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4-Channel Monochrome Image Acquisition

NI 1409

- Up to 4 standard or nonstandard video sources
- 8 or 10-bit digitization
- Compatible with double-speed 60 frames/s progressive scan cameras
- Interlaced/noninterlaced acquisition
- Analog area and line-scan capabilities
- Unlimited acquisition window size with 16 MB of onboard memory
- Triggering
  - 4 external triggers/digital I/O lines
  - 4 digital outputs for camera control
  RTSI bus for synchronization with DAQ and motion

Models
- NI PCI-1409
- NI PXI-1409

Operating Systems
- Windows 2000/NT/XP/Me/9x

Recommended Software
- LabVIEW
- Measurement Studio
- Vision Development Module
  - IMAQ Vision
  - NI Vision Builder

Other Compatible Software
- C/C++

Driver Software (included)
- NI-IMAQ



Overview and Applications

For machine vision and scientific imaging developers who need to acquire high-resolution, measurement-quality images from standard and nonstandard cameras and sensors, the NI 1409 image acquisition hardware offers quick and easy configuration. NI 1409 devices have high-resolution, 10-bit digitization for cameras and sensors that offer 60 dB dynamic range. In addition, you can easily configure the NI 1409 Series to work with standard monochrome cameras (RS-170 or CCIR), slow or variable rate pixel clock cameras, double-speed progressive scan cameras, and analog line-scan cameras.

Measurement-Quality Image Acquisition with Calibration

NI 1409 devices are gain calibrated and delivered with a calibration certificate. Calibration ensures repeatable, consistent image acquisition for your machine vision and scientific imaging applications.

Variable Scan and Nonstandard Video

With NI 1409 devices, you can acquire images from nonstandard video, such as analog line-scan and variable-scan devices with pixel clocks that range from 2 to 40 MHz. The NI 1409 devices work with double-speed (60 frames/s) progressive scan or noninterlaced monochrome cameras from vendors such as Sony and JAI.

10-Bit Image Acquisition

Many high-resolution analog monochrome cameras have dynamic range greater than 48 dB, which means that the camera has resolution capabilities greater than 8-bit or 256 gray scales. For these high-resolution cameras, you should use an image acquisition device that offers comparable or greater resolution. The NI 1409 Series works with the highest quality monochrome cameras and delivers up to 60 dB of dynamic range, which corresponds to 10 bits or 1,024 gray scales. With NI 1409 devices, you have the option to acquire in 8-bit or 10-bit mode at very high rates, such as 60 frames/s with double-speed progressive scan cameras.

INFO CODES
For more information or to order products online, visit *ni.com/info* and enter:

pci1409
pxi1409

BUY ONLINE!

Interchange Cameras with NI-IMAQ

NI-IMAQ driver software for image acquisition can scale between many types of cameras and acquisition methods. With NI-IMAQ, you can begin by using a low-cost RS-170 camera and image acquisition device and then upgrade to a faster, higher-resolution camera and acquisition hardware with minimal software changes. Because NI-IMAQ driver software uses one set of function calls for a wide variety of cameras, there is no need to rewrite your software.

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4-Channel Monochrome Image Acquisition

Quick and Easy Camera Configuration

You can easily configure standard and nonstandard video capture with NI Measurement & Automation Explorer, delivered with NI-IMAQ. This utility is an interactive tool for setting the camera type (RS-170, CCIR, NTSC, and PAL), programmable ROI, aspect ratio, and antichrominance filter. Use this interactive utility to set up acquisition from noninterlaced progressive-scan cameras and to create your own camera configurations for nonstandard video. Use the external lock feature to set variable-scan acquisition for microscopes and other sources that generate their own pixel clock and horizontal and vertical synchronization signals.

Image Acquisition Performance Gains with Partial Image Scanning

For improved throughput and processing bandwidth, the acquisition and ROI control circuitry monitors the incoming video signal and routes the active pixels to the FIFO. In addition to being able to digitize an entire frame, an NI 1409 can perform pixel and line scaling (decimation) and ROI acquisition. With pixel and line scaling, multiples (2,4,8) of pixels and/or lines can be transferred to the PCI bus. Using ROI acquisition, you select an area in the acquisition window that will be transferred to the PCI bus.

Hardware

PCI Interface

The PCI bus is the electrical interface for both NI PCI-1409 and NI PXI-1409. The PCI interface, implemented with the National Instruments MITE ASIC, can transfer data at a maximum sustained rate of 100 Mbytes/s in master mode to maximize the use of the available bandwidth. The interface logic ensures that the NI 1409 meets the loading, driving, and timing requirements of the PCI specification.

Scatter-Gather DMA Controllers

An NI 1409 has three independent onboard DMA controllers. The DMA controllers can transfer data between the Host memory and the onboard FIFO via the PCI bus. Each of these controllers performs scatter-gather DMA, which means the DMA controller can reconfigure on the fly, and thus perform continuous image transfers to either contiguous or fragmented buffers.

Onboard Memory

An NI 1409 has 16 MB of onboard memory used to temporarily store the image being transferred to the PCI bus. With 16 MB, you can buffer large images during image acquisition.

DAQ Synchronization

The RTSI bus or PXI trigger bus provide a flexible synchronization scheme between any National Instruments IMAQ, DAQ, or motion device and your PCI-1409 or PXI-1409, respectively.

Trigger Control and Mapping Circuitry

The trigger control and mapping circuitry routes, monitors, and drives the external and RTSI or PXI trigger bus lines. You can configure each of these lines to start or stop acquisition on a rising or falling edge, or use each line as digital I/O. You can also map the lines to onboard status values (CSYNC, Acquisition in Progress, and Acquisition Complete).

Antichrominance and Lowpass Filter

NI 1409 devices have an antichrominance filter, which can remove chrominance information from a color video signal. There are two software selectable antichrominance filters – one for NTSC color -coded signals (a 3.58 MHz notch filter), and another for PAL color -coded signals (a 4.43 MHz notch filter). Use the lowpass filter at 9 MHz to remove unwanted noise.

10-Bit A/D and Look-Up Table (LUT)

An A/D converter performs the image digitization, the result of which passes to a 1,024 by 10 RAM LUT. You can configure the LUT to implement simple imaging operations, such as gamma manipulation, contrast enhancement, data inversion, or any nonlinear transfer function.

Programmable Gain and Offset

The NI 1409 has programmable gain and offset circuitry for optimizing the input signal range.

VCR Circuitry

Because many commercial and home VCRs have noisy synchronization signals or no synchronization at all, VCRs are difficult to use with most image acquisition hardware. However, with its built-in circuitry and logic for handling video signals from VCRs, the NI 1409 can acquire monochrome images from VCRs.

Digital I/O

The NI 1409 Series includes four general-purpose digital input/output lines for general-purpose triggering and pulse generation capabilities. In addition, each NI 1409 includes four digital output lines for lighting, shutter, camera control, and pulse generation.

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4-Channel Monochrome Image Acquisition

BNC Connector

The BNC connector supplies an immediate connection to the VIDEO0 input of the NI 1409. Use the 2 m BNC cable shipped with the NI 1409 to connect a camera to VIDEO0. You can configure the BNC connector only for RSE mode.

NI 1409 Cable Accessories

The IMAQ-A6822 cable provides 22 BNC connectors to all video signals (VIDEO0, VIDEO1, VIDEO2, and VIDEO3), the external digital I/O lines and triggers, and external signals. The IMAQ A6804 provides four bus connectors to three video signals and one trigger line. The IMAQ SCB-68 provides access to all of the signals on the NI 1409 68-pin connector.

Warranty and Support Services

As a complement to your image acquisition product, consider:

- Technical Support: FREE through Applications Engineers worldwide, Web resources, and Premier Support – *ni.com/support*

Ordering Information

NI PCI-1409	778200-01
NI PXI-1409	778336-01

Includes the NI 1409 hardware, NI-IMAQ software and a 2 m NI-BNC-1 cable.

Cables

IMAQ-A6822 (1 m)	778135-01
IMAQ-A6804	187805-01
IMAQ-BNC-1 (2 m)	183882-02
IMAQ-SCB 68	778410-01

RTSI Bus Cables

2 boards	776249-02
3 boards	776249-03
4 boards	776249-04
5 boards	776249-05

Specifications

Typical for 25 °C unless otherwise stated

Available Formats

RS-170/NTSC	30 frames/s interlaced
CCIR-601/PAL	25 frames/s interlaced
Progressive scan	60 frames/s noninterlaced maximum
Variable scan	2 to 40 MHz pixel clock

Video Input

Quantity	4 monochrome
Video 0	Single-ended (BNC)
Video (1:3)	Single-ended or differential (D-Sub)
Input impedance	75 Ω ± 1%
Bandwidth	Typical 30 MHz (-3 dB)
Input range (black and white)	700 MV (calibrated) or 50mV to 1.4V (variable gain)
Antichrominance filter	Programmable 3.58 MHz notch filter (<-25 dB) 4.43 MHz notch filter (<-25 dB)

A/D Conversion

Gray levels	256 (8 bits) or 1,024 (10 bits)
DNL	±1 LSB maximum
RMS noise	< 0.5 LSB rms
SNR	Typical 56 dB
Sampling rate	2 to 40 MHz

External Synchronization and Trigger Signals

Trigger lines	4
Trigger sense	TTL
Trigger polarity	Programmable (rising or falling)
PCLKIN sense	Selectable (TTL or RS-422)
PCLKIN polarity	Programmable (direct or invert)
HSYNCIN sense	Selectable (TTL or RS-422)
HSYNCIN polarity	Programmable (rising or falling)
VSYNCIN sense	Selectable (TTL or RS-422)
VSYNCIN polarity	Programmable (rising or falling)
CSYNCIN sense	Selectable (TTL or RS-422)CSYNCIN level programmable (rising or falling)
Pulse width	20 ns minimum detectable
VIH (TTL)	2 V
VIL (TTL)	0.8 V

Pixel Clock

Internally generated	
Frequency range	11.0 to 25.8 MHz
Adjustable pixel aspect ratio	
RS-170/NTSC	±5%
CCIR/PAL	±5%
Pixel jitter	<2 ns
Lock time	<1 frame
External PCLK frequency range	2 to 40 MHz

Power Requirements

+5 VDC (±5%)	1.25 A
+12 VDC (±5%)	<100 mA
–12 VDC (±5%)	<100 mA

Physical

Dimensions	
PCI	10.7 by 17.5 cm (4.2 by 6.9 in.)
PXI	10 by 16 cm (3.9 by 6.3 in.)

Environment

Operating temperature	0 to 55 °C
Storage temperature	-20 to 70 °C
Relative humidity	5 to 90%, noncondensing

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