

## PRODUCT FLYER

# Compact Vision Systems

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# Compact Vision Systems

NI CVS-1458 and NI CVS-1459



- Vision Builder for Automated Inspection configuration-based software included for designing and deploying high-performance vision inspection applications
- Dedicated bandwidth for two USB3 or GigE Vision cameras
- Rugged, fanless design with operating temperature up to 0 °C to 55 °C
- OS—Windows Embedded Standard 7 and NI Linux Real-Time
- Processor—1.91 GHz Intel Atom quad-core processor, 4 GB DDR3 RAM, and 32 GB storage
- FPGA—Spartan-6 LX25 for custom I/O timing, synchronization, and control

## Bundling Rugged Hardware With Powerful Software

NI Compact Vision Systems are rugged automation controllers that combine industrial camera connectivity, open communication, and FPGA-based I/O in a small form factor. They are designed to acquire and process images in real time from multiple cameras and provide the flexibility, integration, and ruggedness for machine vision applications.

These systems are powered by quad-core Intel Atom processors and can run either Windows Embedded Standard 7 (WES7) or NI Linux Real-Time, so you can choose the familiarity of a Windows user interface or the reliability of a real-time OS. The NI Linux Real-Time OS gives you access to the Linux community's massive software ecosystem. The embedded user interface capability of NI Linux Real-Time enables the implementation of a local human machine interface to simplify your application development.

NI Compact Vision Systems provide connectivity for communication and synchronization with GigE Vision and USB3 Vision cameras, CompactDAQ chassis, EtherCAT and Ethernet CompactRIO chassis, EtherCAT motion drives, and other automation equipment. In addition, this controller has onboard ISO, TTL, and differential digital I/O, so it can perform synchronization and control tasks without additional tethered I/O.

NI Compact Vision Systems include a development license of Vision Builder for Automated Inspection (AI), an interactive and configuration-based development environment that simplifies programming. You can use Vision Builder AI to access more than 100 powerful machine vision tools including geometric matching, optical character recognition (OCR), and particle analysis to locate, count, measure, identify, and classify objects.

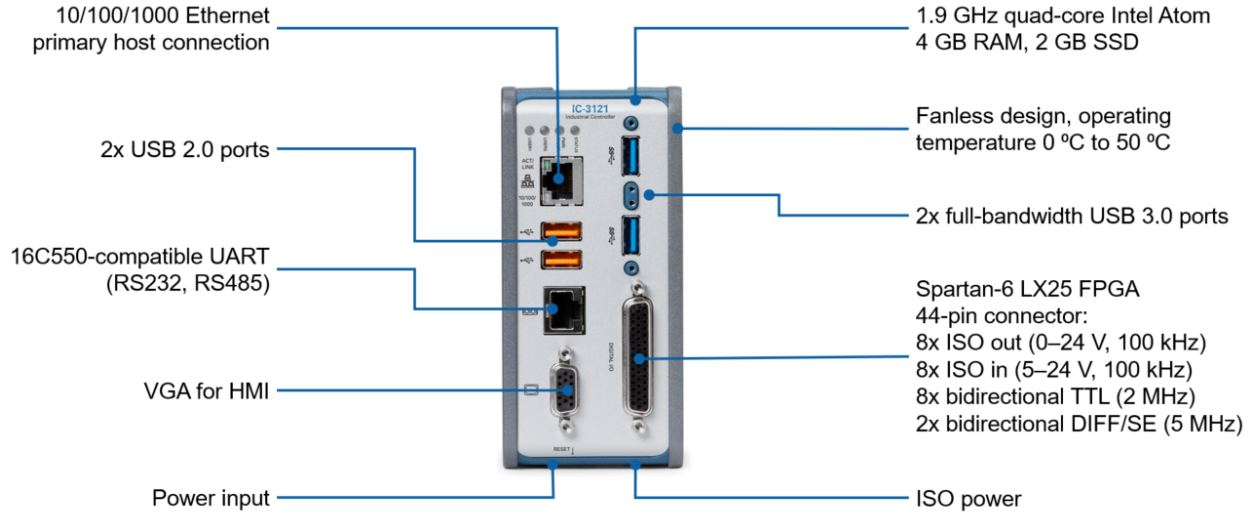
You can also use LabVIEW system design software to create, debug, and deploy logic to NI Compact Vision Systems through hundreds of prewritten libraries for analysis, control, logging, motion, and image processing. With these validated software libraries, you can reduce the time you spend piecing together software components from different vendors and troubleshooting compatibility issues.

*Table 1. NI Compact Vision System Specifications*

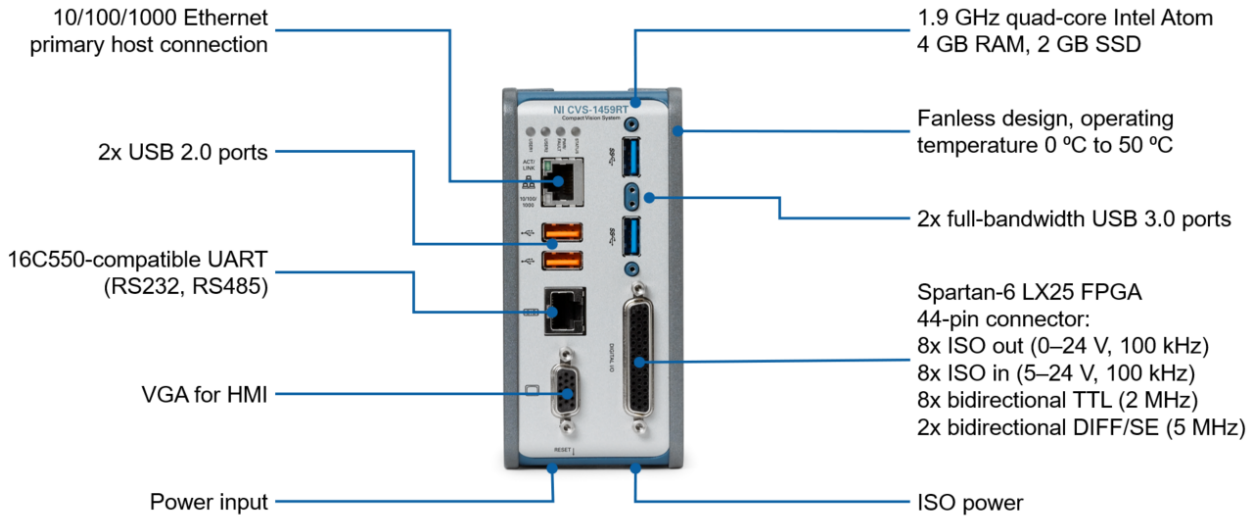
	NI CVS-1458	NI CVS-1459
Processor	1.91 GHz Quad-Core Intel Atom	1.91 GHz Quad-Core Intel Atom
OS	WES 7 or NI Linux Real-Time	WES 7 or NI Linux Real-Time
RAM Size	4 GB	4 GB
Onboard Storage	Up to 32 GB	Up to 32 GB
FPGA	Spartan-6 LX25	Spartan-6 LX25
Industrial I/O	8 ISO In, 8 ISO Out, 8 TTL, 2 DIFF QE	8 ISO In, 8 ISO Out, 8 TTL, 2 DIFF QE
Camera Interface	GigE Vision	USB3 Vision
GigE PoE Ports	2	--
USB 3.0 Ports	--	2
USB 2.0 Ports	2	2
IEEE 1588 (PTP)	Software Timed	Software Timed
Power	12 to 24 V DC	12 to 24 V DC
Temperature Range	0 °C to 55 °C	0 °C to 55 °C
Display	VGA	VGA
IP Rating	IP40	IP40
Size	10.8 cm × 6.1 cm × 13.0 cm	10.8 cm × 6.1 cm × 13.0 cm

# Detailed Views of NI Compact Vision Systems

## NI CVS-1458



## NI CVS-1459



# Key Features

## Performance

NI has strong relationships with key technology providers like Intel and Xilinx. For example, NI is an associate member of the Intel Embedded Alliance, which offers access to the latest Intel product roadmaps and samples. These relationships allow the company to integrate the latest technology into their products shortly after they release, which provides a performance edge in the industry.

Unlike many industrial PCs on the market today, NI Compact Vision Systems feature a heterogeneous processing architecture that contains two processing units: (1) a processor running Windows or a real-time OS for communication and signal processing and (2) an FPGA for use as a co-processor that implements high-speed control and custom timing and triggering directly in the hardware.

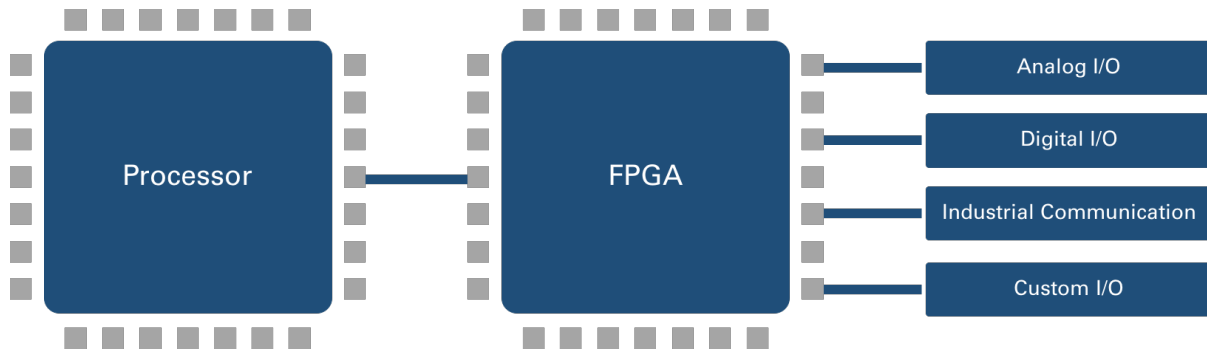


Figure 1. Use the heterogeneous architecture of NI Compact Vision Systems to meet your processing needs.

## Processor

NI Compact Vision Systems contain a 1.91 GHz quad-core Intel Atom processor with low power consumption in an industrial form factor.

## FPGA

The onboard FPGA is a Xilinx Spartan-6 LX25. The Spartan-6 is a great fit for high-speed control as well as custom timing and triggering.

Table 2. Xilinx FPGA Specifications

FPGA	Flip-Flops	6-Input LUTs	DSP48 Slices	Embedded Block RAM (kb)
Spartan-6 LX25	30,064	15,032	38	936

## Optimized for Machine Vision

You can use NI Compact Vision Systems in a wide variety of applications ranging from data acquisition to control. The connectivity options and the unique design make them especially useful in machine vision applications. These controllers support the GigE Vision and USB3 Vision standard, so you can choose the compliant camera of your choice.

## GigE Vision

The NI CVS-1458 features two Power over Ethernet (PoE) ports, each with dedicated bandwidth. If you require more than two GigE Vision cameras, you can use a hub to connect additional cameras with shared bandwidth.

## USB3 Vision

The NI CVS-1459 features two dedicated-bandwidth USB 3.0 ports for connecting USB3 Vision cameras. NI is one of the few vendors that offer cable retention on USB 3.0 ports, which increases the reliability of the connection in industrial environments.

## FPGA-Enabled I/O

With NI Compact Vision Systems, you can use the onboard FPGA for more powerful I/O. The controllers include a prebuilt FPGA personality called Vision RIO, an API that allows you to take advantage of FPGA-enabled I/O without programming the FPGA. With Vision RIO, you can configure a queue of pulses and set line states so, without FPGA programming knowledge, you can reliably synchronize I/O with visually inspected parts. Using the Vision RIO API, you can configure several different scenarios, including triggered acquisition with multiple encoder-controlled and proximity-controlled ejectors and managed ejectors controlled with PLC-issued timestamps.

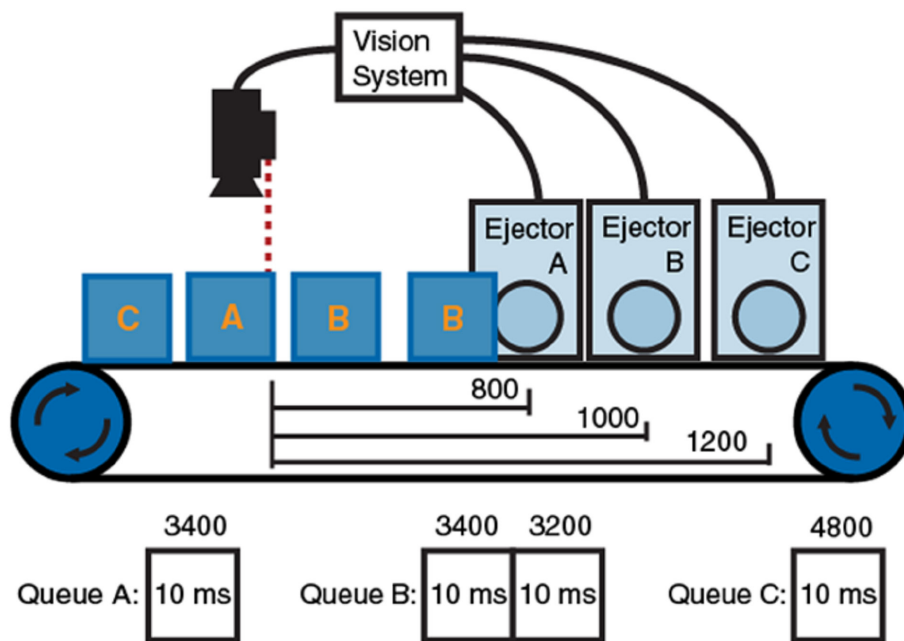


Figure 2. This triggered acquisition example features multiple encoder-controlled ejectors.

Beyond the Vision RIO API, you can take advantage of the LabVIEW FPGA Module to develop custom, application-specific IP to meet your unique application needs.

## Ruggedness

NI Compact Vision Systems are designed, tested, and validated according to stringent design practices to ensure reliable operation in harsh industrial environments. These controllers can meet demanding requirements for performance, operating temperature, and vibration while delivering unrivaled control and data acquisition capabilities in a compact, rugged package. They feature an operating temperature range of 0 °C to 50 °C, 50 g shock and 5 g vibration ratings, and a variety of international safety, HazLoc, and environmental certifications and ratings for operation in harsh industrial environments.

# Integrated Software

You can define—and redefine—the functionality of your NI Compact Vision System with intuitive software and use a single toolchain for every phase of your design cycle, from modeling and simulation to prototyping and validation to deployment and beyond. NI software reduces risk, enhances productivity, and eliminates the need to create and maintain I/O drivers, operating systems, and other middleware.

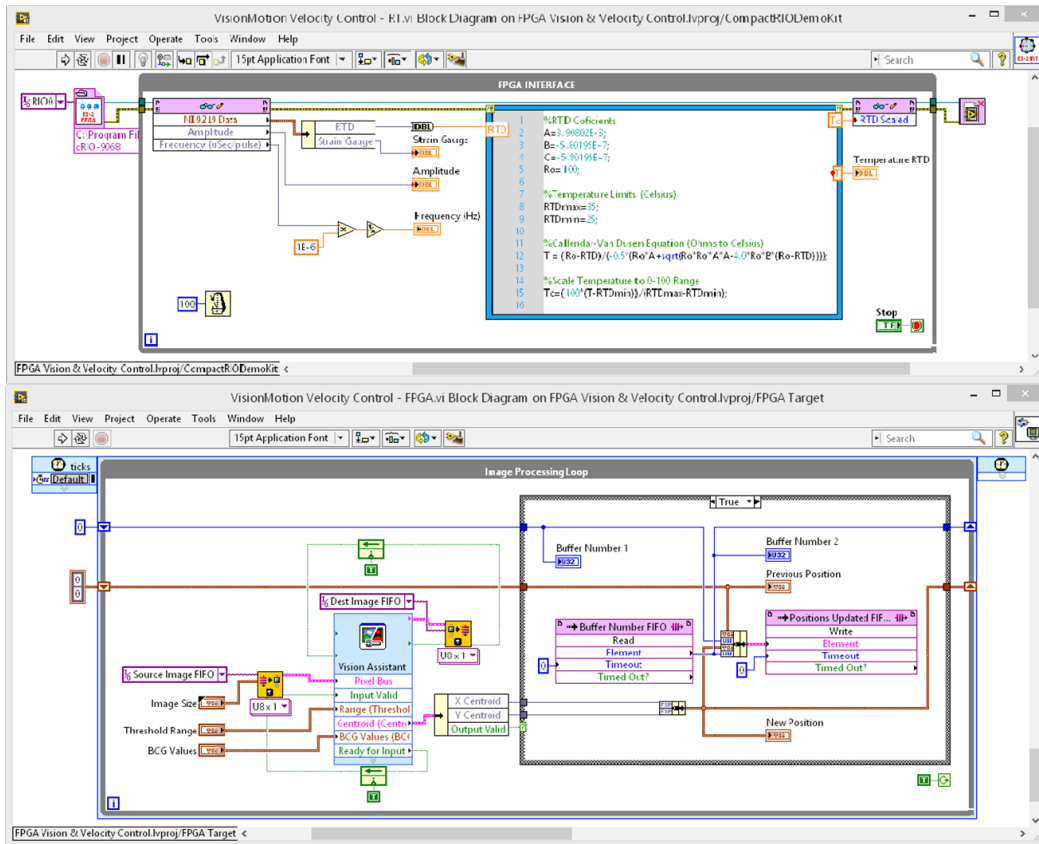


Figure 3. Intuitive and Cohesive Software Programming Environment

## Reduced Development Time

Focus on solving problems, not low-level programming tasks, with built-in constructs to manage timing and memory in an intuitive programming environment.

## Open Software Interoperability

Leverage other programming approaches alongside or within LabVIEW to reuse IP and take advantage of existing expertise.

## Built-In Libraries

Use the over 950 LabVIEW built-in signal processing, analysis, control, and mathematics functions to develop embedded control and monitoring systems faster.

## User-Programmable FPGA

Implement high-speed signal and image processing, custom timing and triggering, and control algorithms directly in hardware to maximize reliability and determinism.

## Remote System Management

Transfer data between systems or remotely update hundreds of controllers at once with built-in system management utilities.

## LabVIEW Tools Network

Extend the capabilities of your system with a vast ecosystem of certified, application-specific add-ons.



# Leverage the Openness of NI Linux Real-Time: A Prebuilt, Validated RTOS

## Development Tool Options

Program the real-time processor with LabVIEW, C/C++, or textual math and reuse code from past projects to save development time.

## Linux Ecosystem

Access thousands of open-source applications, IP, and examples and collaborate with an active community of users and developers.

## Security

Boost security and reliability with native support for Security-Enhanced Linux, which delivers mandatory access control through custom policy creation.

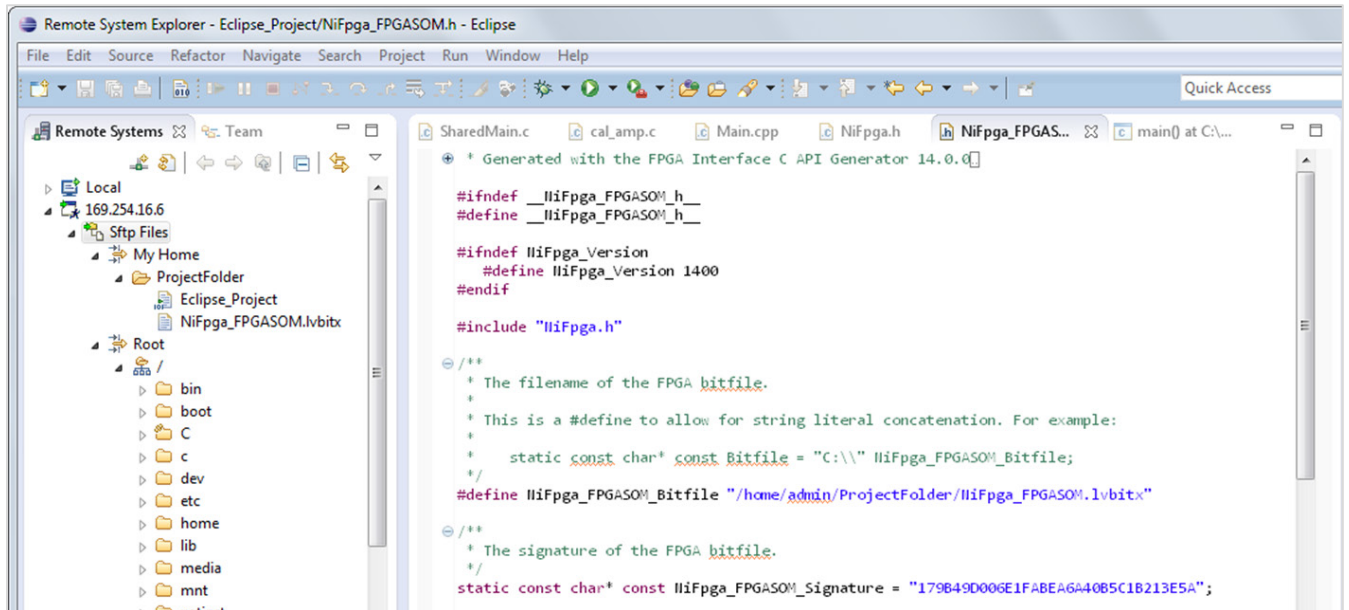


Figure 4. NI Linux Real-Time targets allow you to develop, deploy, and debug C/C++ code using Eclipse or your IDE of choice.

## Customize Programmable Hardware With LabVIEW FPGA

Take advantage of the graphical LabVIEW environment to program the onboard FPGA and unlock the incredible power of these devices even without any knowledge of hardware description languages like VHDL or Verilog. The LabVIEW FPGA Module not only removes the requirement for HDL programming but also eliminates the need to think through timing constraints, I/O configuration, and place and route settings, which are notoriously complex tasks.

- Built-in language constructs to manage clocks/timing, memory, I/O, and data transfer (DMA)
- Cycle-accurate simulation and debugging capabilities
- Support for HDL code integration
- Cloud compile support to reduce compile times
- Access to free IP for complex mathematics, high-speed control, image processing, signal analysis, and more in the FPGA IPNet community



# Vision Software

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## Vision Builder for Automated Inspection

Every NI Compact Vision System is shipped with a development license of Vision Builder for Automated Inspection (AI). Vision Builder AI is a stand-alone configurable software environment that you can use to easily build, benchmark, and deploy applications for pattern matching, character recognition, presence detection, part classification, and more. It offers an interactive menu-driven development environment that replaces the complexities of programming with a simple development and maintenance process without sacrificing performance or range of functionality.

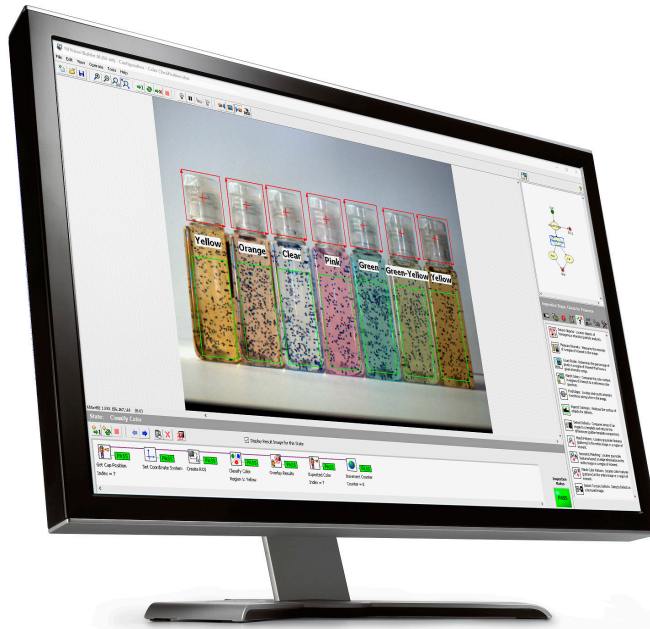


Figure 5. Simplify development with a sophisticated environment.

Vision Builder AI offers the following features:

**Faster Development and Deployment**—Vision Builder AI allows you to develop powerful machine vision applications. Using the menu-driven environment, you can focus on algorithm development instead of programming.

**Advanced Decision Making**—With the built-in State Diagram Editor, digital I/O, and industrial communications, you can deploy your Vision Builder AI application into the rest of your automated system.

**Fully Tested Toolchain**—The scalability of Vision Acquisition Software coupled with third-party camera support provides an open and fully tested infrastructure that saves time and money.

**Reduced Development Time**—By importing or acquiring test images directly into Vision Builder AI, you can use real data to develop your algorithms.

**Customizable Algorithms**—The results of each function in your algorithm can be seen immediately, allowing for easy modifications to your algorithm each step of the way.

**Built-In Productivity Tools**—With tools for template generation, OCR training, pattern matching, and more, you can develop algorithms faster.

## Vision Development Module

The Vision Development Module offers hundreds of image processing algorithms and acquisition functions that you can use across the entire NI vision hardware portfolio to meet any vision application need. For more advanced imaging applications, the Vision Development Module is the ideal software package. With its comprehensive function library, you can access hundreds of image processing algorithms and machine vision functions to enhance images, check for presence, locate features, identify objects, measure parts, and more. The Vision Development Module offers the most flexibility and low-level function control for developing vision application solutions.



Figure 6. Build highly customized applications with systems in mind.

The Vision Development Module offers the following features:

**High-Performance Solutions**—Use hundreds of functions to develop high-performance vision algorithms to run on CPUs and FPGAs.

**The Programming Language of Your Choice**—Program your application in LabVIEW, LabWindows™/CVI, and C/C++.

**Complete System Design**—Expand your application beyond just vision. Incorporate motion control, I/O, and HMI in your design.

**Massive Parallelism**—Remember that FPGAs are parallel in nature, so they are ideally suited for vision applications. Parallelizing your algorithm decreases processing time, reduces latency, and increases overall throughput.

**Infinite Customizability**—Customize your algorithm to meet your exact requirements because FPGA-based image processing is implemented pixel by pixel.

**No FPGA Experience Needed**—Develop high-performance FPGA-based vision algorithms the same way you do for a CPU-based design. You do not need to know traditional FPGA design tools.

# Vision Assistant

One of the challenges of developing software for machine vision applications is that vision algorithm development is an iterative process that requires multiple repetitions of testing, adjusting function parameters, and retesting until the software meets application requirements. This can be especially troublesome when using FPGAs for image processing because the traditional approach to FPGA development can slow down innovation due to the compilation times required between each design change of the algorithm. To address this challenge, the Vision Development Module includes a tool called the Vision Assistant.

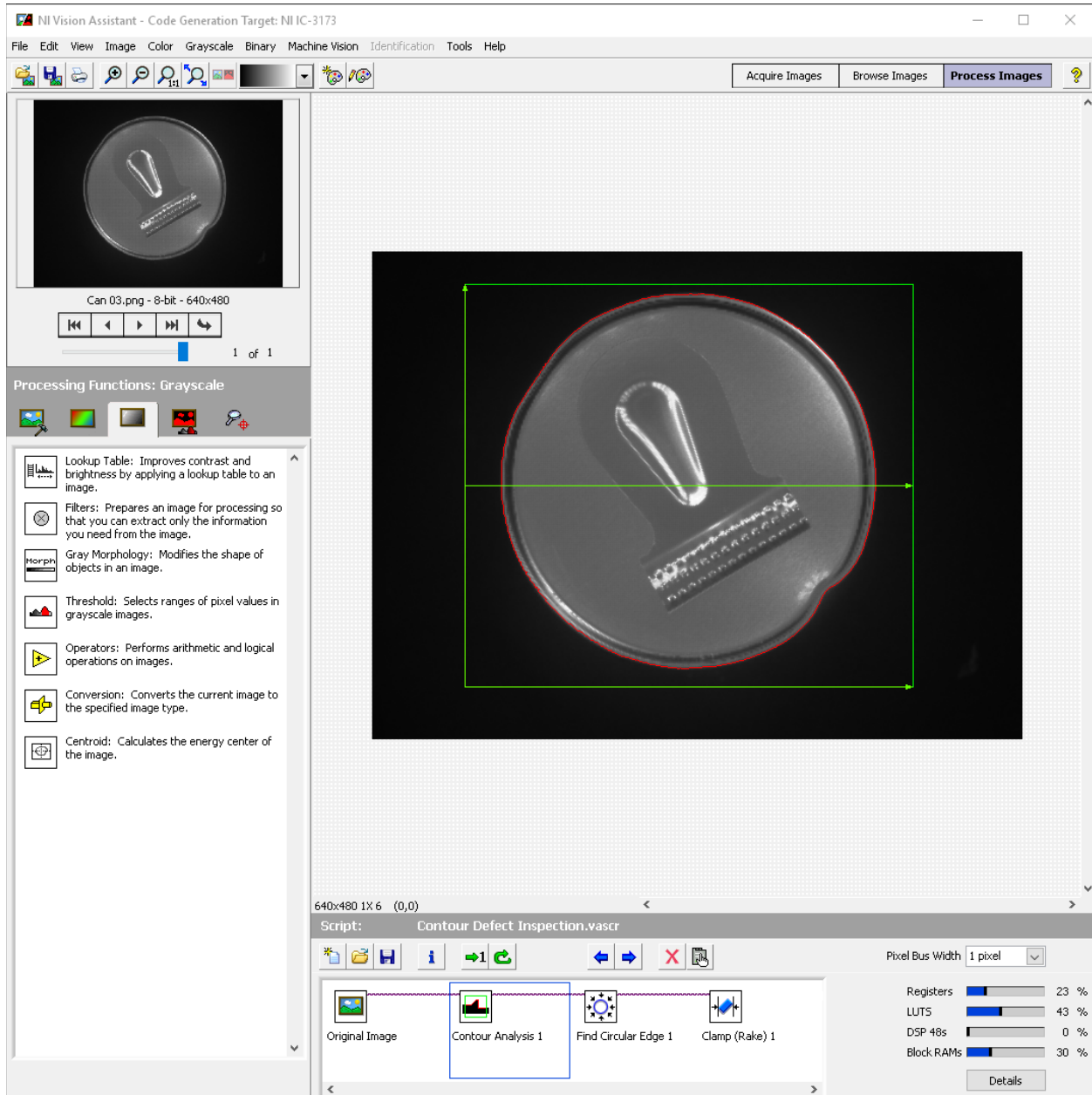


Figure 7. Developing an algorithm in a configuration-based tool for FPGA targets with integrated benchmarking reduces the time spent waiting for code to compile and accelerates development.

The Vision Assistant is an algorithm engineering tool that simplifies vision system design by helping you develop algorithms for deployment on either the CPU or FPGA. Like Vision Builder AI, it provides a configuration-based approach to building vision algorithms. Load or acquire sample images and see the results of each processing step as it is configured so you can rapidly prototype your machine vision algorithm. It also provides the necessary benchmarking tools to gauge the performance of the algorithm. In addition, you can use the Vision Assistant to test the algorithm before compiling and running it on the target hardware while easily accessing throughput and resource utilization information.

Once you are satisfied with your algorithm, you can use the Vision Assistant to generate LabVIEW or C code ready for deployment on the hardware controller of your choice. Here, you can easily modify the generated code to integrate it with other parts of your system.

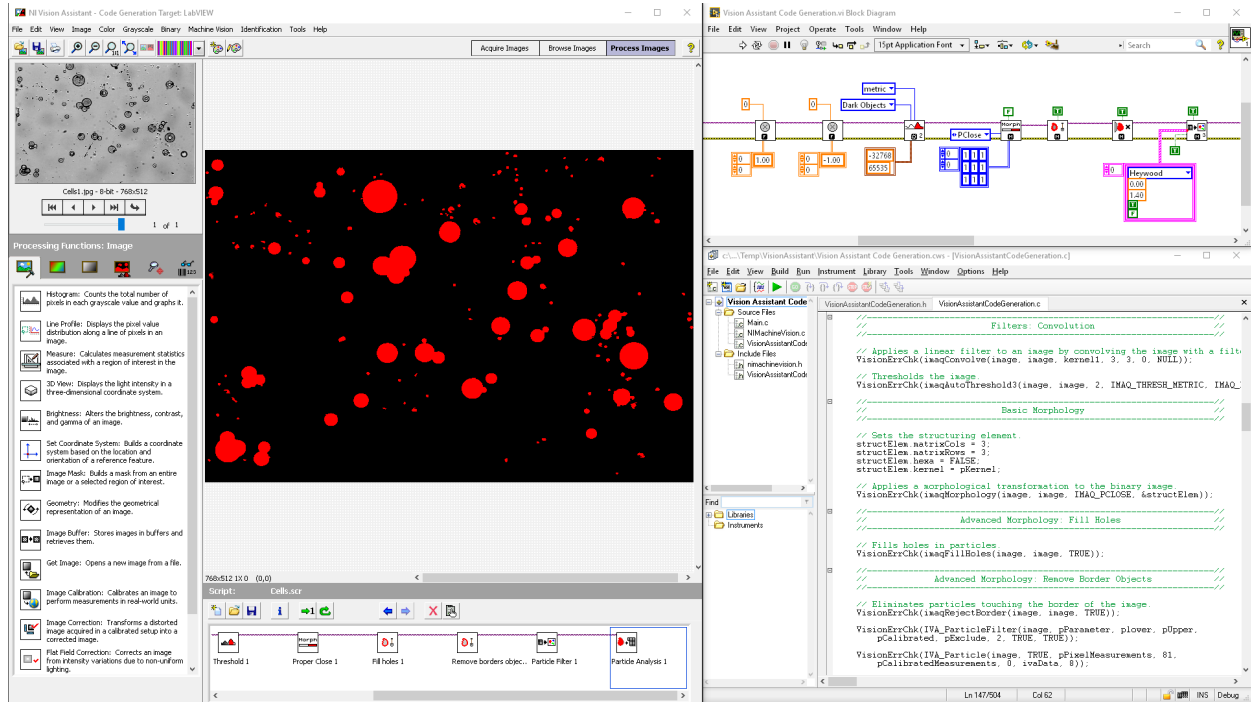


Figure 8. Use the Vision Assistant to generate LabVIEW or C code.

# Hardware Services

All NI hardware includes a one-year warranty for basic repair coverage, and calibration in adherence to NI specifications prior to shipment. PXI systems also include basic assembly and a functional test. NI offers additional entitlements to improve uptime and lower maintenance costs with service programs for hardware. Learn more at [ni.com/services/hardware](http://ni.com/services/hardware).

	Standard	Premium	Description
Program Duration	1, 3, or 5 years	1, 3, or 5 years	Length of service program
Extended Repair Coverage	•	•	NI restores your device's functionality and includes firmware updates and factory calibration.
System Configuration, Assembly, and Test <sup>1</sup>	•	•	NI technicians assemble, install software in, and test your system per your custom configuration prior to shipment.
Advanced Replacement <sup>2</sup>		•	NI stocks replacement hardware that can be shipped immediately if a repair is needed.
System Return Material Authorization (RMA) <sup>1</sup>		•	NI accepts the delivery of fully assembled systems when performing repair services.
Calibration Plan (Optional)	Standard	Expedited <sup>3</sup>	NI performs the requested level of calibration at the specified calibration interval for the duration of the service program.

<sup>1</sup>This option is only available for PXI, CompactRIO, and CompactDAQ systems.

<sup>2</sup>This option is not available for all products in all countries. Contact your local NI sales engineer to confirm availability.

<sup>3</sup>Expedited calibration only includes traceable levels.

## PremiumPlus Service Program

NI can customize the offerings listed above, or offer additional entitlements such as on-site calibration, custom sparring, and life-cycle services through a PremiumPlus Service Program. Contact your NI sales representative to learn more.

## Technical Support

Every NI system includes a 30-day trial for phone and e-mail support from NI engineers, which can be extended through a [Software Service Program \(SSP\)](#) membership. NI has more than 400 support engineers available around the globe to provide local support in more than 30 languages. Additionally, take advantage of NI's award winning [online resources](#) and [communities](#).

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