

# DART Ion Source

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## Operation Manual

For DART CE Units

Version 20070912



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Here we will discuss the operational steps involved in a typical data acquisition run.

## **Installation**

### **Hardware**

Be sure the DART Source and Controller are properly installed; reference the DART Hardware Installation manual for more details.

### **Software**

Install the DART software on your PC if you haven't done so already. See DART Software Manual for installation instructions. Install the software included with your mass spectrometer, and ready it for data acquisition.

## **Using DARTControl**

### **Launch**

Double click the icon on the desktop to launch the DARTControl software. If any errors or warnings appear after launching the program then refer to the DART Software Manual for more information.

Once the software is up and running, click the OFF/ON button on the Status Bar to turn the software ON. Now you can either be in Standby Mode or Run Mode; the software always defaults to Standby when first turning it ON.

### **Set Parameters**

Gas, flow rate, and heater temperatures can be set in Standby Mode. All voltages are controlled in Run Mode

#### **Gas Selection**

- **N<sub>2</sub> (Nitrogen)** is set as the default gas in Standby Mode. N<sub>2</sub> is *generally* less sensitive as an ionization gas. It's usually just used as a 'flushing' gas: keeping heat from cartridge moving, and preventing oxidation within cartridge.
  - It's also the more economic choice, since more time is generally spent in Standby preparing an experiment vs. actually running one.
- **Helium** is set as the default gas in Run Mode. Helium tends to ionize most sample compounds better than N<sub>2</sub> due to the metastable energy level

**NOTE:** *Helium may not always produce the best ionization sensitivity. The choice of gas can be highly sample and matrix dependent.*

○ **Flow Rate**

- Standby Mode
  - Somewhere between 15-25% of the maximum flow rate should be sufficient in Standby Mode. The default should be set to approximately 25%
- Run Mode
  - Once again, this setting is application specific. Around 50% of the maximum flow rate should be a good place to start.
  - The idea is to find a balance of highest sensitivity vs. lowest flow rate
- These parameters can be adjusted in the DART Setup menu, from Setup on the main bar.
  - They can also be adjusted by simply changing the parameters while in Standby/Run Modes. The software will remember these settings next time you switch back and forth.

○ **Heater Temperature**

**NOTE:** *Never heat the DART without gas flowing and always allow DART to cool to at least 200°C before turning off gas flow. Heating without gas flow could cause serious damage to DART.*

- Type in your desired temperature into the 'Set' temperature box.
  - Be sure the heater is turned On, by pushing the On/Off button next to the Set box.
  - The actual temperature will be displayed in the 'Temp' box directly above
- Generally, more volatile compounds can be ionized at lower temperatures, while less volatile compounds require higher temperatures. However, higher temperatures could cause more fragmentation of your molecule.
- It is likely that some experimentation will need to be done to determine the best temperature for the compound you are attempting to analyze. Between 200°C and 250°C is usually a good place to start.
- Set temperature will not change when switching in and out of Standby Mode unless specifically set to do so

○ **Voltages: Needle and Electrodes**

**NOTE:** *Never turn on the Needle voltage to the DART without inert gas flow. Applying the Needle voltage without inert (helium or nitrogen) gas flow could cause serious damage to DART and produce unwanted ionization products.*

- Up until this point the software has been in Standby Mode. To adjust voltages you must click the Standby/Run button in the Status Bar to activate Run Mode.
    - The needle and electrodes will automatically be energized upon turning on Run Mode with default settings
  - Needle
    - For positive ion analysis a voltage between 3000 and 4000 Volts generally works best. A lower voltage seems to work well for negative ion, between 2000 and 3000 Volts.
  - Electrodes: Grid and Discharge
    - In either positive or negative ion mode, voltages between 150 and 250 Volts generally work well
  - Keep in mind that these voltages may not necessarily be the best for your specific compound, and experimentation is always recommended.
  - Set voltage values will not change when switching in and out of Standby Mode.
- **Save Settings: Methods**
    - You can save your settings to a 'Method', and load them again for later use.
      - See DART Software Manual for more detail regarding Methods
- **Data Acquisition**
    - Once all the parameters have been set you are ready to acquire data
    - Standby Mode:
      - While in Standby prepare your sample for introduction to the DART gas beam, and your mass spectrometer software for an acquisition
    - Run Mode:
      - Turn on Run Mode and present samples to DART for ionization
    - Once you are finished ionizing your samples set the DART back to Standby to prepare for another run, or to shut down for later use.
  - **Troubleshooting**
    - **Nozzle Cap Contamination**
      - The exit nozzle of the DART can become accidentally contaminated by touching a sample to the hot surface on the tip. The nozzle cap is ceramic and it can be removed for cleaning. The ceramic is fragile and care must be used when handling it. Due to potential contamination and background from fingerprints, it is recommended that gloves be worn when applying a clean cap. Firstly turn off the DART source and let it cool. The cap can be unscrewed from the nozzle and either cleaned using solvent, high

temperature baking, or replaced with a spare clean cap. Proper safety procedures must be followed when using a solvent or operating a high temperature oven. It is not recommended the cap be baked above 1000°C.

○ **Low Sensitivity**

- Insufficient gas temperature.
  - The temperature readout in the DART software is from a thermocouple embedded in the ceramic heater, not in the gas stream. Therefore the actual gas temperature will be lower than this readout and is a function of the heater core temperature, gas flow rate and heat capacity of the gas. The heater core temperature can be adjusted through the software within defined limits and optimized for the application measurement.
- Grid Electrode contamination.
  - The grid electrode at the tip of the DART nozzle can become contaminated with use. If the grid becomes contaminated the sensitivity of the DART will decrease, particularly in negative ionization mode. If so, the grid should be replaced.
  - This replacement can be easily performed by any user. Contact IonSense regarding a document detailing the procedure if you wish to replace the grid.
- Mass Spec Inlet orifice blockage.
  - Due to the wide variety of samples that can be analyzed and the open nature of the atmospheric pressure inlet to the mass spectrometer, it is possible for contamination to build up on the inlet. This contamination can cause a partial or complete blockage and loss of sensitivity of the mass spectrometer. If you suspect this has happened, turn off the DART, let it cool and remove the DART from the mass spectrometer to gain access to the inlet orifice. Follow the manufacturer's instructions for cleaning the atmospheric inlet orifice and reattach the DART.