## DC Polarity - what it means, how to check it

The Agilent GCMS quadrupole is a fused-silica (quartz) tube coated with a thin layer of gold. The four hyperbolic surfaces create the complex electric fields necessary for mass selection. Segments 180 degrees apart are electrically connected. Segments 90 degrees apart are electrically isolated from each other. Radio frequencies of adjoining segments are 180 degrees out of phase with each other. One connected pair has a positive DC voltage added to the RF voltage, the other connected pair has a negative DC voltage added to the RF voltage. The pair with a positive bias is the high pass filter that filters out all masses lower than the selected m/z. The pair with a negative bias is the low pass filter that filters out all masses higher than the selected m/z. (from the Agilent 5977 Series MSD System Concepts Guide)

The quadrupole's ion transmission efficiency, the number of ions that it passes from the source to the detector, is affected by the selection of the connected pair that is positive and the connected pair that is negative. This is due to inconsistencies of the segments themselves. When Agilent GCMS systems used metal quads, the choice of polarity was very important due to irregularities in the manufacturing process. The molded quartz quads do not exhibit the same amount of differences between the choices.

The software DC polarity selection switches the pairing of the segments.





The MSD has been tested in the factory with both DC Polarities. The recommended DC Polarity was the polarity that yielded optimum results from a test suite. It is listed on the final test sheet accompanying your MSD and also on a label on the RFPA fan cover. The recommended DC Polarity should be used as the initial starting point for

configuring the instrument. The instrument may not be as sensitive as it could be if the appropriate DC polarity is selected.



## The polarity is configured in MSConfig:

Agilent GC/MS Instrument Configuratio	n		
Instrument Name	BU App		
Diffline Instrument			
Mass Spectrometer Model 5977 Address 130.27.109.116	DC Polarity e <u>P</u> ositive (+) Negative (-)		
Gas Chromatograph Mogel 7890 GC Address 130.27.109.115	Use a PAL Sampler Headspace Type	Configure PAL Sampler Headspace Address	
Enable Direct Communication between	n instruments		
Workflow Mode	Enhanced  Cancel	Help	

You can also change it for testing in Manual Tune:

F	🧶 3U i	App Tune	e - El mode	- ATUNE.U						
	File	Tune	Vacuum	Execute	Parameters	Status	View	Abort	Graphics	Help
Recyc					<u>M</u> anua	Tune				
				Edit MS	<u>T</u> empera					
PROFILE				Update	EMV Gair	ents				

arameters				Values	Profile	Scan	Ramp	Captur	e Dynamic		
Ion Polarity	Pos	Mass Gain	-692	Temp	eratures						
Emission	34.6	Mass Offset	-36			Actua	al Se	tpoint	Limit		
Electron Energy	70.0	Amu Gain	1053	MS Source MS Quad		1	230	230 150	250 200		
Filament	1	Amu Offset	124.88			1					
Repeller	32.71	Width219	0.014		Apply						
Ion Focus	90.3	DC Fularity	Pos	Vacuum							
Entrance Lens	17.6	HED Enable	47	Turbo Pump Speed 100.0 %							
Ent Lens Offset	12.36	EM Volts	1076.5	Hi Vac			8.10e-06	Je-06	or		
lon Body	0.00	Extractor Lens	0.00								
PFTBA	Closed										
)				DC Polar	ity (Pos o	rNeg) [	Double-c	lick to ch	ange		

## How to check it:

Tune in both polarities on both filaments (to eliminate possible filament effects) Change the polarity in Manual Tune as shown above and save the tunes as something like atune\_F1\_pos.u, atune\_F1\_neg.u, atune\_F2\_pos.u, and atune\_F2\_neg.u. Run tune evaluation for all four tunes and compare the results.

• Abundance

Is the abundance significantly better (lower EMV) in one polarity compared to the other? This ion transmission efficiency difference is the primary reason to switch.

- Peak Shape --poor ion peak shape in one polarity vs the other. Asymmetry, splitting, or tilting
- Precursors from the Tune Evaluation
  - $\circ$  69 precursor should be <= 3%
  - 219 precursor should be <= 6%
  - $\circ$  502 precursor should be <= 12%

- Isotope Ratios from the Tune Evaluation
  - Ratio of 70:69 = 0.5 to 1.6%
  - Ratio of 220:219 = 3.2 to 5.4%
  - Ratio of 503:502 = 7.9 to 12.3%
  - o Ratios too high or too low may point at an ion transmission problem

These type of problems can also be caused by a dirty source, poor vacuum, no PFTBA in the vial, poor quad contacts, broken or shorting quad contact bridges, rarely a dirty quad, rarely the side board or other electronics.

How many samples have been run on this system? If the system has run an extreme number of dirty samples, the front of the quad may be contaminated enough to affect the ion transmission efficiency. If this is the case, please call Agilent and create a service request.

How old is the EMV – a consumable part? Replacing a used EMV is not covered by the hardware maintenance contract. It may be time to replace it before continuing.

The short version – try both polarities and save as the default in MSConfig the one that exhibits the lowest tune EMV and best tune ion peak shapes. This maximizes the ion transmission efficiency which is one piece of the path to maximizing total GCMS system sensitivity.