

Varian, Inc. 2700 Mitchell Drive Walnut Creek, CA 94598-1675/USA

210-MS and 220-MS GC/MS Ion Trap Mass Spectrometer

# **Installation Procedure**

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## Overview

Before scheduling the installation, call the customer to determine if they have met the site requirements listed in the Pre-Installation Instructions. The critical site requirements are bench space and load, power, temperature, humidity, carrier gas purity (helium), and CI gas purity (methane).

Use these procedures to set up the 210-MS and the 220-MS GC/MS lon Trap (210/220-MS GC/MS), meet product specifications, and familiarize the customer with the system. Also, test and demonstrate the CI ionization mode if it was purchased.

Under normal circumstances, the installation of the 210/220-MS GC/MS Ion Trap with EI requires 2 days on site.

## **Typical Installations**

NOTE: Unless specified, these instructions are for both the 431-GC and the 450-GC

1. System unpacking, setup and checking	2 hours
2. Power up, pump down, demo	4 hours
3. Verification of GC/MS System Operation	2 hours
4. El checkout and demo	1 hours
5. Additional customer familiarization	4 hours
Option Installation	
<i>Option Installation</i> 1. Autosampler installation, check out, familiarization	1.5 hours
<ul><li>Option Installation</li><li>1. Autosampler installation, check out, familiarization</li><li>2. CI ionization mode demo, familiarization</li></ul>	1.5 hours 0.5 hour
<ul> <li>Option Installation</li> <li>1. Autosampler installation, check out, familiarization</li> <li>2. CI ionization mode demo, familiarization</li> <li>3. MS/MS demo</li> </ul>	1.5 hours 0.5 hour 0.5 hour

Enter installation results into the Installation Tracking Database.

NOTE: Test samples are not shipped overseas with the system. Before going on site to do an installation, ensure that you have all the necessary samples, or that they have been shipped to the customer from a local Varian office. Installation engineers outside of the USA should confirm the availability of test samples from their home office as much as two weeks in advance. For US shipments the samples are shipped with the system.

# Setting Up

#### **Checking the Installation Site**

Determine if the installation site meets the requirements listed in the Pre-installation Instructions.

#### Unpacking



The MS, foreline pump, and gas chromatograph are heavy. To prevent personal injury, use appropriate moving and lifting techniques.

While unpacking the system, check thoroughly for missing parts and shipping damage. Use caution when unpacking the MS; do not use the transfer line as a handle.



Using the transfer line to lifting the instrument can result in damage to the analyzer.

Before setting up and starting the GC/MS, ensure that all parts and kits were delivered and are complete. Review with the customer the contents of the accessory kits and their functions.

Report all shipping damage or missing parts to the Customer Service department (Phone: 925-939-2400, Fax: 925-945-2360, email: orders.csb@varianinc.com), Varian, 2700 Mitchell Drive, Walnut Creek, CA, 94598.

Note any shipping damage or missing items on the installation checklist and in the Installation Tracking Database.

#### **Connecting Components**

- 1. Set the GC, MS, and PC on the bench.
- 2. Check that the instruments are wired for the installation site voltages.
- 3. Keep the GC and MS separate at least 46 cm (18 in.) to allow easy access to both instruments.

- 4. Remove the turbo pump shipping restraint from the MS.
- 5. Remove the shipping restraints from the GC including the metal dowel at the rear of the GC.
- 6. Instruct the customer to keep the removed restraints, in case the system needs to be transported.
- Connect the foreline hose to the foreline pump. Connect the power cord of the foreline pump to the LINE VOLTAGE PUMP ONLY connector at the rear of the MS. To minimize vibrations, put the foreline pump on the floor not on the bench.
- 8. Connect the power cords of the MS, the GC, and the PC into the appropriate outlets.
- 9. Connect the GC to the MS as follows:
  - 431-GC: Connect the sync cable to the back of the GC at J2 sync analog out and to the back of the MS at J43 Remote Option.
  - 450-GC: Connect the sync cable under the GC top cover at J401 sync analog out and to the back of the MS at J43 Remote Option.



J2 Sync/Analog Out on back of 431-GC



J401 connection on top of 450-GC



J43 Remote Option on back of 210/220-GC/MS

- 10. Connect the USB cable to the rear of the MS at J42 USB and to a USB port on the PC.
- 11. Connect a crossover Ethernet cable to the GC and to the PC. Be sure to connect the Ethernet cable using the side connector of the Tee and NOT the terminators

# Setting Up the GC

#### Filling the Cal Gas Vial

1. Remove the empty Cal Gas vial from behind the MS front door by loosening the two mounting screws and twisting the vial while pulling down.



Do not overfill the Cal Gas vial installed in the MS. Overfilling can result in FC-43 contamination that interferes with Cal Gas adjustments.

NOTE: The Cal Gas part number, FC-43 392035300, is shipped in a separate ampule. Install the Cal Gas during the installation. Aliquot approximately 0.5 mL of the FC-43 into the Cal Gas vial and install it in the MS. Store the remaining FC-43 in the vials provided in the accessory kit.

2. Fill the vial with approximately 0.5 mL of the FC-43, part number 392035300 provided in the MS Accessory Kit. Re-install the partially (less than half) filled vial into the MS and tighten the mounting screws. The vial must be inserted far enough into the pneumatic block to engage the O-ring. Store the remaining FC-43 in the vials provided in the accessory kit. Be careful not to overfill the Cal Gas vial to avoid FC-43 contamination that can interfere with system performance.

#### **Plumbing and Purging**

- 1. Plumb 99.995% helium to the back of the GCMS system using 1/8 in. copper tubing.
- 2. Insert the pencil filters.
- 3. Set the helium pressure to 80 psi and ensure that the cylinder has at least 500 psi.
- 4. Purge the helium line for 10 minutes at maximum flow.
- 5. Connect the outlet of the filter to the inlet on the back of the GC.
- 6. Purge the GC pneumatics for 10 minutes to remove water or air that may have accumulated during shipping.

#### Installing the Column in the GC

NOTE: the only injector for the 431-GC is the 1177. The 450-GC has the injector the customer ordered.

- 1. Install the column that shipped with the instrument to achieve the best results for the installation tests. If an 1177 injector is installed on the GC, use the 1177 to pass the sensitivity specifications.
- 2. Condition the injector and column once before installing into the MS. This prevents column bleed from contaminating the MS.
- 3. Set the injector to 230 °C and do a split ratio (SR) of 50:1.
- Condition the column starting at 50 °C, ramping at 5 degrees/minute up to 300 °C, and hold for 60 minutes unless this exceeds the maximum allowable operating temperature for the column phase.

#### Installing the Column in the MS

NOTE: Leave a significant service loop of column detached from the column cage so the GC and MS can be easily separated.

- 1. Disengage the transfer line by removing the clip to remove it completely from the manifold.
- Position the column in the transfer line so the end of the column extends 0.5 to 1 mm past the end of the transfer line and leave a big enough loop so the MS and the GC can be easily separated.
- 3. Reinstall the transfer line into the manifold.
- 4. Push the GC and the MS together on the bench. Ensure that the nut on the transfer line column is visible inside the GC oven and the transfer line rubber boot is inside the hole on the GC side panel.

## **Setting Up the Foreline Pump**

#### DS-42 Pump

- 1. Fill the mechanical pump to the mid-point of the sight glass with the supplied Inland 31 vacuum pump oil.
- 2. Put a center ring on the end of the hose.
- 3. Tighten a vacuum clamp over the hose, and pump inlet.



## 

Do not place the foreline pump on the bench with the MS. Vibrations from the foreline pumps will degrade the MS performance.

4. Place the pump under the bench.



The foreline pumps must be connected to a ventilation system.

NOTE: You may observe foam when you look at the oil level. The oil may foam until sufficient oil collects on the filter to create a seal and then it will stop foaming.

# **Powering Up the MS**

- 1. Turn on the power switch of the MS.
- 2. Turn on the CPU and monitor.
- 3. Open **MS Workstation.**
- 4. Allow the foreline pump and the turbo pump to run for about 30 minutes before assuming software control. This allows the pumps to become properly lubricated.



If the foreline pump runs loudly for more that 1 min, turn off the main circuit breaker and check the system for leaks. Possible leak sites include the vacuum hose connections to the turbo or foreline pumps, the manifold or transfer line O-rings and the column connection to the transfer line.

- 5. Open **System Control** from the MS Workstation toolbar to activate communication between the PC and all modules connected to it.
- 6. Check that the status screen displays both MS and GC.
- 7. The turbo pump speed should reach 100% between 1 to 2 minutes. The turbo current should be less than 350 mA when the turbo reaches 100%.
- 8. Check for high mass noise using the daily check method.
  - If OK, then check air/water. There should be a big 18 peak and no 28 peak. Turn off trap.
  - If OK, bakeout MS overnight.

#### **Baking Out the GC/MS**

- 1. Ensure that the Trap and Source temperatures are at least 150 °C and the Manifold temperature is at least 50 °C before heating the transfer line, GC column oven, and injector. This prevents column stationary phase from collecting on low temperature MS components.
- 2. Set the injector temperature to 230 °C with a split ratio of 50:1.
- 3. Set the column temperature to 150 °C.
- 4. Click Temperatures on the Analysis tab and enter these temperatures:
  - Trap: 150 °C
  - Manifold: 40 °C

- Transfer Line: 230 °C
- 5. Click the **Bakeout** tab and enter these temperatures:
  - Trap: 220 °C,
  - Manifold: 120 °C
  - Transfer Line: 250 °C
- 6. Set a **Hold Time that** ends bakeout about 2 hours before you plan to arrive the next day.
- 7. Click Start Bakeout.
- 8. Leave System Control open, if it is closed, bakeout is cancelled.
- 9. Condition the system overnight, before doing the system specification tests. Hydrocarbon and water background levels decrease after the initial bakeout. During bakeout, familiarize the customer with the system.
- 10. After bakeout, reset the manifold bakeout temperature to 80 °C and then click **Save**.

# **Preliminary Tuning**

Before doing preliminary tuning, ensure that the MS has returned to Analysis temperatures and the GC column flow rate is set to 1 mL/min.

#### Monitoring the System

- 1. After bakeout, monitor the following in the **Diagnostics** tab:
  - Heated Zones: Operating Conditions should be close to current set points.
    - Vacuum System:
      - Pump Status -- Ready.
      - Turbo Speed--100%.
      - Turbo Current-- less than 300 mA.
- 2. Turn on the following trap elements.
  - Multiplier.
  - RF.

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Filament.

NOTE: This figure is of an MS with an ion gauge.

Manual Control	Auto Tune	Temperatures	Diagnostics	Shutdown		Acquisition
Control and Status		Diagnostic Method		Monitor States		
State:	Start	System Test		Trap - On/Off-	lon	Gauge - On/O
Monitoring Status	Beset	🔽 🛛 Run To Comp	letion 💌	Multiplier		Ion Gauge
Idle	Tieset			RF		Filament 1
laic	Continue	Heater Test	Manifold	Filament		G Filament 2
			1 manifold			
Hide Keupad Monitor	Window Only		Transfer Line			
Hide Keypad Monitor	Window Only 👱		Transfer Line			
Hide Keypad Monitor	Window Only 👤		Transfer Line	Hanking Contern		
Hide Keypad Monitor	Window Only 👱	Ionization System	Transfer Line	Heating System	[emperature	Thermocoupl
Hide Keypad Monitor Vacuum System Pump Status: F Turbo Speed: 1	Window Only	Ionization System Filament #1: Filament #2:	OK.	Heating System	Femperature	Thermocouple OK
Hide Keypad Monitor Vacuum System Pump Status: F Turbo Speed: 1 Turbo Current: 2	Window Only <u></u> Ready 00 % 280 mA	lonization System Filament #1: Filament #2: El Filament Bias:	OK OK -11.5 V	Heating System Trap: Manifold:	Femperature 148 40	Thermocouple DK DK
Hide Keypad Monitor Vacuum System Pump Status: F Turbo Speed: 1 Turbo Current: 2 Acquisition Sustem	Window Only <u></u> Ready 00 % 280 mA	lonization System Filament #1: Filament #2: El Filament Bias: Cl Filament Bias:	0K 0K -11.5 V -10.5 V	Heating System Trap: Manifold: Transferline:	Femperature 148 40 229	Thermocouple OK OK OK
Hide Keypad Monitor Vacuum System Pump Status: F Turbo Speed: 1 Turbo Current: 2 Acquisition System Multipiler Voltage:	Window Only	Ionization System Filament #1: Filament #2: El Filament Bias: Cl Filament Bias: Emission Current:	0K 0K -11.5 V -10.5 V 10.8 vA	Heating System Trap: Manifold: Transferline:	Femperature 148 40 229	Thermocouple OK OK OK
Hide Keypad Monitor Vacuum System Pump Status: F Turbo Speed: 1 Turbo Current: 2 Acquisition System Multiplier Voltage:	Window Only Ready 00 % 280 mA 1367 V	Ionization System Filament #1: Filament #2: El Filament Bias: Cl Filament Bias: Emission Current: Gate On Voltage:	0K 0K -11.5 V -10.5 V 10.8 vA 150 V	Heating System Trap: Manifold: Transferline: Vacuum Status	Femperature 148 40 229 m : OK	Thermocoupl OK OK OK
Hide Keypad Monitor Vacuum System Pump Status: F Turbo Speed: 1 Turbo Current: 2 Acquisition System Multiplier Voltage: 4 Waveform System Aviel Modulation: 4	Window Only ▼ Ready 00 % 280 mA 1367 V	Ionization System Filament #1: Filament #2: El Filament Bias: Cl Filament Bias: Emission Current: Gate On Voltage: Gate Off Voltage:	0K 0K -11.5 V -10.5 V 10.8 uA 150 V -147 V	Heating System Trap: Manifold: Transferline: Ion Gauge Syste Vacuum Status Filament #1:	Femperature 148 40 229 m : OK OK	Thermocouple OK OK H2: OK

## Adjusting the RF Ramp

1. In the Adjustments tab in Manual Control, click Adjust RF Tuning.

Manual Control	Auto Tune	Temperatures	Diagnostics
Control and Status		Method SetPoints Ad	iustments
Response is Within L	Limits, Continue		CI Reagent
reprovincent to remaining a	ngnoot rodding.	A 10 10 10	_
		Adjust Lai Gas	Adjust

2. Adjust the RF tuning rod to minimize the **Highest** value in the upper right corner of the **Counts** area.



3. Click Save Results when finished.

1 200-MS.41 - Not Ready				
Manual Control Auto Tune	Temperatures	Diagnostics	Shutdown	Acquisition
Control and Status RF Response is Within Limits. Continue Adjustment to Minimize Highest Reading.	Method SetPoints A Adjust Cal Gas Adjust RF Tuning	djustments   CI Reagent Adjust Methane	Operating Conditions Mode State: Adjust F Fault State: No Faul	RFRamp-Idle It
Average 2/3 mignest 003	Save Results	Cancel Adjustment		
Scan Number: 1, Time: 0. RIC: 1.146e+6, Ion Range	000 min: e: 0.0 - 650.0 m/z		Base Peak: 651.0, E Ion: 0 us, Segme	Base Amount: 603 ent: 0, Channel: 1
Counts 400- 200-	217.0 260.0 <sup>3</sup> 172 205	03.0 347.0 397.0 <sup>4</sup> 239 295 331	40.0 482.0 524.0 566. 380 425 478	0_609.0_671.0 03
0 100	200 3	00 400	500 Acqui	600 ired Range m/z

## **Adjusting Cal Gas**

To adjust the cal gas:

- 1. Open the MS door and ensure that the Cal Gas vial is full.
- 2. Click Adjust Cal Gas.
- 3. Adjust the Cal Gas needle valve behind the MS front door until the display shows that the Cal Gas pressure is OK.
- 4. Click Save Results when finished.

NOTE: The Cal Gas adjustment varies with differences in auto tune settings, filament emission current, system sensitivity, and system background levels. Check this adjustment after auto tuning, editing the filament emission current, or when system sensitivity, or background levels change.

1 200-MS.41 - Not Ready					
Manual Control Auto Tune	Temperatures	Diagnostics	Shutdown	Acquisition	n
Control and Status	Method SetPoints A	djustments	Operating Condition	ons	
The calibration gas pressure is OK. Allow time		CI Reagent	Mode State:	Adjust Cal Gas - Scann	ing
equilibrate.	Adjust Cal Gas	Adjust	Fault State:	No Fault	
	Adjust RF Tuning	Methane	i dua Jidic.	nor dat	
Low OK High			Ion Time:	745	
	Save Results	Cancel Adjustment	Ion Count:	6662	
	10 <u></u>		12L		
🔺 🔹 🕫 🖉 - 📕 - 📓	-				
Scan Number: 71, Time: 0.000	min.	Base Pe	ak: 68.8, Base Ar	mount: 1094 Smooth	red(5)
RIC: 6662, Ion Range: 45.0 - 13	/5.0 m/z		lon: 745 us,	Segment: 1, Chan	nel: 1
Counts	914				-1
500-				130.8	-
250-				306	-
	Marian			<u></u>	_
40 50 60	70 80	90 100	110	120 130 Acquired Range	m/z
Instrument 1 : Sep 18 10:33	:51 Module 450-GC	.44: Cannot Downlo	ad; Method does	s not match Setup!	

# **Auto Tuning**

After performing the Adjust RF Tuning and Adjust Cal Gas, the instrument is ready to be Auto Tuned.

## **Auto Tuning**

To auto tune EI and CI:

- 1. Click Auto Tune.
- 2. Click the Method tab and select the following checkboxes:
  - Air/Water Check.
  - Electron Multiplier Tune.
  - FC-43 Mass Calibration.
  - Trap Function Calibration.
- 3. Click Start Auto Tune. The values generated are for both EI and CI.
- 4. Check the event message display, line by line, to review the results of each auto tune function.
- 5. Investigate and resolve auto tune parameters that did not pass and rerun them.

Manual Control	Auto Tune	Temperatures	Diagnostics	Shutdown	Acquisition
Control and Status State: Idle Junction:	Start Auto Tune Reset Continue	Method SetPoints Air / Water Check Clectron Multiplier FC-43 Mass Cal	Tune Ibration	Operating Conditions	
Hide Keypad Spect	um and Event Messas 💌	☐ Sing	le Step		
Hide Keypad Spect	um and Event Messar 💌 II 🔹 🚟 🔹 🕅 her 6. Time: 0.000 m	Sing	Base	Peak 329.8 Base An	nount: 1 Smoother
Hide Keypad Spect	um and Event Messay 🔹 II - 🖂 - 🕅 ber: 6, Time: 0.000 m	∫ <mark> </mark>	e Step Base	Peak: 329.8, Base Am	nount: 1 Smoothed

Run the following tunes once every two weeks for mass assignment:

- Adjust RF Tuning
- Mass Calibration
- Trap Function Calibration.

# **Testing Specifications**

#### **Specification Table**

	210-MS					
Ionization Mode	Test Sample	Amount Measured	m/z	RMS S/N Specification	Library Match (any search type)	
EI	PN 393065201 (1 pg/µL OFN, 5 pg/µL BZP)	1 pg OFN	272	≥ 50:1	≥ 500	
		220-MS	5			
Ionization Mode	Test Sample	Amount Measured	m/z	RMS S/N Specification	Library Match (any search type)	
EI	PN 393065201 (1 pg/µL OFN, 5 pg/µL BZP)	1 pg OFN	272	≥ 50:1	≥ 500	
CI	PN 39065201 (1 pg/µL OFN, 5 pg/uL BZP)	5 pg BZP	183	≥ 20:1	N/A	

## **El Methodology**

NOTE: The MS comes with a CD containing factory test method and data files. Use these method files to pass the installation sensitivity tests. At the factory, the diluted OFN standard is injected using a pressure pulse and splitless injection technique. Retain the Test Files CD for your records.

- 1. Ensure the MS temperatures are set as follows:
  - Trap: 150 °C
  - Manifold: 40 °C
  - Transfer Line: 230 °C
- 2. Click Activate Method from the MS Workstation menu.
- 3. Open the **OFN Method** in the **Service Folder**.

The following shows **System Control** in a **Ready** state. **System Control** is ready when both the GC and the MS are ready.



## **Acquiring OFN**

- 1. Use the Inject Single Sample option.
- 2. Use a lower air gap to avoid losing sample through the tip of the needle. Ensure the syringe plunger is not forced out of the syringe barrel if using a Pressure Pulse.
- 3. Strike the injector auto switch with the syringe barrel. This ensures that the split valve has changed from open to close.
- 4. Make a 1 µL manual injection of OFN

#### **Reviewing the Data**

1. View a data file MS Data Review.



2. Enter 272 in the **lons:** field of the MSDR window to display a single ion chromatogram of the m/z 272 ion signal.



3. Click-and-drag a zoom highlight box around the OFN m/z 272 ion.



4. Right-click the apex scan of the 272 single ion chromatogram to display the **Chromatogram** menu.

## **Calculating the Signal to Noise Ratio**

Library Search Spectrum	
New Spectrum Window	
Export Spectrum	
Select As Reference File (Plot	2)
Save As User Descriptor (Plot	2)
Calculate S/N (Plot 2)	
Integrate	
New Label for Plot 2	
Delete Labels	•
Hide Plot 2	
Print	
Export	

1. Click Chromatogram Plot Preferences.

- 2. Click the Chromatogram Plot tab and do the following:
- 3. In the Plot area, select Filtered Data Only
- 4. In the Filtering area, select **Smooth Data**, type **5** in the **Point Smooth** field, select **Savitsky Golay** for the **Smoothing Method**, enable **Remove Spikes** and type **4** for the **Spike Threshold Factor**.

Markers	TL Annotation	ns	AMDIS An	notation
Noise	Colore Lat	oels 📔	Axes	Font
eatures 🤇	Chromatogram Plot	Plot Tit	les DH	Annotati
Plot	Contraction Contraction			
	Raw Data Only			
	Filtered Data Or	nly		
	C Overlay Filtered.	/Raw Dat	a	
Citation				
- Filtering -	Smooth Data			
		<b>-</b>		
	Point Sm	ooth		
	- Smoothing Metho	d		
	G Cavitaluut	e 11.0		
	· Savitský i	laolay		
	Remove Spikes	E		
	4 Spike Th	reshold Fa	ctor	
	Help	R	eset to Def	aults
		-		
Save Al	as Defaults	Re	set All to D	efaults
		-		

- 5. Click **OK** to enable these selections.
- 6. Click the Noise tab, select RMS for the Noise Calculation, and click OK.

Markers	s TL Annotations		AMDIS Annotations	
Features	Chromatogram Plot   Plot		ot Titles DH Annotati	
Noise	Colors	Labels	Axes	Font
-	RMS			
NUCLEAR	arker Anneara	nce		

Right-click the apex scan of the 272 single ion chromatogram to display the **Chromatogram** menu.

7. Click **Calculate S/N** to generate the RMS signal-to-noise ratio. The following shows both the menu and the S/N data.



## **Library Searching**

1. From the **Chromatogram** menu, click **Set Select Spectra to Average**, and select **3**.



2. From the Chromatogram menu, select Edit Background Correction.



- 3. Click **Auto Background Correction**. The Background Correction Spectra Count is displayed.
- 4. Click Done.



5. Click the apex scan of the m/z 272 single ion chromatogram to generate the spectrum. BC in the upper right corner of the spectral window indicates that



#### the spectrum was background corrected

6. From the Search menu, select Library Search Active Spectrum.



7. From the Library List select **Tutorial**.

NIST Search for Target Sp	oectrum 🛛 🔀
Search Type Identity Searches:	Library List MAINLIB REPLIB
<ul> <li>Normal</li> <li>Similarity Searches:</li> </ul>	
C Simple C Hybrid C Neutral Loss	Edit / Order Library List
Mol. Weight	Max Pre-Search Hits
Reverse Search     Min Abundance	Max Final Search Hits
Use Acqu. Ion Range m/z Range:	Constraints
Comparing 4810 library spectra v	Edit Constraints
Help Reset	Cancel Exit

8. Octafluoronaphthalene has the highest match score > 500.



9. Click the NIST Library Search button.



10. Select **Spectrum Search** to edit the library search parameters. Suggested library search parameters are displayed.

NIST Search for Target Spectrum					
Search Type	- Library List				
Identity Searches:	TUTORIAL				
C Quick	MAINLIB				
• Normal					
Similarity Searches:					
C Simple					
C Hybrid	Edit / Order Library List				
O Neutral Loss					
Mal Vitaiaht	Max Pre-Search Hits				
	6000				
200 Threshold	Max Final Search Hits				
🔲 Reverse Search	100				
100 Min. Abundance					
🔲 Use Acqu. Ion Range					
m/z Range:	Use Constraints				
50 300	Edit Constraints				
Help Reset	Search Exit				

## **CI** Methodology

The following explains the method to use to determine the signal to noise response for the 220-MS CI option.

## **Installing Liquid Cl**

- 1. Condition the CI plumbing to remove air and water by opening the CI solenoids in **Manual Control**, before introducing methanol into the CI plumbing
- 2. Install the Liquid CI Option on the back of the instrument as described in the hardware manual.



## Adjusting Liquid CI Reagent Flow

- 1. Click the Adjustments tab in Manual Control.
- 2. Select the reagent **Methanol**, from the drop down list.
- 3. Click Adjust Cal Gas.



NOTE: Minimize contamination by opening the CI needle valve only as needed.

4. Click Save Results when finished.

📅 200-MS.41 - Not Ready		
Manual Control     Auto Tune       Control and Status     Increase calibration gas pressure by adjusting the calibration gas needle valve. Allow time for the gas to flow and the emission current to equilibrate.       Low     DK       High	Temperatures     Diagnostics       Method     SetPoints     Adjustments       Adjust Cal Gas     Cl Reagent       Adjust RF Tuning     Methanol       Save Results     Cancel Adjustment	Shutdown Acquisition Operating Conditions Mode State: Adjust Cal Gas - Scanning Fault State: No Fault Ion Time: 1204 Ion Count: 6637
▲ ◆ ♥ ● II • 급 • M • Scan Number: 12, Time: 0.000 n RIC: 6637, Ion Range: 45.0 - 13:	nin. Base 5.0 m/z	Peak: 68.8, Base Amount: 1060 Smoothed(5) Ion: 1204 us, Segment: 1, Channel: 1
Counts- 600- 400- 200- 0- 40 50 60	68,8 894 1 70 80 90 10	

#### Methodology

NOTE: The system arrives with a CD containing factory test method and data files. Use these method files to do the sensitivity tests and retain the test files CD for your records.

- 1. Ensure the MS temperatures for this acquisition are set as follows:
  - Trap: 150 °C
  - Manifold: 40 °C
  - Transfer Line: 230 °C
- 2. In System Control, activate the **CI MEOH Test** method from the Service Folder.

#### **Acquiring BZP**

- 1. Use the Inject Single Sample option to make a 1µL manual injection of test mix, part number 393065201.
- 2. Use a lower air gap to avoid sample loss through the tip of the needle.
- 3. Ensure the syringe plunger is not forced out of the syringe barrel if a Pressure Pulse is used in the method.
- 4. Ensure the split valve has changed from open to close before injecting by striking the injector auto-start switch with the syringe barrel before depressing the syringe plunger.
- 5. Inject slowly (1µL/sec) to avoid sample loss through explosive vaporization.

## Calculating the Signal-to-Noise Ratio

- 1. Use the quick load option to load the BZP data file into MSDR.
- 2. Plot a single ion chromatogram of the m/z 183 ion.
- 3. Click the apex scan to display the spectrum.
- 4. Background correct the spectrum.
- 5. Right-click the apex scan and select Calculate Noise
- 6. The RMS signal-to-noise calculation is done on the scan closest to where you clicked. Use 5 Point Savisky Golay smoothing. An example follows.



# Familiarizing the User Representative

Familiarize the User Representative with the software and the basic operation and maintenance of the MS. Determine if the following topics were covered when the preceding tests were done. If not, or if the User Representative would like a review, then cover the indicated topics. Additional training may be necessary for a thorough understanding of the system.

After t covering a topic, places a check mark in the checklist at the end of this section.

#### **Creating a Sample List**

- 1. Click Edit Automation Files on the MS Workstation tool bar.
- 2. Click **File>New>SampleList**. An empty sample list opens for the autosampler configured on the system. Enter the sample information.
- 3. Click **Data Files** to place files in the correct folder.
- 4. Click RecalcList to create a RecalList.
- 5. Save the SampleList. The sample list is configured to make injections and collect data.

	Sample Name	Sample T	уре	Cal. level	lnj.	Injection Notes	AutoLink	Inj. Mr	A <u>d</u> d
1	Default Sample1	Analysis	-		1	none	none	Partial Loopf	Iroort
2	Default Sample2	Analysis	-		1	none	none	Partial Loopf	<u>IT</u> sen
3	Default Sample3	Analysis	-		1	none	none	Partial Loopf	Delete
4	Default Sample4	Analysis	-		1	none	none	Partial Loopf	Eill Down
5	Default Sample5	Analysis	-		1	none	none	Partial Loopf	
6	Default Sample6	Analysis	-		1	none	none	Partial Loopf	Add _ines
7	Default Sample7	Analysis	•		1	none	none	Partial Loopf	Defa <u>u</u> lts
Ē	10 / 10 10	1	1						Hardware
								Dista Files	Reported in

#### Activating and Running a Sample List

- 1. In System Control, select File>Open Sample List.
- 2. Select the sample list from the files listed.
- 3. Click **Begin** to start the injection sequence.

#### **Reviewing Results**

- 1. Click the Review/Process MS Data button.
- 2. MS Data Review opens and shows the most recent data file.
- 3. Select other data files from the tree on the left.



#### **Basic Source Maintenance**

Loss of sensitivity over time is usually due to a dirty or poorly optimized trap and contaminated trap components. Set up a schedule to routinely clean the trap and trap components. The frequency of cleaning depends on the sample matrix and the number of samples injected.

## Checklist for Familiarizing the User Representative

Place a check in the checkbox to indicate that the topic was covered.

Торіс	Performed
Starting up and closing down the system, including MS instrument control.	
Controlling the vacuum system, starting and venting the pumps, monitoring turbo speed.	
Monitoring pressures in the manifold for normal and fault conditions.	
Checking diagnostic for troubleshooting.	
Performing an Auto Tune.	
Acquiring data files as single runs and sample lists.	
Integrating data using standard data files provided with the software.	
Cleaning the trap components.	
Performing routine foreline pumps maintenance.	

# **Appendix 2: Spare Parts**

Part Number	Description
393000591	Assembly, Transfer Line (115V)
393000592	Assembly, Transfer Line (230V)
393033401	Cable, Transfer Line heater (115V)
393033402	Cable, Transfer Line heater (230V)
393000891	Assembly, Vacuum Manifold (115V)
393000892	Assembly, Vacuum Manifold (230V)
393074301	Assembly, Ion Gauge
393074101	Cable, Trap Heater (60 V)

#### Kits, Assemblies, Boards, and Cables

#### **Trap Components**

NOTE: The Silica Coated Spacers have a shiny, mirror like finish on the inside surface.

Part Number	Description
393055201	Gate Conductor
393055101	Gate
1492000900	Wavy Washer
393031501	Assembly, Multiplier
393053501	Spacer, Quartz
393010801	Transfer Line Wrench/Analyzer Alignment Tool
393060191	Assembly, Filament disk with wires
1499822800	Belleville Washer, Small
393036000	Nut, Hex
393654901	Filament Clip
393059191	Tip. Transfer Line (Ultra Clean)
393053502	Quartz Spacer, Silica Coated
393010904	Thermo Well O-ring
393010914	Quad-ring, Viton® Manifold
393010918	Quad-ring, Viton Transfer Line

#### Pumps

Part Number	Description
393077001 393077002	Mechanical Pump, 90 L/min, 115V Varian DS42 Mechanical Pump, 90 L/min, 230V Varian DS42
392035800	Screen, Turbo Pump (V-81)
392051800	7 ft Length Tygon® Tubing
393076401	Turbo Molecular Pump (V-81)
9499305	Inland 31 Vacuum Pump Oil
393847701	Oil Mist Cartridge