Nicolet iS5 Series FT-IR Spectrometers

Nicolet iS5 LS

User Guide

269-299800 Revision B September 2014

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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.

WARNING Avoid an explosion or fire hazard. This instrument or accessory is not designed for use in an explosive atmosphere.

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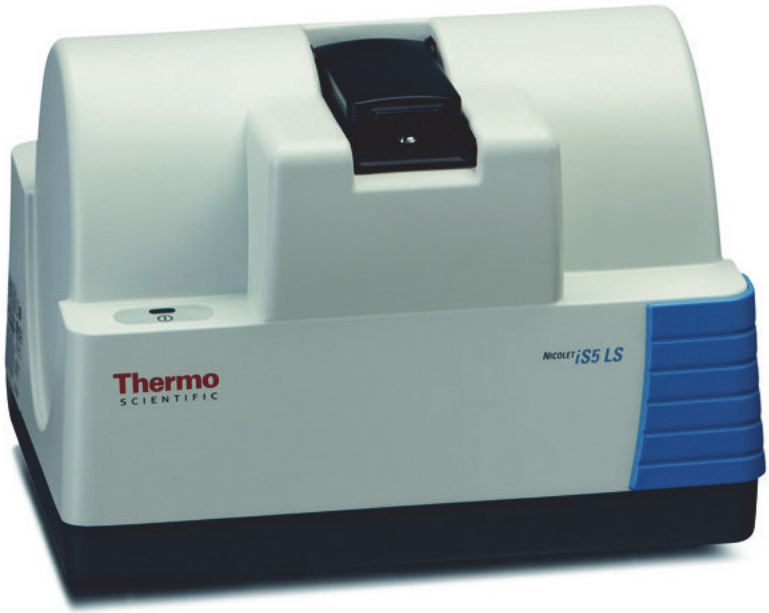
About the Instrument

The Thermo Scientific™ Nicolet™ iS™5 LS FT-IR analyzer lets you perform transmission analyses of liquids, gels and films in the mid-infrared spectral range. The system has integrated verification features, a software suite designed for quality control (QC) applications, and many other features that make sampling and data handling easy.

You can perform minor service and maintenance procedures yourself. This document, or other provided documentation, contains the information needed.

Figure 1. Nicolet iS5 LS FT-IR analyzer



NOTICE Be sure that all persons operating this system read the site and safety manual first.

The instrument is sealed and desiccated to help prevent damage to the optics or other internal components due to humidity or corrosive solvents.

NOTICE Keep the instrument sealed and desiccated at all times and check the humidity indicator regularly. Equipment damage due to failure to maintain seal and desiccation is not covered by the warranty. If you have questions about this requirement, contact us.

Contents

- Finding Information about Your System
- About the Software
- Contacting Us

Finding Information about Your System

We recommend first using the documentation provided with qPro software when you have a question. The qPro Operator application includes a complete Help system for the instrument and software. The electronic documentation contains PDF files of supporting documents that are not in the help system such as the site and safety guide.

Conventions Used

Safety precautions and other important information use the following format:

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

CAUTION 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.

Tip Provides information that can make a task easier.

About the Software

The spectrometer can be operated using the Thermo Scientific™ qPro™ Operator software. qPro Operator provides features for loading and updating workflows and exporting data. It also allows password protected access to system tools and diagnostics. The workflows are created using the qPro Developer application which is included in the qPro Developer suite.

Contacting Us

For U.S. Technical Support, please contact:

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If you have problems with your system, refer to the troubleshooting information for help. If the troubleshooting information doesn't help you solve the problem, call or e-mail Technical Support using the information provided above.

Note To expedite and assist in problem diagnosis, please be prepared to send us a copy of your diagnostics log. The diagnostics log includes a history of important system parameters and events that occur during system operation. The information can be downloaded to the computer or portable media and sent to our Technical Support group. For more information, find the "Retrieving the Diagnostic Log" topic in the qPro Operator Help system.

If you need to send the instrument to us for repair, call or e-mail us first for any shipping requiremen other instructions.
and Excel

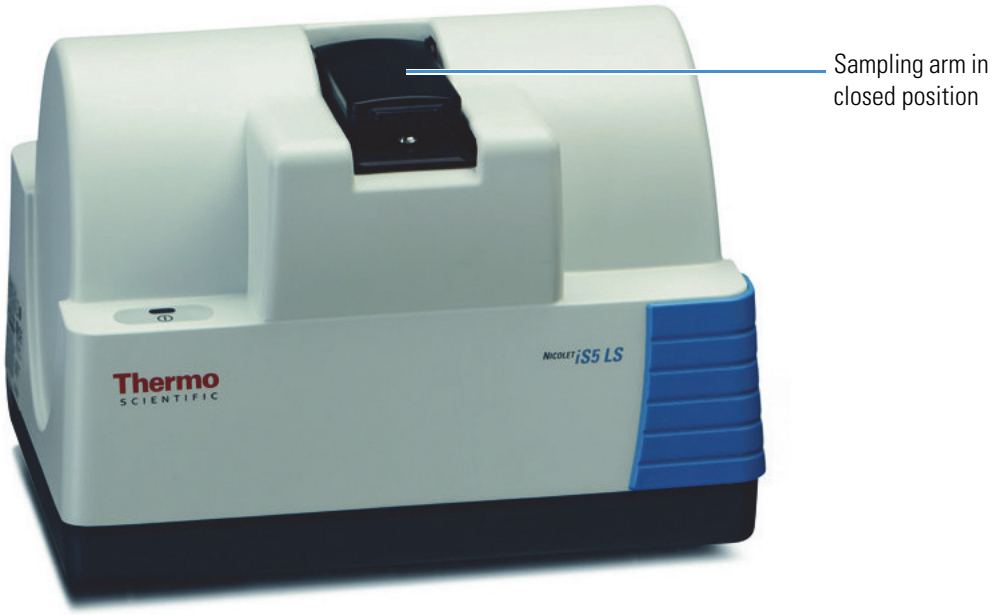
Operating the Instrument

This section explains how to set up the Nicolet iS5 LS analyzer and use it to analyze a basic sample.

Contents

- Setting Up the Instrument
- Operating Precautions
- Cleaning the Sample Windows
- Instrument Performance Tests
- Collecting Data

Figure 2. Nicolet iS5 LS FT-IR analyzer



This instrument is designed for indoor use at altitudes up to 2,000 m (6,500 ft). It operates reliably at a constant temperature between 15 °C and 35 °C (60 °F and 95 °F).

The instrument is sealed and desiccated to help prevent damage to the optics or other internal components due to humidity or corrosive solvents.

NOTICE Keep the instrument sealed and desiccated at all times and check the humidity indicator regularly. Equipment damage due to failure to maintain seal and desiccation is not covered by the warranty. If you have questions about this requirement, contact us.

For optimum instrument stability, the sampling arm should remain closed except when cleaning it or loading a sample. Keeping the arm closed also allows background measurements to occur automatically.

Setting Up the Instrument

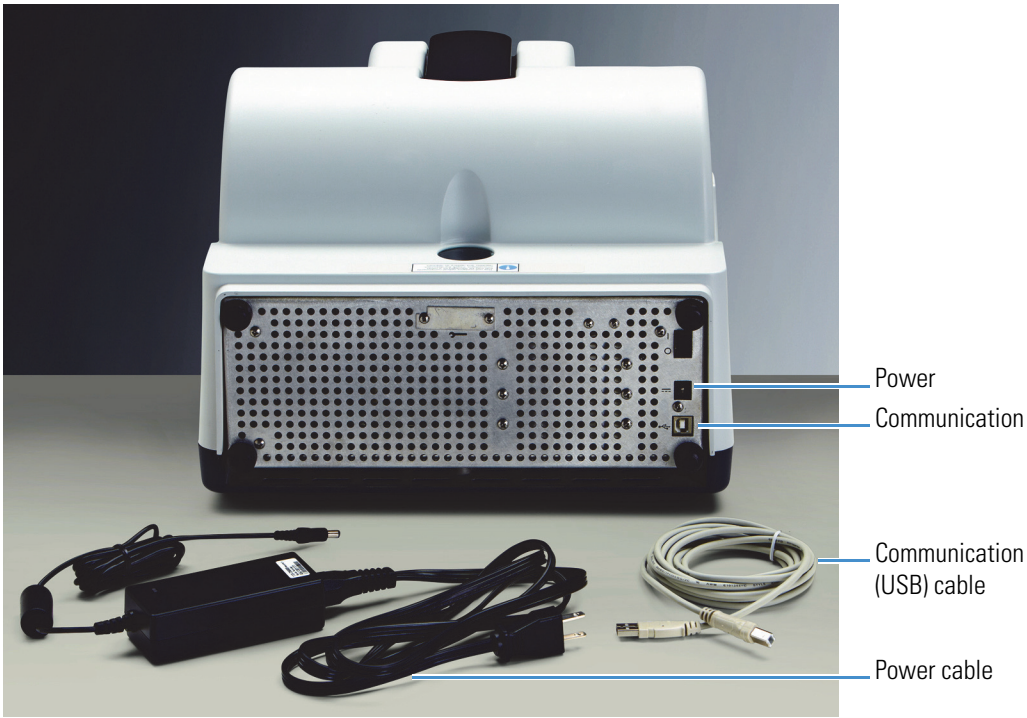
This section covers these topics:

- Electrical and Communication Cabling
- Turning the Power On and Off

Electrical and Communication Cabling

The illustration below shows the correct cable connections for electrical power and data communication.

Figure 3. Electrical and communication cabling for the Nicolet iS5 LS analyzer



Check the *Site and Safety Information* guide in your electronic documentation set for electrical and other system requirements before you connect the power cord. The wall outlet must be equipped with a 3-wire line: live, neutral, and ground.

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

❖ To cable the instrument

1. Connect the power supply to the power receptacle on the back of the spectrometer and to a properly grounded AC power source.
2. Connect the USB cable to the USB receptacle on the back of the spectrometer and to a USB 2.0 port on the computer.

   (Do not use a USB auxiliary port or hub.)

WARNING Do not block access to the power supply, AC power cord or power switch.

Related Topics

- Turning the Power On and Off

Turning the Power On and Off

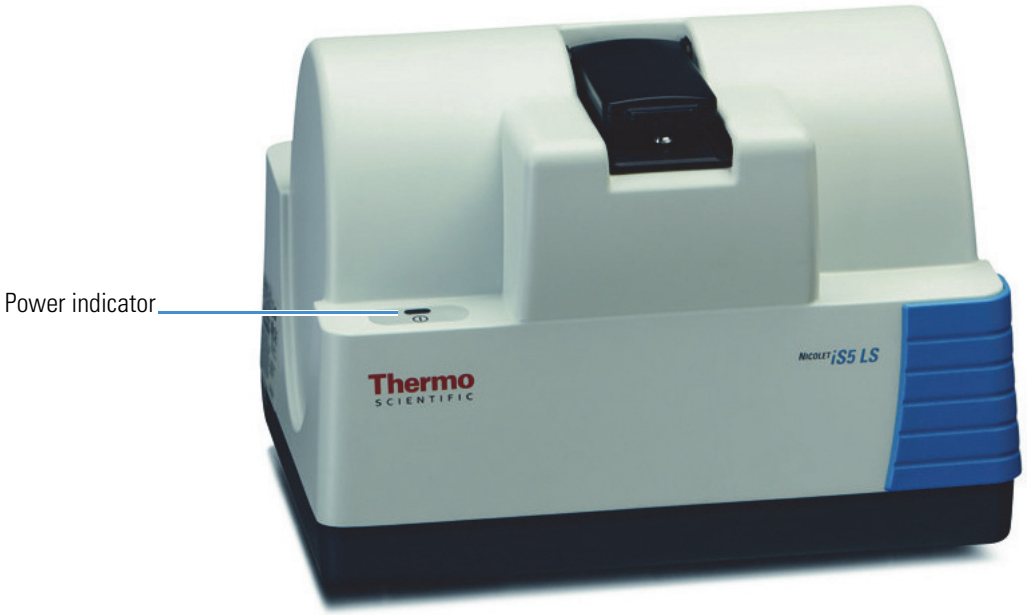
To turn the instrument power on or off, press the power switch on the back panel. For best performance, we recommend that you leave the instrument powered on continuously.

Figure 4. Power switch for the Nicolet iS5 LS analyzer

After the instrument is powered on, the blue power indicator on the main cover flashes while the instrument warms up and performs diagnostics (about 2 minutes) and then the indicator stays lit. The system cannot collect data until initialization is completed.

Note If the System Status indicator in the qPro Operator main window has a red "X," check that the computer USB cable is securely connected to the spectrometer and the computer and the instrument driver was installed from the software media.

Figure 5. Power indicator for the Nicolet iS5 LS analyzer



NOTICE

- Do not block the vents at the back of the instrument. Electronic components can overheat if these vents are blocked.
- Do not place containers of liquids on top of the instrument. Spilled liquids can enter the vents or other openings and cause damage.

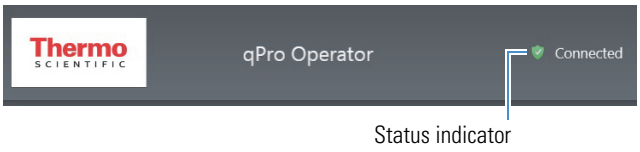
Related Topics

- Electrical and Communication Cabling
- Troubleshooting the Instrument

System Status

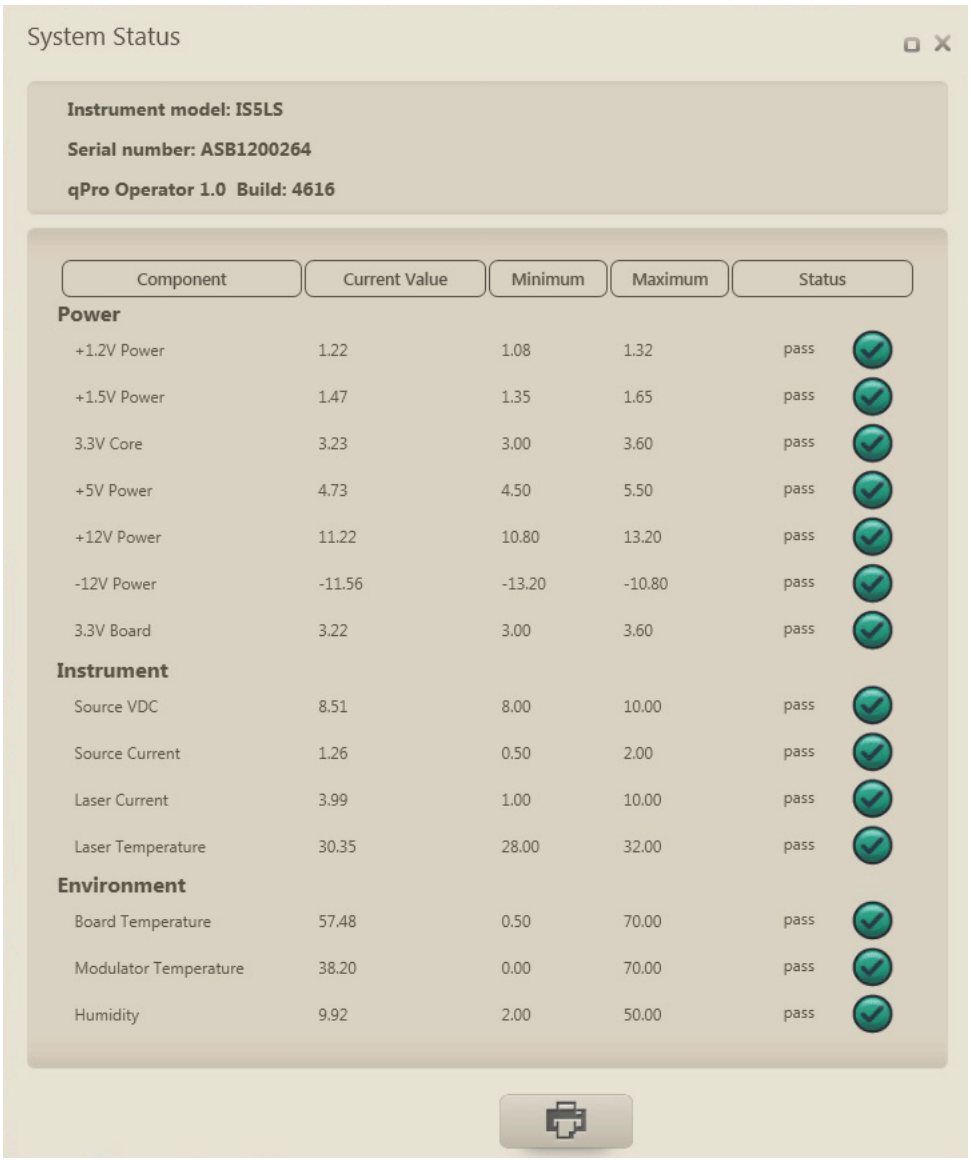
The System Status icon in the qPro Operator main window tells you the current status of the instrument.

Figure 6. System Status icon in the qPro Operator application



Click the system status icon to check the performance of key instrument components such as the laser or source.

Figure 7. System Status report for the Nicolet iS5 LS analyzer



If a component status is red (failed), see the "Troubleshooting the Instrument" section of the instrument user guide or contact us for assistance.

Related Topics

- Troubleshooting the Instrument
- Operating the Instrument

Operating Precautions

WARNING 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.

To prolong the life of your instrument and eliminate the possibility of spectral interference caused by volatile solvent vapors, follow these precautions:

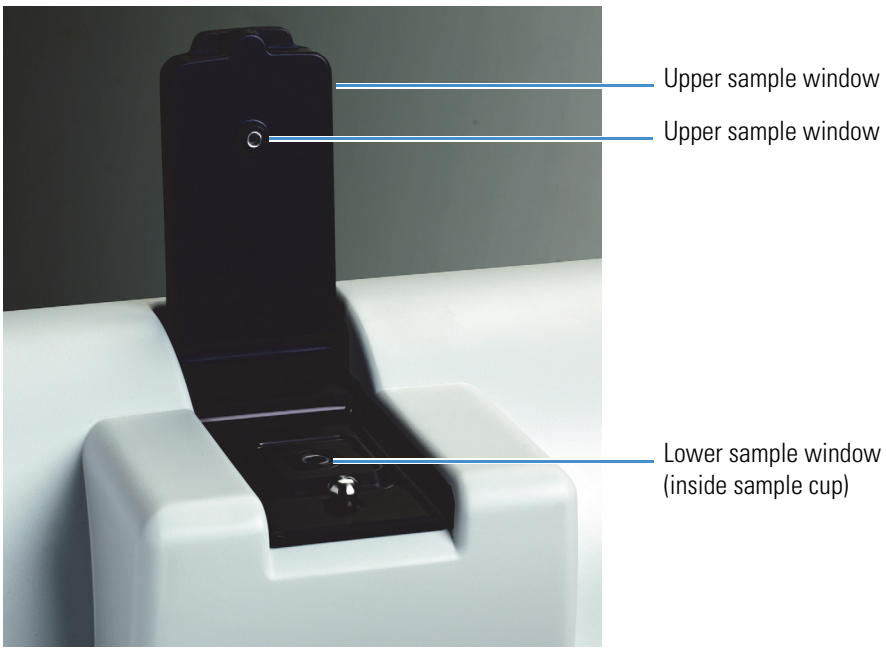
- When cleaning sample windows, avoid using excessive force or you may damage or crack the windows.
- Do not block the vents at the back of the analyzer. Electronic components can overheat if these vents are blocked.
- Do not place containers of liquids on top of the analyzer. Spilled liquids can enter the vents or other openings and cause damage.
- Do not use chlorinated solvents or materials that may produce HCl or HF vapors with or near the analyzer. These solvents may severely damage the instrument.
- Do not leave solvent on the sample windows for longer than 2 minutes.

NOTICE Read the safety guide that came with this instrument before operating the instrument.

Cleaning the Sample Windows

Make sure the sample windows are clean before taking reference and sample measurements with the instrument, and especially before you run the instrument performance tests or perform any maintenance steps. The instrument has two windows that must be cleaned. One is inside the sample cup where you load samples. The other is on the sampling arm.

Figure 8. Sample window locations for the Nicolet iS5 LS analyzer



Materials required:

- Small volume of isooctane or other appropriate solvent
- Small, clean dropper bottle or pipette
- Clean, dry, lint-free laboratory wipes (unscented and lotion-free)
- Powder-free nitrile gloves

CAUTION **Avoid chemical exposure**. Isooctane is a chemical irritant. When handling isooctane:

- avoid contact with skin and eyes
- avoid inhalation of vapor or mist
- wear gloves that provide adequate protection

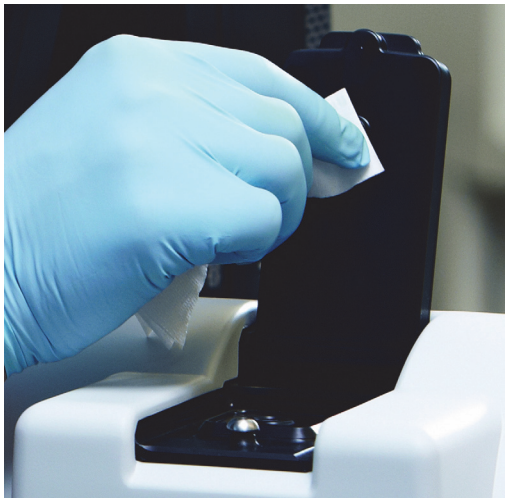
NOTICE When cleaning sample windows, avoid using excessive force or you may damage or crack the windows.

❖ To clean the sample windows

1. Raise the sampling arm a small amount, place a clean, dry lint-free laboratory wipe between the two windows and then lower the arm to soak up most of the sample material. Discard the soiled wipe.
2. Raise the arm and use a clean wipe to gently clean the upper sample window and surrounding area.

   Take care to use a clean portion of the wipe on the last swipe of the window. Discard the soiled wipe.

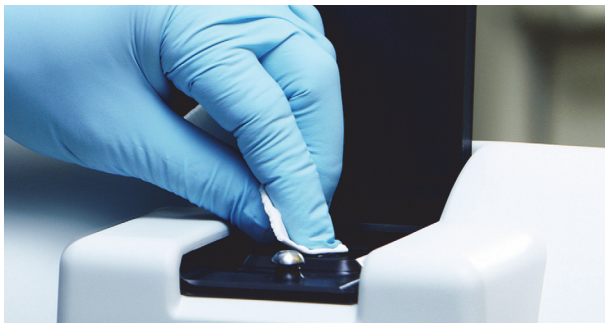
   Figure 9. Gently clean upper sample window

3. Use a clean wipe to gently clean the sample cup and lower window.

   Take care to use a clean portion of the wipe on the last swipe of the window. Discard the soiled wipe.

   Figure 10. Gently clean lower sample window

4. If necessary, place a few drops of cleaning solvent onto a clean wipe and use it to thoroughly clean both windows and the area around them. Discard the soiled wipe.
5. Gently lower the sampling arm.

Instrument Performance Tests

Two workflows are provided to verify instrument performance:

- Daily Performance Test, makes several measurements to verify instrument operation.
- Calibration Check, uses hexadecane to verify wavelength accuracy and sample pathlength.

The performance tests start by verifying that the sample windows are clean. See "Cleaning the Sample Windows" for detailed instructions.

Daily Performance Test

The Daily Performance Test workflow makes several measurements to verify instrument operation. No special materials are required. We recommend that you run the Daily Performance Test workflow at least once each day before you analyze your first sample. The test can be run more often as needed to satisfy your company's internal protocols.

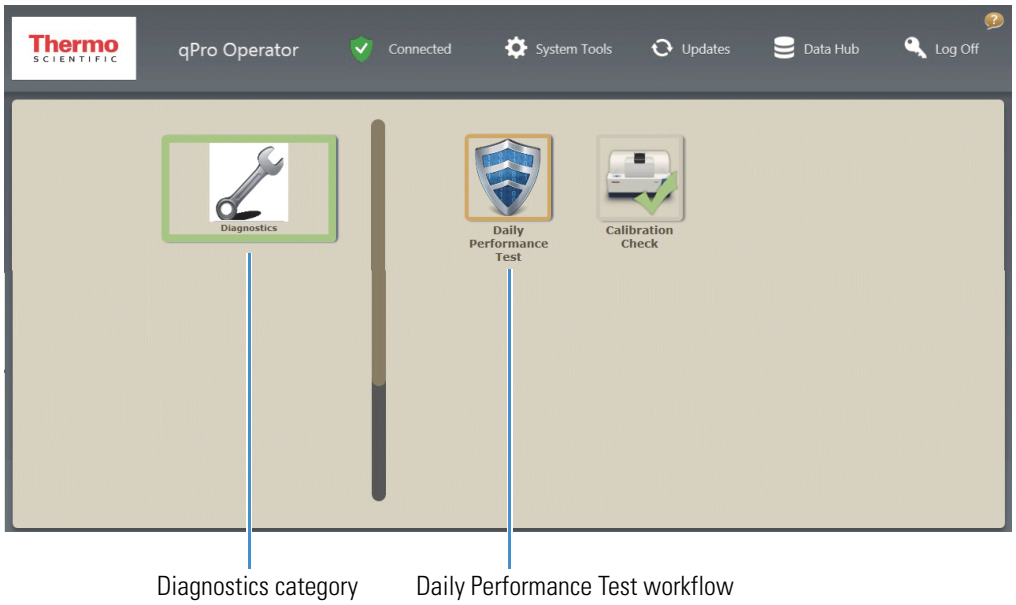
Before you run the Daily Performance Test, the instrument should be powered on for 4 to 6 hours and the qPro Operator software should be running. The sampling arm should be closed.

To continue from one screen to the next in the workflow, click the button.

❖ To run the Daily Performance Test workflow

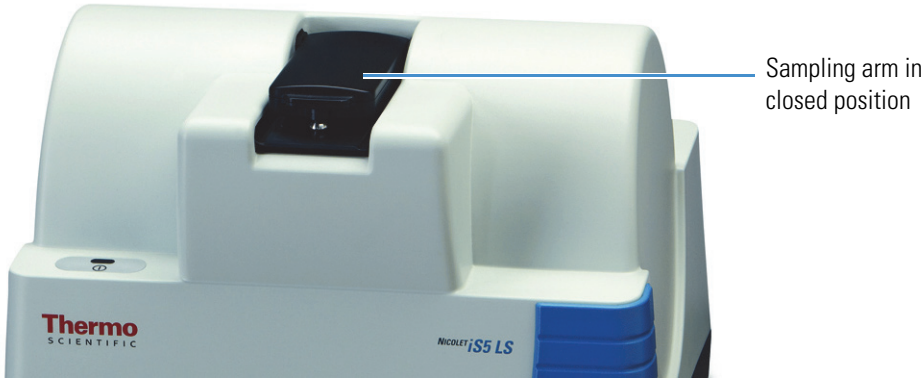
1. Make sure the sample windows are clean and dry.
2. From the qPro Operator main screen, click the **Diagnostics** category in the left pane and then click **Daily Performance Test**.

Figure 11. Diagnostics category in qPro Operator software



The workflow shows its historical results.

3. Make sure the sampling arm is closed and click **continue**.

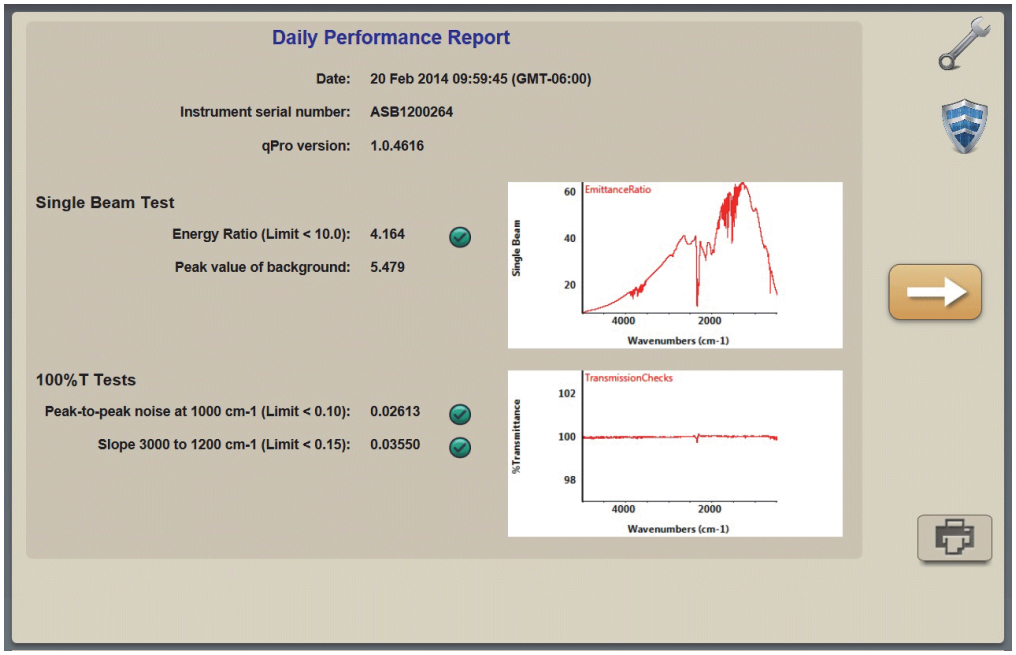


4. Make sure **Run a new performance test** is selected and click **continue** to start the workflow.

   Follow the instructions in the workflow.

   When the workflow is completed, the software displays the report. If the instrument passed, a green check mark appears to the right of each test result and the operator can proceed. Here is an example.

Figure 12. Example Daily Performance Test report



5. If your instrument passed the performance test, click **continue** to complete the workflow.

   If your report includes a red "X," rerun the Daily Performance Test workflow. If the instrument fails again, the resolution depends on which test has the red X. For more information, refer to the Performance test failed topic in the Troubleshooting section of the instrument user guide.

6. To print the report, click the **Print** button.

Note To retrieve data from a Daily Performance Test workflow, use Data Hub.

Related Topics

- Calibration Check
- Instrument Performance Tests

Calibration Check

The Calibration Check workflow uses hexadecane to verify wavelength accuracy and sample pathlength. We recommend that you run the Calibration Check workflow at least once a week. The test can be run more often as needed to satisfy your company's internal protocols.

Before you run the calibration check, the instrument should be powered on for 4 to 6 hours and the qPro Operator software should be running. The sampling arm should be closed.

To continue from one screen to the next in the workflow, click the button.

Materials required:

- Small volume of 99% hexadecane (available from us)
- Small, clean dropper bottle or pipette
- Clean, dry, lint-free laboratory wipes (unscented and lotion-free)
- Powder-free nitrile gloves

CAUTION **Avoid chemical exposure**. Hexadecane is a chemical irritant. When handling hexadecane:

- avoid contact with skin and eyes
- avoid inhalation of vapor or mist
- wear gloves that provide adequate protection

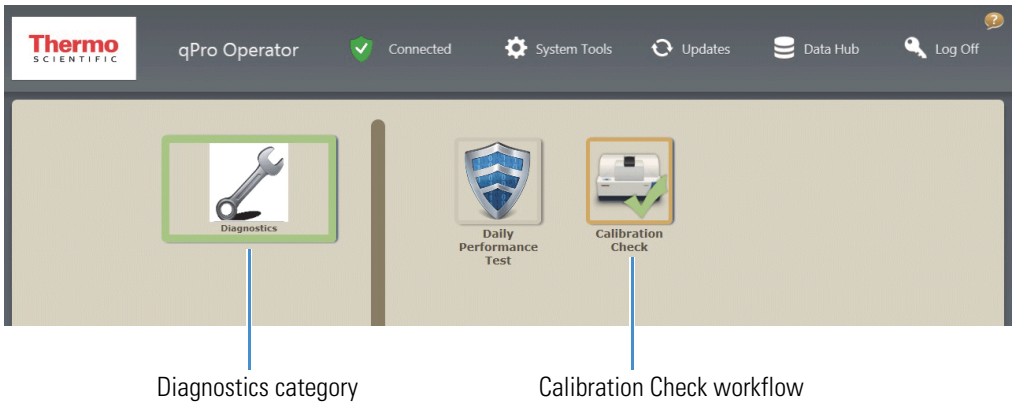
Note

- Use only 99% or higher grade hexadecane for the calibration check.
- Hexadecane solidifies below 18 °C (64 °F). Let it warm to room temperature (or apply gentle heat) to liquefy before use with the analyzer.
- Do not sample hexadecane directly from its original container. Pour into a clean, labeled container and use that container for the calibration checks.

❖ To run the Calibration Check workflow

1. Make sure the sample windows are clean and dry.
2. From the qPro Operator main screen, click the **Diagnostics** category in the left pane and then click **Calibration Check**.

   Figure 13. Diagnostics category in qPro Operator software

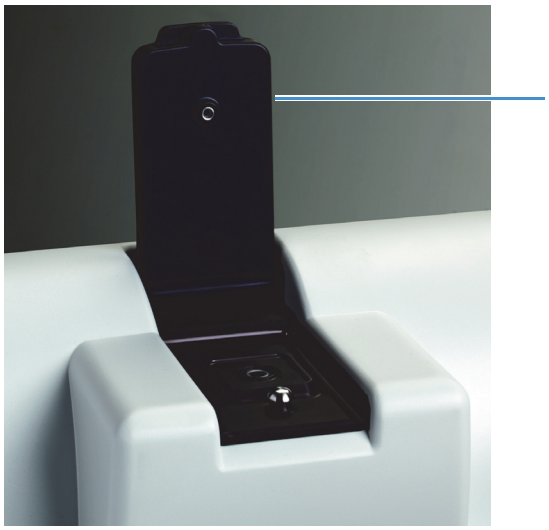


   The workflow shows its historical results.

3. Make sure the sampling arm is closed and click **continue**.
4. Make sure **Run a new calibration check** is selected and click **continue** to start the workflow.

5. When the workflow asks you to load hexadecane, lift the sampling arm and use proper technique to add hexadecane to the sample cup (see "Tips" below).

Figure 14. Nicolet iS5 LS analyzer with sampling arm raised



Tip

- Fill the sample cup with hexadecane (typically 2 drops). Do not overfill the cup.
- Wait a few seconds for the hexadecane in the sample cup to settle before proceeding with the workflow.

6. Gently close the sampling arm and click **continue**.

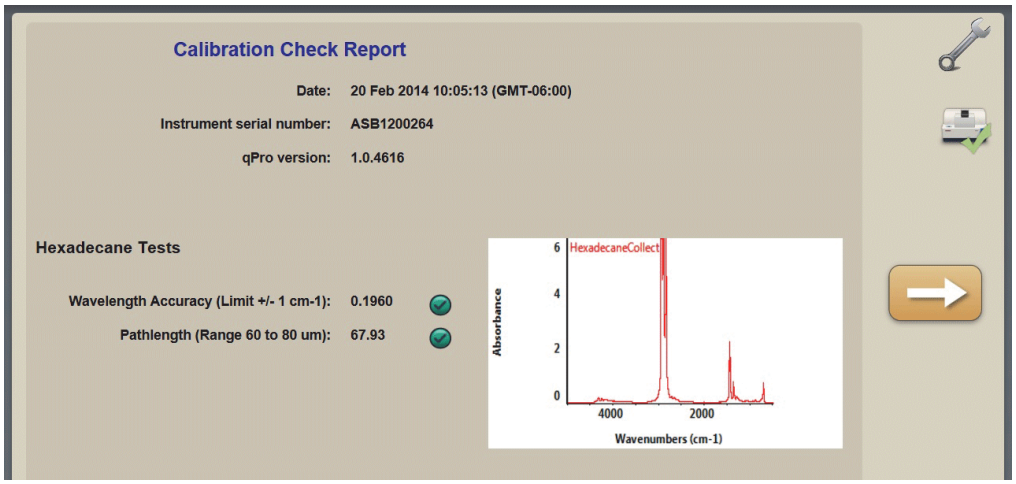
   Do not touch the sampling arm until the measurement is completed.

7. Click **continue**.

   After the pathlength and wavelength accuracy tests are completed, the workflow asks you to clean the sample windows. Follow the instructions in the workflow.

When the workflow is completed, the software displays the report. If the instrument passed, a green check mark appears to the right of each test result and the operator can proceed. Here is an example.

Figure 15. Example Calibration Check report



8. If your instrument passed the performance test, click **continue** to complete the workflow.

   If your report includes a red "X," rerun the Calibration Check workflow. If it fails again, the resolution depends on which test has the red X. For more information, refer to the Performance test failed topic in the Troubleshooting section of the instrument user guide.

9. To print the report, click the **Print** button.

Note To retrieve data from a Calibration Check workflow, use Data Hub.

Related Topics

- Daily Performance Test
- Instrument Performance Tests

Collecting Data

This section explains how samples are analyzed with the instrument. These topics are covered:

- Sampling Tips
- Background Measurement
- Sample Measurements

Sampling Tips

For optimal sampling with the instrument, follow these guidelines:

- Leave the instrument powered on continuously.
- For optimum instrument stability, the sampling arm should remain closed except when cleaning it or loading a sample. Keeping the arm closed also allows background measurements to occur automatically.
- Clean the sample windows thoroughly before you run the instrument performance tests.
- To apply a sample for measurement, use a clean dropper bottle, pipette or glass rod to place a small volume of sample in the sample cup. A micropipette that dispenses approximately 70 µl works well. The cup should be about two thirds full. (Do not overfill the sample cup.)
- Before you start a measurement, gently close the sampling arm and then wait a few seconds for the sample to settle. Measurements can be made only when the arm is down (an error message appears if the arm is up when the measurement starts). Do not touch the sampling arm until the measurement has completed.
- A background measurement is required at predefined intervals during continuous use. We recommend that the time between background collections should not exceed 2 hours. The workflows display a message when a background collection is needed. Make sure the sampling arm is closed and follow any workflow instructions to ensure a good quality background is acquired.

Background Measurement

An FT-IR background measurement is needed to correct for variation in the instrument signal over time. Information from the background is used to separate absorptions that are due to the instrument laboratory environment from absorptions that are due to the sample.

A background measurements is required at predefined intervals during continuous use. We recommend that the time between background collections should not exceed 2 hours. (Backgrounds may be needed more often for some applications.)

The workflows display a message when a background collection is needed. Follow the workflow instructions to ensure a good quality background is acquired.

Before the background is measured, the instrument should be powered on and the qPro Operator software should be running. The sample windows should be clean. There should not be sample material in the sample cup.

Sample Measurements

Samples are measured using site-specific workflows which guide the operator through each step in the analysis. To learn how to load and run site-specific workflows, refer to the “Loading a Workflow Package” topic in the qPro Operator Help system.

Maintaining the Instrument

This section provides instructions for maintaining the Nicolet iS5 LS analyzer and installing and replacing key components.

NOTICE All other maintenance and or repair must be performed by one of our trained and certified service engineers.

Contents

- General Maintenance
- Installing or Replacing Components

WARNING When performing any of the maintenance procedures, always follow the safety precautions included in the user guide or Help system and in any of the other documentation that came with your instrument.

General Maintenance

This section covers these topics:

- Static Electricity Precautions
- Cleaning the Instrument
- Checking the Humidity Indicators
- Aligning the Instrument Optics
- Calibrating the Laser Frequency
- Calibrating the Sample Stage

Static Electricity Precautions

Critical components in the instrument can be permanently damaged by static electricity. To help prevent such damage, follow these recommendations:

- Before you disconnect the power supply, always discharge any static electricity you may have accumulated by touching the perforated metal shield over the power supply.

- Do not touch any printed circuit board in the instrument (such as the circuit board on the detector).
- Do not remove a replacement component from its protective packaging until you are ready to install that component in the instrument.

Related Topics

- Electrical and Communication Cabling
- Troubleshooting the Instrument

Cleaning the Instrument

If the outside of the instrument needs cleaning, turn it off and disconnect the power supply. Then use a soft cloth that is damp (not wet) and a mild soap to clean the outside of the instrument.

CAUTION To avoid a shock hazard, do not allow liquid to run into the power supply or the vents at the back of the instrument.

NOTICE Do not use harsh detergents, solvents, chemicals or abrasives to clean the instrument; these can damage the finish.

Related Topics

- Cleaning the Sample Windows
- Static Electricity Precautions

Checking the Humidity Indicators

The instrument is tightly sealed and its optical components are protected by desiccant that absorbs water vapor.

NOTICE Keep the instrument sealed and desiccated at all times and check the humidity indicator regularly. Equipment damage due to failure to maintain seal and desiccation is not covered under the warranty. If you have questions about this requirement, contact us.

Follow these steps to monitor the humidity level inside the instrument.

- Checking Humidity When the Instrument is Powered Off
- Checking Humidity When the Instrument is Powered On

Related Topics

- Replacing the Desiccant
- Regenerating the Desiccant
- Troubleshooting the Instrument

Checking Humidity When the Instrument is Powered Off

A paper indicator lets you know when to change the desiccant when the instrument is powered off.

Figure 16. Paper humidity indicator

If the instrument's paper humidity indicator is blue, the desiccant is not saturated and does not need replacement. When the desiccant becomes saturated, the humidity indicator turns pink and then light pink or almost white. This means you must replace the desiccant (and the humidity indicator) immediately.

NOTICE Check the paper humidity indicator at least once a month when the instrument is powered off.

Related Topics

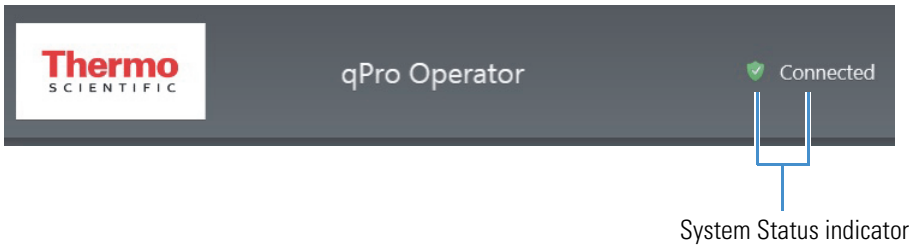
- Checking the Humidity Indicators
- Replacing the Desiccant

Checking Humidity When the Instrument is Powered On

When the instrument is powered on, an internal sensor closely monitors the humidity level inside the instrument and alerts you when the humidity is high.

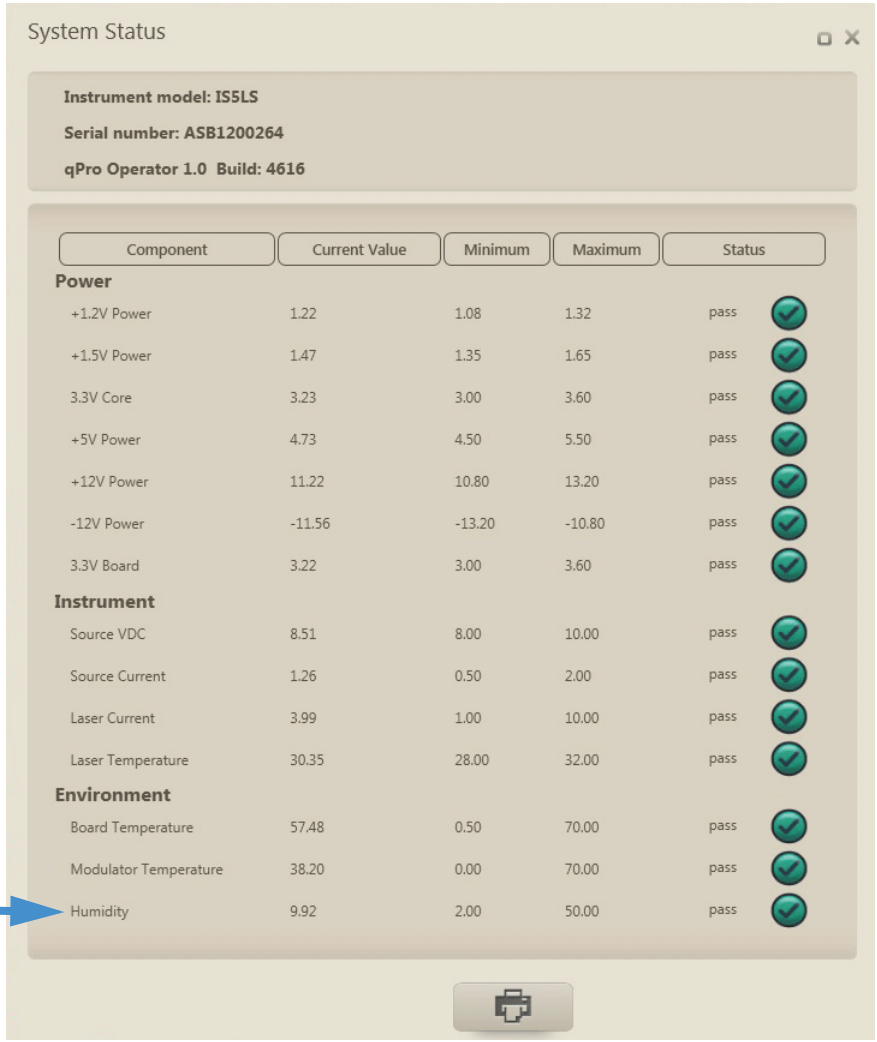
❖ To check the internal humidity indicator

1. From the qPro software main screen, click the **System Status** indicator at the top of the window.



The software opens a window with status information.

Figure 17. Humidity readout in System Status window



2. Verify that the current Humidity value is between 2 and 50%.

Note When the internal humidity is above 50%, the software displays a message to replace the desiccant. If the humidity is above a critical level, the system status indicator will report an instrument failure.

Related Topics

- Checking the Humidity Indicators
- Replacing the Desiccant

Aligning the Instrument Optics

Optical alignment optimizes the energy throughput to the detector. Alignment can change slightly over time, particularly in locations that have large temperature swings or excessive vibration. After you power up the instrument, allow approximately 6 hours for the instrument to reach thermal equilibrium before you align it. **Repeat alignment every two weeks**.

Align the instrument optics immediately:

- If the Daily Performance Test report shows a failed Single Beam or 100% T (transmittance) test
- After you calibrate the laser frequency.

Before you align the instrument, make sure the sample windows are clean and dry. The sampling arm should be down.

To continue from one screen to the next in the workflow, click the button.

❖ To align the instrument optics

1. From the qPro main window, click **System Tools** and then click **Alignment**.

   The workflow shows its historical results.

2. Make sure the sampling arm is closed and then click **continue**.
3. Make sure **Start a new alignment** is selected and then click **continue**.

   Follow the instructions in the workflow. When the workflow is completed, a pass or fail result is displayed. If alignment fails, consult the Alignment failed topic in the Troubleshooting section.

4. Click **continue** to return to System Tools.
5. Click the **Home** button at the top of the qPro window to return to the home screen.

Related Topics

- Calibrating the Laser Frequency
- Calibrating the Sample Stage
- Maintaining the Instrument
- Troubleshooting the Instrument

Calibrating the Laser Frequency

Laser calibration verifies the known frequency of the instrument laser. The laser frequency may drift slightly over time, particularly in locations that have large temperature swings or excessive vibration. After you power up the instrument, allow approximately 6 hours for the instrument to reach thermal equilibrium before you calibrate the laser frequency. **Repeat laser calibration every three months.**

NOTICE Always align the instrument optics and calibrate the sample stage after you calibrate the laser frequency.

Calibrate the laser frequency immediately:

- after you have changed the source
- if the instrument failed the Wavelength Accuracy portion of the Calibration Check
- Before you align the instrument or calibrate the sample stage

Before you calibrate the laser frequency, make sure the sample windows are clean and dry. The sampling arm should be down.

To continue from one screen to the next in the workflow, click the button.

❖ To calibrate the laser frequency

1. From the qPro main window, click **System Tools** and then click **Laser Calibration**.

   The workflow shows its historical results.

2. Make sure the sampling arm is closed and click **continue**.
3. Make sure **Start a new laser calibration** is selected and then click **continue**.

   Follow the instructions in the workflow. When the workflow is completed, a pass or fail result is displayed. If laser calibration fails, consult the Laser frequency calibration failed topic in the Troubleshooting section.

4. Click **continue** to return to System Tools.
5. Click the **Home** button at the top of the qPro window to return to the home screen.

After laser calibration is completed, align the instrument optics and calibrate the sample stage.

Related Topics

- Aligning the Instrument Optics
- Calibrating the Sample Stage
- Maintaining the Instrument
- Troubleshooting the Instrument

Calibrating the Sample Stage

Stage calibration verifies the distance between the two sample windows during measurements. The distance is controlled by the motorized sample stage (lower window), which moves vertically before and after each measurement. After you power up the instrument, allow approximately 6 hours for the instrument to reach thermal equilibrium before you calibrate the sample stage. **Repeat stage calibration every three months.**

Calibrate the sample stage immediately:

- After you have calibrated the laser frequency
- If the instrument failed the Pathlength portion of the Calibration Check

Before you calibrate the sample stage, make sure the sample windows are clean and dry. The sampling arm should be closed.

There are two stage calibration tools:

- Quick Calibration (verifies or finely adjusts stage position)
- Full Calibration (recalibrates the stage)

NOTICE

- Run Full Calibration only if Quick Calibration fails or during preventive maintenance for the instrument.
- Always calibrate the laser frequency and then align the instrument optics before you run Full Calibration.

To continue from one screen to the next in the workflow, click the button.

❖ To calibrate the sample stage

1. From the qPro main window, click **System Tools** and then click **Quick Calibration (or Full Calibration)**.

   The workflow shows its historical results.

2. Make sure the sampling arm is closed and then click **continue**.
3. Make sure **Start a new quick** (or **full) calibration** is selected and then click continue.
4. Follow the instructions in the workflow. When the workflow is completed, a pass or fail result is displayed. If stage calibration fails, consult the Stage calibration failed topic in the Troubleshooting section.
5. Click **continue** to return to System Tools.
6. Click the **Home** button at the top of the qPro window to return to the home screen.

Related Topics

- Aligning the Instrument Optics
- Calibrating the Laser Frequency
- Maintaining the Instrument
- Troubleshooting the Instrument

Installing or Replacing Components

You can replace several key components yourself. All components are serialized to help with performance tracking and diagnostics.

WARNING The following parts must be replaced only with replacement parts supplied by us:

- Power supply
- Desiccant
- Infrared source

This section covers these topics:

- Replacing the Power Supply
- Replacing the Desiccant
- Replacing the Source

NOTICE This instrument must be protected from excessive humidity, since the beamsplitters, detectors, and other components may corrode with exposure to moisture. If you remove a cover for maintenance purposes, complete the maintenance as quickly as possible and then install new desiccant and replace the instrument cover.

Replacing the Power Supply

You can replace the instrument power supply yourself. To order a replacement power supply, contact us.

WARNING

- Before you replace the power supply, turn off the instrument power switch and unplug the power cord.
- Replace the power supply only with parts supplied by us.

Time needed: 5 minutes or less

Tools needed:

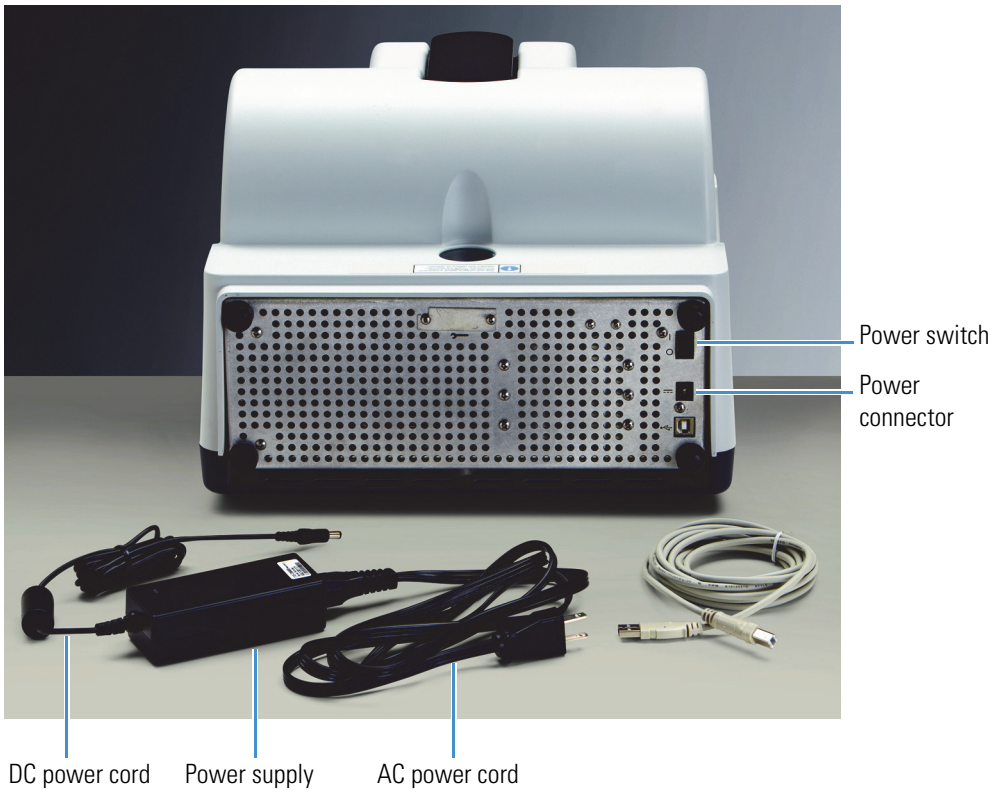
- Power supply replacement kit

CAUTION To avoid a shock hazard, do not:
- Attempt to remove the cover of the power supply.
- Allow liquid to run into the power supply or the back of the instrument.
- Block access to the power supply, AC power cord or power switch.

❖ To replace the power supply

1. Turn off the instrument power switch and unplug the power cord from the wall outlet or power strip.
2. Disconnect the power cord from the instrument.

Figure 18. Nicolet iS5 LS power supply connections



3. Disconnect the AC power cord from the power supply.

Note The power supply replacement kit does not include the AC power cord, which is specific for the location of your installed instrument. Save the cord and use it with the new power supply. If the power cord becomes damaged, contact us to order a new one.

4. Connect your AC power cord to the new power supply.

WARNING To ensure 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 noncurrent-carrying wire connected to earth ground at the main distribution box.

5. Connect the power supply first to the instrument power connector and then to the wall outlet or power strip. The wall outlet you use must be of the correct voltage and equipped with a 3-wire line: live, neutral, and ground.
6. Turn on the instrument power switch.

   Wait 2 minutes for the instrument power indicator to stop flashing.

Note If the instrument does not function normally, turn off the power switch and check the cable connections between the power supply, the instrument, and the wall outlet or power strip. If the connectors are seated properly and the instrument still does not function normally, consult the troubleshooting topics or contact us for assistance.

7. Run the Daily Performance Test.

   Make sure the system has been on for at least 15 minutes (one to six hours for best results) and then run the Daily Performance Test workflow.

Related Topics

- Maintaining the Instrument
- Troubleshooting the Instrument

Replacing the Desiccant

Monitor the humidity level inside the instrument at all times. Replace the desiccant when the paper humidity indicator turns pink (can be light pink or almost white) or the software displays a message indicating the internal humidity reading is above 50%. Replace the paper humidity indicator each time you replace the desiccant. To order a desiccant replacement kit, contact us.

WARNING Replace the desiccant only with parts supplied by us.

Time needed: 15 minutes

Tools needed:

- Desiccant replacement kit (or desiccant canisters that have been regenerated)
- 0.05-inch hex key
- #2 Phillips-head screwdriver
- 7/64-inch ball driver or hex key

WARNING Before you replace the desiccant, turn off the instrument power switch and unplug the power cord. Remove all flammable materials from the area. Entry of flammable liquids or gases into the instrument is an explosion hazard. If such entry occurs, contact us immediately and do not apply power to the instrument until the condition has been corrected.

❖ To replace the desiccant

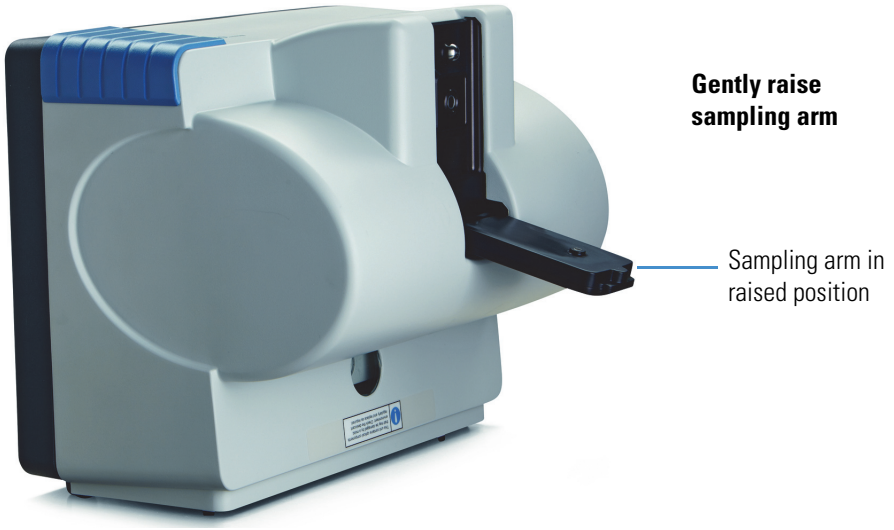
1. Turn off the instrument power switch and unplug the power cord from the wall outlet or power strip.
2. Disconnect the power cord and the USB cable from the instrument back panel.
3. Remove any sample material from the sample cup and clean the sample windows.

   When you are finished, lower the sampling arm so it engages firmly with the magnet.
4. Gently set the instrument on its back so it rests on the back feet.

Figure 19. Nicolet iS5 LS analyzer tipped back for service

5. Raise the sampling arm to avoid damaging it or its cables while you remove the main cover.

Figure 20. Nicolet iS5 LS analyzer tipped back with sampling arm raised



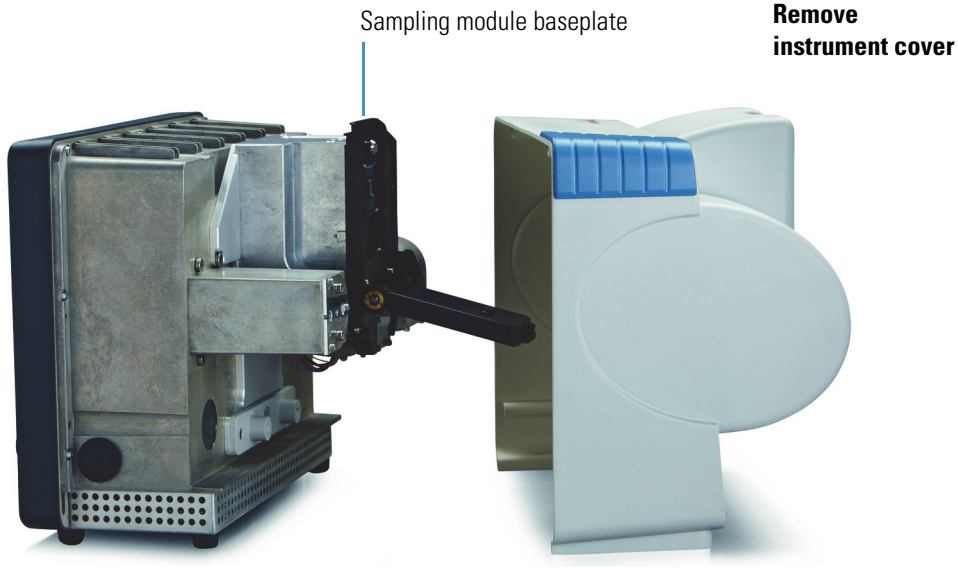
6. Remove the instrument's main cover.

   Use the 7/64-inch ball driver or hex key to remove the four screws that secure the cover to the baseplate. Set the screws aside.

Figure 21. Nicolet iS5 LS analyzer baseplate screws

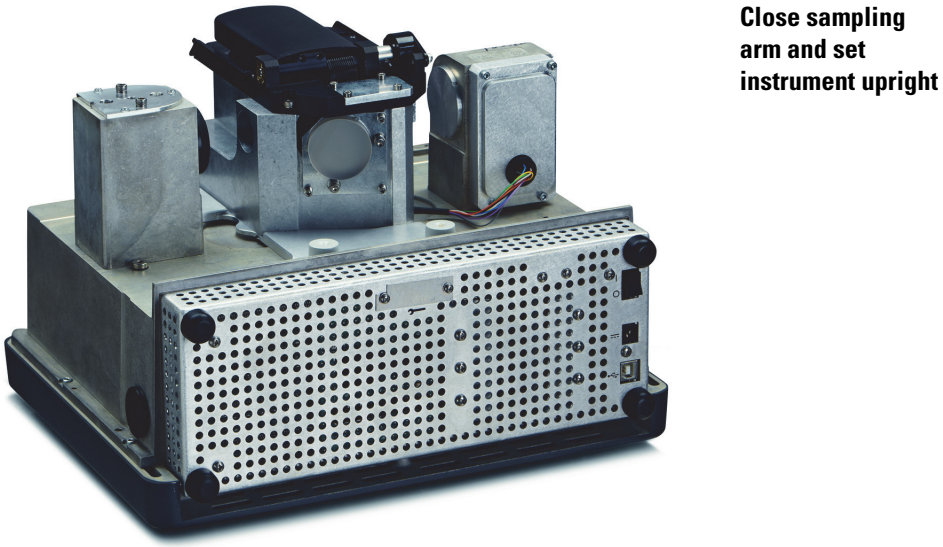
Carefully lift the cover upwards approximately 6 mm (0.25 inches) until it clears the lip of the sampling module baseplate. Then slide the cover straight back until it clears the sampling arm. Set the cover aside.

Figure 22. Nicolet iS5 LS analyzer with cover removed



7. Lower the sampling arm so it engages firmly with the magnet and then set the instrument upright.

Figure 23. Nicolet iS5 LS analyzer with cover removed and sampling arm down

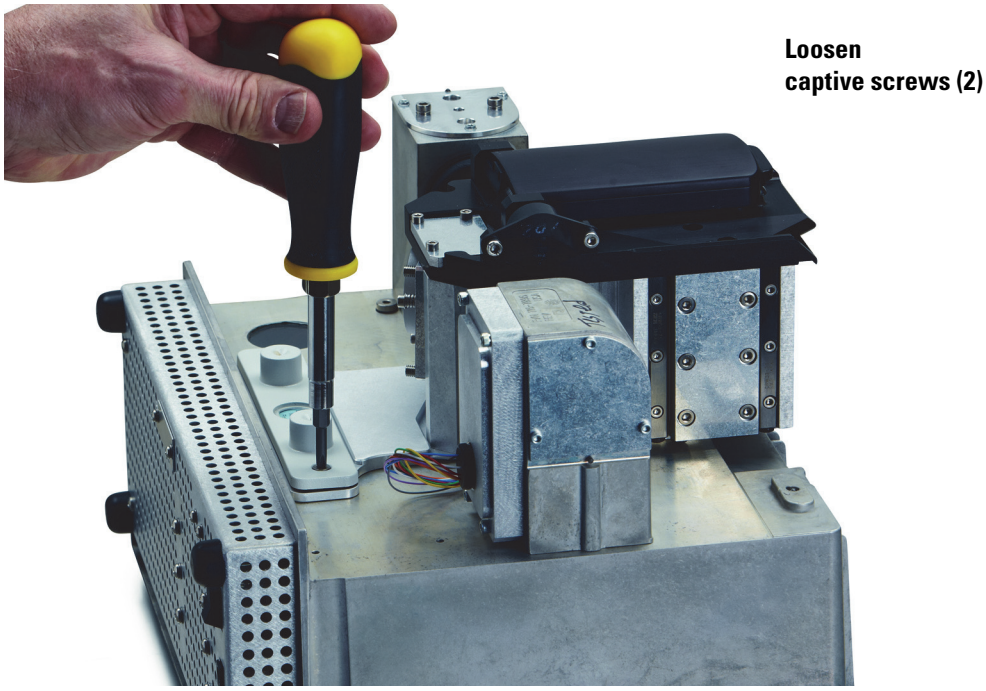


8. Remove the desiccant module.

NOTICE Make sure nothing falls into the instrument while the desiccant module is removed.

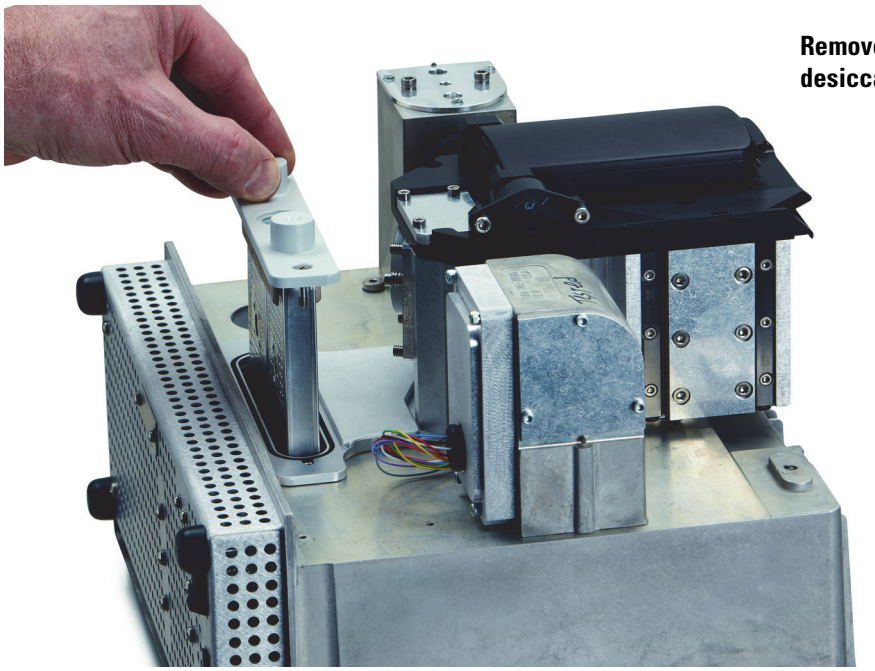
Use the #2 Phillips-head screwdriver to loosen the two captive screws that secure the desiccant module to the instrument.

Figure 24. Nicolet iS5 LS analyzer desiccant module screws



Lift the desiccant module straight up and out of the instrument and set the module aside.

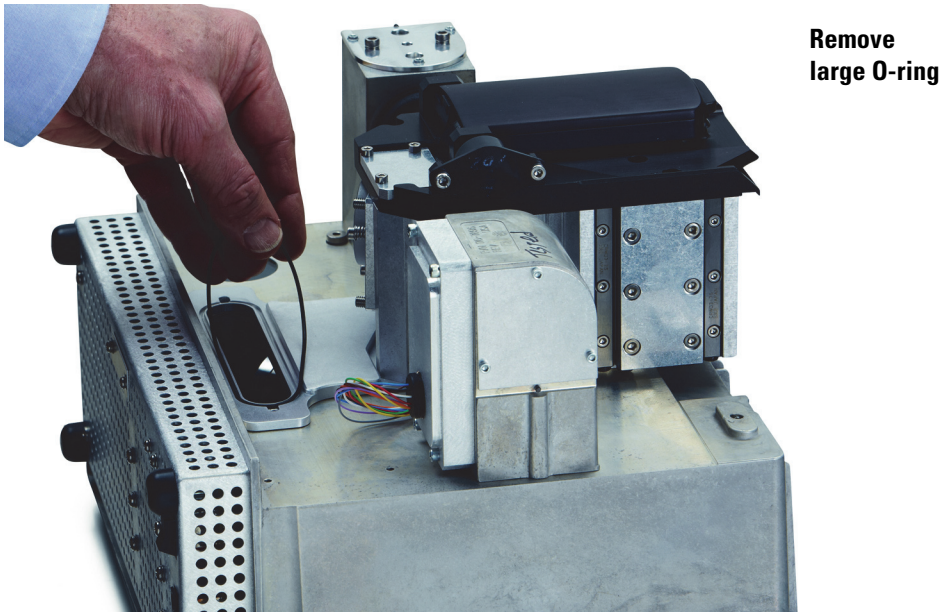
Figure 25. Nicolet iS5 LS analyzer with desiccant module removed



9. Remove and discard the large O-ring around the desiccant module opening.

NOTICE Be careful not to drop the O-ring into the instrument.

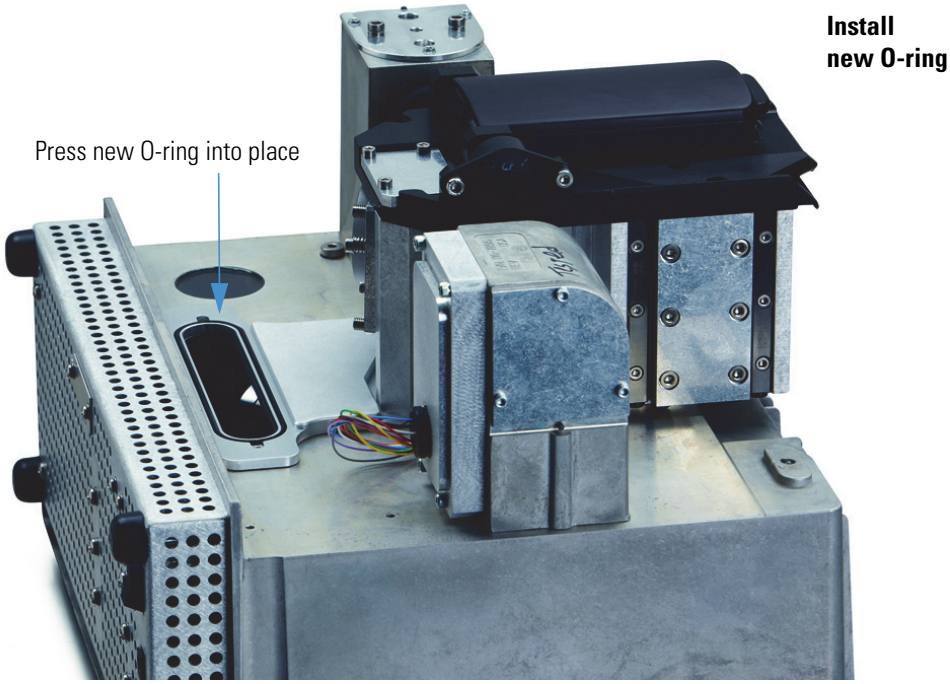
Figure 26. Nicolet iS5 LS analyzer with large desiccant O-ring removed



10. Install a new O-ring.

    Remove the new O-ring from the desiccant replacement kit and install it on the instrument. Press (rather than roll) the new O-ring into place to be sure it is properly seated in the groove. The O-ring should lie flat with little tension.

    Figure 27. Nicolet iS5 LS analyzer with new desiccant O-ring installed

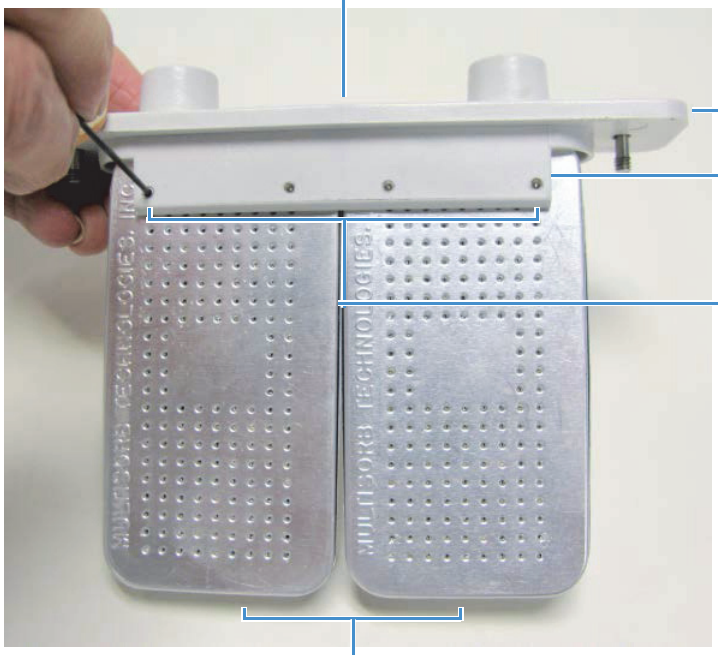


11. Remove the used desiccant canisters.

    Use the 0.05-inch hex key to loosen (approximately two turns) or remove the eight set screws that secure the saturated desiccant canisters to the desiccant module. Remove the canisters.

Note The desiccant canisters can be regenerated. Click here for more information.

Figure 28. Desiccant canister set screws



WARNING The contents of the desiccant canisters (hydrated metal aluminosilicate molecular sieve) could be harmful if ingested. If you discard the saturated canisters, make sure they are properly disposed of.

12. Replace the humidity indicator.

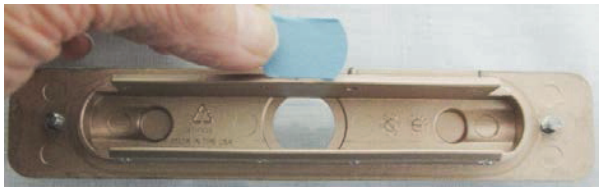
    Turn the desiccant module (see the previous image) upside down and peel the old humidity indicator off the window. Discard the used indicator.

Figure 29. Used paper humidity indicator

Open the sealed packet from the desiccant replacement kit and remove the new humidity indicator (the indicator should be blue).

Press the new indicator onto the window so that the flat edges of the indicator are aligned with the edges of the window. (You can trim the indicator with a pair of scissors if necessary to make it fit the window.) Make sure the indicator is pressed tightly against the window.

Figure 30. New paper humidity indicator



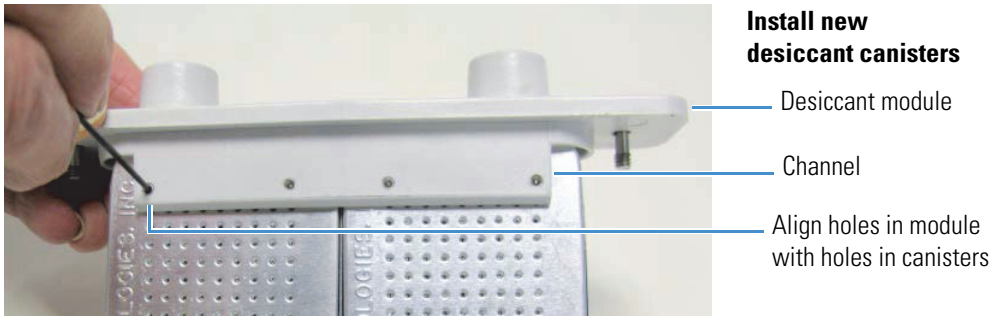
The text on the indicator should be visible through the window when you turn the module right side up.

Figure 31. Desiccant module with humidity indicator properly installed

13. Install the new desiccant canisters.

Insert each canister into the channel of the desiccant module so the holes in the module are aligned with the holes in the canister. If you are replacing the set screws, remove four new ones from the desiccant replacement kit and insert them into the desiccant module. Tighten the screws (approximately 2 turns) until they are flush with the surface of the desiccant module.

Figure 32. Desiccant canister set screws

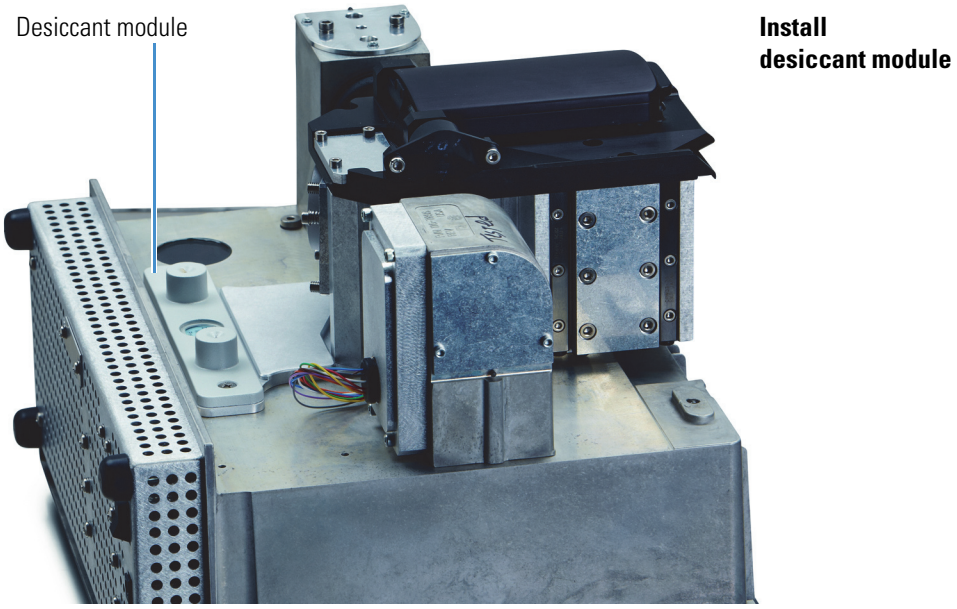


NOTICE Do not overtighten the set screws or you may damage the desiccant module or the canisters. (If the module is bowed, the screws are too tight.)

14. Install the desiccant module.

    Insert the desiccant module into the instrument so that the text on the humidity indicator can be read by someone standing in front of the instrument. Make sure the module is seated properly over the O-ring and then tighten the two captive screws. (If the captive screws are worn or damaged, replace them with the same type of screws from the desiccant replacement kit.)

Figure 33. Nicolet iS5 LS analyzer with desiccant module installed



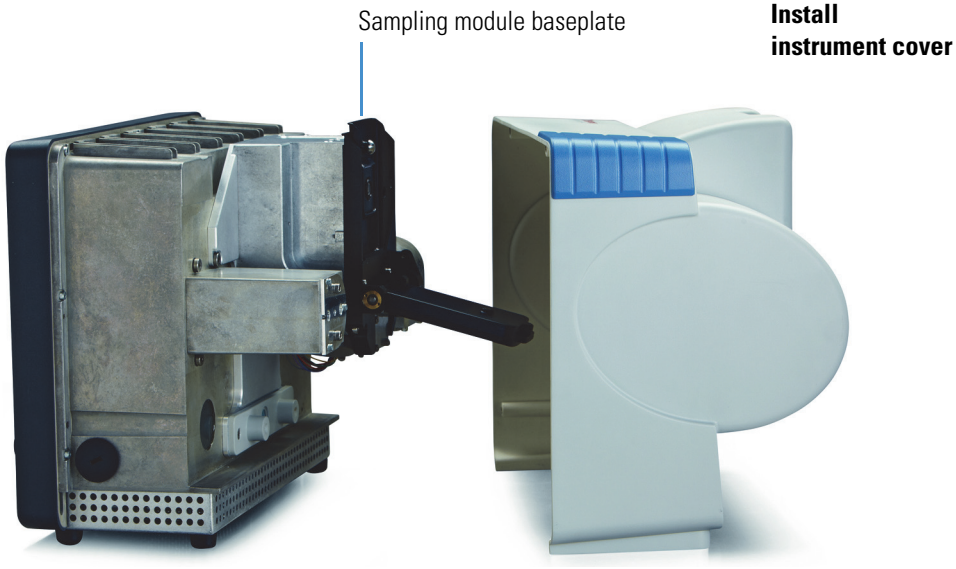
15. Install the instrument's main cover.

    Carefully set the instrument on its back so it rests on the back feet.

    Raise the sampling arm to avoid damaging it or its cables while you install the main cover.

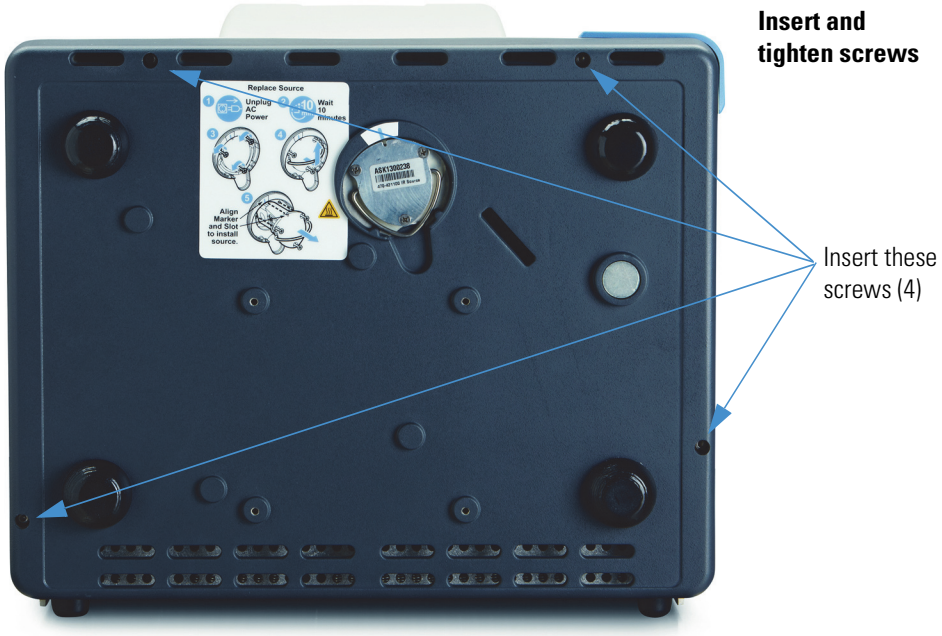
    Carefully slide the cover over the instrument while lifting the cover slightly until it clears the lip of the sampling module baseplate. Then continue sliding the cover forward until it engages with the instrument baseplate.

    Figure 34. Nicolet iS5 LS analyzer with cover positioned for installation



Use your fingers to insert the four screws that secure the cover to the baseplate. Tighten the screws with the 7/64-inch ball driver or hex key.

Figure 35. Nicolet iS5 LS analyzer baseplate screws



16. Lower the sampling arm so it engages firmly with the magnet.
17. Set the instrument upright.
18. Attach the power cord and the USB cable to the instrument.

WARNING To ensure 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 noncurrent-carrying wire connected to earth ground at the main distribution box.

19. Plug the power cord into the same wall outlet or power strip.
20. Turn on the instrument power switch.

    Wait 2 minutes for the instrument power indicator to stop flashing.

    Note If the power indicator does not stop flashing after 2 minutes or other problems occur, consult the troubleshooting topics or contact us for assistance.

21. Run the instrument performance tests.

    Make sure the system has been on for at least 15 minutes (one to six hours for best results) and then run both instrument performance tests.

Related Topics

- Maintaining the Instrument
- Checking the Humidity Indicators
- Regenerating the Desiccant
- Troubleshooting the Instrument

Regenerating the Desiccant

The instrument's desiccant canisters can be regenerated by drying them in an oven.

Note

- If you plan to regenerate the desiccant canisters, you will need a second set to place in the instrument while the first set is being dried.
- If the desiccant canisters are old or damaged, contact us to order new ones.
- If the humidity indicator is no longer blue, the indicator must be replaced. A replacement indicator is included in the desiccant replacement kit.

Time needed: 3 hours

Tools needed:

- Vented oven
- Insulated cloth or hot pad

NOTICE Make sure the insulated cloth or hot pad you use to handle the regenerated desiccant canisters is clean. Contaminants in a used cloth or hot pad could be absorbed by the desiccant and subsequently released into the instrument.

❖ To regenerate the desiccant

NOTICE Do not leave canisters in the oven for more than three hours and do not exceed a temperature of 150 °C (300 °F). Allow the canisters to cool completely in a dry environment before you install them in the instrument.

1. Place the saturated desiccant canisters in a vented oven at 150 °C (about 300 °F) for three hours.

WARNING To avoid a burn hazard, use an insulated cloth or hot pad to handle the heated desiccant canisters. Always wait until the canisters have cooled to room temperature before installing them in the instrument.

2. Use an insulated cloth or hot pad to remove the desiccant canisters from the oven.

   Immediately place the hot canisters in a dry environment such as a desiccator and allow them to cool to room temperature. As soon as the canisters reach room temperature, you must either install them in the instrument or seal them in an airtight container or bag. Otherwise, they will absorb moisture from the air in the room and quickly become saturated again.

Related Topics

- Maintaining the Instrument
- Checking the Humidity Indicators
- Replacing the Desiccant
- Troubleshooting the Instrument

Replacing the Source

You can replace the instrument's infrared source yourself. To order a source replacement kit, contact us.

WARNING

- Before you replace the source, turn off the instrument power switch, unplug the power cord and wait at least 10 minutes for the source to cool to room temperature.
- Replace the source only with parts supplied by us.

Time needed: 20 minutes

Tools needed:

- Source replacement kit (includes desiccant replacement kit)
- #1 Phillips-head screwdriver
- #2 Phillips-head screwdriver
- 7/64-inch ball driver or hex key
- 0.05-inch hex key
- Clean finger cots, gloves or laboratory tissue

NOTICE Never touch a source element with your bare fingers. Skin oils or other deposits on the element will shorten its life. Always use clean finger cots, gloves, or laboratory tissue when handling a source element.

❖ To replace the source

1. Turn off the instrument power switch and unplug the power cord.
2. Disconnect the power cord and the USB cable from the instrument back panel.
3. Remove any sample material from the sample cup and clean the sample windows.

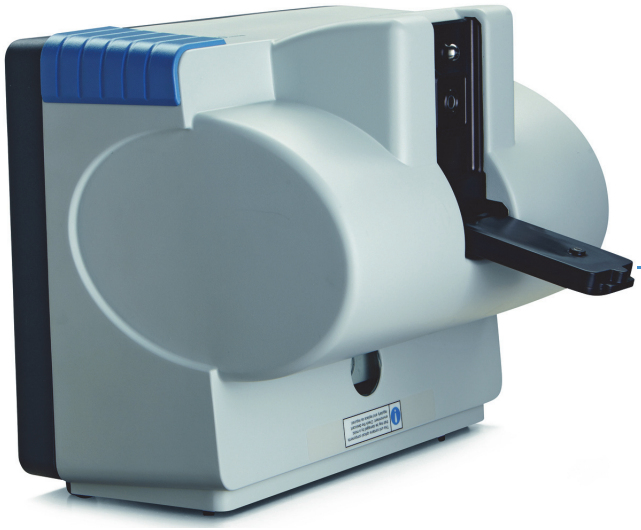
   When you are finished, lower the sampling arm so it engages firmly with the magnet.
4. Carefully set the instrument back on its back so it rests on the back feet.

Figure 36. Nicolet iS5 LS analyzer tipped back for maintenance

Gently set instrument on its back

5. Raise the sampling arm to avoid damaging it or its cables while you remove the main cover.

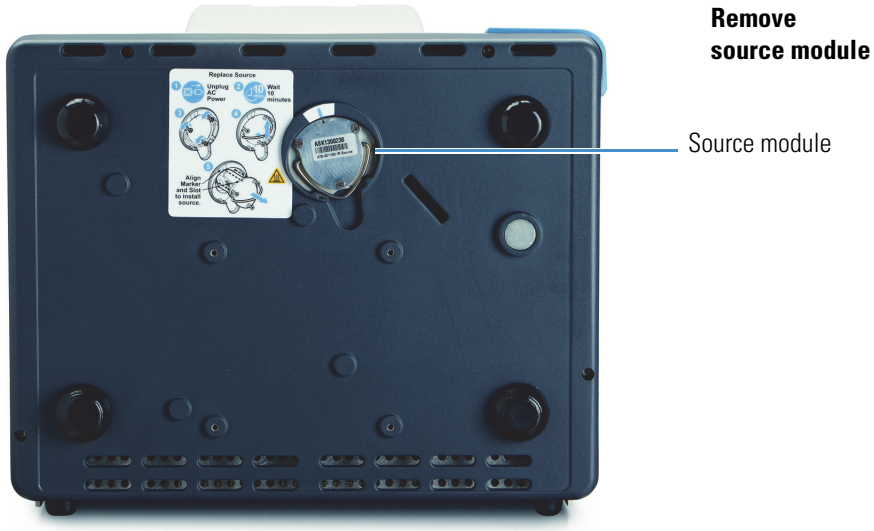
Figure 37. Nicolet iS5 LS analyzer tipped back with sampling arm raised



Note Make sure at least 10 minutes have passed since you turned off the instrument before you perform the next step.

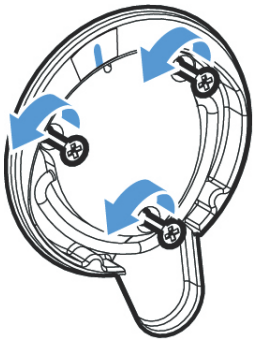
6. Remove the source module (accessible from the bottom of the instrument).

Figure 38. Nicolet iS5 LS analyzer tipped back for maintenance



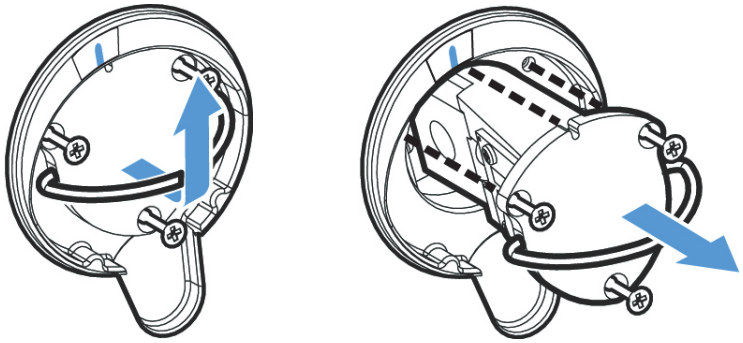
Use a **#1** Phillips-head screwdriver to loosen the three captive screws that secure the source to the instrument baseplate.

Figure 39. Source screws



Grasp the bale firmly and pull the source module straight out of the instrument.

Figure 40. Source removal



7. Carefully unpack the new source module and inspect it for damage.

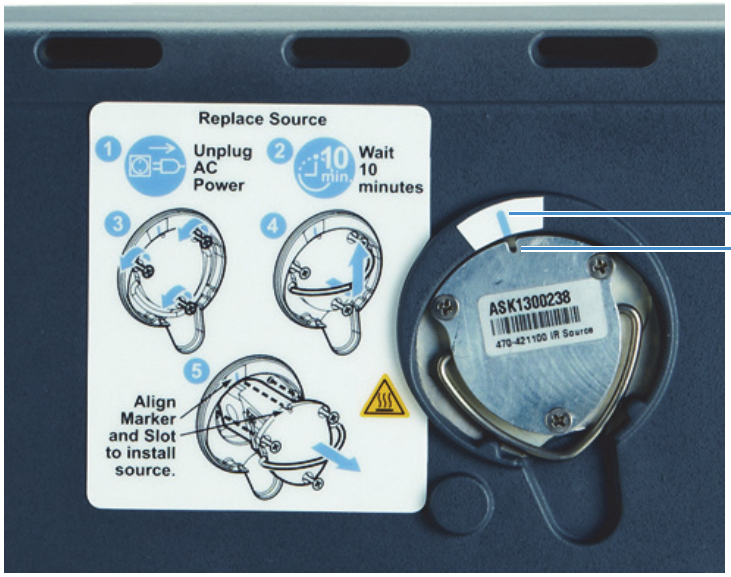
   Lightly tap the source module to remove any loose insulation or other material that might be clinging to it. If you have a source of dry air or nitrogen, set the flow rate to low and use it to lightly clean the source module.

8. Install the new source module.

   Align the slot in the source module with the blue line on the instrument baseplate. Make sure the three captive mounting screws are straight (to avoid cross threading) and then slowly insert the source into the cavity.

   Tip If the source is inserted incorrectly, the screws will not start.

Figure 41. Source installation



   Tighten the screws until the source mount is flush with the instrument baseplate.

   Snap the bale into its storage position.

9. Replace the desiccant.
10. Lower the sampling arm so it engages firmly with the magnet.
11. Set the instrument upright.
12. Attach the power cord and the USB cable to the instrument.

WARNING To ensure 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 noncurrent-carrying wire connected to earth ground at the main distribution box.

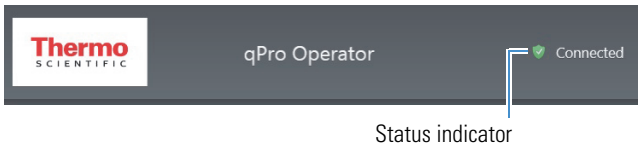
13. Plug the power cord into the same wall outlet or power strip.
14. Turn on the instrument power switch.

    Wait 2 minutes for the instrument power indicator to stop flashing.

    Note If the instrument does not function normally, consult the troubleshooting topics or contact us for assistance.

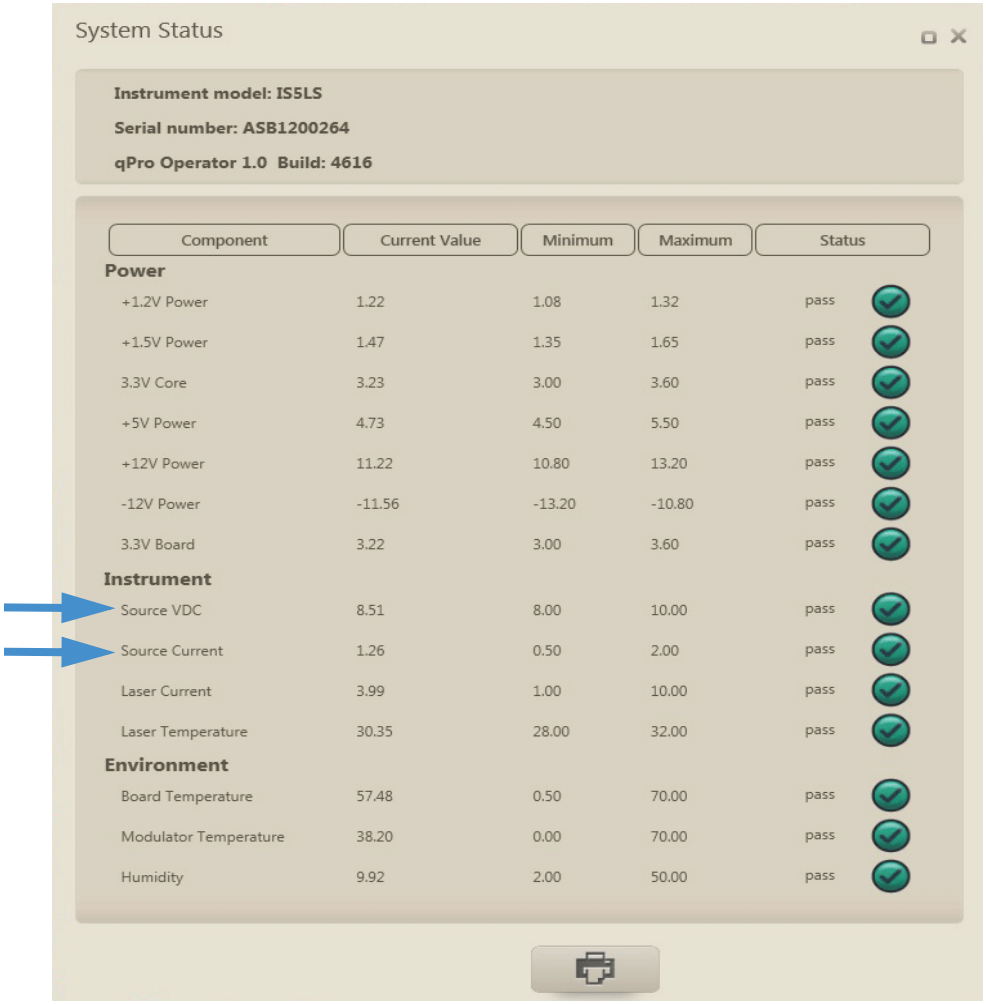
15. From the qPro Operator main window, click the System Status indicator.

Figure 42. System Status indicator in qPro Operator software



The status window is displayed.

Figure 43. System Status showing Source readings



If the **Source VDC** or **Source Current** (or both) show a "fail" status, contact Technical Support.

16. Align the instrument optics.

Make sure the system has been on for at least 15 minutes (one to six hours for best results), and then align the instrument optics.

17. Run both instrument performance tests.

Related Topics

- Maintaining the Instrument
- Troubleshooting the Instrument

Troubleshooting the Instrument

This section contains topics that describe the troubleshooting tools and techniques available for the instrument and solutions to common problems that may occur.

To expedite and assist in problem diagnosis, please be prepared to send us a copy of your diagnostic log. The diagnostic log includes a history of important system parameters and events that occur during system operation. Use the Data Hub in qPro Operator software to save the diagnostics log as a file that can be sent to our Technical Support group.

WARNING When performing any of the procedures in the troubleshooting topics, always follow the safety precautions included in this document or Help system and in any of the other documentation that came with your instrument.

Contents

- Resolving Common Problems
- Troubleshooting Tools

Resolving Common Problems

This section contains topics that address specific problems you may encounter with the instrument. Each topic lists steps you can take to try to resolve the problem.

Contents

- Performance test failed
- Optical alignment failed
- Laser frequency calibration failed
- Stage calibration failed
- Power indicator blinks continuously
- Cannot collect data

Performance test failed

If an instrument performance test fails, follow these steps:

1. Thoroughly clean the sample windows and then repeat both performance tests.
2. If the performance test fails again, take the following action depending upon which test failed:
   - If the single beam or 100% T test fails, complete the following in this order and then repeat the performance test:
     – calibrate the laser frequency
     – align the instrument optics
     – calibrate the sample stage
   - If the wavelength accuracy hexadecane test fails, complete the following in this order and then repeat the performance test:
     – Rerun the Calibration Check workflow using a **fresh hexadecane sample** from a new (unopened) source container to make sure the hexadecane is not contaminated.
     – calibrate the laser frequency
     – calibrate the sample stage
   - If the pathlength hexadecane test fails, run the quick stage calibration. If quick calibration fails, complete the following in this order and then repeat the performance test:
     – Rerun the Calibration Check workflow using a **fresh hexadecane sample** from a new (unopened) source container to make sure the hexadecane is not contaminated.
     – calibrate the laser frequency
     – align the instrument optics
     – run the full stage calibration

NOTICE

- Run the Full (stage) Calibration only if the Quick (stage) Calibration fails.
- Always calibrate the laser frequency and align the instrument before you run Full (stage) Calibration.

Optical alignment failed

If the instrument fails optical alignment or if the single beam or 100% T portions of the Daily Performance Test failed:

1. Check the following and then repeat the alignment:
   - clean the sample windows thoroughly and wait for them to dry
   - close the sampling arm (make sure it is all the way down)
2. If alignment fails again, cycle the power on the instrument and then repeat the alignment.
3. If alignment fails again, use the Data Hub in qPro Operator software to save the diagnostics log file and then contact Technical Support.

Laser frequency calibration failed

If the instrument fails laser calibration or if the wavelength accuracy portion of the Calibration Check failed:

1. Check the following and then repeat the laser calibration:
   - clean the sample windows thoroughly and wait for them to dry
   - close the sampling arm (make sure it is all the way down)
2. If laser calibration fails again, take a large breath and breathe out slowly on the instrument sampling area (sampling arm should be down) and then immediately rerun laser calibration. (Laser calibration requires some water vapor to be present in the sample compartment.)
3. If laser calibration fails again, use the Data Hub in qPro Operator software to save the diagnostics log file and then contact Technical Support.

Stage calibration failed

If the instrument fails quick stage calibration or if the pathlength portion of the Calibration Check failed:

1. Check the following and then repeat the quick stage calibration:
   - clean the sample windows thoroughly and wait for them to dry
   - close the sampling arm (make sure it is all the way down)
2. If quick stage calibration fails again, complete the following in this order:
   - calibrate the laser frequency
   - align the instrument optics
   - run the full stage calibration

3. If full stage calibration fails, use the Data Hub in qPro Operator software to save the diagnostics log file and then contact Technical Support.

Power indicator blinks continuously

The instrument power indicator blinks for two minutes after power up while the instrument runs internal diagnostic tests. If the power indicator continues to blink after two minutes, follow these steps:

1. From the qPro Operator main window, click the System Status indicator.
   - If the Humidity status is "fail," check that the current value for Humidity is within specifications. If it is out of the specified range, replace the desiccant.
   - If the Board Temperature or Modulator Temperature status is "fail," make sure nothing is sitting on top of the instrument and air can flow freely around it.

     If the vents are clear, the ambient temperature may be too high. The ambient temperature should be between 15 °C and 35 °C (60 °F and 95 °F). Allow 1 to 6 hours for the instrument to come to temperature equilibrium. If the problem persists, use the Data Hub in qPro Operator software to save the diagnostics log file and then contact Technical Support.

Cannot collect data

If the instrument cannot collect data or other problems occur in the software, follow these steps:

1. Make sure the system has completed the initialization period (about 2 minutes after you power it up). During initialization, the blue power indicator on the front of the instrument flashes.
2. Log off qPro software and turn off the instrument power switch. Wait a few seconds and then turn the power switch back on and restart qPro software.
3. Shut down the computer and turn off the instrument power. Check the data cable. If the cable is loose or disconnected, reconnect it. If the cable is damaged, replace it. Turn on the instrument power. Then turn on the computer.
4. If the problem persists, use the Data Hub in qPro Operator software to save the diagnostics log file and then contact Technical Support.

Troubleshooting Tools

The software provides a troubleshooting workflow called Spectra Check which collects diagnostic data on the instrument and compares it to a set of reference data. The information is intended for evaluation purposes by our service personnel but can also be helpful for users. Run the Spectra Check workflow only if you are having problems with the instrument and the problem solving steps have failed.

Before you run the Spectra Check workflow, thoroughly clean the sample windows.

Note You can also use this workflow to view sample data.

Materials required:

- Small volume of 99% hexadecane (available from us)
- Isooctane or other appropriate solvent to clean the sample windows
- Small, clean dropper bottle or pipette
- Clean, dry, lint-free laboratory wipes (unscented and lotion-free)
- Powder-free nitrile gloves

CAUTION Avoid chemical exposure. Hexadecane and isooctane are chemical irritants. When handling hexadecane or isooctane:

- avoid contact with skin and eyes
- avoid inhalation of vapor or mist
- wear gloves that provide adequate protection

Note

- Use only 99% or higher grade hexadecane for the pathlength check.
- Hexadecane solidifies below 18 °C (64 °F). Let it warm to room temperature (or apply gentle heat) to liquefy before use with the analyzer.
- Do not sample hexadecane directly from its original container. Pour into a clean, labeled container and use that container for the calibration checks.

❖ To run the Spectra Check workflow

1. From the qPro main window, click **System Tools** and then click **Spectra Check**.

   The workflow collects **interferogram data** from whatever is currently on the sample windows (or from nothing if the windows are clean). When data collection is completed, the measured interferogram is displayed along with an image of a reference interferogram from a typical background measurement (using clean sample windows) and information about the expected maximum signal strength in volts.

2. Click the arrow button to continue.

   The workflow collects a **single-beam spectrum**. When data collection is completed, the single-beam spectrum is displayed along with an image of a reference single-beam spectrum from a typical background measurement (using clean sample windows) along with information about the expected energy ratio and the measured intensities at the labeled hydrocarbon and water vapor peak locations.

3. Click the arrow button to continue.

   The workflow collects **another single-beam spectrum** and ratios it against the one collected previously to produce a 100% transmission spectrum (basically a straight line) to show the level of random noise in the data. When data collection is completed, the spectrum is displayed along with information about the expected peak-to-peak noise value at 1000 cm^{-1} and the expected slope of the 100% transmission line.

4. Click the arrow button to continue.

   The workflow asks if you want to measure wavelength accuracy and sample pathlength.

5. Select **Run hexadecane** and click continue.

6. Add two drops of 99% hexadecane to the sample cup, wait 2 seconds for the sample to settle, gently close the sampling arm and then click continue.

   Do not touch the sampling arm until the measurement is completed.

   When data collection is completed, the spectrum is displayed along with information about the expected peak locations and maximum peak deviation and the expected pathlength range.

7. Click continue and thoroughly clean both sample windows.

8. Click continue to end the workflow.

Note To retrieve data from a Spectra Check workflow, use Data Hub.

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