

HP 5970B Mass Selective Detector and HP 5995C Benchtop GC/MS System

 HEWLETT
PACKARD



You've never been able to put this much GC/MS analytical power on your benchtop before.

Introducing the HP 5970B mass selective detector and the HP 5995C benchtop GC/MS system.

If you're about to buy a benchtop GC/MS your timing couldn't be better. Meet the new HP 5970B and HP 5995C GC/MS systems. Both incorporate the all-new HP GC/MS workstation for ease of use, data handling, analytical and automation capabilities previously associated only with more costly systems.

High speed for capillary GC

The GC/MS workstation optimizes both the HP 5995C and 5970B for capillary GC. It provides high speed data acquisition in both scanning and selected ion monitoring. Scan rates

Three GC/MS workstations are offered:

1. standard shown here, with HP 9816S computer, HP 9133XV disc drive and printer;
2. full-color with HP 9836CS computer, HP 9133XV disc drive and printer; and
3. full-color, same as No. 2 but with larger disc drive, HP 7914P.

higher than 1500 amu/sec assure high resolution of fast peaks.

Automation to handle more samples

To increase your productivity, the new GC/MS workstation will automate the entire GC/MS process . . . from automatic sample introduction through GC separation, mass analysis, data reduction and final printed report. Control of the HP 7672A automatic sampler permits unattended analysis of up to 99 samples. And different samples can be handled by different methods. (For full GC control with the HP 5970B your gas chromatograph must be either the HP 5890 or 5790.)

You can see the data you are getting

In qualitative analysis, during acquisition of mass spectra for compound

identification, you can check the data you are collecting. During the run you can vary the CRT display to monitor a total ion chromatogram, several specific ions and/or spectral data in real time. Spectra are automatically saved on disc. To optimize compound identification you can time program both the scan rate and the mass range scanned.

Selected Ion Monitor (SIM)

In quantitative and trace analysis using SIM, you can monitor and quantitate specific ions characteristic of a compound of interest. In this mode the HP 5970B and 5995C are more sensitive and specific than most specific detectors and can easily replace FID, ECD, NPD and FPD in the laboratory.

Up to ten groups of 20 ions each can be monitored and you can use time programming to monitor different groups at different times during an analysis. A chromatogram is collected for each ion. These chromatograms can be automatically integrated using standard GC methods: Area%, Norm%, ESTD, and ISTD. For better peak quantitation multiple time reference peaks, multiple internal standards, peak ratios, and multi-point calibration curves can be used.

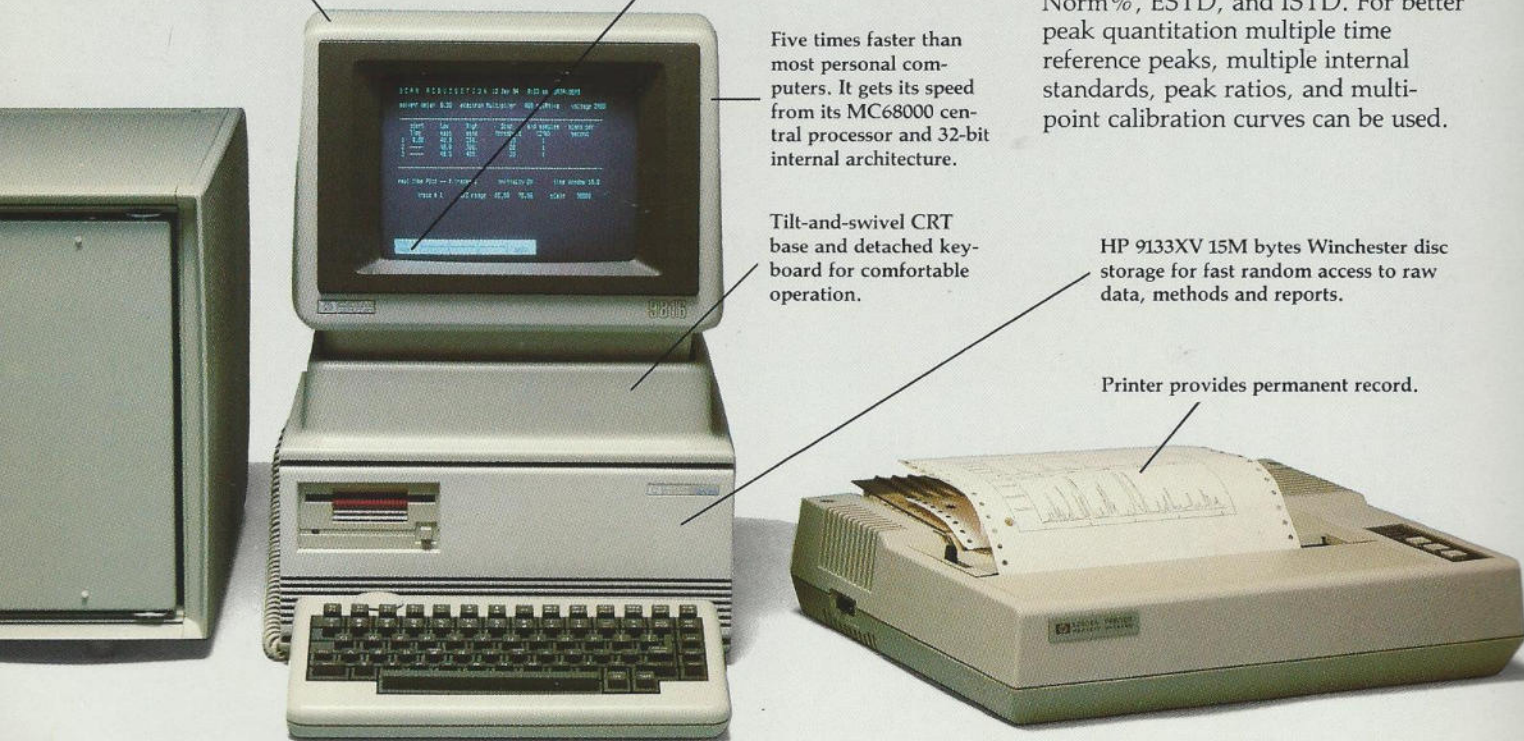
Softkeys for fast, single-stroke control.

Five times faster than most personal computers. It gets its speed from its MC68000 central processor and 32-bit internal architecture.

Tilt-and-swivel CRT base and detached keyboard for comfortable operation.

HP 9133XV 15M bytes Winchester disc storage for fast random access to raw data, methods and reports.

Printer provides permanent record.



You can follow the CRT . . . or do it your way

Interactive CRT makes GC/MS easy. When you build a method the interactive CRT leads you step-by-step, helping you set and time program conditions for every phase of the analysis. Softkeys, up to 10 for each display, permit single pushbutton control of most operations and the softkeys are labelled in the language of chromatography. Once you've established a method you can store it on disc for future callup at the touch of a few keys.

But you don't have to follow the workstation's preset, prompted approach to method building. You can override it and take control of any operation including tuning, set-up conditions and presentation of data. You can be as creative as you need to be. You have great flexibility.

You can be a great data editor

After a run, using HP's new interactive data editing, you can manipulate and display stored data in a fantastic variety of ways that help you identify unknowns and enhance presentation of your results.

You can expand and focus selected portions of your data, display data side-by-side for comparison, subtract one spectrum from another. The possibilities are virtually unlimited. Of course, recorded data can be plotted, tabulated and searched against library spectra. Also, any data or picture on the CRT can be sent to a printer or optional plotter for permanent copy.

Extracted ion profiles. The GC/MS workstation can also create extracted ion profiles from stored mass spectra. This is a very useful technique for analyzing merged GC peaks and detecting low level components. It can also be used to rapidly select peaks of a particular chemical class. Again the interactive CRT makes this technique simple to apply.

Library search

An easy-to-use, effective library search system aids in rapid identification of spectra. A built-in program allows you to create and search your own libraries.

When the NBS library, Revision E, is purchased you can search 38,791 compounds. The library includes: hydrocarbons, flavors, fragrances, industrial pollutants, pesticides, EPA organic priority pollutants, steroids, alkaloids, drugs, amino acids, and carbohydrates.

Automatic or manual tuning

To speed set-up and eliminate the need for an operator skilled in tuning mass spectrometer voltages, HP invented AUTOTUNE. At the touch of a few keys you can automatically tune either the HP 5995C or 5970B. AUTOTUNE also lets you optimize sensitivity in a specific mass range and permits spectral normalization. Spectral normalization greatly increases reproducibility, makes spectral interpretation easier, and improves library search results.

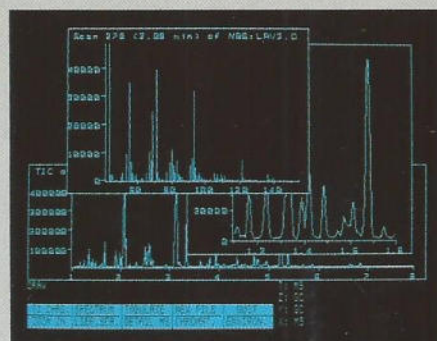
Manual tuning. If you want to further optimize tuning for a particular application, the GC/MS workstation simplifies manual tuning. The interactive CRT presents real-time tuning parameters in a form that guides you in making changes. Softkeys allow single keystroke operations. You can optimize on PFTBA or on a tuning compound more specific to your application.

Choice of report format

Depending on the amount of information you want in your analysis report, you can choose, with a single keystroke, either the short, long or extended format. If a special format would enhance your presentation you can place your GC/MS report in VisiCalc^{®1} just by pressing a softkey. VisiCalc^{®1} lets you organize your report in any format you want. Your data can look as good as it is.

Networking

With its RS232 interface your GC/MS workstation is a gateway to a large mainframe computer, such as the HP 1000, where you can send data for further manipulation. The HP-IB interface and optional terminal emulation capability provide additional flexibility.



To help identify components you can instantly get a spectrum of any point on any peak (upper left) or zoom in on any portion of the chromatogram (upper right).

A high-performance personal computer

When it's not doing GC/MS, your workstation can serve you as a high-performance HP 200 Series technical personal computer that has over 70 software packages. For example:

- Context MBA^{™2} (spreadsheet modeling, word processing, graphics, database management, telecommunications)
- VisiCalc^{®1}
- Graphics Presentation (slide generation)
- Master Word Processor
- Terminal Emulator
- File Management
- Project Management
- Business
- Mathematics / Statistics
- Engineering / Science
- Mailing lists and mailing labels
- Budgeting and manpower projections
- Project planning
- Inventory control and payroll
- Investment analysis
- Instrument calibration

¹VisiCalc is a registered trademark of VisiCorp, Inc.

²Context MBA is a registered trademark of Context Management Systems.

HP 5970B mass selective detector (MSD) . . . from now on, this may be the only capillary GC detector you will ever need.

Compared to other GC detectors the HP 5970B mass selective detector is incredible:

- It is both specific and universal.
- It permits positive, unambiguous compound identification.
- It can selectively monitor for a specific compound (or compounds) with picogram sensitivity.
- It provides highly sensitive detection over a wide range of organic compound classes.
- It is optimized for capillary gas chromatography.
- It includes a GC/MS workstation that simplifies operation and provides fantastic data handling and automation capabilities. See pages 2 and 3.

This is the second generation in the HP 5970 series that introduced MSD to the chromatographer and greatly strengthened Hewlett-Packard's leadership in benchtop GC/MS. The new HP 5970B combines HP's advanced GC/MS and microcomputer technology in a compact benchtop unit that can be mounted on either side of most gas chromatographs. It requires no special utilities and is as easy to use as other GC detectors.

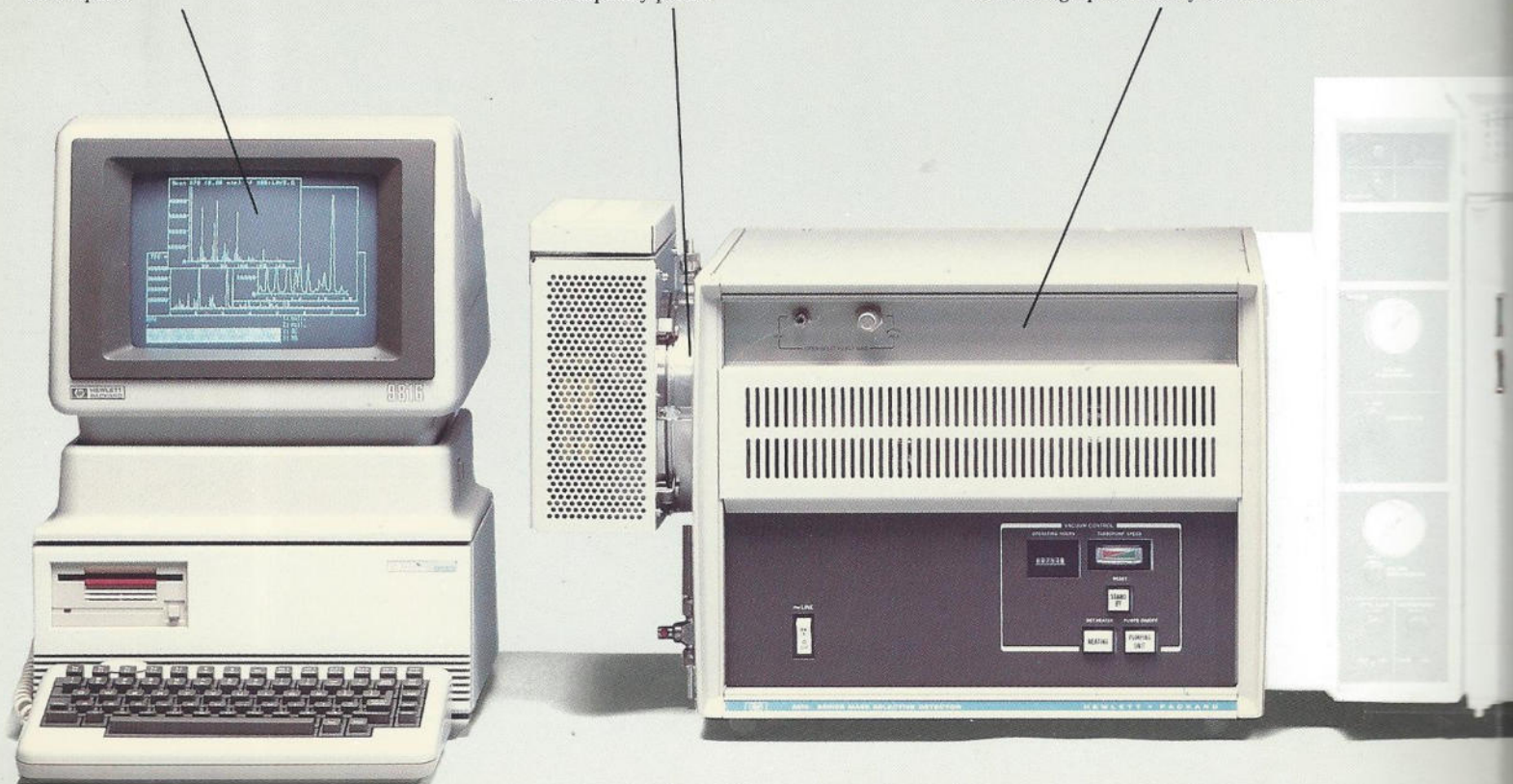
How the MSD helps provide positive compound identification

The mass selective detector (MSD) produces mass spectra and ion chromatograms of components eluting from your capillary gas chromatograph. As sample components elute from your gas chromatograph into the MSD they are ionized by electron impact and the resulting ion fragments are sorted (scanned) and stored according to mass. The stored fragmentation patterns are unique mass spectra. Comparison with reference mass spectra, through library search, can expedite positive compound identification.

The GC/MS workstation's interactive CRT guides MSD operation and helps you get the most out of your data. It takes only a little more than one square foot of benchspace.

HP's proven hyperbolic quadrupole mass filter permits high speed scanning required for fast capillary peaks.

The mass selective detector is available in configurations to mount on most gas chromatographs. It's only 18 inches wide.



Total ion scanning

In the total ion scanning mode each eluting capillary peak is scanned repetitively over the entire mass range. All resulting mass spectra are stored and available for immediate display in a total ion chromatogram of the run and in separate spectra for each peak that can provide unambiguous compound identification.

Optimized for capillary GC

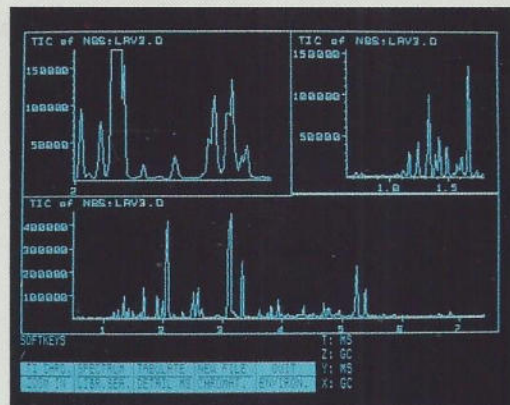
Since capillary peaks are frequently only a few seconds wide, the MSD provides scanning rates > 1500 amu per second, along with the very high speed data acquisition required for accurate compound identification in fast capillary runs. Two capillary interfaces are offered, direct and open-split.

The MSD will scan any mass range between 10 and 800 amu at any of 8 user-selectable scan rates. Scan rates and mass ranges are time-programmable allowing closer examination of masses of interest.

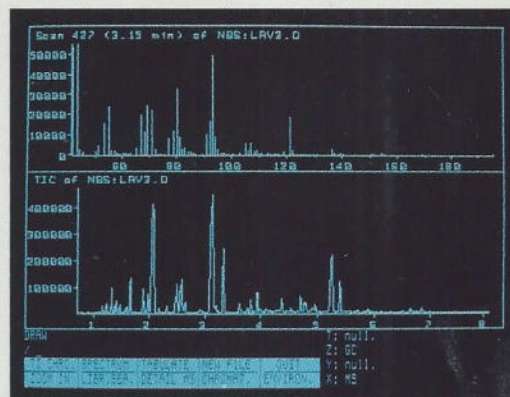
Selected ion monitoring

Other GC detectors achieve very high sensitivity but only the MSD (or a GC/MS) can achieve a high sensitivity with high selectivity for a specific compound. In the selected ion monitoring (SIM) mode the MSD can be set to monitor only those ions that are characteristic of a specific compound. Since selective scanning permits the mass analyzer to dwell longer on specific masses, this mode is far more sensitive than total ion scanning. It permits analysis of selected compounds at very low levels in very complex mixtures—mixtures that may be too complex for resolution by gas chromatography alone.

In the SIM mode up to ten groups of 20 ions each can be monitored and their individual chromatograms can then be automatically integrated.



Interactive data editing lets you magnify and examine sections of your total ion chromatogram.



To get a spectrum of the component at any point on your total ion chromatogram you just press the SPECTRUM soft key and move the cursor to the point.

```

Title : AZOBENZENE QUANTITATION
      Sample Amount : 0.200
      Multilevel Curve Fit : Linear
      Reference Peak Window : 5.00 % of Ret Time
      Non-Reference Peak Window : 5.00 % of Ret Time
      Uncalibrated Peak Response Factor : 0.002      Dilution Factor : 1.000

Ret Time  Pk #  Ch Description  Ret pg/ul  Lvl  Amt/ Area  Pk-Type  Partial Name
5.511      8  Ion Mass 102.1  10.00      1  93.31e-5  1  AZOBENZENE

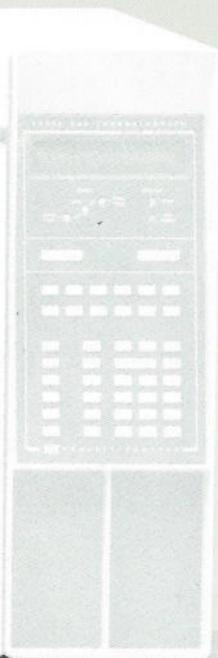
Compound Name: AZOBENZENE

Quantitate Referenced to:
ISTD 1 at 5.90 min.  DIBANTHRAZENE

Confirm Presence of Compound Based Upon:
Channel Description  eExpected Resp  Limits
Ion Mass 51.1  35.00 %  + 10 / - 10 %
Ion Mass 77.0  100.00 %  + 10 / - 10 %
Ion Mass 105.0  75.00 %  + 10 / - 10 %
Ion Mass 152.0  10.00 %  + 5 / - 5 %
    
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In selected ion monitoring with the HP 5970B you can determine the presence of a compound not just by retention time and a single mass (m/z) but by confirmation of the compound's presence on up to five other mass (m/z) channels.

Your gas chromatograph.



HP 5995C—the chromatographer's GC/MS.

Gives you big system results at a benchtop price

This is the third generation in the HP 5995 benchtop series that has put GC/MS in chromatography labs throughout the world and set the standard for price/performance and reliability.

Now the HP 5995C further advances Hewlett-Packard's leadership. The HP 5995C is easier to use, more flexible, faster and even better for capillary GC/MS than its predecessors.

Easier to operate and automate

The biggest difference in the HP 5995C is the new high-performance GC/MS workstation. It helps you do everything better, faster and easier. When you build a method the CRT presents a form. You just follow the cursor and fill in the blanks. Softkeys let you make single keystroke commands. Your method can automatically control the whole system from injection through final printed report.

Other system features such as AUTOTUNE, diagnostics and automatic library search help simplify operation.

Easier to analyze and edit GC/MS data

New interactive data editing gives you data analysis and editing capabilities that until now have been available only with bigger and more expensive systems. Some of these capabilities are shown in the CRT photos throughout this brochure. The optional color GC/MS workstation can add extra clarity to your presentation.

Fast scanning for capillary

The HP 5995C will scan at rates greater than 1500 amu/sec increasing

your ability to obtain spectra of components in fast eluting capillary peaks.

Optimized for capillary

For high-performance capillary GC/MS the HP 5995C has a standard capillary split/splitless injector and a choice of two interfaces between the column and the ion source.

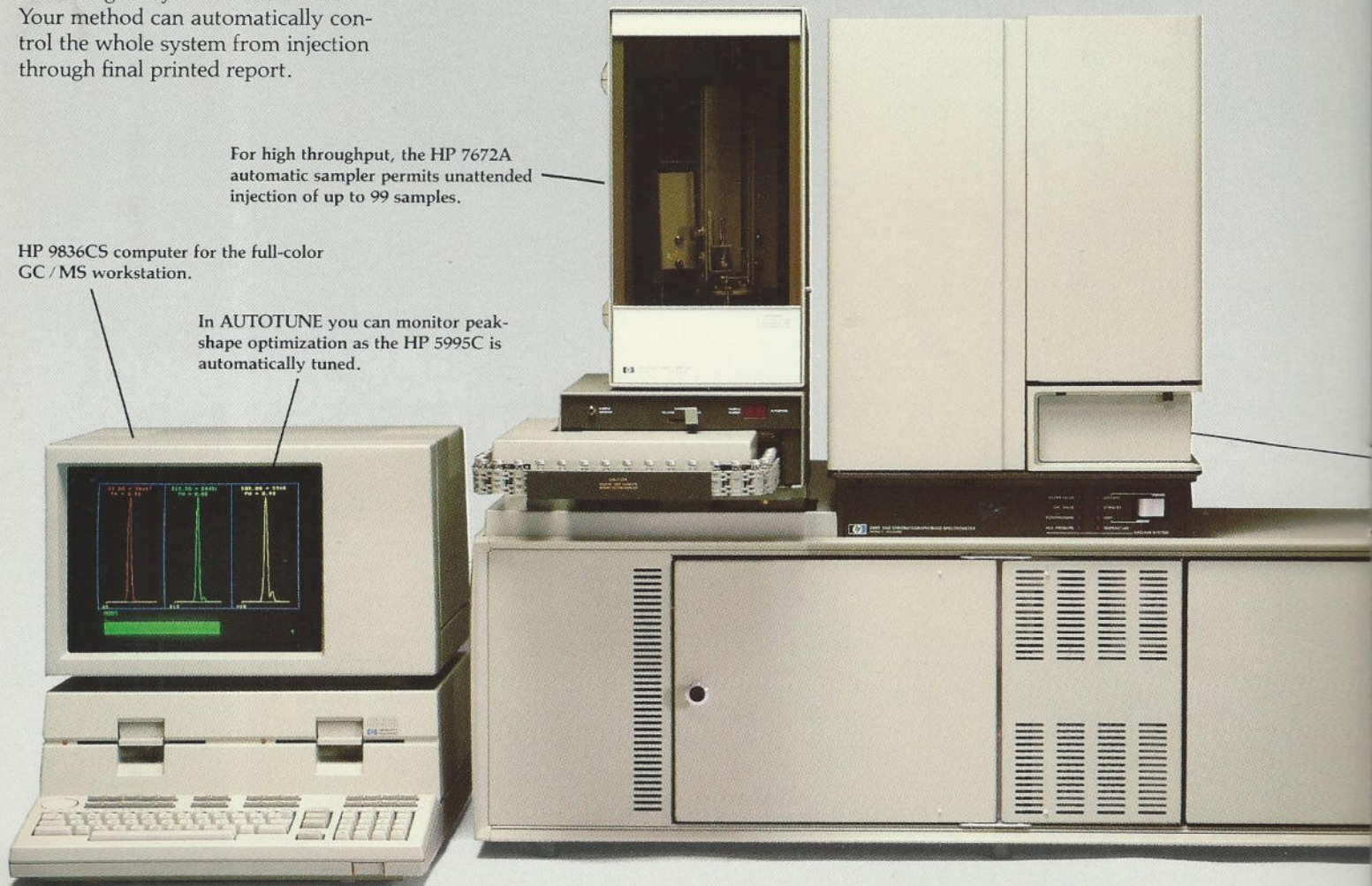
The capillary direct interface provides maximum sensitivity and is extremely simple to operate. It is optimized for use with narrow bore (0.2mm i.d.) fused silica columns which are interfaced directly with the ion source.

The open-split capillary interface is versatile. You can use both narrow and wide bore capillary columns with inside diameters ≥ 0.2 mm. This

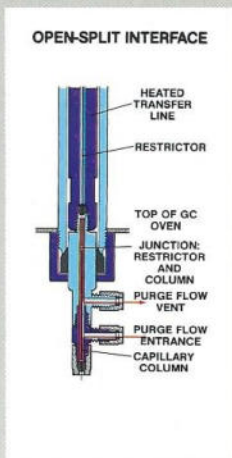
For high throughput, the HP 7672A automatic sampler permits unattended injection of up to 99 samples.

HP 9836CS computer for the full-color GC/MS workstation.

In AUTOTUNE you can monitor peak-shape optimization as the HP 5995C is automatically tuned.



interface is designed so that the purge gas flow rate through the interface can be varied to stabilize the sample flow rate and to "split" samples that are too concentrated while maintaining a yield close to 100% for trace components.



Choice of jet or membrane separator for packed column operation

A separator is required for packed column operation to split the carrier gas from the sample before the sample enters the MS. The more universal jet separator operates over a wide temperature range, is glass-lined for inertness and has a gold mesh to trap particulate matter. The membrane separator is simple and inexpensive but is temperature and compound limited.

Proven HP hyperbolic quadrupole

The HP 5995C uses HP's proven, reliable hyperbolic quadrupole mass filter



Direct insertion probe for non-volatile samples.

for high spectral quality and fast scanning: ≥ 1500 amu/sec over the range from 10 to 800 amu.

Efficient vacuum system

The compact analyzer—ion source, quadrupole and electron multiplier detector—measures only 375 mm long. The required vacuum is provided by an efficient diffusion pump.

It has a contoured design for extra pumping speed (about 200 l/sec for helium). It also has a water-cooled baffle which protects against back-streaming. A turbo-molecular pump is optionally available.

Monitor vacuum pressure. An optional stand-alone ion gauge controller permits monitoring pressure in the high vacuum chamber.

Independent control of five temperature zones

For superior separation and detection, all temperature zones along the sample path are independently controlled: injector, column oven, transfer line, ion source, and quadrupole.

Direct insertion probe

The direct insertion probe option places the sample directly in the ion source and is essential if you need to obtain mass spectra from relatively non-volatile substances that cannot be chromatographed. It is also very useful for pure substances and very small samples. The probe can be heated up to 350°C and programmed at rates between 0.5°C and 65°C/min.

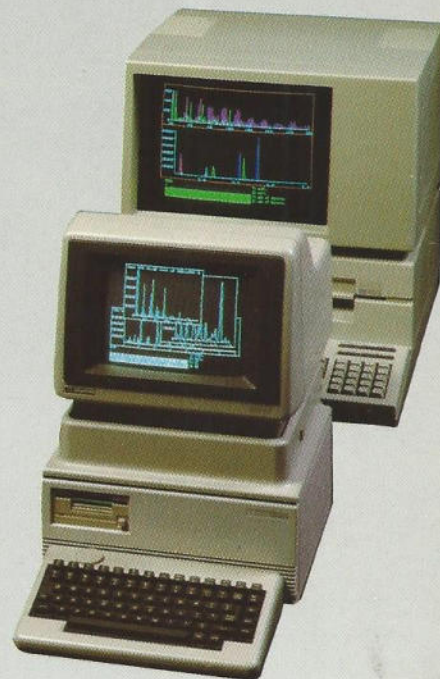
Flame ionization detector

An FID detector is available with an effluent splitter to permit simultaneous FID/MS detection in packed column operation. The FID can also be used independently to establish GC conditions before a GC/MS analysis.

Integrated system

All system components, GC, MS and data system, are built by Hewlett-

Packard and designed to work together. All are supported by the HP assurance of quality and by the service, sales and technical specialists of the HP Analytical Group.



Choose either the standard or the color GC/MS workstation. In the top window of the color CRT the color helps clarify the differences between two overlaid spectra. In the bottom window six ion profiles, each in a different color, are overlaid so you can see, by color, which ions are present in each peak.

CALIBRATION REPORT	
Operator:	J. Chromatographer
Date:	15 January 1984
COMPOUND	AMOUNT
C14	9.00
C15	9.50
AZBENZENE	10.00
ISTD	10.00
MALATHION	9.50
C20	5.00
Total Hydrocarbons: 23.50	

You can present your data in any of the three standard formats provided (short, long and extended) or devise a column format like this using VISICALC[®]. It's built-in to give you extra ability to simplify and clarify reports.

¹ VISICALC is a registered trademark of VISICORP, Inc.

Your access to excellence in analytical instruments and computer-based laboratory systems

Hewlett-Packard designs and manufactures gas chromatographs, liquid chromatographs, GC/Mass spectrometer systems, conventional detectors, spectrophotometric detectors, mass selec-

tive detectors, GC and LC columns, automatic samplers, digital integrators, laboratory automation systems, and accessories and supplies for all instruments and systems.

Your access to excellence in worldwide support

At Hewlett-Packard, excellence does not end with your equipment purchase. It's an integral part of our approach to doing business, and extends to support. HP supports its products from service locations in more than 65 locations throughout the world. Highly qualified people help you choose, install and maintain your HP instruments and systems. You choose from a variety of maintenance agree-

ment options. HP applications chemists are available to help you get maximum performance from your instruments and systems. Consider carefully both product quality and after-sale support before you make a purchase decision. If you need further information, contact one of the Hewlett-Packard locations referred to below.

For more information, call your local HP sales office or call one of these regional offices:

United States

Hewlett-Packard Company
2 Choke Cherry Road
Rockville, MD 20850
(301) 644-5800

Hewlett-Packard Company
1200 East Diehl Road
Naperville, IL 60566
(312) 357-8800

Hewlett-Packard Company
2000 South Park Place
P.O. Box 105005
Atlanta, GA 30348
(404) 955-1500

Hewlett-Packard Company
Neely Sales Region
3939 Lankershim Boulevard
North Hollywood, CA 91604
(818) 506-3700

Europe

Hewlett-Packard Company
P.O. Box CH-1217
Meyrin 2
Geneva, Switzerland
(022) 83 12 12

Japan

Yokogawa-HP
29-21
Takaido Higashi 3-Chome
Suginami-Ku
Tokyo 168
(03) 331-611

Canada

Hewlett-Packard Company
6877 Goreway Drive
Mississauga
Ontario, L4V 1M8
(416) 678-9430

Elsewhere in the World

Hewlett-Packard Company
Intercontinental
3495 Deer Creek Road
Palo Alto, CA 94304
(415) 857-5037



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