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Getting Started with the NI PXI/PCI-1411

The NI PXI/PCI-1411 (NI 1411) is a monochrome and color image acquisition device for PXI, PCI, or CompactPCI. This document describes how to install and configure the necessary hardware and software components to begin using the NI 1411.

What You Need to Get Started

You need the following items to set up and use the NI 1411:

- ❑ NI 1411 image acquisition device
- ❑ Video camera or other video device
- ❑ BNC cable, included with the NI 1411
- ❑ S-Video cable (optional)
- ❑ PXI, PCI, or CompactPCI computer running Microsoft Windows Vista/XP/2000 with at least one available slot

Note Visit `ni.com/info` and enter `rdvisionvista` for more information about National Instruments image acquisition device compatibility with Windows Vista.

- ❑ NI Vision Acquisition Software 8.0 or later, which includes the NI-IMAQ driver software
- ❑ Optional software for developing applications:
  - NI Vision Builder for Automated Inspection
  - NI Vision Development Module
  - LabVIEW
  - LabWindows™/CVI™
  - Microsoft Visual Basic

Related Documentation

The following documents contain additional information that you may find helpful:

- *NI PXI/PCI-1411 User Manual*—Contains information about programming options, hardware functionality, and signal connections.
- *NI Vision Acquisition Software Release Notes*—Contains information about new functionality, minimum system requirements, and installation instructions for the NI-IMAQ driver software.
- *Measurement & Automation Explorer Help for NI-IMAQ*—Describes how to configure the NI-IMAQ driver software, NI image acquisition devices, and cameras using Measurement & Automation Explorer (MAX).
- *NI-IMAQ Help*—Contains fundamental programming concepts for the NI-IMAQ driver software and terminology for using NI image acquisition devices.

Safety Information

Caution The following paragraphs contain important safety information you *must* follow when installing and operating the device.

Do *not* operate the device in a manner not specified in the documentation. Misuse of the device may result in a hazard and may compromise the safety protection built into the device. If the device is damaged, turn it off and do *not* use it until service-trained personnel can check its safety. If necessary, return the device to National Instruments for repair.

Keep away from live circuits. Do *not* remove equipment covers or shields unless you are trained to do so. If signal wires are connected to the device, hazardous voltages can exist even when the equipment is turned off. To avoid a shock hazard, do *not* perform procedures involving cover or shield removal unless you are qualified to do so. Disconnect all field power prior to removing covers or shields.

If the device is rated for use with hazardous voltages (>30 V_{rms}, 42.4 V_{pk}, or 60 V_{dc}), it may require a safety earth-ground connection wire. Refer to the device specifications for maximum voltage ratings.

Because of the danger of introducing additional hazards, do *not* install unauthorized parts or modify the device. Use the device only with the chassis, modules, accessories, and cables specified in the installation instructions. All covers and filler panels *must* be installed while operating the device.

Do *not* operate the device in an explosive atmosphere or where flammable gases or fumes may be present. Operate the device only at or below the pollution degree stated in the specifications. Pollution consists of any foreign matter—solid, liquid, or gas—that may reduce dielectric strength or surface resistivity. The following is a description of pollution degrees.

- Pollution Degree 1—No pollution or only dry, nonconductive pollution occurs. The pollution has no effect.
- Pollution Degree 2—Normally only nonconductive pollution occurs. Occasionally, nonconductive pollution becomes conductive because of condensation.
- Pollution Degree 3—Conductive pollution or dry, nonconductive pollution occurs. Nonconductive pollution becomes conductive because of condensation.

Clean the device and accessories by brushing off light dust with a soft, nonmetallic brush. Remove other contaminants with a stiff, nonmetallic brush. The unit *must* be completely dry and free from contaminants before returning it to service.

You *must* insulate signal connections for the maximum voltage for which the device is rated. Do *not* exceed the maximum ratings for the device. Remove power from signal lines before connection to or disconnection from the device.

Caution National Instruments measurement products may be classified as either Measurement Category I or II. Operate products at or below the Measurement Category level specified in the hardware specifications.

Measurement Category[1]: Measurement circuits are subjected to working voltages[2] and transient stresses (overvoltage) from the circuit to which they are connected during measurement or test. Measurement Category establishes standardized impulse withstand voltage levels that commonly occur

[1] Measurement Categories as defined in electrical safety standard IEC 61010-1.

[2] Working voltage is the highest rms value of an AC or DC voltage that can occur across any particular insulation.

in electrical distribution systems. The following is a description of Measurement (Installation[1]) Categories:

- Measurement Category I is for measurements performed on circuits *not* directly connected to the electrical distribution system referred to as MAINS[2] voltage. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.
- Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet (e.g., 115 V for U.S. or 230 V for Europe). Examples of Measurement Category II are measurements performed on household appliances, portable tools, and similar products.
- Measurement Category III is for measurements performed in the building installation at the distribution level. This category refers to measurements on hard-wired equipment such as equipment in fixed installations, distribution boards, and circuit breakers. Other examples are wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and stationary motors with permanent connections to fixed installations.

Unpacking

The NI 1411 ships in an antistatic package to prevent electrostatic discharge from damaging device components. To avoid such damage in handling your device, take the following precautions:

1. Ground yourself using a grounding strap or by touching a grounded object, such as the computer chassis.
2. Touch the antistatic package to a metal part of the computer chassis before removing the device from the package.



Caution *Never* touch the exposed pins of connectors.

3. Remove the device from the package and inspect it for loose components or any other signs of damage. Notify National Instruments if the device appears damaged in any way. Do *not* install a damaged device in the computer.

Store the NI 1411 in the antistatic package when not in use.

Installation

The following instructions are for general installation. Refer to the documentation provided by your computer manufacturer for specific instructions and warnings. Refer to the *Specifications* section for typical power requirements for the NI 1411.

NI PXI-1411

You can install an NI PXI-1411 in any available 5 V peripheral slot in a PXI or CompactPCI chassis.

1. Install the NI Vision Acquisition Software before installing the NI PXI-1411. Refer to the *NI Vision Acquisition Software Release Notes* for specific installation instructions.
2. Power off and unplug the PXI or CompactPCI chassis.

[1] Measurement Category is also referred to as Installation Category.

[2] MAINS is defined as the (hazardous live) electrical supply system to which equipment is designed to be connected for the purpose of powering the equipment. Suitably rated measuring circuits may be connected to the MAINS for measuring purposes.

Caution To protect yourself and the computer from electrical hazards, the computer *must* remain unplugged until the installation is complete.

3. Choose an unused PXI or CompactPCI 5 V slot that supports bus arbitration or bus-master cards. PXI-compliant chassis must have bus arbitration for all slots.
4. Remove the filler panel for the slot you have chosen.
5. Touch a metal part of the chassis to discharge any static electricity that might be on your clothes or body. Static electricity can damage the device.
6. Insert the NI PXI-1411 in the selected 5 V slot. Use the injector/ejector handle to fully inject the device into place.
7. Secure the front panel of the NI PXI-1411 to the front panel mounting rails of the PXI or CompactPCI chassis.
8. Connect the BNC cable included with the NI PXI-1411 to the camera. Refer to your camera manufacturer documentation for specific instructions about how to connect the cable to your camera.
9. Connect the BNC cable to the VIDEO connector on the NI PXI-1411 front panel.
10. Plug in and power on the PXI or CompactPCI chassis.

The NI PXI-1411 is now installed and the camera is connected.

NI PCI-1411

1. Install the NI Vision Acquisition Software before installing the NI PCI-1411. Refer to the *NI Vision Acquisition Software Release Notes* for specific installation instructions.
2. Power off and unplug the computer.

Caution To protect yourself and the computer from electrical hazards, the computer *must* remain unplugged until the installation is complete.

3. Remove the computer cover to expose the expansion slots.
4. Touch a metal part of the computer to discharge any static electricity that might be on your clothes or body. Static electricity can damage the device.
5. Choose an unused PCI slot, and remove the corresponding expansion slot cover on the back panel of the computer.
6. Remove your device from the antistatic package and gently rock the device into the slot. The connection may be tight, but do *not* force the device into place.

Note Check that the bracket of the device aligns with the hole in the back panel rail of the computer chassis.

7. Secure the device mounting bracket to the back panel rail of the computer.
8. Replace the computer cover.
9. Connect the BNC cable included with the NI PCI-1411 to the camera. Refer to your camera manufacturer documentation for specific instructions about how to connect the cable to your camera.
10. Connect the BNC cable to the VIDEO connector on the NI PCI-1411 front panel.
11. Plug in and power on the computer.

The NI PCI-1411 is now installed and the camera is connected.

Configuring the NI 1411

After you have installed the NI 1411 and powered on the computer, the computer will recognize the device and assign resources to it. Use Measurement & Automation Explorer (MAX), the National Instruments configuration utility, to configure the NI 1411 for acquisition. Refer to the *Measurement & Automation Explorer Help for NI-IMAQ* for additional information about configuring the NI 1411.

Note Before configuring the device in MAX, ensure that you installed the NI-IMAQ driver software.

Specifications

The following specifications apply to the NI 1411 image acquisition device. These specifications are typical at 25 °C unless otherwise specified.

Formats Supported

Input formats

- RS-170/NTSC ..... 29.97 frames/s
- CCIR/PAL ..... 25 frames/s

Output formats

- RGB 32-bit
- HSL 32-bit
- R, G, B, H, S, or L 8-bit
- Pixel aspect ratio ..... Square pixel

Video Input

Quantity ..... 1 (VIDEO)

VIDEO ..... Composite video on BNC (RSE), Y/C on S-Video connector (RSE)

Input impedance ..... 75 Ω ± 1%

Input range (blank to white) ..... 700 mV (calibrated) or
400 mV to 1.00 V (variable gain)
(PCI-1411 revision C and later,
PXI-1411 revision A and later)

Frequency response (luminance)

- Full range ..... 12 MHz (–3 dB) typ
(all filters off)
- Programmable ..... Decimation and lowpass filters

Accuracy

Absolute accuracy[1]

- Luma gain ..... ±2.5% of reading
- Chroma gain ..... ±2.5% of reading
- Temperature drift ..... <250 ppm/°C

A/D Conversion

Quantity ..... One 8-bit 2X oversampling for composite video
Two 8-bit 2X oversampling for Y/C (S-Video)

Dynamic range ..... 46 dB typ

Sampling Frequency

- RS-170/NTSC ..... 27.54 MHz (double rate of square pixel)
- CCIR/PAL ..... 29.5 MHz (double rateof square pixel)

Color Decoding

Composite video

- Luma path ..... Chroma trap filter and/or line comb
- Chroma path ..... Bandpass filter and/or line comb

Memory

Onboard memory ..... 16 MB synchronous dynamic RAM

LUTs ..... Three 256 × 8 (RGB only)

External Connections

Trigger sense ..... TTL

Trigger level ..... Programmable (rising or falling)

PCI Interface

PCI initiator (master) capability ..... Supported

PCI target (slave) capability ..... Supported

Data path ..... 32 bits

Board voltage ..... 5 V, 12 V, –12 V

Board type ..... 32-bit half-size card

Parity generation/checking, error reporting ..... Supported

Target decode speed ..... Medium (1 clock)

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[1] Calibration conditions:
White level 700 mV
Contrast 1.00
Saturation 1.00
Brightness 1.00
Luma bandwidth Full
Ambient temperature 25 °C nominal

Target fast back-to-back capability .....Supported

Resource locking.....Supported as a master and slave

PCI interrupts .....Interrupts passed on INTA# signal

Base address registers .....BAR0 (16 KB)
BAR1 (64 KB)

Expansion ROM.....4 KB

PCI master performance

Ideal .....133 Mbytes/s

Sustained.....100 Mbytes/s

Power Requirements

Voltage .....+5 V (1.00 A)
+12 V (75 mA)

Physical

Dimensions

PCI-1411 .....10.7 × 17.5 cm (4.2 × 6.9 in.)

PXI-1411.....10 × 16 cm (3.9 × 6.3 in.)

Weight

PCI-1411 .....0.136 kg (0.3 lb)

PXI-1411.....0.154 kg (0.34 lb)

Environment

Operating temperature ..... 0 °C to 55 °C

Storage temperature .....–20 °C to 70 °C

Relative humidity.....5%–90%, noncondensing

MTBF.....839,653 h at 30 °C

Emissions .....EN 55011:1991 Group 1 Class A at 10 m FCC Class A at 10 m

Functional shock (PXI only).....MIL-T-28800 E Class 3 (per Section 4.5.5.4.1)
Half-sine shock pulse, 11 ms duration, 30 g peak, 30 shocks per face

Operational random vibration
(PXI only) .....5 to 500 Hz, 0.31 grms, 3 axes

Nonoperational random vibration
(PXI only) .....5 to 500 Hz, 2.5 grms, 3 axes



Note Random vibration profiles were developed in accordance with MIL-T-28800E and MIL-STD-810E Method 514. Test levels exceed those recommended in MIL-STD-810E for Category 1 (Basic Transportation, Figures 514.4-1 through 514.4-3).

Approved at altitudes up to 2,000 m.

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 to product documentation.

CE Compliance

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

- 73/23/EEC; Low-Voltage Directive (safety)
- 89/336/EEC; 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.

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Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At `ni.com/support` you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electronic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting `ni.com/certification`. If your product supports calibration, you can obtain the calibration certificate for your product at `ni.com/calibration`.

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