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M566EN03

Nikon

DS-Ri2
Microscope Camera

DS-Qi2
Monochrome Microscope Camera

< Instructions >

Introduction

Thank you for purchasing the Nikon products.

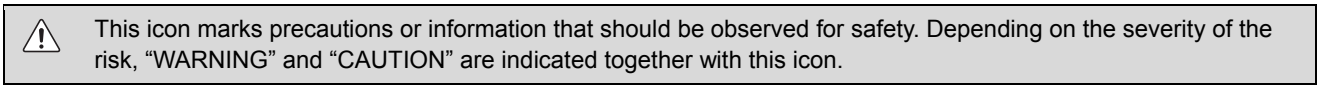
This instruction manual is written for users of the DS-Ri2 microscope camera or DS-Qi2 monochrome microscope camera.

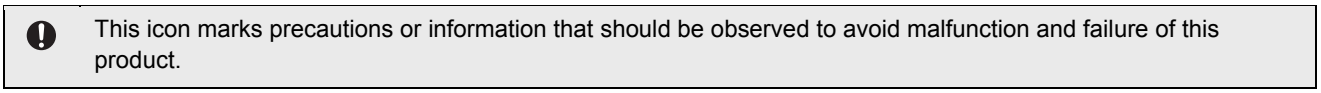
To ensure correct usage, read this manual carefully before operating this product.

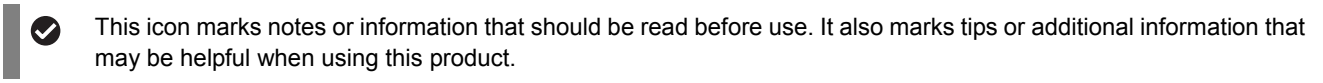
- No part of this manual may be reproduced or transmitted in any form without prior written permission from Nikon.
- The contents of this manual are subject to change without notice.
- The equipment described in this manual may differ from the actual product in its appearance.
- Although every effort has been made to ensure the accuracy of this manual, errors or inconsistencies may remain. If you note any points that are unclear or incorrect, please contact your nearest Nikon representative.
- Some of the equipment described in this manual may not be included in the set you have purchased.
- If you intend to use any other equipment with this product, read the manual for that equipment too.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Symbols used in this manual

This manual uses the following symbols.







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- The “TM” and ® marks are not used to identify registered trademarks and trademarks in manual.

Table of Contents

Safety Precautions

To ensure correct and safe operation, read this manual before using this product.

WARNING and CAUTION Symbols

Although this product is designed and manufactured to be completely safe during use, incorrect usage or failure to follow the safety instructions provided may cause personal injury or property damage. To ensure correct usage, read this manual carefully before using this product. Do not discard this manual and keep it handy for easy reference.

Safety instructions in this manual are marked with the following symbols to indicate their importance. For your safety, always follow the instructions marked with these symbols.

Symbol	Description
WARNING	Disregarding instructions marked with this symbol may lead to serious injury or death.
CAUTION	Disregarding instructions marked with this symbol may lead to injury or property damage.

WARNING

1. **Purpose of this product**

   The principal use of this product is to photograph and display pictures. Do not use this product for other purposes.

2. **Read this manual carefully.**

   For your safety, read carefully this manual and other manuals supplied with the products that will be used together with this product. Be sure to read and observe the warnings and cautions described at the beginning of each manual.

3. **Do not disassemble, repair, or modify this product.**

   Do not attempt to disassemble, repair, or modify this product. Doing so may result in electric shock or failure. Any failure or damage caused by such action will not be covered under warranty. Never attempt to disassemble, repair, or modify any part of this product which is not described in this manual. If you notice any problems with this product, contact your nearest Nikon representative.

   Note especially that the AC adapter for the product has a built-in high-voltage power source. Never dismantle, repair, or modify it.

4. **If the inside of this product is exposed due to breakage, never touch the exposed area.**

   If this product is broken due to falling, etc. and the inside is exposed, do not touch the exposed area. Doing so may cause an electric shock or personal injury on the jagged broken edge. Remove the battery or power cord and ask your nearest Nikon representatives for repair.

5. **Connect the AC adapter directly to a 100 to 240 VAC (frequency of 50 to 60 Hz) power socket.**

   The AC adapter for this product supports input of 100 to 240 VAC (frequency of 50 to 60 Hz). Be sure to connect the AC adapter to a power source within the range above, as well as the rated voltage range specified for the power cord. Failure to do so may cause an incident such as malfunction, fire, etc.

6. **Use the specified power cords.**

   Make sure to use the specified power cord for the AC adapter. If any other power cords are used, it may cause malfunction or overheating of this product or fire.

   - For details about the specified power cords, see “Chapter 7 Major Specifications.”
   - When plugging or unplugging the power cord, make sure that the product is switched off to avoid electrification.
   - The AC adapter for this product falls under the category of electric shock protection class I. Always make sure it is grounded to a protective ground terminal.

WARNING

7. Use the specified AC adapter.

Be sure to use this product with the specified AC adapter. If any other AC adapter is connected, it may cause malfunction or overheating of this product or fire.

- For details about the specified AC adapter, see “Chapter 7 Major Specifications.”
- Place the AC adapter in a well-ventilated location. Do not place an object on the AC adapter, or cover it with an object. Doing so will encumber heat dissipation and may cause overheating.
- Before connecting the AC adapter, be sure to turn off the power supply of the product without fail to prevent failure or malfunction.
- When turning off the product, check that green light for the POWER indicator is out before unplugging the AC adapter from the product or power cord from the AC power socket.

8. Do not allow this product to become wet.

Do not allow this product to become wet. It may cause malfunction, overheating, or electric shock. If this product becomes wet, immediately switch off the product, unplug the power cord, and contact your nearest Nikon representative.

9. Do not allow any foreign material to enter this product.

Do not allow foreign material to enter the inside of this product. It may cause malfunction. If any foreign material enters inside, stop using this product and contact your nearest Nikon representatives.

10. Never use this product in a flammable or combustible environment.

Using this product in a combustible gas or dust environment may cause an explosion or fire.

11. Do not encumber the heat dissipation of the device.

Do not place an object on the product, or cover it with an object. Doing so may encumber heat dissipation and raise the temperature inside the product, causing malfunction or fire.

12. Handling cables

Do not bend a cable excessively or twist it. Doing so may break the cable, causing malfunction or fire.

CAUTION

1. Handle this product with care.

To avoid failure, be careful not to give the device an impact or strong vibration.

2. Precautions against electromagnetic interference

This product generates weak electromagnetic waves. Do not place this product close to a precision electric device. Doing so may affect the accuracy of the device. Place a radio or television some distance away from this product if the reception is affected.

3. Do not orient the image pickup device to the sun or a high-power laser beam.

Do not orient the photographing section of the product directly to the sun or a high-power laser beam. An excessive exposure to the light may cause browning and burn-in of the image pickup device, leading to malfunction.

4. Cautions on installation, assembling, connection, and maintenance

- When you install, assemble, set up connection for, or clean this product, make sure that this product is switched off and the power cord plug is pulled off from the AC power socket in order to avoid electrification, fire, and other accidents.
- In installation and assembling, be careful not to have your fingers or hands caught.
- When you attach this product to a microscope or other optical instruments, make sure that the device body and cables do not interfere with the moving part of the optical device.

5. Precautions for installation/operating environment and storage environment

This product is a precision optical device. Using or storing it under improper environment may result in a failure or degraded precision. When using or storing this product, observe the following conditions.

- Installation/Operating environment
  Use this product in a location where the temperature is between 0 and +40°C, and a relative humidity is 60% RH or less at +40°C (no condensation).
- Storage environment
  Choose a location where the temperature is between -20 and +60°C, and a relative humidity is 90% or less (no condensation).
- Avoid high-temperature, high-humidity locations for installing or storing it.
- Do not place and use this product in a closed space such as a locker or a cabinet.
- Install this product so that there is at least 10 cm of clearance around this product.
- Install this product in a location that is free of dirt and dust. When used or stored in a dirty and dusty environment, dirt or dust may very rarely enter inside of the camera, which results in deterioration of the captured images.
- Install this product in a vibration-free area.
- Place this product in a place which allows easy removal of power cord from the AC inlet of the AC adapter in the event of an emergency.
- For safety's sake, unplug the power cord from the AC power socket when you do not use the product for a long time.
- During storage, place a cover over this product to avoid dust.
- For details about the usage and storage environments for this product, see "Chapter 7 Major Specifications."

6. Handling of the DS-Qi2

Be sure that your usage and storage environments satisfy specifications in "Chapter 7 Major Specifications."

The DS-Qi2 has a built-in mechanism for cooling the image pickup device. This makes it easier to run with condensation compared with other ordinary electric devices when exposed to a rapid temperature change or left in a high-humidity environment for a long time.

Take special care about the environment when using the DS-Qi2 for a long time. After a long period of its use, leave it idle at least several hours before switching it on again.

CAUTION

7. Use the nearest AC socket whenever possible

To supply power to this product and the PC, use an AC power socket as close as possible to the devices. Using a distant AC socket may cause potential difference, which may result in malfunction.

8. Connecting cables

Be sure that the AC adapter and power cord of the devices are unplugged from the AC socket before connecting a PC or other similar devices with a USB cable. Failure to do so may cause malfunction.

☆☆☆

1 Before Use

This chapter describes features of this product and gives you information on accessories supplied with the product as well as peripheral devices that are sold separately.

1.1 Features of DS-Ri2 / DS-Qi2

Nikon DS-Ri2 microscope camera or DS-Qi2 monochrome microscope camera is attached to a microscope or other optical devices such as an optical lens to acquire images as viewed on the computer screen.

Equipped with a large, 16-megapixel CMOS sensor, the DS-Ri2 is capable of acquiring color images while the DS-Qi2 is capable of acquiring monochrome images. Additionally, the DS-Qi2 has a cooling function that reduces noise.

Nikon F-mount, provided as the jointing section for attaching the product to an optical device, enables the attachment of the product onto a camera port of a microscope via an optional adapter. Alternatively, an optical lens can be attached to the F-mount. (Note)

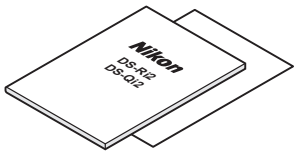
USB 3.0 compliant interface adopted for connection with a PC, the product can be connected to a PC with a commercial USB 3.0 cable.

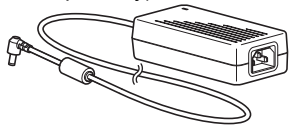
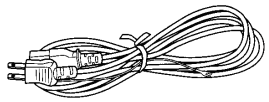
By installing the NIS-Elements application software to the PC, various operations become available on the PC such as viewing the live image and configuring image capture conditions.

Note: Only limited types of optical lenses are available for attachment to the product. For details, refer to “Section 1.3 Peripheral Devices.”

1.2 Checking Accessories and Peripheral Devices

The table below shows accessories supplied with this product and peripheral devices required for operation of the product.

No.	Item
1	DS-Ri2/DS-Qi2 (with F-mount cap, EXT I/O connector cap) 
2	Instruction manual (this manual), inquiry form 

No.	Item
3	AC adapter (sold separately) 
4	Power cord (sold separately) 
5	USB 3.0 cable (sold separately) 

1.3 Peripheral Devices

(1) F-mount adapter for connection with a microscope

An F-mount adapter is required to attach the product onto a camera port of a microscope. Following list a part of adapter products available:

- DS-F F mount adapter (direct attachment type)
- DS-F2.5 F mount adapter 2.5x
- C-TEPF DSC port for ergonomic binocular tube
- TI-BDTV2 F-TV tube for F-mount adapter
- C-TAQ2 tube adapter for quadrocular tube

Type of adapter required for the attachment of camera depends on type of microscope used. For details, please contact your nearest Nikon representative.

(2) F-mount lens

An F-mount lens is required if the image capture target is other than microscope image. Select an optical lens with field diaphragm ring.

> **Note on optical lens**
> The F-mount of this product has no automatic diaphragm lever or electrical contacts. Accordingly, open-aperture metering, autofocusing, and image stabilization functions cannot be used regardless of the type of attached lens.

(3) USB 3.0 cable

A USB 3.0 cable is required to connect this product and the PC.

Use a USB 3.0-compliant A-Micro B type cable. A connector with locking function can be used for the Micro B side.

> **Note on USB cable**
> Use of a cable not conforming to the standards may result in unstable operation or failure in operation.

(4) PC

A PC with NIS-Elements (application software for Nikon products) installed is required to control the product. Connect a PC and the product with a USB cable to operate on the NIS-Elements for controlling the product, viewing the live image, and saving images.

Given below are the PC requirements for the use of the NIS-Elements.

Item	Requirement
PC type	Windows PC
CPU	Intel Xeon E3-1230v2 (3.3 GHz) or higher
Memory	4 GB or more
Hard disk	2-GB available space is required at the time of installation
Video	1280 x 1024 pixels, High Color mode or better (True Color mode recommended)
Graphic controller	NVIDIA Quadro 600 or higher recommended
USB	USB 3.0
OS	Windows 7 Professional 32 bit/64 bit (Japanese/English)

Note: Nikon does not guarantee that the software will work on all the PCs that comply with the operating environments described above. For detail information, contact your nearest Nikon representative.

2 Names of Parts and Their Functions

This chapter explains names and functions of parts of the DS-Ri2 and DS-Qi2.

2.1 DS-Ri2 / DS-Qi2

- **Operation panel**

  Controls are given on this panel to turn on or off this product and to connect to or disconnect from an AC adapter or a PC (see “Section 2.2 Operation Panel”).

- **F-mount**

  A jointing section used to attach this product to a microscope or an optical lens.

  For micrographing, attach an F-mount adapter to attach this product to a microscope.

- **Alignment mark**

  A marking to be used to attach an F-mount adapter or an optical lens at an optimal orientation.

- **Lens releasing button**

  Used to remove an F-mount adapter or an optical lens from the product.

  To remove an F-mount or an optical lens etc., press the button and turn what is to be removed towards the alignment mark.

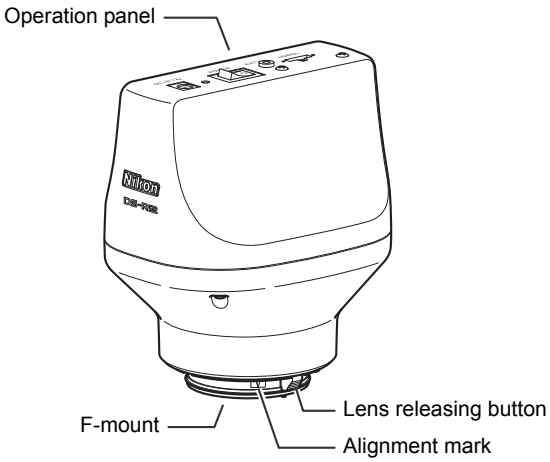
- **Rating plate**

  Product information such as rated power supply and conforming standards is given.

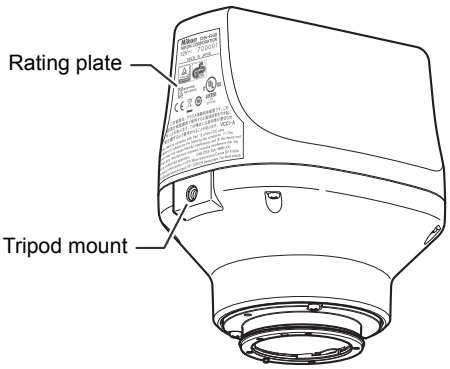
- **Tripod mount**

  Used to attach the product onto a tripod. A screw size of 1/4”, which is the size of generally used tripod screws, fits the mount.

■ **Front/top**



■ **Rear/bottom**



DS-Ri2/DS-Qi2

2.2 Operation Panel

- **DC IN 12V connector**

  Used to connect the dedicated AC adapter.

- **Power indicator (green/red)**

  Lights up in green when power is supplied. It flashes during the sleep mode. The light turns red if the product becomes unavailable for normal operation due to an error or failure.

- **POWER switch**

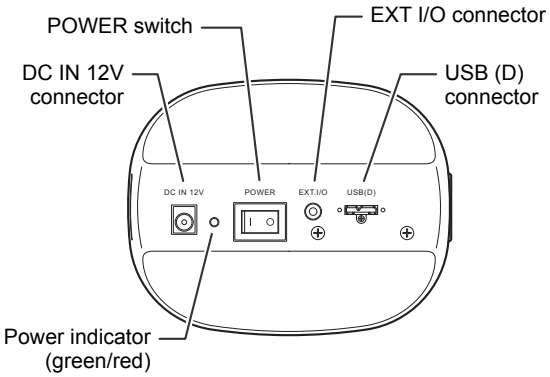
  The power supply switch of the product. Flip to the “I” side to turn on and the “O” side to turn off the power.

- **EXT I/O connector**

  An external device can be connected for external trigger operation or capture operation.

- **USB (D) connector**

  Connect a commercially available USB cable (USB 3.0, Micro B type) to connect this product with a PC.



Operation panel (top view)

3 Installation and Connection

This chapter explains how to install and connect DS-Ri2/DS-Qi2 to a microscope system.

3.1 Check First

3.1.1 Overall Connection

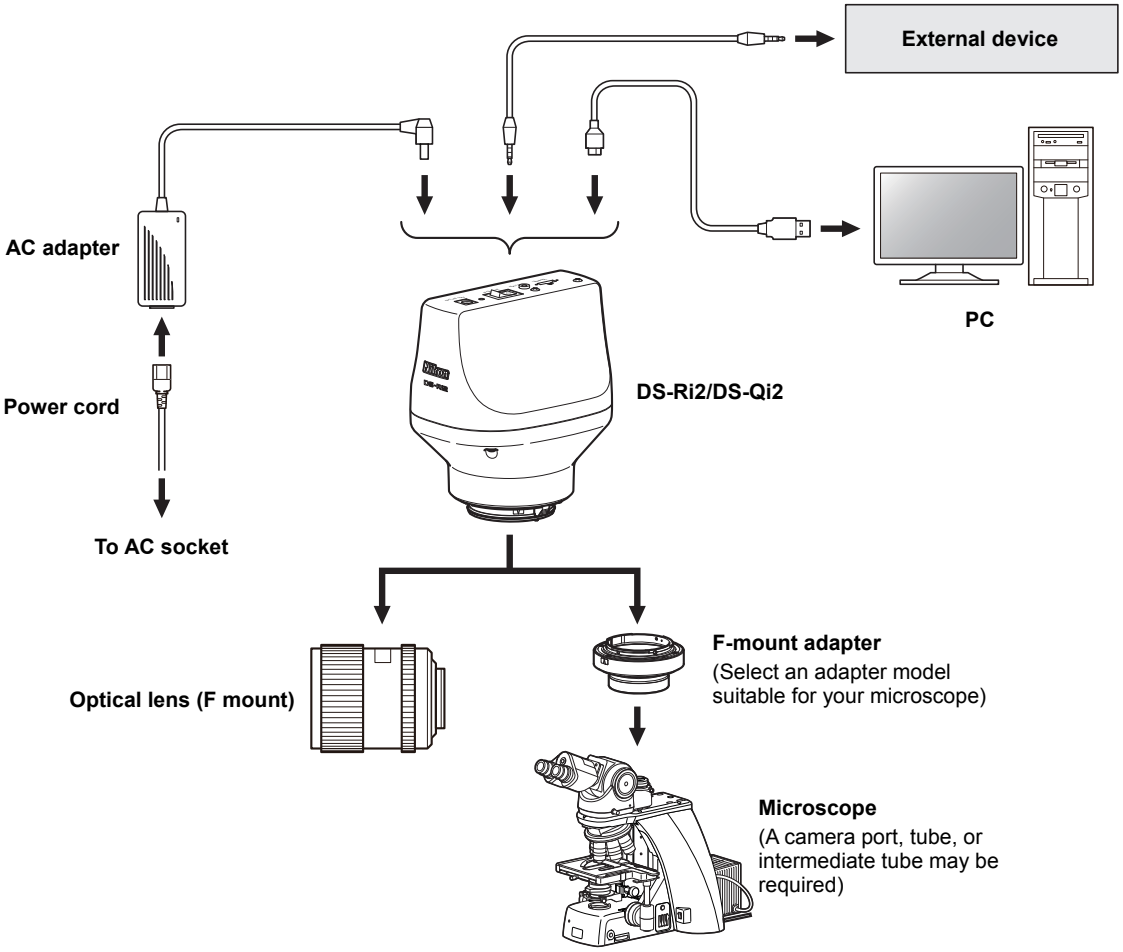


Illustration of overall connection

3.1.2 Attaching / Removing the F-mount Cap

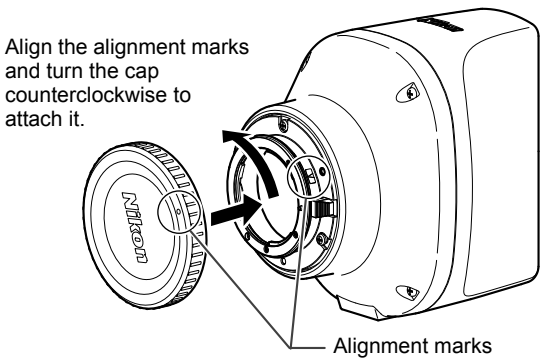
The F-mount cap or a dustproof cover is supplied with the product. Be sure to put it to the F-mount to protect dust from entering the product interior when any adapters are attached for connecting this product with an optical device.

- **Attaching the F-mount cap**

  Align the mark on the cap with the mark on the F-mount and turn the cap counterclockwise to attach the cap to the F-mount.

- **Removing the F-mount cap**

  Turn the F-mount cap clockwise to remove it. You can remove it without pressing the lens releasing button.



Attaching the F-mount cap

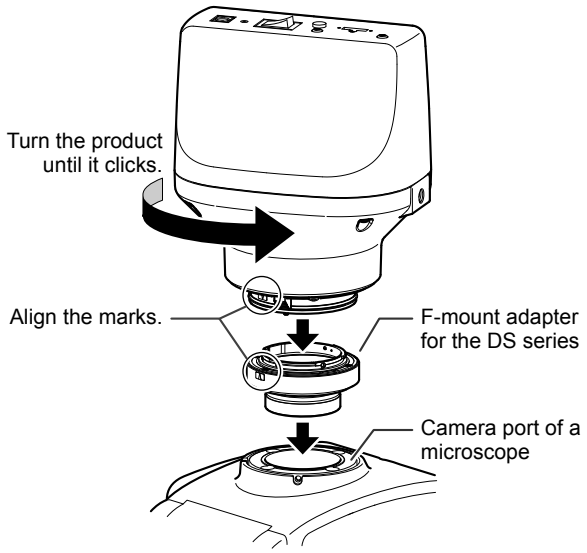
3.2 Attaching the DS-Ri2/DS-Qi2 to a Microscope or Other Optical Device

Attaching the DS-Ri2/DS-Qi2 to an optical device

An adapter or other component may be required to connect this product to an optical device, and type of such component differs according to the type of optical device this product is connected. In this section, procedure to attach this product to an optical device is explained based on an example of connecting it to a camera port of a microscope via a DS-F F-mount adapter.

> **Additional adapter or other attachment may be required between this product and a microscope**
> Adding of an adapter or other type of component to the microscope may be required in order to connect this product and the microscope via an F-mount adapter. For details, please contact your nearest Nikon representative.

1. **Check that the F-mount adapter for the DS series is dust-free.**
   If you see any dust on the adapter, clean it thoroughly with a blower, etc.
2. **Prepare an adapter or other component where necessary, and attach the F-mount adapter for the DS series to the camera port of the optical device.**
   Fix the adapter by tightening fixing screws.
3. **Remove the F-mount cap from this product.**
4. **Align the mark on this product and that on the F-mount adapter for the DS series, and turn this product as shown in the figure on the right until it clicks.**
   Do not press the lens releasing button here.

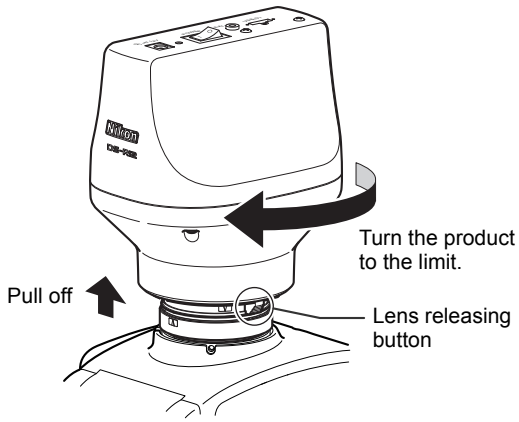


Attaching DS-Ri2/DS-Qi2 to a microscope

Detaching the DS-Ri2/DS-Qi2 from an optical device

1. **Flip the POWER switch to the “O” side to turn off the power to this product.**
2. **Pull off any cables connected to this product.**
3. **Press the lens releasing button and turn this product as shown in the figure on the right to detach it from the optical device.**
4. **Put the F-mount cap on the F-mount.**

> **Remember to put the F-mount cap for dust protection**
> Be sure to put the F-mount cap to the F-mount after detaching this product from an optical device to protect dust from entering the product interior.



Detaching DS-Ri2/DS-Qi2 from a microscope

Supplementary information on attachment of optical lens

An optical lens can be directly added to the F-mount.

To attach one, select an appropriate lens (see “Section 1.3 Peripheral Devices”) to attach to the F-mount of this product.

> **Use of a tripod**
> You can attach a tripod to this product using the tripod mount on the back of this product. It may be useful when an optical lens is attached.

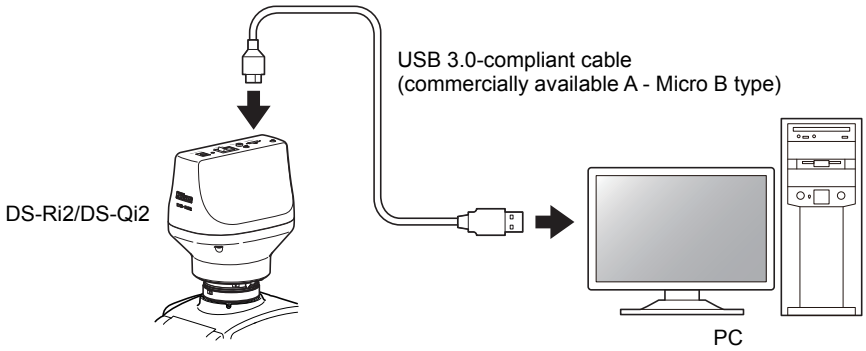
3.3 Connecting Peripheral Devices

Cautions on cable connection

Be sure that the AC adapter and power cord of peripheral devices are unplugged from the AC socket before connecting or disconnecting cables. Failure to do so may cause malfunction.

3.3.1 Connecting a PC

To connect this product with a PC, use a commercially available A-Micro B type, USB 3.0-compliant cable between the USB (D) connector of the product and the USB 3.0 connector of the PC. A Micro B type is also compatible for the connector on the DS-Ri2/DS-Qi2.



Connecting to the PC

3.3.2 Connecting an External Device (External Trigger Output Device)

To use an external device (external trigger output device) for image capturing based on external trigger signal or capture signal, connect the external device to the EXT I/O connector of this product.

Dustproof cap for the EXT I/O connector

A dustproof cap is attached to the EXT I/O connector when the product is delivered. Remove the cap to connect an external device. As long as no external device is to be connected, keep the cap attached. Failure to do so may cause product failure.

Functions available with an external trigger

Adding an external device (external trigger output device) to this product can realize three functions described below:

(1) Inputting capture signals from an external device to send a notification to the PC

A capture signal input from an external device is sent to the PC as notification for image capturing.

Given the notification, the PC application software (e.g., NIS-Elements) performs image capturing.

(2) Inputting trigger signals from an external device for trigger capturing.

Trigger signal input from an external device serves as a cue to perform image capture.

Exposure starts upon input of a trigger signal. Exposure time needs to be set in advance.

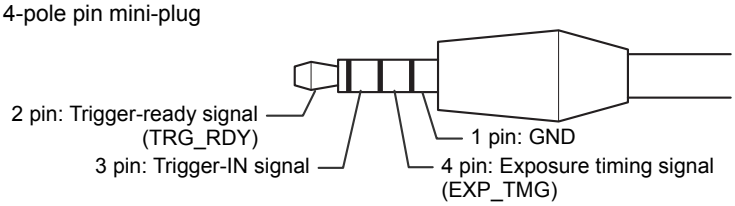
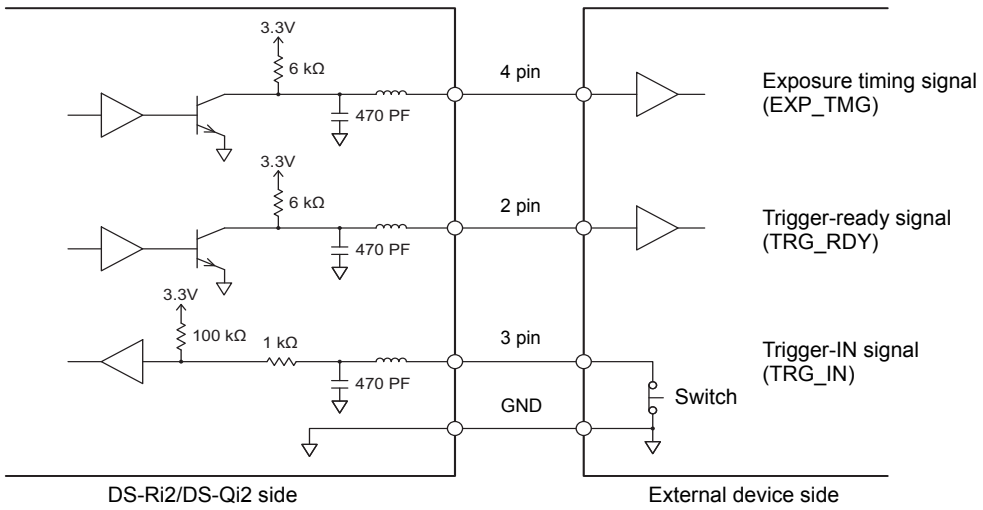
(3) Outputting synchronizing signals to an external device

A timing signal (exposure timing signal) is output to notify the external device that the camera is in an exposure process for trigger capture.

Additionally, a trigger-ready signal is output to notify that the camera is ready to start trigger capturing.

Specifications for External I/O Devices

To prepare an external I/O device, select the product satisfying the following specifications.

Connector	ø3.5, 4-pole pin mini-plug 
Signal	**Input** • Trigger-IN signal (TRG_IN) Input range 0 to 5 V LOW level 0.8 V or less HI level 2.4 V or over Exposure starts at the rising edge **Output** • Exposure timing signal (EXP_TMG) Output at the live operation or trigger operation HI: Currently in exposure process • Trigger-ready signal (TRG_RDY) HI: Trigger-ready status (ready to accept a trigger-IN signal) HI level 2.4 to 3.3 V LOW level 0.0 to 0.8 V
Connection circuit diagram	

Note: For details, please contact your nearest Nikon representative.

3.3.3 Connecting an AC Adapter

Connect an AC adapter (sold separately) to this product to supply power.

⚠ Caution: Connection of an AC adapter and a power cord

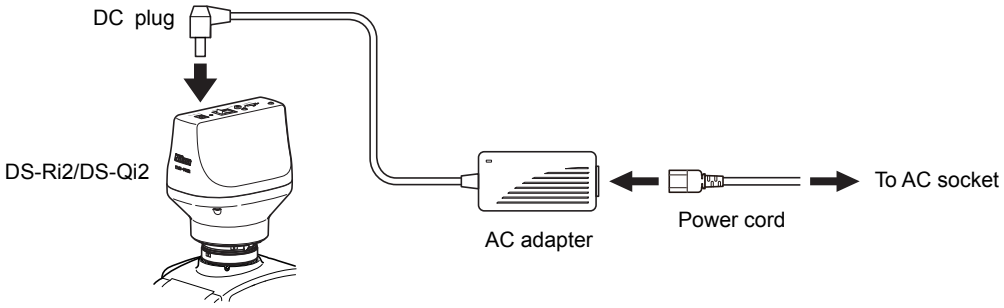
- To avoid electrification, be sure to confirm that this product is switched off before connecting an AC adapter.
- Connect an AC adapter after all other connections are finished.
- Be sure to use the AC adapter dedicated to this product.
- Be sure to use a power cord that is specified by this manual. Using some other power cord may cause malfunction or fire. Refer to “Chapter 7 Major Specifications” for the power cord specification.
  Because this product falls under the category of electric shock protection class I, always make sure to connect it to an AC socket that has a protective ground terminal. If you have broken or lost the power cord, contact your nearest Nikon representative.

1 **Confirm that the power to this product is turned off.**

2 **Connect the DC plug of the AC adapter to the DC IN 12V connector of this product.**

3 **Connect the specified power cord to the AC adapter.**

4 **Connect the plug of the power cord to the AC socket.**



Connecting AC Adapter

4 Capturing Images

This chapter describes procedures to capture images using the DS-Ri2/DS-Qi2.

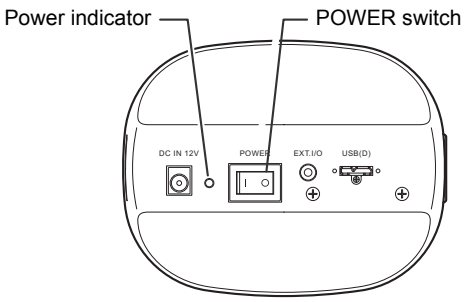
4.1 Starting Capturing Images

4.1.1 Turning On the DS-Ri2/DS-Qi2

1. **Check that installation and connection of this product have been complete.**
2. **Turn on the PC.**
3. **Flip the POWER switch to the "I" side to turn on the power.**

   When the power is supplied to this product, the power indicator beside the POWER switch lights up in green. Wait for about five seconds until the PC recognizes this product, and then go to Step [4].
4. **Start the NIS-Elements.**

   NIS-Elements automatically recognizes the connection of this product and the PC.



Turning on the DS-Ri2/DS-Qi2

> **Sleep mode**
>
> If a period of five minutes or more passes without any operation made on the application, this product enters into the sleep mode, which is indicated by the power indicator flashing in green.
>
> This product returns from the sleep mode when the application software is started, which is indicated by the power indicator lit in green.

4.1.2 Operation on NIS-Elements

Image capturing is controlled on the PC, or the NIS-Elements application software.

> **Operation of NIS-Elements**
>
> For how to operate NIS-Elements, see instruction manual for the NIS-Elements.

Downloading the NIS-Elements F

NIS-Elements F is available for download on the following website.

Check the contents of and notes regarding the software, as well as how to introduce it to your PC before downloading.

- **For Japanese version:**
  http://www.nikon-instruments.jp/jpn/service/download/software/imgsfw/index.aspx
- **For English version:**
  http://www.nikon.com/products/microscope-solutions/support/download/software/index.htm

4.2 Tips on Micrographing

4.2.1 Setting the Environment for Micrographing

When you have attached this product to a microscope, set up the environment for micrographing referring to the following description.

(1) Setting Up the Environment

♦ **Adjusting the brightness of the environment**

When you micrograph a dark specimen by a fluorescent microscope, the light in the room may come into the illumination optical path of the microscope; do the micrographing after making the room dark.

Cover the binocular section by the caps to shut the light out.

♦ **Preventing tremor**

Micrographing is made with a high resolution so that a little tremor affects the image quality. Place the microscope on a backlash-free robust desk standing on a stable floor, so that a tremor does not reach the microscope.

You can reduce the impact of tremors by using a vibration isolation table that suits your microscope. Be careful, especially during micrographing, not to touch the table on which the microscope is placed.

(2) Setting Up the Microscope Condition

♦ **Using an appropriate filter**

For color images:

Insert an NCB filter in the optical path.

For monochrome images:

Insert a filter that suits the photographing purpose in the optical path.

Generally, a GIF (Green Interference) filter achieves a good contrast. Using a filter of the complementary color of the specimen makes the contrast sharp.

> **Using a filter**
> - The way a filter is inserted and removed depends on the microscope. Refer to the manual of your microscope.
> - A third-party color compensation filter (CC filter) can be inserted into the illumination optical path of the microscope to compensate for changes in color balance caused by the length of the exposure time.
> - When using a phase contrast microscope or an interference microscope (two luminous fluxes or multiple luminous fluxes), you can enhance contrast using a green interference filter (GIF) or a monochrome interference filter (IF).
> - We recommend that you use both an NCB filter and GIF (green interference) filter for DS-Qi2.
> - Some microscope model may require a heat-wave absorbing filter.

> **NCB filter**
> An NCB (neutral color balance) filter is a color-balancing compensation filter used to adjust color temperature to daylight values in microscopes that use a halogen bulb as a light source.

> **Complementary color**
> For example, green and magenta, red and cyan, and blue and yellow are all pairs of complementary colors. When complementary colors overlap, their respective hues cancel each other out.

♦ **Setting the field diaphragm**

Adjust the field diaphragm so that it circumscribes the viewfield. The field diaphragm has a significant impact on contrast, especially for fluorescent specimens against dark backgrounds.

Note: For how to adjust the field diaphragm, refer to the instruction manual of your microscope.

♦ Setting the aperture diaphragm

Adjust the aperture diaphragm in the following way according to the illumination type.

For diascopic illumination:

Generally, the numeric value of the condenser aperture diaphragm should be adjusted to approximately 70% to 80% of the numerical aperture (NA) of the objective.

For episcopic illumination:

Generally, the aperture diaphragm should be adjusted to approximately 70% to 80% of the size of the pupil of the objective that can be seen by removing the eyepiece and looking into the eyepiece tube.

> **Adjustment of aperture diaphragm**
>
> - For details of the aperture diaphragm adjustment, refer to the instruction manual of your microscope.
> - For capturing images that have greater depth of focus, close down the aperture diaphragm. Note that closing down the aperture may limit the performance of the objective.

> **Depth of focus**
>
> "Depth of focus" refers to the in-focus range along the direction vertical to the specimen surface. While reducing the aperture diaphragm extends the depth of focus, it reduces resolution to some extent on the other hand. Adjust the aperture diaphragm in accordance with your needs.

♦ Adjusting the focus on the subject

Adjust the focus of the microscope so that the image can be clearly seen on the monitor.

> **Adjusting the focus on a dark subject**
>
> If the subject is dark making the exposure time long and the focusing difficult, we recommend that you use the [DF/FL] scene mode. For how you operate the [DF/FL] scene mode, refer to the instruction manual for the NIS-Elements.

♦ Adjusting the illumination

When capturing a color image, the color reproducibility of the image depends on the lamp voltage.

When a halogen lamp is used as the light source, increasing the lamp voltage produces a bluish light, while decreasing the lamp voltage produces a reddish light.

Except in cases where it is specifically necessary to adjust the tone, the voltage should be set to the proper level for micrography, which depends on the microscope being used. Since this level varies by type of microscope, refer to the instruction manual of your microscope.

Note: If the lamp voltage changes, adjust the white balance once again.

> **White balance during observation with the microscope**
>
> Consider the following when you adjust the white balance while viewing on the microscope.
>
> - When using diascopic illumination for microphotography, adjust the white balance while you are photographing a transparent part of the preparation.
> - When using episcopic illumination for microphotography or using a lens, adjust the white balance using a white subject.
> - For fluorescent photographing, we recommend that the white balance be adjusted under normal light conditions before photographing. If the screen is excessively dark or bright, adjust the light intensity of the light source or the iris diaphragm, or use an ND filter to obtain the appropriate white balance.

♦ Selecting an operation mode

Multiple operation modes are available for image capture using the product, including All pixels, 3 x 3 pixels average, and ROI modes. Refer to the table below to select an operation mode optimum for your subject, application, etc.,

Operation mode	Suitable application
All pixels	High resolution, wide FOV image capture
3 x 3 pixels average	Wide FOV, high frame rate image capture
ROI	Narrow FOV, high frame rate image capture

For more information on pixel count and frame rate for each operation mode, see "Chapter 7 Major Specifications." For information on settings of operation modes, refer to the instruction manual of the NIS-Elements.

♦ **Adjusting the exposure time**

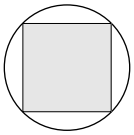
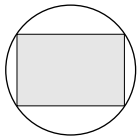
An exposure time in the range of 60 ms to 4 ms is appropriate for a normal image capturing. Adjust the light intensity for the microscope using an ND filter to get an appropriate exposure time.

While automatic exposure is selected, the camera gain and the exposure time are automatically changed to obtain an appropriate exposure. For this reason, a weak light intensity causes a high camera gain making the image coarse, and a long exposure time making the focusing difficult.

> **ND filter**
> An ND filter is a filter that affects only the amount of light passed, not the color balance of the light. For example, an “ND2” filter cuts transmitted light in half, while an “ND16” filter reduces transmitted light to 1/16th of actual levels.

4.2.2 Type of F-mount Adapter and Field of View

Field of view (or angle of view) and image resolution depends on the type of F-mount adapter used to add the product to a microscope or other optical device as shown in the table below.

Adapter type	Field of view	Aspect ratio	Max. resolution	Purpose
DS-F F mount adapter (direct attachment type)	A square inscribed in a 16-mm/ 22-mm/25-mm - diameter circle 	1 : 1	1608 x 1608 2136 x 2136 2424 x 2424	High sensitivity, minimum noise imaging
DS-F2.5 F mount adapter 2.5x	A rectangle inscribed in a17-mm-diameter circle 	Approx.3 : 2	4908 x 3264	High resolution imaging

4.2.3 Calculating the Display Magnification for Microscopic Observation

The table below shows the pixel size (the maximum number of pixels stored) of image pickup device and the effective area (area for the effective number of pixels stored) of this product.

Pixel size (μm)		Recorded pixel count		Effective area (mm)		
Width	**Height**	**Width**	**Height**	**Width**	**Height**	**Diagonal**
7.3	7.3	4908	3264	35.8	23.8	43.0

Use the following formula for calculating the magnification of the subject on the monitor.

- Magnification on the monitor

$$\frac{\text{Optical magnification (objective lens magnification} \times \text{relay lens magnification)} \times \text{Diagonal size of monitor display}}{\text{Diagonal size of effective area for image pickup device}}$$

5 Daily Maintenance

This chapter describes how to maintain the product.

To maintain the performance of this product, Nikon recommends you to perform daily maintenance.

5.1 Cleaning Utensils and Consumables

Cleaning utensils

- Soft-tip brush (Note)
- Soft cloth (nonwoven cloth, cotton cloth, or gauze) (Note)

Note: Use the cleanroom wiper in the cleanroom.

Consumables

- Neutral detergent (only when the product main body is very dirty)

5.2 Cleaning the Camera Body

- To clean the product, see that the F-mount cap or the F-mount adapter is attached to it, and then wipe off stains on the DS-Ri2/DS-Qi2 body using a soft cloth or others. If the product is very dirty, gently wipe stains using gauze moistened with a small amount of diluted neutral detergent.
- Do not use organic solvent (such as alcohol, ether, and thinner) on coated parts, plastic parts, or printed parts. It causes discoloration or exfoliation of printed characters.
- Blow off dust in the mount with an air blower.

Cleaning the mount interior

Blow off dust in the mount using an air blower. Do not touch the components as long as possible. Especially, never touch the glass filter on the front of the image pickup device.

If the glass filter of the image pickup device is touched, or dust adhered to the glass filter cannot be removed, contact your nearest Nikon representative for cleaning.

5.3 Cleaning Optical Devices

Prevent dust or fingerprints from being attached to the lens of optical devices. Stains on the lens degrade the visibility of images.

For details on how to clean optical devices, see the instruction manual of your optical device.

5.4 Storage

- When the product is not in use, turn off the power. When the product is not used for a long period of time, unplug the power cord of the AC adapter.
- Store the product in a location satisfying the storage environment conditions described in “Chapter 7 Major Specifications.”
- Store this system in a location with low humidity where mold is unlikely to form.
- Make sure to attach the F-mount cap to store the DS-Ri2/DS-Qi2.
- During storage, place a plastic cover over the equipment to prevent dust accumulation.
  Before placing the plastic cover, turn off the power switch of the product and wait for the product to cool down.

5.5 Periodic Inspections (Charged)

Periodic inspections are recommended in order to maintain the performance of this product. Consult your Nikon representative for details about periodic inspections.

6 Troubleshooting

This chapter describes items to check if the DS-Ri2/DS-Qi2 does not function as you expected and measures to be taken.

Incorrect use might prevent the product from providing primary performance even though it is not damaged. If a symptom such as those in the following table occurs, take action as described in the table before requesting repair.

If a problem that is not listed in the table occurs or if a problem that occurred is not resolved by taking action as described in the table, disconnect the power cable of the device, and then contact your nearest Nikon representative.

6.1 Power Supply

Symptom	Possible cause	Action
The power does not come on.	The AC adapter is not connected.	Connect the DC output cable of the AC adapter for the product to the DC IN 12V connector on the product.
	The power cord is connected incorrectly to the AC adapter.	Use the specified power cord to plug the AC inlet of the AC adapter into the AC power socket.
	The power switch of the product is turned off.	Flip the power switch to the “I” side to turn on the power to the product.
The device is hot when touched.	The system is used in a hot or confined space.	Use the product within the operating environment described in “Chapter 7 Major Specifications.” Note: When having an unusual odor such as a burning smell, turn off the power switch disconnect the power cord of the AC adapter, and request repairs.

6.2 USB-Related Operation

Symptom	Possible cause	Action
Cannot be connected normally.	The performance of the PC does not satisfy the required specifications for using this product.	Use a PC satisfying requirements given in “Section 1.3 Peripheral Devices.”
	A computer or OS which this product does not support is used.	Use a PC with the following OS installed: Windows 7 Note: Macintosh is not supported.
	The USB device driver is not installed correctly to the PC.	Install a USB host driver from Microsoft Corporation. Note: Operation may be abnormal with the device driver attached with the USB board.
		To use the NIS-Elements, install the dedicated device driver.
Cannot transmit data normally.	USB 3.0-certified products are not used for each USB board, USB cable, and USB hub.	Use USB 3.0-certified products for USB board (on PC), USB cable, and USB hub.
	Two USB hubs are used.	Keep a USB hub to one tier.

6.3 Application Software Startup

Symptom	Possible cause	Action
NIS-Elements does not start.	The product and the PC are not correctly connected.	See “Section 6.2 USB-Related Operation” and connect the product and the PC correctly.
	The power switch of the product is turned off.	Flip the power switch to the “I” side to turn on the power to the product.
	The USB device driver is not installed correctly to the PC.	Install a USB host driver from Microsoft Corporation. Note: Operation may be abnormal with the device driver attached with the USB board.
		To use the NIS-Elements, install the dedicated device driver.
	NIS-Elements is not properly installed.	Confirm how to introduce the NIS-Elements to the system.
	OS on the PC is of a version outside support.	See that your PC has NIS-Elements-supported OS version.
	The performance of the PC does not satisfy the required specifications for using the NIS-Elements.	Use a PC satisfying requirements given in “Section 1.3 Peripheral Devices.”

6.4 Image on the PC Monitor

Symptom	Possible cause	Action
Images are not displayed on the monitor.	The product and the PC are not correctly connected.	See “Section 6.2 USB-Related Operation” and connect the product and the PC correctly.
	The subject image does not enter the microscope or the lens.	Set the subject image to be captured correctly.
	The optical path of the optical device is not set for the camera.	Set the optical path correctly.
	The illumination or exposure setting of the optical device is improper.	Use illumination appropriate for the subject. Adjust exposure properly.
Refresh of images (frame rate) is slow.	A cable that is not USB 3.0-certified is used.	Use a USB 3.0-certifed cable.
	The performance of the PC does not satisfy the required specifications for using the NIS-Elements.	Use a PC satisfying requirements given in “Section 1.3 Peripheral Devices.”
	Other application software is running.	Close the application software.

6.5 View of Images

Symptom	Possible cause	Action
The image blurs.	The optical device is out of focus.	Bring the optical device into focus by operating the focus drive or focusing ring.
	The aperture diaphragm is stopped down too far when using the microscope.	Adjust the aperture diaphragm to 70 to 80 percent of the numerical aperture of the objective, or 70 to 80 percent of the pupil of the objective.
	The magnification setting for the optical device is too high.	Lower the magnification setting for the optical device. Note: As a guide, use 500 to 1000 times the numerical aperture of the objective for the magnifying power.
	The electronic zoom is being used for observation.	Turn off the electronic zooming function. Note: Use of the electronic zoom may cause an image to blur depending on the magnification.
	The exposure time is too long.	Set a higher value for the camera gain and a lower value for the exposure time. Note: If setting the exposure time long for a subject in motion, the subject is blurred.
	The product is used in a place subject to frequent vibration.	Use the system in a stable, vibration-free place.
The image is too dark or too bright.	Illumination for the subject is improper.	Adjust brightness of the illumination properly.
	The exposure is not adequate.	In AE mode, perform exposure compensation. Or, set the photometry area and photometry mode properly. Note: Refer to the instruction manual of the NIS-Elements.
	Monitor is not properly adjusted.	Adjust the display quality of the monitor properly. Note: Refer to the instruction manual of the monitor.
The contrast is low.	The illumination is too bright or too dark.	Adjust brightness of the illumination properly.
		Adjust the exposure.
	Light around the subject affects contrast.	Darken the interior, or put the cap on the binocular tube for a microscope.
	Field diaphragm and aperture diaphragm of the optical device (microscope) are set improperly.	Adjust the field diaphragm to near the size circumscribing the field. Adjust the aperture diaphragm to 70 to 80 percent of the numerical aperture of the objective.
	Filter selection for the optical device (microscope) is improper.	For a phase contrast microscope or interference microscope (dual beam or multiple), insert the specified filter. Note: For negative-positive images, generally, inserting a green interference filter (GIF) improves contrast. Note: Insert a complementary color filter of the color of the specimen for stronger contrast.
	The contrast of the subject itself is low.	Consider illumination and/or microscopy method to compensate for the low contrast.
	The image adjustment is improper.	Set the saturation, hue, contrast, black level, etc. to an appropriate level. Note: Refer to the instruction manual of the NIS-Elements.
	Monitor is not properly adjusted.	Adjust the display quality of the monitor properly. Note: Refer to the instruction manual of the monitor.

Symptom	Possible cause	Action
Color reproducibility is not good.	The color temperature of the illumination is improper.	Adjust the illumination of the optical device so that the subject is seen in the right color.
	The illumination is too bright or too dark.	Adjust brightness of the illumination properly.
		Adjust the exposure.
	The white balance is not set properly.	Obtain the white balance under the same conditions as for the observation and micrography.
	The setting of the camera gain is too high.	Adjust the camera gain properly. Note: Refer to the instruction manual of the NIS-Elements.
	The image adjustment is improper.	Set the saturation, hue, contrast, black level, etc. to an appropriate level. Note: Refer to the instruction manual of the NIS-Elements.
	Monitor is not properly adjusted.	Adjust the display quality of the monitor properly. Note: Refer to the instruction manual of the monitor.
The image quality is rough.	The camera gain is set too high.	Set the illumination brightness, the camera gain, and the exposure time to an appropriate level. Note: Image capturing with high camera gain may result in a noisy image (with texture, unevenness, unwanted lines). Lower the camera gain setting if such a problem occurs. Note: Refer to the instruction manual of the NIS-Elements for adjustment of the camera gain and exposure time.
The image is distorted.	The subject was moving during image acquisition.	Stop the movement of the subject. Note: When you move the XY stage right and left, etc., for image acquisition, the resulted image may look distorted. This is not a hardware failure: a distortion-free image can be acquired once the subject movement is stopped.
Image flickers or horizontal line noises appear on the image.	A fluorescent or sodium vapor lamp is used for illumination.	Change the illumination types or set a longer exposure time. Note: Fluorescent or sodium vapor lamp flickers at a high-speed. This causes flickering or horizontal line noises on an image, which can be minimized by setting a longer exposure time. Note: Refer to the instruction manual of the NIS-Elements for adjustment of the exposure time.

6.6 Other

Symptom	Possible cause	Action
The power indicator on the operation panel is flashing in red.	A product failure has occurred.	Contact your nearest Nikon representative.

6.7 For Inquiries

In order to answer your inquiry immediately, please check the following contents beforehand and contact your supplier. (photocopy and fill out this form)

Date of entry: / /

Contact Information			
Company			
Division			
Contact name			
Address			
Phone number		**E-mail address**	

Product Information			
Date of purchase	/ /	**Store name**	
Product model	☐ DS-Ri2 Serial no.[ ] Version [ ] ☐ DS-Qi2 Serial no.[ ] Version [ ]		
Application software	☐ NIS-Elements Package [ ] Version [ ] ☐ Other Product name [ ] Version [ ]		

Product Environment			
Temperature	°C	**Humidity**	%
PC	Manufacturer [ ] Model [ ] Memory capacity [ ]		
OS	☐ Windows 7 32 bit ☐ Windows 7 64 bit ☐ Other [ ]		
USB	☐ USB 3.0 ☐ USB 2.0 Cable length [ ] m		
External device	☐ Connected to the EXT I/O connector ☐ Connected to a microscope Microscope model [ ]		
Power supply	☐ With a ground ☐ Without a ground		

Problem Details	
First occurred	☐ immediately after product introduction ☐ when product was turned on for the first time after changing peripheral device connections ☐ during use ☐ after OS upgrade for the PC ☐ after firmware upgrade for the camera ☐ after application software upgrade ☐ other [ ]
Frequency	☐ Always ☐ Occasionally (Number of occurrence: [ ] times, every [ ] hours)
Symptom	Please let us know about the problem as detailed as possible to the best of your knowledge. For image-related defects, please provide any example images, if possible.

7 Major Specifications

7.1 Microscope Camera DS-Ri2

Model	DS-Ri2
Image pickup device	CMOS image sensor (36.0 x 23.9 mm) with 16.25 million effective pixels
Color/monochrome	Color
Infrared blocking filter	Built in
Maximum frame rate	With a 2.5x adapter installed: • All pixels: 4908 x 3264 6 fps • ROI 1/2: 2454 x 1632 19 fps • 3 x 3 pixels average: 1636 x 1088 45 fps • 3 x 3 pixels average ROI 1/2: 818 x 544 45 fps
	With a 1.0x adapter installed: • All pixels: 16-mm diameter 1608 x 1608 19 fps 22-mm diameter 2136 x 2136 15 fps 25-mm diameter 2424 x 2424 13 fps • 3 x 3 pixels average: 16-mm diameter 536 x 536 45 fps 22-mm diameter 712 x 712 35 fps 25-mm diameter 808 x 808 35 fps
Quantization	14 bit
Sensitivity	Recommended exposure index (ISO sensitivity): Equivalent to 200 (with gain set at 1.00x, and Tone set at 3)
Cooling image pickup device	N/A
Lens mount	F mount
Output image format	RGB 24 bit
Color space	sRGB
Exposure	100 μsec to 120 sec (specified by three significant figures at minimum unit of 100 μsec)
Gain	1.00 to 64.0x (specified by three significant figures)
Tone	7 levels
Sharpness	Adjustable at 9 levels (-3: softest, +5: sharpest)
Offset	-50 to +50 (1 step)
Hue	-50 to +50 (1step)
Saturation	-50 to +50 (1step)
Scene modes	Seven modes for biological application: Halogen (BF, HE, ELA), LED/BF, DIC, PH, DF/FL, Linear Four modes for industrial application: Wafer/IC, Metal, CIR Board, FPD) One additional mode for other application: Asbestos
White balance	Manual setting, red/blue gain adjustable
Exposure mode	One-push program AE, continuous program AE, manual
Photometry mode	Average photometry, peak photometry
Photometry area	Can be specified in 4 pixels within the effective number of pixels for the camera mode
Exposure compensation	-2 to +2 EV by 1/3 EV step
External trigger	Available (Software trigger with USB also available)
PC interface (USB connector)	USB 3.0 (Micro-B receptacle)
External trigger interface (EXT I/O connector)	ø3.5, 4-pole mini jack
Power supply jack	For AC adapter connection, 2-pin (polarity: center negative)
Tripod screw hole	1/4” (ISO 1222)
Body color	White
External dimensions	134 x 105 x 153 mm
Mass (reference)	Approx. 1.2 kg
Power	Input rating: 12 VDC±5%,1.2 A Power consumption: 13 VA

Operating environment	Temperature:	0 to +40°C
	Humidity:	60% RH Max at +40°C (no condensation)
	Altitude:	2000 m Max
	Pollution degree:	Degree 2
	Indoor use only	
Storage environment	Temperature:	-20 to +60°C
	Humidity:	90% RH Max (no condensation)

7.2 Monochrome Microscope Camera DS-Qi2

Model	DS-Qi2			
Image pickup device	CMOS image sensor (36.0 x 23.9 mm) with 16.25 million effective pixels			
Color/monochrome	Monochrome			
Infrared blocking filter	None			
Maximum frame rate	With a 2.5x adapter installed:			
	• All pixels:		4908 x 3264	6 fps
	• ROI 1/2:		2454 x 1632	19 fps
	• 3 x 3 pixels average:		1636 x 1088	45 fps
	• 3 x 3 pixels average ROI 1/2:		818 x 544	45 fps
	With a 1.0x adapter installed:			
	• All pixels:	16-mm diameter	1608 x 1608	19 fps
		22-mm diameter	2136 x 2136	15 fps
		25-mm diameter	2424 x 2424	13 fps
	• 3 x 3 pixels average:	16-mm diameter	536 x 536	45 fps
		22-mm diameter	712 x 712	35 fps
		25-mm diameter	808 x 808	35 fps
Quantization	14 bit			
Maximum quantum efficiency	77% typ			
Full well capacity	60000 electrons typ			
Readout noise	2.2 electrons r.m.s typ (with 14 bit, all-pixels, exposure time of 10 ms or less, gain of 64.0x)			
Linearity error	±1% typ			
Image pickup device cooling	Electronic cooling			
Lens mount	F mount			
Output image format	Y16 bit (effective number of bit:14 bit)			
Exposure	100 μsec to 120 sec (specified by three significant figures at minimum unit of 100 μsec)			
Gain	1.00 to 64.0x (specified by three significant figures)			
Tone	Linear (one type)			
Offset	-50 to +50 (at 1 step)			
Exposure mode	One-push program AE, manual			
Photometry mode	Average photometry, peak photometry			
Photometry area	Can be specified in 4 pixels within the effective number of pixels for the camera mode			
Exposure compensation	-2 to +2 EV by 1/3 EV step			
External trigger	Available (Software trigger with USB also available)			
PC interface (USB connector)	USB 3.0 (Micro-B receptacle)			
External trigger interface (EXT I/O connector)	ø3.5, 4-pole mini jack			
Power supply jack	For AC adapter connection, 2-pin (polarity: center negative)			
Tripod screw hole	1/4” (ISO 1222)			
Body color	Black			
External dimensions	134 x 105 x 153 mm			
Mass (reference)	Approx. 1.2 kg			

Power	Input rating:	12 VDC±5%, 2.1 A
	Power consumption:	24 VA
Operating environment	Temperature:	0 to +40°C
	Humidity:	60% RH Max at +40°C (no condensation)
	Altitude:	2000 m Max
	Pollution degree:	Degree 2
	Indoor use only	
Storage environment	Temperature:	-20 to +60°C
	Humidity:	90% RH Max (no condensation)

7.3 Safety Standards (DS-Ri2/DS-Qi2)

Conforming standards

- CE marking
  Low Voltage Directive
  EMC Directive
- GS mark
- C-UL-US Listed
- FCC Part 15 Subpart B Class A

  Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules.
  These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.
  This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
- CAN ICES-003(A)/NMB-003(A)
- Australian AS/NZS CISPR22 Class B
- VCCI-A

  Note: This is a Class A product based on the standard of the VCCI Council. If this equipment is used in a domestic environment, radio interference may occur, in which case, the user may be required to take corrective actions.

7.4 AC Adapter

FSP040-RHAN2

Model	FSP040-RHAN2
Manufacturer	FSP Group Inc.
Input rating	100-240 VAC ±10%, 50-60 Hz, 1.5 A Max.
Output rating	12 VDC ±5%, 3.33 A Max.
Power cord	• When used in 100-120 V region, outside Japan UL listed detachable power cord set, 3 conductor grounding (3 conductor grounding Type SVT, NO.18 AWG, 3 m long maximum, rated at 125 VAC minimum) • When used in 220-240 V region Detachable power cord set approved according to EU/EN standard, 3 conductor grounding (3 conductor grounding Type H05VV-F 1 mm^2, 3 m long maximum, rated at 250 VAC minimum) • When used inside Japan PSE approved detachable power cord set, 3 conductor grounding (3 conductor grounding Type VCTF 3x0.75 mm^2, 3 m long maximum, rated at 125 VAC minimum)
External dimensions	110 (L) x 50 (W) x 32 (H) mm
Mass (reference)	Approx. 210 g (without the power cord)
Operating environment	Temperature: 0 to +40°C Humidity: 10 to 90% RH (no condensation) Altitude: 5000 m Max Pollution degree: Degree 2 Overvoltage category: Category II Electric shock protection class: Class I Indoor use only
Storage environment	Temperature: -20 to +75°C Humidity: 5 to 95% RH (no condensation)
Safety standards	• CE marking • GS mark • C-UL-US Listed • PSE mark

EA1050E-120

Model	EA1050E-120
Manufacturer	EDAC POWER Electronics Co., Ltd.
Input rating	100-240 VAC ±10%, 50-60 Hz, 1.8 A Max.
Output rating	12 VDC ±5%, 3.5 A Max.
Power cord	• When used in 100-120 V region, outside Japan UL listed detachable power cord set, 3 conductor grounding (3 conductor grounding Type SVT, NO.18 AWG, 3 m long maximum, rated at 125 VAC minimum) • When used in 220-240 V region Detachable power cord set approved according to EU/EN standard, 3 conductor grounding (3 conductor grounding Type H05VV-F 1 mm^2, 3 m long maximum, rated at 250 VAC minimum) • When used inside Japan PSE approved detachable power cord set, 3 conductor grounding (3 conductor grounding Type VCTF 3x0.75 mm^2, 3 m long maximum, rated at 125 VAC minimum)
External dimensions	120 (L) x 60 (W) x 35 (H) mm
Mass (reference)	Approx. 255 g (without the power cord)

Operating environment	Temperature: Humidity: Altitude: Pollution degree: Overvoltage category: Electric shock protection class: Indoor use only	0 to +40°C 10 to 90% RH (no condensation) 2000 m Max Degree 2 Category II Class I
Storage environment	Temperature: Humidity:	-20 to +85°C 5 to 90% RH (no condensation)
Safety standards	• CE marking • GS mark • C-UL-US Listed • PSE mark	