O P E R A T I N G M A N U A L

HAPSITE® Smart Plus

Chemical Identification System

IPN 074-472-P1C

DETECT TO PROTECT™

INFICON

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HAPSITE® Smart Plus

Chemical Identification System

IPN 074-472-P1C

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East Syracuse, NY 13057
USA

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A Technical Documentation File is also available for review by competent authorities and will be maintained for a period of ten years after the date on which the equipment was last manufactured. In additional to this file technical, safety, installation, maintenance and application related information concerning this equipment can also be found in the Operating Manual(s) for this product or product family.

Equipment Description: HAPSITE Smart Plus Portable GC/MS with or without wireless communications, including the HAPSITE Service Module, NEG Pump, Battery and AC to DC HAPSITE Adapter.

Applicable Directives:

2006/95/EC (LVD)

1999/5/EC (R&TTE / EMC)
(The required compliance statement concerning this directive can be found in Chapter 4 of this manual.)

2004/108/EC (General EMC)

2002/95/EC (RoHS)

Applicable Standards – Units with wireless communications:

Safety: EN 61010-1:2001

Emissions:

ETSI EN 300 328-2 V1.4.1: 2003 (R&TTE Emissions)
(ERM for equipment operating in the 2.4 GHz ISM band)

ETSI EN 301 489-17 V1.2.1: 2002 (Flicker & Harmonics)
(ERM - Specific conditions for 2.4 GHz)

EN 61326-1:1997/A1: 1998/A2: 2001 (Radiated & Conducted Emissions)
Class A: Emissions per Table 3
(EMC – Measurement, Control & Laboratory Equipment)

Immunity: ETSI EN 301 489-17 V1.2.1: 2002 (General EMI)
(ERM - EMC - Specific conditions for 2.4 GHz)

RoHS: Due to the classification of this product it is currently exempt from the RoHS directive.

Wireless Restrictions:

Countries	Restrictions
France	Outdoor use limited to 10mW e.i.r.p. within the band 2454 to 2483.5 MHz.
Italy	If used outside of own premises, general authorization is required.
Luxembourg	General authorization is required for public service.
Romania	On a secondary basis. Individual license required.
Austria, Denmark, Finland, Germany, Greece, Iceland, Ireland, Liechtenstein, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, The United Kingdom	None

Applicable Standards – Units without wireless communications:

Safety: EN 61010-1:2001

Emissions: EN 61326-1:1997/A1: 1998/A2: 2001 (Radiated & Conducted Emissions)
Class A: Emissions per Table 3
(EMC – Measurement, Control & Laboratory Equipment)

EN 61000-3-2: 2000 (Harmonics)

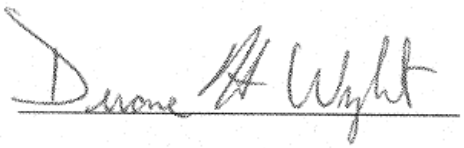
EN 61000-3-3: 1995/A1: 2001 (Flicker)

Immunity: EN 61326-1:1997/A1: 1998/A2: 2001 (General EMC)
Class A: Immunity per Table A.1
(EMC – Measurement, Control & Laboratory Equipment)

RoHS: Due to the classification of this product it is currently exempt from the RoHS directive.

CE Implementation Date: May 1, 2008

Authorized Representative: Duane H. Wright



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Revised 11/04/08 (Rev C)

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Equipment Description: SituProbe
(when used with the HAPSITE Smart Portable GC/MS System)

Applicable Directives: 2006/95/EC (LVD)

2004/108/EC (General EMC)

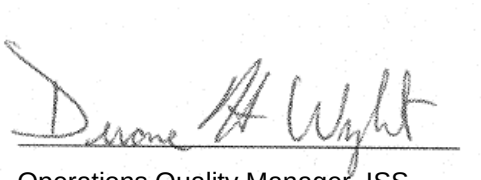
2002/95/EC (RoHS)

Applicable Standards:

Safety:	EN 61010-1:2001
Emissions:	EN 61326-1:1997/A1: 1998/A2: 2001 (Radiated & Conducted Emissions) Class A: Emissions per Table 3 (EMC – Measurement, Control & Laboratory Equipment)
Immunity:	EN 61326-1:1997/A1: 1998/A2: 2001 (General EMC) Class A: Immunity per Table A.1 (EMC – Measurement, Control & Laboratory Equipment)
RoHS:	Due to the classification of this product it is currently exempt from the RoHS directive.

CE Implementation Date: March 31, 2006

Authorized Representative: Duane H. Wright



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A Technical Documentation File is also available for review by competent authorities and will be maintained for a period of ten years after the date on which the equipment was last manufactured. In additional to this file, technical, installation, maintenance and application information concerning this equipment can also be found in the Operating Manual(s) for this product or product family.

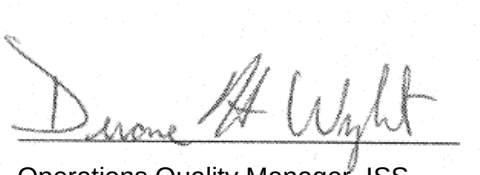
Equipment Description:	Headspace (when used with the HAPSITE Smart Portable GC/MS System)
Applicable Directives:	2006/95/EC (LVD) 2004/108/EC (General EMC) 2002/95/EC (RoHS)

Applicable Standards:

Safety:	EN 61010-1:2001
Emissions:	EN 61326-1:1997/A1: 1998/A2: 2001 (Radiated & Conducted Emissions) Class A: Emissions per Table 3 (EMC – Measurement, Control & Laboratory Equipment)
Immunity:	EN 61326-1:1997/A1: 1998/A2: 2001 (General EMC) Class A: Immunity per Table A.1 (EMC – Measurement, Control & Laboratory Equipment)
RoHS:	Due to the classification of this product it is currently exempt from the RoHS directive.

CE Implementation Date: October 2004

Authorized Representative: Duane H. Wright



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NOTE: These instructions do not provide for every contingency that may arise in connection with the installation, operation or maintenance of this equipment. Should you require further assistance, please contact INFICON.

Definition of Note, Hint, Danger, Warning and Caution Paragraphs

NOTE: This is a note paragraph. Notes provide additional information about the current topic.

HINT: This is a hint paragraph. Hints provide insight into product usage

DANGER

This is a Danger paragraph. Failure to heed these messages has a high likelihood of resulting in serious personal injury or even death!

WARNING

This is a Warning paragraph. It warns of actions that may cause physical injury.

WARNING - Risk Of Electric Shock

This Warning paragraph warns of the presence of electrical voltages which may cause physical injury.

CAUTION

This is a Caution paragraph. It cautions against actions which may damage the instrument or lead to the loss of data.

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Operating Manual Style Conventions

The following information describes the conventions used throughout this manual.

When holding down a key and then pressing another key, this is expressed as (for example) Press Ctrl+C

It is assumed that the hard drive used is drive c. If using another drive, substitute the hard drive letter being used for "`c:`".

Left-click means to press and release the left mouse button (LMB) and right-click means to press and release the right mouse button (RMB).

The HAPSITE software operates in the Windows environment using the Windows® Graphical User Interface (GUI). Actions in the HAPSITE software GUI that are common to the Windows GUI are not explained in detail in this manual. Refer to the Windows documentation supplied by Microsoft®.

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Chapter 1
Introduction

1.1 The HAPSITE Smart Plus System

The HAPSITE® Smart Plus Portable Gas Chromatograph and Mass Spectrometer (GC/MS) is designed to measure volatile organic hazardous air pollutants at parts-per-trillion (PPT) levels, using pre-programmed sets of instructions known as "methods". By operating on battery power using self-contained Carrier Gas and Internal Standard Gas supplies, the HAPSITE Smart Plus is specifically designed to collect and analyze samples while in the field. Results can be viewed on-site, as they are displayed on the front panel and saved on the system's hard drive. Through the use of a USB drive, crossover cable or wireless connection, results can also be downloaded to a separate Laptop (PC) for analysis.

NOTE: This manual is specifically for the HAPSITE Smart Plus. The terms "HAPSITE" and "HAPSITE Smart Plus" are used throughout this manual to refer to the HAPSITE Smart Plus.

Several hardware modules comprise the HAPSITE Smart Plus system:

HAPSITE . . . . . Often referred to as the Analytical Module (AM). The AM contains the Gas Chromatograph, Mass Spectrometer, cylinders of Carrier Gas and Internal Standard Gas, High-vacuum Chemical Pump (for portable operation), control electronics, Battery, Keypad, Display, and a Battery Charger.

Probe . . . . . Also known as the Hand Control Unit, this consists of a hand piece and a heated inlet line. The hand piece contains a small display and buttons. The inlet line connects to the HAPSITE and provides a flexible heated sample flow path to the HAPSITE.

Service Module . . . . . Also known as the SM, the Service Module contains the turbo-molecular high-vacuum pump, the roughing pump, the mechanism for operating the interconnecting valve, a battery-charger and a power supply.

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Headspace Sampling System . . . Also known as the HSS, the HSS is an accessory to the HAPSITE that allows testing for volatile compounds in solids and liquids, including soil and water.

SituProbe™ . . . . . The SituProbe accessory is a water purging device that provides continuous testing of water samples in the field.

1.2 Performance Specifications

The performance specifications for the HAPSITE are shown below:

Mass range	1-300 AMU
Scan Rate	as much as 1000 AMU/sec @ 10 points per AMU
Ionization Mode	70 eV electron impact
Vacuum System	15 l/sec NEG pump; 0.2 l/sec sputter-ion pump
Operating temperature range	0^{o}C to 45^{o}C (32^{o}F to 113^{o}F)
Humidity	95% RH, non-condensing
Dimensions (LxWxH)	46 x 43 x 18 (cm); 18 x 17x 7 (in)
Weight	16 Kg (35 lb) without the battery
Internal Power Consumption	30 watts average, 24 V(dc)
Carrier Gas	Nitrogen
Column Temperature Range	60^{o}C to 180^{o}C
Maximum Sample Moisture Content	8% by weight
pH Range of Sample	2 - 11
Boiling Point of Sample	<250^{o}C
Chemical Composition of Sample	1 - 12 Carbon atoms
GC Column	100% methyl silicone phase, 30 m x 0.32 mm ID x 1.0 μ film
SIM Channels	10
External Communications	Ethernet Port, Wireless
Carrier Gas Use-Rate	1 canister per 8 hours of operation (This depends on the details of the method being used.)

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Internal Standards Gas Use-Rate . . . . . .1 canister per 24 hours of operation (This depends on the details of the method being used.)

Battery Life . . . . . .Approximately 2 to 3 hours.

1.3 Serial Number Location

The serial number of the HAPSITE is located on the inside of the front panel and on the touchscreen. Touch the **HAPSITE** icon, followed by the **HAPSITE System** icon, and then touch **HAPS** to locate it.

1.4 Theory of Operation

The HAPSITE combines two analytical techniques, Gas Chromatography and Mass Spectrometry, to separate, identify, and measure the organic components in a gas phase sample. Using a flow of inert Nitrogen Carrier Gas, the Gas Chromatograph (GC) performs a time separation (Retention Time) of the sample compounds. The separation order is primarily based on increasing compound boiling point. The Mass Spectrometer (MS) detects and identifies the eluting compounds by breaking the molecules apart and detecting the fragments. The resulting mass spectrum is compared to a library of mass spectra to identify the compound.

The Gas Chromatography technique cannot always separate compound mixtures into individually eluting compounds. Some of the eluting responses or peaks may contain two, three, or more compounds which have taken the same time to progress (elute) through the Gas Chromatograph. GC identification of compounds is limited to matching the retention time of the unknown compound to that of a known standard. See section 1.6.1, Gas Chromatograph, on page 1-5 for more information on how the GC works. In order to further identify and measure the individual components of such mixtures, the gas stream is directed into the Mass Spectrometer.

In the Mass Spectrometer, the gas stream of eluting compounds is bombarded with electrons. The electrons fracture the molecules into a characteristic combination of smaller molecules or mass fragments. The Mass Spectrometer (MS) measures and plots the response of these mass fragments to display a mass spectrum. See section 1.6.2, Mass Spectrometer, on page 1-7 for more information on how the MS works.

The introduction of a mixture of many compounds directly to the MS would produce a very complex and uncharacteristic mass spectrum. However, because the GC has largely separated the gases, the MS can usually differentiate between the few co-eluting compounds. This differentiation provides very precise identification and measurement of the quantity of each compound. Qualitative identification can be made by comparing the unknown compound spectrum to the NIST mass spectral

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library (included with the Plus IQ software). See section 9.8, NIST Library Searches, on page 9-24 for more information. Quantitative identifications can be made by analyzing standards of known concentration and creating a target compound library of concentration response curves. See Chapter 12, Target Compound Methods for more information.

In summary, the GC first separates the gaseous compounds by time. Then the MS identifies and measures the gases contained in each of the time-separated peaks. This enables the GC/MS system to report the specific identity and concentration of each of the compounds present in the initial pulse of gas analyzed.

1.5 Instrument Overview

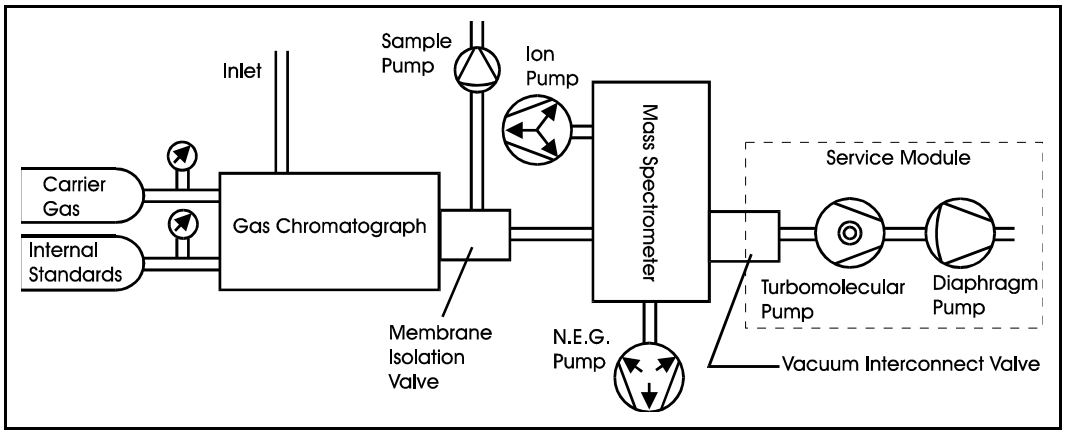
The HAPSITE system is comprised of two modules:

- the HAPSITE, also known as the Analytical Module, and
- the Service Module.

The HAPSITE is comprised of many systems and subsystems. Figure 1-1 shows a diagram of the major subsystems. These subsystems include the several pumps used to provide flow and vacuum.

The Service Module components are identified in Figure 1-1, everything else is housed in the HAPSITE. The Service Module and the HAPSITE module contain a Vacuum Interconnect Valve and electrical connectors through which their vacuum systems join. The modules communicate when the two modules are coupled together.

Figure 1-1 Major HAPSITE Subsystems



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1.6 Description Of Subsystems

The HAPSITE is comprised of the following subsystems:

- Gas Chromatograph
- Mass Spectrometer
- Vacuum System
- Electronic Systems
- Software Systems

1.6.1 Gas Chromatograph

The HAPSITE's GC system utilizes Nitrogen as the Carrier Gas to transport analytes through a column, a narrow-bore fused silica tube 30 meters in length, and then on to the detector. The Nitrogen is referred to as *the mobile phase.*

The inside of the column is coated with a thin layer of a material known as the stationary phase. The stationary phase is a chemical which can selectively attract components in a sample mixture. The mixture of sample compounds in the mobile phase interact with the chemicals of the stationary phase. The chemicals which have the fastest interactions will elute (exit) off the column first. The HAPSITE also utilizes a temperature programmable GC. The oven is programmed to increase the temperature gradually (called ramping) to improve compound separation while decreasing analysis time. As the temperature increases, the compounds with the lowest boiling points will elute first with the standard non-polar phase coated column installed. More selective columns may be ordered for specific applications.

The time taken by an individual compound to travel from injection into the system until the compound elutes from the column is referred to as the *Retention Time* (RT). If the GC conditions remain constant, the same compound will elute from the column at nearly the same retention time for each injection.

An important part of the operation of the HAPSITE is the use of Internal Standards. They verify the performance of the Gas Chromatograph, as well as, the tuning and sensitivity of the mass spectrometer. The Internal Standards are two volatile organic gases at low concentrations which are added to the sample inlet flow. The Internal Standards' Retention Times and responses are used as references for instrument performance.

Figure 1-2 is a graph of eluting organic gases from the Gas Chromatograph that is plotted as a function of time from the injection of a pulse of mixed compounds. The graph demonstrates the separation of the various compounds from each other by the action of the Gas Chromatograph, as described above. This plot is called a Total Ion Chromatogram (TIC).

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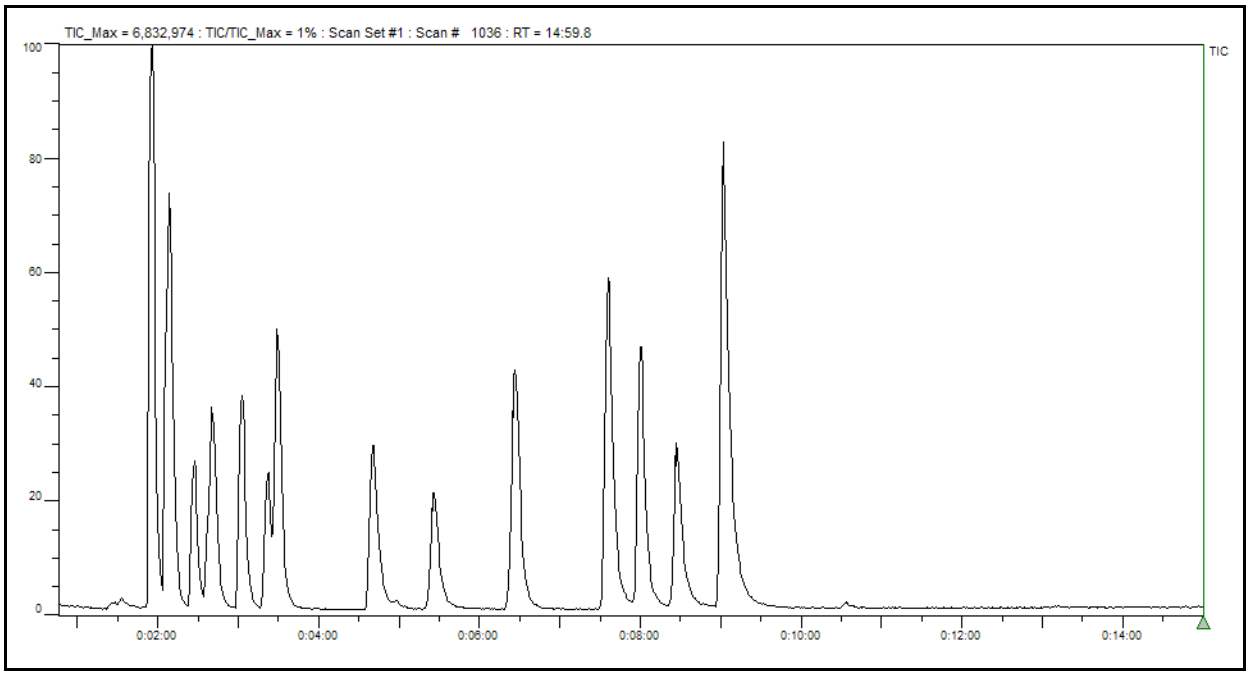
Figure 1-2 Total Ion Chromatogram



The performance of the column is affected by temperature, therefore, the column is housed in a temperature controlled oven.

The gas chromatograph performs many operational functions, including injecting the sample, analyzing the sample, flushing the system, and tuning the system.

GC/MS measurement begins with the Sample Pump drawing the gas to be analyzed into the Sample Loop. It then uses the pressure of the Carrier Gas to flush the sample from the Sample Loop on to the pre-column and the analytical column. This step is termed *injection*.

When the analytes have passed through the pre-column, the Carrier Gas is directed to the junction of the two columns where the Carrier Gas continues to transport the analytes through the analytical column while back-flushing the pre-column to prepare the pre-column for the next analysis sequence. This back-flush continues throughout the next filling of the Sample Loop.

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1.6.1.1 Membrane Isolation Valve

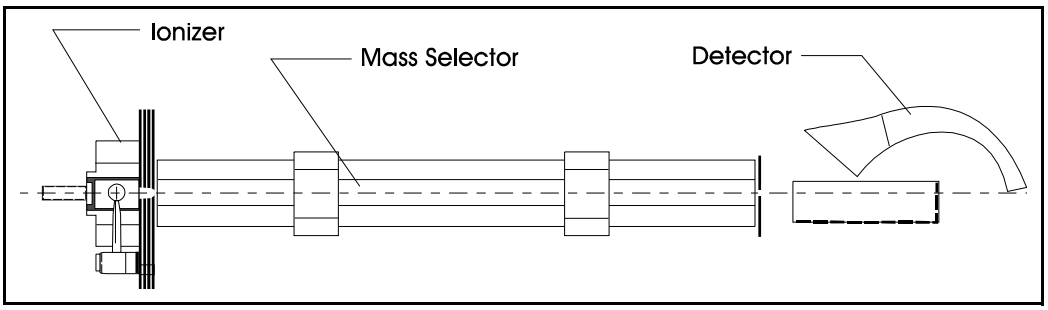
Gas exiting the analytical column crosses the face of a membrane mounted in the membrane isolation valve. This membrane has the special characteristic of transmitting the flow of organic compounds to the Mass Spectrometer, while effectively blocking the flow of inorganic gases (such as the Nitrogen Carrier Gas). When the membrane isolation valve is opened, the appropriate gases are permitted to enter the Mass Spectrometer for analysis while the Mass Spectrometer remains under vacuum. The membrane's performance is affected by temperature fluctuations and requires housing in a temperature-controlled zone.

In the Survey mode of operation, in which air samples are passed directly to the mass spectrometer, the sample pump draws the air sample directly across the membrane with the isolation valve in the open position.

1.6.2 Mass Spectrometer

The Mass Spectrometer is comprised of three basic physical systems: the *Ionizer*, the *Mass Selector*, and the *Ion Detector*. These are mounted together in a vacuum manifold which also includes an inlet, two vacuum pumps, and a portion of the Vacuum Interconnect Valve, as shown in Figure 1-1 on page 1-4. Figure 1-3 is a representation of the three sub-systems of the mass spectrometer.

Figure 1-3 Three Subsystems of the Mass Spectrometer



The inlet flow from the membrane isolation valve is brought directly to the I*onizer*. Within the ionizer, the component introduced from the inlet flow is subjected to a bombardment of electrons which are boiled off the hot *filament*. Collisions with the energetic electrons remove one electron from some of the gas molecules, leaving them with a net positive charge. This process is termed *ionization*. Other gas molecules are fractured into smaller molecules, some of which are also ionized. The remaining stream of gas continues out the far side of the ion volume and is pumped away by the vacuum pump system.

The ionized molecules, or ions, are driven from the ionizer toward the mass selector by the different voltages on the ion volume and the focusing plates. As the ions move through the holes in these plates, the ions are formed into a nearly parallel beam of mixed ions of nearly the same energy.

The Mass Selector (or mass filter) is a quadrupole analyzer. The quadrupole analyzer is comprised of four parallel rods, mounted with precise alignment and spacing. Opposite rods are electrically connected together. The two pairs of rods are connected to a radio frequency (RF) voltage 180^{o} out of phase with each other. In addition, the two pairs of rods have a direct current (DC) voltage applied to them; positive on one pair, negative on the other.

The Ion Beam is directed down the center of the array of rods. At any specific combination of RF and DC fields, some ions are light enough to oscillate harmonically with the RF field. This oscillation causes them to pick up energy and increase speed until the ions impact one of the rods and are neutralized. The DC field acts upon the heavier ions resulting in their movement from the center towards

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the rods. Once on the rod, the heavier ion is neutralized. At a specific combination of RF and DC fields, ions of a specific mass will be able to transit the rod structure and emerge at the exit end to be detected.

When the ions emerge from the Mass Selector, the ions are directed to the detector. The active element of the detector is an Electron Multiplier. The Electron Multiplier responds to the arrival of each individual ion with a cascade of electrons, each of which generates more electrons. The result is a small burst of electrical current in response to each ion emerging from the mass selector. The signal from the electron multiplier is connected to the electronic amplifier and data-handling system outside the vacuum.

In order to determine the constituents of the gas mixture, the ratio of RF to DC field strengths is varied (swept) to permit progressively heavier ions to transit the mass selector. The sweep, or scan, over the full range of masses (from 1 to 300 AMU) only takes about 100 milliseconds; the sweep is usually repeated many times to statistically improve the quality of the data. This produces the mass spectrum, a plot of the partial pressure (or population or intensity or amplitude) of each mass.

The mass spectrum is compared with a library of mass spectra characteristic of many individual compounds, and the HAPSITE reports the compounds which match the observed spectrum.

Alternatively, the Mass Spectrometer can remain tuned to a specific mass or set of masses. The instrument measures the partial pressure of only those masses as a function of time. Operation in this mode, termed selected ion monitoring (SIM), permits very sensitive measurement of the presence of one or a few compounds which have already been identified.

1.6.3 Vacuum System

The Mass Spectrometer is operated in a vacuum for several reasons.

- The ions must travel nearly a foot from the ionizer through the quadrupole to the Electron Multiplier without colliding with another molecule. (A collision would modify their trajectory, and possibly their charge.)
- The gas to be analyzed must be free from interference from other unknown gases.
- The hot filament which generates the electrons would be destroyed if operated at atmospheric pressure in the presence of oxygen.

The vacuum is initially provided by the Turbo-Molecular and Diaphragm Pumps in the Service Module. When a good vacuum level is achieved and the pumps in the HAPSITE are turned on, the Vacuum Interconnect Valve is closed. At this point, the Service Module can be disconnected. The Service Module is not needed again until the NEG Pump in the HAPSITE must be changed.

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The two vacuum pumps of the HAPSITE continue to provide the pumping necessary for operation. These two pumps are the non-evaporate getter (*NEG*) Pump and the smaller Sputter-ion Pump. The NEG Pump incorporates a special zirconium alloy, arranged in sintered disks, which when heated adsorb gas molecules very aggressively.

Over time, the sintered disks gradually become fully saturated with gas molecules and the pumping speed drops. The instrument detects the resultant rise in operating pressure (loss of vacuum) and the software signals that the pump must be replaced.

The NEG Pump is very effective in removing the active gases, but the NEG Pump does not remove noble gases. The sputter-ion pump is provided to remove argon, neon, helium, krypton, and xenon which would otherwise accumulate in the mass spectrometer. The accumulation would raise the mass spectrometer pressure and interfere with operation.

The Turbo Molecular Pump in the Service Module is actually a compound pump, incorporating turbo molecular stages for high pumping speeds at low pressure, and molecular drag stages to provide good compression of the gas at higher pressures. Even with the drag stages, this pump is unable to compress the gas enough to exhaust the gas into atmospheric pressure. An additional Diaphragm Roughing Pump is provided.

The Diaphragm Pump consists of four stages, in series. The Diaphragm Pump draws the gas from the exhaust of the compound pump and compresses the exhaust gas sufficiently to discharge the exhaust into the atmosphere.

1.6.4 Electronic Systems

The electronic systems in the HAPSITE are considered in four groups:

- Mass Spectrometer Control
- Gas Chromatograph Control
- Main Processor
- Interfaces

1.6.4.1 Mass Spectrometer Control

The Mass Spectrometer control electronics include the programmable DC and RF power supplies for the Mass Selector, the DC power supplies for the filament, the Electron Multiplier, the Sputter-ion Pump, and the A/D converter for the signal from the Electron Multiplier.

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1.6.4.2 Gas Chromatograph Control

The Gas Chromatograph control circuitry includes the power supplies for the solenoid valves, the ovens and the heated inlet line. It also contains the control logic for all the valves and heaters of the GC system.

1.6.4.3 Main Processor

The main processor is supported by solid state memory and is located in the central electronics assembly. The main processor accepts data from many points within the system. It controls all the other electronic sub-assemblies, both in routine operation and in managing the data-taking methods.

1.6.4.4 Interfaces

There are several input/output devices within the HAPSITE. These include the front panel touchscreen, keypad and display, the USB drive, the crossover cable connection, the wireless connection, the hand control unit, the power and logic connections to the Service Module, Headspace Sampling System, SituProbe and the pins which read the details of the gas mixture from the gas canisters.

1.6.5 Software Systems

The HAPSITE operates with two separate software systems. The instrument itself incorporates control and analysis software. This control software accepts inputs from the touchscreen, keypad, and other interfaces, and commands the operation and sequencing of all the systems and subsystems. The analysis software analyzes the data from the mass spectrometer, accesses the libraries as required, and displays the results of the analyses on the front panel. The control software allows a method to be started with minor modifications from the front panel. Design or substantive modifications of the method require the use of the HAPSITE Application software on an external PC.

The HAPSITE Application software, Plus IQ, is a Windows® XP and Windows® 2000 based system for use in the accessory Laptop. The Plus IQ software is used to design and modify the methods under which the HAPSITE can operate, view the data, analyze the results, and generate and print reports. The Laptop is linked to the HAPSITE by a crossover cable or wireless connection, which permits uploading of data from the HAPSITE and downloading new or modified methods to the HAPSITE.

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Chapter 2
HAPSITE Components and Assemblies

2.1 Ship Kit Packing Lists
2.2 930-850-G9, G12 Ship Kit Contents

The following items are provided in a typical HAPSITE Smart Plus 930-850-G9, G12 Ship Kit.

Figure 2-1 930-850-G9, G12 Ship Kit Contents Box 1 Contents

Box 1 Contents

- ❑ . 036-0015 . . . . . Shoulder Strap
- ❑ . 074-290 . . . . . Instruction Sheet (Shoulder Strap)
- ❑ . 059-0329 . . . . . Quick Disconnect Stem
- ❑ . 070-0972 . . . . . Plunger Contact (Bag of 4)
- ❑ . 074-490-P1. . . . Quick Start Guide
- ❑ . 074-5010-G1. . . Manual CD
- ❑ . 074-5012-G1. . . Basic Front Panel Operation Training CD
- ❑ . 600-1319-P2. . . Ethernet Cable
- ❑ . 930-021-G1. . . . Gasket Kit
- ❑ . 930-022-G1. . . . Tool Kit
- ❑ . 930-249-G2. . . . Concentrator Cover
- ❑ . 930-251-G1. . . . Concentrator Tube (Tenax®-TA)
- ❑ . 930-716-G1. . . . Concentrator Tube (Tri-Bed)
- ❑ . 930-0221-G1. . . Concentrator Nut and Ferrule
- ❑ . 930-0231-G1. . . Probe Nut and Ferrule
- ❑ . 930-2020-G1. . . Cap Kit
- ❑ . 930-4652-P1. . . Permanent Marker
- ❑ . 930-612-P1. . . . USB Flash Drive

Special Cords for International Ship Kits
Extra Cords for SM and Battery Charger (Qty. 2)

Ship Kit . . . . . Location . . Cord

- ❑ . 930-850-G9. . . . USA . . . . . N/A
- ❑ . 930-850-G12. . . Australia . . 068-0393

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Figure 2-2 930-850-G9, G12 Ship Kit Box 2 Contents

Box 2 Contents

❑ . . . . 930-470-G1 Battery Charger

Figure 2-3 930-850-G9, G12 Ship Kit Box 3 Contents

Box 3 Contents

❑ . . . . 24 V Power Supply (see table)

Power Supply	Ship Kit	Usage
930-469-P1	930-850-G9	110 V USA
930-469-G3	930-850-G12	230 V UK

Figure 2-4 930-850-G9, G12 Ship Kit Box 4 and 5 Contents

Box 4 and 5 Contents

❑. . . . . In two separate boxes,
Battery Pack NiMH (930-4061-G1)

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2.3 930-850-G10, G11 Ship Kit Contents

The following items are provided in a typical HAPSITE Smart Plus 930-850-G10, G11 Ship Kit. See Figure 2-1.

Figure 2-5 930-850-G10, G11 Ship Kit Box 1 Contents

Box 1 Contents

- ❑. . 036-0015 . . . . . Shoulder Strap
- ❑. . 074-290 . . . . . Instruction Sheet (Shoulder Strap)
- ❑. . 059-0329 . . . . . Quick Disconnect Stem
- ❑. . 070-0972 . . . . . Plunger Contact (Bag of 4)
- ❑. . 074-490-P1 . . . Quick Use Guide
- ❑. . 074-5010-G1 . . Manual CD
- ❑. . 600-1319-P2 . . Ethernet Cable
- ❑. . 930-021-G1 . . . Gasket Kit
- ❑. . 930-022-G1 . . . Tool Kit
- ❑. . 930-249-G2 . . . Concentrator Cover
- ❑. . 930-251-G1 . . . Concentrator Tube (Tenax®-TA)
- ❑. . 930-716-G1 . . . Concentrator Tube (Tri-Bed)
- ❑. . 930-0221-G1 . . Concentrator Nut and Ferrule
- ❑. . 930-0231-G1 . . Probe Nut and Ferrule
- ❑. . 930-2020-G1 . . Cap Kit
- ❑. . 930-4652-P1 . . Permanent Marker
- ❑. . 930-612-P1 . . . USB Flash Drive

Special Cords for International Ship Kits
Extra Cords for SM and Battery Charger (Qty. 2)

Ship Kit	Location. . .	Cord
❑. . 930-850-G10 . .	Europe. . . .	068-0151
❑. . 930-850-G11 . .	UK	068-0388

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Figure 2-6 930-850-G10, G11 Ship Kit Box 2 Contents

Box 2 Contents

❑ . . . . 930-470-G1 Battery Charger

Figure 2-7 930-850-G10, G11 Ship Kit Box 3 Contents

Box 3 Contents

❑ . . . . 24 V Power Supply (see table)

Power Supply	Ship Kit	Usage
930-469-P2	930-850-G10	230 V European
930-469-G3	930-850-G11	230 V UK

Figure 2-8 930-850-G10, G11 Ship Kit Box 4 and 5 Contents

Box 4 and 5 Contents

❑. . . . . In two separate boxes,
Battery Pack NiMH (930-4061-G1)

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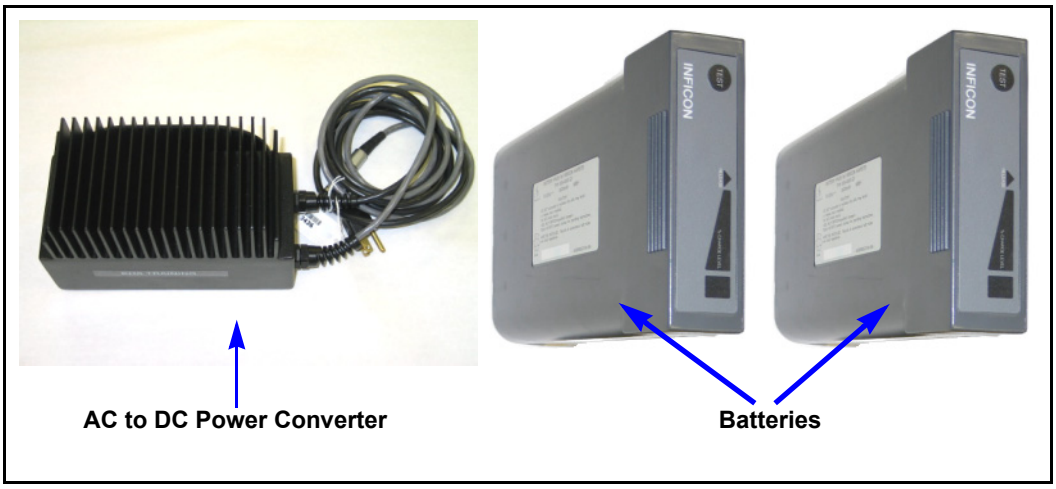
2.3.1 Ship Kits Box 3 and 4

Figure 2-9 USA 24V Power Supply (AC To DC Power Converter) - Box 3 and Battery (2 Shipped) - Boxes 4 and 5



In addition, a Laptop computer and accessories are shipped. The ship kits vary depending on the type of Laptop ordered. The Laptop kits will include the Plus IQ Software CD and NIST Library Install CD.

2.4 Basic Assembly

CAUTION

The HAPSITE should be operated a minimum of every 3 weeks. Recommended storage is in Extended Standby.

Figure 2-10 HAPSITE Parts for Basic Assembly

The basic assembly of the HAPSITE can be accomplished in six easy steps.

2.4.1 Attaching the Probe

To attach the Probe line, plug the LEMO® connector into the port on the top of the HAPSITE as illustrated in Figure 2-11.

Figure 2-11 Attaching the LEMO Connector on the Probe Line to the HAPSITE

HINT: Save all of the caps to cover ports in the event the instrument needs to be decontaminated. Spare caps are provided in the Ship Kit. See Figure 2-12.

Figure 2-12 Spare Cap Kit

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2.4.2 Remove Exhaust (Vent) Cap

The red exhaust (vent) cap is located on the right side of the HAPSITE near the back. This exhaust (vent) cap must be removed for the HAPSITE to function properly. The HAPSITE is shipped with the cap removed. See Figure 2-13.

Figure 2-13 Exhaust Cap Removed

CAUTION

The exhaust cap must be removed for proper HAPSITE operation.

WARNING

Samples will vent to breathing area through the exhaust. To avoid inhalation, attach tubing and vent to a hood or attach an activated charcoal filter if sample is hazardous.

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2.4.3 Installing the Gas Canisters

CAUTION

Only open the front panel in a dry, uncontaminated area.

The gas canisters must be installed inside the front panel. Open the panel by placing thumbs on the top of panel and pulling down. This technique avoids damaging the sealing gasket with fingernails.

The purple banded Nitrogen (also known as Carrier Gas) canister must be inserted into the top round opening of the HAPSITE. The yellow banded Internal Standard canister must be inserted into the bottom round opening.

To insert the canisters, place them into the opening with the top facing into the HAPSITE. Depress the "PUSH" lever while inserting. The canister will slide further into the HAPSITE. Release the "PUSH" lever and remove hands from canister. Gently pull on the cans to ensure the cans are locked into place. See Figure 2-14.

Figure 2-14 Canister Placement

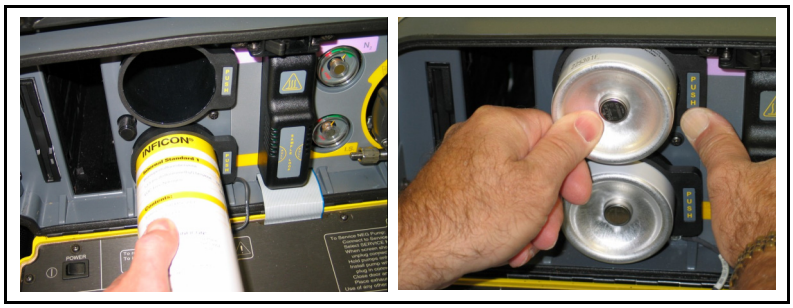
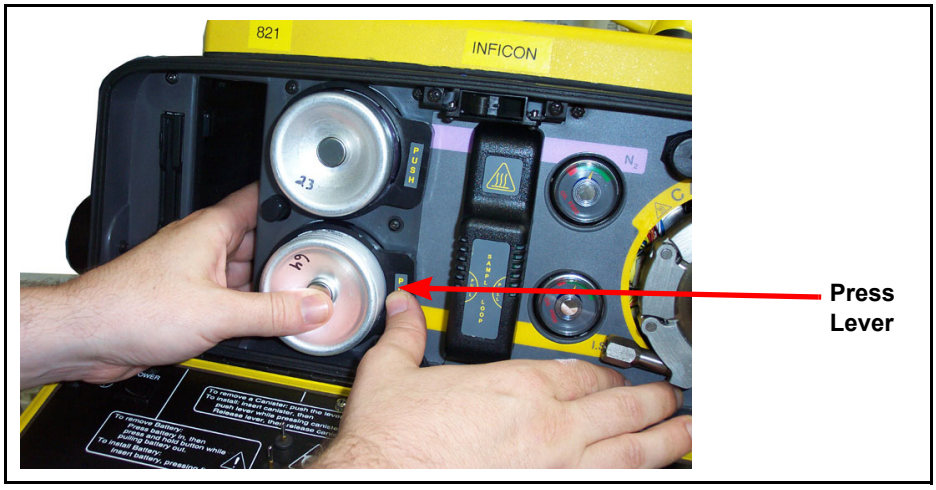


Figure 2-15 Installing A Gas Canister



NOTE: The position of the gas canisters should not be interchanged. To prevent improper placement, the Internal Standard canister has a Teflon® ring that surrounds the inner stem on the top of the can. Do not force the canisters into the wrong location as this would result in contamination of the HAPSITE.

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2.4.3.1 How to Change or Remove a Gas Canister

Push the lever located on the right of the canister. The canister will release. (A slight twist of the canister may be required.) Remove the canister. Refer to Figure 2-16 on page 2-9.

NOTE: The Nitrogen canister will need to be replaced after roughly 8 hours of use. The Internal Standard canister will need to be replaced after 3 to 4 days of continuous use. These numbers are guidelines and will vary.

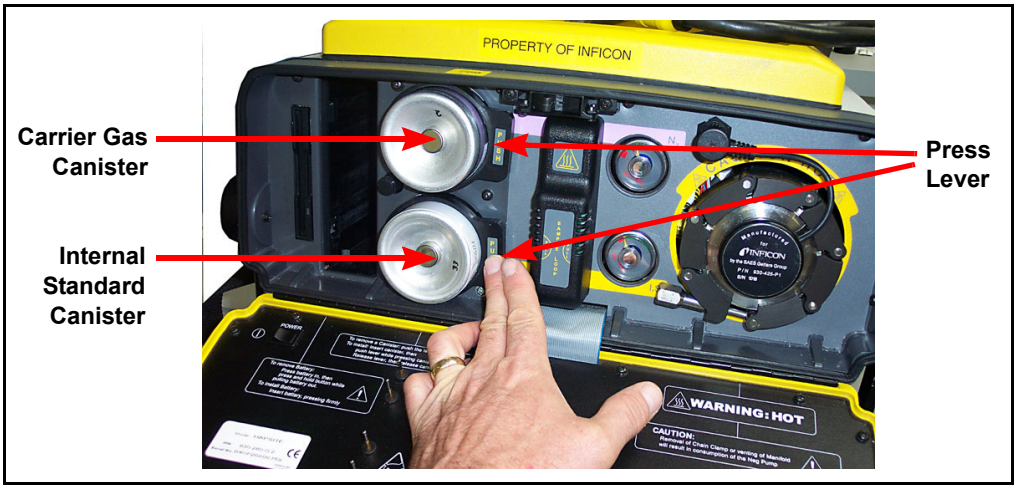
WARNING

Do not refill the canisters. Bodily injury may result. Canisters are designed to be disposable and may fail if filling is attempted.

CAUTION

Closing the front panel when the canisters are not properly installed may damage the HAPSITE and/or canisters.

Figure 2-16 Canister Removal



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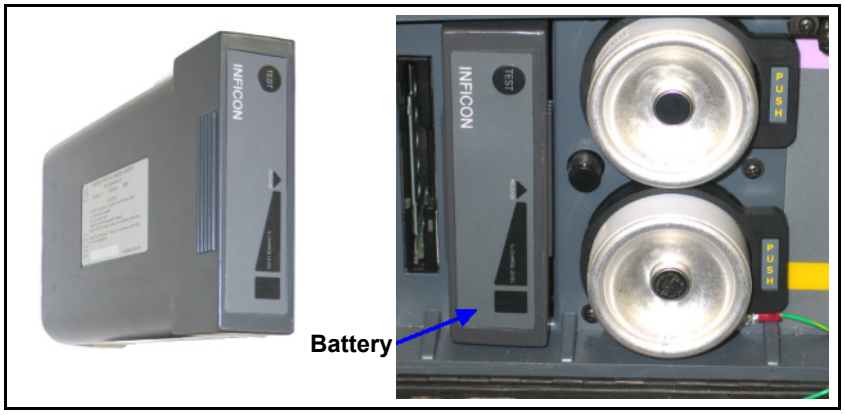
2.4.4 Install Battery

Insert the battery by sliding it into the rectangular opening to the left of the gas canisters. Push firmly and listen for the battery to click into place. Once the battery is installed, gently pull on the battery to make sure the battery is locked into place. See Figure 2-17.

Figure 2-17 Battery Insertion



2.4.5 Connect the AC To DC Power Converter Power Supply

The AC to DC power converter plugs into the four prong plug on the left side of the HAPSITE (when facing the front of the HAPSITE). A red dot on the connector aligns with the corresponding red line on the receptor of the HAPSITE (if the red dot is not visible on the HAPSITE, the red dot on the power supply should be facing forward.) Plug the AC to DC power converter into an outlet. See Figure 2-18.

Figure 2-18 The AC To DC Power Converter Power Supply

2.4.6 Connect Laptop (if desired)

The HAPSITE Plus has two possible configurations for connecting to a Laptop computer. The standard connection is via a crossover cable. All instruments manufactured after December 2006 will have a wireless communication connection option. Older instruments may also have the wireless option if a wireless upgrade was installed.

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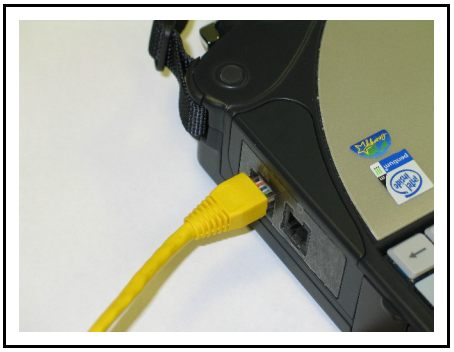
2.4.6.1 Connect Laptop with Yellow Crossover Cable

Unscrew the cap on the port next to the probe connection. Plug in the yellow crossover cable into this port. The opposite end plugs into the COM1 port on the Laptop computer. Once connected, the crossover cable provides the communication connection between the HAPSITE and Laptop computer. See Figure 2-19 and Figure 2-20.

Figure 2-19 Crossover Connection to HAPSITE

Figure 2-20 Crossover Connection to Laptop



2.4.6.2 Connect Laptop with Wireless Connection

See Chapter 4, Wireless and Touch Screen Options for information on enabling the wireless connection.

2.5 Helpful Guidelines

A set of helpful guidelines to keep the HAPSITE safe and operational.

DON'T…	DO…
◆ Ship with a battery installed. ◆ Start up on battery power, if possible. ◆ Draw liquid into the instrument. ◆ Go into a potentially explosive environment without safety checks (the HAPSITE is not intrinsically safe). ◆ Pressure wash the HAPSITE or immerse in water. ◆ Linearize DACS without the help of an INFICON representative. ◆ Sample strong acids (below pH 2) or strong bases (above pH 11). ◆ Use force when assembling any HAPSITE system components. ◆ Modify default methods without changing their name. ◆ Sample for Sulfur Mustard (HD) with the VX conversion tube installed. ◆ Abort an Analyze (GC/MS) method during a sample run. ◆ Over-tighten concentrator tube nuts. ◆ Block the exhaust vent on the HAPSITE. ◆ Use the NEG Pump and Service Module pumps together. ◆ Use expired Internal Standard gas. ◆ Use a LAN or Ethernet cable between Laptop and HAPSITE. ◆ Attach a bag sample without first checking the ferrules in the probe nut.	◆ Leave a battery installed when operating even when AC is connected. ◆ Run a background blank once per week or more. ◆ Use Extended Standby instead of Shutdown whenever possible. ◆ Place appropriate caps over openings before decontaminating. ◆ Use 5% or 10% bleach solution or soap-and-water to decontaminate according to local SOP. ◆ Only use thumbs to open the front panel. ◆ Attempt to reboot as a first step to correct operational discrepancies. ◆ Screen potentially high concentration sample with Survey method to reduce the risk of saturation. ◆ Use the VX conversion tube for identification (and quantification) of VX and R-33. ◆ Use crossover cable between Laptop and HAPSITE. ◆ Take a training course or refresher training. ◆ Contact INFICON at HAPSITE.Support@INFICON.com, 800.223.0633 for help.

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2.6 HAPSITE Configurations

There are 6 basic configurations for the HAPSITE. The first three can either be in portable mode or connected to AC power. Each configuration can be run with or without the Laptop computer connected.

Configuration 1 - HAPSITE with Probe and Sample Loop or Concentrator

Configuration 2 - HAPSITE with Headspace Sampling System and Sample Loop or Concentrator

Configuration 3 - HAPSITE with SituProbe and Sample Loop or Concentrator

Configuration 4 - HAPSITE mounted on Service Module with Probe and Sample Loop or Concentrator

Configuration 5 - HAPSITE mounted on Service Module with Headspace Sampling System and Sample Loop or Concentrator

Configuration 6 - HAPSITE mounted on Service Module with SituProbe and Sample Loop or Concentrator

2.7 Headspace Sampling System

The Headspace Sampling System is an accessory used to test water and solid samples. Samples are heated to release any VOC's into the sample vial headspace. The needle, which is inserted into the vial, samples the headspace. The sample is then transferred into the HAPSITE via the transfer line.

For additional information on the Headspace Sampling System see Chapter 13, Headspace Sampling System.

2.7.1 Headspace Sampling System - Components Received

Headspace Sampling System (HSS) — The main module includes the following:

- Headspace sampling needle assembly
- Heater block with four sample wells
- Compartment for loading an INFICON Nitrogen Carrier Gas canister
- Compartment for loading an INFICON rechargeable battery, INFICON part number 930-4061-G1
- Swagelok® connection for use with an external supply of pressurized Nitrogen
- Power supply connection
- Transfer Line connection

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Transfer Line (INFICON part number 931-401-P2) — A directional heated line which connects the HSS to the HAPSITE. The line transfers the sample from the HSS to HAPSITE and provides communication between the two instruments. Each end is labeled to ensure proper orientation.

Transfer Line Insulation (INFICON part number 931-405-P1) — This foam sleeve is used as insulation for the Transfer Line. The insulation extends battery life by reducing the energy required to heat the line. Once heated, it helps to maintain the temperature.

Replacement Needle Kit (INFICON part number 931-402-P1)— A new needle assembly for when the original needle is worn, plugged, or broken.

HSS Carrying Shoulder Strap (INFICON part number 036-015)— A strap which connects to the mounts on the sides of the HSS. It facilitates carrying the instrument between the office and the field.

Y-Cable (INFICON part number 600-1131-P30)— A power cable to split the power from the AC to DC power converter to both the HAPSITE and the HSS or SituProbe.

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2.7.2 Installing the Headspace Sampling System

Required Parts

The following items are needed to install the HSS:

- Headspace instrument
- Y-cable power splitter
- Transfer line
- Carrier Gas
- Charged Battery

Procedure

1. Install a fully charged battery into the HAPSITE.
2. Unplug the AC to DC power converter power supply from the HAPSITE. See Figure 2-21.

Figure 2-21 Power Supply to HAPSITE from AC To DC Power Converter

3. Connect the single end of the Y-cable (see Figure 2-22) to the power supply connector removed in step 2.
4. Plug one end of the Y-cable into the HAPSITE 24 V(dc) connector.
5. Plug the other end of the Y-cable into the back of the HSS. See Figure 2-22.

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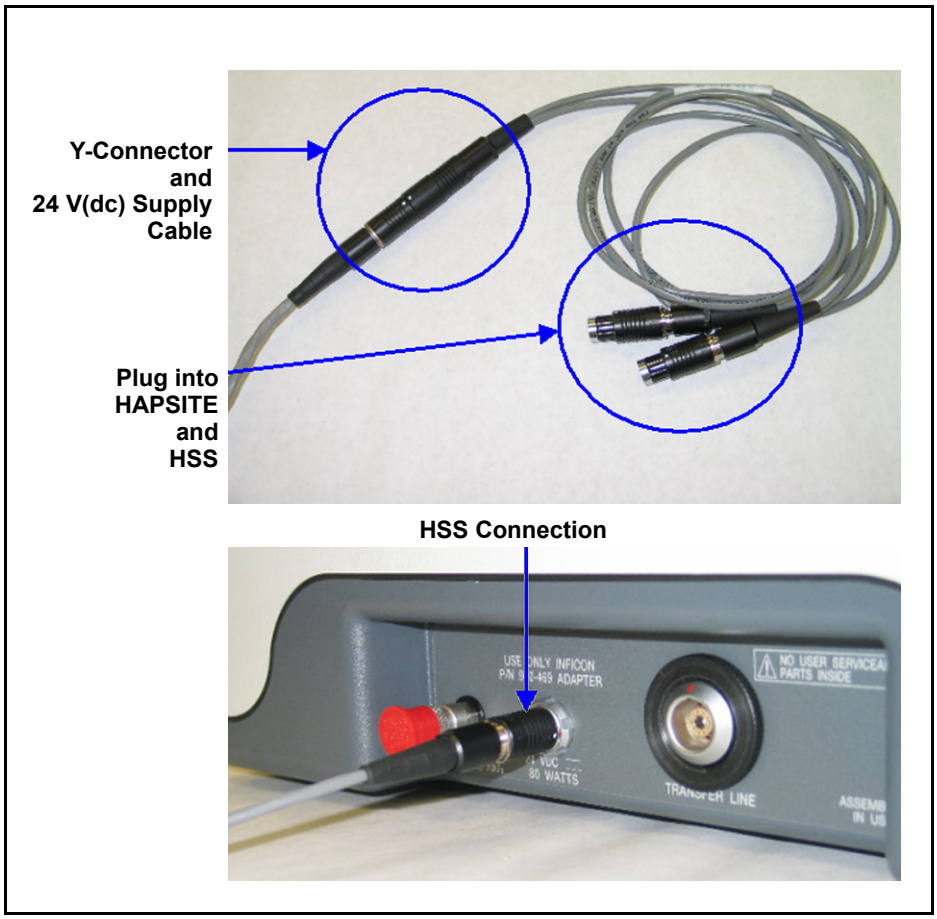
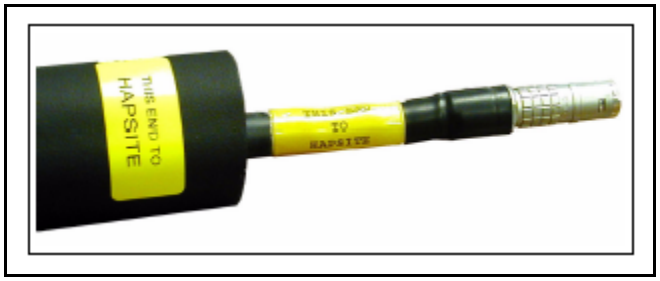
Figure 2-22 Power Supply Y-cable and Back of HSS



6 Properly align the labels on the foam insulation and Transfer Line. The end of the insulation labeled in yellow **THIS END TO HAPSITE** should coincide with the end of the Transfer Line labeled in yellow **THIS END TO HAPSITE**. See Figure 2-23.

Figure 2-23 HAPSITE End of Transfer Line



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7 The white label **THIS END TO ACCESSORY** on the insulation should coincide with the white label **THIS END TO ACCESSORY** on the Transfer Line. See Figure 2-24. When alignment is correct, slide the insulation into place.

Figure 2-24 Accessory End of the Transfer Line

8 Install the Transfer Line between the HAPSITE and Headspace Sampling System. First, disconnect the Probe from the HAPSITE. Install the LEMO connector, which is labeled, **THIS END TO HAPSITE**, in the HAPSITE connector. The opposite end labeled, **THIS END TO ACCESSORY**, will connect to the rear of the Headspace Sampling System. See Figure 2-26. Make sure the red dots on the Transfer Line connectors align with the marks on the HAPSITE and Headspace Sampling System connectors.

Figure 2-25 Attaching the Transfer Line to the HAPSITE

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Figure 2-26 This End to HAPSITE

Figure 2-27 This End to Headspace

9 Connect a pressurized Nitrogen cylinder or install a Nitrogen can into the Headspace instrument.

WARNING

Nitrogen canisters and cylinders are under pressure.

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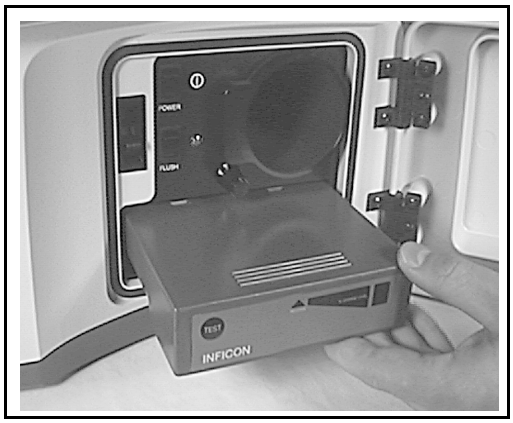
10 If using the HSS in portable mode, a battery will need to be installed. Open the front door of the HSS and insert a charged battery into the rectangular slot below the round carrier gas slot. Make sure when inserting the battery that the lettering is right-side up to insure proper orientation. When inserted correctly, it will click into place and remain snug. After battery has been properly installed, disconnect the AC/DC power supply. See Figure 2-28. (For further instructions on battery installation see section 2.4.4 on page 2-10)

CAUTION

Do not open in a contaminated area. The HSS is not sealed against moisture, debris or contamination with the front door open.

Figure 2-28 Inserting the Battery into the HSS



2.8 Service Module

The Service Module is used to create a vacuum in the HAPSITE. It cannot be used in a portable application.

For additional information on the Service Module, refer to Chapter 15, Service Module.

2.8.1 Setting Up the Service Module

Required Components

- RS-232 communication cable.
- Power cord for Service Module.
- Laptop with Plus IQ software installed.

When stored, the Service Module should have an aluminum plug placed on the top opening. This plug is used to keep the Service Module free of moisture and debris.

NOTE: The aluminum storage plug is supplied with the Service Module. See Figure 2-29.

Figure 2-29 Aluminum Storage Plug on Service Module

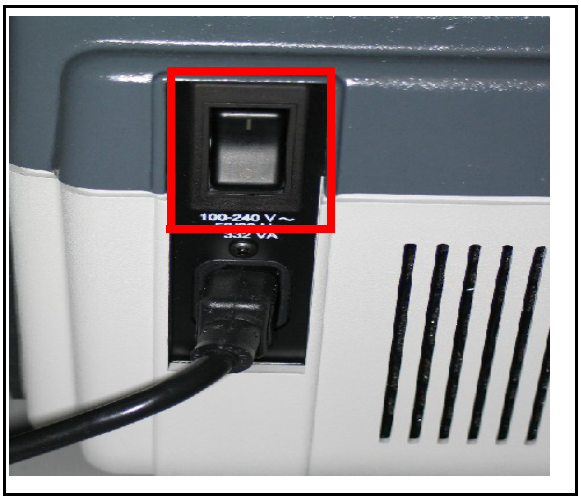
Covering the aluminum plug is a yellow plastic cover, which aids in protecting the opening from foreign debris. See Figure 2-30. Remove the yellow cover before proceeding, and store it in a safe location.

Figure 2-30 Yellow Plastic Protective Cover on Service Module

The Service Module requires a power cable and a RS-232 communications cable to allow communication with the Laptop. Figure 2-31 shows the power cable connected at the left back corner of the Service Module.

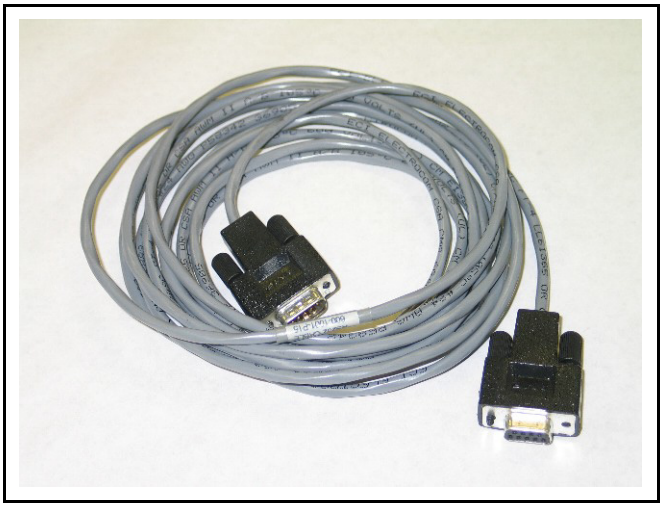
IPN 074-472-P1C

Figure 2-31 Power Cable Attached at Back Left of the Service Module



The RS-232 communication cable is shown in Figure 2-32.

Figure 2-32 RS-232 Communication Cable



To prepare the Service Module for use with the HAPSITE, the aluminum plug must be removed. If the plug is not under vacuum, the plug can easily be removed. If under vacuum, the plug will need to be removed using the following procedure:

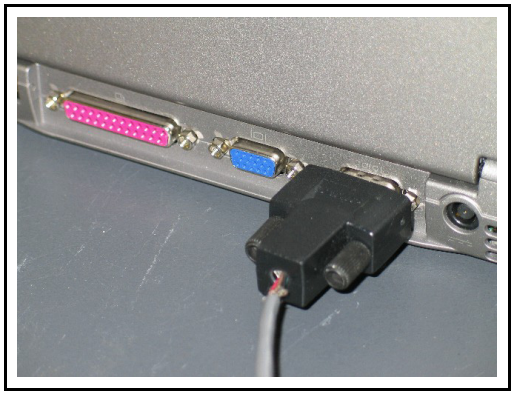
NOTE: The Service Module is shipped under vacuum from the factory with this plug in place.

Attach the RS-232 communications cable to the Service Module, as shown in Figure 2-33.

Figure 2-33 RS-232 Communication Cable Attached to Back Right Side of Service Module

Attach the RS-232 cable to the Laptop computer, as shown in Figure 2-34.

Figure 2-34 RS-232 Communication Cable Attached to Laptop



Turn on the Power switch for the Service Module, located at the back right corner of the Service Module (refer to Figure 2-31).

Turn on the Laptop and open the Plus IQ program.

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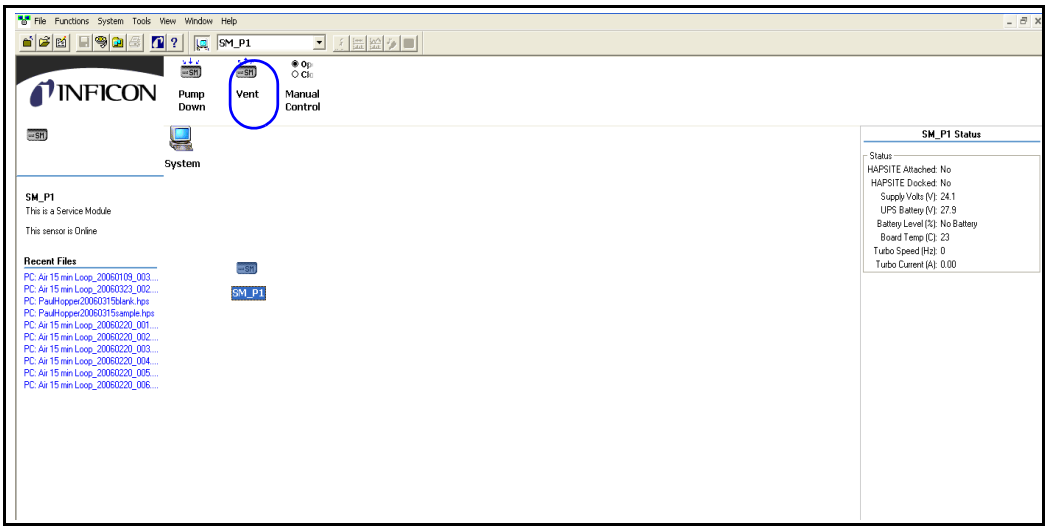
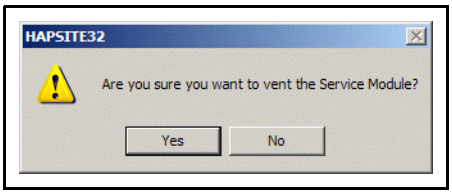
Figure 2-35 System Setup Screen with Service Module



NOTE: If the Service Module icon does not appear, the communications may need to be configured. See section 8.6.3, Establishing Communication with the Service Module, on page 8-20, for information on how to set up a COM port for communicating with the Service Module.

Click on the **Vent** icon. The dialog shown in Figure 2-36 will appear to confirm the venting of the Service Module.

Figure 2-36 Vent Service Module Confirm Window



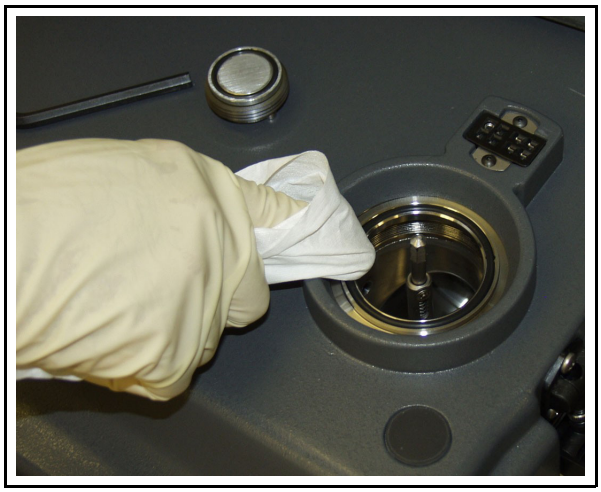
Select **Yes** to vent the Service Module. A window will appear counting down a fifteen-second delay while the vent procedure completes. Once completed, remove the aluminum plug.

Next, clean any debris or dust from the Viton® o-ring using a lint-free wipe with methanol. Wipe the top of the o-ring, following the contour to clean the entire top exposed section. Avoid pushing dust or debris into the middle opening. Cleaning will ensure a tight seal to the HAPSITE, allowing the system to maintain vacuum. See Figure 2-37, which shows the o-ring being cleaned.

WARNING

Wear gloves and safety glasses when handling methanol.

Figure 2-37 Cleaning the Service Module Rubber O-ring using a Lint-free Wipe



After cleaning the rubber o-ring, make sure there are no cuts on it. Also look for any visible cracking of the o-ring. If the o-ring is damaged, the o-ring may need to be replaced. Ensure the o-ring is completely seated in the grove.

2.8.2 Placing the HAPSITE on the Service Module

CAUTION

Never operate the HAPSITE on the Service Module in a moving vehicle.

Remove the yellow plastic protective cover from the bottom of the HAPSITE. The yellow cover is shown in Figure 2-38.

NOTE: Store the yellow cover in a clean, dry place, where it will be easily accessible for later use. This protective cover keeps dust and debris out of the HAPSITE manifold connection.

CAUTION

During decontamination of the HAPSITE, the yellow protective cover must be installed.

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Figure 2-38 Remove the Yellow Plastic Protective Cover on the Bottom of the HAPSITE

Figure 2-39 shows the yellow protective cover removed from the bottom of the HAPSITE.

Figure 2-39 Yellow Plastic Protective Cover Removed from the Bottom of the HAPSITE

Carefully place the HAPSITE on top of the Service Module. The opening at the bottom of the HAPSITE should be placed onto the opening on the Service Module.

Attach the Service Module to the HAPSITE using the black latch at each side of the Service Module. Figure 2-40 shows the right side Service Module latch.

Figure 2-40 Service Module - Showing Latch on Right Side

Figure 2-41 shows the HAPSITE attached to the Service Module using the Service Module latches.

NOTE: Black latches can be adjusted with the thumb screw to ensure proper tension.

Figure 2-41 HAPSITE Attached to Service Module using Service Module Latches - Left Side View

Continue by following the instructions in section 15.6, Starting Up HAPSITE on the Service Module, on page 15-11.

CAUTION

Never attempt to move the Service Module when the turbo pump is spinning. The Turbo Pump must be at 0 Hz before moving or detaching the HAPSITE. Damage can result if the HAPSITE is not properly detached.

2.8.3 Detaching the HAPSITE from the Service Module

Carefully follow the procedures starting with section 15.8, Detaching the HAPSITE, on page 15-17 to detach the HAPSITE from the Service Module.

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2.9 SituProbe

Use the following procedure to set up the SituProbe. For more SituProbe information, see Chapter 14.

1. After verifying that the battery in the HAPSITE is charged, disconnect the AC to DC HAPSITE Adapter power supply.
2. Remove the Probe.
3. Using a Y-Cable Power Splitter, connect the single connector end of the cable to the AC to DC HAPSITE Adapter. Connect one of the split ends of the cable to the left side of the HAPSITE and the other to the back of the SituProbe accessory (IPN 932-220-G1). See Figure 2-42, Figure 2-43 and Figure 2-44.

Figure 2-42 Y- Cable for SituProbe

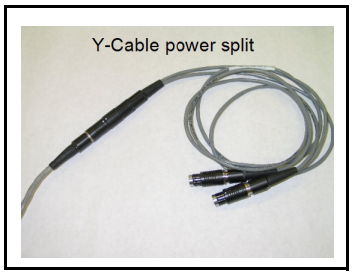
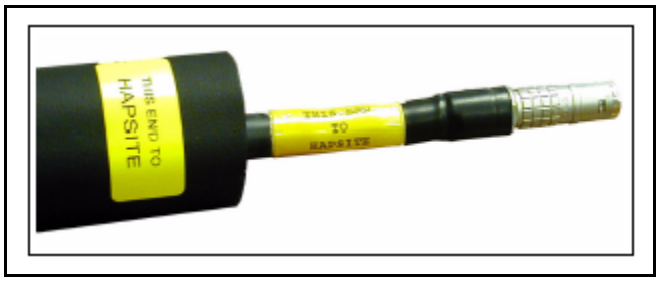


Figure 2-43 Plugging Y-Cable Into HAPSITE

Figure 2-44 Plugging Y-Cable Into SituProbe

4. Properly align the labels on the foam insulation and Transfer Line. The end of the insulation labeled in yellow **THIS END TO HAPSITE** should coincide with the end of the Transfer Line labeled in yellow **THIS END TO HAPSITE**. See Figure 2-23.



5 The white label **THIS END TO ACCESSORY** on the insulation should coincide with the white label **THIS END TO ACCESSORY** on the Transfer Line. See Figure 2-24. When alignment is correct, slide the insulation into place.

Figure 2-45 Accessory End of the Transfer Line

6 Install the Transfer Line between the HAPSITE and the SituProbe. First, disconnect the Probe from the HAPSITE. Install the LEMO connector, which is labeled, **THIS END TO HAPSITE,** in the HAPSITE connector. The opposite end labeled, **THIS END TO ACCESSORY,** will connect to the rear of the SituProbe. See Figure 2-46. Make sure the red dots on the Transfer Line connectors align with the marks on the HAPSITE and SituProbe connectors.

Figure 2-46 Attaching the Transfer Line to the HAPSITE

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Figure 2-47 Plugging Transfer Line Into HAPSITE and SituProbe

7 Open the front panel door of the SituProbe accessory and insert a Nitrogen canister into the canister opening.

CAUTION

Do not open in a contaminated area. The SituProbe is not sealed against moisture, debris and contamination with the front door open.

WARNING

Nitrogen canisters and cylinders are under pressure.

8 OPTIONAL: Insert a charged battery into the SituProbe accessory battery slot. The battery is not required when using the external AC to DC HAPSITE Adapter.

9 Connect the Nitrogen purge and sample lines on the SituProbe purge head (IPN 932-200-G1) onto the side of the SituProbe accessory. See Figure 2-48.

Figure 2-48 Connecting Purge Head

10 Power on the SituProbe accessory by using the toggle switch located inside the front panel door. Close the front panel door before using the SituProbe.

11 If using a purge vessel, fill the vessel with 1L of water. Place the SituProbe purge head into vessel. Sample will flow inward through the side bottom opening and outward through the top side opening. See Figure 2-49.

Figure 2-49 Purge Vessel Water Flow Direction Shown

12 The purge vessel can also be used with the openings capped. In this option, fill the vessel to the 1L mark with the water to be sampled. Place the purge head into the vessel.

13 Alternately, place the SituProbe purge head into the water supply to sample.

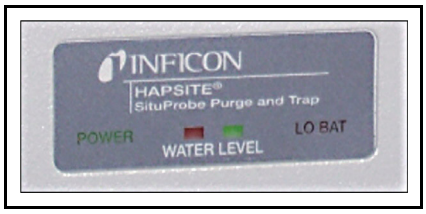
NOTE: Minimum submersion depth is 5.5 inches (14 cm) and the maximum is 18 inches (45.7 cm).The depth should be measured from the bottom of the purge head towards the electrodes.

CAUTION

Submersion greater than 18 inches (45.7 cm) could cause liquid to enter the HAPSITE.

14 The SituProbe accessory (IPN 932-220-G1) displays water level conditions in the purge head. Green signifies that the water level is in operating range. Red signifies that the water level is too low. Red and green together signify that the water level is too high. See Figure 2-50.

Figure 2-50 Water Level Indicator



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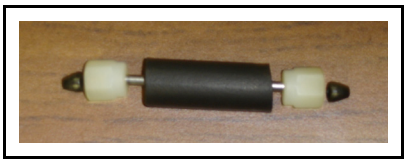
2.10 Sample Collection Modes

The Sample Loop is used to detect chemicals in the low ppm to high ppb concentration range. The Concentrators are used to detect chemicals in the low ppb to high ppt concentration range. The following procedures are used to install and remove the Sample Loop and the Concentrator.

2.10.1 Installing the Sample Loop

The Sample Loop is a hollow stainless steel tube. The sample volume is approximately 200 µL. Black insulation covers the center of the Sample Loop. Each end has a nut and a black, Vespel® ferrule assembly. See Figure 2-51.

Figure 2-51 Sample Loop



Procedure

1. See section 2.10.2, Removing the Sample Loop, on page 2-34 to remove the currently installed Sample Loop or see section 2.10.4, Removing the Concentrator, on page 2-41 to remove the Concentrator.

   NOTE: There is not a specific orientation for the Sample Loop.

2. Make sure a ferrule is installed in each metal nut with the wide end of the cone facing toward the center of the Sample Loop, as shown in Figure 2-51. The ferrules are inserted into the threaded end of the nut.

WARNING

The elbow fittings may be hot. Allow for these components to cool before continuing.

3. While holding the ferrule and nut in place, insert one end of the Sample Loop into the bottom elbow fitting.
4. Lift the top elbow fitting slightly, so that the top of the Sample Loop will fit between the two fittings.
5. Press down on the top elbow. With your fingers, tighten the bottom nut until the nut is finger tight. See Figure 2-52.

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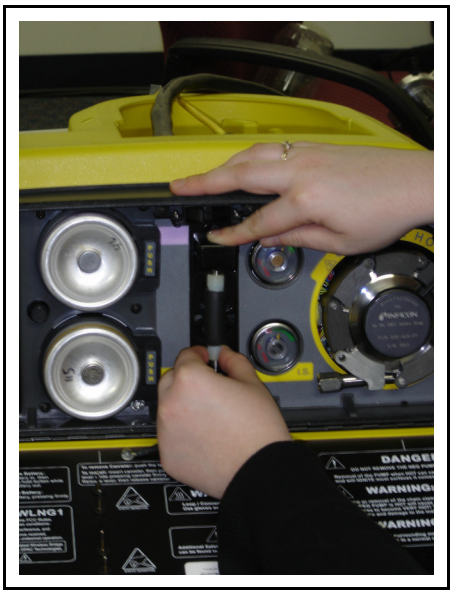
Figure 2-52 Tightening the Bottom Nut



6 Continue pressing on the top elbow and tighten the top nut finger tight. See Figure 2-53.

Figure 2-53 Tightening the Top Nut

7 Using the 7/16" open end wrench supplied with the HAPSITE, tighten both the top and bottom nut approximately 1/8-1/4 of a turn. When pressure is released from the top fitting, the elbow should not move. When gentle upward pressure

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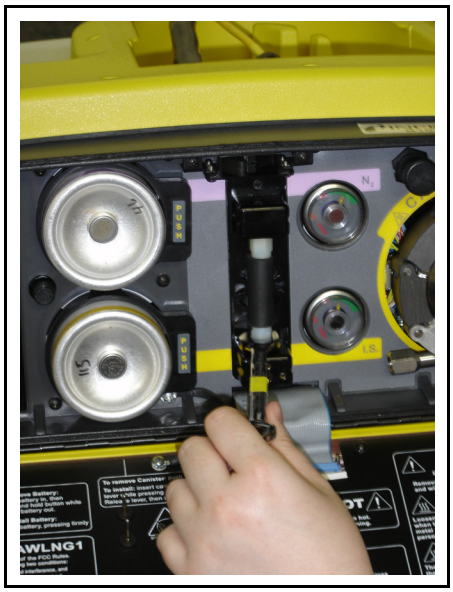
is applied to the top elbow, the elbow should not slip on the Sample Loop. If the elbow moves, the Loop is not properly seated. Reseat Loop and tighten slightly more. See Figure 2-54.

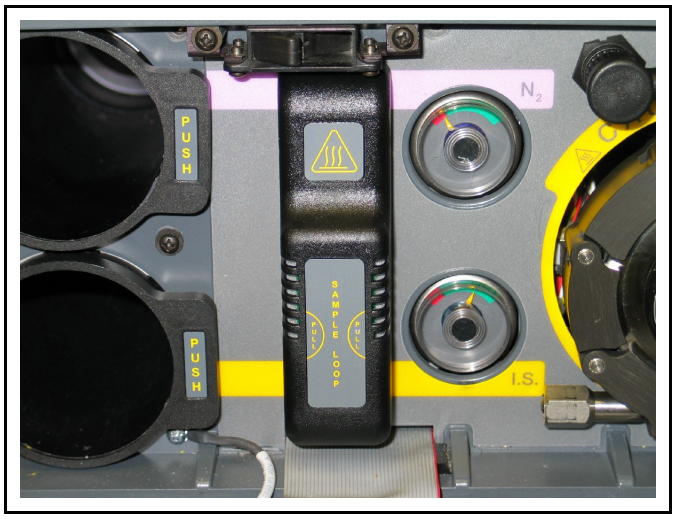
Figure 2-54 Wrench tighten



8 Snap on the black cover labeled **SAMPLE LOOP**. The cover will fit snugly over the Sample Loop. See Figure 2-55.

NOTE: If the cover does not easily fit over the Sample Loop, do not force it. Check to ensure the Loop is correctly installed with the Loop fully seated into both elbows and the nuts properly tightened for a secure fitting.

Figure 2-55 Sample Loop Cover Installed



2.10.2 Removing the Sample Loop

CAUTION

To prevent contamination, only open front panel in a dry, uncontaminated area.

1 Open the front panel of the HAPSITE and remove the black cover labeled **SAMPLE LOOP**.

WARNING

The elbow fittings, nuts and Sample Loop may be hot. Allow for these components to cool before continuing.

2 Using the 7/16" open end wrench suppled by INFICON, loosen the nuts on the top and bottom of the Sample Loop until it becomes free.

3 Remove the Sample Loop, being careful not to lose the ferrules on the top and bottom. Store the Sample Loop in a safe place for future use.

2.10.3 Installing the Tri-Bed or Tenax Concentrator

CAUTION

To prevent contamination, only open front panel in a dry, uncontaminated area.

1 Refer to section 2.10.2, Removing the Sample Loop, on page 2-34 to remove the Sample Loop or see section 2.10.4, Removing the Concentrator, on page 2-41 to remove the currently installed concentrator.

2 Remove the Concentrator from the storage vial and unwrap. Make sure a Teflon® ferrule is installed in each plastic nut with the wide end of the cone facing toward the center of the Concentrator, as shown in Figure 2-56. The ferrules are inserted into the threaded end of the nut.

NOTE: The Tri-Bed Concentrator is directional. The Tri-Bed Concentrator must be installed with the smooth metal sleeve pointing down and the grooved metal sleeve pointing up. See Figure 2-56.

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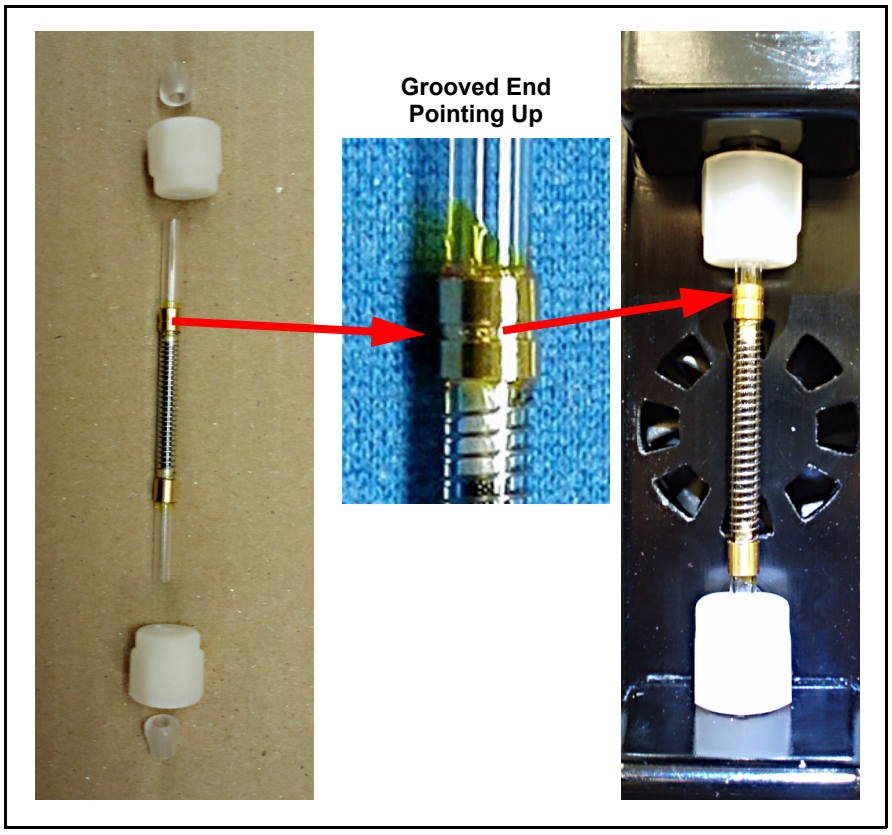
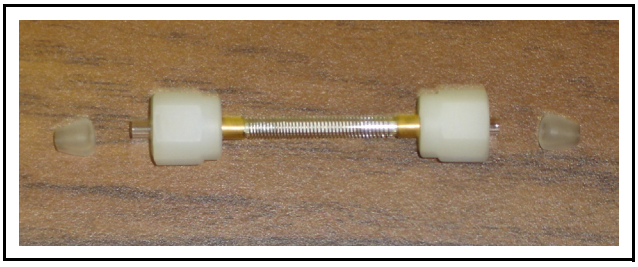
Figure 2-56 Proper Tri-Bed Concentrator Orientation



NOTE: The Tenax Concentrator does not have a specific orientation. See Figure 2-57.

Figure 2-57 Tenax Concentrator



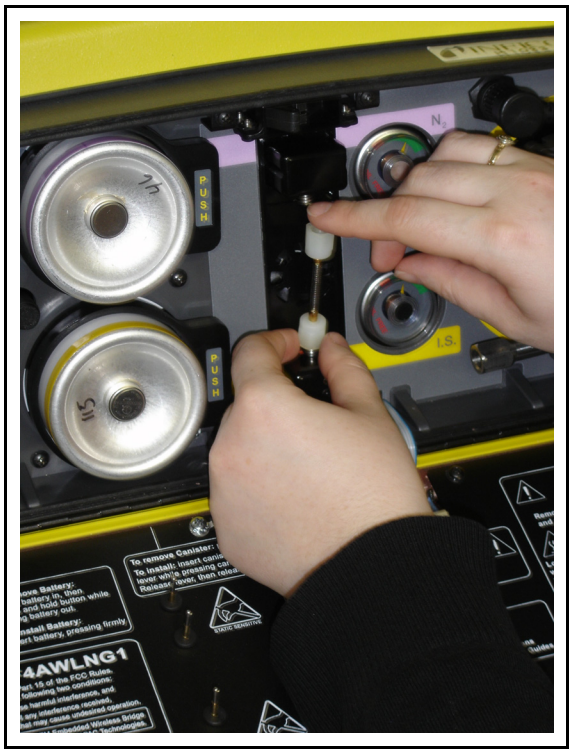
WARNING

The elbow fittings may be hot. Allow for these components to cool before continuing.

3 For the Tri-Bed Concentrator: While holding the nut and ferrule in place, carefully place the smooth metal sleeve end of the Tri-Bed Concentrator into the lower elbow fitting.

3a For the Tenax Concentrator: While holding the nut and ferrule in place, carefully place either end of the Concentrator into the lower elbow fitting. See Figure 2-58.

Figure 2-58 Placing Concentrator in Bottom Elbow



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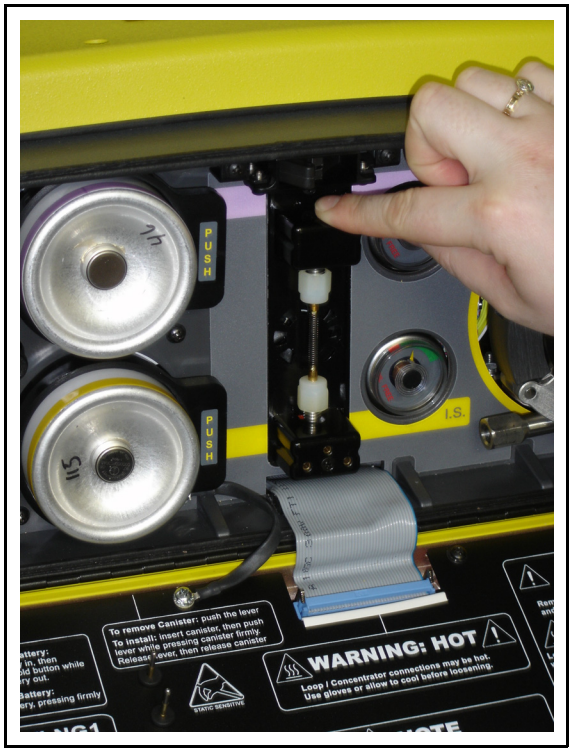
4 For the Tri-Bed Concentrator: Carefully lift up on the top elbow fitting and insert the end of the Concentrator with the grooved metal sleeve into this fitting. See Figure 2-59.

4a For the Tenax Concentrator: Carefully lift up on the top elbow fitting and insert either end of the Concentrator into this fitting. See Figure 2-59.

Figure 2-59 Inserting the Top of the Concentrator

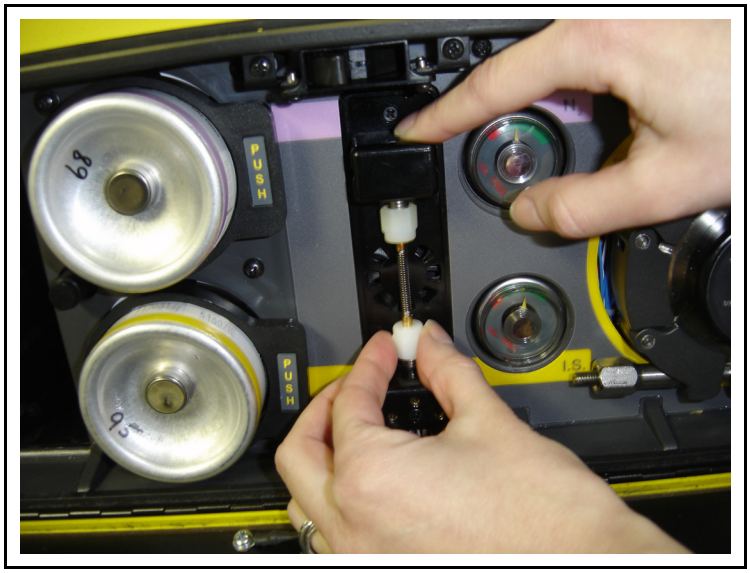
5 Keep the Concentrator aligned between the two elbow fittings while gently pressing down on the top elbow fitting. See Figure 2-60.

Figure 2-60 Pressing Down on Elbow Assembly



6 While maintaining gentle pressure on the top elbow fitting, first finger-tighten the bottom nut of the Concentrator. Then, proceed to finger-tighten the top nut. See Figure 2-61.

Figure 2-61 Tightening the Top and Bottom Nut



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WARNING

Excessive force and/or tightening can cause the fragile glass to break!

7 When pressure is released from the top fitting, the elbow should not move. When gentle upward pressure is applied to the top elbow, the elbow should not slip on the Concentrator. See Figure 2-62. If the elbow moves, the Concentrator is not properly seated, loosen the Concentrator and repeat Step 3 on page 35 through Step 6 on page 38.

Figure 2-62 Checking for Movement

8 Place the black Concentrator Cover (see Figure 2-63) over the Concentrator and elbow assembly. The cover should fit easily, excessive force is not required if the Concentrator is properly installed.

Figure 2-63 Installed Concentrator Cover

NOTE: If the cover does not easily fit over the Concentrator, do not force it on. Check to ensure the Concentrator is correctly installed with the Concentrator fully seated into both elbows and the nuts properly tightened for a secure fitting.

NOTE: The Concentrator Cover contains two metal contacts that are supported by Fiberglass. Inspect the contacts, prior to assembly, to be sure the contacts are not bent or crimped. See Figure 2-64.

WARNING

Use the proper Concentrator cover, which contains an Electronic Circuit board, for the Smart Plus. Do not use the old Concentrator cover from the HAPSITE Smart Plus. If the old cover is used, the cover will overheat and may become damaged.

Figure 2-64 Back of the New Concentrator Cover

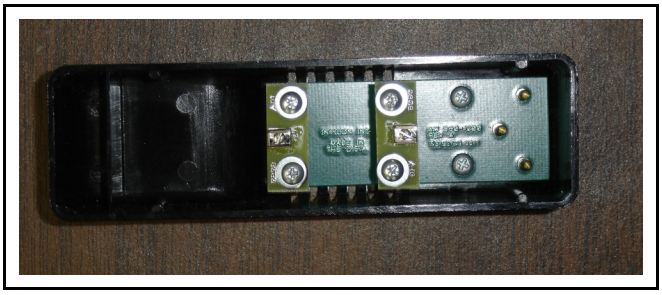

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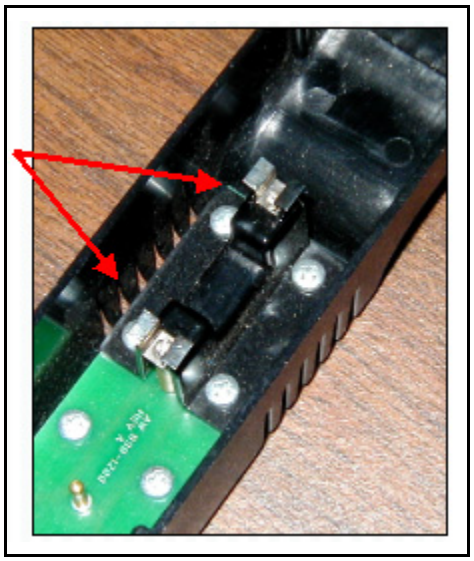
Figure 2-65 Back of the Old Concentrator Cover



9 Close the front panel.

2.10.4 Removing the Concentrator

1 Open the front panel of the HAPSITE and remove the black cover labeled **CONCENTRATOR**.

WARNING

The elbow fittings, nuts and Concentrator may be hot. Allow these components to cool before continuing.

WARNING

Excessive force and/or tightening can cause the fragile glass to break!

2 With fingers, loosen the nuts on the top and bottom of the Concentrator until the it becomes free.

3 Lift the top elbow. Gently lift and angle the Concentrator out of the fixture.

4 Remove the Concentrator from the bottom elbow, being careful not to lose the ferrules inside the nuts.

5 Store the Concentrator wrapped in tissue in its storage vial for future use.

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2.11 Probe Sampling Options and Attachments

To expand the sampling range of the HAPSITE, sample collecting bags can be used and special VX / R-33 Conversion Tubes can be attached.

2.11.1 Probe Nut Assembly

The orientation of the ferrules in the probe nut is critical for attaching a bag sample or VX / R-33 Conversion Tube.

1. Using a guide (golf tee, small screwdriver, plastic pen cap with pocket clip extension), place the metal probe nut over the guide's narrow end. The threads on the nut should be facing up.

CAUTION

Be sure the guide is clean to prevent the introduction of contaminants into the HAPSITE.

2. Place the small, back ferrule over the narrow end of the guide with the beveled side facing up.
3. The cone-shaped ferrule should be placed over the bevel with the narrow end facing up. See Figure 2-66.
4. Carefully remove the nut assembly from the narrow end of the guide. Gently tap the nut so that the ferrules seat properly into the nut.
5. Thread the nut-ferrule assembly onto the probe.
6. Finger-tighten the nut-ferrule assembly into place.

WARNING

Correct ferrule orientation is critical to avoid leaks of hazardous or toxic material

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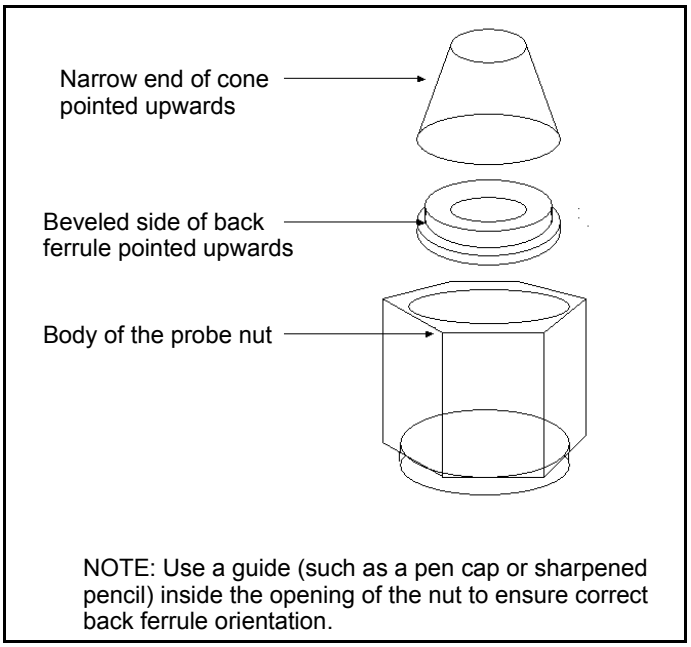
Figure 2-66 Diagram of Proper Ferrule Orientation in the Probe Nut



2.11.2 Attaching a Bag Sample

When samples are collected to be run later, various sampling bags can be used. This procedure outlines the steps used to attach a Tedlar® Bag.

WARNING

Be sure the bag valve remains closed when it is not attached to the probe. Make sure there is an exhaust tube attached to the exhaust port on the HAPSITE. Be sure the exhaust vents to a safe area.

1. Before attaching a Tedlar Bag to the Probe, refer to section 2.11.1, Probe Nut Assembly, on page 2-42 to ensure proper ferrule orientation in the probe nut.
2. Prepare the Tedlar Bag sample. Avoid filling bag more than 80% full. Be sure the white valve is closed on the Tedlar bag.
3. Loosen the nut on the probe by turning the nut counter-clockwise up to two complete revolutions.
4. Guide the white cylindrical stem of the bag valve assembly into the opening of the probe nut. Firmly push the stem into the probe nut. Two cylinder "clicks" are usually felt before the bag is properly seated into the probe nut.
5. Finger tighten the probe nut by turning the nut clockwise.
6. When it is time for the HAPSITE to collect the sample, open the Tedlar Bag by turning the valve one complete counter-clockwise revolution.

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2.11.3 VX / R-33 Conversion Tube

This procedure describes the steps required to prepare the HAPSITE to sample for VX or R-33 using the Conversion Tube. To detect VX or R-33, you must insert the Conversion tube following the guidelines below.

The process of detecting VX or R-33 on the HAPSITE requires the conversion of VX or R-33 (high boiling point chemicals) to the G analog. The VX or R-33 molecule is broken at the sulfur bond when it comes in contact with a silver fluoride pad. The result is the formation of a volatile chemical ethyl methyl phospho no fluoridate in the case of VX, or isobutyl methyl phospho no fluoridate in the case of R-33. These compounds are detected by the HAPSITE as VX-G or R-33-G.

NOTE: Theoretically, other G agents can be detected with the VX conversion pad in place. However, if other G agents are suspected, the sample should also be run without the conversion tube in place.

WARNING

Sulfur mustard cannot be detected with the conversion tube in place.

2.11.3.1 VX / R-33 Conversion Tube Installation

1 Refer to section 2.11.1, Probe Nut Assembly, on page 2-42 to ensure proper ferrule orientation in the probe nut.

WARNING

Correct ferrule placement is critical to ensure a leak-free fit around the conversion tube.

2 Loosen the nut on the end of the probe approximately 1/4 to 1/2 of a turn. See Figure 2-67.

Figure 2-67 Loosening the Nut

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3 Insert either end of the VX / R-33 Conversion Tube into the nut. Make sure the tube is firmly seated into the front ferrule. See Figure 2-68.

Figure 2-68 Inserting the Tube

4 Finger tighten the nut. Pull gently on the conversion tube, it should be held firmly in place. See Figure 2-69.

Figure 2-69 Tightening the Nut

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2.11.3.2 VX / R-33 Conversion Tube Removal

WARNING

If conversion tube has been exposed take proper precautions and wear appropriate Personal Protective Equipment (PPE). PPE guidelines can be found in the chemical's MSDS. Dispose of the conversion tube according to local regulations if it has been exposed.

1. Loosen the nut 1/4 to 1/2 of a turn.
2. Gently pull the VX / R-33 Conversion Tube out of the probe.
3. Finger tighten the nut.

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2.12 Batteries

The battery provides power to the HAPSITE to allow portability. Under optimum conditions, the battery has a 2 to 3 hour life.

NOTE: To test a battery, push on the **TEST** button on the end of the battery. In the elongated triangle, green lighted numbers will appear. The highest illuminated number indicates the percentage of battery power left. The percentage of remaining battery charge is reported in 20% increments. See Figure 2-70.

NOTE: If **OVER** is illuminated, the battery is fully charged.

Figure 2-70 Battery Test Button and Charger Indicator

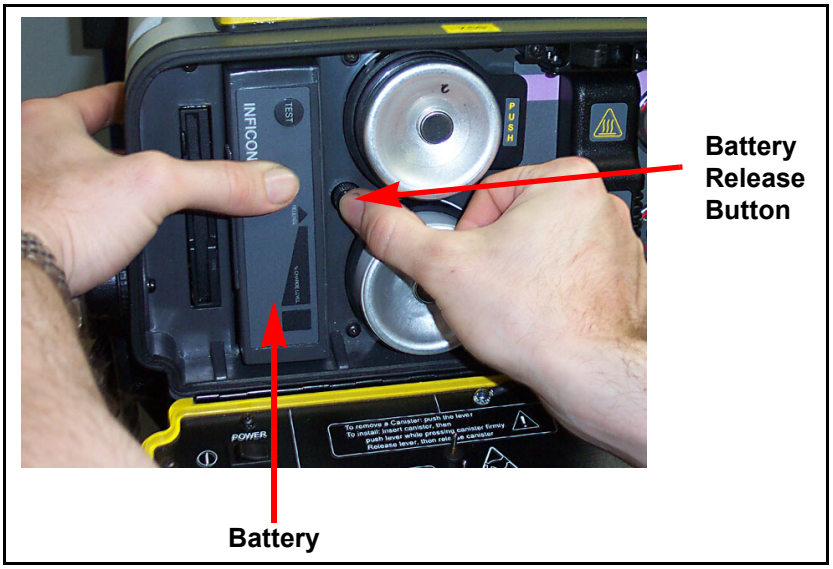
2.12.1 How to Remove a Battery

The black round button to the right of the battery is the battery release button. Two clips hold the battery in the battery compartment. See Figure 2-71. Firmly push in on the battery while simultaneously pressing and holding the battery release button. As the clips release, pull the battery out.

CAUTION

Do not expose the battery compartment to rain or other foreign material. Do not open the compartment in a contaminated or wet area.

Figure 2-71 Battery Release Button



2.12.2 Battery Charger

The auxiliary Battery Charger (part number 930-470-G1—see Figure 2-72) charges up to three HAPSITE batteries in 15 hours or less. It operates using AC power.

CAUTION

The battery charger is not sealed against moisture, debris, or contamination.

Figure 2-72 Battery Charger

The Battery Charger operates from a range of nominal AC voltages from 100 to 230 V. It will continue to operate without internal damage at a voltage as low as 90 V and as high as 253 V. The frequency can be from 50 to 60 Hz. The Battery Charger draws 120 W when fully loaded.

The AC power connects to the Battery Charger through a Type IEC 320 male plug, a two-wire grounded connector rated for the full range of voltages. The connector is recessed at the rear right-hand side of the Battery Charger and incorporates a pair of fuses.

The Battery Charger is designed for indoor use at ambient temperatures from 5 °C to 35 °C (41 °F to 95 °F). The Battery Charger is not designed for exposure to contaminants since decontamination is not possible.

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2.12.2.1 Battery Charger Components

The Battery Charger is shipped with a power cord and spare fuses.

2.12.2.2 Battery Charger Connections and Startup

Plug the power cord into the connector at the right rear of the Battery Charger. Then plug into a grounded outlet. The **ON** light will illuminate. (The Battery Charger does not have a power switch.)

As the Battery Charger performs a self-test, all the indicators will first turn amber. Secondly, all receptacles that do not contain batteries will turn green. If a receptacle contains a battery, it will turn red. Finally, all lights except for the **ON** indicator will extinguish. No further warm-up is required; it is ready to charge batteries.

2.12.2.3 Loading the Battery Charger

The Battery Charger receptacles are identical and batteries in any state of charge can be connected. Place Battery to be charged in one of the charging receptacles. The respective indicator will illuminate green and charging will commence immediately.

CAUTION

Do not use excessive force when placing the battery in the battery charger.

CAUTION

Do not charge batteries in a moving vehicle.

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2.12.2.4 Understanding the Battery Charger Indicators

Each battery receptacle is associated with an indicator light which can be illuminated in any of three colors.

Green . . . . . The battery is being charged. This will continue for 15 hours or less. If a battery with a severely depleted charge is inserted, the green light will flash. If it flashes for more than 10 minutes, the battery will not accept a charge and should be replaced. The actual state of the battery charge can be assessed by using the **TEST** button on the battery.

Amber . . . . . The battery is fully charged. The rate of charge has been reduced to a maintenance level. The battery can be left this way indefinitely.

Red . . . . . The receptacle (or the battery, if one is installed) has a problem. A flashing red light indicates that communication with the battery is unsuccessful.

Off . . . . . The receptacle is ready to charge a battery. If the indicator remains extinguished when a battery is inserted, the battery is severely depleted. In this case, leave the battery in the receptacle and unplug the power cord. Reconnect the power cord and the battery will start to charge.

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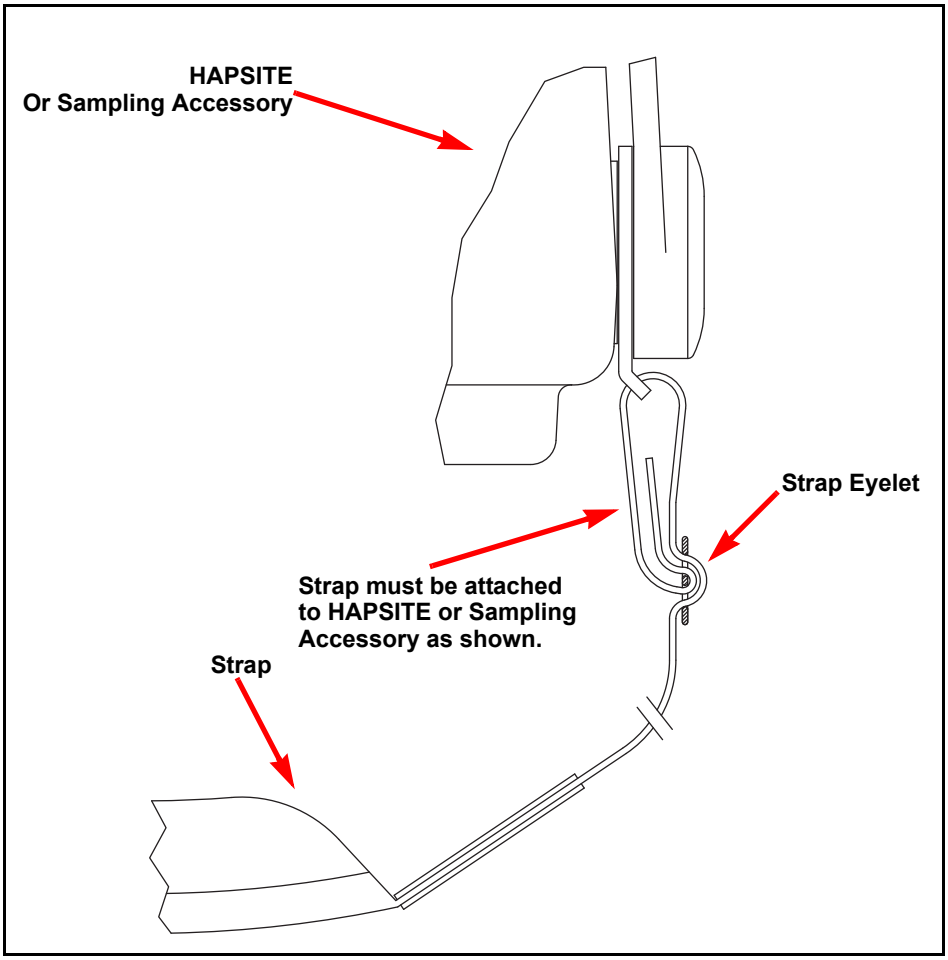
2.13 Portable Accessories

Portability is an important HAPSITE feature. The following accessories facilitate using the HAPSITE in the field.

2.13.1 HAPSITE and Headspace Sampling System Strap

Attach the HAPSITE and Headspace Sampling System straps as illustrated below in Figure 2-73.

Figure 2-73 Attaching the HAPSITE Strap



WARNING

Improper connection of the strap increases the risk of dropping the HAPSITE and/or bodily injury

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2.13.2 HAPSITE Backpack

The backpack is a light weight, high quality hiker's backpack. It has been modified to securely mount the HAPSITE.

2.13.2.1 Adjustment of the Backpack

To adjust the backpack, proceed as follows.

1. Put on the empty backpack.
2. Tighten the hip belt.
3. Arrange the backpack so that:
   - The frame's S-curve matches the curve of your back.
   - The hip belt rests on your hip bones.
   - The shoulder straps come from the frame at a slight downward angle over your shoulders.
4. Note the height and shoulder strap adjustments that need to be made to achieve a proper fit.

   NOTE: Use a mirror to visually check the fit.
5. Take off the backpack.
6. If a height adjustment is needed, use the straps and plastic connectors on the back of the backpack to move the hip belt up or down.
7. If the spacing between the shoulder straps needs adjustment, loosen or tighten the straps located on the back of the backpack.
8. Try on the empty pack again. Repeat as necessary to achieve a proper fit.
9. Release the locks on the two stainless steel buckles.
10. Mount the HAPSITE on the backpack.
11. Correct adjustment of the tension of the buckles permits them to slide slightly on the HAPSITE attachment points.

WARNING

If the HAPSITE is not properly secured to the backpack, the HAPSITE may fall or move unexpectedly which may result in bodily injury to the user.

12. With the HAPSITE securely clipped to the backpack, put on the backpack.
13. Tighten the hip belt and shoulder straps.
14. The weight should be carried by your hips, with the shoulder straps steadying the load.

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2.13.2.2 Care of the Backpack

- Avoid exposing the backpack to solvents and other active chemicals.
- Avoid storing the backpack in direct sunlight.
- Wash the backpack as necessary with water and mild soap.

CAUTION

Do not store the backpack with the fabric in contact with concrete. The moisture and chemicals in concrete can weaken nylon.

2.14 Hot Swap Cable (IPN 930-246-G1)

The Hot Swap Cable is used to provide an external power source for the HAPSITE. When connected between an external battery and the 24 V(dc) power port on the HAPSITE, the Hot Swap Cable permits changing the internal battery without the loss of power to the HAPSITE.

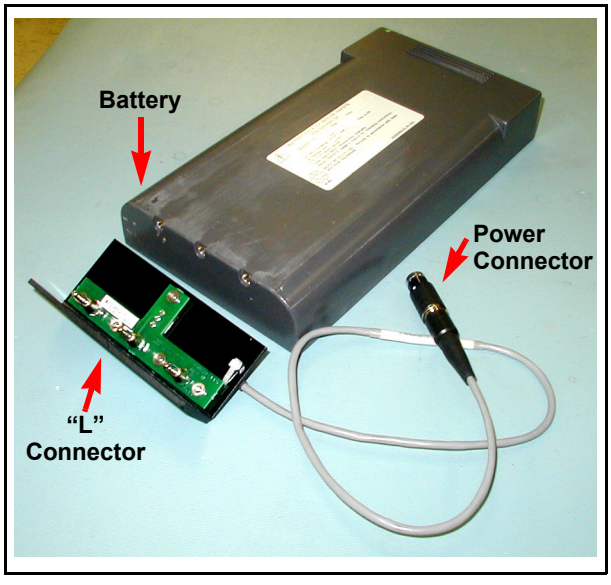
2.14.1 Connecting the Hot Swap Cable

WARNING

Do not use the hot swap cable in the rain.

1 Plug the "L" connector into the back of a charged battery. See Figure 2-74.

Figure 2-74 Hot Swap Cable Components



WARNING - Risk Of Electric Shock

Do not use if the "L" connector is broken.

WARNING - Risk Of Electric Shock

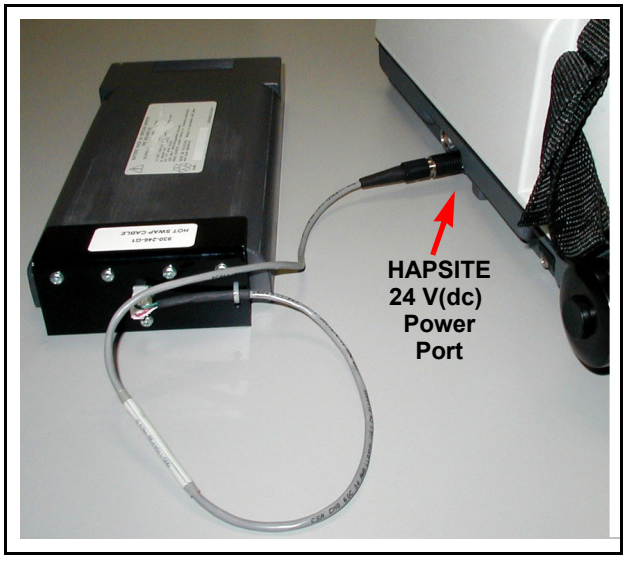
Connect the Hot Swap Cable "L" connector to the battery first. Then, plug the power connector into the HAPSITE 24 V(dc) power port.

2 Plug the power connector into the 24 V(dc) power port on the HAPSITE. The depleted internal battery can now be replaced. After replacing the internal battery, disconnect the Hot Swap Cable. See Figure 2-75.

CAUTION

Do not open the HAPSITE front panel in a contaminated or wet environment.

Figure 2-75 Power Connector



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2.14.2 Storing the Hot Swap Cable

The Hot Swap Cable and Battery have exposed electrical connections. Protect the connections from moisture or contaminated environments by storing the battery and cable connection in a protective plastic bag. See Figure 2-76.

Figure 2-76 Storing

2.14.3 Use as an Additional Battery Source

Attach the Battery to the HAPSITE via the Hot Swap Cable when the front panel shows the level of charge on the internal battery is ≤20%. This will provide an additional battery source.

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Chapter 3
Operating HAPSITE in Portable Mode

3.1 Starting the HAPSITE in Portable Mode

Portable Mode refers to using the HAPSITE without the Laptop computer.

Required Materials

- HAPSITE (Analytical Module)
- Internal Standard Gas Canister
- Carrier Gas Canister
- Charged Battery
- AC to DC Power Converter Power Supply
- Probe

Procedure

1. Assemble the HAPSITE as shown in Section 2.2, Basic Assembly, on page 2-5.
2. Press the **POWER** button on the front panel. The word **POWER** will illuminate. Powering on the HAPSITE takes one (1) to two (2) minutes. See Figure 3-1.

Figure 3-1 The Power Switch

NOTE: Power on the HAPSITE while connected to AC power. Using battery power to turn on and heat the HAPSITE will consume over 40% of the battery's charge.

3. The HAPSITE will boot in approximately one minute and will sense which sample configuration (i.e., concentrator) has been installed. It will begin to prepare the default method for this sample configuration.
4. The HAPSITE will begin to prepare various components. These components include heating the HAPSITE and accessory heaters, running AutoTune (see Step 8 on page 3-3), powering the NEG, and if necessary, running concentrator cleanout.

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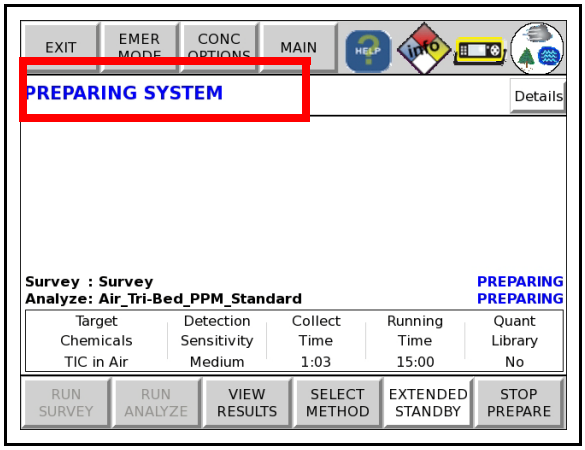
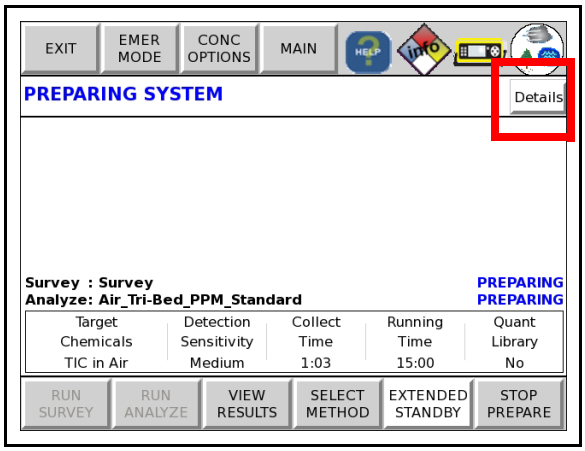
5 During the preparation period, the front panel will display the **PREPARING SYSTEM** message. Depending upon the chosen default method, this screen may show **PREPARING ANALYZE** or **PREPARING SURVEY**. This message will occur when the methods have different temperature setpoints. See Figure 3-2.

Figure 3-2 Front Panel Preparing System



6 To view the preparation details' progress, touch the **Details** button. See Figure 3-3.

Figure 3-3 Details Button



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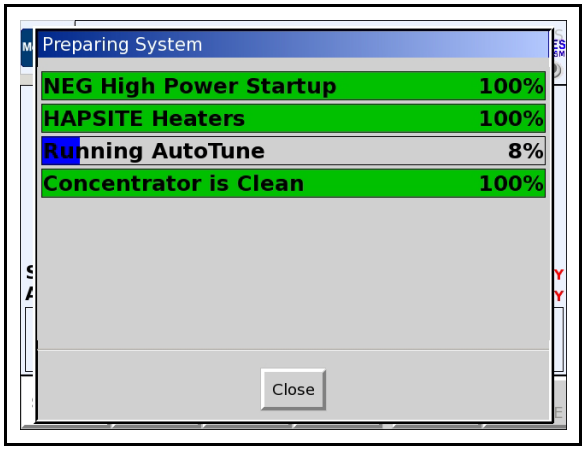
7 The progress of the preparation is shown by a bar graph. If a component is in the process of being prepared, it will be shown in blue. When a component is ready, it will be shown in green. If a component is going to be prepared, but the preparation process has not started, it will be shown in yellow. If the system is not ready, the items that need to be prepared will be shown in red. Figure 3-4.

Figure 3-4 Preparation Bar Graph



8 When the heating sequence is completed, the software will check the mass spectrometer tune and automatically make any necessary adjustments. The automatic tune adjustment is called AutoTune. If AutoTune fails, see Section 6.4, Manual Tune Settings and Controls, on page 6-7.

9 As part of the preparation, a concentrator cleanout will be run when the concentrator is installed. This cleanout will heat the concentrator to 180°C to remove residue. The cleanout will occur when the unit has been turned on, taken out of Extended Standby, the concentrator has been changed or the concentrator has been saturated.

NOTE: If a concentrator cleanout is not desired due to an emergency, see for Emergency Mode (**EMER MODE**) instructions. See Section 3.1.1, Emergency Mode (EMER MODE), on page 3-6.

NOTE: A concentrator cleanout can also be skipped, although skipping the concentrator cleanout is not recommended and may lead to poor results. See Section 3.1.2, Concentrator Options (CONC OPTIONS), on page 3-8.

10 Hold the probe in a clean environment for the duration of the cleanout. If the concentrator cleanout is not successful, see Section 3.1.3, Concentrator Cleanout Failure, on page 3-11.

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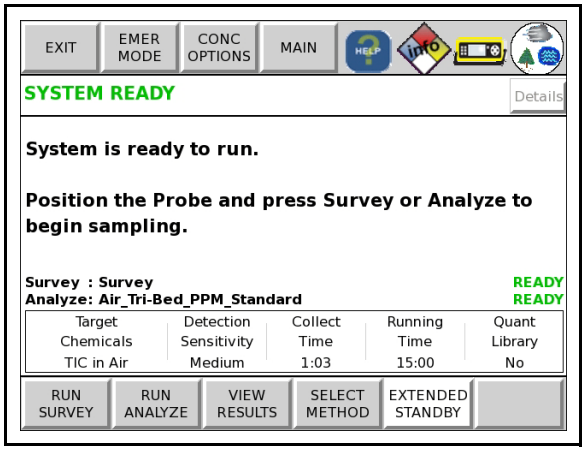
11 When the HAPSITE is ready to run samples, a green **SYSTEM READY**, **SURVEY READY** or **ANALYZE READY** message will be displayed. See Figure 3-5.

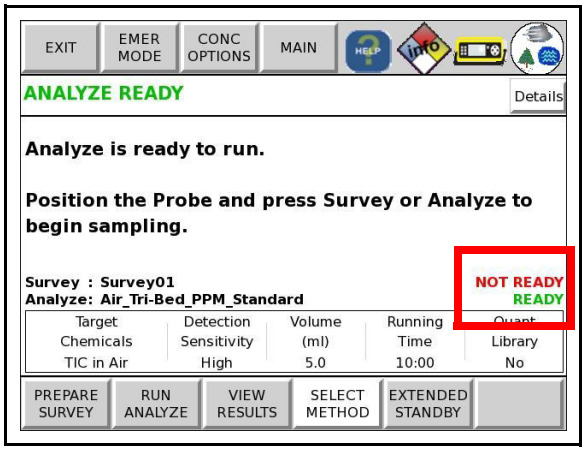
NOTE: The HAPSITE takes about twenty minutes to complete the preparation sequence from a cold start.

Figure 3-5 System Ready



NOTE: If the methods are at different temperature setpoints, the method that is ready to run will have a green **READY** message next to the method name. See Figure 3-6.

Figure 3-6 Ready Message



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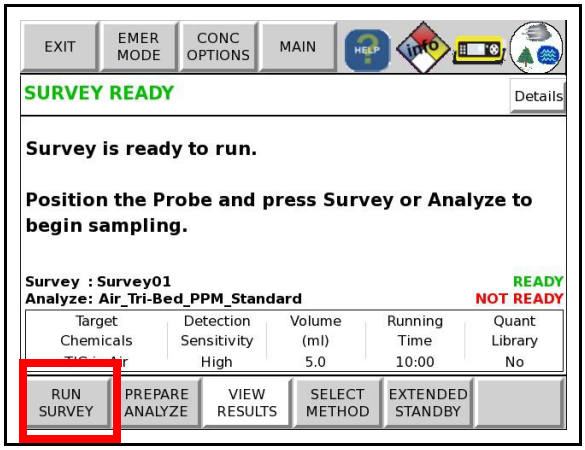
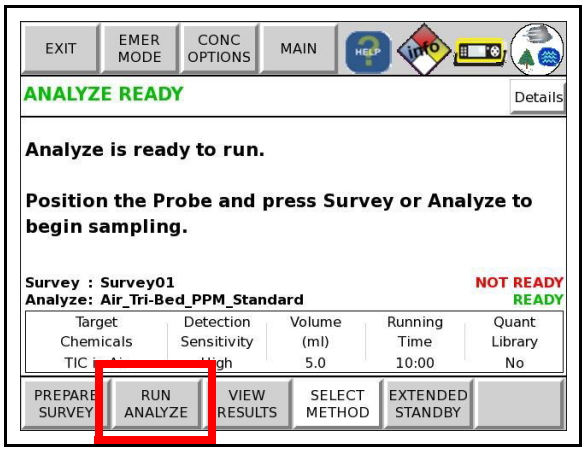
12 If **SURVEY READY** is displayed, touch **RUN SURVEY** or push **SURVEY RUN**. See Figure 3-7

Figure 3-7 Survey Ready



13 If **ANALYZE READY** is displayed, touch **RUN ANALYZE** or push **ANALYZE RUN**. See Figure 3-8.

Figure 3-8 Analyze Ready



NOTE: If the system is preparing a **SURVEY** run and an **ANALYZE** method is desired, touch the **STOP PREPARE** button. Then, touch the **PREPARE ANALYZE** button. Likewise, if an **ANALYZE** method is being prepared and a **SURVEY** is desired, touch **STOP PREPARE**, followed by the **PREPARE SURVEY** button.

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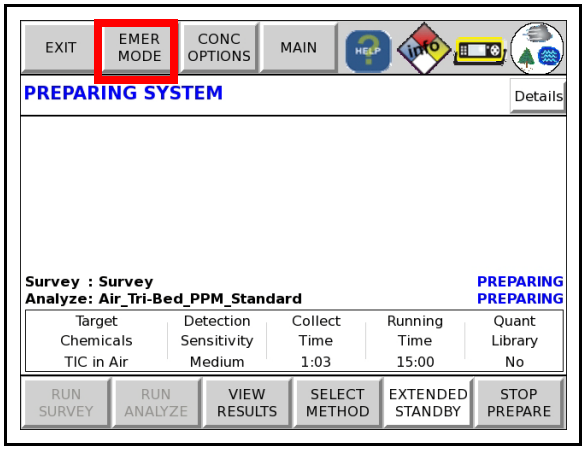
3.1.1 Emergency Mode (EMER MODE)

In an emergency, the concentrator cleanout can be bypassed to allow for faster startup. This is not recommended for everyday use. To place the system into Emergency Mode:

1 Touch **EMER MODE** while the **PREPARING SYSTEM** message is displayed. See Figure 3-9.

Figure 3-9 Emergency Mode



2 Alternately, use the arrow keys to highlight the **EMER MODE** button and push **OK SEL**. See Figure 3-10.

Figure 3-10 Arrow Keys

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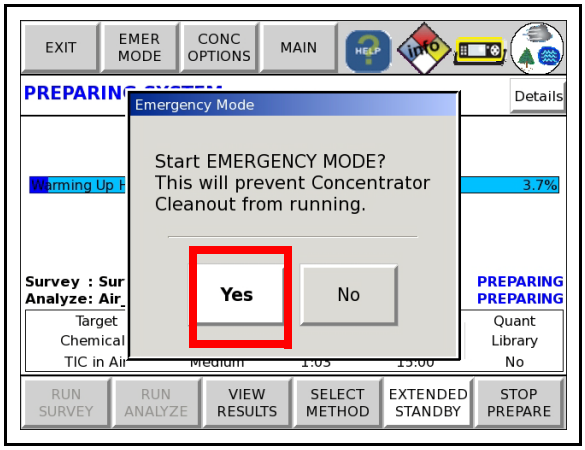
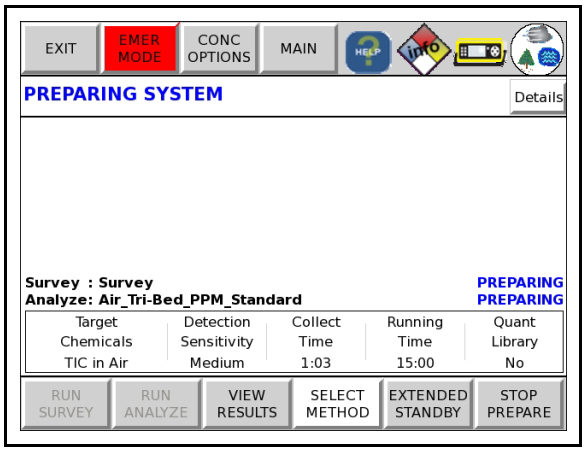
3 A confirmation message will be displayed. Touch **Yes** or push **OK SEL** to continue. See Figure 3-11.

Figure 3-11 Emergency Mode Confirmation



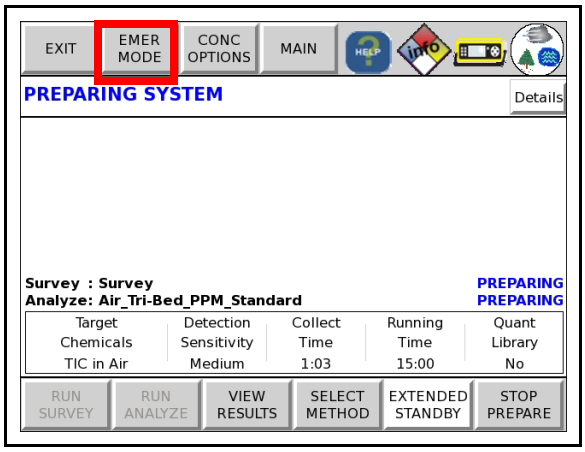
4 The **EMER MODE** button will turn red when Emergency mode is activated. See Figure 3-12.

Figure 3-12 Emergency Mode Active



5 To take the system out of Emergency Mode, touch the **EMER MODE** button. Alternately, use the arrow keys to highlight the **EMER MODE** button and push **OK SEL**. The **EMER MODE** button will turn gray. See Figure 3-13.

Figure 3-13 EMER Mode Inactive



6 The HAPSITE ER will run a concentrator cleanout and prepare for general (non-emergency) use.

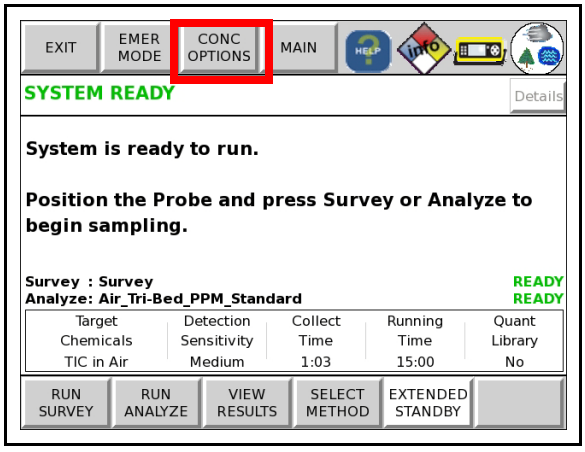
3.1.2 Concentrator Options (CONC OPTIONS)

The **CONC OPTIONS** button has two selections: **Concentrator Cleanout** and **Skip Conc Cleanout**. When **Concentrator Cleanout** is selected, the HAPSITE will run a manual cleanout. When **Skip Conc Cleanout** is selected, the HAPSITE will bypass the concentrator cleanout while the HAPSITE is preparing.

3.1.2.1 Concentrator Cleanout

1 Touch **CONC OPTIONS** or use the **arrow keys** to highlight the **CONC OPTIONS** button and push **OK SEL**. See Figure 3-14.

Figure 3-14 Concentrator Options



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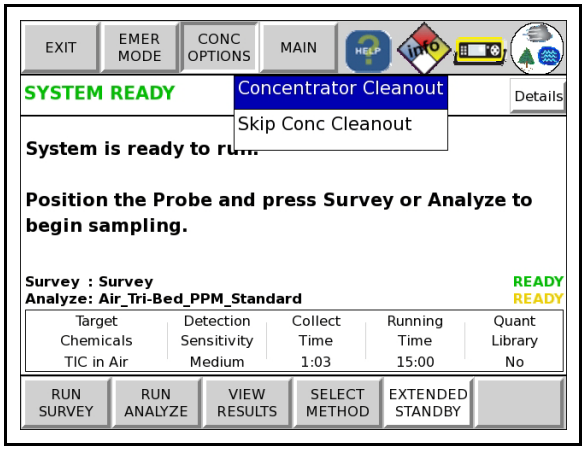
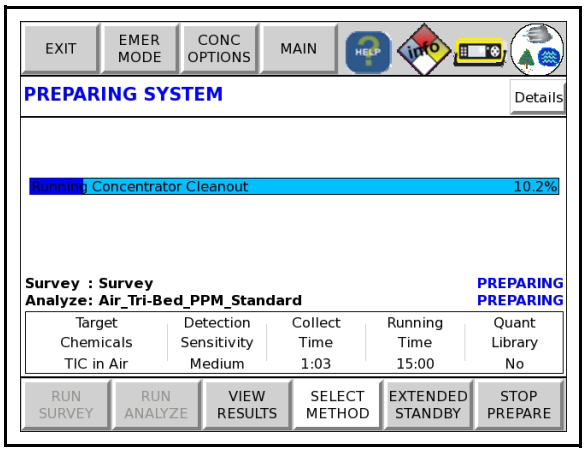
2 Touch **Concentrator Cleanout** or highlight **Concentrator Cleanout** using the **arrow keys**. Push **OK SEL**. See Figure 3-15.

Figure 3-15 Concentrator Cleanout



3 The HAPSITE will run a concentrator cleanout. See Figure 3-16.

Figure 3-16 Concentrator Cleanout



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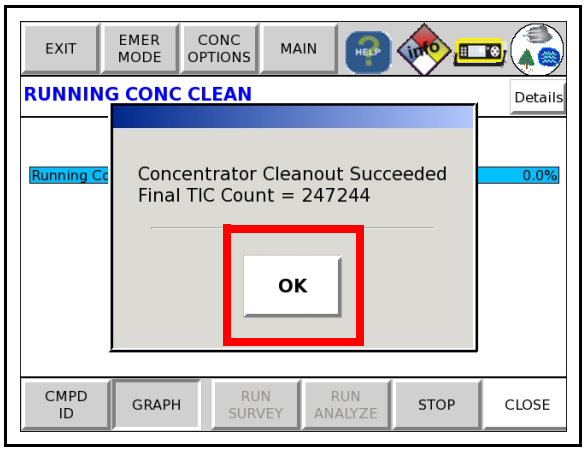
4 When the cleanout is successful, the **Concentrator Cleanout Succeeded** message will be displayed along with the final TIC. Push **OK** to exit the screen. See Figure 3-17.

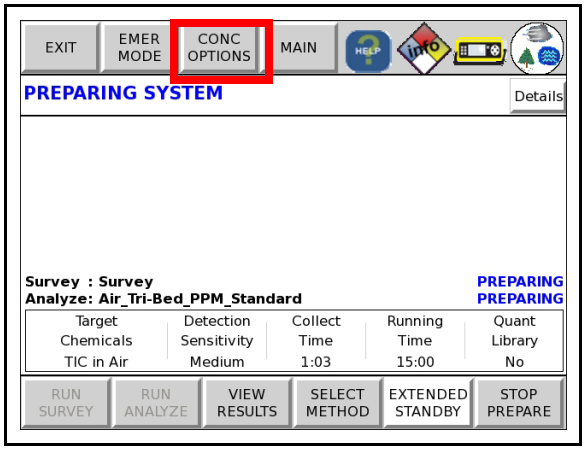
Figure 3-17 Concentrator Cleanout Succeeded



3.1.2.2 Skip Cleanout

1 Touch **CONC OPTIONS** or use the **arrow keys** to highlight the **CONC OPTIONS** button and push **OK SEL**. See Figure 3-14.

Figure 3-18 Conc Options



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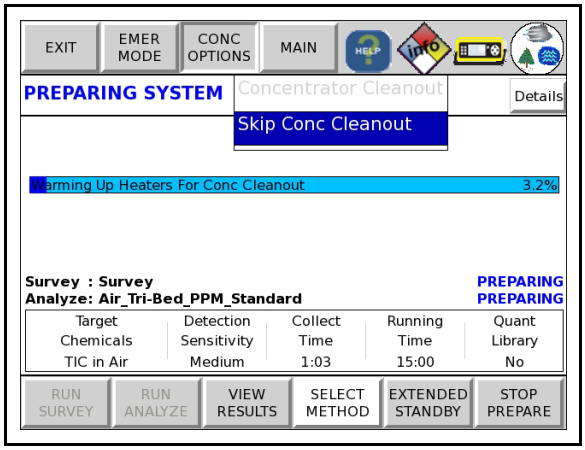
2 Touch **Skip Cleanout** or highlight **Skip Cleanout** using the **arrow keys**. Push **OK SEL**. See Figure 3-15.

Figure 3-19 Skip Cleanout

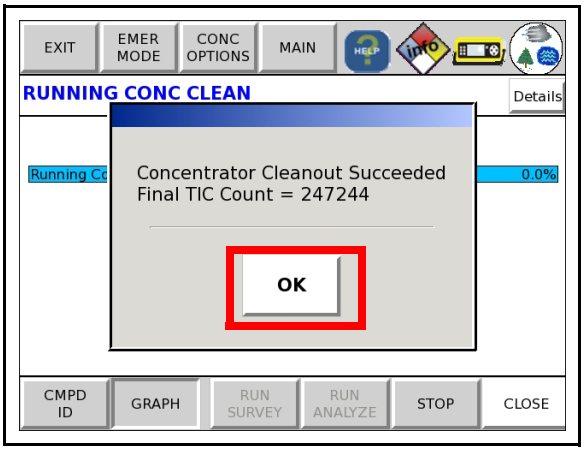


3 The system will not run a cleanout as part of its preparation.

3.1.3 Concentrator Cleanout Failure

If the concentrator cleanout is successful, the screen will display the final TIC. See Figure 3-20.

Figure 3-20 Cleanout Successful



If the concentrator cleanout is unsuccessful, the screen will display a concentrator cleanout failed message. See the instructions below for cleanout options.

1 Touch **Retry** to start another concentrator cleanout sequence.

2 Touch **Skip** to start running a concentrator Analyze method.

3 Touch **Abort** to return to the Main Screen.

NOTE: If **Abort** is touched, the HAPSITE will show that the **SYSTEM IS NOT READY**.

4 The HAPSITE will re-run the cleanout as part of its preparation.

5 If the failure box appears again, check the concentrator to verify that it is not cracked or chipped. Also, try re-installing the concentrator to ensure that it is properly seated.

3.1.4 Quick Reference SOP — Heat-up and Tune

CAUTION

Do not open the front panel in a wet or contaminated area.

1 Insert the internal standard and carrier gas canisters.

2 Insert a charged battery.

3 Connect the AC to DC power converter power supply.

4 Verify that the appropriate sample configuration (i.e., concentrator) is installed.

5 Press the **POWER** button on the front panel.

6 The HAPSITE will heat up the necessary components and perform AutoTune. A prompt to run **SURVEY** or **ANALYZE** will appear when the HAPSITE is ready to run a sample. The process for heating and tuning takes approximately 20 minutes.

7 If the default method is not the desired method, touch **STOP PREPARE**.

8 Touch **SELECT METHOD**. Highlight the desired method. Touch **Select**.

NOTE: If the wireless connection to the Laptop is to be used, see Chapter 4, Communications and Touch Screen Options.

NOTE: When the **SYSTEM READY** message is displayed, touch either **RUN SURVEY** or **RUN ANALYZE**. If using the push buttons, push **SURVEY RUN** or **ANALYZE RUN**.

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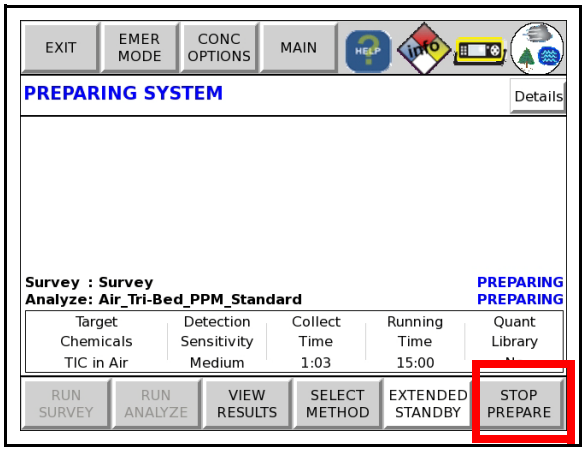
3.2 Selecting a Different Method Using the SELECT METHOD Icon

If the default method is not the desired method, the method can be changed. Changing the method can occur when the system is preparing or when another method has finished preparing.

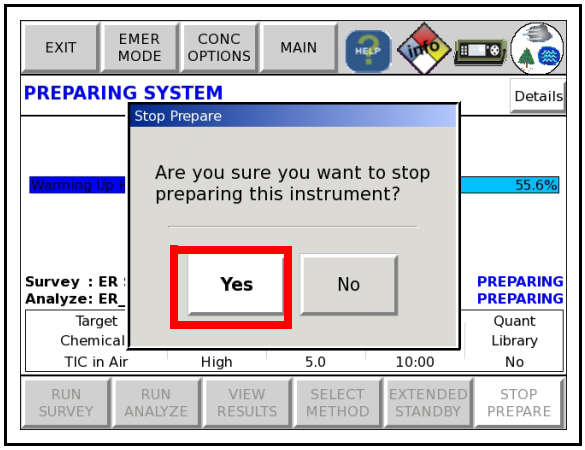
1 When the **PREPARING SYSTEM** screen is displayed, touch **STOP PREPARE**. Alternately, use the **arrow keys** to highlight **STOP PREPARE** and push **OK SEL**. See Figure 3-21.

Figure 3-21 Stop Prepare Screen



2 The screen will prompt, **Are you sure you want to stop preparing this instrument?** Touch **Yes** or using the **arrow keys**, highlight **Yes** and push **OK SEL**. See Figure 3-22.

Figure 3-22 Stopping Preparation



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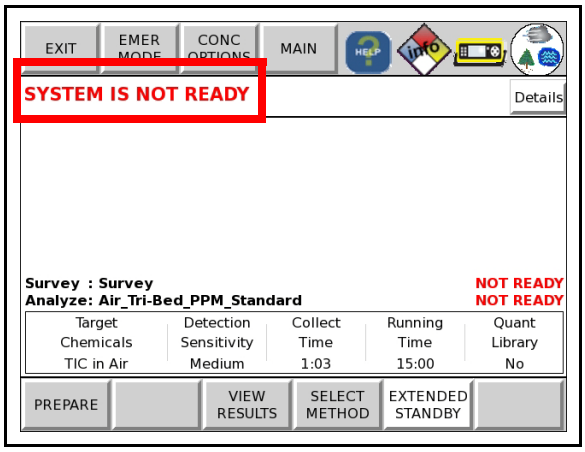
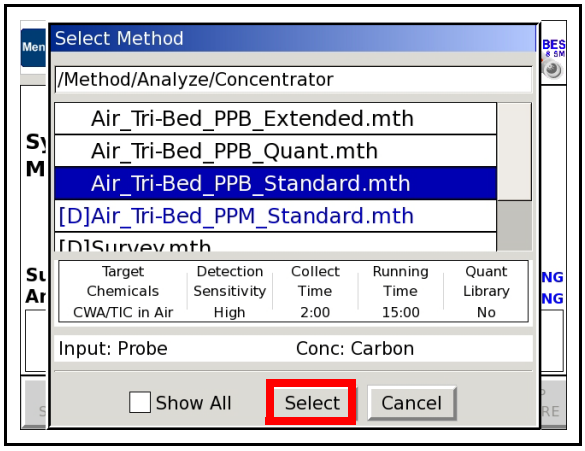
3 The **SYSTEM IS NOT READY** screen will appear. To select a new method, touch **SELECT METHOD** or using the **arrow keys**, highlight **SELECT METHOD** and push **OK SEL**. See Figure 3-23.

Figure 3-23 Selecting a Method Screen



4 Scroll up or down using the scroll bar or with the **arrow keys**. When the desired method is highlighted, touch **Select** or push **OK SEL**. See Figure 3-24.

Figure 3-24 Method Selection



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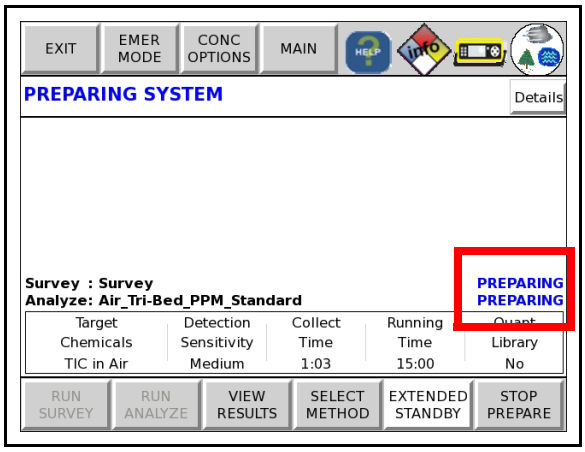
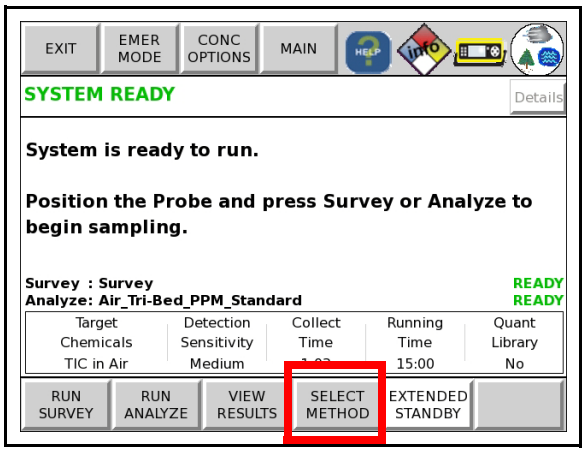
5 The **PREPARING** message will again be displayed. See Figure 3-25. Refer to steps 4-9 of Section 3.2, Selecting a Different Method Using the SELECT METHOD Icon, on page 3-13 for further instructions on system preparation.

Figure 3-25 Preparing System



6 If the **SYSTEM READY, ANALYZE READY** or **SURVEY READY** message is already displayed and the prepared method is not the desired one, touch **SELECT METHOD**. See Figure 3-26.

Figure 3-26 Selecting New Method



7 Scroll up and down with the scroll bar or use the **arrow keys** to highlight the desired method, as shown in Step 4 of section 3.2. Touch **Select** or highlight **Select** using the **arrow keys** and push **OK SEL**.

8 The HAPSITE will begin preparing the new method. Refer to Steps 4-9 of Section 3.2, Selecting a Different Method Using the SELECT METHOD Icon, on page 3-13 for further instructions on system preparation.

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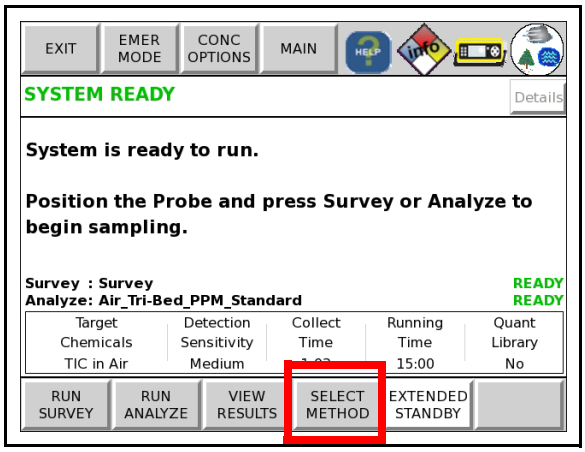
3.2.1 Changing the Default Method

The default method for the HAPSITE can be changed. By changing the default method, the HAPSITE will prepare the newly selected method upon startup.

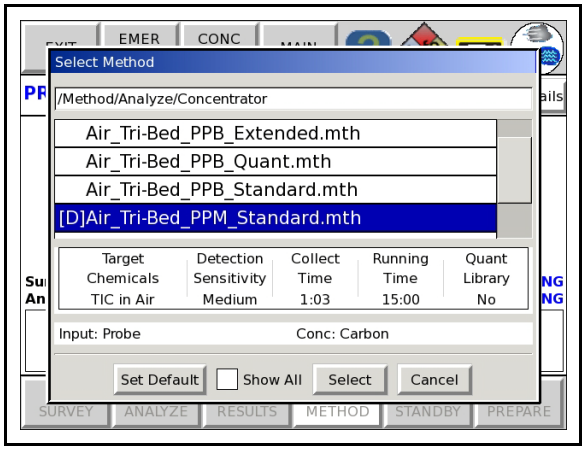
1 Touch **SELECT METHOD**.See Figure 3-27.

Figure 3-27 Select Method



2 Highlight the desired method. See Figure 3-28.

Figure 3-28 Choosing Method



3 Touch the **Set Default** button. Upon the next startup, the HAPSITE will begin preparing the new default method.

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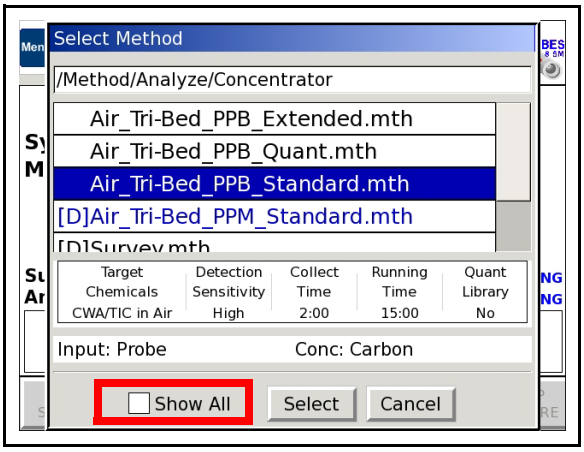
3.2.2 Show All

The HAPSITE will only show methods that are compatible with the current sample and/or accessory configuration. By checking the **Show All** box, all loaded HAPSITE methods will appear in the text box, regardless of configuration. Non-compatible methods will be shown in a lighter gray. The non-compatible methods are for reference only and cannot be selected to run. See Figure 3-29.

Figure 3-29 Show All



3.3 Survey Mode

The Survey mode is used for quick analysis and tentative results. When sampling unknown compounds, it is recommended that a Survey run be completed before running Analyze.

Overview

- Using the probe, sample the air away from the area of concern for one minute. This establishes the background of VOC's currently present in the area.

CAUTION

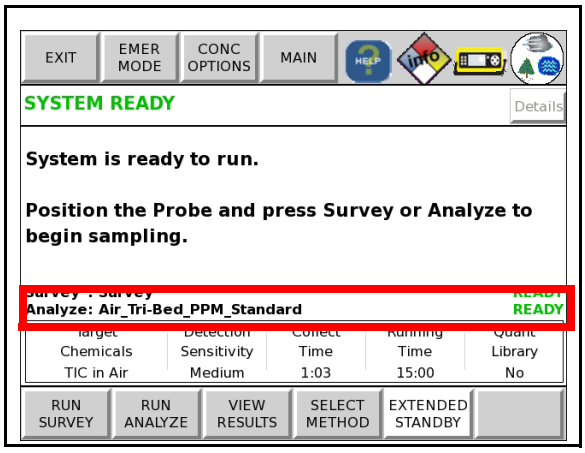
Do not touch the sample with the probe. Do not allow liquids to enter the probe.

- When a background has been established, sample directly over the point of concern. Once the TIC begins to increase, slowly move the probe away from the sample. If a compound has been identified, it will be displayed on the screen.

Procedure

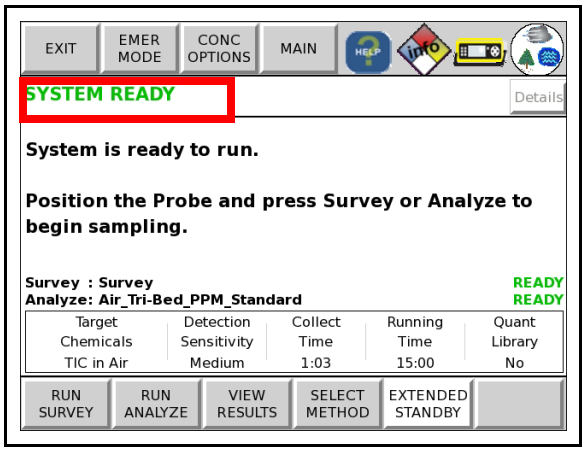
1. If an Analyze method is going to be run after Survey, verify that the appropriate sample configuration (i.e., concentrator) is installed.
2. When powered on or taken out of Extended Standby, the HAPSITE will automatically start preparing an Survey and Analyze method if the probe is attached. Refer to Section 3.1, Starting the HAPSITE in Portable Mode, on page 3-1.
3. Verify that the desired Analyze method is listed under the Survey method. In Figure 3-30, the Analyze method is **Air_Tri-Bed_PPM_Standard**.

Figure 3-30 Analyze Method



4. A **SYSTEM READY** message will appear with instructions to press **Survey** or **Analyze** when the HAPSITE Smart Plus is ready to sample. See Figure 3-31.

Figure 3-31 System Ready



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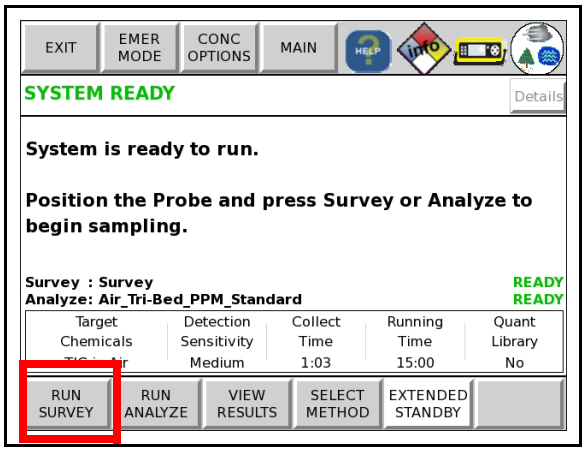
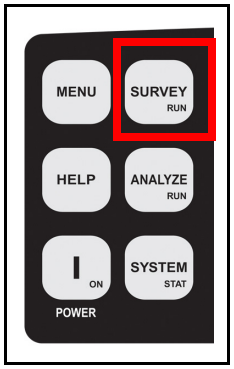
5 Using the touch screen, touch **RUN SURVEY**. See Figure 3-32.

Figure 3-32 Survey Ready



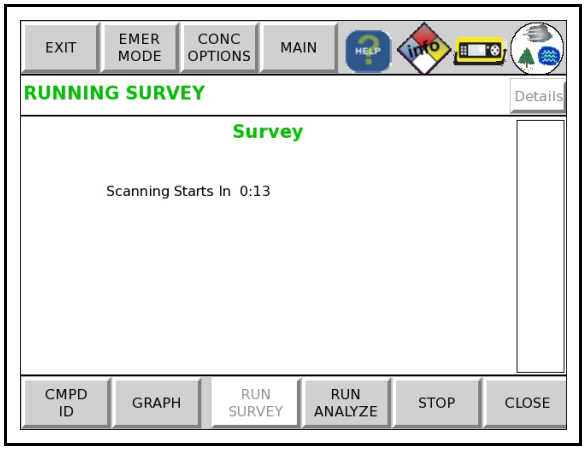
6 Alternately, push **SURVEY RUN** using the push buttons. See Figure 3-33.

Figure 3-33 SURVEY RUN Button



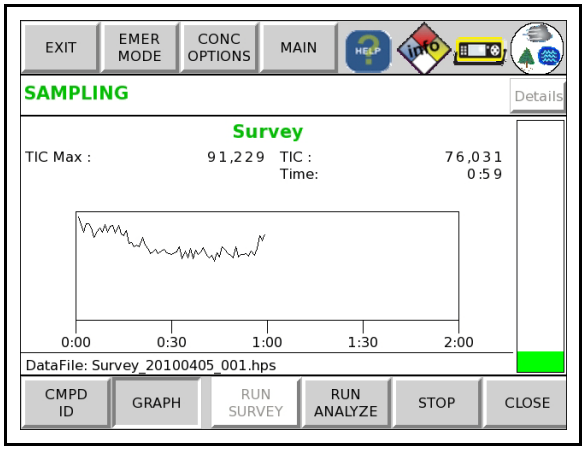
7 The front panel will momentarily display a **Scanning Starts In** message before the Survey run will start.See Figure 3-34.

Figure 3-34 Scanning Starts Screen



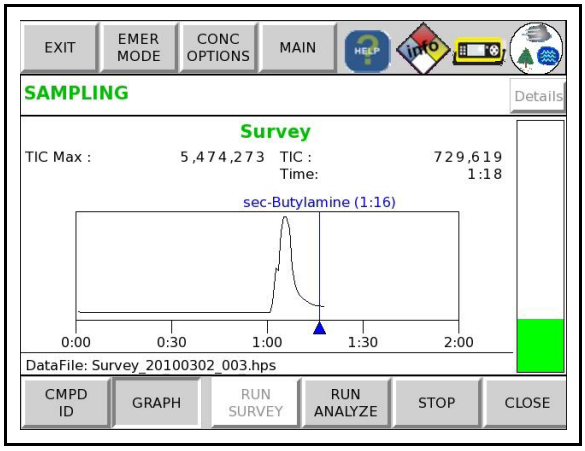
8 Sample air away from the point of concern for one minute. Remember to note the background TIC. See Figure 3-35.

Figure 3-35 Background Sampling



9 Hold the probe over the sample of interest for up to 1 minute. A peak may appear if the compound present is greater than 1 ppm. A compound identification may also be present on the HAPSITE screen. See Figure 3-36.

Figure 3-36 Survey



CAUTION

Do not touch the sample with the probe.
Do not allow liquids to enter the probe.

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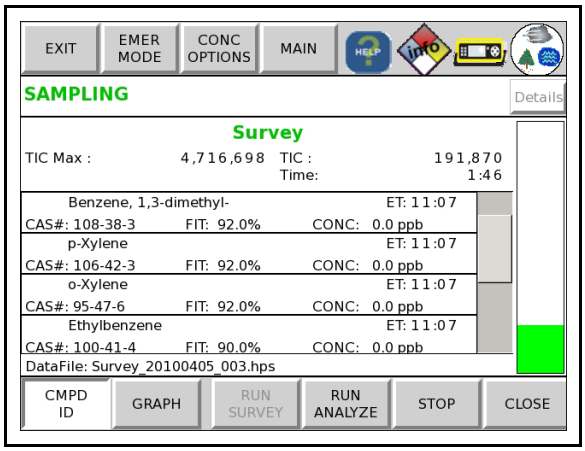
10 By touching **CMPD ID**, a list of identified compounds will appear. See Figure 3-37. The CAS number, the Fit and the elapsed time for each compound will also be displayed. This screen will also display the TIC (Total Ion Count, a measure of response) Max, the current TIC and the time the method has been running.

NOTE: Touching a compound on the list will display its NIOSH database information. See Step 8 on page 3-28.

Figure 3-37 Sample Compound ID List in Survey



11 The **CMPD ID** screen can also be accessed by using the **arrow keys** to highlight **CMPD ID** and pushing **OK SEL**. See Figure 3-38.

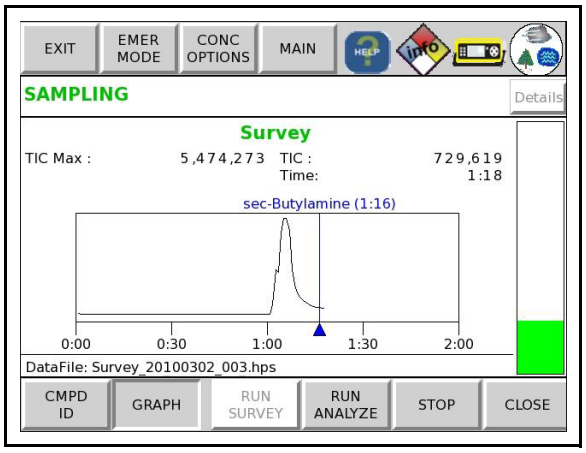
Figure 3-38 Accessing the Compound ID Screen Using the Arrow Keys

12 To view the chromatogram while the method is running, touch **GRAPH**. See Figure 3-39. Alternately, use the **arrow keys** to highlight **GRAPH** and push **OK SEL**.

NOTE: This screen will also display the TIC Max, the current TIC and the time the method has been running.

NOTE: Touching the blue compound identification above the chromatogram will display its NIOSH database information. See Step 8 on page 3-35.

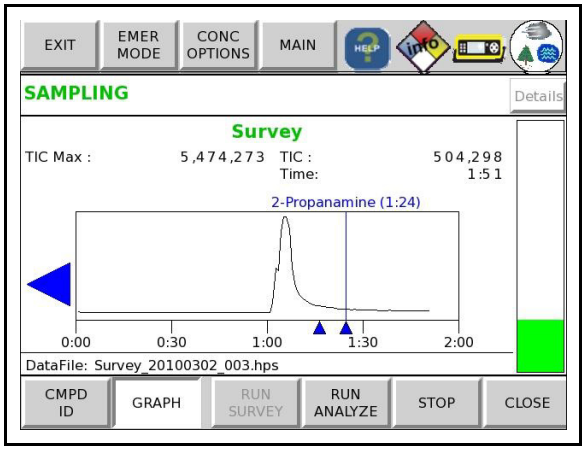
Figure 3-39 Sample GRAPH function



13 When the TIC begins to increase, move the probe away from the sample of interest. Continue the run until the TIC level returns to the initial background level that was noted in Step 8 on page 3-20. See Figure 3-40.

NOTE: Monitor the Probe distance indicator bar on the HAPSITE screen for guidance. The bar rises as the TIC increases and green signifies that the proper sampling distance is being maintained. To avoid saturation, remove the probe from the sample when the bar is high and turns yellow. If saturation occurs, the side bar will turn red and the TIC will be above 60 million. Remove the probe from the sample and continue to run Survey until the saturation is cleared from the sample pathway.

Figure 3-40 Returning to Baseline



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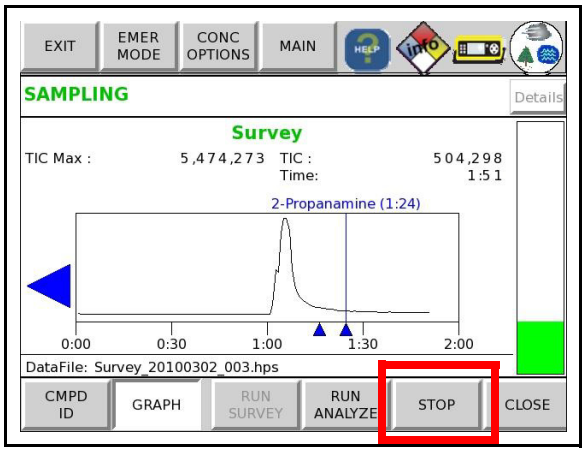
14 To confirm the Survey results with a GC/MS run, **ANALYZE** can be touched or **ANALYZE RUN** can be pushed during the Survey run.

NOTE: It is advised to begin an Analyze run either while a peak is being displayed or Survey has been run for the full two minutes without detecting a compound.

15 If an Analyze method is not going to be run, touch **STOP** to stop the sampling process and automatically save the data. See Figure 3-41.

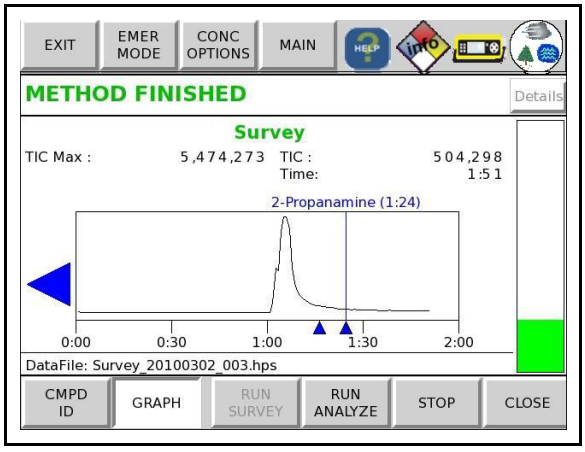
Figure 3-41 ANALYZE and STOP



16 A **METHOD FINISHED** message will appear when the Survey method has ended. See Figure 3-42.

NOTE: The total time required for a Survey analysis is typically less than 3 minutes.

Figure 3-42 Survey Method Finished



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3.3.1 Quick Reference SOP — Survey Method

1 If you are running an Analyze (GC/MS) method after Survey, verify that the appropriate configuration (i.e., concentrator) is installed and the proper Analyze method is displayed on the screen.

2 If powering on HAPSITE or ending Extended Standby, the HAPSITE will automatically begin preparing Survey.

2a If needed, touch **PREPARE** on the touch screen.

2b Alternately, using the **arrow keys**, highlight **PREPARE**. Push **OK SEL**.

3 When prompted by the **SYSTEM READY** message, touch **RUN SURVEY** or push **SURVEY RUN**.

4 Monitor background for one minute.

5 Hold the probe over the sample.

6 Remove the probe from the sample when the TIC begins to increase and a peak begins to form.

6a If the TIC does not increase after a full minute of sampling, remove the probe from the sample.

7 To confirm data with an Analyze (GC/MS) run, touch **RUN ANALYZE** or press **ANALYZE RUN** while sample is being detected.

8 If an Analyze method is not desired, touch **STOP** or push **SURVEY RUN**.

9 A **METHOD FINISHED** message will be displayed when the method has ended.

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3.4 ANALYZE (GC/MS) Mode with the Concentrator

3.4.1 The Tri- Bed Concentrator

The Tri-Bed concentrator is used for analyzing samples with concentration levels in the low part per million to high part per trillion range. Two default qualitative methods are Air_Tri-Bed_PPM_Standard and Air_Tri-Bed_PPB Standard. Use the Air_Tri-Bed_PPM_Standard method when a response is seen in Survey. If a compound is suspected, but Survey does not show an increase in TIC (total ion count, which is a measure of response), use the Air_Tri-Bed_PPB_Standard method.

CAUTION

The concentrator feature has increased sensitivity. Use the appropriate method to avoid saturating the HAPSITE.

3.4.2 The Tenax Concentrator

This method is also used for analyzing samples with concentration levels in the low part per million to high part per trillion range. The Tenax concentrator's use is similar to that of the Tri-Bed concentrator. However, the Tenax concentrator will not effectively concentrate compounds with boiling points below 80 °C.

WARNING

The Tenax concentrator will not effectively concentrate compounds with boiling points below 80°C.

3.4.3 Procedure for Running Concentrator Methods

NOTE: Before an Analyze (GC/MS) can be run in concentrator mode, the concentrator must be installed. Refer to Section 2.3.7, Replacing the Concentrator, on page 2-21 for instructions. Once installed, the concentrator will be automatically cleaned before sampling begins.

1. Verify that the appropriate concentrator is installed.
2. The HAPSITE will automatically start preparing a concentrator method. If HAPSITE does not prepare the desired concentrator method, refer to Section 3.2, Selecting a Different Method Using the SELECT METHOD Icon, on page 3-13.
3. When the HAPSITE has finished preparing and the concentrator cleanout is successful, a **SYSTEM READY** message will appear with a prompt to press Survey or Analyze to begin sampling.

   NOTE: A blank run is recommended before running a sample.

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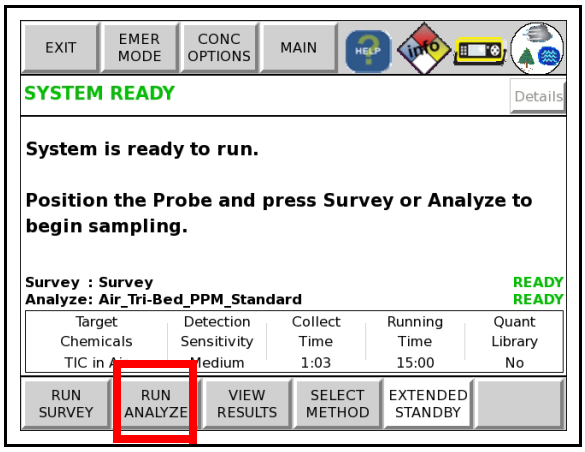
4 Using the touch screen, touch **RUN ANALYZE**. See Figure 3-43.

Figure 3-43 Analyze Button



5 Alternately, if using the push buttons, push **ANALYZE RUN**. See Figure 3-44.

Figure 3-44 Analyze Run

6 When the screen prompts, **Collect Sample Now** hold the probe over the sample. Continue to collect sample during both the Line Purge and ConcFill screens. See Figure 3-45.

NOTE: The Line Purge is based on time while the ConcFill is based on volume. During the Line Purge event, the sample is flowing through the system and out through the exhaust to improve sampling accuracy. During the ConcFill, the sample is being collected by the system for analysis.

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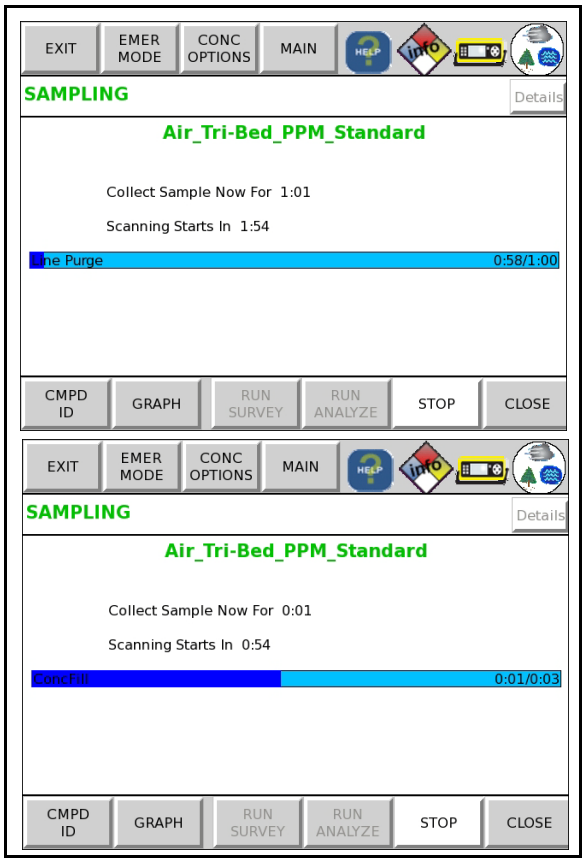
Figure 3-45 Collecting Sample For Concentrator Run

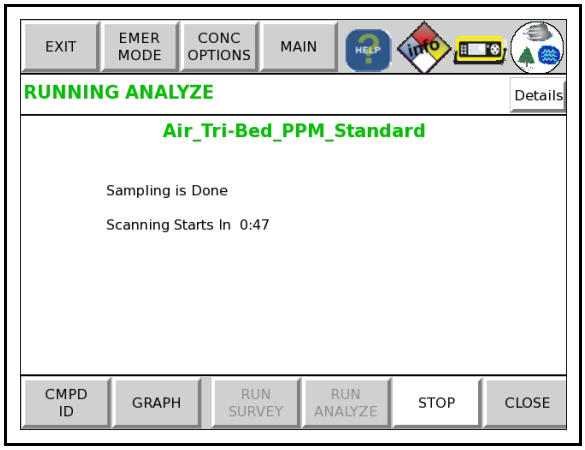


CAUTION

Do not touch the sample with the probe.
Do not allow liquids to enter the probe.

7 Remove probe from the sample when the screen prompts, **Sampling is Done.** See Figure 3-46.

Figure 3-46 Sampling Done on Concentrator Run



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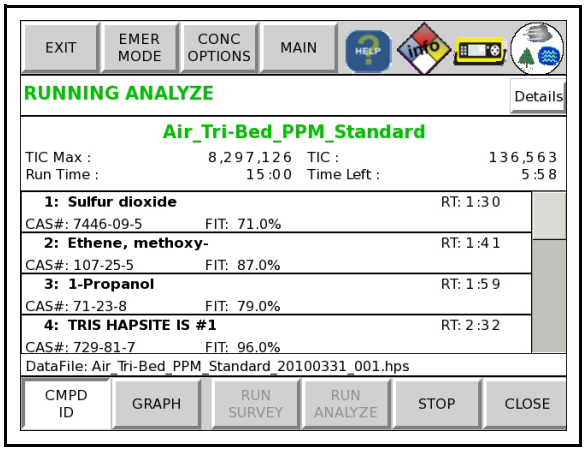
8 By touching **CMPD ID**, a list of found compounds will appear. See Figure 3-47. This page will display for each compound:

- The CAS number
- The Fit
- The retention time
- TIC (Total Ion Count) Max
- The current TIC
- The Run Time
- The Time Left which is the time remaining until the run is finished

NOTE: Touching a compound on the list will display its NIOSH database information. See Step 8 on page 3-35.

8a The **CMPD ID** screen can also be accessed by using the **arrow keys** to highlight **CMPD ID** and pushing **OK SEL**.See Figure 3-47.

Figure 3-47 Sample Compound Identification for Concentrator



9 To view the chromatogram while the method is running, touch **GRAPH**. See Figure 3-48. Alternately, use the **arrow keys** to highlight **GRAPH**. Push **OK SEL**. This screen will display:

- The TIC Max
- The current TIC
- The time remaining until the run is finished
- The Run Time
- The Time Left which is the time remaining until the run is finished

NOTE: Touching the blue compound identification above the chromatogram will display its NIOSH database information. See Step 8 on page 3-28.

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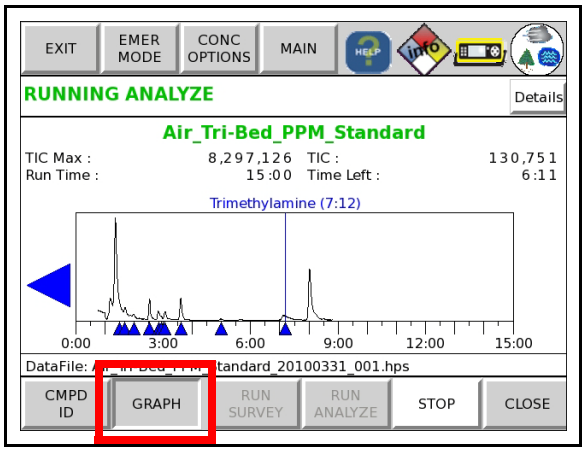
Figure 3-48 Sample Chromatogram View For Concentrator

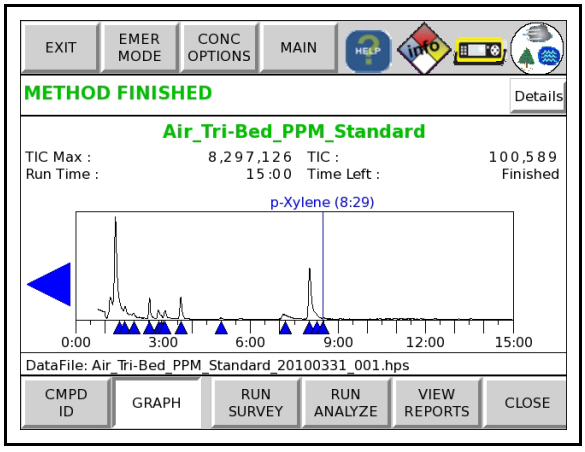


10 A **METHOD FINISHED** message will appear when the Analyze method has ended. See Figure 3-49.

NOTE: Another Analyze (GC/MS) run can be started immediately after one has finished. Depending upon the temperature profile, the column may need to cool before another run may begin.

NOTE: Refer to Section 3.5.1, View Results/View Reports, on page 3-32 for more information on reviewing the data.

Figure 3-49 Sample Concentrator Method Finished



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3.4.4 Quick Reference SOP—Concentrator Methods

1. Verify that the concentrator is installed.
2. Refer to Section 3.1.4, Quick Reference SOP - Heat-up and Tune, on page 3-12 for startup instructions.
3. Verify that the desired method is displayed on the Analyze line.
4. Touch **RUN ANALYZE** or push **ANALYZE RUN** when the **SYSTEM READY** screen is displayed.
5. When the screen prompts, **Collect Sample Now**, hold the probe over the sample until the screen prompts, **Sampling is Done**.
6. When the run is complete, a **Method Finished** message will appear.
7. Refer to Section 3.5.1, View Results/View Reports, on page 3-32 for information on data review.

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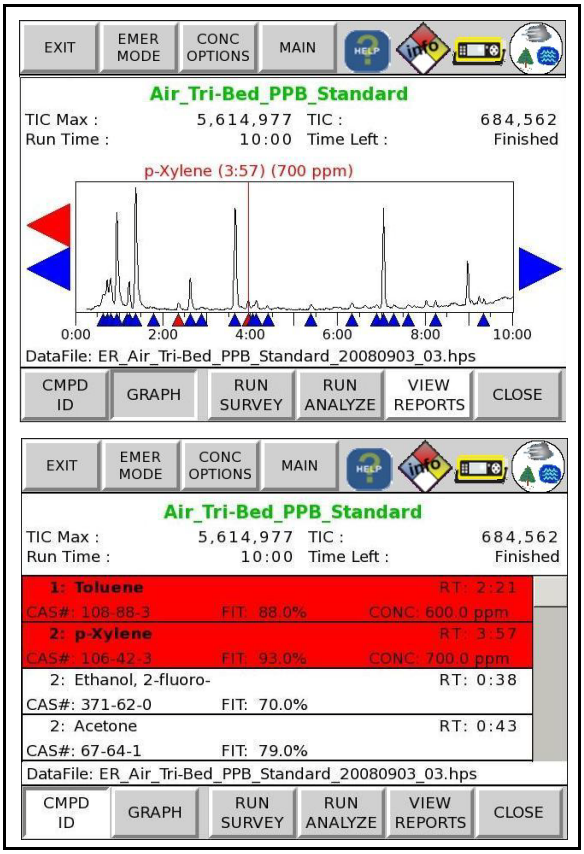
3.5 Detecting Hazardous Chemicals

If the compound identification turns red, a chemical's concentration is either approaching the IDLH limit or the chemical is a Chemical Warfare Agent. In CMPD ID mode, the compound will be highlighted in red and in GRAPH mode, the name of the compound will be written in red. Red arrows will also appear in GRAPH mode if there is more than one red compound. See Figure 3-50.

Figure 3-50 IDLH Warnings

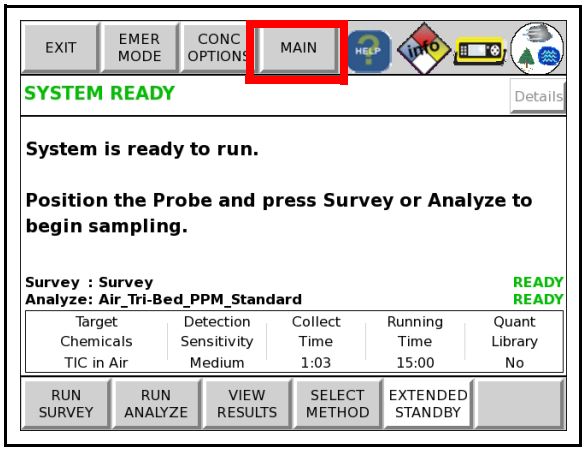


3.5.1 View Results/View Reports

Data files and reports can be viewed from the main front panel screen or from the sample analysis screen. Follow the instructions below to

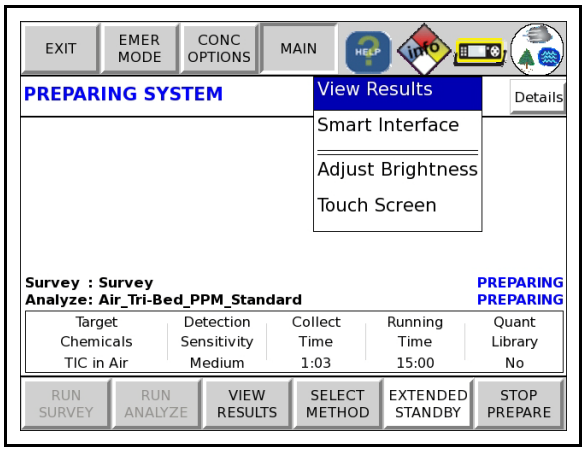
1 To access data files and reports from the main screen, touch **MAIN**. See Figure 3-51.

Figure 3-51 MAIN



2 Touch **View Results**. See Figure 3-52.

Figure 3-52 View Results



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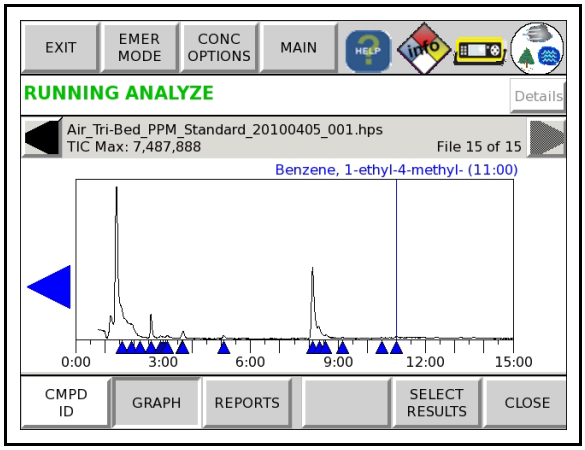
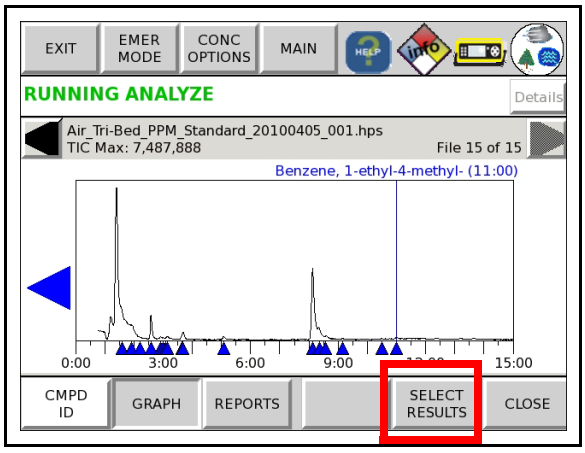
3 The most recent file for the selected method will appear on the screen. Use the black, touch screen **arrow keys** to access other data files from the same method. See Figure 3-55. If using the push buttons, use the front panel **arrow keys**. The left **arrow key** will access earlier files. The right **arrow** will access later ones. See Figure 3-53.

Figure 3-53 Arrow Keys



4 To view files from another method, use the **SELECT RESULTS** button. See Figure 3-54.

Figure 3-54 Select Results



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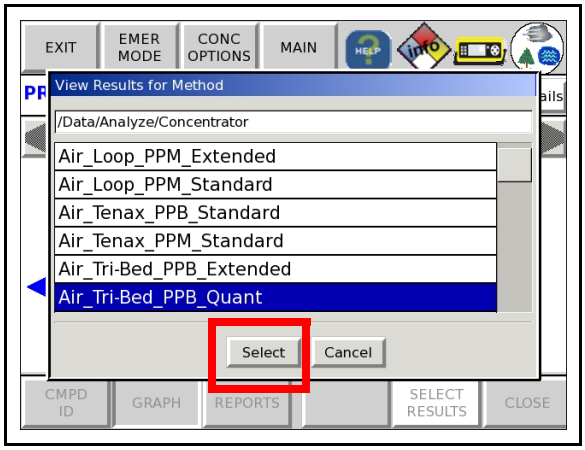
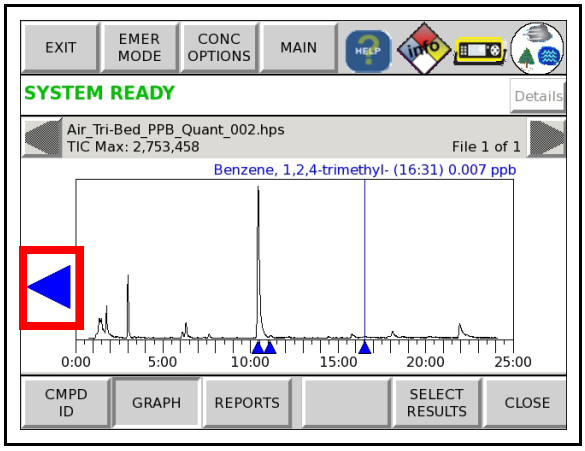
5 Scroll through the method files and highlight the desired method. Either touch **Select** or push **OK SEL**. See Figure 3-55.

Figure 3-55 Selecting Results



6 The big blue arrows are used to scroll through the peaks in the chromatogram. The identified compound and its retention time will appear in the area below the file name. See Figure 3-56.

Figure 3-56 Blue Arrows



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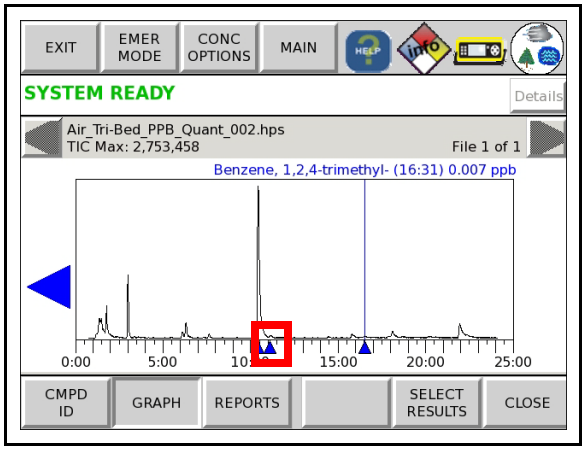
7 Touch the small blue triangles to display the compound identification and retention time for the compound directly above it. See Figure 3-57.

Figure 3-57 Small Blue Triangles



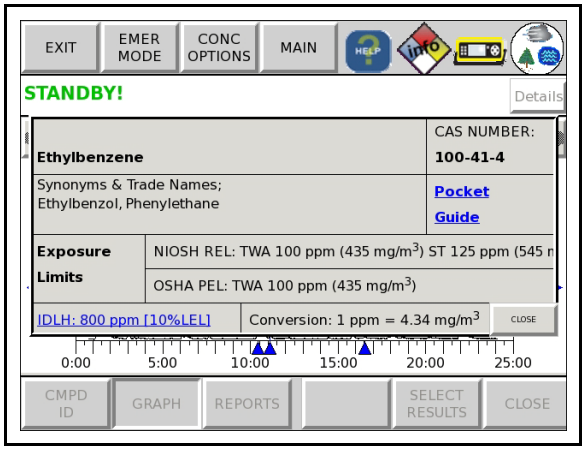
NOTE: Most functions can be accessed using the push buttons. However, accessing the blue triangles and blue arrows are only available on the touch screen.

DANGER

If a RED TRIANGLE is displayed, the HAPSITE has detected a compound with a concentration that is approaching or above the IDLH level or it has detected a Chemical Warfare Agent. Refer to Section 3.5, Detecting Hazardous Chemicals, on page 3-31.

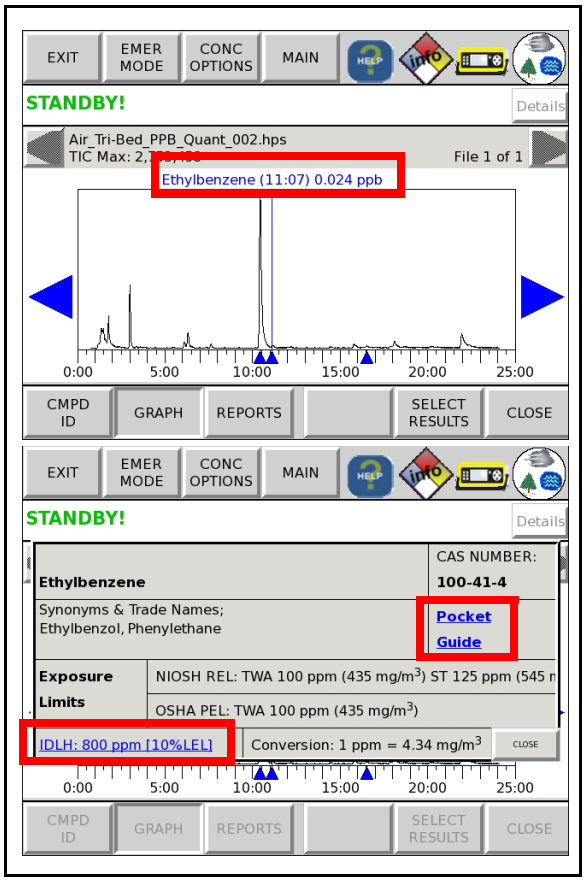
8 Touching a specific compound on the screen will display the NIOSH database information for the identified.

Figure 3-58 Touching the Identification to Access Exposure Limits



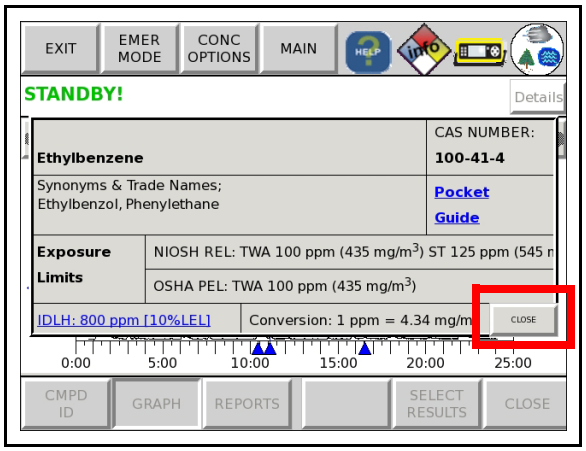
9 A link to the *NIOSH Pocket Guide to Chemical Hazards (NPG)* will also be displayed in blue. The link is entitled Pocket Guide. In the bottom left hand corner, there is a link to the *Immediately Dangerous to Life or Health Concentrations (IDLH).* The link is blue and entitled IDLH. See Figure 3-63. For further instructions on using NIOSH and other info databases, see Section 3.7, The Info Icon, on page 3-43.

Figure 3-59 Links to NPG and IDLH



10 Touch **CLOSE** to return to the data screen.

Figure 3-60 CLOSE



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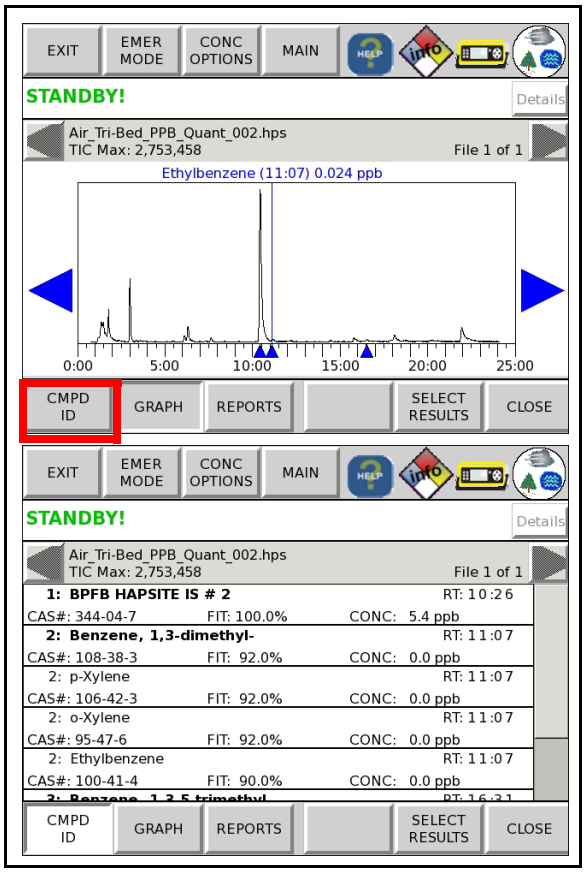
11 Touching the **CMPD ID** (Compound Identification) button while in **Review Results**, will show a list of the compounds found on the selected run. The CAS number, the Net Fit and the retention time for each compound will also be shown. See Figure 3-61.

Figure 3-61 CMPD ID

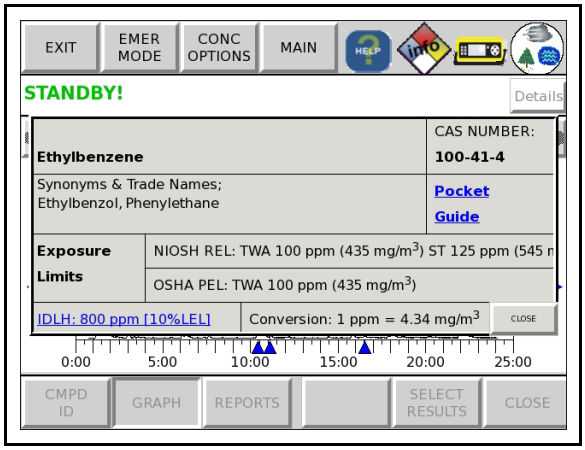


DANGER

If a RED TRIANGLE is displayed, the HAPSITE has detected a compound with a concentration that is approaching or above the IDLH or it has detected a Chemical Warfare Agent. See Section 3.5, Detecting Hazardous Chemicals, on page 3-31.

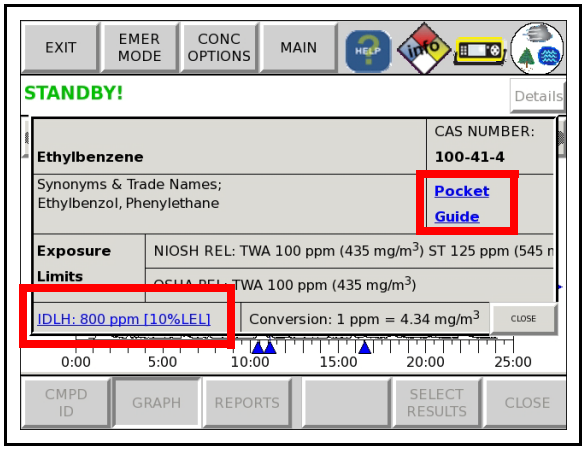
12 Touching a specific compound in the list will display that compound's NIOSH database information. See Figure 3-62.

Figure 3-62 Synonym and Exposure Limits



13 A link to the *NIOSH Pocket Guide to Chemical Hazards (NPG)* will also be displayed in blue. The link is entitled *Pocket Guide*. In the bottom left hand corner, there is a link to the *Immediately Dangerous to Life or Health Concentrations (IDLH).* The link is blue and entitled IDLH. See Figure 3-63. For further instructions on using NIOSH and other *info* databases, see Section 3.7, The Info Icon, on page 3-43.

Figure 3-63 NIOSH Link



NOTE: The HAPSITE can detect more compounds than those contained in the NIOSH databases. Therefore, if the screen displays N/A and does not have links available, the compound is not included in these databases.

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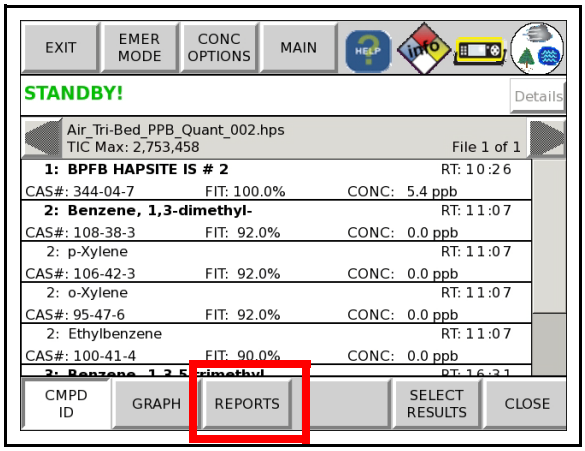
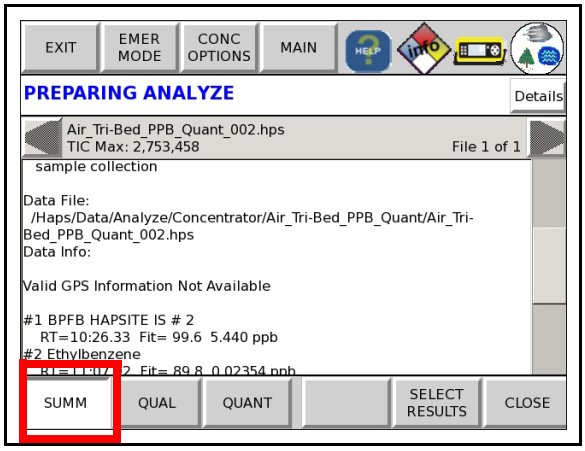
14 To view the **Summary**, **Qualitative** and **Quantitative Reports**, touch the **REPORTS** button. Alternately, use the **arrow keys** to highlight the **REPORTS** button and pushing **OK SEL**. See Figure 3-64. **REPORTS** can be accessed from the **GRAPH** page or the **CMPD ID** from **View Results**.

Figure 3-64 Viewing REPORTS



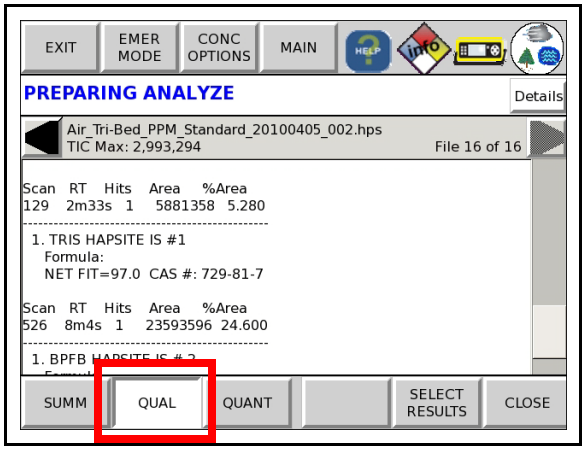
15 The Summary Report can be found by touching the **SUMM** button. See Figure 3-65. Alternately, using the **arrow keys** highlight the **SUMM** button and push **OK SEL**. For each compound found, information regarding the Net Fit and the retention time will be displayed.

Figure 3-65 Summary Report



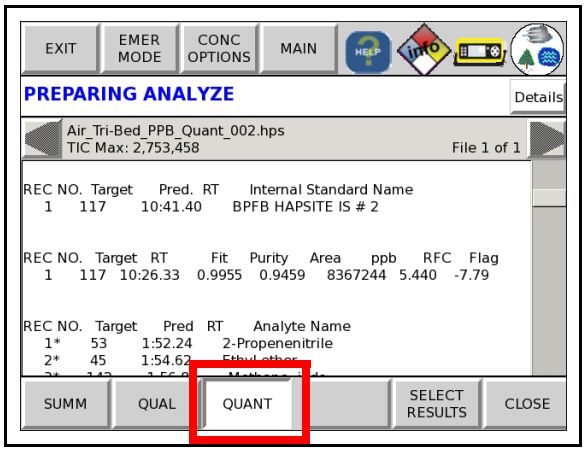
16 The Qualitative Report can be found be touching the **QUAL** button. See Figure 3-66. Alternately, use the **arrow keys** to highlight the **QUAL** button and push **OK SEL**. For each compound found, information regarding the Net Fit, the retention time, the CAS number, the area and the number of hits will be displayed.

Figure 3-66 Qualitative Report



17 The Quantitative Report can be found be touching the **QUANT** button. See Figure 3-67. Alternately, **arrow keys** highlight the **QUANT** button and push **OK SEL**. For each compound found, information regarding the target ion, the retention time, the Net Fit, the purity, the area and the concentration will be displayed.

Figure 3-67 Quantitative Reports



NOTE: If the method is not quantitative, the message "**No Quant Reports Found"** will be displayed on the **QUANT** report screen. To determine if the method is quantitative, see the box in the bottom right hand corner of the main screen. See Figure 3-68.

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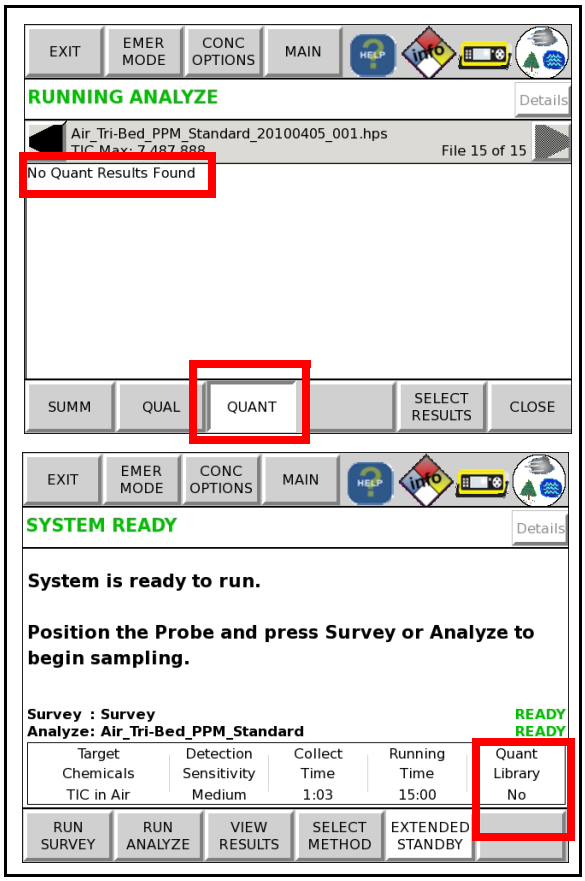
Figure 3-68 Type of Method



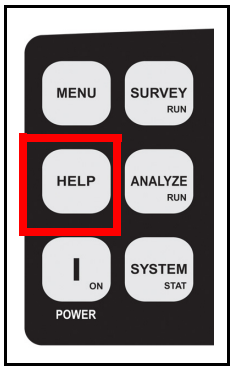
3.6 The Help Icon

The **Help** icon is located on the upper right of the front panel. See Figure 3-69.

Figure 3-69 Help Icon

Help can be accessed by touching this button or pushing the **HELP** button that is located on the front panel. See Figure 3-70.

Figure 3-70 Help Push Button



The Help screen displayed will have a **Survey** link, an **Analyze** link, a **View Results** link, a **Select Method** link and a **Go To Standby** link. Touching a link will give an overview of how to perform that specific function. Touching **Simple Steps** at the bottom of the page will give a step-by-step outline of how to perform the desired function. The **Book** icon will give a more detailed summary of the function.

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3.7 The Info Icon

The **Info** icon is located on the upper right of the front panel. See Figure 3-71. **Info** can be accessed by touching this button or pushing the **STAT** key until the NIOSH database is displayed. When the **Info** page is displayed, the **Info** icon will be highlighted in blue.

Figure 3-71 Info Icon

The NIOSH Database screen will be displayed. See Figure 3-72. This screen provides links to *Immediately Dangerous to Life or Health Concentrations* (*IDLHs), International Chemical Safety Cards, NMAM, The NIOSH Pocket Guide to Chemical Hazards (NPG), OSHA Sampling and Analytical Methods, Recommendations for Chemical Protective Clothing, Specific Medical Tests Published for OSHA Regulated Substances,* and *Toxicologic Review of Selected Chemicals.* These publications provide information on Exposure Limits, Synonyms and Detection Limitations.

Scrolling to the bottom of the page will access additional links.

- The **Conversion Calculator** provides help for determining the proper units in an equation.
- **Hazard ID's** accesses specific NIOSH studies about hazardous conditions.
- **PPE** outlines the proper equipment needed for someone that is going to be exposed to hazardous conditions.
- **Respiratory Protection** connects to OSHA's website so that the user can look up the proper protection needed for a specific environment.
- **Hazard Controls** provides access to specific studies that have identified ways to reduce hazardous exposures.
- **Indoor Air Quality** includes selected publications from the EPA about improving air quality.
- The **Periodic Table** can be accessed for determining the AMUs of a compound to see if it can be detected by the HAPSITE.
- **RTECS User Guide** was designed by NIOSH to give synonyms, skin and eye irritation data, mutation data, and respiratory effects data for certain compounds. It stands for *The Registry of Toxic Effects of Chemical Substances.*

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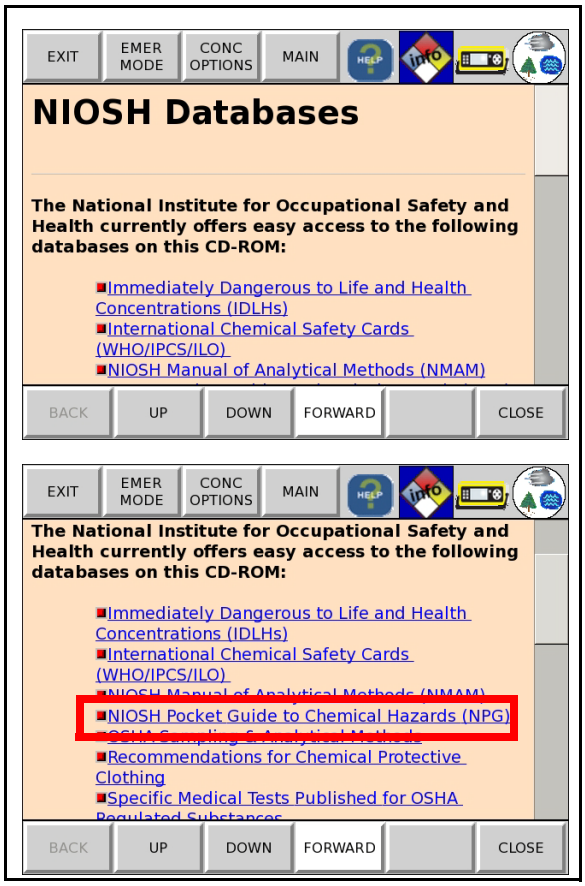
1 An important resource on this database is *The NIOSH Pocket Guide to Chemical Hazards (NPG).* See Figure 3-72. To access, scroll to the fourth option on the list and touch the *The NIOSH Pocket Guide to Chemical Hazards (NPG)* link.

Figure 3-72 NIOSH Pocket Guide to Chemical Hazards



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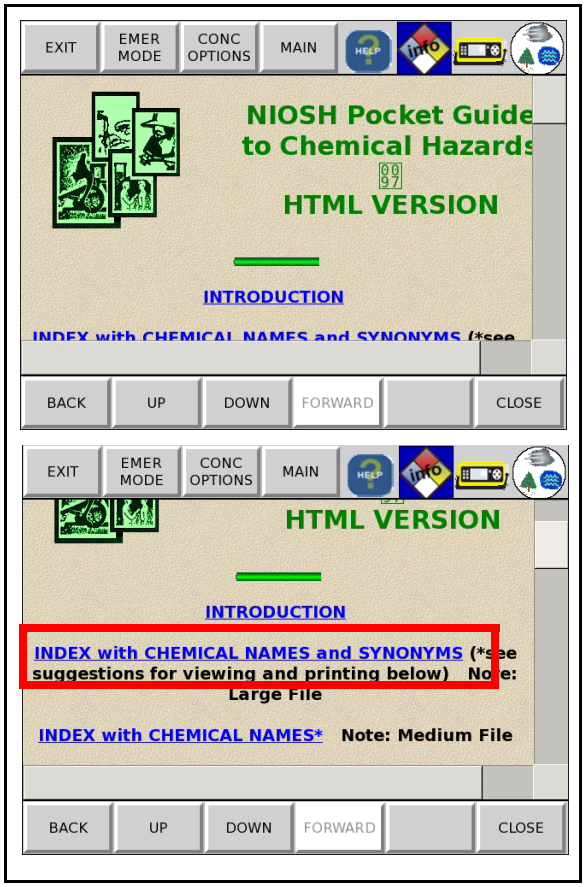
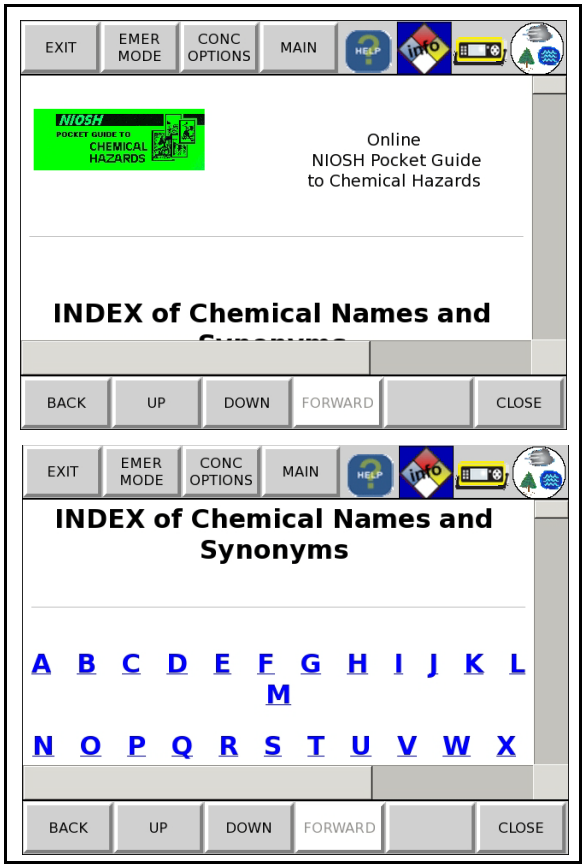
2 When the publication appears, touch **INDEX with CHEMICAL NAMES and SYNONYMS**. See Figure 3-73.

Figure 3-73 NIOSH Pocket Guide



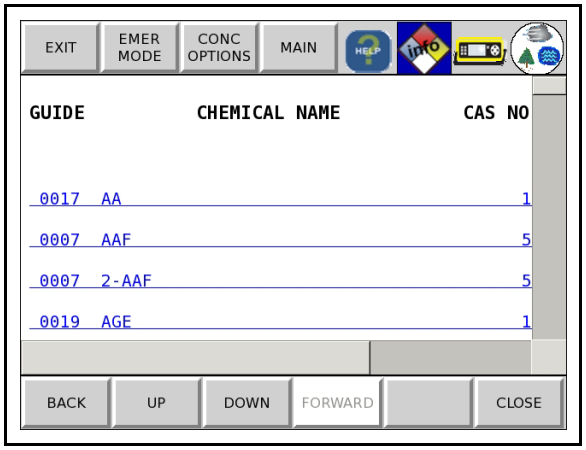
3 Scroll down to display an alphabet. Touch the first letter of the desired compound. See Figure 3-74.

Figure 3-74 Pocket Guide Index



4 A list of the chemicals that start with the selected letter will be displayed. See Figure 3-75.

Figure 3-75 Index of Chemicals By Name



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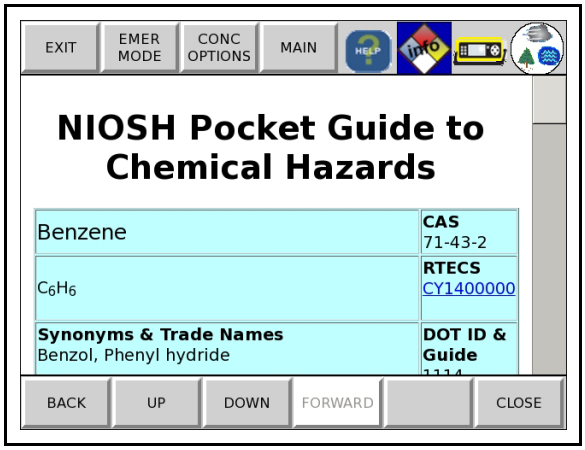
5 Touch the desired chemical. The Pocket Guide for that specific chemical will be displayed. See Figure 3-76.

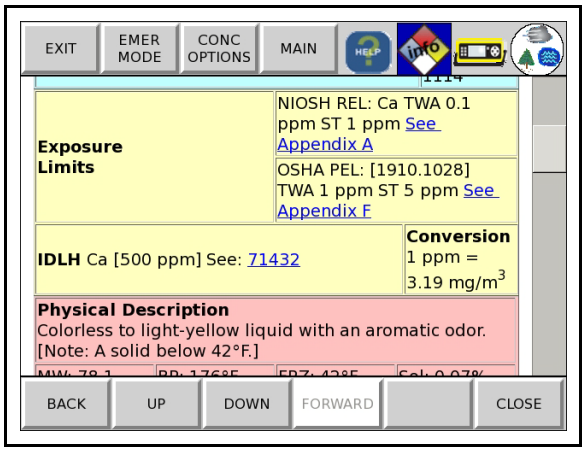
NOTE: Not all compounds that can be detected by the HAPSITE are contained in the NIOSH library.

Figure 3-76 NIOSH Pocket Guide for a Specific Chemical



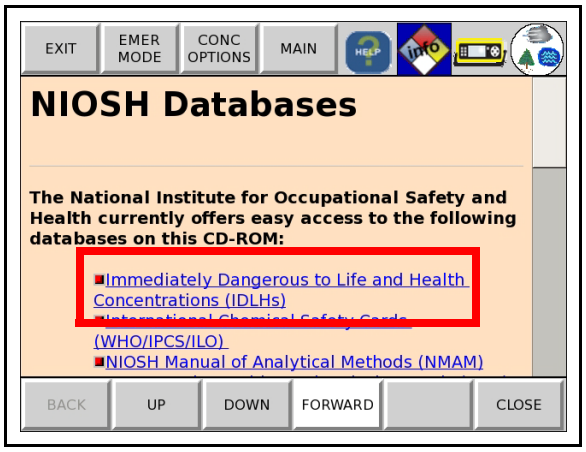
6 Scroll down to display information about the exposure limit and the boiling point of the chemical. The boiling point is important in determining if the chemical can be detected by the HAPSITE. See Figure 3-77.

Figure 3-77 NIOSH Pocket Guide Exposure Limit and IDLH Information



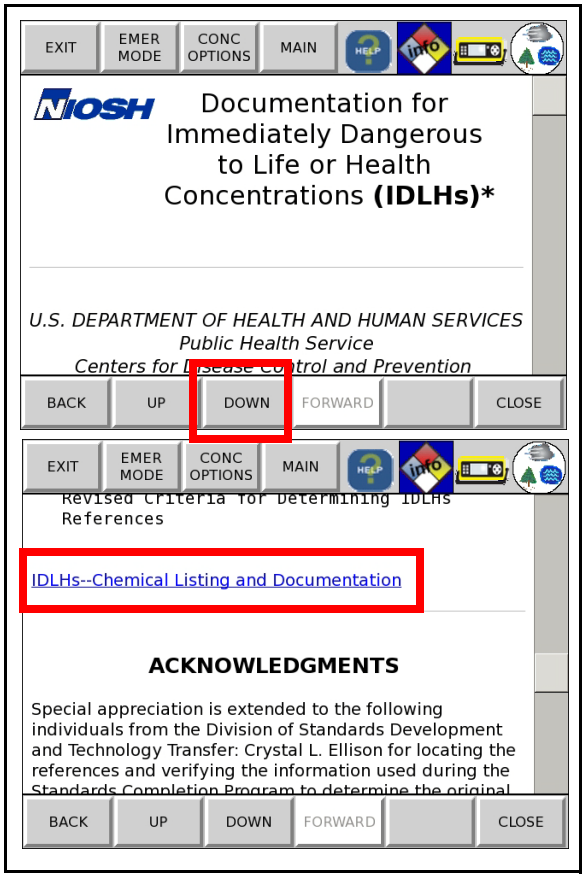
7 To access information regarding *Immediately Dangerous to Life or Health Concentrations* (IDLHs), touch the first hyperlink on the info screen. See Figure 3-78.

Figure 3-78 IDLHs



8 Scroll down or touch **DOWN** until the **IDLHs-Chemical Listing and Documentation** link is showing. Touch this link. See Figure 3-79.

Figure 3-79 Chemical Listing and Documentation Link



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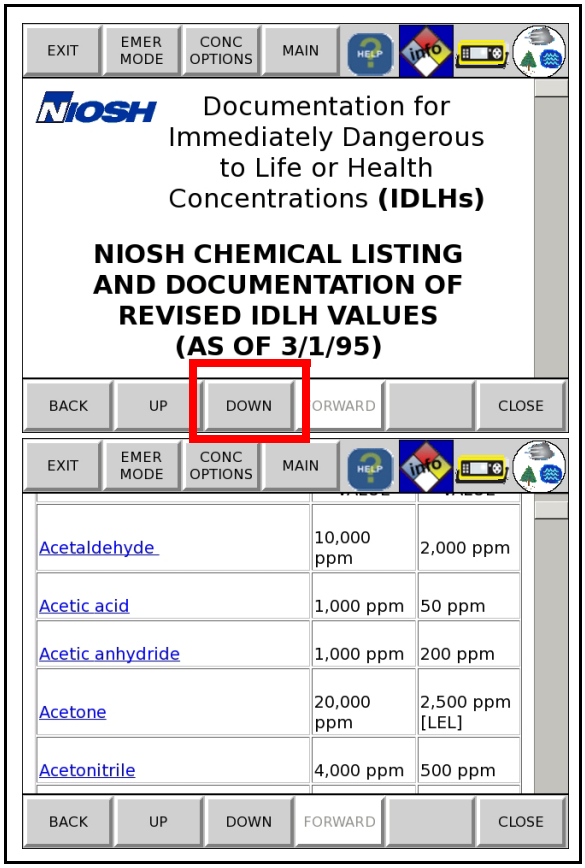
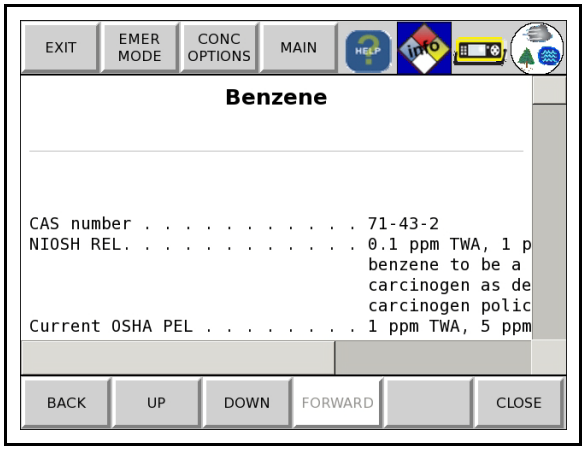
9 Scroll down, press **DOWN** or use the down arrow to find the desired compound. Touch the link to view the compound's information. See Figure 3-80.

Figure 3-80 Selecting IDLH of Compound



10 Information regarding the compound's NIOSH REL, OSHA PEL and toxicity data will be displayed. See Figure 3-81.

Figure 3-81 IDLH Screen

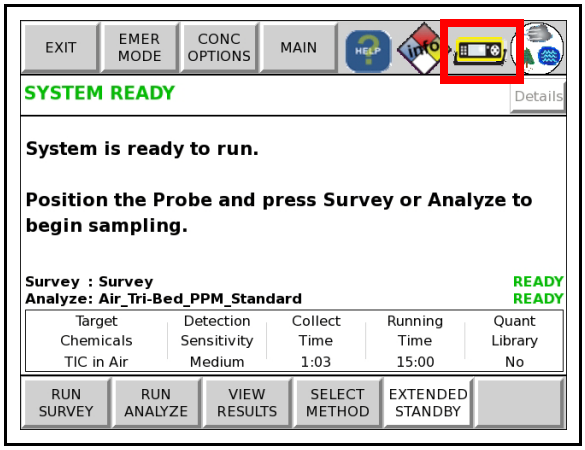


3.7.1 System Parameters

System Parameters provides information about the operation of the HAPSITE and its consumables. Information regarding battery power, gas consumption, heaters, tune status, and GPS can be accessed through this screen.

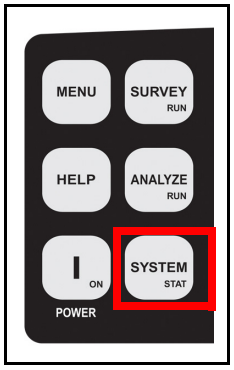
1 The **System Parameters** screen can be displayed by touching the **HAPSITE Smart Plus** icon. See Figure 3-82.

Figure 3-82 HAPSITE Icon



2 Alternately, push the **SYSTEM STAT** button until the **HAPSITE** icon is highlighted.

Figure 3-83 SYSTEM STAT Push Button



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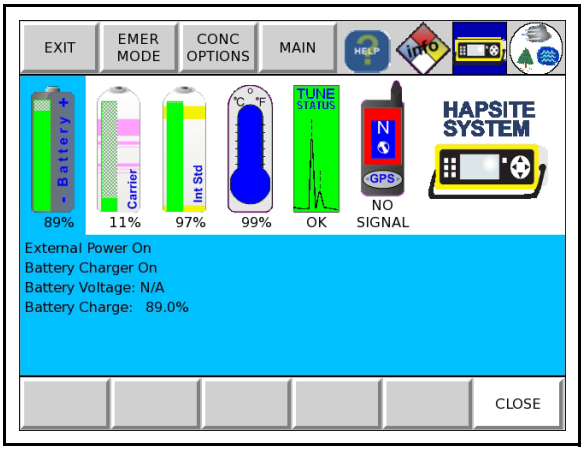
3.7.1.1 Battery Icon

If a battery is installed, the **Battery** icon will display information about the battery's charge level. The charge level is found as a vertical bar graph inside the battery icon. See Figure 3-84. If a battery is not installed, **EXTPWR** will be displayed under the icon and the icon's charge level bar graph will turn red.

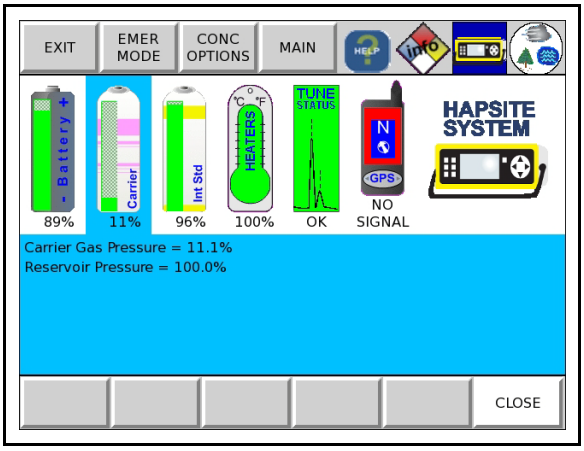
Figure 3-84 Battery Icon



3.7.1.2 Carrier Gas Icon

The HAPSITE uses nitrogen as the carrier gas. Touching the **Carrier Gas** icon, will provide information about the pressure of the carrier gas in the can. A vertical bar graph in the icon will correlate the approximate percentage to the remaining amount of gas in the can. See Figure 3-85.

Figure 3-85 Carrier Gas Icon



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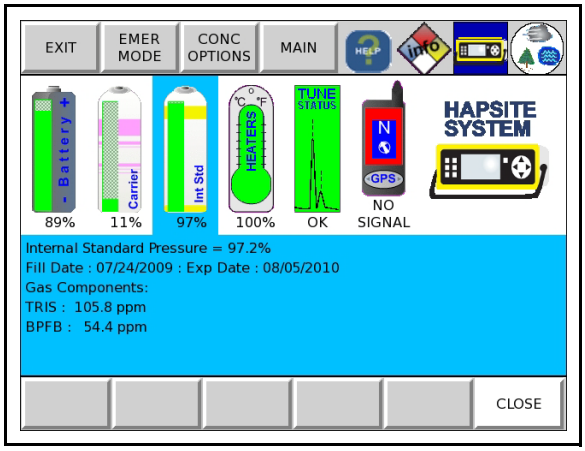
3.7.1.3 Internal Standard Icon

The **Internal Standard** icon uses a vertical bar graph to correlate the approximate percentage to the remaining amount of gas in the canister. Touching the icon will display the canister's fill date, the canister's expiration date, and the actual PPM of TRIS and BPFB concentrations in the canister. See Figure 3-86.

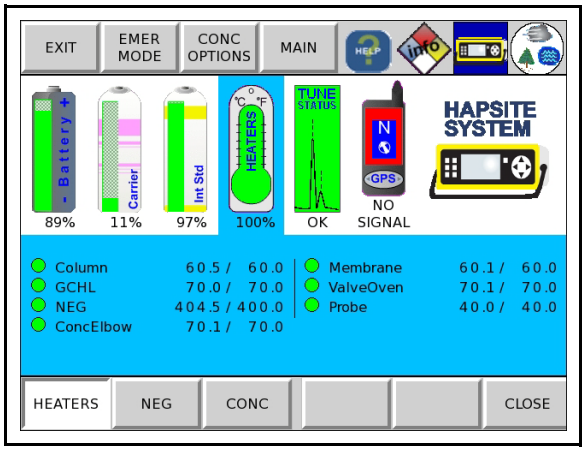
Figure 3-86 Internal Standard Icon



3.7.1.4 HEATERS Icon

The **HEATERS** Icon also has the following options at the bottom of the touch screen: **HEATERS**, **NEG** and **CONC**. The bar graph located on the **HEATERS** icon represents the progress of all of the Heaters. See Figure 3-87.

Figure 3-87 Heaters Icon



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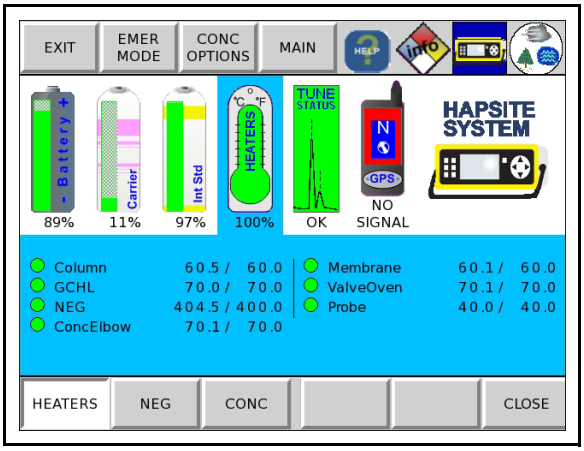
3.7.1.4.1 HEATERS Button

Touching the **HEATERS** icon provides the current temperatures of the column, the membrane, the GCHL, the valve oven, the NEG, the probe, and the Concentrator Elbow as the HAPSITE is heating. The number after the actual temperature is the setpoint temperature. A green circle signifies that the temperature is in range, blue signifies that the heater is reaching its setpoint, and black signifies that the heater is off. See Figure 3-88.

Figure 3-88 Temperatures of Heaters

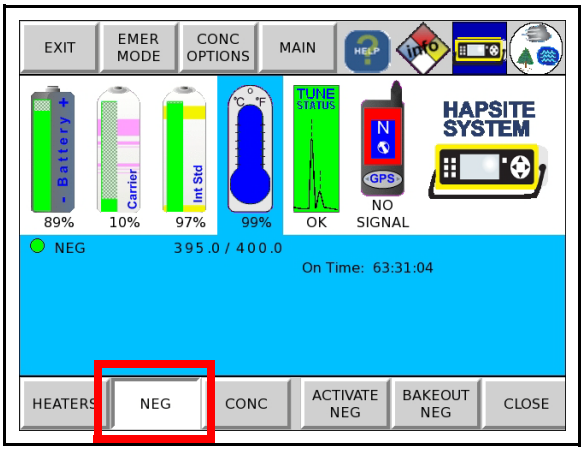


3.7.1.4.2 NEG Button

The **NEG** button provides information about the NEG. This includes the NEG's current and setpoint temperatures, the *On Time* which is the number of hours that the NEG has been used, and the date the NEG was activated. There is also information about the number of times the NEG has been activated and the date(s) of reactivation.

From this screen, there is a button to activate the NEG and also a button for NEG bakeout. See Figure 3-89.

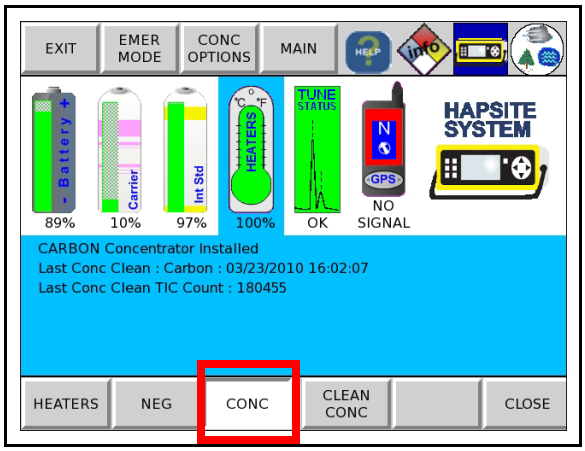
Figure 3-89 NEG Button



3.7.1.4.3 CONC Button

Information about the concentrator can be found through this button. After touching the **CONC** button, another button, **CONC CLEAN**, will be displayed. If this button is active (black lettering), a concentrator cleanout can be run. Touch the **CONC CLEAN** button if a concentrator cleanout is desired. If the **CONC CLEAN** button is grayed out, a concentrator cleanout is in the process of running and a blue bar graph, showing the progress of the cleanout, will be displayed. The **CONC CLEAN** button will also be grayed out when a method is running or a sample loop is installed. See Figure 3-90.

Figure 3-90 CONC Button



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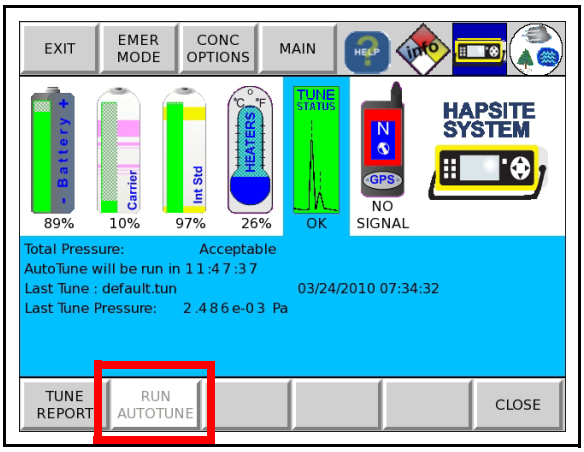
3.7.1.5 TUNE STATUS Icon

This icon provides information about the state of the HAPSITE's tune. If the **TUNE** icon is green, the tune status is good. The **TUNE** icon will turn yellow when a tune check will be run in the near future. The icon will turn blue when the HAPSITE is in the process of tuning. If the **TUNE** icon is red, the AutoTune has failed. When AutoTune fails, an AutoTune will need to be run again or the HAPSITE Smart PLUS should be manually tuned. See Section Chapter 7, Tune, on page 7-1.

To run a tune check, press the **RUN AUTOTUNE** button, which is shown at the bottom of the screen. This button allows for an AutoTune to be run from the front panel. The button will be grayed out when a tune is in progress. See Figure 3-91.

Figure 3-91 Run AutoTune



Touching the **TUNE STATUS** icon will also display the file name of the last tune report, the time the instrument tuned, and the date the instrument tuned. It will also show a countdown of the time to the next tune check.

The pressure of the MS at the last tune check will be displayed. If a method is not running and the last tune pressure was within range, an Acceptable message will be displayed. If a method is being run or manual tune is open, the current MS pressure will also appear.

3.7.1.5.1 TUNE REPORTS

When the **TUNE STATUS** icon has been touched, see Figure 3-92, a button, **TUNE REPORT**, will be shown at the bottom of the screen. This button accesses data from the last Tune Report. See Figure 3-93. For more information on Tune Reports, see Chapter 6, Tune.

Figure 3-92 Tune Status Icon

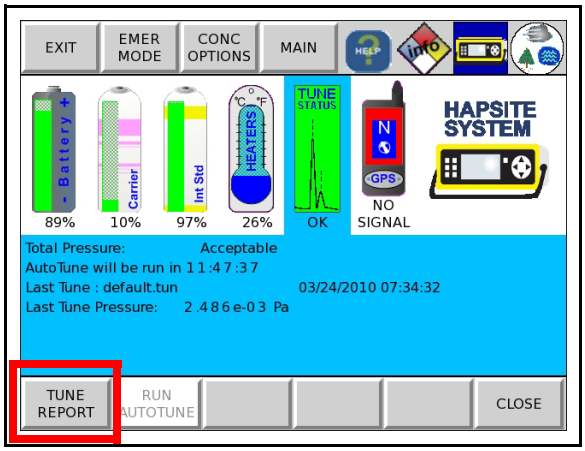
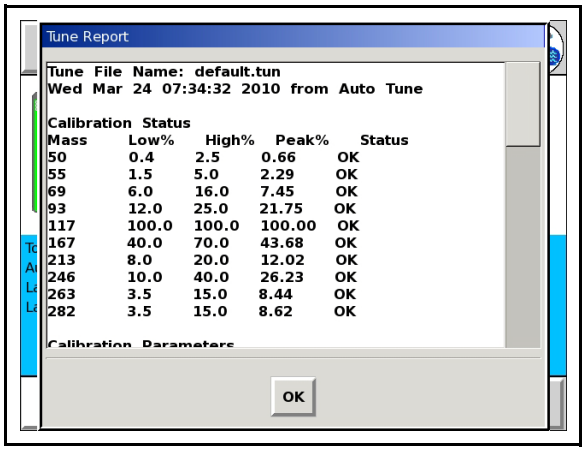


Figure 3-93 Tune Report



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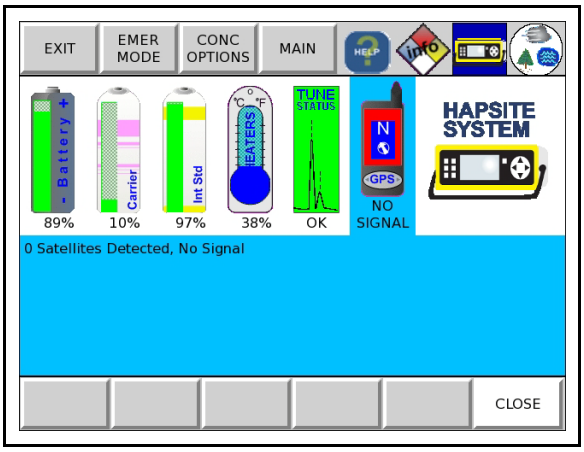
3.7.1.6 GPS Icon

The **GPS** icon will displays the latitude and longitude coordinates of the HAPSITE's position. It will also displays the number of satellites found on the GPS System. **No Signal** will be displayed when a satellites are not detected. See Figure 3-94.

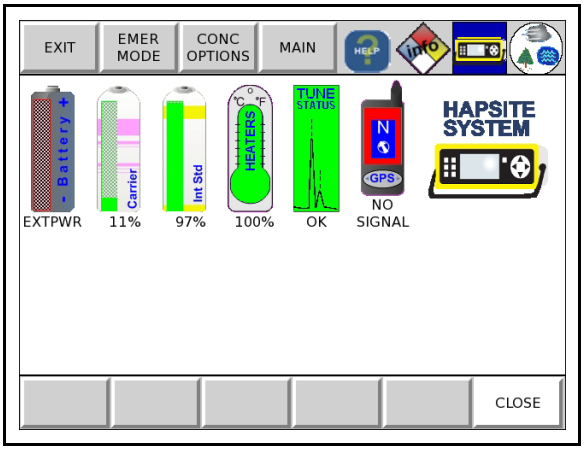
Figure 3-94 GPS Icon



3.7.1.7 HAPSITE SYSTEM Icon

This icon provides additional system information. This information includes the version number of the software and firmware, the date and time, and the IP address. It also provides the HAPSITE's serial number. See Figure 3-95.

Figure 3-95 HAPSITE SYSTEM Icon



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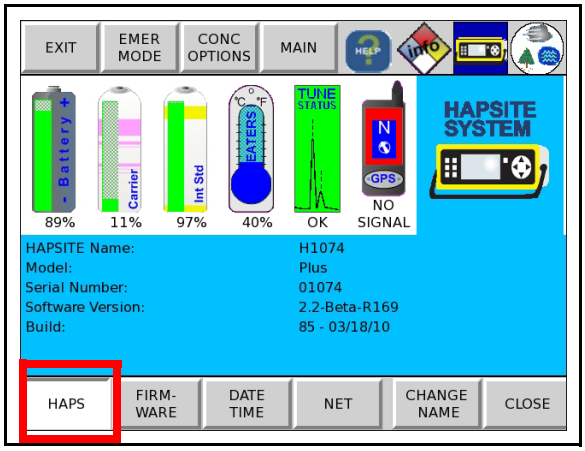
3.7.1.7.1 HAPS Button

The **HAPS** button will provide the HAPSITE name, the HAPSITE's Serial Number, and the current version number of the software. It also provides the date of the software build. See Figure 3-96.

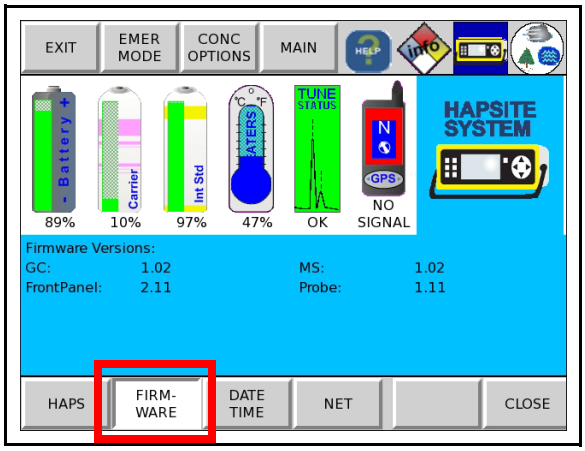
Figure 3-96 HAPS Button



3.7.1.7.2 FIRMWARE Button

The **FIRMWARE** button gives the version number of the GC board, the front panel, the mass spectrometer and the probe. See Figure 3-97.

Figure 3-97 FIRMWARE Button



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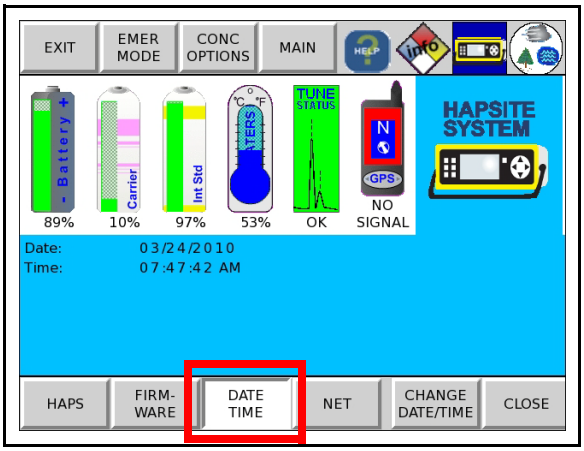
3.7.1.7.3 DATE TIME Button

This button displays the present date and time. See Figure 3-98.

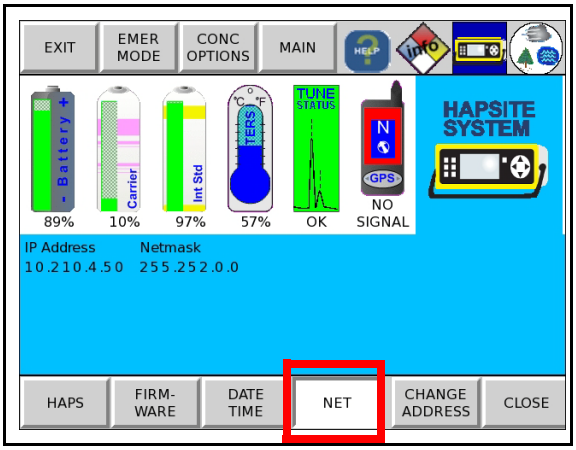
Figure 3-98 DATE TIME



3.7.1.7.4 NET Button

The **NET** button, see Figure 3-99, displays the IP address for the HAPSITE and the Subnet mask. This will be used when using the wireless connection on the Laptop. See Chapter 4, Communications and Touch Screen Options.

Figure 3-99 NET Button



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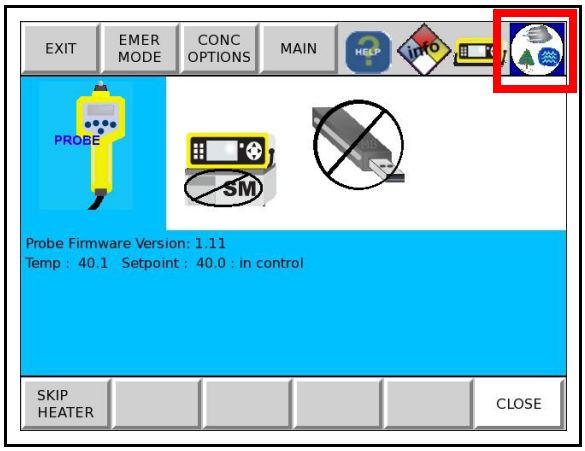
3.7.2 Accessories

The **Accessories** icon will display information regarding the current configuration of the HAPSITE. If the Air Probe is installed, an icon of the probe will be displayed. Touching the **PROBE** icon will display the installed version of the probe's firmware. The **SKIP HEATER** option allows for the HAPSITE to run when the probe is not at temperature. This is useful in cold climates, when it may be difficult for the probe to heat to the set point temperature. See Figure 3-100.

Figure 3-100 Probe Icon



If the Service Module is attached, the Service Module icon will be shown. Touching the **Service Module** icon will display the installed version of the service module's firmware and the turbo speed of the service module's pump. Options for attaching and detaching the service module can be found through this screen. For more information on the service module, see the Service Module Operating Manual.

The Headspace Sampling System (HSS) icon will appear when it is attached to the HAPSITE. Touching the HSS or SituProbe icon will display the information regarding the firmware version and accessory's heaters. See the Headspace Sampling System and SituProbe Purge and Trap Sampling Systems' manuals for further information.

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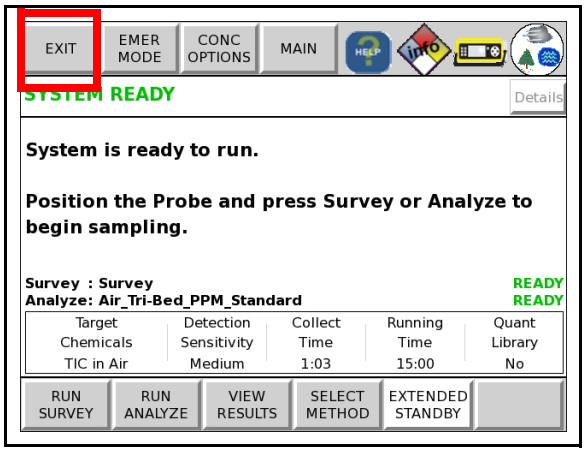
3.8 EXIT Menu

The **EXIT** menu is located on the top row of the front panel. See Figure 3-101. This option will access **Turn Off**, **Reboot** or **Standby**. **Turn Off** will shut down the HAPSITE's power. **Reboot** will reset the microprocessor in the HAPSITE and reload the drivers. It will also restart the operating system, the HAPSITE program and the front panel program. The **Standby** option will put the system into Extended Standby. Refer to section 3.8.1 on page 3-63 for Extended Standby instructions.

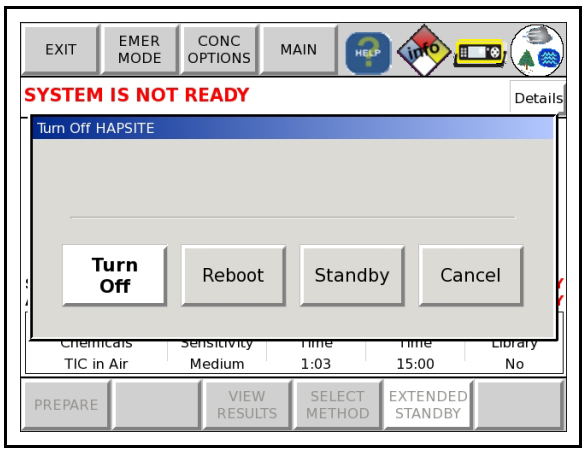
1 Touch **EXIT**. Alternately, use the arrow keys to highlight **EXIT** and push **OK SEL**. See Figure 3-101.

Figure 3-101 Exit Menu



2 The three exit options will be displayed on the screen. There will also be a **Cancel** button. Either touch or use the **arrow keys** to highlight the desired choice on the screen. If using the push buttons, push **OK SEL**. See Figure 3-102.

Figure 3-102 EXIT Selections



3 A prompt will appear to confirm the selection. For example, if **Turn Off** is selected, a prompt **Do you want to shutdown the HAPSITE?** will appear on the screen. Touch **Yes** or select **Yes** and push **OK SEL** to continue.

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4 For **Turn Off**, the screen will become dark and the HAPSITE will turn off the power.

4a For **Reboot**, the screen will become dark. In approximately one minute, the screen will become active again and restart the preparation sequence.

4b For **Standby**, the Extended Standby screen will be displayed. See Section 3.8.1, Extended Standby, on page 3-63.

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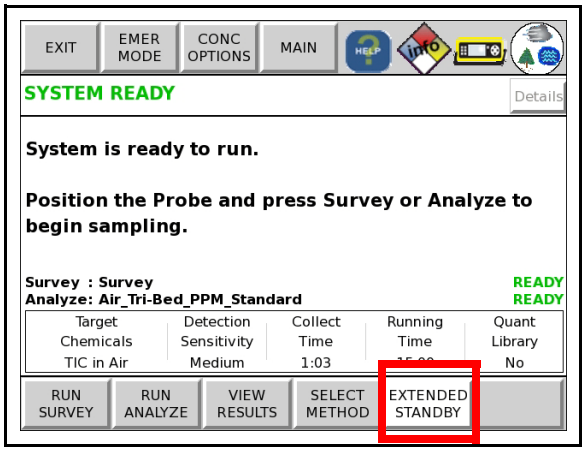
3.8.1 Extended Standby

Extended Standby is the preferred mode for storing the HAPSITE during periods of inactivity. In this state, the NEG remains heated at 400 °C and the ion pump continues pumping to maintain the vacuum in the Mass Spectrometer. The HAPSITE turns off the heaters for all other components. When in Extended Standby, remove the gas canisters to avoid consumption.

Extended Standby extends NEG pump life and makes start up faster. Proceed as follows to place the system into Extended Standby.

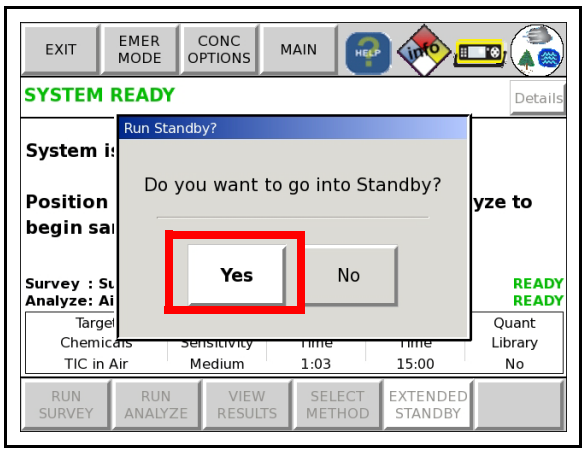
1 Touch **EXTENDED STANDBY**. Alternately, use the arrow keys to highlight **EXTENDED STANDBY** and push **OK SEL**.

Figure 3-103 Extended Standby



2 When the screen prompts, **Do you want to go into Standby?,** touch **Yes**. Alternately, using the **arrow keys**, highlight **Yes** and push **OK SEL**. See Figure 3-104.

Figure 3-104 Confirming Standby Option



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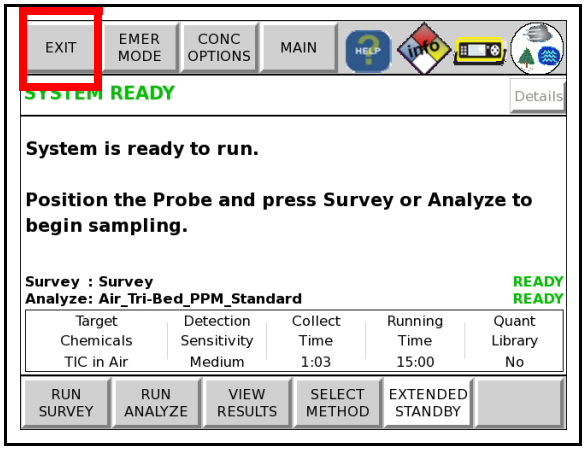
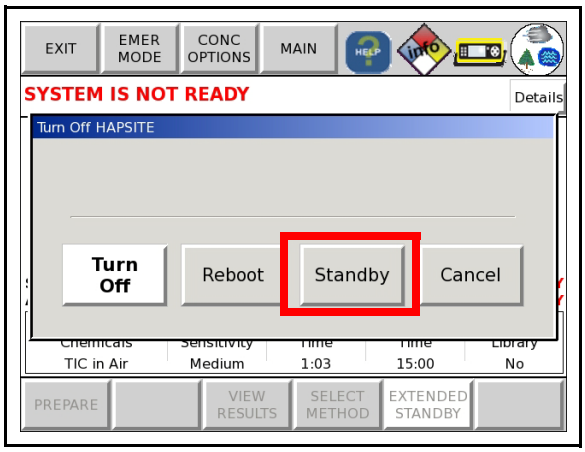
3 Alternately, touch **EXIT** or use the **arrow keys** to highlight **EXIT**. Push **OK SEL**. See Figure 3-105.

Figure 3-105 Go To Standby Button



4 Touch Standby. See Figure 3-106.

Figure 3-106 Standby



5 When the screen prompts, **Do you want to go into Standby?,** touch **Yes**. Alternately, using the **arrow keys**, highlight **Yes** and push **OK SEL**. See Figure 3-107.

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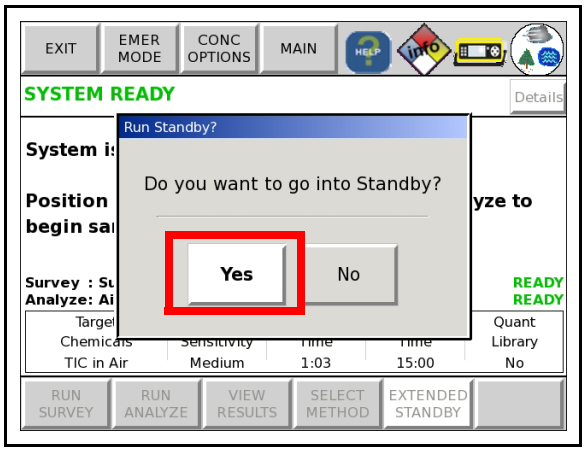
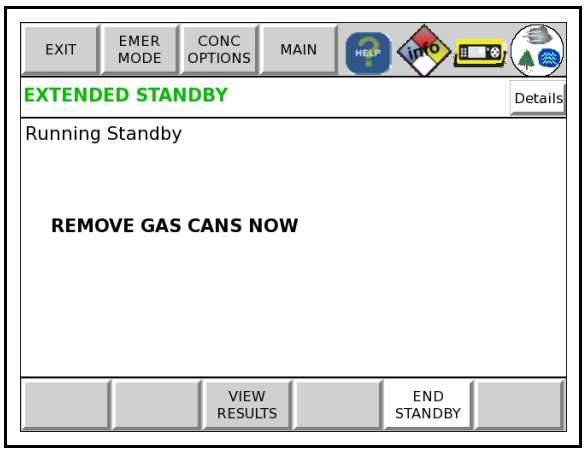
Figure 3-107 Confirming Standby Option



6 The HAPSITE will go into Extended Standby. Remove the gas canisters. See Figure 3-108.

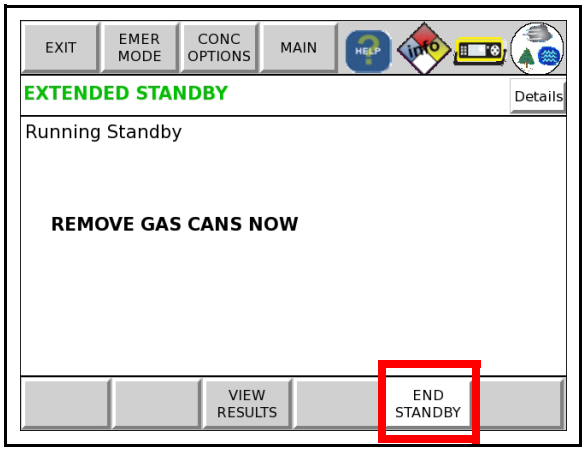
Figure 3-108 Extended Standby



3.8.1.1 End Standby

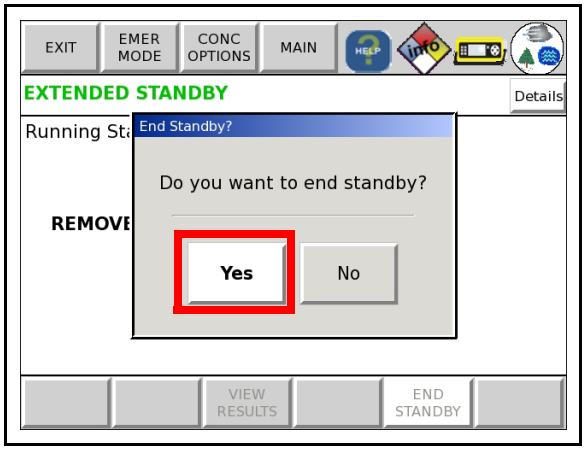
1 To End Standby, touch **END STANDBY** or using the **arrow keys**, highlight **END STANDBY** and push **OK SEL**. See Figure 3-109.

Figure 3-109 END STANDBY



2 When the system prompts, **Do you want to end standby?,** touch **Yes**. Alternately, highlight **Yes** using the **arrow keys** and push **OK SEL**. See Figure 3-110.

Figure 3-110 Confirming End Standby



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3.9 Analyze (GC/MS) Mode with Headspace Sampling System in Portable Mode

The Headspace Sampling System is used to test liquid and soil samples.

NOTE: See Chapter 13, Headspace Sampling System for more information on the Headspace System. Refer to Section 2.7, Headspace Sampling System, on page 2-13 for assembly instructions.

The Concentrator method is used for analyzing samples with concentration levels in the part per trillion range. See Chapter 6, Methods for additional information on GC/MS methods.

1. Verify that the desired sampling configuration is installed (i.e., Concentrator).
2. Make sure that the Headspace Transfer Line is attached.
3. Place a 40 mL vial with either blank or sample into a Headspace well.

   NOTE: Do not fill 40 mL vial more than 20 mL full. See Section 13.2.3, Loading the Wells, on page 13-11 for detailed instructions and information on loading the sample vials into the wells.
4. Place a clean, empty vial into a Headspace well.

WARNING

The Headspace needle is very sharp and the assembly may be hot.

Figure 3-111 Headspace Needle

5 When powered on or taken out of Extended Standby, the HAPSITE will automatically start preparing the default Headspace method. If the Headspace method that the HAPSITE begins preparing is not the desired one, refer to Section 3.2, Selecting a Different Method Using the SELECT METHOD Icon, on page 3-13.

6 The HAPSITE will display the progress of its preparation. Refer to section 3.1 on page 3-1, Step 5 for more information.

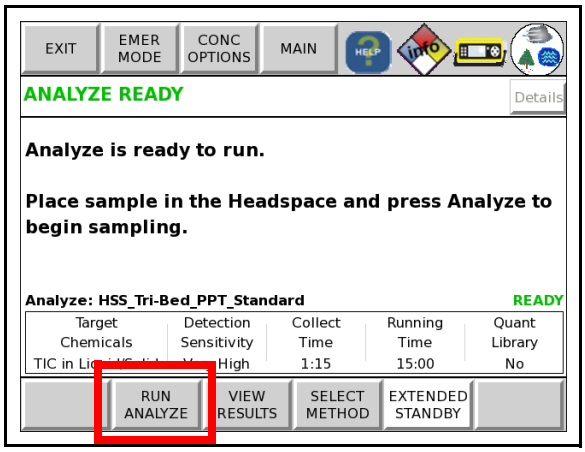
6a If running a Headspace method that requires a Concentrator. The HAPSITE will run a Concentrator Cleanout. Its progress will be shown by a bar graph. If the Concentrator Cleanout is not successful, refer to section Section 3.1.3, Concentrator Cleanout Failure, on page 3-11.

7 When the HAPSITE has finished preparing, a **SYSTEM READY** message will appear with a prompt to press Survey or Analyze to begin sampling.

NOTE: A blank run is recommended before running a sample.

8 Using the touch screen, touch **RUN ANALYZE**. See Figure 3-112**.** If using the push buttons, push **ANALYZE RUN**.

Figure 3-112 HSS Analyze



9 Gently insert the Headspace needle into the septum of the 40 mL vial containing the blank/sample.

10 The screen will prompt **Collecting Sample For**. See Figure 3-113. The Headspace is automatically collecting a sample. No action is required by the user.

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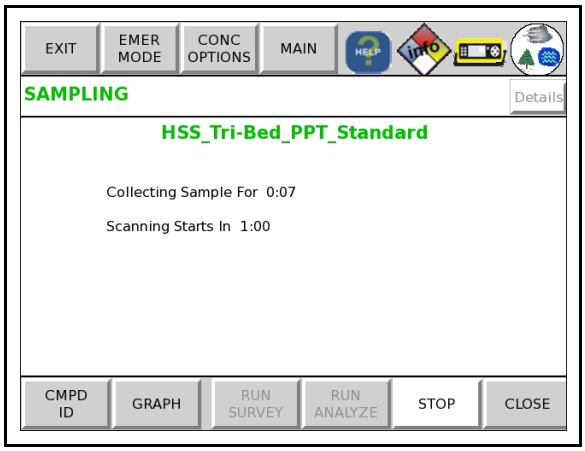
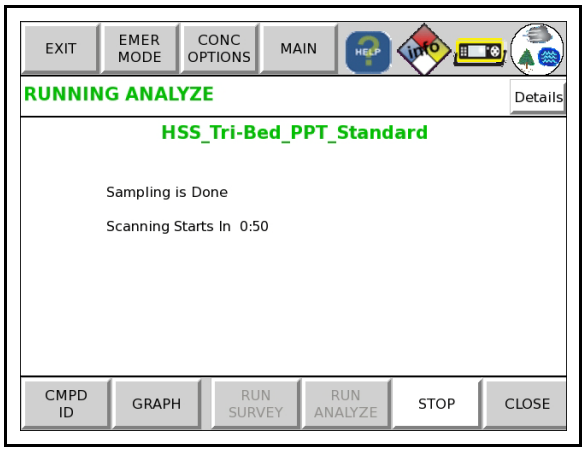
Figure 3-113 Collecting Sample



11 The next screen will prompt **Sampling is Done**. Again, no action is required by the user. See Figure 3-114.

Figure 3-114 Sampling Done HSS



12 By touching **CMPD ID** during the analysis, a list of detected compounds will appear. The CAS number, the Fit and the retention time for each compound will also be displayed. This screen will also display the TIC (Total Ion Count) Max, the current TIC count and the time the method has been running.

NOTE: Touching a compound on the list will display its NIOSH database information.

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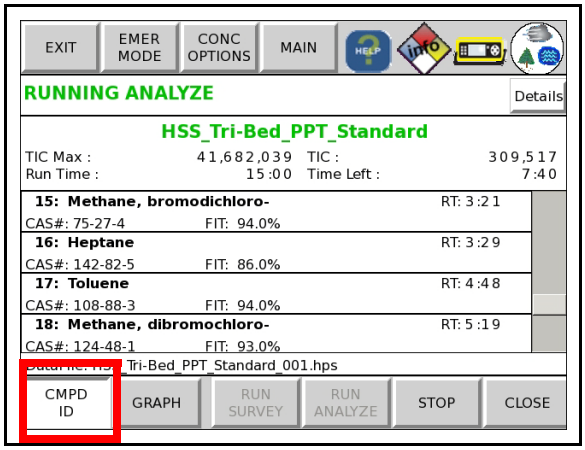
12a The **CMPD ID** screen can also be accessed by using the **arrow keys** to highlight **CMPD ID** and pushing **OK SEL**. See Figure 3-115.

Figure 3-115 Sample Compound ID View for HSS

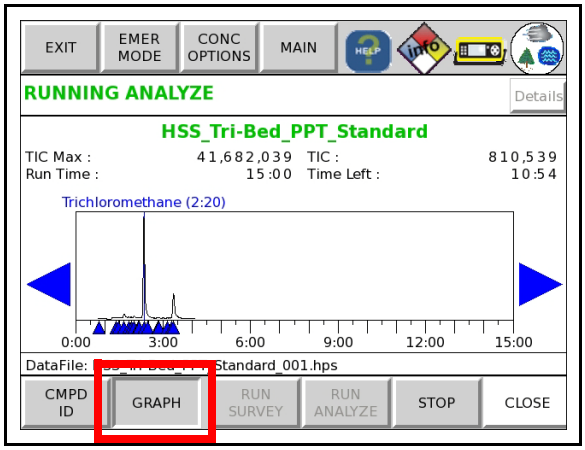


13 To view the chromatogram while the method is running, touch **GRAPH**. See Figure 3-116. Alternately, use the **arrow keys** to highlight **GRAPH**. Push **OK SEL**.

NOTE: This screen will also display the TIC Max, the current TIC Count and the time remaining.

NOTE: Touching the blue compound identification above the chromatogram will display its Synonym and Exposure Limit information.

Figure 3-116 Sample Chromatogram View for HSS



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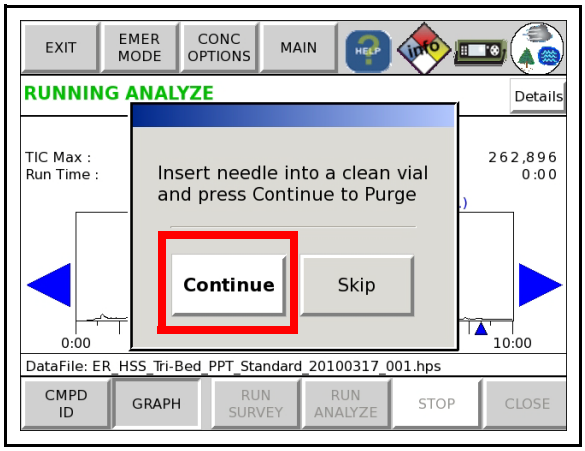
14 At the end of the Headspace run, a prompt will appear. When prompted **Insert needle into a clean vial and press Continue to Purge**, place the needle into the empty vial. When finished, touch the **Continue** button or using the **arrow keys**, highlight **Continue**. Push **OK SEL**.

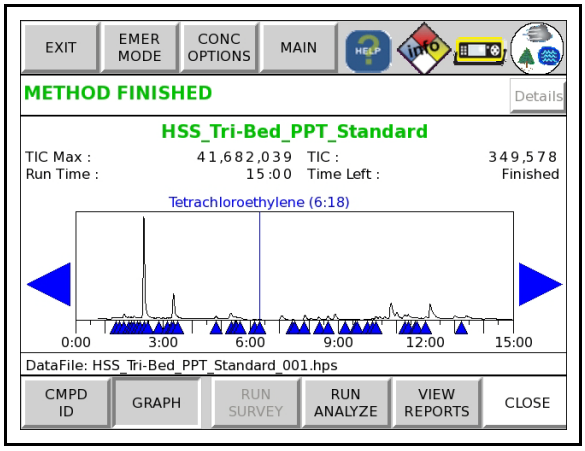
Figure 3-117 Purge



NOTE: If purge is skipped, a full Headspace run must be completed to flush the system. Once purge has been skipped, it is not possible to re-access it.

15 The **METHOD FINISHED** message will appear when the purge method has ended. See Figure 3-118.

Figure 3-118 Sample Method Finished for HSS



NOTE: Another Analyze (GC/MS) method can be started immediately after one has completed. Depending on the temperature profile, the column may need to cool before another run will begin.

NOTE: Refer to Section 3.5.1, View Results/View Reports, on page 3-32 for more information on reviewing the data.

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3.9.1 Quick Reference SOP — GC/MS Mode with HSS in Portable Mode

1. Verify that the desired sampling configuration (i.e., concentrator) is installed.
2. Attach the Transfer Line.
3. If the system is Shutdown or in Extended Standby, either power on the HAPSITE or take the system out of Standby. If a Concentrator is installed, the HAPSITE will begin preparing a Concentrator method. See Section 3.4.3, Procedure for Running Concentrator Methods, on page 3-25.

3a. If the **SYSTEM IS NOT READY** message is displayed, touch **PREPARE ANALYZE**. Alternately, use the **arrow keys** to highlight **PREPARE ANALYZE** and push **OK SEL**.

4. Insert the sample/blank vial into a well and an empty vial into another empty well. Place the needle into sample/ blank vial.
5. Touch **RUN ANALYZE** or push **ANALYZE RUN** when the **SYSTEM READY** screen is displayed.
6. Remember: when the screen prompts, **Collecting Sample Now For** and **Sampling is Done**, no action is required from the user.
7. When prompted, put the needle into the empty vial and press **OK** to purge.
8. When the run is complete, a **METHOD FINISHED** message is displayed.
9. Refer to Section 3.5.1, View Results/View Reports, on page 3-32 for information on data review.

CAUTION

The Concentrator feature has increased sensitivity. Take care to avoid saturating the HAPSITE.

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3.10 SituProbe

For complete information on SituProbe methods, see Chapter 14, SituProbe. For instructions on setting up the SituProbe, refer to Section 2.9, SituProbe, on page 2-27.

3.10.1 Procedure for SituProbe Operation

1. Verify that the desired sample configuration is installed (i.e., Concentrator).
2. Make sure that the Transfer Line is attached.
3. When powered on or taken out of Extended Standby, the HAPSITE will automatically start preparing a SituProbe method. If the SituProbe method that the HAPSITE begins preparing is not the desired one, refer to Section 3.2, Selecting a Different Method Using the SELECT METHOD Icon, on page 3-13.
4. The HAPSITE will display the progress of its preparation. Refer to section 3.1, Step 5 for more information.
5. If using the water vessel, fill the vessel to the top of the outlet connection. See Figure 3-119.

Figure 3-119 SituProbe Vessel

6. Insert probe into vessel or water source.

6a. If running a SituProbe method that requires a Concentrator, the HAPSITE will run a Concentrator Cleanout. Its progress will be shown by a bar graph. If the Concentrator Cleanout is not successful, refer to section on page 3-29.

7. When the HAPSITE has finished preparing, a **SYSTEM READY** message will appear with a prompt to press Survey or Analyze to begin sampling.

NOTE: A blank run is recommended before running a sample.

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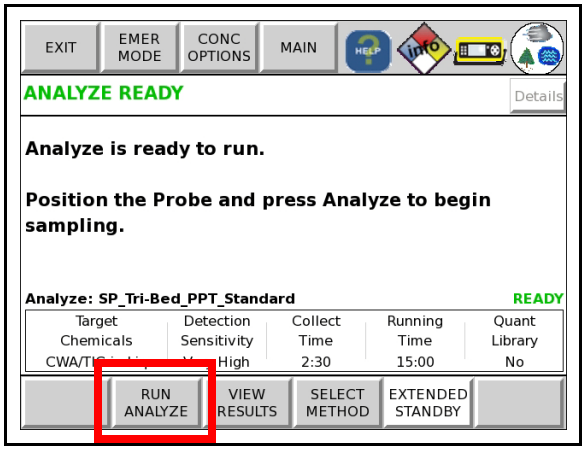
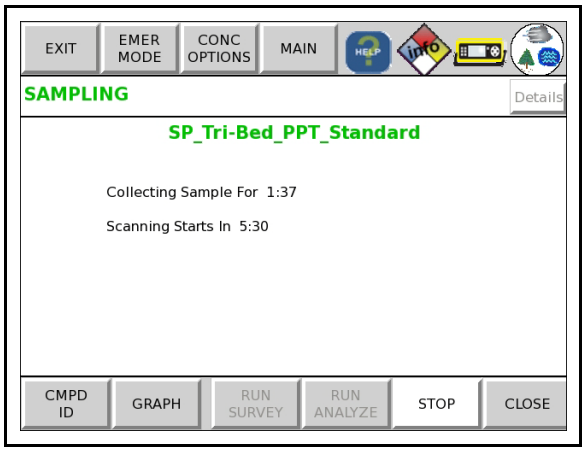
8 Using the touch screen, touch **RUN ANALYZE**. If using the push buttons, push **ANALYZE RUN**.

Figure 3-120 Running Analyze with SituProbe



9 The screen will prompt **Collecting Sample For**. The SituProbe is automatically collecting a sample. No action is required by the user.

Figure 3-121 SituProbe Collecting Sample



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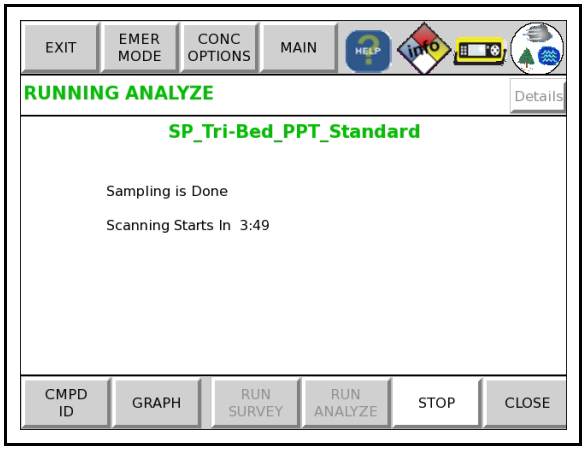
10 The next screen will prompt **Sampling is Done**. See Figure 3-122. Again, no action is required by the user.

Figure 3-122 SituProbe Sampling is Done

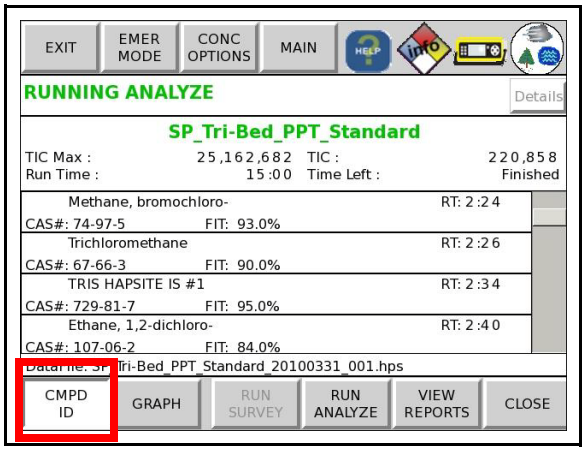


11 By touching the **CMPD ID**, a list of found compounds will appear. See Figure 3-123. The CAS number, the Fit and the retention time for each compound will also be displayed. This screen will also display the TIC (Total Ion Count) Max, the current TIC count and the time remaining.

NOTE: Touching a compound on the list will display its NIOSH database information.

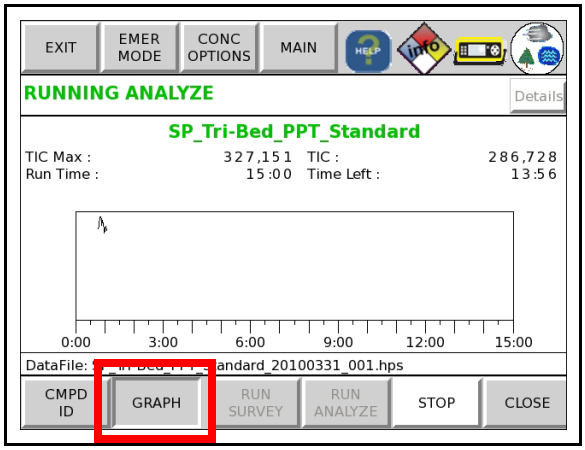
11a The **CMPD ID** screen can also be accessed by using the **arrow keys** to highlight **CMPD ID** and pushing **OK SEL**.

Figure 3-123 Sample Compound ID View for SituProbe



12 To view the chromatogram while the method is running, touch **GRAPH**. Alternately, use the **arrow keys** to highlight **GRAPH**. Push **OK SEL**.

Figure 3-124 Graph View SituProbe

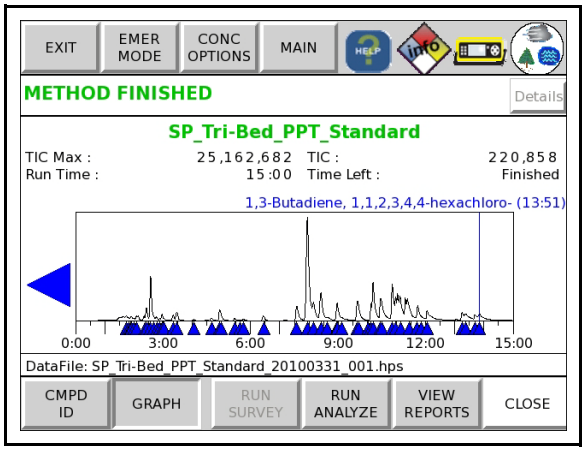


NOTE: This screen will also display the TIC Max, the current TIC Count and the time remaining.

13 Touching the blue compound identification above the chromatogram will display its NIOSH database information.

14 When finished, a **METHOD FINISHED** message will be displayed.

Figure 3-125 SituProbe Method Finished



NOTE: Another Analyze (GC/MS) method can be started immediately after one has completed. Depending on the temperature profile, the column may need to cool before another run will begin.

NOTE: Refer to Section 3.5.1, View Results/View Reports, on page 3-32 for more information on reviewing the data.

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3.10.2 Quick Reference SOP — GC/MS Mode with SituProbe in Portable Mode

1. Verify that the desired sampling configuration (i.e. concentrator) is installed.
2. Attach the Transfer Line.
3. If the system is Shutdown or in Extended Standby, either power on the HAPSITE or take the system out of Standby. If a Concentrator is installed, the HAPSITE will begin preparing a Concentrator method. See Section 3.4.3, Procedure for Running Concentrator Methods, on page 3-25.

3a. If the **SYSTEM IS NOT READY** message is displayed, touch **PREPARE ANALYZE**. Alternately, use the **arrow keys** to highlight **PREPARE ANALYZE** and push **OK SEL**.

4. Optional: Fill vessel to the top of the outlet connection.
5. Place probe in vessel or water source.
6. Touch **RUN ANALYZE** or push **ANALYZE RUN** when the **SYSTEM READY** screen is displayed.
7. Remember: when the screen prompts, **Collecting Sample Now For** and **Sampling Is Done**, no action is required from the user.
8. When the run is complete, a **METHOD FINISHED** prompt will appear.
9. Refer to Section 3.5.1, View Results/View Reports, on page 3-32 for information on data review.

CAUTION

The Concentrator feature has increased sensitivity. Take care to avoid saturating the HAPSITE.

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Chapter 4
Wireless and Touch Screen Options

4.1 Wireless Option

4.1.1 Introduction

The HAPSITE Smart Plus has a wireless communication option.

DANGER

The HAPSITE contains a wireless transmitter/receiver that emits electromagnetic radiation (EMR). This radiation in a tactical or operational environment may potentially be used to locate the HAPSITE and its operators. This radiation also has the potential to detonate some types of unexploded ordnance (UXO), or improvised explosive devices (IEDs), or both, if the HAPSITE is transmitting in the safety exclusion area around the device(s). There is a hardware switch to turn off the wireless radio so that the HAPSITE may still be used in areas where these hazards are a concern. Consult applicable regulations and policies when using the HAPSITE with the wireless device active in such environments.

4.1.2 Regulatory Compliance Information for UNITED STATES Users

This section of the Operating Manual lists FCC compliance information for the Hapsite Smart Plus system that contains the wireless communication option.

NOTE: This equipment contains an OEM Embedded Wireless Bridge (Ethernet to Wireless LAN) Module from Quatech Inc.

FCC ID: F4AWLNG1

This device compiles with Part15 of the FCC rules and is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

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CAUTION

To maintain compliance with FCC standards and regulations and to ensure the proper operation of the wireless communication system used within the Hapsite Smart Plus instrument, ONLY use the antenna that was originally supplied with the instrument. If you damage the original antenna please contact INFICON's service department for a replacement antenna (see Chapter 18 for contact information).

4.1.2.1 FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for assistance.

4.1.2.2 FCC RF Exposure Statement

WARNING

To satisfy RF exposure requirements, this device and its antenna must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

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4.1.3 Regulatory Compliance Information for CANADIAN Users

This section of the Operating Manual lists Industry Canada (IC) compliance information for the Hapsite Smart Plus system that contains the wireless communication option.

NOTE: This equipment contains an OEM Embedded Wireless Bridge (Ethernet to Wireless LAN) Module from Quatech Inc.

IC: 3913A-WLNG1

This device compiles with RSS-210 of Industry Canada (IC) and is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

4.1.3.1 Industry Canada (IC) Notices

This equipment complies with Canadian RSS-210.

CAUTION

This device has been designed to operate with an antenna having a maximum gain of 5.0 dB. An antenna having a higher gain is strictly prohibited per regulations of Industry Canada (IC). The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than required for successful communications.

4.1.4 Regulatory Compliance Information for EUROPEAN Users

This section of the Operating Manual lists CE and R&TTE compliance information for the Hapsite Smart Plus system that contains the wireless communication option.

The Hapsite Smart Plus is marked with the following symbol:

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This symbol indicates compliance with the essential requirements of Directive 73/23/EEC and the essential requirements of articles 3.1(b), 3.2 and 3.3 of Directive 1999/5/EC. Such marking is indicative that this equipment meets or exceeds the following technical standards:

- EN 300 328-2 — Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems; data transmission equipment operating in the 2.4 GHz ISM band and using spread spectrum modulations techniques.
- EN 301 489-17 — Electromagnetic compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for 2.4 GHz wideband transmission systems and 5 GHz high performance RLAN equipment.
- EN 61010-1 — Safety requirements for electrical equipment for measurement, control and laboratory use.

4.1.4.1 European Usage Restrictions

CAUTION

European usage restrictions apply to this equipment! The end user must comply with the usage restrictions noted in the table below when operating this equipment in the counties that have restrictions.

The Hapsite Smart Plus is marked with the following symbol:

This symbol indicates that usage restrictions apply to this equipment. Such marking indicates that the end user must comply with the following statements about usage restrictions:

- To ensure compliance with local regulations, be sure to select the country in which the access point is installed.
- This instrument can be used as shown in Table 4-1:

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Table 4-1 Country - Restriction

Countries	Restrictions
France	Outdoor use limited to 10mW e.i.r.p. within the band 2454 to 2483.5 MHz.
Italy	If used outside of own premises, general authorization is required.
Luxembourg	General authorization is required for public service.
Romania	On a secondary basis. Individual license required.
Austria, Denmark, Finland, Germany, Greece, Iceland, Ireland, Liechtenstein, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, The United Kingdom	None

4.1.4.2 European EMC Compliance Statement

Table 4-2 European EMC Compliance Statements

English	Hereby, INFICON Inc. declares that this HAPSITE Smart Plus Portable GC/MS is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Finnish	INFICON Inc. vakuuttaa täten että HAPSITE Smart Plus Portable GC/MS tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Dutch	Hierbij verklaart INFICON Inc. dat het toestel HAPSITE Smart Plus Portable GC/MS in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.
	Bij deze verklaart INFICON Inc. dat deze HAPSITE Smart Plus Portable GC/MS voldoet aan de essentiële eisen en aan de overige relevante bepalingen van Richtlijn 1999/5/EC.
French	Par la présente INFICON Inc. déclare que l'appareil HAPSITE Smart Plus Portable GC/MS est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.
Danish	Undertegnede INFICON Inc. erklærer herved, at følgende udstyr HAPSITE Smart Plus Portable GC/MS overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.

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Table 4-2 European EMC Compliance Statements (continued)

German	Hiermit erklärt INFICON Inc. dass sich dieser HAPSITE Smart Plus Portable GC/MS in Übereinstimmung mit den grundlegenden Anforderungen und den anderen relevanten Vorschriften der Richtlinie 1999/5/EG befindet". (BMWi)
	Hiermit erklärt INFICON Inc. die Übereinstimmung des Gerätes HAPSITE Smart Plus Portable GC/MS mit den grundlegenden Anforderungen und den anderen relevanten Festlegungen der Richtlinie 1999/5/EG. (Wien)
Swedish	Härmed intygar INFICON Inc. att denna HAPSITE Smart Plus Portable GC/MS står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.
Greek	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ INFICON Inc. ΔΗΛΩΝΕΙ ΟΤΙ HAPSITE Smart Plus Portable GC/MS ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕΚ
Italian	Con la presente INFICON Inc. dichiara che questo HAPSITE Smart Plus Portable GC/MS è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Spanish	Por medio de la presente INFICON Inc. declara que el HAPSITE Smart Plus Portable GC/MS cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
Portuguese	INFICON Inc. declara que este HAPSITE Smart Plus Portable GC/MS está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.

4.1.4.3 European Safety Compliance Statement

This device has been tested and certified according to the safety standard EN 61010-1: 2001 and is intended to be used in accordance with the information provided in this manual. For additional information concerning the directives and standards that this instrument complies with, please refer to the Declaration of Conformity that is located in the front of this manual.

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4.1.5 Wireless Range

The HAPSITE Smart Plus is equipped with an 802.11b/g wireless adapter. The typical range for a signal is 300 ft. (100 meters) line of sight with no obstructions. The following may degrade the signal:

- Metal buildings
- Concrete structures
- Electric devices in the area

Other possible obstructions may exist depending on location.

4.1.6 Turning On the Radio

If wireless communication is desired, the radio must be turned on. This procedure gives instructions for turning on the radio.

DANGER

When the HAPSITE radio is on, even if wireless communication is not being used, a radio signal is being transmitted. The only way to eliminate the radio signal is to turn the radio off.

1. Open the front panel of the HAPSITE.
2. Remove the cover from the power switch (for the wireless radio). It is located on the far left hand side. To remove, unscrew the cover by turning it counter-clockwise. See Figure 4-1.

Figure 4-1 Unscrewing Wireless Cap

DANGER

The HAPSITE contains a wireless transmitter/receiver that emits electromagnetic radiation (EMR). This radiation in a tactical or operational environment may potentially be used to locate the HAPSITE and its operators. This radiation also has the potential to detonate some types of unexploded ordnance (UXO), or improvised explosive devices (IEDs), or both, if the HAPSITE is transmitting in the safety exclusion area around the device(s). There is a hardware switch to turn off the wireless radio so that the HAPSITE may still be used in areas where these hazards are a concern. Consult applicable regulations and policies when using the HAPSITE with the wireless device active in such environments.

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3 Press the button until a click is heard. The green lights adjacent to “Radio” and “WLAN” should illuminate. When the green lights are illuminated, the power to the wireless radio is on. See Figure 4-2.

Figure 4-2 Pushing Wireless Button

4 Replace the switch cover by placing it over the switch. Turn it clock-wise until finger tight.

4.1.7 Establishing Communication

Wireless communication for the HAPSITE Smart Plus is set up at the factory. See the following paragraphs to verify the set up or correct any communication issues.

HINT: Setting up communications in Plus IQ requires the user to be in Advanced Mode. See section 8.9.1, Changing Access Levels, on page 8-24 for directions to set up this mode.

4.1.7.1 Setting the User Access Level

The HAPSITE Smart Plus leaves the factory in Normal operating mode. Setting up communication requires the user to be in Advanced Mode. For information on setting the user level, see section 8.9.1, Changing Access Levels, on page 8-24.

To set up wireless communication between the HAPSITE and Laptop computer, Plus IQ must be configured to communicate with the HAPSITE by setting up the IP address. See section 8.6, Establishing Communications between the HAPSITE and Laptop Computer, on page 8-13 for instructions.

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4.1.7.2 Setting Up Plus IQ for Communication with the HAPSITE

The first step to communication between the HAPSITE and Laptop is to set up a Sensor Icon in Plus IQ. This is the HAPSITE Icon seen on the bottom of the System Setup window of Plus IQ. See section 8.6.1, Setting Up Communications, on page 8-13 for instructions.

The second step to setting up communications is to set the IP address of the Laptop computer for direct communication with the HAPSITE. Instructions for this are found in section 8.6.2, Configuring the HAPSITE for Communications, on page 8-15.

In order for wireless communication between the Laptop and HAPSITE Plus to be successful, the radio on the Laptop computer must be turned on. The basic steps for configuring the Laptop for wireless communication are:

1. Enable the radio on the Laptop computer.
2. Scan for available Wireless Networks.
3. Choose HAPSITE Plus.
4. Create a profile for the Wireless Connection.
5. Connect to the HAPSITE Smart Plus wireless network.
6. Verify the connection protocol is 802.11b.
7. If the connection protocol is not 802.11b, modify the profile.

Due to differences in computer models and brands, refer to the User's Guide of the Laptop for specific instructions on setting up the wireless radio. The Dell™ website has a section on wireless communications called the Wireless Center. This section can be accessed at http://support.dell.com by clicking the Technical Support tab, then selecting Wireless Center. The content applies to many manufacturer's laptop computers, in addition to Dell Laptop computers.

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4.1.8 Wireless Module Indicator Lights

Located on the Wireless Module inside the HAPSITE front cover are four indicator lights.

RADIO . . . . . When illuminated, the radio is enabled.

WLAN . . . . . When illuminated, the wireless connection is linked to the laptop computer. The LED blinks when transmitting or receiving data.

LAN . . . . . When illuminated, the HAPSITE is connected via a crossover cable to the Laptop computer. The LED blinks when transmitting or receiving data. The LED will be extinguished if the crossover cable is disconnected.

586 . . . . . When illuminated, the HAPSITE 586 processor is linked to a wired or wireless connection.

4.1.9 Turning Off the Radio

If wireless communication is not desired, the radio on the HAPSITE Smart Plus can be turned off. See the following procedure for direction on how to turn off the radio.

NOTE: When the HAPSITE radio is on, even if the wireless communication is not being used, a radio signal is being transmitted. The only way to eliminate the radio signal is to turn off the radio.

DANGER

The HAPSITE contains a wireless transmitter/receiver that emits electromagnetic radiation (EMR). This radiation in a tactical or operational environment may potentially be used to locate the HAPSITE and its operators. This radiation also has the potential to detonate some types of unexploded ordnance (UXO), or improvised explosive devices (IEDs), or both, if the HAPSITE is transmitting in the safety exclusion area around the device(s). Discussed below is a hardware switch to turn off the wireless radio so that the HAPSITE may still be used in areas where these hazards are a concern. Consult applicable regulations and policies when using the HAPSITE with the wireless device active in such environments.

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1. Open the front panel of the HAPSITE.
2. Remove the cover from the power switch (for the wireless radio). It is located on the far left hand side. To remove, unscrew the cover by turning it counter-clockwise. See Figure 4-3.

Figure 4-3 Unscrewing Wireless Cap

3. Press the button until a click is heard. The green lights adjacent to “Radio” and “WLAN” should extinguish. When the green lights are extinguished, the power to the wireless radio is off. See Figure 4-4.

Figure 4-4 Pushing Wireless Button

4. Replace the switch cover by placing it over the switch. Turn it clock-wise until finger tight.

4.2 The MAIN Menu

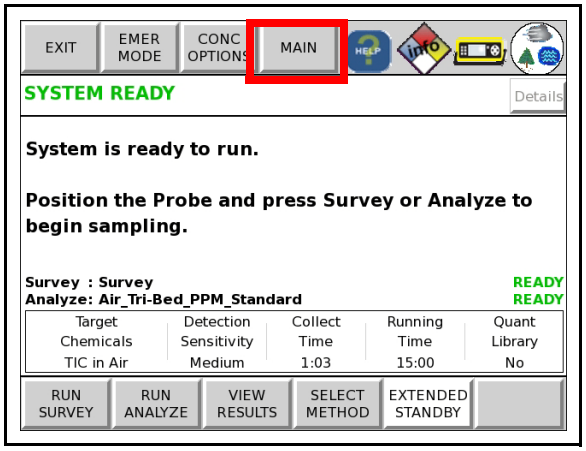
The **MAIN** menu contains the following options: **View Results**, **Smart Interface**, **Adjust Brightness** and **Touch Screen**. See Figure 4-5. For information regarding View Results, refer to section 3.5.1, View Results/View Reports, on page 3-32. The **Smart Interface** option will run the HAPSITE Smart Plus using the HAPSITE Smart software. This makes transitioning from the Smart Software to the Smart Plus software easier. **Adjust Brightness** changes the level of lighting on the touch screen. The **Touch Screen** option will enable or disable the touch screen. The **Touch Screen** option also contains a touch screen calibration feature.

4.2.1 Smart Interface

To convert to the HAPSITE software, follow the procedure below.

1 Touch **MAIN**. See Figure 4-5.

Figure 4-5 MAIN Button



2 Alternately, use the **arrow keys** to highlight **MAIN** and push **OK SEL**. See Figure 4-6.

Figure 4-6 Arrow Keys

3 Touch **Smart Interface** or using the **arrow keys**, highlight **Smart Interface** and push **OK SEL**. See Figure 4-7.

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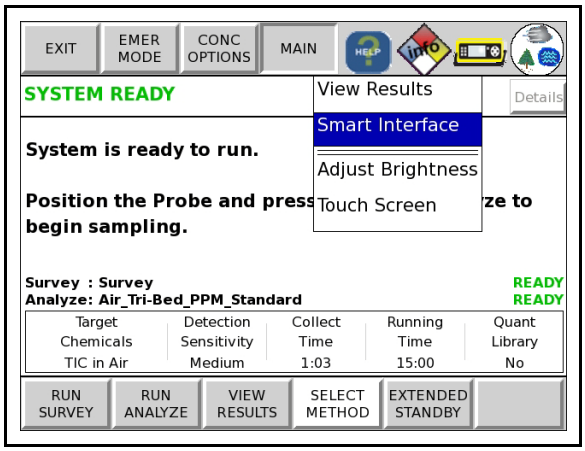
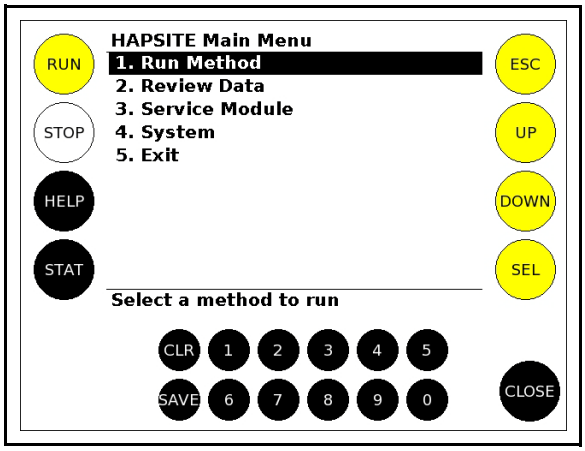
Figure 4-7 Smart Interface



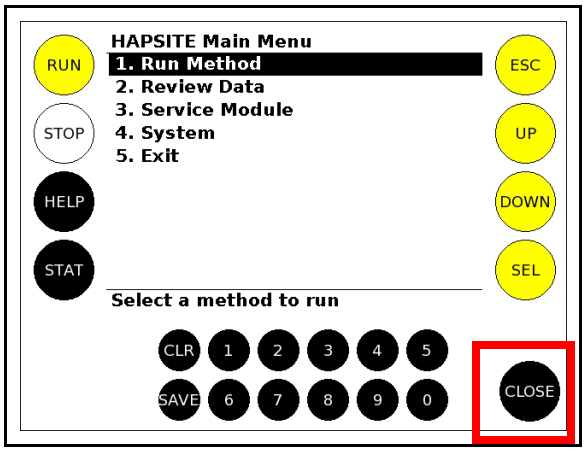
4 The HAPSITE Smart software will be displayed. See Figure 4-8.

Figure 4-8 HAPSITE Smart Screen



5 Touch **CLOSE** to exit the **Smart Interface**.

Figure 4-9 Closing the Smart Interface



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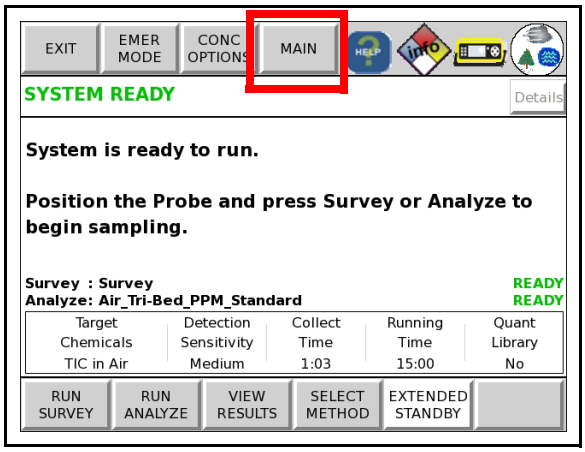
4.2.2 Adjust Brightness

The brightness level of the Touch Screen can be adjusted to make viewing easier.

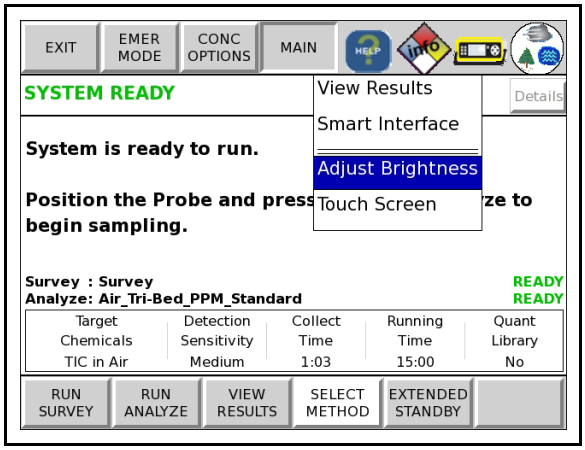
1 Touch **MAIN** or using the **arrow keys**, highlight **MAIN** and touch **OK SEL**. See Figure 4-10.

Figure 4-10 MAIN Button



2 Touch **Adjust Brightness**. See Figure 4-11.

Figure 4-11 Adjust Brightness



3 A scroll bar will appear in the middle of the screen. See Figure 4-12.

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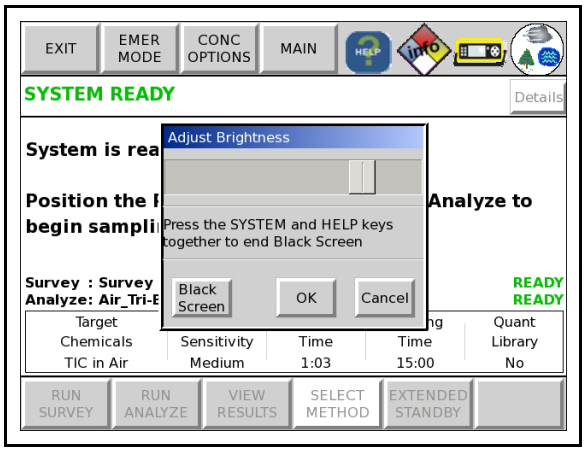
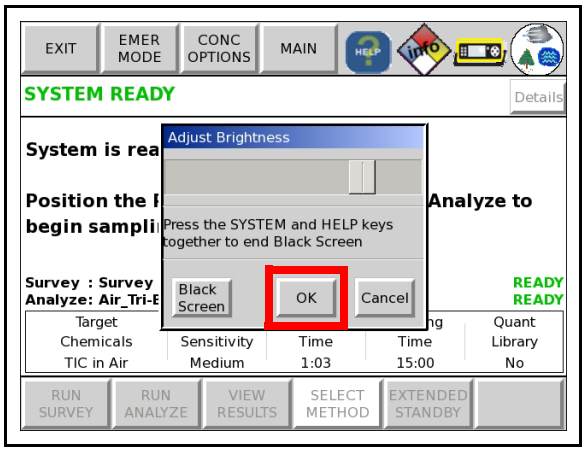
Figure 4-12 Scroll Bar



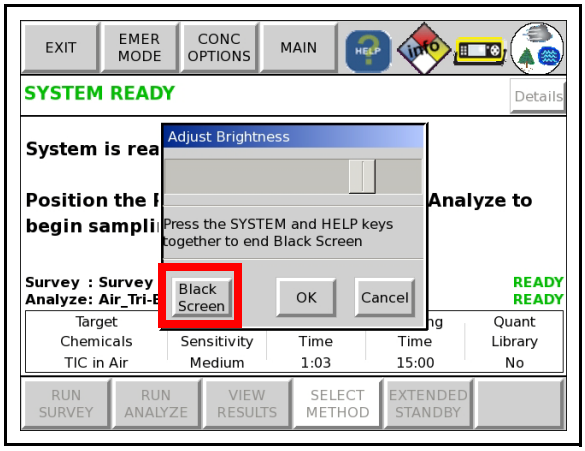
4 To darken the screen, slide the bar to the left. To brighten, slide to the right. Touch **OK** to accept the changes.

Figure 4-13 OK Button



5 To completely darken the screen, touch **Black Screen**.

Figure 4-14 Black Screen



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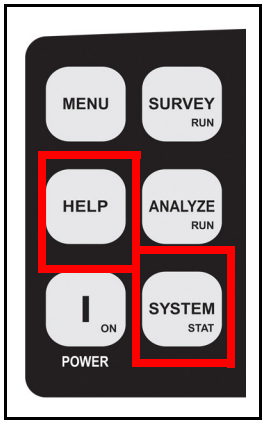
6 To exit the **Black Screen** mode, push the **SYSTEM** and **HELP** Buttons together at the same time. See Figure 4-15.

Figure 4-15 Exiting the Black Screen



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4.3 Touch Screen Options

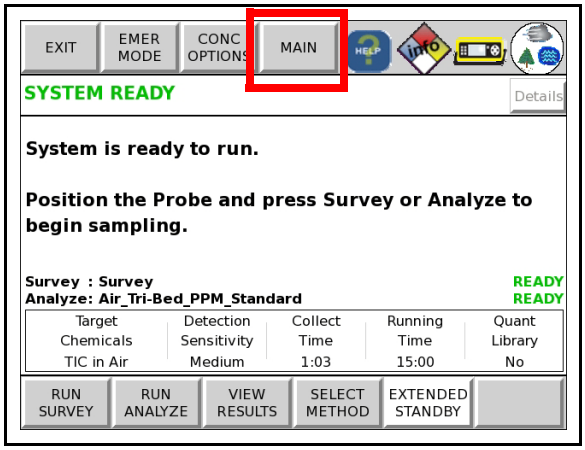
NOTE: If the Touch Screen freezes, pushing the **MENU** and **ESC** keys at the same time will turn off the system. Hold both keys until the systems powers down. Turn system back on with the **POWER** button.

4.3.1 Calibrating The Touch Screen

If the touch point does not align with the icon pressed, a calibration may be necessary. For example, when directly pressing the **info** icon, the **Help** feature (the icon directly next to **info**) is accessed. When similar problems occur, it is necessary to calibrate the touch screen. Proceed as follows to calibrate.

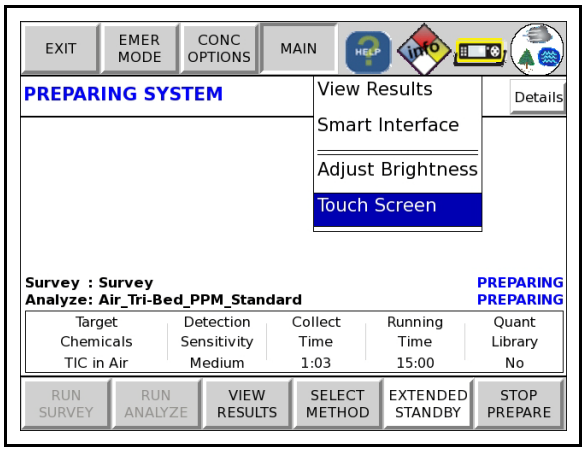
1 Touch **MAIN** or using the **arrow keys**, highlight **MAIN** and touch **OK SEL**. See Figure 4-16.

Figure 4-16 MAIN Button



2 From the dropdown menu, touch **Touch Screen**. Alternately, use the **arrow keys** to highlight **Touch Screen** and push **OK SEL**. See Figure 4-17.

Figure 4-17 Selecting Touch Screen



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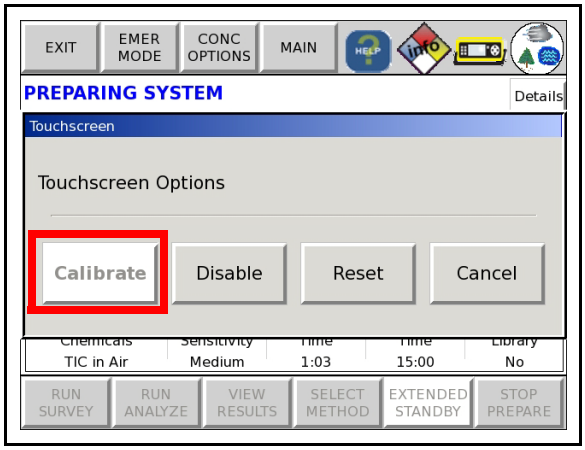
3 Touch **Calibrate** or push **OK SEL** when **Calibrate** is highlighted. See Figure 4-18.

Figure 4-18 Calibrate Button

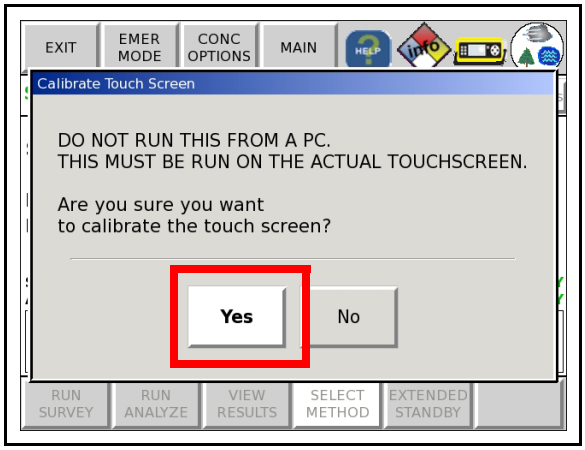


4 A prompt will appear to confirm that touch screen calibration is desired. To continue, touch **Yes** or highlight **OK** with the **arrow keys**. Then push **OK SEL**. See Figure 4-19.

CAUTION

Do not calibrate the front panel touch screen using the front panel emulator on the laptop.

Figure 4-19 Calibration Confirmation



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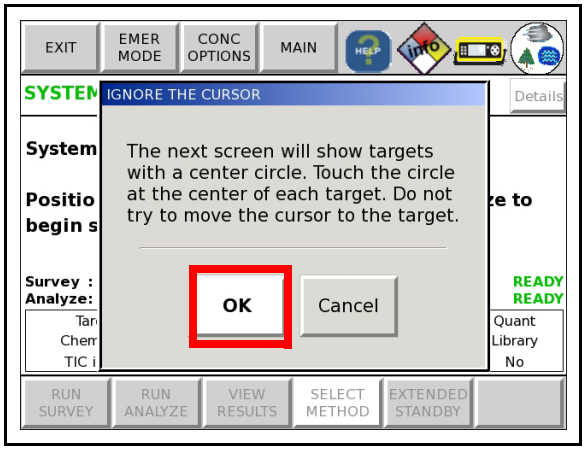
5 Instructions on screen calibration will appear. Touch **OK** or highlight **OK** and push **OK SEL**. See Figure 4-20.

Figure 4-20 Calibration Instructions

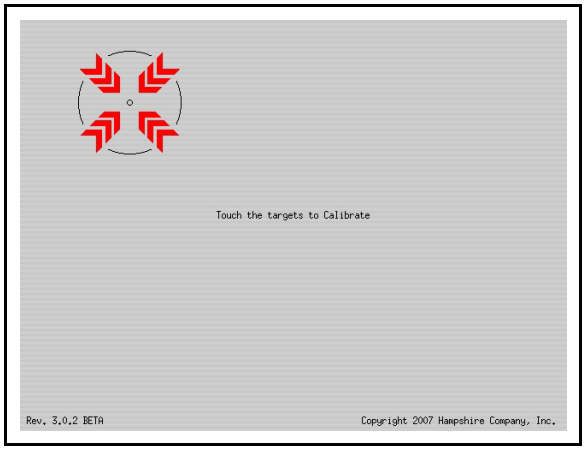


CAUTION

Ignore the cursor when calibrating. Touching the cursor during calibration may improperly calibrate the touchscreen.

6 Touch precisely in the center of each of the four circles when prompted **Touch the targets to Calibrate**. See Figure 4-21.

Figure 4-21 Calibration In Progress



NOTE: The circles will appear on the screen one at a time. After touching the center, the next circle will appear.

7 Touch **OK** in the next ten seconds if the calibration was accurate for all four targets. Otherwise, the touch screen calibration will automatically restart after the ten seconds have passed. See Figure 4-22.

Figure 4-22 Restart Calibration

8 When calibration is complete, the HAPSITE will return to the main screen.

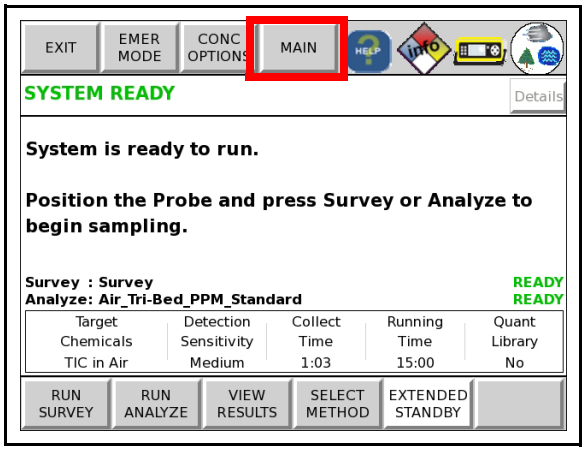
4.3.2 Enabling/ Disabling the Touch Screen

If desired, the touch screen can be disabled and the HAPSITE can be operated completely by the push buttons. This will prevent the screen from being inadvertently touched during usage. The next two procedures outline how to disable and enable the touch screen.

4.3.2.1 Disabling the Touch Screen

1 Touch **MAIN** or using the **arrow keys**, highlight **MAIN** and touch **OK SEL**. See Figure 4-23.

Figure 4-23 Display Button



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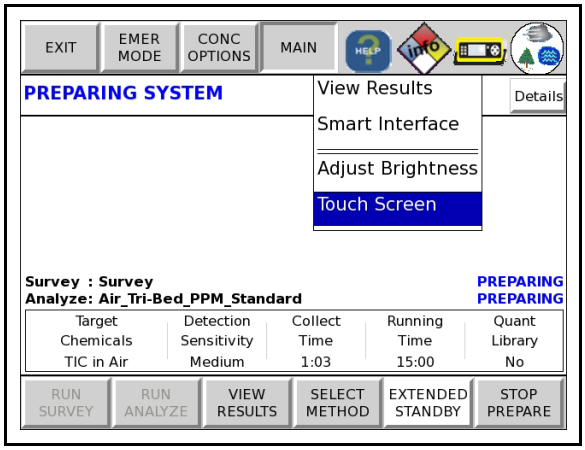
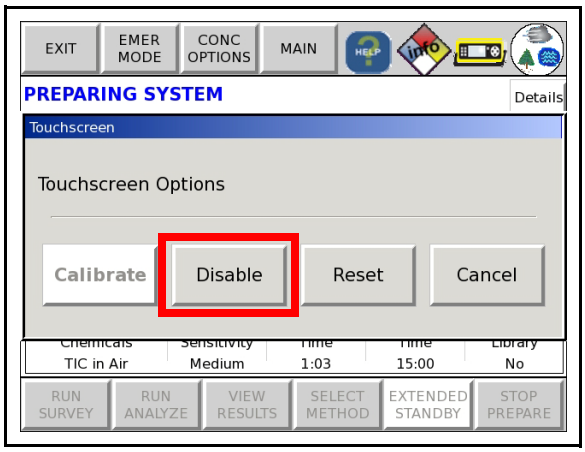
2 From the drop-down menu, touch **Touch Screen**. Alternately, use the **arrow keys** to highlight **Touch Screen** and push **OK SEL**. See Figure 4-24.

Figure 4-24 Touch Screen Option



3 Touch **Disable** or push **OK SEL** when **Disable** is highlighted. See Figure 4-25.

Figure 4-25 Disable Button

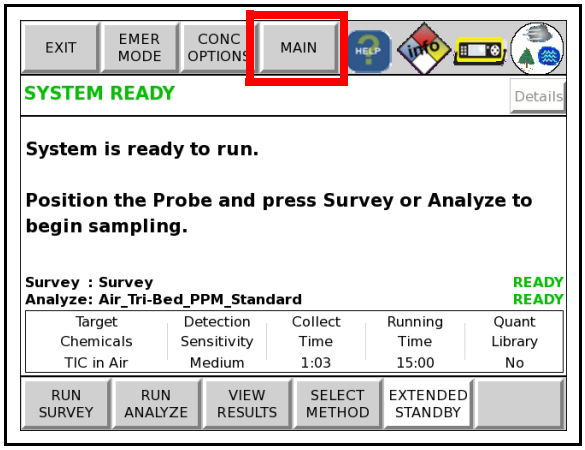


4 The Touch Screen buttons will no longer function.

4.3.2.2 Enabling the Touch Screen

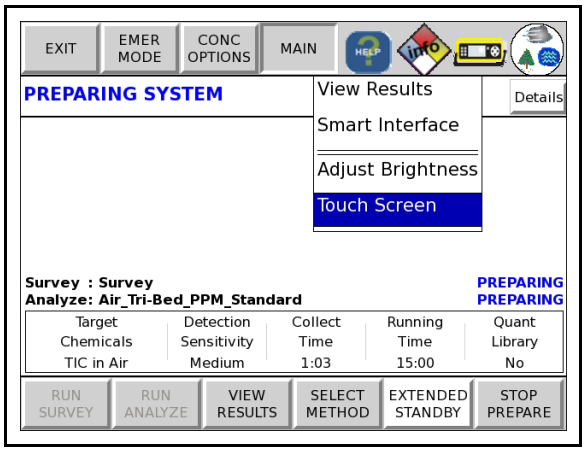
1 Using the **arrow keys**, highlight **MAIN** and touch **OK SEL**. See Figure 4-26.

Figure 4-26 MAIN Button



2 Use the **arrow keys** to highlight **Touch Screen** and push **OK SEL**. See Figure 4-27.

Figure 4-27 Touch Screen Option



3 Use the arrow keys to highlight **Enable**. Push **OK SEL**.

4 The Touch Screen buttons will now be functional.

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4.4 The USB Drive

4.4.1 Copying Files to the USB

Data files can be saved to the USB drive on the HAPSITE.

NOTE: Data is always saved to the hard drive of the HAPSITE. If the laptop is connected, the data file will also be saved to the laptop. The USB drive is designed to be used when the laptop is not connected to the HAPSITE, but the laptop will be used later for further analysis.

1 Insert the USB drive into the USB port which is located on the top left hand side. See Figure 4-28.

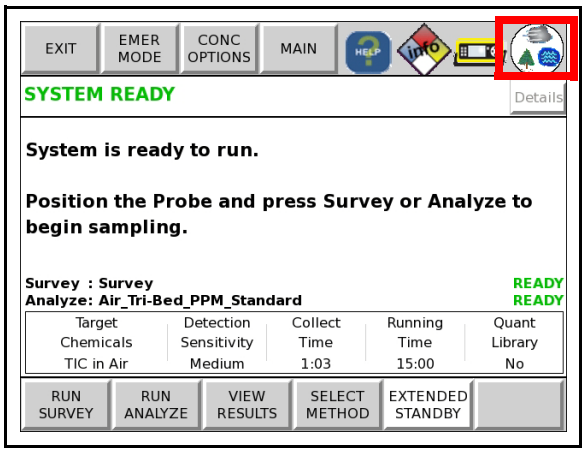
NOTE: When inserting the USB drive, the solid portion should be on the right.

Figure 4-28 USB Drive

2 Close the front panel of the HAPSITE.

3 Touch the **Accessories** icon. Alternately, push the **STAT** button until the **Accessories** icon is highlighted. See Figure 4-29.

Figure 4-29 Accessories Icon



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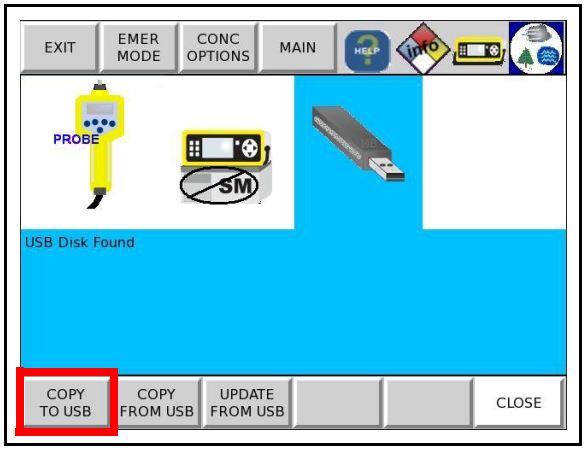
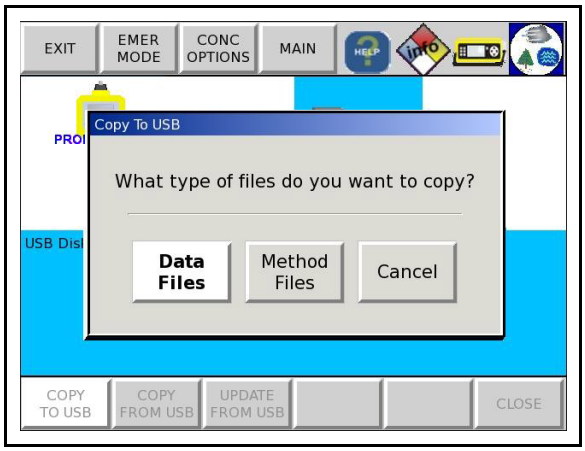
4 Touch the **USB** icon.Touch **Copy to USB** or using the **arrow keys**, highlight **Copy to USB** and push **OK SEL**. See Figure 4-30.

Figure 4-30 USB Icon



5 When the system prompts, **What type of files do you want to copy?**, select the desired option. See Figure 4-31.

Figure 4-31 Type of File



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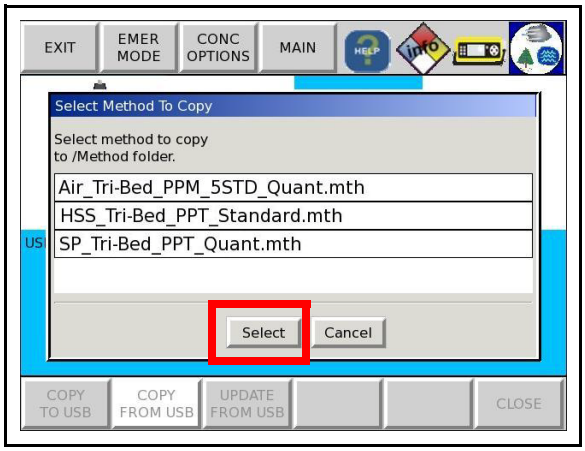
6 Touch the desired file for copying and touch **Select**. Alternately, use the **arrow keys** to highlight the desired file and push **OK SEL**. See Figure 4-32.

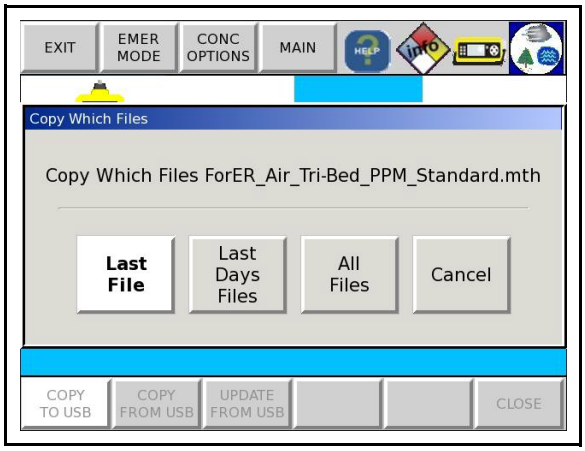
NOTE: If there is only one file on the drive, this option will not be available.

Figure 4-32 Select Files



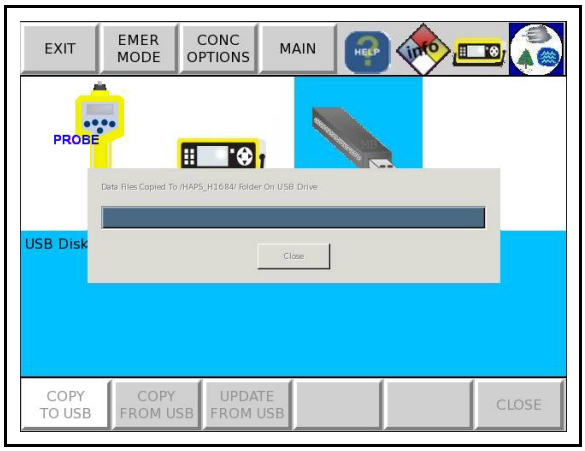
7 Touch the desired copying option or use the **arrow keys** to highlight the desired option and push **OK SEL**. See Figure 4-33.

Figure 4-33 Copy Files



8 A bar will be displayed on the screen to show the download's progress. Touch **Close** to return to the **Accessories** page and complete the download. If another download is desired, touch the **USB** icon again.See Figure 4-34.

Figure 4-34 Progress Bar



4.4.2 Copying Files From the USB

The Copying Files from the USB button can be used to transfer methods from the laptop to the HAPSITE. To copy files to the USB, use the following procedure.

1 Insert the USB drive into the USB port which is located on the top left hand side. See Figure 4-35.

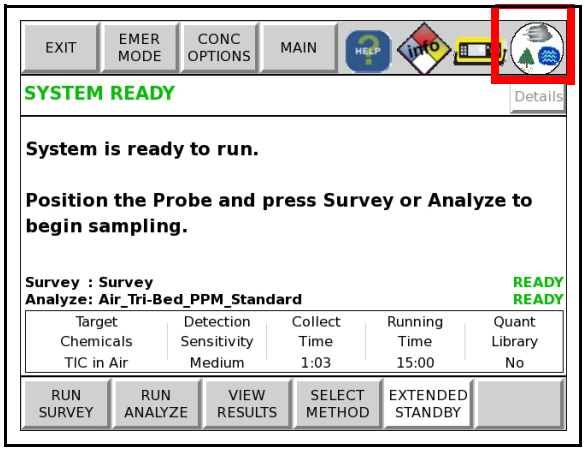
NOTE: When inserting the USB drive, the solid portion should be on the right.

Figure 4-35 Inserting USB Drive

2 Close the front panel of the HAPSITE.

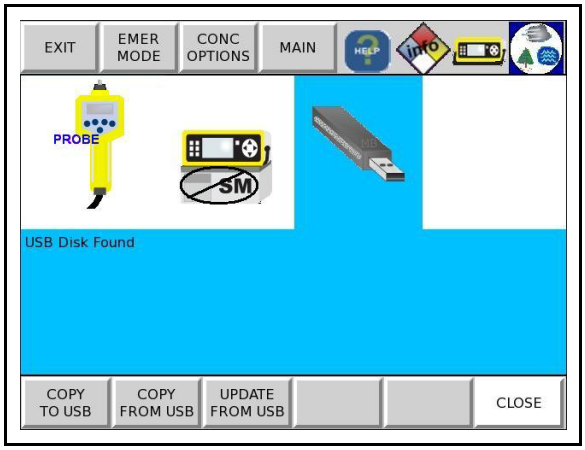
3 Touch the **Accessories** icon. Alternately, push the **STAT** button until the **Accessories** icon is highlighted. See Figure 4-36.

Figure 4-36 Accessories Icon



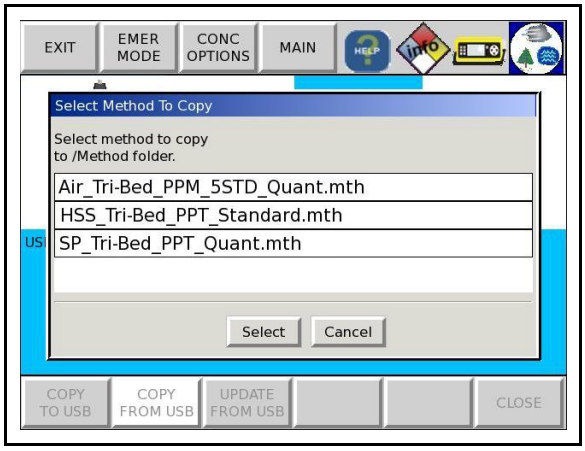
4 Touch the **USB** icon. Touch **COPY FROM USB** or using the **arrow keys**, highlight **COPY FROM USB** and push **OK SEL**. See Figure 4-37.

Figure 4-37 USB Icon



5 If only one file is available, then the download will start automatically. If multiple methods reside on the USB, the following screen will appear. Touch the desired method and touch **Select**. See Figure 4-38.

Figure 4-38 Select File



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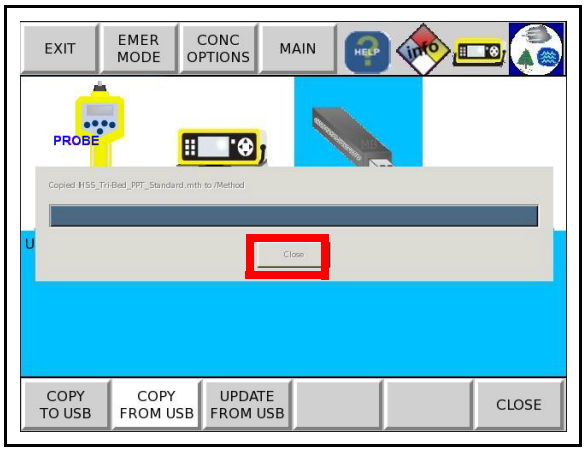
6 A progress bar will be shown on the screen. Touch **Close** to return to the USB screen. If another download is desired, touch the **USB** icon again. See Figure 4-39.

Figure 4-39 Progress Bar



4.4.3 Updating the Front Panel Software from the USB

Periodically, there may be updates to front panel software. The software can be updated using a USB drive.

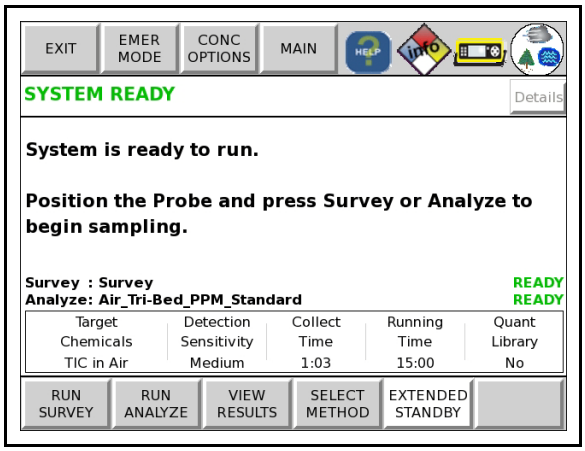
1. Insert the USB drive into the USB port which is located inside the front panel on the top left hand side.

   NOTE: When inserting the USB drive, the solid portion should be on the right.

2. Close the front panel of the HAPSITE.

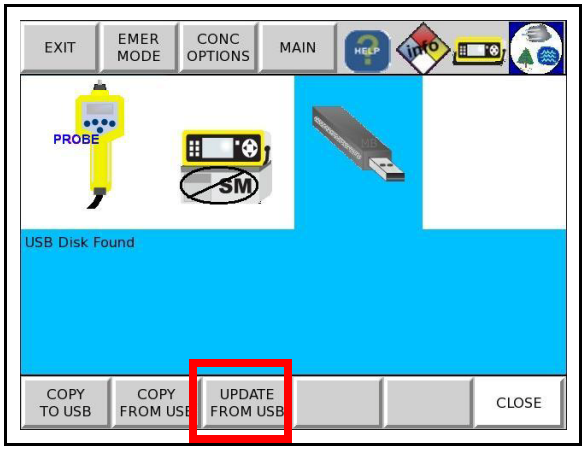
3. Touch the **Accessories** icon. Alternately, push the **STAT** button until the **Accessories** icon is highlighted. See Figure 4-40.

Figure 4-40 Accessories Icon



4. Touch the **USB** icon. Touch **UPDATE FROM USB** or using the **arrow keys**, highlight **UPDATE FROM USB** and push **OK SEL**. See Figure 4-41.

Figure 4-41 USB Icon



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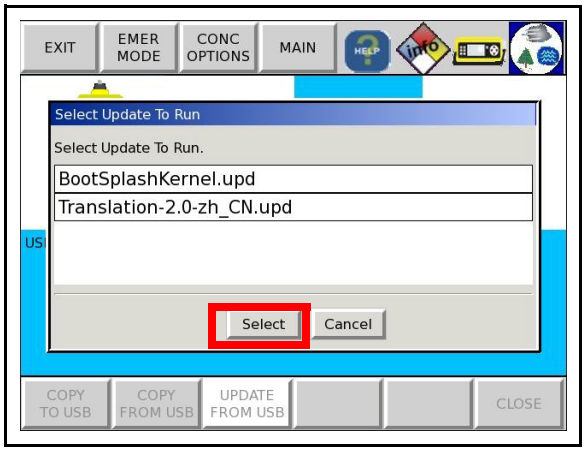
5 Touch the desired update and touch **Select**. See Figure 4-42

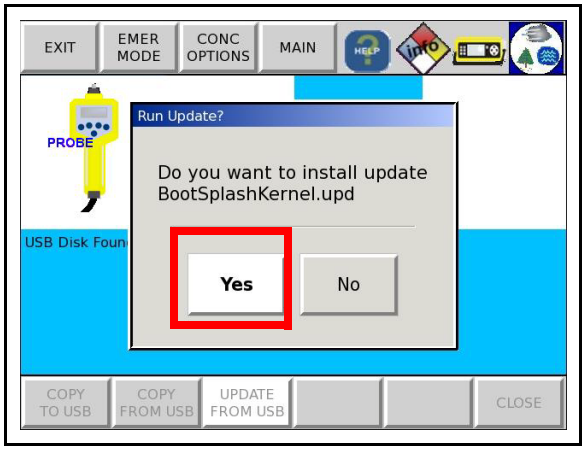
NOTE: If there is not an update file on the USB drive, a message stating that there is not an available update will appear.

Figure 4-42 Update From USB



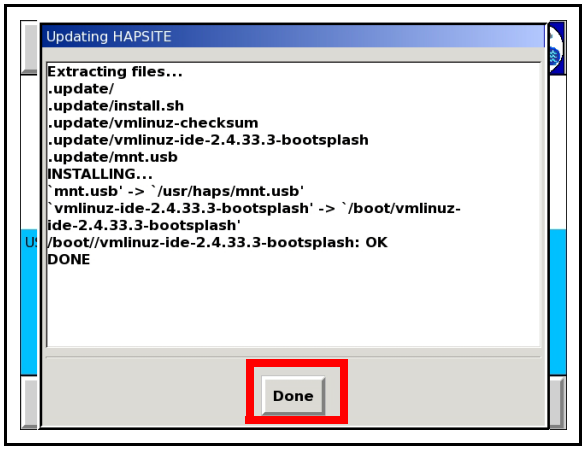
6 A confirmation screen will appear. To continue, touch **Yes**. Otherwise, touch **No**. Alternately, use the **arrow keys** to highlight **Yes** and push **OK SEL**. See Figure 4-43.

Figure 4-43 Confirmation Screen



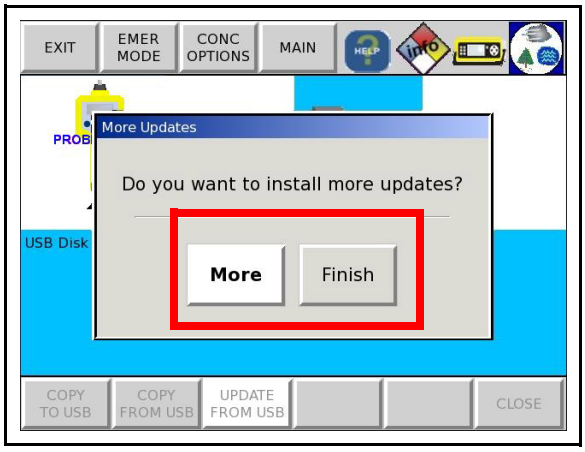
7 The following screen will be displayed while the system is updating. Touch **Done** to exit this screen. See Figure 4-44.

Figure 4-44 Updating HAPSITE



8 The screen will prompt, **Do you want to install more updates?** If another update is desired, touch **More**. To close out of this feature, touch **Finish**. Alternately, use the **arrow keys** to highlight the desired option and push **OK SEL**. See Figure 4-45.

Figure 4-45 Installing Updates



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4.4.4 Retrieving Files from the USB

Once files have been saved to the USB drive, they can be transferred to the Laptop for analysis.

NOTE: There are many ways to access files on the Laptop. These instructions demonstrate only one way to retrieve Data Files.

1. Insert the USB drive into the USB port in the Laptop.
2. Right-click on the **START** button.
3. Left-click on **Explore**. This will open the **Start Menu** window.
4. Left-click to highlight the file to be transferred.
5. Right-click and select **Copy**.
6. Right-click in the destination directory and select **Paste**.

   NOTE: The files need to be placed in the correct directory.

   NOTE: Use the **Safely Remove Hardware** feature of Microsoft Windows before unplugging the USB drive from the PC. Failure to do so can corrupt the USB drive. The HAPSITE USB can be unplugged without using this safety option.

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Chapter 5
Operating HAPSITE in Laptop Mode

5.1 Starting the HAPSITE in Laptop Mode

Starting the HAPSITE in Laptop Mode refers to using the HAPSITE in conjunction with the Laptop computer.

NOTE: See Chapter 8, Plus IQ Software for additional information on the Plus IQ Software installed on the Laptop computer.

Required Materials

- HAPSITE (AM)
- Internal standard gas canister
- Carrier gas canister
- Charged battery
- Probe
- Crossover cable
- Laptop computer
  - Mouse (optional)
  - Power supply
- AC To DC Power Converter power supply, unless powered by a Service Module.

Procedure

1. Assemble the HAPSITE as shown in Section 2.4, Basic Assembly, on page 2-5.
2. Press the **POWER** button on the front panel to turn on the HAPSITE. The HAPSITE takes 1-2 minutes to power on.

   NOTE: If desired and equipped, the HAPSITE can be used with the Laptop computer connected via the wireless connection. Refer to Chapter 4, Wireless and Touch Screen Options for additional information on set-up and usage.
3. The Laptop computer needs to be powered on. Locate the power cord and mouse (optional). Plug them into the appropriate places on the back of the computer. Open the Laptop and press the power button.

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5.2 Survey Mode

The Survey Mode is used for quick analysis and tentative results. The run period is determined by the user, but it is generally two minutes long.

Overview:

- Sample the air away from the area of concern for one minute to determine the background composition.

CAUTION

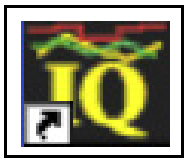
Do not touch the sample with the probe. Do not allow liquids to enter the Probe.

- When the background has been determined, sample directly over the area of concern to see what additional chemicals are present.

NOTE: See Chapter 6, Methods, for additional information on the Survey method.

1 Open the **Plus IQ** software by double-clicking on the icon shown in Figure 5-1.

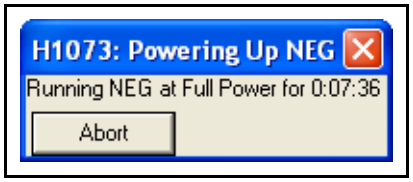
Figure 5-1 Plus IQ Icon



2 When powered on or taken out of Extended Standby (refer to section 3.1 on page 3-1 or section 3.8.1 on page 3-63), the HAPSITE will automatically start preparing the start up method. If this method is not the desired method, see Section 5.3, Selecting a New Method, on page 5-7.

3 The following message will appear on the Laptop during the power on sequence. See Figure 5-2.

Figure 5-2 NEG Full Power



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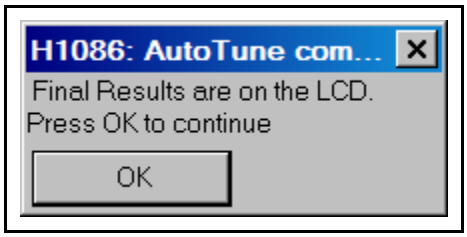
4 As part of the HAPSITE's preparation, it will run AutoTune. If AutoTune successfully runs and completes, the AutoTune OK message will appear. Click **OK**. See Figure 5-3. If AutoTune fails, see Section 7.4, AutoTune Failure, on page 7-6. When the final results message is displayed, click **OK**.

Figure 5-3 AutoTune Complete



5 The HAPSITE will check pressures and automatically heat all necessary zones to the setpoint temperatures specific to the selected method. Progress will be indicated by a bar graph.

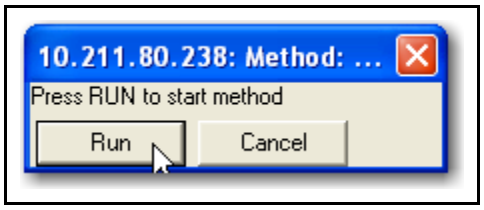
6 Click the **RUN METHOD** icon. Click on the Survey folder. Click on the folder of the desired configuration, and then click on the method folder. See Steps 2-4 of section 5.3.

CAUTION

Do not touch the sample with the Probe. Do not allow liquids to enter the Probe.

7 Click the **RUN** button on the pop-up window or from the control panel on the screen. See Figure 5-4.

Figure 5-4 Run Button



8 Sample the background for one minute and note the TIC.

9 Hold the Probe over the sample of interest for up to 1 minute. If the TIC begins to rise, slowly back the Probe away from the sample. If the TIC does not rise after a full minute, move the probe away from the sample.

9a A peak may appear if the compound present is >10 ppm. A compound identification may also be present on the HAPSITE screen.

NOTE: No response may indicate either the compound present is less than the detection limit, or that no detectable compound is present.

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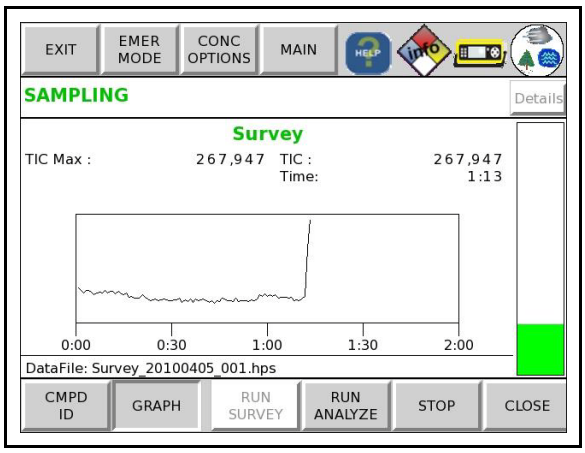
10 Monitor the Probe distance indicator bar on the HAPSITE screen for guidance. See Figure 5-5. The bar rises as the TIC increases. To avoid saturation, remove the Probe from the sample when the bar is high and turns yellow.

Figure 5-5 Survey Probe Distance Indicator Bar



11 Move the probe away from the sample of interest. Monitor the TIC count until the level returns to the initial background level that was noted in step 6.

12 Click on the **STOP** button (in the center of the control panel on the right side of the screen) to stop the sampling process and save the data. See Figure 5-6 and Figure 5-7.

Figure 5-6 Stop Button

NOTE: Remember that this is a tentative identification. For a more positive identification, run an Analyze (GC/MS) method for confirmation of the results.

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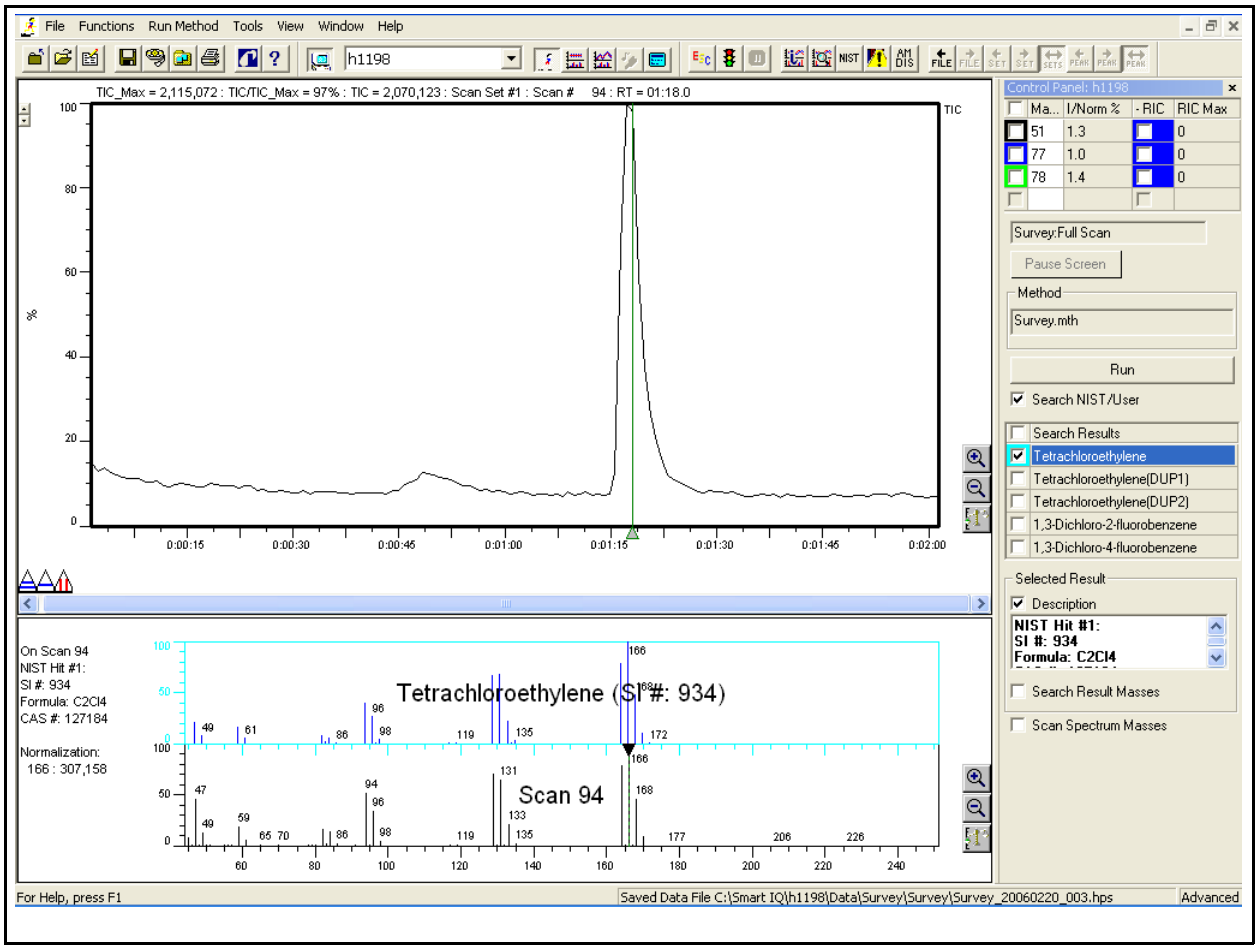
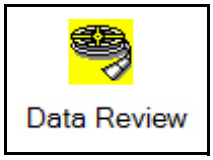
Figure 5-7 Sample Survey Run Complete



13 To view the data, note the data file name and click on the **Data Review** icon. This icon is located in the Setup System window of the Plus IQ software. See Figure 5-8.

Figure 5-8 Data Review Icon



14 Select the Survey folder and locate the data file that was noted. Refer to Figure 5-7. See also Chapter 9, Data Review.

NOTE: If the HAPSITE has been left unattended, the message **SYSTEM IS NOT READY** may appear. To begin preparing the system again, either touch **PREPARE** or using the **arrow keys**, highlight **PREPARE** and push **OK SEL**.

5.2.1 Quick Reference SOP — Running Survey Mode

1. Either power on the HAPSITE or take the HAPSITE out of Extended Standby.
2. Double-click the **Plus IQ** software icon.
3. Wait for heaters to reach the set temperatures.
4. Select the desired method. See Steps 2-4 of section 5.3 on page 5-7.
5. Click the **RUN** button in the pop-up window.
6. Sample background for one minute.

CAUTION

Do not touch the sample with the Probe. Do not allow liquids to enter the Probe.

7. Hold the Probe over the sample for one minute or until observing a response.
8. Press **Stop** to stop the sampling and save the data.

NOTE: This is a tentative identification. For more positive identification, run an Analyze (GC/MS) method.

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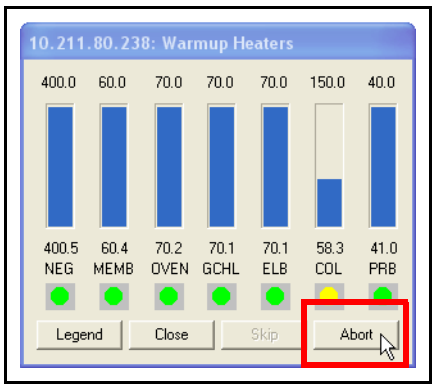
5.3 Selecting a New Method

1 Click the **Abort** button. See Figure 5-9.

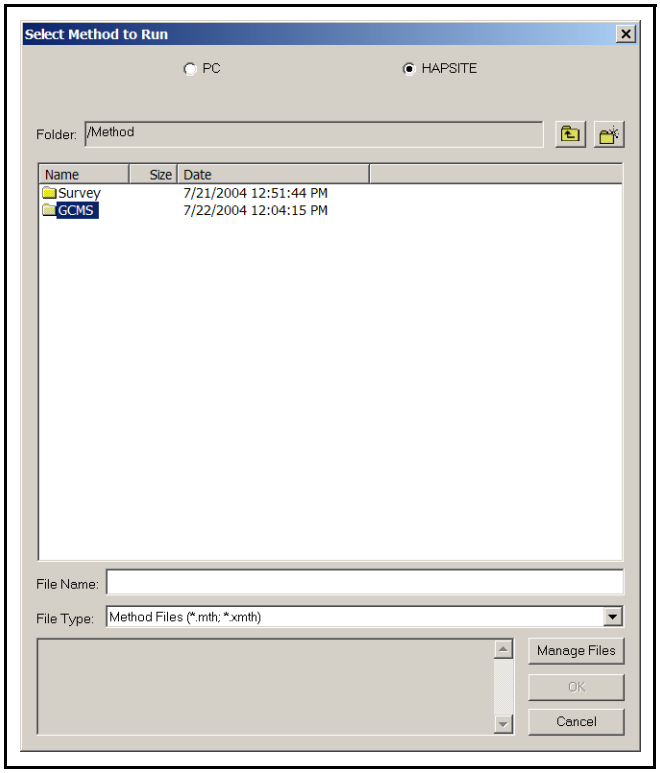
Figure 5-9 Aborting Method



2 Double-click on the **Run Method** icon. A dialog is displayed to choose the type of method to run. This example is an Analyze (GC/MS) run, so double-click the **GCMS** folder. See Figure 5-10.

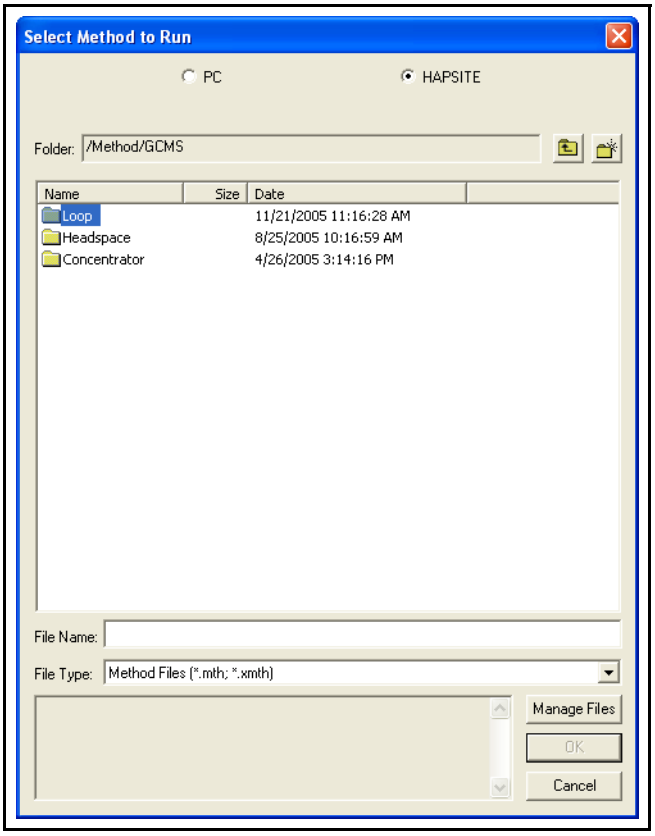
NOTE: Use the buttons at the top of the dialog to choose the methods on the HAPSITE.

Figure 5-10 Choosing the Mode of Operation



3 Choose a folder that matches the physical configuration of the HAPSITE. In this example the Sample Loop is installed; double-click the **Loop** folder. See Figure 5-11.

Figure 5-11 Selecting the Physical Configuration



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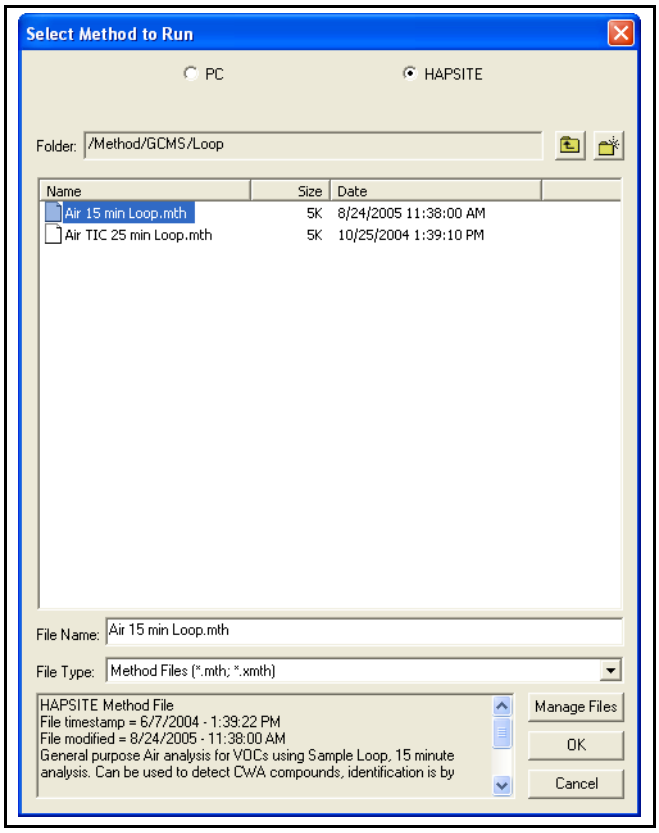
4 Click the desired method and then click **OK**. See Figure 5-12

Figure 5-12 Selecting the Method



5 The software will check the pressure in the gas canisters, heat up all necessary components, run an AutoTune (if required), and make tune adjustments as necessary. A Concentrator Cleanout will also be run if needed. The process may take up to 20 minutes.

6 When it is done heating, a prompt will appear to indicate the HAPSITE is ready to run a sample. Click **RUN**.

CAUTION

Do not touch the sample with the Probe. Do not place the sample Probe in liquids while sampling.

5.4 Analyze (GC/MS) Mode with Loop

This method is used for analyzing samples with concentration levels in the low part per million (ppm) to high part per billion (ppb) range. This can be used after Survey to detect and/ or confirm unknowns in the environment. See Chapter 6, Methods for additional information on (GC/MS) methods.

WARNING

Remember that the Survey method must be followed by an Analyze (GC/MS) method in order to give a positive identification of the unknown.

This section will describe the process required to run a sample with the Sample Loop installed. Make sure that the Sample Loop is installed before turning on or taking the HAPSITE out of Extended Standby. Refer to Section 2.4, Basic Assembly, on page 2-5 and Section 2.10.1, Installing the Sample Loop, on page 2-31.

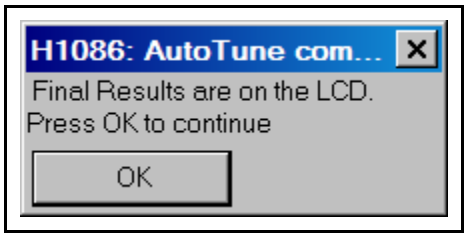
1. Double-click the **Plus IQ** icon to open the software. See Figure 5-13.

Figure 5-13 Plus IQ Icon

2. When powered on or taken out of Extended Standby (refer to section 3.1 on page 3-1 or section 3.8.1 on page 3-63), the HAPSITE will automatically start preparing the start up Loop method. If this method is not the desired method, see Section 5.3, Selecting a New Method, on page 5-7.

3. As part of the preparation progress, it will heat all necessary components, check pressures and run an AutoTune if necessary. Progress of the preparation will be shown as a bar graph on the Laptop screen. If AutoTune fails, see Section 7.4, AutoTune Failure, on page 7-6. When the final results message is displayed, see Figure 5-14, click **OK**.

Figure 5-14 AutoTune Complete



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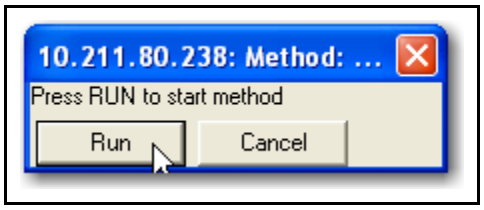
4 The HAPSITE will check pressures and automatically heat up all necessary zones to the setpoint temperatures specific to the selected method. Progress will be indicated by a bar graph.

5 If this method is not the desired method, see Section 5.3, Selecting a New Method, on page 5-7.

6 Click the **RUN METHOD** icon. Click on the GC/MS folder. Click on the folder of the desired configuration and then click on the method folder. See Steps 2-4 of section 5.3.

7 Click **RUN** button on the pop-up window or from the control panel on the Laptop screen. See Figure 5-15.

Figure 5-15 Run Button



8 When the HAPSITE screen prompts **Collect Sample Now**, place the probe over sample for the specified amount of time.

CAUTION

Do not touch the sample with the probe. Do not place the sample Probe in liquids while sampling.

9 Move the probe away from the sample when the screen prompts **Sampling Done**.

10 As the method runs, the chromatogram will begin to appear on the screen. See Figure 5-16 for an example of a chromatogram in progress.

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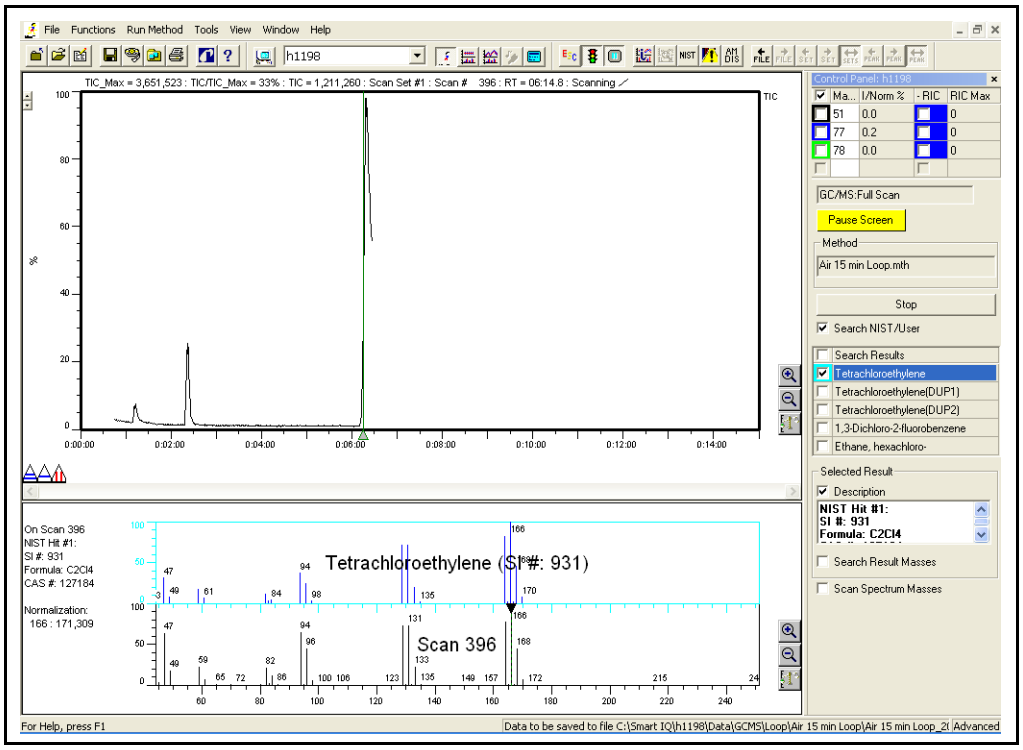
Figure 5-16 Chromatogram in Progress



11 Wait for the method to run to completion. Figure 5-17 is an example of a finished run. The HAPSITE screen will also display a **METHOD FINISHED** message.

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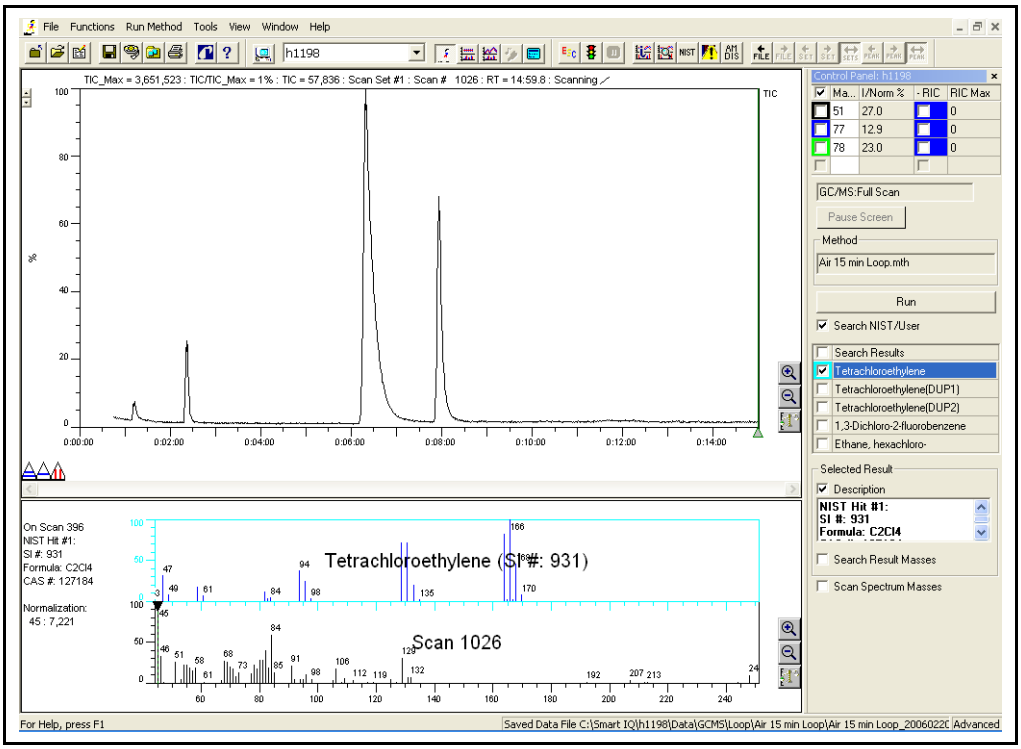
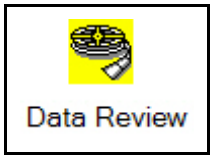
Figure 5-17 Sample Complete



12 Review results at the end of the run.

13 To view the data, note the data file name and click on the **Data Review** icon in the Setup System window of the Plus IQ software. See Figure 5-18.

Figure 5-18 Data Review Icon



14 Select the **Loop** folder and locate the data file that was just run. Full instructions for data review are found in Chapter 9, Data Review.

NOTE: If the HAPSITE has been left unattended, the message **SYSTEM IS NOT READY** may appear. To begin preparing the system again, either touch **PREPARE** or using the **arrow keys**, highlight **PREPARE** and push **OK SEL**.

5.4.1 Quick Reference SOP — Running Analyze (GC/MS) Loop Method

1. Verify that the Sample Loop is installed.
2. Power on or take the HAPSITE out of Extended Standby.
3. The HAPSITE will begin to prepare the start up Loop method. See Section 5.3, Selecting a New Method, on page 5-7 if the start up method is not the desired method.
4. Double-click the **Plus IQ** icon to open the software.
5. If the HAPSITE runs an AutoTune, press **OK** when the screen prompts.
6. Click the **RUN METHOD** icon and choose the method that has been prepared. Refer to Steps 2-4 of section 5.3 on page 5-7.
7. Click the **Run** button in the pop-up window of the software
8. When the screen prompts, **Collect Sample Now**, hold the probe over the sample for the specified amount of time.
9. Remove the Probe from the sample when the screen prompts, **Sampling Is Done**.
10. Let the method run to completion.
11. Review data when run is complete.

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5.5 Analyze (GC/MS) Mode with Concentrator

5.5.1 Tri- Bed Concentrator

This method is used for analyzing samples with concentration levels in the low part per billion to high part per trillion range. It is used when a compound is suspected, but Survey does not show an increase in TIC count. See Chapter 6, Methods, for additional information on Analyze (GC/MS) methods.

5.5.2 The Tenax Concentrator

This method is also used for analyzing samples with concentration levels in the low part per billion to high part per trillion range. The Tenax's use is similar to that of the Tri-Bed. However, the Tenax concentrator will not effectively concentrate compounds with boiling points below 80 degrees Centigrade. See Chapter 6, Methods, for additional information on Analyze (GC/MS) methods.

WARNING

The Tenax Concentrator cannot detect compounds with boiling points below 80 degrees centigrade.

For help installing the Concentrator, refer to Section 2.10.3, Installing the Tri-Bed or Tenax Concentrator, on page 2-34 for instructions. Once installed, the Concentrator must be cleaned before sampling begins.

1. Verify that the Concentrator is installed.
2. When powered on or taken out of Extended Standby (refer to section 3.1 on page 3-1 or section 3.8.1 on page 3-63), the HAPSITE will automatically start preparing the start up Concentrator method. If the method that the HAPSITE begins preparing is not the desired one, refer to Section 5.3, Selecting a New Method, on page 5-7.
3. Power on the Laptop by pushing the **Power** button. Open Plus IQ Software by double-clicking on the **Plus IQ Icon**. See Figure 5-19.

   Figure 5-19 Plus IQ Software Icon

   

4. During the preparation, the HAPSITE will heat all necessary components, check pressures and run an AutoTune if necessary. Progress of the preparation will be shown as a bar graph on the Laptop screen. If AutoTune fails, refer to Section 7.4, AutoTune Failure, on page 7-6. When the final results message is displayed, click **OK**. See Figure 5-20.

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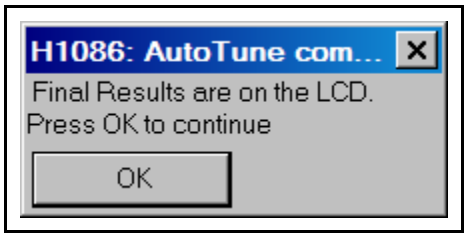
Figure 5-20 AutoTune Complete



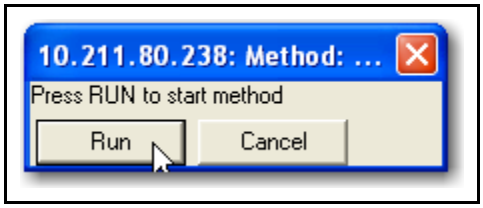
5 A Concentrator Cleanout will also be run as part of the HAPSITE's preparation. If the Cleanout is successful, a green **SYSTEM READY** message will be displayed. If the Cleanout is unsuccessful, refer to Section 3.1.3, Concentrator Cleanout Failure, on page 3-11. If this method is not the desired method, refer to Section 5.3, Selecting a New Method, on page 5-7.

6 Click the **RUN METHOD** icon. Click on the GC/MS folder. Click on the folder of the desired configuration and then click on the method folder. See Steps 2-4 of section 5.3 on page 5-7.

7 Once all temperature zones have reached their setpoints, a prompt will appear **Press RUN to start method**.

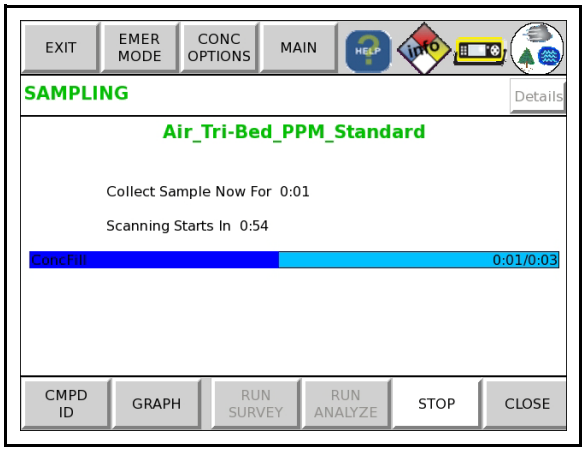
8 Click **RUN** button on the pop-up window or from the control panel on the screen.

Figure 5-21 Run Button



9 When the HAPSITE screen prompts **Collect Sample Now**, sample for the specified amount of time. See Figure 5-22.

Figure 5-22 Collecting Sample for Concentrator



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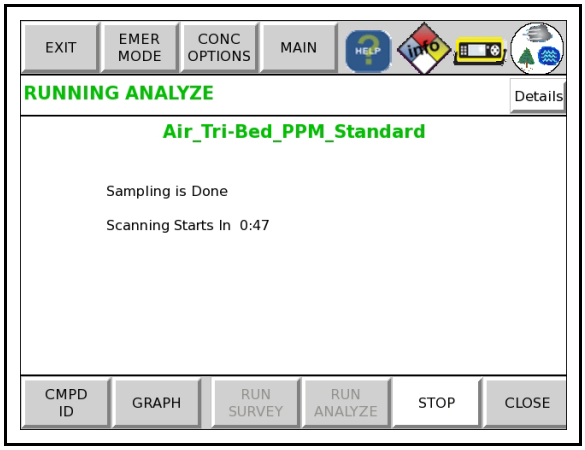
10 When prompted **Sampling is Done** on the HAPSITE screen, remove the probe from the sample source. See Figure 5-23.

Figure 5-23 Sampling Done For Concentrator

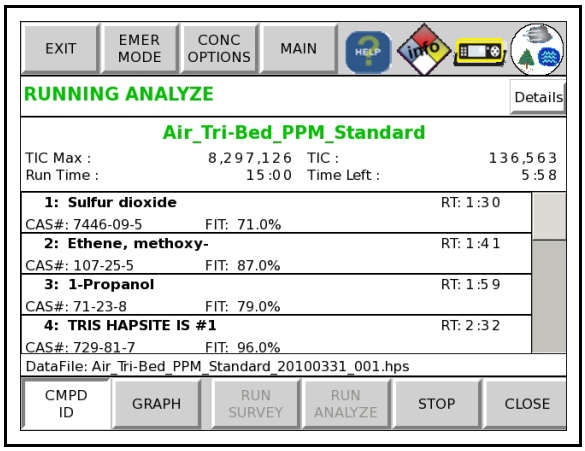


CAUTION

Do not touch the sample to the Probe. Do not place the sample probe in liquids while sampling.

11 The message **METHOD FINISHED** will appear on the HAPSITE screen when the run is complete. See Figure 5-24.

Figure 5-24 Method Finished for Concentrator



CAUTION

The Concentrator feature has increased sensitivity. Take care to avoid saturating the HAPSITE.

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NOTE: If the HAPSITE has been left unattended, the message **SYSTEM IS NOT READY** may appear. To begin preparing the system again, either touch **PREPARE** or using the **arrow keys**, highlight **PREPARE** and push **OK SEL**.

5.5.3 Quick Reference SOP — Tri-Bed Concentrator Method

1. Verify that the Concentrator is installed.
2. Power on or take the HAPSITE out of Extended Standby.
3. The HAPSITE will begin preparing a start up Concentrator method. Refer to Section 3.1.2, Concentrator Options (CONC OPTIONS), on page 3-8 for further information. See Section 5.3, Selecting a New Method, on page 5-7 if the start up method is not the desired method

CAUTION

Do not touch the sample to the Probe. Do not place the sample probe in liquids while sampling.

4. Click the **RUN METHOD** icon and choose the method that has been prepared. Refer to Steps 2-4 of section 5.3 on page 5-7.
5. A prompt to press **Run** will be displayed on the Laptop screen.
6. When the screen prompts, **Collect Sample Now**, hold the probe over the sample until the screen prompts, **Sampling Is Done**.
7. When the run is complete, a **Method Finished** prompt will appear.
8. See Section 3.5.1, View Results/View Reports, on page 3-32 or Chapter 9, Data Review for information on data review.

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5.6 Analyze (GC/MS) Mode with Headspace Sampling System

The Headspace Sampling System is used to test liquid and soil samples. See Chapter 13, Headspace Sampling System for more information on the Headspace System. Refer to Section 2.7, Headspace Sampling System, on page 2-13 for assembly instructions. See Chapter 6, Methods for additional information on GC/MS methods.

When used with the Concentrator, the Headspace can analyze samples with concentration levels in the low part per billion to high part per trillion range. It is used when the Headspace Sampling System with the Sample Loop method fails to detect a chemical. See Chapter 6, Methods for additional information on Analyze (GC/MS) methods.

CAUTION

The Concentrator feature has increased sensitivity. Take care to avoid saturating the HAPSITE.

1. Verify that the desired sample configuration is installed (i.e., Sample Loop or Concentrator.)
2. Double-click the **Plus IQ** icon on the Laptop screen.
3. Make sure that the Headspace Transfer Line is installed.
4. Place a 40 mL vial with either blank or sample into a Headspace well.

   NOTE: Do not fill 40 mL vial more than 20 mL full. See Section 13.2.3, Loading the Wells, on page 13-11 for detailed instructions about loading the sample vials into the wells.
5. Place a clean, empty 40 mL vial into a Headspace well.

WARNING

The Headspace needle is very sharp!

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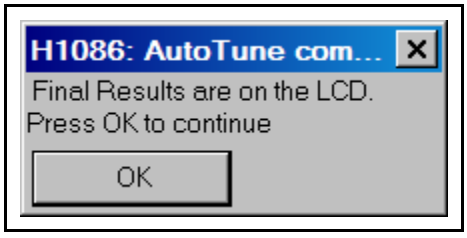
Figure 5-25 Headspace Needle

6 When powered on or taken out of Extended Standby (refer to section 3.1 on page 3-1 or section 3.8.1 on page 3-63), the HAPSITE will automatically start preparing the start up Headspace method. If the method that the HAPSITE begins preparing is not the desired one, refer to Section 5.3, Selecting a New Method, on page 5-7.

6a If running a Headspace method that requires a Concentrator, the HAPSITE will run a Concentrator Cleanout. Its progress will be shown by a bar graph. If the Concentrator Cleanout is not successful, refer to Section 3.1.3, Concentrator Cleanout Failure, on page 3-11.

7 As part of the preparation, the HAPSITE will heat all necessary components, check pressures and run an AutoTune if necessary. Progress of the preparation will be shown as a bar graph on the Laptop screen. If AutoTune fails, refer to Section 7.4, AutoTune Failure, on page 7-6. When the final results message is displayed, click **OK**. See Figure 5-26.

Figure 5-26 AutoTune Complete



8 Click the **RUN METHOD** icon. Click on the GCMS folder. Click on the folder of the desired configuration and then click on the method folder. See Steps 2-4 of section 5.3 on page 5-7.

9 Gently press the Headspace needle into the 40 mL vial that contains the blank/sample. See Figure 5-25.

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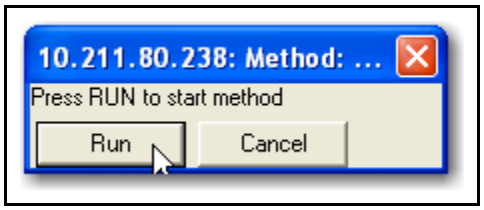
10 A prompt will appear **Press RUN to start method**.

NOTE: The sample must be heated for 20 minutes prior to sampling.

11 Click **RUN** button on the pop-up window or from the control panel on the screen.

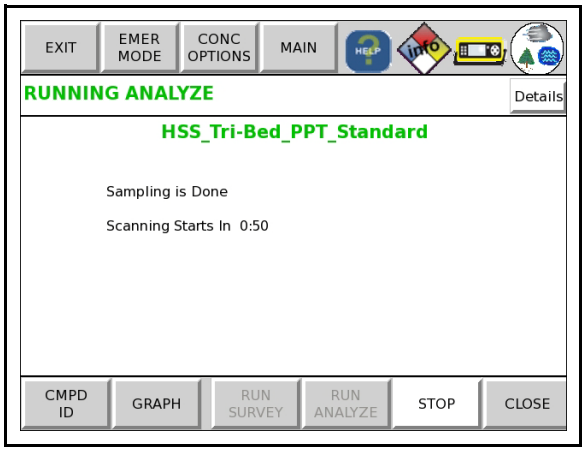
Figure 5-27 Run Button



12 The HAPSITE will prompt **Collecting Sample Now.** The Headspace will automatically start sampling. No action is required by the user.

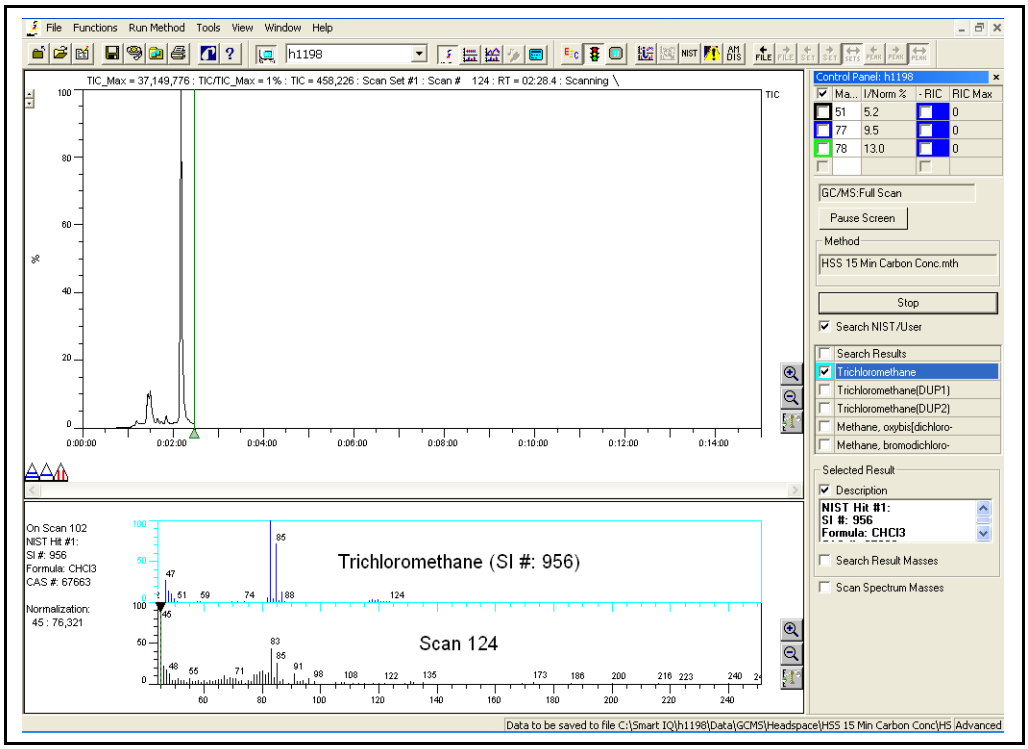
13 When the HAPSITE screen prompts **Sampling Done**, the Headspace has finished sampling. Again, no action is required by the user.

Figure 5-28 HSS Sampling Done



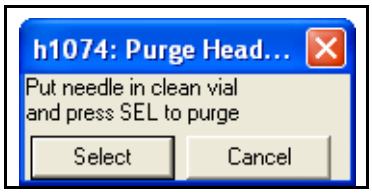
14 The chromatogram, showing the run's progress, will appear on the Laptop screen. See Figure 5-29.

Figure 5-29 Headspace Running a Concentrator Method



15 When prompted at the end of the run, place the Headspace needle into a clean, empty purge vial and click **Select**. See Figure 5-30.

Figure 5-30 Purge Vial Prompt



16 A **METHOD FINISHED** prompt will appear on the HAPSITE screen when the run is complete. See Figure 5-31 for an example of a completed chromatogram.

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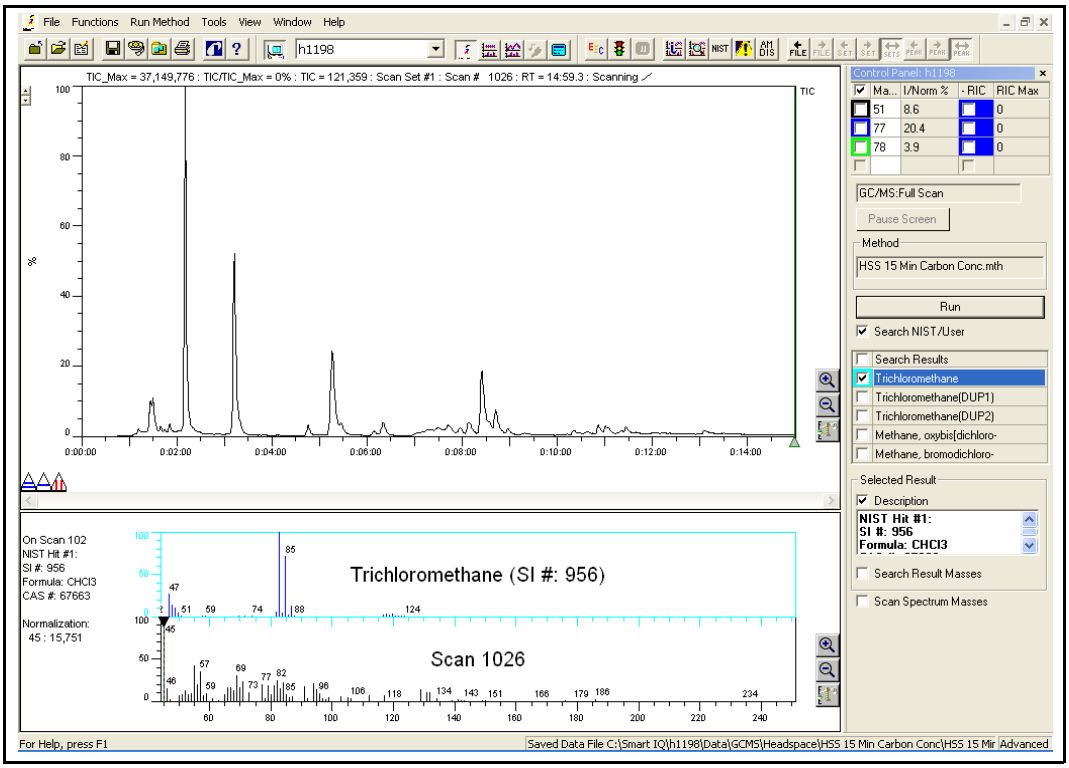
Figure 5-31 HSS Concentrator Method Finished



17 To analyze the data, see Chapter 9, Data Review.

NOTE: If the HAPSITE has been left unattended, the message **SYSTEM IS NOT READY** may appear. To begin preparing the system again, either touch **PREPARE** or using the **arrow keys**, highlight **PREPARE** and push **OK SEL**.

5.6.1 Quick Reference SOP — GC/MS Mode with HSS

1. Double-click the **Plus IQ** software icon.
2. Verify that the desired sample configuration (i.e., Sample Loop or Concentrator) is installed.
3. Power on or take the HAPSITE out of Extended Standby.
4. Depending upon the method, the HAPSITE may initiate a Concentrator cleanout. If needed, see Section 3.1.2, Concentrator Options (CONC OPTIONS), on page 3-8. See Section 5.3, Selecting a New Method, on page 5-7 if the start up method is not the desired method.
5. Following a 20 minute sample temperature equilibration in the HSS oven, gently press the Headspace needle into the 40 mL sample vial.
6. When the system has finished preparing, click the **RUN METHOD** icon and select the desired method. Refer to Steps 2-4 of section 5.3 on page 5-7.
7. Click the **Run** button in the pop-up window.
8. When the screen prompts **Collecting Sample Now** and **Sampling Is Done**, no action is required from the user.
9. When the run is complete, a **METHOD FINISHED** prompt will appear.
10. When prompted, place the Headspace needle in the purge vial and press **OK.**
11. To analyze the data, see Chapter 9, Data Review.

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5.7 SituProbe Methods

See Chapter 14 for more information on running SituProbe methods.

5.7.1 Procedure for SituProbe Operation

1 Verify that the desired sample configuration is installed (i.e., Sample Loop or Concentrator.)

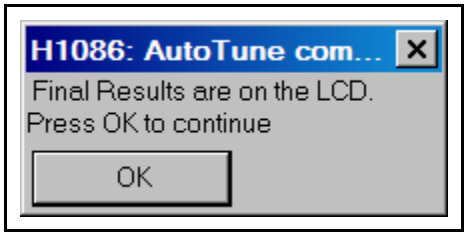
2 Make sure that the Transfer Line is installed.

3 When powered on or taken out of Extended Standby (refer to section 3.1 on page 3-1 or section 3.8.1 on page 3-63), the HAPSITE will automatically start preparing a SituProbe method. If the SituProbe method that the HAPSITE begins preparing is not the desired one, refer to Section 5.3, Selecting a New Method, on page 5-7.

3a When running a SituProbe method that requires a Concentrator, the HAPSITE will run a Concentrator Cleanout. Its progress will be shown by a bar graph. If the Concentrator Cleanout is not successful, refer to section Section 3.1.3, Concentrator Cleanout Failure, on page 3-11.

4 The HAPSITE will begin preparing to run the SituProbe method. It will heat all necessary components, check pressures and run an AutoTune if necessary. Progress of the preparation will be shown by a bar graph on the Laptop screen. If AutoTune fails, see Section 7.4, AutoTune Failure, on page 7-6. When the final results message is displayed, click **OK**. See Figure 5-32.

Figure 5-32 AutoTune Complete



5 Click the **RUN METHOD** icon. Click on the GC/MS folder. Click on the folder of the desired configuration and then click on the method folder. See Steps 2-4 of section 5.3 on page 5-7.

6 A prompt will appear **Press RUN to start method**.

7 Click **RUN** button on the pop-up window or from the control panel on the screen.

8 The screen will prompt **Collecting Sample Now**. The SituProbe is automatically collecting a sample. No action is required by the user.

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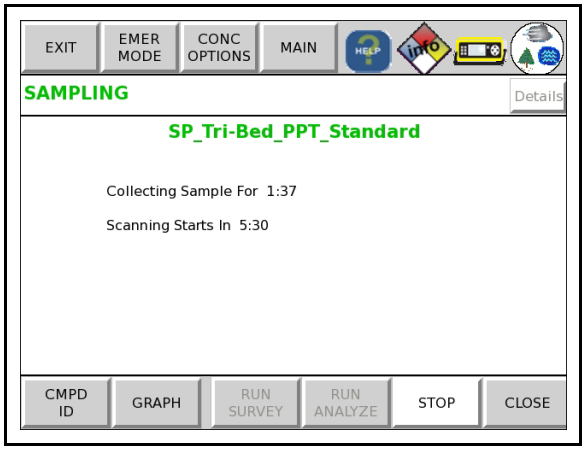
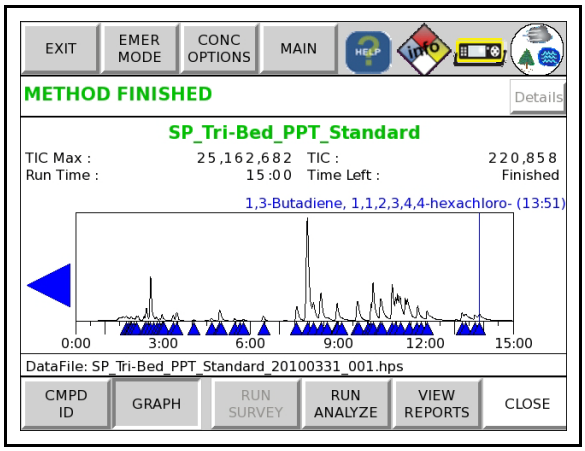
9 The next screen will prompt **Sampling is Done**. See Figure 5-33. No action is required by the user.

Figure 5-33 Sampling Done on SituProbe



10 When the run is complete, a **METHOD FINISHED** message will appear on the HAPSITE screen. See Figure 5-34.

Figure 5-34 SituProbe Method Finished



11 See Chapter 9, Data Review.

NOTE: If the HAPSITE has been left unattended, the message **SYSTEM IS NOT READY** may appear. To begin preparing the system again, either touch **PREPARE** or using the **arrow keys**, highlight **PREPARE** and push **OK SEL**.

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5.7.2 Quick Reference SOP — Analyze Mode with SituProbe

1. Double-click the **Plus IQ** software icon.
2. Verify that the desired sample configuration (i.e., Sample Loop or Concentrator) is installed.
3. Make sure the SituProbe is set-up properly. See Section 2.9, SituProbe, on page 2-27 for assembly information.
4. If necessary, power on the HAPSITE or take the system out of Extended Standby.
5. Depending upon the method, the HAPSITE will begin preparing the Concentrator. If needed, see Section 3.1.2, Concentrator Options (CONC OPTIONS), on page 3-8. See Section 5.3, Selecting a New Method, on page 5-7 if the start up method is not the desired method
6. When the system has finished preparing, click the **RUN METHOD** icon. Select the desired method from the appropriate folder. Refer to Steps 2-4 of section 5.3 on page 5-7.
7. Click the **Run** button in the pop-up window.
8. When the screen prompts, **Collect Sample Now** and **Sampling Is Done**, no action is required from the user.
9. When the run is complete, a **Method Finished** prompt will appear.
10. To analyze the data, see Chapter 9, Data Review.

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Chapter 6
Methods

6.1 Introduction to Methods

The versatility of the HAPSITE lies in the variety of methods available. The HAPSITE can be run in Analyze (GC/MS) mode or Survey (MS only mode) and uses various sampling accessories to extend its capabilities. The accessories include the Concentrator, the Headspace Sampling System and the SituProbe. This chapter describes the various sampling methods.

6.1.1 Sensitivity

The sensitivity of the HAPSITE is dependent on the configuration and sampling mode chosen. The Survey Mode is the least sensitive, requiring levels of greater than 10 ppm (parts per million) for detectability. The Sample Loop with the probe is able to detect levels in the low ppm to high ppb (parts per billion) ranges. With a Concentrator installed and using the probe, the HAPSITE can detect low ppb to high ppt (parts per trillion) levels. The Sample Loop with the Headspace Sampling System detects down to 5 to 10 ppb and will detect even lower with the Concentrator installed.

6.2 Survey Method

Survey is used to quickly screen a location for volatile compounds. The sample is drawn in through the probe and sent directly to the Mass Spectrometer. It bypasses the GC to provide a quick response. The Survey mode of sample collection is also referred to as MIMS (Membrane Interface Mass Spectrometry).

There are two ways the Survey Methods can provide tentative identification of compounds. They can either extract target mass spectra from the MS response or search the total MS response against the AMDIS or NIST library. Survey Methods, when run from the HAPSITE, also provide an indication of the concentrations of VOCs based on the response of the TIC (Total Ion Count). The LCD of the HAPSITE provides a real time plot of response vs. sampling time. Survey Methods can be Selected Ion Monitoring (SIM) or Full Scan methods. The sensitivity of a Survey method in full scan will be approximately 10 ppm or greater. A Survey SIM method gives an improved level of sensitivity compared to a Full Scan method.

NOTE: These sensitivity ranges should be viewed as general guidelines, as the sensitivity of individual compounds can vary.

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CAUTION

All unknown samples should first be collected with the Survey Method to estimate the total VOC response. The Survey Method allows the operator to gain knowledge of how far away to hold the probe from the sample and if a concentrator needs to be used.

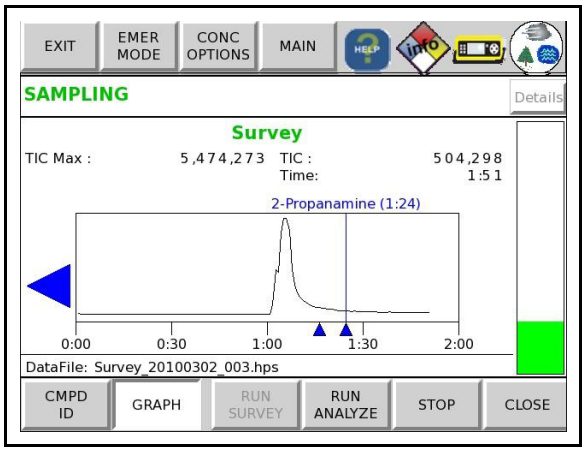
For a Survey run, the probe is, at first, held away from the suspected VOC source. This is to clear the Survey line and obtain a background signal level. The source should be sampled for up to 1 minute, depending on the result. If the TIC count remains under 5,000,000, then continue to sample for up to 1 minute. If the TIC count increases above 5,000,000, sample for 15 seconds. Then, allow the TIC graph to return to the baseline level. If the TIC count increases above 10,000,000. Move the probe back from the source or discontinue sampling. Allow the TIC to return to the background level before stopping the run. See Figure 6-1.

CAUTION

Do not touch the sample to the probe. Do not allow liquids to enter the probe.

HINT: Refer to Chapter 3, Operating HAPSITE in Portable Mode for additional information on running methods.

Figure 6-1 Sample Running Survey Method from the Front Panel



MAX . . . . . Is the maximum signal count for the TIC in the window. The TIC is an indication of the level of VOCs present at the source.

TIC . . . . . Is the current TIC level.

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6.2.1 Building a Survey Method Library File

Survey methods can be designed for data collection in three manners:

- without identification.
- qualitative analysis and identification based on match with the AMDIS library.
- Quantitative/Qualitative analysis, identification and quantification from a target library and unknown identification using the AMDIS library.

In Survey, the GC does not separate VOC's. Therefore, the process of building a Survey method is best accomplished by preparing and running individual standards for the target compounds at the desired concentration levels. Survey methods can be calibrated at a single level or over a concentration range. The accuracy of a Survey method is limited by the manner in which the data is collected and the external calibration technique. Survey method target libraries can be built by running multiple compounds in a single run. However, the user must edit the combined spectrum, and select the appropriate mass fragments for each compound. Compounds that share mass fragments cannot be run in the same standard.

6.2.1.1 Creating Survey Methods for Target Compounds

Collection of Survey data is controlled by the method. Survey methods, like Analyze (GC/MS) methods, are generated or modified using the Method Editor. The Method Editor is covered in detail in Chapter 11, Method Editor.

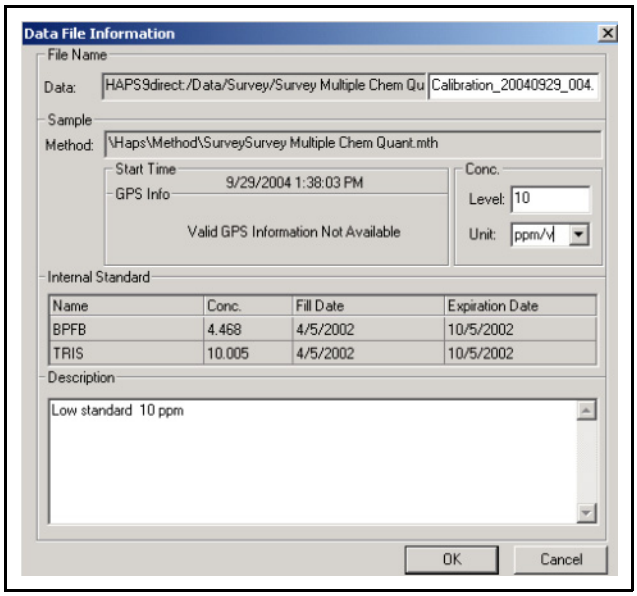
6.2.1.2 Building a Survey Target Compound Library

The library is built using the Calibrate Function. Calibrate is described in detail in Chapter 12, Target Compound Methods. The special features of building a Target compound Method for Survey are detailed in the following example.

Calibration samples must be collected prior to building the library. When collecting the calibration runs, enter the concentration of the calibration standard and the units in the Data File Info Header. The Data File Info Header is accessed by selecting the Data File Info button from the toolbar in the Data Review Window. See section 9.3, Data Review Toolbar, on page 9-5. See Figure 6-2.

 . . . . . Access Data File Info icon.

Figure 6-2 Data File Information Page



During the Calibration run, enter the concentration level of the calibration standard and select the corresponding units.

A description can be entered to help identify the sample.

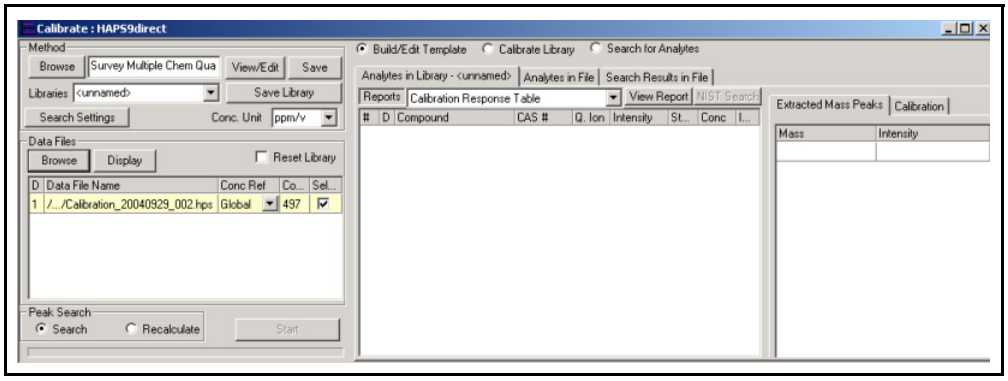
Open the Calibrate Function using the **Toolbar** Icon or the drop down menu. Select **Survey** as the file type and select **OK**. The File selection dialog box will be displayed. Locate and select the method that was used to collect the calibration runs.

Use the **Browse** button in the Data Files section to select and open the data file collected during the calibration run. The file(s) will be used to build the target library template. See Figure 6-3.

Highlighting a data file and pressing the **Display** button will display the calibration run.

NOTE: The best way to work with the graphical data is to expand the plot to full screen.

Figure 6-3 Calibration Window



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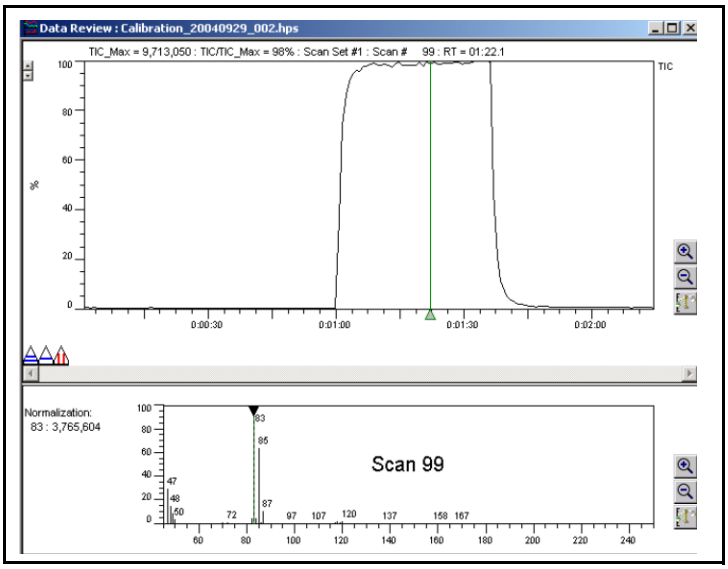
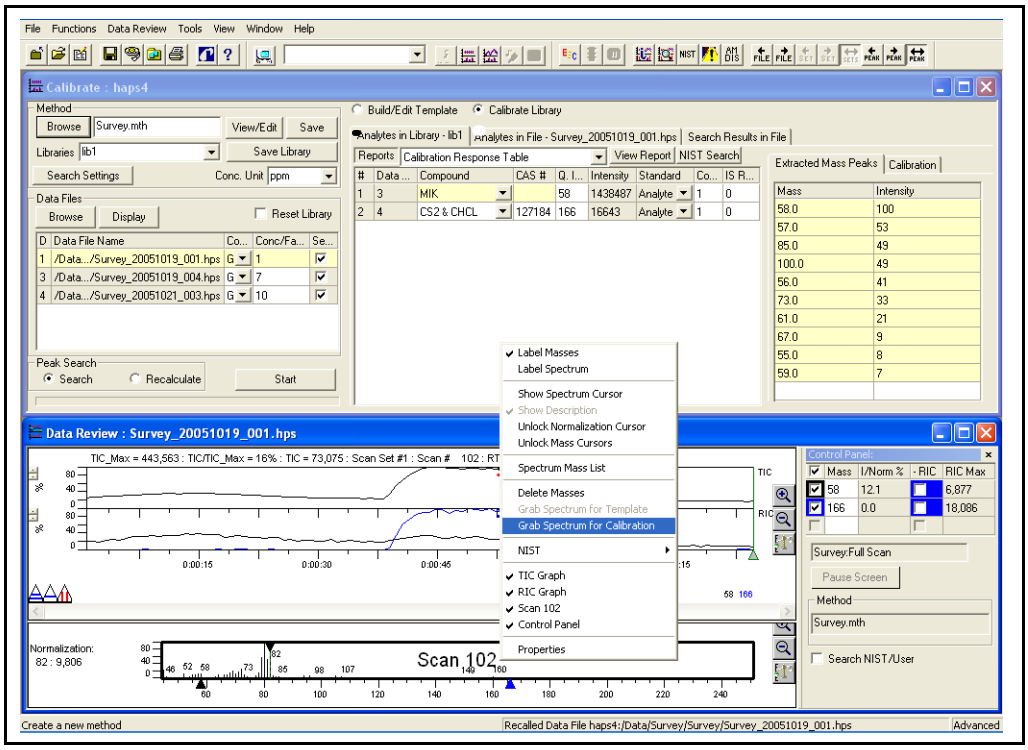
The spectrum of the analyte must be recorded to the target compound library. The spectrum is recorded by placing the scan cursor on the response curve (e.g., the TIC) at a location that represents the concentration of the calibration standard. See Figure 6-4.

Figure 6-4 Sample Placing Cursor on Response Curve at Location of Calibration Standard



The spectrum must be recorded to the library. Highlight the spectrum window and click the right mouse button to bring up the spectrum menu. Highlight **Grab Spectrum for Template** to record the spectrum. See Figure 6-5.

Figure 6-5 Grab Spectrum for Template Window



The compound is displayed in the **Analytes in Library** list and the extracted mass values are displayed. A compound name can be entered and the extracted mass list can be "cleaned up" for low intensity masses and more than one VOC in the Survey run. To edit the extracted mass list, all masses with intensity below 15% should be deleted. To delete a mass, click once on the mass in the **Extracted Mass Peaks** list and press the delete key. After adding all analytes to the template, the library can now be calibrated by checking the **Selection** box for the data file, selecting **Calibrate Library,** and then pressing **Start.**

The library should be saved at this time, the **Save Library** button under Method will display the dialog box to save the library. The library is linked to the method and can be saved using any name.

Additional calibration points can be added to the curve by using the **Browse** button to select additional data files. The selected files can then be processed as described above, and saved to the library. See Figure 6-6.

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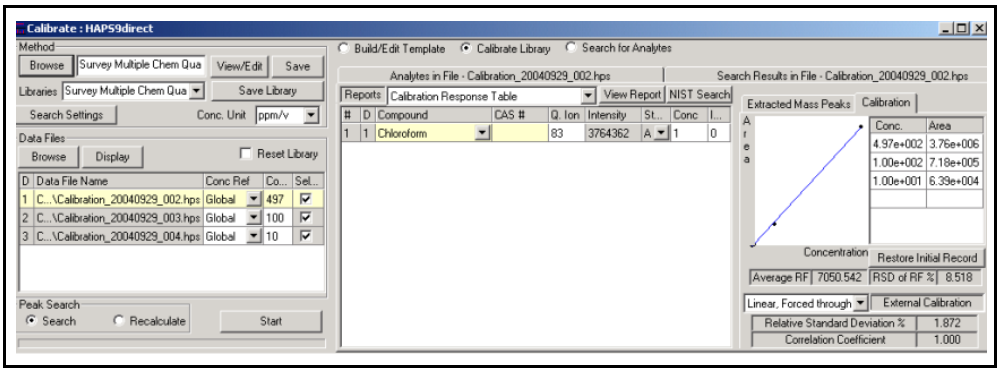
Figure 6-6 Additional Calibration Points



Additional compounds are added by following the same steps.

CAUTION

The Reset Library function is used to delete all calibration curves for all compounds and should only be checked when this action is necessary.

6.3 Analyze (GC/MS) Methods

GC/MS is a reliable means of identifying volatile organic compounds. The sample is drawn in through the probe or other sampling accessory. It is then passed through the GC, where the sample is separated by boiling point and sent to the Mass Spectrometer. Compounds are positively identified by GC retention time and mass spectrum.

Analyze (GC/MS) Methods provide identification of compounds in two ways. By extracting target mass ions from the MS response or as a result of searching the total MS response against the AMDIS and/or NIST libraries. GC/MS Methods can use Selected Ion Monitoring (SIM) or Full Scan MS modes. The sensitivity of an Analyze (GC/MS) Loop method (full scan) will be in the approximate range of high ppb to low ppm. The sensitivity of an Analyze (GC/MS) Concentrator method (full scan) will be in the range from high ppt to low ppb. By comparison, a SIM method will always give slightly improved sensitivity over a Sample Loop or Concentrator method as these methods focus on a limited set of masses for detection. The sensitivity is related to the compound and sampling system; the above are general guidelines.

CAUTION

All unknown samples should first be collected with the Survey Method to avoid saturating the GC. The Survey Method allows the operator to gain knowledge of how far away to hold the probe from the sample and if a Concentrator needs to be used.

The sampling procedure for an Analyze (GC/MS) method is dependent on the HAPSITE configuration. For information on running Sample Loop, Concentrator, HSS and/ or SituProbe samples, see either Chapter 3 for information on running them from the Front Panel or Chapter 5 for information on running them from the Laptop.

6.3.1 Building an Analyze (GC/MS) Method and Target Compound Library File

Collection of Analyze (GC/MS) data is controlled by the method. Analyze (GC/MS) methods are generated or modified using the Method Editor. The Method Editor is covered in detail in Chapter 11, Method Editor. The target compound library is built using the Calibrate Function. The calibrate function is described in detail in Chapter 12, Target Compound Methods.

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Chapter 7
Tune

7.1 Introduction to AutoTune and Manual Tune

Ensuring the mass spectrometer (MS) performance requires a functionality check at start-up and after 12 hours of continuous operation. The process of verifying the Mass Spectrometer functionality is called Tuning. Tuning can be accomplished by the AutoTune program, where the system sets and adjust all parameters, or by a Manual Tune where the user sets the parameters.

The tune of a MS determines the quality of the mass spectrum produced by the system. A good quality spectrum is one which matches either the reference spectrum from the National Institutes of Standards and Technology (NIST) library to give high similarity indexes, or the Automated Mass Spectral De-convolution and Identification Software (AMDIS) libraries to provide high NET matches. The tune file contains the parameters that control the MS and is linked to a data acquisition method. Multiple Tune files can be created for specific methods/requirements. However, the default Tune is generally all that is required. The default Tune is stored on the HAPSITE as **`default.tun`**.

The parameters set in Tune that affect the quality of the spectrum include:

Base Peak Gain . . . . . Sets the sensitivity level of the MS.

Mass Axis Calibration . . . . . Mass Spectrometers measure Atomic Mass Units (AMU); Tune insures that the Mass Axis is accurately calibrated.

Ratio of Mass Peaks. . . . . The Mass Calibration status measures and records the ratio of mass fragments to preset values. The ratio of the mass peaks controls the quality of the mass spectrum generated by the HAPSITE.

AutoTune and Manual Tune are performed using a calibration mixture in which the mass fragments (AMU) and the ratios of the mass fragments are known. The HAPSITE uses a mixture of two compounds that together provide mass fragments across the mass range of interest. The compounds are:

- 1,3,5-Tris (trifluoromethyl) benzene
- Bromopentafluorobenzene.

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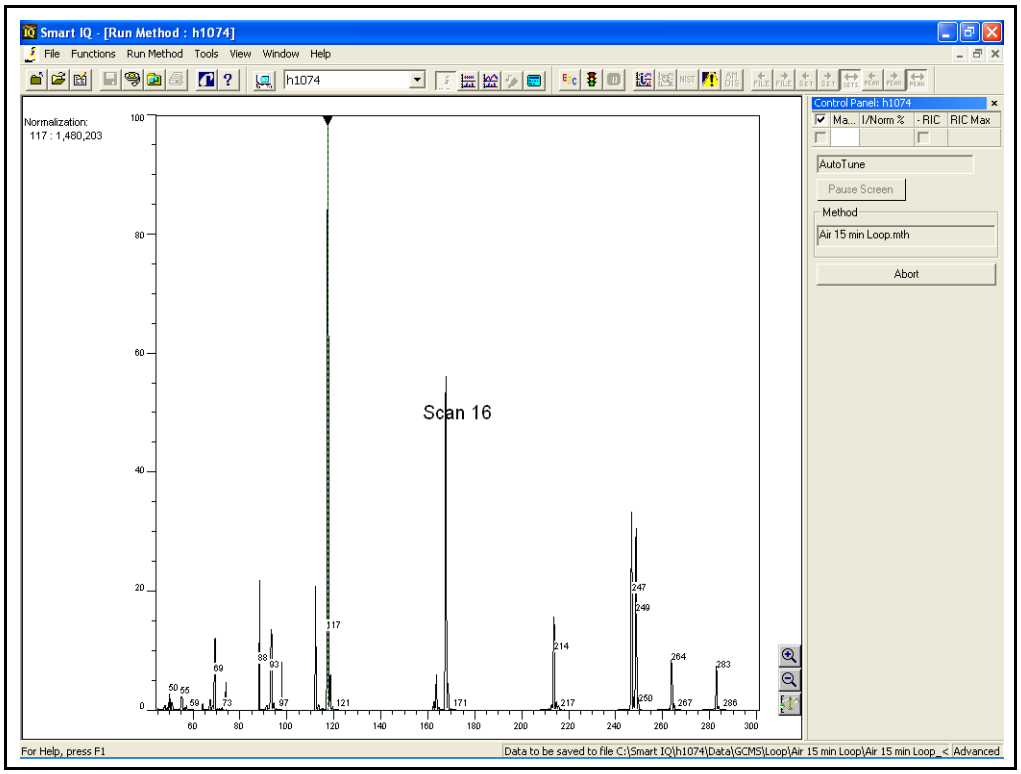
7.2 AutoTune

There are two versions of the AutoTune program: Short and Long. The Short AutoTune program is the daily maintenance tune of the HAPSITE. It is pre-configured to run automatically at startup, after the system has been powered OFF and ON with a method selected, or after an twelve hour period of operation. Short AutoTune can also be invoked from the Manual Tune function at anytime. The Short AutoTune will check if all parameters are within specifications, record the dwell statistics (Baseline/Threshold), create a Tune report and proceed to the Run Method function. If corrections are required, the program will automatically make the correction, measure the dwell statistics, create the report, and then proceed to the Run Method function.

Figure 7-1 show sample screens displayed during an AutoTune. The status screens will vary depending on the corrections or adjustments required.

Figure 7-1 Status Screen from Laptop During AutoTune



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7.2.1 Starting AutoTune from the Manual Tune Screen on the Laptop Computer

1 Double-click on the **Plus IQ icon**. See Figure 7-2.

Figure 7-2 Plus IQ Icon

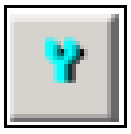
2 Double-click on the **Tune Icon**. See Figure 7-3.

HINT: Only the Advanced Access level can run Manual Tune.

Figure 7-3 Manual Tune Icon

3 Wait until the EM and Emission buttons in the control panel turn green, then click the **Tune icon**. See Figure 7-4.

Figure 7-4 Tune Icon

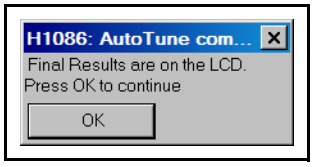


CAUTION

Adjusting other parameters without proper training may damage the instrument.

4 Allow the AutoTune to run to completion and click **OK. Close** the Manual Tune after receiving the message **Final Results are on the LCD**. See Figure 7-5.

Figure 7-5 AutoTune Complete



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7.3 Viewing a Tune Report

The Tune Report can be viewed from the front panel display or from the Laptop computer. See Figure 7-6. Tune Reports are stored on the HAPSITE. Therefore, to access Tune Reports from the Laptop computer, the HAPSITE must be connected to the Laptop.

To view the report from the Laptop computer select **File.** Then select **View Tune Reports** from the drop down menu. Highlight the **default.tun** file and press **OK**. The **Tune Files** and **Tune Reports** are displayed. **Tune Reports** can also be accessed by highlighting the **HAPSITE** icon, or by pressing the right mouse button and selecting **Tune Reports**. Tune Reports are stored, by default, for the last 30 days. The **Tune Reports** display offers the following functions:

Remove . . . . . Deletes the selected report. NO CONFIRMATION IS REQUESTED.

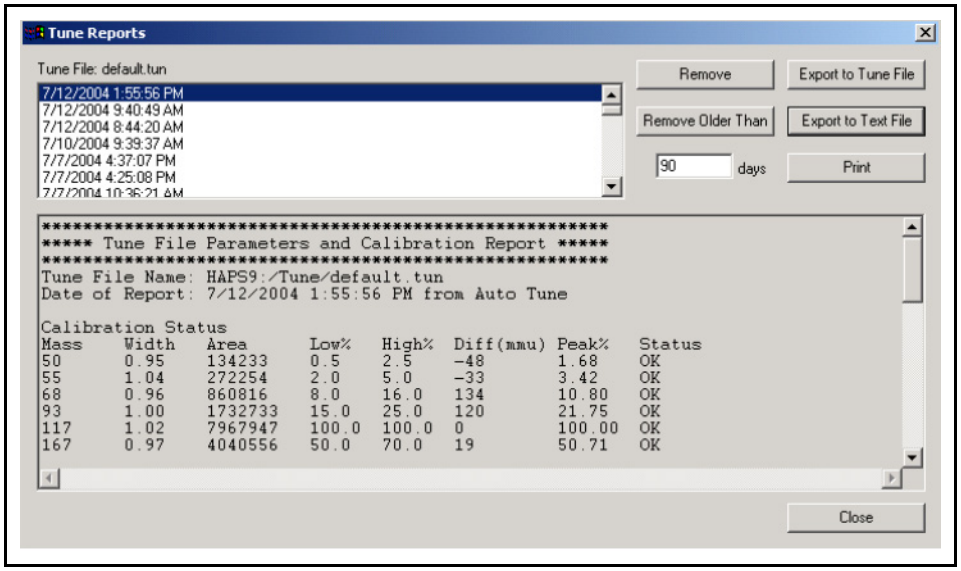
Remove Older Than . . . . . Deletes files older than the number of days specified. Confirmation is requested before the files are deleted.

Export to Tune File . . . . . Converts a Tune Report into a valid Tune file. This feature can be used to recover a good Tune if the current Tune file has been corrupted.

Export to text file . . . . . Creates a text file copy of the Tune Report.

Print . . . . . Prints a copy of the selected Tune Report.

Figure 7-6 Tune Reports Screen from Laptop Computer



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To view the Tune Report from the front panel display, touch the **HAPSITE** icon and then touch the **TUNE** icon. See Figure 7-7. Touching the **TUNE REPORT** key will then display the last Tune Report. See Figure 7-8.

Figure 7-7 Status and Tune Data

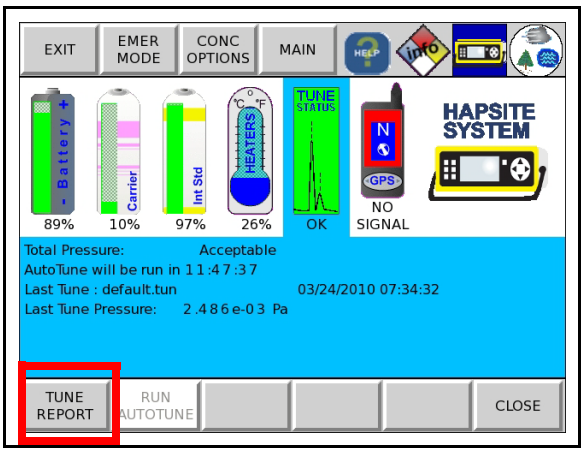
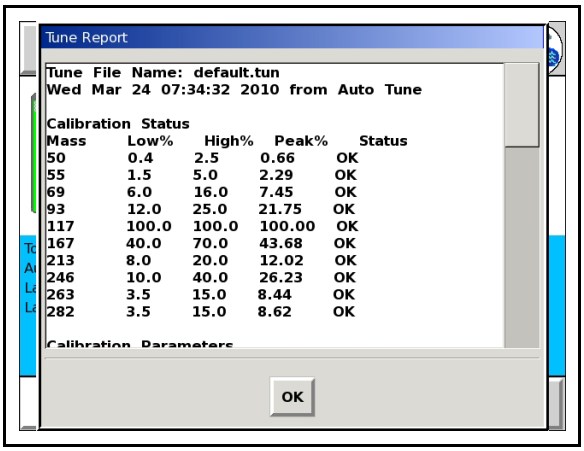


Figure 7-8 Tune Report

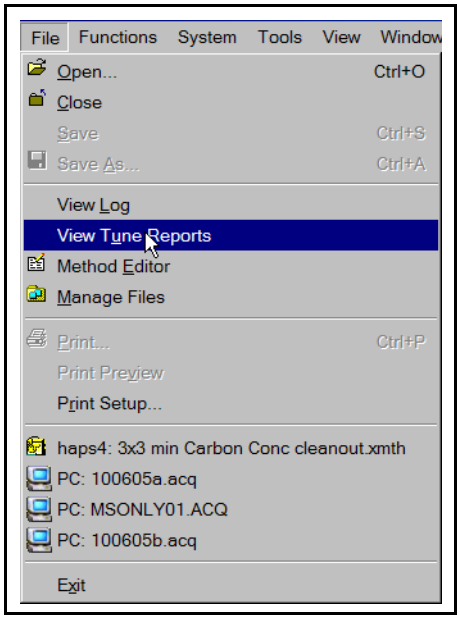


7.4 AutoTune Failure

Occasionally, AutoTune may fail. Follow the procedures outlined below before continuing.

1. When AutoTune fails, check IS canister pressure and expiration date. Replace if necessary.
2. Check reservoir pressure to ensure the reservoir pressure is at least 400 kPa. Replenish if necessary by inserting a full can of Nitrogen (>400 kPa).
3. Rerun AutoTune by rebooting the HAPSITE.
4. If AutoTune fails again, select **File** >> **View Tune Reports** on the Laptop. See Figure 7-9.

Figure 7-9 Selecting View Tune Reports



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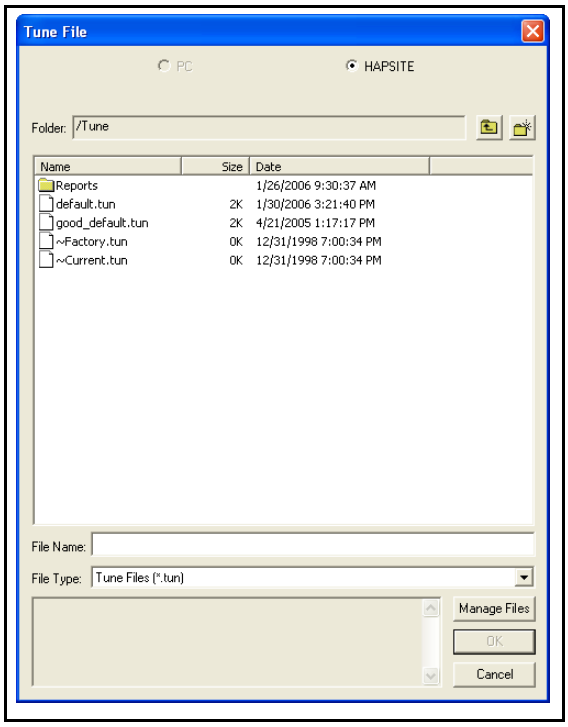
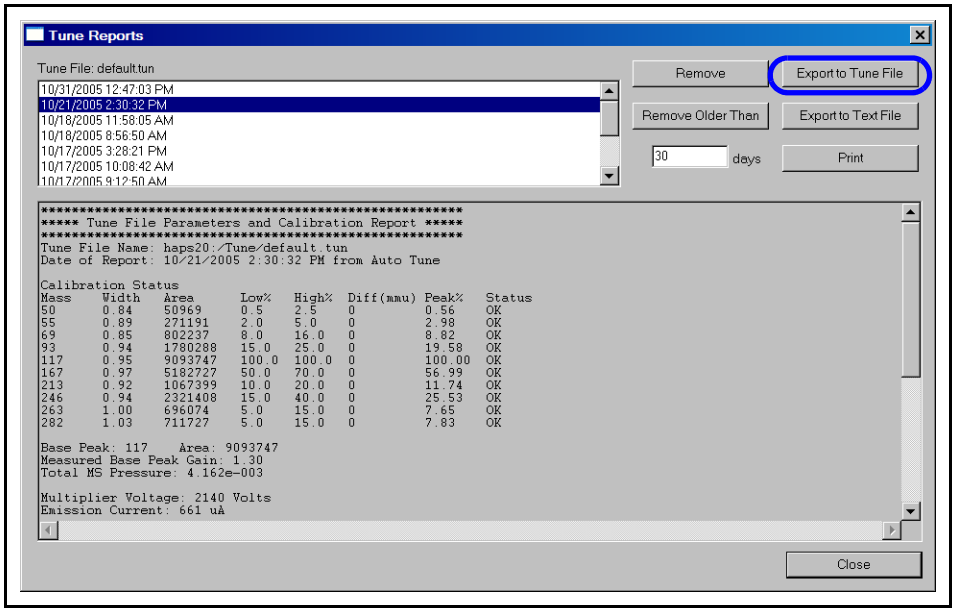
5 Select **default.tun** file and press **OK**. See Figure 7-10.

Figure 7-10 Select "default.tun" File



6 Highlight a "good" tune report. Select **Export to Tune File**. See Figure 7-11.

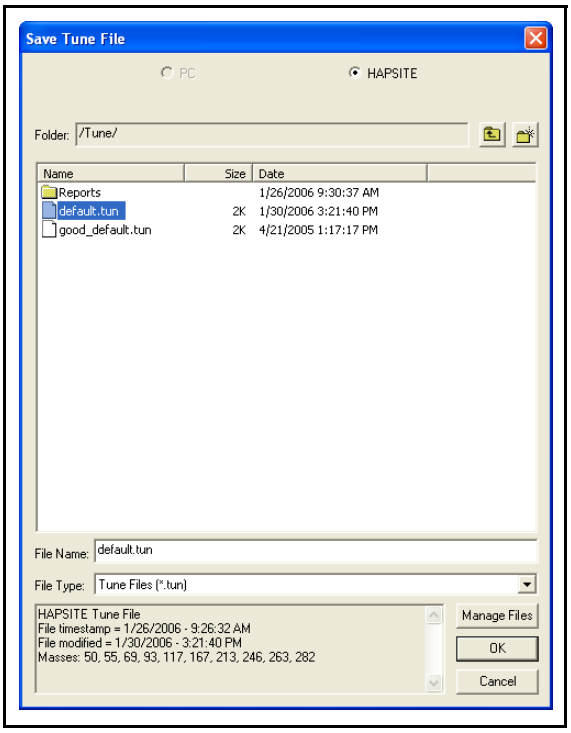
Figure 7-11 Export Good Tune to Current Tune File



7 Highlight **default.tun**. Click **OK**. See Figure 7-12.

NOTE: This will overwrite the **default.tun** file. See section 10.3 on page 10-12 for information on transferring files to the PC if saving a copy of this file is desired prior to overwriting it.

Figure 7-12 Save "default.tun"



8 Replace the existing **default.tun** file when prompted.

9 Reboot HAPSITE from the front panel MAIN menu.

10 If the HAPSITE fails to tune after steps 1-9 have been performed, see section 7.6, Performing Manual Tune, on page 7-25 for information on performing a Manual Tune.

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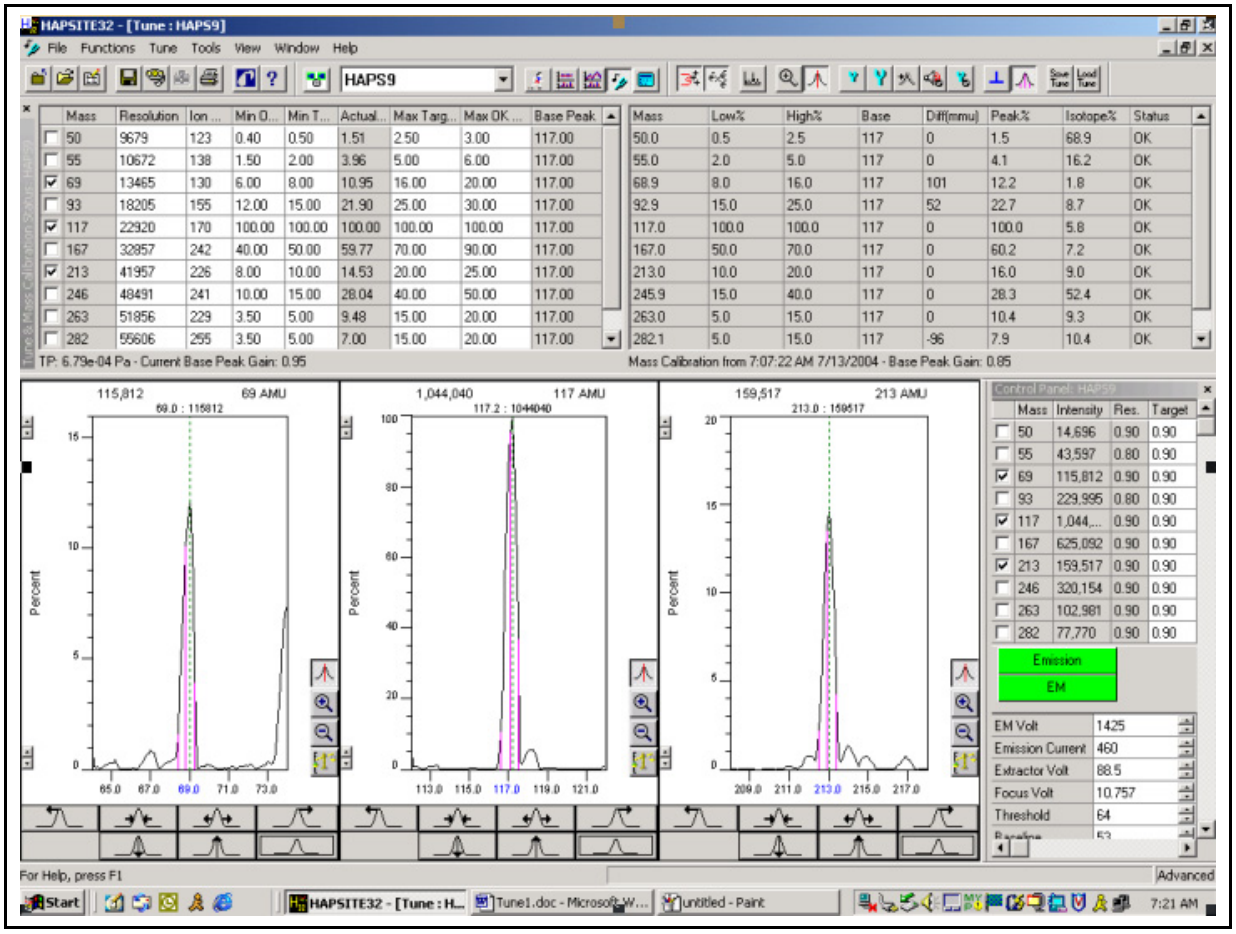
7.5 Manual Tune Settings and Controls

Manual Tune is run from the Laptop computer. The Manual Tune screen can be accessed by selecting the Tune icon from the System Setup screen, or by highlighting the **HAPSITE** icon, clicking the Right Mouse Button and selecting Tune. When the Manual Tune screen is selected the system will initialize all of the controls necessary to perform a Tune (e.g., turning on the filament, multiplier and calibration/tune gas supply).

NOTE: Manual Tune is only available in Advanced user mode.

See Figure 7-13 for a typical Manual Tune screen.

Figure 7-13 Manual Tune Screen



CAUTION

Adjusting parameters without proper training may damage the instrument.

7.5.1 Tool Bar

Figure 7-14 Manual Tune Tool Bar

Filament On/Off . . . . . Turns the emission On or Off.

Multiplier On/Off . . . . . Turns the Electron Multiplier On or Off.

Full Scan . . . . . Switches between Full Scan display mode and Peak Scan display mode.

Zoom . . . . . Enables the cursor to select a section of Full Scan or Peak Scan and zoom to that section.

Mass Adjust . . . . . Enables the cursor to select a mass peak and drag the mass peak to a different position on the mass axis.

Short AutoTune. . . . . Starts the Short AutoTune function.

Long AutoTune . . . . . Starts the Long AutoTune function.

Mass Calibration. . . . . Checks and corrects the ten calibration masses for correct location within the mass range.

Noise Check . . . . . Scans a "quiet" mass range (no peaks) to determine the electronic baseline and threshold noise level.

Perform Tune Checkup . . . Runs a mass calibration and noise check.

Show Target . . . . . Displays the target bar for the mass peak center and peak width at 10% peak height. Displays the target high and low percentage bars for each mass peak.

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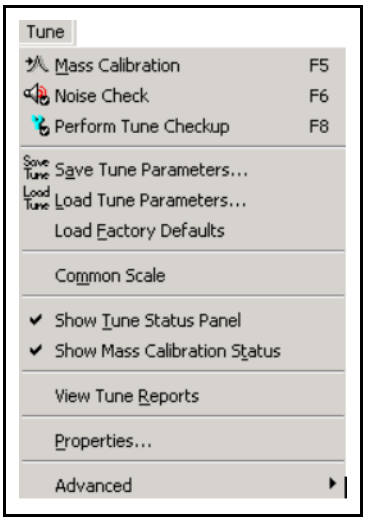
Show Bounds . . . . . Displays the peak centroid and the target peak width at 10% peak height.

Save Tune . . . . . Saves the Tune File.

Load Tune . . . . . Loads a new Tune File and restarts tuning.

7.5.2 Tune Drop Down Menu

Figure 7-15 Tune Drop Down Menu



Mass Calibration. . . . . Checks and corrects the ten calibration masses for correct location within the mass range.

Noise Check . . . . . Scans a "quiet" mass range (no peaks) to determine the electronic baseline and threshold noise level.

Perform Tune Checkup . . . . . Runs a mass calibration and noise check.

Save Tune Parameters... . . . . . Saves the Tune File.

Load Tune Parameters... . . . . . Loads a new Tune File and restarts tuning.

Load Factory Defaults . . . . . Loads the default tune settings from a factory tune file. This is intended to provide a starting point for tuning.

Common Scale . . . . . Sets all of the Mass Peak windows to the same common scale (Y-axis), based on Mass 117.

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Show Tune Status Panel . . . . . Displays the Tune and Mass Calibration Status panel.

Show Mass Calibration Status . . . Displays the Mass Calibration Status panel.

View Tune Reports . . . . . Displays the Tune Reports screen.

Properties . . . . . Displays the Properties window, which is used to set the default screen display and startup/exit conditions for Manual Tune. See Figure 7-16.

Advanced . . . . . Displays the Advanced tune functions.

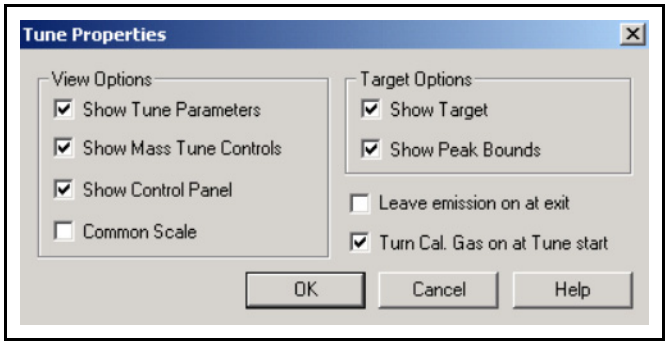
Linearize DACS. . . . . Repositions the tune gas mass peaks on the mass axis by linear extrapolation of the digital to analog control settings.

AutoTune Tolerances . . . . . Sets the AutoTune tolerance for mass resolution and mass axis position.

NOTE: The **Advanced** functions should only be used under the direction of INFICON Support personnel.

7.5.2.1 Tune Properties Window

Figure 7-16 Tune Properties Window



Show Tune Parameters . . . . . Displays the EM Voltage, Ionizer control, Baseline, Threshold and Rod polarity settings on the Control Panel

Show Mass Tune Controls. . . . . Displays the Mass Tune Controls on the Mass Peak Scan windows.

Show Control Panel . . . . . Displays the Control panel.

Common Scale . . . . . Sets the Mass Peak Scan windows to a common scale based on mass 117.

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Show Target . . . . . Displays the target bar for the mass peak center and peak width at 10% peak height. Displays the target high and low percentage bars for each mass peak.

Show Peak Bounds . . . . . Displays the peak centroid and the target peak width at 10% peak height.

Leave emission on at exit . . . . . Leaves the filament and Electron multiplier on when exiting tune. This should not be used except for special service procedures.

Turn Cal. Gas on at Tune start. . . . Turns ON the Calibration gas when the tune program is started. This is checked for normal operation.

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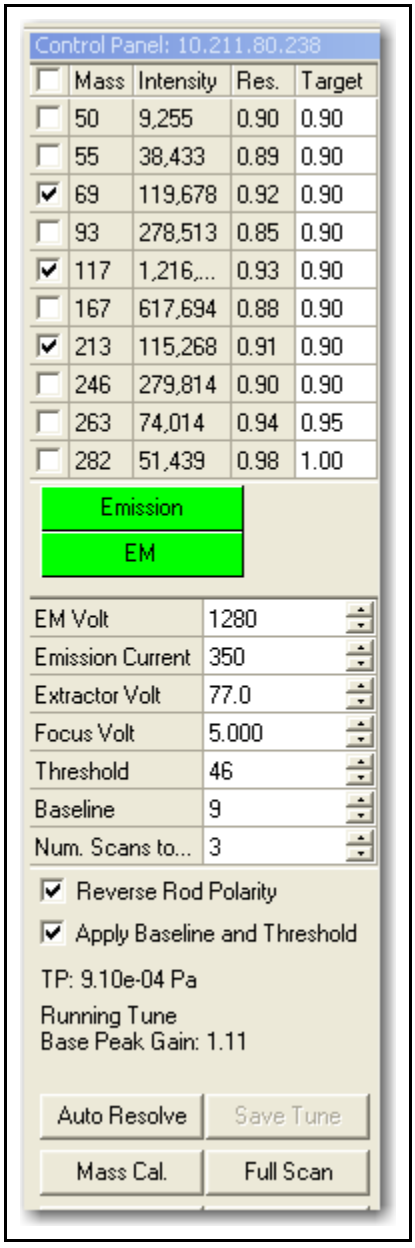
7.5.3 Tune Control Panel

Figure 7-17 Tune Control Panel



The Tune Control Panel provides access to display individual mass peak scans by selecting the check box next to the Mass. The measured intensity and resolution are displayed. The Target Resolution is also displayed and can be modified. Changing the Target Resolution will force an Auto Resolve. Decreasing the Target Resolution narrows the peak, increasing the resolution and lowering the peak percentage. Increasing the Target Resolution will widen the peak, decreasing the resolution and increasing the peak percentage.

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The Emission button turns the filament ON or OFF, the EM button turns the Electron Multiplier ON or OFF. Green signifies ON and is the default condition when the Tune window is opened.

7.5.3.1 Tune Parameters

EM Volt. . . . . Used to increase or decrease the gain of the system. EM voltage should be set to a value that achieves a Base Peak Gain of between 0.8 and 2.0.

Emission Current . . . . . Used to optimize the ionization efficiency of the ionizer. Emission Current is set to achieve maximum intensity for mass 117. Range is 100 - 1000. (300 - 400 is typical.)

Extractor Volt . . . . . Used to optimize the ionization efficiency of the ionizer. Extractor Volt is set to achieve maximum intensity for mass 117. Range is 0 - 100.

Focus Volt . . . . . Used to optimize the ionization efficiency of the ionizer. Focus Volt is set to achieve maximum intensity for mass 117. Range is -12 to +12.

Threshold . . . . . One standard deviation of the Baseline. Threshold determines if a measured point is used in the peak area integration. If the point is used, the baseline is subtracted before use.

Baseline. . . . . The mean value of the measured noise level.

Reverse Rod Polarity . . . . . Changes the Rod polarity on the Mass filter and is selected for optimum performance at mass 117.

TP. . . . . The total MS pressure.

Running Tune Base Peak Gain . . . Current measured Base Peak Gain (BPG).

NOTE: The Base Peak Gain will switch to Red when BPG is outside the target range.

Auto Resolve . . . . . Adjusts the resolution of all Mass Peaks to the target resolution.

Save Tune . . . . . Save the Tune File

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Mass Cal.	Checks and corrects the ten calibration masses for correct location within the mass range.
Full Scan	Switches between Full Scan display mode and Peak Scan display mode
Short AutoTune	Starts the Short AutoTune function
Long AutoTune	Starts the Long AutoTune function
Noise Check	Scans a "quiet" mass range (no peaks) to determine the electronic baseline and threshold noise level.
Tune Checkup	Runs a mass calibration and noise check.
Zoom	Enables the cursor to select a section of Full scan or a peak scan and zoom to that section.
Mass Adjust	Enables the cursor to select a mass peak and drag the mass peak to a different position on the mass axis.

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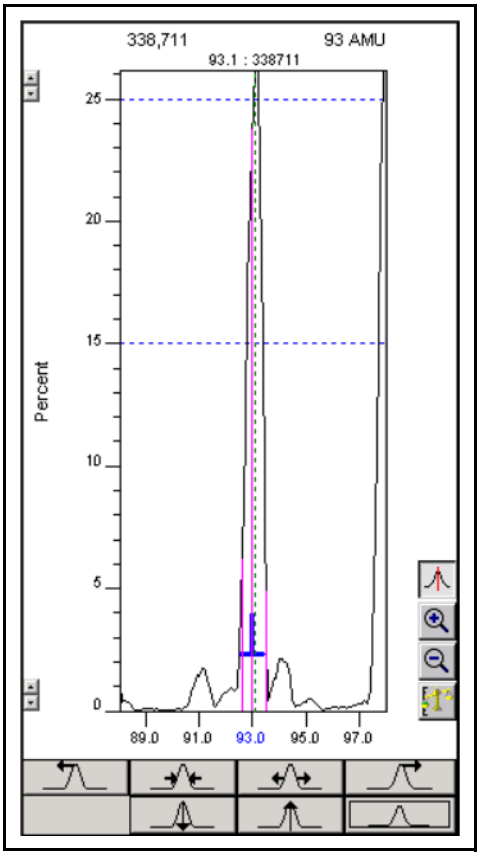
7.5.4 Peak Scan Window

The Peak Scan Window, see Figure 7-18, displays the mass peak and enables the user to manually control/tune the mass peak.

Figure 7-18 The Peak Scan Window and Controls



7.5.4.1 Peak Scan Window Controls

Mass Adjust . . . . . Enables the cursor to select a mass peak and drag the mass peak to a different position on the mass axis.

Zoom . . . . . Enables the cursor to select a section of the peak scan window and zoom to that section.

Zoom Out. . . . . Returns the window to the original X axis and Y axis scale.

Zoom Out Y axis . . . . . Returns the Y axis to original scale.

Y Axis Scale . . . . . Increase or decreases the Y axis scale.

NOTE: For the following controls, The Left Mouse Button (LMB) is used to change by 1 increment, shift-LMB changes in increments of 10, and Ctrl-LMB changes by increments of 100.

. . . . . Shifts the mass peak left.

. . . . . Increases the peak resolution.

. . . . . Decreases the peak resolution.

. . . . . Shifts the mass peak right.

. . . . . Decreases the Ion energy.

. . . . . Increases the Ion energy.

. . . . . Zooms to a single peak scan display window.

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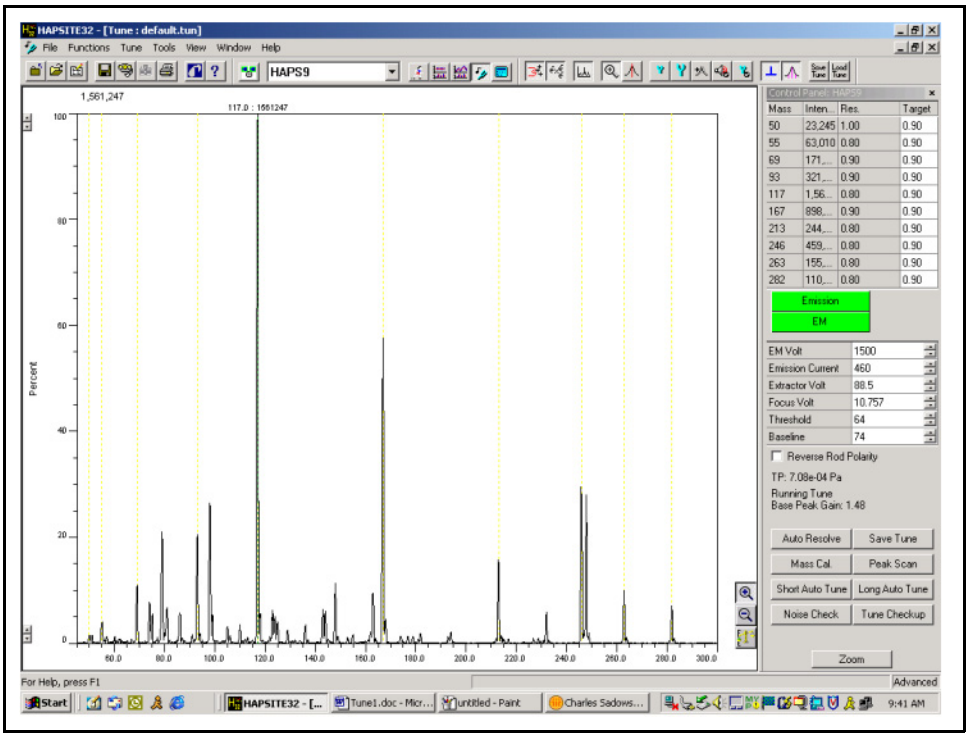
7.5.5 Full Scan Window

The Full scan window (see Figure 7-19) is used for display purposes to evaluate the performance of the MS. All tune adjustments should be made using the Peak Scan windows.

Figure 7-19 Full Scan Window and Controls



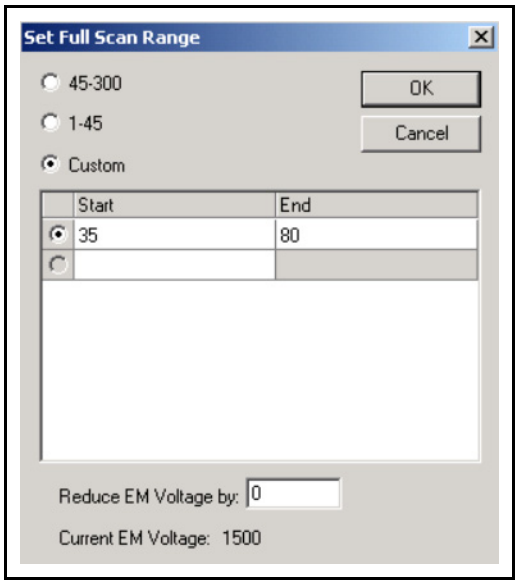
Zoom . . . . . Enables the cursor to select a section of the peak scan window and zoom to that section.

Zoom Out. . . . . Returns the window to the original X axis and Y axis scale.

Zoom Out Y Axis. . . . . Returns the Y axis to the original scale.

Placing the mouse cursor on the x axis of the full scan window and pressing the Right Mouse Button will display the Set Scan Range Window, see Figure 7-20. This allows a custom scan range to be entered and viewed.

Figure 7-20 Setting the Full Scan Range



Default Scan ranges of 45 - 300 AMU or 1 - 45 AMU can be selected.

NOTE: The EM voltage will automatically be decreased by 500 volts (default) anytime a range below mass 45 is scanned. Custom scan ranges can also be viewed by selecting the custom button and entering a start and end mass.

7.5.6 Tune and Mass Calibration Status

The Tune & Mass Calibration Status Panel is shown in Figure 7-21.

Figure 7-21 Tune & Mass Calibration Status Panel

Tune & Mass Calibration Status: H1198

Mass	Target Resolution	Actual Resolution	Resolution	Ion Energy	Position (DAC Value)	Min OK Target Percen.
50	0.90	0.84	9720	100	10301	0.40
55	0.85	0.76	10730	110	11350	1.50
69	1.00	0.89	13450	107	14223	6.00
93	0.90	0.80	18190	135	19177	12.00
117	0.95	0.82	22920	150	24133	100.00
167	0.80	0.81	32817	220	34477	40.00
213	1.10	0.96	41865	182	43974	8.00
246	0.95	0.81	48405	200	50785	10.00
263	1.10	1.00	51735	205	54297	3.50

The Tune Status Panel displays information pertinent to tune and can be used to change some of the Tune parameters. The Tune and Mass Calibration Status Panel can be displayed with a Right Mouse Button click in the Peak Scan window. It can also be displayed by using the Tune drop down menu and selecting the Tune Status Panel. Columns can be displayed or hidden with a right mouse click on the column headings. See Figure 7-22.

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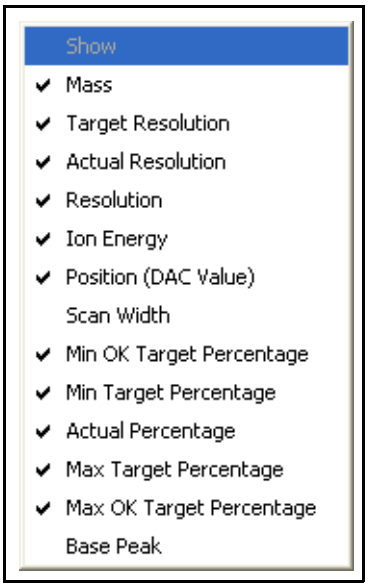
Figure 7-22 Tune and Mass Calibration Status Menu



Mass . . . . . The mass number of the peak. When a mass is selected to display, the mass immediately below and above are also displayed.

Target Resolution . . . . . Target resolution at 10% peak height.

Actual Resolution . . . . . Measured resolution at 10% peak height.

Resolution . . . . . Resolution value; can be used to input a change in resolution value.

Ion Energy . . . . . Ion energy value; can be used to input a change in Ion energy value.

Position (DAC Value) . . . . . Current DAC setting for mass position.

Scan Width . . . . . Displays the points measured per AMU.

Min OK Target Percentage . . . . . Displays the minimum target percentage required for the mass peak to meet the OK LOW criteria.

Min Target Percentage . . . . . Displays the minimum target percentage required for the mass peak to meet OK criteria. Will turn red if actual percentage is below the minimum percentage.

Actual Percentage . . . . . Displays the actual measured target percentage.

Max Target Percentage . . . . . Displays the maximum target percentage required for the Mass Peak to meet OK criteria. Will turn red if actual percentage is above the maximum percentage.

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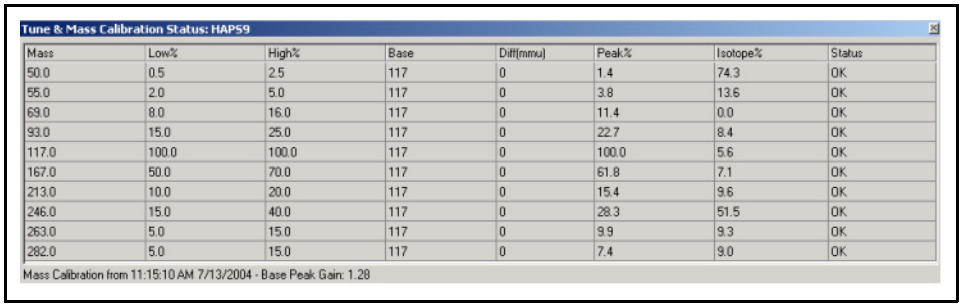
Max OK Target Percentage . . . . . Displays the maximum percentage required for the mass peak to meet the OK High criteria.

Base Peak . . . . . Displays the base peak that the mass peak percentage is measured against.

7.5.7 Mass Calibration Status

The dark gray Mass Calibration Status panel displays the status of the last Mass Calibration. See Figure 7-23. The Mass Calibration Status panel can be displayed by **R**ight **M**ouse **B**utton (RMB) click in the Peak Scan window, or by using the Tune drop down menu and selecting the Mass Calibration Status.

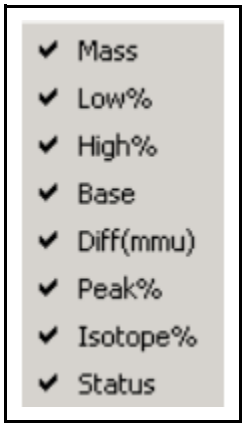
Figure 7-23 Mass Calibration Status



Mass	Low%	High%	Base	Diff(mmu)	Peak%	Isotope%	Status
50.0	0.5	2.5	117	0	1.4	74.3	OK
55.0	2.0	5.0	117	0	3.8	13.6	OK
69.0	8.0	16.0	117	0	11.4	0.0	OK
93.0	15.0	25.0	117	0	22.7	8.4	OK
117.0	100.0	100.0	117	0	100.0	5.6	OK
167.0	50.0	70.0	117	0	61.8	7.1	OK
213.0	10.0	20.0	117	0	15.4	9.6	OK
246.0	15.0	40.0	117	0	28.3	51.5	OK
263.0	5.0	15.0	117	0	9.9	9.3	OK
282.0	5.0	15.0	117	0	7.4	9.0	OK

Columns can be displayed or hidden with a Right Mouse Button click on the column headings. See Figure 7-24.

Figure 7-24 Mass Calibration Menu



Mass . . . . . Mass number.

Low% . . . . . Minimum percentage for peak status OK.

High% . . . . . Maximum percentage for peak status OK.

Base . . . . . Reference mass for peak percentage calculations.

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Diff(mmu) . . . . . Provides an adjustment to DAC value for mass peak alignment, if one is needed since the last mass calibration check. 100 mmu = 0.1 AMU.

Peak% . . . . . Actual peak percentage of reference mass.

Isotope% . . . . . Percentage of the Carbon 13 isotope peak as measured against the mass fragment.

Status . . . . . Status of mass peak.

OK . . . . . Within minimum and maximum values.

OK LOW. . . . . Outside of minimum value but within acceptable tolerance.

OK HIGH . . . . . Outside of maximum value but within acceptable tolerance.

LOW . . . . . Below minimum value; needs adjustment.

HIGH. . . . . Above maximum value; needs adjustment.

FAILED. . . . . Cannot located mas peak within window. AutoTune or Manual Tune is required.

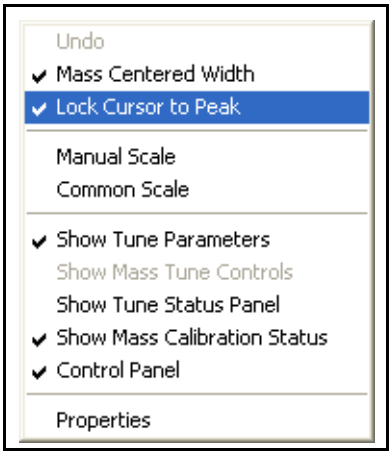
7.5.8 Right Mouse Button (RMB) Menus

In addition to the functions described above, the following menu items are available by pressing the Right Mouse Button (RMB).

7.5.8.1 RMB in Scan Window

Placing the Mouse Cursor in the Peak Scan or Full Scan Window and pressing the RMB displays the menu shown in Figure 7-25.

Figure 7-25 Scan Window Options



Undo . . . . . Undo last function.

Mass Centered Width . . . . . Width in AMU that correctly aligns the calibration peak with the correct position on the mass axis.

Lock Cursor to Peak . . . . . Locks the cursor to the mass peak for adjustment of mass position.

Manual Scale . . . . . Allows the mass peak windows to be set to a user defined scale.

Common Scale . . . . . Sets the mass peak scan windows to a common scale based on mass 117.

Show Tune Parameters . . . . . Displays the EM voltage, Ionizer Control, Baseline, Threshold and Rod Polarity settings on the Control Panel.

Show Mass Tune Controls . . . . . Displays the mass tune controls on the mass peak scan windows.

Show Tune Status Panel . . . . . Displays the tune status panel.

Show Mass Calibration Status . . . Displays the mass calibration status control panel.

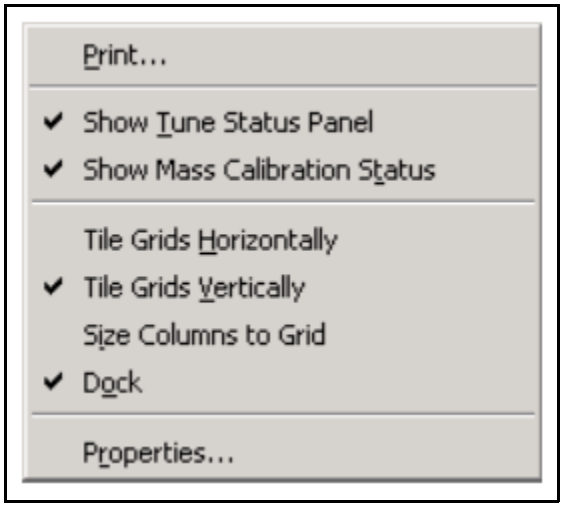
Control Panel . . . . . Displays the control panel.

Properties . . . . . Displays the properties window.

7.5.8.2 RMB in Tune Status Window

Placing the Mouse Cursor in the Tune Status panel or the Mass Calibration Status panel and pressing the Right Mouse Button will display the menu shown in Figure 7-26.

Figure 7-26 RMB Menu in Tune Status Panel



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NOTE: The menu from the control panel is the same as above with the exception of no print function.

Print... . . . . . Prints the Tune Status panel or the Mass Calibration Status panel.

Show Tune Status Panel . . . . . Displays the Tune Status panel.

Show Mass Calibration Status . . . Displays the Mass Calibration Status panel.

Tile Grids Horizontally . . . . . Tiles the Status and Calibration Status panels horizontally.

Tile Grids Vertically . . . . . Tiles the Status and Calibration Status panels vertically.

Size Columns To Grid . . . . . Resets the column size to the current grid.

Dock. . . . . Locks the display position to a fixed position.

Properties.... . . . . Displays the Properties window.

7.5.8.3 RMB on Y Axis

Positioning the mouse cursor on the Y axis scale near the top and selecting the Right Mouse Button will bring up a Y axis scale scroll window.

7.6 Performing Manual Tune

CAUTION

Manual Tune is a procedure that should only be attempted by experienced HAPSITE users who have preferably taken the Advanced Training course provided by INFICON.

Read section 7.5, Manual Tune Settings and Controls, on page 7-9 to learn about the various controls and settings involved in manual tune. Remember, if after a few cycles through the Manual Tune process and the HAPSITE is still not tuning, call INFICON Support for additional guidance. Below are general guidelines for performing a manual tune.

NOTE: Do not save a Tune file from a Manual Tune if it indicates the HAPSITE is not tuned.

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7.6.1 Adjusting Base Peak Gain

1 Double-click on the **Plus IQ icon**. See Figure 7-27.

Figure 7-27 Plus IQ Icon

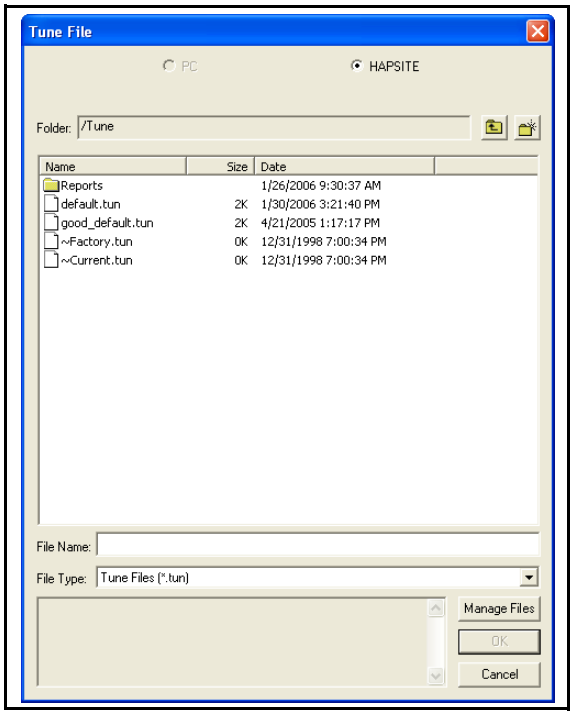
2 Double-click on the **Tune icon**. See Figure 7-28.

NOTE: Manual Tune can only be opened in Advanced User Mode.

Figure 7-28 Manual Tune Icon

3 Select **default.tun** file and press **OK**. See Figure 7-29.

Figure 7-29 Select default.tun File



4 Wait for the automated process of opening the tune to complete.

5 Check the **Base Peak Gain (BPG)**. Is the value between **0.8 and 2.0**? See Figure 7-30 and Figure 7-31.

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Figure 7-30 Checking BPG and EM Voltage

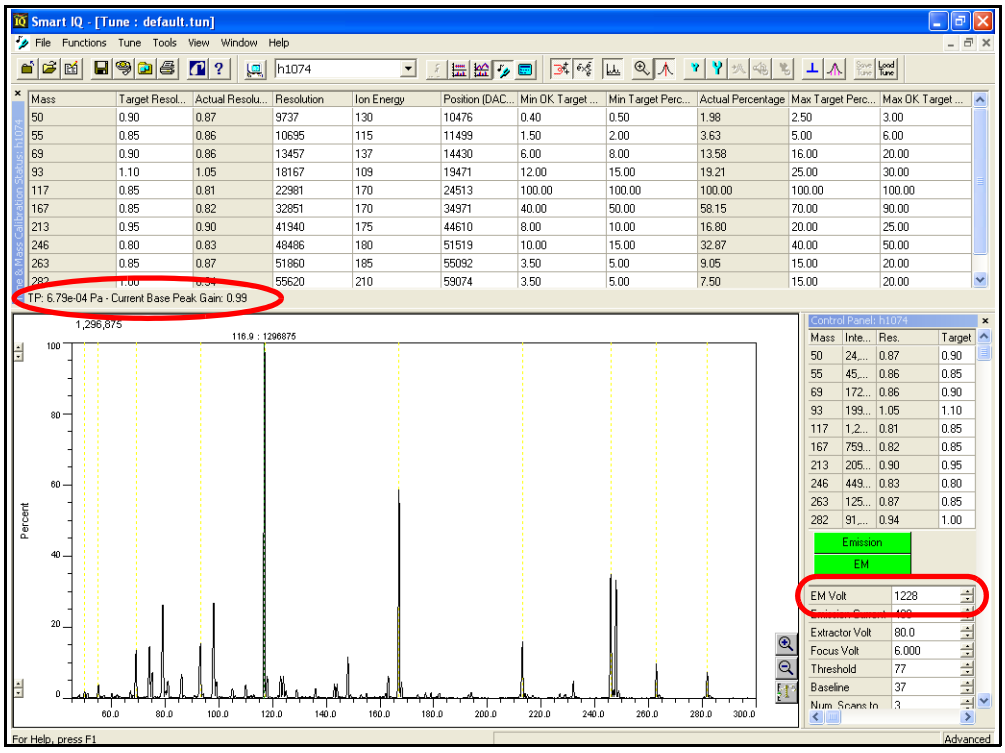
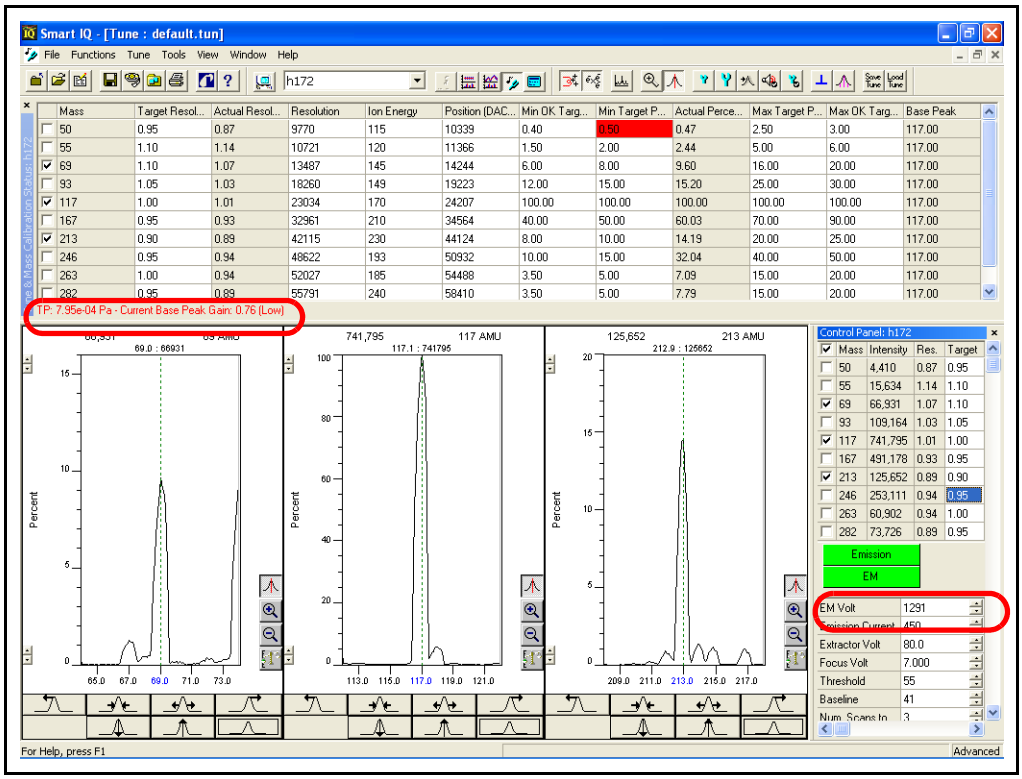


Figure 7-31 BPG Low



5a If **yes**, then the BPG does not need adjustment. **Proceed** to Step 8.

5b If **no**, the BPG will need to be adjusted. **Proceed** to Step 6.

6 To **raise** the **Base Peak Gain**, **increase** the value of the **EM Voltage** by **25 volts**. To **lower** the BPG, **decrease** the value of the **EM Voltage** by **25 volts**.

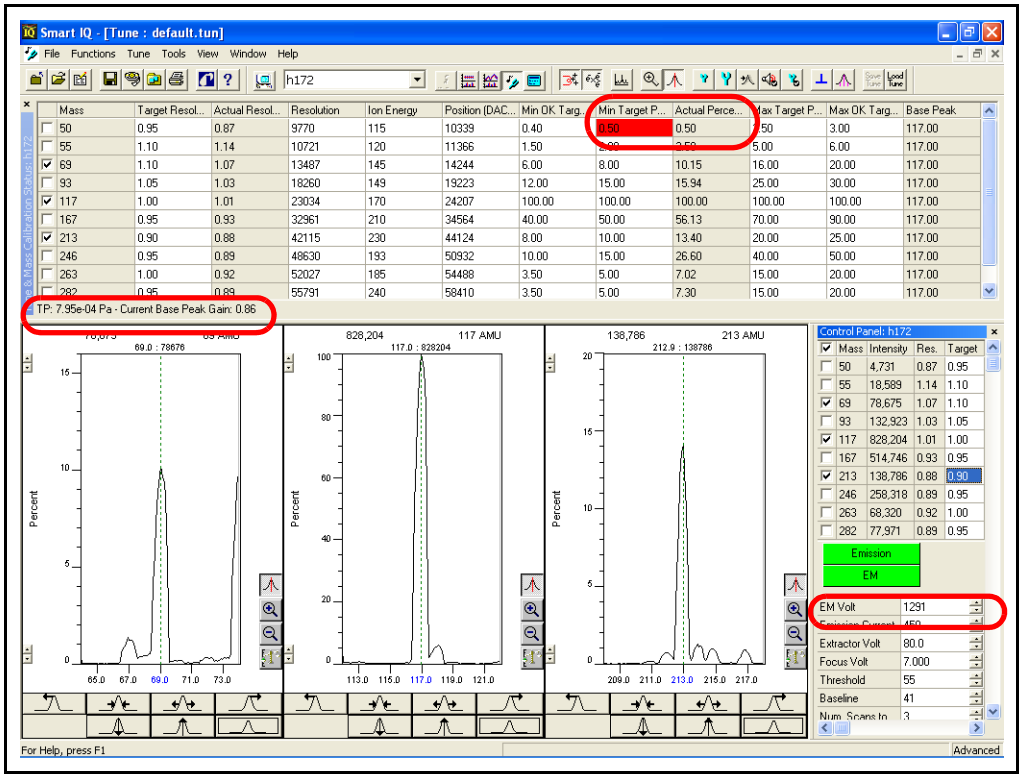
7 Check the **Base Peak Gain value** to see if the BPG is now in the **range (0.8 to 2.0)**.

7a If the **Base Peak Gain** is still **out of range**, **repeat** Step 6 until the value comes into range.

7b If the **Base Peak Gain** is in **range**, continue with Step 8.

8 Check the Tune and Mass Calibration Status panel to see if any of the masses are highlighted in red. A red box indicates the mass is **High** or **Low**. See Figure 7-32.

Figure 7-32 BPG Good with Mass 50 Low



8a If all mass percentages are within limits, then the instrument is tuned. Proceed to section 7.6.2, Adjusting Resolution, on page 7-29.

8b If any mass percentages are High or Low (red boxes), then proceed to Adjusting Resolution.

7.6.2 Adjusting Resolution

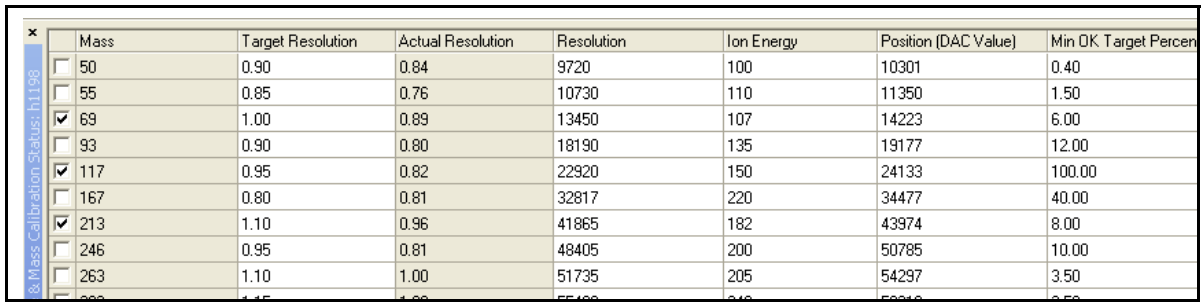
1 Before adjusting Resolution, Base Peak Gain must be adjusted. Refer to section 7.6.1, Adjusting Base Peak Gain, on page 7-26.

2 Resolution needs to be adjusted for masses that read High or Low in the Tune and Mass Calibration Status panel. Ideally, the tune report should have an OK reading for all masses. (No red boxes.)

NOTE: Resolution can also be adjusted for masses that read OK High and OK Low in the Mass Calibration Report. (Press F5 to update the report.)

3 On the Tune and Mass Calibration Status panel the resolution will appear in two columns as Target Resolution and Actual Resolution. Actual Resolution is the actual reading and Target Resolution is the resolution setting. The range for the Target Resolution is between 0.85 and 1.10.

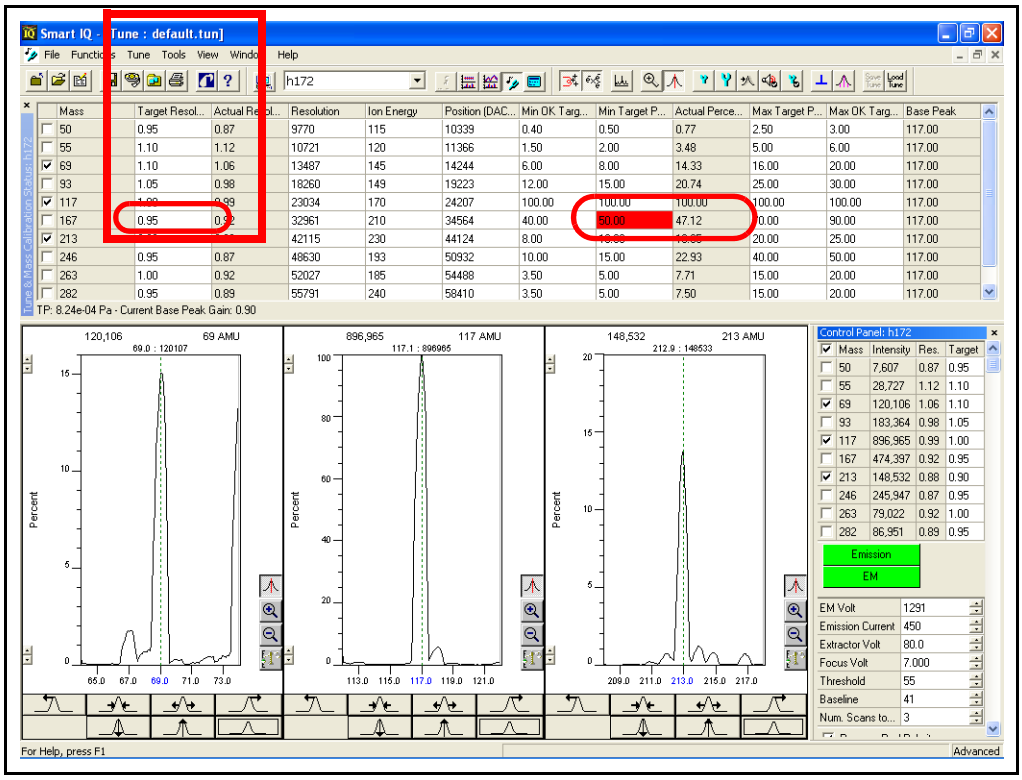
Figure 7-33 Actual Resolution and Target Resolution



	Mass	Target Resolution	Actual Resolution	Resolution	Ion Energy	Position (DAC Value)	Min OK Target Percen
☐	50	0.90	0.84	9720	100	10301	0.40
☐	55	0.85	0.76	10730	110	11350	1.50
☑	69	1.00	0.89	13450	107	14223	6.00
☐	93	0.90	0.80	18190	135	19177	12.00
☑	117	0.95	0.82	22920	150	24133	100.00
☐	167	0.80	0.81	32817	220	34477	40.00
☑	213	1.10	0.96	41865	182	43974	8.00
☐	246	0.95	0.81	48405	200	50785	10.00
☐	263	1.10	1.00	51735	205	54297	3.50

3a If the red box is in the **Min Target Percentage** column, the Target Resolution will need to be increased. Use increments of 0.05 to change the Target Resolution. If the Target Resolution reaches 1.10, proceed to Step 4 and follow with Step 4c, if needed.

Figure 7-34 Target Percentage Low



3b If the red box is in the **Max Target Percentage**, the **Target Resolution** needs to be decreased. Use increments of 0.05 to make changes to the Resolution. If the **Target Resolution** reaches **0.85**, proceed to Step 4 and follow with Step 4c, if needed.

4 Check to see if the mass percentage is in range. (Red box has disappeared.)

4a If the Resolution is in range, proceed to Step 4, section 7.6.3, Adjusting the Ion Energy, on page 7-31.

4b If the **Min or Max Target Percentage** is red and the Target Resolution is within 0.85 and 1.10, repeat Step 3 and Step 4 until the masses all no longer show red.

4c If the **Min or Max Target Percentage** is red, more adjustments need to be made. If the Target Resolution is at the low end of the range (0.85) and mass percentage still needs to be lowered, the Ion Energy will need to be adjusted. If the Target Resolution is at the high end (1.10) and the mass percentage is not OK, an Ion Energy adjustment is also needed. Proceed to section 7.6.3.

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7.6.3 Adjusting the Ion Energy

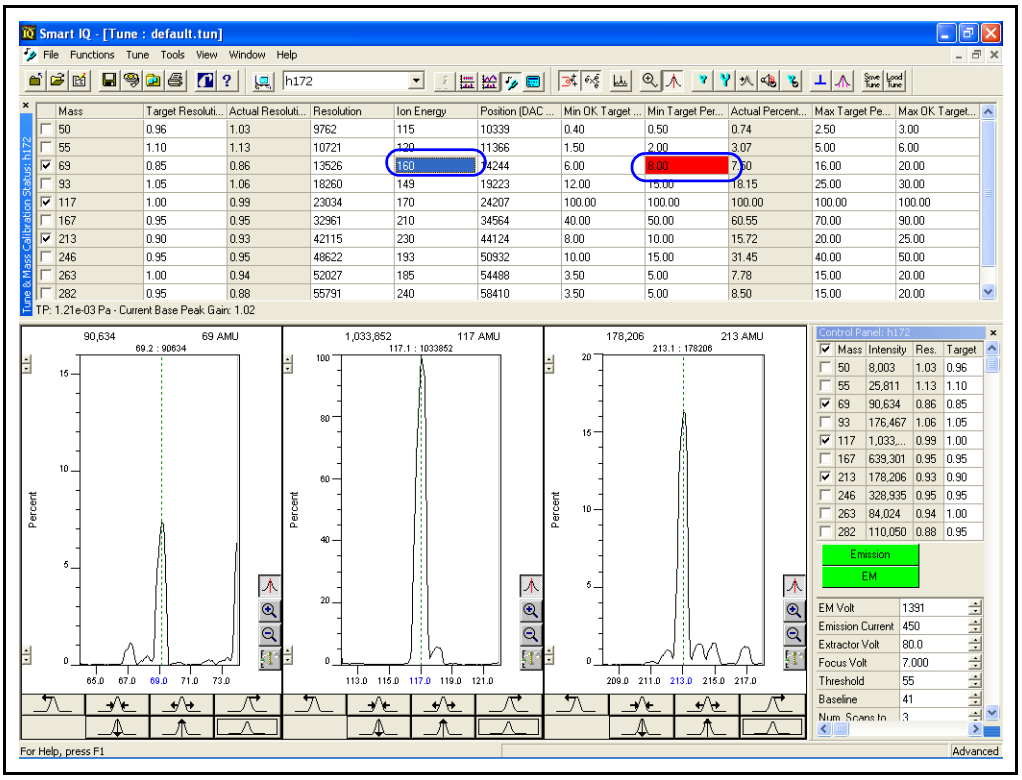
1 Prior to performing this procedure, follow the steps outlined in section 7.6.1, Adjusting Base Peak Gain, on page 7-26 and section 7.6.2, Adjusting Resolution, on page 7-29.

2 Check the Actual Percentage column:

2a If the **Actual Percentage** is above the acceptable range, (red box appears to the right of the column, indicating the mass response is too high) the ion energy needs to be reduced. Lower the ion energy by increments of 5 at a time.

2b If the **Actual Percentage** is below the acceptable range, (red box appears to the left of the column, indicating the mass response is too low) the ion energy needs to be increased. Raise the ion energy by increments of 5 at a time.

Figure 7-35 Ion Energy Needs to be Increased



NOTE: When adjusting ion energy, there are low and high limits for each mass. Make sure manual adjustments stay within the limits shown in Table 7-1.

Table 7-1 Manual Adjustments Guidelines

MASS	IE low	IE high
50	90	170
55	90	170
69	90	170

Table 7-1 Manual Adjustments Guidelines (continued)

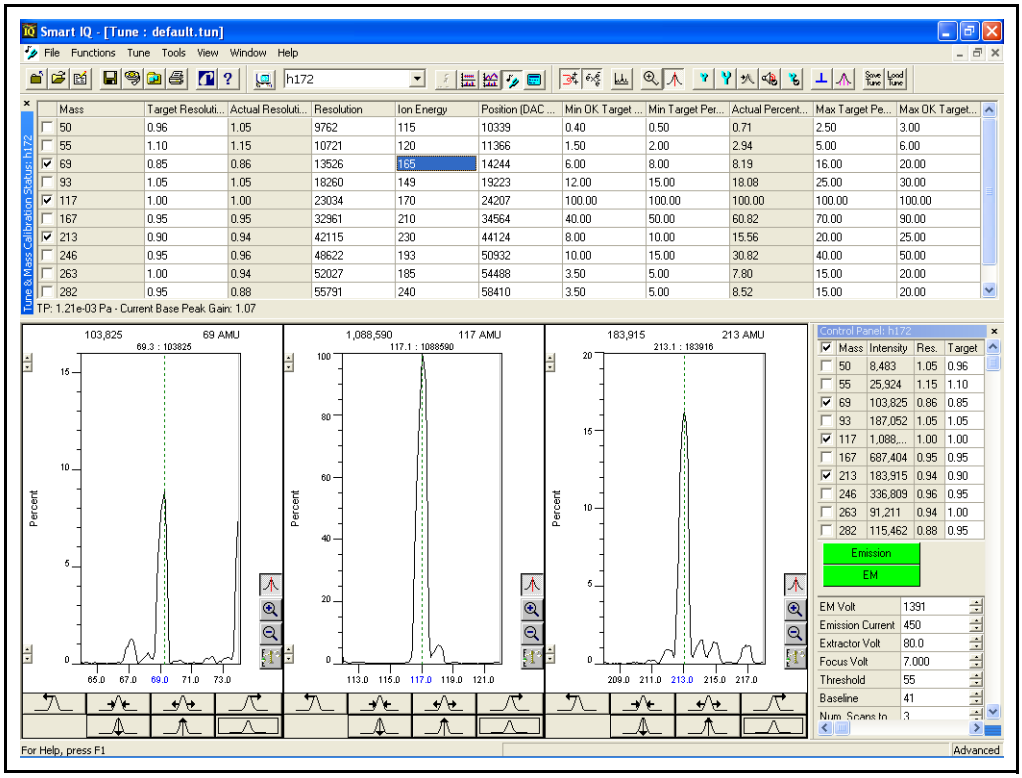
MASS	IE low	IE high
93	90	170
117	140	170
167	140	220
213	175	230
246	180	230
263	185	250
282	190	255

3 After making Ion Energy adjustments:

3a If the red boxes no longer appear, indicating the Actual Resolution is within range, proceed to Step 4. See Figure 7-36.

3b If the HAPSITE is failing to Tune, then repeat the Manual Tune procedure. Proceed to section 7.6.1, Adjusting Base Peak Gain, on page 7-26. If this procedure is repeated more than 2 times, contact INFICON.

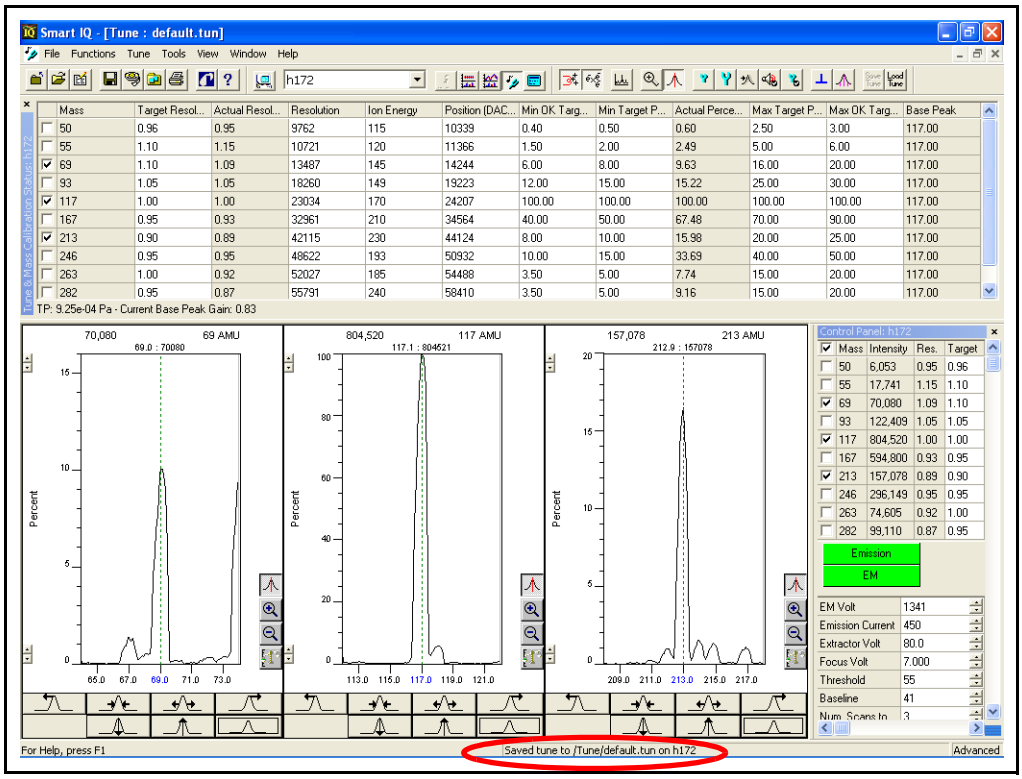
Figure 7-36 Good Manual Tune



4 Save the Tune file. Click **Save Tune** button on the upper Toolbar. See Figure 7-37 and Figure 7-38.

Figure 7-37 Save Tune Button

Figure 7-38 Tune Saved



5 Exit Manual Tune by closing the Tune window. The HAPSITE is ready for sampling.

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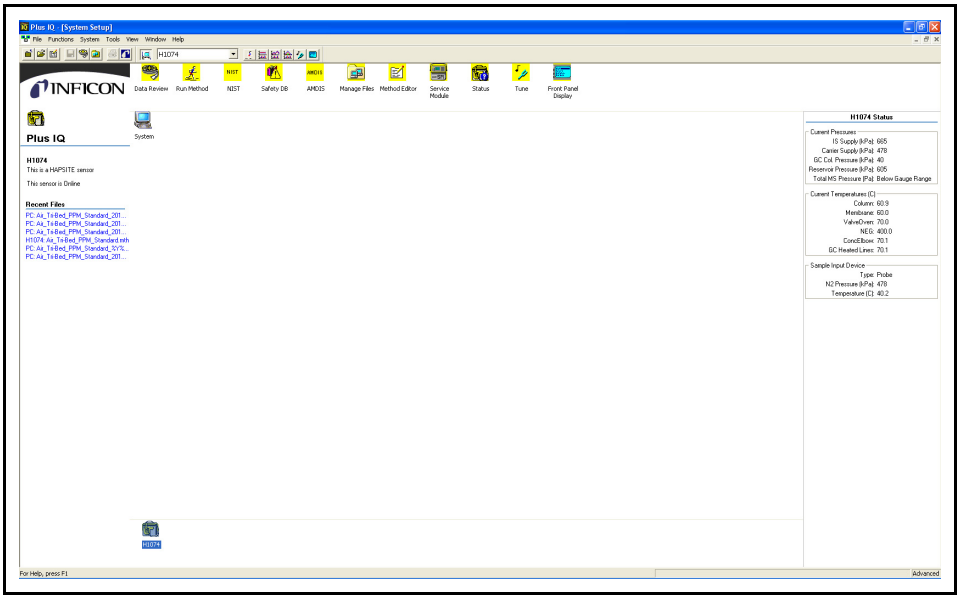
Chapter 8
Plus IQ Software

8.1 The HAPSITE Software - Plus IQ

Plus IQ software includes all of the functions and controls for the HAPSITE Chemical Identification System and its accessories. The software controls instrument operation, runs analyses, manages files and creates reports. Plus IQ can also view and interpret data collected by HAPSITE. The Plus IQ software operates on a Laptop.

The main window of the Plus IQ software is called System Setup. This appears as the first screen when the Plus IQ software is run. See Figure 8-1.

Figure 8-1 System Setup View in Plus IQ Software



8.2 Computer System Requirements

The following is the minimum recommended computer system for communication with one HAPSITE.

Processor . . . . . Pentium III 550 MHz or greater

RAM . . . . . 512 MB or greater

Hard Disk Space
to load Plus IQ. . . . . 20 Mb

Hard Disk Space for storage . . . . . 10 GB

Disk Drives . . . . . (1) CD, (1) USB drive

Monitor . . . . . 15 inch, SVGA or greater

Monitor Resolution . . . . . 1024 x 768 or greater

Communications . . . . . (1) RS-232 port and (1) Ethernet port

Operating System . . . . . Windows 2000 or XP

8.3 Installing and Updating the HAPSITE Smart Plus and Plus IQ Software

The steps for installing and updating the Plus IQ software are the same.

CAUTION

The most important point to remember is to <u>always</u> update the HAPSITE Plus software prior to updating the Plus IQ software on the computer.

8.3.1 Updating the HAPSITE Smart Plus Software

The HAPSITE Smart Plus is delivered with factory-installed software. These instructions explain how to upgrade that software.

The HAPSITE will need to be connected to the Laptop computer and communicating. Refer to Section 2.4.6, Connect Laptop (if desired), on page 2-10 if the HAPSITE and Laptop are not connected. See Section 8.6, Establishing Communications between the HAPSITE and Laptop Computer, on page 8-13 if communications need to be established.

For software installation instructions, refer to the instructions that are located on the software disk.

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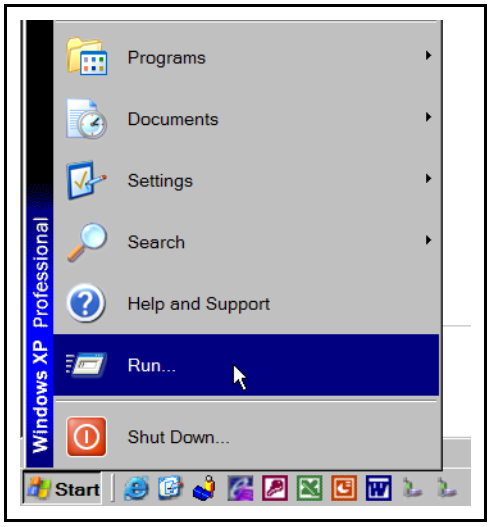
8.4 Installing/Updating NIST and AMDIS

The NIST and AMDIS mass spectral libraries are powerful tools for identifying VOCs contained in samples.

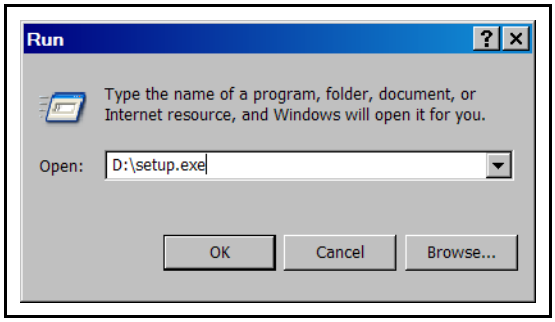
1. Insert the NIST Installation CD into the CD Drive of the Laptop.
2. Select **Start >> Run**. See Figure 8-2.

Figure 8-2 Selecting the Run Function



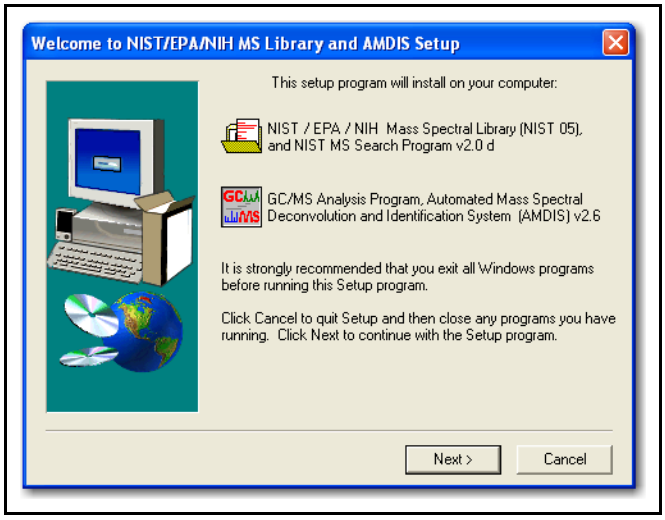
3. Type **D:\setup.exe**. Press **OK**. See Figure 8-3.

Figure 8-3 Running the Setup.exe Program



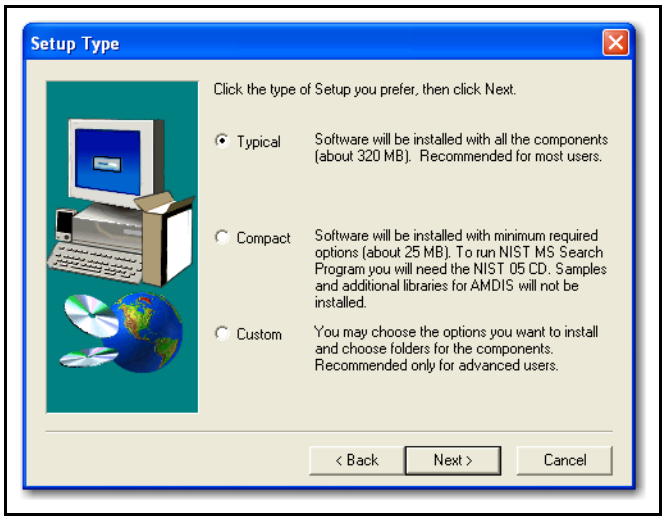
4 The welcome window for the NIST and AMDIS setup will appear. Press **Next**. See Figure 8-4.

Figure 8-4 NIST and AMDIS Installation Welcome Window



5 On the Setup window, select **Typical**. See Figure 8-5.

Figure 8-5 NIST and AMDIS Installation Setup Window



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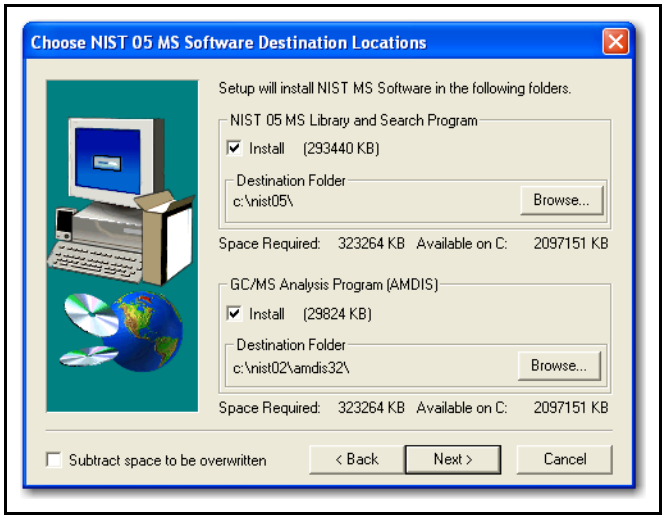
6 Press **Next**. Refer to Figure 8-5.

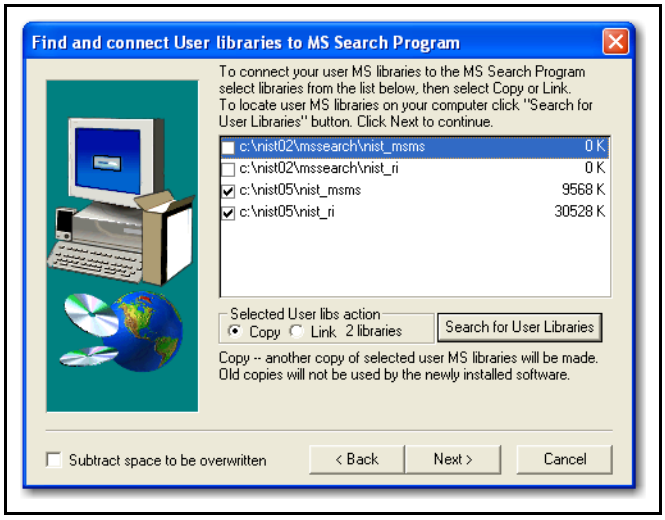
7 When prompted to choose the software destination location, ensure the **Install** check boxes are checked for NIST and AMDIS and press **Next**. See Figure 8-6.

Figure 8-6 NIST and AMDIS Program Designation Window



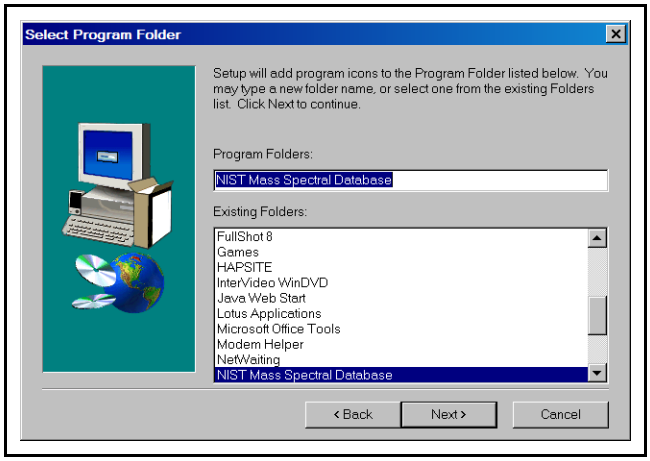
8 When prompted to find and connect to user libraries, make the selections shown in Figure 8-7 and press **Next**.

Figure 8-7 NIST and ADMIS Libraries



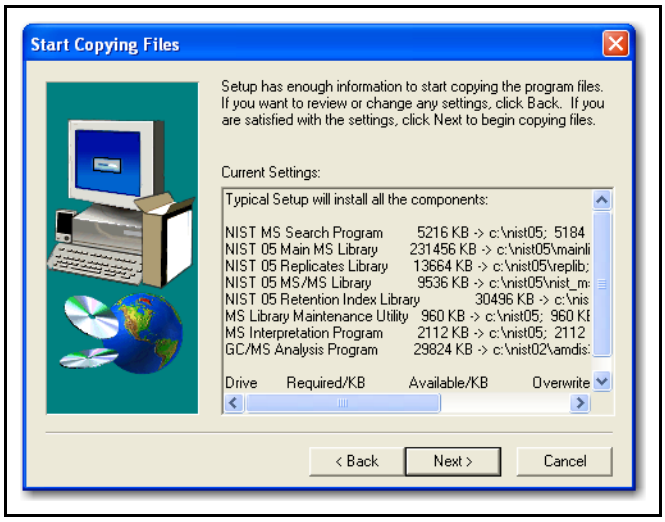
9 When prompted to select a program folder, use the default shown in Figure 8-8 and press **Next**.

Figure 8-8 Choosing the NIST and AMDIS Program Folder



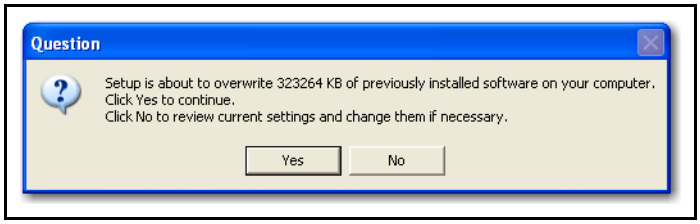
10 Press **Next** to start copying files. See Figure 8-9.

Figure 8-9 NIST and AMDIS Installation Copying Files



11 If a window appears asking to overwrite existing files, press **Yes**. See Figure 8-10.

Figure 8-10 Overwrite Files Prompt



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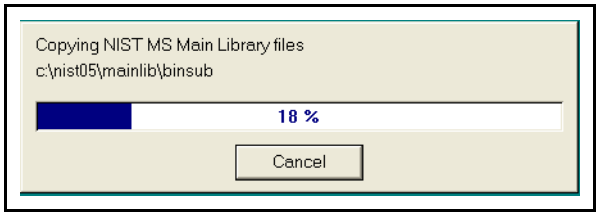
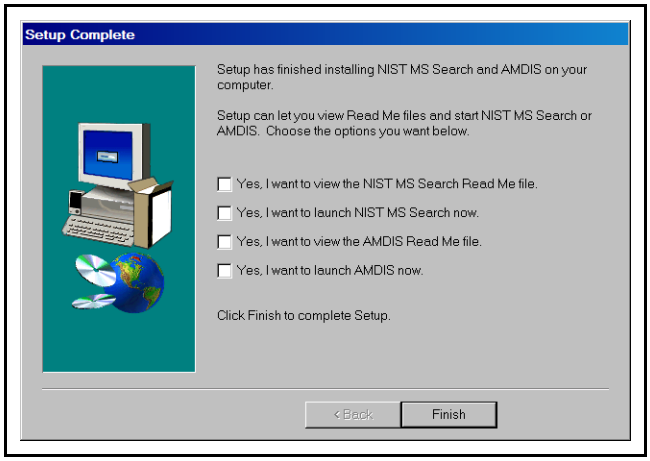
12 The installation will proceed automatically and will last a few minutes. See Figure 8-11.

Figure 8-11 NIST and ADMIS Installation Progress Window



13 A series of setup windows will appear, which is followed by a create program files window. When the Setup Complete window appears, press **Finish** to close the installation program. See Figure 8-12.

Figure 8-12 NIST and AMDIS Installation Complete Window



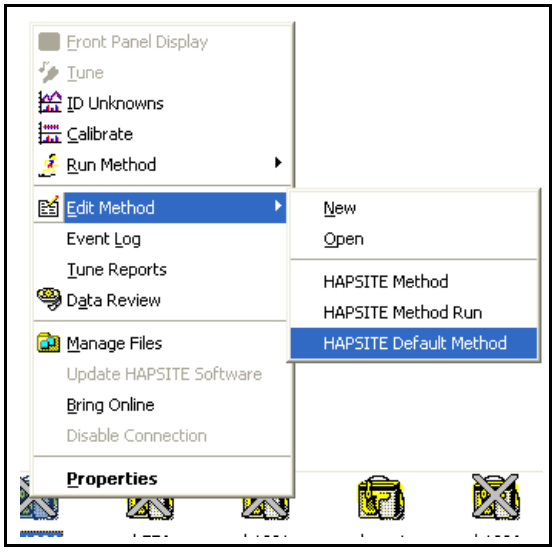
8.5 Reloading Default HAPSITE Methods

All of the default methods are saved on the Laptop. These methods can be loaded and modified or used as they are.

8.5.1 Locating Default Methods

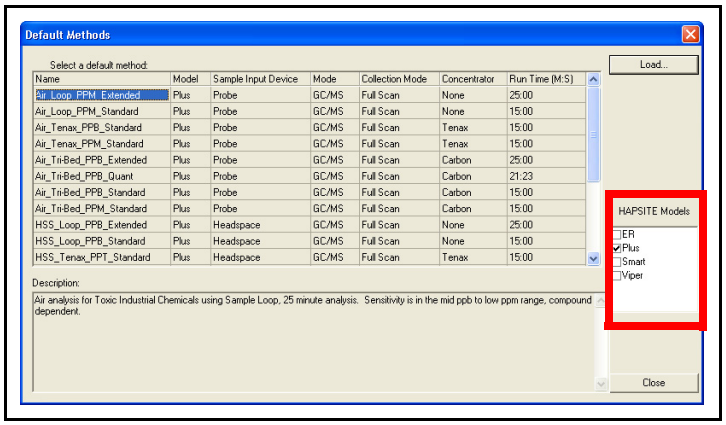
Right-click on the HAPSITE icon to access the menu. Highlight the **Edit Method** option and a second menu will appear. On this menu the bottom choice is **HAPSITE Default Method**. This provides access to the default methods. See Figure 8-13.

Figure 8-13 Finding Default Methods



Clicking on the **HAPSITE Default Method** option will bring up a window with the default methods. Check the **Plus** box to view Smart Plus methods. See Figure 8-14.

Figure 8-14 HAPSITE Default Methods



The methods found in the **Default Methods** window are general purpose methods for each of the HAPSITE Plus configurations.

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Air_Tri-Bed_PPB_Standard . . . . . Basic Carbon Concentrator method (15 minute analysis time)

Air_Tri-Bed_PPM_Standard. . . . . Carbon Concentrator Method to be used in lieu of Air_Loop_PPM_Standard (15 minute analysis time)

Air_Tenax_PPM_Standard . . . . . Tenax Concentrator Method to be used in lieu of Air_Loop_PPM_Standard (15 minute analysis time)

Air_Tenax_PPB_Standard . . . . . VOC and Chemical Warfare Agent Air Analysis using Tenax Concentrator (15 minute analysis sample time. Consists of 1 minute inlet purge plus one minute sample collection.)

Air_Loop_PPM_Standard . . . . . VOC and Chemical Warfare Agent analysis using Sample Loop (15 minute analysis time)

HSS_Tri-Bed_PPT_Standard . . . . . VOC and Chemical Warfare Agent Headspace Solid/Liquid analysis using the Tri-Bed Concentrator (15 minute analysis time)

HSS_Loop_PPB_Standard . . . . . VOC and Chemical Warfare Agent Headspace Solid/Liquid analysis using Sample Loop (15 minute analysis time)

HSS_Tenax_ PPT_Standard. . . . . VOC and Chemical Warfare Agent Headspace Solid/Liquid analysis using Tenax Concentrator (15 minute analysis time)

SP_Tri-Bed_PPT_Standard . . . . . General purpose analysis for VOCs in a water matrix using the Tri-Bed Concentrator and SituProbe (15 minute analysis)

SP_Loop_PPB_Standard. . . . . General purpose analysis for VOCs in a water matrix using Sample Loop and SituProbe (15 minute analysis)

SP_Tenax_PPT_Standard . . . . . General purpose analysis for VOCs in a water matrix using Tenax Concentrator and SituProbe (15 minute analysis)

Survey . . . . . Quick analysis to determine if there are VOCs in an area (analysis time is determined by the user, 2 minutes is suggested)

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NOTE: In addition to the standard 15 minute methods, there are 25 minute methods for the Sample Loop and Concentrators. These methods end in Extended in place of the Standard portion of the name. The analysis of Toxic Industrial Chemicals is the suggested use for these methods. The extended analysis time provides improved resolution of multiple compounds and elution of higher boiling point compounds.

8.5.2 Loading a Default Method to the HAPSITE

1. From the Default Methods Menu, select the default method to load. Refer to Figure 8-14, HAPSITE Default Methods, on page 8-8.

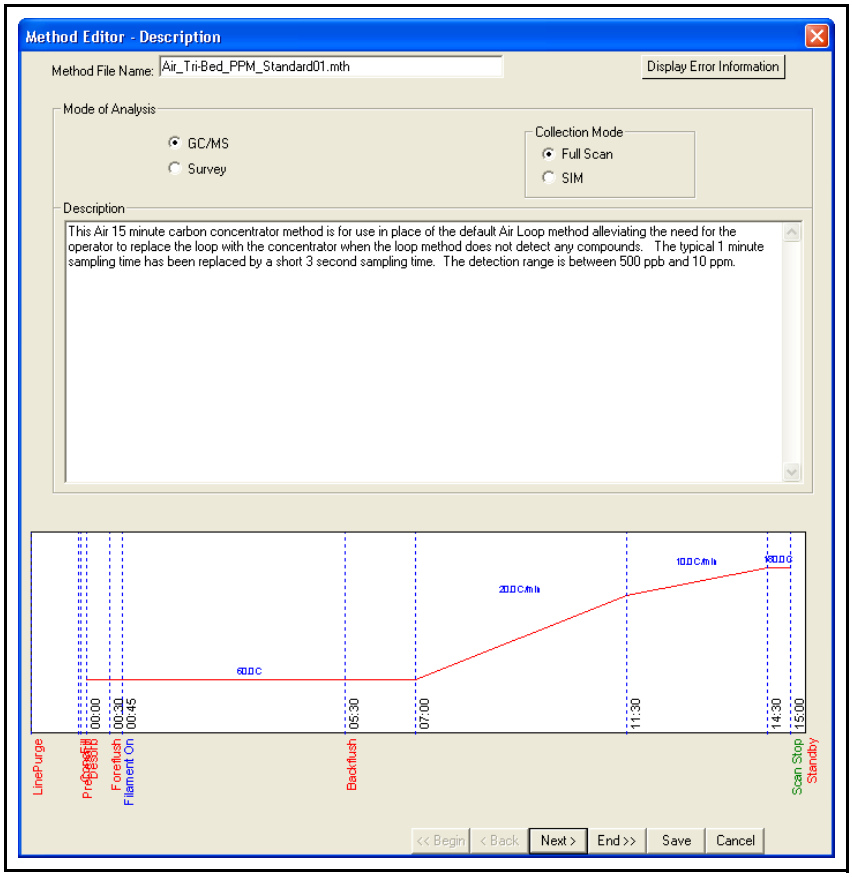
   HINT: Refer to Section 8.5.1, Locating Default Methods, on page 8-8 to find the default methods.

2. Press the **Load** button. See Figure 8-14, HAPSITE Default Methods, on page 8-8.

3. Press the **Save** button at the bottom of the Method Editor Description window. See Figure 8-15.

   NOTE: The method file name is the default method name with a two digit number appended (e.g., 01). If the two digits are not desired, then remove them from the file name before pressing the **Save** button.

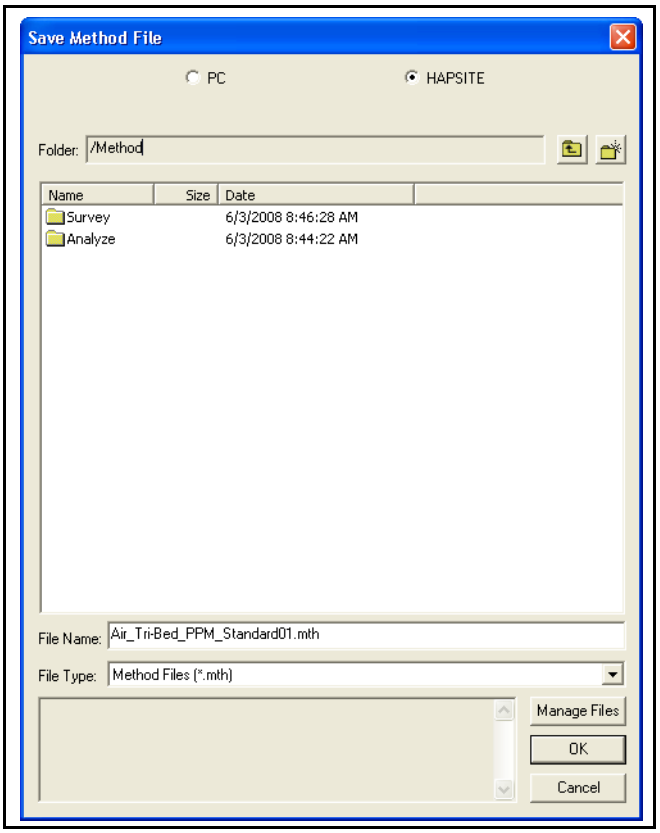
Figure 8-15 Default Methods Method Editor Description Window



4 Double-click the **Analyze** folder for Analyze methods (or Survey folder for a Survey method). See Figure 8-16.

HINT: Make sure HAPSITE is selected at the top of the Save Method File dialog. See Figure 8-16.

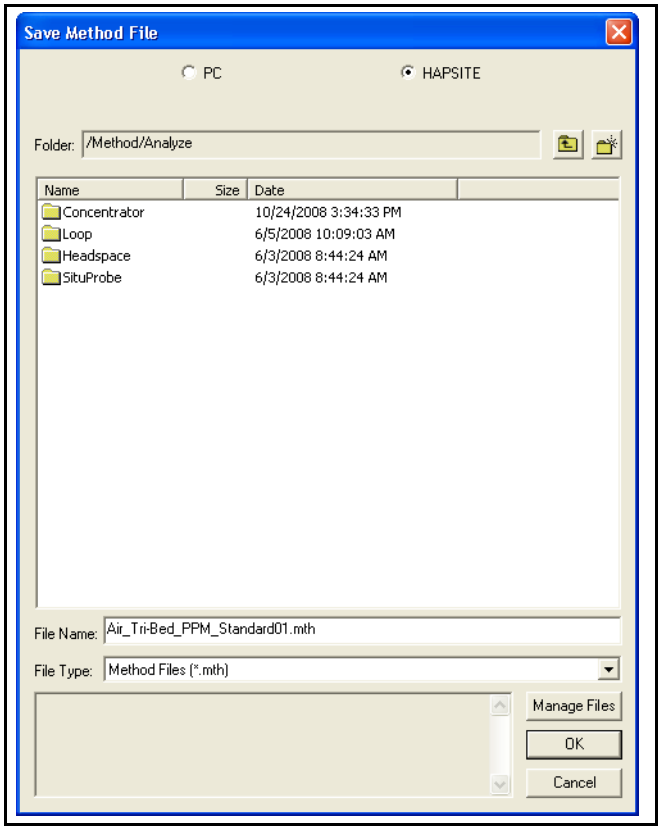
Figure 8-16 Choosing the Analyze Folder



5 Double-click on the appropriate folder for the method to be saved. See Figure 8-17.

NOTE: If using a Survey Method, skip Step 5.

Figure 8-17 Choosing the Appropriate Folder



6 The default name is automatically modified by Plus IQ, or it can be manually renamed. Press **OK**. The method is now saved to the HAPSITE.

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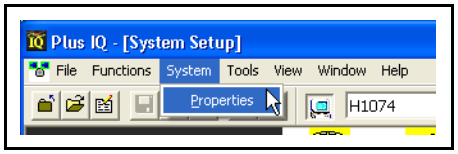
8.6 Establishing Communications between the HAPSITE and Laptop Computer

Establishing communications between the HAPSITE, Laptop and Service Module (if connected) is necessary to perform many advanced functions. The sections which follow explain the steps needed to establish communications.

8.6.1 Setting Up Communications

1 Open Plus IQ. From the **System** drop-down menu, select **Properties**. See Figure 8-18.

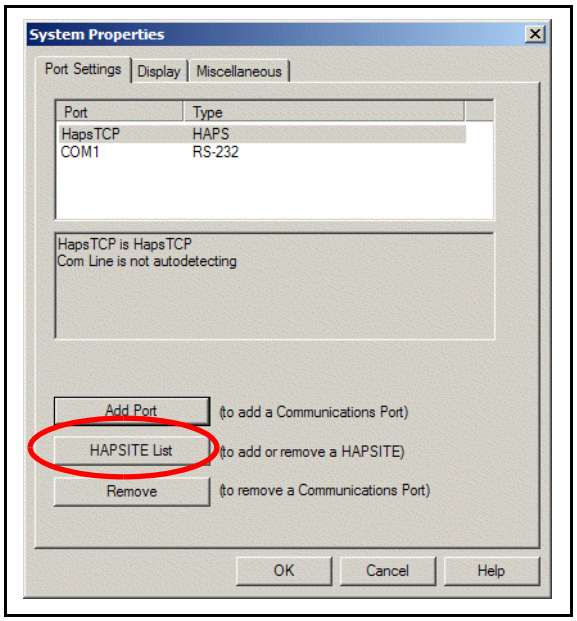
Figure 8-18 Selecting Properties from the System Drop-down Menu



NOTE: You must be in Advanced User Mode to set up communications. See Section 8.9, Access Levels, on page 8-23.

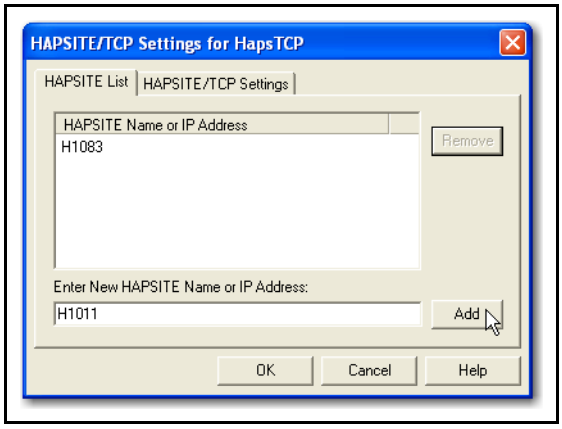
2 Press the **HAPSITE List** button. See Figure 8-19.

Figure 8-19 HAPSITE List Button



3 Enter the letter "**H**", followed by the last **3 or 4 significant digits of the Serial Number** of the HAPSITE that requires communication setup. (The Serial Number can be found on the inside front cover of the HAPSITE or by touching the **HAPSITE** icon, then the **HAPSITE System** icon and then the **NET** button.) For example: "**H1086**". Select **Add**. See Figure 8-20.

Figure 8-20 Add HAPSITE



4 The newly added HAPSITE will appear in the HAPSITE List. Press **OK**.

5 Press **OK** on the System Properties Window.

6 The newly added HAPSITE icon will now appear at the bottom of the System Setup Window. If the HAPSITE appears as in Figure 8-21, then communications have been established.

Figure 8-21 Newly Added HAPSITE

6a If the HAPSITE icon appears with a Blue "X" through the icon, then communication has not been fully established. See Figure 8-22.

Figure 8-22 Communication Has Not Been Established

6b Continue with Configuring the HAPSITE for Communications, see section 8.6.2.

NOTE: If the HAPSITE is shown with an a Blue "X", setting up the HAPSITE for communication using the IP address can also be tried.

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8.6.2 Configuring the HAPSITE for Communications

1 If communication between the HAPSITE and the Laptop could not be established using Section 8.6.1, Setting Up Communications, on page 8-13 continue with Step 2.

2 Press the **STAT** key on the front panel of the HAPSITE until the System Parameters page is displayed.

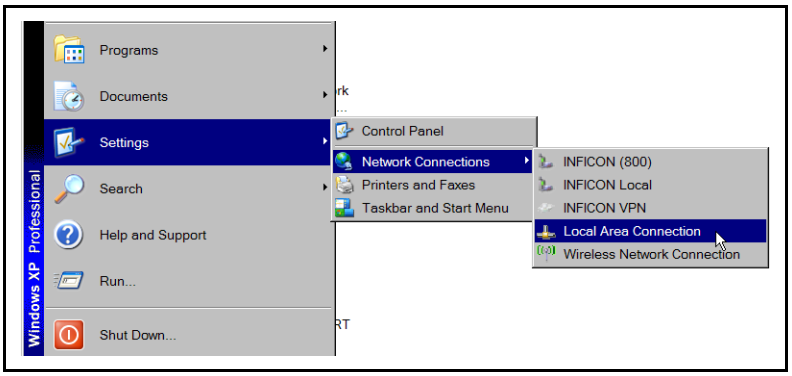
3 Use the **arrow keys** to highlight **NET**, push **OK SEL**. Alternately, touch **NET**. The IP address of the HAPSITE will be displayed. Example: 10.210.4.62 / 255.254.0.0. Each HAPSITE will have a unique IP address.

4 On the Laptop, press **Start**. Depending on the Laptop's setup follow either Step 4a or Step 4b.

4a Click on **Settings**, drag the cursor over **Network Connections,** drag the cursor over **Local Area Connection** and click the Left Mouse Button. See Figure 8-23.

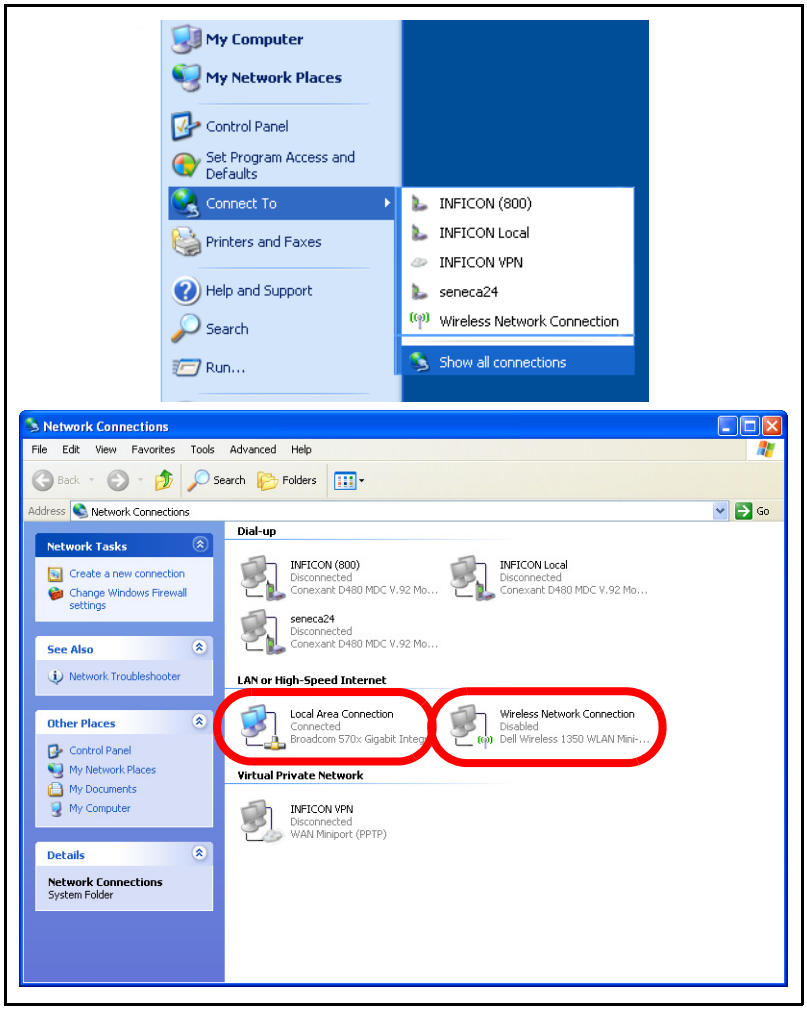
NOTE: For wireless connections, select **Wireless Network Connection**.

Figure 8-23 Network Connections Classic View



4b Click on **Connect to**, drag the cursor over **Show All Connections** and click **Left Mouse Button**. Click on **Local Area Connection**. See Figure 8-24.

Figure 8-24 Network Connections Standard View



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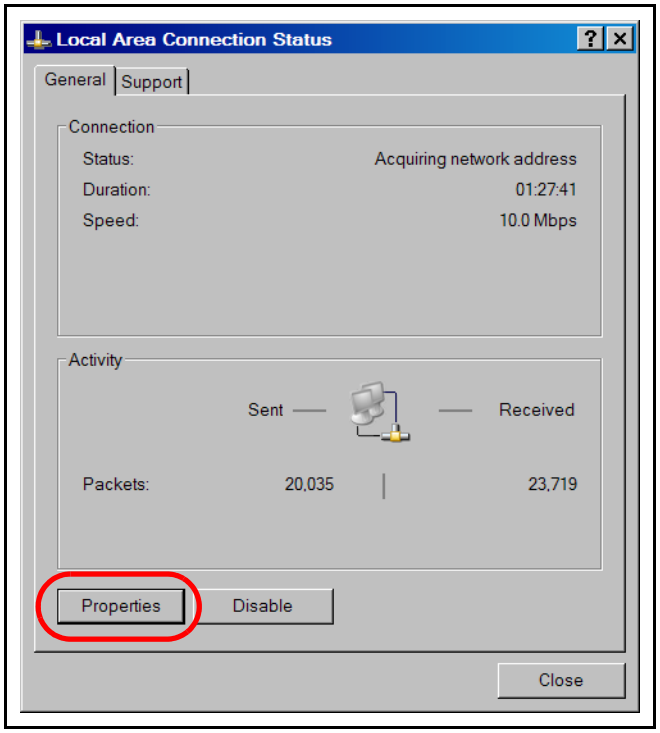
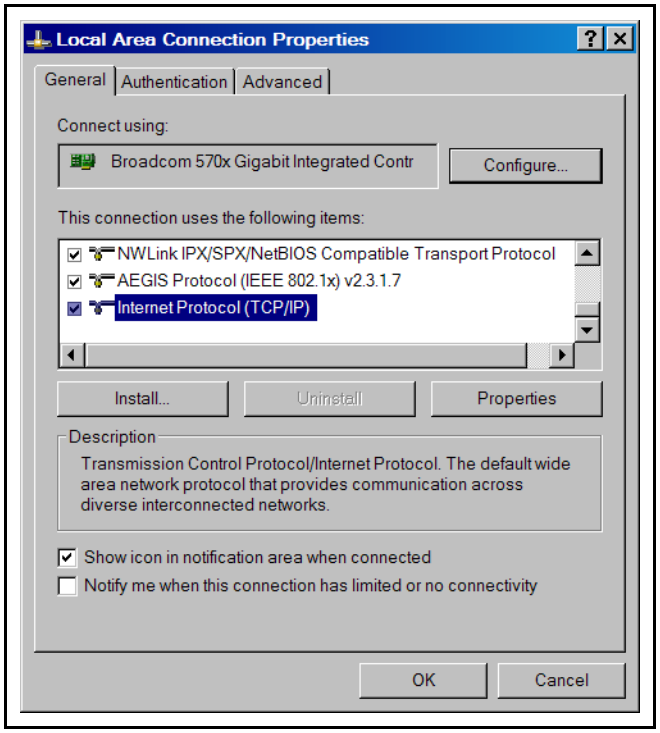
5 The Network Connection Status Window will open. Click the desired connection and press **Properties**. See Figure 8-25.

Figure 8-25 Local Area Connection Status Window



6 In the General tab, scroll down and highlight **Internet Protocol (TCP/IP)**, press **Properties**. See Figure 8-26.

Figure 8-26 Selecting Internet Protocol (TCP/IP)



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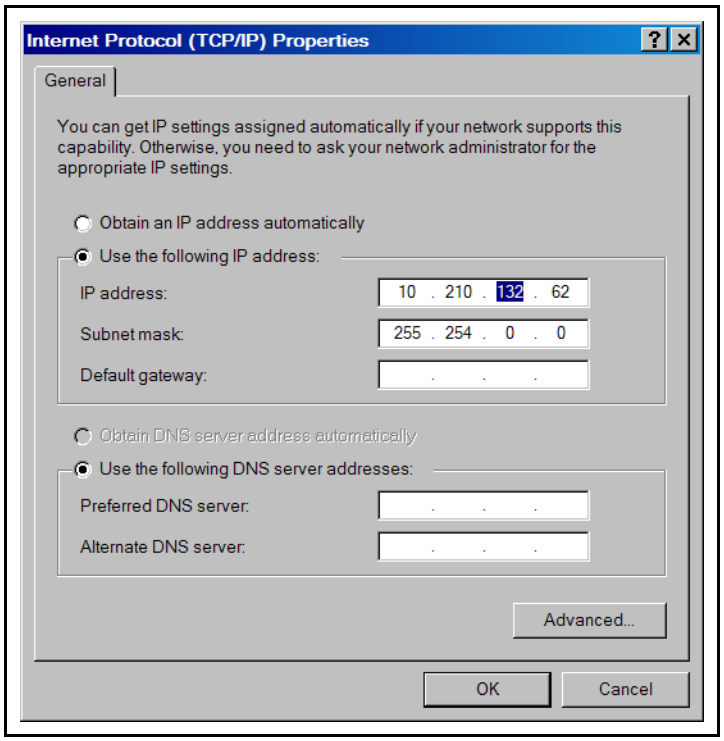
7 Select **Use the following IP address** and enter the IP address of the HAPSITE, (refer to Step 3 on page 8-22), with the number 128 added to the third number of the first line of the IP address. This is necessary in order for the system to configure communications properly. Example: 10.210.4.62 becomes 10.210.132.62. Press **OK**.

NOTE: If configuring the HAPSITE for a wireless configuration, change the second number, 210, to 209.

Figure 8-27 Entering IP Address



8 Press **OK** in the Internet Protocol Window to close the window.

9 Communication between the HAPSITE and the Laptop is now established as indicated by the HAPSITE Sensor in the Plus IQ System Setup Window.

Figure 8-28 Active HAPSITE Sensor Icon

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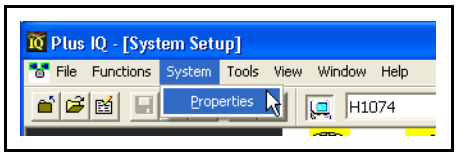
8.6.3 Establishing Communication with the Service Module

Service Module communications will be established automatically if a COM port has been selected. Plus IQ has been set up with COM1 communications, so Plus IQ will automatically recognize and communicate when a Service Module is connected using a RS-232 cable.

Open Plus IQ. From the **System** drop-down menu, select **Properties**. See Figure 8-18.

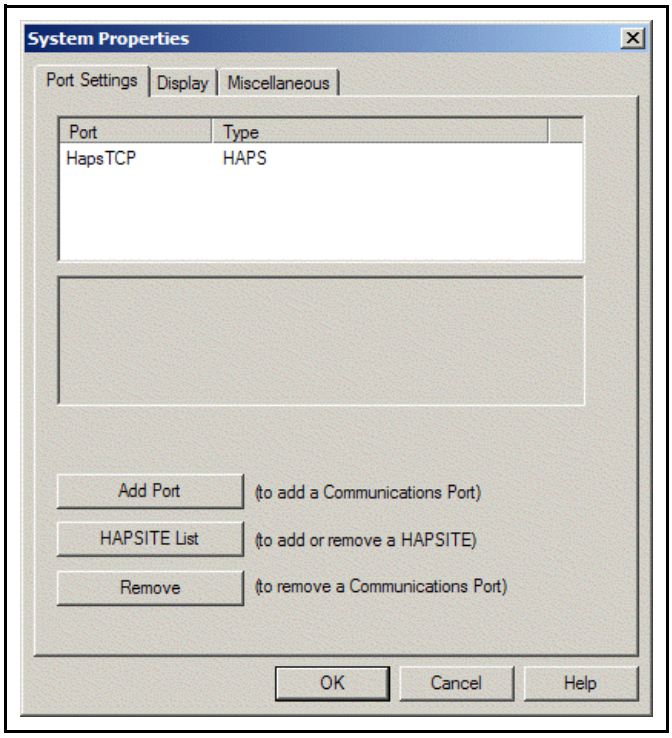
Figure 8-29 Selecting Properties from the System Drop-Down Menu



NOTE: You must be in Advanced User Mode to set up communications. See Section 8.9, Access Levels, on page 8-23.

In case the COM port communication has been removed, select the **Add Port** button. See Figure 8-30.

Figure 8-30 Port Settings in System Properties Window



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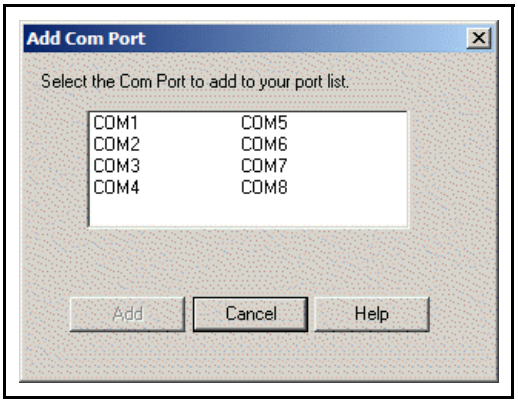
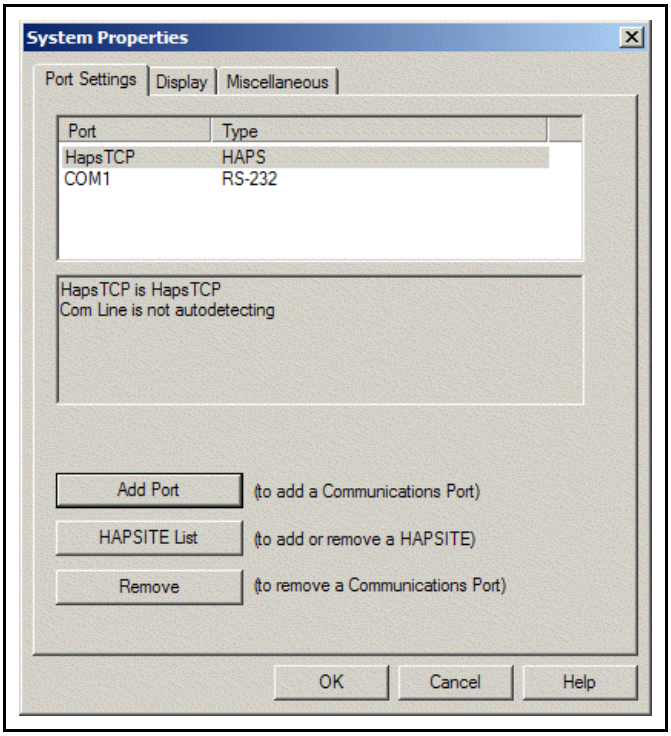
When **Add Port** is selected, the window shown in Figure 8-31 will appear. Select the appropriate COM port to add. Select **COM1** or the appropriate COM port.

Figure 8-31 Selecting a COM Port to Add



After the COM port has been selected, the COM port will appear in the **Port** list in the System Properties window, as shown in Figure 8-32.

Figure 8-32 Port List in Port Settings Tab of System Properties



Press the **OK** button. The system will automatically establish communications with a Service Module (if powered on and connected using a RS-232 cable.) Please refer to Section 2.8.1, Setting Up the Service Module, on page 2-19 for more details.

8.7 Establishing Communications between the HAPSITE and Laptop Computer Using the Wireless Connection

Refer to Chapter 4, Wireless and Touch Screen Options and Section 8.6.2, Configuring the HAPSITE for Communications, on page 8-15 for information on configuring the HAPSITE Plus to communicate via the wireless connection with the Laptop computer.

8.8 Setting the HAPSITE Time Zone

To set the HAPSITE Time Zone, continue on with this procedure.

1 Open the **Plus IQ** software. See Figure 8-33.

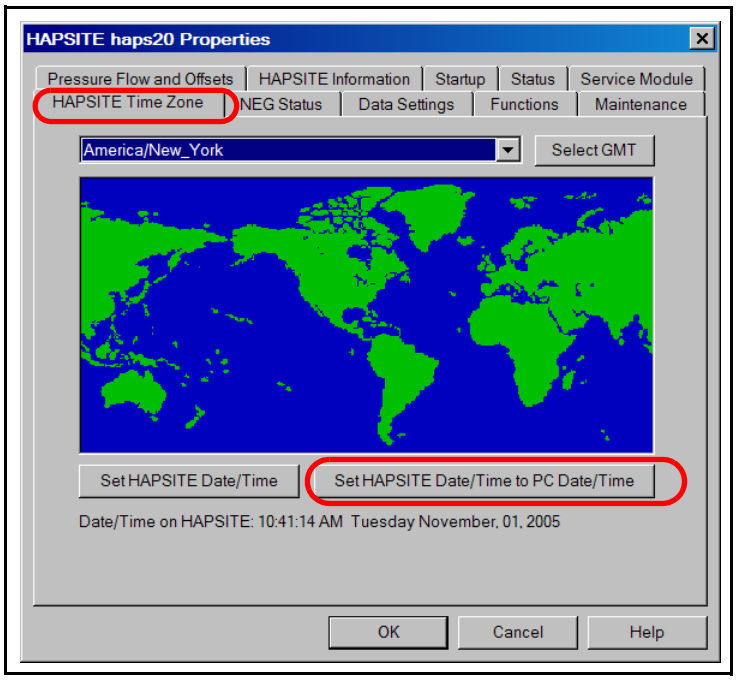
Figure 8-33 Plus IQ Icon

2 On the System Set-up Page, double-click on the **HAPSITE Sensor Icon**. See Figure 8-34.

Figure 8-34 HAPSITE Sensor Icon

3 Click on the **HAPSITE Time Zone** tab in the Properties Window. See Figure 8-35.

Figure 8-35 HAPSITE Time Zone Tab



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4 Select the correct Time Zone from the drop-down list above the map.

5 Press **OK** and reboot the HAPSITE. A reboot is required to set the Time Zone.

6 Return to the dialog shown in Figure 8-35 to synchronize the Laptop and HAPSITE data and time.

7 Click on **Set HAPSITE Date/Time to PC Date/Time**. Press **OK**. Refer to Figure 8-35.

8 The HAPSITE will be synchronized with the Date and Time of the computer.

8.9 Access Levels

There are two user Access Levels which can be set in Plus IQ: **Normal** and **Advanced**. Neither Access Level is installed with a password.

Normal users can run samples, view results and perform basic operations with HAPSITE Plus.

Advanced is a higher level which allows access to all user operations. This includes everything a Normal user is allowed plus Tune, Method Editor, and some service actions.

WARNING

The Advanced user level allows changes to key setpoints. Trained users should only adjust these setpoints to prevent adjustments that may result in inaccurate data collection.

The default access level is Normal, and no password is set by the factory. To restrict access to advanced functions, an Advanced user password can be set. Once the password is set, the password must be entered each time the Plus IQ program is restarted, or whenever the access level is changed from Normal to Advanced.

NOTE: Lost passwords may delay Service and Repairs.

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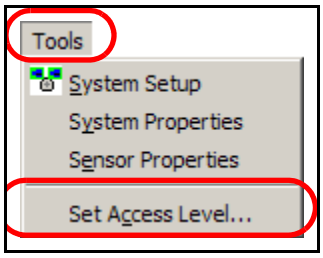
8.9.1 Changing Access Levels

NOTE: When **Normal** access level is selected, a message will appear stating that some areas of Plus IQ will be restricted from access.

1 To change the access level, click on **Tools** on the System Startup Page.

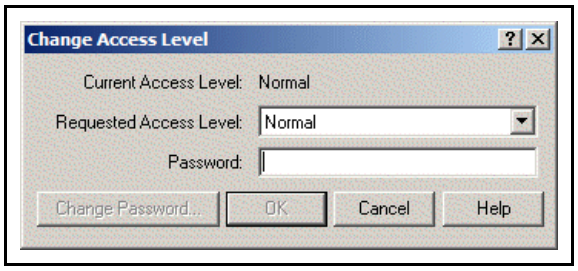
1a Select **Set Access Level...**. See Figure 8-36.

Figure 8-36 Choose Set Access Level.... from Tools Menu



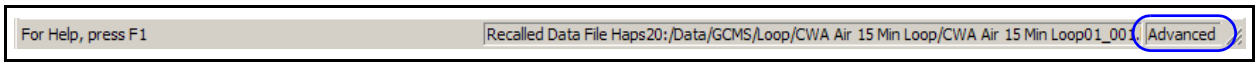
2 To select advanced access, click on the **Requested Access Level** pull-down menu and select **Advanced**. If a password has been entered, the **current password** will need to be entered in the password box before pressing **OK**. See Figure 8-37.

Figure 8-37 Change Access Level Window



3 The current access level of the system is shown at the bottom right corner of the Plus IQ program, in the Status Bar, as shown in Figure 8-38.

Figure 8-38 Current Access level, shown in Status Bar



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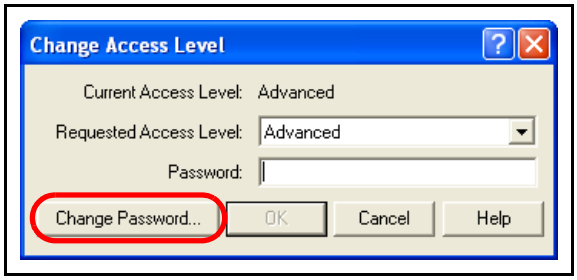
8.9.2 Setting or Changing the Access Level Password

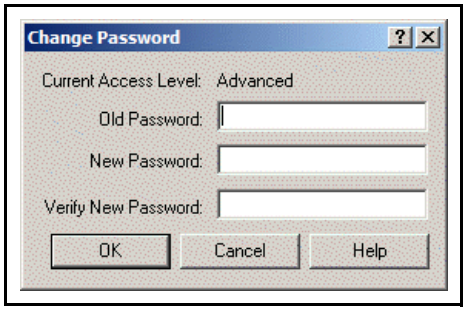
1. To change the Advanced level password, first enter Advanced level.
2. Press the **Change Password** button. See Figure 8-39.

Figure 8-39 Change Password Button



3. The window shown in Figure 8-40 will appear.

Figure 8-40 Change Password Window



4. In order to change the password, the correct existing password must be entered in the **Old Password** box. The new password must be entered in both **New Password** and **Verify New Password** boxes. Press **OK** to set the new password, or press cancel to exit without resetting the password.
5. Once the new password has been entered, the Change Access Level window will re-appear. Press the **Cancel** button to close the window. Refer to Figure 8-39.

NOTE: Plus IQ remembers the last access level when closed. When the program is re-opened, the system will default to the last access level used. If a password has been set, the user will be required to enter the correct password to open with Advanced access. If the password is not known, the user can select Normal access and continue.

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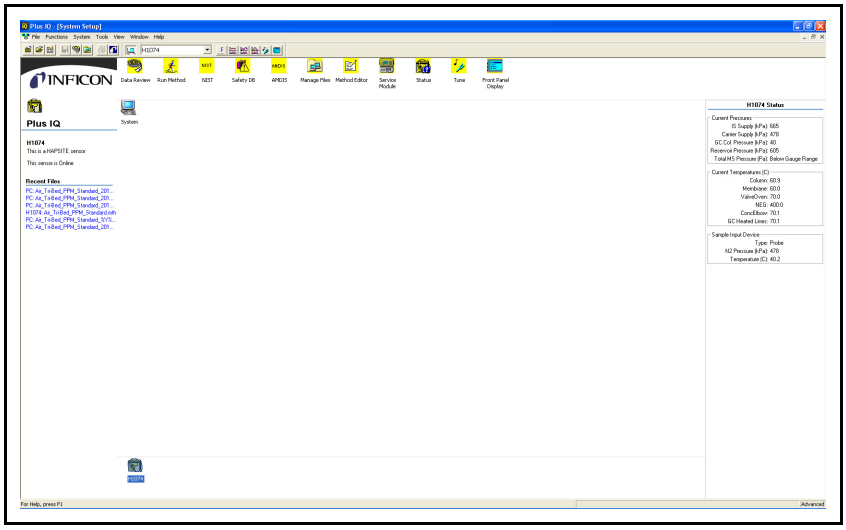
8.10 Plus IQ Controls

The System Setup Page is the main screen of the Plus IQ software. The System Setup Page appears as shown in Figure 8-41 upon initial installation.

Figure 8-41 Plus IQ - System Setup View



The screen includes various user interfaces, including:

- A menu, located at the top of the window
- Toolbars to perform various actions
- A main screen which displays component connections, such as HAPSITE and Service Modules connected. This screen also shows the status of the selected HAPSITE or Service Module.
- When a HAPSITE sensor or Service Module sensor is selected, the sensor displays icons to execute functions for that device.

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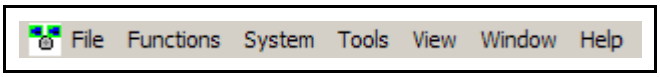
8.10.1 System Setup Main Menu

The Main Menu in the System Setup view includes entries which can change, depending upon the item selected and the user Access Level selected. See Figure 8-42.

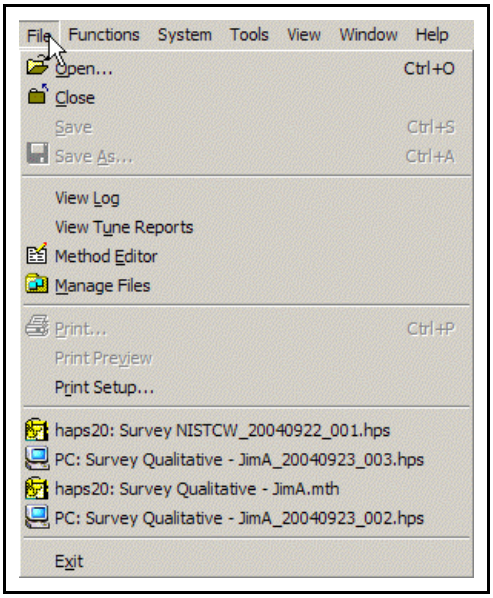
Figure 8-42 System Setup Main Menu



8.10.1.1 File

The **File** drop-down menu is shown in Figure 8-43.

Figure 8-43 File menu selection



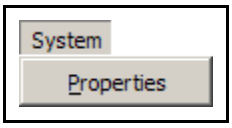
8.10.1.2 Functions

Functions are only available when a component is selected (System, HAPSITE, Service Module, etc.).

8.10.1.3 System

The **System** menu accesses **Properties**. See Figure 8-44.

Figure 8-44 System Menu



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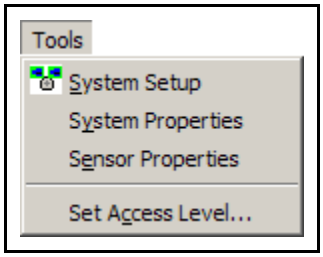
8.10.1.4 Tools Menu

The **Tools** menu, shown in Figure 8-45, is consistent for all screens in Plus IQ. Tools includes **System Setup**, which allows switching back to the System Setup view. The menu also includes **System Properties**, **Sensor Properties**, and **Set Access Level...**.

Figure 8-45 Tools Menu



8.10.1.5 View Menu

The View menu provides selections for displaying and removing parts of the user interface. There is also a choice to use large Toolbar buttons.

8.10.1.6 Window Menu

The Window menu is a standard menu for maximizing and minimizing windows in the program.

8.10.1.7 Help Menu

The Help menu provides version information about Plus IQ.

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8.11 Software Versions for the HAPSITE and Laptop

Table 8-1 Plus IQ and HAPSITE Smart Plus Compatibility Guide

Plus IQ Version (PC)	HAPSITE Smart Plus (AM)	Release Date
2.0	2.0	May 2008
2.1	2.1	May 2009
2.2	2.2	April 2010

HAPSITE Smart Plus's use HAPSITE Smart Plus software. Laptops use Plus IQ software. Even though the two programs usually are distributed on the same CD, the programs are not the same and require separate installations. Refer to Section 8.3, Installing and Updating the HAPSITE Smart Plus and Plus IQ Software, on page 8-2.

Click on the Plus IQ Information icon to check the software version for the Laptop.

Figure 8-46 Plus IQ Information Icon

Refer to Section 3.7.1, System Parameters, on page 3-50 to determine how to check the version of the HAPSITE Plus software installed on the HAPSITE.

CAUTION

If possible both the Laptop and HAPSITE should always have the most current version of the software installed. The chart above shows the compatibility of the Plus IQ and HAPSITE Smart Plus software. Do not try to run incompatible versions of software together..

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8.12 HAPSITE Icons

Table 8-2 HAPSITE Icons

Icon	Description
	Starts Plus IQ Software from Desktop.
 System	System Properties (Communications, Display, Miscellaneous)
 haps4	HAPSITE Sensor. Right Mouse Button to access menu.
 Data Review	Accesses all saved data files.
 Run Method	Accesses methods to initiate a run.
NIST NIST	Accesses the NIST software and Library.
	Accesses the NIOSH Database.
AMDIS AMDIS	Accesses the AMDIS software and library.
 Manage Files	Allows transfer of files between HAPSITE and Laptop.

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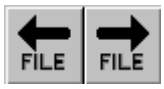
Table 8-2 HAPSITE Icons (continued)

Icon	Description
 Method Editor	Allows editing and creating methods.
 Service Module	Accesses the Service Module when attached.
 Status	Accesses HAPSITE Properties.
 Tune	Accesses the HAPSITE tune program.
 Front Panel	Opens the HAPSITE Front Panel display on the Laptop screen.
	Accesses Data file information.
	Returns the current screen to the System Setup screen.
	Accesses Plus IQ software information.
	Accesses the Calibrate function.
	Accesses the ID Unknowns function.
	Accesses Chromatogram Overlay function.

Table 8-2 HAPSITE Icons (continued)

Icon	Description
	Navigates through files in Data Review.
	Navigates through peaks in “search for peaks”.
	Returns to the complete full chromatogram (TIC) display in “search for peaks”.

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Chapter 9
Data Review

9.1 Introduction to Data Review

The **Data Review** section of the HAPSITE Smart Plus software allows access to previously acquired data for review and analysis, or to view data that is being acquired in real time. Data Review functionality includes:

- Searching quickly for individual components using the NIST Library and the F7 key.
- The **Search for Peaks** function to scan and tentatively identify all peaks in a Total Ion Chromatogram (TIC), as well as generate a report.
- Specifying which masses to view in a Reconstructed Ion Chromatogram (RIC).
- Selecting Scan ranges to be viewed in the TIC.
- Zooming in/out of TIC/RIC.
- Subtracting backgrounds from TIC.
- Subtracting specific scans from acquired spectra.
- Grabbing spectra for analysis utilizing the full NIST database program.
- Searching with **AMDIS** (**A**utomated **M**ass Spectral **D**econvolution and **I**dentification **S**ystem) for TIC qualitative identification.
- Reviewing data file information.
- Labeling TIC and individual spectra.
- Viewing the method used to acquire data.
- Viewing the GC column temperature profile (if applicable).
- Adjusting properties of the Data Review.

These features will allow the tentative identification of unknowns using the NIST or AMDIS spectral libraries. They also prepare reports that will aid in the identification of unknown chemicals.

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9.2 Accessing the Data Review Feature

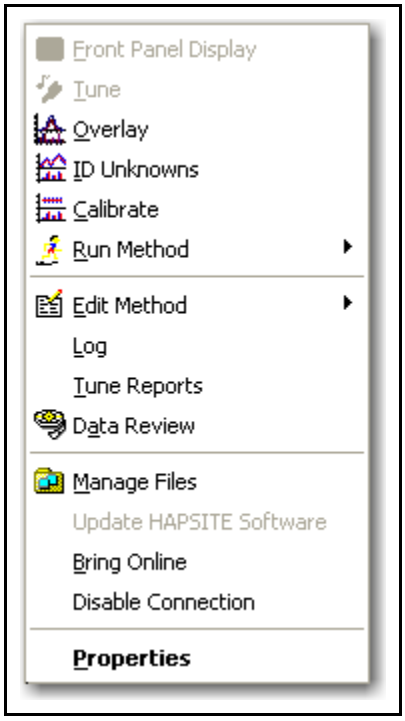
The **Data Review** feature can be accessed as follows:

- Double-click the **Data Review** icon, see Figure 9-1, or

Figure 9-1 Data Review Icon

- Right-click the **HAPSITE** icon. The menu shown in Figure 9-2 will appear. Click **Data Review**.

Figure 9-2 Data Review Menu



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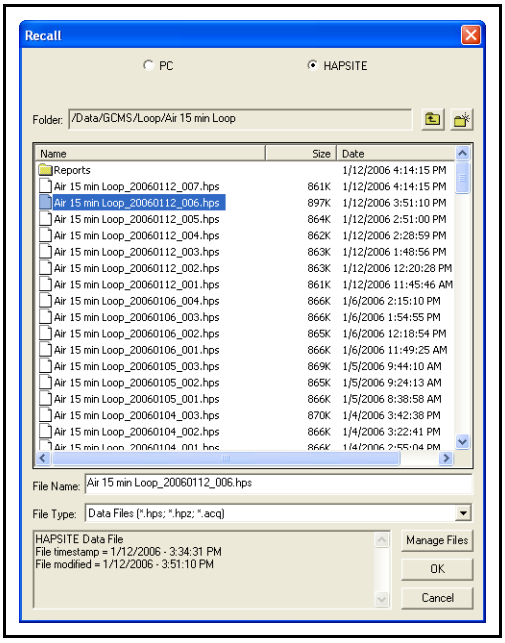
The Recall window will appear. Select the desired data file, either from the PC or the HAPSITE. See Figure 9-3.

Figure 9-3 Data Recall Window



There are three data file extensions that are available:

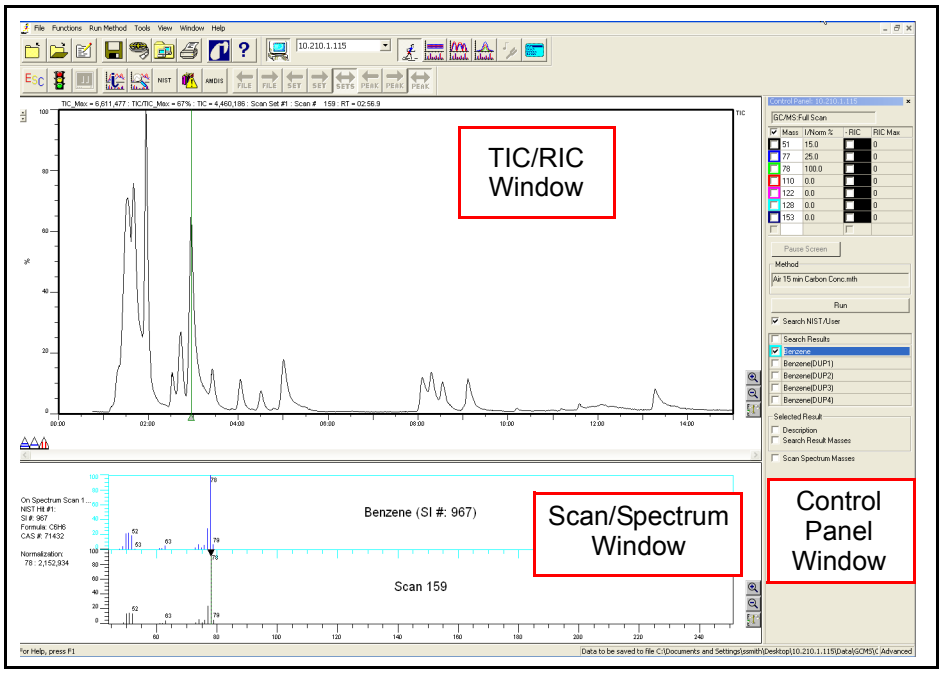
***.hps**. . . . . HAPSITE Smart Plus data file extension

***.hpz**. . . . . Compressed HAPSITE Smart Plus data file extension

***.acq**. . . . . HAPSITE 5.2 and below data file extension

Once selected, the Data Review screen with the requested data file will be displayed. The Data Review screen is divided into three sections, as shown in Figure 9-4.

Figure 9-4 Sections of the Data Review Screen



TIC/RIC Window . . . . . This window displays the Total Ion Chromatogram. This is the screen where basic data analysis, such as background subtraction and selecting peaks, is conducted.

Control Panel Window . . . . . This window allows the input of masses to plot RICs for the specified mass. Check **Search NIST/User** to search the NIST library for the current spectrum.

Scan/Spectrum Window . . . . . This window displays the spectrum generated from the TIC/RIC window. This window will also display NIST matches if **Search NIST/User** is checked in the Control Panel.

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9.3 Data Review Toolbar

The Data Review toolbar is shown in Figure 9-5.

Figure 9-5 Data Review Toolbar

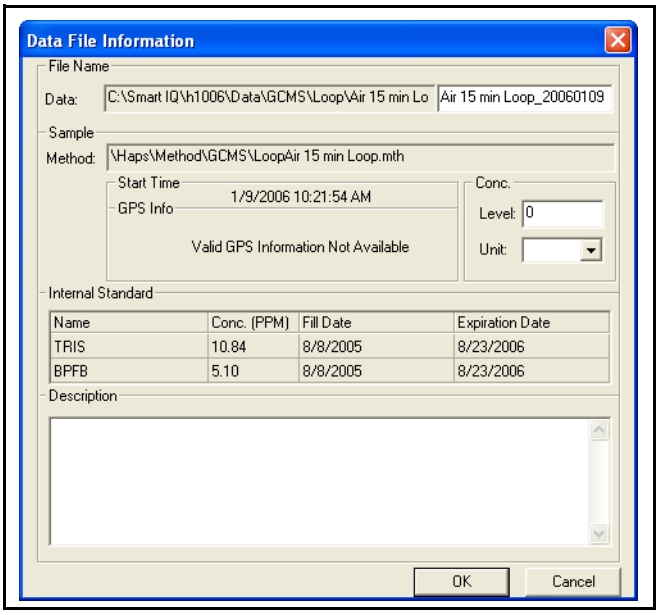
. . . . . Aborts a running method.


. . . . . Start/Stops a method.


. . . . . Pauses a Run in Progress.


. . . . . Accesses Data File Information Page (see Figure 9-6).

Figure 9-6 Data File Information Page




. . . . . Views search reports for this data file.

. . . . . Opens NIST Program.


. . . . . Opens NIOSH Database.

. . . . . Opens AMDIS Program.

. . . . . Opens the previous file in the current directory.

. . . . . Opens the next file in the current directory.

. . . . . Opens previous SIM Set (used when scanning by SIM).

. . . . . Opens next SIM Set (used when scanning by SIM).

. . . . . Opens all SIM Sets.

. . . . . Moves to previous peak when **Search for Peaks** function has been run.

. . . . . Moves to next peak when **Search for Peaks** function has been run.

. . . . . Returns to the full chromatogram display.

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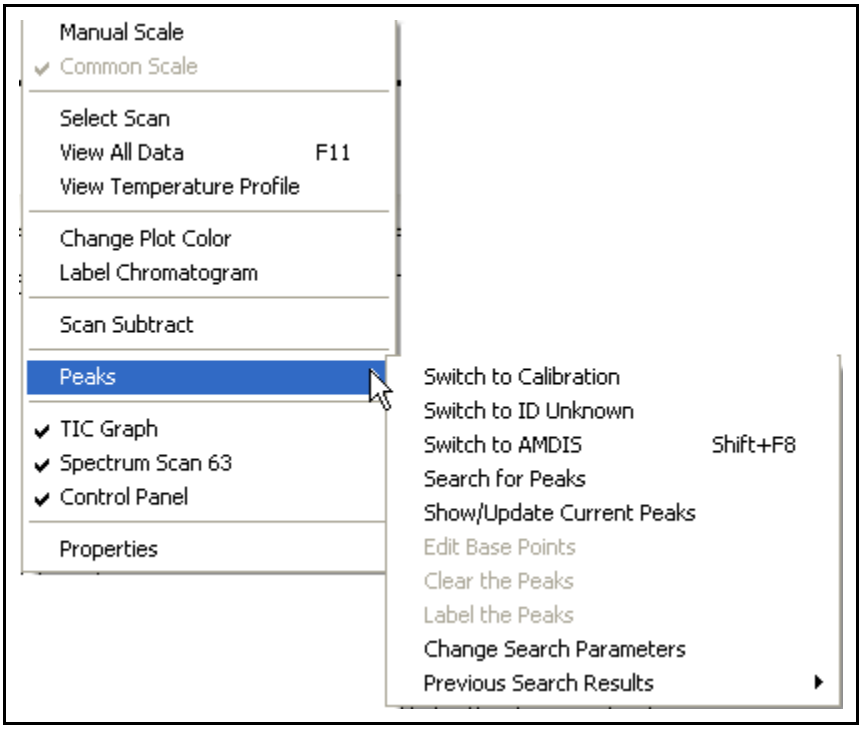
9.4 RMB (Right Mouse Button) Menus within Data Review

All functions within Data Review can be obtained by right-clicking the mouse button on the appropriate window, be it the TIC window, the Spectrum window, the RIC window, or the Control Panel window.

9.4.1 RMB in the TIC/RIC Window

The Figure 9-7 shows the functions available when right-clicking on the TIC window.

Figure 9-7 RMB Menu in TIC/RIC Window



Common Scale . . . . . When checked, all RIC plots will be plotted to the same scale; when not checked all RIC plots will be individually scaled to 100%.

Select Scan . . . . . Allows the scan cursor to select a specific scan.

View All Data . . . . . Rescales the plot to display the entire run. Also accessed by **F-11**.

View Temperature Profile . . . . . Graphically show the GC temperature profile from the method.

Change Plot Color . . . . . Changes the color of the TIC plot.

Label Chromatogram . . . . . Brings up a text box to label the chromatogram. The label can be moved with the cursor and can be saved with the data file.

Scan Subtract . . . . . Subtracts the current scan from the displayed RIC plots.

Peaks gives you the following submenu:

- **Switch to AMDIS** . . . . . Switches to the AMDIS program. Also accessed by **Shift+F8**.
- **Search for Peaks** . . . . . Search the TIC for peaks.
- **Show Current Search Results** . . . . . Displays the results of the Search for Peaks selection.
- **Clear the Peaks** . . . . . Clears the identification of peaks from the TIC graph.
- **Label the Peaks** . . . . . Labels identified peaks with retention time and area.
- **Change Search Parameters** . . . . . Displays the peak search parameters, enables modification of the parameters.
- **Previous Search Results** . . . . . View results from a previous search. (Drop down menu of previously opened data files.)

TIC Graph . . . . . When checked, displays TIC window.

RIC Graph . . . . . When checked, displays the RIC window.

Spectrum Scan ### . . . . . When checked, displays current Spectrum/Scan window.

Control Panel . . . . . When checked, displays the Control Panel.

Properties . . . . . Allows access to the properties of the display.

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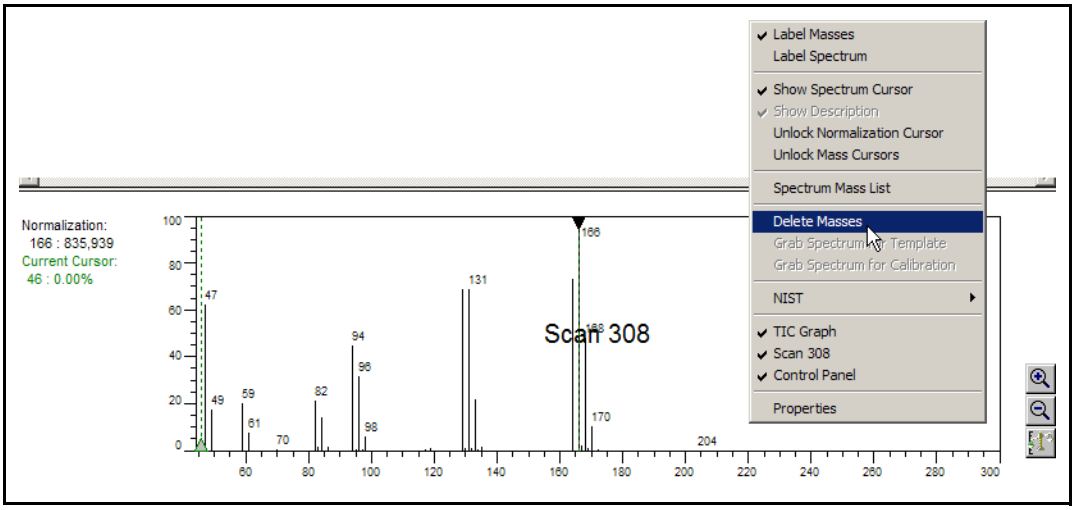
9.4.2 RMB in the Spectrum Display Window

The Spectrum display is shown in the Scan Window. Every time the LMB (Left Mouse Button) is double-clicked in the TIC window, a spectrum for that scan is displayed. Clicking the RMB in the Scan/Spectrum window will access the menu shown in Figure 9-8.

Figure 9-8 Spectrum Display Menu



Label Masses . . . . . When checked, will display the mass numbers in the Spectrum window.

Label Spectrum. . . . . Brings up a text box to allow the analyst to manually label the spectrum in the Spectrum window.

Show Spectrum Cursor . . . . . Shows the Spectrum Cursor in the Spectrum window.

Show Description . . . . . Will display the description of the Scan Cursor location and normalization mass. If Search the NIST Library is checked, this will display the NIST match information in the spectrum window along with providing additional description options in the Control Panel Window.

NOTE: Is only active if Search NIST/User is selected.

Unlock Normalization Cursor . . . . Must be unlocked to move the normalization cursor to a mass other than the 100% mass fragment.

Unlock Mass Cursors. . . . . Unlocks the mass cursors to change any RICs assigned to the display.

Spectrum Mass List	Displays a report of all the masses in the spectrum.
Delete Masses	Deletes masses from the display and for the purpose of searching the NIST library. (Does not delete data.)
Grab Spectrum for Template	Used for target compound methods. See Chapter 12, Target Compound Methods.
Grab Spectrum for Calibration	Used for Survey target compound methods. See Chapter 12, Target Compound Methods.
NIST	Allows the analyst to utilize the NIST database for qualitative identification of the displayed spectrum.
TIC Graph	When checked, displays TIC window.
Spectrum Scan ###	When checked, displays current Spectrum/Scan window.
Control Panel	When checked, display the Control Panel.
Properties	Allows access to the properties of the display.

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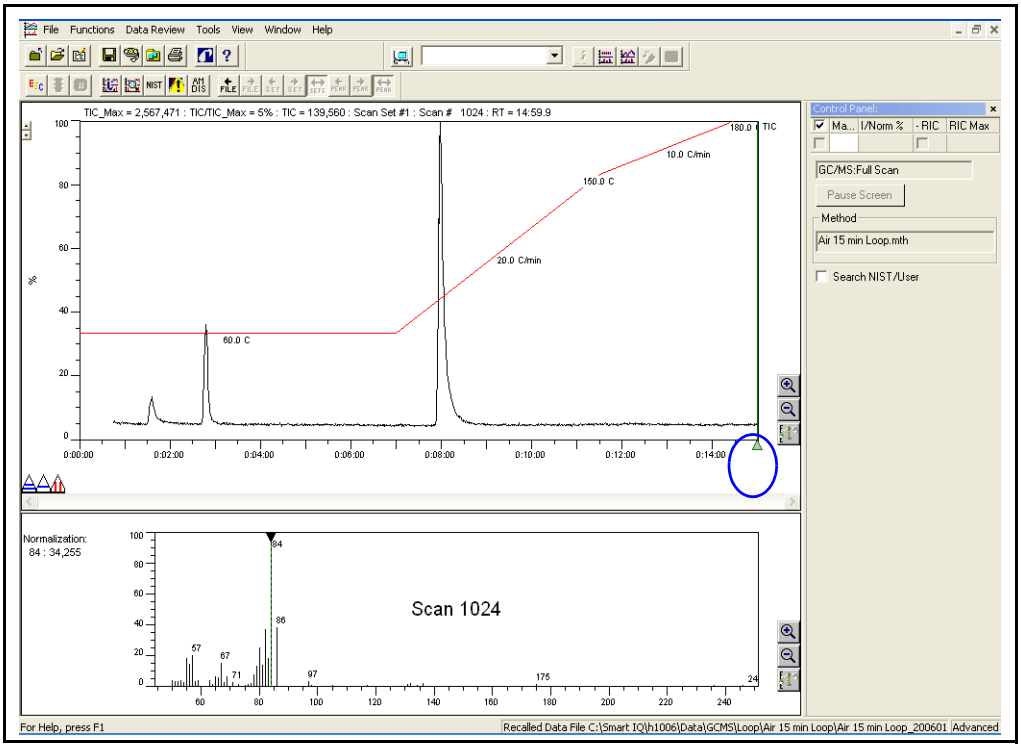
9.5 The TIC/RIC Display Functions

There are tools available to assist in the Data Review process.

9.5.1 How to Access the Scan Cursor

The specific scan displayed in the Spectrum window is accessed using the Scan Cursor in the TIC window. See Figure 9-9.

Figure 9-9 Location of the Scan Cursor



The Scan Cursor can be moved to the desired location by:

- Placing the mouse cursor over the Green Triangle, click and hold the Left Mouse Button, then drag the cursor to the peak/area of interest.
- Double clicking the Left Mouse Button over the peak/area of interest.
- Using the arrow keys on the computer.

9.5.2 How to Use Background Subtraction

WARNING

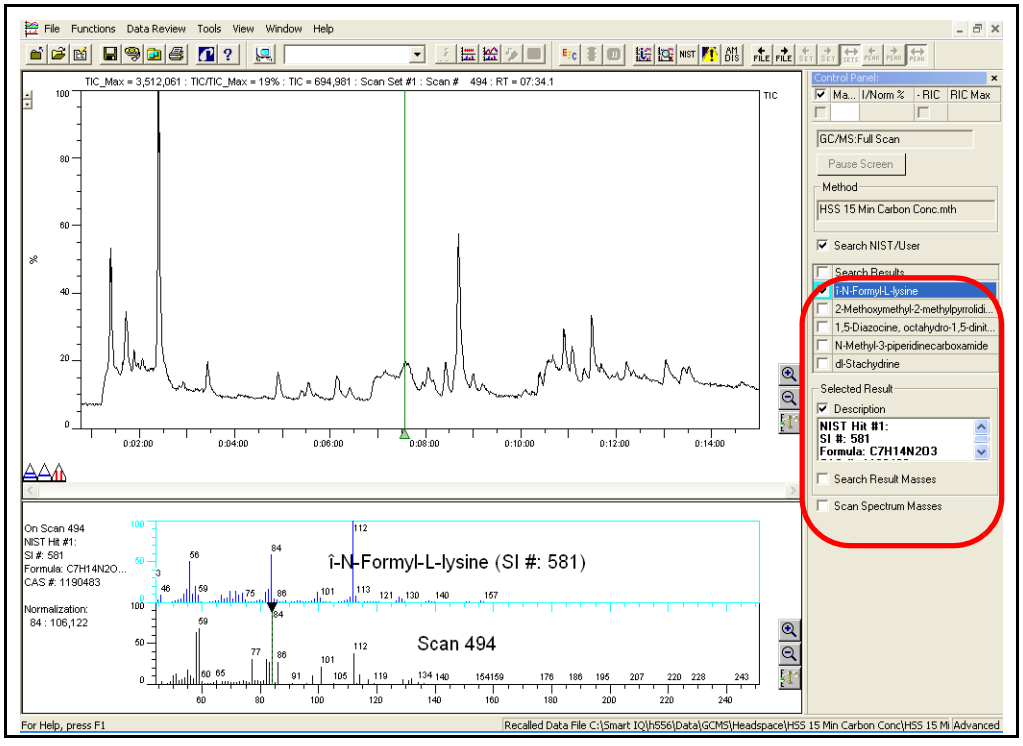
Be careful not to subtract a data/peaks that may be needed for proper identification within the chromatogram.

Background subtraction is a key component in "cleaning up" spectra before attempting to search against a database such as NIST. In order to obtain background spectra, there are two triangles ("cursors"), one with one blue line designated as Background 1 (B1), the other with two blue lines designated as Background 2 (B2), located at the bottom left of the TIC window.

NOTE: All background subtractions are indicated in the Spectrum window by the designation **Scan Number - B1(range) - B2(range).**

9.5.2.1 Steps Required to Perform a One Point Background Subtraction

Figure 9-10 Original Chromatogram



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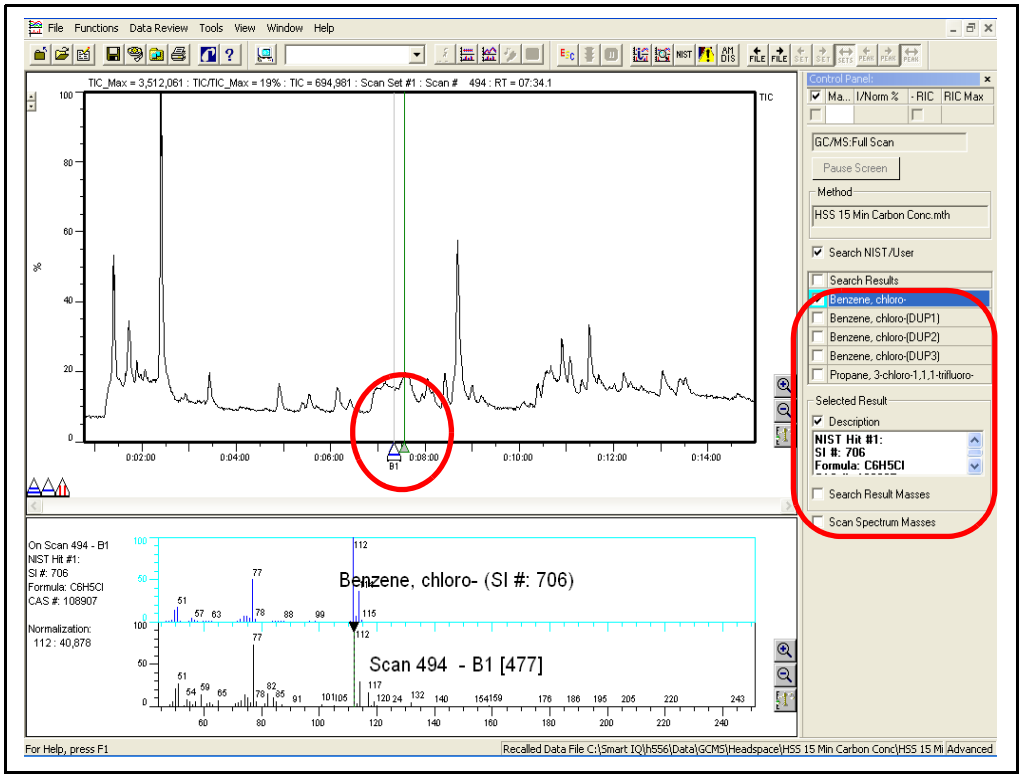
1 Using the Scan Cursor, select a peak of interest in the chromatogram. Refer to Figure 9-10.

2 Perform a manual NIST search by pressing the **F7** key or by checking the **Search NIST/User** box in the Control Panel. The search shows multiple results. Refer to Figure 9-10.

Figure 9-11 Using Background Subtract



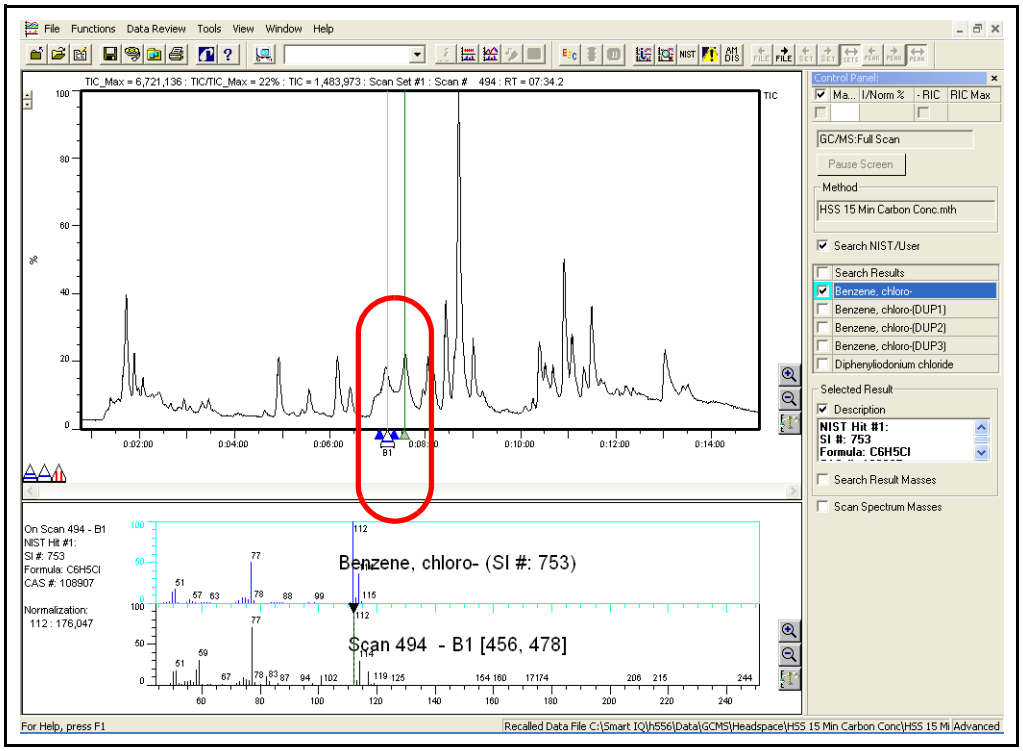
3 Select the background subtract blue triangle from the lower left side of the chromatogram and drag to an area on either side of the selected peak. Refer to Figure 9-11.

4 The identification is now chlorobenzene with three duplications. The first ID has an SI# of 706. Refer to Figure 9-11.

NOTE: Both background subtract tools can be used if two background subtract ranges are desired.

9.5.2.2 Background Subtraction Using a Range of Points

Figure 9-12 Using Background Subtraction to Remove a Smaller Peak



Multiple scans in an area, such as a smaller peak on the side of a larger peak, can complicate the chromatograph. The background can be widened to remove an area. Refer to Figure 9-12.

1 Place the cursor on the triangle with ONE blue line (B1). Click and hold the LMB (Left Mouse Button), then drag B1 to the location where the background should be subtracted.

2 Move the cursor to the tip of the B1 marker. The cursor should change to a vertical double headed arrow. Holding the LMB while moving the double headed arrow up, widens or selects a range for the background. Moving it down narrows the range of the background. The left and right side boundaries can be manually adjusted using a drag and drop with the LMB.

3 Repeat Step 2 for Background 2 (if desired) using the triangle with TWO blue lines (B2).

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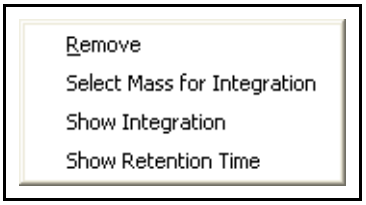
9.5.2.3 Additional Features of the Background Tool

If the cursor is placed over B1 or B2, and the Right Mouse Button is clicked, see Figure 9-13, a menu will pop-up that will give the analyst the option to:

Figure 9-13 Background Subtract RMB Menu



Remove . . . . . Remove the Background cursor

Select Mass for Integration . . . . . Select the TIC or RIC for Integration

Show Integration . . . . . Displays the integration on the x-axis

Show Retention Time . . . . . Displays the retention time on the x-axis

9.5.3 Utilizing the Range Tool

WARNING

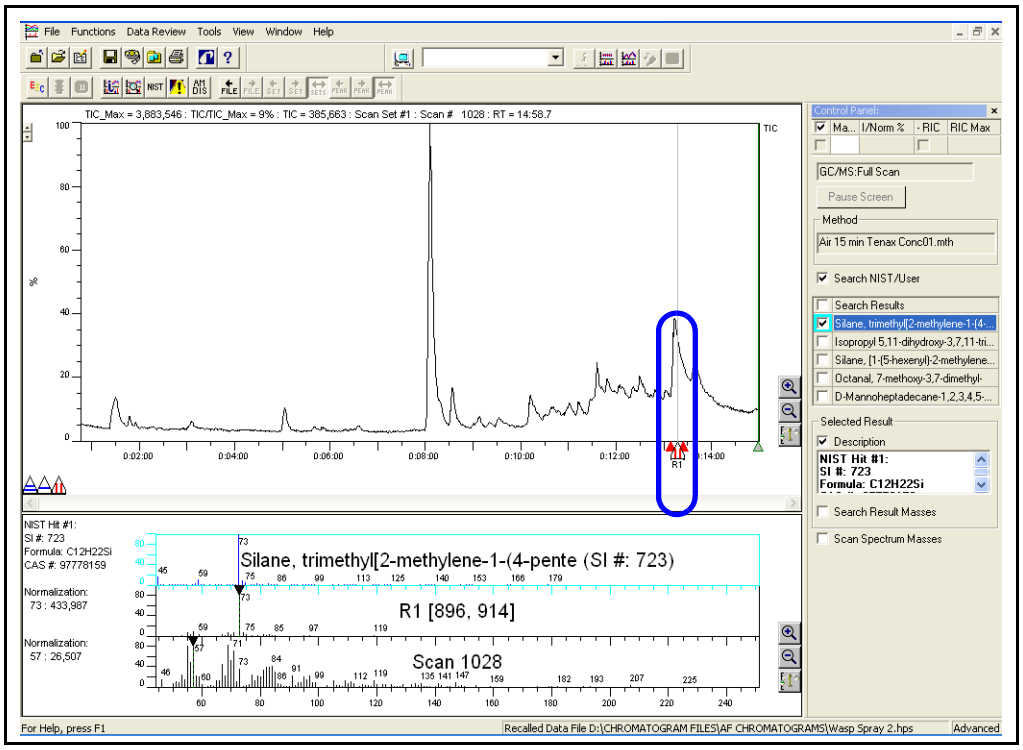
Be careful not to leave out data/peaks that may be needed for proper identification within the chromatogram.

The Range Tool provides the analyst with the ability to average spectra over a "range" of scans across a given peak. This is helpful when analytes are in low concentrations or to select a section of a peak when there is co-elution. The ability to establish a range and average the spectra within that range will allow better matches with the NIST database. The range tool is the triangle with the two red vertical lines located at the bottom left hand of the TIC window.

Figure 9-14 displays a TIC/RIC window showing how it would look if ranging is initiated.

NOTE: All ranges are indicated in the Scan/Spectrum window by the designation: R1 [Range Start Scan, Range End Scan].

Figure 9-14 Using the Range Tool



9.5.3.1 Steps Required to Range Acquisition

1. Place the cursor on the triangle with Two Red Vertical Lines (R1). Click and hold the LMB. Then, drag R1 to the location where the scans should be averaged. Refer to Figure 9-14.
2. Move the cursor to the tip of the R1 marker. The cursor should change to a vertical double-headed arrow. Holding the LMB, moving the double-headed arrow up widens a range. Moving the arrow down narrows the range of the peak averaging. The red range lines should intersect the peak sides at 50% of their height. The left and right side boundaries can be manually adjusted using a drag and drop with the LMB.

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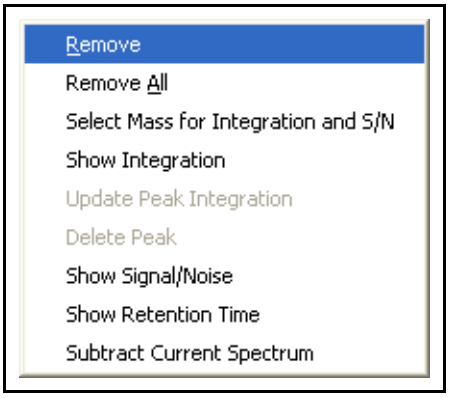
9.5.3.2 Additional Features of the Range Tool

If the cursor is placed over R1, and the RMB is clicked, the following menu items are available. See Figure 9-15.

Figure 9-15 Range Tool RMB Menu



Remove . . . . . Removes the Range cursor

Select Mass for Integration . . . . . Selects the TIC or RIC for Integration

Show Integration . . . . . Displays the integration on the x-axis

Show Retention Time . . . . . Displays the retention time on the x-axis

Show Signal/Noise . . . . . Shows Signal to Noise Ratio. A Background Must be Selected using B1 first.

Subtract Current Spectrum . . . . . Subtracts the current spectrum (Green Triangle) from the range.

9.6 Using the Zoom Function

WARNING

Be careful not to leave out data/peaks that may be needed for proper identification within the chromatogram.

The Zoom function allows targeting a particular section of the chromatogram for a detailed view.

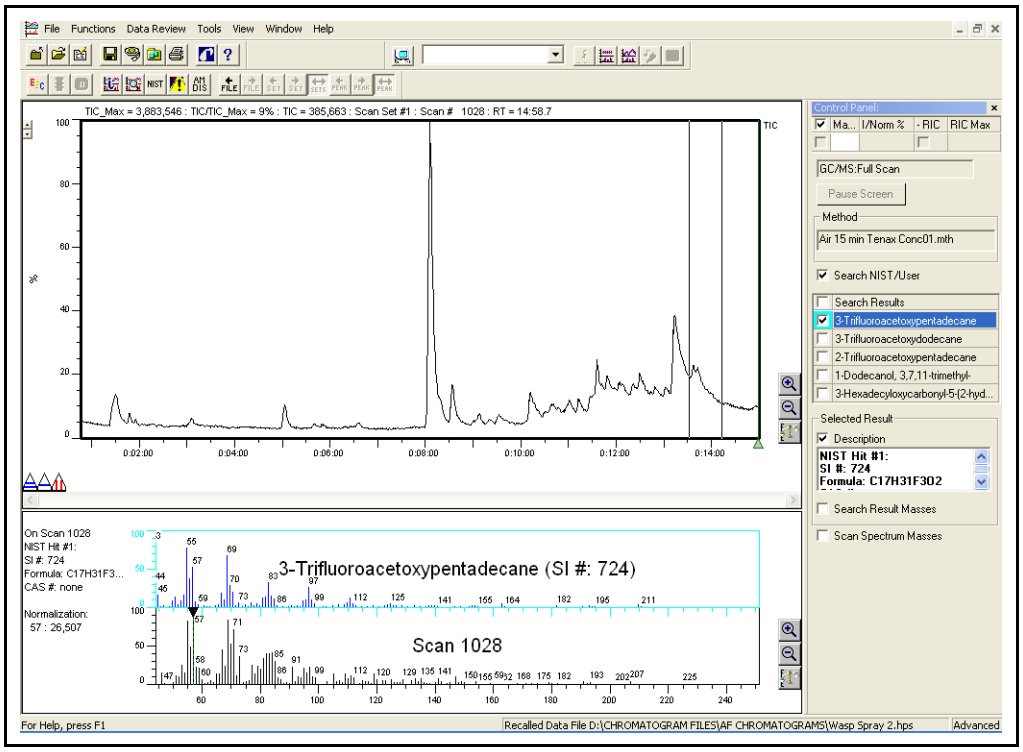
Co-elution of peaks can be detected by zooming in on odd shaped peaks.

9.6.1 Using the Zoom Function in the TIC/RIC Window

There are two ways to Zoom into a TIC/RIC:

1. Move the mouse cursor to the Magnifying glass with the "+" inside. When the Left Mouse Button (LMB) is clicked, there will appear two vertical lines on the TIC/RIC graph window. Place the cursor on one of the vertical lines. Click and hold the LMB. Drag the vertical line to where zooming may begin. Repeat the actions of the previous sentence for the second vertical line. See Figure 9-16. Once the Zoom range has been set, move the mouse cursor within the range. The cursor will turn into a magnifying glass. Click the LMB, and the display will Zoom in on the area selected.

Figure 9-16 Selecting Area to Zoom



2. Press and hold the LMB at the point in the TIC where Zoom should begin. A vertical line will appear. Drag the cursor to the position that Zoom should end, and release LMB. Place the mouse cursor within the two vertical lines. The cursor will turn into a magnifying glass. Click the LMB, and the display will zoom in on the area selected. Refer to Figure 9-17.

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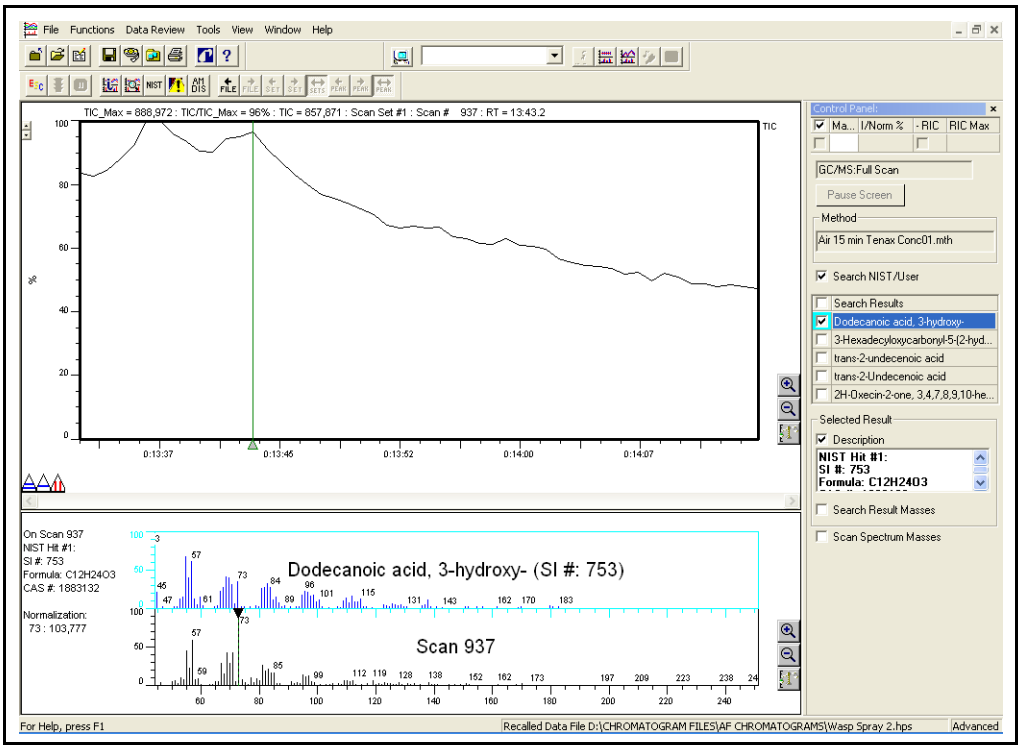
Figure 9-17 Zoomed Spectrum



3 To Unzoom, click on the Magnifying Glass with the "-" inside. Alternately, move the cursor below the x-axis of the TIC window. Then click the LMB.

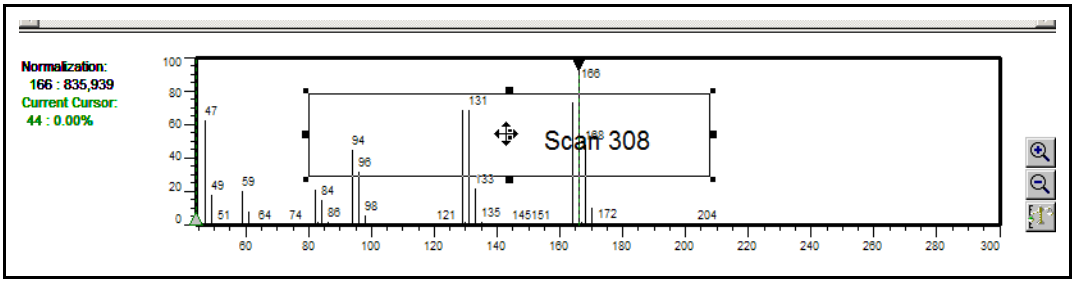
9.6.2 Using The Zoom Spectrum Function

Zooming into a spectrum requires selection of the Zoom buttons on the right side of the spectrum window.

1 Click the Zoom button, and a rectangle is displayed in the spectrum window.

2 Place the cursor in the middle of the rectangle until the cursor turns into a four-headed arrow. See Figure 9-18.

Figure 9-18 Selecting Area to Zoom

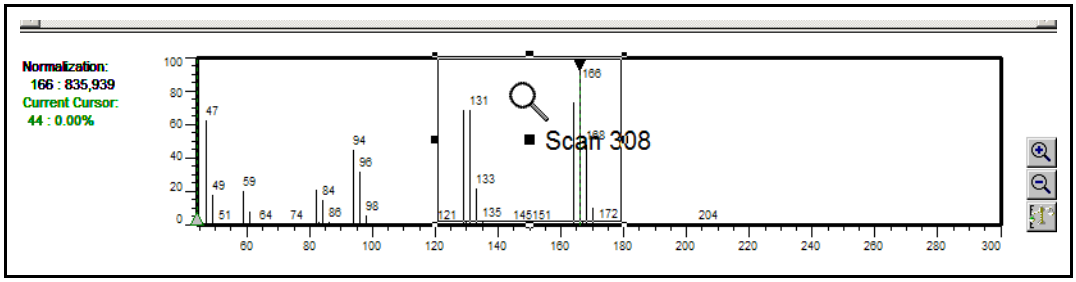


3 Press and hold the LMB, then drag the box to the Zoom location.

4 Adjust the box size to the desired Zoom area.

5 Place cursor within the desired Zoom area, the cursor will turn into a magnifying glass. Click the LMB. See Figure 9-19.

Figure 9-19 Placing Cursor in Area to Be Zoomed



To unzoom, either one of the following actions will accomplish the task:

- Click on the magnifying glass on the right hand side of the window with the "**-**" inside the magnifying glass.
- Clicking the cursor outside the spectrum box. This is located underneath the x-axis.

9.7 Displaying Reconstructed Ion Chromatograms (RIC)

RIC plots are useful when locating specific compounds in a chromatogram. A RIC plot of the top two or three mass fragments can help locate the peak of interest.

There are two ways to display RICs:

- Using the Control Panel window, click on the **Mass** box. Type in the desired RIC mass, then press the **Enter** key. Multiple masses can be entered and displayed in the RIC plot. Each RIC will have a unique color plot displayed in the RIC window, and the same color Control Panel check box. See Figure 9-20.
- In the Spectrum Window, select the mass to be displayed. Double-clicking on a mass in the Scan Window will automatically insert the selected mass in the Control Panel table as well as display the RIC for the selected mass. Multiple masses can be selected and displayed.

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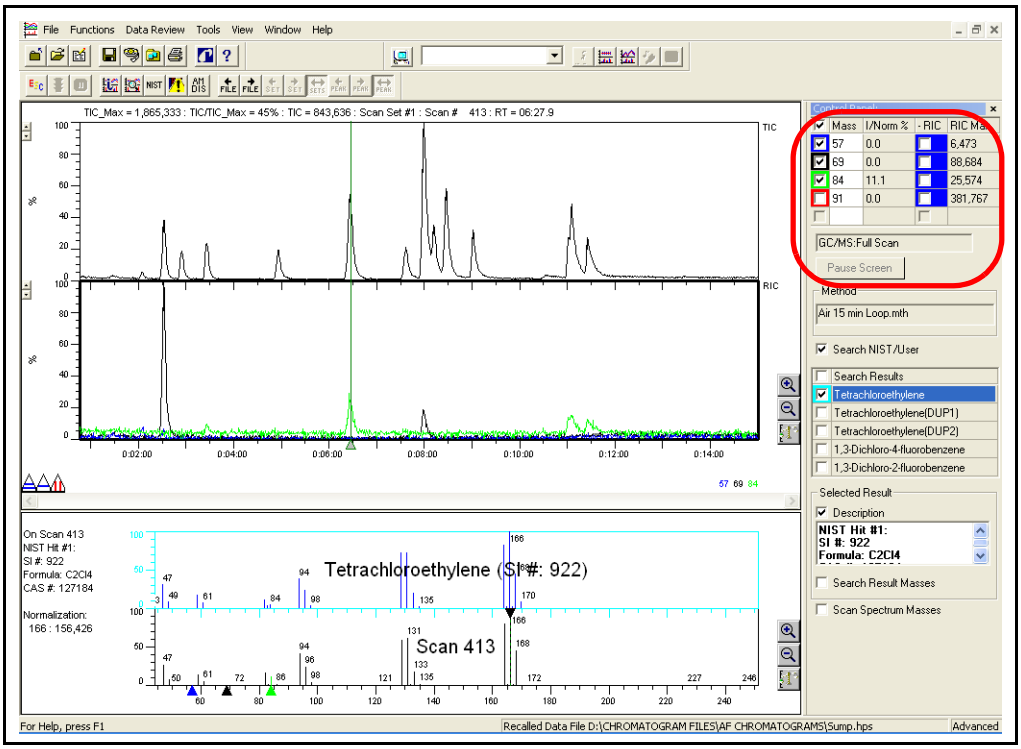
Figure 9-20 RIC Plot



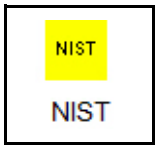
When the box in the Control Panel labeled **-RIC** is checked, the TIC/RIC window will display the TIC minus the RIC selected.

9.7.1 RIC Plot to Locate Specific Compounds

NOTE: Before running NIST, position the scan cursor over the peak of interest in the TIC plot.

1 Either from the System Setup View or the Data Review screen, double-click on the **NIST** icon. See Figure 9-21.

Figure 9-21 NIST Icon

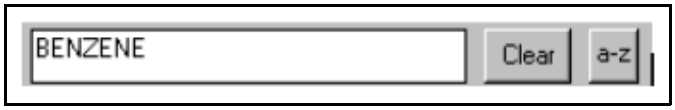


2 Click on the **NAMES** tab at the bottom of the NIST screen. See Figure 9-22.

Figure 9-22 NIST Names Tab

3 Enter the name of the compound, to be located, in the box on the top left of the screen. EXAMPLE: Benzene. See Figure 9-23.

Figure 9-23 NIST Name Entry

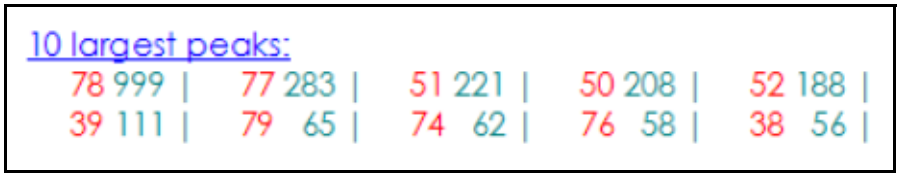


4 The spectrum and information about the compound will appear in the two boxes to the right of the names column.

5 In the bottom right box, the **10 Largest Peaks** will be listed. Make a note of the three largest mass peaks that are between 45-300 AMU.

NOTE: Peaks are listed in order from the largest to the smallest. EXAMPLE: Benzene's three largest peaks are masses 78, 77 and 51. See Figure 9-24.

Figure 9-24 Top 10 Masses

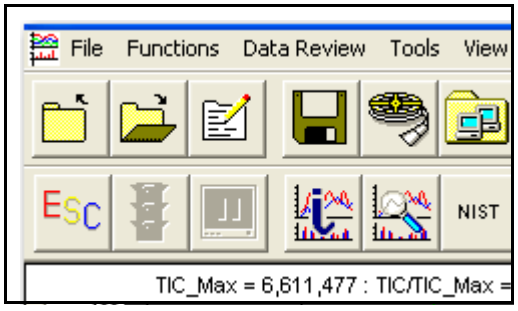


6 Minimize the NIST window and return to the Plus IQ Data screen displaying the TIC chromatogram.

7 Enter the three largest peaks in the boxes under the **Mass** (it may also be shown as **Ma...**) in the control panel box. Figure 9-20. For the Benzene example, 78, 77 and 51 are entered.

8 Check the box to the left of the mass or press ENTER. This will plot the mass in the RIC window and create a new row in the control panel for an additional mass to be entered. See Figure 9-25.

Figure 9-25 Entering Masses in Control Panel



9 As soon as the first mass is checked, a RIC plot will open directly under the TIC plot. See Figure 9-26.

NOTE: This RIC window can be closed by un-checking the masses selected in the control panel.

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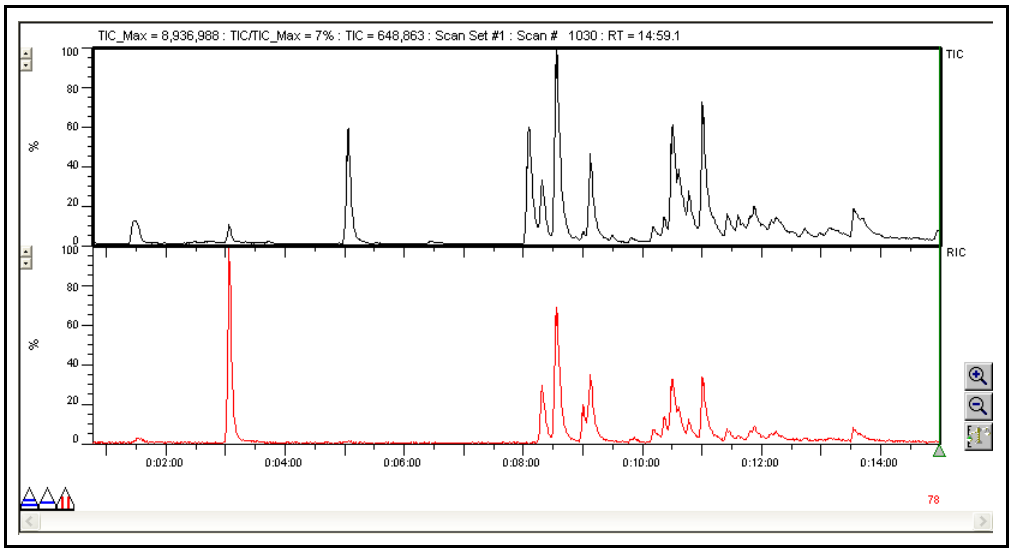
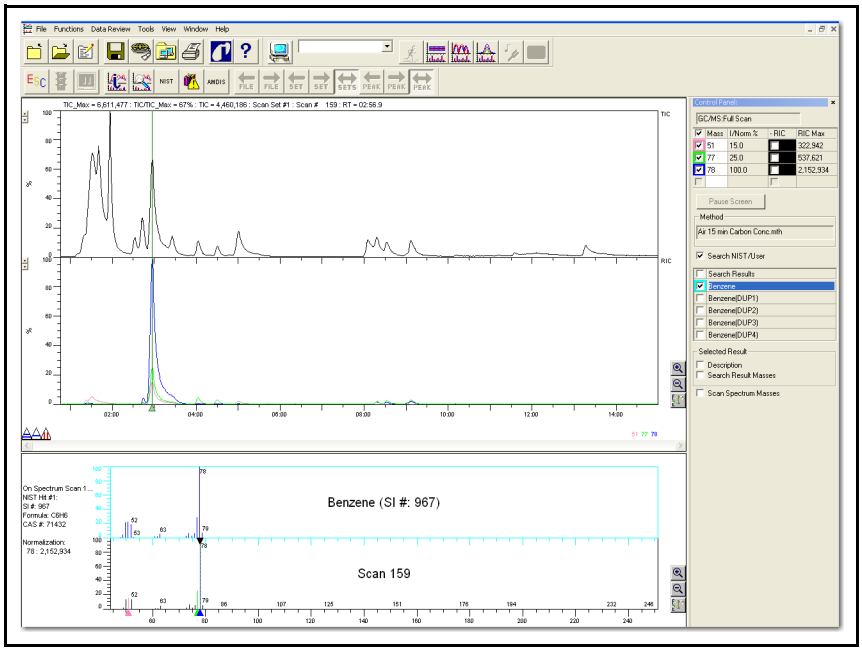
Figure 9-26 RIC Plot for Suspected Benzene One Mass Selected



10 The compound may be present in the unknown sample if all three masses (peaks) align in the RIC plot. Use F7 NIST program to confirm identification of the suspected compound. See Figure 9-27.

NOTE: There may or may not be a peak visible in the TIC plot.

Figure 9-27 RIC Plot to locate Benzene — Three Masses Selected



11 The compound was not detected in the unknown sample if all three masses (peaks) are not present, or do not align together in the RIC plot.

9.8 NIST Library Searches

A TIC or sequential SIM peak qualitative identification can be accomplished using the integrated features of the NIST Mass Spectral Database found on the Laptop.

Figure 9-28 Searching a Library

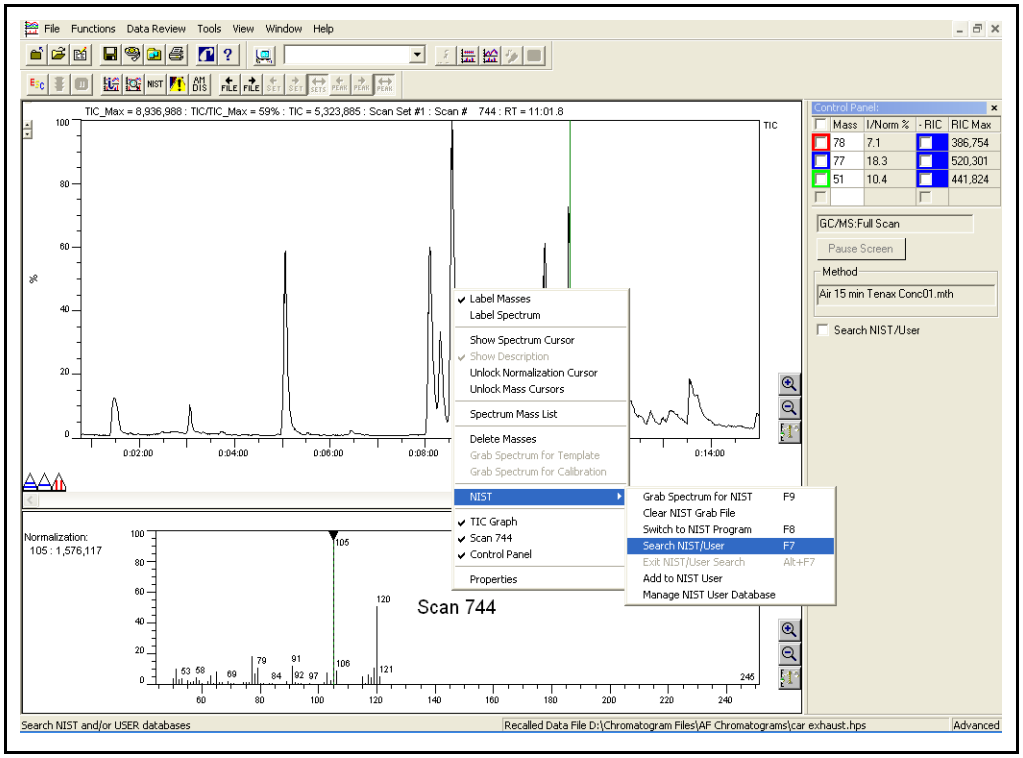


Figure 9-28 shows the TIC Window, the Spectrum Window and the Control Panel Window. Steps required to invoke a qualitative search are:

1. Click the cursor on the peak of interest in the TIC window.
2. The spectrum will be displayed in the Spectrum window.
3. Press the **F7** key, or use the **RMB** to display the pop-up windows as shown. **Search NIST/User** box in the Control Panel window can also be checked to initiate a NIST search.
4. The search results are displayed both in the Spectrum window as well as the Control Panel window. See Figure 9-29.

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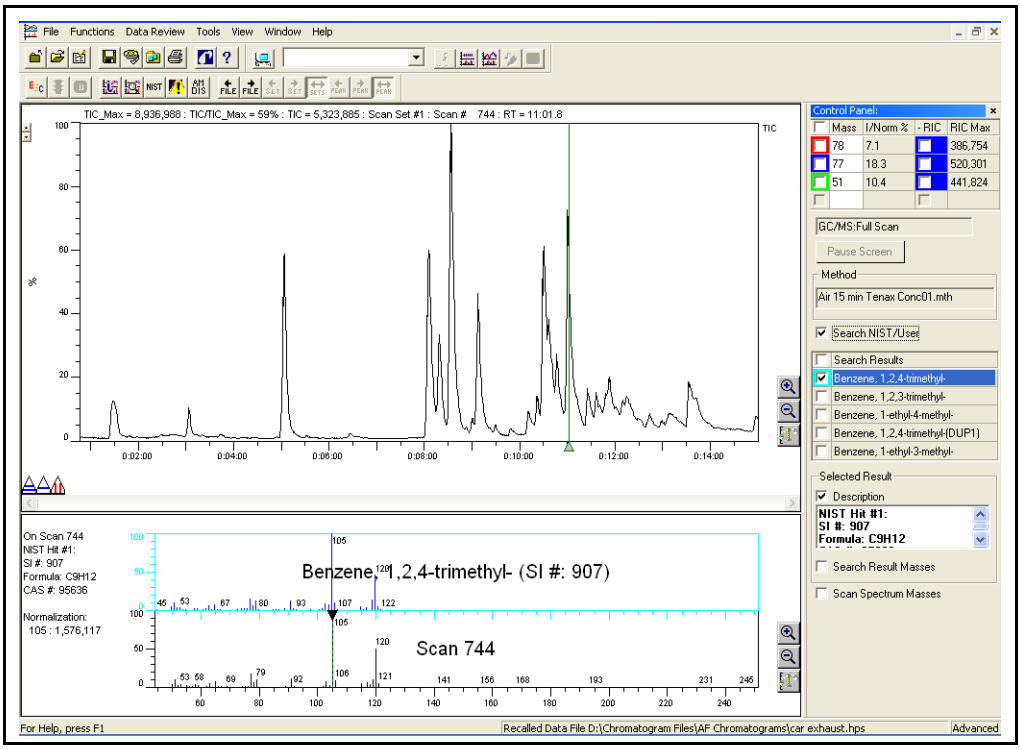
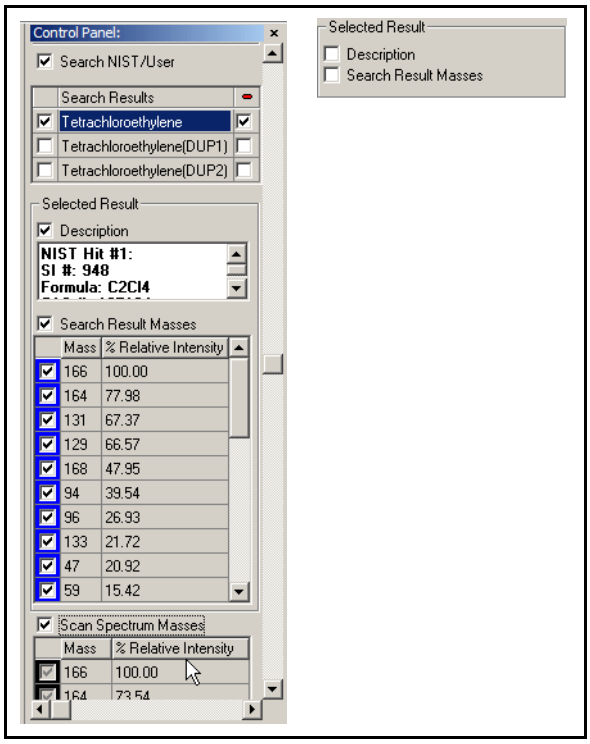
Figure 9-29 Search Results Display



Additional information may be obtained by checking the boxes in the Control Panel.

These boxes, when checked, will provide information so that the NIST Match and the spectrum generated by HAPSITE Plus IQ can be compared. See Figure 9-30.

Figure 9-30 Comparison of NIST and Spectrum



If the **Description** box is checked, the NIST header information such as Similarity Index (SI), Formula, and CAS number will be displayed.

If the **Search Result Masses** box is checked, the masses and relative intensities are displayed for the NIST reference spectrum.

If the **Scan Spectrum Masses** box is checked, the HAPSITE Plus IQ masses and relative intensities are displayed for the unknown spectrum.

9.8.1 Searching Peaks

The **Search for Peaks** function allows the analyst the capability to search the entire TIC for qualitative identification of each peak detected by the search function. The **Search for Peaks** function will also integrate each peak area that meets the search criteria. It will then give the analyst a report showing the area percent that peak contributed to the total area of all peaks found.

The **Search for Peaks** function is accessed by clicking the RMB on the TIC/RIC window.

Select **Peaks**. The submenu pops up displaying the choices. See Figure 9-31.

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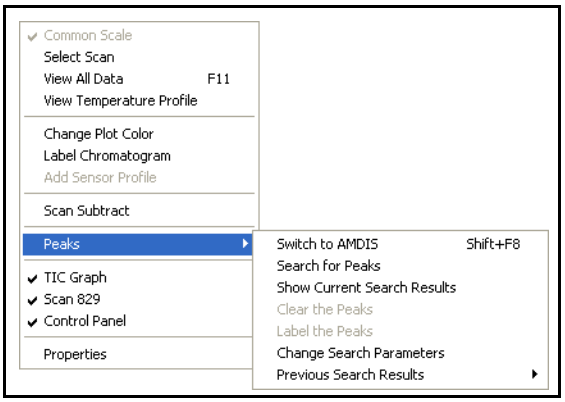
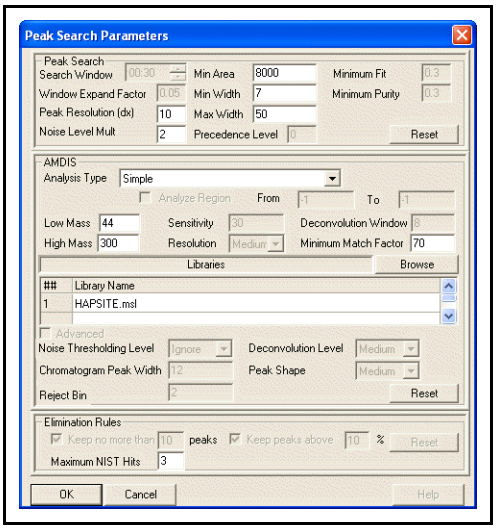
Figure 9-31 Peaks Menu Choices



To view and adjust the search parameters, select **Change Search Parameters** from the submenu.

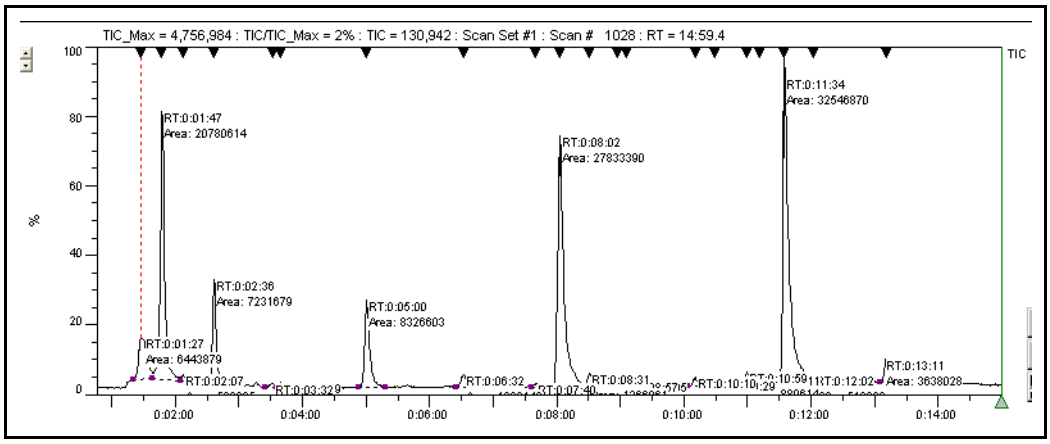
Figure 9-32 displays the parameters that will determine what peaks are found. The Peak Search Parameters window is divided into sections of **Peak Search, AMDIS, Libraries, and Elimination Rules**. These can be modified to make the search as selective or as general as required.

Figure 9-32 Peak Search Parameters Window



After the Peak Search parameters have been optimized, select **Peaks >> Search for Peaks**. After analysis, the following will be displayed (see Figure 9-33):

Figure 9-33 Post Analysis Display

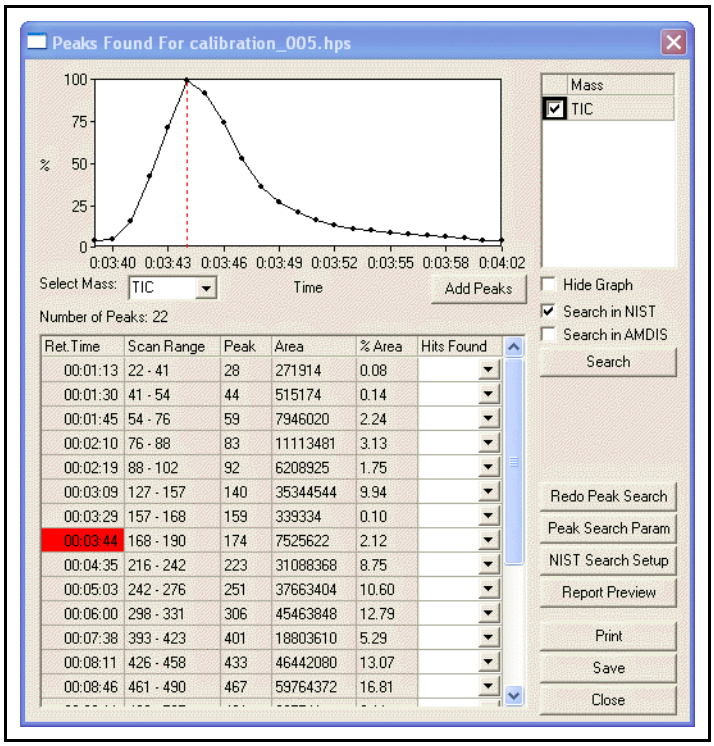


In Figure 9-33, both the **Search for Peaks** function and the **Label the Peaks** function have been selected. Therefore, the retention time of each peak is displayed in the TIC/RIC window. At the top of the TIC/RIC window, the black triangles mark each peak that met the search parameters.

To display the results, select **Peaks >> Show current search results**. The results screen will be displayed.

The results screen displays the information pertaining to each peak that met the search criteria. See Figure 9-34.

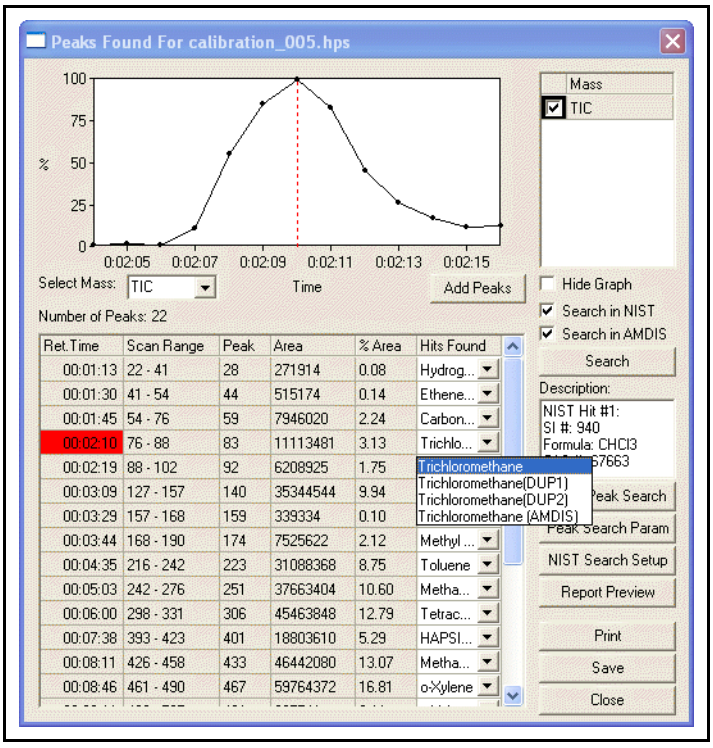
Figure 9-34 Results Display



Ret.Time	Scan Range	Peak	Area	% Area	Hits Found
00:01:13	22 - 41	28	271914	0.08	
00:01:30	41 - 54	44	515174	0.14	
00:01:45	54 - 76	59	7946020	2.24	
00:02:10	76 - 88	83	11113481	3.13	
00:02:19	88 - 102	92	6208925	1.75	
00:03:09	127 - 157	140	35344544	9.94	
00:03:29	157 - 168	159	339334	0.10	
00:03:44	168 - 190	174	7525622	2.12	
00:04:35	216 - 242	223	31088368	8.75	
00:05:03	242 - 276	251	37663404	10.60	
00:06:00	298 - 331	306	45463848	12.79	
00:07:38	393 - 423	401	18803610	5.29	
00:08:11	426 - 458	433	46442080	13.07	
00:08:46	461 - 490	467	59764372	16.81	

Qualitative identification of each peak found by the Search function can be done by checking either **Search in NIST, Search in AMDIS** or both. After the search is selected and the **Search** button is clicked, the screen shown in Figure 9-35 is displayed.

Figure 9-35 Identification of Each Peak



When the search is completed, each peak will have identifications in the **Hits Found** section of the table. Click on the arrow button next to each peak in the **Hits Found** section to display all of the hits as per the Search Parameters.

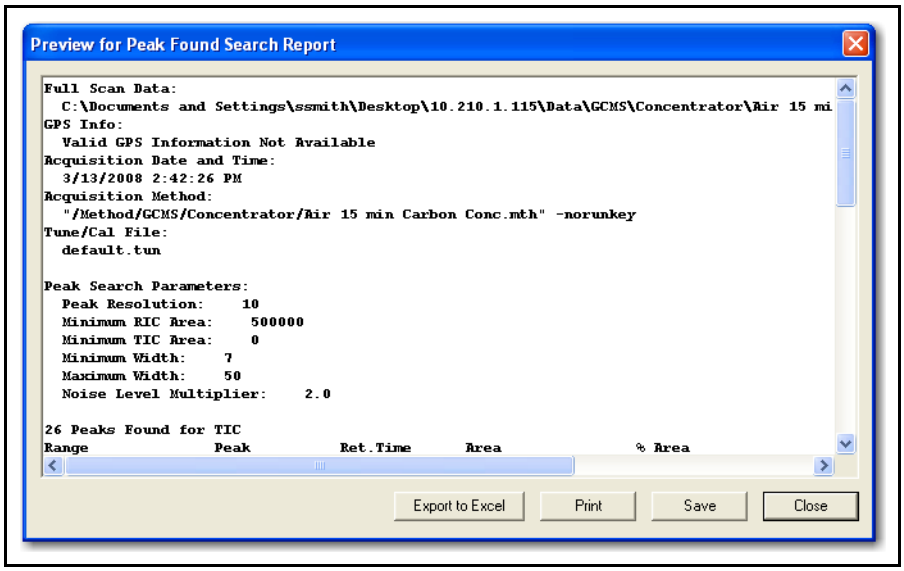
NOTE: When the **Hits Found** are displayed, the hits found in the AMDIS library will have the words (AMDIS) displayed. NIST hits do not display the word (NIST).

From the Peaks Found screen, other functions can be accessed:

- **NIST Search Setup,** where the libraries that NIST will use are defined
- **Peak Search Parameters**, where parameters can be changed to improve the search
- **Redo Peak Search**, where the search can be reanalyzed after changes to the Peak Search Parameters have been made.

To print a report of the results, click on the **Report Preview** button**.** This will result in the following screen being displayed.

Figure 9-36 Preview Screen



The report is displayed, refer to Figure 9-36. Some options are:

- Check the box that says **Report as shown in the grid**. This will only display the first hit found for each peak. With the box unchecked, all hits for each peak are displayed.
- **Export to Excel** will create an Excel® text file, open Excel and display the file.
- **Print** will print the report as displayed.

9.8.2 Analyzing Data Using AMDIS

AMDIS is an additional program provided by NIST and can be used to analyze data generated by the HAPSITE Plus IQ. AMDIS is the acronym for Automated Mass Spectrum Deconvolution and Identification System.

AMDIS utilizes its own databases. The HAPSITE Plus IQ utilizes the **HAPSITE.msl** AMDIS library.

9.8.3 How To Access AMDIS

AMDIS can be accessed by the following methods:

- Selecting the **AMDIS** button on the Function Toolbar, or
- Right click in the TIC window, then select **Peaks >> Switch to AMDIS**, or
- With the TIC window as the active window, press the **Shift+F8** key.

NOTE: AMDIS only works on the TIC data. AMDIS does not use spectrum data.

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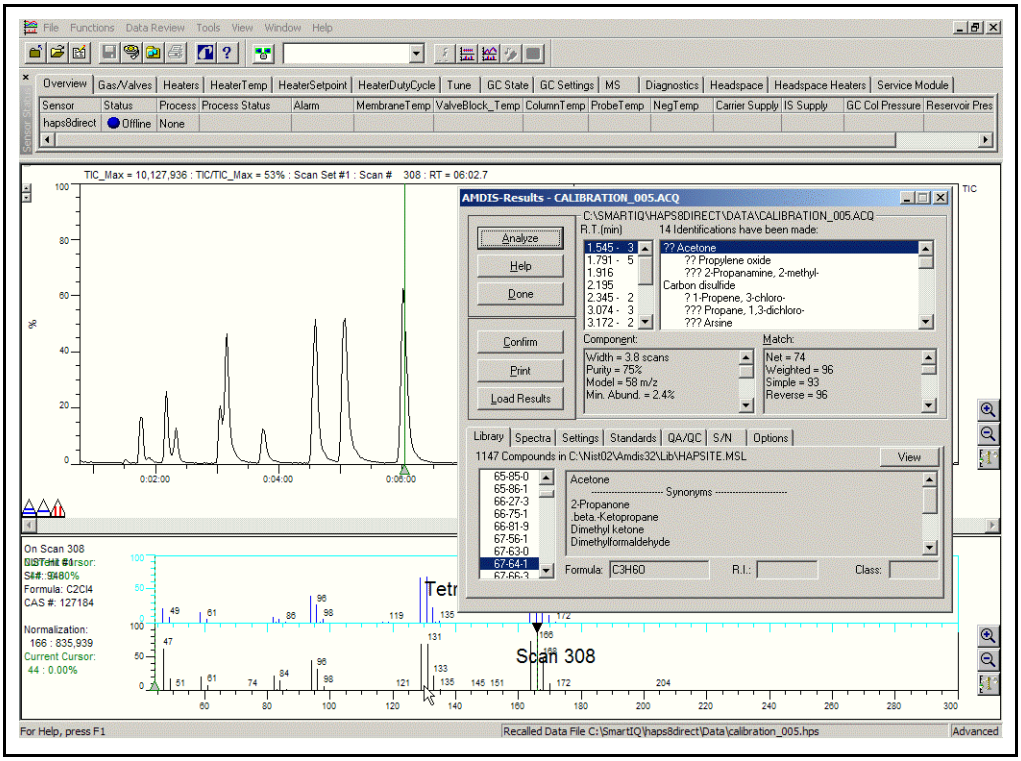
When the analyst invokes AMDIS, upon completion of the analysis, the program returns the **Results Screen**. See the inset in Figure 9-37. The results screen includes:

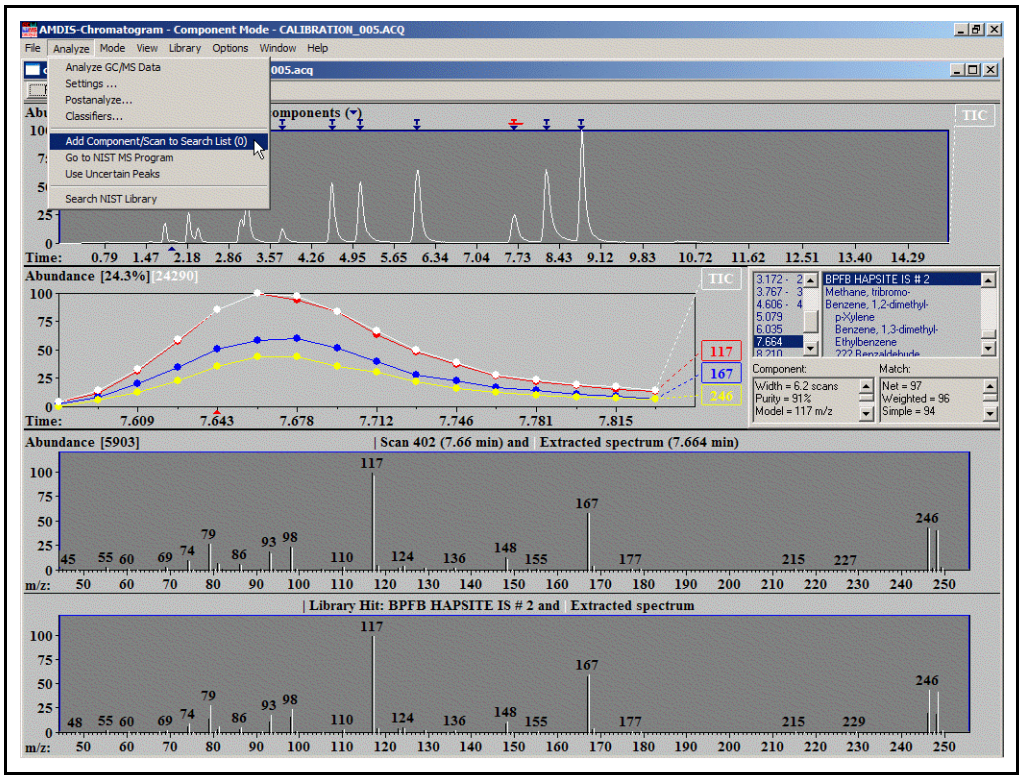
- Retention Time Window
- Identifications Window
- Component Window
- Match Quality Window
- Library Tab

Figure 9-37 AMDIS Results Screen



This provides the results of the AMDIS data analysis and provides all the data that most analysts need. If a particular analysis needs additional confirmation, press the **Confirm** button to access the Confirm Window, see Figure 9-38.

Figure 9-38 AMDIS Confirm Window



This window shows the complete analysis, peak by peak. If there are any peaks that were not identified by AMDIS, use the NIST database to identify them.

9.8.3.1 Accessing NIST from AMDIS

To use the NIST database to identify a peak not identified by AMDIS:

1 Highlight the peak not identified by clicking on the triangle above the peak

2 Select **Analyze >> Add component/scan to search list**

3 Select **Analyze >> Go to NIST MS Program**

This will place the selected component scan from the search list into the NIST program and will utilize the NIST database for identification. See Figure 9-39.

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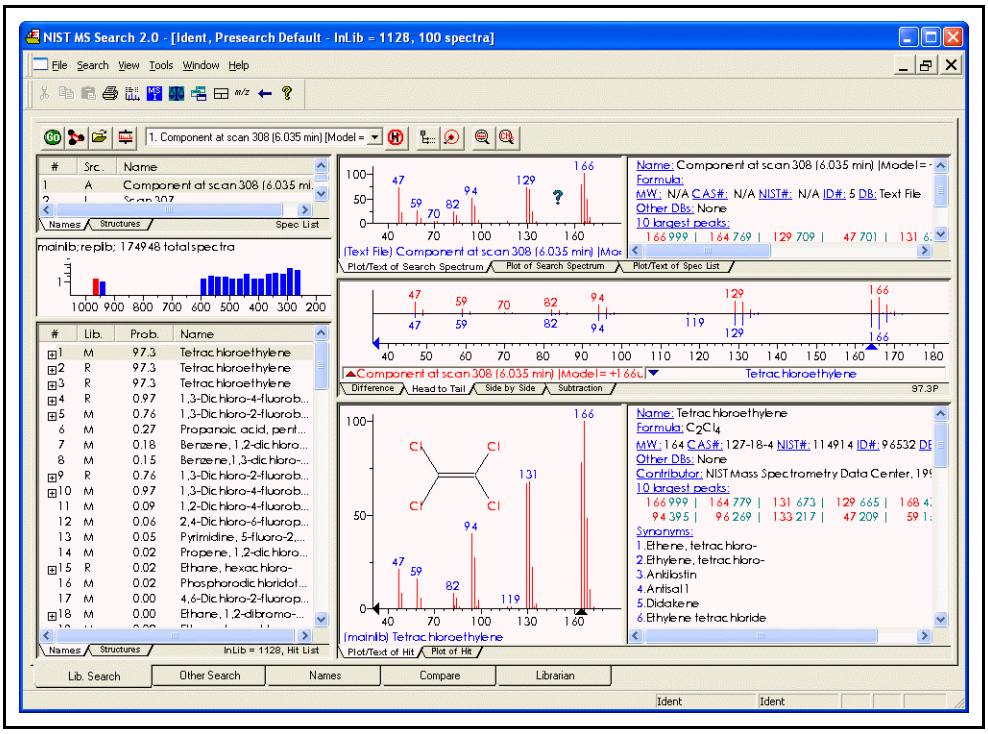
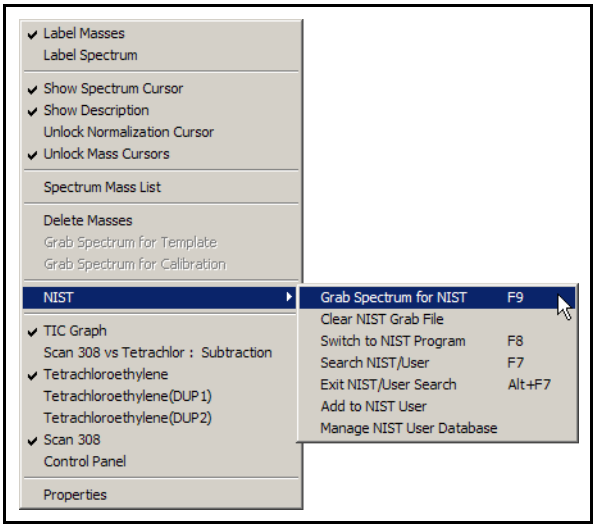
Figure 9-39 NIST Database Search



9.8.4 Analyzing Data Using NIST

By right-clicking on the Spectrum window, the NIST menu appears. See Figure 9-40.

Figure 9-40 NIST Menu



Grab Spectrum for NIST (F9) . . . . . This function will grab the spectrum selected and put the spectrum in the grab file for use within the NIST program.

Clear NIST Grab file . . . . . Clears the grab file of previous files.

Switch to NIST Program (F8). . . . . Starts the full NIST program and will place any files that are in the grab file into the Spec List. It then begins analysis of them.

Search NIST/User (F7) . . . . . Starts the NIST program and does searches. Displays matches on the Scan /Spectrum window and Control Panel.

Exit Search NIST/User (Alt+F7) . . . Exits the Search NIST/User database search function.

Add to NIST User . . . . . Add selected spectrum to a Search NIST/User database.

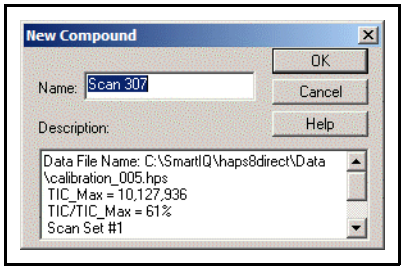
Manage NIST User Database. . . . . Display, delete or plot entries in a Search NIST/User database.

9.8.5 How to Grab Spectra/Utilize the Full NIST Program

The sequence of events required to utilize the full NIST program are:

1. Double-click on the peak in the TIC/RIC window to update the spectrum window.
2. Place the cursor in the Spectrum window and RMB click. Select **NIST >> Clear NIST Grabfile**
3. Place the cursor in the Spectrum window and RMB click. Select **NIST >> Grab Spectrum for NIST**. See Figure 9-41.

Figure 9-41 Pop-Up WIndow, Grab Spectrum for NIST



4. After the spectrum has been grabbed, either:
   - press **F8** to open the full NIST program.
   - select **NIST >> Switch to NIST Program.**

Once inside the NIST Program, the analysis will be performed. There are many other features that the NIST program has to offer. See Figure 9-42.

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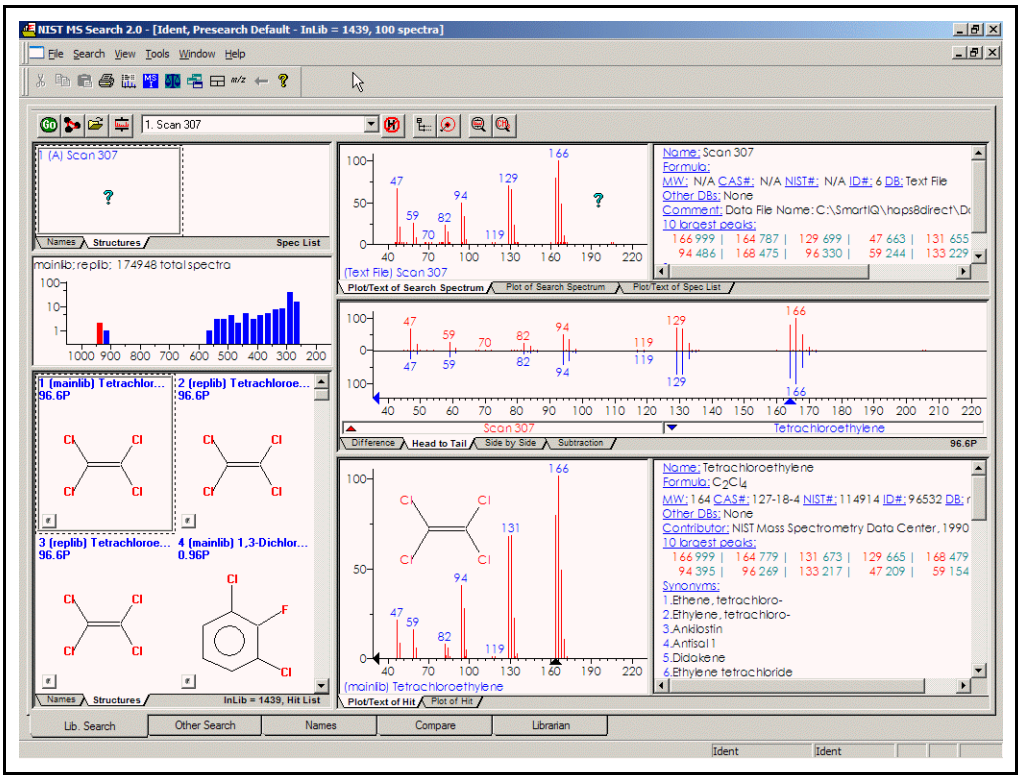
Figure 9-42 NIST Database



Notice the tabs at the bottom of the NIST window. These are multiple windows that make use of all the functions in the NIST software.

The NIST program is a third-party software that comes with the HAPSITE Plus IQ software. Instructions on how to fully utilize the NIST and AMDIS software are included in the **NIST Mass Spectral Database** folder on the Laptop and the **HELP** selection of either program from the Menu selection.

9.9 Reporting and Printing Data

Reports are generated in Data Review utilizing the HAPSITE Plus IQ software by:

- using the method that acquired the data
- utilizing the Search for Peaks function
- printing a report

9.9.1 Method Generated Reports

To access reports generated by the method that acquired the data being reviewed, the **View Search Results** icon should be accessed from the Results screen. See Figure 9-43. Alternately, **View Search Results** may be accessed in the Data Review pull down menu. It will display the screen shown in Figure 9-44.

Figure 9-43 View Search Results Icon

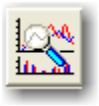
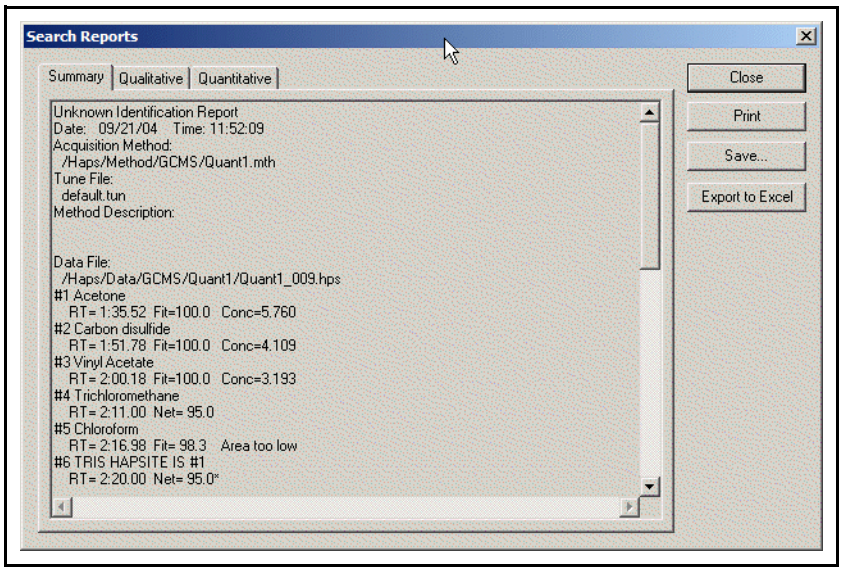


Figure 9-44 Search Reports Screen



There are a maximum of three reports available, depending on how the method used to generate the data was configured. They are:

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Summary . . . . . Generates a report based upon the Qualitative and Quantitative results. It will display quantitative results for identified compounds included in the Target Library. Compounds not included in the Target Library will be identified by the AMDIS Library.

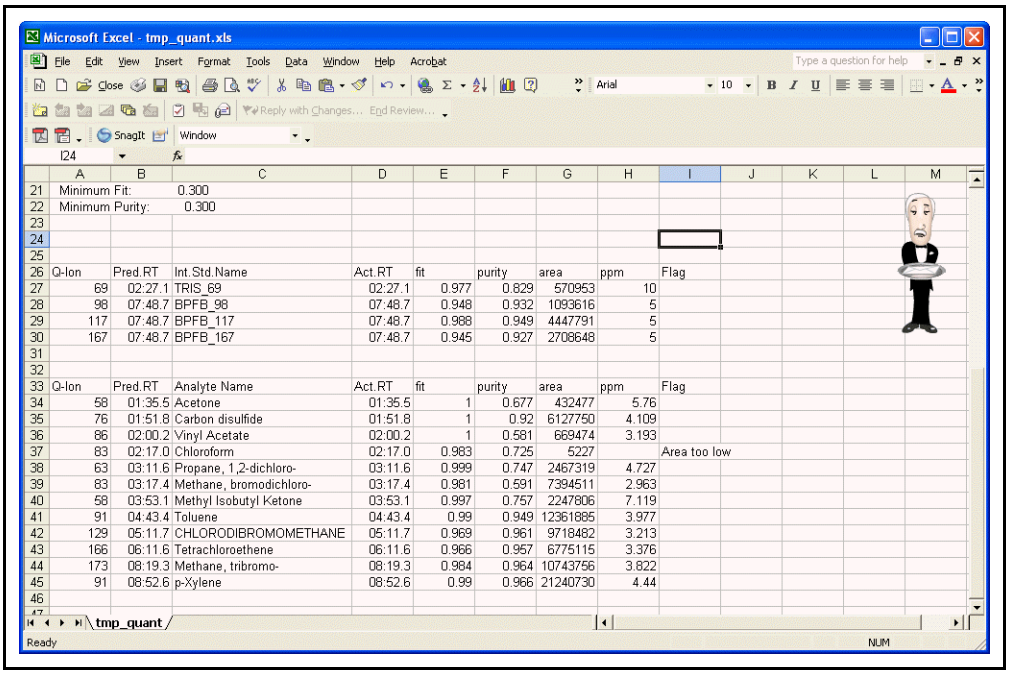
Qualitative . . . . . Generates a report based upon searching the ADMIS library and displaying a predetermined number of matches based upon the search criteria

Quantitative . . . . . Generates a report based upon a calibrated Target Compound Library. Results are reported in the specified units. This report can be exported to Excel.

NOTE: This will be empty if no calibration library is in use.

To export the Quantitative Report to Excel for further work, click on the **Export to Excel** button, which will produce the window shown in Figure 9-45.

Figure 9-45 Qualitative Report in Excel



9.10 Plus IQ Hot Keys

Table 9-1 Plus IQ Hot Keys

Keys	Functions
Crtl+o	Open data file
F3	Datafile Info
F7	Search NIST (when a peak is selected)
Alt+N	Next NIST Hit (when NIST is showing)
Alt+P	Previous NIST Hit (when NIST is showing)
F8	Switch to NIST Program
F9	Grab spectrum for NIST
Shift+F8	Switch to AMDIS
F11	Full Plot (resumes chromatogram to live data, or restores a zoomed area)
Ctrl+P	Print
Page up	Expands the Y Axis view to show twice the current max scale (if it was 100%, it will show 200% after it is pressed-up to 800%)
Page down	Zooms the Y Axis view to show half the current max setting (if it was 100%, it will show 50%-down to 0.4%)

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Chapter 10
Saving and Managing Files

10.1 Saving Files on the HAPSITE

File types are created two ways, either by the HAPSITE software or by the analyst when analyses are performed. The list of possible file types includes:

- Method files
- Event Log files
- Data files
- Tune files
- Report files

10.1.1 Method Files

Method files are created using the HAPSITE Plus IQ software to direct the instrument how to collect and analyze samples. Once created and saved, a Method file can be selected to run samples. Method files are created using the Method Editor and saved using either to a directory on the Laptop or to the HAPSITE hard drive.

To save a newly created method using the Method Editor, press the **Save** button at the bottom of the Method Editor window. The dialog window shown in Figure 10-1 is displayed. Notice that the default location to save a method file is to the HAPSITE.

NOTE: Method files can be saved to the HAPSITE only if the HAPSITE is connected to the PC. Refer to section 2.4.6, Connect Laptop (if desired), on page 2-10 for additional information on how to connect the Laptop to the HAPSITE.

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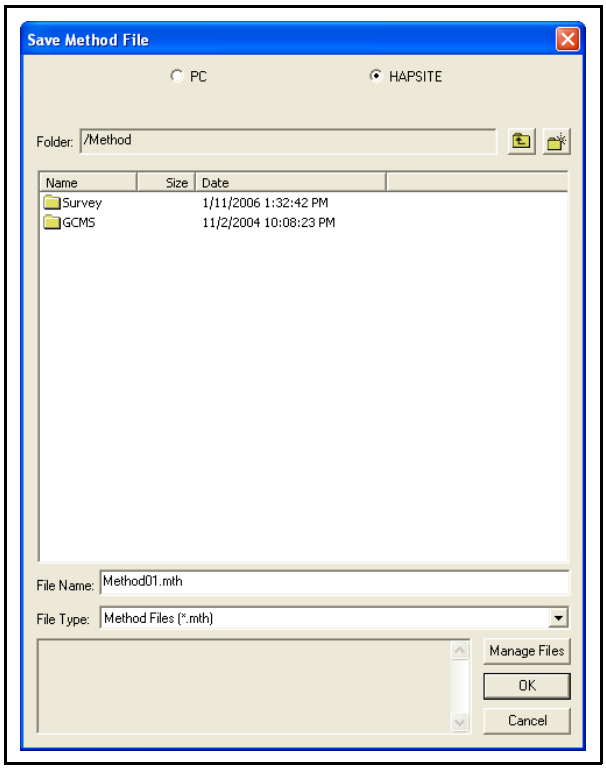
Figure 10-1 Save Method File Dialog Window - HAPSITE Option Selected

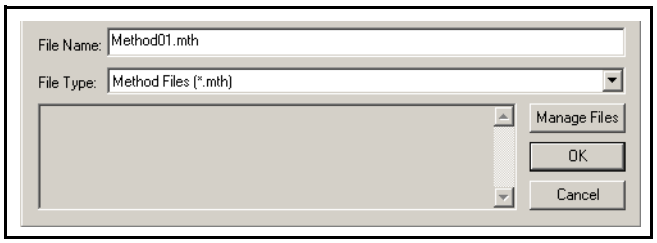


Enter the new file name in the box labeled **File Name**. The file location may be changed to save in the **GCMS (Analyze)** or **Survey** directory, or a new directory may be created using the **Create Folder** button, as shown in Figure 10-2.

Figure 10-2 Create Folder Button

To create a new folder, name the new folder then open the new folder before saving the Method file. Once the location and name have been chosen, press **OK** to save the file. See Figure 10-3.

Figure 10-3 Entering a New Method File Name



HINT: The HAPSITE Plus software is case sensitive. Folder names on the HAPSITE and Laptop must be exactly the same. Example: Bakeout must be written in both places as Bakeout, not as bakeout and BAKEOUT.

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10.1.2 Event Log Files

Event Log Files are created automatically by the system to record system state information (such as heating, valve changes, etc.) for future reference. These files are created daily when running the HAPSITE using the Plus IQ software. These files are saved on the Laptop. Refer to section 10.2, Saving Files to the Laptop, on page 10-9, for more information.

10.1.3 Data Files

Data files are automatically saved to the HAPSITE hard drive, in a data directory under a folder named the same as the Method used to run the analysis. For example, in the case where a Method named Method01 was used to run the analysis, the folder where files are saved for that method would be data\Method01\.

The default naming convention for these files is to use the method name with an underscore and 3 digits added to the end. The first file would start with _001. This file name would then be incremented each time a new analysis is performed. The name may be modified by selecting the **Method Editor - Data** page, shown in Figure 10-4.

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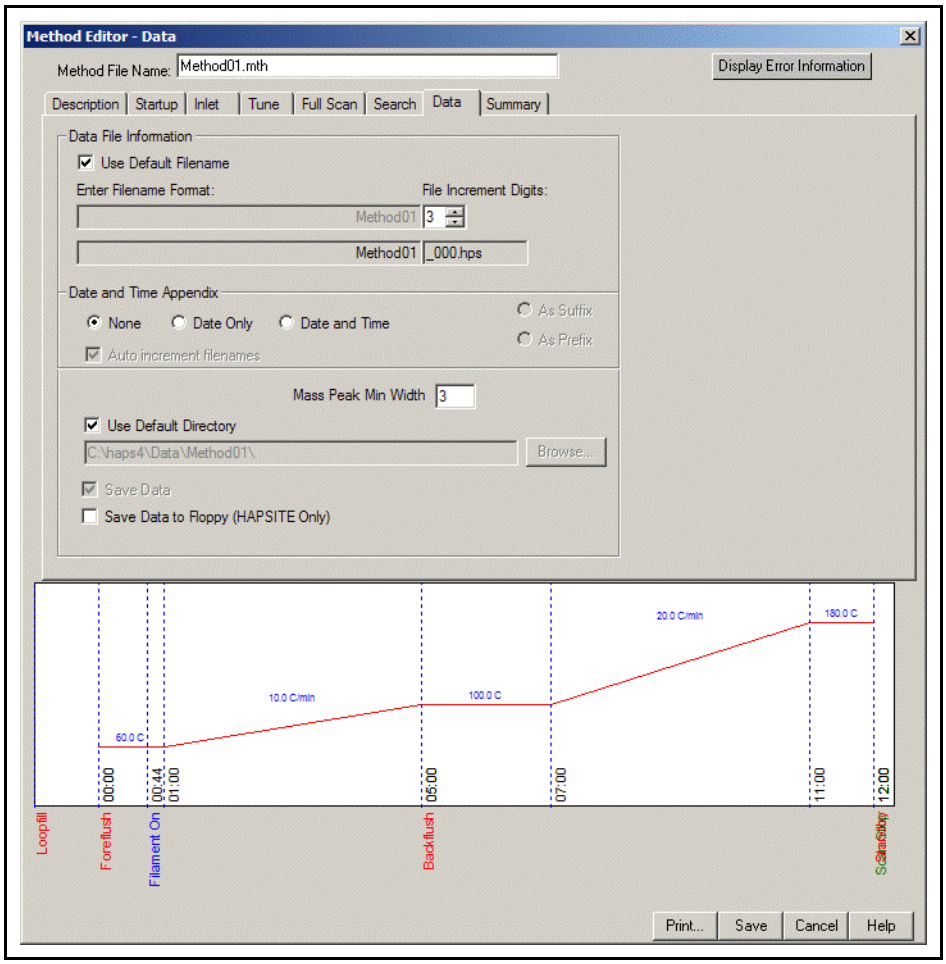
Figure 10-4 Method Editor - Data, Showing File Name Options



The system allows flexibility to add Date or Date and Time as a prefix or suffix. A different naming convention if **Use Default Filename** is not selected.

10.1.4 Tune Files

Refer to Chapter 7, Tune for additional information on Tune.

NOTE: Manual Tuning requires Advanced access. Normal users do not have access to Manual Tune. Refer to section 8.9, Access Levels, on page 8-23 for additional information on Access Levels.

If Manual Tune is performed, the file must be saved to the Tune folder on the HAPSITE. Figure 10-5 shows a typical Manual Tune screen, which is opened by selecting the **Tune** icon in the System Setup window, or by right-clicking on a sensor icon and selecting **Tune**. To save changes made during manual tuning, press the **Save Tune** button on the Sensor Toolbar and tune will be saved immediately. Other ways to save a tune file include using **File >> Save**, **File >> Save As**, or **Tune >> Save Tune Parameters**.

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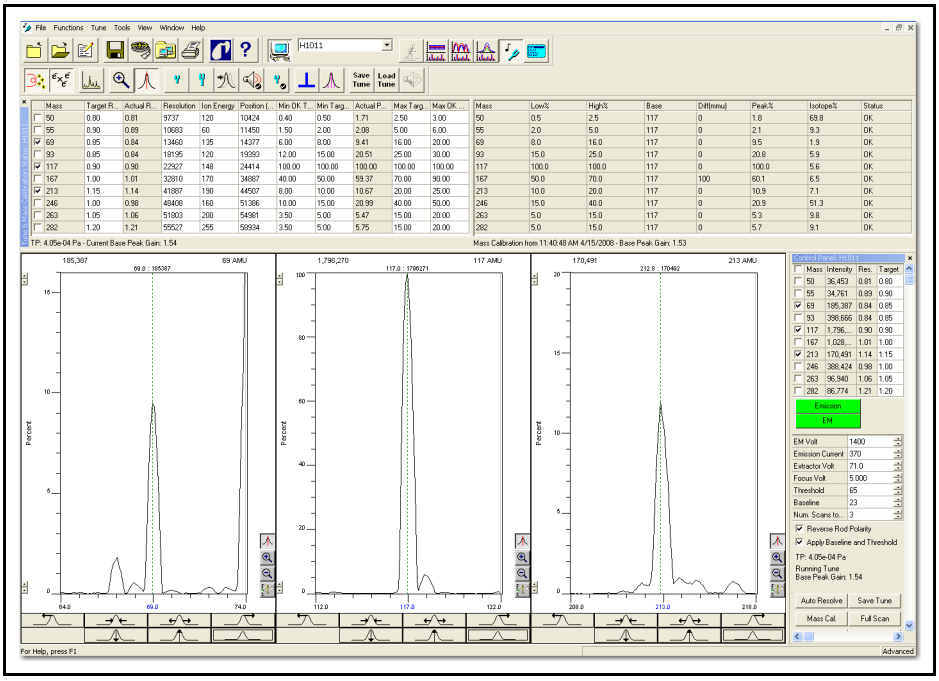
NOTE: Tune files are saved, by default, to the HAPSITE hard drive under the \Tune folder.

Figure 10-5 Manual Tuning Screen Showing Save Tune Button



When an attempt is made to exit manual tune without saving, a window will appear asking **Do you want to save the changes to a tune file?** See Figure 10-6. To save the file, press **Yes**. If not saving the tune file, press **No**. Pressing **Cancel** will abort exiting tune without saving the tune file. If saving the tune file, the **Save Tune File** window will appear as shown in Figure 10-7. Select a Tune file name and press **OK**.

HINT: It is highly recommended to always save the tune as **`default.tun`**.

Figure 10-6 Save Changes Prompt

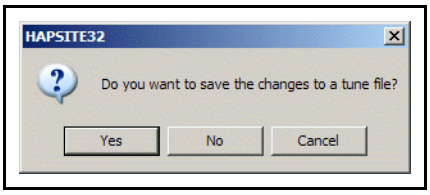
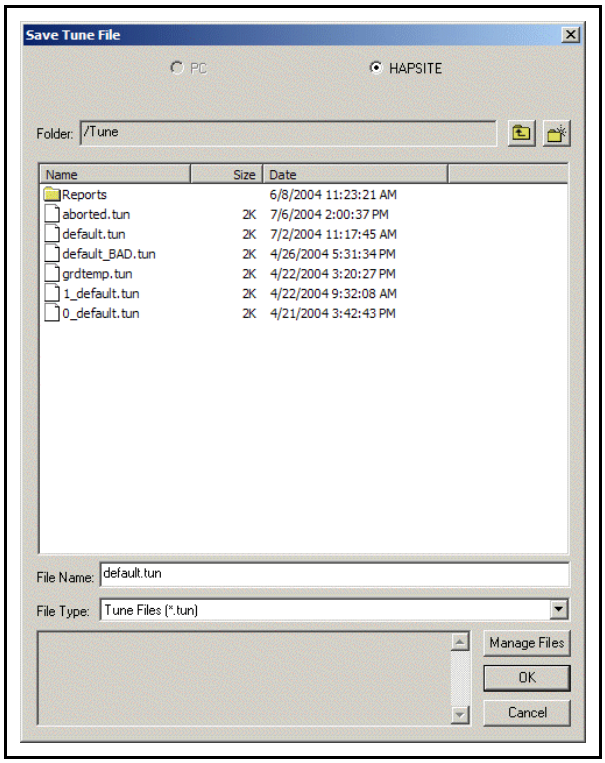


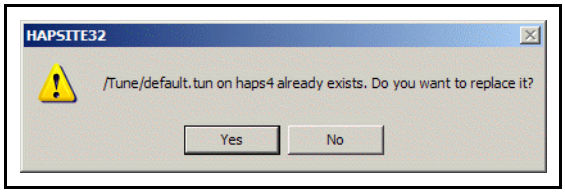
Figure 10-7 Save Tune File Screen



Once the Tune file is saved, the Save Tune File and Manual Tune windows will be closed.

If the Tune file already exists, a prompt will appear to confirm that the file will be overwritten. The confirmation window is shown in Figure 10-8.

Figure 10-8 Overwrite Existing Tune File Confirm Window



To overwrite the file, select **Yes**, otherwise select **No**. If **No** is selected, the **Save Tune File** window will appear.

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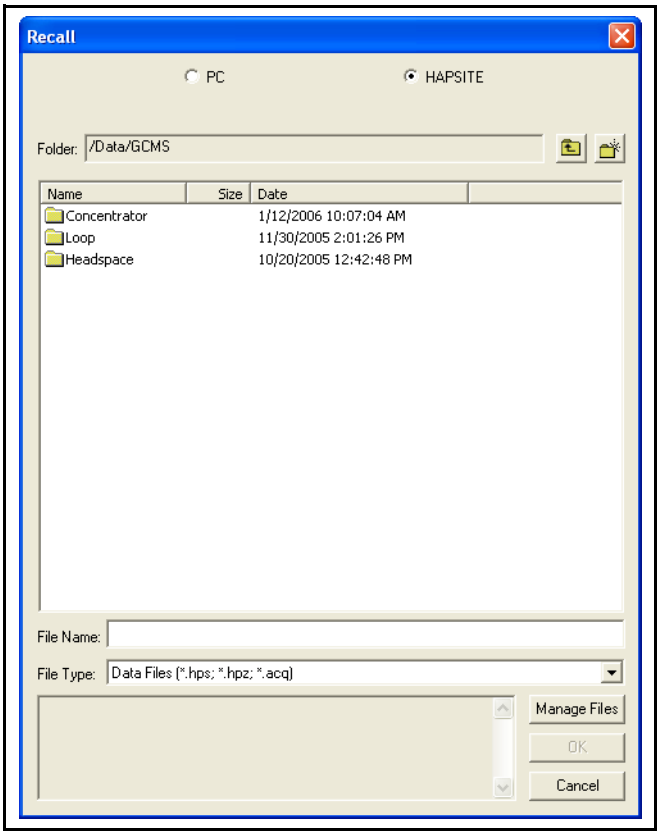
10.1.5 Data Review

Data review is used to view and analyze data files. To open files, double-click on the **Data Review** icon in the System Setup window, or right-click on a HAPSITE icon and select **Data Review**, or select a file from the **Recent Files** list in System Setup view. The Data Review window is shown in Figure 10-9. Refer to Chapter 9, Data Review for additional information on Data Review.

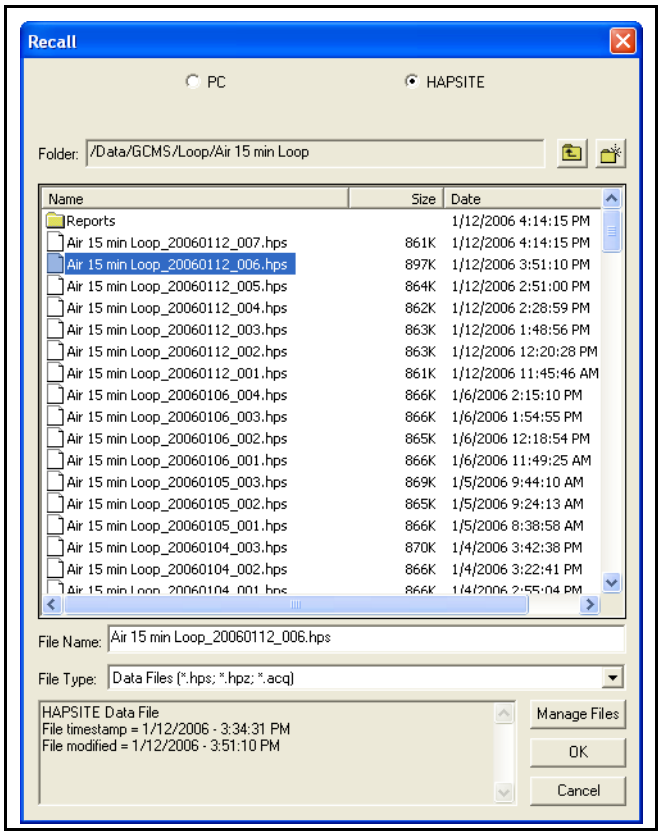
Figure 10-9 Data Review Recall Window



The window opens showing the data folder for the currently selected HAPSITE Data Files, organized the same as method files. Data files are saved under **`/Data/method_folder_name/`** where the **`method_folder_name`** corresponds to the folder in which the method is located. For example, if the method called Default was used to run the analysis, the folder would be Data/Default. To select a file to open, open a folder then click on the desired data file to open, then click the **OK** button. See Figure 10-10, which shows a selected data file.

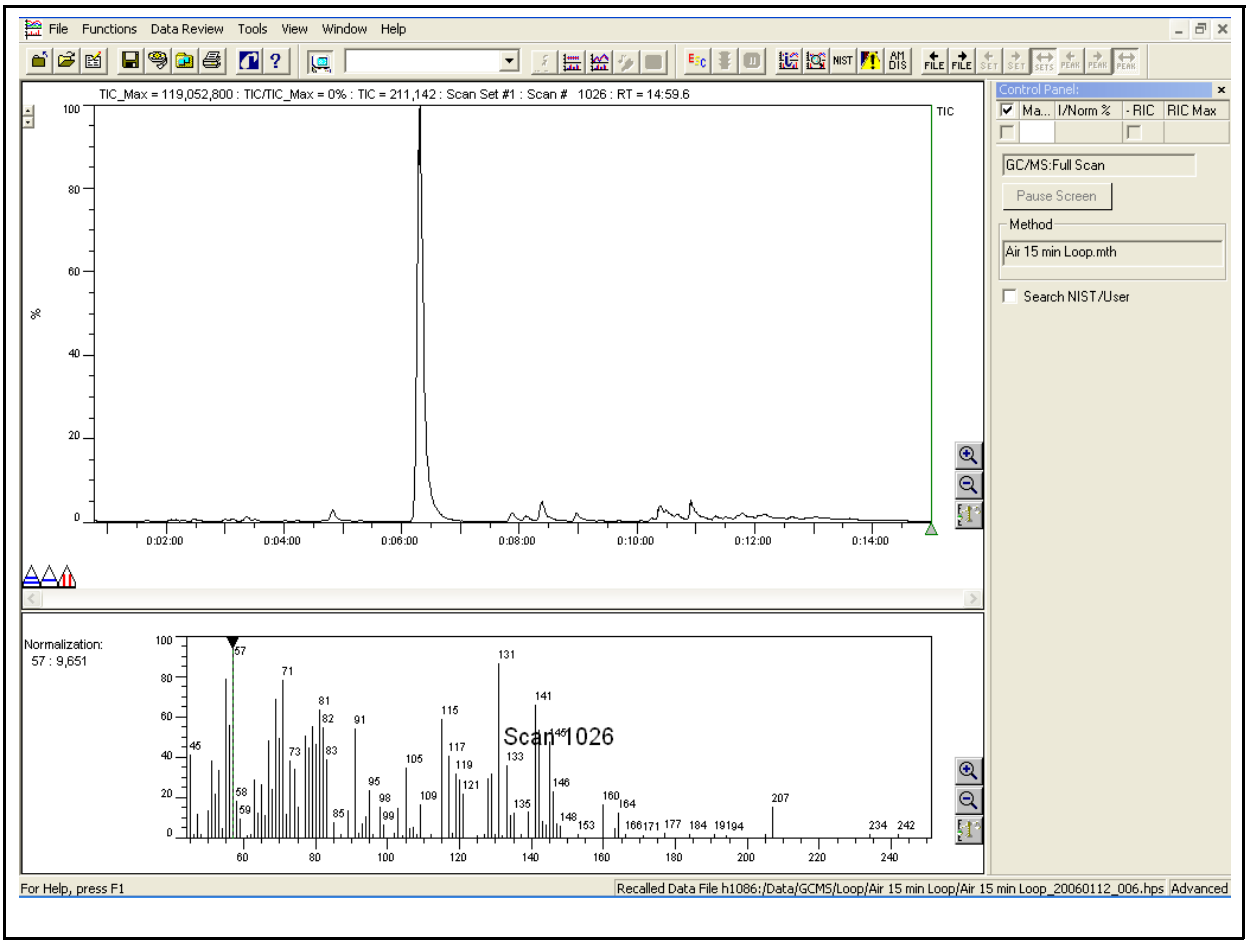
NOTE: Plus IQ data files are saved with a .hps file extension at the end of the filename.

Figure 10-10 Data Review Recall Window



The data file is opened in the Data Review window, as shown in Figure 10-11.

Figure 10-11 Viewing Results in the Data Review Window



Data files stored on the Laptop may also be opened for review. To open files on the Laptop, select the **PC** button at the top of the Data Review window, refer to Figure 10-10, then select the appropriate file from the Laptop hard drive.

NOTE: Alternately, select **Manage Files**, to copy files, manage folders, or delete files and folders on either the HAPSITE or Laptop hard drive.

10.2 Saving Files to the Laptop

File types are created two ways, either by the analyst or by the HAPSITE software when analyses are performed. The list of possible file types includes:

- Method files
- Event Log files
- Data files
- Tune files
- Report files

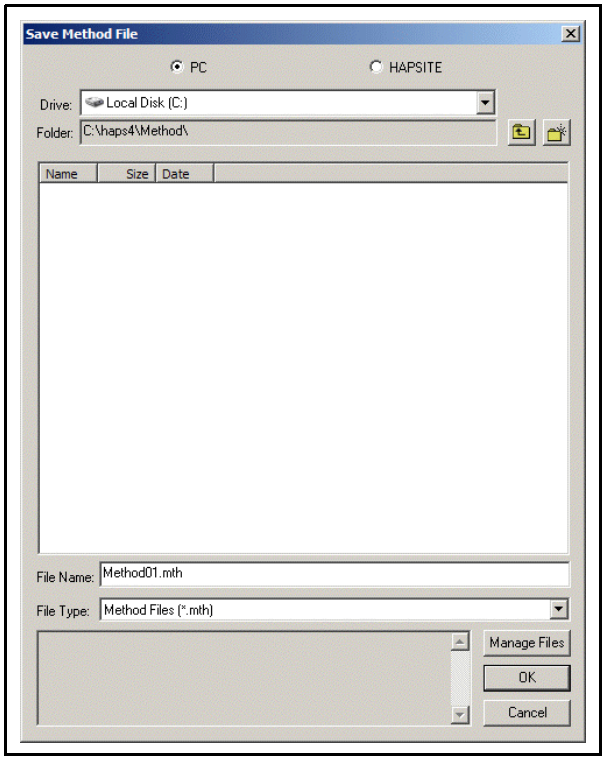
10.2.1 Method Files

Method files are created using the HAPSITE Plus IQ software to direct the instrument how to collect and analyze samples. Once created and saved, a Method file can be selected to run samples. Method files are created and saved using the Method Editor, to either a folder on the Laptop or the HAPSITE hard drive.

After method parameter changes are entered, the method needs to be saved. When ready to save the method, press the **Save** button at the bottom of the Method Editor window and the dialog window below is displayed. Notice that the default location to save a method file is to the HAPSITE. Method files may be saved to the Laptop hard drive in a manner similar to the way they are saved to the HAPSITE.

To save Method files to the Laptop, select the **PC** option as shown below in Figure 10-12.

Figure 10-12 Save Method File Dialog Window - PC Option Selected



Selecting a different Laptop disk drive is achieved by clicking on the drive drop down box. (Figure 10-12 shows **Local Disk (C:)** selected.) To change folders on a drive and choose from a list of available hard drives, move up using the **Up One Level** button (shown in Figure 10-13), or by double-clicking on an entry in the main file list. New folders may be created by selecting the **New Folder** button.

Figure 10-13 Up One Level Button

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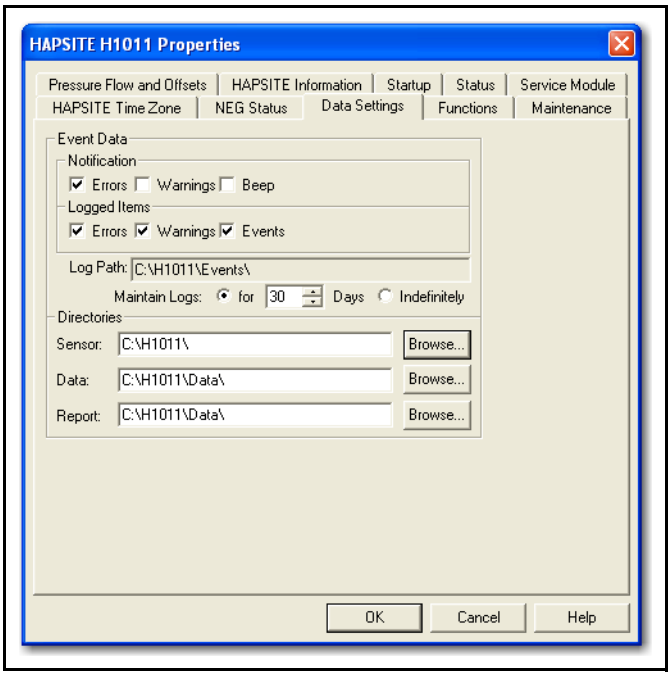
10.2.2 Event Log Files

Event Log Files are created automatically by the system to record system state information, such as heating or valve changes, for future reference. These files are created daily when running the HAPSITE using the Laptop Plus IQ software. These files are saved in the Sensor directory Events folder (as shown in Figure 10-14) as **`C:\haps4\`**. The events would be saved in **`C:\haps4\Events`** by specifying this location. The location where log files are saved can be changed only by changing the Sensor directory.

By default, log files are deleted after 30 days. To modify how long the files are saved, open up sensor properties by right-clicking on a **HAPSITE Sensor** icon and selecting **Properties**. It can also be modified by double-clicking on a sensor or by selecting the menu item **Tools >> Sensor Properties**. Select the **Data Settings** tab. The window shown in Figure 10-14 below will appear.

Figure 10-14 Sensor Properties - Data Settings



On the **Maintain Logs** line of Data Settings, the number of days which the log file will be saved may be changed. **Maintain Logs** can also be used to save all created files indefinitely. If a number of days is selected, each time HAPSITE Plus IQ is run the HAPSITE will delete files which are older than the number of days selected.

NOTE: This setting is saved in the HAPSITE Plus IQ.ini file in the HAPSITE Plus IQ program install directory. If for any reason the HAPSITE.ini file is reloaded or deleted, the setting will change back to the default setting of **Maintain Logs** for 30 days. Log files use the naming convention: LogYYYYMMDD.evt, where YYYY is year, MM is month, and DD is day.

10.2.3 Data Files

Data files are automatically saved to the HAPSITE hard drive. Data files are also saved to the Laptop if the Laptop is connected and running Plus IQ when the method finishes. To save these files to the Laptop, use the Manage Files dialog to transfer the files from the HAPSITE to the Laptop. For more information on transferring files, see section 10.3, Transferring Files Between the HAPSITE and Laptop, on page 10-12.

10.2.4 Tune Files

Tune files are automatically saved to the HAPSITE hard drive. To save Tune files to the Laptop, use the Manage Files dialog to transfer the files from the HAPSITE to the Laptop. For more information on transferring files, see section 10.3, Transferring Files Between the HAPSITE and Laptop, on page 10-12.

10.2.5 Report Files

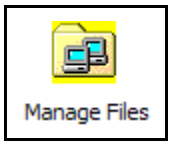
Report files are automatically saved to the HAPSITE hard drive. To save Report files to the Laptop, use the Manage Files dialog to transfer the files from the HAPSITE to the Laptop. For more information on transferring files, see section 10.3, Transferring Files Between the HAPSITE and Laptop, on page 10-12.

NOTE: Report files are embedded in the data files so copying them to the PC is not critical.

10.3 Transferring Files Between the HAPSITE and Laptop

Transfer of files between the HAPSITE and Laptop in the HAPSITE Plus IQ software can be performed using Manage Files. To open the Manage File dialog, either right click on a sensor icon then select **Manage Files**, or select a sensor then double-click on the **Manage Files** icon in the System Setup view. The Manage Files icon is shown in Figure 10-15.

Figure 10-15 Manage Files Icon in System Setup View



The **Manage Files** dialog allows the transfer of files directly from the HAPSITE to the Laptop, or from the Laptop to the HAPSITE. The **Manage Files** dialog is shown in Figure 10-16.

NOTE: Data files cannot be copied from the Laptop to the HAPSITE.

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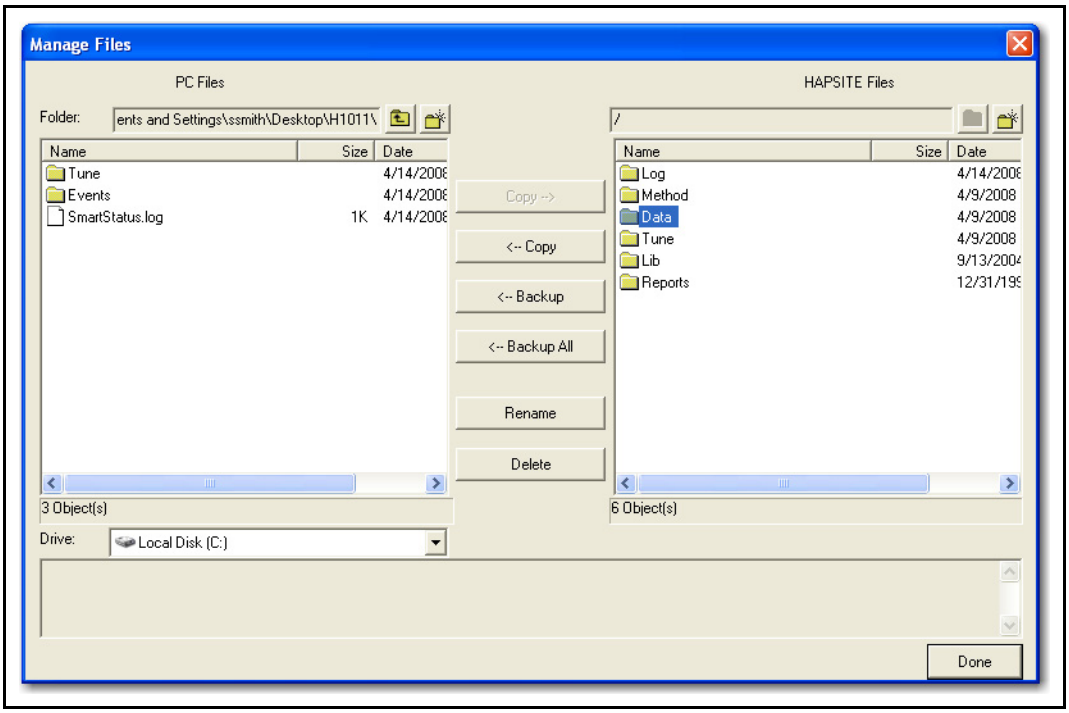
Figure 10-16 Manage Files Dialog Window

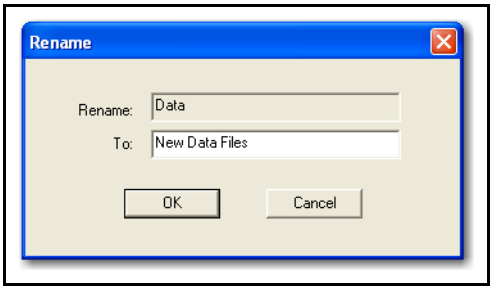


In the Manage Files window, the left side displays PC files while the right side displays HAPSITE files. The current folder directory is listed for both the PC and HAPSITE at the top of the window. The PC drive can be changed by clicking on the **Drive** pull-down list and selecting another available drive. Pressing the **Up One Level** button will move the directory back to the parent directory. Double-clicking on a folder will open the folder.

HINT: The **Name**, **Size**, and **Date** columns can be resized by clicking and holding the left mouse button on the line at the right edge of the field. Then drag it to resize. Double-clicking on the right edge of any field will size the field to fit the data. Single-clicking on a column heading will sort the list based on that column.

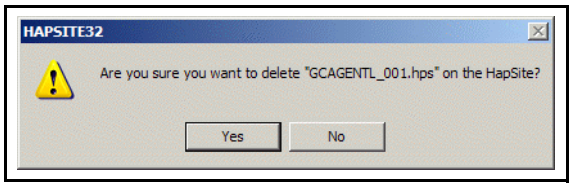
Folders or files may be renamed by selecting the appropriate file or folder, then selecting the **Rename** button. The **Rename** dialog is shown in Figure 10-17.

Figure 10-17 Manage Files - Rename Window



Files or folders may be deleted using the **Delete** button. Select the desired file or folder to delete, then press the **Delete** button. A window will appear asking for confirmation to delete the file or folder. Select **Yes** to perform the delete, otherwise select **No**. The delete confirm window is shown in Figure 10-18.

Figure 10-18 Manage Files - Delete Confirm Window



Folders or individual files or groups of files within a folder may be moved between the Laptop and HAPSITE. To move a single file, make sure the desired destination directory is already opened. Then, click on the file and press the arrow button to move the file to the selected directory. A section of files may be moved by clicking on the first file in the section, holding the shift key, then clicking on the last file in the section to move. Individual files may also be added to the list by holding down the Ctrl key and clicking on files. To complete the transfer, press the arrow button.

HINT: To move files from the Laptop to the HAPSITE, use the **Copy** button with the arrow pointed right (see Figure 10-19). To move files from the HAPSITE to the Laptop, use the **Copy** button with the arrow pointing left.

NOTE: Only method files may be moved to the HAPSITE.

Figure 10-19 Copying Files from the Laptop to HAPSITE Button

HINT: New folders may be created using the **Create Folder** button.

NOTE: Information about a selected file is listed in the bottom box of the window. The information will vary based on the type of file selected and the description information entered for that file.

The **Backup** Function will back up the selected file(s) that are on the HAPSITE onto the Laptop.

The **Backup All** Function will backup all files on the HAPSITE onto the Laptop.

When finished, click the **Done** button to close the **Manage Files** window.

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Chapter 11
Method Editor

11.1 The Method Editor

WARNING

Only trained users should create methods. Selecting a parameter that is incorrect may provide an inaccurate analysis of the compound(s) sampled.

The HAPSITE Method File provides for the identification, quantitative, and qualitative analysis of volatile compounds in the sample. The main components covered in this section, which are used to build the HAPSITE Method File, are the Inlet component, which is built on the Inlet page, the Acquisition component, which is built on the Full Scan page, and the Calibration/Quantitation component, which is built on the Search page.

When completed, the HAPSITE Method File normally is saved to the HAPSITE so that the HAPSITE can run in Portable Mode, without the need for an external computer. This chapter will instruct how to build a method to quantify a VOC (Volatile Organic Compound).

The Method File is used at an incident site where the hazard has not been identified. A HAPSITE Method File will allow a search from a default range of 45 to 300 AMU and generate a data file for analysis. The file will include many target compounds, for which the HAPSITE can be calibrated, but may also include unexpected compounds. The unexpected compounds are tentatively identified by a NIST library search, allowing only for an approximate quantitation.

Before being able to quantify a compound, one must develop a HAPSITE Method File with a calibrated target library of selected compounds. The information needed for each component of the HAPSITE Method File is described on the following pages:

- The **Description** page, which specifies the type of Method being built.
- The **Startup** page, where all initial temperatures are set, and where the input device is selected (i.e., Probe, Headspace or SituProbe).
- The **Inlet** page, defines the temperatures, timing, and other gas chromatograph parameters as well as accessory control parameters if installed.
- The **Tune** page requires the selection of a **Tune/Calibration** file, which defines the mass spectrometer response parameters. The tune report can be displayed on this page and on the Tune page.

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- The **Full Scan** component, which defines the mass range and other parameters of the Mass Spectrometer operation, is defined on the **Full Scan** page. For **SIM** collection, this component is configured on the **SIM** page.
- The **Search** page sets the **Calibration/Quantitation** component, which designates the target library file to access and search, the global GC/MS peak designation/integration parameters, and various reporting options.
- The **Data** page, which sets the **Data File (**file extension **.hps)** component, and specifies where the data will be stored. By default, data files are located in the data folder, in the program folder and Method name pathway, e.g., **C:\HAPSITE32\Method01\data\filename.hps.**
- A **Summary** page is provided, at the end of the Method Editor, which allows for review and printing of the Method parameters.

NOTE: Methods cannot be viewed, created or changed when Access Level is set to Normal.

Each functional page of the Method Editor shows a common profile at the bottom, which depicts the **Inlet States** and **Temperature Profile**. Newly created Methods start with a default set of **Inlet States** and a default **Temperature Profile**. These can be changed as required by the application.

The Method Editor can be run in a Wizard mode, which displays one page at a time and moves through the pages in a logical sequence while allowing movement forward or back through the pages to make or review changes (see Figure 11-1).

Figure 11-1 Method Editor Navigation Buttons

In "non-Wizard" mode, which is recommended only for experienced users, all pages are available through a tab interface. To change the Wizard mode settings, click **System Properties >> Miscellaneous** page (see Figure 11-2). The Method Editor must be closed to change and affect this setting.

Figure 11-2 System Properties Miscellaneous Page Wizard Setting

All Method parameters, on each page of the **Method Editor**, are checked for synchronization and correctness. The Method Editor automatically adjusts timing of the Inlet and Acquisition components to force synchronization. Prior to making automatic adjustments, the Method Editor colors the background of all questionable parameters with yellow. Each Method Editor page also has an **Error Information** button (see Figure 11-3), which is colored yellow when parameters are not synchronized. The editor permits movement from page to page, even when errors are present, because some errors may be repaired on one of many pages and some require repair on specific pages.

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Figure 11-3 Error Information Button

The order of pages that appear in Wizard mode for various collection and analysis modes are listed in Table 11-1.

Table 11-1 Method Editor Page Flow

GC/MS Full Scan	GC/MS SIM	Survey Full Scan	Survey SIM
Description	Description	Description	Description
Startup	Startup	Startup	Startup
Inlet	Inlet	Tune	Tune
Tune	Tune	Full Scan	SIM
Full Scan	SIM	Search	Search
Search	Search	Data	Data
Data	Data	Summary	Summary
Summary	Summary		

Development of a Method starts with a set of default components. The default settings are extracted from the software when editing a **New** Method. A **New** Method is also supplied with a default Method filename, which can be changed on any page of the editor. The editor will automatically increment the default name with each successful launch and exit of the editor, provided the resulting Method is saved.

Both section 11.2 and section 11.3 describe and define the Method Editor interface. It also describes all the parameters used to create a HAPSITE Method File. A HAPSITE Method File can be deployed in numerous configurations. However, development of the complete method is done only on the Laptop and is then downloaded to the HAPSITE.

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11.2 Accessing Method Editor

CAUTION

Read all of Chapter 11 before creating a method.

NOTE: For questions relating to specific settings, refer to the previous sections of this chapter.

Creating a method is a very involved process. Creating a method from scratch is best left to experts; however, custom methods can be written by modifying a default method.

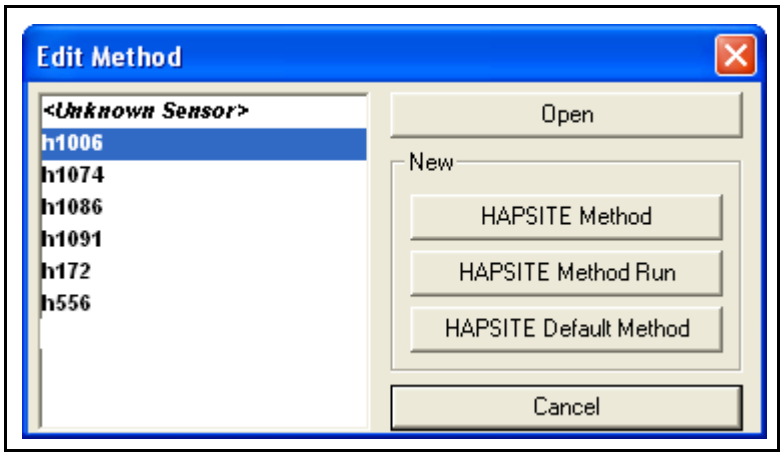
To access Method Editor:

1. On the System Setup View, double-click on the **Method Editor** icon. See Figure 11-46.

Figure 11-4 Method Editor Icon

2. Choose the HAPSITE to which the method will be applied and click **Open**. See Figure 11-47.

Figure 11-5 Method Editor Open Window



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11.3 Description Page

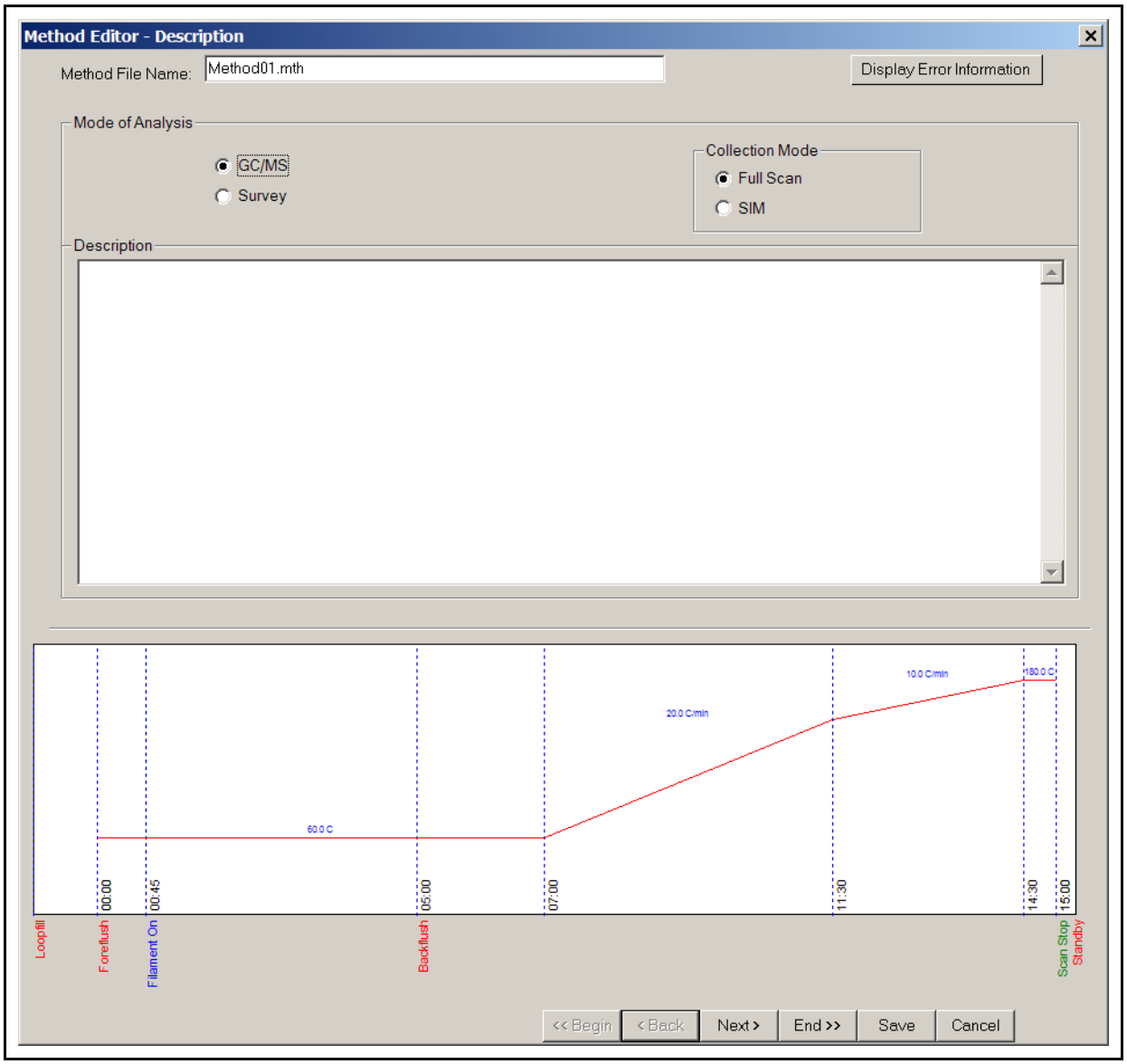
WARNING

Incorrect selections for the mode of analysis may not identify and/or quantify the compounds being sampled.

The first page displayed in the Method Editor is the **Description** Page (Figure 11-6), which provides selections for the **Mode of Analysis** and **Collection Mode**. These selections determine the default content of the remaining Editor pages and the content of the Method file itself.

NOTE: A Method File ends with a file extension of .mth.

Figure 11-6 Method Editor Description Page



Mode of Analysis

Analyze (GC/MS) . . . . . This analysis uses both the Gas Chromatograph (GC) and Mass Spectrometer (MS) to separate and analyze compounds. Compounds are tentatively identified by a library search.

Survey . . . . . This mode uses only the Mass Spectrometer and provides an immediate response and approximate quantitation. Samples flow directly to the Mass Spectrometer with no separation of compounds by the GC.

Collection Mode

Full Scan . . . . . This mode scans all the masses across a given range. This is used for general analysis of samples when several compounds are to be quantified or when attempting to identify unknowns. Full Scan is available for both Analyze (GC/MS) and Survey modes of analysis.

SIM . . . . . Selected Ion Monitoring, this mode is used for specific target compounds expected to be in the sample. A higher degree of sensitivity is provided with this mode of collection. SIM is available for both Analyze (GC/MS) and Survey modes of analysis. Survey analysis in SIM Mode can be used for leak detection.

WARNING

Collection modes must be carefully selected to be sure all the compounds are identified.

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11.3.1 Full Scan Method

A full scan Analyze (GC/MS) method is used for the full identification and quantitation of volatile compounds in the sample.

The analysis may include expected (or target) compounds (for which the instrument will be calibrated), but may also include unexpected compounds. These must be tentatively identified by a library search, and their quantitation can only be approximated.

Method elements are:

- If the HAPSITE is to operate separate from the Service Module, the HAPSITE must have a NEG Pump installed and activated. Refer to section 2.8, Service Module, on page 2-19 and Chapter 15, Service Module.
- The method components must be defined. This includes the definition of:
  - the Data file (where the data will be stored)
  - the Full-scan parameters (which defines the mass range and other parameters of the mass spectrometer operation)
  - the Library Search parameters (which designates which library file to access, individual and collective peak search, integration parameters, and various reporting options)
  - the Inlet parameters (which defines the events and the order in which they occur, the temperature profile and ramping rate, the filament delay time, as well as the control parameters of the HSS or SituProbe, if installed)
  - the Tune file (which optimizes the mass spectral response to the target compounds and the Internal Standards)
  - If the HAPSITE is to operate without the Laptop, the method must be saved on the HAPSITE.
  - The HAPSITE must be tuned. (Refer to Chapter 7, Tune.)
  - The HAPSITE must be calibrated to the target compounds. (See Chapter 12, Target Compound Methods.)

11.3.2 SIM Method

The SIM Analyze (GC/MS) method is used for the identification and quantitation of only specific (or target) compounds expected to be in the sample.

This type of analysis should be used where the highest sensitivity (lowest minimum detectable concentration) is required, and where the compounds to be measured are known. The SIM Analyze (GC/MS) method might include one or many specific compounds for which the HAPSITE will be calibrated.

This work may be carried out with just the HAPSITE, or a Laptop, Service Module, HSS, SituProbe, and/or sample conditioning probe may be used. Regardless of the configuration, certain method elements must be defined and set-up procedures must be carried out. The method elements are:

- If the HAPSITE is to operate separate from the Service Module, the HAPSITE must have a NEG Pump installed and activated. Refer to section 2.8, Service Module, on page 2-19, or Chapter 15, Service Module for additional information.

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- The quantitation sequence method must be defined. This includes the definition of:
  - the Data file (where the data will be stored)
  - the Selected Ion Method parameters (which defines the masses to be monitored and the elution times expected, as well as other parameters of the mass spectrometer operation)
  - the Library Search parameters (which designates which library file to access, individual and collective peak search, integration parameters, and various reporting options)
  - the Inlet method file (which defines the temperatures, timing, and other gas chromatograph and head space parameters)
  - the Tune/calibration file (which defines the mass spectral response to the target compounds and the internal standards)
- The HAPSITE must be tuned, either with the AutoTune or Manual Tune program. (Refer to Chapter 7, Tune.)
- The HAPSITE must be calibrated to the target compounds. (See Chapter 12, Target Compound Methods.)

WARNING

Temperature settings are critical to get the proper results. Only trained users should modify these.

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11.4 Startup Page

The Startup Page, shown in Figure 11-7 and Figure 11-8, allows for setting the initial parameters for the HAPSITE system heaters and selection of the sample input device.

Figure 11-7 Method Editor Startup Page for Analyze (GC/MS) Methods

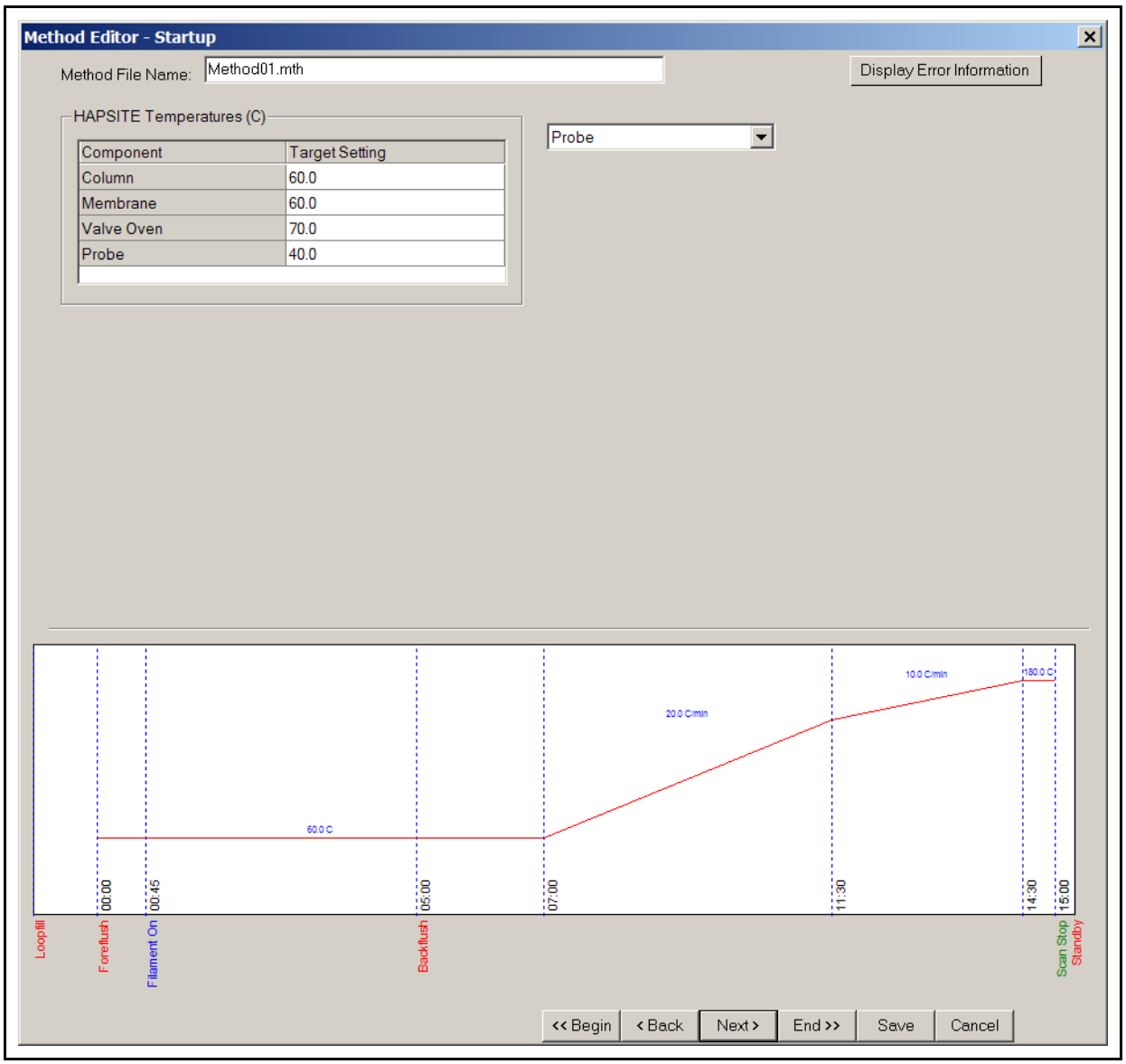
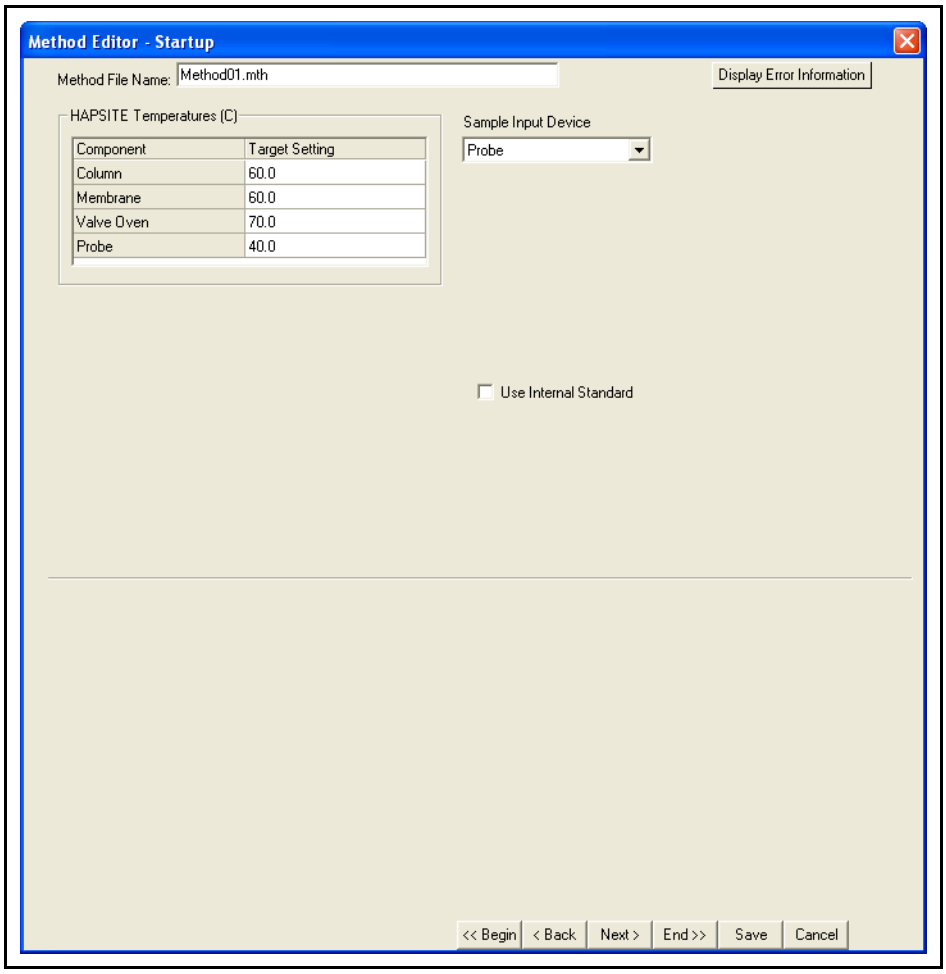


Figure 11-8 Method Editor Startup Page for Survey Methods



The parameters on the Startup page are:

Use Internal Standard . . . . . This option is shown on the Startup Page for Survey methods. Refer to Figure 11-8.

HAPSITE Temperatures (C)

Column . . . . . The target temperature the Column must achieve before starting data acquisition. (Not used for Survey methods.)

Membrane . . . . . The target temperature the Membrane must achieve before setting before starting data acquisition.

Valve Oven . . . . . The target temperature the Valve Oven must achieve before starting data acquisition.

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Probe . . . . . The target temperature the Probe must achieve before starting data acquisition. This setting is not available when the Headspace or SituProbe is enabled.

Sample Input Device

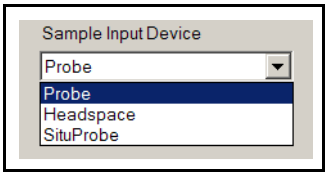
Probe . . . . . The Probe is used for analyzing air samples for volatile organic compounds.

Headspace. . . . . This accessory is used for analyzing solids and liquids for volatile organic compounds. Additional components and their target settings appear that are specific to the Headspace. Refer to Chapter 13, Headspace Sampling System.

SituProbe . . . . . This accessory is used for direct analysis of liquid samples. For example, it can be placed directly in a flowing sample stream (continuous monitoring). Additional components and their target settings appear that are specific to the SituProbe.

In selecting a method, the Probe will automatically be highlighted in the drop down box for the Sample Input Device Options. See Figure 11-9.

Figure 11-9 Sample Input Device Options



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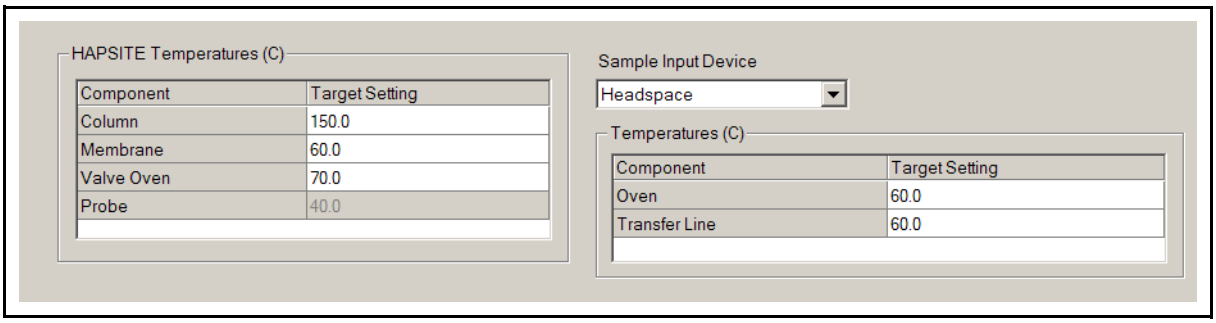
11.4.1 Headspace

WARNING

Only trained users should create methods. Choosing the incorrect sampling device and/or temperatures may result in inaccurate data.

To create a Headspace method, choose the **Headspace Sample Input Device**. This will bring up another temperature setting window for setting the Headspace Oven and Transfer Line temperature. See Figure 11-10.

Figure 11-10 Headspace Parameters



Headspace Temperatures (C)

Oven . . . . . The target temperature the Oven must achieve before starting data acquisition. This setting is not available when the Headspace is disabled.

Transfer Line. . . . . The target temperature the Transfer Line must achieve before starting data acquisition. This setting is not available when the Headspace is disabled.

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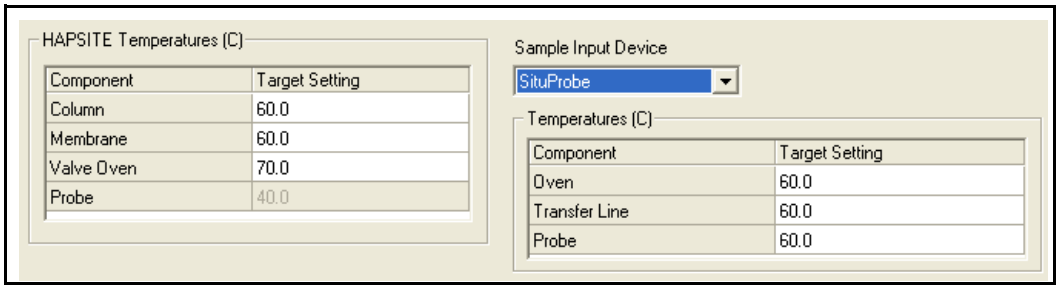
11.4.2 SituProbe

WARNING

Only trained users should create methods. Choosing the incorrect sampling device and/or temperatures may result in inaccurate data.

To create a SituProbe method, choose the **SituProbe Sample Input Device**. This will bring up another temperature setting window for setting the SituProbe Oven and Transfer Line temperatures. See Figure 11-11.

Figure 11-11 SituProbe Parameters



SituProbe Temperatures (C)

Oven . . . . . The target temperature the Oven must achieve before starting data acquisition. This setting is not available when the SituProbe is disabled.

Transfer Line . . . . . The target temperature the Transfer Line must achieve before starting data acquisition. This setting is not available when the SituProbe is disabled.

Probe . . . . . SituProbe temperature settings before starting the method. This setting is not available when the SituProbe is disabled.

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11.5 Inlet Page

WARNING

Only trained users should modify methods. Changing parameters may result in incorrect analysis.

NOTE: The Inlet page is not used (or displayed) when creating Survey methods.

Figure 11-12 shows the default settings for the Inlet page for an Analyze (GC/MS) Full Scan Method. From this page, the Inlet States, GC Temperature Profiles and Run Time are integrated and synchronized to form the Inlet Component of the Method. Changing one item on this page often affects others and that effect is shown in the profile, at the bottom of the page, for clarity. There is a synchronization requirement between the start time of the Standby Inlet Event, the total time of the Temperature Profile, and the Run Time. Changing a time related to one of these entries will automatically change a related time in the other entries, in most cases.

For example, in Figure 11-12, increasing the Run Time will increase the Duration of the Backflush Inlet State and will result in a later Start time for the Standby event. The Run Time increase will also result in an increase to the Hold Time at 180 degrees Celsius in the GC Temperature Profiles.

NOTE: In the rare case that the settings cannot be automatically synchronized, the incorrect cells are colored yellow as a guide to what needs correction.

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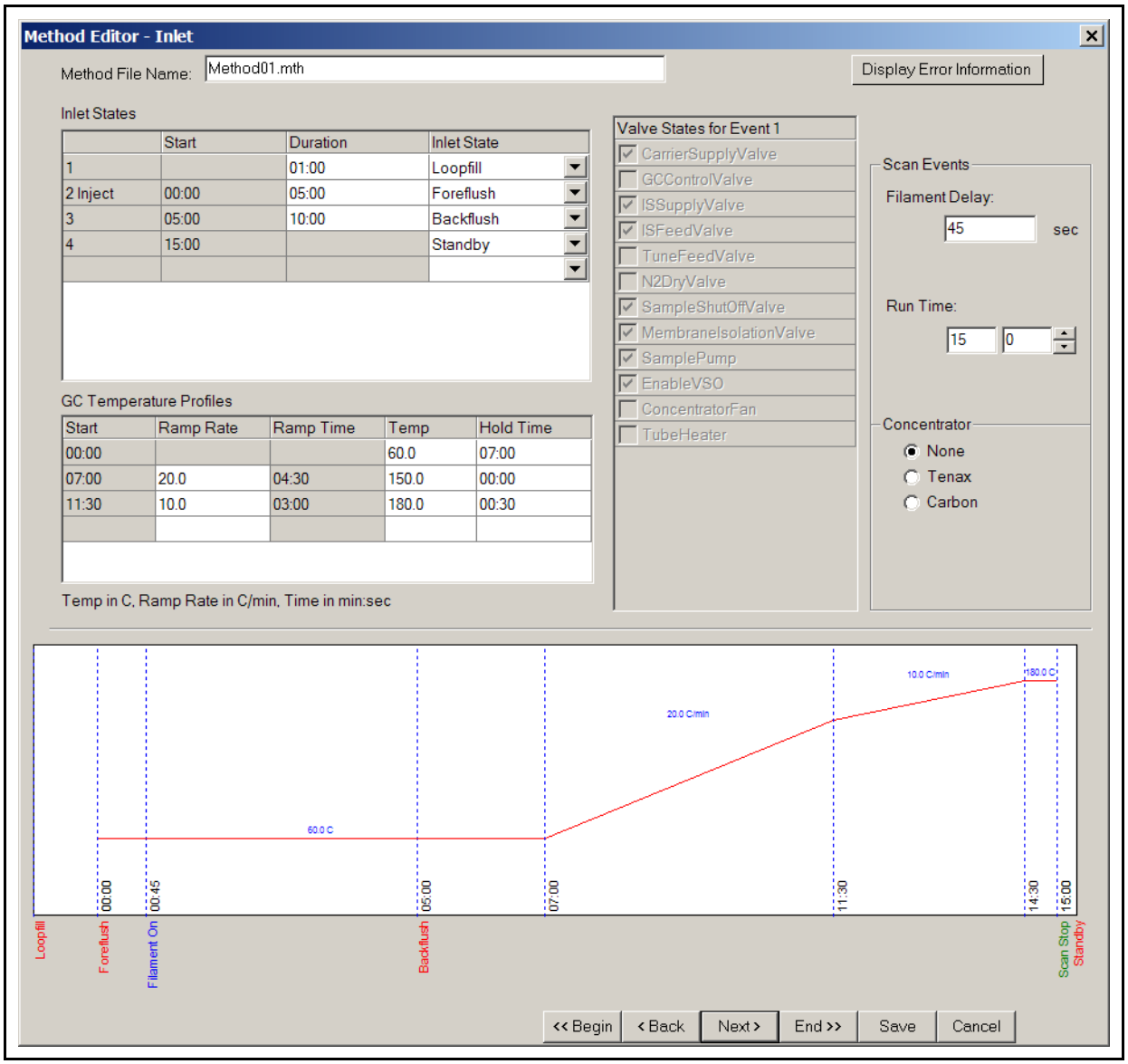
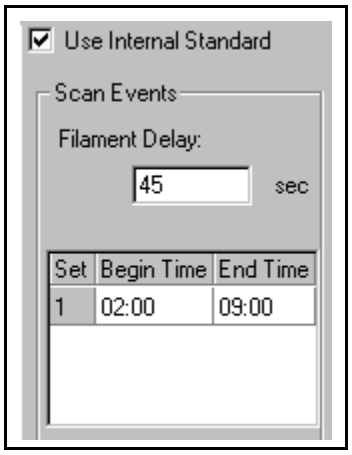
Figure 11-12 Method Editor Inlet Page for GC/MS Full Scan



The only difference on the Inlet page between an Analyze (GC/MS) Full Scan method and an Analyze (GC/MS) SIM method is that the Run Time parameter entry is replaced with a table showing the SIM Sets as programmed on the SIM page (refer to section 11.3.2, SIM Method, on page 11-7). This difference is shown in Figure 11-13.

Figure 11-13 Inlet Page for Analyze (GC/MS) SIM



11.5.1 Inlet States

WARNING

Only trained users should modify methods. Changing inlet states may result in incorrect analysis.

Inlet States specify the HAPSITE and accessory valve settings that control the sampling, analysis and clean-out of the HAPSITE. The Inlet component of the Method features multiple Inlet States, which are programmable for duration but not for valve settings. One generic Inlet State, Other, is available for creating a custom set of valve settings. Figure 11-14 shows the grid used to program the Inlet States in a GC/MS Method.

Figure 11-14 Method Editor Inlet Page: Inlet States

Inlet States

	Start	Duration	Inlet State
1		00:30	Loopfill
2 Inject	00:00	05:00	Foreflush
3	05:00	07:00	Backflush
4	12:00		Standby

The basic steps when editing the Inlet States grid is to first select the desired Inlet State from the **Inlet State** column. The duration for that Inlet State is entered in the **Duration** column. After the duration is entered, the editor will automatically calculate and enter the **Start** time for the next Inlet State. There is always a default Inlet component of Method; this can be modified by highlighting any cell in the grid and pressing the **Delete** key, to remove a row, or the **Insert** key to add a row. After adding a row the first entry must be the Inlet State.

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HINT: When editing from the keyboard, the Alt+DownArrow key combination will "pull" the pull-down in the Inlet State column. Also, the Insert and Delete keys work for this grid.

The following parameters are found on the **Inlet States** page:

Start . . . . . This is the start time of each Inlet State and is not programmable. The start of the Run Time actually is the start of the first Injection event. This being the case, there can be several events occurring before the actual start of the Run Time. Each Inlet State starts at the end of the duration of the previous state.

Duration. . . . . Displays the run time, in minutes and seconds, of each Inlet State event.

Inlet State . . . . . The flow order of the entire Method is programmed via the Inlet States page and specifically via the Inlet State column. A set of pre-programmed Inlet States exist and are selected from the pull-down menu in the Inlet State column. Selecting an Inlet State will show the Valve States used for that Inlet State (see Figure 11-15). An Inlet State of Other can be selected, which allows for a custom set of Valve States to be set for that particular Inlet State (see Figure 11-16). The selection of some Inlet States is dependent on the configuration or placement within the Method. Some Valve States cannot be changed for certain Inlet States.

NOTE: The list of Valve States may also include pumps, heaters and fans, depending on the system configuration. Selecting a component on the Valve States list tells the system to activate the component. An empty checkbox (not check marked) tells the system to deactivate the valve or component.

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Figure 11-15 Valve States for an Inlet State Event

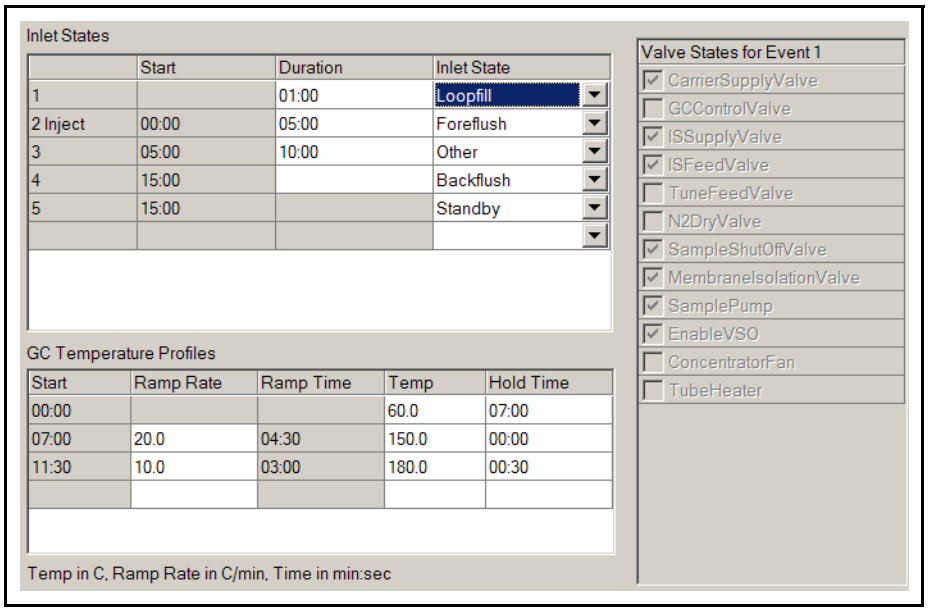
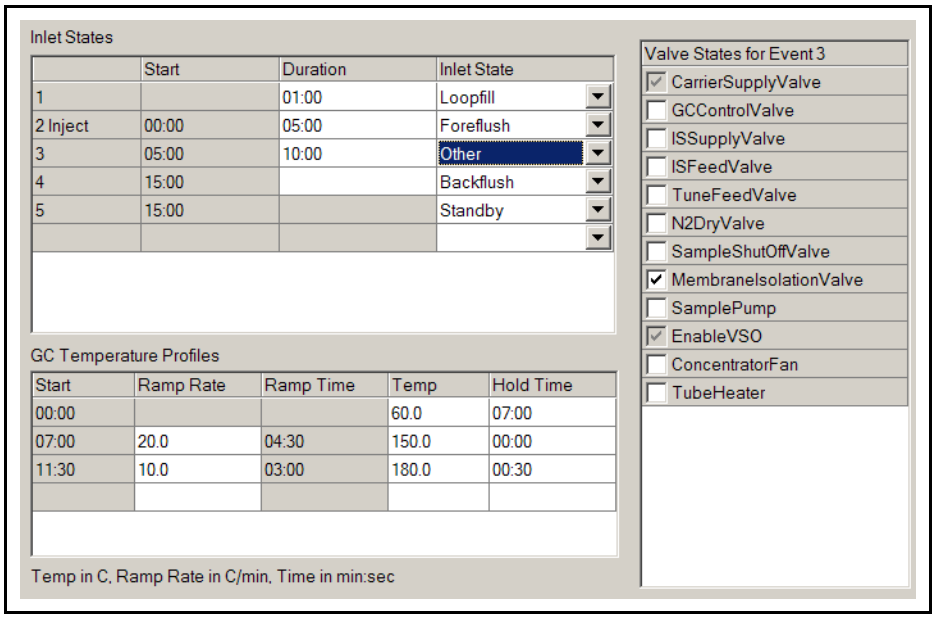


Figure 11-16 Customizing the Valve States for an Inlet State



Inlet States can be selected from the pull-down within the Inlet State column as shown in Figure 11-17. Some Inlet States are not available as the first state and some are only available after specific states have been selected. Some Inlet States occur before the Inject time 00:00, which is considered the chromatographic start event.

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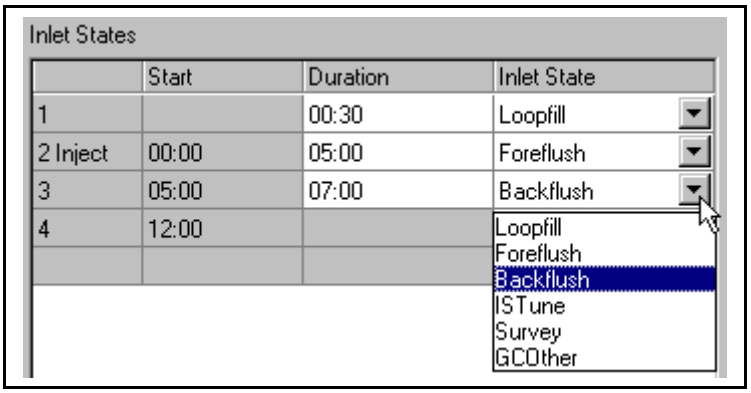
Figure 11-17 Accessing the Inlet States



The following choices are available in the Inlet States column:

Loopfill. . . . . This sets the GC valves when a Loop is being used so that the sample pump pulls the sample through the Sample Loop. The recommendation is the Loopfill duration be at least 60 seconds. This allows for clearing the sample line of the previous sample as well as good mixing with the Internal Standard (if used).

Line Purge. . . . . This Inlet State pulls the sample through the probe and out through the exhaust vent. The sample does not go through the Concentrator.

Foreflush. . . . . This sets the GC valves so that Carrier Gas will push sample out of the Sample Loop and onto the precolumn. The Foreflush time should be set so that all of the volatile compounds of interest will pass through the precolumn and onto the analytical column prior to Backflush.

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Backflush . . . . . This Inlet State sets the GC valves so that carrier gas is directed to the input of the analytical column and into the output of the precolumn. The Backflush state provides the ability to customize the GC method so volatile compounds that pass quickly through the precolumn and onto the analytical column, during the Foreflush state, can be separated from less volatile compounds. The less volatile compounds are pushed back out of the precolumn, while the more volatile compounds of interest are separated on the analytical column for MS analysis.

ISTune . . . . . This state sets the GC valves so the Internal Standard gas is directed to the Mass Spectrometer for MS tuning.

Survey . . . . . This Inlet State sets the GC valves and turns on the sampling pump so the sample will by-pass the GC and be directed to the inlet of the MS for real time analysis.

NOTE: Survey is the Inlet State used (by default) in the Survey and Direct Sample, Single Compound Methods. This cannot be changed.

Other . . . . . This allows the customization of each specific GC valve for a custom GC valve state. Useful for GC troubleshooting.

Standby . . . . . This Inlet State must be included in every Method as the last state. Standby closes the Membrane Isolation valve and turns the Mass Spectrometer filament off.

The following additional Inlet States are available in the Inlet States column when a Concentrator is being used:

ConcFill . . . . . Equivalent to Loopfill, when a Concentrator is installed the sample passes through the Concentrator.

ConcCooldown . . . . . This Inlet State provides a Duration Value that allows the Concentrator cool down to a desired operating temperature.

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Line Purge . . . . . This Inlet State turns on the sampling pump and pulls sample through the Probe and out the exhaust vent, while bypassing the Concentrator.

PreDesorb . . . . . PreDesorb begins the process of heat desorption of the analytes adsorbed on the Concentrator prior to introduction onto the GC column.

Desorb . . . . . This completes the desorption of analytes off the Concentrator and onto the GC column.

The following Inlet States are only available in the Inlet States column when the Headspace Sampling System (HSS) is enabled for use:

HSSample . . . . . This Inlet State sets the valves of both the HAPSITE and HSS. It turns on the sample pump for analysis. The collection of the sample trapped in the vial headspace sample passes through the Transfer Line and to the HAPSITE Analytical Module. The suggested HSSample duration is approximately 15 seconds.

HSPurge . . . . . This Inlet state sets the valves for Nitrogen to flow through the lines, the needle assembly and then through the Transfer Line. This removes moisture and cleans out the previous sample. The needle should be inserted into a clean, dry vial during purge.

HSConcDry . . . . . This Inlet State allows dry N_2 gas to flow through the Transfer Line and Concentrator to remove moisture prior to sample injection. This should only be used if the Headspace system is connected to an external cylinder of Carrier Gas.

The following Inlet States are only available in the Inlet States column when the SituProbe (SP) is enabled for use:

SPLinePurge . . . . . This state sets the valves for Nitrogen to flow through the lines and SituProbe assembly, then through the transfer line. This cleans out the previous sample. The recommended event duration is at least 60 seconds to allow for clearing the sample line of the previous sample as well as good mixing with the Internal Standard (if used).

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SPConcFill . . . . . This sets the GC valves so that the sample pump pulls the sample through the concentrator.

SPLoopFill . . . . . This sets the GC valves so that the sample pump pulls the sample through the Sample Loop. The recommended duration is at least 60 seconds to allow for clearing the sample line of the previous sample as well as good mixing with the Internal Standard (if used).

SPN2DryPurge . . . . . This Inlet State purges the transfer line and concentrator system with dry N_2 before sample injection to remove moisture.

11.5.2 GC Temperature Profile

WARNING

Only trained users should modify methods. Changing GC temperature profiles may result in incorrect analysis.

GC Temperature Profiles (see Figure 11-18) specify the temperature ramp and hold settings for the HAPSITE Method. Any profile can be edited by changing the value in the **Temp**, **Ramp Rate** or **Hold Time** column. When a new profile is added, the first value entered will force the other values to be calculated and entered automatically. However, this automatic entry does not prohibit the values from being edited. The **Start** time of each profile is automatically derived from the preceding profile. The **Ramp Time** is automatically calculated based on the **Ramp Rate** and **Temp** entries. It cannot be edited directly.

Figure 11-18 Method Editor Inlet Page: GC Temperature Profiles

GC Temperature Profiles

Start	Ramp Rate	Ramp Time	Temp	Hold Time
00:00			60.0	01:00
01:00	10.0	04:00	100.0	02:00
07:00	20.0	04:00	180.0	00:00

Temp in C, Ramp Rate in C/min, Time in min:sec

The Insert key does not work for this grid. Changes to the profiles must be made by editing the **Temp**, **Ramp Rate** or **Hold Time** and adding heater profiles.

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11.5.3 Use Internal Standard

The selection to use an Internal Standard is available for Loopfill, Concfill and LinePurge events.

Figure 11-19 Selection to Use Internal Standard

If **Use Internal Standard** is checkmarked, the Internal Standard will automatically be mixed at a ratio of 1:10 with the sample to be analyzed.

NOTE: Use Internal Standard is not available when the HSS is enabled.

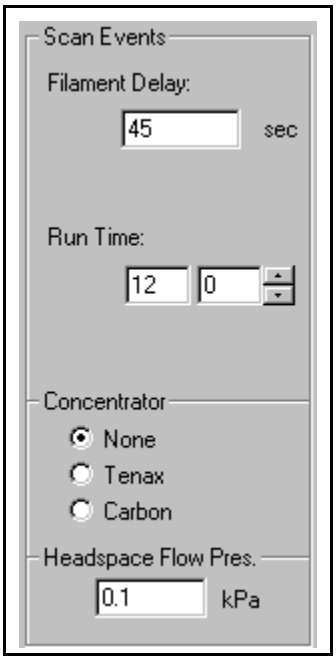
11.5.4 Scan Events

WARNING

Only trained users should modify methods. Changing parameters may result in incorrect analysis.

The following describes the Scan Events of the Method (Figure 11-20).

Figure 11-20 Scan Events



The **Filament Delay** is a delay, after the start of analysis, which must pass before the filament is turned on. This delay should be set as a protection for the filament; a large enough delay should be set to allow the components of the air peak or solvents to pass through the Mass Spectrometer before turning the filament on.

HINT: In some applications, if the Mass Spectrometer starts collection of data too soon, then the high pressure burst caused by a solvent peak may shut it down and stop the analysis.

The **Run Time** is calculated based on the Inlet Events and GC Temperature Profiles and is the cumulative time of the Method at the point of sample injection onto the GC column.

WARNING

Only trained users should modify methods. If the incorrect Concentrator is selected when creating a method the detection limit may not provide the correct concentration of the media.

11.5.5 Concentrator Selection

There are three selections available for the **Concentrator**:

None . . . . . Select this when no Concentrator will be used with this Method.

Carbon. . . . . Select this when a Tri-Bed Concentrator will be used with this Method.

Tenax . . . . . Select this when a Tenax Concentrator will be used with this Method.

11.5.6 Headspace Flow Parameter

WARNING

Only trained users should modify methods. Incorrect flow rates may lead to improper analysis.

Headspace Flow Pressure controls the flow rate of Nitrogen through the HSS during the Sample and Purge states. This parameter is only available when the HSS is used.

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11.5.7 SituProbe Flow Parameter

WARNING

Only trained users should modify methods. Incorrect flow rates may lead to improper analysis.

SituProbe Flow Pressure controls the flow rate of Nitrogen through the SituProbe during the Sample and Purge states. This parameter is only available when the SituProbe is used.

11.6 Tune Page

The **Tune** Page is divided into two pages, Report and Param, that each provide information about the Tune file.

11.6.1 Param Page

The **Param** Page (see Figure 11-21) provides the filename of the Tune file on the HAPSITE, which provides the MS tune parameters used with the method. These parameters are updated after every successful tune. The default filename is **`default.tun`**. If a different Tune file exists on the HAPSITE then the **Browse** button can be used to locate and specify the desired tune for the Method. The **`default.tun`** file always contains the most recent Tune parameters.

This page also has a **Show Details** checkbox (Figure 11-22), which will produce a grid of Tune parameters contained in the file and produced by the Tune Report. These parameters cannot be edited.

11.6.2 Report Page

The **Report** Page (Figure 11-23) provides a printable report saved after the most recent execution of AutoTune.

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Figure 11-21 Method Editor Tune Parameter Page

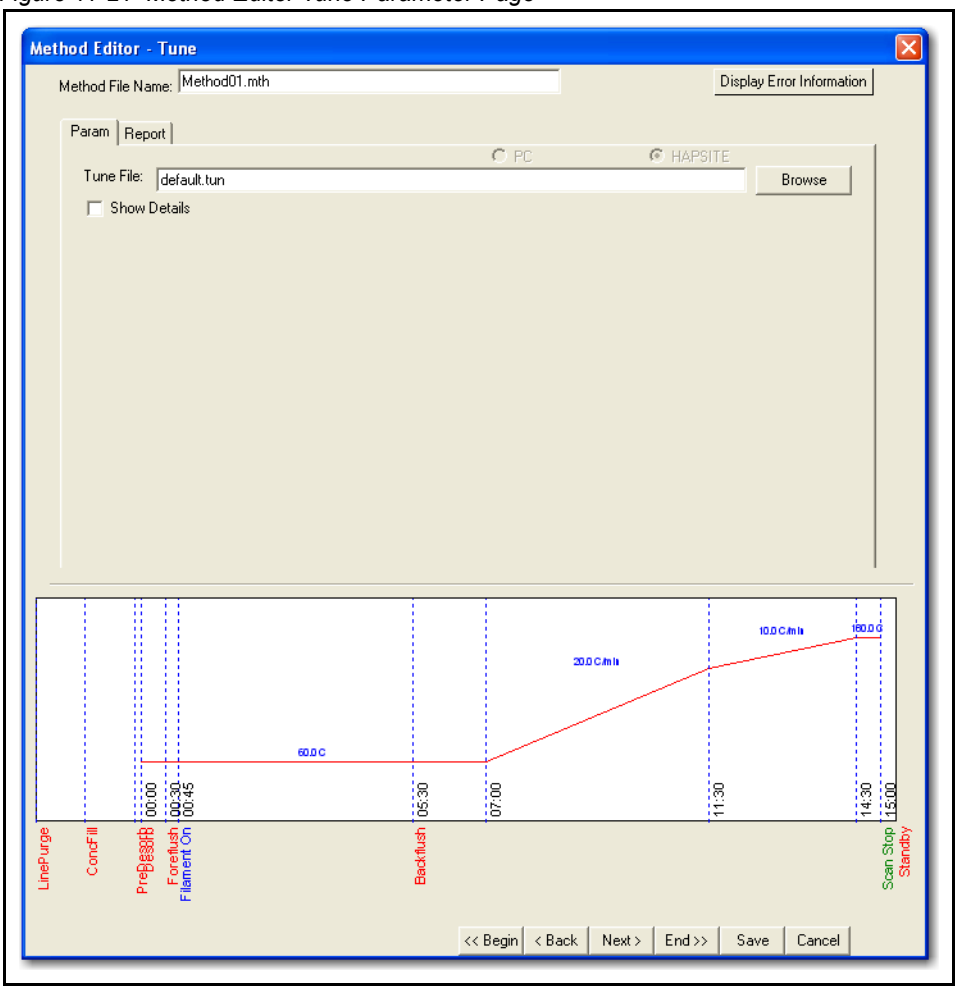


Figure 11-22 Method Editor Tune Parameter Page - Show Details

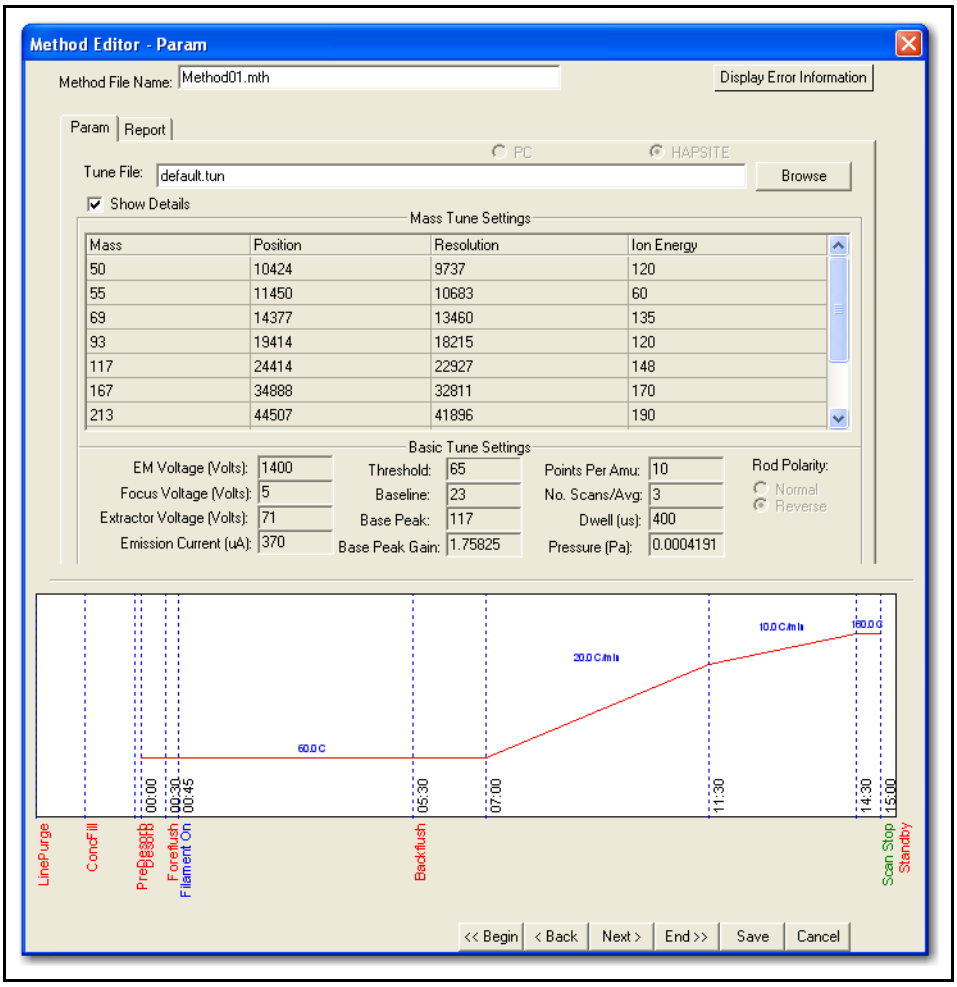
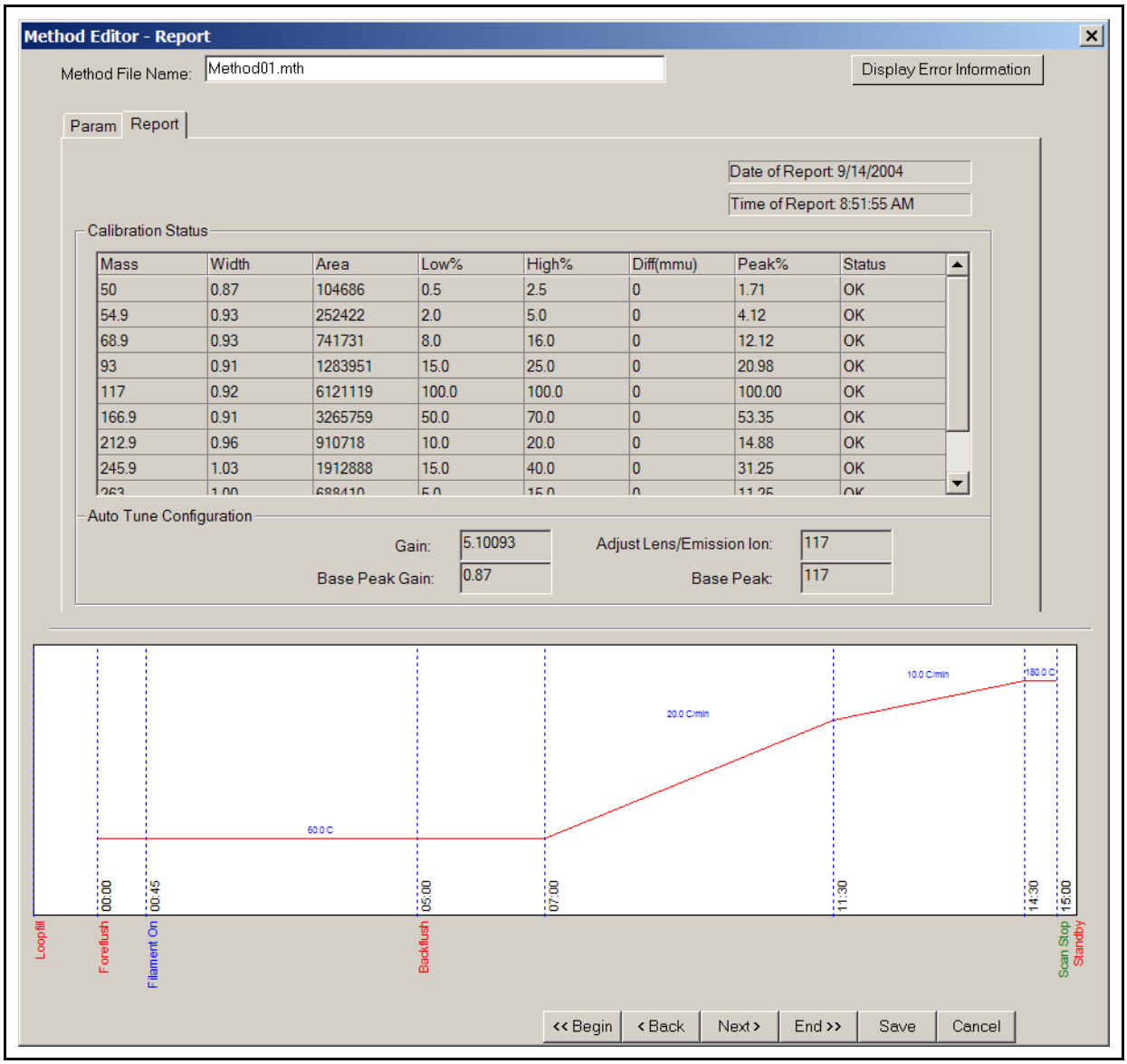


Figure 11-23 Method Editor Tune Report Page



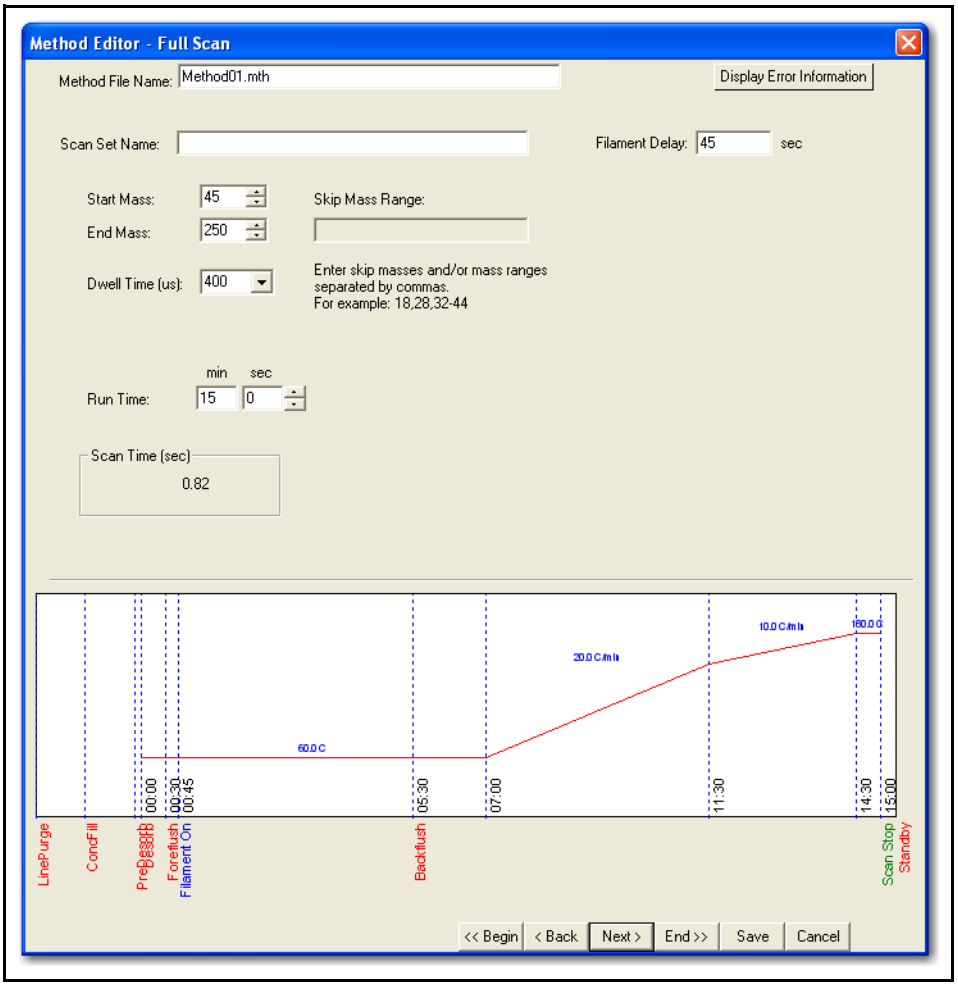
11.7 Full Scan Page

WARNING

Only trained users should modify methods. Changing parameters may result in incorrect analysis.

The **Full Scan** page contains the mass range and other parameters of the Mass Spectrometer operation (see Figure 11-24). The full parameter set can be assigned a **Scan Set Name** for easy identification, if desired. The **Filament Delay**, from the **Inlet Page** (see section 11.5.4, Scan Events, on page 11-23), is also shown on the **Full Scan** page. Changing the **Filament Delay** on this page may require a review of, and changes to, the **Inlet Page**.

Figure 11-24 Method Editor Full Scan Page



The following Mass Spectrometer parameters can be programmed:

Start Mass . . . . . The mass at which the Mass Spectrometer will start to scan. The starting mass can be set from 1-300 AMU.

NOTE: Start as high as possible to decrease the scan time and collect as many scans as possible.

NOTE: If possible, avoid starting below 45 AMU. There is a significant response to components of air at mass 44 and below. This would add to the instrument background and make it more difficult to detect low concentrations of other compounds in the TIC.

End Mass . . . . . The mass at which the Mass Spectrometer will end a scan. The end mass can be set from 1-300 AMU.

NOTE: End the scan at least 2 AMU above any mass used for compound identification. End as low as possible to decrease the scan time to collect as many scans as possible.

Dwell Time. . . . . The Dwell Time is the length of time the Mass Spectrometer will sample data at each sampling point. The longer the Dwell Time, the better the signal to noise ratio of the Analyte.

Run Time. . . . . The time span of the method from start to finish.

11.8 SIM Page

WARNING

Only trained users should modify methods. Changing parameters may result in incorrect analysis.

Figure 11-25 shows the **SIM** page, which is presented with different content depending on the mode of analysis — Analyze (GC/MS) or Survey (Figure 11-26). **Selected Ion Monitoring** (**SIM**) uses a set or sets of specific masses to scan with the highest sensitivity for known compounds.

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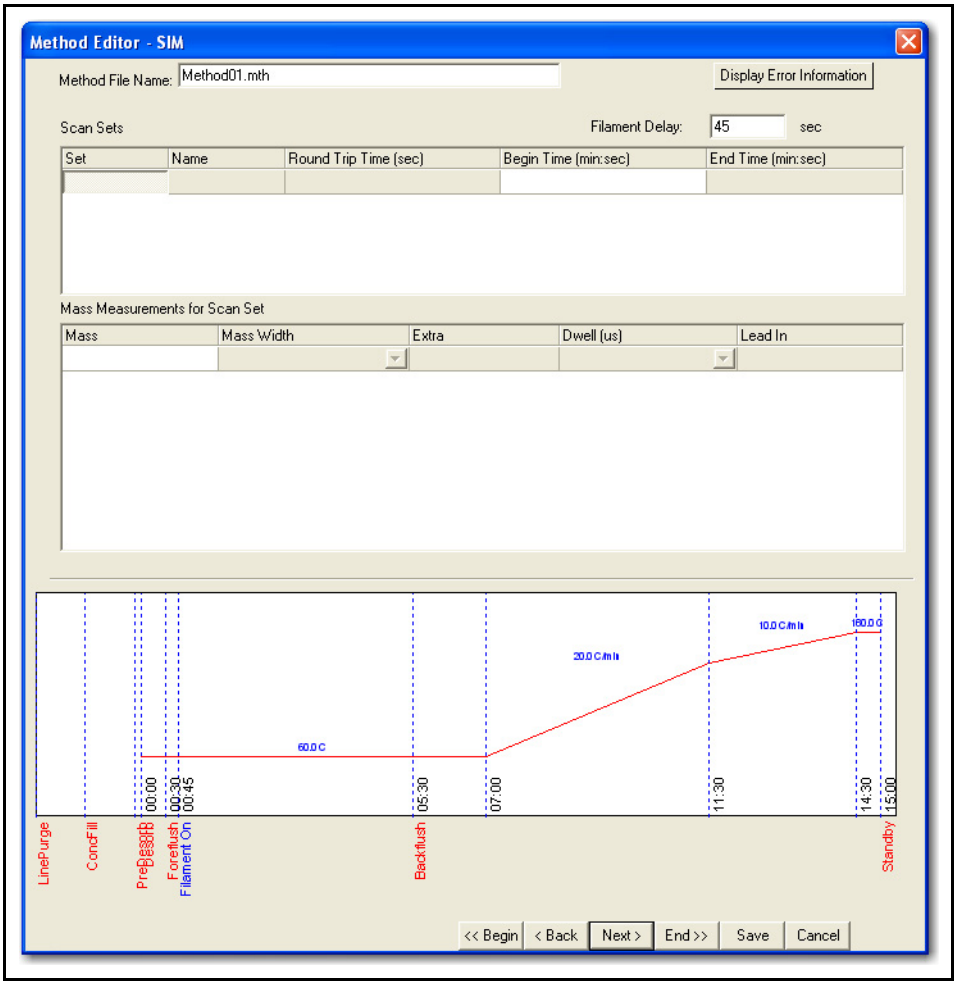
11.8.1 SIM for Analyze (GC/MS)

Figure 11-25 Method Editor SIM Page for Analyze (GC/MS) Analysis



SIM for the Analyze (GC/MS) mode allows for creation of multiple sets of masses. Each set has a **Begin Time** and an **End Time** which must be entered when programming the **Set**. After the **Begin** and **End Times** are entered, as well as an optional **Name**, the **Mass** list for the **Set** can be entered. Default settings for each **Mass** are automatically entered based on the previous **Mass**. As the **Mass** list is entered, the **Round Trip Time** is automatically calculated and entered in the **Scan Sets** grid.

The Scan Sets fields are as follows, in the order recommended for editing:

Begin Time . . . . . In minutes: seconds, the time at which collection of the listed masses should start.

End Time . . . . . In minutes: seconds, the time at which collection of the listed masses should stop.

Name . . . . . Each Scan set can be assigned a name for identification purposes. This entry is optional.

NOTE: One of the column entries listed above must be highlighted to enable editing of the **Mass** list for that specific **Scan Set**.

Mass . . . . . The masses for each set are entered here in a list. The title above the Mass column - "*Mass Measurements for Scan Set x*" - indicates which Scan Set is being edited.

Mass Width . . . . . This defines the number of points, the mass spectrometer will scan, around the selected mass in tenths of an AMU. For example, a **Mass Width** of 0.6 will scan 0.3 on each side of the peak centroid.

Extra . . . . . This sets the number of extra scans, from 0 - 10, for each mass. Extra scans lower the detection limits by increasing the intensity within the Mass Spectrometer. Extra scans should be used when scanning for ppb level compounds. Do not set this for Internal Standards because this will lower the intensity from the other masses, causing loss of possible target masses.

Dwell . . . . . This is the amount of time the mass spectrometer will sample data at each sampling point. The dwell can be set from 100 µs - 5,000 µs. 400 µs is recommended. Increasing the **Dwell** decreases the detection limit.

Lead In. . . . . This determines the number of points the mass spectrometer will skip prior to scanning the desired mass peak. Best practice is to set the **Lead In** to at least a 1000 µs delay prior to collecting data. The delay is based on **Lead In** multiplied by the **Dwell**.

NOTE: The **Mass Width**, **Extra**, **Dwell** and **Lead In** values for each newly entered Mass are inherited from the value in the row above the new entry.

NOTE: To automatically fill any column, click in the desired cell and press Ctrl+D. This automatically fills "down", with that cell's value, to the end of the column.

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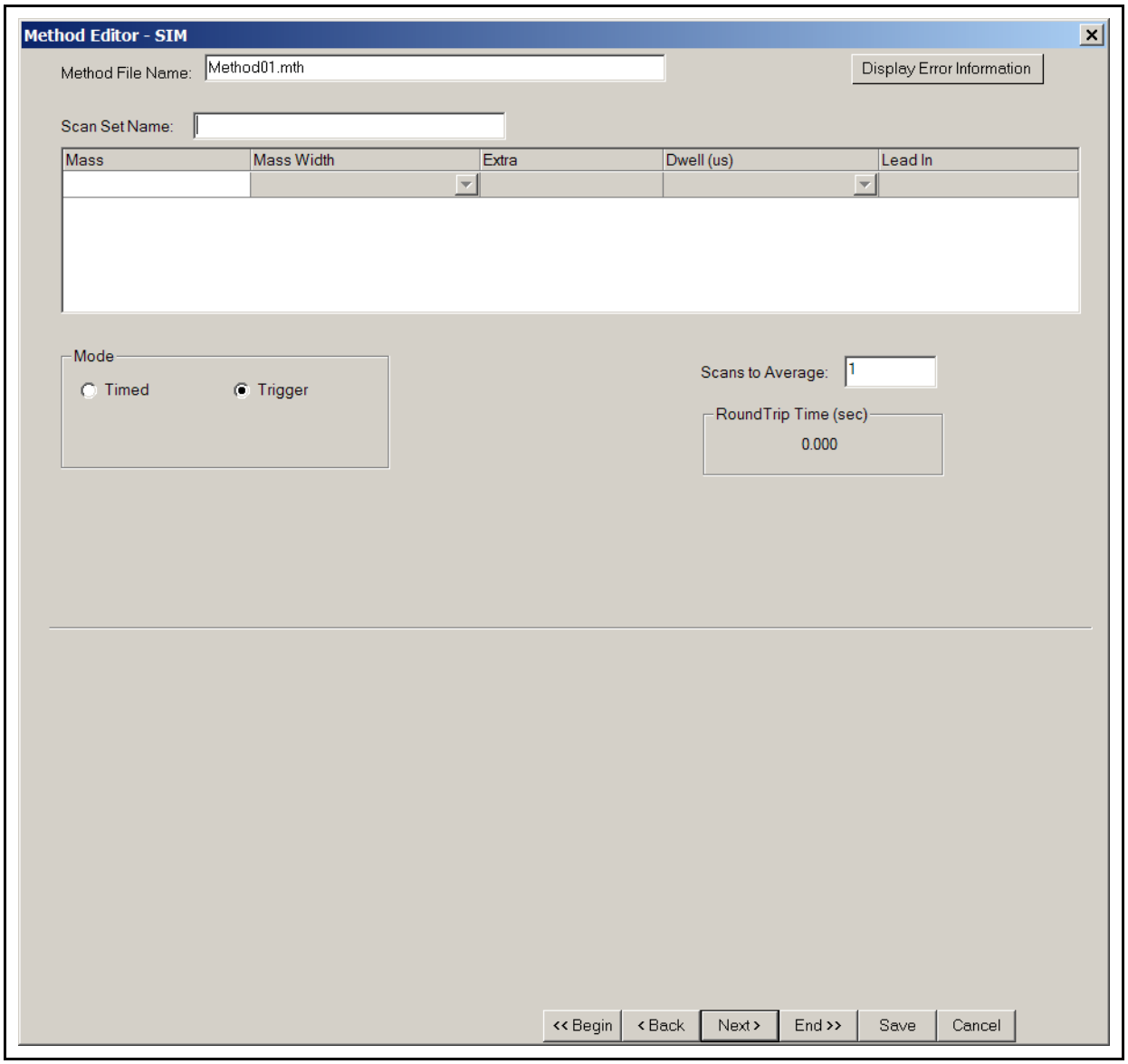
11.8.2 SIM for Survey

Figure 11-26 SIM Page, Differences for Survey Analysis



The SIM page for Survey mode provides the ability to create only one Scan Set of multiple masses. Refer to Figure 11-26.

Scan Set Name . . . . . A name should be created here to reference the specific set of ions being detected.

Timed Mode . . . . . When selected, allows the time of the survey method to be set to a determined length. This method will run for a programmed amount of time.

Trigger Mode. . . . . When selected, programs this method to start or stop based on the **Run** button. When the **RUN** button is pressed the sample pump will turn on, signaling the beginning of the run. Pressing **RUN** again will turn off the sample pump and end the sample run.

Scans to Average . . . . . This determines how many scans will be collected and averaged before the results are updated on the chromatogram.

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11.9 Search Page

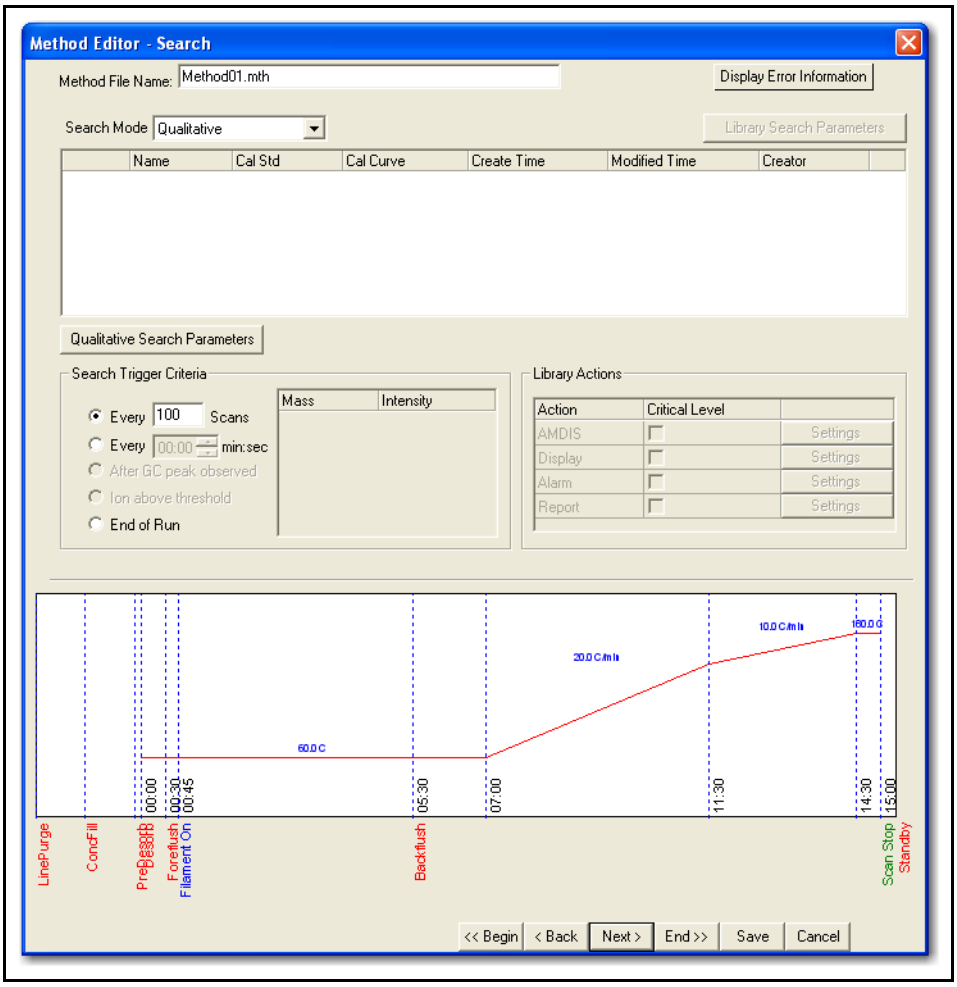
WARNING

Only trained users should modify methods. Depending on the search mode selected, results may not be real-time.

The **Search Page** provides all the criteria needed to qualify and quantify data. Calibrated libraries will need to be created in order to quantify results. The setting of parameters on this page mostly govern the actions that take place during front panel operation of the HAPSITE. See Figure 11-27.

NOTE: SIM Method only allows **No Search** as the search option.

Figure 11-27 Method Editor Search Page



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There are four choices in the **Search Mode** drop down menu.

No Search . . . . . If this option is highlighted no library search will be conducted and no report will be displayed on the front panel at the end of a run.

Qualitative . . . . . This will allow the AMDIS library to be searched during the run, providing real-time identifications. A report will be generated at the end of the run, to be viewed on the front panel display.

Quantitative . . . . . This will allow for a quantitative report to be generated at the end of a run, referencing the library designated by the Library Search Parameters.

Qualitative / Quantitative . . . . . This option allows for both the AMDIS library to be searched during analysis and for the quantitation library to be searched giving results at the end of a run.

11.9.1 Setting Up a Qualitative Search

WARNING

Only trained users should modify methods. Changing parameters may result in incorrect data.

To set up a qualitative search, the drop down menu for the Search Mode must be set to **Qualitative**. This tells the method that chemical identifications are required. Once this is selected, the method must be told where to look for the identifications. This is done using the **AMDIS Search Parameters** button. See Figure 11-28.

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Figure 11-28 AMDIS Search Settings

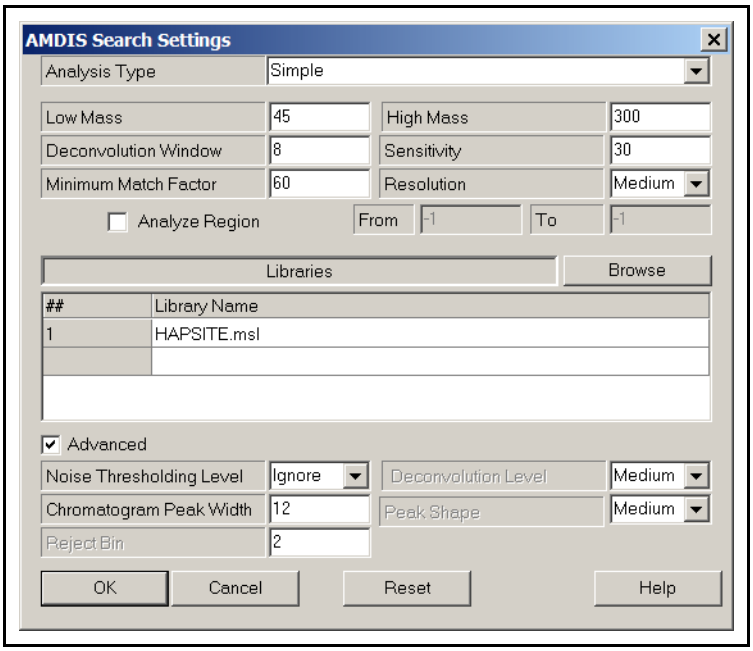
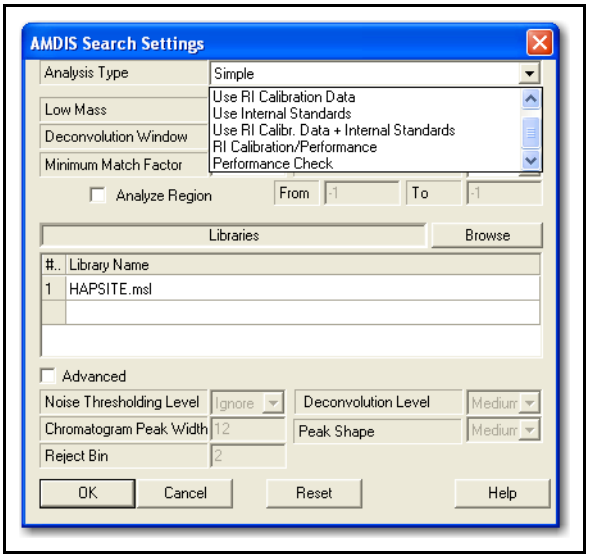


Figure 11-29 lists the different analysis types available for the search.

Figure 11-29 Type of Analysis



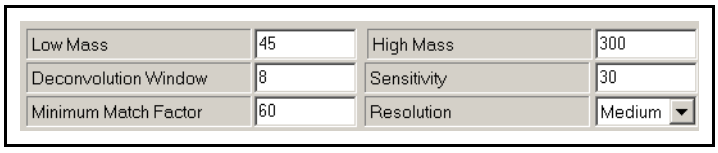
Analysis Type

- **Simple** - Uses only the mass spectral data for the individual target compounds in the library to identify the compounds. The calculated match factor depends only on the quality of the match between the deconvoluted component spectra and the target library spectra.
- **RI Calibration Data** - This type of analysis uses an external calibration file. This analysis assumes that on a periodic basis, an experiment is run to generate a correlation between retention time and retention index for a set of

retention index standards. In addition to mass spectral data, if the identified compound is not within a specified retention window, the program will penalize the match factor by a specified amount.

- **RI Calibr. Data + Internal Std.** - In this mode the retention indices are calculated from the external calibration file as in Use RI Calibration Data type of analysis. The internal standards are used only to insure that the instrument is functioning correctly or that the sample preparation has been performed correctly. The Internal Standards are not used to calculate retention indices.
- **RI Calibration/Performance** - Unlike all of the previous analysis modes, this is presumed to be run on a clean mixture of known composition. This analysis establishes the correlation between the Retention Time of a component and the retention index using the set of standards specified in the calibration library. Usually, the C-series or the normal hydrocarbons are used as retention index standards, but there is no requirement that this be the case. Retention standards that are not uniform can even be used.
- **Performance Check** - This analysis type only checks the performance for compounds identified as performance compounds in the CSL library. The analysis does not perform a calibration.

Figure 11-30 Performance Window



Low Mass . . . . . The lowest mass in the range of masses being considered. For most cases involving the HAPSITE, this value is 45.

Deconvolution Window . . . . . The number of adjacent peaks subtracted from the deconvoluted peak.

Minimum Match Factor . . . . . The threshold net match factor value for an identification to be reported. Values at or above 80 are good matches, 70-79 are fair and less than 70 is poor. For most cases, a match factor of 80 is the minimum that should be used if identification rather than detection is desired.

High Mass . . . . . The highest mass in the range being considered. The maximum value for the HAPSITE is 300.

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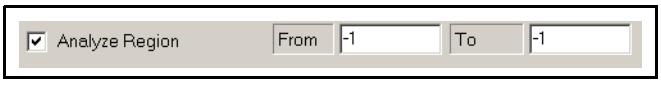
Sensitivity . . . . . 1-30, used in model peak perception ranges: 30, 15, 10, 3, 1. As the value for this parameter increases, increasingly noisy and broad peaks are sought at the expense of analysis time and increased risk of false positives. An increase in the sensitivity will extract broader peaks, resulting in an increase in the extraction of smaller and noisier peaks.

Resolution . . . . . High/Medium/Low, Default Medium: As the level of resolution goes up, the program separates peaks that are closer together.

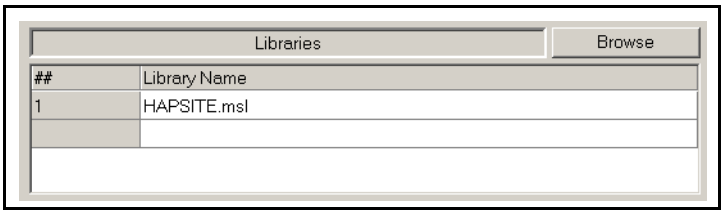
If **Analyze Region** is selected, see Figure 11-31, the AMDIS is directed to only search in the scan range selected. This is for specialized use, and does not need to be utilized for normal usage. The default of **Analyze Region** off (i.e., unchecked) will search the entire range specified by **Low Mass** and **High Mass**.

Figure 11-31 Analyze Region



When setting up the AMDIS library for qualitative analysis the HAPSITE.msl is the default library for the system. See Figure 11-32.

Figure 11-32 The Libraries

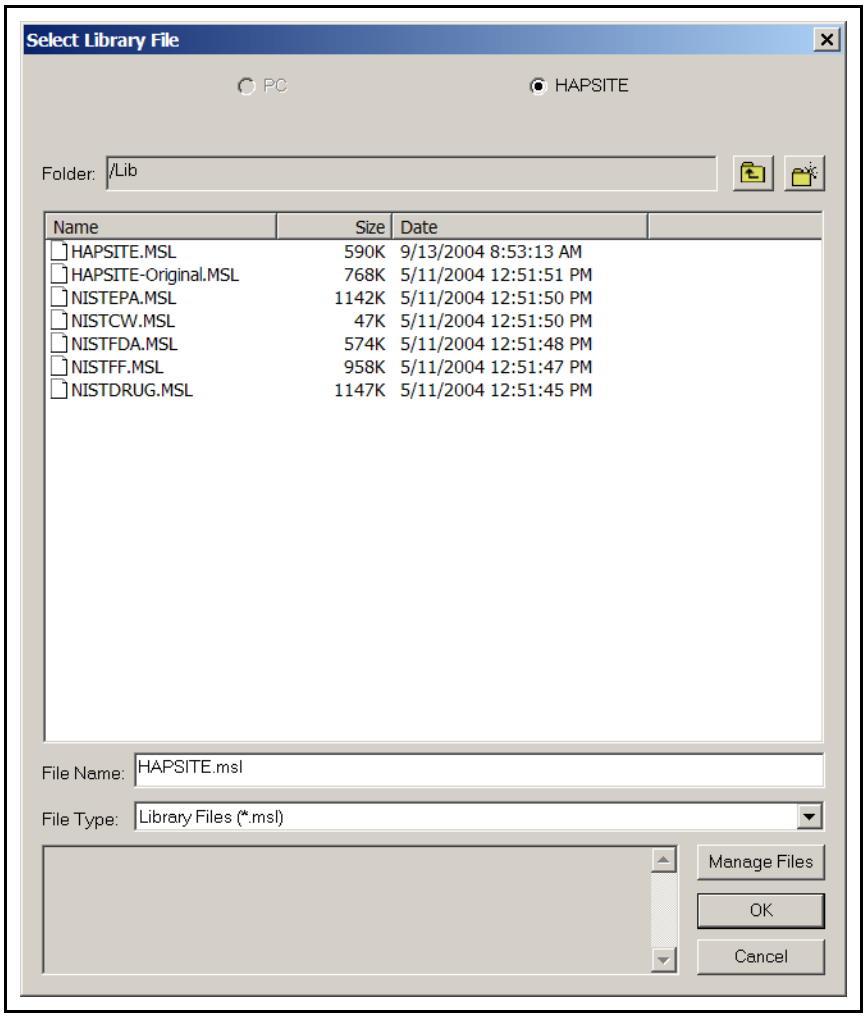


To view other library choices, select the Browse button, refer to Figure 11-32. There are several small and specific libraries in addition to the HAPSITE.MSL See Figure 11-33. Many of the compounds found in these small libraries, that can be detected by the HAPSITE, are incorporated in the HAPSITE.MSL file.

NOTE: INFICON recommends using HAPSITE.MSL.

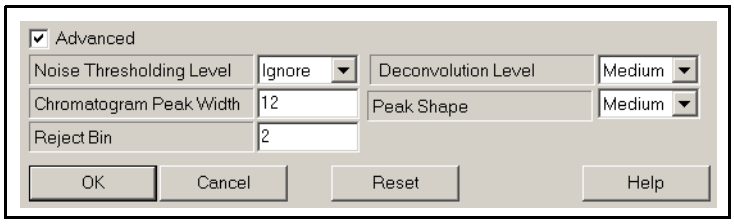
- HAPSITE.MSL
- NISTEPA.MSL
- NISTCW.MSL
- NISTFDA.MSL
- NISTFF.MSL
- NISTDRUG.MSL

Figure 11-33 Library Options



Advanced Settings

Figure 11-34 Advanced Settings



NOTE: INFICON recommends leaving the Advance Settings at their default.

Noise Thresholding Level . . . . . Refers to the minimum signal recorded. Will filter out noise along the baseline.

Chromatogram Peak Width . . . . . Forces deconvoluted peaks to have the same shape by specifying width in AMUs.

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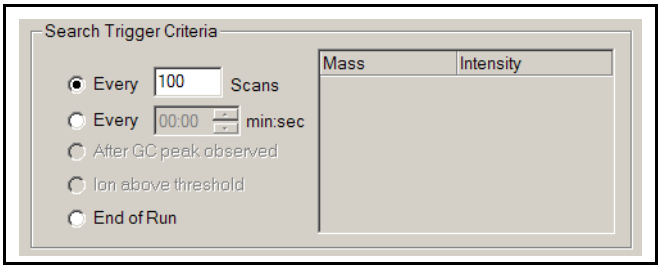
Reject Bin . . . . . Rejects peaks with less than set number of scans.

Deconvolution Level . . . . . High/Medium/Low, Default Medium: As the level of deconvoltution goes up, the program separates peaks that are closer together.

Peak Shape . . . . . The shape requirement is a way of forcing all of the deconvoluted peaks to have the same shape. As the shape requirement increases, the shape of the individual ions must be more nearly the same.

In the **Search Trigger Criteria** section of the **Search** page, the decision of how often and when to run an AMDIS search is determined. There are three choices, see Figure 11-35.

Figure 11-35 Search Trigger Criteria



Every ____ Scans . . . . . The value typed into the box determines the interval at which AMDIS will run a search. The default value for this is 100 scans.

Every ____ min:sec . . . . . The value typed into the box determines the time interval in which AMDIS will run a search.

End of Run . . . . . If this is selected, an AMDIS search will only be conducted at the end of a run.

11.9.2 Setting Up a Quantitative Search

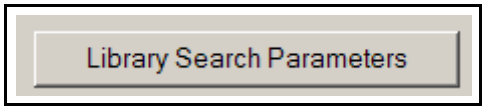
WARNING

Only trained users should modify methods. Changing parameters may result in incorrect data.

When setting up a quantitative method, a quantitative library needs to be created using the Calibration function of the software. See Chapter 12, Target Compound Methods.

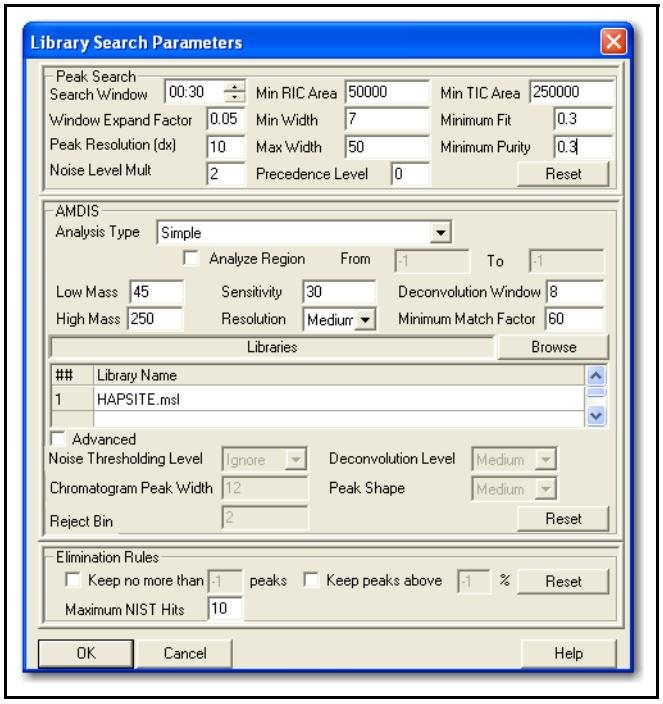
Writing a quantitative method still begins with Method Editor, but certain buttons will not be available until the library is created. All the settings described in section 11.9.1, Setting Up a Qualitative Search, on page 11-36 still apply to the creation of a quantitative method. In addition two more options become active, The Library Search Parameters button and the Library Actions window, see Figure 11-36.

Figure 11-36 Library Search Parameters Button



Clicking the Library Search Parameters button opens the window shown in Figure 11-37. The center section refers to the AMDIS parameters and is exactly the same as described in Figure 11-28 on page 11-37.

Figure 11-37 Library Search Parameters Window



The Peak Search section is comprised of all the elements that define a peak in the chromatogram.

Search Window . . . . . This value indicates the time window allowed for a peak to appear. 30 seconds indicates that the acceptable window for a peak is 15 seconds on either side of the expected retention time.

Window Expand Factor . . . . . This value has a default of 0.05. This value is multiplied by the run time and then added to the search window time. The search window is then expanded by the time calculated.

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Peak Resolution (dx) . . . . . This number indicates the minimum number of scans between two peaks which is used to determine whether to split a peak into two or consider it as one peak.

Noise Level Mult . . . . . A peak intensity must be greater than this number multiplied by the baseline noise in order to be called an analyte.

Min. Area . . . . . This number discriminates against low responses which are usually attributed to noise rather than detection of the analyte. Increase this number to 10,000 or more if false hits are encountered.

Min. Width . . . . . This number specifies the minimum number of scans to comprise a peak. This is another discrimination against low responses or noise.

Max Width . . . . . This number specifies the maximum number of scans to comprise a peak. This allows discrimination against a very broad peak.

Precedence Level . . . . . When compared to the compound-specific precedence level, it determines which search parameters to use — the global parameters specified in Figure 11-37 or the compound-specific parameters. As a general rule, leaving this set to 0 allows one to use specific search parameters for individual compounds as discussed in Chapter 12.

Min. Fit . . . . . This compares the expected mass intensities relative to each other to those saved in the library. Reasonable values depend on how selective the calibration, but typically 0.5 to 0.9 is used. This value is a way of lowering false positives, where a higher number is more discriminative.

Min. Purity . . . . . This measures the purity level of the peak detected compared to the mass peak in the library. Reasonable values depend on how selective the calibration, but typically 0.5 to 0.9 is used. This value is a way of lowering false positives, where a higher number is more discriminative.

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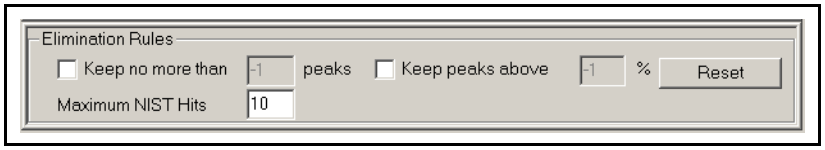
The **Reset** button allows for default values to be reset in the Peak Search window. See Figure 11-38.

Figure 11-38 Resetting Default Search Parameters

The **Elimination Rules** section gives parameters for peaks to be reported. There are three options. See Figure 11-39.

Figure 11-39 Elimination Rules Window



Keep no more than . . . . . This check box determines how many peaks are to be shown. This refers to the Mass Spectrum. If 10 is selected, only the top ten peaks will be displayed.

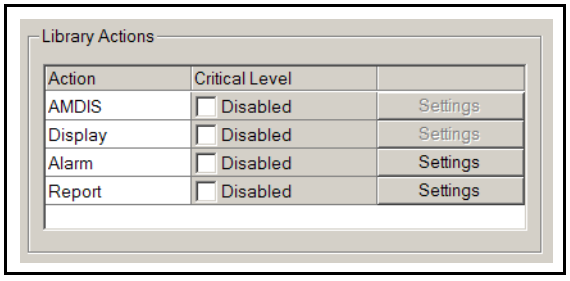
Keep peaks above . . . . . This check box defines the percent intensity of a mass peak to be displayed on the Mass Spectrum. Fifteen is generally used as the low end for intensity.

Maximum NIST Hits . . . . . This value is the number of matches reported by NIST.

NOTE: This section also has a **Reset** button, which will set any changed values back to the default setting.

The **Library Action** box has four main sections. Each can be enabled using a check box. See Figure 11-40.

Figure 11-40 Library Actions



AMDIS . . . . . When enabled, a concentration can be entered. This will determine the critical level of concentration at which AMDIS will identify the chemical on the front panel display of the HAPSITE.

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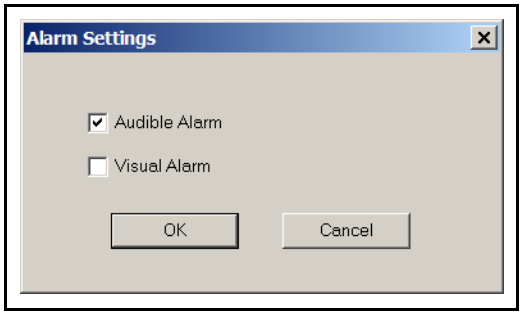
Display . . . . . When enabled, a concentration can be entered which will determine the critical concentration level at which a peak will be displayed.

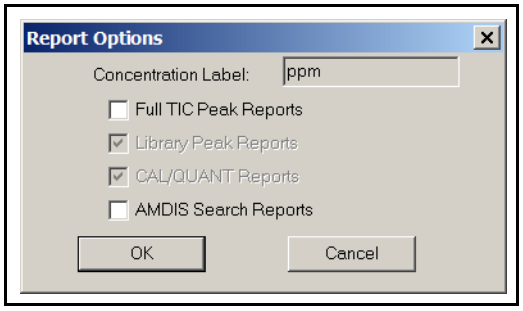
Alarm . . . . . When enabled, a concentration can be entered which will trigger an alarm. The alarm can be set to be either visual or audible by using the **Settings** button. See Figure 11-41.

Figure 11-41 Setting the Alarm



Report . . . . . When enabled, a concentration can be entered which will create a report when the critical concentration level is reached. See Figure 11-42.

Figure 11-42 Setting the Report

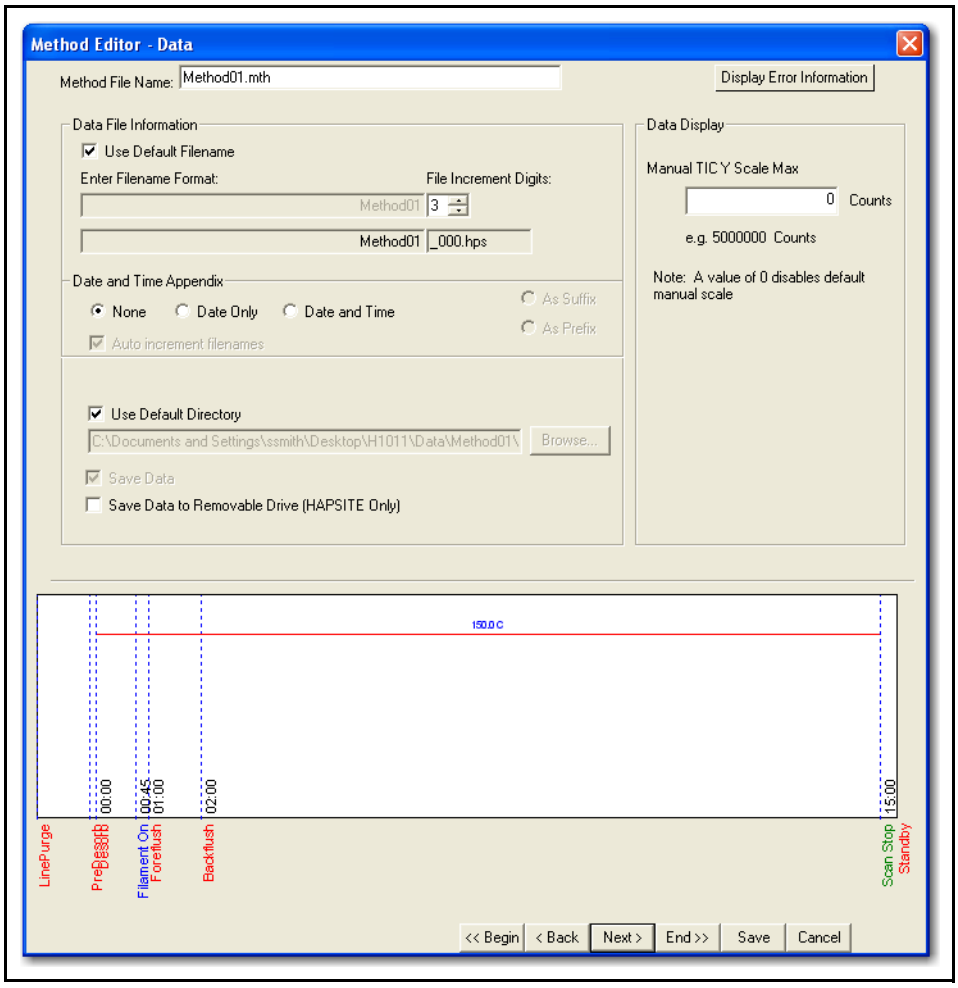


There are two choices for reports, the **Full TIC Peak Report** and the **AMDIS Search Report**.

11.10 Data Page

The **Data Page** provides the capability to customize the data filenames, and storage of data files, for the Method. Defaults are provided that assure automatic storage of data in a filename format that increments with each data file stored.

Figure 11-43 Method Editor Data Page



The following parameters can be set on the **Data Page**:

Use default filename . . . . . This check box, which is selected as a default, allows the Method to use a default format for the data filename. The default filename is a combination of the Method filename and an index, which is automatically incremented with each saved data file.

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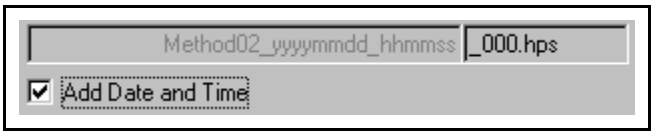
File increment digits. . . . . This parameter sets the number of digits used in the index, starting at 000 and incrementing up to the maximum number provided by the index digits (in this case, 999). By default, the index is three digits, but can be specifically changed here for this method or for the entire system on the **System Properties >> Miscellaneous** page.

Add Date and Time. . . . . This parameter adds the date and time, in the format yyyymmdd_hhmmss to the filename (see Figure 11-44). This can be added as a suffix, which uses an underscore before the "yyyy" information, or as a prefix, which uses an underscore after the "ss" information. The format of the date and time is:

- yyyy is the year the data was collected
- mm is the month the data was collected
- dd is the day the data was collected
- hh is the hour data collection was started
- mm is the minute data collection was started
- ss is the second data collection was started.

Figure 11-44 Example of Date and Time Appended to the Filename



Add as Suffix . . . . . When selected, along with **Add Date and Time**, the date and time are added to the end of the filename. It is preceded by an underscore.

Use default directory . . . . . This selection sets the Method to store all data, collected with this Method, in the default directory specified in the **Data File Path**. When this selection is unchecked, any valid path can be entered in the **Data File Path** to specify data storage.

Data File Path . . . . . The entry box for the data file path is used to specify where this method should save the data. This entry box is automatically filled with the default path, derived from the **HAPSITE Properties >> Data Settings** page, if the **Use default directory** box is checked.

Save Data to Removable Drive . . . This selection is always enabled and cannot be changed. Data is saved to the hard drive in the folder (directory) shown immediately above this check box.

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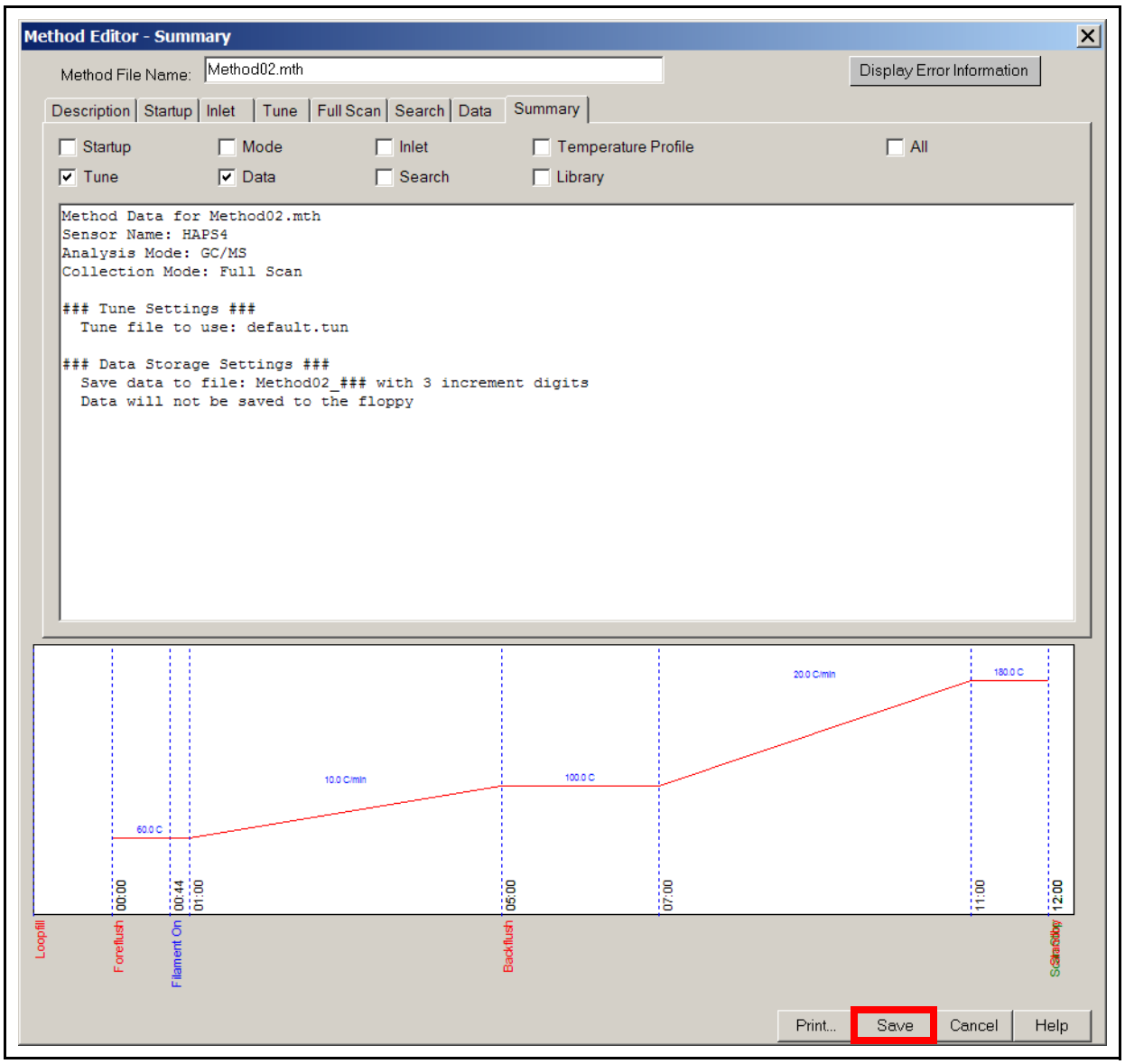
11.11 Summary Page

The **Summary Page**, see Figure 11-45, provides selections to show any component, or all components, of the Method in a text summary. These selections effect both the displayed and printed information. This page allows for a review of the Method settings before saving the Method to a file.

Figure 11-45 Method Editor Summary Page



11.12 How to Create a Method

WARNING

Only trained users should create methods. Selecting a parameter that is incorrect may provide an inaccurate analysis of the media being sampled.

CAUTION

Read all of Chapter 11 before creating a method.

HINT: For questions relating to specific settings, refer to the previous sections of this chapter.

Creating a method is a very involved process. Creating a method from scratch is best left to experts; however, custom methods can be written by modifying a default method.

11.12.1 Creating a New Custom Method from an Existing Method

1. On the System Setup View, double-click on the **Method Editor** icon. See Figure 11-46.

   Figure 11-46 Method Editor Icon

2. Choose the HAPSITE to which the method will be applied and click **Open**. See Figure 11-47.

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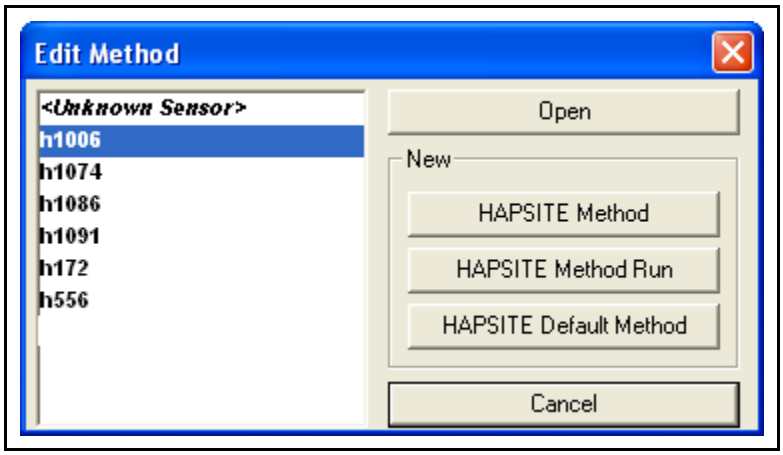
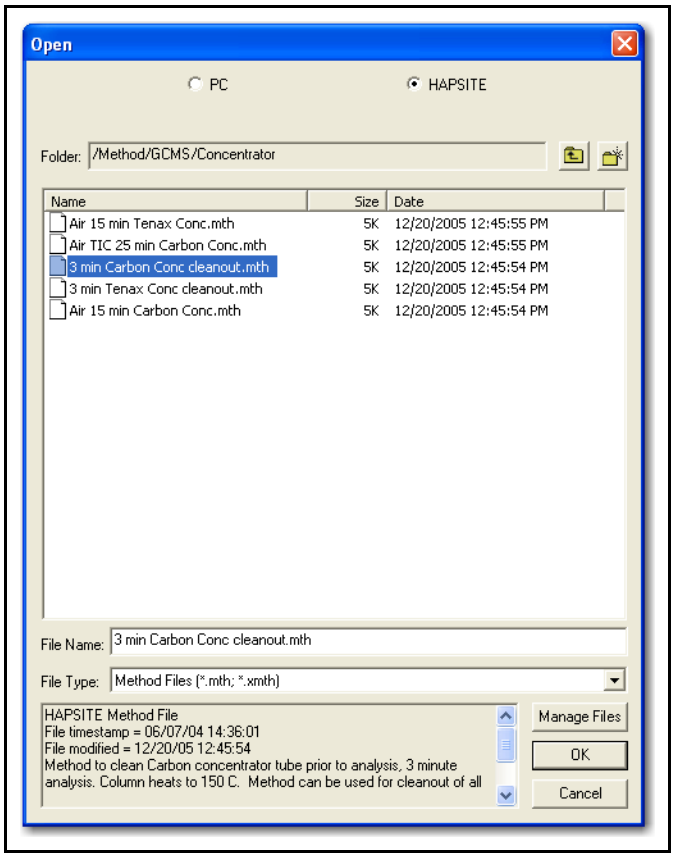
Figure 11-47 Method Editor Open Window



3 Choose the method file to be the template for the new method. Click **OK**. See Figure 11-48.

Figure 11-48 Choose Method

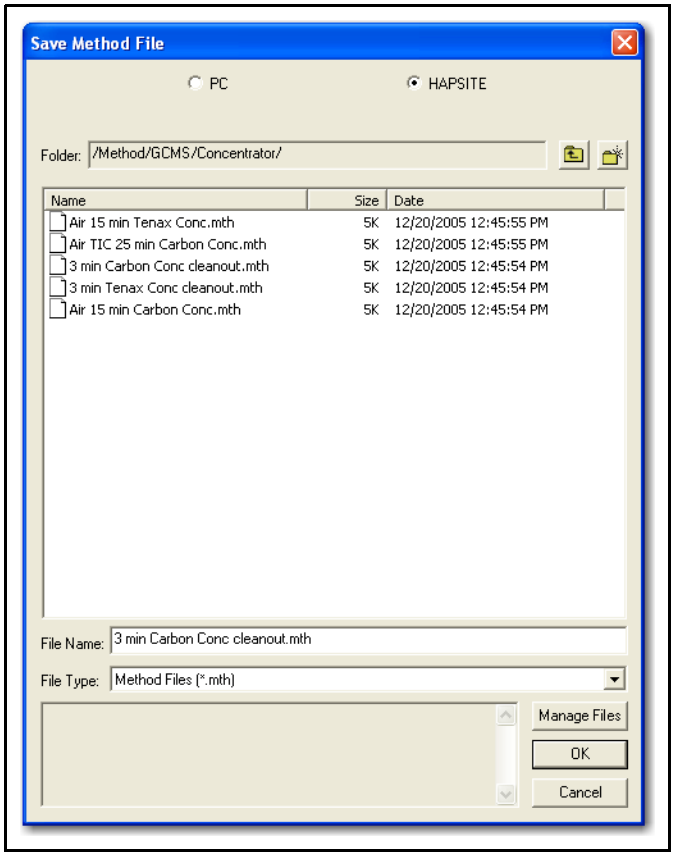


4 Refer to section 11.3, Description Page, on page 11-5 through section 11.10, Data Page, on page 11-46 for details on changing options.

5 To save a newly created method from the Method Editor, press the **Save** button at the bottom right of the Method Editor Summary Page (see Figure 11-45). The dialog window shown in Figure 11-49 is displayed. Notice that the default location to save a method file is to the HAPSITE.

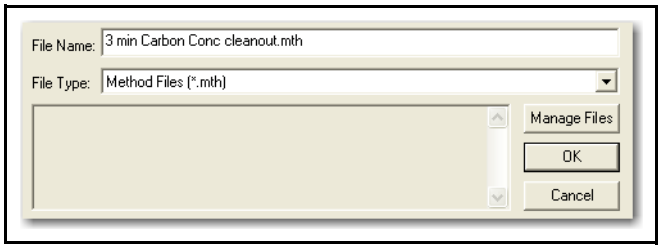
NOTE: Method files can be saved to the HAPSITE only if the HAPSITE is attached to the Laptop. Refer to section 2.4.6, Connect Laptop (if desired), on page 2-10 for additional information on how to connect the Laptop and HAPSITE.

Figure 11-49 Save Method File Dialog Window - HAPSITE Option Selected



6 On the **File Name** line, type a **NEW** file name. Refer to Figure 11-50.

Figure 11-50 Entering a New Method File Name



7 The file location may be changed to save in the **GCMS (Analyze)** or **Survey** directory, or a new one may be created using the **Create Folder** button, as shown in Figure 11-51.

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Figure 11-51 Create Folder Button

7a If creating a new folder, name the new folder and then open the new folder before saving the Method file.

CAUTION

Saving the new method file with the original name will overwrite (replace) the method that was used as the template.

8 Once the location and name have been chosen, press **OK** to save the file. Refer to Figure 11-49 or Figure 11-50.

11.13 How to Sequence Methods

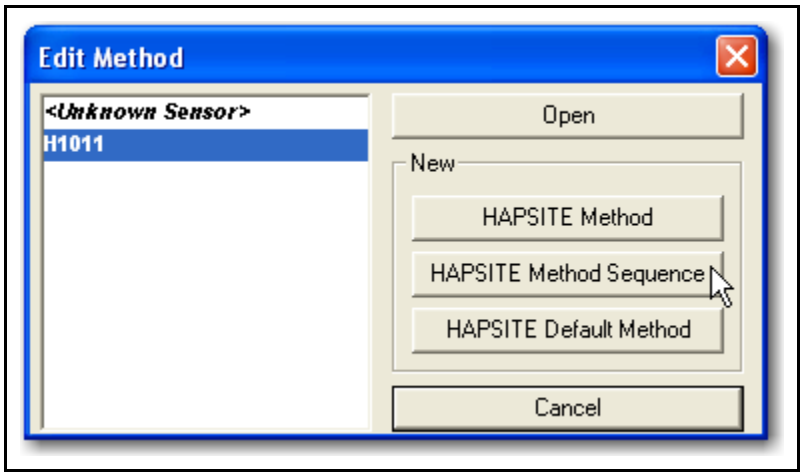
Sequencing methods is very useful when a group of methods needs to be run unattended, repeatedly, or at timed intervals.

1 From the Plus IQ system setup screen, double-click the **Method Editor** Icon. See Figure 11-52.

Figure 11-52 Method Editor Icon

2 Select **HAPSITE Method Sequence**. See Figure 11-53.

Figure 11-53 Method Editor Open Window



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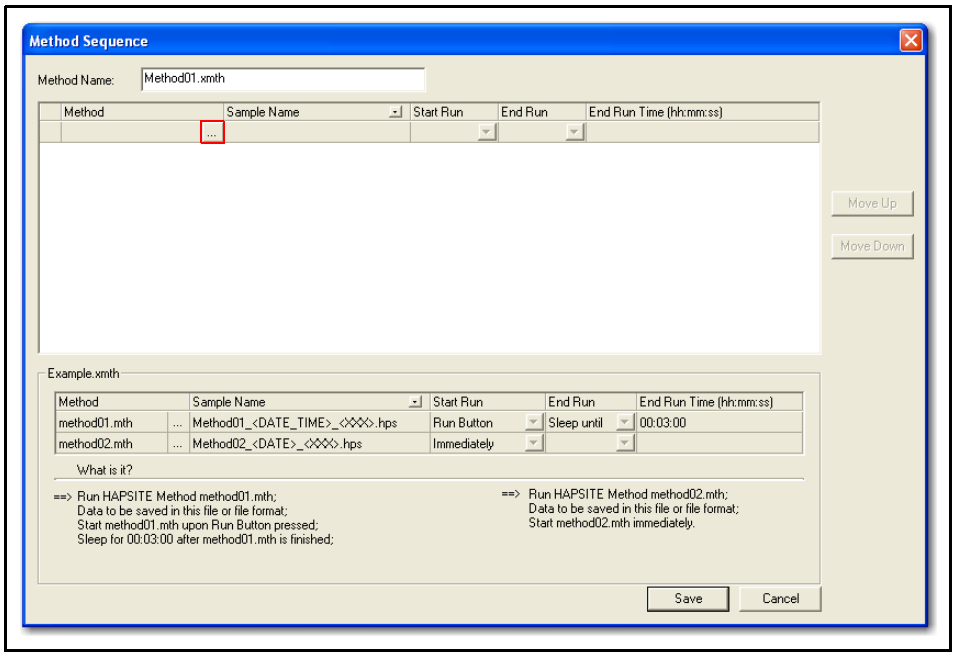
3 Type a new name for the sequenced method or use the name provided. See Figure 11-54.

NOTE: Method runs (i.e., sequence of methods) use the **`.xmth`** file extension.

4 Click the **...** button. See Figure 11-54.

Figure 11-54 Method Run List



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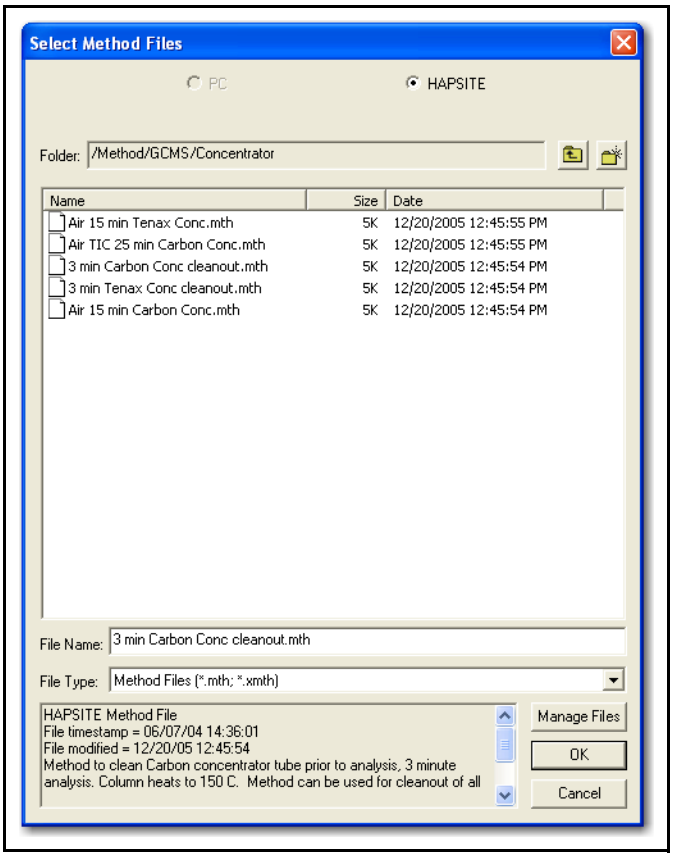
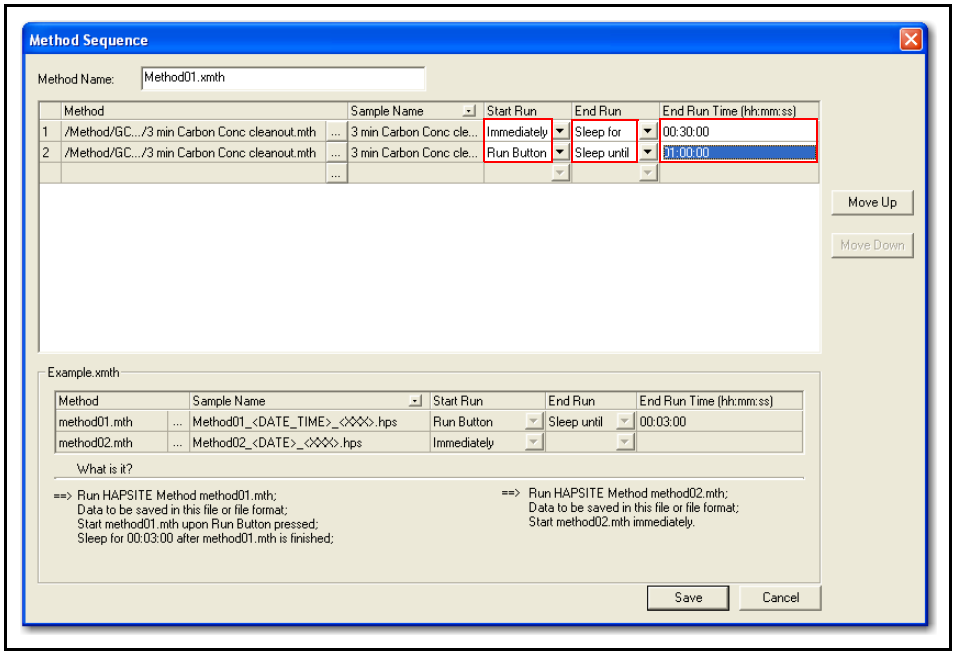
5 Choose a method file to add to the sequence. Click **OK**. See Figure 11-55.

Figure 11-55 Choose Method



6 **Repeat** Step 4 and Step 5 until all desired methods are listed in the Method Run List. See Figure 11-56.

Figure 11-56 Sequenced Method Options



7 In the Start column chose either **Run Button** or **Immediately** for each method. This selection determines how each method in the run is started. Refer to Figure 11-56.

8 In the Sleep column, choose **for** or **until** for each method. Refer to Figure 11-56.

9 In the Time column, enter the desired **Time** for the next method to start or the length of **Time** to sleep before the next method starts. Refer to Figure 11-56.

10 Click **Save**. Refer to Figure 11-56.

11 Save the sequenced method to the desired location. Click **OK**. See Figure 11-57.

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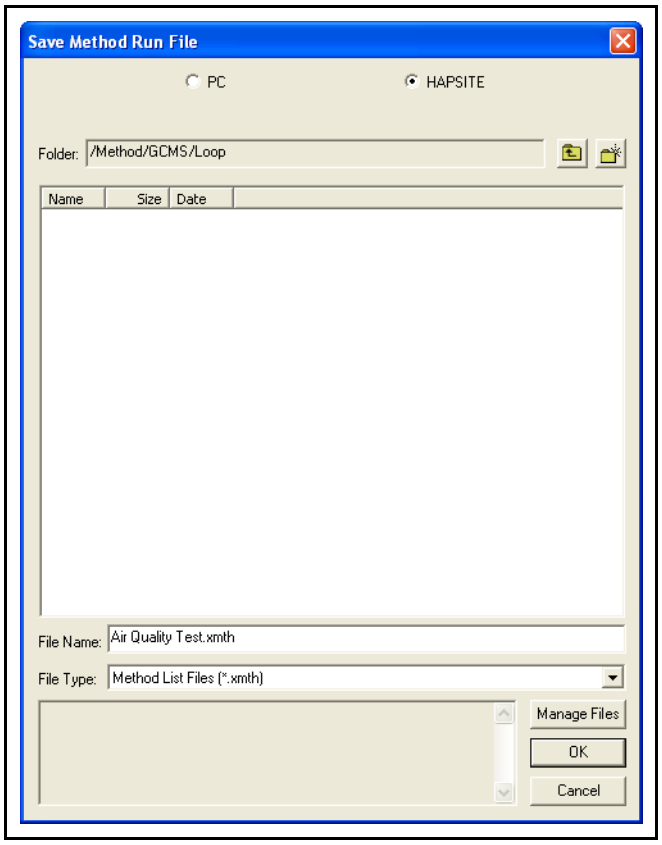
Figure 11-57 Saving Sequenced Method



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Chapter 12
Target Compound Methods

12.1 Introduction To Quantitative Analysis

Quantitative analysis is the process of building a method calibration library of target compounds, analyzing samples and converting target compound responses to concentration results. The process of building a quantitative analysis method includes the following steps:

1. Preparation of a standard or standards at multiple concentrations.

WARNING

Wear appropriate Personal Protection Equipment (PPE) as advised by the MSDS of the standard(s) being used.

2. Collecting representative data files of the compounds at one or more concentration levels.
3. Identifying the compounds and building a target compound library.
4. Calibrating the library.
5. Collecting and processing unknown samples for target compounds.

The **Calibrate** function of the HAPSITE software is used to set up or define the quantitative method. The **ID Unknowns** function is used to process and review results from a quantitative method. Quantitative results are automatically displayed on the HAPSITE front panel display after data collection.

A HAPSITE method can be developed to collect, process and quantitate data. This method must meet the chromatography performance requirements of the application, e.g., retention times, compound separations, sensitivity, etc. It will be used throughout the process of building the library and processing results. Refer to Chapter 11, Method Editor for additional information on building a method.

The library is the key component in the quantitative method. The library contains three types of information: the Retention Time (time it takes the compound to elute from the column), mass spectral data used to confirm compound identity, and the response factor that is used to calculate the concentration of the compound.

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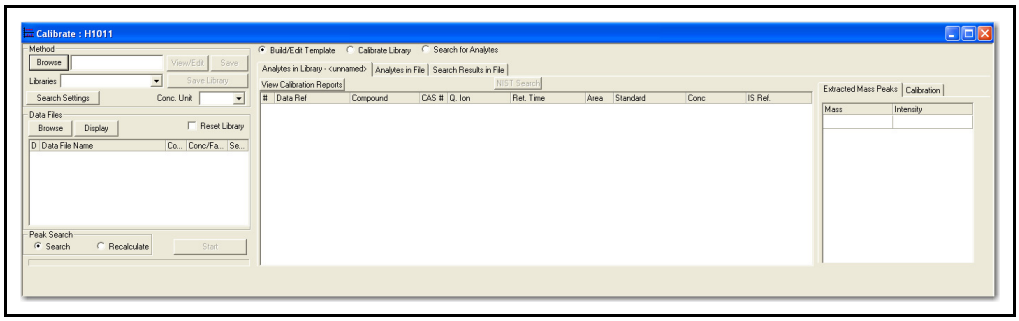
12.2 Definition of Terms in the Calibrate Window

Figure 12-1 Calibrate Window



12.2.1 Method

Browse . . . . . Brings up the Method Selection window.

View/Edit . . . . . Opens the Method Editor with the current method.

Save . . . . . Saves the current Method.

Libraries . . . . . Displays the currently saved libraries.

Save Library . . . . . Brings up the dialog box to save the library.

Search Settings . . . . . Displays the search parameter settings.

Conc. Unit . . . . . Used to input or select the concentration units.

12.2.2 Data Files

Browse . . . . . Used to select the data files for building and calibrating the library; when a data file is selected the data is listed as follows:

- **D** . . . . . Shows the data file reference number.
- **Data File Name** . . . . . Displays the data file name and path.
- **Conc Ref** . . . . . Basis for calculating the concentration. Global (all analytes are at the same concentration) or Analyte (analytes are in file at specific concentrations).
- **Conc/Factor** . . . . . Data file concentration of analytes if Global is selected, or Concentration Multiplier if Analyte is selected.
- **Selection** . . . . . If checked, file will be processed when **Start** is pressed.

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Display . . . . . Displays the chromatogram for the selected data file.

Reset Library . . . . . If checked, will reset the calibration curve, deleting all points currently contained in the library.

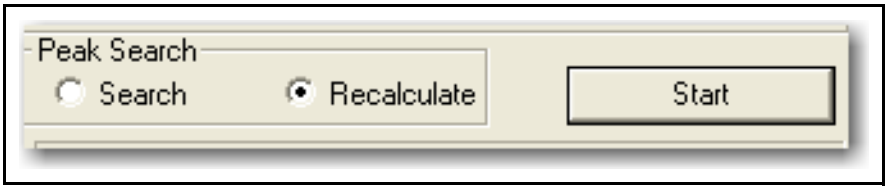
12.2.3 Peak Search

Search . . . . . Performs two functions, depending on whether **Build/Edit Template** or **Calibrate Library** is selected. When **Build/Edit** is selected, the Search performs a peak detection and integration on the selected files and loads the results into the library template. When **Calibrate** is selected, search performs the calibration of the library and calculates response factors.

Recalculate . . . . . Recalculates the peak areas and response factors without performing a peak search. This is most useful following manual editing of peak baseline points.

Start . . . . . Initiates the Search or Recalculation. See Figure 12-2.

Figure 12-2 Search for Recalculation



Build/Edit Template . . . . . Selects the mode in which a data file is searched to locate compounds, and loads/edits compounds into the library template.

Calibrate Library . . . . . When selected, data files are processed to calibrate the library.

Search for Analytes . . . . . Enables a search to be performed on the selected data file/files without adding the detected analytes automatically to the library. This enables review of data files and the addition of all or selected compounds to the library template.

NOTE: When adding compounds to an existing library or Template, use **Search for Analytes**. If using **Build/Edit Template**, the original template is lost.

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12.2.4 Analytes

Analytes in Library . . . . . Displays the analytes in the library

Analytes in File . . . . . Displays the analytes in the currently displayed or selected file

Search Results in File . . . . . If a search has been performed with **Search for Analytes** selected, a review of the analytes detected in the file is enabled. Individual analytes can then be added to the template by Right Mouse Button clicking on the compound name and then selecting **Add To Template** or **Add All** to add all compounds detected in the file.

12.2.5 Reports

View Calibration Reports:

Calibration Response Table . . Report that displays the response factor and curve statistics based on the selected curve type.

Calibration Report . . . . . Report that displays the area fit and purity for the calibration standards.

NIST Search . . . . . The initial search when building a template/library is performed using the AMDIS library. If peaks are detected and loaded into the template without an identification, the NIST Search can be used to identify these compounds.

. . . . . Shows the analyte number in the library

Data Ref . . . . . Data Reference, shows the reference to the data file in which the analyte was found.

Compound . . . . . Shows the compound name found in AMDIS, NIST library or assigned by the user for the analyte.

CAS # . . . . . Shows the Chemical Abstracts Service Number for the analyte from the AMDIS or NIST library.

Q Ion . . . . . Shows the Quantitation Ion for the analyte.

Ret. Time . . . . . Show the Retention Time for the analyte.

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Area . . . . . Displays the integrated analyte area quant-ion.

Standard . . . . . Designates the compound as an analyte or an Internal Standard.

Conc . . . . . Shows the concentration of the analyte or Internal Standard in the displayed file.

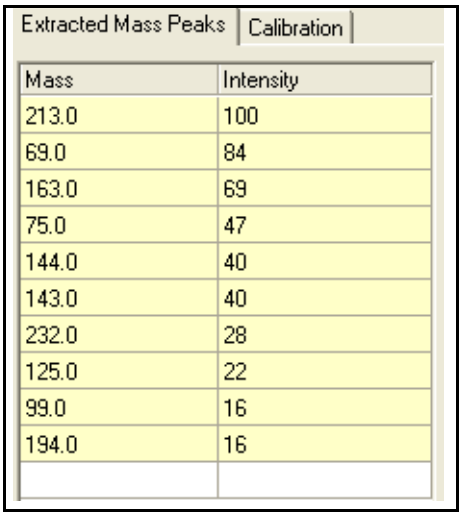
NOTE: This field is not used if the concentration flag is set to global.

IS Ref. . . . . . Displays the Internal Standard reference number for analyte quantitation.

12.2.6 Extracted Mass Peaks

Displays the mass peaks and relative percentages for the selected analyte. See Figure 12-3.

Figure 12-3 Extracted Mass Peaks

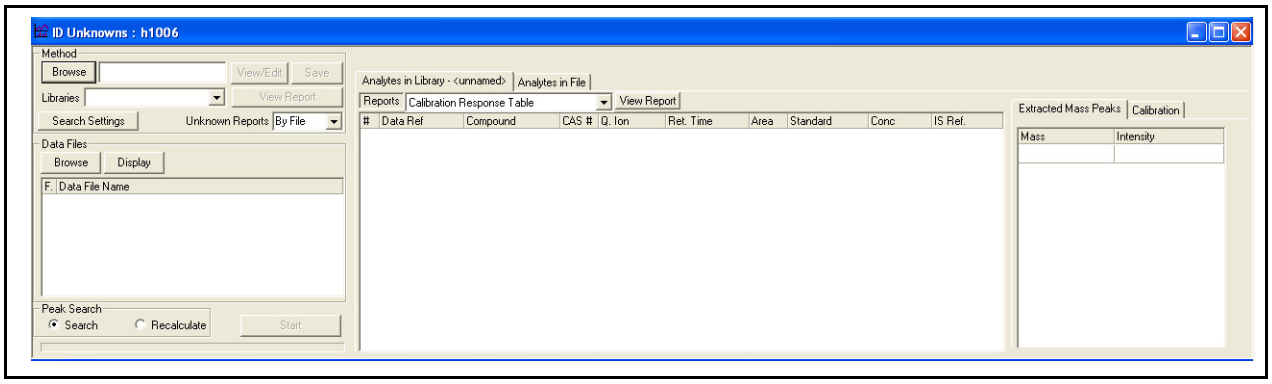


12.2.7 Calibration

Displays the calibration curve and curve statistics for the selected analyte.

12.3 Definition of Terms in the ID Unknowns Window

Figure 12-4 ID Unknowns Window



12.3.1 Method

Browse . . . . . Brings up the Method selection window.

View/Edit . . . . . Opens the Method editor with the current method.

Save . . . . . Saves the current Method.

Libraries . . . . . Displays the currently saved libraries.

View Report . . . . . Displays a report of the last processed data files.

Search Settings . . . . . Displays the search parameter settings.

Unknown Reports

By File . . . . . Displays report by file.

By Analyte . . . . . Displays report by analyte.

12.3.2 Data Files

Browse . . . . . Used to select the data file for processing. When a data file is selected, the data is listed as follows:

Display . . . . . Will display a chromatogram with a **T** over the compounds found in the calibration report. See section 12.4.

File Entry . . . . . Lists the reference number for the file.

Data File Name . . . . . List the file name and path of the selected files.

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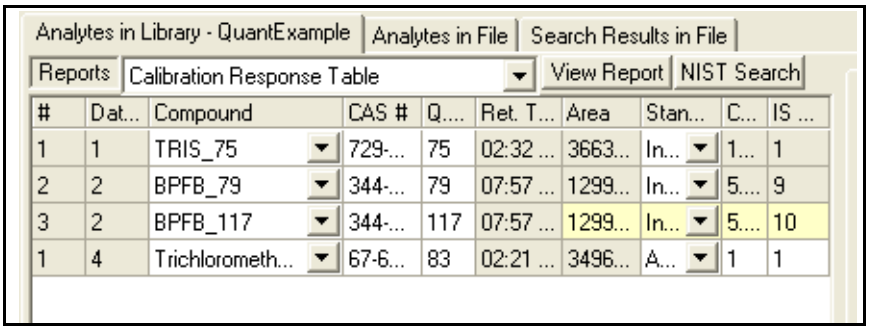
12.3.3 Peak Search

Search . . . . . Performs a peak detection and integration on the selected files, producing the quantitation report.

Recalculate . . . . . Integrates analyte peak areas and recalculates the concentrations without performing a peak search. Typically used following manual editing of peak baseline points.

Start . . . . . Initiates the Search or Recalculation. See Figure 12-5.

Figure 12-5 Analytes Display



12.3.4 Analytes

Analytes in Library . . . . . Displays the analytes in the library.

Analytes in File . . . . . Displays the analytes in the currently displayed or selected file.

12.3.5 Reports

Calibration Response Table . . . . . Report that displays the response factor and curve statistics based on the selected curve type.

Calibration Report . . . . . Report that displays the area fit and purity for the calibration standards.

View Report . . . . . Displays the selected calibration report.

. . . . . Shows the analyte number in the library.

D . . . . . Data Reference: lists the reference to the data file in which the analyte was found.

Compound . . . . . Shows the compound name found in AMDIS, NIST library or assigned by the user for the analyte.

CAS #. . . . . Shows the Chemical Abstracts Services Number for the analyte from the AMDIS or NIST library.

Q ION . . . . . Shows the quantitation ion for the analyte.

Ret. Time . . . . . Shows the Retention Time for the analyte.

Area . . . . . Displays the analyte integrated quant ion area.

Standard . . . . . Designates the compound as an analyte or an internal standard.

Conc: . . . . . Shows the concentration of the analyte or Internal Standard in the displayed file.

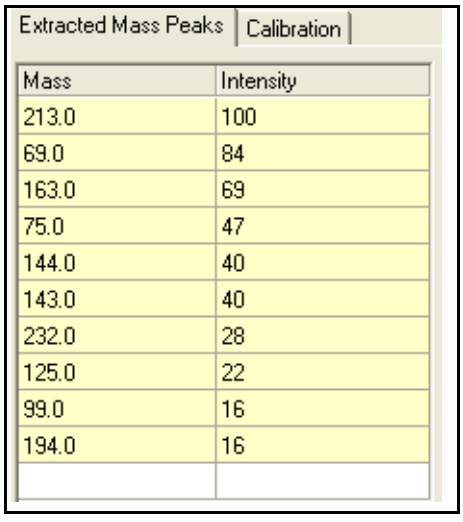
NOTE: The field is not used if the concentration flag is set to global.

IS Ref . . . . . Displays the Internal Standard reference number for analyte quantitation.

12.3.6 Extracted Mass Peaks

Displays the mass peaks and relative percentages for the selected analyte. See Figure 12-6.

Figure 12-6 Extracted Mass Peaks



12.3.7 Calibration

Displays the calibration curve and curve statistics for the selected analyte.

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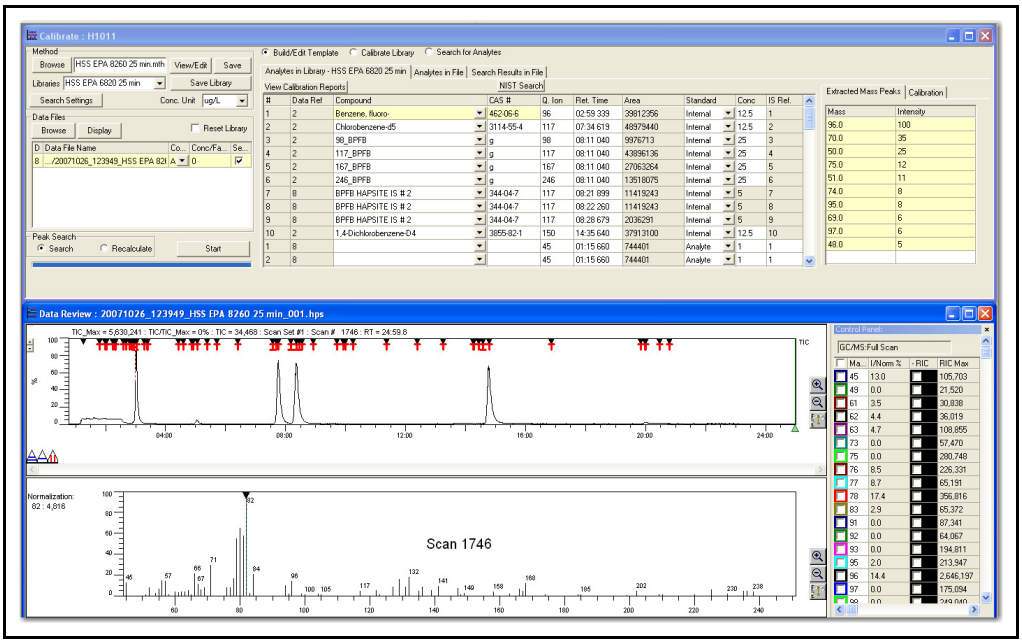
12.4 Display Function

The Display button in the Data Files section of both Calibrate and ID Unknowns shows the selected data file's spectrum. This feature is beneficial when reviewing and revising identifications, selecting spectral peaks, adding to a library and manually integrating peak areas. See Figure 12-7.

Figure 12-7 Calibration Display File



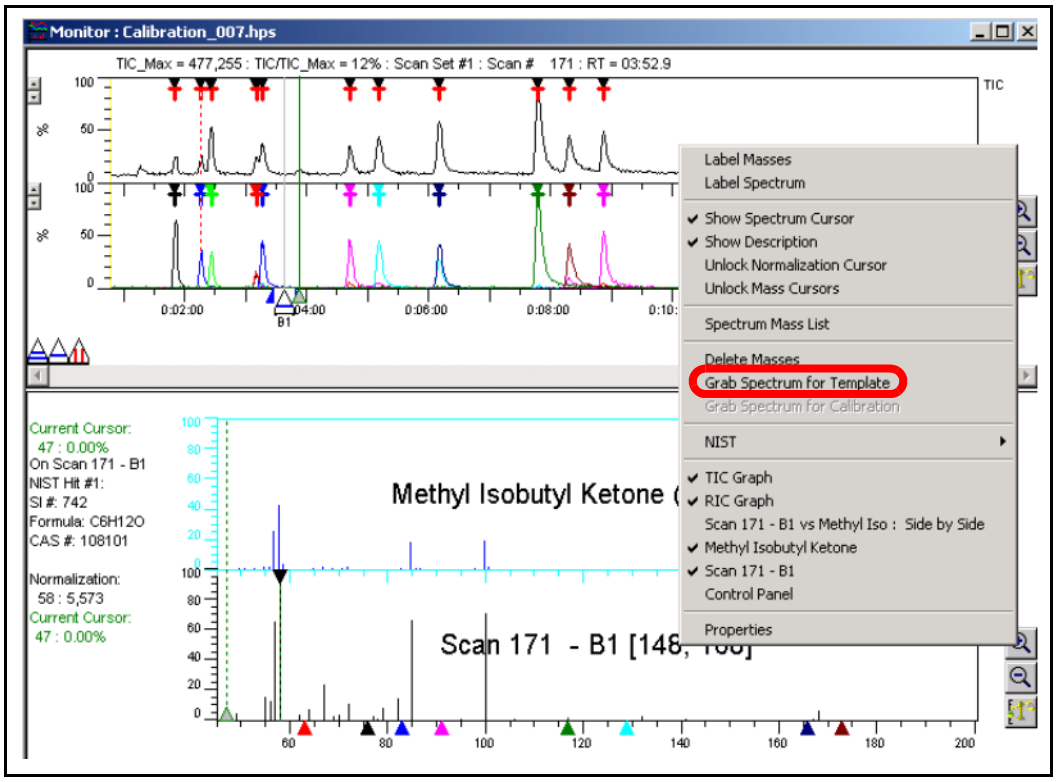
To display a chromatogram while in Calibrate or ID Unknowns, select the file by highlighting with the Left Mouse Button and selecting the **Display** button.

The controls of the Display function are similar to the data review functions for working with RICs (Reconstructed Ion Chromatograms) and Mass Spectra. Data Review is described in Chapter 9, Data Review. Additional features are described below.

With the **Build/Edit Template** option selected in the **Calibrate** window, the **Display** button will show the peaks detected and selected for the library template when a peak search is performed. See Figure 12-8. Peaks selected for the template are indicated on the plot with a **T**. The quant mass for each analyte is displayed on the RIC plot. The **T** symbol will be the same color as the mass number color displayed in the lower right corner of the RIC graph. If a peak has not been detected, the mass spectrum of that peak can be manually selected and the compound it represents added. After selecting the Spectrum for the compound to

be added, place the cursor in the mass spectrum window and click the right mouse button to open up the spectrum pop-up menu. See Figure 12-8. Select the **Grab Spectrum for Template** menu option.

Figure 12-8 Calibration Display



12.5 Using the Calibrate Function

WARNING

Wear appropriate Personal Protection Equipment (PPE) as advised in the MSDS of the standard(s) being used.

1 A standard or series of standards must be prepared from the list of analytes to be quantified. If practical, prepare all standards in a single sample. If not, the template/library can be built from multiple files. If possible, prepare standards for multi level calibration by serial dilution. Analytes can be prepared at the same concentration for all compounds or at different concentrations. When using individual concentrations, an initial concentration of each analyte must be entered into the library using the method editor. Additional concentration levels are then processed by using the dilution factor to calculate the concentration at each level.

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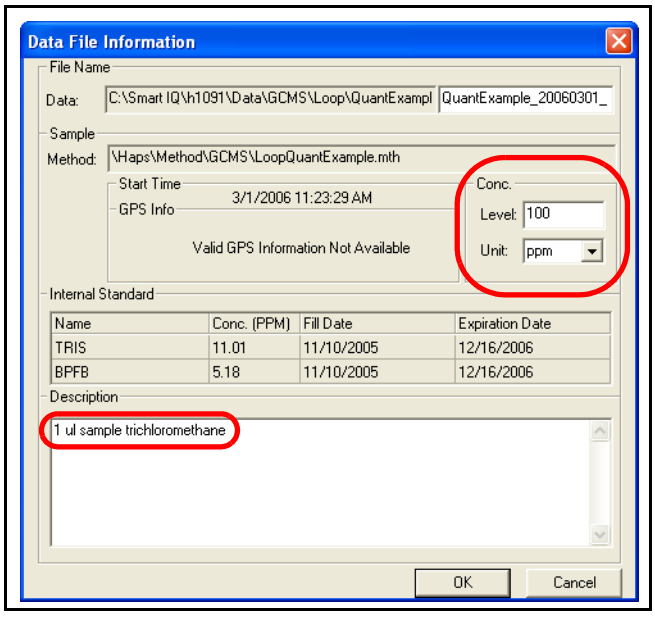
2 After the standard(s) have been prepared, a method must be developed to collect the data. The method can be a default method or a modified method using the Method Editor. All method development and chromatographic changes which can affect the retention time must be made prior to collecting the standard runs that are to be used for building and calibrating the library. Refer to Chapter 11, Method Editor for additional information on method development.

HINT: When running each sample, enter the concentration and a description on the Data File Information page. See Figure 12-9. To access this page refer to section 9.3, Data Review Toolbar, on page 9-5.

Figure 12-9 Data File Information Page

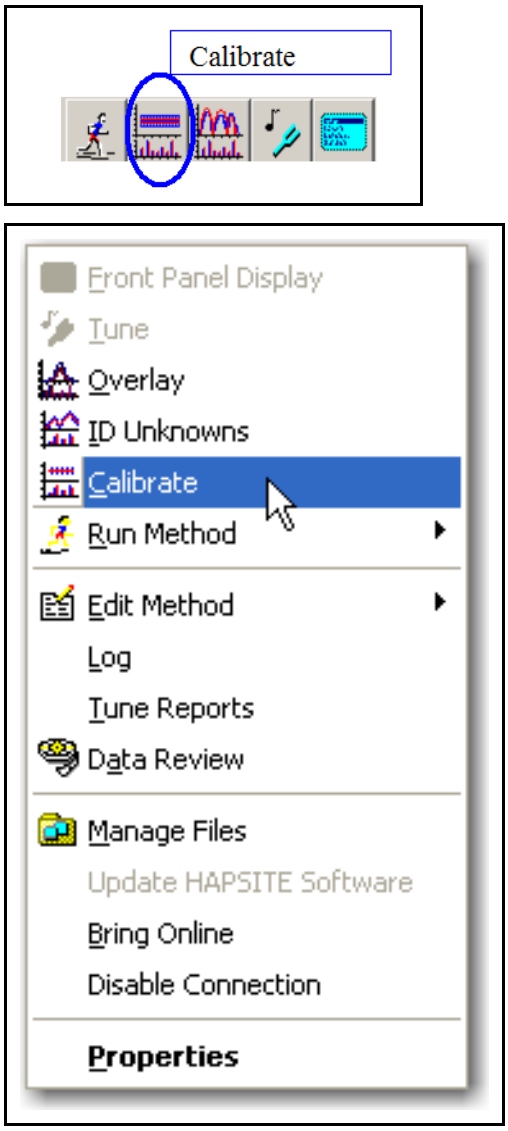


NOTE: In this example, a series of standards at four concentration levels were prepared by serial dilution. The method, QuantExample, was used to collect the data. Start with one method for collection and continue with that method. These are arbitrary concentrations for example only and NOT actual concentrations.

- QuantExample_20060301_005 = 150 PPM
- QuantExample_20060301_004 = 50 PPM
- QuantExample_20060301_002 = 200 PPM
- QuantExample_20060301_001 =100 PPM

3 After the data has been collected, open the **Calibration** function which can be accessed from the drop-down menu, by right mouse button clicking on the **HAPSITE** icon, by the toolbar icon or via the **Status** icon and **Function** tab. See Figure 12-10.

Figure 12-10 Accessing the Calibrate Function



3a Selecting the **Calibrate** function will display a dialog box used to select the type of quantitative method being developed — **Analyze (GC/MS)** or **Survey**. See Figure 12-11.

NOTE: Methods can be built for Full Scan data or SIM (Selected Ion Monitoring) data. Best practice is for the **Select Method First** box to be checked, as the library is linked to the method.

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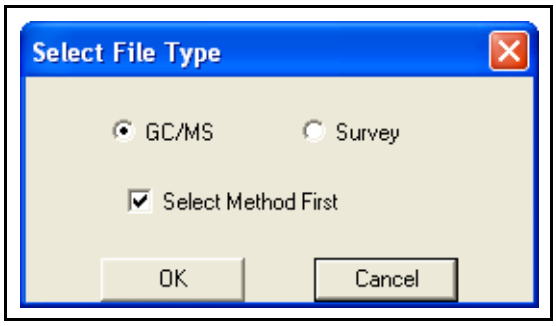
Figure 12-11 Selecting the Type of Quantitative Method

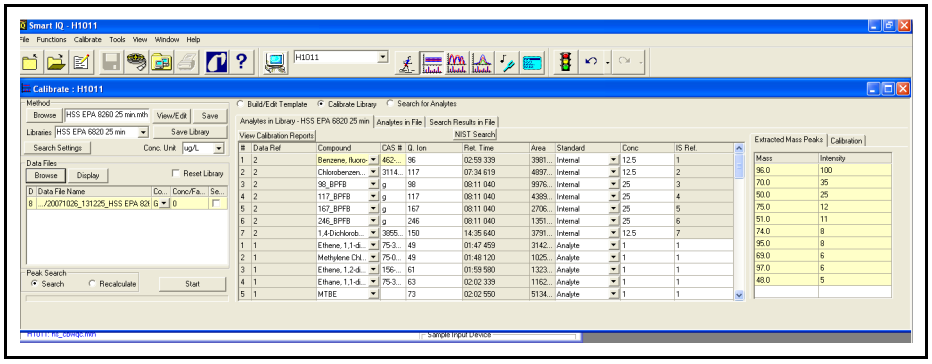


3b Click **OK**.

3c The Method File window will be displayed. Select the method which will contain the library. This will open the **Calibration Control Panel**.

4 Use the **Browse** button under **Data Files** to select the data file to be used to create the library template. This should be a data file (or files) collected when running known samples. See Figure 12-12.

Figure 12-12 Calibration Control Panel with Data File Selected



NOTE: Best practice is to use a high or mid range standard and not the lowest concentration level for calibration library development. Low concentration standards may not have peaks too small to be detected with current **Search Settings**.

HINT: Step 5 and Step 6 will be automatically completed if the information was entered in the Data File Information screen when the sample was run.

5 Enter or select the concentration units.

6 Enter the concentration units of the standard.

7 The Concentration reference should be set to **Global**.

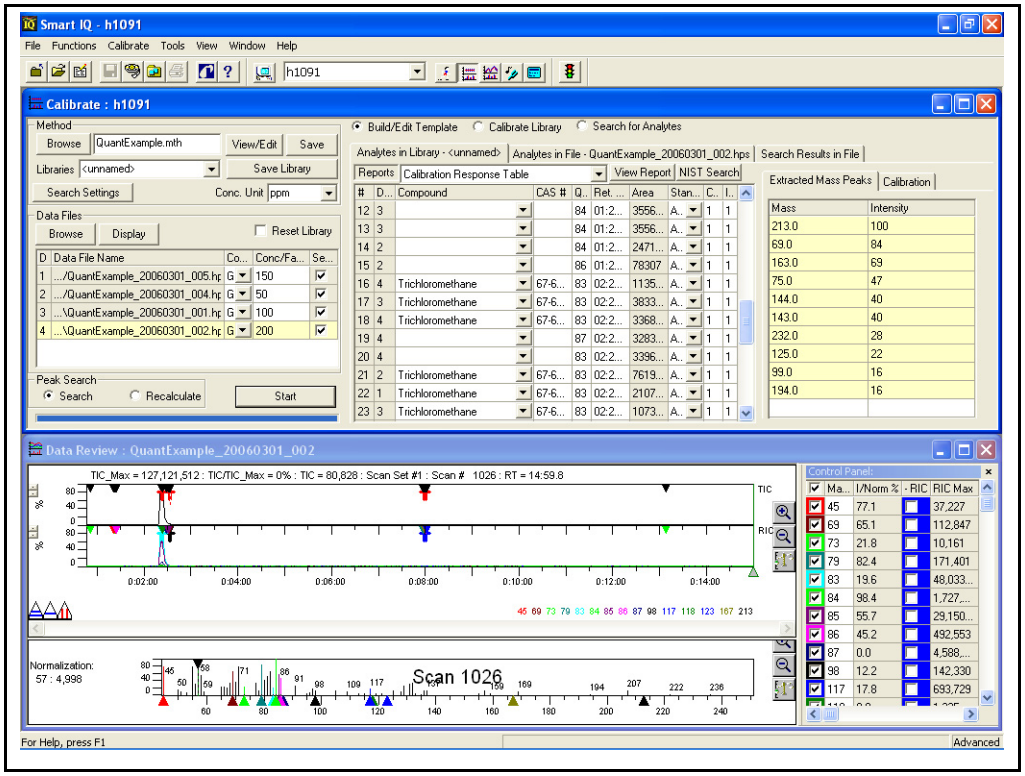
8 Check the selection box. Select **Global**.

9 Make sure the **Build/Edit Template** button is selected and then select **Start**. The data file will be processed and the detected compounds displayed. Peaks are detected according to the **Search Settings**. The library template will be filled in with the detected peaks. The compounds identified by AMDIS will have

Compound names and CAS#'s. See Figure 12-13. The Chromatogram display window will automatically open below the calibration control panel to display the plot and the detected peaks.

The peaks marked with a **T** have been identified by AMDIS, and those with only the black triangle have not been identified. All of the features described in Chapter 9, Data Review can be used to interact with the plot.

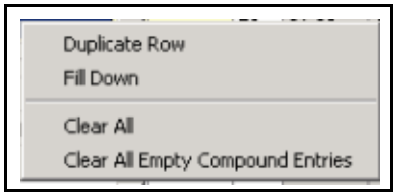
Figure 12-13 Calibrate Display with Detected Peaks



10 The template can now be edited to remove duplicate and unidentified entries from the analyte list. Place the mouse cursor over the compound name of an entry to be deleted or edited. Refer to Figure 12-13 and Figure 12-15.

HINT: Only keep one entry for each compound. In this example, the Internal Standards and the compound of interest are repeated multiple times. Delete the duplicate entries.

Figure 12-14 Right Mouse Button in Calibration Control Panel



Press and hold the Right Mouse Button. The options available are:

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Duplicate Row . . . . . Creates a duplicate entry for the highlighted row.

Fill down . . . . . Replaces the contents of all rows below the highlighted row with the name of the selected compound.

Clear All . . . . . Erases all entries in the Template.

Clear All Empty

Compound Entries . . . . . Deletes all entries that do not have a compound name associated with them.

NOTE: The down arrow next to the compound name can be used to select a different name if more than one possible match has been determined by the AMDIS search.

10a For this file, all of the blank entries are to be deleted. Click the Right Mouse Button in the **Compound** field and select **Clear All Empty Compound Entries**. Refer to Figure 12-13.

HINT: If a compound is unidentified (blank), but is known to the analyst, name the peak by highlighting the blank compound name field and entering the name.

10b Next, the Internal Standards must be selected. When using Internal Standards, best practice is to use a quant ion from the internal standard that is close in mass to the quant ion of the compound to be quantitated. The software always selects the largest mass fragment in the spectrum as the quant ion. To change the quant ion, highlight the field and type in the new number. Change the quant ion for TRIS from **213** to **75**. The software will warn that a re-calibration is required. This is true if a quant ion is changed after calibration. To signify which quant mass is being used, change the name of **TRIS HAPSITE IS #1** to **TRIS_75**. See Figure 12-15.

NOTE: If the name of the analyte begins with TRIS or BPFB the software will recognize the analyte as a HAPSITE IS and automatically enter the concentration from the IS canister into the method for calibration and quantitation.

10c More than one quant ion can be used from a single Internal Standard peak. Highlight the second Internal Standard and click the Right Mouse Button, select **Duplicate Row**, then change the name of the Internal Standard peaks to **BPFB_79** and **BPFB_117**. Next the **Quant Ion** should be changed to **79** and **117**. See Figure 12-15.

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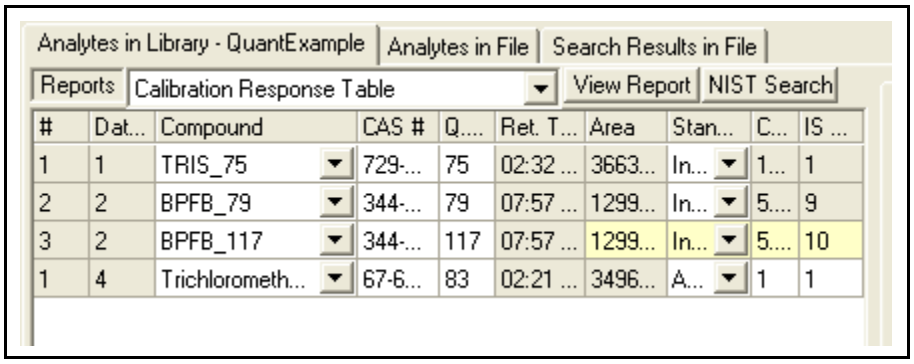
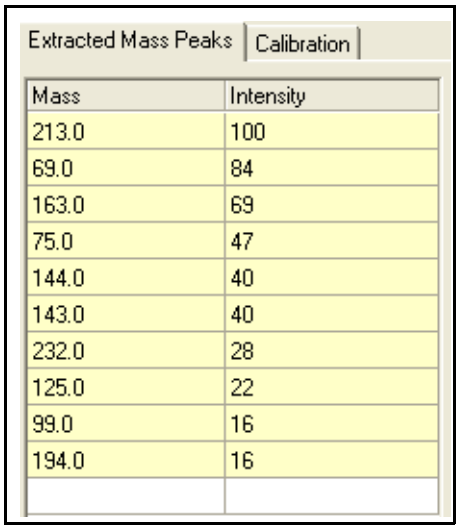
Figure 12-15 Finished Analytes Chart



#	Dat...	Compound	CAS #	Q....	Ret. T...	Area	Stan...	C...	IS ...
1	1	TRIS_75	729-...	75	02:32 ...	3663...	In...	1...	1
2	2	BPFB_79	344-...	79	07:57 ...	1299...	In...	5....	9
3	2	BPFB_117	344-...	117	07:57 ...	1299...	In...	5....	10
1	4	Trichlorometh...	67-6...	83	02:21 ...	3496...	A...	1	1

10d To finish the template, the concentration of each analyte must be individually entered if not using the global concentration flag. In this example, the concentration of all analytes is the same, so Global is being used. The concentration field is not a required entry. For analyte specific concentrations, the Concentration field should contain the individual analyte concentrations for the selected data file. Each additional file would have a specific multiplication factor entered in the Conc/Factor field in the Data Files control panel.

Figure 12-16 Extracted Mass Peaks



Mass	Intensity
213.0	100
69.0	84
163.0	69
75.0	47
144.0	40
143.0	40
232.0	28
125.0	22
99.0	16
194.0	16

10e The Extracted Mass Peaks can also be edited to delete mass fragments with intensities below 15%. The exception would be a molecular ion if the fragmentation pattern is not very distinct. To delete unwanted mass fragments, highlight the field and press the delete key. Refer to Figure 12-16.

11 The finished library needs to be saved. Select the **Save Library** button under the **Method** controls. Enter a library name and save it as part of the method. See Figure 12-17.

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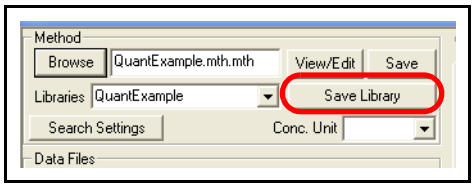
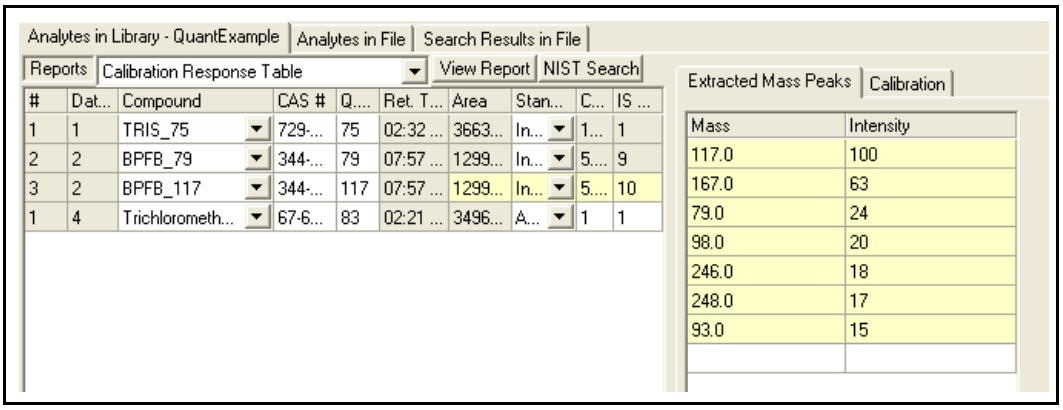
Figure 12-17 Save Library Button



12 The template is complete and the library is ready for Calibration. Refer to Figure 12-18.

Figure 12-18 Library Ready for Calibration

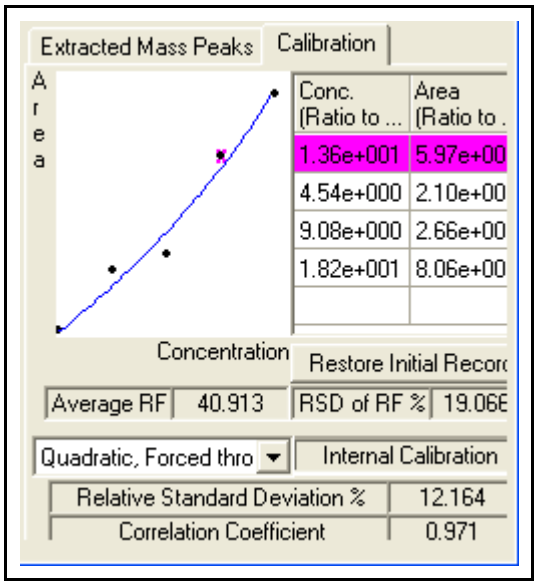


12a Prior to calibration, the curve fit should be selected. To change the curve fit from the default **Linear, Forced through Origin**, select the **View/Edit** button under the **Method** controls. Select the curve fit and save the method.

12b To calibrate the library, select the standard data files, select **Calibrate Library** and press the **Start** button under **Peak Search**.

12c Review the curves for each analyte. To review each analyte, select the **Calibration** tab and use the mouse to select each compound. See Figure 12-19.

Figure 12-19 Calibration Curve



12d Additional calibration points can be added to the curve at any time by using the **Browse** button under **Data Files**. First add the data file. Select the data file added and make sure that the previous data file is no longer selected by un-checking the select field. Select **Start** under **Peak Search**. Review the curves as with the previous data file. Each curve should have all of the calibration points.

NOTE: To investigate problems use the **View Reports** function to examine the **Calibration Report**. If an outlying point is detected on the curve, delete the point by highlighting and clicking delete.

12e When the curve is complete, save the Library and the Method. The Quant library is now part of the Method.

HINT: Whenever this Method is run from the front panel or the Laptop, the Method will report concentration for the target compounds by selecting the **Quantitative** tab of the report.

12.6 Using the ID Unknown Function

Files can be reprocessed on the laptop using the **ID Unknowns** function.

1 The **ID Unknowns** function can be accessed from the **Function** drop down menu, by clicking the right mouse button on the **HAPSITE** icon, by the toolbar or via the **Status** icon and **Function** tab. See Figure 12-20.

HINT: The **ID Unknowns** function is very similar to the **Calibrate** function.

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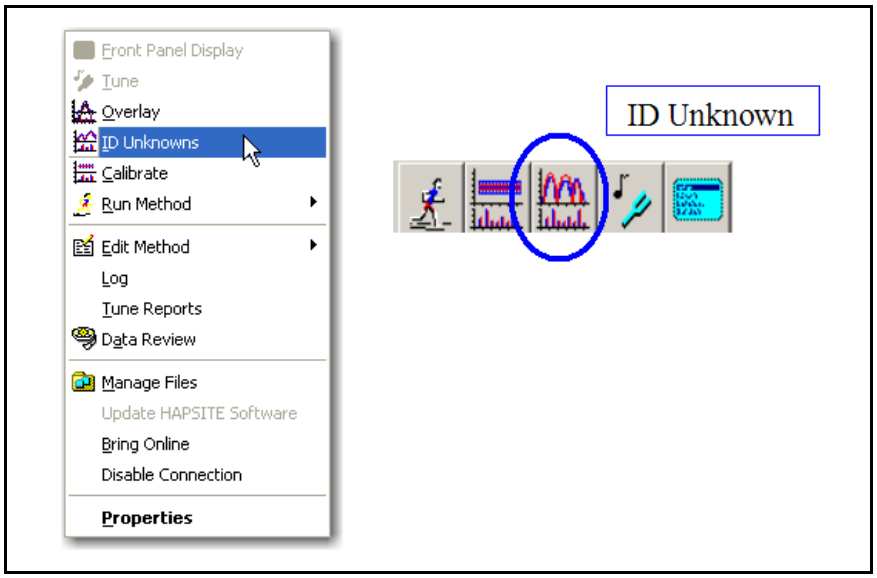
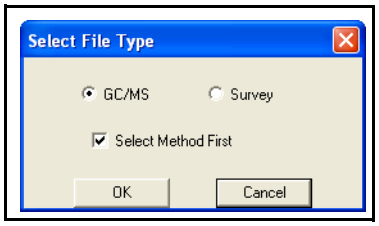
Figure 12-20 Accessing ID Unknowns Function



1a Selecting **ID Unknowns** will display the **Select File Type** dialog box used to select the type of quantitative method, **GC/MS** or **Survey**. See Figure 12-21.

Figure 12-21 Selecting the File Type



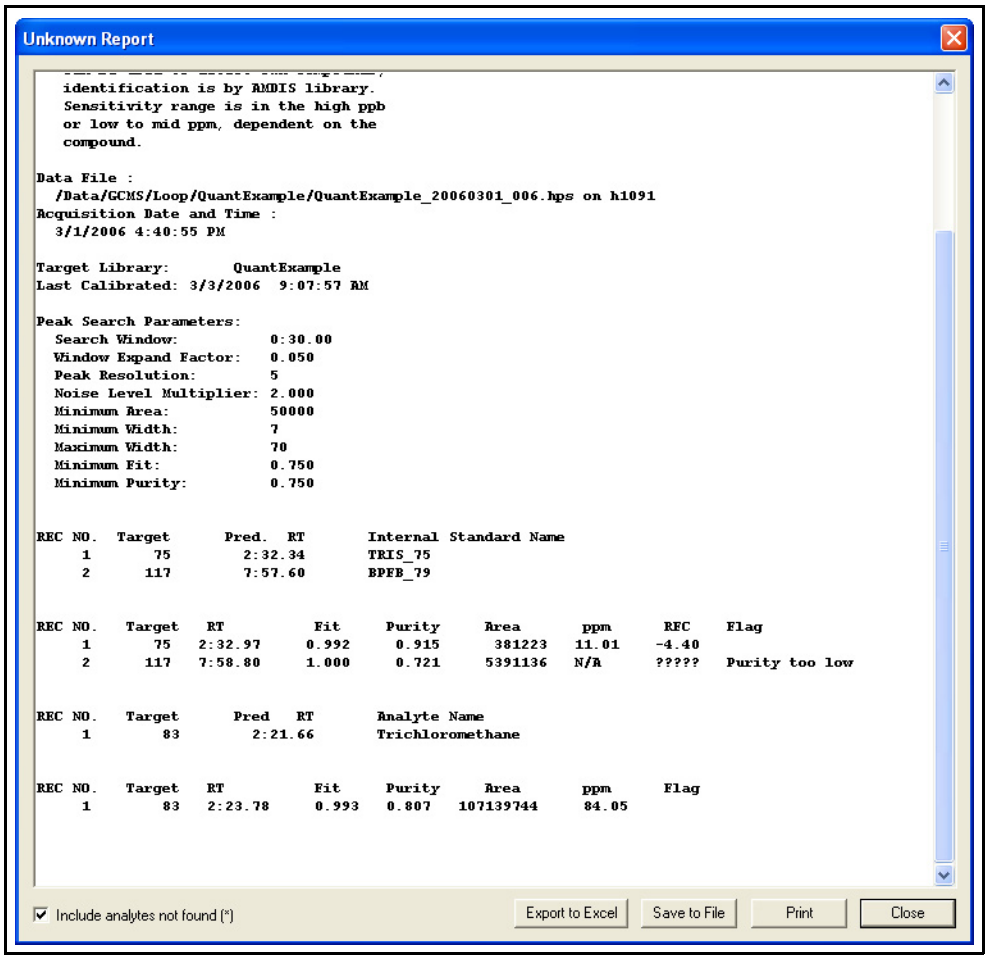
2 Select the **method** to be used to process or re-process the data. After a method is selected, the **ID Unknowns** control panel will be displayed.

3 Use **Browse** to select the **Data File(s)**.

4 Select **Start** to reprocess the data.

5 View results. See Figure 12-22.

Figure 12-22 Sample Quantitation Report

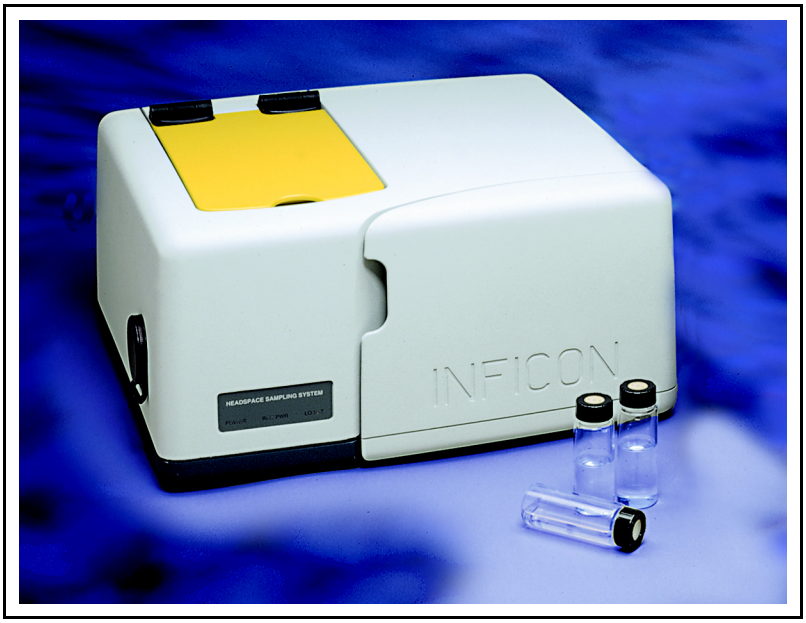


Chapter 13
Headspace Sampling System

13.1 Introduction

The Headspace Sampling System (HSS) is an accessory to the HAPSITE portable GC/MS, allowing testing for volatile compounds in various solid and liquid matrices, including soil and water. Used in combination with the HAPSITE, the Headspace Sampling System attachment provides the opportunity to perform soil and water analyses for quantitative and qualitative results in the field. See Figure 13-1.

Figure 13-1 Headspace Sampling System



The HAPSITE is designed to analyze volatile compounds in air, so samples must be introduced in the gas phase. HSS technology involves heating samples of soil or water in a closed sample container to a known temperature. Heat forces the volatile components to partition between the sample and the headspace above the sample. After allowing sufficient time for equilibration to occur, a portion of the headspace (now containing volatile compounds from the sample) is introduced to the HAPSITE as a gas sample.

Unknowns are tentatively identified using the National Institute of Standards and Technology (NIST) mass spectral library. Known compounds can be quantified using a prepared calibration curve.

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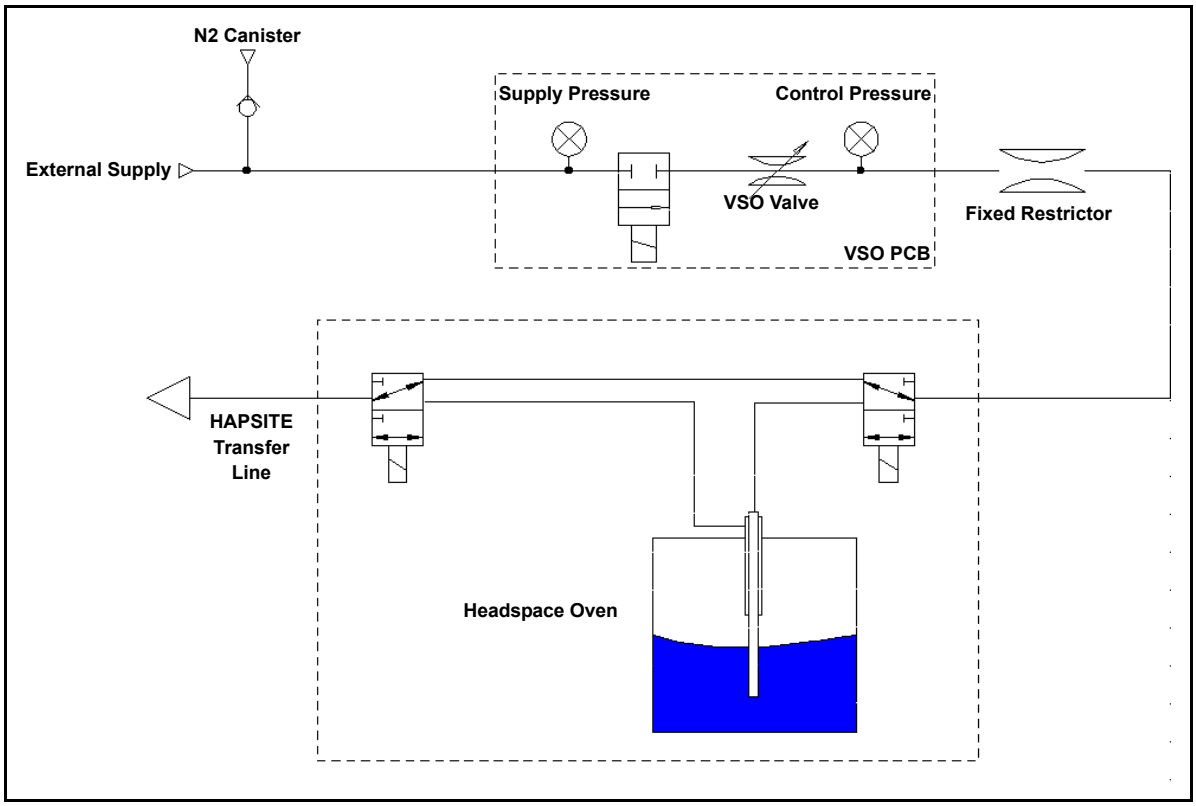
13.1.1 How the HSS Operates

The function of the HSS is to provide consistent partition of analytes between the sample and the headspace, and to transfer a representative sample of the headspace to the HAPSITE for analysis.

Figure 13-2 is a schematic of the gas flow system which accomplishes these functions. The flow starts with the Nitrogen supply, at the upper left. This can be from disposable canisters or from an external cylinder supply. The Nitrogen pressure and flow are controlled by two pressure gauges, a shut-off valve (the variable orifice valve) and a fixed restrictor. All the valves in this system are operated under software control.

Figure 13-2 HSS Operation Flow Diagram



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Two three-way valves direct the flow to either bypass the vial (in the position shown) or purge through the vial. While a sample is being transferred to the HAPSITE, the flow is directed through the long needle, below the surface of the sample. The Nitrogen flow into the vial is approximately balanced by the HAPSITE's sample pump draw out of the vial. The headspace sample is transferred to the HAPSITE while maintaining neutral pressure in the vial.

At the end of the analysis, if a Purge cycle is programmed, the operator is prompted to insert the needle into a clean vial and acknowledge it by pressing **RUN**. Purge is achieved by providing a flow of clean Nitrogen through the needle, heated line and the sample path in the HAPSITE. This clean flow removes residual organics

and moisture from the previous run. During the Purge cycle, the three-way valves change state, assuring that the bypass line is also purged. The sample pump continues to run during Purge.

The temperature-controlled oven contains not only the sample wells, but the three-way valves and the entire sample line up to the connection with the HAPSITE heated Transfer Line. This design precludes the condensation of volatiles at cold spots.

13.1.2 Performance Specifications

Operating Conditions	10°C to 45°C, up to 95% Relative Humidity (non-condensing)
Dimensions (L x W x H)	36 cm x 39.5 cm x 19 cm
Weight (including battery)	12 kg
Power Consumption	30 W at 24 V
Oven Temperature Range	Ambient to 80°C
Equilibrium Stabilization Time	20 minutes
Practical Quantitation Limit (toluene)	5 µg/liter
Mounting Requirement	Upright, ±15°

13.1.3 HSS Indicators

The HSS has three indicators in the left side of the front panel and under the label **Headspace Sampling System**. When illuminated, these indicate **POWER**, **RMT PWR**, and **LO BAT**. The left and center indicators are green when illuminated, while the right is red when illuminated.

POWER	When the left indicator is illuminated, the HSS power is on.
RMT PWR	When the center indicator is illuminated, the HSS is connected to remote power.
LO BAT	When the right indicator is illuminated, the battery power is getting low, and HSS power will soon be lost. Either replace the battery with a charged battery or connect to a power source using the AC-to-24 V(dc) adapter.

NOTE: The HSS and the Transfer Line are powered by the HSS instrument. If the instrument loses power or is turned off, the temperatures of both the HSS and the Transfer Line will begin to drop. Power up the HSS and run a HSS method to restart the heaters.

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13.1.4 Consumables Required

The following consumables are required for routine analysis when using the HSS.

Compressed Nitrogen — A source of pressurized, high-purity nitrogen is required for analysis and purging of the system. Nitrogen canisters are available from the sales agency which provided the HSS, or an external source of Nitrogen, regulated to 700 kPa, may be connected using the 3/16" Swagelok quick connect fitting located at the back of the instrument.

The nitrogen canisters are available as the following INFICON part numbers:

- Box of 6 — IPN 930-432-P6
- Box of 12 — IPN 930-432-P12
- Box of 24 — IPN 930-432-P24

CAUTION

The Nitrogen must have less than 50 ppb of volatile organic compounds, and argon less than 40 PPM. More detailed specifications can be obtained by contacting INFICON, see Chapter 18, Customer Support.

40 milliliter (mL) Glass Sample Vials — These vials are used for all analyses, including calibration standards, blanks, quality control samples, and samples regardless of matrix.

NOTE: The sample vials must have dimensions of 29 mm OD x 81 mm length to ensure a proper fit in the HSS sample heating block. A proper fit allows the sample heating block to most effectively heat the samples. Supelco, Inc. (1- 800 247-6628) offers clear glass vials of this size with PTFE-silicone septa and open-top phenolic closures. The vials are Supelco part number 2-7180 (box of 100).

Water — Water is used for syringe cleaning, blank analysis, calibration standard preparation, calibration check standard preparation, and sample dilutions if necessary. This water must be free from volatile organic compounds, or "VOC-free".

Calibration Mix — This mix should consist of the target compounds for sample quantitation. The mix is used to prepare standards for a calibration curve. The calibration curve is used for quantification.

INFICON has created a four component mix used as Internal Standards for Headspace Sampling (HSS) runs. This mix is added in conjunction with calibration mixes used to create calibration curves for quantification methods. The part number for this mix is:

4 component (HSS) Internal Standard — IPN 071-748

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NOTE: Calibration Mixes may be purchased from a variety of laboratory supply businesses in liquid form, usually in a methanol matrix. Typical laboratory mixes are readily available as off-the-shelf items, while custom mixtures can be made to specifications.

13.1.5 Connecting the HSS to the HAPSITE

Determine a suitable location, on a level surface, where the HAPSITE and the HSS are close enough together to connect via the Transfer Line. Refer to section 2.7.2, Installing the Headspace Sampling System, on page 2-15 for detailed installation instructions.

CAUTION

Care must be taken to avoid sharp bends of the Transfer Line, which could lead to flow restriction or breakage.

13.1.6 Providing Power to the HSS

The HSS may use AC power from an outlet, or may also use an INFICON rechargeable battery. A description of the connections for each power supply follows.

13.1.6.1 If AC Power is Available

If AC power is available, use the Y-cable furnished to "split" the 24 V(dc) power from the HAPSITE's AC to DC power converter. Connect one connector of the Y-cable to the HAPSITE's power connection and connect the other connector to the back of the HSS. Then connect the two-cable connector to the output line of the AC to DC power converter. Finally, plug the AC to DC power converter into the AC power outlet.

Refer also to section 2.7.2, Installing the Headspace Sampling System, on page 2-15.

NOTE: Do not use the Y-cable to power two HAPSITE instruments.

HINT: If the HAPSITE is not shut down, do not disconnect the power cable unless a charged battery is installed.

13.1.6.2 If AC Power is Not Available

For field operations, or whenever AC power is not available, batteries must be used. A battery will provide power to the HSS for approximately 3 hours of use, depending on ambient temperature and the parameters of the method being used.

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13.2 Using the HAPSITE with HSS

The following instructions can be used as a guideline for sample and standard preparation unless more specific operating instructions are available.

13.2.1 Powering on the HSS

CAUTION

Do not open the front door in a contaminated or wet area.

Open the front door and press the **POWER** button to turn on the HSS. See Figure 13-3.

HINT: The **POWER** button is a toggle switch. Once pressed and released the switch returns back to its previous position.

Figure 13-3 Powering on the Headspace Instrument

Once the HSS is connected to the HAPSITE, and the HSS power is on, run one of the Headspace methods using the Run Method icon. This will heat up the Headspace instrument. See section 5.6, Analyze (GC/MS) Mode with Headspace Sampling System, on page 5-19 and section 3.9, Analyze (GC/MS) Mode with Headspace Sampling System in Portable Mode, on page 3-67.

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13.2.2 Loading the Vials

WARNING

Wear appropriate Personal Protection Equipment (PPE) as advised by the MSDS of the compound(s) being used.

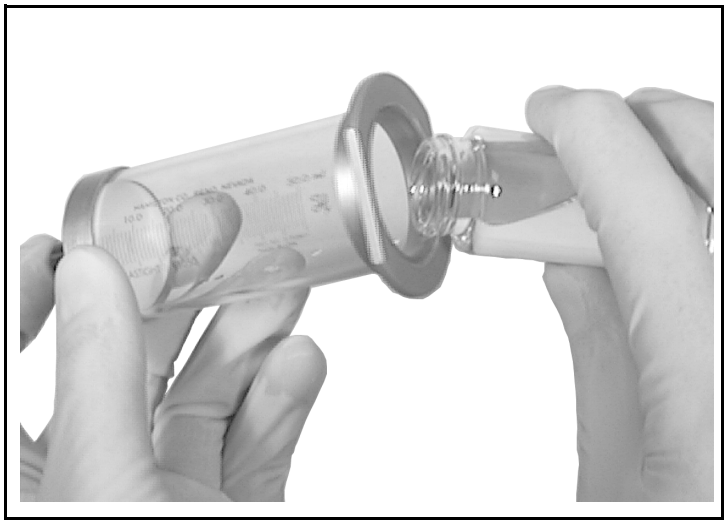
Loading of vials is accomplished in a manner which best preserves the integrity of the sample. The HSS works on the basis of heating a sample to partition the volatiles between the sample and the headspace within the vial. Just as heat drives off volatiles, aeration also removes volatiles from a sample.

NOTE: Use Volatile Organic Compound (VOC) free water to rinse a syringe (either 25 or 50 mL size Luer-Lock tip syringe is suggested). No needle is required for this syringe.

To load a water sample into the vial:

1. Rinse a small clean vessel (such as a beaker) with VOC-free water and discard the water.
2. Pour some VOC-free water in the rinsed vessel for rinsing of the sample syringe.
3. Rinse the sample syringe with VOC-free water by drawing the water up into the syringe through the tip. Push the syringe plunger to discard the water. Repeat three times.
4. Remove the plunger from the sample syringe. Hold the sample syringe at an angle with the large open end up, and the small end (where a needle would be) stopped against a gloved finger. See Figure 13-4. Carefully transfer the sample into the sample syringe.

Figure 13-4 Transferring the Sample into a Sample Syringe



NOTE: The 40 mL sample vials are intended for one time use only and should be properly discarded when finished.

5 Adjust the amount of sample in the sample syringe to 20 mL while removing the air bubble. See Figure 13-5.

WARNING

Do not insert a vial, which is completely full of liquid sample, into a Headspace sample well. An adequate airspace above the sample is required to allow for sample expansion during heating. Failure to leave an airspace in the vial may result in failure of the vial and personal injury. Do not fill the vial with more then 20 mL of liquid.

Figure 13-5 Clearing the Air Bubble from the Sample Syringe

6 Add Internal Standard and surrogates into the sample.

NOTE: The Internal Standards are a set of compounds which are injected at a consistent known concentration with each calibration standard, continuing calibration check, blank, quality control sample, as well as with each sample. The Internal Standards are used to correct for method inconsistencies. Internal Standards are chosen so that interference with compounds from the sample is not encountered.

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NOTE: Surrogates are used to indicate consistency within the analysis as compared to internal standards. These compounds are also injected into the sample at a consistent known concentration similar to the Internal Standard. Surrogates are also chosen to avoid interference with compounds in the sample. Surrogates are reported as recovery values in percent (%) compared to expected response value.

6a Rinse the 10 µL syringe, with cemented needle (pictured in Figure 13-6), to be used for the injection of the Internal Standard/Surrogate mixture, with high purity methanol three times, discarding the methanol according to local regulations (preferably in a vented hood) after each rinse.

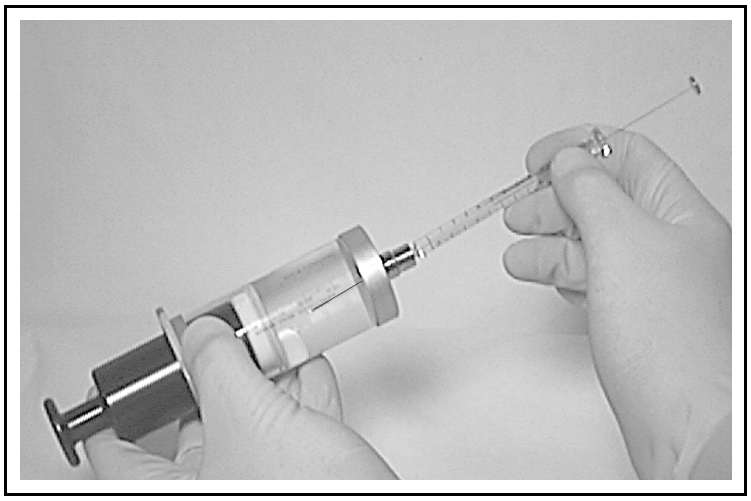
WARNING

The needle tip is sharp, be careful to avoid injury.

6b Rinse the 10 µL syringe once with the Internal Standard/Surrogate mixture, and discard the internal standard/surrogate mix from the 10 µL syringe.

6c Inject the desired amount of Internal Standard/Surrogate mixture into the sample through the small end of the sample syringe. See Figure 13-6.

Figure 13-6 Injecting the Mix into the Sample Syringe



For calibration standard preparation, injection of the proper amount of a calibration mixture is performed to achieve the desired compound concentrations. Rinse a separate 10 µL syringe with methanol three times. (Discard the methanol from each rinse according to local regulations.) Then, rinse once with the calibration mixture (discard this as well). Inject the desired amount of the calibration mixture through the small end of the sample syringe to complete the calibration standard.

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The following is a set of examples for amounts of standard mix (at 200 and 2000 µg/mL) to be injected into 20 mL of water to achieve the stated concentrations. See Table 13-1, Example Calibration Concentration Table, on page 13-10.

Table 13-1 Example Calibration Concentration Table

Concentration Desired	Amount (at 200 µg/mL) to be injected
20 PPB	2 µL
50 PPB	5 µL
100 PPB	10 µL
If using a 2000 µg/mL standard mix:	
400 PPB	4 µL
1000 PPB	10 µL

The formula used to calculate the amount needed for injection (as above) is as follows (1 PPB = 1 ng/mL):

$X = C_F / C_C \times 1000\ \mu L/mL \times 1\ \mu g/1000\ ng \times 20\ mL$ [1]

where:

- X = µL to be Injected
- C_F = Final Desired Concentration in ng/mL (PPB)
- C_C = Calibration Mix Concentration in µg/mL (PPM)

6d Uncap a new sample vial, tilt the vial, and transfer the sample from the sample syringe, taking care to avoid aerating (bubbling) in the sample. Cap the sample vial tightly. See Figure 13-7.

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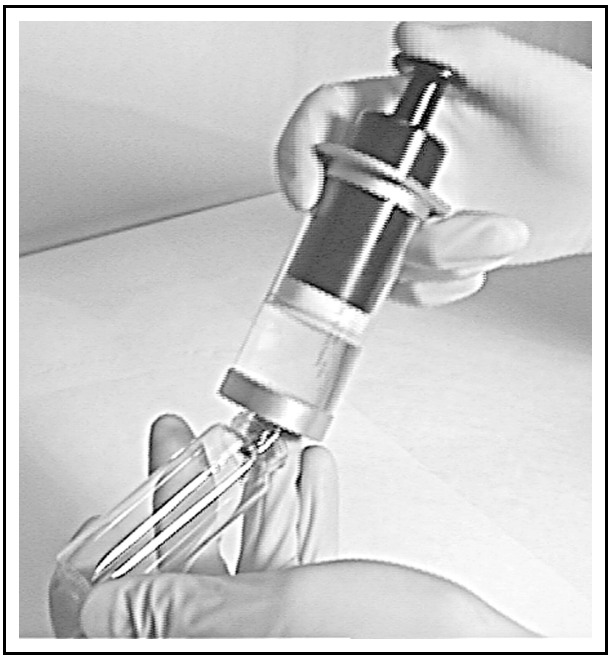
Figure 13-7 Transferring the Sample to a 40 mL Vial



7 Label the vial with the appropriate information.

13.2.3 Loading the Wells

This section describes the procedure for loading a sample into the well of the HSS.

1 Open the top yellow cover of the HSS to expose the sample needle assembly and metal heater block with four sample wells.

WARNING

Be careful to avoid injury when handling hot sample vials.

WARNING

Be careful to avoid injury when loading/unloading samples, as the HSS metal sampling needle tip is sharp.

WARNING

Be careful to avoid injury from any broken glass.

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WARNING

Do not insert a vial which is completely full of liquid sample. An adequate airspace above the sample is required to allow for sample expansion during heating. Failure to leave an airspace in the vial may result in failure of the vial and personal injury. Do not fill the vial with more then 20 mL of liquid.

CAUTION

Do not open the HSS door in a contaminated or wet area.

2 Pull up on the needle assembly while grasping each side between the thumb and forefingers. Swivel the needle assembly left or right as needed to expose a free path to the sample well.

3 Insert the vial, plastic cap facing up, into the desired well.

4 Lower the needle, either into an empty well or an empty vial. See Figure 13-8.

NOTE: DO NOT puncture the sample septum until the sample has had adequate time to equilibrate.

Figure 13-8 Inserting the Needle into a Vial

5 Close the yellow cover to prevent heat loss and promote thorough heating of the needle assembly.

6 Keep track of the time when each sample was inserted into the well to monitor equilibrium time. See section 13.2.4, Cycling the Vials, on page 13-13.

HINT: Consistency of heating times is very important!

NOTE: The 40 mL sample vials are intended for one time use only. The vial and sample should be discarded properly when finished.

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13.2.4 Cycling the Vials

Cycling the vials is performed to thermally equilibrate and analyze samples as efficiently as possible. Four sample wells allow rotation of samples during analysis for equilibrium times which are longer than a single sample run time.

Cycling the vials to achieve the desired equilibrium time:

- Insert the first sample after the HSS sample heating block has reached the setpoint temperature. Allow the sample to equilibrate for the desired time (as determined when the calibration analyses were performed) and continue with the analysis.
- For subsequent samples, determine a strategy for achieving the desired equilibrium time while minimizing time between sample analysis.

  HINT: Develop a consistent system such as analyzing samples in the same position each time, and rotating samples clockwise or counter-clockwise to that position during each sample shift.

  NOTE: The 40 mL sample vials are intended for one time use only. The vial and sample should be discarded properly when finished.

13.2.5 Making the Measurement

To make a measurement using the HSS, a method is required. To quantify the analytes detected, a calibration library in the method is required.

Once the calibration library method is completed, samples may be analyzed and compared to the calibration library for quantitative analysis. Sample analysis must be performed using the same procedure used to perform the calibration runs.

Refer to Chapter 11, Method Editor and Chapter 12, Target Compound Methods for additional information on developing methods and calibration libraries for quantitative analysis.

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13.3 Maintenance of HSS

Other than replacement of consumable items, most maintenance will involve routine purging of the system, as needed such as when analyzing high concentration samples, needle replacement, or cleaning of the sample wells. See section 16.9, Replacing the Headspace Sampling System Needle, on page 16-47.

13.3.1 Clean Out after a High Concentration Sample

When high concentration samples are analyzed using the HSS, the system can retain analytes which will be detected if the next sample has low levels of those compounds. This is typically referred to as a carry-over contamination. Carry-over contamination can be reduced to approximately 0.1% by using **Purge**. In the case of severe carryover, use the **Flush** function.

13.3.1.1 Purge Procedure

To purge the HSS, run a blank with the HSS needle in a clean, empty 40 mL purge vial. In some cases, the blank may need to be run more than once.

HINT: A blank is the same method run without introducing a sample.

13.3.2 Cleaning Up a High Background

High background is usually encountered because some compounds are retained in the HSS or the HAPSITE. These compounds could be in the HSS valves, transfer line, or within the HAPSITE.

To test whether the background is in the HSS or the HAPSITE, disconnect the Transfer Line, connect the air sampling probe to the HAPSITE, and analyze a clean air sample. If the contamination is no longer present, the contamination is in the HSS or Transfer Line.

Once the HAPSITE has been tested, test the Transfer Line by reconnecting it to the HAPSITE and disconnecting it from the HSS. Perform an analysis of clean air with the Transfer Line connected. If the contamination is not present, then the contamination is in the HSS.

13.3.2.1 Flush Procedure

Contamination may be flushed from the HSS by disconnecting the Transfer Line from the HAPSITE but leaving the line connected to the HSS. Once the Transfer Line to the HAPSITE is disconnected, press the **FLUSH** switch inside the front panel of the HSS (see Figure 13-9). This will pass Nitrogen through the system while heating the sample well to 80 °C. The length of time the flush will need to operate will depend on the level of contamination.

NOTE: The Flush function will continue to operate until the **FLUSH** toggle switch is pressed again to turn it off.

HINT: Make sure that the HSS needle is inserted into a clean, new, empty vial during flushing.

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Figure 13-9 Flush Switch Inside The Headspace Instrument

13.3.3 Cleaning the HSS Wells

The heating block is constructed of aluminum and is normally easy to keep clean. Routine cleaning of the wells is not usually necessary, but debris and liquids may be removed easily.

WARNING

Be careful to avoid burns if the surfaces are hot. Surfaces may still be hot, even if the HSS has been turned off.

WARNING

Be careful to avoid injury from the sharp sampling needle.

The four wells may be cleaned, as necessary, using a damp paper towel or cloth. Cleaning should be performed after the heating block has been allowed to cool to ambient temperature or a reasonable temperature to avoid injury.

HINT: When cleaning the wells, position the needle assembly inside a well not currently being cleaned. Use this as a precaution against possible injury from the sharp needle point of the assembly.

To remove liquids, roll a paper towel or cloth into a tube shape which will fit easily into the well, insert, twist and remove.

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Loose debris may be removed by turning the HSS upside down with the top door open. (Remove the battery first to reduce the weight.) Make sure no samples are in the wells before performing this cleaning method.

If necessary, water, solvents, or detergent can be used to clean the wells. Be sure to think about contamination issues if using anything other than water!

CAUTION

Do not completely fill the vials heater area with any liquids, since damage to the instrument may result.

13.3.4 Decontaminating the HSS

The HSS is designed to be water resistant, but not waterproof. The HSS can withstand rainfall, but should be removed to a dry area as soon as possible. The front door has a seal which prevents water from passing into the instrument when the door is closed. There is also a seal around the entire instrument where the Headspace cover meets the base plate of the Headspace. Proceed as follows to wash the HSS.

WARNING - Risk Of Electric Shock

Be careful to avoid shock. Disconnect the Headspace instrument from its power source before continuing.

WARNING

Be careful to avoid burns if the surfaces are still hot.

WARNING

The needle tip is sharp, be careful to avoid injury.

1. Disconnect the HSS from the external power supply.
2. Remove the battery.
3. Remove all vials from the HSS heater wells. (Be careful of the sharp needle).
4. Disconnect the Transfer Line at the back of the HSS.
5. Close access doors.
6. Install the red plastic and metal plugs on all gas and electrical inlets and outlets on the outside of the HSS.

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7 Decontaminate the instrument with a soft cloth and 10% bleach. For decontamination of the wells, refer to section 13.3.3, Cleaning the HSS Wells, on page 13-15.

NOTE: Solvents, abrasives, and strong soaps should not be used.

8 Use a soft cloth to wipe the HSS with clean water.

9 Allow the HSS to dry thoroughly before reconnecting any power supply.

13.3.5 Replacing The HSS Battery

Replacement of the battery is performed on an as needed basis. The battery is used when a remote power source is not available. When the battery charge reads 20%, a battery change is needed.

NOTE: The battery level can be monitored by pressing the **TEST** button located on the front of the HAPSITE battery. While the **TEST** button is pressed, the **% Charge Level** will indicate charge in increments of 20% from **20%** to **100%**, as well as **OVER**. A charge reading of **OVER** indicates a charge above expected, and should be considered beneficial.

When the battery charge is low, the **LO BAT** indicator on the HSS is illuminated. If this warning is ignored, the HSS will eventually turn off, and the HAPSITE (or laptop, if used) will display a message stating that communication is lost.

Battery replacement should be performed between sample runs, and in a dry and non-hazardous environment, since the front door must be opened.

1 Open the front door and turn off the HSS by pressing the **POWER** switch located behind the front door.

HINT: The HAPSITE and laptop, if connected will display a message that communication has been lost.

2 Hold the HSS instrument in place and push the installed battery further into the slot to free the latch.

3 Press the black button above the battery and hold while releasing the battery. The springs will push the battery out, and the battery can be easily withdrawn from the slot.

4 Place a charged battery in the slot, making sure the lettering is right-side up.

5 Press the battery into the slot until snug. The latch inside the slot will lock the battery in position when properly installed.

6 Turn on the HSS by pressing the **POWER** switch located behind the front door.

NOTE: The HAPSITE and Laptop, if connected, will reestablish communications with the HSS.

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13.3.6 Replacing The HSS Nitrogen Canister

Replacement of the Nitrogen Canister is on an as needed basis. When the pressure is below approximately 140 kPa, the canister will need to be replaced with a new nitrogen canister. Replacement should be performed between sample runs, and in a dry and non-hazardous environment, since the front door must be opened.

To change the Nitrogen Carrier Gas canister:

1. Open the front door of the HSS and locate the Nitrogen canister.
2. Press the black release tab on the left side of the Nitrogen canister and the canister will partially pop out.
3. Remove the canister from the slot. A slight twist may be necessary to remove can.
4. Remove the plastic protective cap from a new Nitrogen canister and insert into the canister slot.
5. Press and hold the black release tab while pushing the canister until the canister stops, then release the tab. The canister should be snug and locked in place.

WARNING

Do not refill the canisters after use. These canisters are disposable and not designed for re-filling. Canisters may fail upon refilling, causing bodily injury.

13.4 Shipping the HSS

The HSS can be readily shipped to a field location. The cardboard box in which the HSS was received, together with the cut-foam end-caps can be reused. A reinforced plastic shipping case (IPN 931-406-P1) is also available.

Before shipping the HSS, place an empty vial in one of the wells and insert the needle in it, for protection. Remove the battery and the canister. Install the protective caps. No other steps are required to prepare the HSS for shipment.

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13.5 Charging the HAPSITE Battery using the HSS

HAPSITE batteries may be charged one at a time using the HSS.

To charge a battery, connect the HSS to remote power using the AC-to-24 V(dc) adapter. Turn on the HSS by pressing the power toggle switch inside the front door. Insert the battery to be charged into the battery compartment, with the lettering right-side-up, until the battery is engaged.

Leave the HSS power on until the battery is fully charged. The battery should take approximately 12 hours to fully charge. The approximate level of the battery's charge can be monitored by pressing the **TEST** button on the battery. The battery level is indicated in 20% increments. Refer to section 2.12, Batteries, on page 2-47 for additional information on batteries.

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Chapter 14
SituProbe

14.1 SituProbe

The SituProbe™ Purge and Trap System is a sampling accessory for the HAPSITE® Smart Plus portable GC/MS used for in-situ testing of volatile organic compounds (VOCs) in water. When used in combination with the HAPSITE, the SituProbe accessory performs water analyses for qualitative and quantitative results in the field. The SituProbe can be configured for unattended continuous sampling as well as user-initiated, manual sampling.

The HAPSITE GC/MS is designed to analyze volatile organic compounds in air. Therefore, the water sample VOCs must also be introduced to the HAPSITE in the gas phase. The SituProbe uses Nitrogen to create a headspace in the probe and to purge VOCs from the water sample. The Nitrogen purge gas collects in the headspace at the top of the probe head. A portion of the headspace, containing the VOCs, is sampled by the HAPSITE for analysis.

Unknown VOCs are tentatively identified using the National Institute of Standards and Technology (NIST) mass spectral library. Known VOC compounds can be quantified when a calibrated target compound library is included in the analytical method.

14.2 Theory

The SituProbe and HAPSITE is a dynamic purge and trap system. The SituProbe purges the VOCs from the water sample while the HAPSITE collects those VOCs on an absorbent trap or in a fixed volume Sampling Loop within the HAPSITE. The accumulated VOCs are subsequently desorbed from the trap or flushed from the sampling loop and analyzed by the HAPSITE.

To purge VOCs from the water sample, Nitrogen gas bubbles are introduced at the bottom of the SituProbe purge tube. The bubbles rise approximately five inches through the water and collect in the headspace at the top of the purge tube. As the bubbles rise through the water sample, a portion of the VOCs pass from the water phase to the gas phase. The technical term for this transition is "partitioning". The ratio of the VOC concentration in the water phase, VOC_{water}, to the concentration in the gas phase, VOC_{gas}, is the partition coefficient. See equation [1].

$$\text{Partition Coefficient} = \frac{VOC_{water}}{VOC_{gas}} \quad [1]$$

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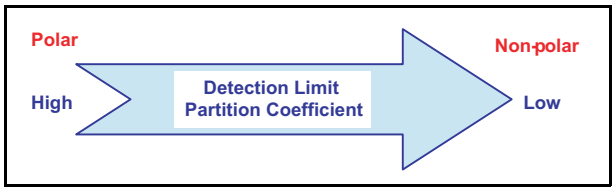
Each compound will partition according to its solubility in the water phase and its vapor pressure. Because only the headspace (gas phase) is sampled for the HAPSITE analysis, the quantity of VOCs and therefore the detection limits are dependent on the partition coefficient. Furthermore, each compound will have a unique interaction with the specific water sample matrix and temperature, making the partition coefficient dependent on the sampling conditions. Analyte response is determined largely by the partitioning coefficient.

Solubility is determined by the polarity of the VOC molecule. Water is a polar compound and therefore the more polar VOCs are more soluble in water. The polar VOCs will partition more in the water while the less polar VOCs will readily volatilize out of the water and partition more into the gas phase. Therefore, it is expected that on a scale of more polar to less polar VOCs, as VOCs become less polar, detection limits will decrease. See Figure 14-1.

Figure 14-1 Detection Limits



In combination with the purging characteristics described above, the duration of the purge and trap event will determine the quantity of each analyte collected on the trap. Analyte response is directly related to the analyte mass collected for analysis.

14.3 Physical Specifications

Dimensions (L x W x H)	14.25 in x 15.5 in x 7.5 in (362 mm x 394 mm x 191 mm)
Transfer line	4 ft (1.2 m) with LEMO® connectors
Probe line	6 ft (1.8 m) with LEMO connector and quick-connect for nitrogen purge gas
Weight (including battery)	30 lb (13.6 kg)
External Carrier Gas Input	1/8 in Swagelok® miniature quick-connect at the back of unit. Accepts 60-100 psi input pressure (approx. 420-700 kPa).

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14.4 Operating Specifications

Environmental Temperature	Operating: 5 to 45°C, 0-95% RH (non-condensing) Storage: -40 to 70°C (stored dry)
Water Sample	
Temperature	5 to 30°C Above 26°C, Dry Purge may be extended
Conductivity	ionic conductivity is used to sense the proper water level in the probe head before starting the analysis. Therefore, the water sample must exhibit conductivity before the analysis can begin. Very pure water, such as deionized or distilled water, may require the addition of a salt before the analysis sequence will start.
pH Range	2-11
Probe Depth	minimum, 5.5 in (140 mm) maximum, 18 in (457 mm)
Heated Zones	
Probe	30 to 60°C
Oven	30 to 60°C
Transfer Line	30 to 60°C 80°C during Flush Mode (External Power Only)
Practical Quantitation Limit	ppt to ppb, based on HAPSITE configuration and method parameters
Internal N2 Carrier Gas:	Standard HAPSITE (770 kPa) N2 disposable can
Power Requirements	
DC Power	24 V(dc) ±5% via HAPSITE Power Adapter 80 W maximum
Battery Power	Standard 19.2 V(dc) HAPSITE battery. Flush mode not recommended on battery power.
Software	HAPSITE Plus IQ Software

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14.5 Consumables

14.5.1 Compressed Nitrogen

A source of pressurized, ultra high purity Nitrogen is required for sample purging and analysis. Nitrogen delivered by on-board canister or an external Nitrogen source, regulated to 60-100 psi (approx. 420-700 kPa), may be connected through the 3/16 in Swagelok quick-connect fitting located at the back of the instrument.

External ultra high purity Nitrogen cylinders must meet the following requirements:

- less than 50 ppb VOCs
- less than 40 ppm Argon

The default methods for the SituProbe consume approximately 370 mL of Nitrogen per run. Therefore, approximately 8 samples can be collected from a full Nitrogen Gas canister. For mobile, in-the-field sampling, a 110 L bulk tank of Nitrogen is available. Larger bulk cylinders of ultra high purity Nitrogen, e.g., 300 ft^3, can be used in fixed locations.

WARNING

Nitrogen gas canisters are under pressure.

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14.6 Heated Zones

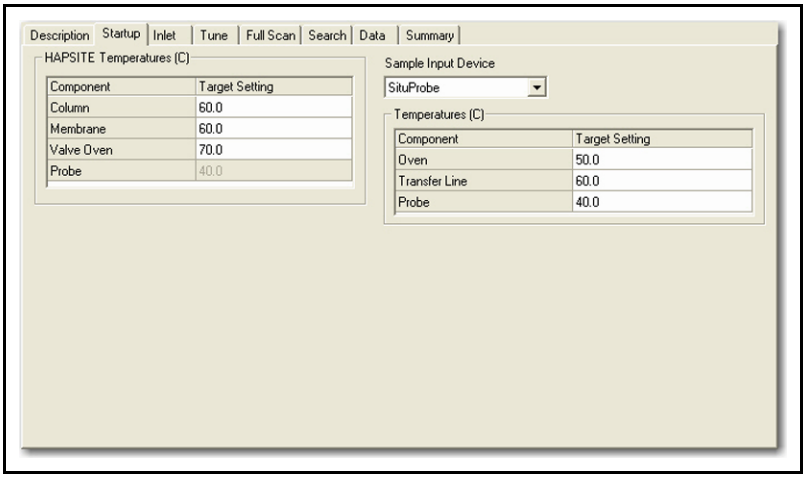
There are several heated zones that must be maintained when operating the SituProbe to keep VOCs and moisture from condensing in the sample pathway. The temperature zones are set through the HAPSITE Plus software and are implemented with the start of the method. See Figure 14-2. The method will not advance until the zones are heated to the correct temperatures. Once a method is started and the zones are heating, the Transfer Line can be disconnected at the HAPSITE without affecting the SituProbe's heat-up process. Therefore, anytime the SituProbe is disconnected from the HAPSITE it will maintain the heated zones and be ready for immediate use when re-connected.

The table below contains information on each of the heated zones — their typical operating and input range of temperatures.

Table 14-1 Heated Zone Temperatures

Heated Zone	Default Operating Temperature (°C)	Temperature Range
Oven	50	30 - 60
Transfer Line	60	30 - 60
Probe	40	30 - 60

Figure 14-2 Method Editor Page for Entering Temperature Settings.



14.7 Valves and Sequences

The SituProbe follows a fixed sequence of events to volatilize, transfer, and collect the water sample VOCs for HAPSITE analysis. The order of these events cannot be changed, however the duration of each event can be adjusted (within ranges) to meet the application's analytical requirements.

The SituProbe accessory module contains heated valves and tubing to direct sample and Nitrogen flows in the process of collecting and transferring sample VOCs. The source of Nitrogen used by the SituProbe is either the onboard canister mounted in the module or a pressure regulated bulk cylinder supplied through the quick-connect at the back of the module. Nitrogen is not provided by the HAPSITE for SituProbe operations.

Before the method will start, the Sampling Probe must be properly immersed in the water sample, as sensed by the conductivity electrodes and indicated by the LED display on the front of the SituProbe.

14.7.1 Headspace

CAUTION

Without a headspace, the instrument could pull water into the system.

The first operation is to create a headspace in the sampling probe. For five seconds, a flow of nitrogen is directed from the SituProbe module, through the sampling line and through the center of the probe head. The sample water level is pushed down to the upper holes in the purge tube, creating the headspace volume.

14.7.2 Purge

Valves in the SituProbe are set to provide Nitrogen to the long tube at the bottom of the probe purge tube. Simultaneously, the HAPSITE sample pump starts, and the Nitrogen purging through the sample is drawn out through the center opening of the probe head, through the SituProbe, and to the HAPSITE. The Nitrogen purge flow rate must exceed the HAPSITE's sample pump flow rate to maintain the headspace. As a safety feature, if the headspace decreases and the water reaches the upper conductivity electrode, a valve in the SituProbe module will open to prevent water from being drawn into the system.

During sample purging, the SituProbe provides a continuous flow of sample VOCs to the HAPSITE. The HAPSITE's configuration determines whether the VOCs are simply purging the sample pathway or are being collected on a Concentrator. When

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a Concentrator is installed, the HAPSITE's sampling pathway initially bypasses the Concentrator and then switches to sampling through the concentrator for the time period specified in the method.

14.7.3 Dry Purge

For a HAPSITE method that utilizes the Concentrator, a dry purge event follows sample collection to expel moisture from the Concentrator. The SituProbe provides a nitrogen flow of approximately 20 mL/min through the transfer line and the HAPSITE's Concentrator, sample pump, and exhaust port pathway.

This completes the SituProbe sampling portion of the analysis. The HAPSITE continues with the analysis as it would for any other collected air sample.

14.8 SituProbe Operation

14.8.1 Headspace Creation

A series of several system checks are initiated when a SituProbe method is started. One of the most critical conditions to check is the presence of a headspace in the sampling probe. VOCs will be collected into the headspace, but more importantly the headspace volume must be maintained throughout the sampling process to prevent the water sample from being pulled into the SituProbe module and the HAPSITE.

The water level in the Sample Probe is determined by conductivity measurements from electrodes located in the sampling probe head. The state of the electrode sensors is displayed through the LEDs mounted on the SituProbe accessory. At the start of a method, the system will always attempt to create a headspace or reinforce an existing headspace by flowing Nitrogen gas into the probe head for five seconds. The headspace creation step is not part of any method's events and does not require any operator input. If the water level is within the proper range, the method will continue. Otherwise, the method will stop and require operator attention to correct the water level error before proceeding.

14.8.2 Purge Rate Adjustment

Following headspace creation is the SPLoopFill event. During this event, Nitrogen purges into the probe sampling tube while the HAPSITE's sample pump begins sampling from the headspace. The purge rate must exceed the sample pump rate to maintain the headspace volume. Adjust the purge flow by changing the "SituProbe Flow Pres." (pressure) parameter in the method editor. See Figure 14-3. Increasing the parameter value will increase the purge flow rate. The purge flow setting will be correct when a few bubbles are observed exiting the upper holes in the purge tube during the sampling events (sample pump ON). See Figure 14-4. Once the proper setting is determined, it can be used for all methods.

NOTE: The parameter change can only be made between runs.

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Figure 14-3 Method Editor Screen for a Default Open Loop Method

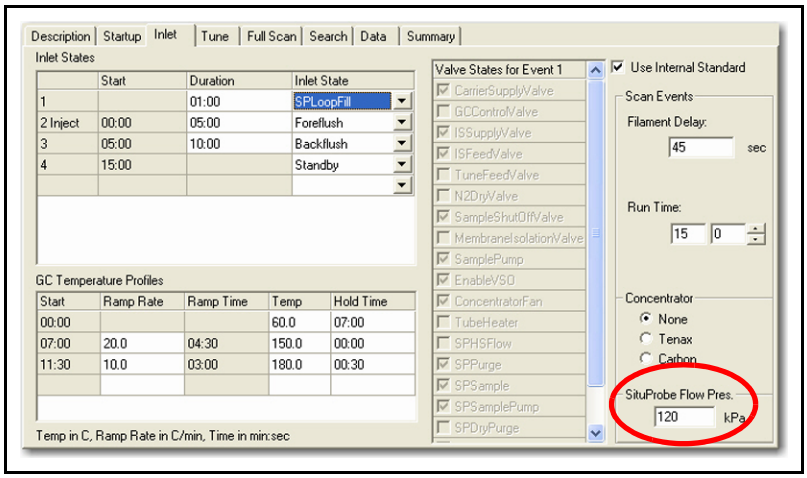
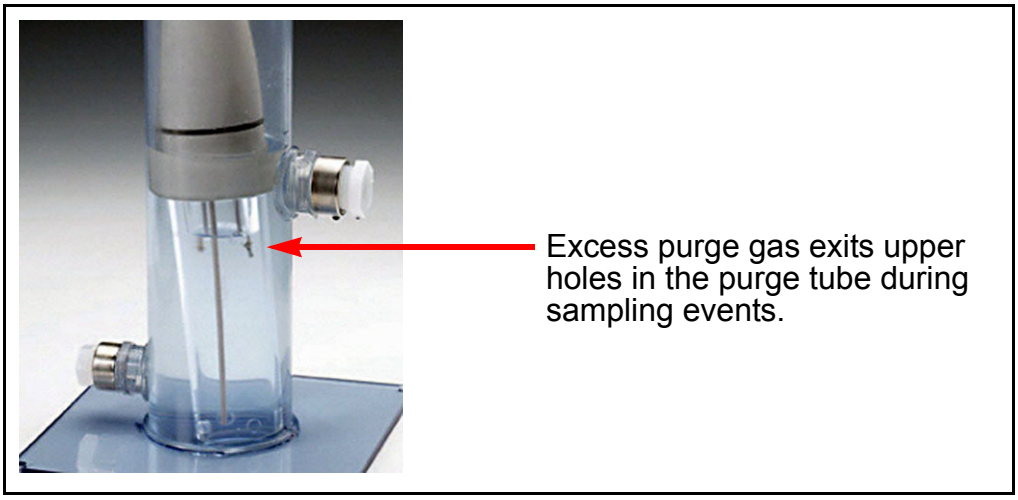


Figure 14-4 Purge Tube



14.8.3 Method Events

The HAPSITE can be configured for either Loop or Concentrator sampling of the SituProbe's headspace. Separate methods and events are required for these configurations. For more information regarding Loop and Concentrator method events refer to Chapter 11, Method Editor.

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14.9 Background Cleanup

14.9.1 Introduction

The SituProbe / HAPSITE system, with Concentrator installed, routinely detects VOCs at the ppt level. Occasionally, an operator may unknowingly expose the system to an excessively high VOC level resulting in carryover in subsequent blank analyses. The chromatogram indications of carryover can be broad baseline increases or individual peaks of the analytes or other matrix VOCs that persistently appear. Polymer components such as PEEK™ tubing in Transfer Lines and Teflon® in Diaphragm Valves are likely sources of carryover. If the background persists after a few blank runs with clean water then more aggressive measures may be required.

14.9.2 Cleanup Steps

14.9.2.1 Probe Head

Because the contamination must originate with the water sample, the probe head should be cleaned. Thoroughly rinse the probe head with VOC-free water. Unscrew the glass or plastic purging sleeve being careful not to damage the other components in the probe head. The sealing o-ring can also be removed and rinsed with water. Clean the sleeve in detergent followed by thorough rinsing with VOC-free water. Gently wipe the probe head components and surfaces that show signs of contamination. Re-install the purging tube.

NOTE: The purge tube and o-ring are replaceable items.

14.9.2.2 HAPSITE

A simple troubleshooting step will determine if the contamination is in the HAPSITE as well as the SituProbe. Disconnect the transfer line from the HAPSITE and attach the air-sampling probe. Perform a blank run while sampling clean air or Nitrogen and compare the background and/or contamination peaks to the SituProbe blanks. Repeat once or twice if necessary. If the contaminant is only in the SituProbe, then continue directly to the SituProbe cleanup procedure below. If the contaminant is in the HAPSITE, then the HAPSITE and SituProbe will require the cleanup procedure. The HAPSITE should be baked out by setting the heated zones to higher temperatures for a few hours, followed by blank runs using a HAPSITE Loop method or a default HAPSITE "cleanout" method (air-probe sampling, Concentrator installed) as appropriate.

14.9.2.3 SituProbe FLUSH

The SituProbe has a built-in FLUSH mode for system cleanup. To prepare for this operation, remove the transfer line at the HAPSITE connection. Leave the transfer line connected to the SituProbe. Remove the probe head from the water vessel and lay it on a clean surface. If possible connect the SituProbe to a bulk Nitrogen cylinder, although an on-board canister can be used for shorter periods of time.

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Open the SituProbe front door and press the FLUSH switch. The SituProbe will increase the temperatures of the heated zones and actuate valves to Nitrogen flush all sample pathways. This process will continue until the the FLUSH switch is pressed a second time or the system runs out of Nitrogen gas. The system should be flushed for a minimum of at least one hour to as long as overnight, depending on the level of contamination. An installed Nitrogen gas canister will provide approximately two hours of flush time. A bulk Nitrogen cylinder is recommended for a longer flush times.

14.10 Operating Tips

14.10.1 Reducing Background

Operator judgment is the first and best means of reducing background and carryover contamination in the SituProbe.

14.10.1.1 Sampling Precautions

Avoid immersing the probe into an organic phase indicated by a sheen on the surface of the water phase. Alternatively, try locating a less contaminated sampling area or collect a sample from below the surface with a separate sampling vessel. In addition to the analytes of interest, consider all VOCs that may be present in the water sample.

14.10.1.2 Expected Concentration

Select a Loop or Concentrator method based on detection limit requirements. Prepare and analyze standards within the concentration operating range of the SituProbe/HAPSITE configuration.

When using a Concentrator method, set an appropriate ConcFill event time for the expected VOC concentration range and detection limit requirements. Collecting on the Concentrator for longer than required will unnecessarily emphasize background interference.

Analyze clean water blanks on a regular basis to purge the system and monitor the background level for use in interpreting sample data.

14.10.2 Nitrogen Usage

The Nitrogen supply to the SituProbe is only consumed during sample analysis. There is no Nitrogen usage between sample runs. Nitrogen is consumed during headspace creation, sample purging, and dry purge events. The operator has control over the timing of the last two events. The sample purging events consume the most nitrogen because the flow rate must exceed the HAPSITE sample pump flow rate. Nitrogen sample purge usage can be managed in two ways:

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- The SituProbe Flow Pressure method parameter should be set to supply an excess of a few nitrogen bubbles exiting the upper holes in the purge tube during the purge event.
- Sample purge time should be set to the minimum time required to properly purge and equilibrate the sample pathway and to collect the proper amount of sample for concentrator methods. Experience with the analysis will determine the correct timing.

The dry purge Nitrogen (Concentrator methods only) flow is fixed at approximately 20 mL/min, but the event time can be controlled. The amount of moisture collected on the Concentrator during sample purging will depend on the water sample's temperature and the length of the ConcFill event. When moisture from the Concentrator exits the analytical column and crosses the membrane into the mass spectrometer, the MS pressure reading rises. Therefore, the amount of moisture left on the Concentrator, prior to thermal desorption, must be managed to keep the MS pressure within the software controlled limits. The proper dry purge time should be empirically determined for the sampling conditions.

14.11 Calibration Standards

14.11.1 Introduction

Custom and ready-to-purchase calibration mixes may be purchased from a variety of vendors. These calibration mixes are prepared in a water-soluble matrix such as methanol for easy dilution into a known volume of water. The standard matrix must be water soluble to evenly disperse the analytes. The low molecular weight of methanol is below the normal scan range and therefore it is not detected by the HAPSITE's mass spectrometer.

14.11.2 Standard Preparation

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Commercially available calibration mixes are a reliable and convenient source for calibration standards. These standards are normally received in flame sealed glass vials that are easily opened by snapping the flame sealed end and transferring the contents to a screw-cap vial with a septum seal.

The water standard is prepared for immediate use by transferring a measured quantity of the standard mix, with a syringe, into a known volume of VOC free water. The transfer volume of the typical spiking process is a few microliters of the standard mix into one liter of water. Two acceptable spiking techniques are:

1 Prepare the standard directly in the purging vessel. See Figure 14-5.

1a Transfer a known volume of water into the purging vessel. The water level must meet depth specifications with the probe immersed.

1b Draw the required volume of standard mix into a syringe.

1c With a stirrer, begin swirling the water. Remove the stirrer and rapidly dispense the standard below the water surface.

1d Quickly withdraw the syringe and allow a few seconds for the standard to disperse with the water's movement.

1e For Internal Standard calibration, a second spike of the Internal Standard mix can also be added.

1f Immerse the probe and immediately begin the analysis to avoid loss of VOCs.

NOTE: The sample purging process removes VOCs from the water sample. Therefore, there can only be one analysis per water standard.

NOTE: The water standard and sample temperatures should be closely matched for similar purging characteristics (partition coefficient). The readout from the temperature sensor in the probe is displayed on the HAPSITE and PC for easy temperature monitoring. An Internal Standard spike into the water will correct for some temperature variations.

Figure 14-5 Standard spiking into a purge vessel.

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2 Prepare the standard in volumetric glassware.

2a Follow the above procedure for spiking the standard into the measured volume of water.

2b Stopper the flask and carefully mix by gently inverting a few times.

2c Transfer the flask's contents to the purging vessel without agitation.

2d Immerse the probe and immediately begin the analysis.

14.11.3 Calculations

The following equation can be used to calculate the volume of standard mix that must be injected into the water sample for the desired final concentration of VOCs.

$$\text{Injected Vol. } (\mu L) = \frac{\text{Water Std. Conc. (ng/mL)}}{\text{Calib. Mix Conc. } (\mu g/mL)} \times \text{Water Vol. (mL)} \times \frac{1000\ \mu L}{1\ mL} \times \frac{1\ \mu g}{1000\ ng} \quad [1]$$

Simplified,

$$\text{Injected Vol. } (\mu L) = \frac{\text{Water Std. Conc. (ng/mL)}}{\text{Calib. Mix Conc. } (\mu g/mL)} \times \text{Water Std. Vol. (mL)} \quad [2]$$

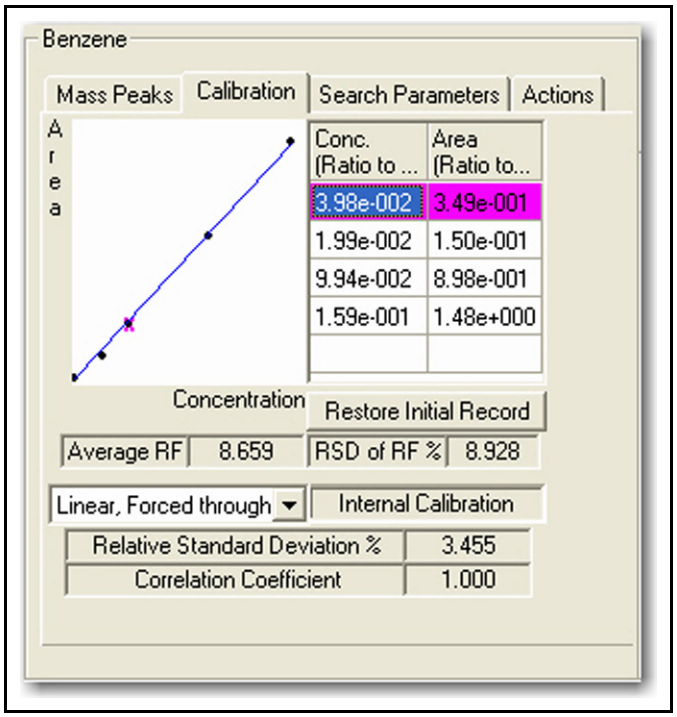
Units: ng/mL (ppb); µg/mL (ppm)

NOTE: The injected standard volume is deliberately small compared to the sample water volume so the sample composition is never significantly altered.

14.12 Calibration Curves

The HAPSITE Plus IQ software accepts single or multiple calibration points in constructing a calibration curve of concentration vs response (target mass area). The number of calibration points used may depend on the application's requirements, method protocol, response curve definition, and the analyst's judgment.

Figure 14-6 Figure 6-3. Multi-Point Internal Standard Calibration



14.13 Maintenance

Periodic cleaning is the only maintenance required for the SituProbe accessory. The Viton® o-ring, between the sample collection tube and the purge head, should be checked and cleaned or replaced as necessary.

14.13.1 Surface Cleaning

Probe head surfaces will eventually become fouled with aquatic and bacterial growth from long-term contact with water samples. Surface coating of the conductivity sensors can result in sensing errors and method termination. Coatings on the sample collection tube and probe head may trap VOCs and contribute to carryover. The sample collection tube can be unscrewed from the purge head and cleaned with soap and water, followed by thorough rinsing with clean water.

NOTE: To remove the sample collection tube, hold the probe head close to the sample collection tube. Unscrew only the sample collection tube. Do not unscrew the probe head. See Figure 14-7.

The o-ring can be cleaned with a lint-free cloth and clean water. Gently wipe the electrodes and probe head surfaces with a wet lint-free cloth. Rinse thoroughly with clean water. Regular cleaning is recommended as a preventive measure.

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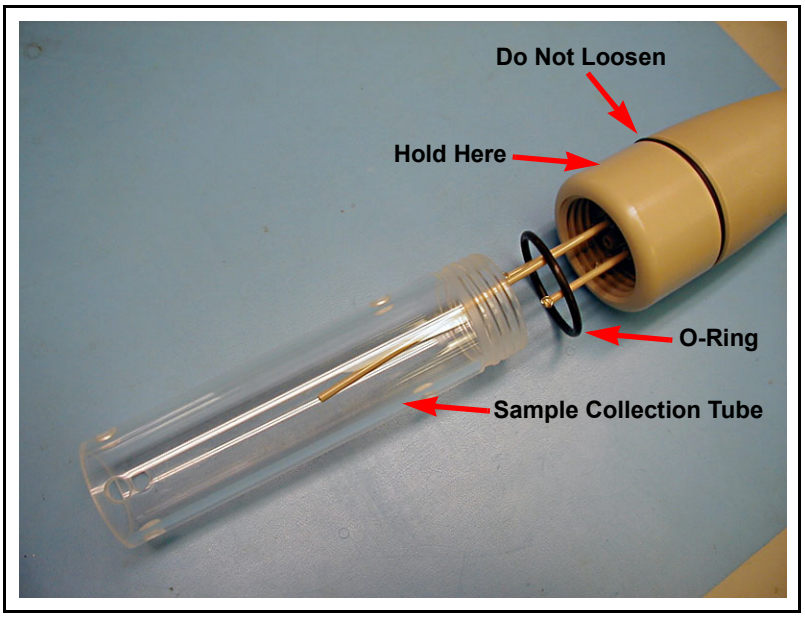
Figure 14-7 Disassembled View of the Sample Collection Tube and Sealing O-Ring



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Chapter 15
Service Module

15.1 Introduction

The Service Module (also called the SM) provides several support functions for the HAPSITE. The Service Module contains pumps that create vacuum for the HAPSITE manifold, both during GC/MS operation in the lab and NEG Pump activation. This vacuum system comprises a Service Module Manifold, two vacuum pumps in series connected by a foreline, a Manifold Vent Valve, Foreline Vent Valve, and controllers to operate and monitor the pumping operations. The Vacuum Interconnect Valve is physically opened and closed from the Service Module. A 24 V(dc) power supply in the Service Module provides the HAPSITE with power. The Service Module also contains backup batteries to provide a controlled shutdown of the Service Module if power is lost.

The Service Module operates using two separate, but connected, pumps. These two pumps are called the Roughing Pump and Turbo Pump.

The Roughing Pump has a two or four stage design, depending on the version. The newer version of the Roughing Pump has four stages. Each stage of the Roughing Pump has a rubber diaphragm which is pushed against a smooth plate several times a second in order to remove air through small holes in the plate. The Roughing Pump is sometimes referred to as a Diaphragm Pump.

The Roughing Pump works in series with the Turbo Pump to create a vacuum (typically about 1e-03 to 3e-03 Pa pressure) which is suitable for operating the HAPSITE Mass Spectrometer.

The Turbo Pump has a set of precision balanced blades which rotate at approximately 1,500 Hz (1,500 revolutions/second), or 90,000 RPM.

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CAUTION

Due to the rotational speed the blades, the Service Module should not be moved while it is operating.

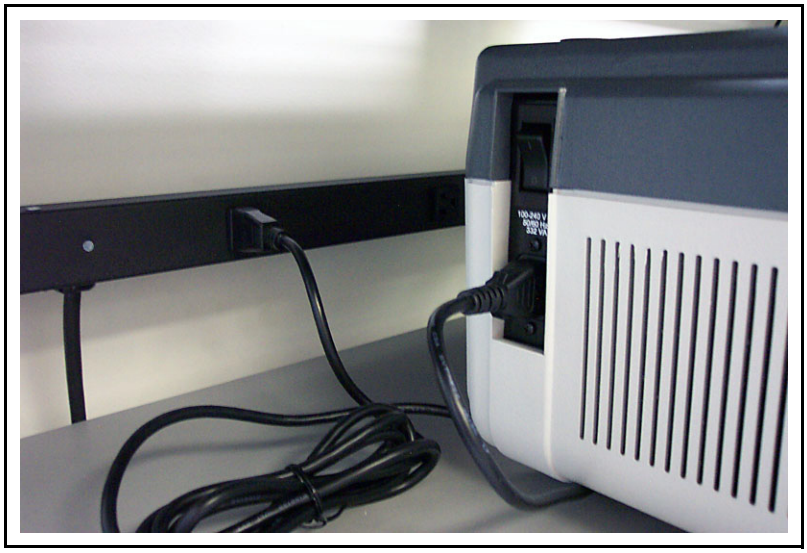
15.2 Service Module Input Power

Service Modules are available in either 110/220 V(ac) (IPN 930-202-G1) or 24 V(dc) (IPN 930-202-G3) input power models. With the exception of input power, both models are identical.

15.2.1 Service Module 110/220 V(ac) Input

The 110/220 V(ac) model operates from 110/220 V(ac) line voltage. See Figure 15-1.

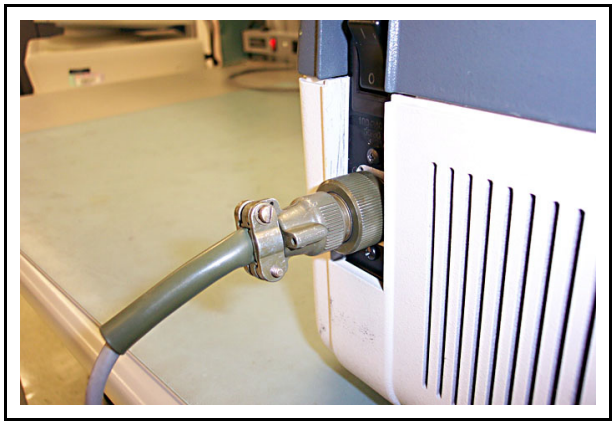
Figure 15-1 Service Module 110 / 200 V(ac) Version



15.2.2 Service Module 24 V(dc) Input

The 24 V(dc) model operates from an external 24 V(dc) power supply. See Figure 15-2.

Figure 15-2 Service Module 24 volts



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15.3 Components of the Service Module

The following section describes the components of both Service Module models.

15.3.1 Backup Batteries

NOTE: The Service Module contains two 12 V(dc) (24 V(dc) total) lead-acid gel cells that will safely shut down the Service Module when power is lost. This includes closing the Vacuum Interconnect Valve (if necessary), venting the Service Module manifold, and a controlled shutdown of the electronics. This procedure takes about 30 seconds, during which the **POWER** indicator on the Service Module display will remain illuminated.

CAUTION

When power is regained after a loss, all operations that were interrupted must be restarted by the user.
When the Service Module is turned off by the user, the Service Module will undergo the same controlled shutdown procedure.

NOTE: Backup batteries are kept charged whenever the Service Module is powered.

15.3.2 MDP/Turbo Pump

The Molecular Dispersion Pump (MDP), also known as MDP/Turbo Pump, provides high vacuum to the HAPSITE Manifold. The top speed is 1500 Hertz (90,000 RPM). This is controlled by the MDP/Turbo Pump controller, which is controlled by the Service Module Processor. The pump is lubricated with special vacuum pump oil at its base. Over-temperature protection is built into the pump.

15.3.3 Manifold Vent Valve

The Manifold Vent Valve is located in the middle of the MDP/Turbo Pump. The Manifold Vent Valve is the main vent for the Service Module vacuum system. Normally, the Manifold Vent Valve will vent the Service Module to atmosphere. If it is desired to vent the vacuum system to another gas (dry nitrogen for example), this can be done by connecting the gas supply to the Service Module at the port marked *VENT.* This port accepts an 1/8” OD tube. The maximum gas pressure at this vent should be 10 psig (25 psia).

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15.3.4 Foreline Vent Valve

The Foreline Vent Valve is located in the middle of the MDP/Turbo Pump. This valve vents the foreline to atmosphere through a small orifice. This valve is either off, pulsed, or continuously open, depending on the situation.

The inside surfaces of the vacuum system will absorb water vapor when exposed to the atmosphere. The amount absorbed is a function of the time exposed and humidity. When the Service Module pumps are operated, this water vapor is released and needs to be pumped out of the system. The roughing pump cannot pump this water without aid of periodic venting of the foreline by the Foreline Vent Valve. This is controlled automatically when the operation **Attach HAPSITE** or **Activate NEG** is selected.

CAUTION

The system will not be ready for use until a MDP/Turbo Pump speed of 1480 Hz is reached.

NOTE: Depending on the amount of water vapor present, reaching a pump speed of 1480 Hz may take from five minutes for a dry system to several hours in extreme cases.

The ***TMP*** indicator on the Service Module display will light up ***ACCL*** (accelerate) when the MDP/Turbo Pump is accelerating and ***NORM*** (normal) when the MDP/Turbo Pump has reached 1480 Hertz.

15.3.5 Roughing Pump

The Roughing Pump is a diaphragm pump. During normal operation, this pump will evacuate the foreline to about 3 Torr. This pump is not designed to start when the foreline is under vacuum. Over-temperature protection is provided to the pump motor.

15.3.6 Vacuum Interconnect Valve Actuator

The Service Module contains an actuator for the Vacuum Interconnect Valve. Part of the actuator mechanism operates inside the Service Module Manifold and connects with the HAPSITE when the two are mated. This part of the actuator is driven by a high torque motor through a rotary vacuum feed through.

15.3.7 Battery Charger

The Service Module contains a battery charger that will charge a HAPSITE battery pack. The **CHARGE** indicator on the Service Module display will illuminate while the battery is charging. This light will be extinguished when the charging compartment is empty or the battery is fully charged.

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15.3.8 Power Supply

The Service Module Power Supply is a 24 V(dc) supply that provides power to the Service Module Components and is only available in the 110/220 V(ac) Service Module (IPN 930-202-G1) model. The Service Module Power Supply also supplies power to the Analytical Module when attached. The 24 V(dc) power is not supplied to the electrical connector at the top of the Service Module unless the Analytical Module is connected. The 24 V(dc) Service Module (IPN 930-202-G3) utilizes the external 24 V(dc) power supply to power the Service Module and Analytical Module.

15.3.9 Communications

Communications to the Service Module are made through the electrical connector on the top of the instrument. This is a RS-485 communication port utilized by the HAPSITE and by the PC through the HAPSITE. There is also a RS-232 communication port on the side of the instrument that is used by service personnel.

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15.4 When to Use the Service Module

The Service Module (SM) can be used with the HAPSITE Chemical Identification System to provide vacuum for the Mass Spectrometer manifold. The Service Module is to be used as an alternative to using the NEG pump to maintain a vacuum in the MS manifold.

The Service Module is shown in Figure 15-3.

Figure 15-3 Service Module - Front And Top View

The Service Module is used:

- to change NEG Pumps quickly, without sending the HAPSITE back to the INFICON Service Department.

WARNING

To avoid personal injury, obtain proper maintenance training before attempting to install and activate a NEG Pump.

- as an alternative, or backup method, to using a NEG Pump to provide vacuum for the HAPSITE (i.e., the NEG Pump is not installed).
- to perform troubleshooting operations with guidance from an INFICON service representative.

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15.5 Plus IQ Software for the Service Module

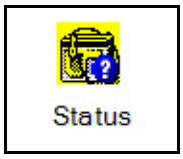
The Plus IQ software for the Service Module can be accessed in three ways from the System Setup View:

- Double-click on the **Service Module** icon. See Figure 15-4.

Figure 15-4 Service Module Icon

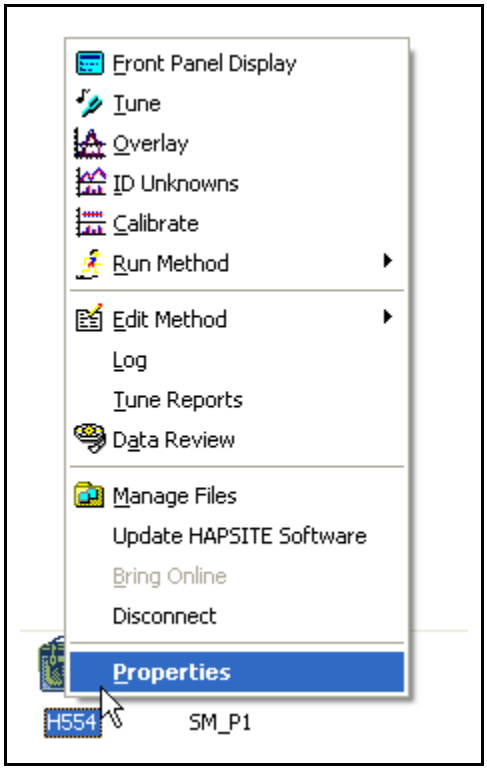
- Double-click on the **Status** icon. See Figure 15-5. Click on the **Service Module** Tab. See Figure 15-7.

Figure 15-5 Status Icon



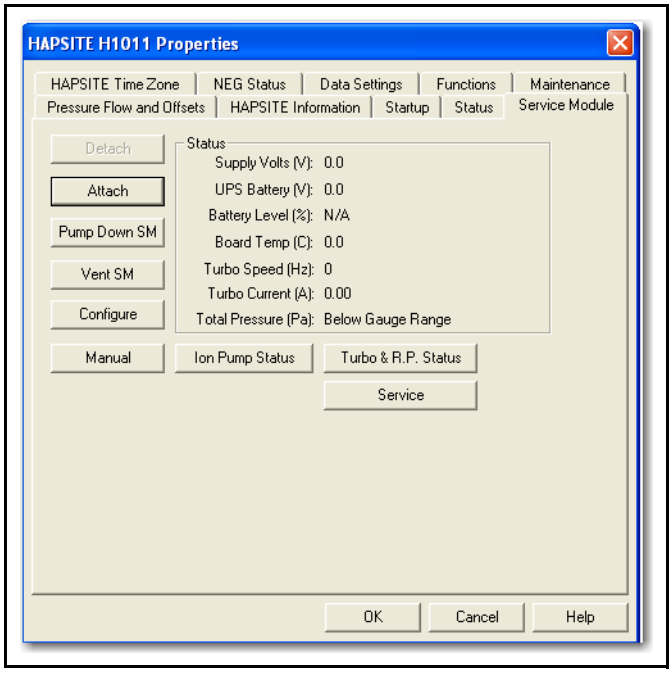
- Click on the **Sensor** icon with the right mouse button. Click on **Properties** with the left mouse button. See Figure 15-6. Click on the **Service Module** Tab. See Figure 15-7.

Figure 15-6 Accessing Service Module in Plus IQ from the HAPSITE Sensor Icon



15.5.1 The Service Module Tab in Properties Window

Figure 15-7 Service Module Tab in Properties Window



The following options are available:

Detach . . . . . Used to release the vacuum between the Service Module and the HAPSITE before physical removal. (Vacuum is maintained in the Mass Spectrometer.)

Attach . . . . . Used to create the vacuum between the HAPSITE and Service Module and within the Mass Spectrometer after physically connecting.

Pump Down SM . . . . . Used to place the Service Module in storage.

Vent SM . . . . . Used to take the Service Module out of storage.

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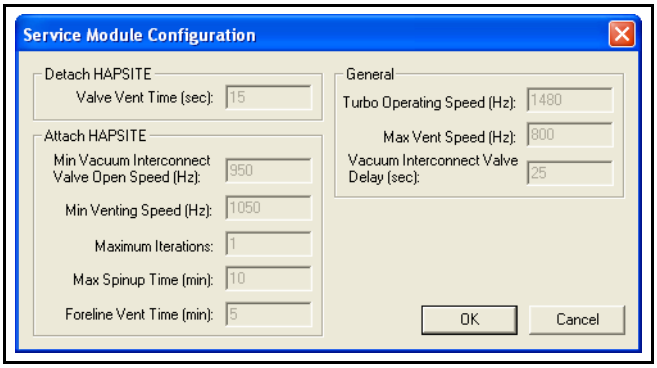
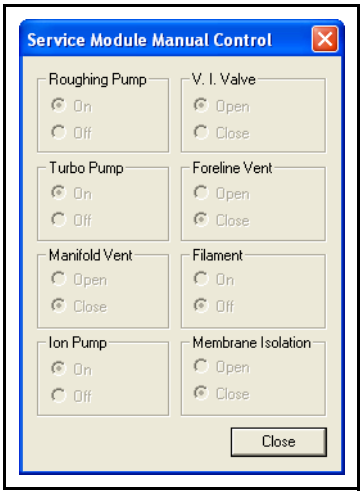
Configure . . . . . Displays control information. See Figure 15-8.

Figure 15-8 Configure Window



Manual . . . . . Displays additional control information. See Figure 15-9.

Figure 15-9 Manual Control Window



Ion Pump Status . . . . . Displays the Ion Pump Status. See Figure 15-10.

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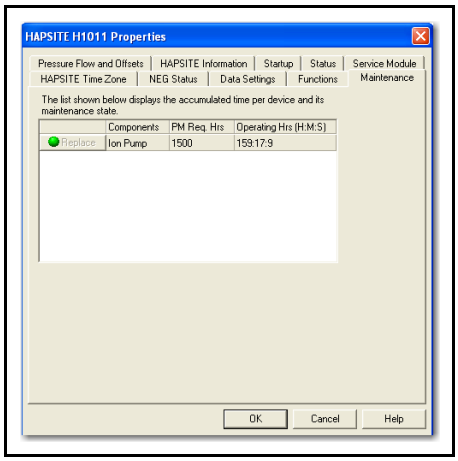
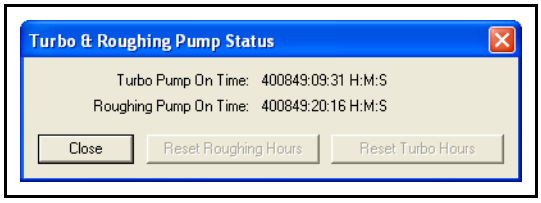
Figure 15-10 Ion Pump Status Window



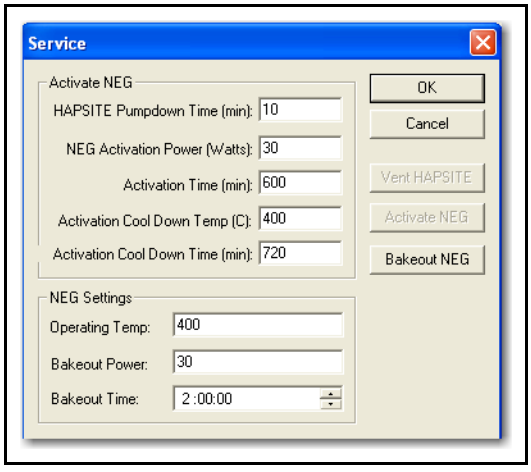
Turbo & R.P. Status . . . . . Displays the Turbo & R.P. Status. See Figure 15-11.

Figure 15-11 Turbo & Roughing Pump Status Window



Service . . . . . Contains controls to Activate NEG, Vent HAPSITE and Bakeout NEG. See Figure 15-12.

Figure 15-12 Service Window



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The following status items are reported in the Service Module tab Properties Window. Refer to Figure 15-7.:

Supply Volts (V) . . . . . The voltage being supplied to the HAPSITE (normally about 24).

UPS Battery (V) . . . . . The Uninterrupted Power Supply (UPS) voltage, nominally 24 V.

Battery Level (%) . . . . . Displays the charge percentage of the HAPSITE battery (inserted in the battery compartment of the Service Module), as a percentage of the nominal design capacity. Displays “No Battery" if a battery is not installed.

Board Temp (C) . . . . . Displays the temperature near the processor board in the Service Module in degrees Celsius.

Turbo Speed (Hz) . . . . . Indicates the speed of the Turbo Pump in Hertz (equivalent to rotational speed in revolutions per second).

Turbo Current (A) . . . . . Indicates the current draw of the Turbo Pump in amperes.

Total Press (Pa). . . . . The vacuum pressure in the Mass Spectrometer in Pascals.

15.6 Starting Up HAPSITE on the Service Module

CAUTION

Damage to the Turbo Pump may result from moving the Service Module while the Service Module pumps are operating.

NOTE: If the Service Module must be moved and the HAPSITE is Attached (Turbo Pump is running), first Detach the HAPSITE. See section 15.8, Detaching the HAPSITE, on page 15-17.

Before turning on power to the Service Module, refer to section 2.8, Service Module, on page 2-19 for the physical setup instructions.

Power for the HAPSITE is provided through the Service Module, as long as the Service Module is connected to a power source and turned on. Turn on the HAPSITE by pushing the **POWER** button on the outside front panel.

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NOTE: If the HAPSITE is already powered on, it does not need to be turned off before placing it on the Service Module.

HINT: The HAPSITE will take approximately 60 seconds to completely power on, or "Boot Up".

WARNING

If the NEG Pump is allowed to heat, the Attach procedure will damage the NEG Pump and may cause injury. To avoid heating, touch STOP PREPARE or using the arrow keys, highlight STOP PREPARE and push OK SEL, when the HAPSITE is starting.

15.7 Attaching the HAPSITE to the Service Module

The HAPSITE should be attached to the Service Module to create the vacuum in the Mass Spectrometer. The alternative method of maintaining vacuum in the HAPSITE is to use an installed and activated NEG Pump. Attaching the HAPSITE involves physically placing the HAPSITE on the Service Module.

CAUTION

Before attaching the HAPSITE to the Service Module, the NEG Pump must be cooled overnight to allow it to reach room temperature.

If the Service Module has been in storage, refer to section 2.8, Service Module, on page 2-19 before proceeding.

The HAPSITE must be turned on before proceeding (refer to section 15.6, Starting Up HAPSITE on the Service Module, on page 15-11). The HAPSITE can be attached to the Service Module using the Plus IQ software, or using the HAPSITE front panel.

CAUTION

When running the Service Module, the left and right side vents must be kept clear to allow free airflow. Air flows from right to left through the Service Module to allow cooling of the pumps. A blockage can prevent the air from cooling the pumps properly and may cause the pumps to shut down to prevent overheating.

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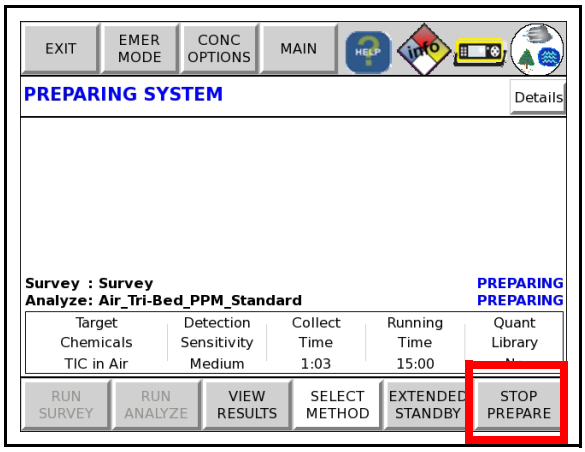
15.7.1 Attaching the HAPSITE to the Service Module using the Plus IQ Software

Be sure to connect the HAPSITE to the Laptop before continuing. Refer to section 2.4.6, Connect Laptop (if desired), on page 2-10, if a connection is needed.

1 Make sure that the HAPSITE does not heat. On the HAPSITE screen, touch **STOP PREPARE** or using the **arrow keys**, highlight **STOP PREPARE** and push **OK SEL**. See Figure 15-13.

Figure 15-13 Stop Prepare Button



2 In Plus IQ, left-click on the desired HAPSITE sensor, then double-click the **Service Module** icon, shown in Figure 15-14.

Figure 15-14 Service Module Icon in System Setup View, after Selecting HAPSITE Sensor

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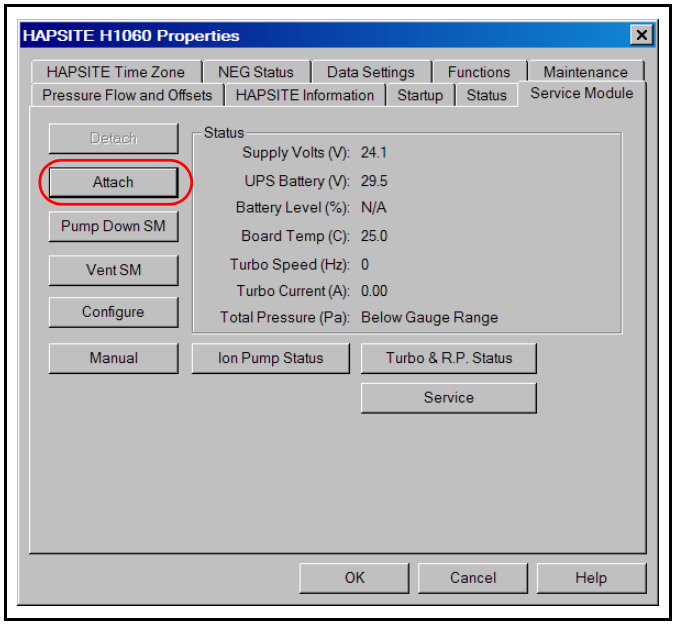
3 Double-clicking on the **Service Module** icon will open the **Service Module** tab in the **HAPSITE Properties** window, as shown in Figure 15-15.

Figure 15-15 Service Module Tab Selected in HAPSITE Properties Window



4 In the **Service Module** tab shown above, select the **Attach** button. A confirmation window will open. Click **Yes**. See Figure 15-16.

Figure 15-16 Attach Confirmation Request

5 The Roughing Pump will start first, then the Turbo Pump will begin to speed up, as shown on the Turbo Speed (Hz) line in Figure 15-15 above (initially listed as 0).

NOTE: The Attach procedure typically takes about 5 minutes to complete.

After selecting the **Attach** button, the **HAPSITE Properties** window can be closed at any time.

While attaching, the following prompt will appear.

Figure 15-17 Attach In Process

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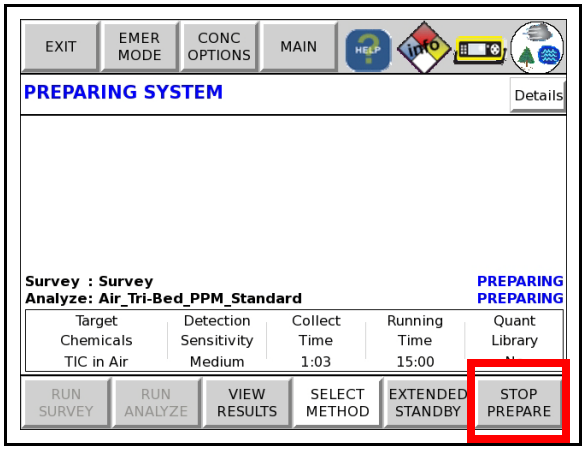
6 When the Attach procedure is finished, the following message will be displayed on the screen.

Figure 15-18 Attach Successful

15.7.2 Attaching the HAPSITE to the Service Module using the HAPSITE Front Panel Controls

1 To avoid running the start up method or AutoTune, touch **STOP PREPARE**. See Figure 15-19.

Figure 15-19 Stop Prepare Button

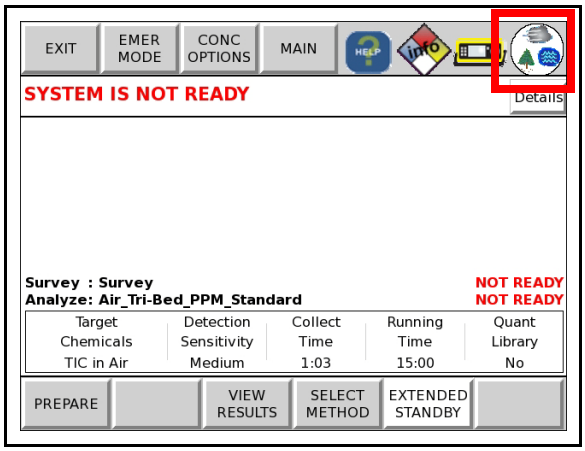


1a If using the push button keys, highlight **STOP PREPARE** with the arrow keys. Push **OK SEL**.

2 The **SYSTEM IS NOT READY!** message will appear.

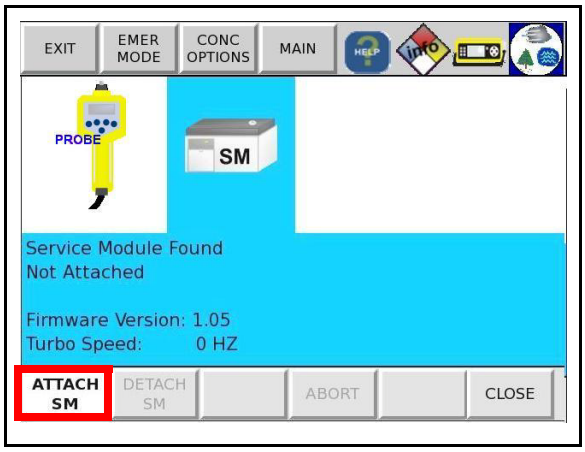
3 Touch the **Accessories** icon or push the **STAT** key until the probe page appears. See Figure 15-20.

Figure 15-20 Accessories



4 Touch the **ATTACH SM** button or using the **arrow keys**, highlight the **ATTACH SM** button and push **OK SEL**. See Figure 15-21.

Figure 15-21 Service Model Attach Button



5 A bar graph displaying the progress of the attach will be displayed.

NOTE: The **ATTACH SM** button will become grayed out.

6 When the Attach has successfully completed, the **Service Module Attached** message will be displayed. See Figure 15-22.

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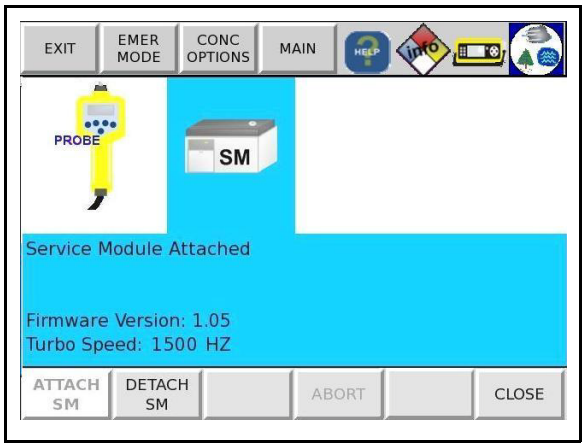
Figure 15-22 Service Model Attached



15.8 Detaching the HAPSITE

Detaching the HAPSITE allows the safe removal of the HAPSITE from the Service Module. The Detach procedure ensures that the interconnect plug on the HAPSITE is closed at the proper time, and the two pumps in the Service Module are properly shut down.

The detach procedure can be carried out either using Plus IQ software, or using the HAPSITE front panel display.

15.8.1 Using Plus IQ Software to Detach

1. Be sure to connect the HAPSITE to the Laptop using a crossover cable before continuing. Refer to section 2.4.6, Connect Laptop (if desired), on page 2-10 if a connection needs to be made.
2. In Plus IQ, left-click on the HAPSITE sensor to detach, then double-click the **Service Module** icon, shown below in Figure 15-23.

Figure 15-23 Service Module Icon

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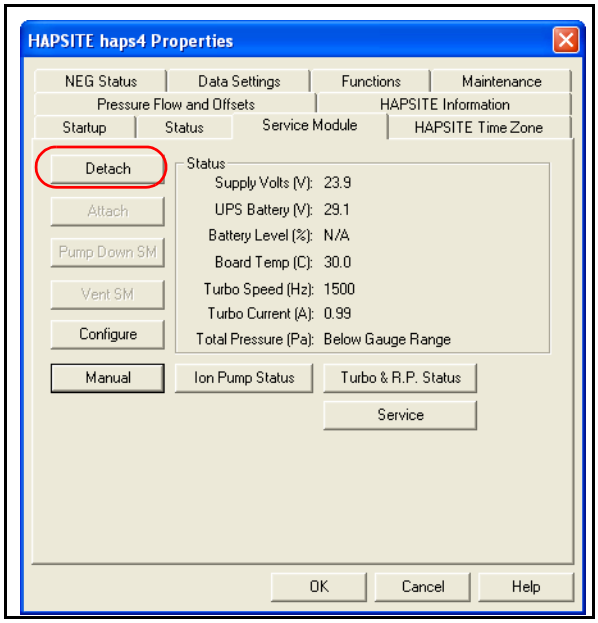
3 Double-clicking on the **Service Module** icon will open the **Service Module** tab in the HAPSITE Properties window, as shown in Figure 15-24.

Figure 15-24 Service Module Tab Selected in HAPSITE Properties Window



4 In the **Service Module** tab shown above, select the **Detach** button. A message will appear looking for confirmation to detach the HAPSITE, as shown in Figure 15-25. Select **Yes**. A **Detaching Service Module** message is displayed. See Figure 15-26.

Figure 15-25 Detach HAPSITE Confirm Window

Figure 15-26 Detach In Process

5 The HAPSITE Vacuum Interconnect valve will close shortly after selecting **DETACH**.

NOTE: The detach procedure typically takes about 3 to 5 minutes to complete.

NOTE: After pressing the **Detach** button and selecting **Yes** on the confirm window, the HAPSITE **Properties** window can be closed.

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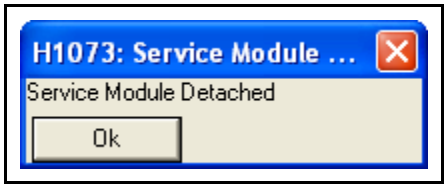
6 When the Detach procedure is complete, a message will appear confirming a successful detachment. See Figure 15-27.

Figure 15-27 Detach Successful



NOTE: To place the Service Module in storage see section 15.10, Storing the Service Module, on page 15-20.

15.8.2 Using the Front Panel Display to Detach

1 Touch **Menu** or push **MENU**.

2 Touch the **PROBES & SM** icon. Alternately, push the **STAT** button until the **PROBES & SM** page is displayed.

3 Touch the **DETACH SM** button. Alternately, using the **arrow keys**, highlight the **DETACH SM** button. Push **OK SEL**

4 A bar graph displaying the progress of the Detach procedure will appear on the front panel of the HAPSITE.

5 The message **Service Module Found, Not Attached** will be displayed on the screen.

CAUTION

Wait until the Turbo Speed reads zero before physically removing the HAPSITE from the Service Module.

6 To place the Service Module in storage, see section 15.10, Storing the Service Module, on page 15-20.

15.9 Physically Removing the HAPSITE from the Service Module

The HAPSITE cannot be physically removed from the SM until a "Detach SM" has been performed. Refer to section 15.8, Detaching the HAPSITE, on page 15-17 before physically removing the HAPSITE from the Service Module.

After the HAPSITE has been detached from the Service Module, release the latches on each side of the Service Module.

HINT: To continue using the HAPSITE, place a charged battery in the HAPSITE or connect exterior power before removing the HAPSITE from the docked position on the Service Module.

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Physically remove the HAPSITE from the Service Module. Lift the HAPSITE off the Service Module in a straight, upward direction. Once the HAPSITE is undocked, replace the yellow plastic protective cover on the bottom of the HAPSITE, as shown in Figure 15-28.

Figure 15-28 Placing Yellow Protective Cover on Bottom of HAPSITE

This yellow cover is used to keep out dust and debris, as well as keep the opening dry during decontamination.

15.10 Storing the Service Module

When not attached to the HAPSITE, the Service Module should be stored with the aluminum storage plug in place. To store the Service Module in this configuration, a Pump Down procedure which turns on the Roughing Pump for 60 seconds to create a partial vacuum, is performed. The vacuum holds the aluminum storage plug in place. The plug protects the Service Module from dust, debris, and moisture, which can negatively affect the performance of the pumps in the Service Module.

NOTE: If the HAPSITE is Attached to the Service Module, the Service Module must first be Detached. Refer to section 15.8, Detaching the HAPSITE, on page 15-17 before proceeding.

NOTE: The HAPSITE is considered Attached if the HAPSITE is docked on the Service Module, and the Turbo Pump is running at a speed greater than 0 Hz.

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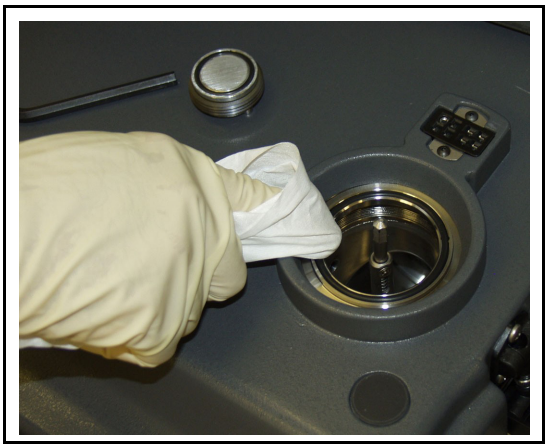
NOTE: Clean any debris or dust from the black rubber o-ring using a lint-free wipe. Wipe the top of the o-ring, following the contour to clean the entire top exposed section. Avoid pushing dust or debris into the middle opening leading to the pumps.

Cleaning the o-ring will help ensure that a good seal to the aluminum storage plug is achieved. The seal allows the system to maintain vacuum more effectively. See Figure 15-29 shows the o-ring being cleaned.

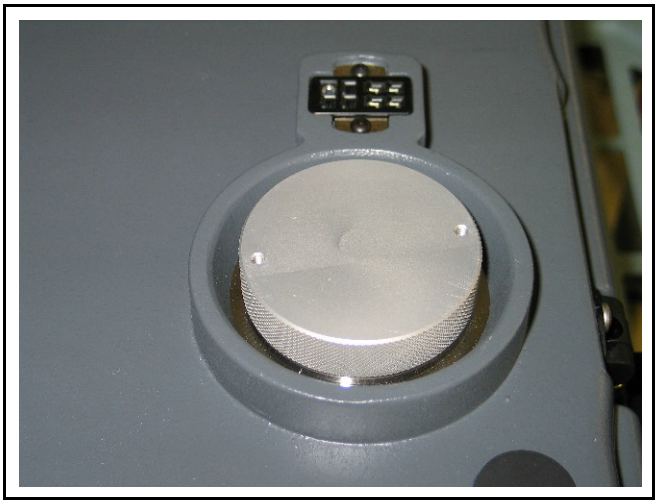
Figure 15-29 Cleaning the Service Module Rubber O-ring using a Lint-free Wipe



After cleaning the rubber o-ring, make sure there are no cuts. Also look for any visible cracking of the o-ring. If the o-ring is damaged, it may need to be replaced.

To place the Service Module in storage, the aluminum storage plug is placed on the opening where the HAPSITE connects, as shown in Figure 15-30.

Figure 15-30 Service Module Aluminum Storage Plug in Place

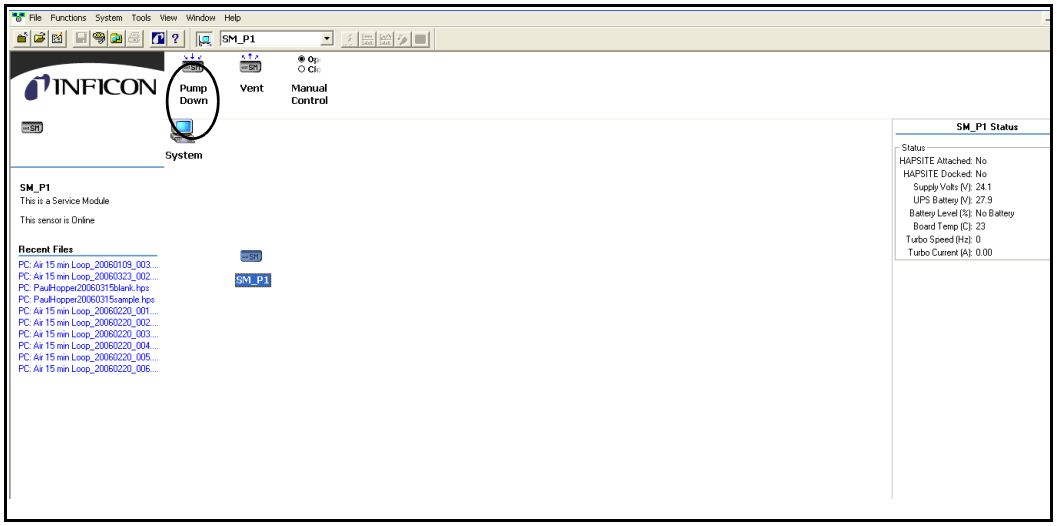


HINT: Confirm the RS-232 communication cable is connected to the Service Module and Laptop. If the RS-232 communication cable is not attached, refer to section 2.8.1, Setting Up the Service Module, on page 2-19 before proceeding.

The Service Module must be pumped down. Open the Plus IQ program.

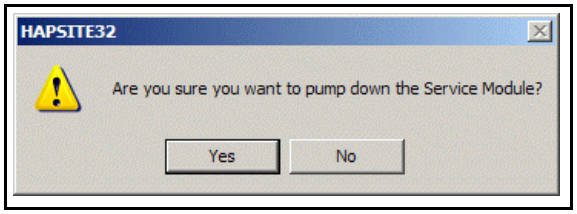
Double-clicking on the **Pump Down** icon will start the pump down process, as shown in Figure 15-31.

Figure 15-31 Service Module Pump Down Button



The prompt shown will appear to confirm pumping down the Service Module. See Figure 15-32.

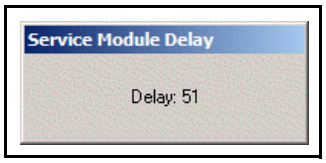
Figure 15-32 Pump Down Service Module Confirm Window



Select **Yes** to pump down the Service Module. A window will appear counting down a sixty second delay while the pump down procedure completes, as shown in Figure 15-33.

NOTE: The Pump Down procedure turns on the Roughing pump for sixty seconds to create a partial vacuum, sealing the aluminum storage plug in place.

Figure 15-33 Pump Down Service Module Delay Screen



After the pump down is complete, place the yellow protective cover on top of the Service Module aluminum storage plug, as shown in Figure 15-34.

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Figure 15-34 Yellow Protective Cover Placed Over Aluminum Storage Plug on Service Module

To complete the Service Module storage procedure, turn off the Service Module power switch at the back left of the instrument.

CAUTION

The Service Module should be stored in a clean and dry area. Avoid storing the Service Module in areas which are outside the temperature range of 40 to 95 °F (5 to 35 °C).

15.11 When Power to the Service Module is Lost

In case of a sudden loss of supplied power, the Service Module will close the HAPSITE Interconnect Plug and shut down the pumps properly. This happens automatically in order to preserve the vacuum in the HAPSITE Mass Spectrometer manifold and to protect the Service Module pumps from being damaged.

When power is restored, the HAPSITE and Service Module must be attached again before the Service Module will provide proper vacuum for the HAPSITE. Refer to section 15.7, Attaching the HAPSITE to the Service Module, on page 15-12.

NOTE: See Chapter 16, Maintenance for additional information on using the Service Module to perform maintenance on the HAPSITE.

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Chapter 16
Maintenance

16.1 Introduction

The HAPSITE is designed to require minimal service. Repairs will normally be carried out at the factory or other INFICON Service Facilities. Preventive maintenance includes cleaning the air filters and replacement of certain consumables.

Additionally, the HAPSITE checks the system components each time a start up is performed, and will notify the user if the following items need to have maintenance performed:

- Turbo Pump usage hours (Service Module)
- Roughing Pump usage hours (Service Module)
- Ion Pump usage hours (HAPSITE)
- NEG Pump usage hours (HAPSITE)

For Turbo Pump, Roughing Pump, and Ion Pump maintenance, service must be performed by a qualified INFICON Service Representative. (See Chapter 18, Customer Support.)

NEG Pump installation and removal is explained later in this chapter.

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16.2 Safety Considerations

WARNING

When operating, the NEG Pump is hot! Do not remove when hot or slightly warm. Always allow NEG to completely cool before removing. Burns may result from handling the hot flange and the NEG will become unusable.

WARNING

Metal alloys within the NEG Pump may ignite if exposed to atmospheric pressure while hot. If ignition occurs, drop pump into a bucket of sand and cover with additional sand. If this is not practical, set the pump on its black plastic base on a non-flammable surface. The NEG Pump will burn out in a few minutes.

WARNING - Risk Of Electric Shock

Whenever accessing the internal components of the Service Module, always disconnect the power cord and remove the battery to reduce the danger of electrical shock.

WARNING - Risk Of Electric Shock

The cover of the HAPSITE should never be removed. No serviceable parts inside.

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16.3 HAPSITE Symptom - Cause - Remedy Chart

Table 16-1 Diagnosing Problems - HAPSITE

Symptom	Cause	Remedy
1. Filament will not turn on (**`Unable to turn on filament error!`** on user interface.)	1a. Remove Ionizer source and check to see if filament has opened.	1a. If opened, replace ion source (see section 16.8, Replacing the Ionizer of the Mass Spectrometer, on page 16-41), otherwise contact Customer Support (see Chapter 18).
2. Filament shut off. (Over pressure fault.)	2a. System shuts down filament if pressure spikes. An old Ion Pump will "burp" N_2 and Ar which can cause the system to shut down.	2a. Replace Ion Pump. Contact Customer Support (see Chapter 18).
	2b. System has an air leak. Turn off carrier gas and check to see if mass 32 is relatively large (10 to 20% of peak 28)	2b. Contact Customer Support (see Chapter 18).
	2c. MDP/Turbo Pump or Roughing Pump may need servicing.	2c. Check Turbo Speed in the Service Module program. Service pumps if speed is less then 1480 Hz, and there are no air leaks.
	2d. NEG Pump is depleted.	2d. Replace NEG Pump using INFICON part # 930-425-P1. See section 16.7 on page 16-21.
3. “Electron Multiplier fault.” message at user interface.	3a. High pressure in vacuum system caused by the failure of the Ion Pump to pump Ar with a NEG Pump installed.	3a. Contact Customer Support (see Chapter 18).
	3b. Short in Electron Multiplier, or fault in high voltage power supply	3b. Contact Customer Support (see Chapter 18).
4. Poor sensitivity in Tune.	4a. Ionizer has degraded.	4a. Replace Ionizer using INFICON part # 930-205-G1. See section 16.8, Replacing the Ionizer of the Mass Spectrometer, on page 16-41.
	4b. Quadrupole/EM assembly has degraded.	4b. Contact Customer Support (see Chapter 18).

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Table 16-1 Diagnosing Problems - HAPSITE

Symptom	Cause	Remedy
	4c. Make sure that there is a full unexpired Internal Standard canister in the GC, and make sure that a Carrier Gas can was not placed into the Internal Standard slot by mistake.	4c. Replace canister with a full Internal Standard Gas can. INFICON Part # 930-433-P6
5. Communication Error - HAPSITE and Laptop are not communicating.	5a. External crossover cable has become disconnected.	5a. Reconnect crossover cable and reboot system if necessary.
	5b. Problem with port on external computer or with the HAPSITE internal communications system.	5b. Contact Customer Support (see Chapter 18).
6. Instrument will not turn on.	6a. Battery is no longer providing power to the instrument.	6a. Check battery charge. Replace battery with a freshly charged one or connect instrument to external supply.
	6b. External supply, Service Module not receiving line power.	6b. Check line power.
	6c. Failure with internal power supplies.	6c. Contact Customer Support (see Chapter 18).
7. Mass spectrum drift with time. Both in resolution and position.	7a. Thermal problem on the high voltage Rf board.	7a. Contact Customer Support (see Chapter 18).
8. Instrument turns on but fails to boot properly.	8a. CPU or hard drive failure.	8a. Contact Customer Support (see Chapter 18).
9. **"Pressure too high to read"** error message at user interfaces.	9a. High background. If components have been changed or instrument vented, H_20 or other trace contamination could cause the base pressure above $1.0x10^{-2}$ Pa.	9a. System should clean itself out after a few hours of pumping. (Best to leave system pumping overnight.) **Note**: The pressure will decrease above the $1.0x10^{-2}$ Pa upper pressure limit while activating an NEG Pump. This will shut down the filament and EM.
	9b. Pressure is high. NEG Pump depleted.	9b. Replace NEG Pump using INFICON part # 930-425-P1. See section 16.7, NEG Pump Removal, Installation and Activation, on page 16-21.
	9c. Ion Pump shorted.	9c. Contact Customer Support (see Chapter 18).

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Table 16-1 Diagnosing Problems - HAPSITE

Symptom	Cause	Remedy
	9d. Check Turbo Speed in Service Module program. If less then 1480 Hz, Service Module pumps may need maintenance or the system may have an air leak.	9d. Contact INFICON (see Chapter 18).
10. **"Pressure too low to read"** message at user interfaces.	10a. Pressure is too low to read. The system pressure gauge can only read down to $1x10^{-4}$ Pa.	10a. Open membrane isolation valve. This will bring the pressure to $1\text{-}3x10^{-3}$ Pa.
	10b. Ion Pump has failed to turn on.	10b. Close and open the membrane valve a few times. If this fails to shock the Ion Pump into starting, contact Customer Support (see Chapter 18).
11. Sample carry-over from one run to the next.	11a. Cold spot in the sampling system.	11a. Check to see if heat zones are at temperature.
12. Internal standard in background.	12a. Low pneumatic (carrier gas) pressure at GC 10-port valve.	12a. Check carrier gas pressure, and replace canister if low.
13. Temperature zones read 99.8 ^{o}C or higher.	13a. Component in the zone is hot.	13a. GCC card has a problem controlling the temperature zone. Contact Customer Support (see Chapter 18).
	13b. Zone is cold.	13b. Sensor could be bad. Contact Customer Support (see Chapter 18).
14. Unable to read memory chips on gas canister.	14a. Poor connections or damaged contact.	14a. Try re-seating canister or try a known good can. If this fails, contact Customer Support (see Chapter 18).
	14b. Processor card failure.	14b. Contact Customer Support (see Chapter 18).
15. Water enters system during decontamination.	15a. Dirt on the gaskets, or improper seal. Clean gasket and check seals.	15a. If problem cannot be corrected, contact Customer Support (see Chapter 18).
16. Poor Gas Chromatographic Peaks/ Poor GC sensitivity.	16a. GC column has degraded.	16a. Contact Customer Support (see Chapter 18).
	16b. Loose connections at sample loop, concentrator or ferrules.	16b. Check to see if fittings and ferrules are properly installed.
17. Temperature zone fails to heat.	17a. Open heater or bad controller card.	17a. Contact Customer Support (see Chapter 18).

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Table 16-1 Diagnosing Problems - HAPSITE

Symptom	Cause	Remedy
18. Retention Time in Chromatograph has drifted.	18a. Unstable carrier gas flow.	18a. Contact Customer Support (see Chapter 18).
	18b. Improper GC heating.	18b. Contact Customer Support (see Chapter 18)
19. "**Low Carrier Gas**" error message at the user interfaces.	19a. Carrier gas pressure is low (pneumatic valve failure can occur.)	19a. Replace with a fresh canister of N_2. INFICON Part Number 930-432-P6.
20. Leaking carrier or internal standard canisters while installed in the HAPSITE AM.		20a. Contact Customer Support (see Chapter 18).
21. Elevated chromatogram baseline.	21a. HAPSITE is contaminated.	21a. See section 16.5, Contamination, on page 16-7.
	21b. Improper baseline and threshold settings.	21b. Set baseline and threshold in Tune.
22. Higher than normal base pressure.	22a. System could be contaminated. Check the background in Tune. Look for excessive amounts of water or abnormal levels of organics in the spectrum.	22a. See section 16.5, Contamination, on page 16-7.
	22b. Slight air leak.	22b. Contact Customer Support (see Chapter 18)
23. Organic contamination in the background of the mass spectrum.	23a. System could be contaminated.	23a. See section 16.5.1, Contamination of the Mass Spectrometer, on page 16-8.
24. Wireless Problem	24a. Connection problem.	24a. Check to see that Wireless is on and that the computer is configured properly. Refer to Chapter 4.

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16.4 Required Environment for General Maintenance

The HAPSITE is designed for use in the field, away from ideal laboratory conditions. However, when the HAPSITE is serviced, appropriate care must be taken to assure the internal components remain uncontaminated. For example, removing and replacing batteries can generally be performed outdoors, as long as rain or foreign materials do not enter the battery compartment. If the HAPSITE is being used in a contaminated hot zone, the HAPSITE must be taken to the decontamination area before the door is opened. Opening the front door breaks the seal of the case and the internal components cannot be decontaminated by simple procedures. In such a situation, even changing batteries should be done in the decontamination area.

Changing the NEG Pump or the ionizer requires the use of the Service Module. This module is not designed for use outdoors. The Service Module should be set up in a relatively clean indoor area with AC power available. When the vacuum flange (where the NEG Pump is installed) is open, ensure dust, moisture, oils, or other contaminants are not permitted to enter the Mass Spectrometer manifold.

CAUTION

Do not touch the inside surfaces of the manifold with bare hands.The natural skin oils will produce an interfering background signal on the HAPSITE's sensitive detection system. The use of cotton gloves is required when handling any part of the manifold system.

16.5 Contamination

Contamination of the HAPSITE is defined as the undesirable introduction of a substance or compound into the instrument. This can consist of anything from water, to organic compounds with high or low vapor pressures, to liquids. Keep in mind that the HAPSITE will have no problem detecting trace contaminants on "New Cleaned Components". Most of these contaminants can be flushed from the system by purging the HAPSITE with clean nitrogen and elevating the temperature of heated zones. If the contamination is severe enough, major system components may have to be replaced. The two major sub-systems of the HAPSITE that can become contaminated are the Mass Spectrometer and the Gas Chromatograph.

NOTE: High activation temperatures will cause the NEG pump to emit large amounts of unwanted compounds. This emission will diminish when the pump cools to operational temperatures.

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16.5.1 Contamination of the Mass Spectrometer

Contamination of the Mass Spectrometer manifold can occur every time an internal component is changed, or vacuum is broken. This can consist of water and/or light hydrocarbons. These will be seen in the mass spectrum even when the isolation valve is closed. (The source of contamination is not coming from the GC module.)

16.5.1.1 Symptoms

Symptoms of contamination are a high background of water or hydrocarbons in the mass spectrum, a high baseline in the TIC plot, or a higher than normal base pressure. Contaminants on the Ion Source or the NEG Pump will be driven off as these components are heated. Use this heat to decontaminate the instrument.

16.5.1.2 Decontamination

Decontaminate the vacuum manifold using the Service Module. Pump for a few hours for water or light hydrocarbons contamination, or as long as 24 hours if the contamination is heavy. Remember that various components of the vacuum manifold will get hot and aid in driving off unwanted substances. Turn the Ion Source filament ON and heat the NEG Pump to 400 °C when decontaminating a system. If the contamination will not go away after a full day of pumping, the suspect component must be removed and replaced. Remember, care must be taken when handling internal components of the vacuum system. Always use new gloves or a clean lint free cloth to avoid contact with skin oils.

16.5.2 Contamination of the Gas Chromatograph

Contamination of the Gas Chromatograph (GC) can occur if hot heavy organic gases are sampled, and then condense in the system. These will be seen in the mass spectrum only when the isolation valve is opened. (Background may be high after the isolation valve is first closed, but will drop off after a few minutes.)

16.5.2.1 Symptoms

Symptoms of contamination are a high background of hydrocarbons in the mass spectrum, or a high baseline in the TIC plot.

16.5.2.2 Decontamination

Decontaminate the GC by moving the HAPSITE to an area where the air is relatively clean or connect the transfer line to a canister of a pure gas (N_2 or Air). Flush the sampling pathway by setting up a GC method to Loopfill for 5 minutes. Repeat this method until the source of the contamination is flushed out. Heating all temperature zones to the maximum allowable setting will aid in the cleansing of the GC. Some compounds may become trapped at unheated locations and might require a longer time period to be flushed out. If the boiling point of the contaminate is greater than the maximum temperature of the heated zones, or if a liquid sample has been pulled into the system, the GC and Transfer Line may need to be replaced.

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16.5.3 Contamination of the Probe and Probe Line

Contamination of the Probe and Probe Line can occur when the Probe Tip actually touches a sample or a compound "sticks" in the Probe Line.

16.5.3.1 Symptoms

Symptoms of contamination in the Probe and Probe Line include a high continuous base line with the same or similar identification in Survey Mode. It can also be seen as a persistent peak in Analyze (GC/MS) Mode.

16.5.3.2 Decontaminate

1. Remove the Probe from the HAPSITE.
2. Hold the Probe and Probe Line in a "U" shape.
3. Holding the Probe, pour methanol from a squeeze bottle into the Probe nut opening until methanol is seen coming out of the Probe Line through the LEMO connector.

WARNING

For safety precautions, wear recommended Personal Protective Equipment (PPE) according to the MSDS while handling methanol. See Figure 16-1.

Figure 16-1 Pouring Methanol into Probe and Probe Line

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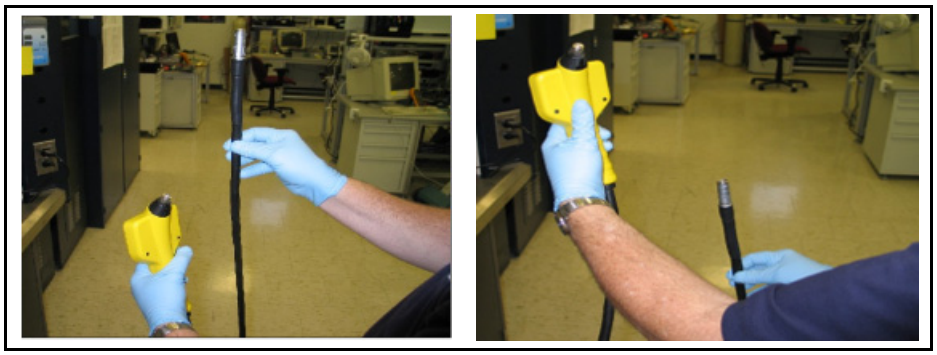
4 With each end of the Probe in a separate hand, alternately move each ends of the Probe Line up and down until methanol comes out of either end of the Probe. Repeat this a couple of times so the methanol can dissolve any contaminants in the Probe Line. See Figure 16-2.

Figure 16-2 Moving Methanol Around in Probe and Probe Line



5 Empty the methanol remaining in the Probe Line by tipping one end of the Probe Line downward until all of the methanol drains from it. See Figure 16-3.

Figure 16-3 Empty Methanol from Probe and Probe Line

6 Blow out the Probe Line with Nitrogen to remove any residual methanol that may be left in the Probe Line. See Figure 16-4.

WARNING

Point both ends of Probe away from you when blowing out the Probe Line with Nitrogen. Continue to wear appropriate Personal Protection Equipment (PPE) while blowing out the Probe Line.

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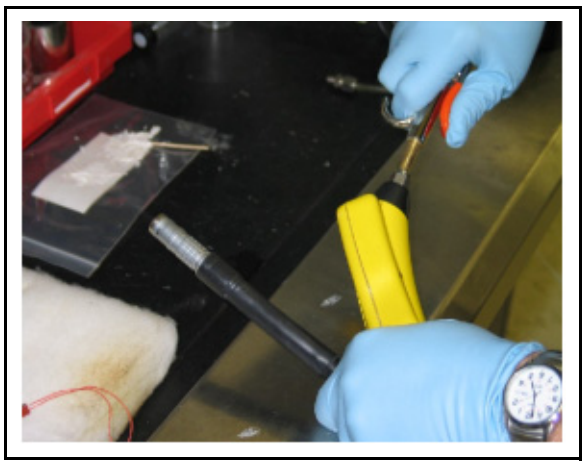
Figure 16-4 Blow Out Probe Line and Probe with N_2

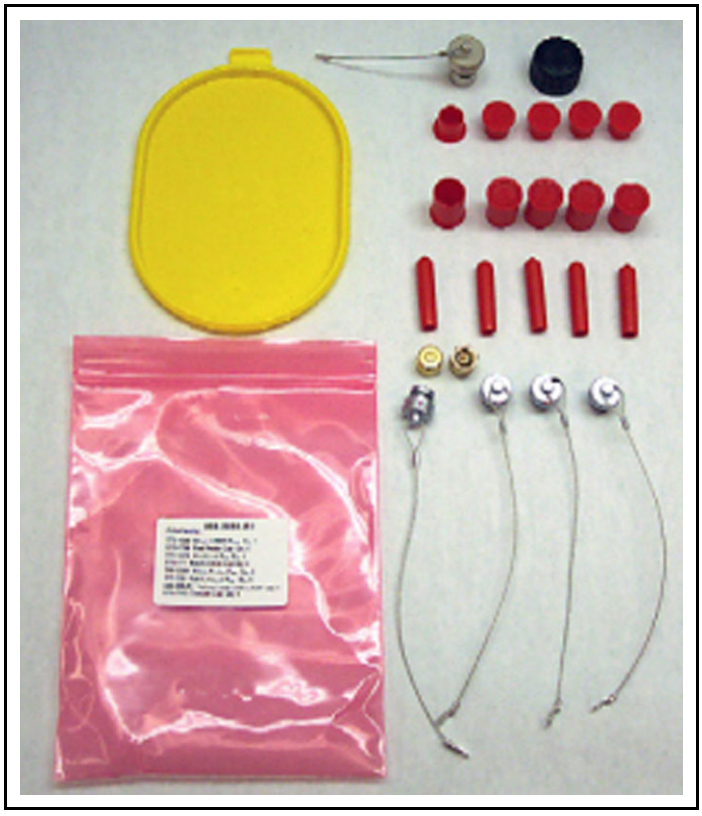


7 Re-attach the Probe Line to the HAPSITE.

16.5.4 Decontaminating the Outside of the Analytical Module

1 Decontamination cap and plug kit number 930-2020-G1 contains tall the plugs and caps needed to seal the Analytical Module for decontamination. See Figure 16-5.

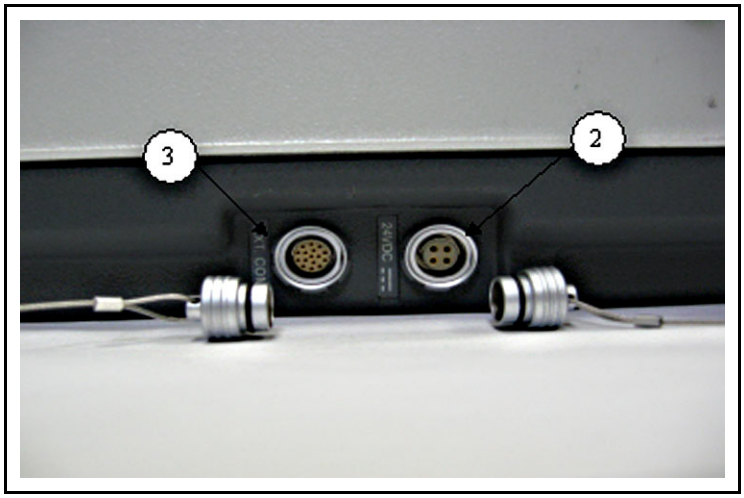
Figure 16-5 Plugs and Caps



2 Install the 24 V Power electrical cap (P/N 070-1273). See Figure 16-6.

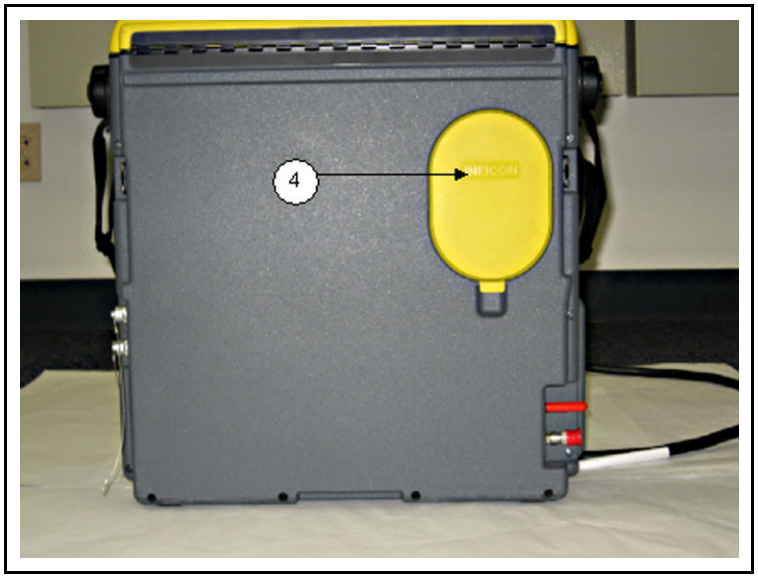
3 Install the EXT COM electrical cap (P/N 070-1273). See Figure 15-6.

Figure 16-6 24 V and EXT COM Caps



4 Install the yellow load lock cover (P/N 930-308-P1). See Figure 16-7.

Figure 16-7 Yellow Load Lock Cover



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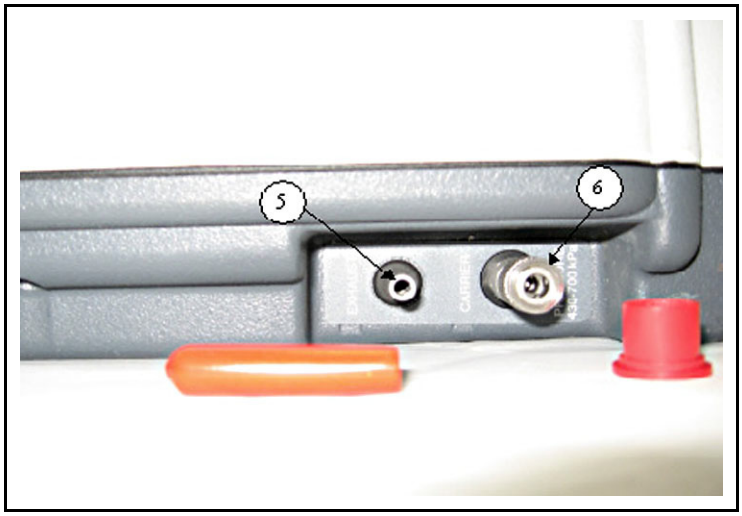
5 Install the red exhaust cap (P/N 070-338). See Figure 16-8.

6 Install the red N2 inlet cap (P/N 070-171). See Figure 15-8.

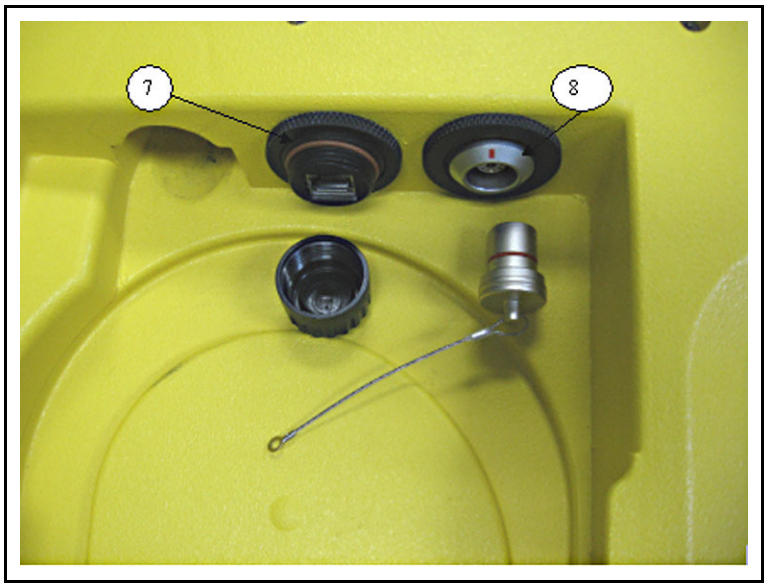
Figure 16-8 Red Exhaust and N2 Cap



7 Install the ethernet port cap. See Figure 16-9.

8 Install the silver LEMO plug (P/N 070-1040). See Figure 15-9.

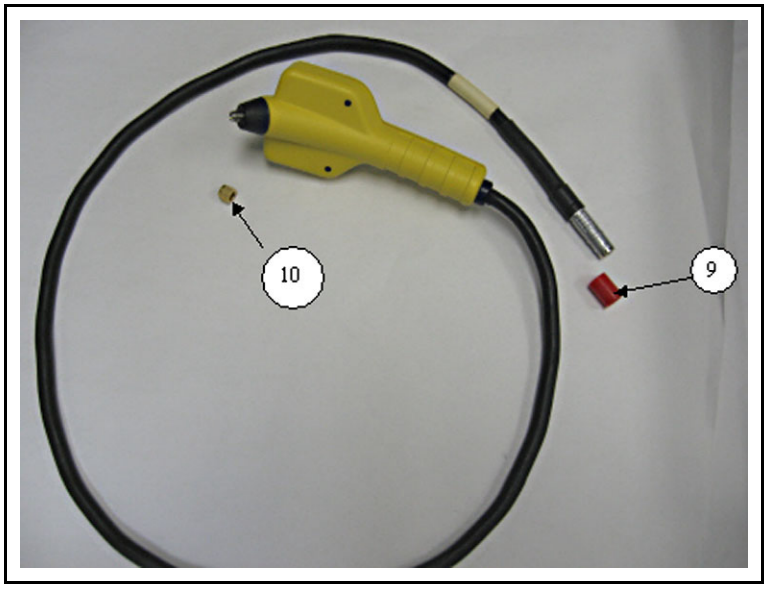
Figure 16-9 Ethernet Cap and Silver LEMO Plug



9 Install the red probe cap (P/N 059-0382). See Figure 16-10.

10 Install the brass probe nozzle cap. See Figure 15-10.

Figure 16-10 Red Probe Line Cap and Brass Probe Cap



NOTE: The outside of the probe line can be decontaminated while it is still attached to the Analytical Module. To decontaminate the inside of the probe line, refer to Contamination of the Probe and Probe Line, section 16.5.3 on page 16-9

CAUTION

All caps must be in place and the front door must be firmly shut before decontaminating the Analytical Module.

WARNING

Make sure that you are in a well ventilated area.

WARNING

Wear appropriate PPE (Personal Protective Equipment). Refer to the MSDS for the appropriate PPE.

11 Wipe the Analytical Module down using a soft cloth and a 10% hydrochlorite (bleach) solution (i.e., 1 part bleach to 9 parts water).

12 Use a soft cloth and warm water and wipe the Analytical Module down again.

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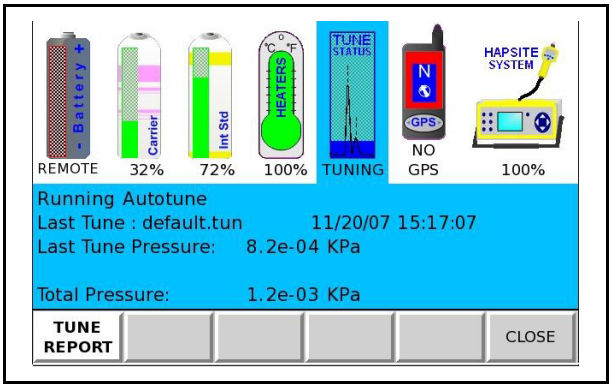
16.6 NEG Pump Troubleshooting

If an MS Pressure Warning message is displayed on the front panel of the HAPSITE, go to the **TUNE STATUS** option on the **PROBES & SM** page menu. See Figure 16-11. If the MS warning is seen on the Laptop, (see Figure 16-11) check the **System Status** bar on the right side of the **System Setup** screen or go to the **Service Module Tab** in the **Properties** menu on the Laptop in Plus IQ to check the MS Pressure. See Figure 16-12 and Figure 15-7 on page 15-8.

Figure 16-11 MS Pressure Error

Figure 16-12 Pressure Location on HAPSITE



A MS Vacuum Pressure reading of **Below Gauge Range** indicates the HAPSITE is ready to sample. If the MS Vacuum Pressure is 3E-003, order a new NEG Pump. If the MS Vacuum Pressure is 6E-003, replace the NEG Pump.

NEG Pumps have an expected life of approximately 150 hours. If the NEG Pump has 70 hours or less consider trying a bakeout (formerly called Reactivation) to extend the NEG Pump's life. To check the NEG Pump hours used, go to the **NEG Status** tab on the **Properties** menu. See section Figure 16-13.

NOTE: If the NEG Pump has more than 150 hours, a bakeout or reactivation can be tried, though the results are likely to be limited.

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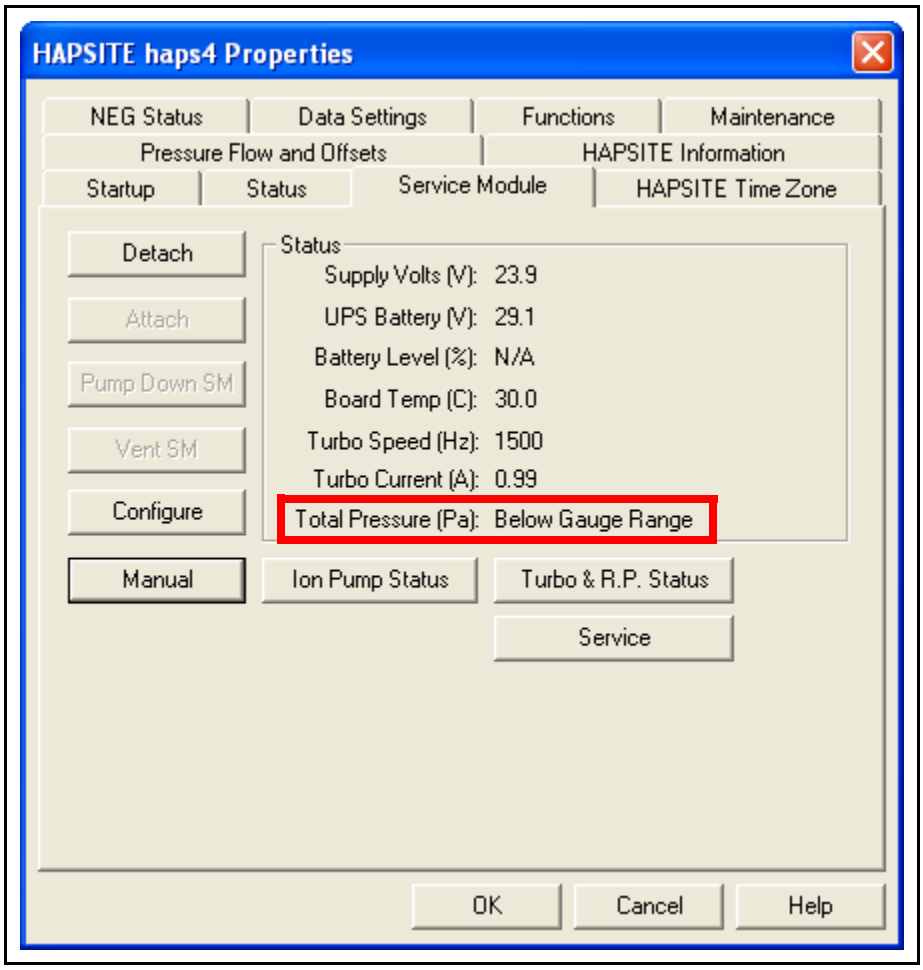
Figure 16-13 Service Module Tab



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16.6.1 NEG Pump Bakeout Procedure

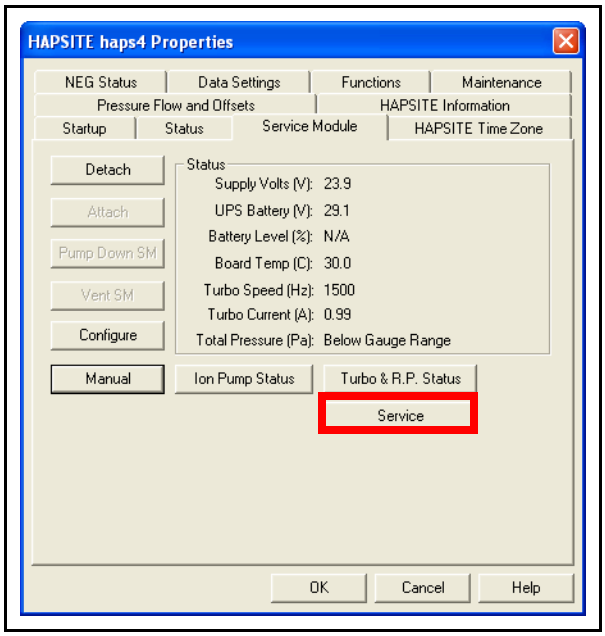
A bakeout can be performed with or without the use of the Service Module. A bakeout heats the NEG Pump to 700 degrees Centigrade for a specified length of time (usually 2 hours). Refer to section 2.8, Service Module, on page 2-19 for more information on setting up the Service Module.

16.6.1.1 Bakeout Using the Laptop

For Service Module set up instructions, refer to

1. Click on the **Service Module** tab of the **Properties** menu.
2. Click on the **Service** button. See Figure 16-14.

Figure 16-14 Service Button on the Service Module Tab



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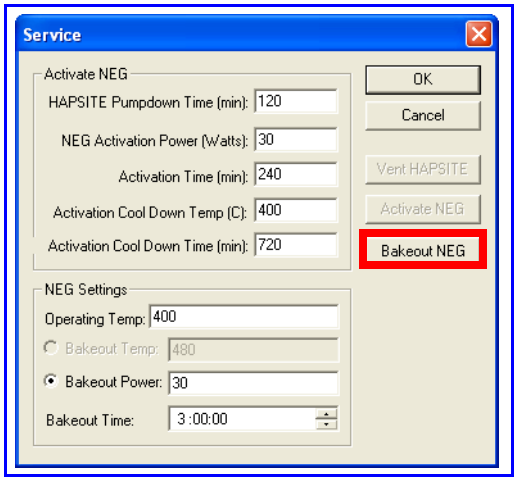
3 Set the **Bakeout Power** to **30**. The **Bakeout Time** is usually set to **2** hours. See Figure 16-15.

Figure 16-15 Service Window



4 Click the **Bakeout NEG** button.

16.6.1.2 Bakeout From Front Panel

1 Touch or using the **arrow keys**, highlight the **HAPSITE** icon. Push **OK SEL**.

2 Touch the **HEATERS** icon.

3 Touch the **NEG** button. Alternately, using the **arrow keys**, highlight **NEG** button. Push **OK SEL**.

4 Touch the **NEG BAKEOUT** button. Alternately, using the **arrow keys**, highlight **NEG BAKEOUT**. Push **OK SEL**.

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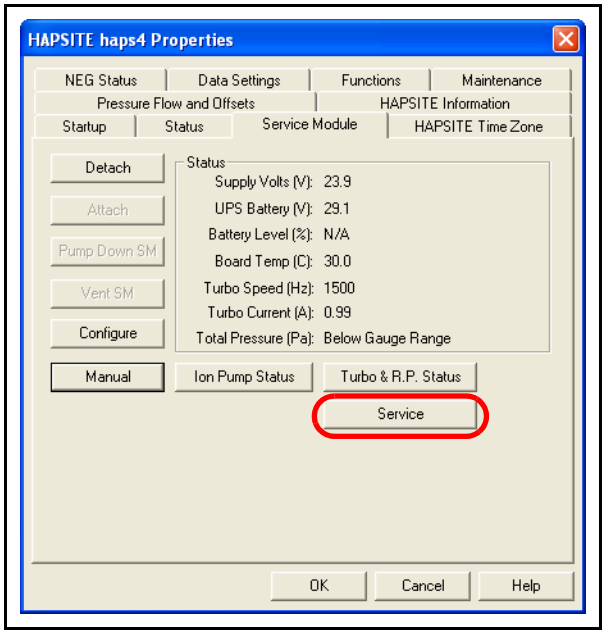
16.6.2 Reactivating the NEG Pump

Reactivating the NEG Pump requires having the Service Module attached to the HAPSITE for at least 22 hours. The procedure is basically the same as activating a new NEG Pump. Refer to section 2.8, Service Module, on page 2-19 for more information on setting up the Service Module.

16.6.2.1 Reactivation Using the Laptop

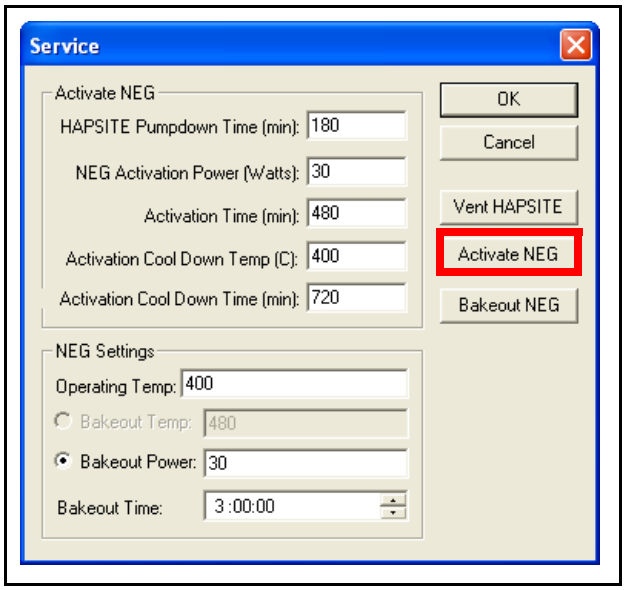
1. Click on the **Service Module** tab of the **Properties** menu.
2. Click on the **Service** button. See Figure 16-16.

Figure 16-16 Service Button on the Service Module Tab



3. Use the Activate NEG settings below as a guideline. However, change the HAPSITE Pumpdown Time which should be set to **180**. See Figure 16-17.

Figure 16-17 Service Window



4 Click the **Activate NEG** button.

5 At the end of the reactivation, the program will detach the HAPSITE from the Service Module as part of the process.

16.6.2.2 Reactivation Using the Front Panel

1 Touch or using the **arrow keys**, highlight the **HAPSITE** icon. Push **OK SEL**.

2 Touch the **HEATERS** icon.

3 Touch the **NEG** button. Alternately, using the **arrow keys**, highlight **NEG** button. Push **OK SEL**.

Touch the **ACTIVATE NEG** button. Alternately, using the **arrow keys**, highlight **ACTIVATE NEG**. Push **OK SEL**.

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16.7 NEG Pump Removal, Installation and Activation

During boot-up, the HAPSITE will check system components for needed routine maintenance and will notify the analyst if the NEG Pump has reached the end of typical usable life. The notification will be shown on the front display of the HAPSITE after completing the boot-up routine. Replacement of the NEG should be considered at that time.

NEG Pump removal, installation and activation should be performed in the following order:

- Part 1: NEG Pump Removal, section 16.7.2 on page 16-23
- Part 2: Service Module Vacuum Interconnect (VI) Valve Cleaning, section 16.7.3 on page 16-26
- Part 3: Install the New NEG Pump, section 16.7.4 on page 16-29
- Part 4: Leak Check of the Vacuum System, section 16.7.5 on page 16-34
- Part 5: Activation of the NEG Pump, section 16.7.6 on page 16-40

NOTE: Read all instructions before starting the procedure making special note of all cautions and warnings.

NOTE: Contact INFICON prior to performing the following procedures.

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16.7.1 Required Tools and Equipment

- Service Module (not pictured)
- Laptop computer (not pictured)
- New NEG Pump
- 1/4” Allen wrench
- Torque wrench set for 70 inch/pounds
- Gloves (cotton or latex)
- Lint free wipes
- Methanol
- MicroDuster® III (containing 1,1,1,2 tetrafluoroethane)

CAUTION

Refer to the MSDS for Personal Protection Equipment (PPE) guidelines, wipe all tools with methanol before starting this procedure.

Figure 16-18 Required Tools and Equipment

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16.7.2 Part 1: NEG Pump Removal

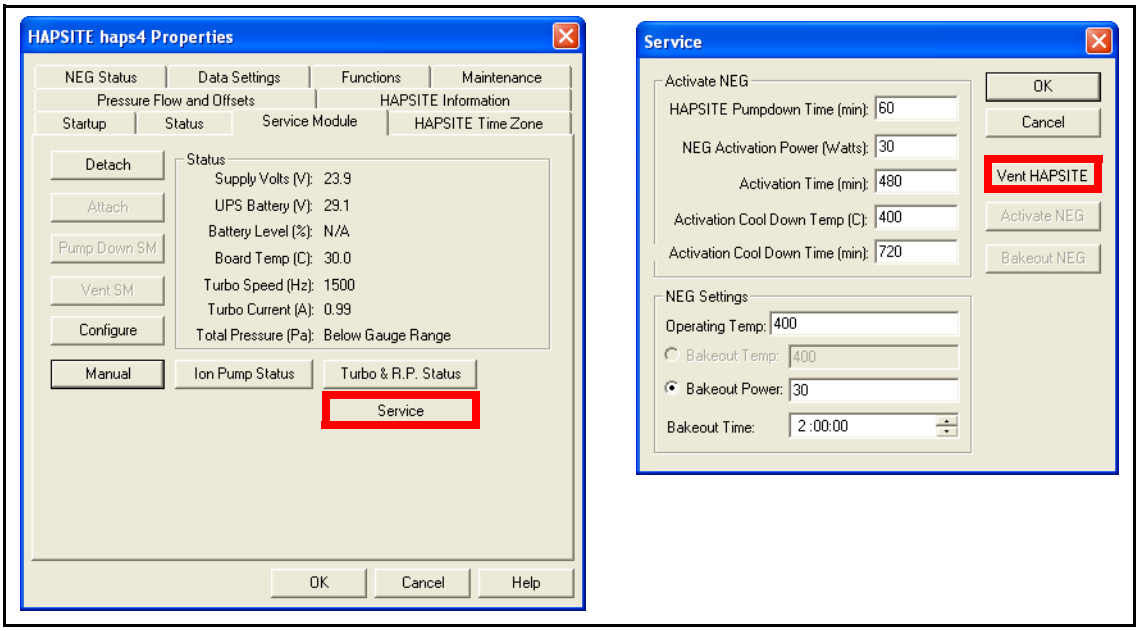
1. This procedure requires the use of a Service Module. The HAPSITE should be physically placed on the Service Module and attached. Refer to section 2.8, Service Module, on page 2-19 and Chapter 15, Service Module for more information on setting up and using the Service Module.
2. If the NEG Pump is hot from recent use, let the system cool overnight before performing this procedure. The NEG Pump should cool to below 80 °C before proceeding.

WARNING

Burn hazard. Do not bypass the cool down step! The NEG Pump will react with air when it is hot. This will cause it to become very hot and possibly create sparks.

3. Vent the HAPSITE by choosing **Vent HAPSITE** on the Service window of the Service Module tab in the **Properties** window (see Figure 16-19). This starts an automatic process which includes monitoring the cooling of the NEG Pump.

Figure 16-19 Vent HAPSITE in Service Window from Service Button on Service Module Tab



WARNING

The NEG Pump becomes very hot when in operation. The software-controlled sequence provides a cool- down period to remove the pump provides a cool-down period before removing. This sequencing must not be bypassed. In addition to the danger of burns from handling the hot flange, the reactive metal alloys within the pump can ignite if exposed to atmospheric pressure while hot. If this should occur, drop the pump into a bucket of sand and cover the hot NEG Pump with additional sand. If this step is not practical, set the pump on its black plastic base on a non-flammable surface. The NEG Pump will burn out in a few minutes.

4 When the screen shows **Vent Manifold Has Been Completed**, unplug the NEG Pump's black cable from the inside of the front panel by loosening the locking ring. Then pull the connector straight back.

WARNING

Burn Hazard. DO NOT disconnect the NEG Pump's black cable before receiving the "Vent Manifold Has Been Completed" message. Disconnecting the black cable will also disconnect the temperature sensor. Due to the disconnection, the temperature sensor may read that the NEG is cold, when in fact, the NEG is still hot.

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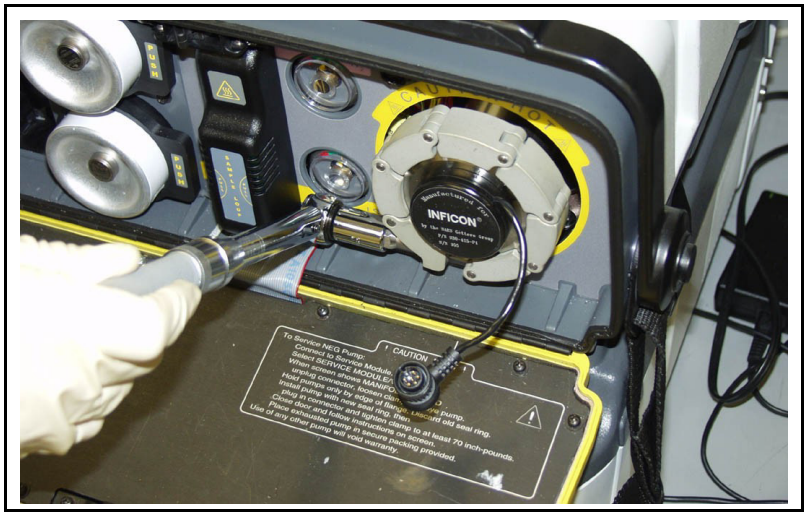
5 To loosen the chain clamp, turn the nut counter-clockwise until loose. See Figure 16-20

Figure 16-20 Loosening Chain Clamp



6 Remove chain clamp.

7 Pull the NEG Pump out.

NOTE: The aluminum gasket can not be reused. Bend the old gasket to avoid possible reuse. Place the "USED" sticker, found in the new NEG Pump Ship Kit, on the old NEG Pump. Follow the instructions provided with the new NEG Pump to return the used NEG Pump.

8 Continue on to section 16.7.3, Part 2: Service Module Vacuum Interconnect (VI) Valve Cleaning, on page 16-26.

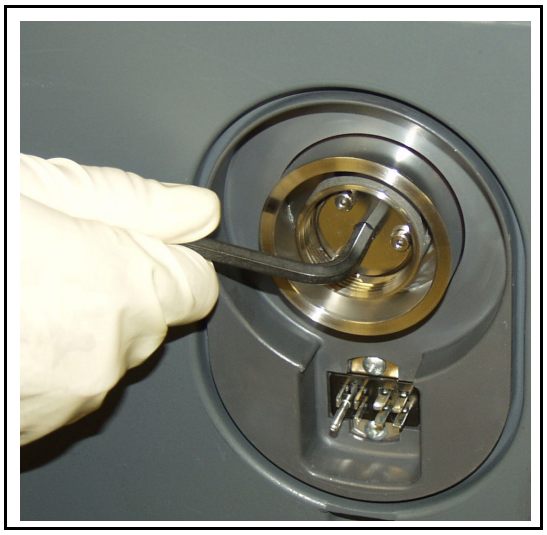
16.7.3 Part 2: Service Module Vacuum Interconnect (VI) Valve Cleaning

WARNING

Gloves must be worn while performing all of the following steps. Wear safety glasses and appropriate PPE according to the MSDS when handling chemicals.

1. Remove the HAPSITE from the Service Module (see section 15.9, Physically Removing the HAPSITE from the Service Module, on page 15-19).
2. On the underside of the Analytical Module remove the VI valve using the 1/4” Allen wrench. See Figure 16-21.

Figure 16-21 Removing the VI Valve



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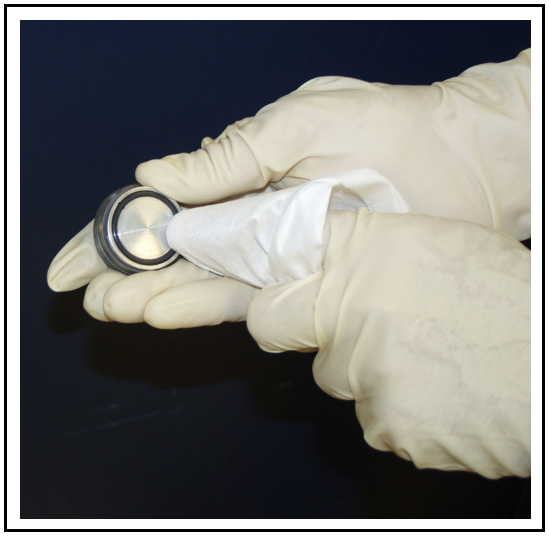
3 Wearing safety glasses and gloves, clean the o-ring on the VI valve with methanol. See Figure 16-22.

Figure 16-22 Cleaning VI Valve O-ring



4 Clean the bottom of the manifold, where the VI valve was removed, with methanol. See Figure 16-23.

Figure 16-23 Cleaning Bottom of Manifold

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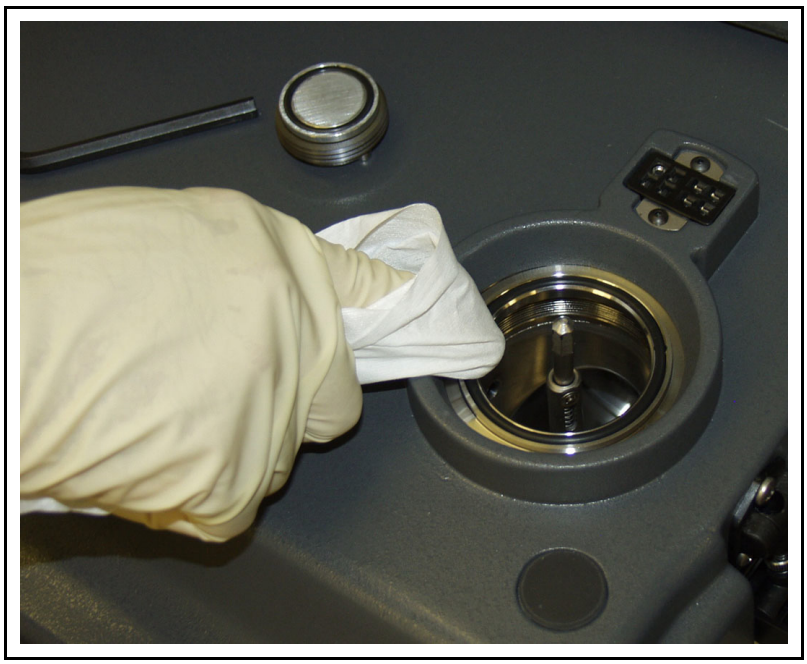
5 Replace the VI valve into the bottom of the manifold. Hand tighten. See Figure 16-24.

Figure 16-24 Replacing the VI Valve

6 Clean the o-ring on the Service Module with Methanol on a lint free wipe. See Figure 16-25.

Figure 16-25 Cleaning O-ring on the Service Module



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7 Place the HAPSITE on the Service Module and lock down with the black side latches. Refer to section 2.8.2, Placing the HAPSITE on the Service Module, on page 2-24 for additional instructions, if needed.

8 Continue on to section 16.7.4, Part 3: Install the New NEG Pump, on page 16-29.

16.7.4 Part 3: Install the New NEG Pump

WARNING

Gloves must be worn while performing all of the following steps. Wear safety glasses and appropriate PPE according to the MSDS when handling chemicals.

1 Wearing safety glasses and gloves, clean the manifold flange with methanol on a lint free wipe. See Figure 16-26.

Figure 16-26 Cleaning Manifold Flange

2 Remove the new NEG Pump and aluminum gasket from the shipping container. See Figure 16-27.

Figure 16-27 New NEG Pump and Aluminum Gasket

3 Clean the aluminum gasket with methanol on a lint free wipe. Be careful to handle the aluminum gasket by the outer band and keep the knife-edges on the inner ring from getting nicked. See Figure 16-28.

Figure 16-28 Cleaning Aluminum Gasket

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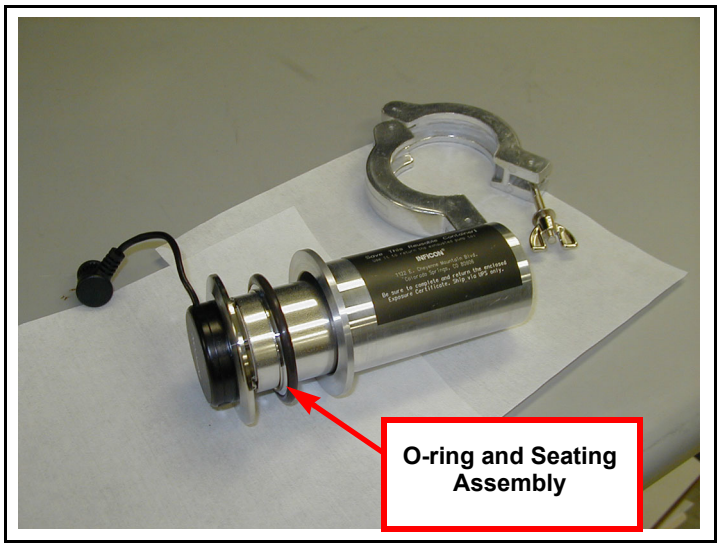
4 Remove the new NEG Pump from the protective container. See Figure 16-29.

CAUTION

The NEG Pump is stored under a vacuum. The shelf life is 5 years. If the vacuum is compromised, shelf life is reduced to 1 year.

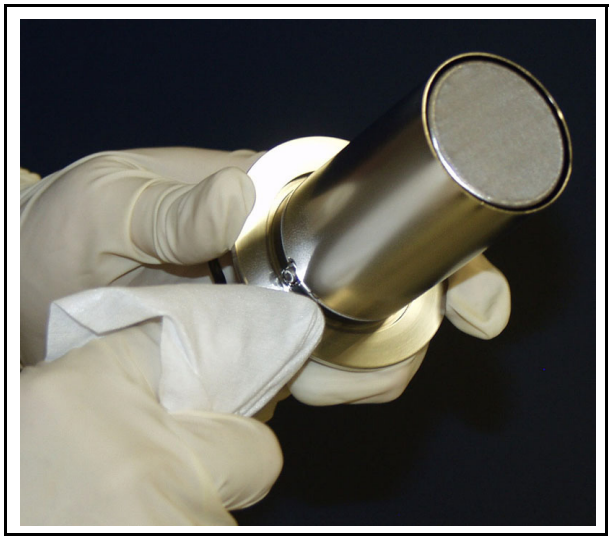
5 Remove the o-ring and seating ring assembly from the new NEG Pump. See Figure 16-29.

Figure 16-29 New NEG Pump



6 On the new NEG Pump, wipe inside the flange with methanol on a lint free wipe. See Figure 16-30.

Figure 16-30 Cleaning Flange with Methanol



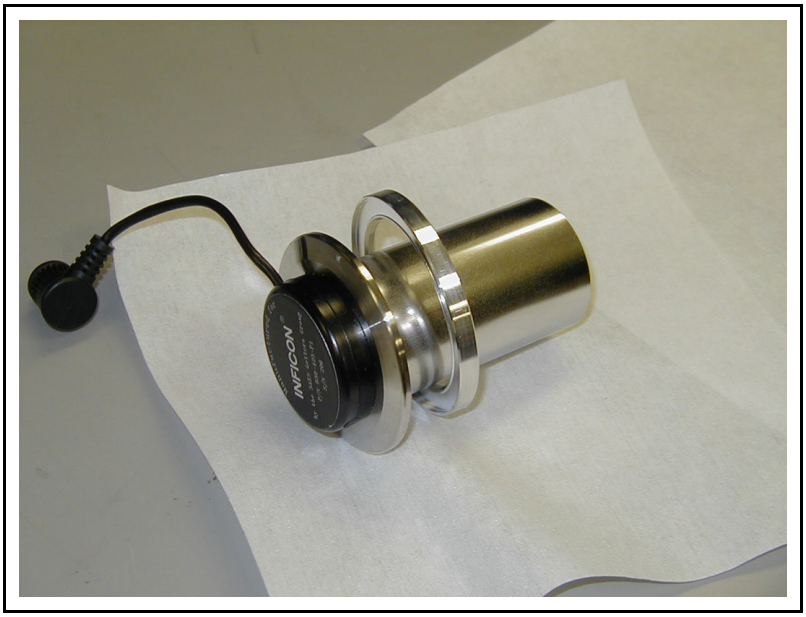
7 Save the rubber “O” ring assembly and container to dispose of the old NEG Pump.

8 Place the new aluminum gasket on the new NEG Pump. See Figure 16-31.

NOTE: Inspect the manifold face, ionizer and manifold inside for nicks, residue, and scratches.

NOTE: Write down the Serial Number of the new NEG Pump.

Figure 16-31 Aluminum Gasket on NEG Pump



9 Insert the new NEG Pump and aluminum gasket into the manifold. See Figure 16-32.

Figure 16-32 Installing New NEG Pump

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10 Replace the chain clamp insuring that the nut points to the left. Use the torque wrench and tighten to 70 inch /pounds or 8 Nm. See Figure 16-33.

Figure 16-33 Torquing Chain Clamp

CAUTION

Do not connect the black plug from the new NEG Pump to the black socket at this time. This will avoid any accidental heating of the NEG Pump.

11 Place the old NEG Pump into the protective container with the o-ring assembly and place back in the box. See Figure 16-34.

Figure 16-34 Old NEG Pump

12 Perform the **Attach** function by selecting the **Attach** button on the Service Module tab of the Properties section. Refer to section 15.7, Attaching the HAPSITE to the Service Module, on page 15-12.

13 Continue on to section 16.7.5, Part 4: Leak Check of the Vacuum System, on page 16-34.

16.7.5 Part 4: Leak Check of the Vacuum System

CAUTION

Checking for leaks is very important. Air leaks will shorten NEG Pump life.

NOTE: In this step, an aerosol can of MicroDuster® will be used to locate any leaks. Any aerosol type "canned air" or dust cleaner will work as long as the canned air has the following component: 1,1,1,2-tetrafloroethane. Please check the label for contents. If using a duster with compounds other than 1,1,1,2- tetra fluoroethane, the range and target masses will have to be adjusted to the major ions produced in the MS.

1 After the HAPSITE has pumped down for at least two hours, double-click on the **Plus IQ icon**. See Figure 16-35.

Figure 16-35 Plus IQ Icon

2 Click on the **Tune Icon**. See Figure 16-36.

NOTE: In order to open Manual Tune, the user must have the current Access Level set to Advanced. See Changing Access Levels, section 8.9.1 on page 8-24.

Figure 16-36 Manual Tune Icon

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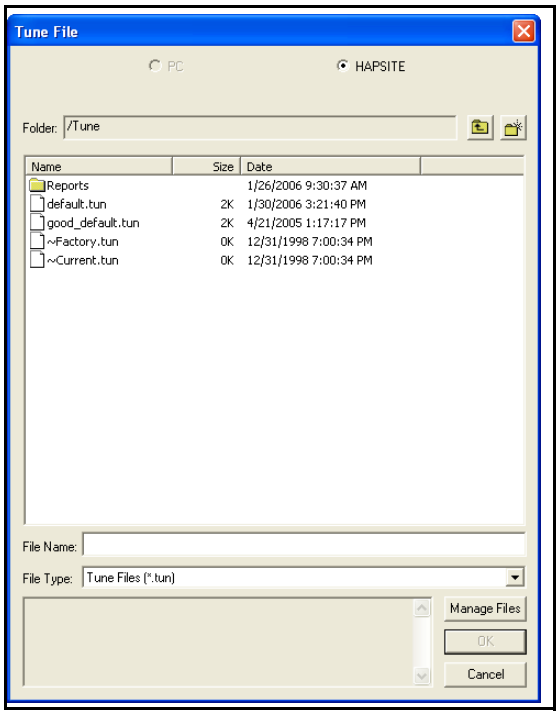
3 Select **`default.tun`** file. See Figure 16-37.

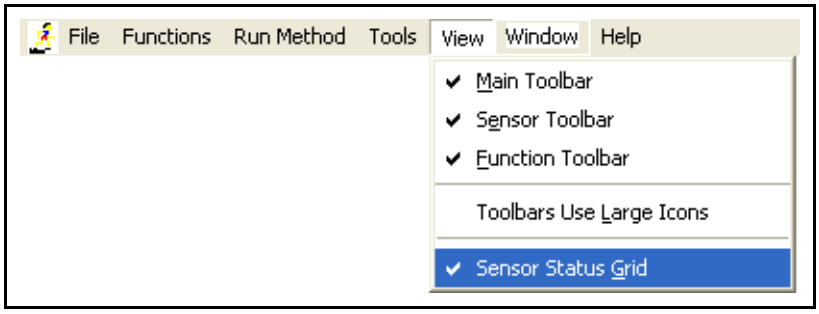
Figure 16-37 Select "default.tun" File



4 Wait for the automated process of opening tune to complete.

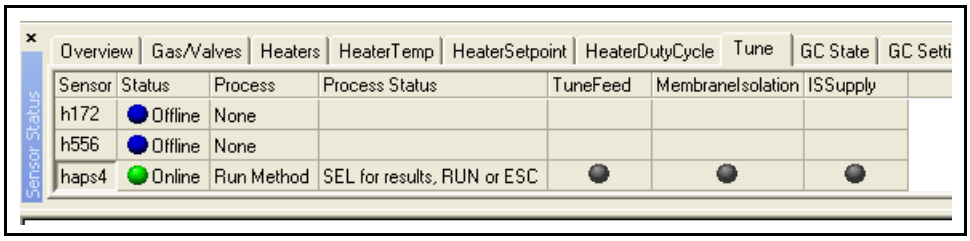
5 Click on **View/Sensor Status Grid**. See Figure 16-38.

Figure 16-38 Opening Sensor Status Grid



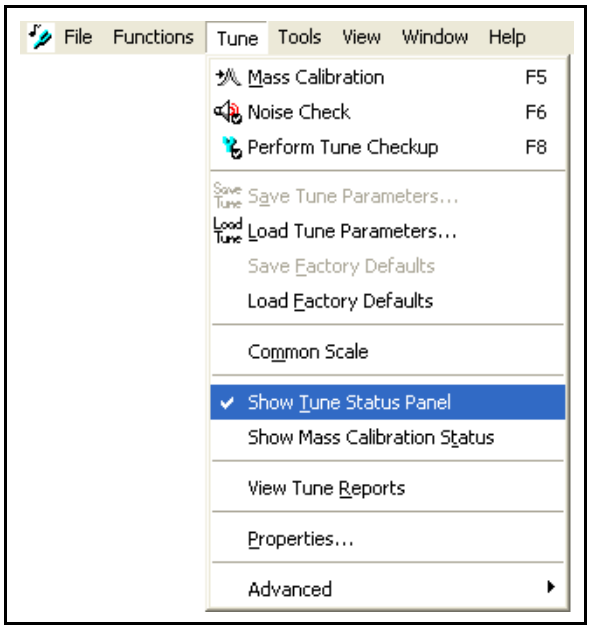
6 Turn off the **IS Supply** and **Tune Feed** valves by clicking on the button under each valve. The buttons are green when the valves are open and black when closed. See Figure 16-39.

Figure 16-39 Sensor Status Grid



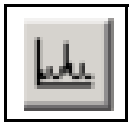
7 Close the Tune Status Panel and the Mass Calibration Status by deselecting each. See Figure 16-40.

Figure 16-40 Closing Tune Status Panel and Mass Calibration Status



8 Click on the **Full Scan** icon in the Tune window. See Figure 16-41.

Figure 16-41 Full Scan Icon



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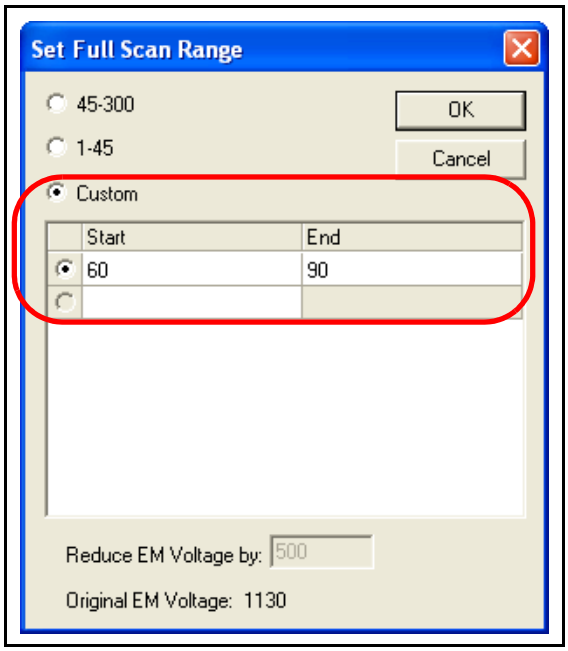
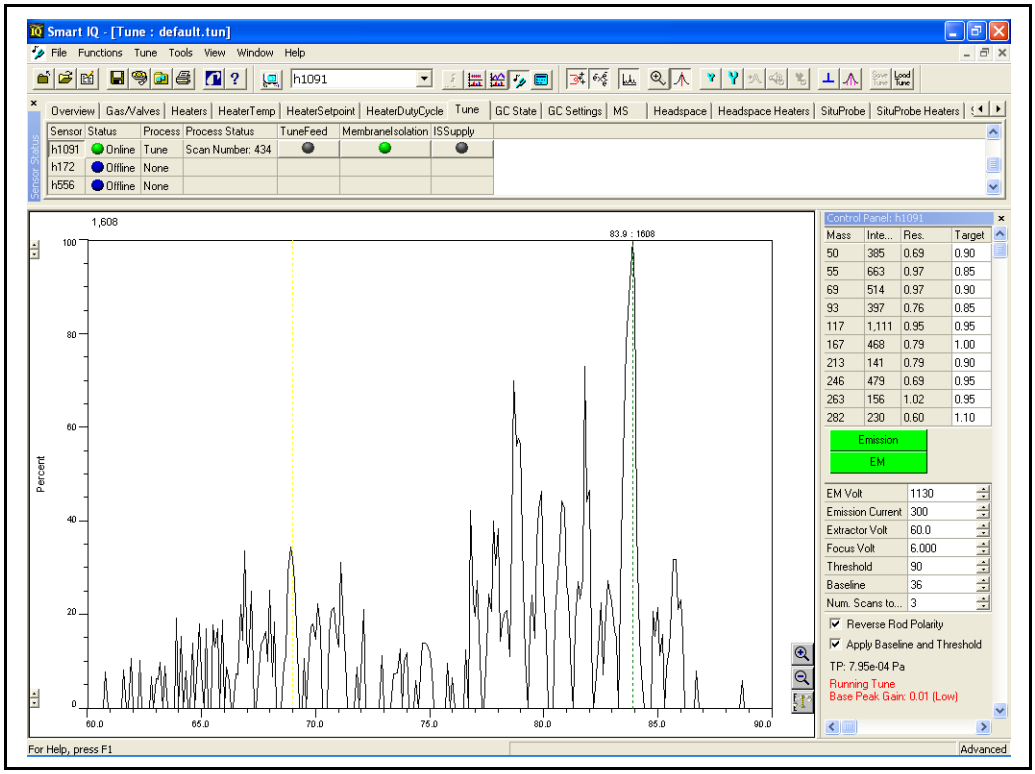
9 Click the Right Mouse Button on the X-axis to access the **Full Scan Range**. See Figure 16-42.

Figure 16-42 Setting Full Scan Range



10 Select **Custom**. Type 60 in the Start Field and 90 in the End Field. This will enable the analyst to scan for both the **69** and **83** masses. (These are the predominant masses in a can of MicroDuster that contains 1,1,1,2-tetrafluorefloroethane, the compound being used to check for leaks.) See Figure 16-43.

Figure 16-43 Checking For Leaks



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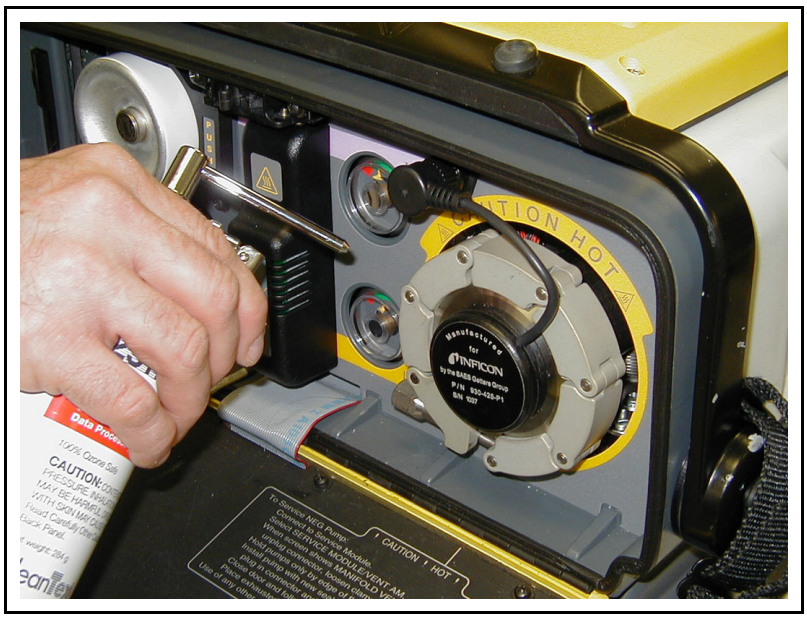
11 Spray the MicroDuster around the orifices listed below that could be the source of a possible leak, while checking the scan on the laptop in the tune program. If there is a leak, the response for the **69** and **83 masses will** increase. See Figure 16-44.

The critical areas to be checked are:

- The seam between the NEG Pump and the manifold.
- The seam between the Service Module and Analytical Module on the manifold side.

Figure 16-44 Spraying MicroDuster



12 After the manifold has been leak tested and no leaks found, plug the black cable on the front of the NEG Pump into the black socket located above the NEG Pump.

13 In the Tune window, turn the **IS Supply** and **Tune Feed** on by clicking on the buttons which should change from the color black to the color green. See Figure 16-39.

14 At this point, a tune check should be performed on the system. Click on the **Short Tune** icon. See Figure 16-45. Refer to section 7.2, AutoTune, on page 7-2.

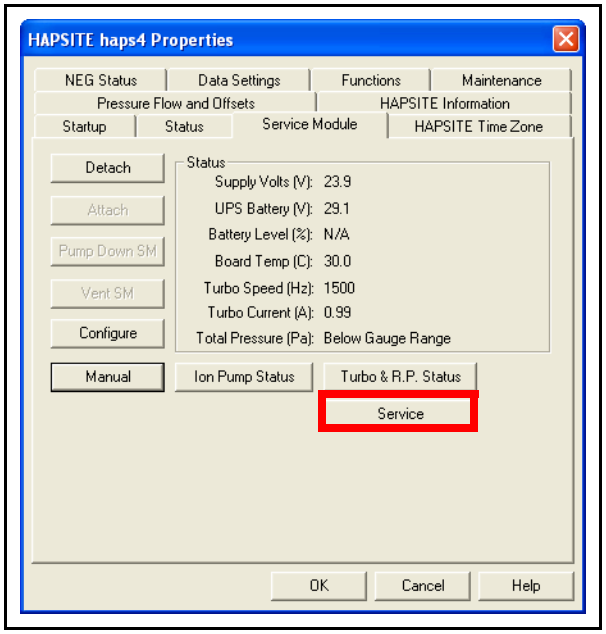
Figure 16-45 Short Tune Icon

15 Continue on to section 16.7.6, Part 5: Activation of the NEG Pump, on page 16-40.

16.7.6 Part 5: Activation of the NEG Pump

1. Click on the **Service Module** tab of the **Properties** menu.
2. Click on the **Service** button. See Figure 16-46.

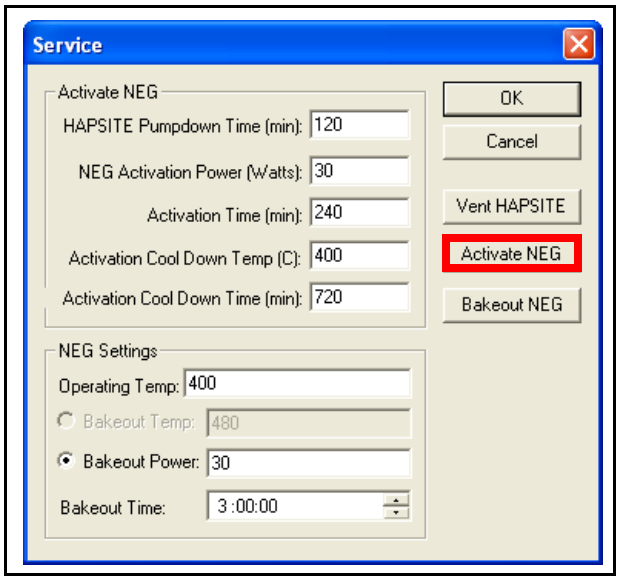
Figure 16-46 Service Button on the Service Module Tab



3. Use the **Activate NEG** settings below as a guideline.
   - **HAPSITE Pump Down Time (min) = 60**
   - **NEG Activation Power (Watts) = 30**
   - **Activation Time (min) = 480**
   - **Activation Cool Down Temp (C) = 400**
   - **Activation Cool Down Time (min) = 720**

   See Figure 16-47.

Figure 16-47 Service Window



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4 Select **Activate NEG**.

5 When prompted on the front panel, enter the **Serial Number** of the new NEG Pump.

6 The NEG Pump will take approximately 18 hours to activate. The process is completely automated and does not require any user interaction until the process is complete.

7 Once the NEG Pump is activated, remove the HAPSITE from the Service Module. (Power the HAPSITE with battery or an external power supply.) Refer to the section 15.8, Detaching the HAPSITE, on page 15-17 for instructions on safely removing the HAPSITE from the Service Module.

8 Repeat the leak check portion of the process. Instead of checking for a leak between the Analytical Module and Service Module, check the **VI** valve on the bottom of the HAPSITE. This is where the Service Module physically attaches. (Refer to section 16.7.5 on page 16-34.)

9 If there is a leak, the leak must be sealed by repeating section 16.7.2 through section 16.7.4. Repeat the leak check portion in section 16.7.5 and the NEG Pump reactivation in section 16.7.6.

16.8 Replacing the Ionizer of the Mass Spectrometer

The Ionizer is located in the mass spectrometer vacuum manifold behind the NEG Pump, (or a blank off plate if a NEG Pump is not installed). The NEG pump must be removed in this procedure. If a NEG Pump is installed, it can be reinstalled and re-activated. Some of the NEG Pump lifetime will be lost during this process. If a NEG Pump has greater than 50 hours (approximately 1/2 the expected life) the more economical choice may be to replace the pump, based on the reduced lifetime after exposure to atmospheric pressure.

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16.8.1 Required Tools and Equipment

- Flat head screw driver
- Ionizer removal tool
- 13 mm open end wrench
- 13 mm torque wrench.
- Methanol
- Lint free cloth
- Powder free gloves
- Replacement aluminum seal ring (if NEG Pump is to be installed)

CAUTION

If the NEG Pump is to be reinstalled, it must be removed when it is at room temperature. If the NEG Pump has been used within 8 hours, let it cool overnight prior to removal.

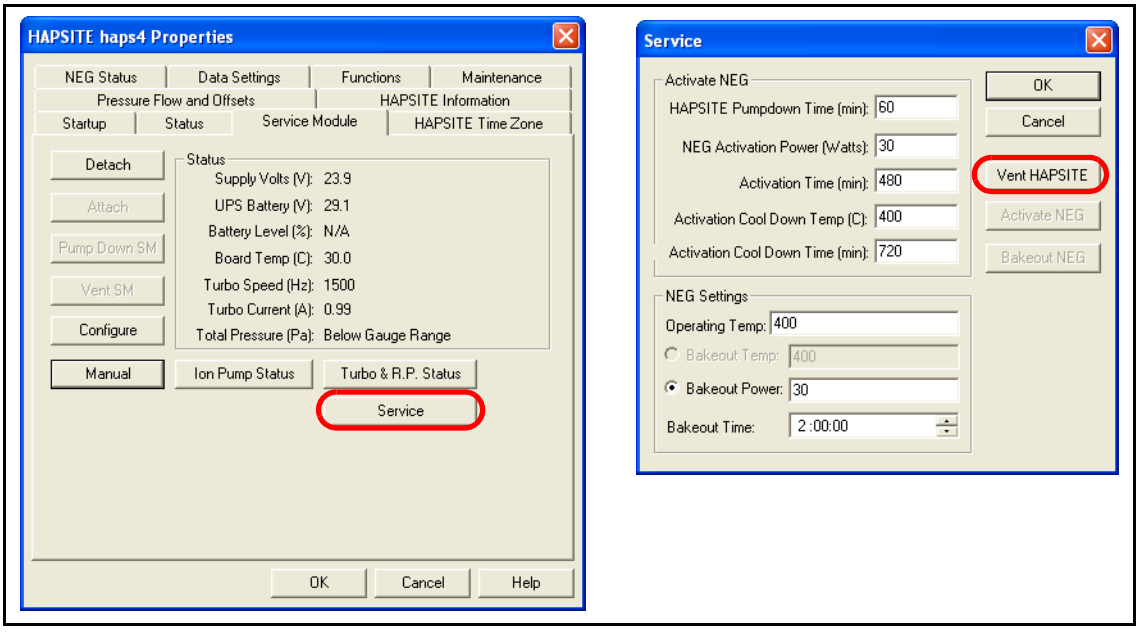
1. This procedure requires the use of a Service Module. The HAPSITE should be physically placed on the Service Module and attached. Refer to section 2.8, Service Module, on page 2-19 and Chapter 15, Service Module for more information on setting up and using the Service Module.
2. If the NEG Pump is hot from recent use, let the system cool overnight before performing this procedure. Refer to section 16.7.2, Part 1: NEG Pump Removal, on page 16-23.

WARNING

Burn hazard. Do not bypass the cool down step! The NEG Pump will react with air when it is hot. This will cause it to become very hot and possibly create sparks.

3. Vent the HAPSITE by choosing **Vent HAPSITE** on the Service window of the Service Module tab in the Properties window. This starts a process which includes monitoring the cooling of the NEG Pump. See Figure 16-48.

Figure 16-48 Vent HAPSITE from Plus IQ Software



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CAUTION

The NEG pump becomes very hot when in operation. The software-controlled sequence provides a cool down period before removing the pump provides a cool down period time to cool. This sequence must not be bypassed. In addition to the danger of burns from handling the hot flange, the reactive metal alloys within the pump can ignite if exposed to atmospheric pressure while hot. If this should occur, drop the pump into a bucket of sand and cover the hot NEG pump with additional sand. If this step is not practical, set the pump on the black plastic base on a non-flammable surface. The NEG pump will burn out in a few minutes.

4 When the screen shows **Vent Manifold Has Been Completed**, unplug the NEG Pump's black cable from the front panel by loosening the locking ring, then pull the connector straight back.

WARNING

Burn Hazard. DO NOT disconnect the NEG Pump's black cable before receiving the "Vent Manifold Has Been Completed" message. Disconnecting the black cable will also disconnect the temperature sensor. Due to the disconnection, the temperature sensor may read that the NEG is cold, when in fact, the NEG is still hot.

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5 To loosen the chain clamp, turn the nut counter-clockwise until loose. See Figure 16-20.

Figure 16-49 Loosening Chain Clamp

6 Remove chain clamp.

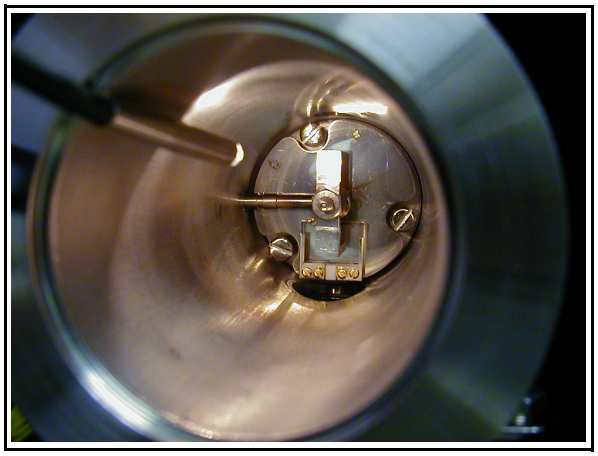
7 Pull the NEG Pump out and place on a lint free cloth.

8 Immediately bend and discard the old aluminum seal ring.

NOTE: Be careful not to touch any part of the pump with bare hands.

9 Look inside the manifold to see the Ionizer, and a 3/16" diameter stainless steel tube entering the manifold from the left and connecting to the small cylindrical ion volume at the center of the Ionizer. See Figure 16-50. This tube transfers the sample from the membrane isolation valve into the ion volume, and must be detached and slid into the ion volume before the Ionizer can be removed.

Figure 16-50 Ionizer



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CAUTION

Make sure all tools are clean by wiping them with methanol on a lint free cloth. Wear powder free gloves for the rest of this procedure. Wear appropriate PPE according to the MSDS guidelines.

10 Insert the forked end of the Ionizer removal tool (see Figure 16-51) behind the collar on the stainless steel tube about 1/4" from the left side manifold wall.

11 Insure the stainless steel pin on the Ionizer removal tool is facing toward the left manifold wall.

Figure 16-51 Ion Source Removal Tool

12 Apply pressure, using the stainless steel pin as a leverage point. Slide the extension tube from the membrane isolation valve into the ion volume. The extension tube should disengage completely from the membrane isolation valve.

NOTE: If the extension tube does not slide easily into the ion column, loosen the Ionizer. Then use the Ionizer removal tool to reposition the Ionizer, which will enable the extension tube to slide into the ion volume as displayed in Figure 16-52.

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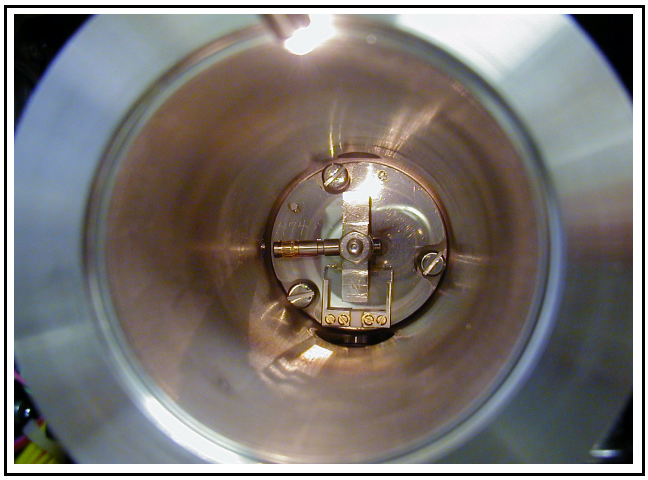
Figure 16-52 Extension Tube Slid into the Ion Volume



13 Use the flat head screw driver to loosen the three screws which secure the Ionizer to the quadrupole within the manifold. The screws are captive and will not fall out.

14 Thread the Ionizer removal tool onto the stud in the center of the Ionizer. See Figure 16-53.

Figure 16-53 Ionizer Removal Tool

15 Use a slight rocking motion pulling straight back and remove the Ionizer from the manifold.

16 Remove the extension tube from the old Ionizer and carefully insert into the ion volume of the new Ionizer.

17 Thread the Ionizer removal tool onto the stud in the center of the new Ionizer, and insert the Ionizer into the manifold. Position the Ionizer so the ceramic filament holding block is at the bottom. When the assembler feels the five connector pins registering with their respective sockets, press the Ionizer firmly into place, and unscrew the tool.

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18 Tighten the three securing screws with the screw driver. Tighten them alternately and gently to ensure that the Ionizer is installed straight.

NOTE: As you install and tighten the Ionizer, make sure the extension tube remains positioned in the ion volume and is lined up with the membrane isolation valve.

19 With the forked end of the Ionizer removal tool, grab the extension tube and slide it into the membrane isolation valve so that it is not protruding into the ion volume.

20 Install a new NEG Pump or reinstall the old NEG Pump with a new aluminum sealing ring. Perform the activation process or put the blank off flange with o-ring on the manifold.

NOTE: See section 16.7.4, Part 3: Install the New NEG Pump, on page 16-29 through section 16.7.6, Part 5: Activation of the NEG Pump, on page 16-40 for detailed information regarding NEG Pump installation.

16.9 Replacing the Headspace Sampling System Needle

Replacement of the needle in the needle assembly should be performed on an as needed basis. The needle will need to be replaced if it is significantly deformed, if it is broken, if the point becomes blunted, or if the holes become plugged with debris.

Tools Required

- A No. 2 Phillips screwdriver.
- 1/4" open end wrench or equivalent.

WARNING

The needle tips are sharp. Be careful to avoid injury.

WARNING

Be careful to avoid burns if the surfaces are still hot.

Procedure

1 Open the top yellow cover of the HSS to expose the needle assembly.

2 Using the Phillips screwdriver, loosen and remove the two screws on top of the assembly.

3 Remove the top cover of the needle assembly to expose the needle and the 1/4" connection fittings.

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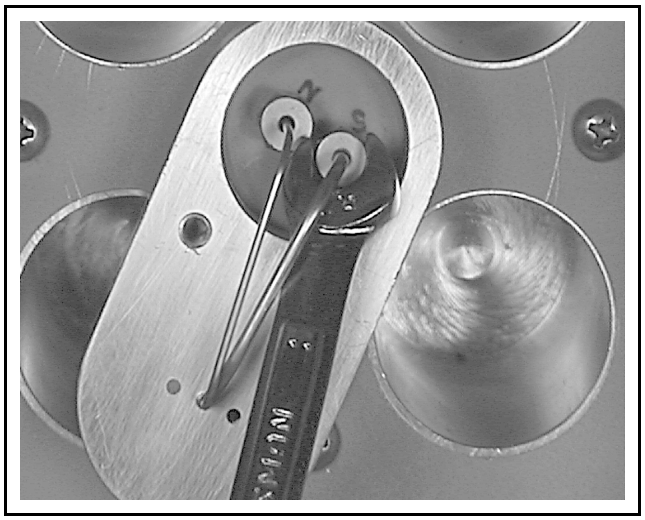
4 Using the 1/4" wrench, loosen both 1/4" connection fittings. Note the position of the N and S labels, which refer to Nitrogen and Sample. See Figure 16-54.

CAUTION

Nitrogen and Sample orientation is very important to avoid pulling the sample into the HAPSITE.

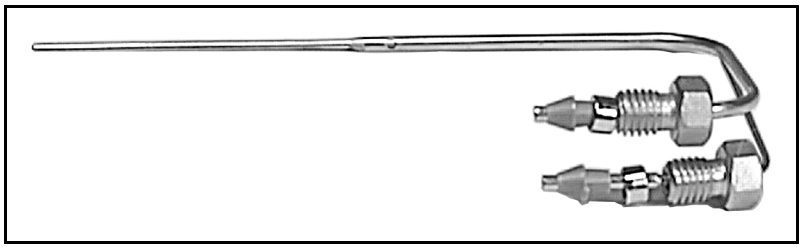
Figure 16-54 Removing the Nuts



5 Once both the connection fittings have been completely loosened, pull straight up on the needle while holding the assembly in place. Set the used needle aside, as well as the nut and ferrules at the end of the needle.

6 Place the nut and ferrules on both parts of the needle where they will be re-inserted into the assembly. See Figure 16-55.

Figure 16-55 Needle Assembly with Nuts and Ferrules



7 Place the replacement needle back through the opening from which the used needle has just been removed.

8 Guide the two connections to the appropriate openings. While firmly holding down the needle to properly seat the ferrules, snugly tighten both connection fittings using a 1/4" wrench. See Figure 16-56.

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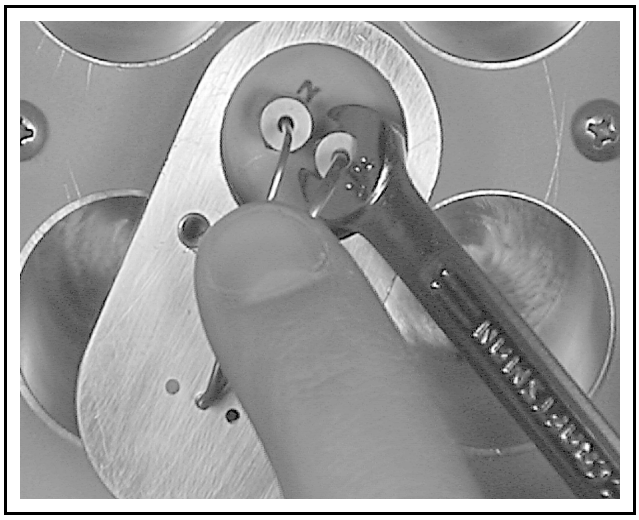
Figure 16-56 Holding Down the Needle while Tightening the Nuts (So Ferrules Seat Properly)



9 Now that the needle is securely in place, replace the cover and two screws. Tighten both screws using the Phillips screwdriver.

10 The HSS is now equipped with a new needle and is ready to operate.

16.10 Battery Charger Maintenance and Troubleshooting

WARNING - Risk Of Electric Shock

Do not attempt to open the case of the Battery Charger. There are no user-serviceable parts inside.

16.10.1 Cleaning The Battery Charger

WARNING - Risk Of Electric Shock

Disconnect the power cord and remove any batteries from the Battery Charger before proceeding.

Clean the surfaces with a damp cloth or sponge and (if desired) a mild household cleaner. Do not use excess water or allow water into the receptacles.

Be sure the cooling slots at the back are clean, as well as the holes in the aluminum base-plate. Be sure the Battery Charger is dry before applying power.

16.10.2 Troubleshooting The Battery Charger

16.10.2.1 If No Indicators are Illuminated

This indicates that AC power is not reaching the power supply within the Battery Charger.

- Check the AC outlet to be sure it is "live" by connecting some other device, such as a lamp.
- Unplug the power cord from the outlet and examine the power cord for wear or breakage.
- Disconnect the power cord from the back-panel connector and replace the fuse. The correct fuse is part number 062-0063, rated for 1.25 A, 250 V (time delay). The slider which holds the fuse can be pried open with a small screwdriver once the power cord has been withdrawn.

NOTE: If the battery charger's connector protrudes from the back panel and requires pressing a clip to open the drawer, the battery charger will contain two fuses. Perhaps only one will be blown.

If the problem persists, contact INFICON Customer Support. See Chapter 18, Customer Support.

16.10.2.2 If the Red Indicator is Flashing

This indicates that the Battery Charger is unable to communicate with the battery (through the center pin).

First, try the battery in a different receptacle. If the problem persists, contact INFICON Customer Support. See Chapter 18, Customer Support.

If the problem is solved, proceed to charge the battery, but suspect a problem with the receptacle. Inspect the receptacle, especially examining the center pin for any insulating material or for signs of looseness. If nothing seems wrong, contact INFICON Customer Support. See Chapter 18, Customer Support.

16.10.2.3 If a Battery Does Not Accept a Charge

If a battery's charge status does not change during the charging cycle and the respective indicator has been green, the battery may be at the end of life.

To be certain that the problem is not with the Battery Charger receptacle, try to charge the battery in an alternate receptacle. If the problem persists, replace the battery. If the battery should not be near the end of life, contact INFICON to discuss other possible steps. See Chapter 18, Customer Support.

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Chapter 17
Glossary

17.1 Glossary

Air peak . . . . . A response by the mass spectrometer to components of air. The compounds in this peak are un-retained, or uninhibited by the standard 30 meter 1.0 μm film thickness boiling point column. This set of compounds typically elutes 1 to 1.5 minutes from the start of analysis.

Alignment . . . . . A part of the tuning process which assures that the mass peaks fall at their calibrated position on the mass scale.

AM . . . . . Analytical Module, also called the HAPSITE and HAPSITE Smart Plus.

AMDIS . . . . . Automated Mass Spectral Deconvolution and Identification System Software

AMU . . . . . (Atomic Mass Unit) The dimension in which a number of protons and neutrons are stated.

Analyte . . . . . That portion of a sample which comprises compounds to be analyzed; that is, separated, identified and measured.

Atomic Weight . . . . . The AMU representation of the number of protons and neutrons in a specified atom.

AutoTune . . . . . A process that occurs when the instrument is initially started up; it automatically performs mass alignment, resolution adjustment and adjustment of relative intensity of the peaks. AutoTune will take place once the heated zones have reached the proper temperature.

Baseline . . . . . A measure of the intensity of the background noise of the mass spectrometer. This is determined using the Noise Check feature in the Tune program.

Calibration Curve . . . . . The mean value of the measured noise level.

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Carrier Gas . . . . . The pure inorganic gas used to aid the flow of sample gas through the chromatograph for analysis. In the HAPSITE VOC-free Nitrogen is normally used.

Column . . . . . The active element of the Gas Chromatograph. The column is a long glass capillary which is lined with a material (called the “stationary phase”) with which the analytes interact based on their physical characteristics, slowing their flow. The degree of this interaction, which is a characteristic of each compound and the chemistry of the stationary phase, progressively separates the different compounds from one another during elution.

Computed Integration Time. . . . . This is the amount of time (in milliseconds) during which the signal from each of the masses in the specified mass range will be gathered by the mass spectrometer. The computation of this time incorporates the Scan Time (sec) and the mass range.

Concentration. . . . . A measure of the amount of a compound in a given volume or weight. This is represented as a ratio, either in mass/mass, mass/volume, or volume/volume terms. For example: 10 ppm/v refers to a mix in which the specified compound is present as 1 X 10^{-5} parts of the whole, in volume terms.

DAC . . . . . Digital to Analog Converter. An element of the electronic circuitry which converts the microprocessor’s digital instructions to the analog requirements for control of the instrument.

DOC . . . . . Declaration of Contamination document that declared what type of chemicals that the instrument has been exposed to.

Electron Multiplier (EM) . . . . . The ion detector of the mass spectrometer. Arrival of an ion causes emission of a burst of electrons, each of which cause more electrons to be emitted, providing a burst of current in response to each ion.

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Elution time . . . . . The time from injection of a specific compound onto the GC until the compound appears at the exit (same as Retention Time).

Equilibrium Time . . . . . The time allowed for a solid or liquid to heat and equilibrate volatile compounds between the sample and associated headspace within a sample vial.

ET . . . . . Elapsed time of sample run. Used for MS scanning.

Extra Measurements . . . . . These determine the number of times the mass spectrometer will scan a mass in SIM analysis before scanning the next mass. Extra measurements effectively increase the response to a mass but also increases the scan time.

Filament . . . . . A hot wire in the ionizer from which electrons are emitted.

Filament Delay . . . . . This specifies the amount of time between the start of analysis and the time which the HAPSITE turns on the filament. Filament delay is a filament preserving measure which allows components of the air peak or solvents to pass through the mass spectrometer before the filament is turned on.

Fit . . . . . A description of how well a reference spectrum matches an acquired spectrum in location and intensity of peaks.

Flow Pressure . . . . . This setting controls the flow rate of Nitrogen through the Headspace Sampling System during the Sample and Purge states.

Flush . . . . . A Headspace Sampling System function which is used to clean out the HSS by heating the sample block and transfer line to 80 degrees Celsius while pushing clean nitrogen through the system (but not into the HAPSITE). Flush is initiated by disconnecting the transfer line from the HAPSITE and pressing the flush switch inside the front door of the HSS.

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Full Method . . . . . Full method allows the user to specify a range of masses to scan during analysis. This is used when analyzing for several compounds (typical analysis) or for analysis of unknowns for tentative identification.

GC . . . . . Gas Chromatograph.

Global Search Parameters . . . . . This specifies the various parameters which will be used to identify compounds which have been included in the Library. These parameters are used unless a separate set of parameters is specified in the compound entry of the Library and set at a higher precedence level.

GUI . . . . . Graphical User Interface.

Hand Control Unit . . . . . The inlet probe of the HAPSITE which comprises a heated line and a hand piece with a display and four control keys.

HAPSITE . . . . . Analytical Module acronym that stands for Hazardous Air Pollutants on Site.

Headspace . . . . . The gaseous volume above a solid or liquid sample in a closed vial, from which a gaseous sample is taken for analysis.

Heated Line . . . . . The inlet line to the HAPSITE, comprising a PEEK tube with a heating jacket, temperature sensors and protective sheath.

HSS . . . . . Headspace Sampling System. This includes components which, when used in conjunction with the HAPSITE, allows the user to quantify and qualify volatile compounds in liquid and solid matrices.

Initialization . . . . . The act of sending target temperature and pressure settings to the HAPSITE or HAPSITE and Headspace Sampling System, then allowing the instruments to achieve these settings.

Injection . . . . . The application of a discrete amount of gas and/or vapor at the entrance of the gas chromatograph column.

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Inlet State . . . . . This refers to a specification of the state of the valves in either the HAPSITE or HAPSITE with Headspace Sampling System. The states of the valves control sampling, analysis, clean-out of the HAPSITE and Headspace Sampling System. It can also be user specified.

Internal Standard . . . . . A mix of known concentrations of known compounds which are installed in the HAPSITE. They are mixed with calibration compounds during calibration and with samples during analysis to validate the response of the HAPSITE to the target analytes.

Ion Energy . . . . . These settings in the Tune program directly affect the intensity of mass peaks. Ion energies are commonly used to set the relative mass intensities of the tuning ions.

Ion Volume . . . . . The specific space in the ionizer within which ionization of the sample takes place.

Ion . . . . . An atom or molecule which carries an electric charge due to depletion or addition of one or more electrons.

Ionizer . . . . . The assembly of parts in the mass spectrometer into which the sample flows and which projects a beam of mixed ions into the mass filter.

I.S. Reference . . . . . This section of the Compound Library identifies the target ion of the internal standard which will be used for quantification of the chosen compound.

kPa . . . . . Kilo Pascal. Unit of pressure measurement which is equivalent to approximately 0.145 PSI.

LCD . . . . . Liquid Crystal Display. This refers to the display screen on the front panel of the HAPSITE.

Lead In . . . . . The time which is allowed for the mass spectrometer to stabilize before detecting a mass during SIM analysis.

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Library . . . . . A user compiled list of compounds, which includes both analytes and internal standards (if chosen). The Library keeps information such as the name, target ion, concentration, retention time, relative mass intensities, and compound specific search parameters (if selected).

LL . . . . . Left Limit.

LMB . . . . . Left Mouse Button.

Mass Calibration . . . . . A function of the HAPSITE which uses Internal Standard gas to check the alignment of masses, and also to check the relative intensities of the tune masses.

Mass Fragment . . . . . A molecule (or ion) resulting from the break-up of a parent molecule.

Mass Defect . . . . . The effect on a mass spectrum of the difference between the atomic weight of a compound or fragment and a whole number.

Mass spectrum . . . . . A display of the amount of each mass fragment present at the specific time, plotted as amplitude vs. molecular weight.

MDP . . . . . Molecular Dispersion Pump.

Membrane Isolation Valve . . . . . The valve which supports the Mass Spectrometer's inlet membrane and (when closed) interrupts the flow of analyte from the membrane into the Mass Spectrometer.

Method . . . . . A set of instructions for a function of the HAPSITE.

Molecular Weight . . . . . The AMU representation of the total number of protons and neutrons in a specified molecule.

MS . . . . . Mass Spectrometer

ms . . . . . milliseconds

MSDS . . . . . Material Safety Data Sheet

Multiplier Voltage . . . . . The voltage applied to the multiplier in the mass spectrometer, which directly effects the amplitude of signal and background noise.

NEG . . . . . Non-evaporative getter as a vacuum source

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NIST Library . . . . . NIST stands for National Institute of Standards and Technology Mass Spectral Library. This is a library of spectra of compounds which can be searched to tentatively identify unknown compounds.

Noise Check . . . . . An option in the Tune program and on the HAPSITE LCD which checks the system for background noise. The results of the noise check are used to discriminate against baseline noise during analysis.

Pascal (pa) . . . . . Unit of pressure, equal to 1 dyne per cm^2. Equivalent to 7.5×10^{-3} Torr and 1.45×10^{-4} PSI.

PEEK . . . . . Polyetheretherketone. A contamination resistant material used for a number of fittings in the HAPSITE and Headspace Sampling System.

Phase . . . . . The coating on the inside of the gas chromatograph column by which organic vapors are retained.

PPB . . . . . Parts per billion concentration level.

PPE . . . . . Personal Protective Equipment.

PPM . . . . . Parts per million concentration level.

PPT . . . . . Parts per trillion concentration level.

Purge . . . . . A Headspace Sampling System state which is used to remove moisture and sample from the system by pushing clean nitrogen through the Headspace Sampling System and HAPSITE. This function is specified in the Inlet Method in the Acquire program.

Purity . . . . . A description of how well an acquired spectrum matches a reference spectrum in location and intensity of peaks.

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Recalculate . . . . . An option in the Calibration section of the Run Method screen which allows the user to compare an analysis to the calibration curve without changing peak integrations. This should be used when the user would like to re-calibrate using the existing parameters. The alternate choice is Search, which does peak integration automatically based on selected calibration curves.

Remote Power . . . . . Power supplied to the HAPSITE and HSS either from the Service Module (for the HAPSITE) or external AC - 24 V(dc) converter.

Resolution . . . . . These settings in the Tune program affect the way the mass spectrometer resolves peaks. Increasing the resolution narrows the peaks in that mass range, while lowering the resolution will broaden the peaks.

Retention Time . . . . . The time from injection of a specific compound onto the GC until the compound appears at the exit (same as elution time).

Reverse Search . . . . . A function of the NIST search (tentative unknown identification) library which allows compounds which are specified in the user Library to be identified as part of the search.

RH . . . . . Relative humidity.

RIC . . . . . (Reconstructed Ion Chromatogram) A presentation of the chromatographic record which extracts from the TIC and displays the intensity of the ion or ions specified.

Round Trip Time . . . . . The amount of time required to complete a scan of all the masses specified in a SIM method. This includes the number of masses, integration time, number of extra measurements, lead in time, and peak width.

RL . . . . . Right Limit.

RMA . . . . . Return material authorization document. Returning material can not be sent back without this document.

RMB . . . . . Right Mouse Button.

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% RSD . . . . . Percent Relative Standard Deviation. This is a measure of the linearity (using mathematical regression analysis) of the concentration levels in the calibration curve for each compound.

Sample Loop . . . . . The portion of the gas chromatograph through which the inlet flow is directed and from which the injection is made.

Sample Vial . . . . . In this situation, sample vial refers to a 40 mL glass vial with a plastic cap and PTFE/silicon septum.

Sample Well . . . . . A section of the Headspace Sampling System which allows insertion of a 40 mL sample vial, and is used to heat the sample during equilibrium.

Scan Method . . . . . This method specifies the masses to be scanned by the MS, length of the run, filament delay, and scan and integration times.

Scan Time . . . . . In Full Scan analysis, this refers to the cumulative time required to make a scan of all the masses in the range specified. The calculation of Scan Time includes the integration time and the points/AMU.

Septum . . . . . Rubber or silicone part of a sample vial. It allows for piercing with a needle to inject standards while retaining an ‘air tight’ seal to retain volatile compounds.

SIM . . . . . Selected Ion Monitoring. Mass analysis of one or several ion peaks without scanning the entire spectrum.

SIM Method . . . . . Selected Ion Mode Method. This allows the user to set up specific masses to be detected during an analysis. This is used for better response to specific masses for known compounds.

IPN 074-472-P1C

SituProbe . . . . . The SituProbe Purge and Trap System is a sampling accessory for the HAPSITE. It is used for in-situ testing of volatile organic compounds (VOCs) in water. Used in combination with the HAPSITE, the SituProbe accessory performs water analyses for qualitative and quantitative results in the field. The SituProbe can be configured for both unattended and continuous sampling as well as user-initiated, manual sampling.

SM . . . . . Service Module

Spectrum Grab . . . . . This action is performed in the Run Method program to store information about a compound, including name, retention time, and relative mass intensities for the 10 largest mass peaks. This information, when grabbed, is stored in a grabfile.

Target Ion . . . . . The specific ion mass which will be used for quantification or primary identification of a compound in the Library (also referred to as Compound Library).

Temperature Programmable . . . . . Software controlled temperature programming that allows the user to reach temperatures from ambient to 225 °C in a controlled ramp.

Threshold . . . . . A measure of the amplitude of the background noise of the mass spectrometer. This is determined using the Noise Check feature in the Tune program.

TIC . . . . . Total Ion Chromatogram. A presentation of the flow from the GC as measured by the mass spectrometer, adding up the signals from all the masses programmed and presented as a function of time.

TMP . . . . . Turbo Molecular Pump

Torr . . . . . Unit of sub-atmospheric pressure. Equivalent to 133.3 pa.

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Tune . . . . . A term (noun or verb) which generally refers to mass spectrometer settings used to distinguish and detect mass fragments.

Vacuum Interconnect Valve . . . . . The two-part valve which seals the HAPSITE manifold, when closed, and opens it to the vacuum pumps in the Service Module, when open. The Vacuum Interconnect Valve is powered by a motor within the Service Module, under direction of the HAPSITE.

VSO Valve . . . . . Voltage Sensitive Orifice valve. This valve uses voltage applied to the valve to control the size of its orifice. This in turn controls the flow rate of gas through the Headspace Sampling System and HAPSITE, when connected.

Y-Cable . . . . . A cable which connects to the power supply and enables powering of both the HAPSITE and Headspace Sampling System simultaneously from one converter.

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Chapter 18
Customer Support

18.1 How To Contact Customer Support

Worldwide support information regarding:

- Technical Support, to contact an applications engineer with questions regarding INFICON products and applications, or
- Sales and Customer Service, to contact the INFICON Sales office nearest you, or
- Repair Service, to contact the INFICON Service Center nearest you,

is available at www.inficon.com.

If you are experiencing a problem with your instrument, please have the following information readily available:

- the serial number for your instrument,
- a description of your problem,
- an explanation of any corrective action that you may have already attempted,
- and the exact wording of any error messages that you may have received.

To contact Customer Support, see Support at www.inficon.com.

18.2 Returning Your Instrument to INFICON

Do not return any component of your instrument to INFICON without first speaking with a Customer Support Representative. You must obtain a Return Material Authorization (RMA) number from the Customer Support Representative.

If you deliver a package to INFICON without an RMA number, your package will be held and you will be contacted. This will result in delays in servicing your instrument.

Prior to being given an RMA number, you will be required to complete a Declaration Of Contamination (DOC) form. DOC forms must be approved by INFICON before an RMA number is issued. INFICON may require that the instrument be sent to a designated decontamination facility, not to the factory.

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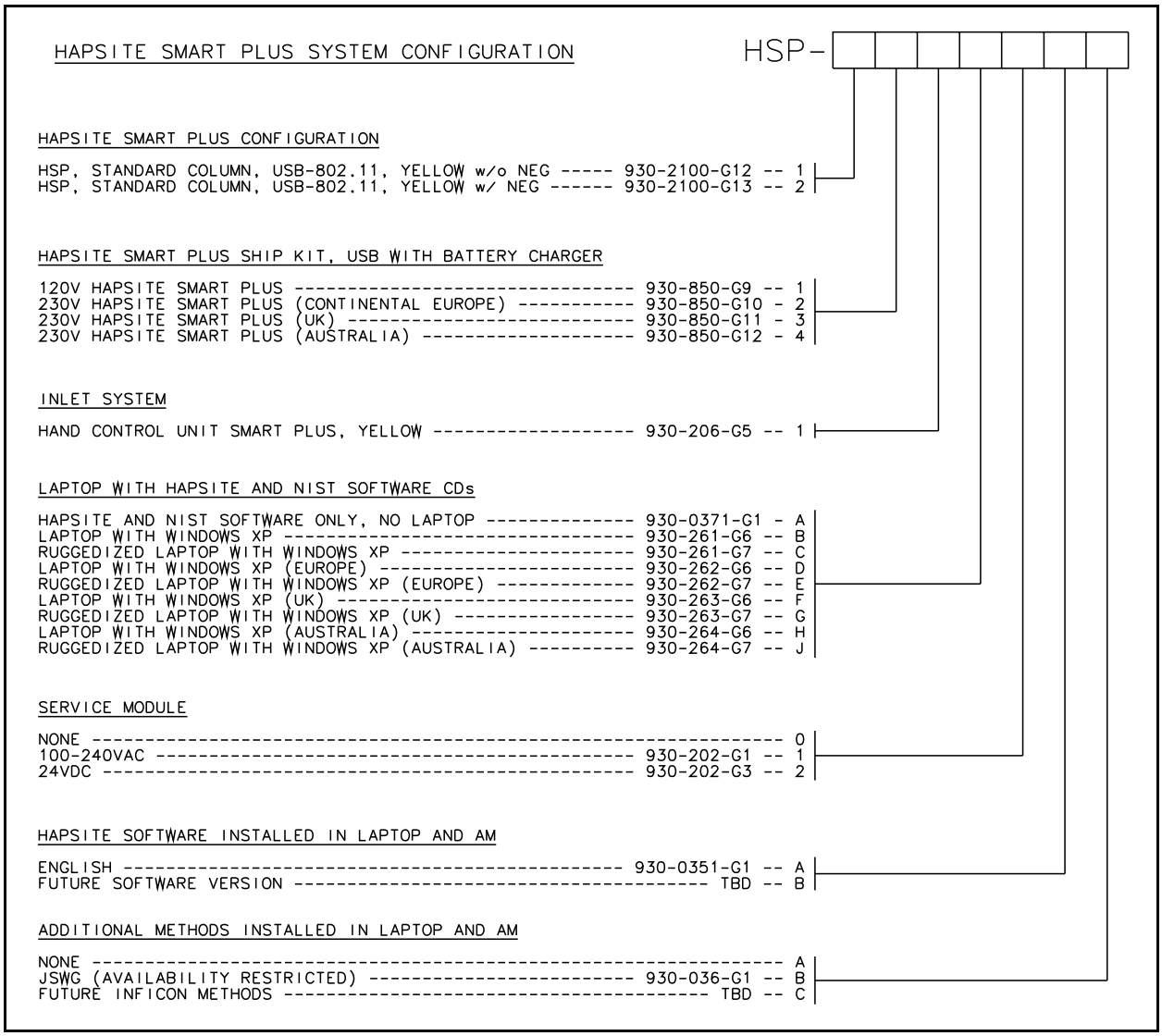
Chapter 19
Part Numbers

19.1 HAPSITE Smart Plus System Configuration

Figure 19-1 HAPSITE Smart Plus System Configuration



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19.2 HAPSITE Smart Plus Accessories

Service Module

930-202-G1 . . . . . 100/120/230 V(ac)

930-202-G3 . . . . . 24 V(dc)

931-205-G1 . . . . . Headspace Sampling System

932-220-G1 . . . . . HAPSITE SituProbe Sampling System

19.3 HAPSITE Smart Plus Spare Parts

059-329 . . . . . Quick Disconnect Stem for N2

068-002 . . . . . Battery Charger / Service Module Power Cord, U.S.

074-5010-G1 . . . . . HAPSITE Smart Plus Manuals CD

Cables

600-1319-P1. . . . . Ethernet Communication Cable (Crossed) - Yellow Cable (12 ft)

930-246-G1 . . . . . Hot Swap Cable (Battery Test Bracket)

Kits

930-021-G1 . . . . . Gasket Kit

930-0221-G1 . . . . . Concentrator Tube Nut and Ferrule Kit, 10 each

930-022-G1 . . . . . Tool Kit with Torque Wrench Kit

930-0231-G1 . . . . . Probe Nut and Ferrule Kit, 5 each

930-2020-G1 . . . . . Decon Cap Plug Kit

930-705-G1 . . . . . Sample Loop Tube Kit

930-206-G1 . . . . . Hand Control Unit (Probe)

930-249-G2 . . . . . Concentrator Cover

930-250-G1 . . . . . Sample Loop Cover

Concentrator Tubes

930-251-G1 . . . . . w/Heater, Tenax

930-252-G1 . . . . . w/Heater, Carbopack X (Modified)

930-716-G1 . . . . . w/Heater, Tri-Bed Concentrator Tube Kit

930-4051-P1 . . . . . Cold Weather Insulating Bag

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930-4061-G1 . . . . . Battery

Line Insulation

931-405-P2. . . . . Thin Probe Insulation

931-408-P2. . . . . Heavy Probe Insulation

NIST

930-4071-G1 . . . . . NIST Version Upgrade to NIST '05

930-4081-G1 . . . . . NIST '05 (with AMDIS)

930-4141-P1. . . . . VX Conversion Tubes, 10 each

930-4551-G1 . . . . . Backpack, HAPSPACK

Shipping Cases

930-464-P1. . . . . HAPSITE

932-403-P1. . . . . HAPSITE SituProbe (replaces SPS-1062-G1)

930-4131-P1. . . . . HAPSITE Accessory Case

930-469-P1. . . . . 110 V(ac) - 24V(dc) HAPSITE Power Supply

930-470-G1 . . . . . Battery Charger

19.4 HAPSITE Smart Plus Consumables

NEG Pumps

930-242-G1 . . . . . Installed and Activated at Factory

930-425-P1. . . . . Spare Pump

Carrier Gas Canisters

930-432-P6. . . . . 6 each

930-432-P12. . . . . 12 each

930-432-P24. . . . . 24 each

Extended Life Carrier Gas Canisters

930-720-G1 . . . . . Extended Life Carrier Gas Deployment Kit (110 liter)

930-4611-P1 . . . . . Extended Life Carrier Gas (110 liter cylinder)

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Internal Standard Canisters

930-433-P6. . . . . Canister, Internal Standard Gas, 6 each

930-433-P12. . . . . Canister, Internal Standard Gas, 12 each

930-433-P24. . . . . Canister, Internal Standard Gas, 24 each

Combo Pack Canisters

930-477-P1. . . . . Gas Combo Pack (4 Carrier Gas and 2 Internal Standard)

071-747 . . . . . Performance Standard Concentrator / Air (5 analytes) in Methanol 1.2 mL

071-760 . . . . . HAPSITE Chemical Standards Kit, 12 part (for training/practice)

930-205-G1 . . . . . Ionizer With Magnet

19.5 Headspace Spare Parts

070-1204 . . . . . Sample Vials, Case of 100

931-702-G10 . . . . . Vial Needle Guide,10 each

Syringes

070-1205 . . . . . 25 mL Gastight (not supplied with needle), each

070-1206 . . . . . 10 µL Gastight w/Removable Needle, each

070-1223 . . . . . 10 µL w/Fixed Needle, 6 each

070-1224 . . . . . 50 mL Luer Lock, each (not supplied with needle)

070-1207 . . . . . Replacement 10 µL Needle for Syringe (070-1206), each

931-402-P1 . . . . . Sample Needle, Headspace

071-748 . . . . . Performance/IS Standard Headspace (4 analytes) in Methanol 1.2 mL

930-4151-P1 . . . . . VX Conversion Pads (Headspace), 10 sets

931-406-P1 . . . . . Shipping Case, Headspace

Line Insulation

931-405-P1. . . . . Thin

931-408-P1. . . . . Heavy

600-1131-P30. . . . . Y Power Cable

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19.6 Service Module Spare Parts

068-002 . . . . . Battery Charger / Service Module Power Cord, U.S.

930-0211-G1. . . . . Torque Wrench Kit

930-465-P1. . . . . Shipping Case, Service Module

600-1001-P15. . . . . RS232 Cable (15 ft)

19.7 HAPSITE SituProbe Spare Parts

940-700-G1 . . . . . SituProbe Vessel and Plugs

933-700-G1 . . . . . Collection Tube Replacement Kit

931-401-P2. . . . . Transfer Line

Line Insulation

931-405-P1. . . . . Thin

931-408-P1. . . . . Heavy

600-1131-P30. . . . . Y Power Cable

932-220-G1 . . . . . HAPSITE SituProbe Accessory (6 ft), Replacement

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Appendix A
HAPSITE Target Compounds

A.1 Compounds In Order Of Elution

Name	Formula		k	Quantion AMU	I.S. AMU	CAS #
Chloromethane	CH3Cl	a	0.08	50	50	74-87-3
Vinyl Chloride	CH2=CHCl	a	0.11	62	50	75-01-4
Bromomethane	CH3Br	b	0.17	96	9	74-83-9
Chloroethane	CH3CH2Cl	b	0.19	64	69	75-00-3
Acetone	CH3COCH3		0.27	43,58	50	67-64-1
1,1-Dichloroethylene	CCl2=CH2	c	0.37	98	99	75-35-4
Methylene Chloride	CH2Cl2	c	0.39	86	99	75-09-2
Carbon Disulfide	CS2		0.46	76	69	75-15-0
trans-1,2-Dichloroethylene	CClH=CHCl		0.51	96	69	540-59-0
1,1-Dichloroethane	CHCl2CH3	d	0.57	65	69	75-34-3
Vinyl Acetate	CH3COOC(H)CH2	d	0.57	43,86	50	108-05-4
2-Butanone	CH3COCH2CH3		0.63	43,58	69	78-93-3
cis-1,2-Dichloroethylene	CClH=CClH		0.73	96	99	540-59-0
Chloroform	CHCl3		0.78	83	69	67-66-3
1,3,5Tris(trifluoromethyl)benzene	C6H3(CF3)3	e	0.96	Note 1		729-81-7
1,2-Dichloroethane	CClH2CClH2	e	0.98	64	69	107-06-2
1,1,1-Trichloroethane	CCl3CH3		1.07	97	99	71-55-6
Benzene	C6H6		1.22	78	69	71-43-2
Carbon Tetrachloride	CCl4		1.26	117	125	56-23-5
1,2-Dichloropropane	CH2ClCHClCH3		1.51	63	69	78-87-5
Bromodichloromethane	BrCl2CH	f	1.59	83	69	75-27-4
Trichloroethene	ClCH=CCl2	f	1.61	130	99	79-01-6
cis-1,3-Dichloropropene	CClH=CCClH2(H)	g	2.08	75	69	542-75-6
4-Methyl-2-Pentanone	CH3COCH2CH(CH3)CH3	g	2.11	43,58	69	108-10-1
trans-1,3-Dichloropropene	CClH=C(H)CClH2		2.44	75	69	542-75-6
1,1,2-Trichloroethane	CHCl2CH2Cl		2.56	97	99	79-00-5
Toluene	C6H5CH3		2.8	91	79	108-88-3
2-Hexanone	CH3CO(CH2)3CH3	h	3.08	43,58	79	591-78-6
Dibromochloromethane	Br2ClCH	h	3.16	127	117	124-48-1
Tetrachloroethylene	Cl2C=CCl2		4.02	129	167	127-18-4
Chlorobenzene	C6H5Cl		5.07	122	117	108-90-7
Bromopentafluorobenzene	C6BrF5		5.59	Note 2		344-4-7
Ethyl Benzene	CH3CH2C6H5		5.91	91	79	100-41-4
Bromoform	CHBr3	i	6.24	173	167	75-25-2
m-Xylene	C6H4(CH3)2	i	6.35	106	117	1330-20-7
p-Xylene	C6H4(CH3)2	i	6.35	106	117	1330-20-7
Styrene	C6H5CH=CH2		7.25	104	117	100-42-5
o-Xylene	C6H4(CH3)2	j	7.52	91	79	1330-20-7
1,1,2,2-Tetrachloroethane	CHCl2CHCl2	j	7.52	83	79	79-34-5

Internal Standards

Note 1: 69, 75, 99, 125
Note 2: 79, 117, 167

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Appendix B
Calibrating Gas Mixtures

B.1 Acquisition, Preparation, and Handling

WARNING

Failure to calibrate the instrument may lead to inaccurate identification and quantification of compounds being sampled.

WARNING

When using chemicals, wear appropriate PPE according to MSDS and take recommended precautions (fume hood, etc.)

The HAPSITE (or any GCMS instrument) must be calibrated at one or more concentration levels of the organic compound(s) of interest for quantitative analysis of these target compounds. In the case of the HAPSITE, the target compounds must be supplied to the instrument as a gaseous mixture of known volume/volume composition (mole/mole % or ppmv levels in air or nitrogen) and at atmospheric pressure.

There are a number of important factors to consider where attention to detail is important in acquiring, preparing, and handling gaseous standard calibration mixtures. These can be organized in three groups:

1. How to establish the desired concentrations of the required compounds. See section B.1.1 on page B-2.
2. Correct delivery of the mix to the inlet of the HAPSITE. See section B.1.2 on page B-3.
3. Gas cylinder safety, contamination checks and corrective steps in the equipment. See section B.1.3 on page B-6.

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B.1.1 How to Establish the Desired Concentrations

There are two basic ways to obtain several concentrations of a given mix of compounds. The most obvious is to buy the compounds, premixed to specification, in cylinders containing the several concentrations desired. The second is to buy a master cylinder of the compounds at the highest concentration needed, and dilute to the lower concentrations required. Each of these options is discussed below.

B.1.1.1 Using Cylinders Charged with Each Concentration

To perform a calibration, have the known gas mixtures on hand. A gas supplier (such as Scott Specialty Gases[1]) can provide a choice of cylinder sizes with the compounds of interest mixed in a suitable matrix at the requisite concentrations. The matrix (or balance gas) for the mixture should be specified as "VOC-free Nitrogen" or "VOC-free Air", to minimize the level of background VOC's in the calibration mix.

The concentrations for calibration of the various target compounds will probably be defined in the method being followed. The method may specify, for example, 0.1 ppm, 1 ppm, and 10 ppm of each compound. Calibrate the HAPSITE to bracket the concentrations at which the target compounds will occur in samples.

The mixtures received will be tagged with the precise value of the concentration of each compound as delivered; these will be approximately the concentrations ordered. The concentration supplied will generally be within ±10% tolerance; this is termed the *blend accuracy.*

The precise values are the ones to be used in the course of building the calibration libraries, and are accurate to +2 -20 %, depending on the target concentration levels and the certification methods used; this is termed the *analytical accuracy.* The certified concentrations in each cylinder mixture will generally be stable at room temperature conditions for about six months.

The selected gas supplier should be able to advise about the reactivity of the compounds needed, and the materials of cylinder construction to provide the best long term stability of the concentration. The supplier will recommend the use of stainless steel regulators with stainless diaphragms. To minimize stagnant volumes where VOCs can accumulate, the regulator body should be designed with minimum internal dead-volume. Use 1 " diameter gauges, or eliminate the gauges altogether. The regulators and the tubing following should be rated for high purity, mildly corrosive (or corrosive) service if any halogenated VOC's are to be delivered.

NOTE: A regulator/transfer line system must be well purged with pure nitrogen or air to remove any residual VOCs prior to use with a cylinder containing a lower concentration mix.

1.Scott Specialty Gases: (215) 766-8861

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Transfer fittings should be of the stainless steel Swagelok[2] type, and transfer lines should be clean, stainless steel or nickel 1/8 inch tubing. Teflon tubing should be avoided due to its permeability. Ideally, regulators and transfer lines should be heat-traced to maintain above ambient temperatures (35-55 °C) and to reduce adsorption of the higher boiling VOC's.

B.1.1.2 Diluting the Gas On SIte

The comments above, concerning hardware, relate as well to the case of dilution systems. Guidelines to verify acceptable performance of suitable dynamic gas mixing/dilution systems are suggested in the Federal Register (vol. 59, No. 148, Aug. 3, 1994 Proposed Rules, 40 CFR Part 51 Method 205),

Systems conforming to the Method 205 suggestions are available commercially from Environics[3] (Series 2014 Computerized VOC Gas Dilution System) and Alltech[4] (GB-2 Gas Blender).

The materials in the flow stream must be inert to the VOC compounds to be used, and heat-traced to prevent condensation and accumulation of any VOC's in the flow channels. A good gas mixing system minimizes future outlay in certified cylinder gas standard mixes. This allows a lab to require only the cylinders at the highest calibration concentration levels. Lower concentrations (by as much as a factor of 1000) can be prepared by serial dilution (with VOC-free Nitrogen or air) of these cylinder mixes to the desired calibration levels with the gas mixing system. This is probably the most economic route for labs which must frequently do multi concentration re-calibrations for known VOC mixtures.

B.1.2 Correct Delivery of the Mix to the Inlet of the HAPSITE

The HAPSITE is designed to draw in samples which are at atmospheric pressure. Internal Standards gas is mixed with the sample in a ratio which is dependent on the flow rate of the sample gas and the suction of the pump.

WARNING

Connecting the inlet of the Hand Control Unit to a sample at a pressure above or below atmospheric will cause the mixing ratio of the Internal Standards to be incorrect, so the resultant calibration will be invalid.

2.Swagelock (Crawford Fitting Company): (216) 248-4600
3.Environics: (203) 429-5040
4.Alltech: (800) 255-8324

There are two basic approaches to assuring that the calibration mix is at atmospheric pressure: a free flow of gas or capture of the gas mixture in an inert sample bag.

B.1.2.1 Free Flow of Gas

The free flow of gas from the regulator of a pressure cylinder is reduced to atmospheric pressure when the impedance to flow is small. This can be achieved by placing a sampling tee at the point where the line becomes large in diameter. The connection of the HAPSITE sample probe inlet should be at right angles to the direction of gas flow with 1/8" stainless steel Swagelok fittings.

WARNING

The excess vent flow (overflow) from this sampling tee (in the gas flow direction) should exit through stainless steel fittings of at least 1/4" size and a short vent line to a fume hood or other exhaust system.

The smaller "leg" of the sampling tee is coupled to the HAPSITE. The total flow to the sampling tee should be approximately 1 liter/min. to allow sufficient excess over the HAPSITE sampling flow rate which is approximately 200 cc/min. and to prevent external air from being drawn back into the vent "leg" of the sampling tee which would alter the concentrations delivered from the cylinder or mixer.

B.1.2.2 Inert Sample Bag

Ultra clean Tedlar sample bags, dedicated to a given VOC compound mix/concentration level, will be the most economic option for regular calibration (more than once a week) and eliminates the waste of certified gas mix out of the sampling tee vent. The dedicated Tedlar bag can be filled directly from the associated gas cylinder or gas mixing system effluent.

WARNING

Regulate the gas delivery to avoid overfilling the bag. The bags are not designed to be pressurized.

Alternatively, a bag can be filled by delivery of a set volume of the diluent gas (via a mass flow meter), then adding a set volume of the certified cylinder VOC gas mix, followed by mixing to homogeneity in the bag to obtain the proper dilution. A 12-liter Tedlar bag will allow about 60 HAPSITE samplings of the contents between refills.

The use of properly filled Tedlar bags inherently assures that the gaseous contents are at atmospheric pressure for sampling. A properly filled Tedlar bag will have plenty of flex left in the bag walls so that the bag can be easily kneaded to mix the

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contents. The bag should not be filled to the point where the bag appears like a firm "air pillow", as the bag would then be at above atmospheric pressure, and could not be sampled accurately by the HAPSITE. In addition, this would lead to eventual leakage along the bag seams, destroying the integrity. The use of straight through on-off valves on the Tedlar bags (such as on 231 -XX series bags by SKC[5], Inc.) should minimize any flow restriction variation in gas delivery to the HAPSITE and are preferred.

Clean Tedlar bags to be filled with a certified gas mix should be filled once with the gas mix and allowed to stand several minutes for preconditioning, then evacuated with a transfer line and a diaphragm vacuum pump and refilled again with the mix.

Fittings on the Tedlar bags are typically 3/16" diameter; the inlet systems for the HAPSITE are 1/8" diameter. Connection of the Hand Control Unit (or the Heated Line) to the Tedlar bag can be made with a stainless steel Swagelok type adapter, 3/16" to 1/8". The recommended parts for this adapter include:

3/16" to 1/8" Reducer . . . . . (Swagelok part# SS-300-R-2)

3/16" Teflon Ferrule Set . . . . . (Swagelok part# T-300-Set)

1/8" Nut . . . . . (Swagelok part# S-S-202-1)

1/8" Ferrule Set . . . . . (Swagelok part# SS-200-Set)

The 3/16" O.D. tube on the Tedlar bag valve will slip into and out of the 3/16" nut on the adapter, which can be easily finger tightened to seal leak free on the Teflon ferrule set. Care should be taken to not completely unscrew the 3/16" nut from the adapter each time a Tedlar bag is removed, to prevent dropped and lost nuts and ferrules. The 1/8" end of the adapter is a swaged connection to the 1/8" male Swagelok fitting on the end of the HAPSITE Hand Control Unit, so wrenches will be required to make a leak free connection here.

The Tedlar bag valve should be open only during the HAPSITE sample taking cycle to save gas usage.

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5.SKC: (800) 752-8472

B.1.3 Gas Cylinder Safety, Contamination Checks, and Corrective Steps

WARNING

Safety of operations should always take precedence in the working environment. Gas cylinders should be properly affixed to lab benches with clamps, or chained to the wall for safety. A safety certified gas cylinder cart should be available in the vicinity of where the cylinders are normally used, for moving them and replacing empty cylinders. Gas cylinders should never be transported with the regulator attached!

Tedlar bags may be cleaned for reuse, or replaced with new bags. To clean a Tedlar bag for use with different VOC's or concentrations, partially fill with VOC-free N_2 or VOC-free air, heat it to 40-50 °C by wrapping the bag with an electric blanket for several minutes, then evacuate the bag contents through the open valve with a clean transfer line to a diaphragm vacuum pump. This operation should be repeated 3 times for a normal cleaning. Then the bag may be stored filled with VOC free N_2 or VOC-free air until needed.

To protect the concentration integrity in the bag, care should be taken to purge and refill any standard gas mix after two weeks. Keep the standard gas mix at room temperature between samplings with the bag valve securely closed,

This is especially important for concentrations below 1 ppmv and for VOC's of limited stability in the Tedlar sample bags. Depending on the compounds (and their concentrations) that were previously present in the bags, and if the bags are to contain less than 1 ppmv standard gas mixes, pre-analyze the bag (after the cleaning process above) while the bag is still filled with the VOC-free N_2, or VOC-free air, using the HAPSITE. The detection of any target compounds in the bag should necessitate recleaning or replacement with a bag known to be "clean".

A supply of clean Tedlar bags can be useful for quick standards preparation by direct liquid injection of VOC's not regularly analyzed into an N_2 or air matrix in the bags. This allows a more convenient and rapid alternative to gaseous cylinder mixes in such uses as new applications development or verification of unknown VOCs by component spiking. This should be qualified by saying that accurate gas standard preparation by direct liquid injection is only recommended at levels greater than 5 ppmv, because the minimum liquid volume deliverable by syringe at an acceptable accuracy and precision is about 0.5 µL. This corresponds to approximately 10 ppmv in a 12 liter Tedlar bag, or approximately 3 ppmv in a 40 liter Tedlar bag. Larger Tedlar bags are available but convenience in regular handling and the possibility of target compound adsorption on the larger interior surface area may be matters of concern.

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Appendix C
Shipping the HAPSITE and Consumables

C.1 Introduction

The HAPSITE instrument and its Service Module are designed to be easy to ship for use at remote locations. The instruments can be reshipped in the cardboard boxes (with the same cut-foam inserts) you received them in. These will probably not suffice for frequent shipping. A heavy-duty fitted shipping case for the HAPSITE is available from INFICON as part number 930-464-P1. The case for the Service Module is part number 930-465-P1. Protected by these cases, the instruments will survive handling by most airline, air freight, and trucking handlers.

While there is room for the necessary cables in each case, additional boxing must be done for certain accessories and consumables, as detailed below.

CAUTION

The batteries should be removed from the HAPSITE and the Service Module before shipping, as their weight, under the shock-loads of shipment, will damage the respective instrument.

Batteries will require their own packaging for shipment. The Laptop, if required at the remote site, should be hand-carried.

NEG Pumps can easily be shipped in the box in which they are received. A NEG pump installed in the HAPSITE will not be damaged by shipment.

C.2 Shipping the Canisters

WARNING

When shipping canisters, follow DOT regulations for packaging, labeling, and methods in which hazardous materials can be shipped.

The canisters of carrier gas and internal standard gas are pressurized to 700 kPa (100 psig) or more. The canisters are approved by the Department of Transportation (DOT), but they are considered hazardous cargo because of the pressure. They are permitted to be transported on passenger aircraft, but not in the passenger compartment, nor checked as luggage, nor in luggage. The labeling of

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the cartons and the paperwork required are exacting and can be tedious, so the easiest approach is to contact INFICON and order the required gases to be shipped directly to the site.

WARNING

Do not ship canisters installed in the HAPSITE; they are considered hazardous

If personal gases are chosen to be shipped, the original cartons can be used to save time. If new cartons must be used, refer to the old shipping packages for the required labeling.

The regulations governing shipments of hazardous goods are found in the DOT portion of the Code of Federal Regulations: Part 171, 172 and 173 of 49 C.F.R. The gas canisters, pressurized, are classified as hazardous materials under Section 172.101. When shipped from INFICON, they meet all the packaging requirements set forth in Section 173.

Federal Express, UPS, and the passenger airlines are forbidden to accept such cargo unless it is accompanied with the required "Shipper's Declaration for Dangerous Goods" in four copies. Both FedEx and UPS have their own version and will provide instructions. The generic version, for use with airlines, is shown after page C-3, and for instructions on filling out the form, see below.

In filling out the form, it is important to be precise. In the "Transport Details" box, firmly *cross out* the term "Cargo Aircraft Only". To the right of the box, *cross out* the term "Radioactive".

The "Proper Shipping Name" and "UN or ID NO." are either:

- Nitrogen, Compressed, UN 1066, or
- Compressed Gases, n. o. s., UN 1956 respectively (Bromo-pentafluorobenzene, Nitrogen)

The "Class or Division" is *2.2*. "Packing Group" and "Subsidiary Risk" are left blank. "Quantity and Type of Packing" for a single six-pack would read:
6 DOT 2M Canisters in Fiberboard Box X 0.04 Kg.

For two six-packs in a single larger box (which must carry the green diamond and other placarding), this would read *12 DOT 2M Canisters in 2 Fiberboard Boxes X 0.08 Kg (Overpack Used)*. The Kg number refers to the total mass of the gas, not the gross weight.

In the "Packing Inst." column write *200*. The "Authorization" column is left blank. The signature section is very important; fill it out completely.

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The "Shipper's Declaration for Dangerous Goods" is a "Style F83R" from Label master in Chicago; their phone number is 800 621-5808. They are carbon-less four-part forms and may be available from local stationary suppliers. The form, and all its copies, must have red markings along the borders; black and white copies will not be accepted.

Although the airline will carry the box of canisters in the same cargo hold as the goods you check as baggage, they will not accept hazardous materials at the check-in counter. Take the box of canisters with the form filled out to the desk of your airline at the ***air freight terminal*** at your airport. They will be able to accept it and get it onto the flight.

C.3 Empty Canisters

It is important to remember that it is the *pressure* of the gas in the canisters which is considered hazardous. The gases themselves are basically nitrogen, which is a simple asphyxiant. (The amount of the organic Internal Standards compounds is 50 ppm and 100 ppm).

To discard the canisters, simply discharge them outdoors by inserting any small point into the valve. Once they are empty, they can be disposed of as aluminum scrap.

WARNING

When discharging the canisters, point them away from people and stand upwind of the discharge. Whenever possible discharge canisters in vent hoods.

If the empty canisters cannot be recycled or disposed, they may be shipped back to their point of origin for disposal:

Be certain that they are empty (less than 30 psi) then package them in a *plain* cardboard box, *without* any green diamond label. Mark the box as "**Empty Canisters for Destruction"**. Ship them, prepaid, to

Scott Specialty Gases
2330 Hamilton Boulevard
South Plainfield NJ 07080

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AMERICAN LABELMARK CO. — CHICAGO, IL 60646 309141-DP

SHIPPER'S DECLARATION FOR DANGEROUS GOODS

(Provide at least two copies to the airline.)

Shipper	Air Waybill No. Page of Pages Shipper's Reference Number *(optional)*
Consignee	

Two completed and signed copies of this Declaration must be handed to the operator

TRANSPORT DETAILS

This shipment is within the limitations prescribed for: *(delete non-applicable)*

PASSENGER AND CARGO AIRCRAFT | CARGO AIRCRAFT ONLY

Airport of Departure

Airport of Destination:

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

Shipment type: *(delete non-applicable)*

NON-RADIOACTIVE | RADIOACTIVE

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification					Quantity and Type of packing	Packing Inst.	Authorization
Proper Shipping Name	Class or Division	UN or ID No.	Packing Group	Subsidiary Risk			

Additional Handling Information

24 hr. Emergency Contact Tel. No._____

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Name/Title of Signatory

Place and Date

Signature
(see warning above)

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