

Troubleshooting the Saturn/ 210/220 GC/MS

Understand and Isolate the problem

Before and during the visit:

- Get a thorough understanding of the problem from the user
- Find out the history – has this method been running for a while, or is it just developed?
- Were there any changes preceding the failure?
- Collect as much hard data as possible

When you visit:

- Visually inspect the instrument
- Run Diagnostics
- Compare good data to current performance
- **Isolate the problem** – eliminate the GC as much as possible and look MS performance

No Peaks or Loss of Sensitivity?

Isolate the Problem to the MS or GC

- Scan the calgas and check the calgas peaks for good response and resolution
- Run Diagnostics
- Autotune and compare the EM setting to previous
- Check the mass calibration
- Look at the background with the trap on
- Check air/water

If the Calgas and diagnostics look good:

The problem is before the Mass Spec

- Make sure the problem is not matrix related – test sensitivity using standards first
- Try direct injection to rule out autosampler
- Check column parameters on GC
- Check for leaks in the GC
- Perform injector port maintenance (replace insert, o-ring, & septa and clip column)
- Be sure column is installed correctly on detector end
- Replace column if necessary

Analyze the nature of the loss of sensitivity

Affects all compounds?

- If all compounds effected the problem may be
 - ✓ Autosampler
 - ✓ Sample prep
 - ✓ Leak
 - ✓ Other

Affects low MW, low boilers only? Affects high MW, high boilers only?

- If only certain compounds it may be
 - ✓ Column
 - ✓ Cold spot
 - ✓ Active site

If the system has a complicated configuration

Return System back to basic configuration

- Put in standard (installation) column
- Use the same liner used for specs
- Remove Quick Switch Valve (QSV)
- Test OFN injection for sensitivity and/or reproducibility
- If this looks good, the problem is not in the MS – it may be application or QSV

If peaks are low/absent in the *Calgas* Scan:

Problem is with the MS:

➤ Make sure FC-43 is present in Calgas bulb

(if no FC-43 peaks are present, check that air/water peaks can be seen).

➤ Run Diagnostics

➤ Check the filament

➤ Check that the turbo is at 100 +/-2%

➤ Check the RF adjustment

➤ Check method parameters

Problem in MS (Cont.)

- Run autotune if you have low peaks or poor resolution

- Check the axial modulation readback – should be ~4.
 - If close to 0, trap may be assembled incorrectly or transfer line tip is shorting to the trap.

 - If the readback is too high (~ 3-5 volts), you have a grounding problem with either the upper or lower manifold board in the analyzer assembly (typically lower). Make sure the little tab cutouts are contacting the metallic portions of each board.

- Check the EM readback. If it's only a few volts, the EM may have shorted to ground. Replace EM.

Things that might fix low calgas peaks

- Check for leaks
- Switch to other filament
- Adjust the RF ramp
- Tune the EM
- Adjust method parameters: ion time, target TIC
- Clean the trap
- Clean or replace the gate and/or key
- Clean or replace the trap oven

There may be carbon deposits in the hole

- Replace the filament
- Replace the multiplier

Isolating the problem works for various issues:

- No peaks = same process as low peaks
- Contamination = same as no peaks; looking for absence of contamination rather than presence of peaks
- Fluctuating response = rule out obvious autosampler/GC issues first

Standard Conditions

Turbo Current	<280mA Saturn <350mA 210/220 <200mA 225
Filament bias	-11.3 - -11.7
Emission current readback	Close to setpoint EI ~20uA, CI ` 10uA
Gate	-150 Off +150 On
Ion Gauge	<60uTorr @ 1mL/min He flow
Manifold	35-80C
Trap	120-180C

MS not connecting to PC?

- Make sure the correct instrument is enabled in the software

2000 Series:

- Check that the cable is connected from the PC to the MS and the IEEE card is properly installed in the PC.
- Ensure IEEE driver installed and working

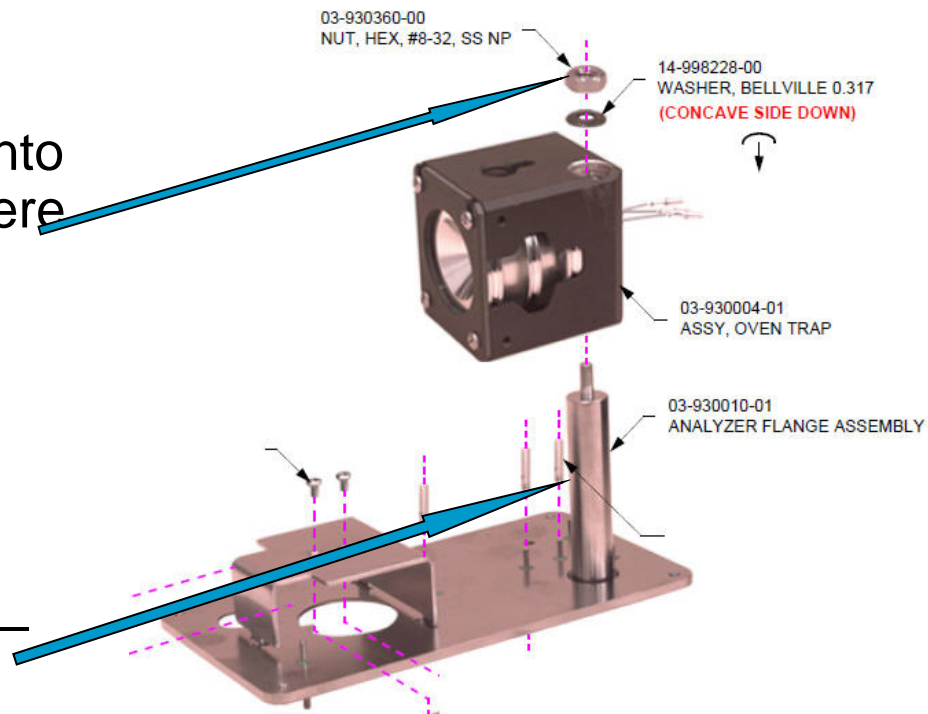
200 Series:

- Check that the USB cable is connected from the PC to the MS.
- Ensure USB MS driver correctly installed.
- Try it on your laptop

SAPwave PCB(2000)/ controller PWA (200) is where all communication comes through, try replacing if all else fails

Trap Oven Not heating?

- Make sure the thermocouple and heater are properly installed
- Check the nut holding the plate onto the trap oven – a bad connection here will cause heating problems
- Replace heater
- Try replacing the analyzer flange – the post may have been bent



Not passing S/N specs?

- Check that “RMS” is used to calculate noise, and the correct data smoothing has been turned on
- Check for air leaks and make sure you have a good tune
- Check that the column nuts on the injector and transfer line are tight
- For CI make sure CI gas is adjusted properly
- Try direct injection
- Check for background contamination (septa, helium, filters, column, etc.)
- Compare method used on site to method used in factory (files on CD)
- Try reducing the Target TIC to 20,000 and Max Ion time to 25,000
- Check for column bleed – condition
- Bake trap



Poor Peak Shape in Autotune?

- Check He flow is ~ 1mL/min

- Check for high water in system

- Space charging due to too many ions in the trap
 - Check/reduce target TIC and ion time in method
 - Clean trap
 - Calibrate EM (if too low, AGC will overload trap and cause space charging)

- Check axial modulation

- Make sure axial modulation readback matches set point. If not, transfer line may be shorting to trap – check transfer line tip installation.

Big Leaks

- Listen for loud rough pumps (“gurgling”)

- Check for high manifold pressure reading

- Check for high turbo current reading

- Check the air/water segment in Daily Checks method.

A major leak of will produce no defined peaks of any kind, but instead a "rolling" baseline.

- Check the RF tune.

A major leak will show the RF maxed out on the scale and will not be adjustable. These symptoms are diagnostic of a major leak at or very near the MS.

Moderate to small leaks

Use the air/water diagnostic to determine if there's a leak.

Spray dust-off around fitting to locate leak:

- Column connections
- Transfer line (both ends)
- Manifold vacuum gasket
- CI/Calgas manifold
- Other points on top of the manifold

2x0 Turbo not starting and controller blinking

The LED on the turbo controller should be green.

If it is red, it blinks in a coded mode: it flashes a number of times equal to the error code, then stays off

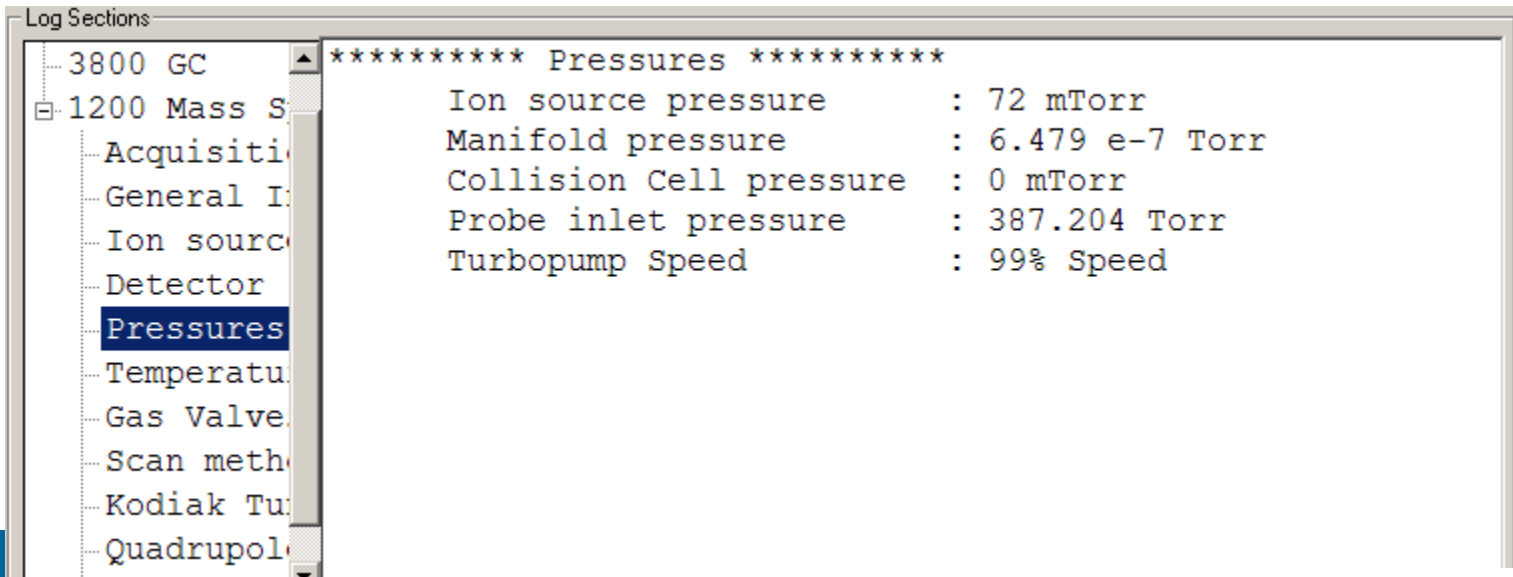
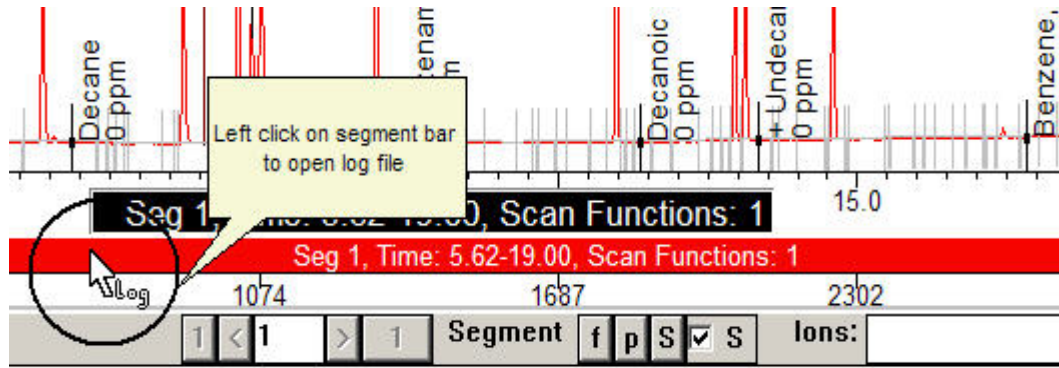
<u># of Blinks</u>	<u>Error</u>
1	Output current too high
2	Pump not connected
3	Output current >1.5A for 15sec
4	Bearing temp >60C
5	Heat exchanger temp >60C
6	Normal not reached at run up time
9	Vp voltage 8V lower than nominal for 5sec
10	Soft start ramp not ended within expected time

Record Any Changes

Question and re-question the end user about what changes were made between good performance and bad performance.

Look at the method to make sure parameters look reasonable –
Check the log from a good and bad run and make sure the method and GC/MS conditions match.

Logs contain all GC/MS acquisition parameters and conditions



Phone Support



When contacting Tech Support, be prepared to send data files, methods, and/or diagnostic results.

Tell us the version of software and the instrument configuration. These are great aids in troubleshooting many problems.

We will typically want a screenshot of the diagnostics page with everything turned on and a datafile of an acquisition done with the DailyChecks method

Having these ready will often cut down resolution time.

Example email

System:

DELL Optiplex GX740, s/n 62Q1B3J
GC3800 : 3Com 3C900COMBO-based Ethernet Adapter (Generic)
Company Network: Broadcom NETXtreme 57xx Gigabit control
MS WS 6.90 SP2 + hf100028
MS1200 TQ s/n 00731
new RF board Rev. 17 s/n 310404295

Problem: MS WS 6.90 "System Control" intermittent closes a few times per week, either during sequence cool down

Actions:

- all Readback + Hardware Diagnostics ok (please see attached file!)
- deleted all files in MSGLOG + SYSLOG
- executed Disk Cleanup, Error-Checking, Defragmenter
- checked Dual CPU (can not be turned off!), Firewall, Automatic Updates, Antivirus, Power Options, Network
- replaced PC by same Model DELL Optiplex GX740
- fixed GC3800 IP 10.2.128.11 (no BOOTP)
- chemis32.gpf file to Varian Tech Support (please see attached file!)
- done "R" Repair Windows from Reinstallation CD
- configured PC as standalone (detached from company domain, no network, Firewall, Automatic Updates,

Hello Terri,

Unfortunately the MSWS "System Control" still crashes sporadically. In fact the problem was seen since I upgraded the MS WS from 6.8 ??? to 6.90 SP2 + hf100028. Was something changed in the software? The What other hard- or software could cause such a crash? Please let me know whether I can check something. Thank you very much in advance!

Marcel

All details in the first email will reduce resolution time significantly!

Appendix

Specific Saturn/2x0 problems and solutions

Integrator Zero Problems – Saturn only

Symptoms:

The Saturn Workstation software keeps generating an error message each time the Acquisition button is clicked telling the user to run a multiplier calibration even though the user has just completed a calibration.

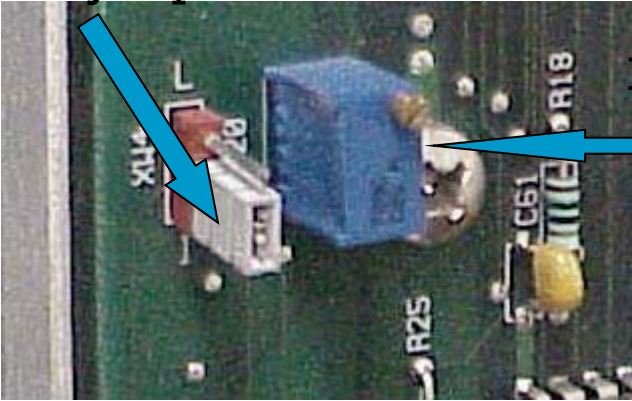
Problem:

The integrator zero may not be adjusting electronically and may need a manual adjustment.

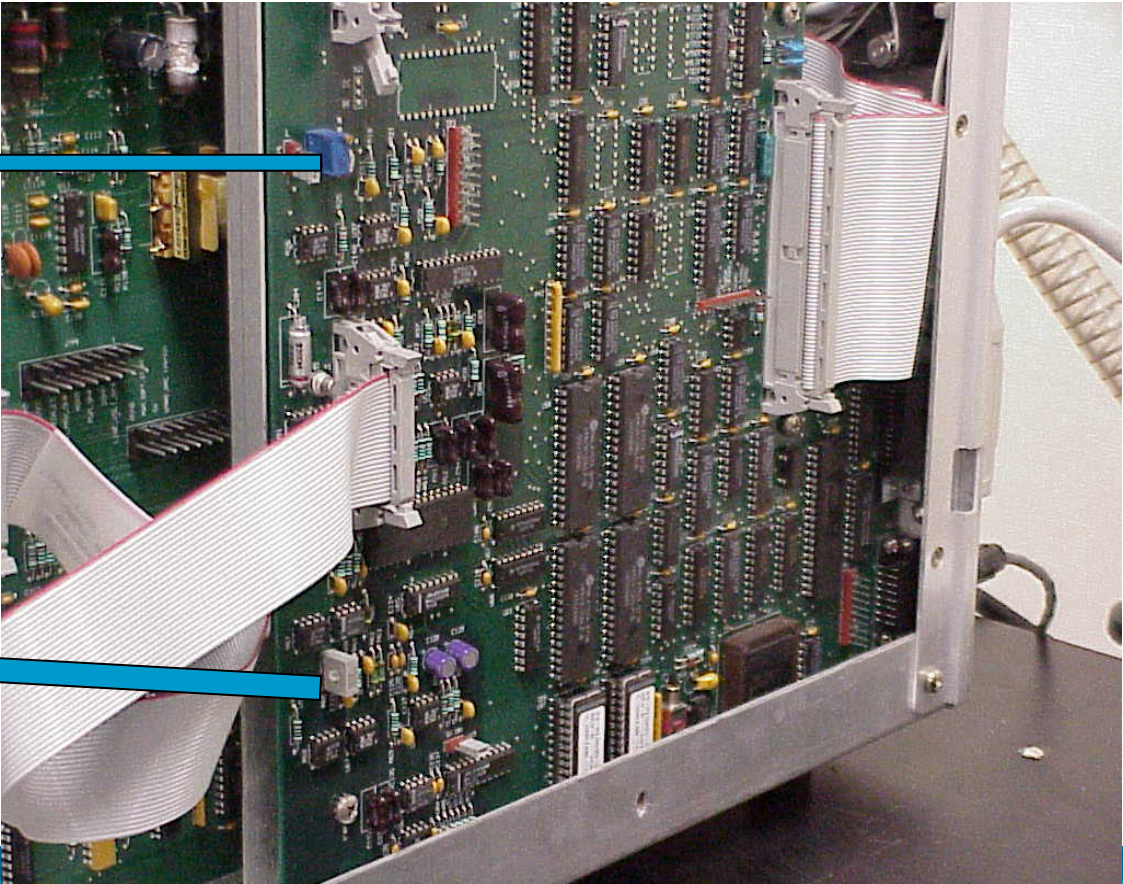
Check the results in the current module attributes to see if the Integrator zero test was "OK", "High", or "Low". If the results was "High" or "Low", the integrator zero needs a manual adjustment.

Adjust R66 and R20

XW4 Jumper



R66



R20

Adjustment

Run EM part of autotune: 1st test is integrator zero

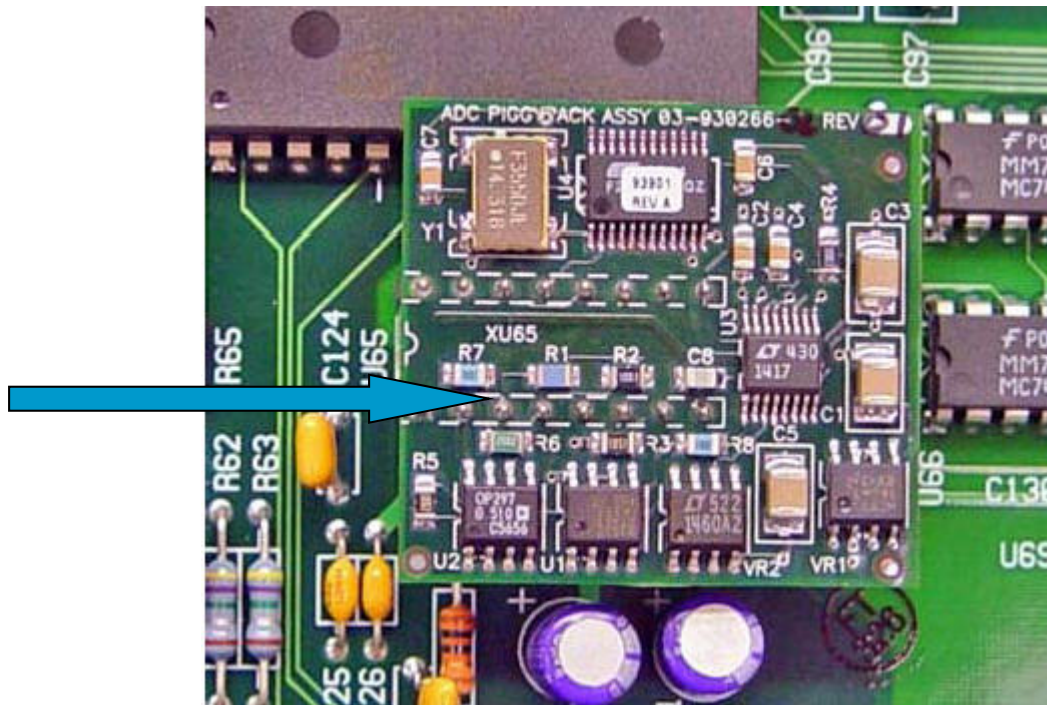
Put Jumper in “L” position and adjust R66 until integrator zero value is OK

Put jumper in “I” position and adjust R20 until integrator zero value is OK.

Adjustment

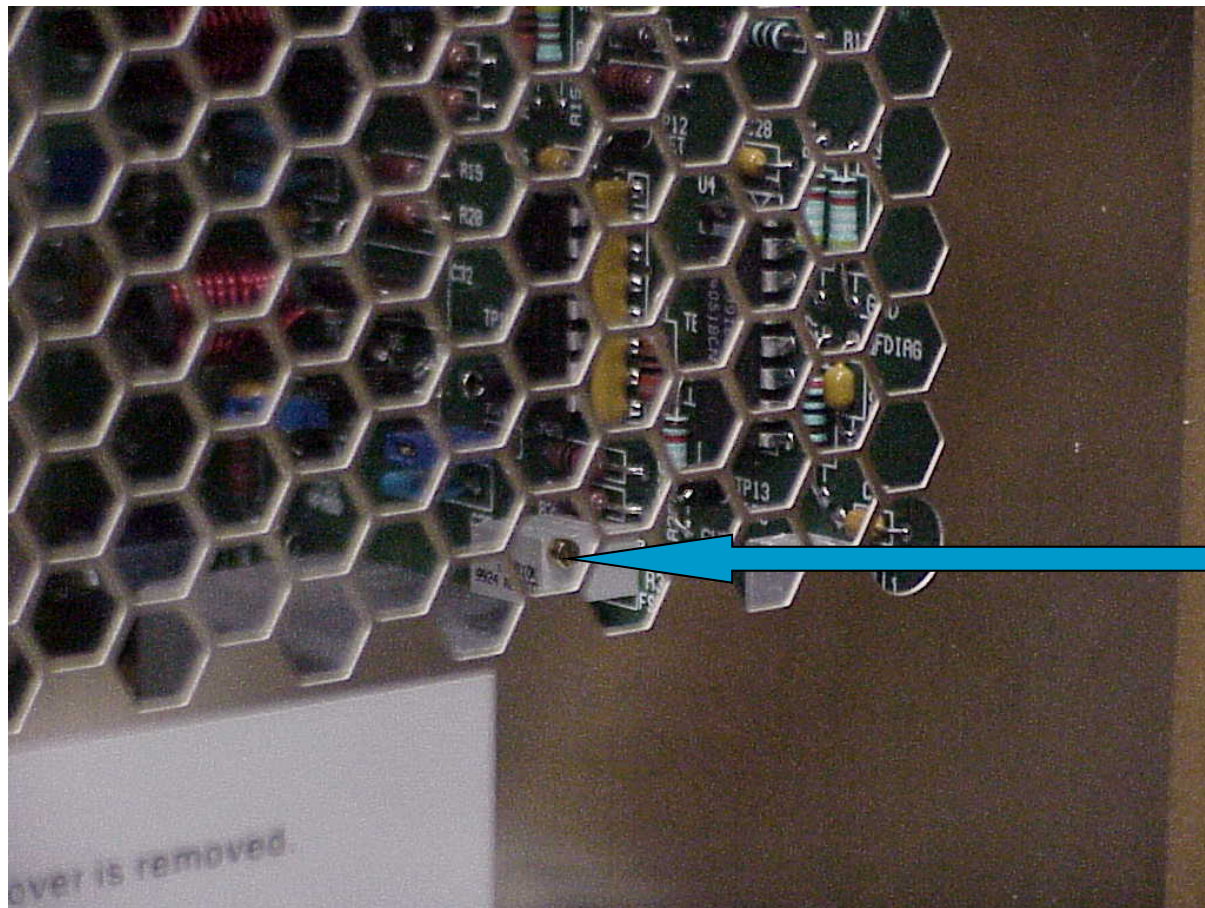
If you can no longer adjust integrator zero properly, install a piggy back or replace the SAP waveboard

Piggyback board
Installs on U65 chip



Anytime you replace the SAP waveboard, adjust integrator zero

Mass Calibration problems - Saturn



Adjust the trimpot on the RF Generator board if the mass calibration fails during autotune

RF Full Scale Adjustment

Run a straight line mass calibration in Autotune.

Go to Manual Control and activate the DailyChecks method file.

Go to the second segment.

Turn on the trap and calgas.

Zoom in on each calgas peak (69, 264, 464, 502, 614), starting with 69, and adjust the trim pot until the 69 peak is centered over the tick mark for mass 69 +/- 1 m/z. When this is correctly adjusted, repeat the process for each calgas peak until mass 614 has been adjusted.

Note: Do not go back and re-check lower masses. They will shift as the higher masses are calibrated.

Run an FC-43 calibration in the AUTOTUNE page to make sure each calgas peak is found and properly assigned.

The average slope should be less than 6.3. If it is greater than 6.3, readjust the RF Full scale.

2x0 MS

- Integrator Zero adjustment is automatic
- No adjustment or piggyback board required
- No RF full scale adjustment is required

RF Tune not working

- Check that the spring contact from the RF coil to the RF electrode is making good connection
- Make sure quartz spacers are not broken and trap is assembled correctly
- Hardware problems can only be related to RF coil or RF generator board
- If those are working – the problem has something to do with the capacitance of the trap changing due to poor isolation of the RF electrode, poor spring contact, etc.

Saturn Comm troubleshooting

If the computer or GPIB card is being replaced or you are troubleshooting 2x00 communication problems, follow the instructions below. The order in which these steps are performed is critical to establishing communication between the PC and MS.

- 1) Uninstall the GPIB driver from the PC (if loaded).
- 2) Shut down the PC.
- 3) Remove the GPIB card (if installed).
- 4) Boot up the PC with no card and no driver installed.
- 5) Install the GPIB driver.*
- 6) Shut down the PC.
- 7) Install the GPIB card.
- 8) Boot up the PC. (PC should show messages it has detected new hardware.)
- 9) Install the MSWS software if it's a new computer. If you are troubleshooting a computer with MSWS already installed, Start MSWS and see if can establish 2000 communication and re-install MSWS only if it still cannot establish communication.

* Refer to Service Bulletin MSS-2001-04 for information on different GPIB cards and drivers.