# Real-Time Embedded Vision System

## NI EVS-1464RT

- Rugged, fanless, machine vision system
- Intel Core 2 Duo processor (1.66 GHz)
- 1 GB solid-state drive and external flash
- 1 GB DDR2 memory
- Small footprint

**Connectivity Options**
- GigE Vision and IEEE 1394 IIDC native support
- 29 TTL and isolated DIO lines
  - 15 input (13 isolated 24 V, 2 TTL)
  - 14 output (4 isolated 24 V, 10 TTL)
- Reconfigurable DIO with LabVIEW FPGA
- MXI-Express connector
- RS232 port
- DVI video output

**Operating Systems**
- Real-time OS

**Recommended Software**
- Vision Builder for Automated Inspection (AI), or
- LabVIEW with LabVIEW Real-Time Vision Development Bundle

**Optional Software**
- LabVIEW FPGA Module

**Driver Software (included)**
- NI Vision Acquisition Software

**Run-Time Licenses (included)**
- Vision Builder AI Run-Time License
- Vision Development Module Run-Time License

## Overview

The NI Embedded Vision System is a rugged automation controller that combines industrial camera connectivity with open communication and multicore performance. The NI EVS-1464RT is designed to acquire and process images in real time from multiple IEEE 1394 and GigE Vision cameras, and is ideal for machine vision applications such as high-speed sorting, assembly verification, and packaging inspection.

The NI Embedded Vision System offers a fanless design, extended temperature range, real-time operating system, and solid-state drive, making it ready for demanding manufacturing conditions by reducing maintenance requirements with no moving parts and increasing reliability.

A diverse range of digital I/O and industrial communication options means that the EVS-1464RT can communicate and integrate with a wide variety of automation devices including programmable logic controllers (PLCs), human machine interfaces (HMIs), robotics, sensors, and actuators. The fast multicore processor and real-time OS make this vision system ideal for more complex, higher-speed inspections.

## Multicore Image Processing

With NI LabVIEW and NI vision software, the NI Embedded Vision System takes full advantage of its multicore processor by automatically balancing the computational load on each core. Machine vision applications can run deterministically and reliably with LabVIEW Real-Time Module software, which you can use to achieve low-level control for prioritizing crucial tasks, such as image processing, over less time-critical tasks such as video display.

## Camera Selection and Multicamera Support

The NI Embedded Vision System works with any IIDC-compliant IEEE 1394 camera and any GigE Vision-compliant Ethernet camera. National Instruments has developed the first real-time driver software for communicating, configuring, and acquiring images from both IEEE 1394 and GigE Vision cameras in realtime.

The system provides a low-cost way to simultaneously acquire and process images from several cameras to inspect parts from multiple angles, increase overall system resolution, and use several specialty cameras at once (color, monochrome, infrared, line scan, and so on). With dual IEEE 1394b and Gigabit Ethernet ports, you can simultaneously power and acquire from up to four IEEE 1394a and b cameras and connect as many GigE Vision cameras as the bandwidth permits. You can expand beyond the number of ports using hubs and external power sources for additional cameras. To find a complete list of cameras, visit the NI Camera Advisor at **ni.com/camera**.

## Rugged Industrial Design

The NI Embedded Vision System was designed for harsh industrial environments. The absence of moving parts make this machine vision system less susceptible to damage from ambient vibration, reducing maintenance requirements and making it a reliable addition to your packaging, assembly, and manufacturing environments. The EVS-1464RT runs with a 1 GB solid-state drive, which can be expanded with CompactFlash storage for logging images and data, as well as external IEEE 1394 hard drives and USB mass storage devices. It is also cooled by convection, and the temperature range of 0 to 45 °C ensures that uptime is kept at a maximum.

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(2) Gigabit Ethernet for enterprise connectivity and GigE Vision cameras

(4) Hi-Speed USB for mass storage devices

(1) MXI-Express for PCI bus expansion

(29) Reconfigurable digital I/O lines

RS232 serial

External flash for logging images and data

10 to 30 VDC power

DVI video output

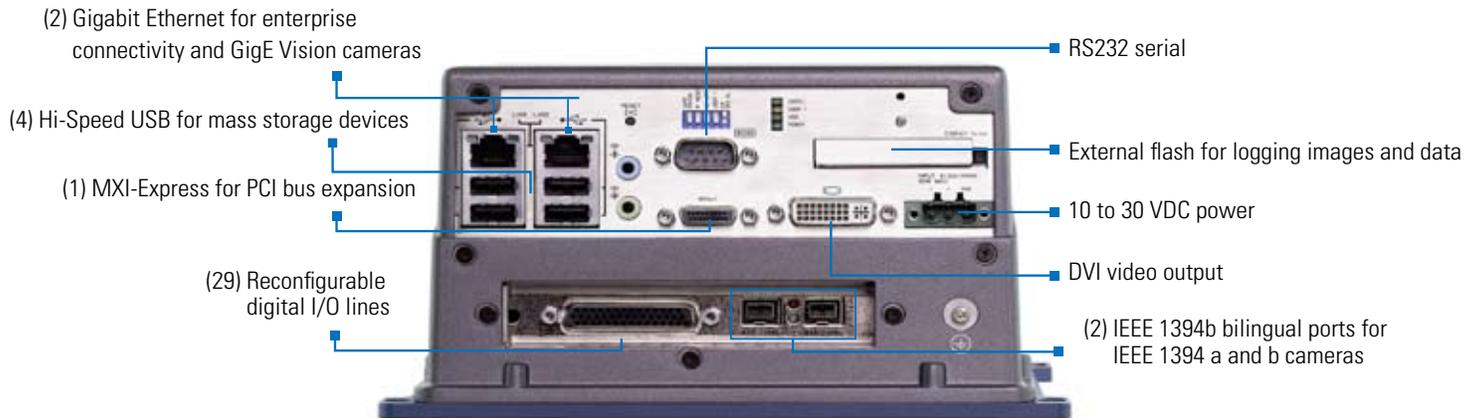(2) IEEE 1394b bilingual ports for IEEE 1394 a and b cameras

*Figure 1. NI EVS-1464RT Connectivity Options*

## Industrial Communication and Onboard Digital I/O

The EVS-1464RT has 29 reconfigurable digital I/O lines – TTL and isolated. These lines feature built-in functionality for communicating with external devices, such as reading from a quadrature encoder, generating strobe pulses, triggering, and writing/reading from digital lines. Using these signals, you can dynamically control your lighting or cameras, synchronize with a conveyor belt, drive mechanisms for sorting parts or integrate the NI Embedded Vision System with PLCs.

In addition, you can use the system to send commands and data to other devices, such as PLCs and operator interfaces, using Ethernet protocols such as TCP/IP, EtherNet/IP, and Modbus TCP, as well as serial protocols such as RS232 and Modbus serial. With enterprise connectivity, you can also monitor the inspection results, view images, or store data in databases for statistical process control.

### Customized I/O with LabVIEW FPGA

The EVS-1464RT features a field-programmable gate array (FPGA) directly connected to the digital I/O lines. If your application requires custom I/O behavior, you can use LabVIEW FPGA to reconfigure the digital I/O lines to achieve additional I/O functionality such as custom triggers, timing, PWM outputs, encoder-based queued pulse generators, customer digital protocols and high-speed counters.

The LabVIEW FPGA IPNet site (**ni.com/ipnet**) hosts a collection of existing FPGA examples and intellectual property (IP) from National Instruments developers and external users in the LabVIEW FPGA community that you can use with your real-time NI Embedded Vision System.

## Real-Time Display and HMI

The EVS-1464RT outputs real-time images and pass/fail results from the inspection through the built-in DVI port. All of the image overlays are user-definable and can be changed programmatically to create custom user displays.

Also, a simple Web browser on any Windows CE, XP, or XP Embedded touch panel can act as an operator interface for selecting inspections, updating parameters, or training a new part. In addition to being a Web server, the EVS-1464RT can be configured in LabVIEW to host Web services to stream data.

## Software Scalability

National Instruments uses the same configuration software (Vision Builder for Automated Inspection) and programming software (Vision Development Module) across the NI vision hardware portfolio. This means that after learning just one set of vision software, you can easily reduce time and costs to maintain your systems or build new applications while enjoying the freedom to choose the suitable hardware for each application, be it a PC, an NI Embedded Vision System, or an NI Smart Camera. All NI vision software comes with NI Vision Acquisition Software, a collection of drivers for IEEE 1394 and GigE cameras that scales to support a larger range of camera types for use with other NI vision hardware.

# Real-Time Embedded Vision System

## NI Vision Software

### Configure or Program Your Inspection

With the National Instruments machine vision software approach, you can configure your inspection with easy-to-use, stand-alone NI Vision Builder for Automated Inspection software or program it for more advanced customization using the NI Vision Development Module. Both options feature hundreds of built-in machine vision and image processing functions you can use to enhance images, check for presence, locate features, identify objects, and measure parts.



*Figure 2. You can configure the EVS-1464RT using Vision Builder AI or program the system using the Vision Development Module.*

## Vision Builder for Automated Inspection

Vision Builder for Automated Inspection (AI) simplifies the development and maintenance process by replacing programming complexity with an interactive development environment, without sacrificing performance or range of functionality. With Vision Builder AI, you can easily configure, benchmark, and deploy a vision system that addresses most vision applications from pattern matching to code reading and presence detection to precision alignment and classification.

Vision Builder AI includes a deployment interface for quick deployment and features the ability to set up complex pass/fail decisions to control digital I/O devices and communicate with serial or Ethernet devices such as programmable automation controllers (PACs), PLCs, and HMIs.

### Dynamic Execution

For inspections that require complex decisions, conditional branches, or iterative loops, Vision Builder AI offers an innovative state diagram process model. In this model, you configure each state to perform a certain series of actions from acquiring images to gauging a part to communicating with external devices. The results of these steps determine which transition path you take to the next state. By using state diagrams, you can create seemingly complex machine vision applications that provide the flexibility of a programming language with the ease of use of a configuration environment. State diagrams are not only an intuitive way to represent machine vision applications but also a self-documenting method that is easy to share among colleagues.
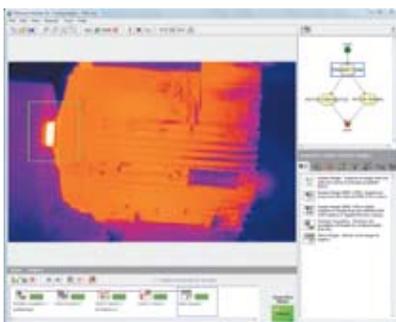


*Figure 3. Vision Builder AI Configuration Interface*

## LabVIEW Real-Time Vision Development Bundle

The LabVIEW Real-Time Vision Development Bundle is an addition to LabVIEW that includes all the software you need to program all your real-time machine vision applications for the NI Embedded Vision System. The bundle includes:
- Vision Development Module
- LabVIEW Real-Time Module
- LabVIEW Application Builder

With the Vision Development Module, you have complete freedom to build highly customized real-time machine vision applications using the LabVIEW graphical programming environment. You also have the option to develop your own custom image processing algorithms, optimize your inspection for speed, or take advantage of the large choice of toolkits or add-ons that complement the LabVIEW environment, such as LabVIEW FPGA.

Using LabVIEW graphical programming, you can develop your machine vision applications on a desktop PC and then download the program to run on the real-time NI Embedded Vision System. Thus, you can use all the powerful development tools of LabVIEW to develop deterministic, reliable solutions.

The Vision Development Module also includes NI Vision Assistant, an interactive prototyping environment that generates ready-to-run code.
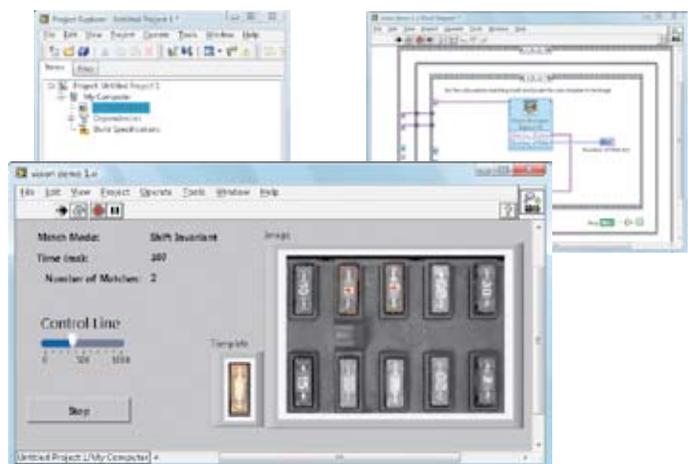


*Figure 4. LabVIEW Front Panel, Block Diagram, and Project Explorer in a Vision Development Module Application*

## Ordering Information

NI EVS-1464RT..............................................................780913-01

### Software

Vision Builder for Automated Inspection.......................................778649-09

LabVIEW Full Development System................................................776670-39

LabVIEW Real-Time Vision Development Bundle..........................779324-03
(includes Vision Development Module, LabVIEW Real-Time Module, LabVIEW Application Builder)

NI LabVIEW FPGA Module............................................................778694-09

### Embedded Vision System Accessories

PS-5 Power Supply, 24 VDC, 5 A, Universal Power Input..............778805-90

I/O Terminal Block and Prototyping Accessory w/Cable ..............779166-01

I/O Terminal Block, Vertical DIN Rail Mount and Cable................778791-01

I/O Terminal Block, Horizontal DIN Rail Mount and Cable............778790-01

CompactFlash, 4 GB, Industrially Rated ...................................778622-4096

CompactFlash, 2 GB, Industrially Rated ...................................778622-2048

CompactFlash, 1 GB, Industrially Rated ...................................778622-1024

### IEEE 1394 Cameras

Basler scA640-70fm (IEEE 1394b, 659x490, 70 fps, Mono)..........779982-01

Basler scA640-70fc (IEEE 1394b, 659X490, 71 fps, Color) ............780880-01

Basler scA1390-17fm (IEEE 1394b, 1392x1040, 17 fps, Mono).....779980-01

Basler scA1390-17fc (IEEE 1394b, 1390X1040, 17 fps, Color) ......780881-01

Basler scA1600-14fm (IEEE 1394b, 2MP, 14 fps, Mono) ..............780883-01

Basler A601f (IEEE 1394a, 656x491, 60 fps, Mono) .....................778785-01

### IEEE 1394 Cables and Accessories

IEEE 1394b to 1394b Cable (4 m)..................................................196283-04

IEEE 1394a to 1394b Cable (4 m)..................................................196284-04

Cable, Basler Trigger and I/O Cable for IEEE 1394b Cameras.......779984-01

### GigE Vision cameras

Basler scA640-70gm (GigE, 659X490, 70 fps, Mono)...................779983-01

Basler scA640-70gc (GigE, 659X494, 70 fps, Color) .....................780884-01

Basler scA1390-17gm (GigE, 1392x1040, 17 fps, Mono) ...............779981-01

Basler scA1390-17gc (GigE, 1392X1040, 17 fps, Color) ...............780885-01

Basler scA1600-14gm (GigE, 2 MP, 14 fps, Mono) .......................780886-01

### GigE Vision Accessories and Ethernet Cables

CAT5E Ethernet Cable, Twisted-Pair, 1 m ....................................182219-01

CAT5E Ethernet Cable, Twisted-Pair, 5 m ....................................182219-05

CAT5E Ethernet Cable, Twisted-Pair, 10 m ..................................182219-10

Power Supply, Basler Power Supply for GigE Vision Cameras .......779986-01

Cable, Basler Trigger and I/O Cable for GigE Vision Cameras........779985-01

### Lenses

Computar lens (8 mm, F1.4) ........................................................780024-01

Computar lens (12 mm, F1.4) ......................................................780025-01

Computar lens (16 mm, F1.4) ......................................................780026-01

Computar lens (25 mm, F1.4) ......................................................780027-01

## BUY NOW

For complete product specifications, pricing, and accessory information, call 800 813 3693 (U.S.) or go to **ni.com/vision**.

# Real-Time Embedded Vision System

## Specifications

These specifications are typical at 25 °C, unless otherwise stated.

### Power Requirements

Main supply voltage..............................10 VDC to 30 VDC

   Power (excluding cameras)..............50 W maximum

   IEEE 1394 bus power........................18 W maximum (shared by both ports)

Isolated supply......................................5 to 30 VDC

Camera interface..................................Gigabit Ethernet and IEEE 1394b bilingual

   (compatible with IEEE 1394 a & b cameras)

### TTL Inputs and Outputs

Digital logic levels

| Level | Minimum | Maximum |
|---|---|---|
| Input low voltage (VIL) | 0 V | 0.5 V |
| Input high voltage (VIH) | 2.2 V | 5 V |
| Output low voltage (VOL), at 5 mA | – | 0.4 V |
| Output high voltage (VOH), at 5 mA | 2.4 V | – |

#### TTL Inputs

Number of channels..............................2

Maximum pulse rate.............................2 MHz

Minimum pulse detected......................500 ns

Power-on state.....................................Input (high-impedance) 61.9 kΩ

   pull-up to 5 V

#### TTL Outputs

Number of channels..............................10

Output voltage range............................0 to 5 V

Maximum pulse rate.............................2 MHz

### Optically Isolated Inputs and Outputs

#### Isolated (Current Sinking) Inputs

Number of channels..............................13

Input voltage range...............................0 to 30 V

Input ON voltage..................................3.5 to 30 V

Input OFF voltage.................................0 to 2 V

Turn-on current

   Typical..............................................7.1 mA

   Maximum.........................................14 mA

Maximum pulse rate.............................100 kHz

Minimum pulse detected......................10 µs

Reverse polarity protection...................Yes, -30 V

#### Isolated (Current Sourcing) Outputs

Number of channels..............................4

On-state voltage range.........................5 to 30 V maximum

   Maximum on-state voltage

   drop from V.......................................1.2 V at 100 mA

Output current

   5 V isopower....................................50 mA maximum

   24 V isopower..................................100 mA maximum

   30 V isopower..................................100 mA maximum

Maximum pulse rate.............................10 kHz (maximum load resistance 100 kΩ)

Minimum pulse generated....................100 µs

Reverse polarity protection...................Yes

### Physical

Unit dimensions....................................110 by 200 by 220 mm

   (4.3 by 7.9 by 8.66 in.)

Weight...................................................3.76 kg (8.28 lb)

### Environment

The NI EVS-1464RT is intended for indoor use only.

Measurement category.........................I

Maximum altitude.................................2,000 m

Pollution degree (IEC 60664)................2

#### Operating Environment

Ambient temperature range..................0 to 45 °C

   (IEC 60068-2-1 and IEC 60068-2-2)

Relative humidity range........................10 to 90% noncondensing

   (IEC 60068-2-56)

#### Storage Environment

Ambient temperature range..................-40 to 70 °C

   (IEC 60068-2-1 and IEC 60068-2-2)

Relative humidity range........................5 to 95% noncondensing

   (IEC 60068-2-56)

### Shock and Vibration

Operational shock.................................30 g peak, half-sine, 11 ms pulse

   (tested in accordance with IEC-60068-2-27;

   test profile developed in accordance with

   MIL-PRF-28800F)

Random vibration

   Operating.........................................5 to 500 Hz, 0.3 $g_{rms}$

   Nonoperating...................................5 to 500 Hz, 2.4 $g_{rms}$ (tested in accordance

   with IEC-60068-2-64; nonoperating test

   profile exceeds the requirements of

   MIL-PRF-28800F, Class 3)

# Real-Time Embedded Vision System

## Safety and Compliance

### Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

**Note:** For UL and other safety certifications, refer to the product label or visit **ni.com/certification**, search by model number or product line, and click the appropriate link in the Certification column.

### Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

**Note:** For EMC compliance, operate this device according to product documentation.

### CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

**Note:** Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit **ni.com/certification**, search by model number or product line, and click the appropriate link in the Certification column.

### Waste Electrical and Electronic Equipment (WEEE)

**EU Customers:** At the end of their life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit **ni.com/environment/weee.htm**.

#### 电子信息产品污染控制管理办法（中国 RoHS）

**中国客户** National Instruments 符合中国电子信息产品中限制使用某些有害物质指令（RoHS）。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

### Battery Replacement and Disposal

This device contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized National Instruments service representative. After replacement, recycle the old battery. For additional information, visit ni.com/environment.

# NI Services and Support

NI has the services and support to meet your needs around the globe and through the application life cycle – from planning and development through deployment and ongoing maintenance. We offer services and service levels to meet customer requirements in research, design, validation, and manufacturing. Visit **ni.com/services**.

## Training and Certification

NI training is the fastest, most certain route to productivity with our products. NI training can shorten your learning curve, save development time, and reduce maintenance costs over the application life cycle. We schedule instructor-led courses in cities worldwide, or we can hold a course at your facility. We also offer a professional certification program that identifies individuals who have high levels of skill and knowledge on using NI products. Visit **ni.com/training**.

## Professional Services

Our NI Professional Services team is composed of NI applications and systems engineers and a worldwide National Instruments Alliance Partner program of more than 600 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit **ni.com/alliance**.

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Certified Alliance Partner

## OEM Support

We offer design-in consulting and product integration assistance if you want to use our products for OEM applications. For information about special pricing and services for OEM customers, visit **ni.com/oem**.

## Local Sales and Technical Support

In offices worldwide, our staff is local to the country, giving you access to engineers who speak your language. NI delivers industry-leading technical support through online knowledge bases, our applications engineers, and access to 14,000 measurement and automation professionals within NI Developer Exchange forums. Find immediate answers to your questions at **ni.com/support**.

We also offer service programs that provide automatic upgrades to your application development environment and higher levels of technical support. Visit **ni.com/ssp**.

## Hardware Services

### System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at **ni.com/advisor** to find a system assurance program to meet your needs.

### Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit **ni.com/calibration**.

### Repair and Extended Warranty

NI provides complete repair services for our products. Express repair and advance replacement services are also available. We offer extended warranties to help you meet project life-cycle requirements. Visit **ni.com/services**.

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