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High-Performance NI Smart Cameras

NI 177x Smart Cameras

- Color and monochrome sensors available
- Immersible and dustproof design with IP67 rating, M12 connectors, and lens cover
- High-performance Intel Atom 1.6 GHz processor and real-time operating system
- Sensor resolutions include VGA, 1.3 MP, 2 MP, 5 MP
- VGA output for viewing inspection images
- I/O includes digital lines (4 input, 4 output), an RS232 serial connection, and a Gigabit Ethernet connection
- Includes NI Vision Builder for Automated Inspection software
- Compatible with industry-standard accessories for mounting

Overview

The NI 177x Smart Cameras offer a range of sensors, a powerful Intel Atom 1.6 GHz processor, IP67 housing, M12 connectors, a lens cover, and multiple I/O options to perform in the most demanding applications. This high-performance hardware is paired with a real-time operating system to create a high-performance, deterministic machine vision system.

In addition to high-performance image acquisition and processing, you can use built-in digital I/O and industrial communication options for dynamic, real-time communication and integration with industrial automation devices including programmable logic controllers (PLCs), human machine interfaces (HMIs), robotics, sensors, and industrial machinery.

NI vision software, including Vision Builder for Automated Inspection and the Vision Development Module, provides a menu-driven or graphical programming option to develop applications for the NI 177x Smart Cameras.

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Requirements and Compatibility

OS Information

- Real-Time OS

Driver Information

- NI-IMAQdx

Software Compatibility

- LabVIEW
- LabVIEW Real-Time Module
- LabVIEW Vision Development Module
- NI Vision Builder for Automated Inspection

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Application and Technology

	NI 1772	NI 1772C	NI 1774	NI 1774C	NI 1776	NI 1776C	NI 1
Processor	1.6 GHz Intel Atom	1.6 GHz Intel Atom	1.6 GHz Intel Atom	1.6 GHz Intel Atom	1.6 GHz Intel Atom	1.6 GHz Intel Atom	1.6 G Intel A

System Memory	512 MB	512 MB	512 MB	512 MB	512 MB	512 MB	512
Firmware and Job Storage	2 GB Flash	2 GB Flash	2 GB Flash	2 GB Flash	2 GB Flash	2 GB Flash	2 GB F
Resolution	640x480	640x480	1280x960	1280x960	1600x1200	1600x1200	2448x
Color	-	√	-	√	-	√	-
Acquisition Rate (frames per second)	110 fps	65 fps	22.5 fps	17 fps	15 fps	10 fps	15 f
Digital Inputs	4 Sinking	4 Sinking	4 Sinking	4 Sinking	4 Sinking	4 Sinking	4 Sinl
Digital Outputs	4 Sourcing	4 Sourcing	4 Sourcing	4 Sourcing	4 Sourcing	4 Sourcing	4 Sou
Ethernet	Gigabit Ethernet	Gigabit Ethernet	Gigabit Ethernet	Gigabit Ethernet	Gigabit Ethernet	Gigabit Ethernet	Gigabit E
RS232	√	√	√	√	√	√	√
Lighting Trigger	√	√	√	√	√	√	√
Current Controller	500 mA Max	500 mA Max	500 mA Max	500 mA Max	500 mA Max	500 mA Max	500 mA
External Image Display	VGA Video Out	VGA Video Out	VGA Video Out	VGA Video Out	VGA Video Out	VGA Video Out	VGA Vid
Included Configuration Software	Vision Builder AI	Vision Builder AI	Vision Builder AI	Vision Builder AI	Vision Builder AI	Vision Builder AI	Vision Bu
Camera	0 to 50 °C	0 to 50 °C	0 to 50 °C	0 to 50 °C	0 to 50 °C	0 to 50 °C	0 to 5
Housing Material	Metal	Metal	Metal	Metal	Metal	Metal	Met

Ordering Information

Model Number	Part Number
NI 1772	781853-01
NI 1772C	781854-01

NI 1774	781855-01
NI 1774C	781856-01
NI 1776	781857-01
NI 1776C	781858-01
NI 1778	781859-01
Starter Kit for NI 177x Smart Cameras[1]	782043-01

[1]The Starter Kit for the new NI Smart Cameras contains the power and I/O connector block, cable required for the connector block, cable for VGA/USB connections, cable for Ethernet connection, and the power supply.

You can purchase additional accessories including cables, lighting, lenses, and mounting hardware.

NI Vision Software

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.

Vision Builder for Automated Inspection and the Vision Development Module are used across the NI vision hardware portfolio. This means that after learning 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.

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.

Figure 1. Vision Builder AI Configuration Interface

NI LabVIEW Real-Time Vision Development Bundle

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

- 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 the LabVIEW FPGA Module.

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 Smart Camera. Thus, you can use all of the powerful development tools of LabVIEW to develop deterministic, reliable solutions.

Figure 2. LabVIEW Front Panel, Block Diagram, and Project Explorer in a Vision Development Module Application

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Support and Services

Technical Support

Get answers to your technical questions using the following National Instruments resources.

- **Support** - Visit ni.com/support to access the NI KnowledgeBase, example programs, and tutorials or to contact our applications engineers who are located in NI sales offices around the world and speak the local language.
- **Discussion Forums** - Visit forums.ni.com for a diverse set of discussion boards on topics you care about.
- **Online Community** - Visit community.ni.com to find, contribute, or collaborate on customer-contributed technical content with users like you.

Repair

While you may never need your hardware repaired, NI understands that unexpected events may lead to necessary repairs. NI offers repair services performed by highly trained technicians who quickly return your device with the guarantee that it will perform to factory specifications. For more information, visit ni.com/repair.

Training and Certifications

The NI training and certification program delivers the fastest, most certain route to increased proficiency and productivity using NI software and hardware. Training builds the skills to more efficiently develop robust, maintainable applications, while certification validates your knowledge and ability.

- **Classroom training in cities worldwide** - the most comprehensive hands-on training taught by engineers.
- **On-site training at your facility** - an excellent option to train multiple employees at the same time.
- **Online instructor-led training** - lower-cost, remote training if classroom or on-site courses are not possible.
- **Course kits** - lowest-cost, self-paced training that you can use as reference guides.
- **Training memberships** and training credits - to buy now and schedule training later.

Visit ni.com/training for more information.

Extended Warranty

NI offers options for extending the standard product warranty to meet the life-cycle requirements of your project. In addition, because NI understands that your requirements may change, the extended warranty is flexible in length and easily renewed. For more information, visit ni.com/warranty.

OEM

NI offers design-in consulting and product integration assistance if you need NI products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

Alliance

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, 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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Detailed Specifications

These specifications are typical at 25 °C unless otherwise specified.

Power Requirements	
⚠ **Caution:** Use the NI 177x Smart Camera only with a 12 W, 24 VDC ±10%, UL listed, limited power source (LPS) supply. The power supply should bear the UL listed mark, LPS. The power supply must meet any safety and compliance requirements for the country of use.	
Typical power consumption	12 W 24 VDC, ±10%
Processing and Memory	
CPU	Intel® Atom™ Z530 (1.60 GHz processor)
DDR2 RAM	512 MB
Storage	2 GB solid state
Opto-Coupled Inputs	
Channels	4
Output type	Opto-coupled
Input current	1.6 mA

On voltage level	Greater than 15 V
Off voltage level	Less than 0.8 V
On current (minimum)	0.5 mA
Off to on responsiveness	5 µs
On to off responsiveness	25 µs

Open Collector Outputs

Channels	4
Input type	Open collector
Operating voltage range	24 V (max)
Sinking current range	0 to 100 mA
Maximum current leakage	10 µA
On voltage drop	25 mV
Maximum inrush current	4 A for 300 µs (max)
On to off responsiveness	250 ns
Off to on responsiveness	250 ns

Controlled Current Output

Operating voltage	24 V
Output voltage	2.4 to 21 V
Output current range	0 to 500 mA

Serial

Baud rates	Up to 115.2 Kbps
Default baud rate	9,600 bps
Hardware flow control	No

Network

Connector	8-pin female M12
Network interface	Ethernet
Speed	10; 100; 1,000 Mbps
Duplex	Full, half
Speed autodetection	yes
Duplex autodetection	yes
Auto MDI/MDI-X correction	yes
DHCP Support	yes

Image Sensor

All NI 177x Smart Cameras use a progressive scan CCD sensor. The following table describes sensor characteristics for each camera.

Camera Model	Sensor	Optical Format (in.)	Active Pixels	Pixel Size (µm)	Maximum Usable Frame Rate (fps)	Minimum Exposure Time (µs)
NI 1772	Kodak KAI-0340S	1/3	640 × 480 (VGA)	7.4× 7.4	110	34
NI 1772C	Kodak KAI-0340SCM	1/3	640 × 480 (VGA)	7.4× 7.4	65	34
NI 1774	Sony ICX445AL	1/3	1,280 × 96 (SXGA)	3.75× 3.75	22.5	58
NI 1774C	Sony ICX445AQ	1/3	1,280 × 96 (SXGA)	3.75× 3.75	17	58
NI 1776	Sony ICX274AL	1/1.8	1,600 × 1,200 (UXGA)	4.4 × 4.4	15	88
NI 1776C	Sony ICX274AQ	1/1.8	1,600 × 1,200 (UXGA)	4.4 × 4.4	10	88
NI 1778	Sony ICX625AL	2/3	2,448 × 2,050 (5 MP)	3.45 × 3.45	15	58

Table 1. NI 177x Smart Camera Sensor Characteristics

Sensor readout	Progressive Scan
VGA Sensor Spectral Characteristics	
NI 1772, monochrome	Refer to Figure 1

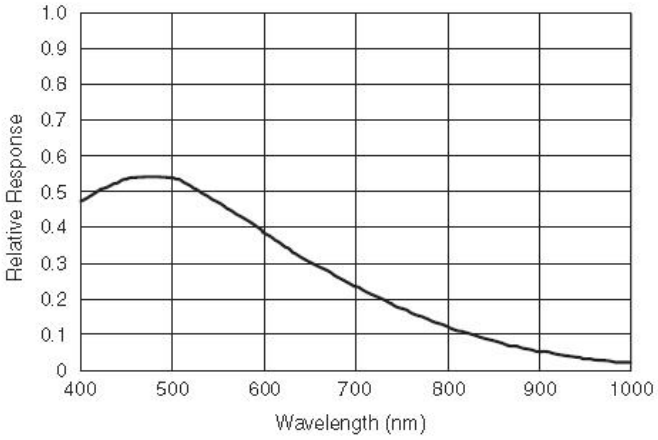

Figure 1. 1772 VGA Sensor Spectral Response Curves

NI 1772C, color	Refer to Figure 2

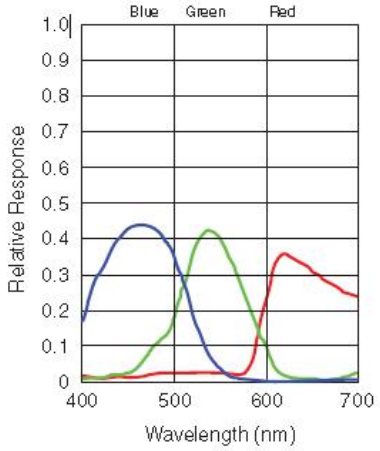

Figure 2. 1772C VGA Sensor Spectral Response Curves

SXGA Sensor Spectral Characteristics	
NI 1774, monochrome	Refer to Figure 3

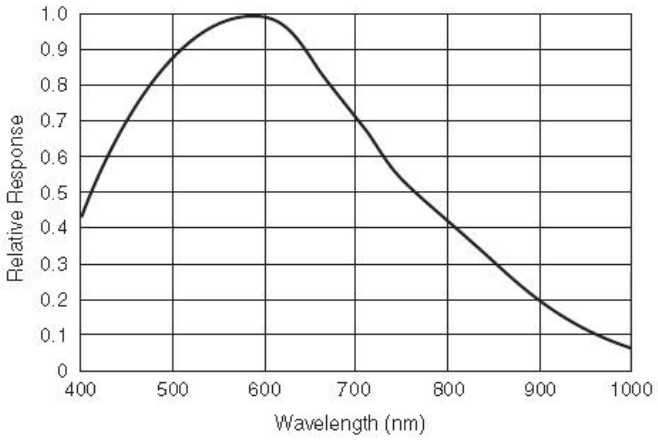

Figure 3. 1774 SXGA Sensor Spectral Response Curves

NI 1774C, color	Refer to Figure 4

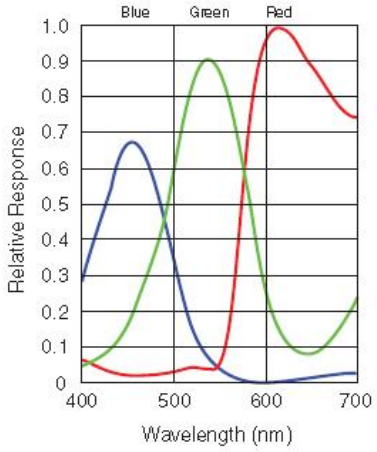

Figure 4. 1774C SXGA Sensor Spectral Response Curves

UXGA Sensor Spectral Characteristics	
NI 1776, monochrome	Refer to Figure 5

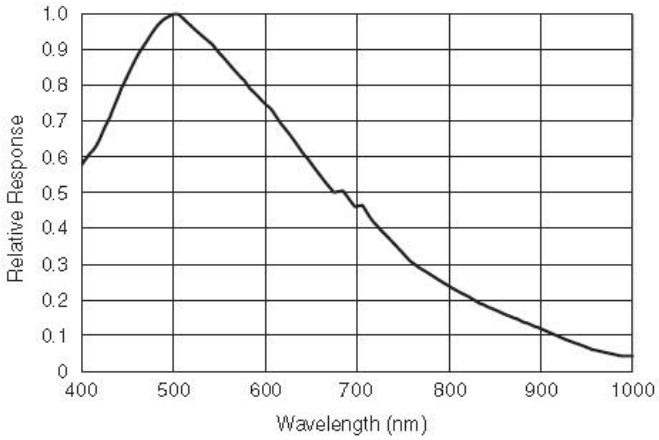

Figure 5. 1776 UXGA Sensor Spectral Response Curves

NI 1776C, color	Refer to Figure 6

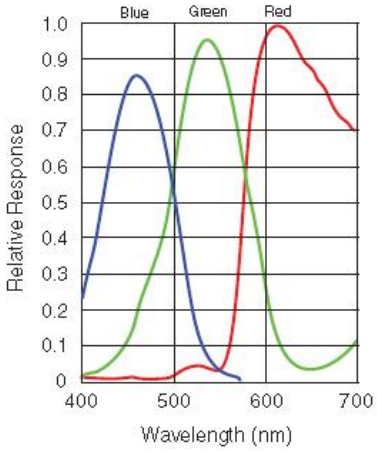

Figure 6. 1776C UXGA Sensor Spectral Response Curves

5 MP Sensor Spectral Characteristics	
NI 1778, monochrome	Refer to Figure 7

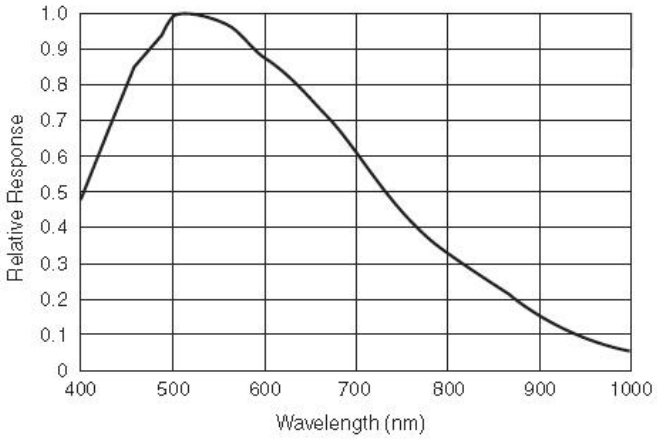

Figure 7. 1778 5 Megapixel Sensor Spectral Response Curves

Physical Characteristics	
Lens mount	C-mount
Camera housing	Painted aluminium
Dimensions (without lens cover)	11 cm × 7.5 cm × 4.98 cm (4.33 in. × 2.95 in. × 1.96 in.)
Environment	
The NI Smart Camera is intended for indoor use only.	
Operating ambient temperature	0 °C to 50 °C
Humidity	10% to 90% RH, noncondensing
IP rating	67
Pollution Degree	2
Operating shock (IEC 60068-2-27)	50 g, 3 ms half sine, 18 shocks at 6 orientations; 30 g, 11 ms half sine, 18 shocks at 6 orientations
Operating vibration	
Random (IEC 60068-2-34)	10 Hz to 500 Hz, 5 Grms
Swept sine (IEC 60068-2-6)	10 Hz to 500 Hz, 5 g
Approved at altitudes up to 2,000 m.	

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

NI 177x Smart Cameras meet the following EMC standards for information technology equipment:

- EN 55022 Emissions; Group 1, Class A
- EN 55024 Immunity; Basic Levels
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class

CE Compliance CE

NI 177x Smart Cameras meet the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 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.

Environmental Management

National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National

Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment, visit ni.com/environment/weee.htm.

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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)。
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