Digital Cameras for Microscopes

DIGITAL CAMERAS FOR MICROSCOPES

DIGITAL SIGHT SERIES
Nikon Digital Sight Series
New Lineup

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.
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.

Microscope Camera

DS-Fi3

5.9 megapixel Color High-resolution

Tubular adenoma, HE staining (Objective: CFI Plan Apochromat λ 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.

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 x 1200 pixel display. The DS-Fi3 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.

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.
**DS-Qi2**

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

**DS-Ri2**

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.

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

Malleablecastiron (Objective: TU Plan Fluor 20x)

The tissues of the liver, HE staining (Objective: CFI Plan Apochromat λ 10x)
Photos courtesy of: Kazuhiro Muraska, Photography Division, Tokyo Women’s Medical University
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.

Microscope Camera

DS-Ri2

16.25 megapixel
Color
High-resolution

Pancreatic cancer cell, NGFR immunostaining*1
(Objective: CFI Plan Apochromat λ 40x)

Human glomerulus of kidney, Azan stain*2
(Objective: CFI Plan Apochromat λ 40x)

*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-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.

Mouse cerebellum sagittal section, HE staining (Objective: CFI Plan Apochromat λ 40x)
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.

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

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.

Semi-conductors (IC wafers)
(Objective: TU Plan Fluor 20x)

Resolution chart
(Objective: TU Plan Fluor 20x)

Conventional camera

DS-Ri2
Capture Low light fluorescence and Large Fields of View

Monochrome Microscope Camera

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 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.

Indian Muntjac Deer Skin Fibroblast Cells, Cytoskeletal F-actin labeled with Alexa Fluor 488
Sample courtesy of: Michael Davidson and Florida State University

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
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 Phalloidin (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.

**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

* 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.

Auto measurement (Object Counting)

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

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.

Grain size analysis

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

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.

Cast iron analysis

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

**DS-Fi3**
- Dimensions: 100 x 60 x 40 mm

**DS-Ri2 / DS-Qi2**
- Dimensions: 105 x 65 x 45 mm

**DS-L4 cradle AC adapter**
- Dimensions: 105 x 65 x 45 mm

**System Diagram**

- **AC power adapter**
- **USB 3.0**
- **USB 2.0**
- **USB 3.0**
- **Microscope**
- **F-mount adapter**
- **C-mount adapter**
- **Smartphone/Tablet terminal**
- **Network server (WEB, FTP, telnet)**
- **Large-screen monitor (External output)**
- **Wireless LAN**
- **LAN (Ethernet)**
- **USB memory**
- **USB mouse**
- **USB keyboard**
- **microSD card**
- **Bluetooth mouse**
- **Bluetooth keyboard**
- **DS-L4 cradle AC adapter**

*1: Compatible with DS-Ri2 only
*2: Analog RGB/Displayport/microHDMI
Connectable cameras DS-Fi3, DS-Ri2

- Live image FULL (resolution emphasized), FAST (display frame rate emphasized)
- Format: RGB 24bits
- Exposure control Program AE/ Focus AE/ Manual AE
- With AE lock function
- Brightness adjustment Exposure mode AE: Exposure compensation adjustment, Exposure mode manual AE: Exposure time or gain adjustment
- Exposure metering Average metering, Peak hold metering
- Exposure metering area Position/size variable
- White balance One-push operation
- Image correction Tone, sharpness, black level, hue, chroma, R/B adjustment, shading correction, special effect
- Scene mode LED/halogen, Biological/industrial/asbestos/standard
- Custom: Up to 7 types can be registered
- Recording format Colorspace: sRGB
- Still image: Tiff/Jpeg/DICOM, movie: AVI
- Computer control
- Measurement/drawing/ measurement
- Measurement target: Point-to-point distance, perpendicular line length, angle, circle, distance, between center points of two circles, area
- Measurementunit calibration registration: Auto registration calibration by objective information setting (seven types registerable)
- Manual registration calibration: Manual calibration/Optical calibration by entering objective magnification (14types)
- Measurement/drawing/ scale
- Measurement target: Point-to-point distance, perpendicular line length, angle, circle, distance, between center points of two circles, area
- Measurementunit calibration registration: Auto registration calibration by objective information setting (seven types registerable)
- Manual registration calibration: Manual calibration/Optical calibration by entering objective magnification (14types)
- Drawing: Text, line, arrow, pen, marker, scale bar
- Scale: Cross, grid line, X scale (cross scale), XY scale
- Microscope control
- Biological microscope: Ni-E/Ni-U/Ci-E/Ti2-E/Ti2-A
- Industrial microscope: LV150NA/LV100DA-U/LV100NDA
- Stereo microscope: SMZ25/SMZ18/SMZ1270i
- Supported language English, Japanese
- Security 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
- LCD display 10.1-inch wide TFT LCD display (1920×1200 WUXGA)
- Interface USB 3.0 host port ×1, USB 2.0 port ×4, DisplayPort, microHDMI, LAN (IEEE 802.3 10/100/1000Base-TX, IEEE 802.11 a/b/g/n), Bluetooth, microSD card slot
- Power supply AC100-240V 50Hz/60Hz
- Power consumption 4.8 W 13W 24W
- Dimensions 100(W) × 66(D) × 65(H)mm 105(W) × 134(D) × 153(H)mm
- Weight 400g (approx.) 1200g (approx.)
- Operating environment 0-40°C, 60% RH max. (without condensation) 0-30°C, 80% RH max. 30-40°C, 60% RH max. (without condensation)
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