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4000 GC/MS

Pre-Installation Instructions

Use these instructions to prepare your site for the installation of the 4000 GC/MS. After you have prepared the site, and your 4000 GC/MS has been delivered, please contact your local Varian, Inc. office to schedule the installation of your 4000 GC/MS.

For additional information about the GC refer to the CP-3800 GC Pre-Installation Instructions.

The Varian 4000 GC/MS has been designed to operate reliably under carefully controlled environmental conditions. It is your responsibility to provide a suitable location, power source, and operating environment. Operating or maintaining a system in operational conditions outside of the power and operating environment limits described below could cause failures of many types. The repair of such failures is specifically excluded from the Warranty and Service contract conditions.

The Varian 4000 GC/MS is tested according to Safety Standard EN 61010-1 and EMC Standard 61326-A1+A2, which is comprised of Electrical Immunity and Susceptibility Standards.



CAUTION

All phases of the installation site preparation must conform to local safety, electrical, and building codes. These codes take precedence over any recommendations in these instructions, and compliance to them is the responsibility of the customer.

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Space and Weight Requirements

Before arranging for delivery of the 4000 GC/MS to your facility, please make sure that all passages to the site of installation are at least 91.5 cm (36 in.) wide. Allow additional room for maneuvering the shipping container around corners and/or through doors.

Table 1 identifies the space and weight requirements of the 4000 GC/MS components. The 4000 GC/MS is intended to sit on a workbench that is wide enough and deep enough to accommodate these components, and sturdy enough to support their combined weight. Varian recommends the layout shown in Figure 1, and the space allowances in Table 2.

Table 1 Dimensions and Weights of the 4000 MS System Components¹

<i>Instrument</i>	<i>Height</i>		<i>Width</i>		<i>Depth</i>		<i>Weight</i>	
	<i>in.</i>	<i>cm</i>	<i>in.</i>	<i>cm</i>	<i>in.</i>	<i>cm</i>	<i>lb.</i>	<i>kg</i>
4000 MS	18	44	15	37	26	66	89	40
CP-3800 GC	21	53	26	66	22	56	95	43
CP-8400 AutoSampler / CP-8410 AutoInjector (sits on top of GC)	16	41	9	23	18	46	20	9
Tekmar 3000 Purge and Trap	19	48	9	23	18	46	37	17
Archon Purge and Trap AutoSampler	17	43	22	55	21	53	80	36
Tekmar ALS-2016	27	69	15	38	15	38	35	16
Genesis Headspace AutoSampler	22	56	28	71	18	46	110	50
MS Workstation (computer with monitor, approximate values)	20	51	17	43	21	53	35	16

¹Rounded up to nearest unit.

Table 2 Spatial Set-up Requirements for 4000 GC/MS

<i>Recommendations</i>	<i>Purpose</i>	<i>Recommended Distance</i>
Allow adequate space to the right of the GC/MS.	Permit access to the transfer line and turbomolecular pump. See Figure 1.	~ 61 cm (24 in.)
Allow adequate space behind the system.	Provide clear space for air circulation, gas lines, and electrical connections.	15 to 30 cm (6 to 12 in.)
Allow vertical clearance above the GC/MS.	Dissipate heat and allow for routine maintenance.	≥102 cm (40 in.)
Allow additional bench space beside the Workstation keyboard	Enable mouse operation.	20 cm x 20 cm (8 in. x 8 in.)

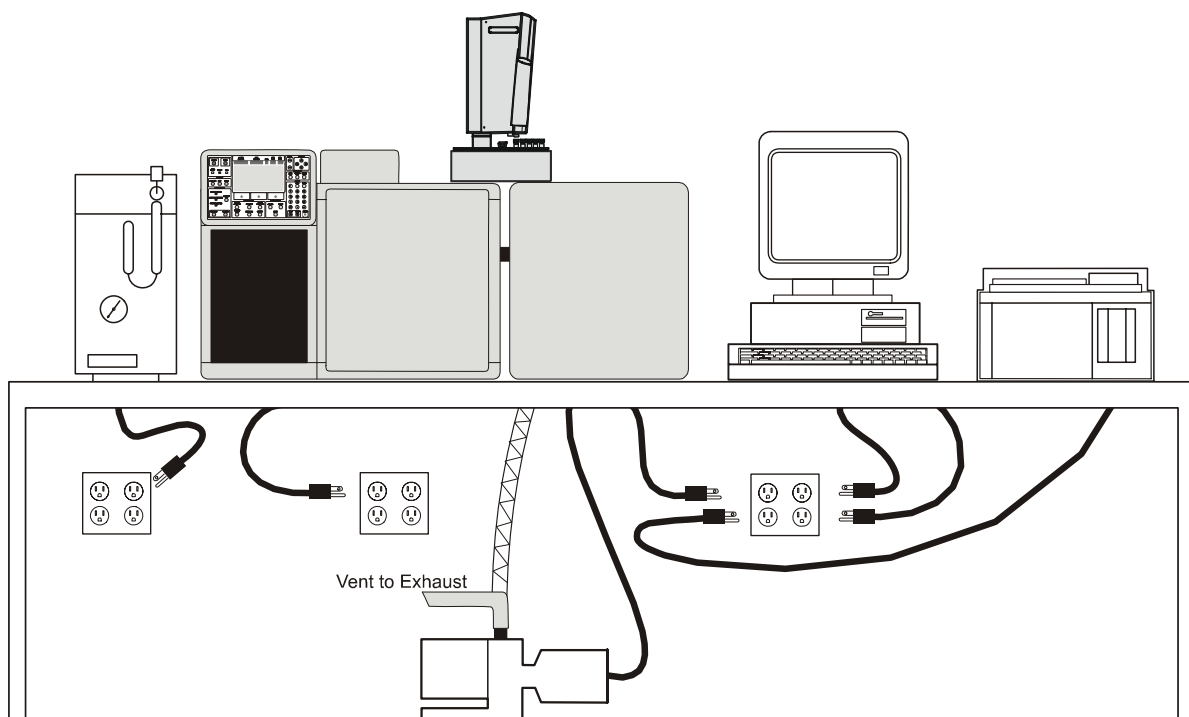


Figure 1 Recommended System Layout

The 24.5 kg (54 lb) mechanical pump belongs on the floor beneath the workbench on which the 4000 GC/MS system sits. To accommodate the pump, the workbench should be no higher than 91 cm (36 in.); if you use a higher table, be sure to place a suitable stand or support under the table to elevate the pump. If your bench adjoins a wall, you will either need to drill a 38 mm (1.5 in.) diameter hole through the bench to accommodate the vacuum hose, or to place a suitable shelf above the 4000 GC/MS for the pump.

The cable between the computer and MS cannot be longer than five meters (16.4 feet) without adding powered hubs or extension cables which could affect performance.

Power Requirements

You are responsible for providing two dedicated fourplex single-phase power sources with earth grounds hard-wired to the main power panel ground. Within North America and Japan these power sources must be 20A, 90-130 Vac, 60 Hz $\pm$ 3 Hz, and outside these locations they must be 10A, 180-260 Vac, 50 Hz $\pm$ 3 Hz. One of these fourplex power sources is for the mass spectrometer, computer, monitor, and printer. The other fourplex power source is for the gas chromatograph. If you have additional sample preparation devices or test equipment, we recommend a separate dedicated power source for their operation.

Care must be taken to ensure that sources of radio frequency interference (RFI) and electromagnetic interference (EMI) are not placed on the same power line, or share the same ground plane, since this can degrade the performance of the GC. Equipment such as motors, solenoids, fluorescent light fixtures, and radio communication transmitters should be isolated from the instrument and connecting cables as much as possible.

The power cable from the GC is approximately 2m (6 ft) long and fitted with National Electronics Manufacturers Association (NEMA) 5-20P power plugs. The NEMA 5-20P power plug and corresponding outlet are shown in Figure 2(a). NEMA 5-20P plugs are rated at 20A and 120 Vac.

The power cable from the mass spectrometer is approximately 2.5m (8 ft) long and fitted with US Standard National Electronics Manufacturers Association (NEMA) 5-15P power plugs. The NEMA 5-15P power plug and corresponding outlet are shown in Figure 2(b). NEMA 5-15P plugs are rated at 15A and 120 Vac.

Systems shipped outside the United States, Canada, and Japan are fitted with CEE 7/7 plugs; these are rated at 16A and 230 Vac. The CEE 7/7 plug and outlet are shown in Figure 2(c).

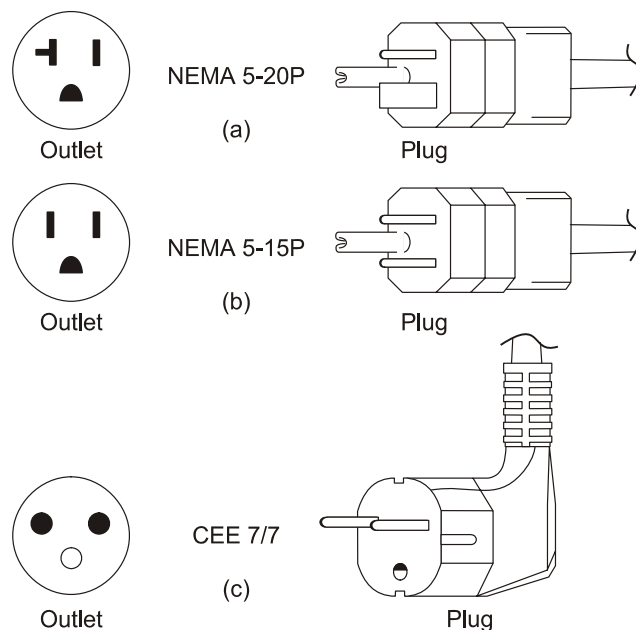


Figure 2 NEMA 5-20P, NEMA 5-15P, and CEE 7/7 Power Plugs and Outlets

The power cables for the computer, monitor, and printer are approximately 2m (6 ft) long. They are fitted with NEMA 5-15P plugs.

With a 120V power source, the maximum amperage requirements for each of the 4000 GC/MS components are as follows:

<i>Component</i>	<i>Amperes</i>
Mass Spectrometer	12
CP-3800 Gas Chromatograph	20
CP-8400 AutoSampler	0.5
Computer	3
Monitor	2
Laser Printer	3-4

NOTE: With a 230V power source, the maximum amperage requirement of each of the above components is one-half of the amperage given above.

Never plug the mass spectrometer and the gas chromatograph into the same power source as you may overload the fourplex power source. Never use the free outlet on each of the power sources for equipment drawing more than 2A.

The quality of the power supplied to your 4000 GC/MS is very important. The power must be 90-130 Vac, 60 Hz $\pm$ 3 Hz (180-260 Vac, 50 Hz $\pm$ 3 Hz outside North America), and it must be stable, i.e., it must be free of fluctuations due to slow changes in the average voltage or to changes resulting from surges, sags, or transients.

Under normal operating conditions the MS unit draws about 600 watts of power. Under bake out conditions this can increase to 1000 watts. The GC can draw up to 2.5 kilowatts of power but usually will average half that amount even when using demanding methods.

Slow, average voltage changes are gradual, long-term changes in the average root mean square (RMS) voltage level, with typical durations greater than 2 seconds.

- Sags and surges are sudden changes in average RMS voltage level, with typical durations between 50 μ sec and 2 seconds.
- Transients (or impulses) are brief voltage excursions of up to several thousand volts with durations of less than 50 μ sec.

Constant high line voltage or surges in voltage may produce overheating and component failures. Constant low line voltage or sags in voltage may cause the system to function erratically, or even to cease functioning. Transients, even of a few microseconds duration, may cause electronic devices to fail catastrophically or degrade sufficiently to significantly shorten device lifetime. It is important to establish the quality of the line power in your laboratory prior to installation of the 4000 GC/MS.

Occasionally, you may encounter line power sources of unacceptable quality; such power sources may adversely affect the operation of the 4000 GC/MS. The 4000 GC/MS is tested under EMC Standard 61326-A1 + A2. If voltage conditions exceed those standards, additional power conditioning or surge protection is advised. You may want to contact a specialist in power conditioning services.

To protect against power failures, an Uninterruptible Power Supply (UPS) can be used. The amount of power drawn depends on instrument operating conditions but 4KVA should be sufficient under typical acquisition conditions, at normal line voltage. Greater power may be drawn during system power up or bakeout. The UPS should have a switchover time of 20 ms. or less.

Operating Environment

You are responsible for providing an acceptable operating environment. Attention paid to the operating environment will ensure the continued peak performance of your 4000 GC/MS.

Temperature/Humidity

The optimum operating temperature is between 18° and 21 °C (65° and 70 °F).



CAUTION

As laboratory temperature increases, system reliability decreases. All electronic components generate heat while operating. This heat must be dissipated to the surrounding air if the components are to operate reliably.

The turbomolecular pump temperature cutoff control protects the bearing and prolongs the pump lifetime. If the laboratory temperature is significantly above 27 °C (80 °F), the pump cutoff temperature could be reached causing the pump to shut down.

There must be good air flow around the system. Your air conditioning system must be capable of maintaining a constant temperature (within operational limits) in the immediate vicinity of the system. The average steady-state heat load of the 4000 GC/MS is 6000 BTUs/hour.

Hot air vented from the GC column oven may contribute to room heating and to the resulting air conditioning load. Ducting the GC column oven air out of the lab should reduce this heating effect.

The relative humidity (RH) of the operating environment must be between 40 and 80%, with no condensation. Operating a 4000 GC/MS at very low humidity will result in the accumulation and discharge of static electricity shortening the life of electronic components. Operating the system at high humidity will produce condensation and result in short circuits.

Varian recommends that your laboratory be equipped with a temperature/humidity monitor. This will ensure that your laboratory is always in conformance with temperature and humidity specifications.

Particulate Matter

Take necessary precautions to minimize particulates in the laboratory environment. A layer of dust on the electronic components could act as an insulating blanket, and reduce heat transfer to the surrounding air.

Vibration

Ensure that lab benches are free from vibrations, e.g., those caused by equipment in adjoining locations. Because the mechanical pump vibrates during operation, you should install it on the floor beneath the 4000 GC/MS, rather than alongside the system on the workbench.

Exhaust System

It is your responsibility to provide an adequate exhaust system. Most compounds introduced into the mass spectrometer will eventually be exhausted from the mechanical pump, along with the small amounts of oil vapor that these pumps characteristically emit. Therefore, the pump outlets should be connected to a fume exhaust system. Consult local regulations for the proper method of exhausting the fumes from your system.

Gas Requirements

GC Carrier Gases

Helium

Minimum 99.998% ultra-high purity, with less than 1.0 ppm each of water, oxygen, and total hydrocarbons. One 257 ft³ tank with an Alltech regulator #AL8111, or equivalent tank and regulator.

NOTE: The presence of >1 ppm oxygen or water in the carrier gas supply may significantly affect the performance of the 4000 GC/MS; it may also damage such components as the capillary column, filaments, and multiplier. Varian recommends that you verify that your gas suppliers use controlled tanks; this will ensure that purity standards are maintained. If you purchase pure gases in contaminated tanks, you may end up with a contaminated system requiring costly and time consuming repair.

Use of a carrier gas filter is required for optimum performance and to protect your system from potential contamination. Your GC Accessory Kit includes a GC/MS Gas Clean Oxygen/Moisture filter (part number CP-17973) and filter base. This easy-to-remove gas filter cartridge combines three highly adsorptive materials in one filter to remove water, oxygen, and organic compounds to purify the GC/MS gas. Carrier gas filters should be installed in a location where the indicator is visible. The filter should be replaced when the indicator shows that the filter is saturated. For replacement procedures, refer to the instructions enclosed with your filter.

CI Reagent Gases (with CI option only)

Methane gas is required for External Ionization CI system installation. Only Methanol is required for Internal Ionization CI. Similar purity is recommended for other CI gases used with customer applications.

Methane

99.99% purity. One lecture bottle with a two-stage pressure regulator which has a stainless steel diaphragm, and a 0 to 100 psi output gauge.

Other Gases

See the CP-3800 GC Pre-Installation Instructions for information on gases required for Cryogenic options.

Gas Lines

Methane and isobutane supply lines connect directly to the CI gas inlet without any terminating fittings. For other gas line requirements see the CP-3800 GC Pre-Installation Instructions.

Capillary Columns

The 4000 GC/MS accommodates the following GC fused-silica capillary columns:

- Narrow bore: 0.25 mm ID; length ≥ 15 m (50 ft)
- Wide bore: 0.32 mm ID; length ≥ 30 m (100 ft)

Solvents and Materials

When the FSR uses the OFN standard to demonstrate sensitivity in EI mode, its concentration must be reduced. The FSR can accomplish this by doing a split style injection or by diluting the OFN standard. If you require the OFN standard to be diluted you must provide 2,2,4-trimethylpentane (isooctane), high purity grade solvent (99.5%) and clean materials as described.

Isooctane: To minimize impurities that would adversely affect the sensitivity specification test purchase 2,2,4-trimethylpentane from one of the following vendors and provide a new, unopened bottle for the installation.

- EMD Chemicals, OmniSolv® 2,2,4-trimethylpentane, Catalog Number TX1389-6, <http://www.emdchemicals.com>
- Acros Organics, 2,2,4-trimethylpentane (ECD tested for pesticide analysis), Product Number 326620010, <http://www.acros.com>

Materials: Provide the following materials for diluting the OFN standard.

- 10 mL volumetric flask
- 1 mL volumetric pipette

Provide the following solvents for operation and maintenance

- Methanol, HPLC grade
- Acetone, HPLC grade

NOTE: Handle and store all solvents in accordance with standard safety procedures.

Network Requirements

If you are planning to connect your GC/MS to a company network, you will need to provide a 10BaseT (Ethernet) connection to the back panel of the CP-3800 GC. In addition, the company network must allow TCP/IP communications to be routed across it from the GC to the 4000 GC/MS Workstation. For basic Ethernet cabling information, please refer to the *CP-3800 GC Operator's Manual*, included on the MS Workstation CD. Any hardware, adapters, cables, configuration and setup work required to convert from the company network wiring type to 10BaseT wiring will need to be provided by you or your network administrator. This hardware must comply with the IEEE 802.3 standard.

System Requirements / Qualified Computer Equipment

If you are planning to install the Varian MS Workstation software on a computer that was not purchased from Varian, it is your responsibility to ensure that this computer is adequately equipped and compatible with the operation of the data system and its communication interfaces. Please consult the current list of requirements, available on-line at:

http://www.varianinc.com/cgi-bin/nav?products/chrom/gcms/msws_computer_req

For a list of the currently qualified equipment and/or if you have difficulties accessing this site, contact your Sales Representative.

Inspection

When your 4000 GC/MS arrives, carefully inspect the exterior of the shipping cartons for evidence of any damage that might have occurred during shipment. Inspect the cartons for the following:

- Water stains
- Cuts, punctures, or deep indentations
- Crushed corners or excessively abraded edges

If one or more of the above conditions are evident on any of the shipping cartons, report the conditions to the carrier at time of receipt.

Systems are shipped either **FOB Varian** or **FOB Destination**. The manner of shipment determines who has responsibility for filing a claim against the carrier if the system is damaged in transit. Most systems are shipped **FOB Varian**, and in this instance any damages incurred in shipment are the responsibility of the purchaser and the carrier. Contact Varian Service for assistance with claims filing and billing for repairs if necessary. If the system is shipped **FOB Destination**, contact Varian Order Processing who will file a claim against the carrier. Note, however, that Varian will not accept liability for damage if you receive obviously damaged materials but do not make note of the damage on the receiving documents.

When your 4000 GC/MS arrives, move it indoors to a protected place and call Varian Service to schedule your installation.

Unpacking and Installation

A Varian Field Service Representative will unpack and install the 4000 GC/MS once it has arrived and you have prepared the installation site. At the time of installation, the Field Service Representative will demonstrate the fundamentals of operation and maintenance. To take full advantage of this on-site visit, please arrange to have your system operator available during the installation.

At the time of installation, the Field Service Representative will demonstrate that your system meets the performance specifications written into your sales contract. Please do not make plans to analyze samples with the system until after the installation has been completed and you have accepted the conditions of delivery.

Parts and Supplies

The *4000 GC/MS Hardware Operation Manual* provides a list of parts and supplies for routine operation.

Preventive Maintenance

You will be responsible for performing routine and preventive maintenance of the gas chromatograph, mass spectrometer, and data system.

Please note that it is essential that you perform regular preventive maintenance. By performing this maintenance, you will increase the life of the system, increase system uptime, and enjoy optimum system performance. Please refer to the *4000 GC/MS Hardware Operation Manual* for details. Your Varian field service representative will also describe and demonstrate these procedures at installation time.

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