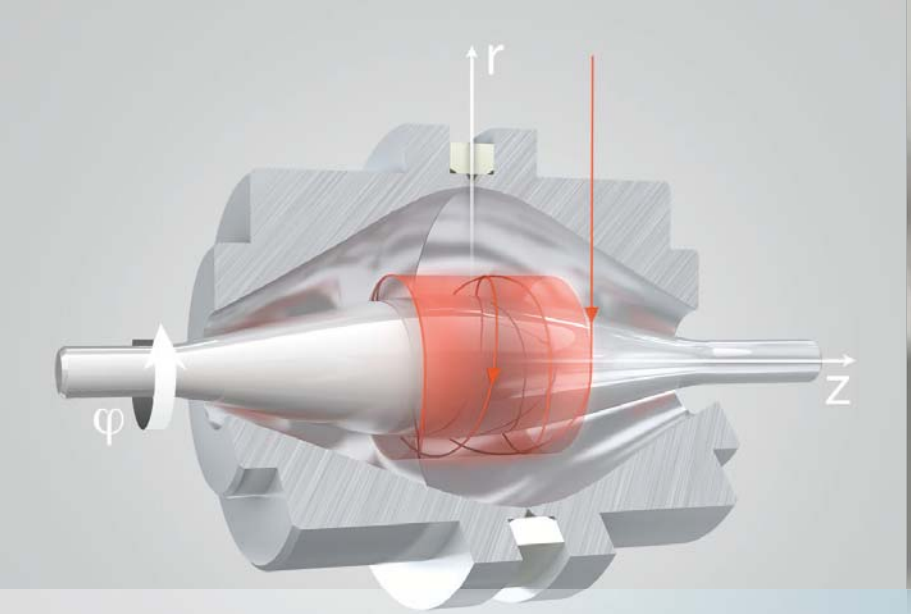

Exactive Series

Exactive Plus, Exactive Plus EMR, Q Exactive, Q Exactive Focus, Q Exactive Plus, and Q Exactive HF

Pre-Installation Requirements Guide

1288111 Revision E June 2015

Thermo SCIENTIFIC

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Release History: Revision A released in March 2012.
Revision B released in August 2013.
Revision C released in May 2014.
Revision D released in September 2014.
Revision E released in June 2015.

For Research Use Only. Not for use in diagnostic procedures.

Exactive Series Installation Request Form

Please refer to the *Exactive Series Pre-Installation Requirements Guide* (P/N 1288111) for the complete site requirements. Circle "Yes" or "No" as to whether the site meets the requirements as specified in the Preinstallation Guide. Provide the additional information where requested.

1. **Yes** **No** All laboratory remodeling has been completed and the space available is sufficient to meet the minimum requirements for the configuration ordered? The floor is certified to meet the load requirements of the system?
2. **Yes** **No** Your instrument has been delivered and is either in the laboratory or can be delivered immediately on the arrival of the installation engineer?
3. **Yes** **No** The key operator will be available during the installation period. The person with the authority to accept the instrument at the end of the installation will also be available to sign the required acceptance document?
   Please provide the names of these individuals: _____
4. **Yes** **No** The entrance to the laboratory and the route from the loading dock are at least 90 cm (36 in.) wide with additional space at corners?
5. **Yes** **No** Sufficient bench space is available for all of the equipment? List the following:
   Width: _____, Depth: _____, Height: _____
6. **Yes** **No** Workbench can support the load of the system including optional equipment and is free from vibration?
7. **Yes** **No** Lighting is adequate?
8. **Yes** **No** Floor vibrations and electromagnetic interferences are below the specified levels?
9. **Yes** **No** Main power is installed and in compliance with local electrical codes?
10. **Yes** **No** The power outlets are of the correct configuration?
11. **Yes** **No** The electrical power has been measured?
    Please note voltage: _____ Volts AC input to ground.
    Please note voltage: _____ Volts AC neutral to ground.
    Please note voltage: _____ Volts AC input to neutral.
12. **Yes** **No** Power is free from fluctuations due to slow changes in the average voltage or changes due to surges, sags, or transients?
13. **Yes** **No** Air conditioning is adequate for temperature, humidity, and particulate matter control? The laboratory can be maintained at a constant temperature, between 15 and 26 °C (59 and 78 °F)?
14. **Yes** **No** The relative humidity is between 40% and 70%, with no condensation?
15. **Yes** **No** The system work area is free from magnetic disruption and electrostatic discharge?
16. **Yes** **No** All gases required are on site, gas lines are installed, and appropriate gas regulators are available?
    List gases and purity: _____
17. **Yes** **No** Is there is a suitable exhaust system present that is separate from solvent waste? You must provide one exhaust system for the API source and a second exhaust system for the forepump.
18. **Yes** **No** Provision has been made for collecting solvent waste from the API source?
19. **Yes** **No** There is a functional telephone close to the system? Phone number _____
20. **Yes** **No** All relevant local safety regulations have been met and the equipment installed will not affect compliance?
21. **Yes** **No** All required chemicals and equipment for installing the system are on site?
22. **Yes** **No** Have any special acceptance specifications been agreed within the contract?
    If **YES**, please attach full details of specification.
23. **Yes** **No** Is there any additional equipment that needs to be interfaced for the system?
    If **YES**, please supply details.

I, the undersigned, confirm that the site requirements as stated above have been accomplished and the laboratory is prepared for the installation of the Thermo Scientific Exactive Series instrument. I understand that I may be liable for a Field Service Representatives' travel or lodging expenses if they are unable to carry out the installation on the pre-scheduled date due to insufficient lab preparation. If circumstances warrants, Thermo Fisher Scientific will make every effort to reschedule an installation as soon as possible with the next available representative.

Signed: _____ Print Name: _____
Company name: _____ Email: _____
Date: _____ Phone: _____

Fax to: Attn: Local Service Engineer
Note After we receive this checklist, your local Field Service Representative will contact you to schedule installation. ▲

Contacting Us

There are several ways to contact Thermo Fisher Scientific.

Assistance

For technical support and ordering information, please visit:

www.thermoscientific.com/orbitrap

Service contact details are available under:

www.unitylabservice.com

For brochures, application notes and other material, please visit:

www.thermoscientific.com

Visit our customer SharePoint to download current revisions of user manuals and other customer-oriented documents for your product. Translations into other languages and software packages may be available there as well.

With the serial number (S/N) of your instrument, request access as a customer via www.thermoscientific.com/Technicaldocumentation. For the first login, you have to create an account. Follow the instructions given on screen. Please accept the invitation within six days and log in with your created Microsoft™ password.

Suggestions to the Manual

❖ **To suggest changes to this manual**

- Send your comments to:

  Editors, Technical Documentation
  Thermo Fisher Scientific (Bremen) GmbH
  Hanna-Kunath-Str. 11
  28199 Bremen
  Germany

- Send an e-mail message to the Technical Editor at

  documentation.bremen@thermofisher.com

You are encouraged to report errors or omissions in the text or index. Thank you.

Contents

Chapter 1 Using This Manual

Welcome to the Thermo Scientific™ Exactive™ Series system! Exactive Series systems are members of the Thermo Scientific family of mass spectrometer (MS) detectors that are powered by Orbitrap™ technology.

Contents

About This Manual

This *Exactive Series Pre-Installation Requirements Guide* is intended primarily for those who are responsible for the site planning of a laboratory in preparation for the installation of a new Exactive Series instrument. This guide should be retained for future guidance if your instrument needs to be relocated in future.

The purchaser is responsible for providing a suitable location, a suitable operating environment, a source of power of acceptable quality, correct gas and solvent supplies, and proper waste and exhaust systems.

This *Exactive Series Pre-Installation Requirements Guide* provides information to assist in planning and preparing your lab site for the system prior to delivery and installation. Read each section carefully to be sure that your laboratory is ready for the installation of your system. For additional information, request specific preinstallation support directly through your local Thermo Fisher Scientific office.

Thermo Scientific mass spectrometers are designed to operate reliably under carefully controlled environmental conditions. Operating a system or maintaining it in a condition outside the power and operating environment specifications described in this guide might cause failures of many types. The repair of such failures is specifically excluded from the standard warranty and service contract coverage.

Exactive Series Mass Spectrometers

Exactive Series instruments are designed to be placed on a bench in the laboratory and comprise the following mass spectrometers:

- The Exactive Plus, an instrument with an API source with S-lens ion optics technology for LC/MS high-throughput applications. It offers an inject flatapole and octapole for ion transfer and collision cell for all-ion-fragmentation. The Exactive Plus is equipped with Orbitrap mass analyzer.
- The Exactive Plus EMR, an instrument with an API source with S-Lens ion optics technology and a collision cell, for analysis of very large molecules, offering a mass range up to *m/z* 20000.The Exactive Plus EMR is equipped with Orbitrap mass analyzer.
- The Q Exactive, an instrument with an API source with S-lens ion optics technology, a quadrupole mass filter for precursor ion selection, and a collision cell for performing MS/MS experiments. The Q Exactive is equipped with Orbitrap mass analyzer.
- The Q Exactive Focus, an instrument with an API source with S-lens ions optics technology, an inject flatapole, a hyperbolic quadrupole mass filter for precursor ion selection, and a collision cell for performing MS/MS experiments. The Q Exactive Focus offers a mass range up to *m/z* 2000 and is equipped with Orbitrap mass analyzer.
- The Q Exactive Plus, an instrument with an API source with S-lens ion optics technology, an injection flatapole with mass resolving capabilities, a segmented quadrupole mass filter for optimal precursor ion selection, and a collision cell for performing MS/MS experiments. The Q Exactive Plus is equipped with Orbitrap mass analyzer.
- The Q Exactive HF, an instrument with an API source with S-lens ion optics technology, an injection flatapole with mass resolving capabilities, a segmented quadrupole mass filter for optimal precursor ion selection, and a collision cell for performing MS/MS experiments. The Q Exactive HF is equipped with an ultra-high-field Orbitrap mass analyzer resulting in an increased scan speed compared to the other Exactive Series instruments.

For brevity, throughout this manual all references to Exactive Plus also apply to Exactive Plus EMR and all references to Q Exactive also apply to Q Exactive Focus, Q Exactive Plus, and Q Exactive HF.

Typographical Conventions

This section describes typographical conventions that have been established for Thermo Fisher Scientific manuals.

Signal Word

Make sure that you follow the precautionary statements presented in this manual. The special notices appear different from the main flow of text:

NOTICE Points out possible material damage and other important information in connection with the instrument. ▲

Viewpoint Orientation

The expressions *left* and *right* used in this manual always refer to the viewpoint of a person that is facing the front side of the instrument.

Data Input

Throughout this manual, the following conventions indicate data input and output via the computer:

- Messages displayed on the screen are represented by capitalizing the initial letter of each word and by italicizing each word.
- Input that you enter by keyboard is identified by quotation marks: single quotes for single characters, double quotes for strings.
- For brevity, expressions such as "choose **File > Directories**" are used rather than "pull down the File menu and choose Directories."
- Any command enclosed in angle brackets < > represents a single keystroke. For example, "press **<F1>**" means press the key labeled *F1*.
- Any command that requires pressing two or more keys simultaneously is shown with a plus sign connecting the keys. For example, "press **<Shift>** + **<F1>**" means press and hold the <Shift> key and then press the <F1> key.
- Any button that you click on the screen is represented in bold face letters. For example, "click **Close**".

Topic Headings

The following headings are used to show the organization of topics within a chapter:

Chapter 1 Chapter Name

Second Level Topics

Third Level Topics

Fourth Level Topics

Reference Documentation

Reference documentation for the Exactive Series mass spectrometers includes the following:

- *Exactive Series Operating Manual*
- *Exactive Plus Software Manual* and *Exactive Plus QuickStart Guide* (with Exactive Plus system)
- *Exactive Plus EMR Software Manual* and *Exactive Plus EMR QuickStart Guide* (with Exactive Plus EMR system)
- *Q Exactive Software Manual* and *Q Exactive QuickStart Guide* (with Q Exactive system)
- *Q Exactive Focus Software Manual* and *Q Exactive Focus QuickStart Guide* (with Q Exactive Focus system)
- *Q Exactive Plus Software Manual* and *Q Exactive Plus QuickStart Guide* (with Q Exactive Plus system)
- *Q Exactive HF Software Manual* and *Q Exactive HF QuickStart Guide* (with Q Exactive HF system)
- *Ion Max and Ion Max-S API Source Hardware Manual*
- *HESI-II Probe User Guide*

You can access PDF files of the documents listed above and of this manual from the data system computer. The software also provides Help.

❖ **To view product manuals**

Go to **Start > All Programs > Thermo Exactive Series > Manuals**.

A printed version of the *Exactive Series Pre-Installation Requirements Guide* is part of the Preinstallation Kit. This kit is sent to your laboratory before the arrival of the Exactive Series mass spectrometer.

NOTICE If this manual is in a language other than English: Translations of the above documents that are available in this language are shown with their titles translated and the English title in parentheses. See "Contacting Us" at the beginning of this manual for information about obtaining current manuals. ▲

Refer also to the user documentation provided by the manufacturers of third-party components:

- Forepump
- Turbomolecular pumps
- Syringe pump

- Switching valve
- Data system computer and monitor
- Safety data sheets

Chapter 2 Site Preparation

Before your instrument can be installed by the Thermo Fisher Scientific field service engineer, the site must be prepared. The hallways and doors must be wide enough to allow passage of the instrument.

NOTICE It is your responsibility as the user to provide a suitable location, a source of power of acceptable quality, a suitable operating environment, and a proper exhaust system. ▲

Contents

Entrance Requirements

This section lists data for packed units of typical Exactive Series systems. The instrument (basic unit) is shipped in the largest container. Other modules such as the data system, liquid chromatograph, and accessories are shipped in their own containers. Their dimensions and weight are less than that of the container for the basic unit.

The listed shipping containers may be replaced by other packings because of the legal requirements in the receiving countries, the mode of transportation, or the climatic conditions in some tropic regions. As a result, the dimensions and weights will differ from those shown in the tables.

NOTICE Some chemicals that are needed for installation will be shipped in a separate package. See "Calibration- and Test-Chemicals" on page 7-3 for details. ▲

Thermo Fisher Scientific recommends checking whether the container with the instrument fits through the laboratory entrance. Also allow additional room for maneuvering the system around corners, into elevators, or through doorways. Please note that it is necessary to use a means of transport (a pallet jack, for example).

If the entrance to your laboratory will not accommodate the container, you can remove the instrument from the container before moving it into the room. The *unpacked* instrument fits through a door with a minimum width of 80 cm (32 in.). Consider that six persons are required to carry the instrument who require considerable space for maneuvering. See "Moving the Instrument" on page 2-10. Therefore, Thermo Fisher Scientific recommends using a pallet jack when passing the unpacked instrument through a narrow door.

NOTICE Do not remove the instrument from its shipping container unless authorized by Thermo Fisher Scientific personnel. Make sure that all the contents of the container remain with the instrument. ▲

Shipping Containers

Your Exactive Series instrument is shipped in a container, the smallest dimension of which is 90 cm (36 in.). To allow moving a *packed* instrument, the entrance to your facility and the width of all hallways, elevators, etc., should have a minimum width of 91 cm (36 in.).The basic unit is shipped in a container with the following dimensions: *h* 115 cm (46 in.), *w* 90 cm (36 in.), *l* 132 cm (52 in.). The container and its contents weigh approximately 225 kg (496 lb). Dimensions and weights of the shipping containers for Exactive Series LC/MS systems are given in Table 2-1.

Table 2-1. Data of packed units of a typical Exactive Series system

Module	Height		Width		Length		Weight	
	cm	in.	cm	in.	cm	in.	kg	lb
Basic unit	115	46	90	36	132	52	225	496
Auxiliary box	88	35	62	25	101	40	34	75
Box (Computer)	88	35	62	25	101	40	61	135
Box (Forepump)	63	25	62	25	96	38	74	164
Box (Accela LC system)[a]	110	44	60	24	80	32	80	177

[a] optional

Space and Load Requirements

The floor of your laboratory should be able to carry the weight of the installed Exactive Series instrument with data system. Also, consider the weight of any other option (liquid chromatograph, for example) that is added to the system and the weights of the workbenches.

To set up a typical LC/MS system, Thermo Fisher Scientific recommends having a minimum of two workbenches.

Placing the Data System

Thermo Fisher Scientific recommends using one workbench with minimum dimensions of 1 × 1.20 m (3 × 4 ft) to hold the data system computer and monitor. Thus, it also provides sufficient place for an optional printer.[1] The workbench must be capable of supporting the weight of the data system [20 kg (44 lb)] and the printer, if applicable.

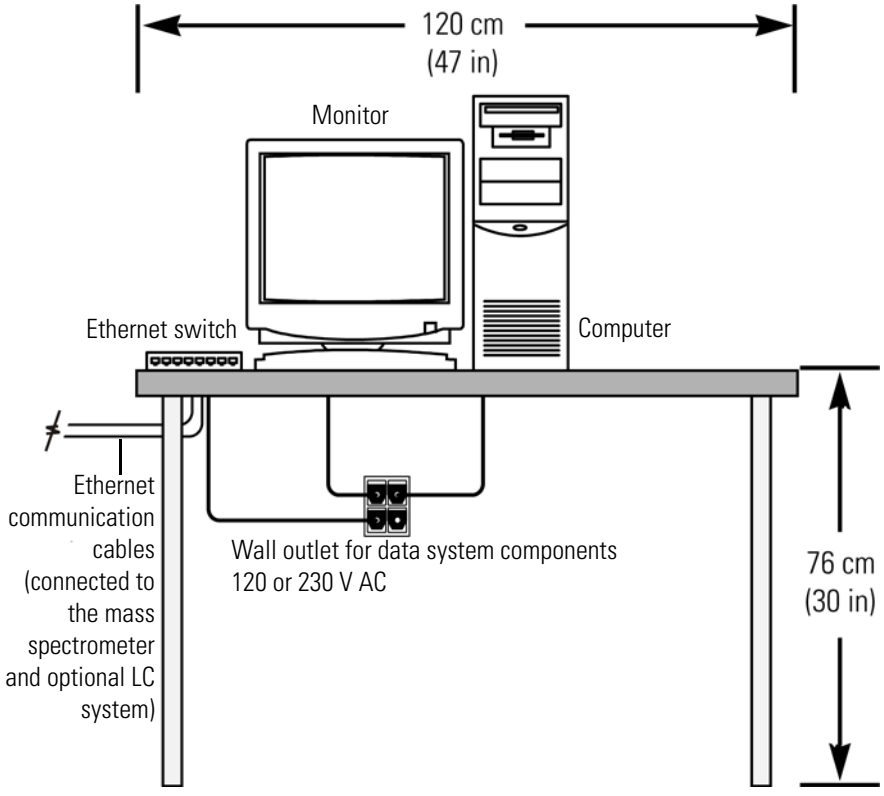

Figure 2-1. Typical data system workbench

[1] A printer is not a standard part of the data system.

See Table 2-2 and Figure 2-1 for the space requirements and weights of the typical data system hardware components.

Table 2-2. Space and load requirements of typical data system hardware components

Module	Height		Width		Length		Weight	
	cm	in.	cm	in.	cm	in.	kg	lb
Monitor	36	14	41	16	18	7	6	13
Minitower computer	48	19	18	7	43	17	14	30
Laser printer[a]	20	8	41	16	46	18	7	16

[a] Not a standard part of the data system. The actual values depend upon your equipment.

The Ethernet communication cables between the Ethernet switch and the mass spectrometer or optional LC system components must be no longer than 3 m (10 ft) each. Therefore, the workbench that holds the data system must be located next to the workbench or workbenches that hold the mass spectrometer and optional LC system.

NOTICE To ensure compliance with safety and EMC regulations, use category 5, shielded Ethernet cables no longer than 3 m (10 ft) in length. ▲

Placing the MS System

Use the other workbench to hold the mass spectrometer, the LC, and any other MS/LC options. This workbench must have minimum dimensions of 1 × 1.53 m (3 × 5 ft) and be capable of supporting the weight of the mass spectrometer (about 180 kg) plus the weight of any option (liquid chromatograph, for example). The workbench dimensions provide sufficient space for the special holder for syringe pump and switching valve(s). If you intend to place the MS separately, use a workbench with minimum dimensions of 1 × 1 m (3 × 3 ft).

NOTICE The optimal position for a Thermo Scientific EASY-nLC™ liquid chromatograph would be in front of the mass spectrometer. ▲

The workbench for the LC/MS system must stand in a secure and level position. Note that only workbenches with four legs provide sufficient stability for the instrument. The workbench top must be dry and clean (free of grease). Thermo Fisher Scientific recommends using a workbench with a skid proof top.

Minimum Clearance

Allow at least 15 cm (6 in.) of clear space behind the system for proper air circulation and for clearance of the gas lines and electrical connections. This also provides sufficient space for accessing the fan filters on the rear side of the MS. In addition, allow at least 92 cm (36 in.) of vertical clearance between the top of the mass spectrometer and any shelves above it.
To allow shutting off the mass spectrometer in an emergency, free access to the power panel on the left side and to the power column on the rear side of the instrument must be possible at any time.

NOTICE Avoid blocking the ventilation slots at the rear of the instrument. Items may fall behind the instrument, inhibit airflow, and cause the system to overheat. ▲

Instrument Dimensions

Exactive Plus instruments have maximum dimensions of *h* 94 cm (37 in.), *w* 91 cm (36 in.), *l* 83 cm (33 in.). See Figure 2-3.

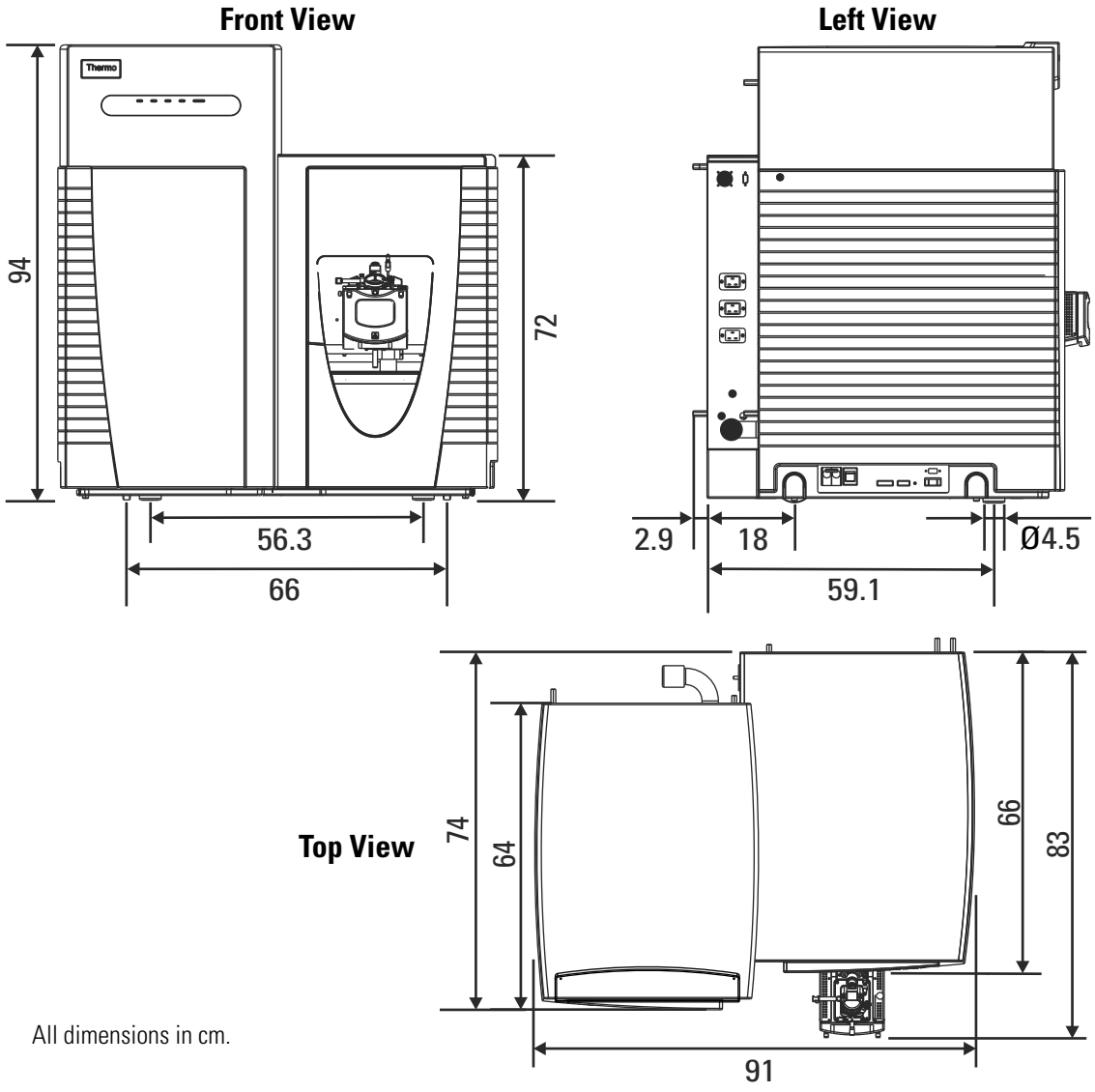

Figure 2-2. Dimensions of Exactive Plus and Exactive Plus EMR MS

Q Exactive instruments have maximum dimensions of *h* 95 cm (37 in.), *w* 91 cm (36 in.), *l* 83 cm (33 in.). See Figure 2-3.

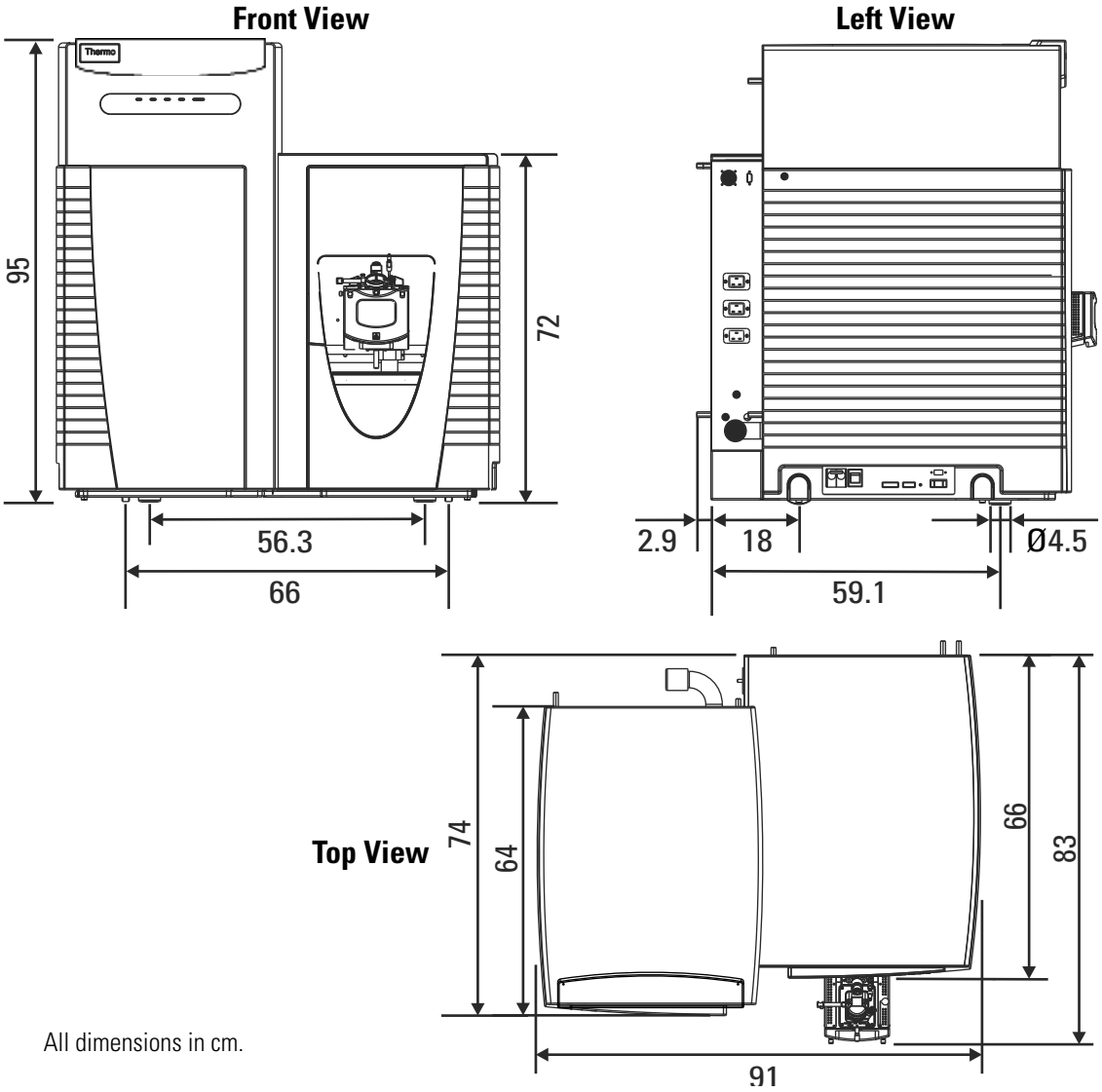

Figure 2-3. Dimensions of Q Exactive, Q Exactive Focus, Q Exactive Plus, and Q Exactive HF MS

Placing an Exactive Series LC/MS System

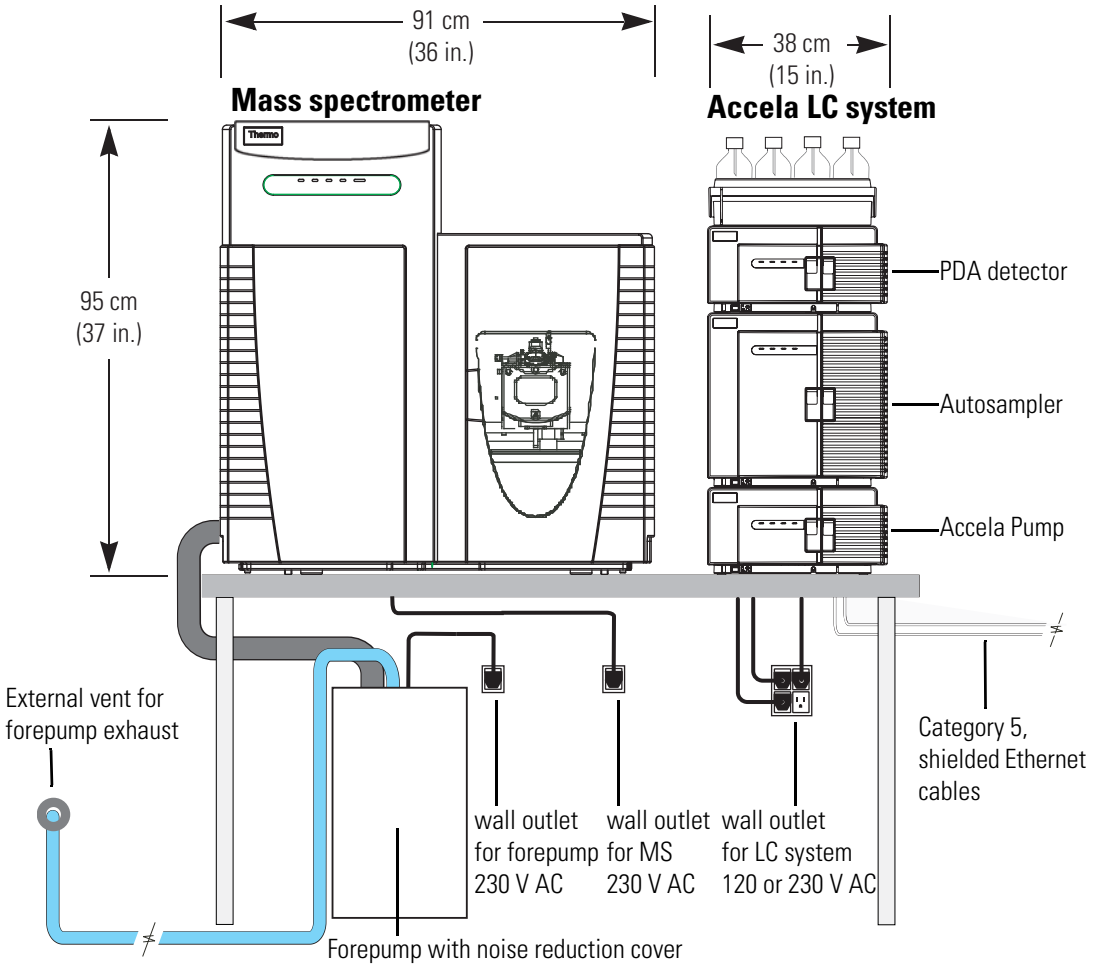

Figure 2-4. Exactive Series system installation and space requirements

Table 2-3. Space and load requirements of Exactive Series LC/MS systems

Module		Height		Width		Length		Weight	
		cm	in.	cm	in.	cm	in.	kg	lb
Mass spectrometer	Exactive Plus	94[a]	37	91	36	83	33	175	386
	Q Exactive	95[a]	37	91	36	83	33	182	401
Liquid chromatograph[b]		73	30	38	15	51	20	67	147
Forepump		36	14	33	13	53	21	60	132
Noise reduction cover		53.5	21	50	20	82.5	32	10	22

[a] Height for left part of instruments. The height of the right part is 72 cm / 28 inch.

[b] The space and weight requirements listed for the liquid chromatograph are those for a system containing an Accela Pump, Accela Autosampler, and Accela PDA Detector. Allow at least 114 cm (45 in.) of vertical height for the stack with the pump, autosampler, detector, solvent platform, and standard 1 L solvent bottles. This height provision will allow sufficient access to the 1 L solvent bottles in the solvent platform. If you plan to use larger solvent containers, allow more vertical space. See also the note on page 2-5.

Moving the Instrument

Exactive Series instruments are provided with four retractable handles. Each instrument is shipped on a pallet with the handles pulled out and fixed on the pallet. Safety catches prevent the handles from unintentionally being retracted after they have been pulled out.

Because of a weight of about 180 kg, Exactive Series instruments are too heavy for one person alone to handle safely. Lifting and moving an instrument requires the effort of at least *six persons*. The instrument is shipped with two lifting devices, each providing sufficient space for three persons that are standing side by side. Refer to the *Exactive Series Operating Manual* for instructions about using the lifting devices.

An instrument with attached lifting devices does not fit through a door with a width of 80 cm (32 in.), in contrast to the unpacked instrument alone. Furthermore, the six persons that carry the instrument require considerable space for maneuvering. Therefore, Thermo Fisher Scientific recommends using a pallet jack to move the instrument and to lift it to the height of the workbench.

NOTICE The instrument's center of gravity is at the top of the front side: the instrument has a tendency to tilt forward. When lifting the instrument, support the top of the instrument and keep the tilt angle below 5°; never exceed 10°. ▲

The rear pair of the four support points for the instrument consists of wheels. Thus, only two persons are necessary for moving the instrument into its final position on a bench, while holding the two front handles. See Figure 2-3 on page 2-8 for information about the position of the support points.

Placing the Forepump

The instrument is shipped with a forepump, a noise reduction cover for the forepump, a vacuum hose for connecting the MS to the forepump, and an exhaust hose for connecting the forepump to the exhaust system. Install the forepump on the floor beneath the workbench, immediately behind the MS. If no space for the pump is available beneath the workbench, you can place the pump near the left side of the bench. In this case, the left side of the MS should align with the left side of the workbench.

When placing the forepump, Thermo Fisher Scientific strongly recommends considering the information contained in "Vibration" on page 3-3.

Connecting the Forepump

Connect the power supply cord for the forepump of an Exactive Series mass spectrometer to a wall outlet. Connect the pump switch cord of the forepump to the port on the rear side of the MS. See Figure 2-5.

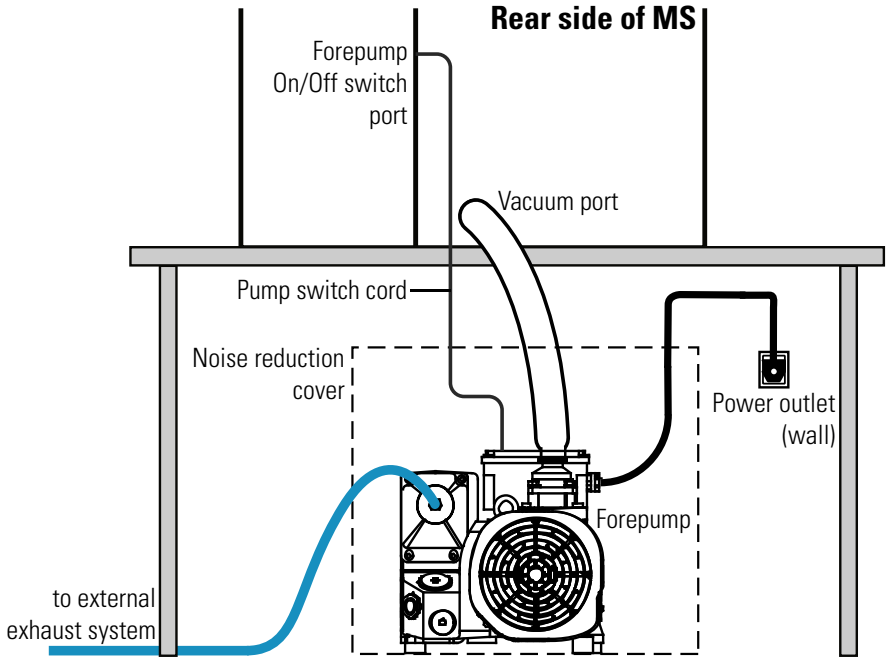

Figure 2-5. Connecting the forepump of an Exactive Series MS

Vacuum Hose

The vacuum hose is made of reinforced material. It has a length of 2.0 m (79 in.). Because of its large bending radius the actual length of the vacuum hose is significantly shorter. Either run the hose behind the workbench or make a cutout through the bench for it. The cutout must have minimum dimensions of 7 × 10 cm (3 × 4 in.). See Figure 2-6 for a schematic drawing.

Allow for room to run the switch cord from the MS to the forepump through the hole.

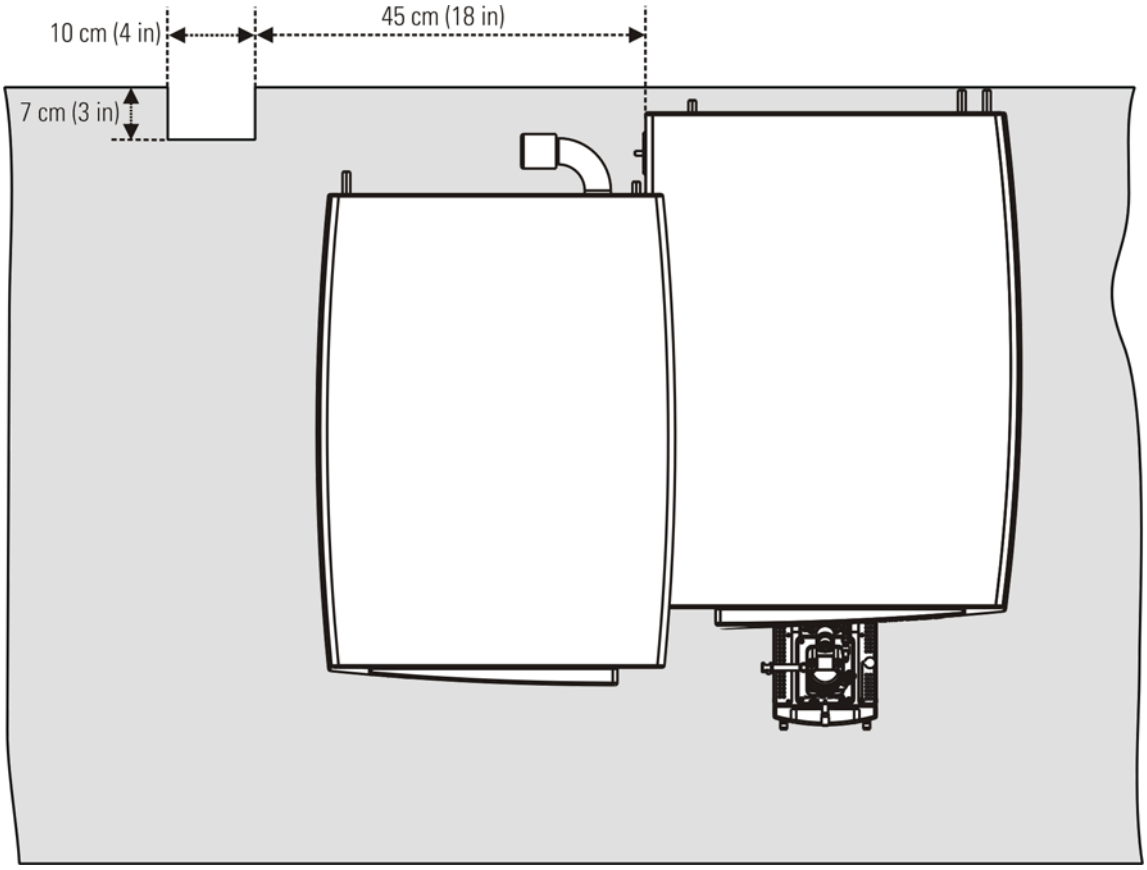

Figure 2-6. Top view of Exactive Series MS with dimensions of cutout for vacuum hose

For information about the exhaust system, see page 6-2.

Chapter 3 Operating Environment

Attention to the operating environment will ensure continued high performance of your system. Any expenditures for air conditioning are more than offset by good sample throughput and reduced repair costs. The air conditioning must be capable of maintaining a constant temperature in the immediate vicinity of the system without producing excessive draft.

NOTICE It is your responsibility as the user to provide an acceptable operating environment. ▲

Contents

Temperature

The laboratory room temperature must be maintained between 15 and 26 °C (59 and 78 °F).

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

There must be a good flow of room air around the system, and the air conditioning system must be capable of maintaining a constant temperature (within the temperature specification given above) in the immediate vicinity of the system.
We recommend the installation of an air conditioner, if the specified limits will be exceeded due to unfavorable climatic conditions. Preferably, the air conditioner should be equipped with a flow controller valve and PID microprocessor control (available e.g. from Landis & Gyr, Polygyr RWX…, see www.landisgyr.com). This ensures temperature drifts within the limits given above.

NOTICE Do not put the instrument under an air duct, near windows, or near heating and cooling sources. Temperature fluctuations of 1°C or more over a 10 minutes period can affect performance. ▲

Heat Output of Exactive Series LC/MS Systems

The air conditioning load for a typical Exactive Series LC/MS system (with data system and a typical LC) is approximately 3.5 kW (12000 BTU/h). Refer to your LC manual for the heat output of your LC equipment. Table 3-1 shows the approximate heat output of each module.

Table 3-1. Heat output for a typical Exactive Series LC/MS system

Module	Heat output [W]	Heat output [BTU/h]
Mass spectrometer	1500	5120
Liquid chromatograph	1080[a]	3690[a]
Monitor	35	120
Computer	470	1600
Laser printer (optional)	350[a]	1200[a]
Total	**3435**	**11730**

[a] Approximate. The actual value depends on your equipment.

Humidity

The relative humidity of the operating environment must be between 40 and 70%, with no condensation. It is recommended that your laboratory be equipped with a temperature/humidity monitor to ensure that your laboratory is always within the required temperature and humidity specifications.

NOTICE Operating an Exactive Series system at very low humidity might cause the accumulation and discharge of static electricity, which can shorten the life of electronic components. Operating the system at high humidity might cause condensation, oxidation, and short circuits, and will also block the filters on the cooling fans. ▲

Vibration

Floors must be free of vibration caused, for example, by equipment in adjoining locations.

NOTICE Because of the natural vibration of the forepump during operation, it must not have any mechanical contact to the mass spectrometer with exception of the vacuum hose. Otherwise, the vibration might impede the performance of the instrument. Therefore, install the pump on the floor beneath the mass spectrometer and not near the system on the workbench. ▲

Propagation of vibrations and their influence on complex instrumentations are difficult to predict. We encourage you to contact us at support.ftms.bremen@thermofisher.com if you have questions or concerns about your laboratory.

Radio Frequencies

Exactive Series instruments are able to withstand electromagnetic fields of 1 V/m in the frequency range 26 MHz to 1 GHz without any influence to operation.

Exactive Series instruments are designed to work in a controlled electromagnetic environment. Do not use radio frequency transmitters, such as mobile phones, in close proximity to the instrument.

If strong radio transmitters are operating close to your laboratory, you should contact us at support.ftms.bremen@thermofisher.com for advice. Because of the complexity of such influences, no general suggestion can be given in this guide.

Altitude

Exactive Series LC/MS systems are designed for indoor use at an altitude of up to 2000 m (6500 ft) above sea level. For altitudes above 2000 m, contact Thermo Fisher Scientific.

Chapter 4 Line Power

The performance and longevity of your system can be affected by the quality of line power supplied to the system. To ensure that your instrument performs optimally and that it is not damaged by line power fluctuations, please verify that you comply with all power quality requirements.

NOTICE It is your responsibility as the user to provide a source of power of acceptable quality for the operation of your system. ▲

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Available Outlets

Exactive Series instruments operate at a nominal voltage of 230 V AC, 50/60 Hz. Line voltages can vary between a minimum of 207 V AC and a maximum of 253 V AC.

Notice for Customers in North America Systems installed in areas with 208 V power experience voltage sags during high use periods that might place the line voltage below the operating parameters discussed in this section. In this case, you must protect your instrument by using a buck/boost transformer to ensure that power is within the specified parameters at all times. You need to supply a dedicated single phase 30 amp 208 V AC power line with a good earth ground that terminates in a NEMA L6-30R receptacle located within 6 feet of the desired instrument location. ▲

The mass spectrometer must be properly grounded. For this reason, the power cable of the MS must be connected to a wall outlet with grounding pin. Make sure that the grounding pin of this power cable is connected to earth ground, even when a buck/boost transformer or other upstream equipment (for example, UPS) is used.

The interconnected power outlets for the system are to have a common point to one ground connector. If there are two such points, each of which is connected to separate external ground, they will cause noise current to flow through the ground system via the ground loop that is formed.

Voltage between ground and neutral line should be less that 1 Volt.

NOTICE Power is to remain on. The system should remain on and pumping continuously for optimum performance. Nevertheless, the system must be disconnected from mains in case of emergency or for other reasons (for example, maintenance). ▲

Basic Power Requirements for Exactive Series LC/MS Systems

An Exactive Series LC/MS system has the following basic power requirements:

- For the mass spectrometer, a wall receptacle, fused with 15 A or 16 A (tripping characteristic C)
  Nominal voltage of 230 V AC, ±10%, frequency of 50/60 Hz, single phase
  The instrument has an apparent power of 750 VA and an effective power of 700 W.

- For the forepump, a wall receptacle, fused with 15 A or 16 A (tripping characteristic C)
  Nominal voltage of 230 V AC, ±10%, frequency of 50/60 Hz, single phase
  The forepump has an apparent power of 1250 VA and an effective power of 750 W.

  In areas with 208 V AC (120/208 V wye power system for North America) line power, an additional transformer for the forepump is not required.

- Additional single-phase wall outlets for data system (computer, monitor, and Ethernet switch) and liquid chromatography
  Nominal voltage of 230 V AC, ±10%, 50/60 Hz, fused with 10 A, or nominal voltage of 120 V AC, ±10%, 50/60 Hz, fused with 20 A

  The Exactive Series mass spectrometer provides electric power for syringe pump and switching valve(s). A power strip is shipped with the instrument.

NOTICE Any conditioning devices that are installed with the system must be able to handle the potentially high currents that are drawn during the initial startup of the system. The system inrush (start) current for Exactive Series mass spectrometers is 11 A. The maximum inrush current for the forepump (Oerlikon Leybold Vacuum™, model SOGEVAC™ SV 65 BI) is 12 A. The average duration of the forepump's inrush current is less than 1 second. Therefore, this initial energy demand from the AC power line is very low. ▲

Power Cables and Connectors

The power cable to the mass spectrometer is 5 m (16 ft) long. See left photo in Figure 4-1. This power cable is shipped with the 16 A version of a 3 pole CEE male connector, which is rated at 16 A and 230 V AC. The right photo in Figure 4-1 shows the wall receptacle required for the mass spectrometer (IP 44; 3 poles; 250 Volt; 50/60 Hz; blue; IEC 60309.1 and 60309.2). The receptacle (P/N 2105500) is provided by Thermo Fisher Scientific as part of the Preinstallation Kit. The power cable (P/N 2112490) is provided by Thermo Fisher Scientific as part of the Installation Kit.

Figure 4-1. Power cable and wall receptacle

Power Cable for the Forepump

The power cable for the forevacuum pump is shipped as part of the forevacuum pump package. The power cable has a length of 5 m and is shipped with the 16 A version of a 3 pole CEE male connector, which is rated at 16 A and 230 V AC (analogous to the cable shown in Figure 4-1). The power cable needs to be plugged into a separate wall receptacle (P/N 2105500) (IP 44; 3 poles; 250 Volt; 50/60 Hz; blue; IEC 60309.1 and 60309.2). The receptacle is provided by Thermo Fisher Scientific as part of the Preinstallation Kit.

Power Cables of Peripherals

The cables for personal computer, monitor, Ethernet switch, syringe pump, and switching valve(s) are provided by Thermo Fisher Scientific. They are approximately 2 m (6 ft) long. Local codes in your area might require the installation of another type of plug and receptacle. The Thermo Fisher Scientific field service engineer for your country provides the appropriate power plugs.

Connecting Mass Spectrometer and Modules to Wall Outlets

Ensure that the wall outlet specifications are not exceeded. The mass spectrometer must have a separate “clean” line leading to a main fuse to guarantee disturbance-free operation. Locally supplied personal computer hardware must use the same power line and ground connection as the mass spectrometer.

The electrical wall outlet for the main power of the mass spectrometer should be located at the wall near the intended location of the instrument.

Power Supply for the Forepump

Connect the power supply cord for the forepump of an Exactive Series mass spectrometer to a dedicated wall outlet. See “Power Cable for the Forepump” on page 4-4.

Power Supply for Other Modules

For liquid chromatograph and data system, please use wall outlets. Additional power outlets might be required for test and cleaning equipment, such as an oscilloscope and ultrasonic bath. See Table 4-1 on page 4-6 for a sample laboratory setup.

The maximum load for a 120 V AC fourplex outlet is typically 20 A, and the maximum load for a 230 V AC fourplex outlet is typically 16 A. We recommend at least six (6) spare outlets behind the system and three (3) close to the workbench space within your laboratory. All single-phase auxiliary wall outlets should use the same ground as the power line of the instrument. To prevent overloading the circuit, connect mass spectrometer, forepump, liquid chromatograph, and data system to separate wall outlets.

NOTICE To prevent overloading the circuit, never connect mass spectrometer and LC to the same electrical wall outlet circuit. ▲

NOTICE The specifications on the individual modules might vary from those in this guide. Refer to the manuals that came with your modules for power requirements and specifications. The power specifications on the module and in the respective manual always supersede those in this guide. ▲

Power Outlets in Laboratories

Installing a complete LC/MS system can require extensive electrical resources. Plan the power system properly, with numerous outlets, to ensure that you can connect and power all of your equipment. Place the outlets for the MS system, forepump, and LC system behind the MS workbench. Place the outlets for the data system—computer, monitor, Ethernet switch, and (optional) printer—behind the data system workbench. See Figure 2-1 on page 2-4 and Figure 2-4 on page 2-9 for the optimum locations for power outlets in the most typical workbench setups.

See the sample laboratory setup in Table 4-1 for the recommended number of outlets.

Table 4-1. Sample laboratory setup

	Item	Outlets
LC system	Autosampler	1
	LC pump	1
	UV/Vis or PDA detector (optional)	1
	Column heater (optional)	1
	External controller (optional)	1
MS system	Mass spectrometer	1 (230 V)
	Forepump	1 (230 V)
	Syringe pump	—[a]
	Switching valve(s)	—[a]
Data System	Data system computer	1
	Monitor	1
	Printer (optional)	1
	Ethernet switch	1
Optional	High intensity lamp (for help in instrument maintenance)	1
	Laboratory stereoscope (for inspecting fused-silica parts)	1
	Nitrogen generator	1
Total outlets required for this configuration		6–14

[a] Power is supplied by MS.

NOTICE If your local area is susceptible to corrupted power or power disruptions, then an uninterruptible power supply (UPS) should be installed in your laboratory. Take the values listed in Table 3-1 on page 3-2 as guideline for dimensioning an UPS. ▲

Chapter 5 Consumables

Your instrument requires gases and solvents that must meet defined purity specifications. The Thermo Fisher Scientific field service engineer might also require certain solvents for the installation verification of your system.

NOTICE It is your responsibility as the user to provide correct gas and solvent supplies for the operation of your system. ▲

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Fittings and Parts

Table 5-1 lists the minimum parts that are required to connect the mass spectrometer to your gas delivery system.

Table 5-1. Gas connection hardware required

	Description	Provided / Not provided
Nitrogen	6 mm OD Teflon™ hose (P/N 0690280)	10 m (33 ft) provided. You might require additional length.
	Connection for the opposite end of the Teflon hose to the nitrogen gas source	**Not provided in kit. You supply these parts.**
	T-piece (P/N 1128140)	provided

NOTICE Your connections and gas delivery system might vary, and it is your responsibility to supply any fittings or connections necessary during installation.
If the pressure regulator of the laboratory gas supply has an 1/8 inch NPT outlet, examples[1] of suitable 1/8-in.-to-6-mm adapters are Swagelok™ part numbers B-6M0-7-2 (female) and B-6M0-1-2 (male). ▲

[1] Thermo Fisher Scientific does not endorse any manufacturer, nor does it endorse products other than its own. Companies and products listed in this guide are given as examples only.

Gases

Exactive Series instruments require nitrogen gas for the API sheath gas, API auxiliary/sweep gas, C-Trap bath gas, and HCD collision gas. Your system can use large amounts of gas during daily operations. It is essential that the gas be delivered with the necessary pressure and purity. This section provides information on the purity and pressure that your system requires.

NOTICE Contaminants introduced during the installation of house lines used for gas delivery can cause damage to the system. Ensure that all gas lines used with your system have been cleaned of all particulates and oils. You are responsible for any damage to the instrument caused by contaminants introduced from your gas delivery system. ▲

NOTICE Do not store gas cylinders where they can damage cables or gas lines, and secure them in accordance with standard safety practices. ▲

Nitrogen Gas

The nitrogen gas should be of high purity (99%). Particulate filters can be a source of contamination, they are not recommended. The required gas pressure is 800 ± 30 kPa (8.0 ± 0.3 bar, 116 ± 4 psi).

Maximum nitrogen gas consumption (nitrogen on 24 hours per day) is 72000 L (2540 ft^3) per day. Therefore, it is recommended that nitrogen be supplied from one of the following sources:

- A large, sealed, thermally insulated cylinder containing liquid nitrogen, from which the nitrogen is boiled off. The 230 psi model is recommended. The 35 and 80 psi models do not provide sufficient gas pressure. A typical cylinder of size 240 L yields 143850 L (5080 ft^3) of gas. The replacement frequency is approximately every other day.

  Liquid nitrogen conversion factors:
  1.0 lb of liquid nitrogen=0.5612 L, 1.0 kg of liquid nitrogen=1.237 L

- A nitrogen generator with minimum capacity of 72000 L (2540 ft^3) per day at 99% purity with 800 kPa (116 psi) at the side panel. Worst case consumption of nitrogen gas is 50 L/min (106 Standard Cubic Feet per Hour). This is a continuous source with no replacement required.

  Nitrogen generators require an air compressor. Some models of air compressor are quite noisy; therefore, be careful to select a quiet compressor.

Solvent Recommendations

The solvents listed in Table 5-2 are useful in operating and maintaining your instrument. Installation of the instrument requires LC/MS grade methanol and water. Solvent modifiers might also be required during the installation of some systems.

Some solvent impurities are transparent to UV/VIS detectors. Therefore, some LC/MS grade solvents might contain contaminants that interfere with the performance of the mass spectrometer. For operation of your instrument, choose high purity solvents with minimum contamination. You can order specific chemicals from Thermo Fisher Scientific, which are sold under its Fisher Chemical brand. As specified in Table 5-2, use only LC/MS grade chemicals for operating your system.

Table 5-2. Recommended solvents and reagents

Solvent / Reagent	Specifications	Fisher Chemical P/N
Methanol	LC/MS grade	A456-4
Acetonitrile	LC/MS grade	A955-4
Water	LC/MS grade	W6-4
Isopropyl alcohol	LC/MS grade	A461-4
Acetic acid (modifier)	LC/MS grade	A507-500 or A35-500
Formic acid (modifier)	99–100% (This acid must be supplied in a glass bottle.)	A117-50

For a complete selection of LC/MS grade consumables from Fisher Scientific, visit www.FisherLCMS.com.

NOTICE Do not filter solvents. Filtering solvents can introduce contamination. ▲

NOTICE Store and handle all chemicals in accordance with standard safety procedures. ▲

Cleaning Agents

We recommend having the following cleaning agents available:

- A solvent like acetone (in accordance with your local safety practices).
- A detergent, for example, RBS 50 (trade name of Messrs. Carl Roth, Karlsruhe, Germany).
- Several liters of distilled water.

Chapter 6 Exhaust and Waste

The proper performance of your system can be affected by the waste and exhaust arrangements for the instrument. Vacuum and solvent wastes must be vented separately, and wastes must be collected and disposed of properly.

NOTICE It is your responsibility as the user to provide proper waste and exhaust systems for the operation of your system. ▲

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Exhaust System

It is mandatory to connect the forepump to a fume exhaust system. The forepump eventually exhausts much of what is introduced into the mass spectrometer, including the small amount of oil vapor that mechanical pumps can emit. It is your responsibility to provide an adequate exhaust system.

NOTICE An efficient fume exhaust system is required for the proper operation of your forepump. Most API applications contribute to the accumulation of solvents in the forepump. These solvents must be purged from the mechanical pump oil periodically by opening the ballast valve located on the top of the pump. When the ballast valve is opened, a large volume of volatile solvent waste might enter the fume exhaust system. Therefore, your fume exhaust system must be able to accommodate the periodic purging of the solvents. The frequency of the purging is dependent on the throughput of your system. ▲

The forepump (also referred to as a mechanical, rotary-vane, roughing, or backing pump) provides a vacuum for the API source and backing pressure for the turbomolecular pumps in the Exactive Series system.

The exhaust port of the rotary pump should be connected to an exhaust gas line leading out of the building or exhaust system. See Figure 2-5 on page 2-11. The inner diameter of the pipe should be at least 25 mm (1 in.). An exhaust hose for connecting the forepump to the exhaust system comes with the system (P/N 0690720) and is 5 m (16 ft) long. It has dimensions of 13 mm (1/2 in.) ID and 20 mm (25/32 in.) OD. The exhaust system for the forepump must be able to accommodate an initial inrush flow rate of 3 L/min and a continuous flow rate of 1 L/min.

NOTICE Do not route exhaust tubing from the pump vertically toward the ceiling. To maintain pump integrity, route the tubing from the exhaust port down to the floor. ▲

NOTICE The exhaust hose should travel at floor level for a minimum of two meters (78.5 in.) before it reaches the external exhaust system. This tubing acts as a trap for exhaust fumes that would otherwise recondense in the forepump oil. ▲

Ventilation

Most of the nitrogen that is introduced into the API source escapes into the laboratory atmosphere. Therefore, provide for good air exchange to prevent accumulation of gaseous nitrogen in the laboratory.

Solvent Waste

Because the Ion Max API source can accommodate high flow rates, you must collect the waste solvent in a manner that avoids pressure buildup in the source. The Ion Max API source is fitted with a 25.4-mm (1.0 in.) OD outlet for solvent drainage. A 25.4-mm to 12.7-mm (1 in. to 0.5 in.) reducing fitting (P/N 00101-03-00001) connects to a waste container (P/N 00301-57020), both of which come with the system. To avoid pressure buildup in the source, make sure that the 1-inch diameter hose from the API source drain to the reducing fitting (P/N 00101-03-00001) is as long as possible. The 25.4-mm (1 in.) diameter Tygon™ tubing (P/N 00301-01-00020) that comes with the system is 1.52 m (5 ft) long.

NOTICE Always operate the Ion Max API source with the drain tubing assembly mounted to the source housing drain. The drain tubing must lead to a waste container that is connected to a dedicated fume exhaust system. Do not vent the drain tubing (or any vent tubing connected to the waste container) to the same fume exhaust system to which you have connected the forepump. To prevent the laboratory from being accidentally contaminated by solvent waste, protect the waste container against overturning. ▲

Chapter 7 Installation

Prior to installation, make sure that all preparations described in the previous chapters are complete.

When your lab site preparation is completed and the system is delivered, please call your Thermo Fisher Scientific office to arrange for an installation date.

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NOTICE Store the instrument in a protected location indoors. Take the specifications described in "Temperature" on page 3-2 as a guideline for the temperature in the storage room. ▲

Equipment Needed for Installation

The mass spectrometer requires a syringe pump for delivering sample solution and/or sheath liquid from a syringe into the API ion source. A suitable syringe pump (Chemyx Fusion 100) is shipped with the mass spectrometer.

Place the syringe pump next to the API source on the holder that is shipped with the mass spectrometer. See "Power Supply for Other Modules" on page 4-5 for information about the power supply for the syringe pump.

Solvents Needed For Installation

For preparing a calibration solution with the chemicals described in "Calibration- and Test-Chemicals" below, have the following solvents ready at the time of installation:

- Methanol,
- Water,
- Acetonitrile, and
- Glacial acetic acid.

See "Solvent Recommendations" on page 5-4 for information about solvent requirements.

Calibration- and Test-Chemicals

The chemicals listed in Table 7-1 are needed for installation. They do not come with the mass spectrometer but will be shipped separately as part of the Preinstallation Kit.

NOTICE The installation will not begin until the arrival of all chemicals listed in Table 7-1! ▲

Table 7-1. Calibration- and Test-Chemicals

Description	Quantity	Supplier Product Number
Supplier: Sigma™ Chemical Company, see below.		
n-Butylamine[a]	25 mL	471305-25ML
Sodium Dodecyl Sulfate	10 g	L4509-10G
Sodium Taurocholate Hydrate	250 mg	T4009-250MG
Caffeine Methanol Solution	1 mL	C6035-1ML
Buspirone hydrochloride	1 g	B7148-1G
Supplier: ABCR GmbH & Co. KG, see below.		
Ultramark™ 1621 Mass Spec. Standard	250 mg	AB172435
Supplier: Thermo Fisher Scientific		
Met-Arg-Phe-Ala acetate salt	1 mg	1305050

[a] If ordering elsewhere, use only mass spec grade quality.

To order more of these compounds, contact:

Sigma Chemical Company
P. O. Box 14508
St. Louis, Missouri, USA 63178-9916

Phone (800) 325-3010 (in the USA or Canada)
(314) 771-3750 (outside the USA or Canada)

Web site www.sigma-aldrich.com

or

ABCR GmbH & Co. KG
Im Schlehert 10
D-76187 Karlsruhe, Germany

Phone +49 (0)721 950 61-0

Fax +49 (0)721 950 61-80

Email info@abcr.de

Web site www.abcr.de

Obtaining Ready-to-Use Calibration Solutions

To free you from time-consuming mixing and dilution steps and to allow you to focus on data acquisition, Thermo Fisher Scientific provides ready-to-use calibration solutions. Table 7-2 shows the available calibration solution packages.

Table 7-2. Calibration solutions packages for Exactive Series instruments

Calibration Solution	Product Name	Product Number
Positive ion mode	Pierce LTQ Velos ESI Positive Ion Calibration Solution, 10 mL	88323
Negative ion mode	Pierce ESI Negative Ion Calibration Solution, 10 mL	88324

You can order ready-to-use calibration solutions from www.thermo.com/pierce or www.fishersci.com. The prepared calibration solutions are shipped at ambient temperature and stable at 2–8 °C for 1.5 years.

Chapter 8 General Preinstallation Information

This chapter provides general pre-installation information for your instrument.

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Instrument Arrival

When your lab site preparation is completed, and the system is delivered, call your local Thermo Fisher Scientific office to arrange for an installation date.

Thermo Scientific instruments are transported either by carriers who specialize in the handling of delicate machinery, or for long distance shipment by airfreight. Occasionally, however, equipment inadvertently does get damaged in transit.

Take the following precautions when receiving material:

- Check carefully for obvious damage or evidence of rough handling.
- If external damage is apparent, take photographs, note this fact on all copies of the receiving documents and describe briefly the extent of the damage. Drivers should sign (or put their initials) next to your comments to signify agreement with your observations.
- Contact your Thermo Fisher Scientific office to report the damage and—please—let Thermo Fisher Scientific field service engineers check for further damage.

NOTICE If the instrument shipping container, ShockWatch™, or other indicator shows any evidence of damage or mishandling during shipment, do NOT open the container. Call your Thermo Fisher Scientific representative for instructions on what to do. If the system arrives safely, proceed with the following instructions. ▲

NOTICE Freight insurance requires that obvious damage be noted on the receiving documents. Thermo Fisher Scientific will not accept liability for damage if materials are received with obvious damage and the damage is not recorded on the receiving documents. ▲

When your system arrives, **move it to a protected location indoors**, preferably the installation site. Take the specifications described for the laboratory in this guide as a guideline for the temperature and humidity in the storage room. If you have questions about moving your system, contact your local Thermo Fisher Scientific office.

Transportation Risk

Transportation risk depends on the terms of delivery agreed. The terms of shipment determine who has responsibility for filing a claim against the carrier if the system is damaged in transit.

Installation

It is the policy of Thermo Fisher Scientific that the customer should not unpack the system or accessory items prior to installation of the system.

NOTICE Where buck/boost transformers or power conditioning units are supplied, it is the responsibility of the operator to have these units installed by an electrician prior to instrument installation. ▲

NOTICE A forklift or a pallet jack will be of great benefit for unpacking and in-house transportation of the instrument components. ▲

Installing the System

When your new instrument is on site and ready for installation, a Thermo Fisher Scientific field service engineer will install it.

During the installation, the Thermo Fisher Scientific field service engineer will demonstrate the following:

- The basics of equipment operation and routine maintenance.
- The performance specifications that are in force at the time of the purchase of the system.

NOTICE Consumables sent with the system are intended for use by the Thermo Fisher Scientific field service engineer during the installation. ▲

Key Operator

Experience has shown that the maximum benefit can be derived from a scientific instrument if there is one person, a key operator, who has major responsibility for that instrument. It is recommended that you designate a key operator to oversee the operation and maintenance of the system in your laboratory. The key operator should be available to the installing engineer throughout the installation. This person will also be the key figure in the communication between your laboratory and Thermo Fisher Scientific.

NOTICE Do not plan to use your new system for sample analysis until the installation is complete and the Acceptance Form has been signed. ▲

Advanced Training Courses

Thermo Fisher Scientific provides both introductory and advanced training courses in analytical techniques, together with specialized operation and maintenance courses for Thermo Scientific products.

It is also recommended that some months after your instrument has been installed, the key operator receive an advanced training for the operation and maintenance of the system from Thermo Fisher Scientific. After this training, the key operator can conduct an in-house training program on your site for your own people and certify others to operate the instrument.

For information concerning course schedules and fees, please contact the following address or your local Thermo Fisher Scientific office:

Thermo Fisher Scientific
Hanna-Kunath-Str. 11
28199 Bremen

Germany

Phone: +49 (0) 421 - 54 93 0
Fax: +49 (0) 421 - 54 93 426
E-mail: training.bremen@thermo.com

Preventive Maintenance

Routine and preventive maintenance of the instrument is in the responsibility of the operator. Included in this category are the replacement of worn parts, the exchange of operating resources, and similar activities.

Regular preventive maintenance is essential. It will increase the life of the system, result in maximum uptime of the system, and ensure optimum system performance. Maintenance techniques are covered in the Operating Manual for your Thermo Scientific instrument. Refer also to the manufacturers' manuals shipped with the instrument—especially for the maintenance of mechanical pumps and turbomolecular pumps.

Operating Environment

These general specifications for the operating environment help ensuring continued high performance of the system.

Lighting

Good lighting makes any work area more enjoyable. Because a lot of work is done on the computer terminal, it may be convenient to have a dimmer switch on the lights to reduce eyestrain. A small, high-intensity lamp is recommended for cleaning instrument components, source inspection, and manipulation of small components. Contact your local safety officer for advice and regulations on adequate working place conditions.

Particulate Matter

Particulate matter might contaminate the samples and the ion source and may limit the background level of the instrument.

The air in your laboratory must not contain excessive dust, smoke, or other particulate matter. For reference, the air should contain fewer than 35×10^6 particles per cubic meter (1×10^6 particles per cubic foot) in excess of 5 µm.

Dust can clog the air filters, causing a reduction in air flow around electronic components. Dust will also form a layer on electronic components that will act as an insulating blanket and thus reduce the heat transfer from the components to the surrounding air.

Quality of Power

The quality of power supplied to your system is very important for its performance. The quality of line voltage must be stable and within the specifications listed in this manual. The line voltage must be free of voltage surges, sags, or transients.

Below are definitions for the most common voltage disturbances:

- *Harmonic distortion* is a high-frequency disturbance that might affect operation of your system. This disturbance appears as distortion of the fundamental sine wave.
- *Slow average* is a gradual, long-term change in average root mean square (RMS) voltage level, with typical durations greater than 2 s.
- *Sags and surges* are sudden changes in average RMS voltage level, with typical durations between 50 µs and 2 s.

- *Transients* (or impulses) are brief voltage excursions of up to several thousand volts with durations of less than 50 µs.

Harmonic distortion causes noise in the power supply lines and degrades instrument performance. Constant high line voltage, impulses, or surges in voltage can cause overheating and component failures. Constant low line voltage or sags in voltage can cause the system to function erratically or not at all. Transients, even of a few microseconds duration, can cause electronic devices to fail catastrophically or to degrade and eventually shorten the lifetime of your system.

Thermo Fisher Scientific recommends using power monitoring and conditioning devices. Contact your local Thermo Fisher Scientific office and see "Technical Assistance" on page 8-8 for electrical equipment suppliers.

Power Monitoring Devices

Power monitoring devices help decide whether it is necessary to install a power conditioning device.

Power line disturbance analyzers are capable of detecting and recording most types of power supply problems. These instruments provide a continuous record of line performance by analyzing and printing out information on three types of voltage disturbances:

- Slow average
- Sag and surge
- Transient

In the first two cases, the duration as well as the amplitude of the disturbance is indicated by time interval recording.

The power line must be monitored continuously for seven consecutive days, 24 hours a day. If inspection of the printout indicates disturbances, the test should be terminated and corrective action taken. Then, the power should be monitored again as described above.

A variety of devices is available to monitor power supply quality. The Leibert Corporation Model 3600 and the Dranetz™ 606 Series power line disturbance analyzers are two devices capable of detecting and recording most types of power supply problems.

NOTICE Thermo Fisher Scientific does not endorse any manufacturer, nor does it endorse products other than its own. Companies and products listed in this guide are given as examples only. ▲

Line monitors can be rented from electrical equipment suppliers. If necessary, your local Thermo Fisher Scientific office can assist in interpretation of the results and recommend appropriate corrective measures.

Power Conditioning Devices

Various line voltage conditioning devices are available that can correct your line voltage problem. If you have good regulation but the power line disturbance analyzer shows transient voltages, then an isolation/noise suppression transformer should be adequate to resolve the problem. If there are both transient and regulation problems, then you should consider power conditioners, which can control both of these problems.

When nominal voltage is free from voltage sags, surges, and impulses but different from 230 V AC line to ground, the supply voltage can be lowered (bucked) or raised (boosted) using a buck/boost transformer. Buck/boost transformers are also available from Thermo Fisher Scientific.

Your electrician should install the buck/boost transformer before the installation of your system is started.

NOTICE For compliance and safety, ensure that your power conditioning devices are certified by recognized domestic and international organizations (for example, UL, CSA, TÜV, and VDE). ▲

Uninterruptible Power Supply

If your local area is susceptible to corrupted power or power disruptions, then an uninterruptible power supply (UPS) should be installed in your laboratory.

NOTICE For compliance and safety, ensure that your uninterruptible power supply (UPS) devices are certified by recognized domestic and international organizations (for example, UL, CSA, TÜV, and VDE). ▲

Technical Assistance

Occasionally, Thermo Fisher Scientific encounters line-voltage sources of unacceptable quality that adversely affect the operation of the instrument. Rectifying such power-supply problems is the responsibility of the operator. However, (upon request) Thermo Fisher Scientific will attempt to assist in diagnosis, but does not undertake to isolate and correct power-supply quality problems.

Contact your Thermo Fisher Scientific office for assistance in monitoring the line voltage in your laboratory, in selecting a line conditioner, or in locating a power consultant in your area.

Specifying power conditioning equipment is a complex task that is best handled by a company or consultant specializing in that field.

A selection of such companies is listed in Table 8-1:

Table 8-1. Companies specifying power conditioning equipment

Company	Address or comment	Internet
General Electric Company	Worldwide distribution network	www.ge.com
JOVYATLAS Elektrische Umformtechnik GmbH	Groninger Straße 29-37 26789 Leer, Germany Phone: +49 (491) 6002 0 Fax: +49 (491) 6002 48	www.jovyatlas.info
OnLine Power, Inc.	Conform to all applicable standards, worldwide	www.onlinepower.com
POWERVAR, Inc.		www.powervar.com
Sola/ HD		www.sola-hevi-duty.com

NOTICE Thermo Fisher Scientific does not endorse any manufacturer, nor does it endorse products other than its own. Companies and products listed in this guide are given as examples only. ▲

Electrostatic Discharge

Electrostatic discharge (ESD) can damage the electronic components of your instrument. Thermo Scientific instruments are designed to withstand electrostatic discharges (ESD) up to 4 kV (air discharge) and 4 kV (contact discharge) with all panels in place. However, if the panels are removed and the PCBs are handled without proper precautions, the electronic components might be damaged or fail prematurely. Static electricity can develop in a variety of ways. A few examples of how electrostatic charge can develop are as follows:

- When walking across a carpet in a room that is at 20% relative humidity, as much as 35000 V of electrostatic potential can be generated on the surface of your body. This same motion in a room at 80% relative humidity generates about 1500 V of electrostatic potential.
- Sitting and working in a chair padded with polyurethane foam in a room at 20% relative humidity can cause as much as 18000 V of electrostatic potential to develop on your skin or 1500 V at 80% relative humidity.
- Working in laboratory coats and clothing made of synthetic fibers can cause the accumulation of static electricity on your skin.
- Polystyrene cups and packing materials typically have a considerable electrostatic charge on them.

Many electronic components can be damaged by a discharge of electrostatic potential of as little as 50 V. ESD damage can be catastrophic causing your system to cease functioning. More commonly, however, ESD damage might cause latent problems that are detrimental to sensitive electrical components, causing premature failures. Therefore, Thermo Fisher Scientific recommends the following precautions, especially when you are operating your system at the lower end of the relative humidity specification listed above:

- Use a static-dissipating floor covering (such as tile or conductive linoleum) in the room that houses your instrument.
- Use laboratory chairs covered with natural fiber or other static dissipating material.
- When operating the instrument, wear laboratory coats and clothing made of natural fiber or other static-dissipating material.
- Do not place polystyrene cups or packing materials on the instrument.

Legal Documents

This chapter provides legal documents.

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FCC Compliance Statement

THIS DEVICE COMPLIES WITH PART 18 OF THE FCC RULES.

WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Thermo Fisher Scientific is registered with B2B Compliance (B2Bcompliance.org.uk) in the UK and with the European Recycling Platform (ERP-recycling.org) in all other countries of the European Union and in Norway.

If this product is located in Europe and you want to participate in the Thermo Fisher Scientific Business-to-Business (B2B) Recycling Program, send an email request to weee.recycle@thermofisher.com with the following information:

- WEEE product class
- Name of the manufacturer or distributor (where you purchased the product)
- Number of product pieces, and the estimated total weight and volume
- Pick-up address and contact person (include contact information)
- Appropriate pick-up time
- Declaration of decontamination, stating that all hazardous fluids or material have been removed from the product

For additional information about the Restriction on Hazardous Substances (RoHS) Directive for the European Union, search for RoHS on the Thermo Fisher Scientific European language websites.

NOTICE This recycling program is not for biological hazard products or for products that have been medically contaminated. You must treat these types of products as biohazard waste and dispose of them in accordance with your local regulations. ▲

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