

NI Machine Vision and Scientific Imaging

Solve your machine vision and scientific imaging applications with:

- Configurable machine vision software for quick system setup*
- More than 200 imaging functions in the development environment of your choice*
- Rugged and compact machine vision systems*

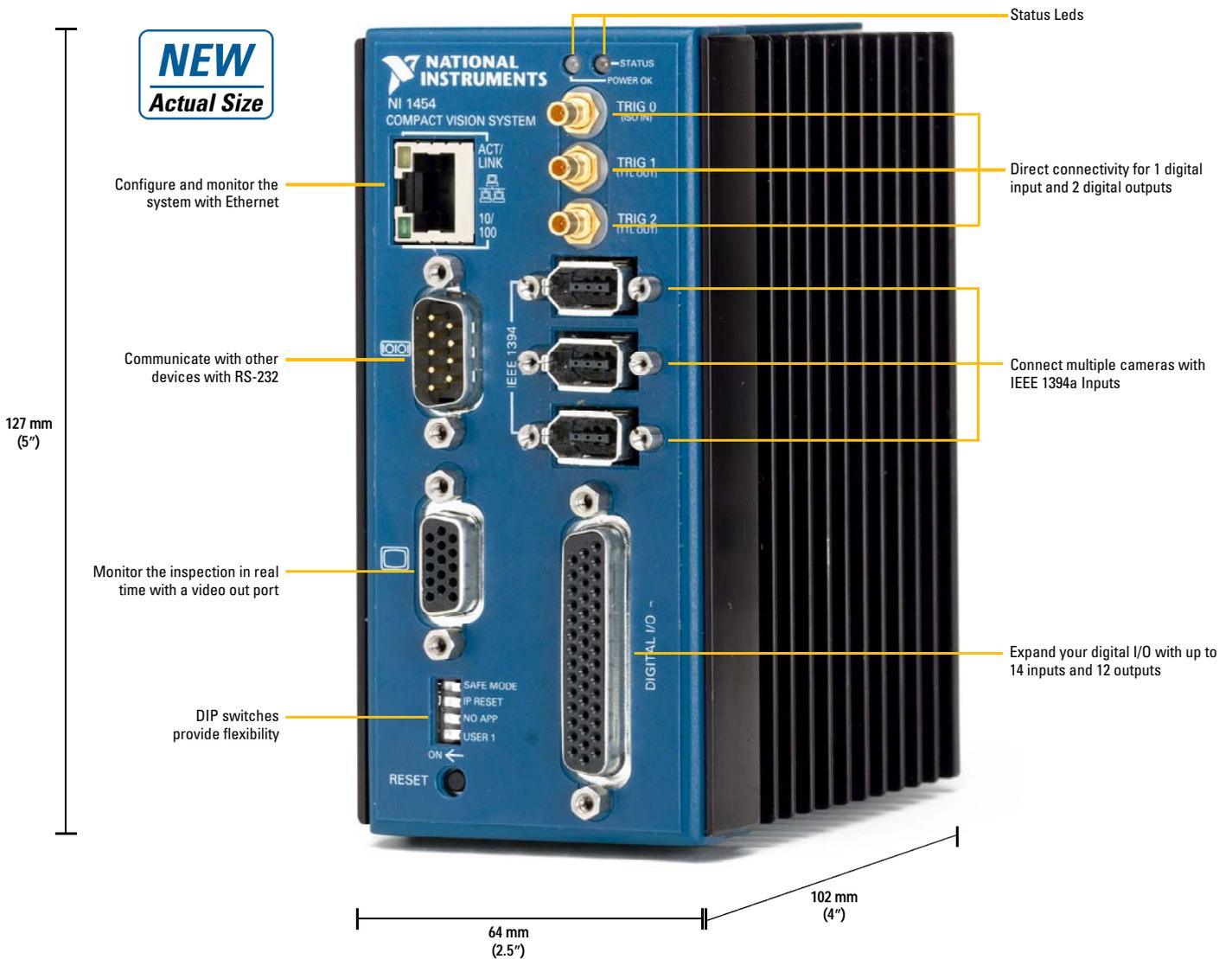


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NI Compact Vision System



The NI Compact Vision System offers more processing power, more I/O, and more camera options for your inspection needs.

With easy-to-use software and hardware, NI Compact Vision System gives you the power and functionality of multiple smart cameras. The high-performance processor can tackle tough inspection applications, and the IEEE 1394 ports deliver connectivity to multiple cameras. Communicate with a multitude of automation devices using Ethernet, RS-232, or a large number of digital I/O channels. Choose the NI Compact Vision System for rugged environments.

	NI CVS 1454	NI CVS 1455	Typical Smart Camera
Configurable Software	Vision Builder for Automated Inspection	Vision Builder Automated Inspection	Available
Programmable Software	LabVIEW Real-Time	LabVIEW Real-Time	Not available
Typical Processor Performance	883 MIPS*	1436 MIPS*	60-360 MIPS*
Digital I/O	29 DIO	29 DIO	2-20 DIO
Cameras	up to 16	up to 16	1
Resolution	up to 2000 x 2000	up to 2000 x 2000	640 x 480
Frame Rate	up to 100 fps	up to 100 fps	30 fps
Non-volatile Storage	32 MB	128 MB	4-16 MB

*MIPS: Million Instructions Per Second

To view an online technical seminar and data sheet, visit ni.com/info and enter **dymkav**.

Algorithms

National Instruments Vision software provides more than 200 image processing and analysis functions, including:



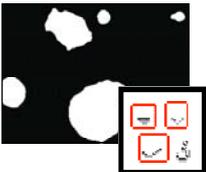
Pattern Matching

Use pattern matching to quickly locate known reference patterns, or fiducials, in an image, even with changes in position, rotation, lighting and occlusion. Create a model or template that represents the object for which you are searching. Then search for the model in each acquired image, calculating a score for each match.



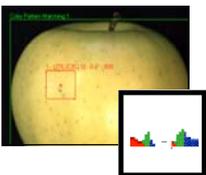
Optical Character Recognition

NI OCR functions use a trainable optical character recognition algorithm specifically designed to identify all types of fonts, characters, and symbols despite poor and inconsistent image quality. Train different types of fonts and symbols including common industrial fonts such as OCR A, OCR B, and SEMI.



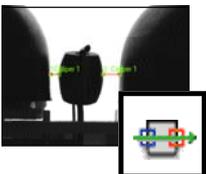
Particle Analysis

Use particle analysis to detect connected regions or groupings of pixels in an image and make selected measurements of those regions. Choose from more than 80 unique measurements that return data in both real-world and pixel values.



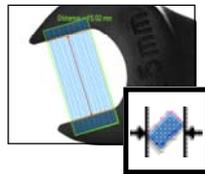
Color Matching

Color matching quantifies which colors and how much of each color exists in a region of an image and uses this information to check if another image contains the same colors in the same ratio.



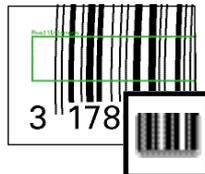
Edge Detection

Use the edge detection tools to identify and locate discontinuities in the pixel intensities of an image. Find edges in order to align, measure, or detect features in the image.



Gauging

You can use dimensional measurement or gauging tools to obtain quantifiable, critical distance measurements—such as distances, angles, areas, line fits, circular fits, and counts—to determine if a certain product was manufactured correctly.



Barcodes

Barcodes are important in the identification and tracking of products. A wide variety of formats are available to use with the NI Vision software.

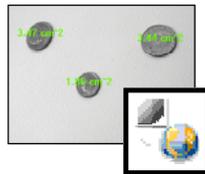


Image Calibration

Account for distortion arising from optics or perspective. Spatial calibration is the process of computing pixel to real-world unit transformations while accounting for many errors inherent to the imaging setup.

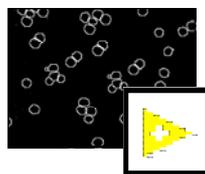
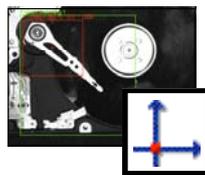


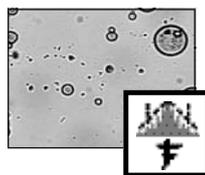
Image Arithmetic and Logic Functions

Operators perform basic arithmetic and logical operations on images. Use operators to add, subtract, multiply, and divide an image with other images or constants. Perform logical operations, such as AND/NAND, OR/NOR, and XOR/XNOR, and make pixel comparisons between an image and other images or a constant.



Coordinate Systems

Set up coordinate systems to ensure that all your measurements move with the object within the field of view.



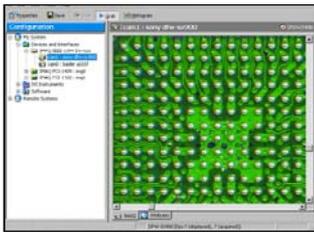
Complex and Fourier Image Analysis

Frequency filters alter pixel values with respect to the periodicity and spatial distribution of the variations in light intensity in the image. Get the frequency representation of an image through the Fast Fourier transform (FFT) function, which reveals information about the periodicity and dispersion of the patterns found in the source image.

Machine Vision Software

Overview

For image processing and analysis, National Instruments provides more than 200 machine vision and scientific imaging functions to solve your application. If you prefer to configure and deploy your system, Vision Builder for Automated Inspection is right for you. If you prefer to have the complete control and functionality of an application development environment, such as LabVIEW, Visual Basic, C, or C++, choose the NI Vision Development Module.



NI-IMAQ Driver Software

For easy image acquisition from a wide variety of hardware platforms, including PCI, PXI, NI-IMAQ driver software provides an easy set of function calls to acquire, display, and save. In addition, stream images to

disk with the uncompressed AVI formats. The driver software is compatible with a wide range of imaging buses, including analog, parallel digital, and Camera Link. The ability to buffer, control camera attributes, and grab images continuously are a few of the many features available in the driver software. NI-IMAQ is included with every hardware purchase.

NI-IMAQ for IEEE 1394 Cameras

IEEE 1394 offers many advantages for industrial machine vision. Simple cabling, digital data transfer, and plug-and-play configuration allow for IEEE 1394 cameras to be more flexible than analog cameras. The number of cameras on the market is increasing rapidly, including low cost, high-speed, and high-resolution cameras. The flexibility of the digital interface allows for a wider variety of resolution and speed configurations than analog.

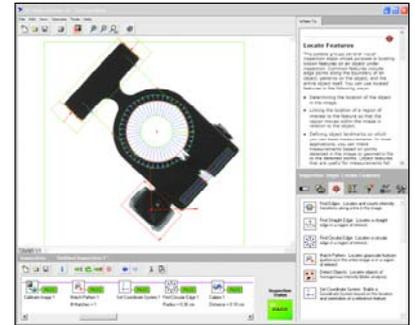
NI-IMAQ for IEEE 1394 driver software offers a mobile, easy-to-use solution for acquiring images from FireWire cameras. The driver software integrates with NI Measurement & Automation Explorer, so you can easily configure your camera and acquire images within minutes of setup. With a set of easy-to-use functions, you can quickly create applications in LabVIEW, Visual Basic, C, or C++ by creating VIs or directly accessing the C library functions. The software works with cameras that are IIDC or DCAM-compliant.



For a more comprehensive list of algorithms and functions supported by NI Vision Software, go to ni.com/vision.

Vision Builder for Automated Inspection

NI Vision Builder for Automated Inspection is configurable machine vision software for building, benchmarking, and deploying applications. NI Vision Builder for Automated Inspection does not require programming, yet is scalable to LabVIEW graphical programming environments.



Vision Builder for Automated Inspection includes a built-in deployment interface, with which you can quickly deploy your application once you have finished development.

Based on industry-proven National Instruments imaging functions, NI Vision Builder AI offers an extensive set of optimized functions for gauging, coordinate systems, pattern matching, particle counting, optical character recognition, spatial calibration, and more. Improve yields and product quality of automotive and electronics components, metals, fasteners, health care products, semiconductor wafers, food and beverage containers, and more.

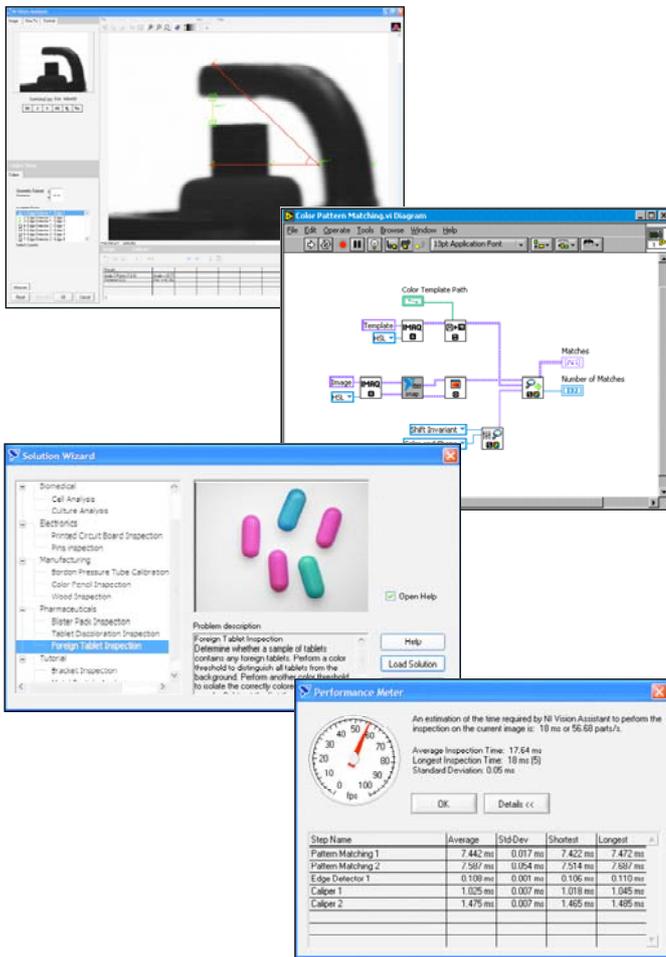
With the decision-making interface, you can define pass/fail criteria and classify parts. You can set limits for each individual inspection step and also use the intuitive decision-making interface to create complex decision expressions for the entire system. The results of these decisions can be routed to digital lines, the user interface, or a serial port.

From the configuration interface of Vision Builder for Automated Inspection, you can control the digital lines on any NI data acquisition product that has static DIO capabilities (e.g. NI 6527, E Series DAQ). These I/O signals can be mapped to global system signals such as acquisition ready, part fail, and acquisition in progress. You can also send and receive messages over the serial port of the computer. You can create messages that include inspection data, inspection results, and customized data for transmission over the serial lines.

- | | | | |
|--|-------------------------------------|--|--|
| | Acquire FireWire cameras | | Caliper distance measurements |
| | Find and match patterns | | Calibrate measurements to real-world units |
| | Set up coordinate systems | | Measure intensity |
| | Detect and measure objects | | Communicate with external devices (PLCs, etc.) |
| | Find any number of edges | | Read text (OCR) |
| | Find circular edges | | Read 1D bar codes |
| | Find and measure straight edges | | Pass/Fail decision-making |
| | Perform advanced geometric analysis | | |

Sample of the many functions available in Vision Builder for Automated Inspection

Machine Vision Software



	NI-IMAQ Driver Software	Vision Builder for Automated Inspection	Vision Development Module
	Comes with IMAQ hardware	Stand-Alone Configuration Software	Programming Libraries
One-shot acquisition	✓	✓	✓
Continuous acquisition	✓	✓	✓
Triggered acquisition	✓	✓	✓
Camera configuration	✓	✓	✓
Trigger output	✓	✓	✓
Full frame rate display	✓	✓	✓
Save images to disk	✓	✓	✓
Write uncompressed AVI	✓	–	✓
Write compressed AVI	–	–	✓
Image manipulation tools	–	✓	✓
Pixel manipulation tools	–	✓	✓
Image filters	–	✓	✓
Image arithmetic	–	✓	✓
Image logic functions	–	✓	✓
Morphology	–	✓	✓
Region of interest tools	–	✓	✓
Particle analysis	–	✓	✓
Gauging	–	✓	✓
Pattern matching	–	✓	✓
Distortion calibration	–	✓	✓
Real-world measurements	–	✓	✓
1D barcode reader	–	✓	✓
Coordinate systems	–	✓	✓
Complex and Fourier analysis	–	–	✓
Optical character recognition	–	✓	✓*
Color matching	–	–	✓
Color pattern matching	–	–	✓
Instrument reader	–	–	✓
LabVIEW Real-Time compatible	–	✓	✓
Performance benchmarking	–	✓	✓
LabVIEW VI generation	–	✓	✓
Time-banded Algorithms	–	–	✓
Customizable user interface	–	–	✓
Integration with motion control	–	–	✓
Integration with data acquisition	–	–	✓

*Requires NI OCR Software



NI Vision Development Module

The NI Vision Development Module is a suite of software tools that offers high-level interactive software as well as low-level image processing functions. The module includes Vision Assistant, an interactive prototyping tool that accelerates your development, and IMAQ Vision, a collection of more than 200 image processing and analysis functions. These tools work together for fast application development for industrial and scientific imaging applications.

Vision Assistant is a prototyping tool that generates code for LabVIEW, Visual Basic, and C. Vision Assistant is ideal for applications where fast time to market and low cost of ownership is a must. With Vision Assistant software you can quickly set up and benchmark an imaging strategy using hundreds of image processing and analysis functions.

Use IMAQ Vision in the development environment of your choice such as LabVIEW, Visual Basic, C, and C++ to customize your imaging strategy developed by Vision Assistant; add integration to other devices such as motion control, data acquisition, and other automation devices; and develop a deployable software solution with a customized user interface.

Optical Character Recognition (OCR)

NI OCR Software is trainable optical character recognition software specifically designed to identify all types of fonts, characters, and symbols. NI OCR Software provides high-speed, reliable reading performance despite poor and inconsistent image quality that may result from industrial process variations. You can use OCR for applications including pharmaceutical inspection of pill bottle labels and lot codes, semiconductor verification of wafers and IC package codes, quality control for stamped machine parts, and sorting of mail packages and parcels.

You can train different types of fonts and symbols, including common industrial fonts such as OCR A, OCR B, and SEMI, to create a reliable optical character recognition system.

Machine Vision Hardware: Compact Vision System



Overview

National Instruments CVS-1450 series systems give you flexibility, integration, and ruggedness for all of your inspection, alignment, gauging, and identification applications. A high-performance processor integrated with three FireWire ports means that NI CVS-1450 systems are equipped to handle any inspection task. A diverse range of digital I/O options means that CVS-1450 systems can communicate with a wide range of automation devices including PLCs, relays, and robotics.

Multicamera Inspection

The NI Compact Vision System provides a low-cost way to inspect from several angles. With three FireWire ports, you can connect up to 16 cameras to the Compact Vision System with ease. Each camera shares a portion of the 400 Mb/s bandwidth.

Choice of Sensor

By using FireWire image acquisition, an NI Compact Vision System gives you the option of choosing the sensor that is right for your application. You can choose a low-cost, low-resolution sensor or a high-performance sensor. In addition, as new improved industrial FireWire cameras enter the marketplace, CVS-1450 series systems are ready for them.

External Device Control

The CVS-1450 series has 29 digital I/O lines with built-in functionality for communicating with external devices, such as reading quadrature encoder inputs, generating strobe pulses, and writing to or reading from digital lines. Using these signals, you can dynamically control your lighting or cameras, synchronize with a conveyor belt, or communicate with relays that control solenoids and other actuators. Digital inputs and outputs are available for both 24 V and TTL-signaling levels. The CVS-1450 series has 15 digital input lines – 13 isolated 24 V lines and two dedicated TTL lines. There are also 14 digital output lines – four 24 V and 10 dedicated TTL. In addition, CVS-1450 systems can send commands and data to other devices, such as PLCs, via Ethernet and RS-232 Serial.

Real-Time Display

Using the VGA output, you can see the product under inspection in real time, as well as pass/fail and inspection data. All of the overlays are user definable; you can change the overlays programmatically and create custom user displays. Connect the system to any network to monitor the inspection. Send images over the network for viewing or store them in a database for future reference. In addition, you can use NI VI Server technology to publish your data and results in real time to a Web browser.

	NI CVS 1454	NI CVS 1455
Processor	883 MIPS*	1436 MIPS*
Memory	128 MB	128 MB
Storage	32 MB	128 MB
DIO	29	29
Operating Temperature	0 - 55 °C	0 - 55 °C
Cameras	up to 15	up to 15

*MIPS: Million Instructions Per Second

Connect to Compact FieldPoint

CVS-1450 systems connect easily to Compact FieldPoint, the National Instruments real-time modular industrial control and measurement system. If you need analog signals, specialized digital inputs, or other types of distributed control to interface with your NI Compact Vision System, you can link them easily with the combination of the Compact Vision System and Compact FieldPoint.

Rugged, Reliable Design

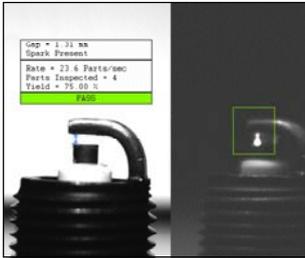
Run your application with confidence. The Compact Vision System uses the award-winning LabVIEW Real-Time engine, a reliable and embedded programming environment. Time-bounded algorithms ensure that you can meet the deterministic demands of your system. The temperature range of 0 to 55 °C ensures that uptime is kept at a maximum. No fans, vents, or moving parts ensures reliable industrial inspection for robotics, packaging, or assembly applications.



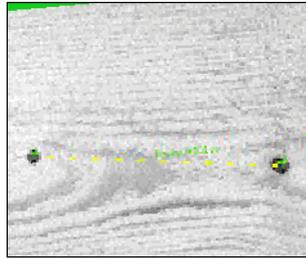
AWARD WINNER

Test & Measurement World recently recognized the NI-CVS 1454 as a Best in Test winner and a finalist for Test Product of the Year 2004.

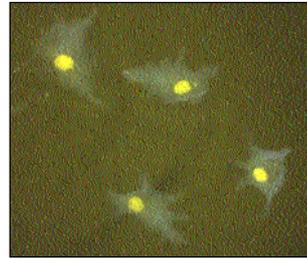
Sample Applications



Automotive



Web Inspection



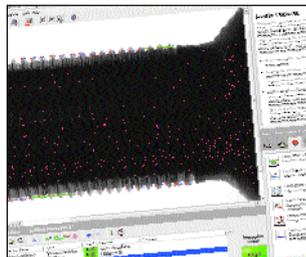
Biotechnology



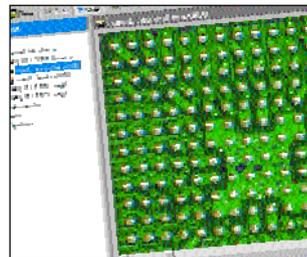
Consumer Goods



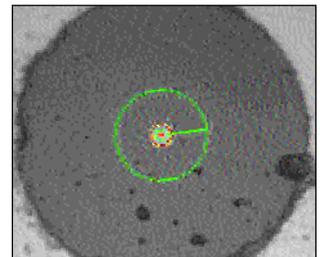
Government/Defense



Industrial Inspection



Semiconductor/Electronics



Telecommunications

NI imaging products have been used in a wide range of applications from automotive to telecommunications. Sample applications are listed below.

Automotive

- Automotive cluster inspection
- Automated brake inspection system
- Spark plug inspection and verification
- Fuel spray inspection and characterization

Web Inspection

- Plastic sheet shearing inspection
- Automated straightening of steel bars
- Wood plank inspection

Biotechnology/Biomedical/Pharmaceutical

- Automated analysis of ultrasound images
- Automated human eye tracking
- Pharmaceutical process monitoring
- Quantitative analysis of cytoskeletal fiber orientation
- Automated drug delivery test system

Consumer Goods

- Automated control and inspection of bottling line
- Print registration quality control
- Precision watch inspection
- Diamond manufacturing inspection

For a more complete list on these applications, visit ni.com/vision and select **Customer Solutions**.

Government/Defense

- Bank note inspection
- Airport security check inspection
- Government lab security surveillance
- Mask lens fogging inspection

Industrial Inspection

- Inspection and analysis of air bubbles in liquids
- Surface flaw detection in plastic film
- Automated pencil sorting
- Smart card manufacturing

Semiconductor/Electronics

- Automated electron beam physical vapor deposition
- Patterning for DFB laser manufacturing
- Production of precision alloy microspheres
- Thickness measurement of micromachined silicon wafers

Telecommunications

- High-speed precision alignment of fiber-optic components
- Flat panel display inspection
- Fiber-optic end face inspection
- Liquid crystal display (LCD) inspection system

Resources

Get Your Vision System Right the First Time!

NI provides many Web resources for building your vision system correctly the first time. Find hundreds of user solutions, applications notes, and tutorials. Browse the thousands of example programs and use them in your software today at ni.com/vision. You can also evaluate NI products on the Vision Demo CD and Demo Software.

Find the right camera with Camera Advisor.

Explore thousands of example programs, applications notes, and user solutions.

Take advantage of online product demos, manuals, training, and other resources.

Learn more about NI Vision products.

View Web events on demand from industry experts.

Camera Advisor ni.com/camera

To assist in selecting the correct camera for your application, select from hundreds of cameras from more than 30 vendors such as:

- Adimec
- Basler
- Cohu
- DVC
- Dalsa
- FLIR Systems
- Hamamatsu
- Hitachi
- Imaging Solutions Group
- Indigo Systems
- JAI-Pulnix
- Perkin Elmer
- Raytheon
- Redlake
- SVS-Vistek
- Sensors Unlimited
- Sensovation
- Sentech
- Sony
- UNIQ Vision



Camera, Optics, and Lighting

If you are interested in designing the system yourself but need assistance in selecting the correct components of your system, including optics, lighting, and cameras, consult one of our product partners. They have the expertise to help you select the right components for your system every time:

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System Integrators

If you need a complete turnkey inspection application or just some assistance on a certain aspect, these system integrators have the expertise and know-how to solve machine vision and scientific imaging applications. In addition, most of them have experience in industrial automation environments and skills to integrate motion control, process control, and other measurement functionality into your system.

- PVI Systems
- MicroCraft
- Aegis Solutions
- Viewpoint Systems
- Bloomy Controls
- Epic Systems
- Alliance Vision
- Wineman Technologies
- VI Engineering
- Cal-Bay Systems
- Soliton Automation
- Qualimatest
- Data Science Automation
- NVSI

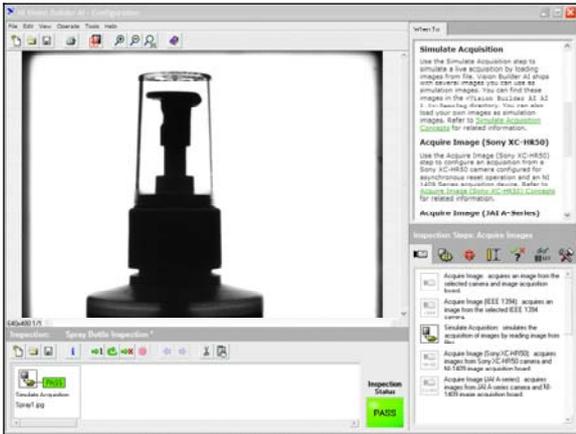
"With the NI Compact Vision System, I'm now able to take machine vision into places where ruggedness and reliability are crucial."

Robert Eastlund
 Graftek Imaging

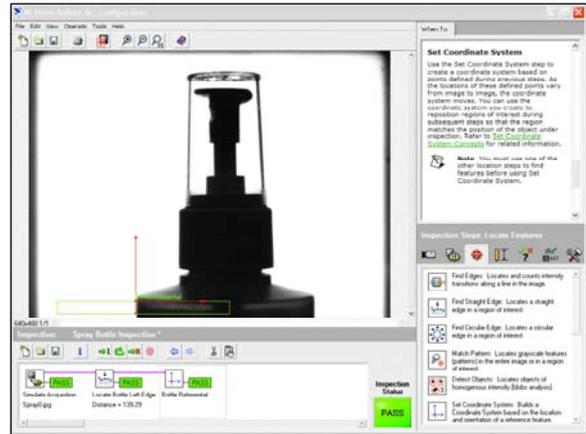
Evaluation Software Tutorial

The following inspection example is included with the Vision Builder for Automated Inspection Evaluation CD. It inspects a spray bottle to ensure the pump is threaded correctly, the cap is present, and the nozzle is correctly assembled.

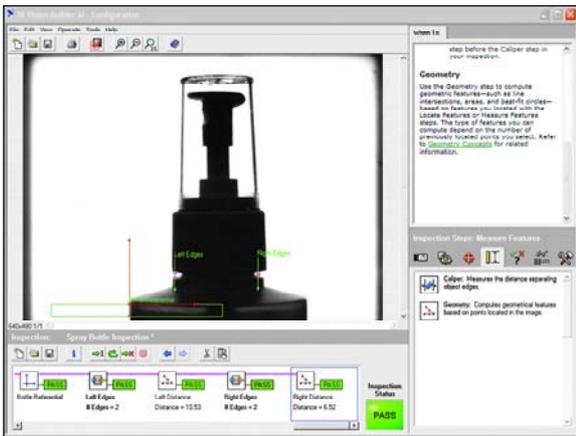
To launch this example in Vision Builder for Automated Inspection, choose Configure Inspection from the initial splash screen. From the Configuration Interface, select File>>Open and choose the example titled *Spray Bottle Inspection*.



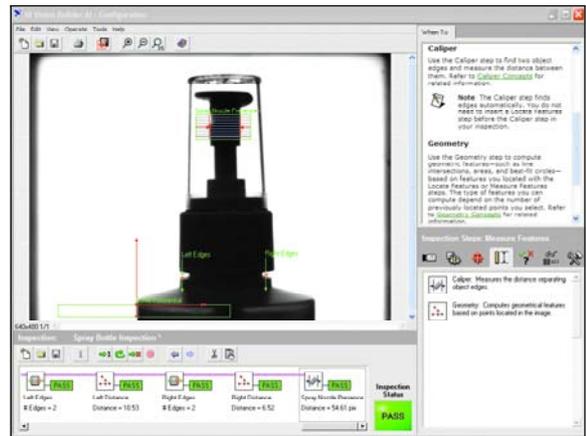
Step 1. Simulate an image capture.



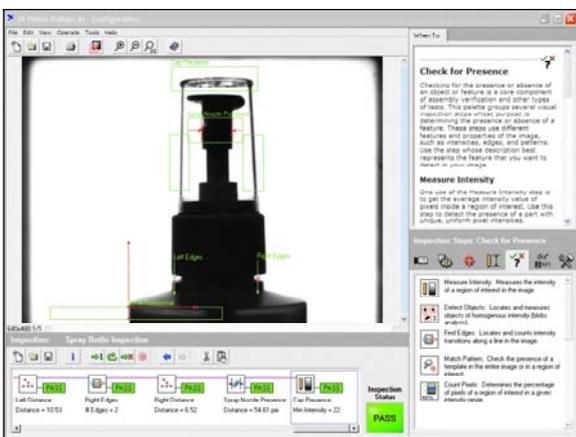
Step 2. Use the bottle's left edge to build a coordinate system.



Step 3. Measure the distance between the pump base and the bottle.



Step 4. Ensure the spray nozzle is present.



Step 5. Check if the cap is correctly placed.

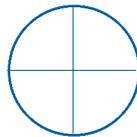


Step 6. Deploy the completed inspection with a single mouse click.

Evaluation Software

Develop your application without
programming using NI Vision Builder for
Automated Inspection

Interessiert an einer kostenlosen Demo CD?



einfach anrufen:

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Tel: +49(0)7243 / 604-180

Fax: +49(0)7243 / 69944

E-Mail: bv@polytec.de

www.polytec.de/bv

Acquire from IEEE 1394 Cameras
with Evaluation Driver Software