for configuration, results, and help.



# Operator View



Design a customized Operator View



Resulting Operator View as seen in a web browser

## 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<sup>3</sup>. Local viewing is done on the same computer or Matrox vision controller as was used for development. Local viewing is also available with a Matrox 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 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 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.

# Vision Tools

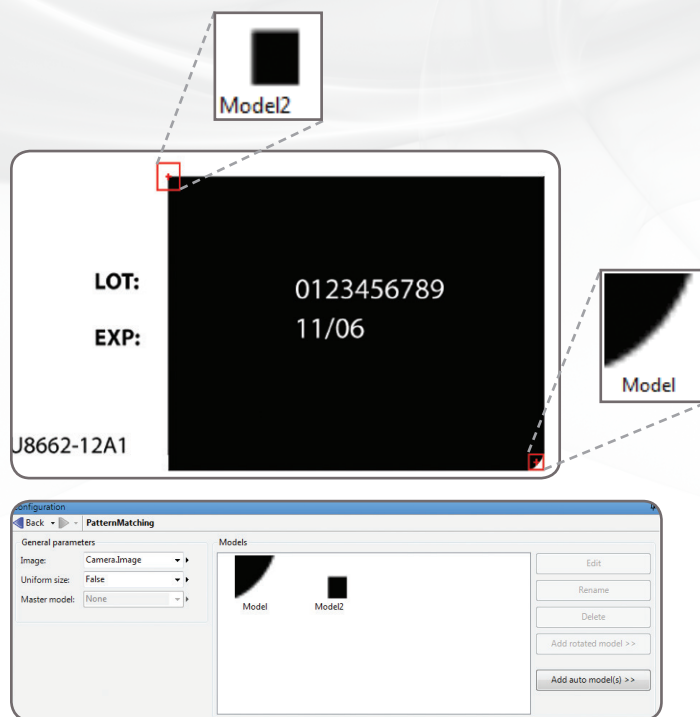
## Image analysis and processing

Central to Matrox Design Assistant 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

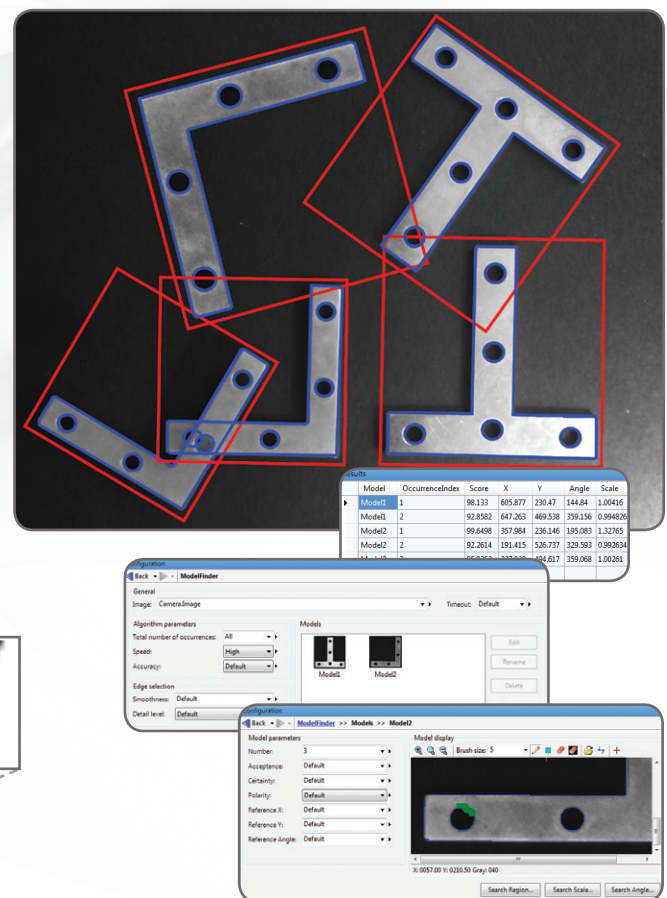
Matrox Design Assistant includes two steps for performing pattern recognition: Pattern Matching and Model Finder. These steps are primarily used to locate complex objects for guiding a gantry, stage, or robot, or for directing subsequent measurement steps.

The Pattern Matching 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.



Pattern Matching

The Model Finder 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.

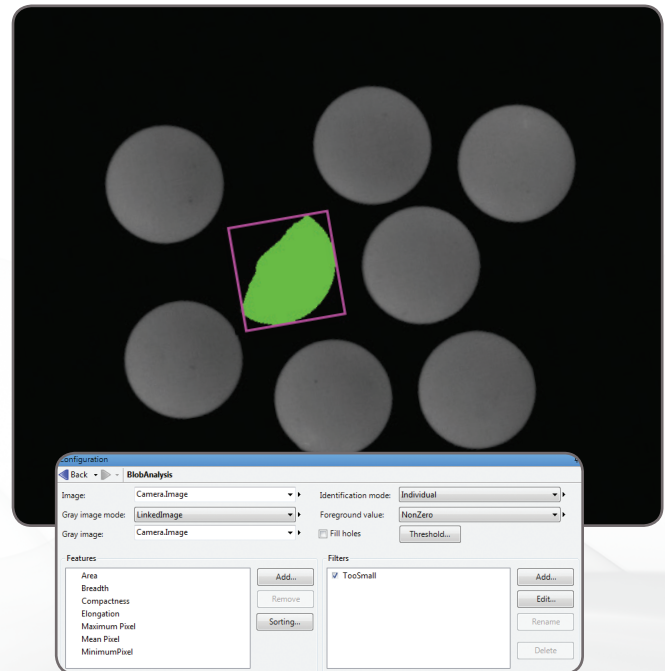


Model Finder

# Vision Tools (cont.)

## Feature extraction and analysis

The Blob Analysis step 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.



Blob Analysis



# Vision Tools (cont.)

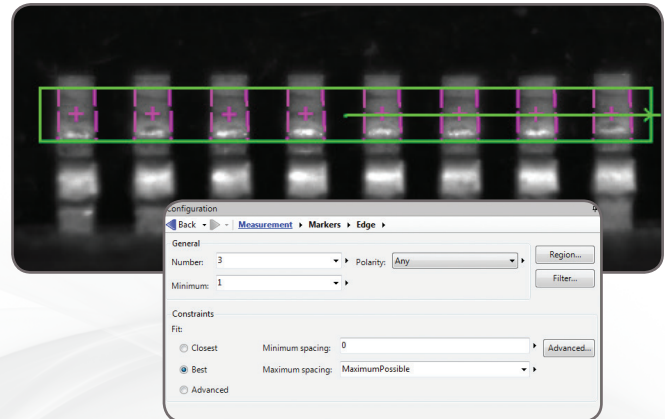
## 1D and 2D measurements

Matrox Design Assistant includes three steps for measuring: Measurement, Bead inspection, and Metrology. These tools are predominantly used to assess manufacturing quality.

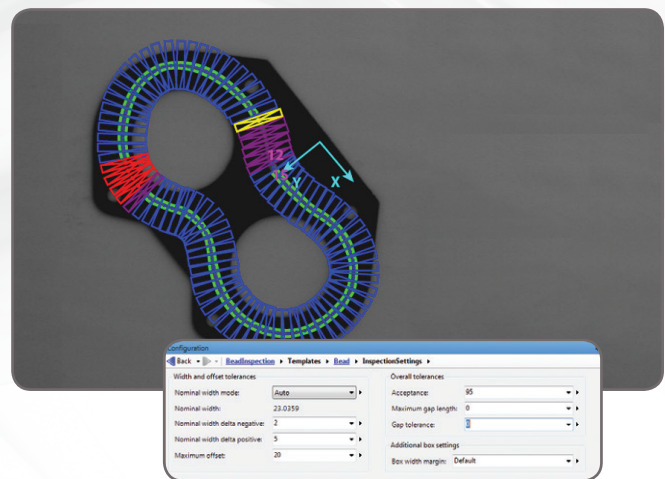
The Measurement step uses the projection of image intensity to very quickly locate and measure straight edges or stripes within a carefully defined rectangular region. The tool can make several 1D measurements on edges and stripes, as well as between edges or stripes.

The Bead inspection 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 Bead inspection 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.

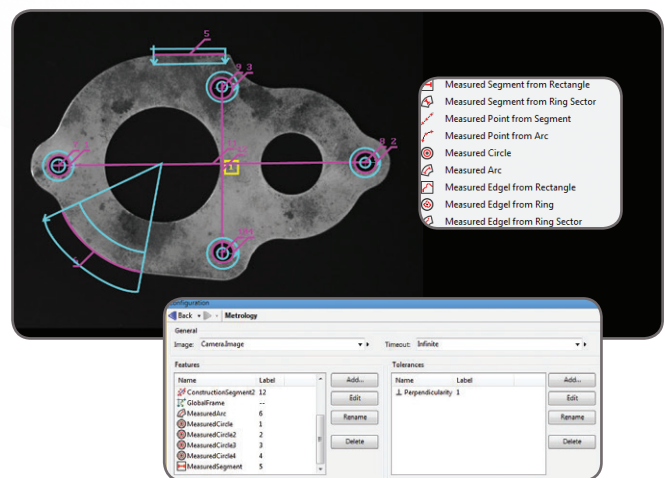
The Metrology step is intended for 2D geometric dimensioning and tolerancing applications. The step extracts edges within defined regions to best fit geometric features. It also supports the construction of geometric features derived from measured ones or defined mathematically. Geometric features include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



Measurement



Bead inspection



Metrology



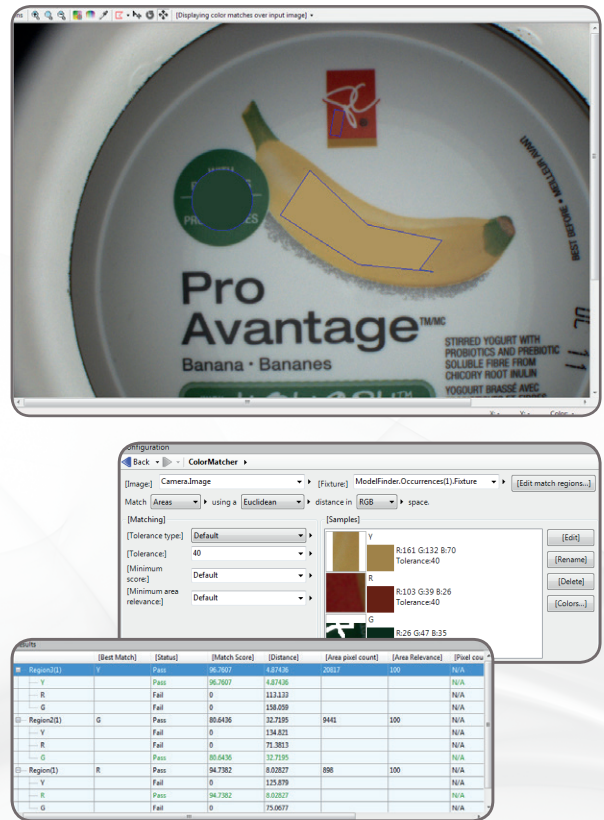
# Vision Tools (cont.)

## Color analysis

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

The Color Matcher 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 Color Matcher 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 Blob Analysis.

The Image Processing 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.



Color Matcher

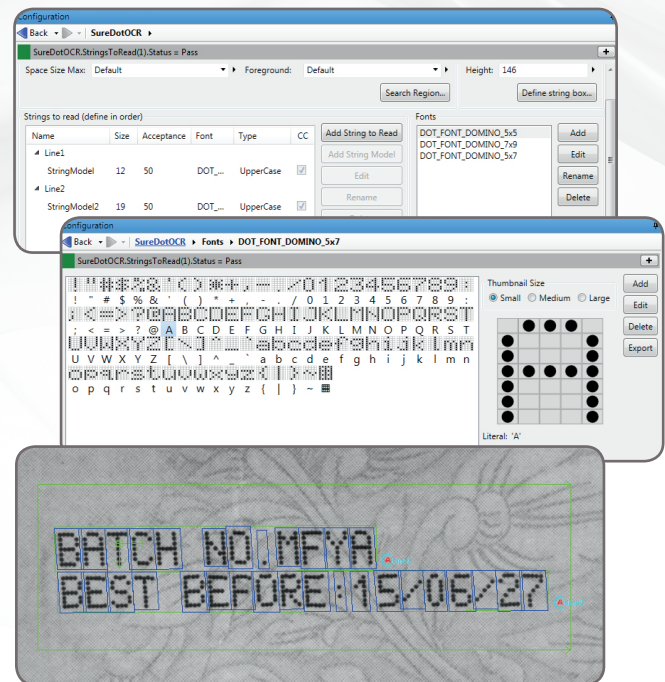
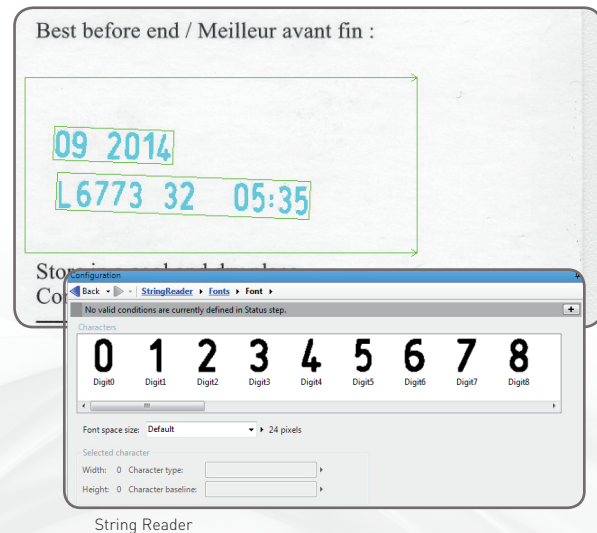
# Vision Tools (cont.)

## Character recognition

Matrox Design Assistant provides two steps for character recognition: SureDotOCR and String Reader. 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 String Reader 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.

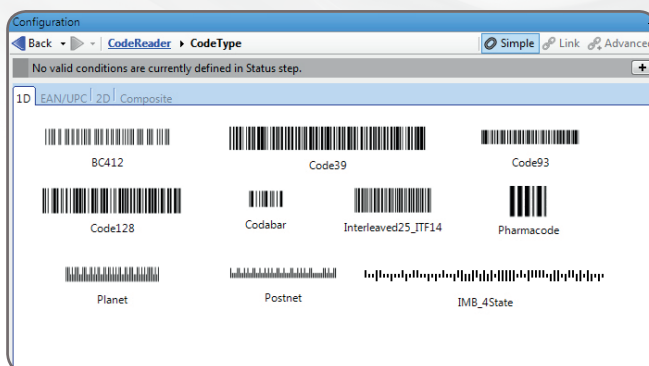
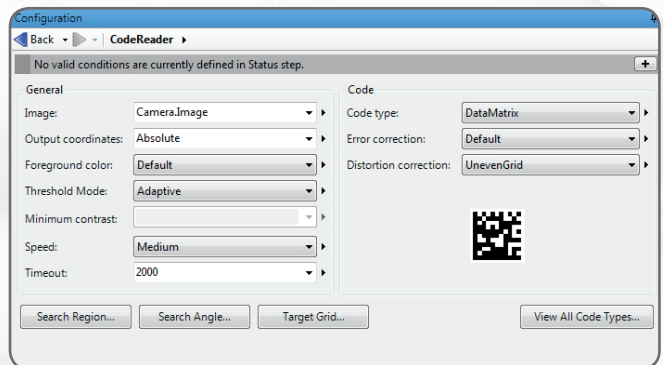
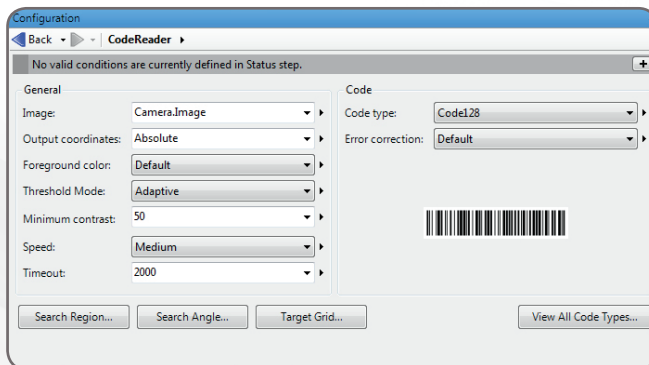


# Vision Tools (cont.)

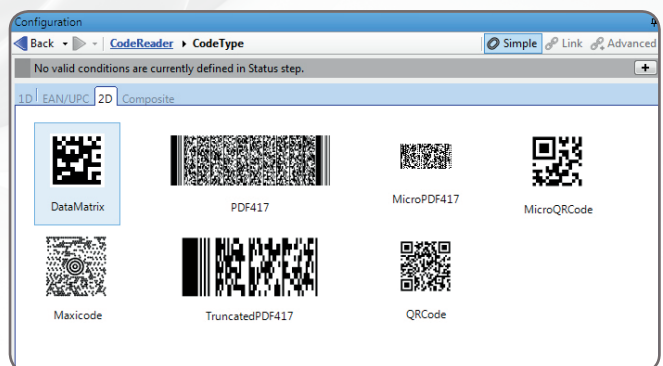
## 1D and 2D code reading and verification

Code Reader is a step for locating and reading 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 Code Verify step verifies the quality of a code based on the ANSI/AIM and ISO/IEC grading standards.



Code Reader (1D)



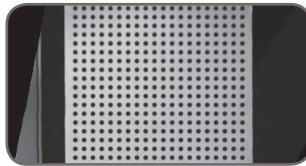
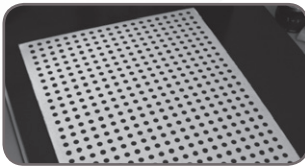
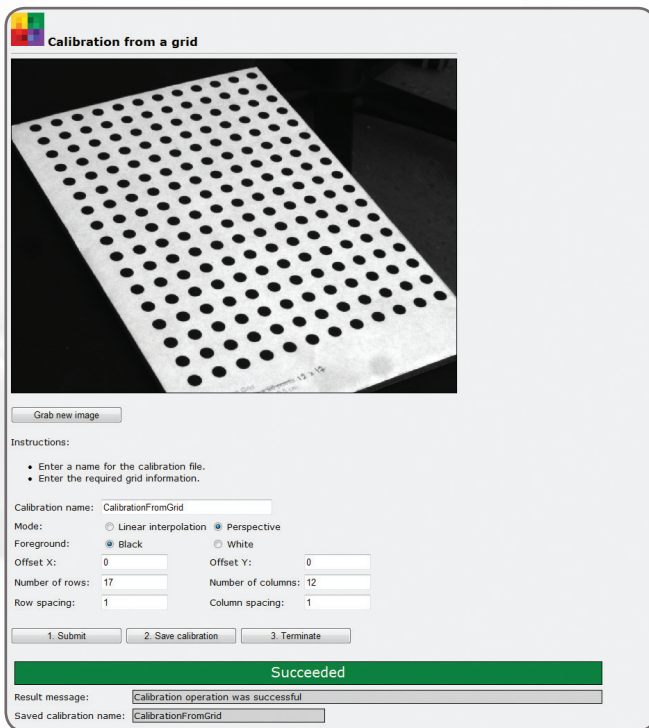
Code Reader (2D)



# Vision Tools (cont.)

## Calibration

Calibration is a routine requirement for machine vision. Matrox Design Assistant includes a 2D Calibration step to convert results (i.e., positions and measurements) from pixel to real-world units and vice-versa. The tool 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 configuration portal.



Calibration

## Basic image processing

Matrox Design Assistant includes the Image Processing 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 also includes Edge Locator and Intensity Checker. Edge Locator finds objects by locating straight edges and Intensity Checker is used to analyze an object using image intensity.

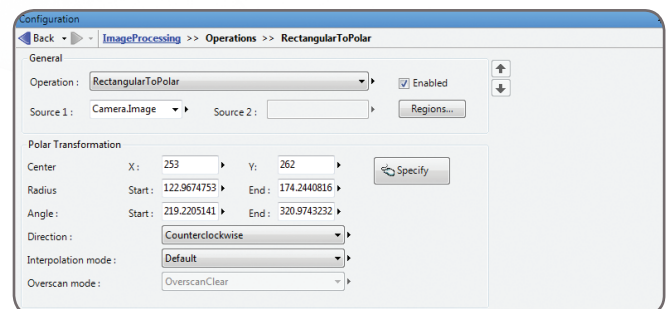
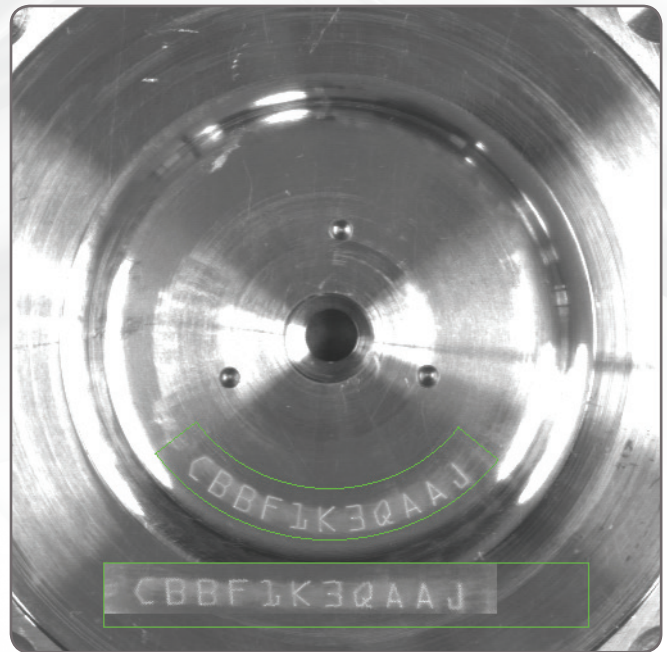


Image Processing



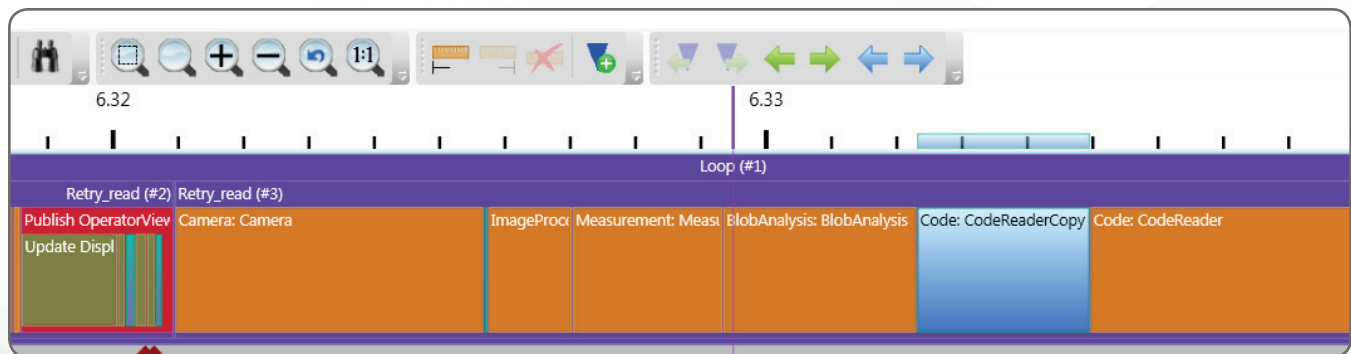
# Utilities

## Matrox Profiler

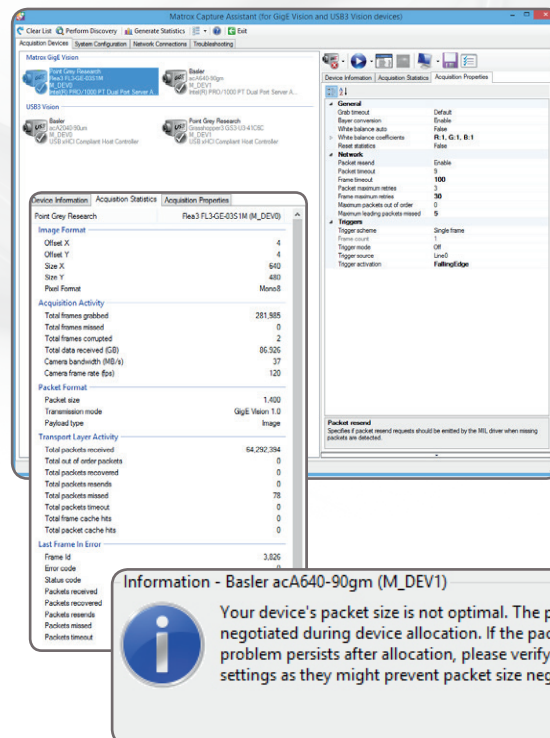
Matrox Design Assistant includes Matrox Profiler, a separate utility to post-analyze the execution of a vision project for performance bottlenecks and timing issues. It presents the flowchart steps executed over time on a navigable timeline. Matrox Profiler permits searching for and selecting specific 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 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.



Matrox Profiler



Matrox Capture Assistant GigE Vision and USB Vision<sup>3</sup> configuration and test tool

# Utilities (cont.)

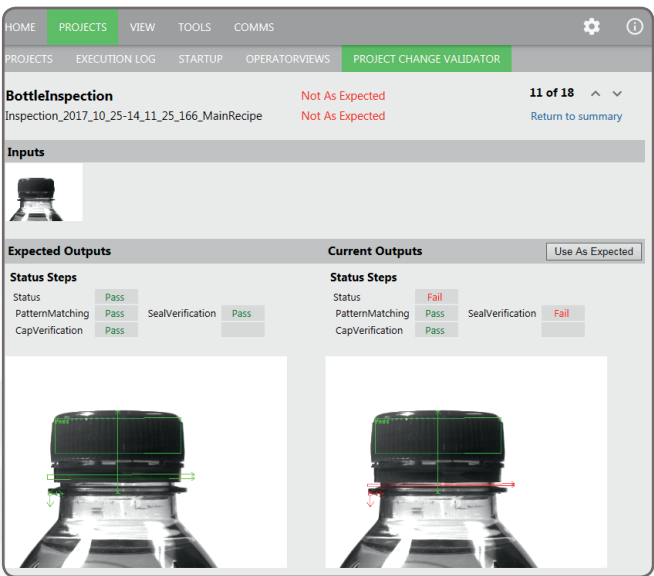
## Project Change Validator

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.

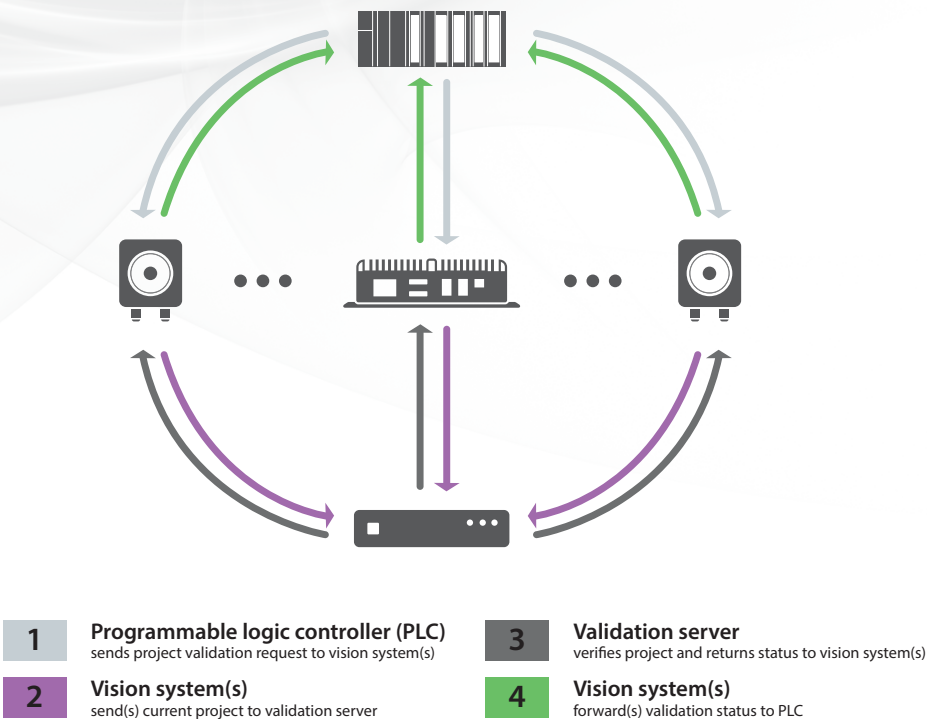
This archived reference data is then used to validate changes made to the project. Changes are validated by running the modified project with the reference data and comparing the

projects' operation against this data. Validation is performed by the server—typically running on a separate computer<sup>4</sup>—which is reachable over a network.

The Matrox Design Assistant 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 portal, an automation controller, or an HMI panel.



Project Change Validator (view from portal)



- 1 Programmable logic controller (PLC)**  
sends project validation request to vision system(s)
- 2 Vision system(s)**  
send(s) current project to validation server
- 3 Validation server**  
verifies project and returns status to vision system(s)
- 4 Vision system(s)**  
forward(s) validation status to PLC

# Connectivity

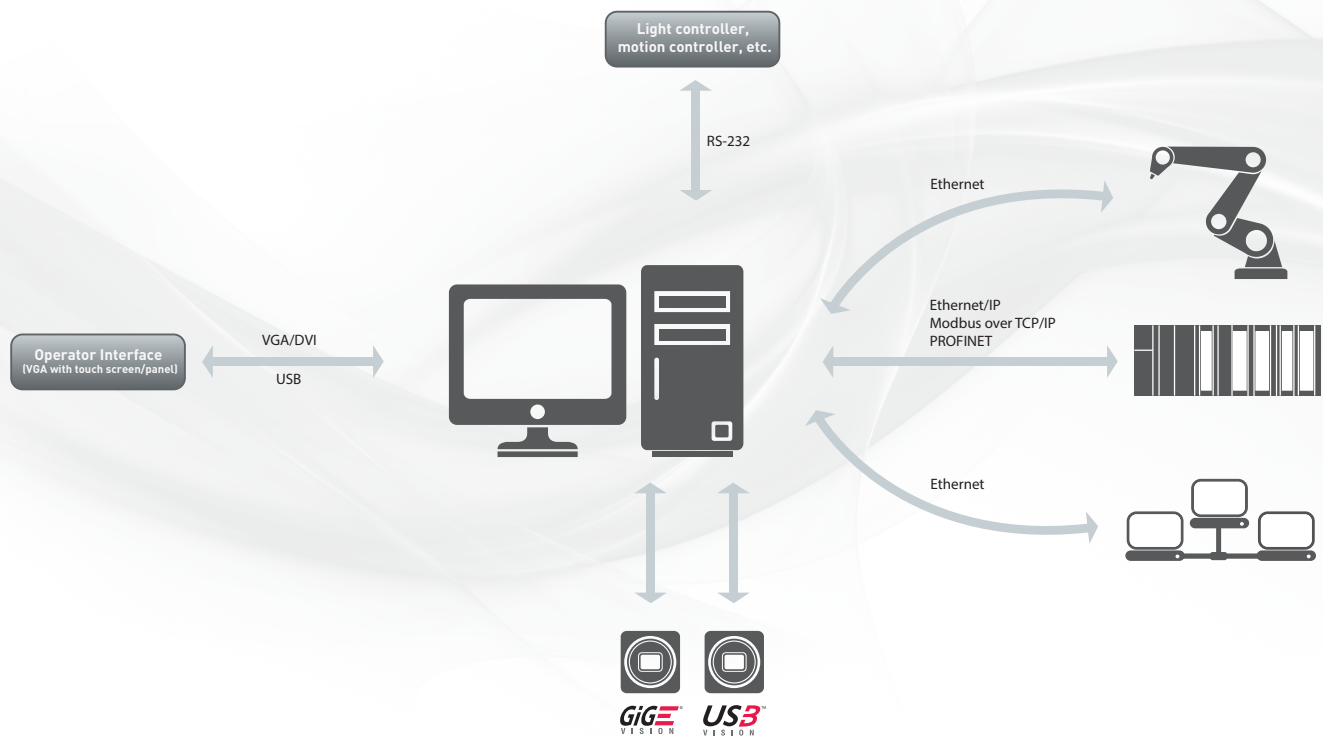
## Connect to devices and networks

Matrox Design Assistant can capture images from any GigE Vision and USB3 Vision compliant camera. The software can communicate over Ethernet networks using the TCP / IP as well as the EtherNet / IP<sup>2</sup>, 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 supports direct communication with select robot controllers<sup>5</sup> for 2D vision-guided robotic applications.

Matrox Design Assistant can also be configured to interact with automation devices through a computer's COM ports. Matrox Design Assistant can directly interact with the I/Os built into a Matrox 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

- 64-bit Windows 7 with SP1, 8.1, and 10 (versions 1511, 1607, 1703, and 1709).



# Training and Support

## Matrox Vision Academy

Matrox Vision Academy provides online and on-premises training for Matrox Design Assistant.

Online, Vision Academy comprises an on-demand training resource, with a multitude of categorized instructional videos on how to use Matrox Design Assistant to create vision applications. Available to customers with valid Matrox Design Assistant maintenance subscriptions, as well as those evaluating the software, users can seek out training on specific topics of interest, where and when needed.

On-premises intensive instructor-led training courses are regularly held at Matrox headquarters, and can also be customized for onsite delivery. These courses cover the main aspects of using Matrox Design Assistant to develop vision applications. Each course combines lectures—delivered by support and/or development staff—with hands-on labs to get attendees going with either software environment.

Matrox Vision Academy aims to help users increase productivity, reduce development costs, and bring applications to market sooner. For more information, please visit [www.matrox.com/imaging/en/support/training/](http://www.matrox.com/imaging/en/support/training/).



## Matrox Vision Squad

Matrox Imaging's devoted front-line support and applications teams are on call to offer timely product installation, usage, interoperability, and integration assistance matters.

We also offer the assistance of our exclusive Matrox Vision Squad. The Vision Squad's knowledgeable staff provides more in-depth support, helping assess application feasibility, recommend best methods, and even prototype solutions for Matrox Design Assistant users.

## Matrox Design Assistant maintenance program

Matrox Design Assistant provides registered users automatic enrollment in the maintenance program for one year. This maintenance program entitles registered users to technical support and free software upgrades from Matrox Imaging, as well as access to Matrox Vision Academy, our online repository of on-demand training resources for Matrox Design Assistant. Just before the expiration of the maintenance program, registered users will have the opportunity to extend the program for another year. For more information, refer to the Matrox Imaging Software Maintenance Programs brochure or visit [www.matrox.com/imaging/en/support/support\\_maintenance/](http://www.matrox.com/imaging/en/support/support_maintenance/).





# Ordering Information

## Matrox Design Assistant 5 Development Package

Part number	Description
DA5WINPU Ask for availability.	Matrox Design Assistant 5 flowchart-based vision software for Windows. Includes DVD with IDE and online documentation. Also includes a single-user USB hardware license key for the design-time and run-time environments (for Bead, Blob Analysis, Code Reader, Color Analysis, Edge Locator, Image Processing, Intensity Checker, Measurement, Metrology, Model Finder, Pattern Matching, SureDotOCR, String Reader, calibration, I/O, communication, GigE Vision, and USB3 Vision camera interfaces), as well as a Matrox Design Assistant maintenance registration number.

Note: 75% discount for DA5WINPU if purchased with MIL 10 development package (i.e., MILXWINPU) for the same user or for a MIL user with valid maintenance with the registration number as proof. 50% educational discount for DA5WINPU with proof of affiliation with an academic institution. Discounts cannot be combined.

## Matrox Design Assistant Maintenance Program

Part number	Description
DAMAIN	One-year extension to Matrox Design Assistant maintenance program per developer.

Included in the original purchase price of the Matrox Design Assistant development package, it entitles registered users to one year of technical support and access to updates.

Note: 75% discount for DAMAIN if purchased with MIL Maintenance (i.e., MILMAINTENANCE) for the same user. 50% educational discount for DAMAIN with proof of affiliation with an academic institution. Discounts cannot be combined.

### Matrox Design Assistant 5 Run-Time Licenses

Refer to MIL datasheet – MIL 10 Run-Time 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 your local representative for more information.

## Matrox Vision Academy Training

Online	
For access	Description
<a href="http://www.matrox.com/imaging/vision_academy/login/">www.matrox.com/imaging/vision_academy/login/</a>	Matrox Vision Academy Online provides a range of categorized instructional videos on how to use the software to create vision applications.  Vision Academy Online is available to customers with current Matrox Design Assistant maintenance subscriptions, as well as those evaluating the software.  Visit <a href="http://www.matroximaging.com/training">www.matroximaging.com/training</a> for more information.

## Matrox Vision Academy Training

On-Premises	
Part number	Description
DATRAIN Ask for availability.	<i>Matrox Design Assistant:</i> Three-day instructor-led training on developing machine vision applications using the Matrox Design Assistant IDE.  <i>Key topics:</i> Developing a vision or inspection system; using flowcharts to replace coding; setting up operator view; choosing analysis and processing tools; interfacing with IDE.  Visit <a href="http://www.matrox.com/imaging/en/support/training/classroom/">www.matrox.com/imaging/en/support/training/classroom/</a> for more information.

### 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.
3. Internet Explorer®, Google Chrome™ / Chromium, and Firefox®.
4. With the Matrox Design Assistant run-time environment running natively, or in a virtual machine if the project to validate involves a Matrox Iris GTR smart camera.
5. Currently supports ABB IRC5, DENSO RC8, Epson RC420+ / RC520+, Fanuc LRMate200iC / LRMate200iD, KUKA KR C2, and Stäubli CS8 / CS8C HP / CS9 controllers.



### 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, 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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