

Nicolet RaptIR FTIR Microscope

Site and Safety Guide

This manual contains a description of site requirements and a summary of the safety precautions that must be followed when using a Thermo Scientific™ Nicolet™ RaptIR™ FTIR Microscope.

Using this instrument in a manner not specified in any of the documentation that came with the instrument may create a hazardous condition. Each person who will be using, maintaining, or servicing this instrument should read this manual.

For Research Use Only. This instrument or accessory is not a medical device and is not intended to be used for the prevention, diagnosis, treatment or cure of disease.

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1.1 Manual conventions

The following conventions are used in this manual to draw your attention to important information:

DANGER



Avoid hazard. Indicates a hazardous situation which, if not avoided, will result in serious injury or death.

WARNING



Avoid hazard. Indicates a hazardous situation which, if not avoided, could result in serious injury or death.

CAUTION



Avoid hazard. Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Follow instructions with this label to avoid damaging the system hardware or losing data.

Note Contains helpful supplementary information.

Symbol

Description



This is a mandatory action symbol. It is used to indicate that an action shall be taken to avoid a hazard.



This is the general warning sign. Failure to heed the safety precautions could result in personal injury.

Symbol	Description	Symbol	Description
	Direct current		USB

1.2 Questions or concerns

In case of emergency, follow the procedures established by your facility.

If you have questions or concerns about safety or need assistance with operation, repairs, or replacement parts, contact our sales or service representative in your area or contact us at www.thermofisher.com.

1.3 When the microscope arrives

When the microscope arrives, check the exterior of the shipping box for signs of damage. If the box appears damaged, contact us for instructions.

Your microscope will be unpacked and installed by one of our service representatives, and that person will check for damage and will verify that the shipment is complete.

Move the shipping box to the installation location at least 24 hours before the installation, and read the following notices.

NOTICE

While moving the instrument, keep the shipping box upright. Damage due to improper moving techniques is not covered by the warranty.

If needed, you can unpack the shipping boxes before the installation, but do not do so unless it is absolutely necessary.

If you open the shipping box before the system is installed by one of our service engineers, the warranty will not cover any missing or damaged parts.

2. Workspace requirements

Use the information in this section to plan the workspace for your system.

2.1 Microscope weight and dimensions

2.1.1 Weight

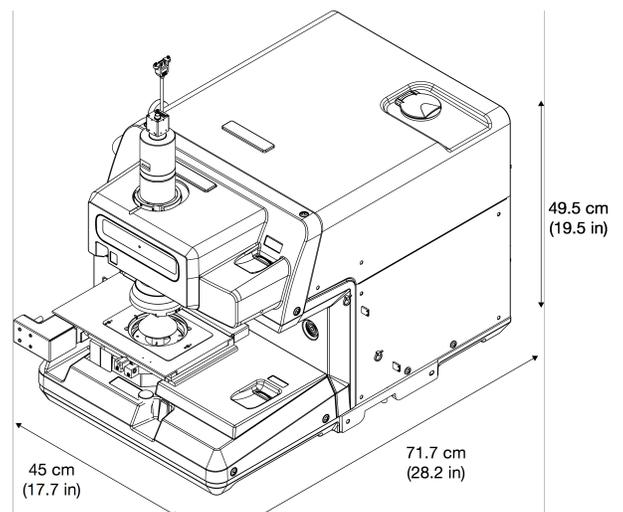
Your microscope weighs a maximum of 70.3 kg (155 lb).

Make sure your work surface can support this much weight in addition to the weight of the Nicolet iS50 spectrometer, the system computer, and any accessories you are using.

2.1.2 Dimensions

The dimensions of your microscope are shown below.

- Wide: 45 cm (17.7 in)
- Tall: 49.5 cm (19.5 in)
- Deep: 71.7 cm (28.2 in)



2.1.3 Clearances

Leave space around and behind the system to reach the cable and purge connections. Leaving additional space around the instrument so that it is easier to access will also make service calls faster and easier.

2.2 Environmental factors

The following are the environmental factors you should consider when planning your workspace.

2.2.1 Temperature

Maintain the temperature in the workspace between 16 °C and 27 °C (60 °F and 80 °F).

For better long-term stability, keep the temperature between 20 °C and 22 °C (68 °F and 72 °F). Temperature changes may result in long-term drift in the system response.

Once the instrument has been installed, plan to leave it turned on. The stability of the electronics and the optics will be improved if it is left on consistently. Small changes may occur if the instrument is frequently switched on and off.

Place the system away from sources of heat or cool air, such as heating or air conditioning vents and ducts, large windows, hot plates, and heating mantles.

2.2.2 Vibration

Floor vibration or acoustical noise from heavy manufacturing equipment or other sources will not damage the system, but it can affect performance and spectral quality.

Keep the system away from machinery that may vibrate the floor, and minimize or eliminate acoustic noise and vibration wherever possible.

2.2.3 Dust and particulates

The microscope must be installed in a location where it will not be exposed to excessive dust or other airborne particulate matter.

2.2.4 Humidity and moisture

The microscope is not sealed, and none of the parts are hygroscopic. However, if you are in an environment with high humidity, we recommend the following additional measures to protect the instrument and to improve the quality of spectra:

- Purge the system with dry air or nitrogen. For more information on purging your instrument, see ["Purging the microscope"](#)
- Maintain the environmental humidity in the range of 20% to 80% noncondensing.
- Avoid rapid changes in temperature that may cause condensation.

NOTICE

The external power supply must be placed in a location where it will not be exposed to moisture or liquids of any kind.

Whenever the instrument, a detector, or an accessory has been stored or shipped, immediate exposure to room air can cause condensation, which may damage the instrument. Wait for the package and its contents to warm or cool to room temperature before opening it.

2.2.5 Static electricity

Since static electricity can destroy electronic components, your instrument was specially designed to meet the international standard: "IEC 61000-4-2; electrostatic discharge immunity test for measurement, control, and laboratory use. "

If you have trouble with static electricity in your laboratory, you can further protect your instrument by following these guidelines:

- Maintain the environmental humidity in the range of 20% to 80% noncondensing.
- Use conductive flooring in the work space.
- Place antistatic mats over conventional carpet.
- Avoid plastic chairs that may build up large static potentials.
- Wear natural fiber clothing.
- Use a grounding strap.

2.2.6 Magnetic fields

The instrument was tested and found to meet the requirements of IEC 61000-4-8 Immunity, according to Criteria A. In this test, the microscope was subjected to 3 A/m at 50/60 Hz and continued to perform normally. Install the microscope in a location that does not exceed the tested magnetic field strength.

2.2.7 Electromagnetic radiation

This instrument was tested for immunity to electromagnetic radiation and found to meet the requirements of IEC 61000-4-3 Immunity, Criteria A. In this test, the microscope continued to perform normally while it was subjected to strong radiated electromagnetic fields.

2.3 Utility requirements

If at all possible, the power connections for the instrument and accessories should be easily accessible for service purposes.

Any line for dry air or nitrogen, which is used to purge the system, should also be accessible if service is required, and you should have direct control over the system utilities.

Note It is important to have all system utilities installed before the instrument arrives. Utility installations must comply with all local building and safety codes.

2.4 Electrical requirements

An electrical power source must be within 2 m (7 ft) of the system. Power supplied to the system should be from dedicated, uninterrupted sources. Power must be free of voltage dropouts, transient spikes, frequency shifts, and other line disturbances that impair reliable performance. Each wall outlet you use must be equipped with a 3-wire line: live, neutral, and ground.

If you suspect power quality problems at your site, or if your system will be installed in a heavy industrial environment, we recommend a power quality audit before installation. Contact us or your local electrical authority for more information.

WARNING



Avoid shock hazard.

To assure a good ground connection and avoid shock hazard, do not use an outlet that is connected to a conduit ground. The ground must be a non-current-carrying wire connected to earth ground at the main distribution box.

Note Some accessories require their own separate power connections.

Note Your instrument was specially designed to meet the requirements of standard IEC 61000-4-4.

2.4.1 Power line conditioning accessories

Uninterruptible power supplies (UPS) are available from us. A UPS reduces the probability of a system shutdown if power is lost elsewhere in the building. Power line conditioners (which ensure that your service is free from sags, surges or other line disturbances) also are available in the

U.S.A. from us for 120-volt operation. Line conditioners for 220-volt operation can be purchased locally. Contact technical support for information about power conditioners and UPS.

2.4.2 Electrical service specifications

The following table lists the specifications for electrical service. Contact our service representative in your area if you have questions about the requirements. If you are not sure that your power lines meet these requirements, contact technical support for information about power audits.

Requirement	Specification
Input current	3.2 A
Input voltage	100 to 240 VAC
Line frequency	47 to 63 Hz
Line disturbances	Sags, surges or other line disturbances must not exceed 10% of input voltage (even for a half cycle).
Noise	less than 2 V (common mode) less than 20 V (normal mode)

2.4.3 Power consumption

Generally, 50% more power should be available than the entire system (including accessories) typically uses. Maximum power consumption and heat dissipation specifications for the microscope and accessories are shown below. The values are approximate.

Item	Power Consumption	Max. Heat Dissipation
Nicolet™ RaptIR™ FTIR Microscope	130 W	443 Btu/hr
Standard computer and monitor*	460 W	1,570 Btu/hr
* Values shown are estimates. See the power specifications on the rear panels or undersides of these units.		

2.4.4 Grounding

Each wall outlet you use must be equipped with a 3-wire line: live, neutral, and ground. The ground must be a non-current carrying wire connected to earth ground at the main distribution box. To assure a good ground connection and avoid shock hazard, do not use an outlet that has ground connected to a conduit ground.

2.4.5 Power cords

Be sure to use an appropriate power cord for the electrical service. The power cord supplied with accessories is a 3-wire, grounded power cord, appropriate for use in the country listed as the shipping destination for the microscope. To prevent electrical hazards, do not remove or defeat the ground prong on the power cord. If you use an extension cord, it must have a protective conductor.

If the power cord becomes damaged, replace it. Contact us if you need additional information about replacement cord or extension cord specifications.

2.5 Liquid nitrogen

Because the microscope uses a cooled detector, you need a supply of liquid nitrogen to cool the detector element.

WARNING



Avoid hazard.

The gas boiling off liquid nitrogen can create an oxygen deficient environment in an insufficiently ventilated room.

CAUTION



Avoid hazard.

Be careful not to contact the liquid nitrogen with your skin. It is extremely cold. Exposure may cause burns. Wear protective gloves and goggles and follow standard laboratory safety practices. When filling a vacuum bottle or the dewar, pour slowly. Pouring too quickly can cause the bottle or dewar to expel liquid nitrogen.

2.6 Purging the microscope

Purging your instrument can provide more accurate results and will protect your instrument from damage from condensation or corrosive solvents and gases. To protect the microscope's sensitive optical components, we recommend that you purge your instrument continuously (24 hours per day), particularly if your lab is often humid.

Moisture and humidity will damage the microscope's sensitive optical components. Purging the instrument with clean, dry air or nitrogen will protect the sensitive components from condensation.

NOTICE

Optical damage caused by failure to purge the instrument is not covered under your warranty.

Purging the instrument will also help protect the sensitive optical components from any solvents or other agents that can corrode instrument components. Although the interferometer optics of

the spectrometer are desiccated, we recommend that you install a source of dry air or nitrogen to continuously purge the instrument of water vapor, carbon dioxide, and volatile solvents.

NOTICE

Chlorinated solvents, perfluorochlorinated solvents, and other solvents containing halogenated hydrocarbons chemically react with an IR source and will corrode instrument components.

Do not leave these sample solvents around the instrument any longer than necessary.

2.6.1 Selecting a purge gas

Purge the instrument with clean, dry air or nitrogen. Both dry air and nitrogen effectively remove water vapor and solvents from the system. If you want to remove carbon dioxide from the system as well, use a source of dry air with a carbon dioxide scrubber or use nitrogen as your purge gas.

The purge gas must be free of moisture, oil, and other reactive materials. To remove particulate matter and oil, you may need to install a 10-micrometer oil-trap filter.

The dry air or nitrogen purge gas should be dried to a dew point of $-70\text{ }^{\circ}\text{C}$ ($-94\text{ }^{\circ}\text{F}$) or below for best performance.

NOTICE

Do not use argon as a purge gas. Argon is a good insulator and prevents the HeNe laser from cooling properly. This significantly shortens the life of the HeNe laser and can also cause the source to overheat.

WARNING



Avoid explosion hazard.

Never use a flammable, combustible, or toxic gas to purge the instrument. The IR source is an ignition source.

2.6.2 Purge gas generators

If your facility does not have a source of clean, dry compressed air or nitrogen for system purge, we recommend using a purge gas generator and not gas cylinders. A purge gas generator is cheaper and more effective than cylinders and dewars. This device cleans and dries the air supplied by a high-quality, continuously running air compressor so that it can be used to purge your instrument.

If your facility does not have an air compressor, a complete dry-air generating system is available. Contact our sales or service representative in your area for more information.

NOTICE

If you use a purge gas generator, position it away from the instrument to reduce noise and vibration.

Purge gas generators require a minimum pressure for proper operation and typically run best at 100 PSI. If you do not supply proper pressure and flow, moisture may enter the system, causing permanent damage. See the manufacturer's instructions for proper pressure and flow settings.

Read the manufacturer's instructions before installing air-drying equipment or performing any maintenance. The installation and maintenance of air-drying equipment is your responsibility. Failure to perform routine maintenance as specified by the manufacturer may void your instrument warranty.

Before you connect a new air dryer to the instrument, it is vital that you purge the dryer of water and particulates by running it for at least 24 hours at nominal air flow. Otherwise, you risk severe damage to the instrument when you connect the pure air dryer.

Installing purge gas fittings

If you plan to purge the instrument, install the purge line and the necessary fittings before the instrument arrives.

The microscope uses a Dual Zone Purge Pneumatics purge kit (Part number 840-371700) to purge both the microscope and the spectrometer at the same time.

Installing the purge pneumatics assembly requires you to attach the quick-release pressure coupling to the source of your purge gas, insert the assembly into the quick connect coupling, and connect the purge lines to the instruments.

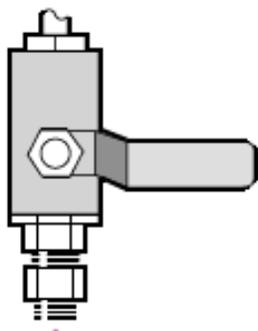
Materials needed

In addition to the purge kit, you will need the following:

- 3/4-inch (20 mm) open-ended wrench
- 11/16-inch (18 mm) open-ended wrench
- #2 Phillips head screwdriver
- Thread seal tape ("Teflon™ tape" or "PTFE tape")

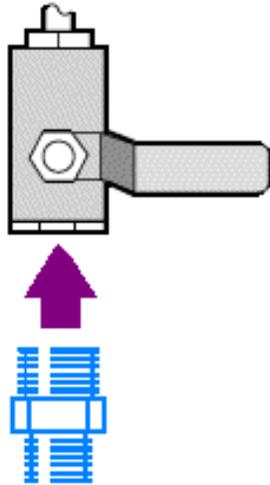
❖ To install a purge kit

1. Connect the quick-release pressure fitting to the source of the purge gas.
 - a. Install the regulator valve and either a 1/4-inch male fitting or a 3/8-inch female fitting on the purge gas source. (Choose a valve and fittings that are appropriate for the purge gas source.)

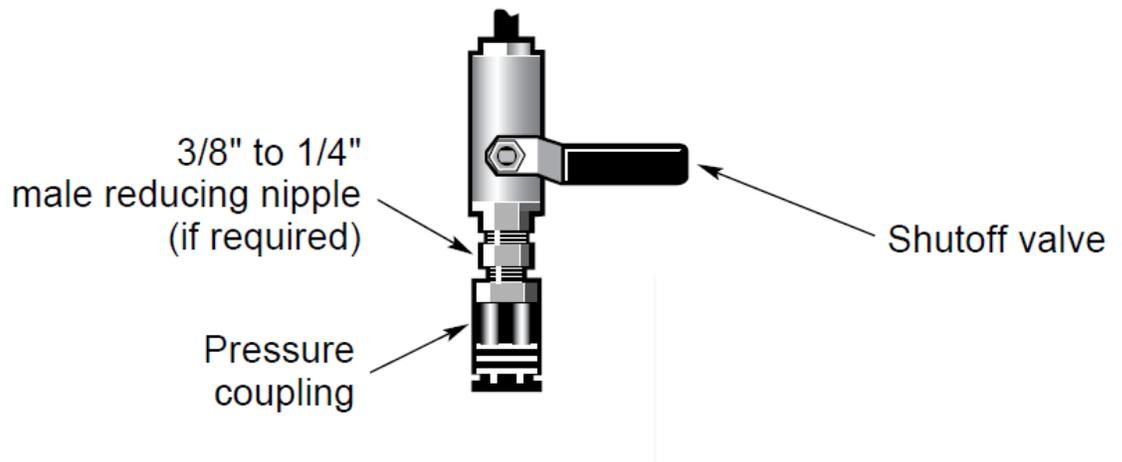


- b. If you used a 1/4-inch male fitting, proceed to the next step.

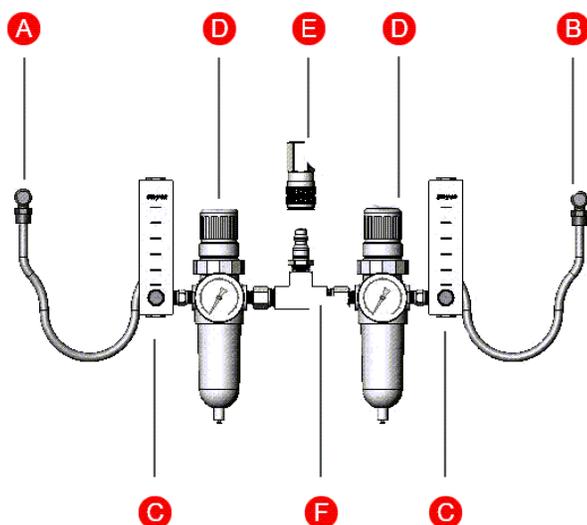
If you used a 3/8-inch female fitting on the purge gas source, install the 3/8-inch to 1/4-inch reducing nipple that was included with your purge kit. Wrap the reducing nipple with thread seal tape before you install it, and use an 11/16-inch open-ended wrench to tighten the connection.



- c. Wrap the reducing nipple or the 1/4-inch male fitting with thread seal tape, and then install the pressure coupling. Use a 3/4-inch open-ended wrench to tighten the connection.



2. Snap the male inlet of the wall plumbing assembly firmly into the quick release fitting.



- | | |
|----------|------------------------|
| A | To microscope |
| B | To spectrometer |
| C | Flowmeter |
| D | Pressure regulator |
| E | Quick release fitting |
| F | Wall plumbing assembly |

3. Connect the gas lines to the instruments.
 - a. Snap the quick connect from the purge pneumatic assembly (labeled “to spectrometer”) into the purge inlet on the spectrometer’s lower rear panel.
 - b. Snap the second quick connect from the purge pneumatic assembly (labeled “to microscope”) to the purge inlet on the microscope’s lower rear panel.
4. Set the purge gas controls.

- a. Rotate the main shutoff valve to the open position.
- b. On the 'to spectrometer' connection side of the assembly, pull up on the pressure regulator and rotate it to set the dial to 20 PSI.
- c. Press the regulator back down.
- d. Rotate the flowmeter control to set the flow to 20 SCFH.
- e. Repeat for the second side of the purge pneumatic assembly so that the controls for both the spectrometer and the microscope are set as follows:

Hardware	Pressure (PSI)	Flow Rate (SCFH)
RaptIR Microscope	20	20
iS50 Spectrometer	20	20

- f. Plug in the power cord to the instruments and turn on the power.
- g. Wait 30 to 60 minutes for the instrument to fully purge before you use the instrument. Continue to purge continuously. If you turn off the instrument and the purge, first turn on the purge and wait 30 to 60 minutes again to fully purge the instrument before use.

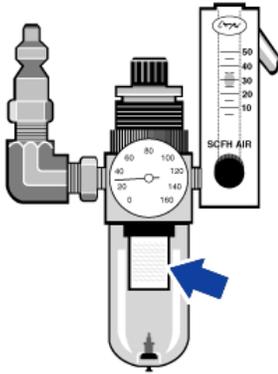
2.6.3 Check the purge gas filter

The purge filter is green when dry and turns yellow when it is damp. If the filter turns yellow permanently or is otherwise discolored or contaminated with debris or oil, replace the entire purge pneumatic assembly. Contact technical support for details.

NOTICE

We recommend purging the instrument continuously (24 hours per day). Equipment damage due to failure to maintain seal and desiccation and/or purge is not covered under the warranty. If you have questions about this requirement, please contact us.

Figure 2-1: The purge filter is located inside of the plastic bowl below the pressure gauge



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3. Important safeguards

To use your microscope safely and to avoid any potential hazards, always adhere to the following safety precautions when performing the activities described in this section.

Carefully read all instructions before operating the microscope for the first time.

3.1 Lifting or moving the instrument

This instrument weighs approximately 70.3 kg (155 lb) and should be lifted by at least two people. To avoid risk of injury, use proper lifting techniques.

3.2 Plugging in the microscope

Always use an appropriate, undamaged, grounded power cord when plugging in your microscope.

WARNING



Avoid shock hazard.

Use only a 3-wire, grounded power cord appropriate for use in your country.

Do not, under any circumstances, cut or remove the ground prong from the power cord or use an adapter.

Regularly inspect the power cord for signs of damage and replace the power cord if it becomes damaged.

3.3 Moving the stage or turret

The microscope features a motorized stage and turret, which can be moved only by the software or by the optional joystick. Never attempt to move the stage or turret manually.

CAUTION



Avoid pinch hazard.

Keep your hands and fingers away from the motorized turret and the stage area except to position the sample or change accessories. Remove your hands from the system when operating the software.

3.4 Using liquid nitrogen

Liquid nitrogen is extremely cold and therefore potentially hazardous. The warm laboratory dewar, funnel, and detector may cause the liquid nitrogen to boil rapidly and spatter. When filling the detector dewar, be careful not to contact the liquid nitrogen with your skin.

WARNING



Avoid hazard.

Always wear protective gloves and splash-proof goggles when refilling the liquid nitrogen dewar. Follow precautions described in the material safety data sheets provided by your liquid nitrogen vendor.

Use proper ventilation when refilling the liquid nitrogen dewar. Gases formed as liquid nitrogen boils off can create an oxygen deficient atmosphere in an insufficiently ventilated room.

3.5 Choosing samples and solvents

When selecting samples and solvents, avoid potentially dangerous materials.

Corrosives, solvents and pressurized gases

Many standard spectroscopy methods are based on the use of solvents. Others involve corrosive samples or pressurized samples in a gaseous state. All these sample materials can be measured using your spectrometer, but special precautions must be taken.

DANGER



Avoid explosion hazard.

Never use a flammable gas to purge an instrument. Heat from the source or from laser absorption could ignite the gas. The purge gas must be free of moisture, oil, and other reactive materials. Use dried air or nitrogen to purge the instrument. Other gasses, even inert gasses such as argon (AR), can damage the instrument.

Volatile solvents

If you use volatile solvents regularly, follow these guidelines.

- Do not leave exposed solvent in the sample compartment for longer than necessary.
- Do not leave the solvents near the instrument.
- Be sure that your work space is properly ventilated.

DANGER



Avoid fire and explosion hazard.

Prevent fire and explosion. The infrared source inside the instrument is an ignition source. If you are using volatile solvents, provide a fume hood or other active venting system that is free of spark and other ignition sources and prevents flammable vapors from collecting in the atmosphere surrounding the instrument.

These measures will help prolong the life of your instrument and will eliminate the possibility of spectral interference caused by volatile solvent vapors.

Solvents containing halogenated hydrocarbons

Chlorinated solvents, perfluorochlorinated solvents, and other solvents containing halogenated hydrocarbons are often used as sample solvents. The pyrolysis of these solvents by an infrared source or by excessive heating caused by laser absorption may produce hydrochloric acid (HCl), hydrofluoric acid (HF), or phosgene (COCl₂)

Materials such as hydrochloric acid and hydrofluoric acid are highly corrosive and may cause accelerated corrosion of the metallic and optical components in the spectrometer.

A high concentration of corrosive gasses in the air due to improper sampling techniques will damage the instrument.

WARNING



Avoid toxic inhalation hazard.

Materials such as hydrochloric acid, hydrofluoric acid and phosgene are highly toxic. If you regularly use solvents containing halogenated hydrocarbons, be sure your work area is properly ventilated.

3.6 Selecting a purge gas

Take care when selecting a purge gas for your microscope. Use only nitrogen or dry air to purge the instrument.

Danger



Avoid fire and explosion hazard.

Never use a flammable or combustible gas to purge the instrument. Heat from the source or from laser absorption could ignite the gas.

The purge gas must be free of moisture, oil, and other reactive materials. Use dried air or nitrogen to purge the microscope.