

Highlight me, press F9, and respond to the prompts.

Installation 1

Organization of the Manual	1-1
Conventions Used in the Manual	1-2
Type.....	1-2
Notes	1-2
Cautions and Warnings	1-2
Overview of the TurboMass Instrument.....	1-3
AutoSystem XL GC.....	1-4
TurboMass Mass Spectrometer.....	1-6

Highlight me, press F9, and respond to the prompts.

Installation 1

This manual is a complete reference for the Perkin-Elmer Field Service Engineers (FSEs) who install and service the TurboMass Gas Chromatographic Mass Detector System.

Note: Before trying to service the TurboMass system, you should have completed the Basic Service Training for the Perkin-Elmer TurboMass product line.

Organization of the Manual

This manual is divided into seven “Parts,” that are themselves divided into Chapters. The Parts are arranged in the following manner:

- If another injector is installed, a screen similar to the following appears:
- Part 1 includes this chapter, an introduction to the manual and to the instrument. Part 1 also includes a chapter on hazards and safety practices.
- Part 2 describes how to prepare the laboratory prior to installation, unpacking and installation procedures, and post-installation performance tests and adjustments.
- Part 3 provides detailed descriptions of the TurboMass system and how to service and troubleshoot these systems.
- Part 4 includes chapters on overall instrument troubleshooting and system diagnostics.
- Part 5 is a reference section that includes simplified operating instructions and instrument specifications.
- Part 6 is designed as the Illustrated Parts List (IPL). The IPL includes the reduced CAD drawings that are pertinent to FSEs. Because of its size, the IPL has been released in its own 3-ring binder as a SEPARATE MANUAL. The Perkin-Elmer part number is [REDACTED].
- Part 7 is simply a place to store Service Data Bulletins (SDBs) and other late-breaking TurboMass information.

Note This manual includes the electrical schematics for the TurboMass systems. These schematics are located at the end of the chapters that describe the system in which the board is a part of.

Conventions Used in the Manual

The following text conventions are used throughout this manual:

Type

Bold type is used for:

- commands, for example: **████████**
- the name of an icon that you click on, for example: **████████████████**
- a button that you click on, for example: Click on **OK**.
- words that you type, for example: Type **████████** and press Enter

An asterisk (*) is used to indicate a one-step procedure.

Underlines and *italics* are used for clarification or emphasis.

Notes

In this manual, the following special format is used to set apart important information and notes:

Note **Notes emphasize significant information in a procedure or description.**

Cautions and Warnings



Warning

A warning indicates an operation that could cause *personal injury* if precautions are not followed.

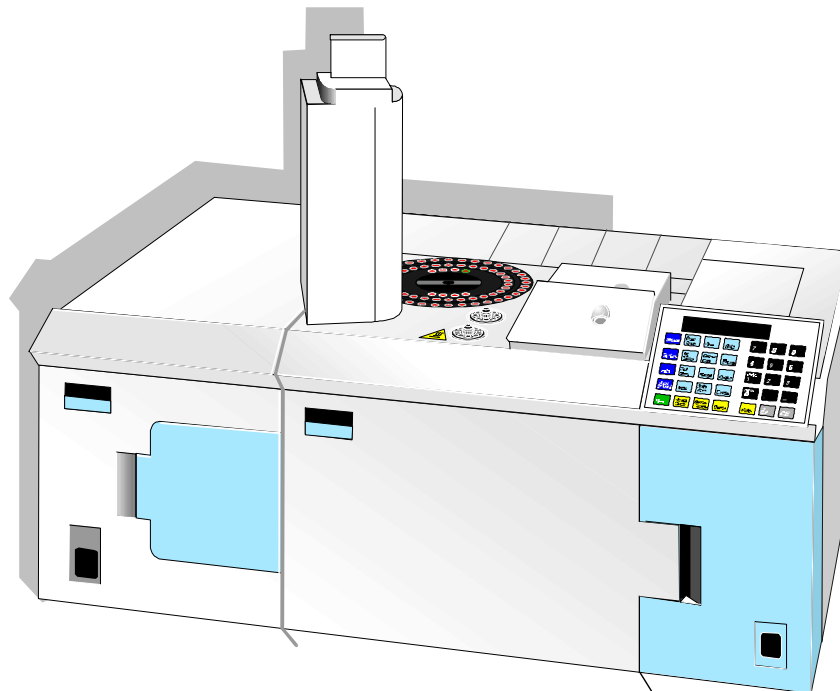


Caution

A caution indicates an operation that could cause *instrument damage* if precautions are not followed.

Overview of the TurboMass Instrument

The TurboMass™ mass spectrometer is a compact benchtop instrument that produces positive identification and quantitation of compounds separated by the AutoSystem XL GC. Even if the compounds coelute, the TurboMass can still positively identify and quantitate each compound. TurboMass is designed to run analyses that best identify your sample by using the electron impact (EI) or chemical ionization (CI) mode{ XE "Introduction to TurboMass" }.



TurboMass is controlled by a personal computer (PC) based data system using the Microsoft Windows NT™ operating environment. The user interface contains color graphics and provides full user interaction with either the keyboard or the mouse. TurboMass completely controls the GC/MS system from tuning and data acquisition (scanning or selected ion recording mode), through quantifying your results. Complete operating instructions of all TurboMass controls are in the *TurboMass Software Guide* (P/N S270-1610), supplied with the system.

A high-performance, research-grade analytical quadrupole mass analyzer with a quadrupole prefilter assembly transmits only those ions having your selected mass-to-charge ratio. The prefilter rod set protects the analytical quadrupole rods from contaminating ion deposits. Ions emerging from the quadrupole mass analyzer are detected by the photomultiplier detector system. The low noise photomultiplier typically operates with a gain of 10^5 that amplifies the ion current collected.

The TurboMass System consists of two major components: AutoSystem XL GC and TurboMass Mass Spectrometer.

Brief descriptions of each of these major components follows.

AutoSystem XL GC

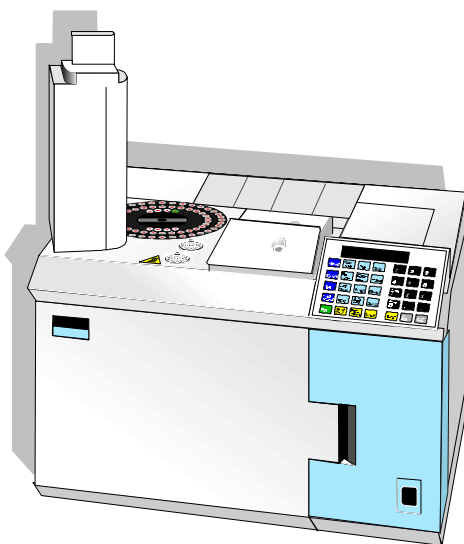


Figure 1-1. AutoSystem XL GC.

The AutoSystem XL Gas Chromatograph is a dual-channel, temperature-programmable gas chromatograph (GC). It is available in many configurations,

such as with or without, an autosampler, programmable pneumatic control (PPC™), and a variety of injector/detector combinations to provide you with total GC flexibility. {xe "Overview:AutoSystem XL GC"}The AutoSystem XL GC is microprocessor controlled, where you enter the operating parameters from the color-coded keyboard and view the prompting text and monitor instrument functions on a large two-line vacuum fluorescence display.

In the Manual Pneumatics Version of the AutoSystem XL GC, the carrier gas controls and, if equipped with optional detectors, the detector gas controls are built into the pneumatics control panel on the AutoSystem XL. The carrier gas controls are used to set the flow for programmed on-column (POC) injectors and the pressure for capillary (CAP) and programmed split/splitless (PSS) injectors.

In the Programmed Pneumatic Control (PPC) Version of the AutoSystem XL GC, the carrier gas and detector gases are monitored and controlled by the microprocessor, thereby producing a fully automated system that is capable of managing all pneumatic functions within the gas chromatograph.

The AutoSystem XL GC can store up to five GC methods. Methods can be generated, copied, deleted, edited, set up, and printed. These methods are normally developed and stored on the TurboMass data system. The automatic liquid autosampler can run up to 15 injections per vial from as many as 82 vials and one priority vial using one or two autosampler programs (if not under TurboMass control). In the latter case, a different GC method can be used by each program if desired.

Real-time digital readouts are provided to simplify setting carrier gas pressures and flows, if flow readout or PPC is installed.

TurboMass Mass Spectrometer

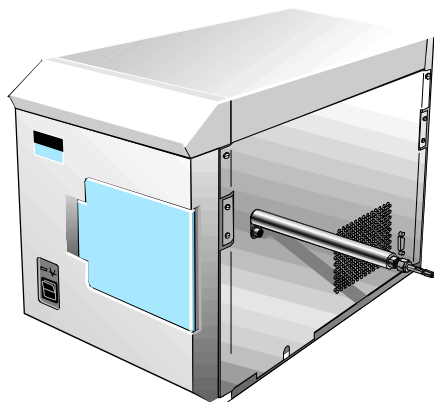


Figure 1-2. TurboMass Mass Spectrometer.

The TurboMass Mass Spectrometer consists of the following principal components or assemblies:

- RF Generator**
- Head Amplifier**
- Penning Gauge**
- Forepump Line**
- Transfer Line**
- Pirani Gauge**
- Turbo Pump**
- CI Adjustment Valve**
- On/Off Switch**
- Calibration Gas**
- Inner Source**
- Outer Source**

The Figure below shows these components or assemblies that comprise the TurboMass Mass Spectrometer.

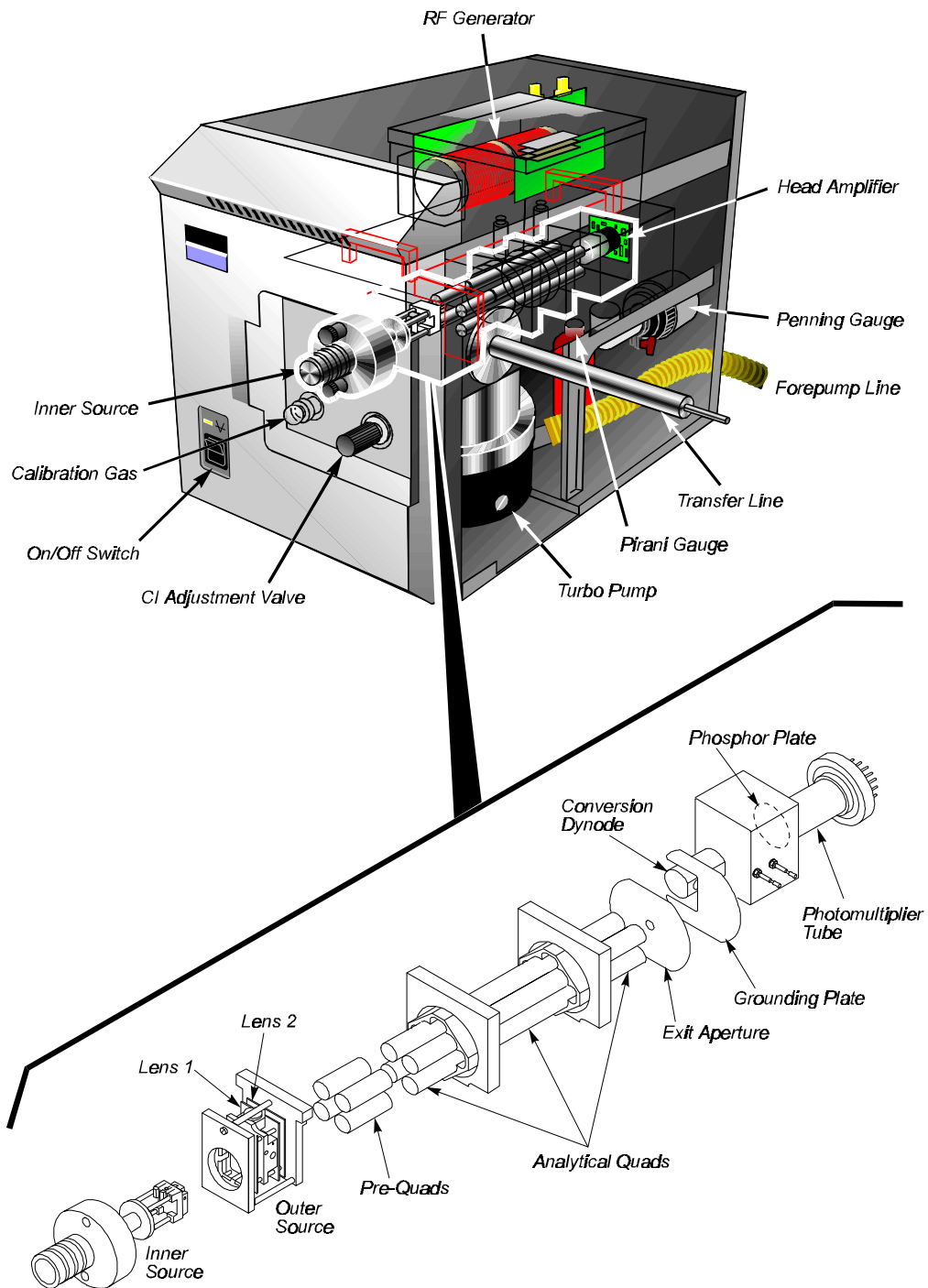


Figure 1-3. Components of the TurboMass and a detail of the ion optics path. { XE "Overview:components" }

Ion Optics Path

Ion Source

The ion source consists of a removable EI or CI inner source and a fixed outer source. In the EI source, molecules exit the column where they are bombarded by electrons from the filament and ionized into positive and negative ions as well as neutral species. The positive electron trap attracts the negative ions and electrons and the repeller directs the positive ions out of the inner source through a focusing lens to the mass analyzer. Those remaining molecules and neutral fragments are pumped away by the vacuum. Heaters in the outer source raise the source temperature high enough to prevent sample molecules from condensing in the source and minimize any contamination. { XE "Overview:ion source" } { XE "Ion Source" }

Mass Analyzer

The mass analyzer element of this high performance quadrupole mass spectrometer is a finely machined assembly which has been precisely aligned using specialized equipment. *Under no circumstances* should the main analyzer rod set assembly ever be dismantled.

TurboMass is fitted with a quadrupole prefilter assembly that is designed to protect the main analyzer by intercepting the majority of any contamination. As a consequence, the main analyzer should never require cleaning.

On occasion, it may be necessary to remove the prefilter rods for cleaning. The need to clean these rods is usually indicated by poor peak shape or loss of resolution, although other more likely causes, such as source contamination, should be eliminated first. It is necessary to remove the inner and outer ion source assembly before the prefilter assembly can be removed. {xe "Overview:mass analyzer"}{xe "Mass Analyzer"}

Detector

The detector consists of a conversion dynode, phosphor plate, and photomultiplier tube. The detector works by accelerating positive or negative sample ions onto a dynode surface which emits electrons. The electrons are then accelerated to strike a phosphor, which produces photons of light that are amplified by the photomultiplier and collected as the signal. {xe "Overview:detector"}{xe "Detector"}

Photomultiplier

The photomultiplier consists of a photosensitive surface and electron multiplier sealed in a glass tube. The light strikes the front window, electrons are emitted and accelerated onto the first dynode of the electron multiplier and avalanche down the chain of dynodes. The multiplier is sealed in its own permanent vacuum chamber (glass tube) and cannot be contaminated. {xe "Overview:photomultiplier"}{xe "photomultiplier"}

Electronics

The TurboMass electronics consist of a communications board (Tdat) in the PC, and an analog board, multiple processor unit, backplane, PMT electrometer, high voltage and low voltage power supply boards in TurboMass.

The Transputer Processor Card (TPC) controls all aspects of the instrument and data acquisition. It primarily consists of three processors. The Scan Processor Unit (SPU) controls the instrument, communicates with the Data system and organizes acquisition. The Peak Processing Unit (PPU) controls the acquisition. The acquisition processor (APU) is responsible for processing the analogue signal output, performing peak detection, multiple separation and thresholding, and thus producing peak mass and intensity information.

Ions exiting from the quadrupole are accelerated into a cup-shaped dynode where they strike the inner surface. Electrons are emitted into an electric field which extracts them from the conversion dynode and passes them onto the phosphor. The phosphor is held at a higher positive potential than the dynode. Light is emitted when the electrons strike the phosphor. The resulting optical signal is detected by the photomultiplier. {xe "Overview:electronics"}{xe "Electronics"}

Reference Gas Inlet

The reference gas inlet system consists of a glass bulb filled with heptacosane (FC43) that is connected to tubing which directs it to the ion source. You can switch the reference gas solenoid valve on and off and also purge the reference gas lines from the Tune screen. {xe "Overview:reference gas inlet"}{xe "Reference Gas Inlet"}

GC Interface (Transfer Line)

The detector end of a capillary GC column in the AutoSystem XL GC oven is inserted through a temperature-controlled transfer line and optimally positioned so that the column end is flush with the inner wall of the EI or CI ion source. The transfer line is temperature controlled by TurboMass and has a 350 °C upper limit. If the AutoSystem XL GC detects improper operation (for example, no carrier gas) and goes into an alarm condition, it will turn off the temperature to the transfer line. {xe "Overview:transfer line"}{xe "Transfer line"}



Caution

Do not use metal capillary columns in the transfer line. They may electrically short-out the source.

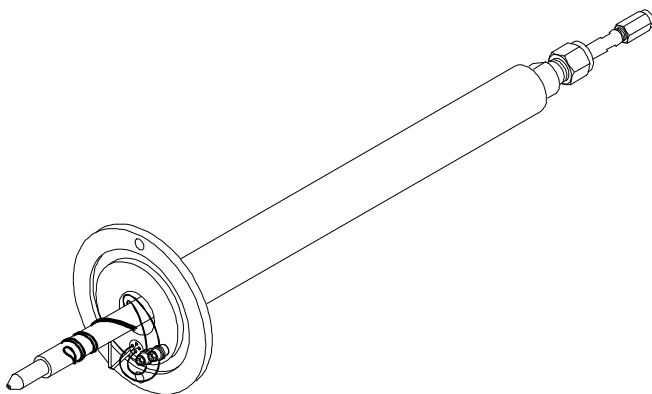


Figure 1-4. The TurboMass transfer line.

Vacuum System

{ XE "Vacuum system" } { XE "Vacuum system:rotary pump" }The source, ion optics, analyzer, and detector are fitted inside a cast aluminum chamber. Vacuum is applied to the chamber using a rotary pump and a turbomolecular

pump. The vacuum is monitored through an optionally installed Pirani gauge and a Penning gauge. The rotary pump sits on the floor and one of the following high vacuum pumps is mounted under the ion optics chamber:

- 80 L/sec oil diffusion pump
- 250 L/sec turbomolecular pump

Rotary Pump

The TurboMass has a 3 m³/hr computer controlled mechanical pump. The high vacuum pump (diffusion or turbomolecular) is backed by this direct drive rotary pump. The rotary pump is floor mounted and may be positioned beneath the instrument. Operation and maintenance details about these pumps can be found in the manuals provided with the pump.

A floor-mounted rotary (fore) pump provides the first level of vacuum to approximately 2×10^{-3} torr. The pump has a dual voltage input and is matched to the turbomolecular pump.

Connect the rotary pump exhaust to a line vented to the atmosphere outside the laboratory.



Caution

To prevent contamination of the vacuum system, the AC line cord for rotary pump must be plugged into the designated receptacle on the back of the TurboMass. The pump is controlled by the TurboMass software.

Connecting the turbopump hose to the exhaust connection of the forepump will severely contaminate TurboMass.

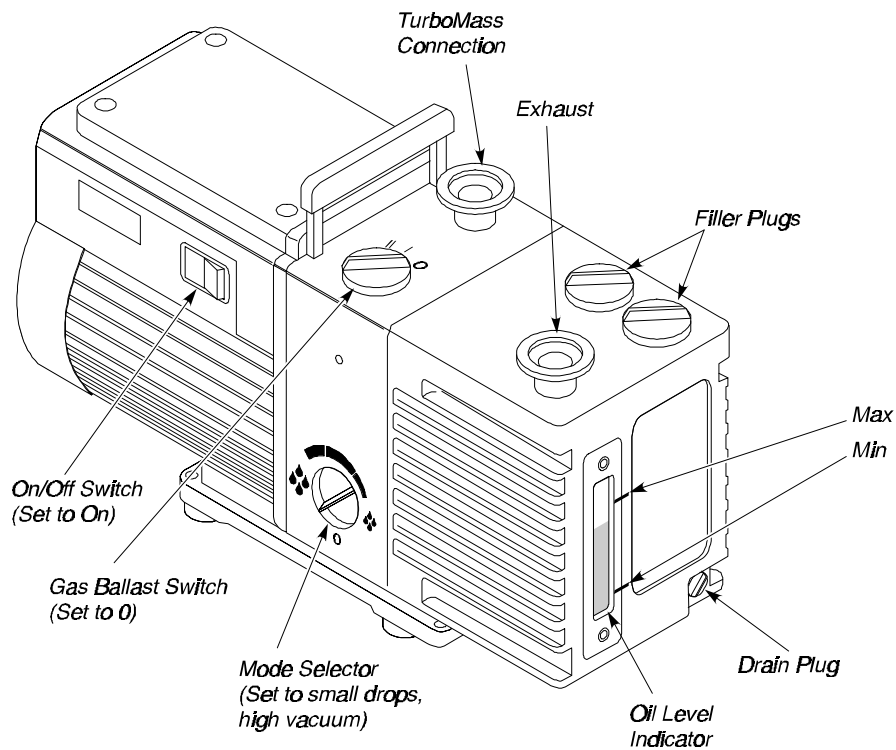


Figure 1-5. The rotary (fore) pump.

Turbomolecular Pump

{ XE "Vacuum system:turbomolecular pump" } TurboMass has a 250 L/sec software-controlled turbomolecular pump. When the pump slows to 50% full speed, a hardware-controlled vent valve vents the pump. Even though the system can be vented to air, it will pump-down faster if you vent to a clean, dry gas such as nitrogen or helium.

Pirani Gauge

The optional Pirani gauge monitors the low vacuum during pump-down. Typically from atmosphere to 10^{-4} mbar. This gauge is equipped with the oil diffusion pump to turn on the pump. When it reaches a vacuum of 1×10^{-3} Torr the system turns on.

Penning Gauge

The Penning gauge monitors the high vacuum, typically from 10^{-4} to 10^{-6} torr.

Computer

{ XE "Computer" }The computer uses the TurboMass software to control the TurboMass system. To ensure that your system performs at the expected high level, your computer must at least be configured to the following minimum requirements.

- 166 MHz Pentium processor
 - 32 MB of system memory
 - SVGA 640 x 480, 256 colors and a 15-inch monitor
 - 2 GB hard drive
 - 1 serial port
 - CD ROM Drive
 - Microsoft serial mouse or any pointing device supported by Microsoft.
 - One 1.44-MB 3.5-in. floppy disk drive.
 - One parallel printer port with a 25-pin female connector.
 - One internal ISA slot for the TurboMass interface card (TDAT).
 - Country kit
 - Microsoft Windows NT 4.0 with Service Pack 3 or later.
-