Introducing two new high resolution 16.25 megapixel CMOS cameras to Nikon’s lineup of cameras for microscopy

Two Nikon FX-format CMOS sensor cameras join the Digital Sight series of microscope digital cameras: the DS-Ri2 color digital camera and the DS-Qi2 monochrome digital camera.

High pixel density and large field of view coupled with USB3.0 high speed data transfer offer fast frame rates and high resolution images with these new CMOS sensors.

Large Format CMOS Sensors

Nikon manufactures CMOS sensors and imaging technologies for professional DSLR cameras, and now has optimized our sensors for microscopy.

DS-Ri2

16.25 million pixels (not interpolated) and accurate color rendition are features that make the DS-Ri2 an excellent choice for recreating color images as they eyes see them.

DS-Qi2

High pixel density, high sensitivity and low noise are key features of the DS-Qi2 monochrome camera.

Liver tissues (Objective: CFI Plan Apochromat λ 10x)

Pig kidney epithelial cells expressing GFP-EB3 tubulin

Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University

Lysosomes (Objective: TU Plan Fluor 20x)

Madecassoside (Objective: TU Plan Fluor 20x)

Photos courtesy of: Kazuhiro Muraoka, Photography Division, Tokyo Women’s Medical University

Item dimensions: 36.0 mm X 23.9 mm
Photography with the natural colors seen through the microscope

Nikon is a leader in development of algorithms for reproducing color just as the eyes see it. The DS models’ new image processing engine is based on extensive data accumulated over many years of developing microscope color digital cameras, resulting in perfect reproduction of the colors your eyes see in the microscope.

**High-resolution images**

16.25-megapixel CMOS sensors for astonishing image quality

The DS series enables one-shot instantaneous capture and fast storage of images with resolution as high as 4908 x 3264 pixels, without pixel shifting or pixel stepping. This pixel density is ideally suited for photomicrography of ultra-fine structures or patterns in biological or industrial samples, at low or high magnifications.

**High-speed live display**

High-speed display, even of supra-HDTV-class live images

The DS-Ri2 can display 4908×3264 pixel (full pixel) images at 6 fps, or 1636×1088 pixel (3×3 pixel averaging) images at 45 fps. This fast live frame rate makes fine focusing easy to perform.

**High sensitivity, low noise**

Fluorescent color image capture with high signal-to-noise ratio

Sensitivity settings that span the range from ISO200 to ISO12800 allow the capture of vivid fluorescent-color images.

Photos courtesy of: Drs. Keiko Gengyo-Ando and Junichi Nakai, Saitama University Brain Science Institute

Example of combination with the LV100nd industrial microscope

Semiconductors (IC wafers)

(Oppjective: TU Plan Fluor 5x)

1636×1088 pixel / Exposure time: 100μsec

Resolution chart

(Oppjective: TU Plan Fluor 20x)

147μm / Magnification: 100x
**Capture Low light fluorescence and Large Fields of View**

**DS-Qi2**

### High sensitivity
Detects even faint fluorescent signals

- 7.3µm pixels, high quantum efficiency, and very low read noise allow the DS-Qi2 to read in even faint fluorescent signals.

### Excellent linearity
Reliable quantitative analysis made possible

- With a linearity error of ±1%, the DS-Qi2 is a superb tool for measuring intensities in fluorescence samples, including time-based intensity measurement and ratiometric measurement.

### High frame rate
Fast focusing, even with fluorescent images

- With a high-sensitivity CMOS sensor and USB 3.0-based data transfer, the DS-Qi2 enables high-speed live imaging and image capture at up to 45 fps (1636×1088 pixels).

### Low noise
Acquires dim fluorescent signals with ultra-low noise

- Both 2.2 electrons read noise coupled with a large full-well capacity and 0.6 electrons dark current allow the acquisition of fluorescence images with very little noise.

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#### Fluorescent time-lapse imaging through integration with NIS-Elements software

With a large field of view and pixel density, and low noise, the DS-Qi2 is ideal for time-resolved imaging applications.

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**DS-Qi2 / Quantum efficiency**

<table>
<thead>
<tr>
<th>Wave length (nm)</th>
<th>Quantum efficiency (%)</th>
</tr>
</thead>
<tbody>
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<td></td>
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</table>

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**LLC-PK1 cells expressing GFP-EB3 tubulin with low noise. Large linear full well capacity allows acquiring both the brightest and dimmest areas in a single capture. Sample courtesy of Michael Davidson, National High Magnetic Field Laboratory, Florida State University**

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**Indian Muntjac Deer Skin Fibroblast Cells, Cytoskeletal F-actin labeled with Alexa Fluor 488**

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**Monochrome Microscope Camera**

- 16.25-megapixel
- Monochrome
- Cooled

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**Time-lapse images (every 1 second) of LLC-PK1 cells with GFP-EB3 tubulin. Each image represents the maximum intensity projection of the time-lapse, allowing visualization of the end-binding protein located on the microtubule plus-ends, and allowing tracing of the microtubule path. DS-Qi2 captures an extremely large field of view, but still represents very fine details as demonstrated in this cropped time-lapse sequence from a large FOV image. Objective: CFI Plan Apochromat A 60x oil / NA: 1.4. Sample courtesy of Michael Davidson, National High Magnetic Field Laboratory, Florida State University**

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**Rat primary culture neurons, Dendrites labeled with MAP-2 (Red) and Actin (cytoskeleton) labeled with Phalloidin (Green)**

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**Time-lapse photography**

**Indian Muntjac Deer Skin Fibroblast Cells, Cytoskeletal F-actin labeled with Alexa Fluor 488**

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**LLC-PK1 cells expressing GFP-EB3 tubulin (green) and H2B-labeled histones (red) illustrating the large field of view of the DS-Q2 camera. Sample courtesy of Michael Davidson, National High Magnetic Field Laboratory, Florida State University**
A microscope digital camera system with selectable combinations of camera head and controller for every application

Three models of compact color digital cameras for microscopy are available as camera heads. Two models of controller are available: a stand-alone type with built-in monitor for easy image capture, and a PC-use controlled type that enables advanced image processing and analysis via imaging software.

The three camera head models and two controller models can be freely combined to create a system for every purpose.

**DS-Vi1**
- 2.0-megapixel color CCD
- SXGA video at 15 fps* (maximum 29 fps)
- Monitoring applications with excellent balance of smooth movement and clear imaging
- Suitable with NIS-Elements

**DS-Fi1c**
- 5.0-megapixel color CCD and Peltier element
- Cooling to -20°C ambient temperature
- High-contrast images with limited thermal background noise

**DS-Fi2**
- 2560×1920 pixel shooting
- High-speed frame rate of 21 fps*
- Suitable for brightfield, phase contrast, and differential interference

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**Table: Camera Heads and Features**

<table>
<thead>
<tr>
<th>Camera Heads</th>
<th>Image Sensor</th>
<th>Max Recordable Pixels</th>
<th>Display Speed</th>
<th>ISO Sensitivity</th>
<th>Features and Main Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS-Fi2</td>
<td>1/3&quot; color, 5.0 megapixels, CCD</td>
<td>2560×1920</td>
<td>Maximum 29 fps</td>
<td>Equivalent to ISO 64</td>
<td>High resolution/brightfield, phase contrast, differential interference, etc.</td>
</tr>
<tr>
<td>DS-Fi1c</td>
<td>1/3&quot; color, 5.0 megapixels, CCD</td>
<td>2560×1920</td>
<td>Maximum 29 fps</td>
<td>Equivalent to ISO 64</td>
<td>High resolution/brightfield, phase contrast, differential interference, etc.</td>
</tr>
<tr>
<td>DS-Vi1</td>
<td>1/1.8&quot; color, 2.0 megapixels, CCD</td>
<td>1600×1200</td>
<td>Maximum 29 fps</td>
<td>Equivalent to ISO 100</td>
<td>High-speed live display/brightfield, phase contrast, differential interference, etc.</td>
</tr>
</tbody>
</table>
**Stand-alone control unit**

**DS-L3**

Equipped with a large touch panel monitor and a rich feature set, the DS-L3's ease of operation enables quick image acquisition even without a PC or computer monitor.

**High-definition touch panel monitor**

Built-in 8.4” 1024×768 monitor. Easy to see and easy to use, the large touch-panel monitor allows simple setting and operation of the camera head with a touch of a finger or stylus.

**GUI for intuitive operation**

The DS-L3’s icon-based menu screens offer excellent recognizability. From image acquisition to setting of shooting parameters, measurement, and export of image data, all operations can be performed easily by touching the screen.

**Scene mode**

Optimal imaging parameters for each sample type and observation method can be set through the icons. A choice of five modes for biological imaging and four modes for industrial imaging are available, and a wide variety of applications can be covered.

**Improved image processing performance**

The DS-L3 reduces or eliminates diagonal line jaggedness in images and improves color reproduction as well, reducing unevenness in sample colors caused by cameras.

**Integration with microscopes**

When used with a microscope equipped with motorized units or state detection units, the microscope motor functions and peripheral equipment can be controlled through the DS-L3, with automatic detection of information such as objective lens magnification.

**A wide variety of tools**

The DS-L3 enables the conducting of simple measurements on images, with input of lines and comments. These can also be written onto and saved with the image, and measurement data can be output.

**Measurement function**

- Measurement (2 point distance)
- Distance (arc distance, radial distance, oval distance, area (pixel distance))

**Position and size comparison functions**

- Video magnification
- XY scale
- XY measurement

**Drawing functions**

- Count marking
- Text input

**Interface for a full range of peripheral equipment**

- Video output (2 ports)
- USB Type A
- CF card slot
- Connector, Type II
- 2.0/1.1 compatible, Vendor unique
- 2.0/1.1 compatible, PTP
- 2.0/1.1 compatible
- USB memory stick
- CF card Type I

**Adaptable to a wide range of applications**

Using NIS-Elements imaging software (available separately; see page 12), you can perform image acquisition, processing, and analysis with integrated control of the camera and microscope peripherals.

**Integration with microscopes**

The DS-U3 enables the control of a motorized microscope system (turning of nosepiece or filter turret, etc.) and automatic detection of objective magnification using a data detection nosepiece.
Integration with the comprehensive imaging software series

Nikon uses the NIS-Elements series as control software. NIS-Elements allows functions from basic imaging to control of the microscope and peripheral devices to be performed, as well as the measurement, analysis, and management of acquired images. Four basic packages and a variety of optional modules are available to suit every application and objective.

* See the NIS-Elements Catalog for details.

**Free package**
The bundled free package offers functions for the display of scale on live images, full-screen display, and more. The simple operation screen makes shooting easy.

**Documentation package**
The documentation package is equipped with measurement and report creation functions. It enables general microscopic image acquisition in fields from biomedical to industrial, and is expandable through optional added features such as EDF and databases.

**Research package**
The research package enables the construction of advanced image acquisition systems, including multidimensional imaging (up to 4 dimensions for Br, 6 dimensions for Ar), through integration with systemized microscopes. Sets equipped with a rich range of image processing and analysis functions are available for every application.

Compatible OS: Windows® 7 Pro 32/64bit (DS-Ri2 / DS-Qi2 / DS-U3 / DS-L3 vender unique mode)

* Nikon provides confirmed compatible PCs with up-to-date specifications. Contact Nikon for details.

**Multichannel (multi color)**
NIS-Elements can acquire full bit depth multi-color images, combining multiple fluorescence wavelengths and different illumination methods (DIC, phase contrast etc.), while offering independently scalable channels.

**Z-series**
Through motorized focus control, NIS-Elements reconstructs and renders 3D images from multiple Z-axis planes.

**Multi-dimensional Image Display**
NIS-Elements displays time lapse, multi-channel, multiple X, Y, Z positions in an intuitive layout, which allows for automatic playback and the ability to select subsections of the data to be saved as a new file.

**HDR (High Dynamic Range) image acquisition**
HDR creates an image with appropriate brightness in both the dark and bright regions in a sample by combining multiple images acquired with different exposure settings. It is also possible to create HDR image using multiple captured images.

**EDF (Extended Depth of Focus)**
Creates a single, all-in-focus image from images of differing focus. Such images can now be created by simply turning the focus knobs.

**HDR**
(High Dynamic Range)
image acquisition

**EDF**
(Extended Depth of Focus)
image acquisition

**Grain size analysis**
Detects and measures grains in one and two phase samples according to JIS G0551 or ASTM E112-96/E1382-97 standards.

**Cast iron analysis**
Detects, measures and classifies graphite content as well as ferrite content in graphite-corrected samples according to JIS D5052 or ASTM A247-08 standards.

**Manual measurement and image annotation**
Manual/Measurement allows easy measurement of length and area by drawing lines or an object directly on the image. The results can be attached to the image, and also exported as text or to an Excel spreadsheet.

**Auto measurement (Object Counting)**
Performs binarization on images using previously set thresholds to measure the number, area, brightness, etc. of identified objects.

**Image stitching (Large Image)**
Stitches together images from multiple fields of view during shooting to create an image with wide field of view. Images already acquired can also be stitched together.
### Dimensions

**System Diagram**

- **DS-R12 / DS-Q12**
  - Dimensions: 105 (W) × 134 (D) × 153 (H) mm
  - Weight: 1200g

- **DS-FI2**
  - Dimensions: 77 (W) × 76 (D) × 44 (H) mm
  - Weight: 260g

- **DS-V1 / DS-FI1c**
  - Dimensions: 82 (W) × 77.5 (D) × 48 (H) mm
  - Weight: 1600g

- **LS-L3**
  - Dimensions: 77 (W) × 76 (D) × 44 (H) mm
  - Weight: 36W

- **US-U3**
  - Dimensions: 193 (W) × 196 (D) × 35 (H) mm
  - Weight: 360g

### Specifications

#### Camera Type

**DS-R12**
- Image sensor: 1/1.8 in. high-density CCD (5.25 megapixels - effective 3.07 megapixels)
- Resolution: W: 2560 × H: 1920 (max. 10 fps), 1280 × 960 (max. 21 fps)
- Live display mode: ROI mode (max. 27 fps)
- ISO sensitivity: Standard: equivalent to ISO 200 (selectable from ISO200 to 12800 equivalent)
- Dark current: 0.6e-/p/s (Ta=25°C) (typ.)
- Full well capacity: 60000e- (typ.)
- Quantum efficiency: 77%
- Recordable pixels: 2560 × 1920 (max. 21 fps), 1280 × 960 (max. 7.8 fps), 640 × 480 (max. 18 fps), 320 × 240 (max. 20 fps), 160 × 120 (max. 18 fps)
- Image format: BMP, TIFF, JPEG, JPEG2000 etc., selectable in NIS-Elements
- Lens mount: F mount
- Live display mode: Full-pixel 4908×3264 pixel (max 6fps) / 3×3 pixel averaging 1636×1088 (max 45fps)
- White balance: Set method, Color balance adjustable
- Exposition metering range: Position/size adjustable
- Exposure correction: Correction range: ±2.0, Step: 1/3
- Digital zoom: Up to 16× (8 steps)

**DS-FI1c**
- Image sensor: 2.11 megapixels (effective 2.01 megapixels)
- Resolution: W: 1600 × H: 1200 (max. 12 fps), 800 × 600 (max. 27 fps), 400 × 300 (max. 47 fps)
- Live display mode: 600, 400, 200, 100 (max. 27 fps), 600, 400, 200, 100 (max. 27 fps)
- ISO sensitivity: Standard: equivalent to ISO 100 (selectable from ISO50 to 2000 equivalent)
- Image format: RGB 8 bit/16 bit
- Monitor: 1024 × 768, 60Hz
- Power consumption: 36W
- Operating environment: 0-40°C, 60% RH max. (without condensation)

**DS-V1**
- Image sensor: 1/1.8 in. high-density CCD (2.8 megapixels - effective 2.01 megapixels)
- Resolution: W: 2560 × H: 1920 (max. 10 fps), 1280 × 960 (max. 21 fps)
- Live display mode: ROI mode (max. 23 fps)
- ISO sensitivity: Standard: equivalent to ISO 200 (selectable from ISO200 to 12800 equivalent)
- Image format: RGB 8 bit
- Monitor: 1024 × 768, 60Hz
- Power consumption: 25W
- Operating environment: 0-40°C, 60% RH max. (without condensation)

### System Type (Camera Head + Control Unit)

**DS-L3 (Standard type)**
- Dimensions: 193 (W) × 196 (D) × 35 (H) mm
  - Power: 36W
  - Weight: 1400g

**DS-L3 (Standalone mode)**
- Dimensions: 1800 (W) × 66.5 (D) × 200 (H) mm
  - Power: 70W

**US-U3**
- Dimensions: 193 (W) × 196 (D) × 35 (H) mm
  - Power: 36W

**Note:** Please refer to the manuals for detailed information on the NIS-Elements image integration software version.
Specifications and equipment are subject to change without any notice or obligation on the part of the manufacturer. June 2014 ©2004-2014 NIKON CORPORATION

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*Products: Hardware and its technical information (including software)

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