Preparing Your Site

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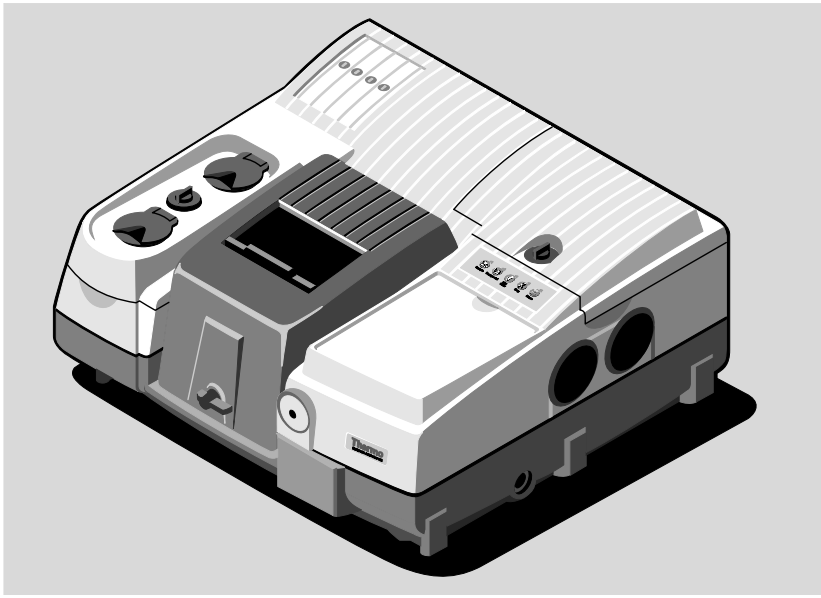
Contents

Introduction

Thermo Scientific Nicolet™ FT-IR spectrometers are designed to be extremely durable and reliable. They will work under adverse conditions for extended periods; however, to best ensure accurate results on a repeatable basis, you should maintain a stable working environment.



Before installation, please read this manual and consider its points for your system's work space. Four major areas are covered in this manual:

Location – Consult the dimensional drawings of the spectrometer and accessories when planning the location of your system. Leave extra space around the system for clearance and service access.

Environmental considerations – Avoid excessive static electricity, temperatures, vibration, intense magnetic fields, and humidity.

Utility requirements – Before the system arrives, it is important to install any necessary utilities in the planned work space. You will need electrical power. You may also need a telephone line, a source of dry air or nitrogen and a supply of liquid nitrogen.

Accessories – If you ordered a microscope, gas cell or any accessory modules, consult the appropriate dimensional drawings to help plan the location of your system. Other preinstallation concerns are included.

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, you can contact our sales or service representative in your area or use the information at the beginning of this document to contact us.

Conventions used in this manual

This manual includes safety precautions and other important information presented in the following format:

Note Notes contain helpful supplementary information. ▲

Important Follow instructions labeled “Important” to avoid damaging the system hardware or losing data. ▲

⚠ Caution Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. ▲

⚠ Warning Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. ▲

⚠ Danger Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. ▲

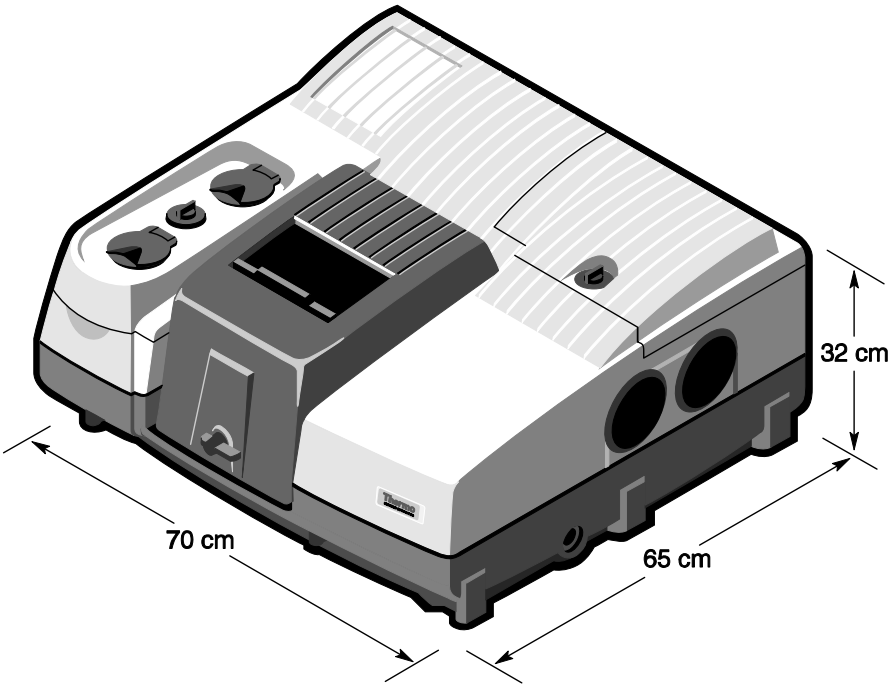
Location

Consider these points when planning the location of your system:

- If possible, choose a site easily accessible by our personnel and have a telephone near the system. Should the system require service or technical support, these measures will save time.
- An electrical earth grounded power source must be nearby.
- The floor (and table or counter used for a work surface) should be level, structurally able t o support the weight of the system, and rigid to avoid vibration. Keep the spectrometer away from air conditioners, refrigeration units and other machinery that may vibrate the floor. While vibration will not damage the spectrometer, it can compromise spectral quality. This is particularly true for Nicolet 8700 spectrometers used for step-scan or slow-scan experiments and systems used for imaging.
- Make sure the spectrometer and any accessories will fit in the work space you choose. Compare the work space with the dimensions shown in the next section and in the “Utility Requirements” and “Accessories” chapters.
- If you use more than one table to support the spectrometer and any accessory modules, the table tops must be the same height; otherwise, external beam ports will not align.
- Choose a table height that allows you to work comfortably with the spectrometer. If you will be using a microscope accessory, keep in mind that the eyepiece will be 48 to 53 cm (19 to 21 in) above the table top.

System dimensions and weight

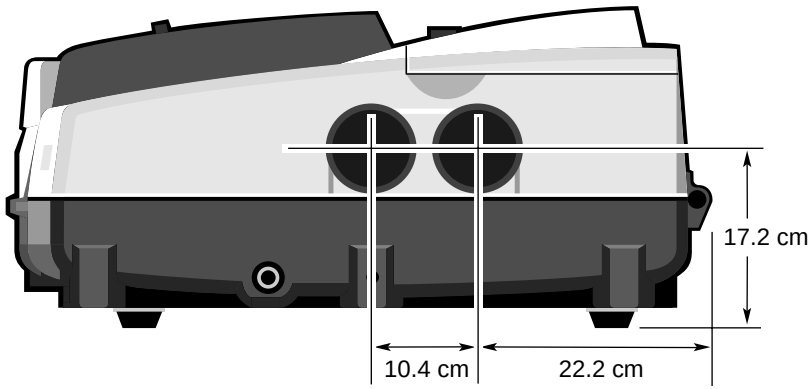
Nicolet FT-IR spectrometers weigh about 64 kg (140 lb). They are approximately 65 cm (25.5 in) deep by 70 cm (27.5 in) wide by 32 cm (12.5 in) high.



Nicolet FT-IR spectrometer dimensions

Locations of ports

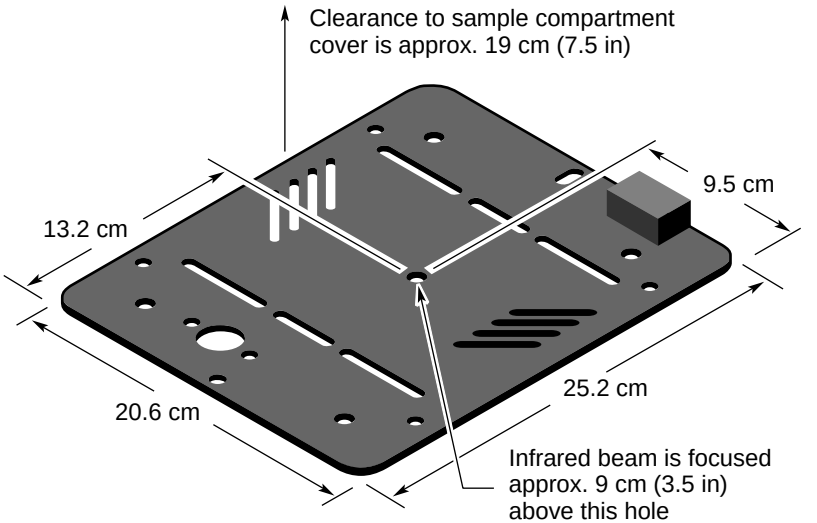
The following illustrations show the locations of the beam ports on the right side of the Nicolet FT-IR spectrometer. See the user's guide that you will receive with the spectrometer for complete information on the use of these ports.



Location of ports on right side of a Nicolet FT-IR spectrometer

Sample compartment baseplate dimensions

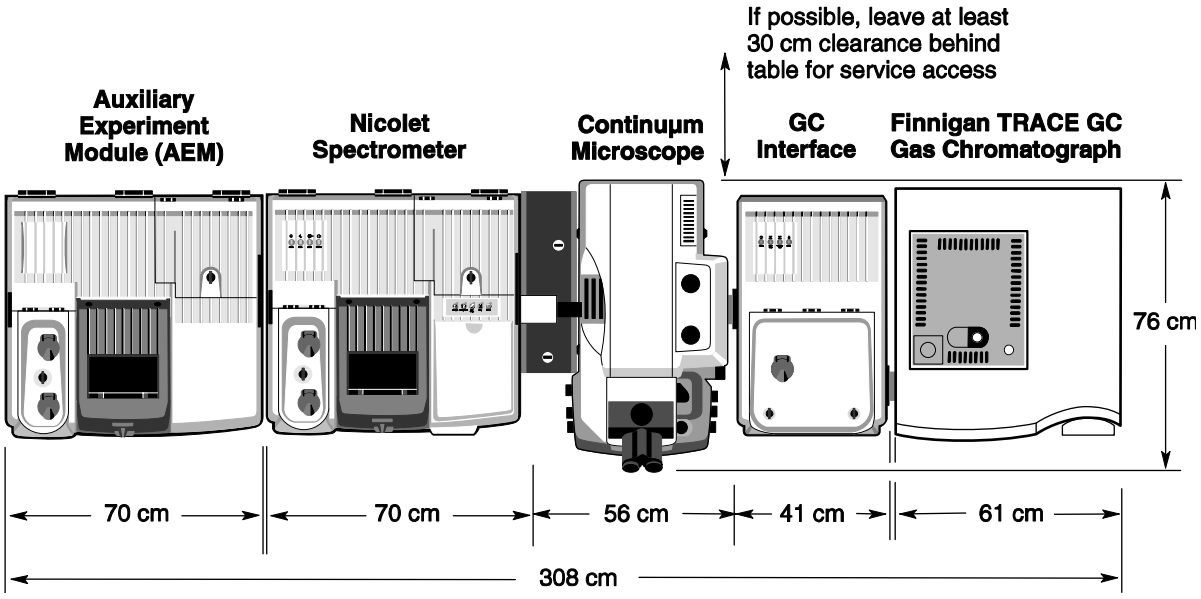
The following illustration shows the dimensions of the sample compartment baseplate. See the “Spectrometer Tour” and “Spectrometer Help Topics” tutorials that you will receive with your spectrometer for complete information on installing and using the baseplate.



Sample compartment baseplate dimensions

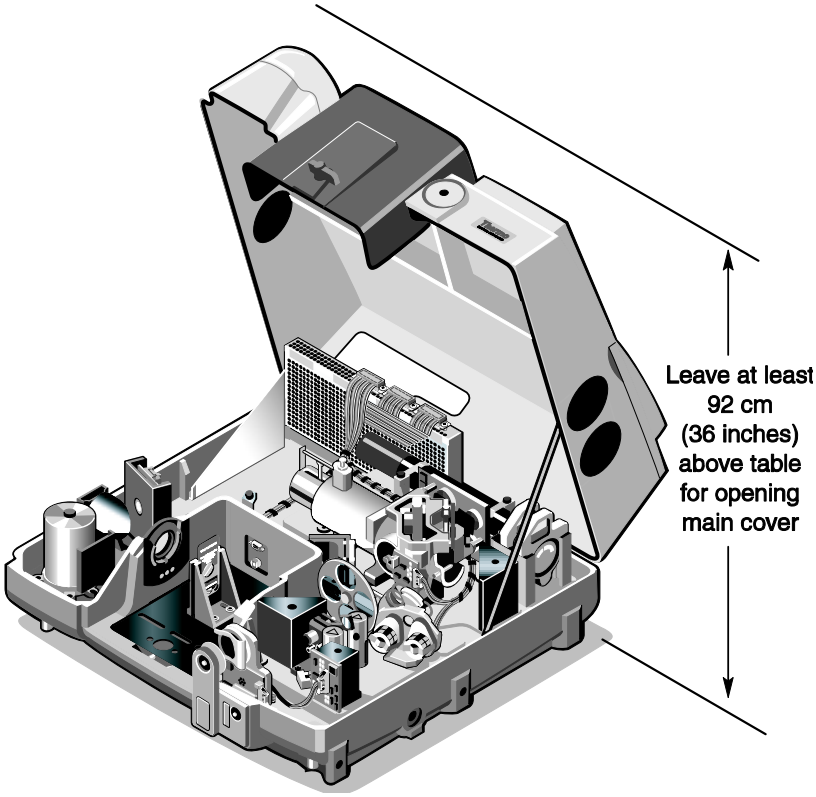
Overall system dimensions and required clearances

Use the dimensions shown below to plan your work space. A standard table depth of 76 cm (30 in) will accommodate the spectrometer and any combination of accessories. Note the clearance needed behind system components for service access. (See the chapter titled “Accessories” for information about the spatial requirements for the modules, gas cells and microscopes.)



Top views

There must be at least 92 cm (36 in) of clearance above the top of the table to allow the spectrometer's main cover to open fully for accessing internal parts during servicing.



Clearance needed above the spectrometer

Environmental Considerations

Environmental considerations include temperature, vibration, magnetic fields, humidity and static electricity.

Temperature

Maintain the temperature in the work space between 16° and 27°C (60° and 80°F). For better long-term stability, keep the temperature between 20° and 22°C (68° and 72°F). Temperature changes may result in long-term drift in the system response.

Once the spectrometer has been installed, plan to leave it turned on. The internal temperature and stability of the spectrometer will change significantly if it is switched on and off daily. Long-term stability improves with the length of time the spectrometer has been on.

Avoid placing the system near air conditioning ducts or large windows. Even if the windows have curtains, there is still significant heat loss through the glass at night.

Keep sources of heat, such as hot plates and heating mantles, away from the instrument. Do not place the spectrometer near heating or air conditioning vents.

Vibration

Floor vibration or acoustical noise from heavy manufacturing equipment or other sources can affect the performance of your spectrometer. Minimize or eliminate noise and vibration wherever possible. If vibration is a problem in your work space, consider placing the spectrometer on a marble-top table or counter.

Magnetic fields

Intense magnetic fields, such as those produced by superconducting magnets, can affect spectrometer performance. The spectrometer should be at least 5.5 meters (18 feet) away from these fields. Minimize or eliminate exposure to magnetic fields wherever possible.

Humidity

Infrared beamsplitters and detector windows are hygroscopic and become irreversibly opaque when exposed to moisture. The beamsplitter, detector and other components of the spectrometer may corrode with exposure to moisture.

If you ordered the sealed and desiccated option for your spectrometer, then it has a measure of protection against excessive humidity. If not, you must:

- Purge the system with dry air or nitrogen. (We provide more information about purge later in this manual.)
- Maintain the room humidity in the range of 20% to 80% noncondensing.
- Avoid rapid changes in temperature that may cause condensation.

Important If a beamsplitter, detector or accessory has been stored or shipped, immediate exposure to room air can cause condensation damage. *Wait 24 hours for the package and its contents to warm or cool to room temperature before opening it.* ▲

If you are moving the system between sampling sites, protect the instrument from extreme changes in temperature and humidity. Such changes may cause moisture condensation, which can permanently damage the optical components.

Static electricity

Since static electricity can destroy electronic components, your spectrometer was specially designed to meet the international standard: IEC 801-2; electrostatic discharge immunity requirements for industrial process, measurement and control equipment. If you have trouble with static electricity in your laboratory, you can further protect your spectrometer (especially when you are servicing or handling components inside the spectrometer) by observing the following guidelines:

- Maintain the humidity in the range of 20% to 80% noncondensing.
- Use conducting carpet 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.

Ventilation

There are no special ventilation requirements for a Nicolet FT-IR spectrometer. The types of analysis you plan may require special ventilation (for example, if you will be analyzing highly toxic samples, dissolving your samples in solvents that interact with infrared sources, or sampling flammable gases). Chlorinated solvents, perfluorochlorinated solvents, and other solvents containing halogenated hydrocarbons are often used as FT-IR solvents. The pyrolysis of these solvents by an infrared source may produce hydrochloric acid (HCl), hydrofluoric acid (HF), or phosgene ($COCl_2$).

Hydrochloric acid and hydrofluoric acid are highly corrosive and may cause accelerated corrosion of the metallic and optical components in the spectrometer if seals are not properly maintained or the concentration level of corrosive gasses in the air is excessively high due to improper sampling techniques.

⚠ Warning Hydrochloric acid, hydrofluoric acid and phosgene are highly toxic. If you plan to regularly use solvents containing halogenated hydrocarbons, be sure your work area is properly ventilated. ▲

Be sure to provide storage space away from the spectrometer for solvents containing halogenated hydrocarbons; they should not be left in the sample compartment for an extended time. If measurements require the sample compartment cover to be closed, the sample compartment must be purged while the solvents are used. An optional purge kit is available from Thermo Fisher Scientific.

⚠ Danger Prevent fire and explosion. The infrared source inside the spectrometer is an ignition source. If you plan to sample flammable gases, you must vent the check valves away from the spectrometer. Provide a fume hood or other active venting system that is free of spark and other ignition sources and that prevents flammable vapors from collecting in the atmosphere surrounding the instrument. ▲

Utility Requirements

If at all possible, the power connections for the spectrometer and accessories should be easily accessible for service purposes. The line for dry air or nitrogen, which is used to purge the system, should also be accessible if service is required.

You should have direct control over the system utilities.

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

Electrical requirements

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.

⚠ **Danger** 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 Many of the larger accessories offered with the spectrometer, such as microscopes, the GC interface, the thermogravimetric (TGA) interface and the FT-Raman module, require their own power connections. ▲

Your spectrometer was designed to meet the international standard: IEC 801-4; electrical fast transient burst immunity requirements for industrial process, measurement and control equipment.

Power line conditioning accessories

Uninterruptible power supplies (UPS) are available from Thermo Fisher Scientific. 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.

Electrical service specifications

The following table lists the specifications for electrical service. Contact your local Thermo Fisher Scientific service representative 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*
AC input	100 to 240 *vac*
	The GC interface can operate on either voltage; we set the voltage according to your requirements.
	The GC oven must be ordered for one voltage.
line frequency	50-60 Hz; printers and plotters may require special 50-Hz versions.
Current	15 A (120-volt operation)
	7.5 A (220-volt operation)
	Separate 20 A service is required for a GC oven.
line disturbances	Sags, surges or other line disturbances must not exceed 10% of input voltage (even for a half cycle).
Noise	< 2 volts (common mode)
	< 20 volts (normal mode)

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 spectrometer and accessories are shown below. The values are approximate.

Component	*Power Consumption*	
Spectrometer		
Nicolet 4700	110 W	375 Btu/hr
Nicolet 5700	110 W	375 Btu/hr
Nicolet 6700	110 W	375 Btu/hr
Nicolet 8700	110 W	375 Btu/hr
computer and monitor*	460 W	1,570 Btu/hr
standard printer*	200 W	683 Btu/hr
gas generators and dryers		
Whatman purge gas	10 W	34 Btu/hr
Whatman pure air	1,000 W	3,414 Btu/hr
Thermogravimetric Analysis		
TGA module	1,650W	5,633 Btu/hr
TGA interface	356 W	1,215 Btu/hr
Gas Chromatograph		
GC interface	1,650 W	5,633 Btu/hr
Finnigan TRACE™ GC OVEN**	1,934 W	6,600 Btu/hr
Agilent 6890 GC oven (standard ramp)	2,250 W	7,672 Btu/hr

Component	*Power Consumption*	
Microscopes		
Nicolet Continuμm™	250 W	852 Btu/hr
Nicolet Continuμm XL	250 W	852 Btu/hr
Nicolet Centaurμs™	65 W	222 Btu/hr
IR-Plan™	204 W	696 Btu/hr
Nic-Plan	200 W	683 Btu/hr
InspectIR™	65W	222 Btu/hr
ImageMax™	300 W	1,024 Btu/hr
FT-Raman module	180 W	615 Btu/hr
PEM module or TOM kit		
dual channel programmable filter	45 W	154 Btu/hr
Digital lock-in amplifier	40 W	137 Btu/hr
PEM controller	300 W	1,024 Btu/hr
Synchronous Sampling Demodulator	10 W	34 Btu/hr
Map300 accessory	30 W	102 Btu/hr

*Values shown are estimates. *See* the power specifications on the rear panels or undersides of these units.

**Air conditioning load for the basic TRACE system is approximately 2,650W (9,100 Btu/hr). See the documentation that accompanies the TRACE GC oven for specifics.

Telephone

If possible, install a telephone with an outside line near the spectrometer. Should you require assistance, a telephone in the lab will save time.

If your system has the RSVP™ Remote Diagnostics Package, install a separate analog phone line for the modem. The line must be capable of accepting incoming calls. See the next section for modem specifications.

Note We recommend that you dedicate a phone line for data modem calls. If you require assistance, our service engineer can discuss the problem with you through the voice line while running diagnostic tests on your system through the modem line. ▲

Modem line specifications

The data modem requires an analog phone line (an outside line in most businesses). Many private branch exchange (PBX) phone systems use digital phone lines that will not work with your data modem. Ask your PBX administrator for a direct, outside line or a sampled analog trunk line that allows incoming calls from an outside source.

Use the following guidelines to determine whether or not you have an analog phone line.

Rotary phone – All rotary phones are analog phones. If you hear a dial tone when you plug a rotary phone into the phone wall jack, you have an analog phone line and your data modem will work.

Push-button phone – If you have a push-button phone, check the bottom of the phone to see whether it has a ringer equivalence number (REN) or a load number (LN). All analog phones have an REN or an LN. If you hear a dial tone when you plug a push-button phone that has an REN or an LN into the wall jack, you have an analog phone line and your data modem will work.

Wall jack specifications

In the U.S.A., install an RJ-11 jack; in Canada, install a CA11A jack. For other locations, contact your local Thermo Fisher Scientific office for jack requirements.

Purge

The spectrometer contains precise optical components that may be damaged by a moist environment.

Important Optical damage caused by failure to keep the spectrometer free of undesirable gases is not covered under warranty. ▲

You may also have a laboratory environment that is contaminated with solvents or other agents that can corrode spectrometer components. Purging the spectrometer (forcing dried air or nitrogen through the spectrometer to eliminate water vapor, carbon dioxide and other airborne contaminants) will better protect the components. If your spectrometer is not sealed and desiccated, you must install a source of dry air or nitrogen to purge the spectrometer of water vapor, carbon dioxide and volatile solvents.

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

Important The interaction of chlorinated solvents, perfluorochlorinated solvents or other solvents containing halogenated hydrocarbons (for example, Freon®) with an IR source can corrode spectrometer components. Do not leave these solvents exposed around the spectrometer any longer than necessary. ▲

Purging the spectrometer can also ensure more accurate results. This is particularly true when you collect data for sample components that are also present in your laboratory environment.

Note If you ordered accessory modules such as an auxiliary experiment module or a gas chromatography interface, you might need more than one purge line. Contact technical support for more information. ▲

Selecting a purge gas

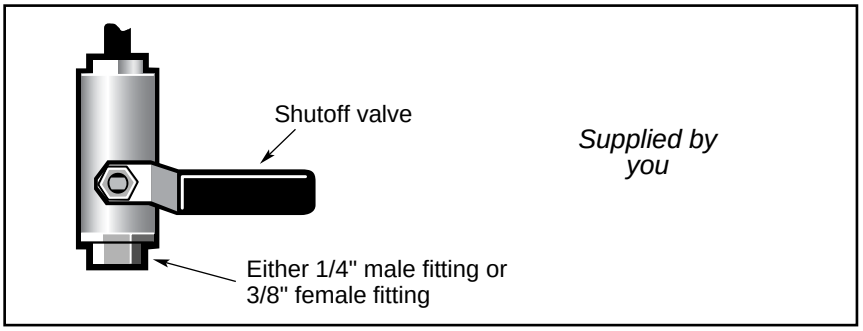
Dry air and nitrogen are equally effective in eliminating water vapor and volatile solvents, but nitrogen is more effective against carbon dioxide. The purge gas must be free of moisture, oil and other reactive materials. To remove particulate matter and oil, you may need to install a 10-micrometer filter. Dry air or nitrogen supplied for purge should be dried to a dew point of -70°C (-94°F) or below for best performance.

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

⚠ Warning *Never* use a flammable, combustible or toxic gas to purge the spectrometer. The IR source is an ignition source. ▲

Installing purge gas fittings

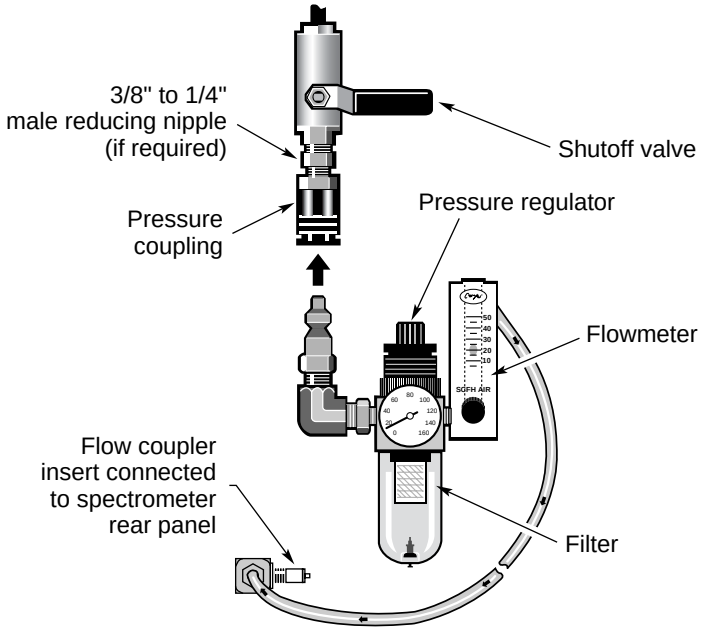
If you plan to purge the spectrometer, install the purge line and the necessary fittings *before* the spectrometer arrives (see the illustration below). The source line pressure should be at least 20 psig and must not exceed 100 psig.



A pressure regulator and flowmeter will be installed by us to maintain the line pressure between 20 and 40 psig at the flowmeter inlet and a flow rate of 30 scfh for optimal data collection with a standard purge. If you have the Smart Purge™ option, set the line pressure regulator to 80 psig and the flow rate up to 100 scfh.

Note If your source of purge gas cannot provide the higher flow rate needed for Smart Purge (for example, you use a Whatman purge gas generator or pure air generator), an auxiliary accumulator tank must be installed. See “Smart Purge auxiliary tank” in this chapter for more information. ▲

Install the air or nitrogen line vertically, as shown in the following illustration. This prevents the flowmeter and pressure gauge scale from tilting when the gauge and regulator assembly are attached later. It also prevents moisture from accumulating in the system. We installs the pressure coupling and the reducing nipple (if it is needed).



Once the line is installed, attach either a 1/4-inch male fitting or a 3/8-inch female fitting. The pressure coupling will be attached to the 1/4-inch male fitting by us. If you used the 3/8-inch female fitting, the reducing nipple will be installed by us before the pressure coupling is attached.

The pressure regulator, flowmeter and other related hardware will arrive preassembled with the spectrometer. (For additional information, see “Installing purge controls” under “Installing optional hardware” in Spectrometer Help Topics.)

Note If you are purging a system with a tabletop optics module (TOM), or another experiment module, you will need to install a purge manifold. (For installation instructions, see “Connecting an accessory to purge gas” in the “Installing optional hardware” book in Spectrometer Help Topics.) ▲

Purge gas generators

If your facility does not have a source of clean, dry, compressed air or nitrogen for system purge, consider using a purge gas generator. This device cleans and dries the air supplied by an air compressor for purging a spectrometer. (For facilities without an air compressor, a complete dry-air generating system is available; see the next section.)

The spectrometer works well with the Whatman® (Balston®) purge gas generators shown in the following table. The generator supply voltage and frequency are not adjustable, so be sure to order the correct items for your local utility service. The power consumption of the generators is listed earlier in the section called “Power consumption.”

Specification	*Whatman Model Numbers* Thermo Fisher Scientific Part Numbers *75-52* 869-050500	 *75-52EU* 869-050600
Nominal input line voltage	120 *vac*	240 *vac*
Dew point	-73°C (-100°F)	-73°C (-100°F)
Maximum dry (outlet) air flow rate for specified dew points*		
inlet pressure 8.50 atm (125 psig)	34 liters/min (72 scfh)	34 liters/min (72 scfh)
inlet pressure 4.08 atm (60 psig)	17 liters/min (36 scfh)	17 liters/min (36 scfh)
Air consumption for regeneration**	28 liters/min (60 scfh)	28 liters/min (60 scfh)
Minimum inlet air pressure	4.08 *atm* (60 psig)	4.08 *atm* (60 psig)
CO_2 concentration	< 1 ppm	< 1 ppm
Maximum inlet air temp.***	25°C (78°F)	25°C (78°F)
Inlet/outlet port size	1/4 inch NPT (female)	1/4 inch NPT (female)
Shipping weight	18 kg (40 lb)	18 kg (40 lb)

* Dew point will be lower than specified at lower air flow.

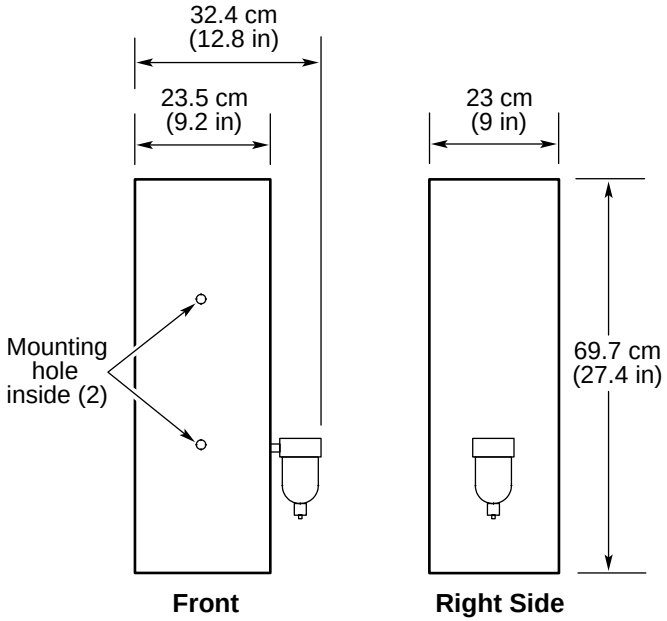
** Total air required = air loss + process demand (up to maximum dry air flow rate).

*** Outlet dew point will increase at higher inlet compressed air temperatures.

Note Position the purge gas generator away from the spectrometer to reduce noise and vibration. ▲

Important Purge gas generators require a minimum pressure for proper operation. Failure to supply this pressure may allow moisture to enter the system, causing permanent damage. See the preceding table for the minimum pressure values. ▲

The following illustration shows the dimensions of the Whatman Models 75-52 and 75-52EU purge gas generators and the locations of holes that can be used for mounting the generators on a wall. When not wall-mounted, these models should be placed on the floor.



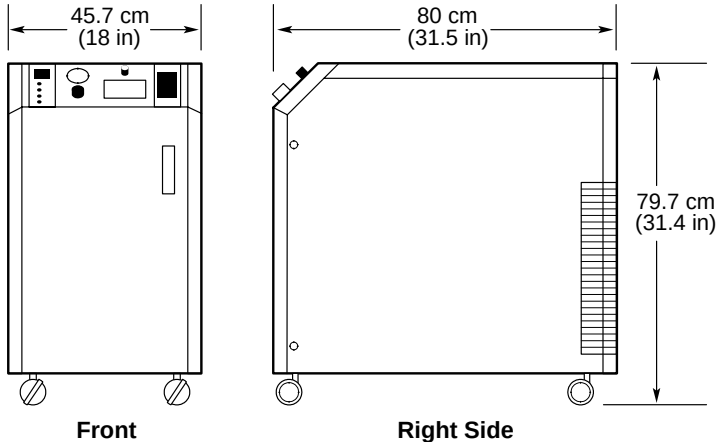
Model 75-52 (and 75-52EU)

Pure air generator

We also offer a pure air generator. This is a complete dry-air generating system that contains an air compressor, so it can be used in facilities that do not have a source of compressed air. The system also includes a dryer, prefilters, a final filter/moisture indicator and flow controls. The following table lists the part numbers and specifications for the two available generator models.

	Whatman Model Numbers Thermo Fisher Scientific Part Numbers	
Specification	*74-5041* 869-065500	*74-5041EU* 869-065600
nom. input line voltage, freq.	110 *vac*, 60 Hz	220 *vac*, 50 Hz
dew point	-73°C (-100°F)	-73°C (-100°F)
max. air flow rate at 80 psig	28 liters/min (60 scfh)	28 liters/min (60 scfh)
CO_2 concentration	< 1 ppm	< 1 ppm
outlet port size	1/4 inch NPT (female)	1/4 inch NPT (female)
Shipping weight	114 kg (250 lb)	114 kg (250 lb)

The dimensions of the pure air generator are as follows.



Pure air generator

Note Read the manufacturer's instructions before installing air-drying equipment or performing any maintenance, such as changing the filters. The installation and maintenance of air-drying equipment is *your* responsibility. Failure to change the filters at least once a year and perform other routine maintenance can void the warranty. ▲

Important *Before* you connect a pure air generator to the spectrometer, it is *vital* that you purge the generator of water and particulates by running it for at least 12 hours at nominal air flow. Otherwise, you risk severe damage to the beamsplitter and detectors in the spectrometer when you connect the pure air generator. ▲

Smart Purge auxiliary tank

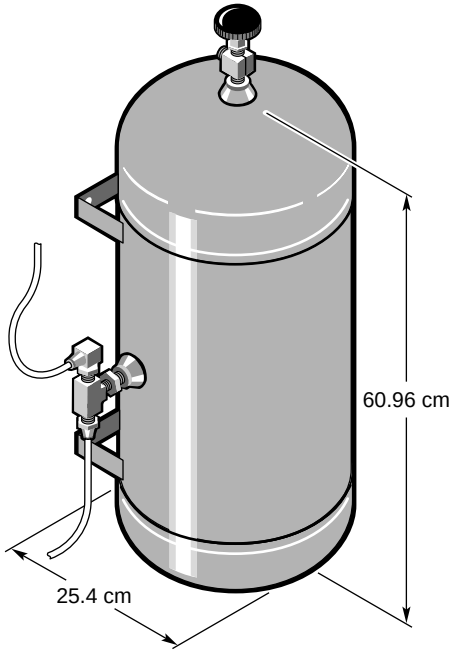
The Smart Purge option increases the purge gas flow rate when you install or remove samples. Using the optional purge tank will improve the Smart Purge performance if your purge gas source pressure is not high enough. See the following table for details.

*Flow Rate**	*Tank Needed?*	*Comments:*
less than 50 scfh	Yes	Some purge gas and pure air generators provide a flow rate of less than 50 scfh.
50-99 scfh	optional	Using the tank will improve performance.
100 scfh or more	No	A flow rate of 100 scfh gives the best results.

* Flow rates greater than 50 scfh cannot be measured with the flowmeter installed by us. See your air dryer manual or contact the department that maintains your purge equipment if you don't know the flow rate of the purge gas source.

The illustration that follows shows the dimensions of the Smart Purge auxiliary tank and fittings.

The Smart Purge auxiliary tank and fittings weigh a total of 3.64 kg (8.0 lb). To mount the tank on a wall, you need anchoring hardware and either 10-32 or 10-24 screws.

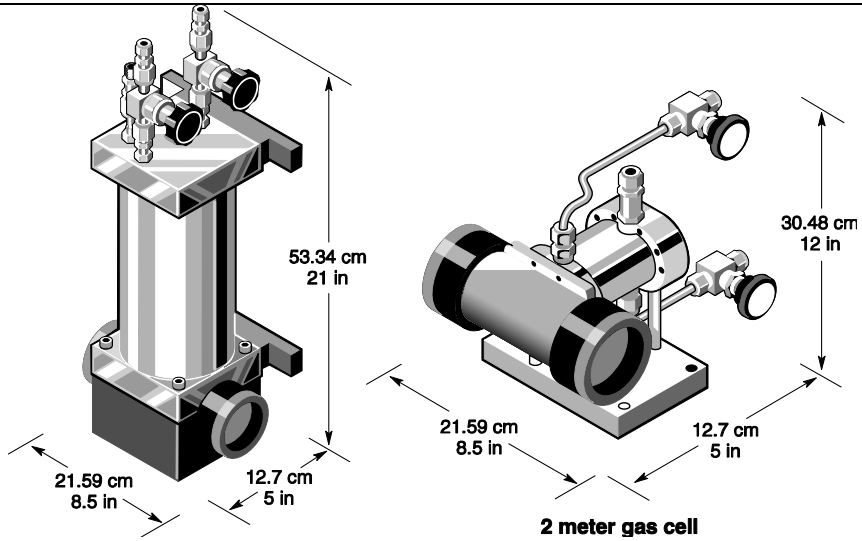


Purge tank dimensions

Gas cells

If you plan to use a gas cell with your Nicolet FT-IR spectrometer, you are required to provide all sample transfer and ventilation lines. Check with your fire, public safety, and other regulatory authorities for specific requirements for your location.

Component	*Height*	*Width*	*Depth*	*Weight*
Nicolet 10 meter gas cell	60.96 cm (21 in)	21.59 cm (8.5 in)	12.7 cm (5 in)	6.804 kg (15 lb)
Nicolet 2 meter gas cell	30.48 cm (12 in)	21.59 cm (8.5 in)	12.7 cm (5 in)	3.629 kg (8 lb)



Additional space is required for any pressure or temperature controllers you plan to use. See the documentation that accompanies the controller for specifics.

⚠ Warning Check valves are provided for each gas cell. In the event of over pressurization in a system sampling flammable gases, flammable vapors can build in the atmosphere, presenting a fire or explosion hazard. To avoid fire or explosion, be sure that the workspace is well ventilated to prevent the buildup of flammable gases in the atmosphere surrounding the spectrometer. ▲

We recommend using sample transfer lines to vent the check valves in systems that will be used to analyze flammable, hazardous, noxious, toxic, reactive, and/or asphyxiant gases.

The table that follows lists the components that are protected by check valves and the connections required to vent them using sample transfer lines.

Component	*Check valve connector type*	*Check valve customer supplies*
Nicolet 10 meter gas cell	0.25" male VCR	0.25" female stainless VCR
Nicolet 2 meter gas cell	0.25" Swagelok®	0.25" stainless tubing

Liquid nitrogen

If you plan to use a spectrometer or accessory that has a cooled detector, you will need a supply of liquid nitrogen to cool the detector element. The amount of liquid nitrogen needed varies, but an MCT detector uses about one liter of liquid nitrogen during eight hours of continuous use. If you are using a Nicolet Continuµm or Nicolet Centaurµs microscope, 750 milliliters will provide approximately 18 hours of cooling.

⚠ Caution 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 detector dewar, pour slowly. Pouring too quickly can cause the bottle or dewar to expel liquid nitrogen. ▲

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

Important Do not spill liquid nitrogen onto or near the detector window. Rapid cooling of the window's O-ring seal can cause the dewar to lose vacuum. Prolonged exposure to atmospheric pressure can damage the detector element. ▲

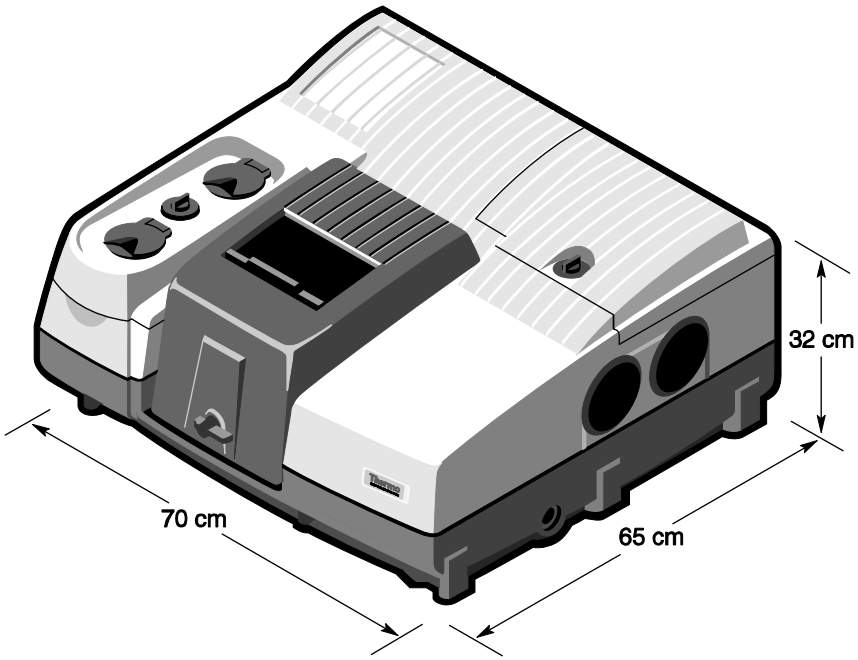
Accessories

This chapter provides preinstallation considerations and dimensional drawings for Nicolet FT-IR accessory modules, microscopes and gas cells. Study the drawings to help plan your bench work space.

We will install all accessory modules and microscopes.

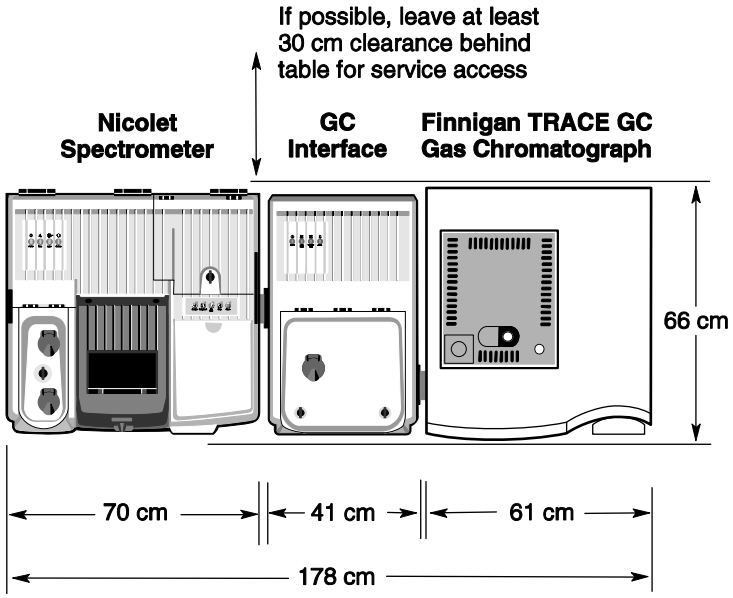
Auxiliary experiment module

The auxiliary experiment module (AEM) weighs approximately 46 kg (102 lb). It is 65 cm (25.5 in) deep by 70 cm (27.5 in) wide by 32 cm (12.5 in) high. The AEM can be installed on either side of a Nicolet FT-IR spectrometer, and any accessory or detector that can be installed in the main spectrometer can be installed in the AEM.



GC interface module

This interface lets you analyze spectra from GC experiments. It connects to the right side of the main spectrometer and to a gas chromatograph (GC) as shown below.



GC system dimensions

The Nicolet FT-IR spectrometer, GC interface and GC require a continuous space of at least 178 cm (70 in). If possible, leave at least 30 cm (12 in) behind the units to allow service access.

An adjustable-height table for the GC interface and GC is available from us. Setting the GC interface and oven on a separate table helps prevent heat transfer from the GC oven to the spectrometer.

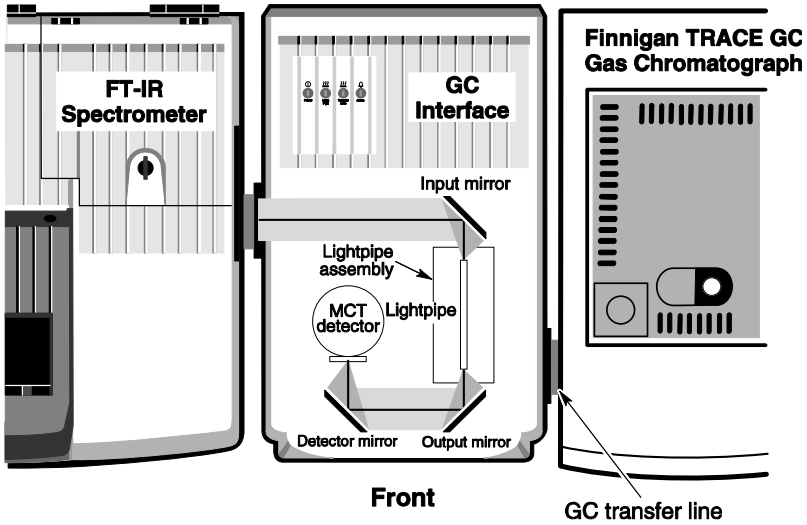
GC carrier gas

Before GC installation, you must provide a supply of carrier gas appropriate for standard GC operation (usually helium). Contact the GC oven manufacturer for more details.

GC detector gases

A flame ionization detector (FID) is optional for the GC. It burns the eluate exiting the column and detects the ions produced by the combustion. The FID is for GC experiments that do not make use of FT-IR. If you want an FID, you must provide supplies of hydrogen and dry air, plus regulators for their use. If you have an operating manual for the GC, check it for instructions on supplying hydrogen and dry air. If you don't have an operating manual, check with our service representative.

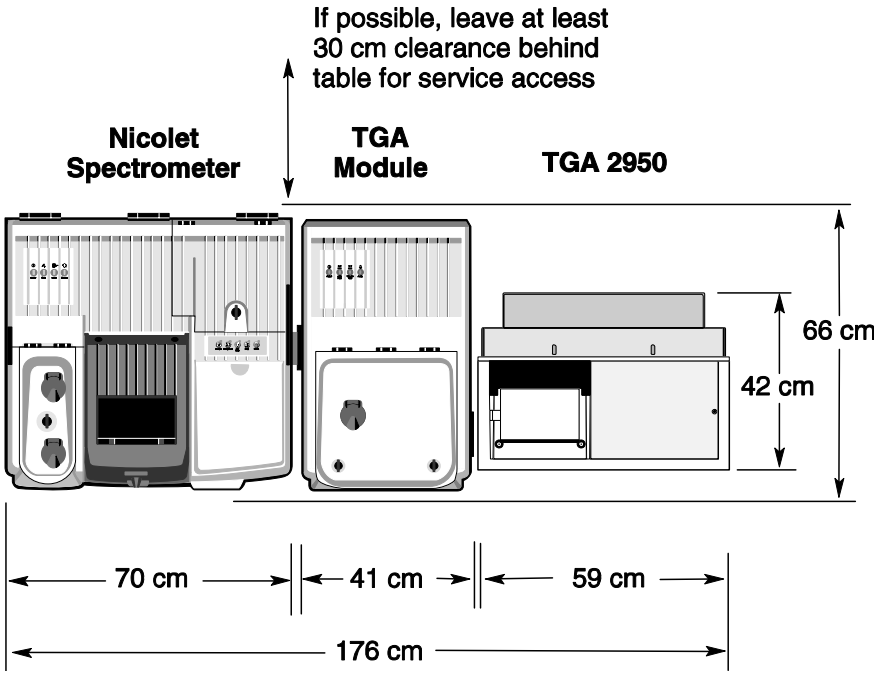
⚠ Warning Hydrogen gas can flow into the GC oven and create an explosion hazard. Therefore, all plumbing must be leak-tested with helium at recommended pressures before hydrogen can be used. See the manuals provided with the GC for pertinent safety precautions and procedures. If we install the GC oven, our representative will perform the needed tests. ▲



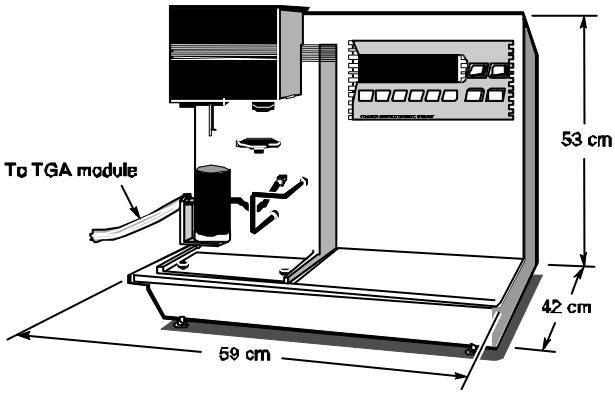
GC interface optical layout

TGA module

This interface lets you analyze spectra from TGA experiments. It connects to the right side of the main spectrometer and to a gas thermogravimetric furnace as shown below.



TGA system dimensions



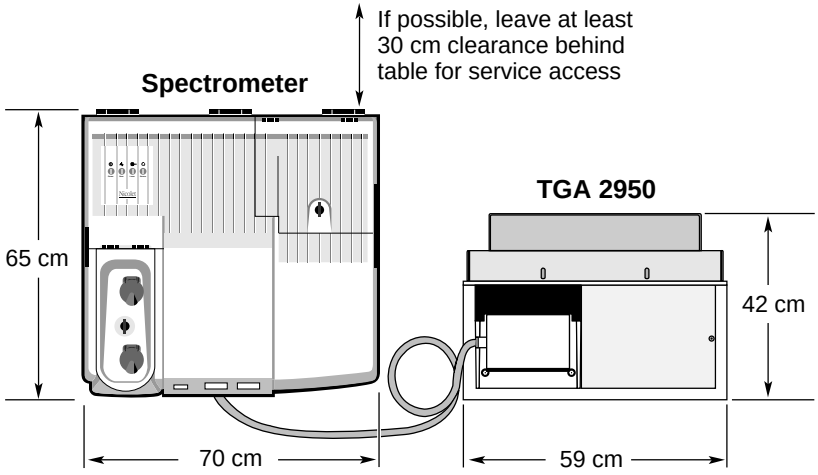
TGA furnace dimensions

The Nicolet FT-IR spectrometer, TGA module and TGA furnace require a continuous space of at least 176 cm (69 in). If possible, leave at least 30 cm (12 in) behind the units to allow service access.

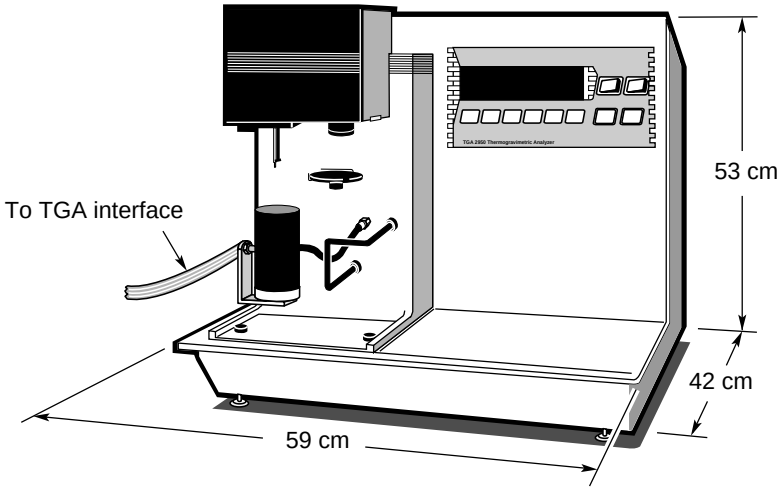
An adjustable-height table for the TGA module and TGA furnace is available from us. Setting the TGA modules and furnace on a separate table helps prevent heat transfer from the TGA furnace to the spectrometer.

TGA interface

This interface allows you to analyze the evolved gases from thermogravimetric analysis (TGA) experiments. It fits in the sample compartment of the main spectrometer and is equipped with a built-in, temperature-controlled flow cell. The interface connects the spectrometer to a TGA furnace.



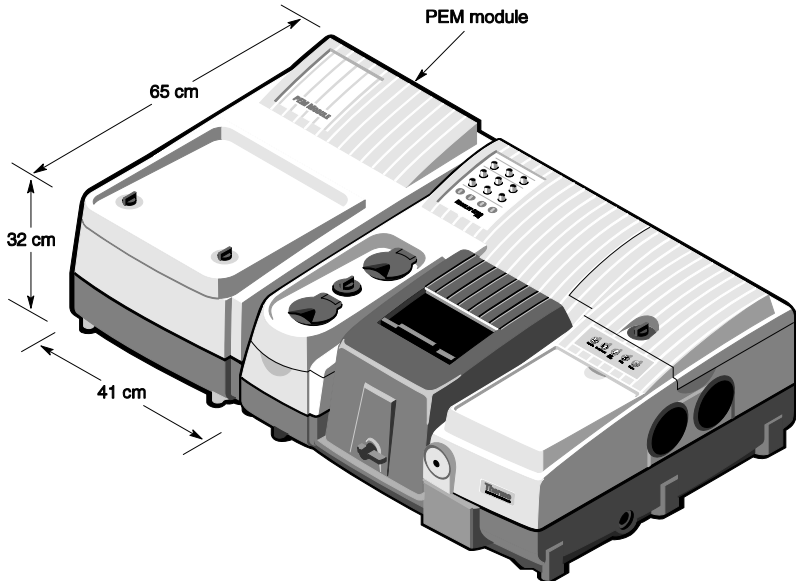
TGA system dimensions



TGA dimensions

PEM module

The photoelastic modulator (PEM) module weighs approximately 32 kg (70 lb) and is 65 cm (25.5 in) deep by 41 cm (16.1 in) wide by 32 cm (12.5 in) high. This module can be installed on the left side of a Nicolet 8700 or a Nicolet 6700 FT-IR dual-channel spectrometer.



PEM module dimensions

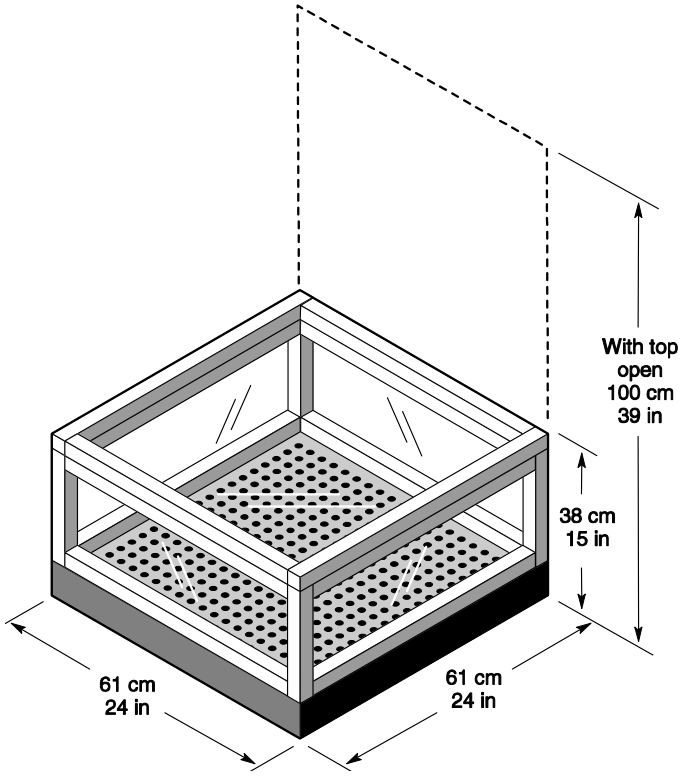
The table below shows the approximate dimensions and weights of the PEM components.

Component	*Width*	*Height*	*Depth*	*Weight*
PEM Controller	21.3 cm (8.4 in)	9.9 cm (3.9 in)	30.5 cm (12 in)	2.5 kg (5.4 lb)
Synchronous Sampling Demodulator (SSD)	21.6 cm (8.5 in)	14.6 cm (5.8 in)	33.0 cm (13.0 in)	3.9 kg (8.5 lb)

Tabletop optics module (TOM)

The tabletop optics module (TOM) external hardware kit includes a table-top optical mounting plate with a purgeable enclosure. You may also have an SSD (synchronous sampling demodulator), a high-pass filter, the PEM (photoelastic modulator) controller and heads, transmission and grazing angle sample holders, a polarizer, transfer and focusing optics, and optical filters.

The optical mounting plate, the largest component, must be placed next to the spectrometer. It can be installed on either the right or left side. The following illustration shows the optical mounting plate installed on the right side of the spectrometer.

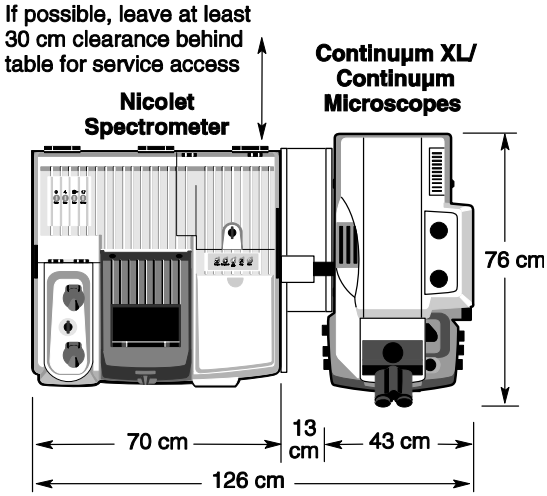


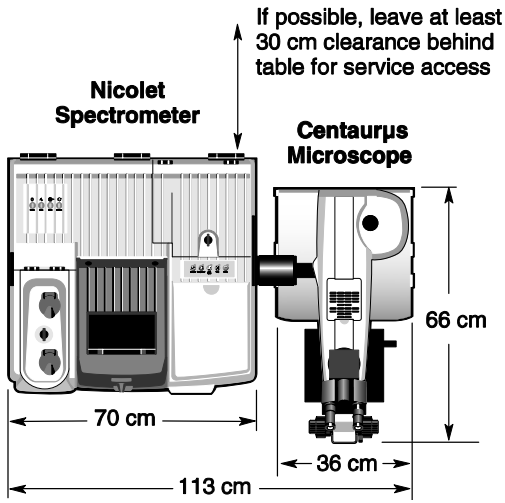
The table below shows the approximate dimensions and weights of the TOM kit components. Components not listed in the table are part of the TOM optical mounting plate. Your work area must be large enough to accommodate all of the listed components.

Component	*Width*	*Height*	*Depth*	*Weight*
TOM mounting plate kit	63.8 cm (25.1 in)	38.6 cm (15.2 in)	61.0 cm (24.0 in)	55.0 kg (120.0 lb)
Synchronous Sampling Demodulator (SSD)	21.6 cm (8.5 in)	14.6 cm (5.8 in)	33.0 cm (13.0 in)	3.9 kg (8.5 lb)
PEM controller	21.3 cm (8.4 in)	9.9 cm (3.9 in)	30.5 cm (12.0 in)	2.5 kg (5.4 lb)

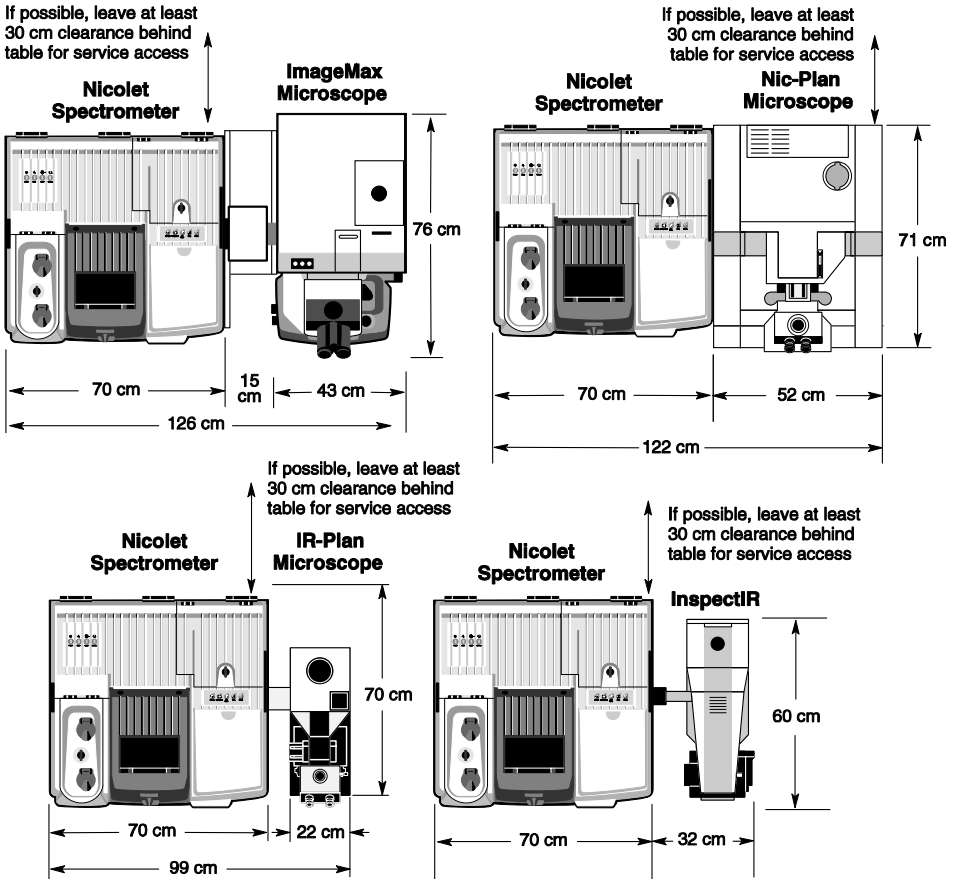
IR microscopes

We offer microscopes that attach directly to the side of the main spectrometer. The Nicolet Continuμm, Nicolet Continuμm XL and Nicolet Centaurμs microscopes can be installed between the spectrometer and other accessory modules. If you plan to attach one of these microscopes to a Nicolet FT-IR spectrometer, use the following drawings to plan your work space. Choose a table height that allows you to work comfortably with the spectrometer, but keep in mind that the microscope eyepiece will be 48 to 53 cm (19 to 21 in) above the table top.



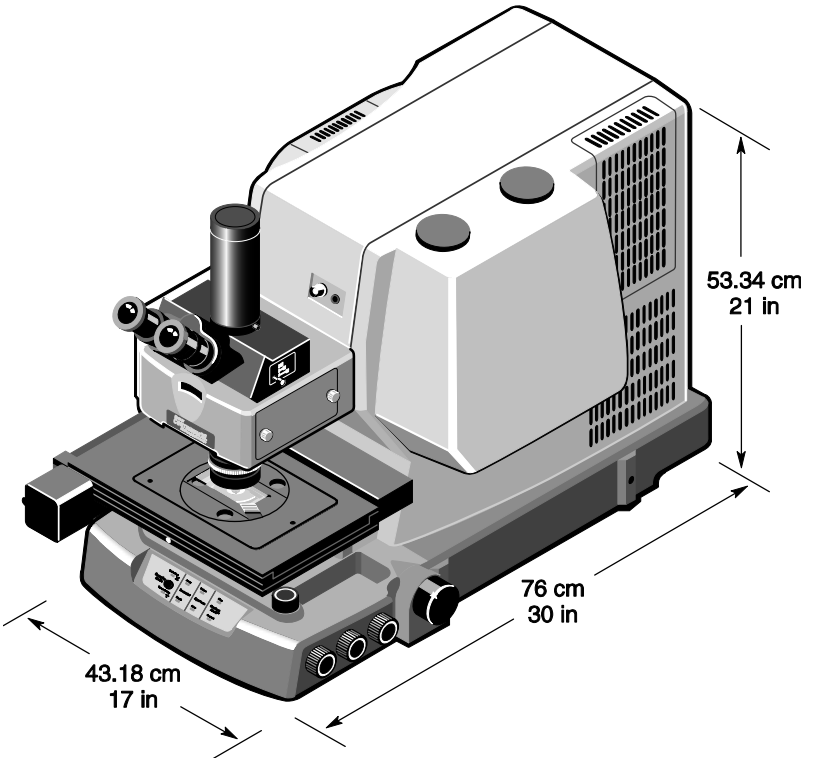


Older microscope models may also be installed with Nicolet FT-IR spectrometers. If your laboratory plans to attach a Nic-Plan, ImageMax, InspectIR, or IR-Plan microscope to the spectrometer, use the drawing that follows to plan the workspace.



Nicolet Continuμm and Nicolet Continuμm XL

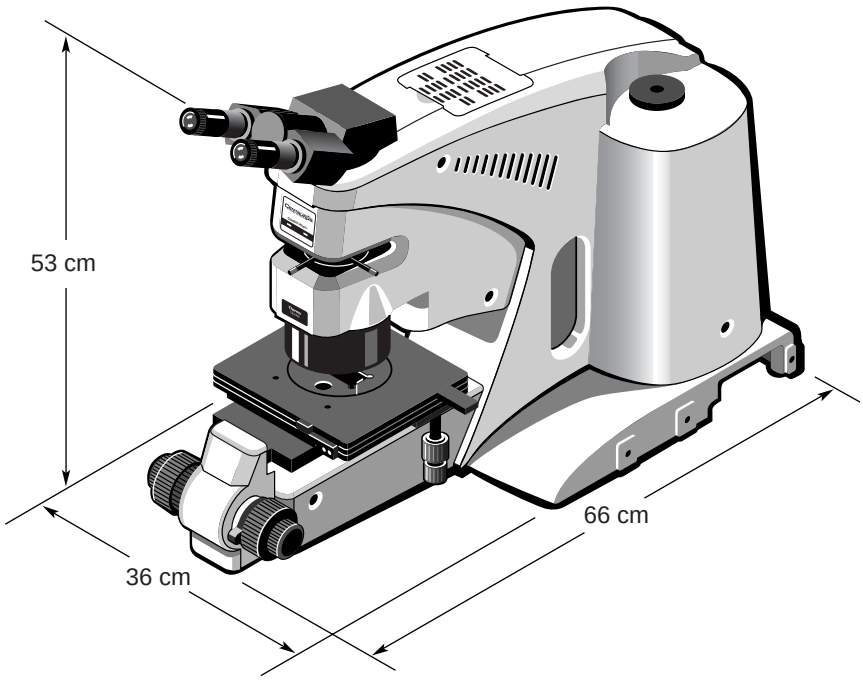
Nicolet Continuμm and Nicolet Continuμm XL microscopes weigh approximately 79.38 kg (175 lb). Use the dimensions shown in the following illustration to help plan your work space.



Nicolet Continuμm and Nicolet Continuμm XL dimensions

Nicolet Centaurμs

Nicolet Centaurμs microscopes weigh approximately 30 kg (65 lb). The beam port on the Nicolet Centaurμs can attach to either side of a Nicolet FT-IR spectrometer, but it cannot pass the beam through to another accessory. When the beam port attachment is present, 7.6 cm (3 in) is added to the width of the microscope. In addition, if the optional eyepiece is installed, 11.5 cm (4.5 in) is added to the height. Use the dimensions shown in the following illustration to help plan your work space.



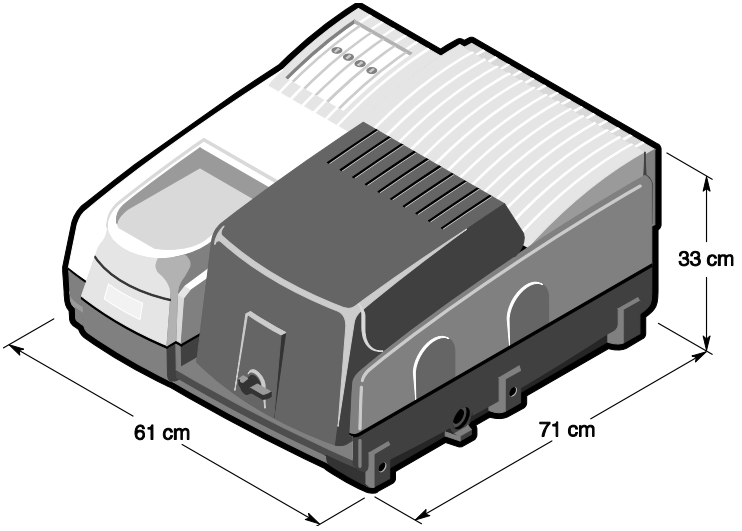
Nicolet Centaurμs dimensions

FT-Raman module

The FT-Raman module must be installed on the right side of a Nicolet FT-IR spectrometer. No other modules can be installed on the right side of the FT-Raman module. Your work space must be wide enough to accommodate the spectrometer, the FT-Raman module and any other modules that are installed on the left side of the spectrometer.

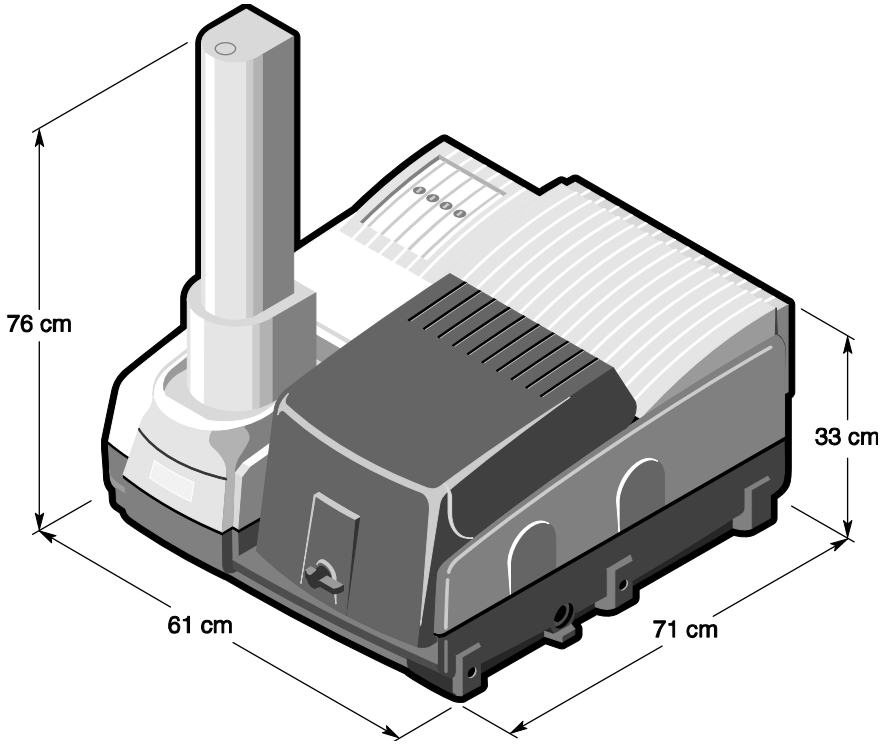
Important The excitation laser and electronics are air-cooled by two fans, one located in the FT-Raman module rear panel and one located in the bottom of the accessory. To avoid overheating of the instrument, do not block the free flow of air into or out of the rear panel or the flow of air under the accessory. There should be at least 15 cm (6 in) of clearance behind the accessory. ▲

If the FT-Raman module is equipped with a standard InGaAs (Indium-Gallium Arsenide) detector, it weighs about 45 kg (100 lb). It is 61 cm (24 in) wide by 71 cm (28 in) deep by 33 cm (13 in) high.



Nicolet FT-Raman module dimensions

If the module is equipped with an optional Ge (germanium) detector, it weights approximately 52 kg (115 lb). It is 61 cm (24 in) wide by 71 cm (28 in) deep by 76 cm (30 in) high.



Nicolet FT-Raman module with optional Ge detector

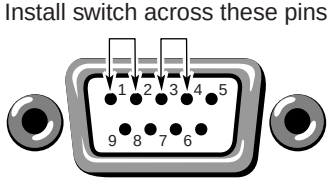
External safety interlock

The Nicolet FT-Raman Module is a Class II laser product that contains a Class IV, Nd-YAG 1064 nm laser. You may be required to install an external remote interlock to protect against exposure to visible or invisible laser radiation during service.

In compliance with the United States Code of Federal Regulations and international laser safety standards, the Nicolet FT-Raman module can be connected to an external remote safety interlock system that you have designed. Such a system allows the excitation laser beam to be blocked in the event that a safety perimeter around the spectrometer is breached; for example, by an unauthorized person opening a laboratory door.

⚠ Warning Verify that your laboratory is compliant with the American National Standard for the safe use of lasers (ANSI Z136.1-1986) and any other national or local laser safety requirements. This includes, but is not limited to:

- hazard evaluation and classification
- control measures
- laser safety and training programs
- special considerations
- criteria for exposure of the eye and skin. ▲



To make use of the external safety interlock system, you need to prepare a connector that has strain relief and install a switch across pins 1 and 2 and across pins 3 and 4 of the 9-pin, D-type connector.

When closed, the switch must be able to accommodate +12 VDC at 1 A.

⚠ Warning To prevent personal injury, the connector and other components of the laser safety circuit must be designed and built by persons you have properly trained. ▲

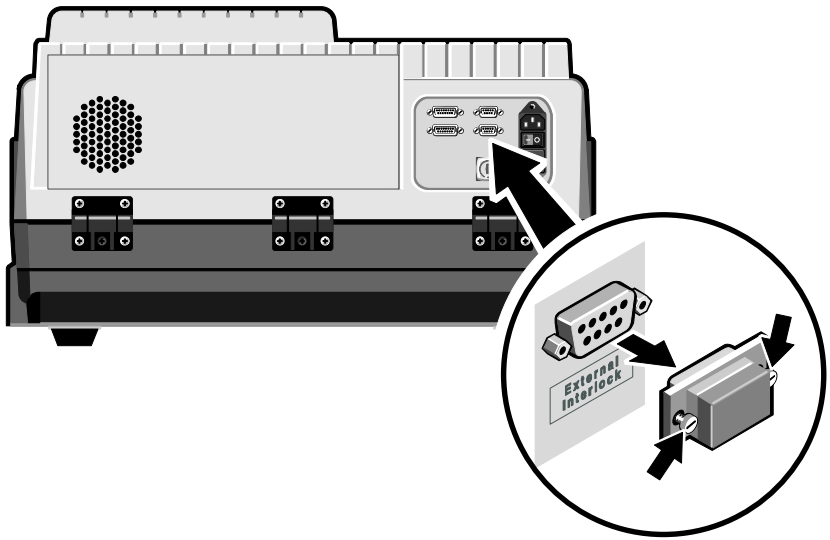
When the connector is installed on the accessory, closing the switch unblocks the laser beam; opening the switch blocks the beam. Contact technical support if you need help installing and testing a remote interlock system.

To connect a remote interlock system to a Nicolet FT-Raman Module:

1. **Loosen the strain relief screws until they spin freely and then remove the remote interlock override.**

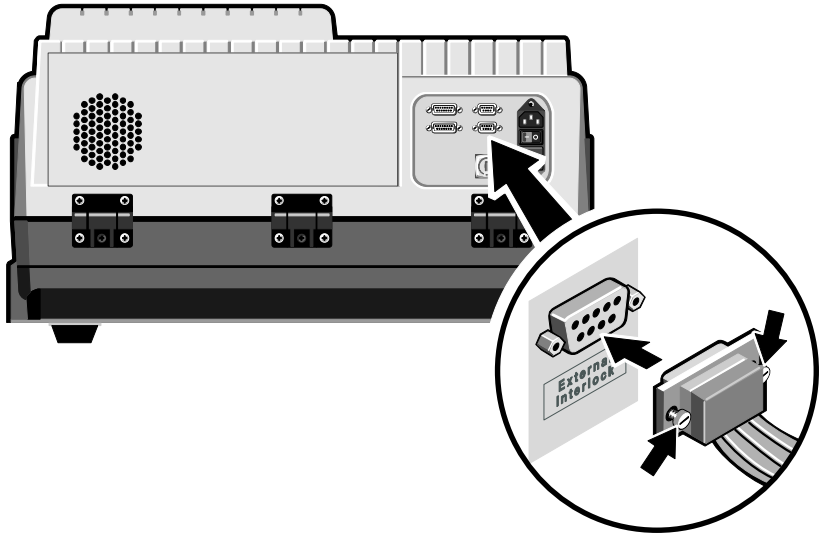
   Store the remote interlock override in a safe place. You cannot collect data unless the accessory is connected to a remote interlock system that enables the laser or the override is firmly in place.

Nicolet FT-Raman Module



2. **Connect the cabling from the remote interlock system to the external interlock connector.**

Nicolet FT-Raman Module



3. **Verify that the safety interlocks are operating properly.**

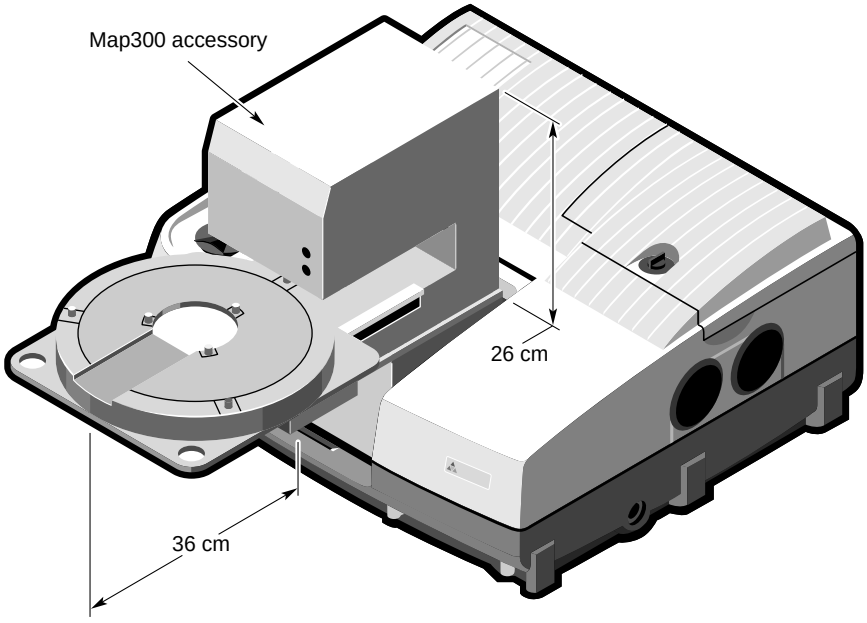
   The Laser at Sample indicator on top of the module should shut off when your remote interlock system engages the beam blockers.

ECO/RS

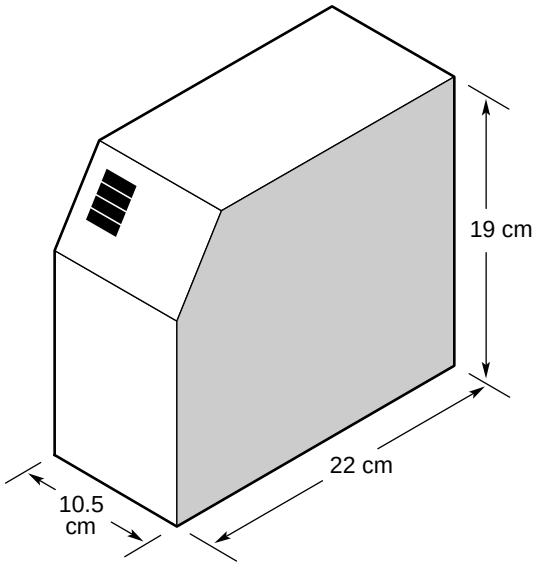
The ECO/RS is an integrated FT-IR system designed for analyzing semiconductor wafers. The ECO/RS spectrometer includes the following components:

- Nicolet 4700 FT-IR spectrometer.
- Map300 wafer handling accessory from PIKE Technologies.
- ECO software.

As shown in the illustration below, the wafer handling accessory extends approximately 26 cm (11 in) above the top of the spectrometer and 36 cm (14 in) beyond the front of the spectrometer. The accessory's motor controller rests on the table next to the spectrometer and contains the electronics and power supply for the accessory. To determine the space needed for your particular spectrometer and the accessory (not including the motor controller), add these distances to the appropriate dimensions of your spectrometer. See "System dimensions and weight" in the "Location" chapter for the dimensions of your spectrometer.



The motor controller for the wafer handling accessory is approximately 10.5 cm (4 in) wide by 22 cm (9 in) deep by 19 cm (7.5 in) high.



The following table shows the approximate weights of the wafer handling accessory components.

Component	*Weight*
Map300 accessory	16 kg (35 lb)
Motor controller	1.8 kg (4 lb)

Computer Requirements

If you are supplying your own computer, be sure that it meets the following requirements for hardware and software.

- One of the following versions of Windows® software:
  - Windows 2000 (latest Service Pack recommended)
  - Windows XP Professional (latest Service Pack recommended)
- Microprocessor:
  Intel® Pentium® III, 1.0 GHz (recommend)
  Intel Pentium II, 400 MHz (minimum)
- Random access memory (RAM):
  256 megabytes (recommended)
  128 megabytes (minimum)
  If you plan to use a microscope,
  1 gigabyte (recommended)
  512 megabytes (minimum)
- Disk drives:
  5.0 gigabytes (recommended) hard disk drive
  2.0 gigabytes (minimum) hard disk drive
  1.44-megabyte floppy disk drive for 3.5-inch floppy disks
  Quad speed CD-ROM drive
- Video:
  15-inch SVGA
  4 megabytes of video RAM
  16-bit video card capable of displaying at least 256 colors with 1024 by 768 resolution

- IO devices and card slots:
  Sound card and speakers for listening to the audio portions of tutorials

  Keyboard and serial, USB or PS/2®-style mouse

  Printer port (USB, parallel and/or serial) if you plan to print on a local printer

  One USB 2.0 connector (not a hub) for 6700, 5700 and 4700 data transfer

  One PCI slot for data transfer from 8700 spectrometers with dual-channel data collection compatibility

  Ethernet port if you plan to connect the system to a network
  Internet connection if you plan to use the internet features of the software

  One additional serial port if you plan to use PLUS™ 2 Liquid Analysis System, Centaurμs microscope with motorized stage, or standard Continuμm microscope

  Two additional serial ports if you plan to use a Continuμm microscope with a motorized stage

  Two additional serial ports and one additional USB 2.0 connection (not a hub) if you plan to use a Continuμm XL microscope

  One additional PCI slot if you plan to use a microscope with video capability or 8700 with step-scan time-resolved capability

Preinstallation Check List

Use this check list to ensure that all preinstallation steps have been performed. You will then be ready to install the system.

Location

- ❒ The location is easily accessible to our personnel.
- ❒ The system fits through the necessary doorways and elevators.
- ❒ There are no floor vibrations from air conditioners, motors, etc.
- ❒ There are no intense magnetic fields.
- ❒ The floor and table(s) are strong enough to support the system.
- ❒ The table height is convenient for the spectrometer and accessories.
- ❒ There is adequate clearance around and above the system.
- ❒ A telephone is available within reach of the operator on line.

Environmental considerations

- ❒ There is no static-producing carpet.
- ❒ No windows are nearby.
- ❒ The temperature stays between 16° and 27°C (68° and 80°F). For best performance, the temperature should be between 20° and 22°C (68° and 72°F)
- ❒ The humidity (noncondensing) is between 20% and 80%.
- ❒ The environment is free of dust.

Utility service

- ❒ A dedicated power line is available.
- ❒ There is enough power to run the spectrometer and accessories.
- ❒ There is a definite earth ground (*not* neutral) for power outlets.
- ❒ Adherence to local building and safety codes is verified.
- ❒ A source of dry air or nitrogen is installed, unless your system is sealed and desiccated.

Other supplies

- ❒ A supply of liquid nitrogen is available if an MCT, InSb or other cooled detector will be used.

If you are supplying your own computer

- ❒ The computer meets the minimum requirements.
- ❒ Windows operating system software is installed on the computer.

When the System Arrives

Check carefully for obvious exterior damage of the shipping crates. If damage is apparent, contact Technical Support for specific instructions. The service engineer will also check for damage and verify the completeness of the shipment.

Move the shipping cartons to the installation location at least 24 hours prior to the installation appointment. This allows the instrument to slowly warm (or cool) to room temperature before the shipping cartons are opened and protective packaging is moved.

Important While moving the instrument to the installation location, keep the cartons upright. Damage due to improper moving techniques is not covered by warranty. ▲

Important The spectrometer is encased in a plastic bag to keep the optical components dry during shipment. Allow the spectrometer 24 hours to reach ambient temperature before opening the bag. If the bag is opened before the spectrometer has warmed (or cooled) to ambient temperature, moisture from the air could result in condensation on the optical components causing permanent damage. ▲

Spectrometers must be unpacked and installed only by our qualified service engineer. Shipping restraints and other specialized packaging protects your spectrometer and accessories during shipment. Improper unpacking can permanently damage the instrument. Do not open the shipping cartons. Do not unpack any components.

Important If the shipping cartons have been opened, your warranty does not cover missing or damaged parts. ▲

Do not connect the spectrometer to power. Powering on the instrument before the shipping restraints are removed will damage it. Damage caused by powering on before the shipping restraints are removed is not covered by your warranty.