A new system for imaging: the DS-Fi3, a high resolution and sensitivity general purpose color camera has been added to the Nikon Digital Sight series. The DS-Fi3 can be connected to a PC, or the new compact tablet-style DS-L4.
Microscope Camera

DS-Fi3

High-resolution images

A CMOS high density 5.9 megapixel sensor produces high resolution images. USB3.0 data transfer allows fast focusing at high resolution, and easy capture images in all types of observation methods such as brightfield, differential interference contrast, and phase contrast.

Tubular adenoma, HE staining (Objective: CFI Plan Apochromat Lambda 4X)
Photos courtesy of Dr. Yasunori Ohta, Department of Pathology, IMSUT Hospital, Institute of Medical Science, The University of Tokyo

Liquid crystal panel
(Objective: TU Plan Fluor 10X)
Superior color reproduction

Nikon is well-known for outstanding and lifelike color reproduction, and developing superior algorithms for creating results that look like the actual samples. These algorithms are used in all of the color cameras in the digital sight lineup.

High-speed live display

Fast USB3.0 data transfer means fast, smooth live updating of images for finding samples or focusing, even at full resolution.

High sensitivity, low noise

Quantum efficiency and read noise have been greatly improved, providing better capability for acquisition of fluorescent images with better signal-to-noise ratios than before.

Camera Control

The DS-Fi3 interfaces with PC computers via a USB3.0 interface directly to the camera head, and uses NIS-Elements series software for image acquisition.
Compact, easy-to-use tablet-type microscope camera control unit.

DS-Fi3 and DS-Ri2 can be optionally connected to the DS-L4 tablet-style control unit, eliminating the need and space requirements of a desktop PC. DS-L4 has a large number of built-in functions for measurement and annotations, and has built-in security for network connectivity.

Tablet-type camera control unit

Large, 10.1 inch, touch-screen 1920 × 1200 pixel display: The DS-Fi3 and DS-Ri2 can be set and operated simply and easily through the tablet by touch, or by connecting Bluetooth accessories such as a keyboard or mouse.

User Interface for naturally simple operation

The camera control menu uses recognizable and intuitive icons. Frequently used icons are in two rows, and the display space for live images and photographed images is large and prominently displayed.

Scene mode

When connected to biological, industrial, or stereoscopic microscopes equipped with motorized hardware units and observation mode sensors, it is possible to both control the microscope and detect its observation mode state. Storing the objective lens information is convenient when making measurements.

## Biological Scene Mode

- Brightfield
- HE
- ELISA

## Industrial Scene Mode

- Wafer/IC
- Metal, Ceramic/Plastic
- Circuit board
- Flat Panel Display

Integration with microscopes

Optimal imaging parameters for the microscope’s light source, (LED or halogen), each sample type, and observation method can easily be set through the icons. A choice of three modes for biological and four modes for industrial imaging are available, and up to seven custom modes with freely configurable shooting parameters can be set.

A wide variety of tools

The DS-L4 enables easy measurements directly on images, with input of lines and comments. These can also be written and saved with the image, and measurement data can also be output.

Tighten security

McAfee embedded control with White List method is preinstalled for the virus measurement. The program which is not registered at White List cannot be launched so that the virus cannot be activated. Only registered users are able to use by implementing user registration. Those security protect the important images.
Two Large Sensor high resolution 16.25-megapixel CMOS image sensors for microscopy

Two Nikon FX-format CMOS image 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 CMOS image sensors.

Large Format CMOS image sensors

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

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

Pig kidney epithelial cells expressing GFP-EB3 tubulin
Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University

Malleable cast iron (Objective: TU Plan Fluor 20X)

The tissues of the liver, HE staining (Objective: CFI Plan Apochromat Lambda 10X)
Photos courtesy of: Kazuhiro Muraoka, Photography Division, Tokyo Women's Medical University
Fast, one-shot capture of ultra-high resolution color images.

Microscope Camera

**DS-Ri2**

**16.25 megapixel**

**Color**

**High-resolution**

High-resolution images

*16.25-megapixel CMOS image 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.

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' 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.

Pancreatic cancer cell, NGFR immunostaining\(^1\)

*(Objective: CFI Plan Apochromat Lambda 40XC)*

Mouse cerebellum sagittal section, HE staining (Objective: CFI Plan Apochromat Lambda 4X)

Human glomerulus of kidney, Azan stain\(^2\)

*(Objective: CFI Plan Apochromat Lambda 40XC)*

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*\(^1\), \(^2\) Photos courtesy of: Dr. Atsushi Furuhata and Noriyoshi Sueyoshi, Assistant General Manager, Laboratory of morphology and image analysis, BioMedical Research Center, Juntendo University Graduate School of Medicine
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.

Transgenic C. elegans expressing venus in the head neurons and EGFP in the body wall muscles.

Capture Low light fluorescence and Large Fields of View

Monochrome Microscope Camera

DS-Qi2

16.25 megapixel
Monochrome
Cooled

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 image sensor and USB 3.0-based data transfer, the DS-Qi2 enables high-speed live imaging and image capture at up to 45 fps (1636x1088 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 14bit fluorescence images with very little noise.

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

Indian Muntjac Deer Skin Fibroblast Cells, Cytoskeletal F-actin labeled with Alexa Fluor 488
Sample courtesy of: Michael Davidson and Florida State University
With a large field of view and pixel density, and low noise, the DS-Qi2 is ideal for time-resolved imaging applications.

Time-lapse photography

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.

Rat primary culture neuron
Dendron labeled with MAP-2(Red) and Actin(cytoskeleton) labeled with Phallolidin (Green)

LLC-PK1 cells expressing GFP-EB3 tubulin (green) and H2B-labeled histones (red) illustrating the large field of view of the DS-Qi2 camera.
Sample courtesy of: Michael Davidson, National High Magnetic Field Laboratory, Florida State University
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.

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.

Compatible OS: Windows® 10 Pro 64bit, Windows® 7 Pro 32/64bit  
* Nikon provides confirmed compatible PCs with up-to-date specifications. Contact Nikon for details.
**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.

![HDR image example](image1)

Area 1 is underexposed  
Area 2 is overexposed

Captures both areas 1 and 2 with optimal exposure

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**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.

![Manual measurement example](image2)

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**Auto measurement (Object Counting)**

Performs binarization on images using previously set thresholds to measure the number, area, brightness, etc. of identified objects.

![Auto measurement example](image3)

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**Grain size analysis**

Detects and measures grains in one and two phase samples according to JIS G0551, ASTM E112-96/E1382-97 and ISO643 standards.

![Grain size analysis example](image4)

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**Cast iron analysis**

Detects, measures and classifies graphite content as well as ferrite content in graphite-corrected samples according to JIS G5502, ASTM A247-06 and ISO945-1 standards.

![Cast iron analysis example](image5)

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**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 knob.

![EDF example](image6)

Selects the in-focus area and produces one all-in-focus image

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**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.

![Image stitching example](image7)

Images are stitched together during shooting
Dimensions

DS-Fi3

DS-Ri2/DS-Qi2

DS-L4

System Diagram

*1: Compatible with DS-Ri2 only
*2: Analog RGB/Displayport/microHDMI
Specifications

Microscope Digital Camera

<table>
<thead>
<tr>
<th>Model name</th>
<th>DS-Fi3</th>
<th>DS-Ri2</th>
<th>DS-Qi2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image sensor</td>
<td>1/1.8 inch Nikon FX-format Color CMOS image sensor Size: 6.91 x 4.92 mm</td>
<td>Nikon FX-format Color CMOS image sensor Size: 36.0 x 23.9 mm</td>
<td>Nikon FX-format Monochrome CMOS image sensor Size: 36.0 x 23.9 mm</td>
</tr>
<tr>
<td>Recordable pixels</td>
<td>All pixels: 2880 x 2048 2 Vertical and 2 horizontal pixels average: (1440 x 1024): 30 fps</td>
<td>All pixels: 4908 x 3264 3 x 3 pixels average: 1636 x 1088</td>
<td></td>
</tr>
<tr>
<td>Lens mount</td>
<td>C-mount</td>
<td>C-mount</td>
<td>C-mount</td>
</tr>
<tr>
<td>Cooling method</td>
<td>—</td>
<td>—</td>
<td>Electronic cooling</td>
</tr>
<tr>
<td>ISO sensitivity (recommended exposure index)</td>
<td>Standard: equivalent to ISO 50 (Select from ISO 50 to ISO 1200 equivalent)</td>
<td>Standard: equivalent to ISO 200 (Select from ISO 200 to ISO 51200 equivalent)</td>
<td>Standard: equivalent to ISO 50 (Select from ISO 50 to ISO 1200 equivalent)</td>
</tr>
<tr>
<td>Quantum efficiency</td>
<td>—</td>
<td>77%</td>
<td>—</td>
</tr>
<tr>
<td>Full well Capacity</td>
<td>—</td>
<td>60000e (typ.)</td>
<td>—</td>
</tr>
<tr>
<td>Readout noise</td>
<td>—</td>
<td>2.2e (typ.)</td>
<td>—</td>
</tr>
<tr>
<td>Dark current</td>
<td>—</td>
<td>0.6e-/p/s (Ta=25°C) (typ.)</td>
<td>—</td>
</tr>
<tr>
<td>Live display mode*1 (maximum fps)</td>
<td>All pixels (2880 x 2048): 15 fps 2 Vertical and 2 horizontal pixels average (1440 x 1024): 30 fps</td>
<td>All pixels (4908 x 3264): 6 fps 3 x 3 pixels average (1636 x 1088): 45 fps</td>
<td></td>
</tr>
<tr>
<td>Exposure time</td>
<td>100 usec ~ 30 sec</td>
<td>100 usec ~ 120 sec</td>
<td></td>
</tr>
<tr>
<td>Photometry mode</td>
<td>Average photometry: Average intensity within the photometry area Peak photometry: Maximum intensity within the photometry area</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Exposure control</td>
<td>One-time automatic exposure: Exposure time is adjusted automatically for one-time within the optimum range for the camera Continuous automatic exposure: Automatic exposure adjustment is performed continuously to keep the exposure within the camera Manual exposure: Exposure time and gain settings are made manually</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Exposure correction</td>
<td>±1EV Step:1/6EV</td>
<td>Average metering: -1EV ~ +1/2EV Peak hold metering: -1EV ~ +0 EV</td>
<td>—</td>
</tr>
<tr>
<td>Interface</td>
<td>USB3.0 (connect with PC, DS-L4) x 1, External trigger x 1</td>
<td>USB3.0 (connect with PC) x 1, External trigger x 1</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>AC100-240V 50Hz/60Hz</td>
<td>13W</td>
<td>24W</td>
</tr>
<tr>
<td>Power consumption</td>
<td>4.8 W</td>
<td>13W</td>
<td>24W</td>
</tr>
<tr>
<td>Dimensions</td>
<td>100(W) x 66(D) x 65(H)mm</td>
<td>105(W) x 134(D) x 153(H)mm</td>
<td>120(W) x 134(D) x 153(H)mm</td>
</tr>
<tr>
<td>Weight</td>
<td>400g (approx.)</td>
<td>1200g (approx.)</td>
<td>1200g (approx.)</td>
</tr>
<tr>
<td>Operating environment</td>
<td>0-40°C, 60% RH max. (without condensation)</td>
<td>0-30°C, 80% RH max. 30-40°C, 60% RH max. (without condensation)</td>
<td></td>
</tr>
</tbody>
</table>

Microscope Camera Control Unit

<table>
<thead>
<tr>
<th>Model name</th>
<th>DS-L4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectable cameras</td>
<td>DS-Fi3, DS-Ri2</td>
</tr>
<tr>
<td>Live image</td>
<td>FULL (resolution emphasized), FAST (display frame rate emphasized) Format: RGB 24bits</td>
</tr>
<tr>
<td>Exposure control</td>
<td>Program AE/Focus AE/Manual AE With AE lock function</td>
</tr>
<tr>
<td>Brightness adjustment</td>
<td>Exposure mode AE: Exposure compensation adjustment, Exposure mode manual AE: Exposure time or gain adjustment</td>
</tr>
<tr>
<td>Exposure metering</td>
<td>Average metering, Peak hold metering</td>
</tr>
<tr>
<td>Exposure metering area</td>
<td>Position/size variable</td>
</tr>
<tr>
<td>White balance</td>
<td>One-push operation</td>
</tr>
<tr>
<td>Image correction</td>
<td>Tone, sharpness, black level, hue, chroma, R/B adjustment, shading correction, special effect</td>
</tr>
<tr>
<td>Scene mode</td>
<td>LED/halogen, Biological/industrial/asbestos/standard Custom: Up to 7 types can be registered</td>
</tr>
<tr>
<td>Recording format</td>
<td>Colorspace: sRGB Still image: Tiff/Jpeg/DCIM, movie: AVI</td>
</tr>
<tr>
<td>Saving destination</td>
<td>Internal drive (flash memory 64GB, approx. 28GB available) microSD/USB memory/SMB file server</td>
</tr>
<tr>
<td>Measurement/drawing/ scale</td>
<td>Measurement target: Point-to-point distance, perpendicular line length, angle, circle, distance, between center points of two circles, area Measurement unit calibration registration: Auto registration calibration by objective information setting (seven types registerable) Manual registration calibration: Manual calibration/Optical calibration by entering objective magnification (14 types) Drawing: Text, line, arrow, pen, marker, scale bar Scale: Cross, grid line, X scale (cross scale), XY scale</td>
</tr>
<tr>
<td>Microscope control*2</td>
<td>Biological microscope: Ni-E/Ni-U/Ci-E/Ti2-E/Ti2-A Industrial microscope: LV150NA/LV100DA-U/LV100NDA Stereo microscope: SMZ25/SMZ18/SMZ1270i</td>
</tr>
<tr>
<td>Supported language</td>
<td>English, Japanese</td>
</tr>
<tr>
<td>Security</td>
<td>Anti-virus: McAfee Embedded Control is preinstalled. Programs that are started by the white list method are controlled. User login method: With DS-L4 user registration, login is possible by entering user ID and password</td>
</tr>
<tr>
<td>LCD display</td>
<td>10.1-inch wide TFT LCD display (1920 x 1200 WUXGA)</td>
</tr>
<tr>
<td>Interface</td>
<td>USB 3.0 host port x1, USB 2.0 port x4, DisplayPort, microHDMI, LAN (IEEE 802.3 10/100/1000Base-TX, IEEE 802.11 a/b/g/n), Bluetooth, microSD card slot</td>
</tr>
<tr>
<td>Power supply</td>
<td>AC100-240V 50Hz/60Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>65W</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Main body: 265 x 188 x 10 mm, Including extended cradle: 265 x 201 x 107 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>Main body: 630g (approx.), Including extended cradle: 1060g (approx.)</td>
</tr>
<tr>
<td>Operating environment</td>
<td>5-35°C, 20-80% RH max. (without condensation)</td>
</tr>
</tbody>
</table>

*1: Maximum frame rate depends on exposure time.  
*2: Please contact Nikon for details.