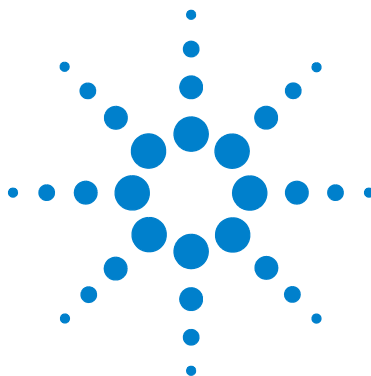




**Agilent G9214AA
RapidFire 360
High-throughput Mass
Spectrometry System**

User Guide



Agilent Technologies

Notices

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CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

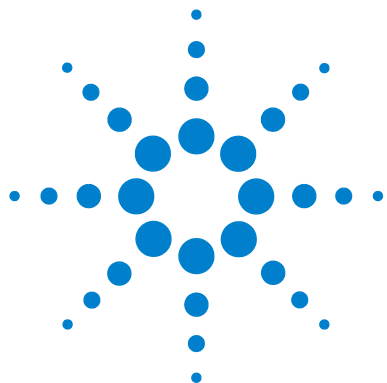
A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

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System Preparation

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This chapter contains information to help you start up and turn off the Agilent RapidFire 360 High-throughput Mass Spectrometry System for daily use.



1 System Preparation

To prepare solvents

What is the Agilent RapidFire 360 High-throughput Mass Spectrometry System?

The Agilent RapidFire 360 High-throughput Mass Spectrometry System instrumentation and screening services help to eliminate bottlenecks in your drug discovery workflow. By feeding samples directly to the mass spectrometer, RapidFire-MS System technology enables the acceleration of drug discovery pipeline decisions.

This ultra high throughput mass spectrometry system consists of a proprietary sample purification and injection system which replaces the HPLC unit used in conventional LC-MS applications.

To prepare solvents

Only use HPLC grade, filtered, degassed solvents. Change solvents according to your assay.

- 1 Pull out the solvent drawer.



- 2 Check that you have enough solvent for the runs you plan to do today. When needed, pour additional solvents as follows into their respective containers:
 - Aqueous in bottle A to pump 1
 - Organic in bottle B to pumps 2 and 3
 - Water in bottle labeled 100% water
 - Acetonitrile in bottle labeled 100% acetonitrile

CAUTION

Handle solvents safely as described in “General chemical safety” on page 94.

- 3 Gently shake the filters and whirl the flasks around to get rid of potential air bubbles.

To check waste capacity

- 1 Check that the waste flasks are empty enough to accommodate all of the runs you plan to make.
- 2 If more capacity is needed:
 - a Empty the waste carboy where the two green RapidFire-MS System waste lines are directed, the vacuum waste flask, and the waste-from-pumps bottle.
 - b Check that the two green RapidFire-MS System waste lines are not dipping in waste fluid, but merely sticking out of the lid of the carboy.

CAUTION

Handle waste solvents safely as described in “Chemical waste safety” on page 95.

To start the vacuum system

- 1 Open up the vacuum valve or switch on your stand-alone vacuum pump.

1 System Preparation

To start the software

To start the software

- 1 Double-click the **RapidFire 360 Control Panel** desktop icon.

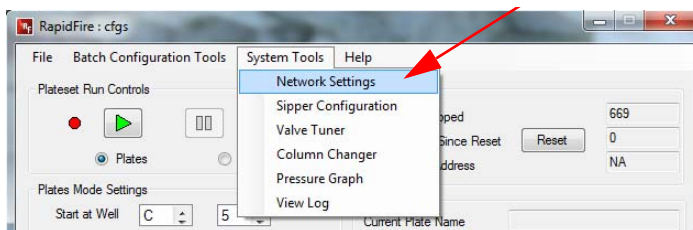


- 2 Click **File > Choose CFGs**.
- 3 Select the configuration folder under **C:\Program Files\Agilent\ RapidFire**.
- 4 Click **Start** on the Control Panel dialog box.

The icons turn green as the system components start up.



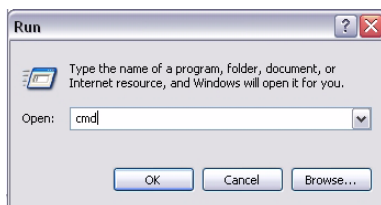
- 5 Double-click the **RapidFire360 UI** desktop icon.
- 6 Click **System Tools > Network Settings**.



- 7 Assign IP addresses for the RapidFire-MS System computer and the mass spectrometer computer.

Tip To find out your IP address if you do not know it:

- a Click **Run** on the Windows Start menu.
- b When the run dialog box opens, type **cmd** and click **OK**.



- c When a command window opens, type **ipconfig -all** and press **Enter**.

The IP address is displayed in the window.

- 8 Click the **Connect** button in the main window to connect to the program server.

The icon next to the Connect button turns green.

To home the stages

Use this procedure to calibrate the RapidFire-MS System positions in any of the following situations:

- When you replace the sipper tube.
- When you change type of plates, such as from shallow to deep well or from round to conical bottom.

Before you begin For this calibration protocol, you need example empty plates in either the 96- or 384-well formats.

- 1 Click **System Tools > Sipper Configuration** to open the Sipper Configuration wizard.
- 2 Click the **Home** button in the wizard and wait until all three (x,y,z) stages have found their home positions (0,0,0).

The position numbers (at the top of the screen) are set at 0.0.

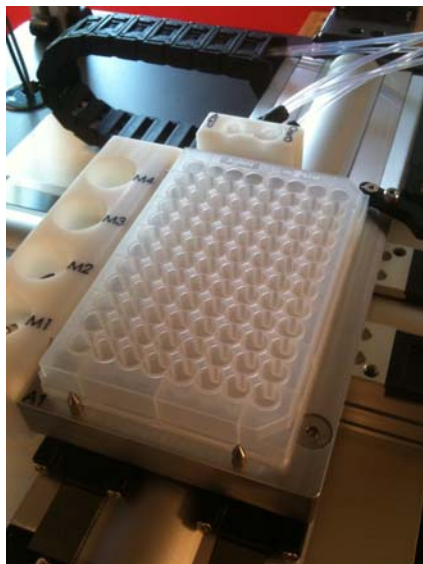
- 3 If your experiments use the same plate types as the plate types last used to calibrate the RapidFire-MS System:
 - a Close the wizard.

To home the stages

- Otherwise, continue with Step 4 to set a sipper safe height.

-

5 Place an empty plate on the holder between the metal pins. Use the same plate type as you are using for your experiment.



- a** Manually adjust the stage to clear the plate and wash station by about 0.5 cm.

- b** Click **Set**, then **Next**, in the software wizard.

Tip

To manually move the stage, do *either* of the following:

- Open one of the interlocked doors, *or*
- Press the **E-STOP** button to cut power, turn the stage knobs until the stage reaches the desired position, then release the **E-STOP** button.

CAUTION

- 6** When the Left (Aqueous) Wash Station Position window appears:
- a** Manually adjust the stage so that the sipper tube is deep within the left wash station chimney, but does not contact the walls or bottom.



- b** Click **Set**, then **Next**.

CAUTION

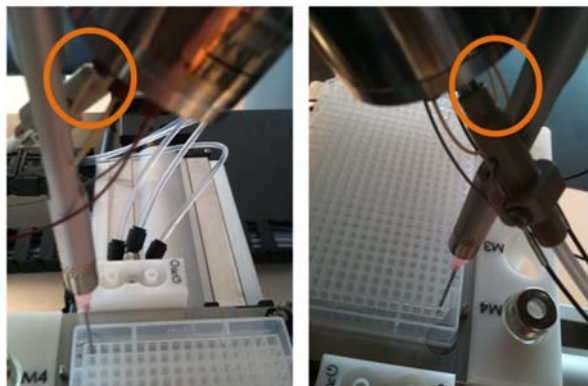
- 7** When the Right (Organic) Wash Station Position window appears.
- a** Manually adjust the stage so that the sipper tube is deep within the right wash station, but does not contact the walls or bottom.
- b** Click **Set**, then **Next**.

1 System Preparation

To home the stages

CAUTION

- 8 When the Middle (Trough) Wash Station Position window appears:
 - a Manually adjust the stage so that the sipper tube is within the central drain of the wash station.
 - b Set the position so that the tube is deep enough to prevent any splashes from occurring during a sipper flush.
 - c Click **Set**, then **Next**.
-
- 9 When the Set the H-1 Position window appears:
 - a Manually adjust the stage so that the sipper tube goes all the way down into the H-1 well of a 96-well plate and is properly centered within the well.
 - b Slowly and carefully lower the stage until the sipper tube flexes only slightly, as shown in the photos. Move the stage up a notch from this position and watch the sipper tube bounce back down.

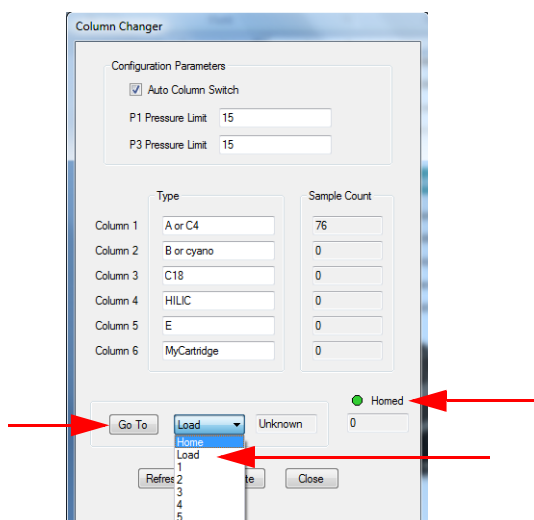


- 10 Repeat Step 9 to define positions A-1 and A-12 of the 96-well plate or P1, A1, and A24 of a 384-well plate.
- 11 When the Set the Matrix 1 Position window appears, specify where you want the sipper tube to travel in the matrix bottles 1-4.
- 12 Click **Home** or **Swap**, then close the Sipper Configuration Wizard.

To home the column changer and replace the cartridge

- 1 Click **System Tools** > **Column Changer** to open the Column Changer dialog box.
- 2 If the **Homed** icon is red instead of green, home the device as follows:
 - a Click **Home** in the drop-down menu.
 - b Click **Go To**.

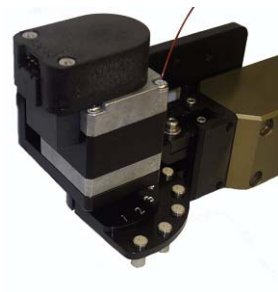
The **Homed** icon turns green.



Note that a cartridge must be present in the Column 1 slot, as the column changer travels to this position after performing its homing routine.

- 3 To load up to six new cartridges in the holder:
 - a Click **Load** in the drop-down menu.
 - b Click **Go To** to get access to the slots.

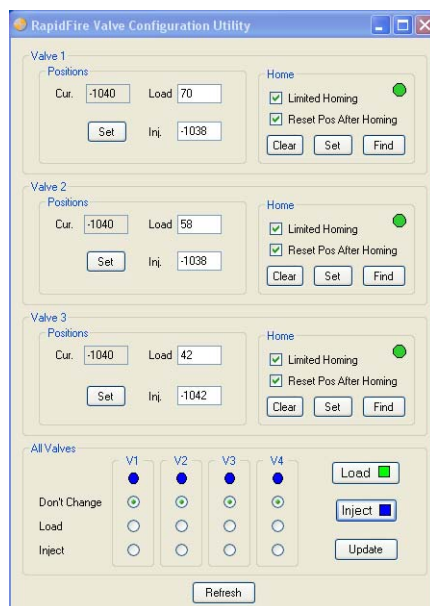
To home the column changer and replace the cartridge



- See “RapidFire-MS System Cartridges” on page 67 for list of columns available for the RapidFire-MS System.

To check the valves

- 1 Click **System Tools > Valve Tuner** to open the Valve Configuration Utility dialog box.



- 2 Check the status of the three nanovalves (Valve 1, Valve 2, and Valve 3) in the lower part of the screen. For normal operation, the status icons are either blue (Inject) or green (Load) for all three valves.
- 3 If the status lights for the valves are yellow or if their Home icons are red, then home them by clicking their **Find** buttons.

The Home icons turn green, and their **Cur. Positions** are set to 0.

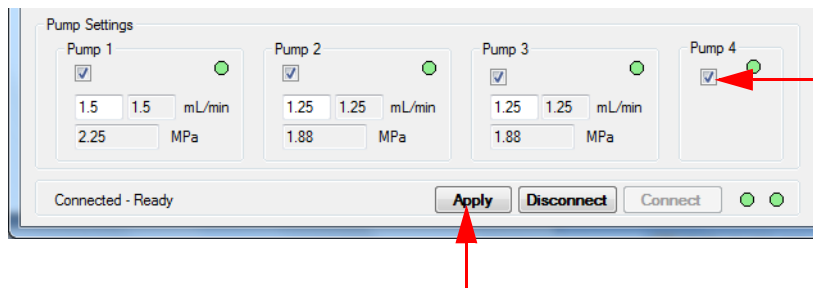
- 4 Check that switching the valves from their load to their inject position is smooth and quiet.

1 System Preparation

To prepare the peristaltic pump

To prepare the peristaltic pump

- 1 Turn on the peristaltic pump connected to the wash stations:
 - a Select Pump 4 as **Active**.
 - b Click the **Apply** button.



- 2 Check that the peristaltic pump is rotating clockwise.
 - You can adjust the flow rate of the peristaltic pump manually by means of the up and down arrows of its control panel.
 - If the peristaltic has been off for hours, then the organic channel takes a few minutes longer than the aqueous one to get primed and reach the right side chimney.



- 3 With the vacuum on, check that fluid is being aspirated from the drain (central trough). Be sure not to overflow the wash station.

To prepare the isocratic pumps

Use this procedure to prime the isocratic pumps, which removes air bubbles in the fluidics lines, in the following situations:

- When you use the system for the first time
- When the system has not been used for a few days
- When a large air bubble is trapped in the pump or its tubes

Otherwise, go to [“To flush the sipper tube”](#) on page 21.

- 1 To turn on the pump, click the **Apply** button with the pump selected as Active (Pumps 1, 2, and 3).
- 2 Turn the diversionary valve (black knob) counterclockwise to open it.



- 3 Increase the flow rate (step-wise: 3 mL/min, 5 mL/min...) to 10 mL/min.

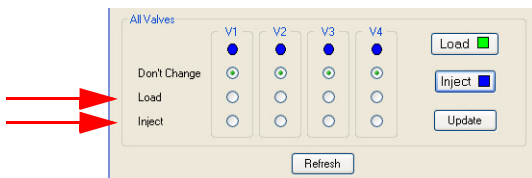
To change the flow rate, enter the desired value in mL/min in the Pump Settings panel and click **Apply**.

- 4 When the flow is constant and no air bubbles are visible in the pump lines, decrease the flow rate. Set the flow to the assay-specific rate such as 1.25 mL/min.
- 5 Turn the diversionary valve clockwise to close it. *Tighten it finger-tight only.*
- 6 Check the pressure readings, keeping in mind the following:

1 System Preparation

To prepare the isocratic pumps

- You can view the pump pressure history on the **System Tools > Pump Pressure Graph** plots.
 - The pumps status icons remain red until the pumps are running at the set flow rate.
 - The maximum system pressure is 20 MPa.
- Click **System Tools > Valve Tuner** to open the Valve Configuration Utility dialog box.
 - Select the **Inject** (blue) position for Valve 1, 2, and 3 and check the back pressure of each pump.
 - Select the **Load** (green) position for Valve 1, 2, and 3 and check the back pressure of each pump.



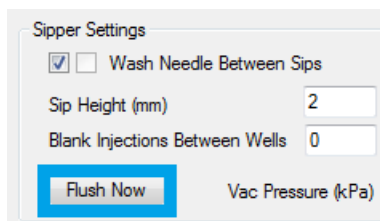
Here are some typical values:

Valve Position	Pump number	Back pressure
V1, V2, and V3 blue (Inject position)	P1	~1 - 10 MPa (or 10 - 100 bar)
	P2	~0.1 - 3 MPa
	P3	~1 - 10 MPa
V1, V2, and V3 green (Load position)	P1	~0.1 - 10 MPa (lower than in blue)
	P2	~0.1 - 3 MPa (higher than in blue)
	P3	~1 - 10 MPa (higher than in blue)

If the value is outside of the range of the typical values shown for each pump position, refer to the *RapidFire 360 High-throughput Mass Spectrometry System Troubleshooting Guide*.

To flush the sipper tube

- 1 Click the **Flush Now** button in the Sipper Settings area of the main window.



The following things happen automatically:

- Pump 1 is turned on.
- The sipper tube is positioned above the wash station drain.
- Valve 4 is actuated.
- The flow rate for Pump 1 is ramped up to 8 mL/min. This rate is maintained for 1 minute, then is reduced to its default flow rate setting.
- Valve 4 is rotated back.
- The pumps are turned off.
- The stages are moved to the swap position.

1 System Preparation

To prepare the mass spectrometer computer

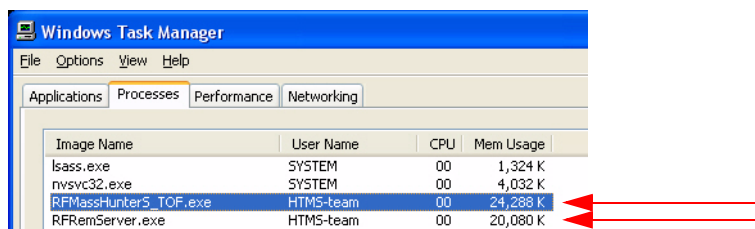
To prepare the mass spectrometer computer

- 1 Double-click the desktop icon **Launch RapidFire COM**.

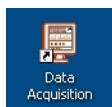
The following programs start up:

- **RFRemServer.exe**
- **RFMassHunterS_TOF.exe**

These programs are required for software integration with the RapidFire-MS System.

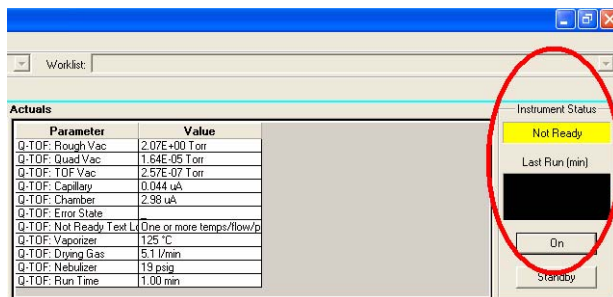


- 2 Double-click the **Data Acquisition** desktop icon to start the Agilent MassHunter Data Acquisition software.

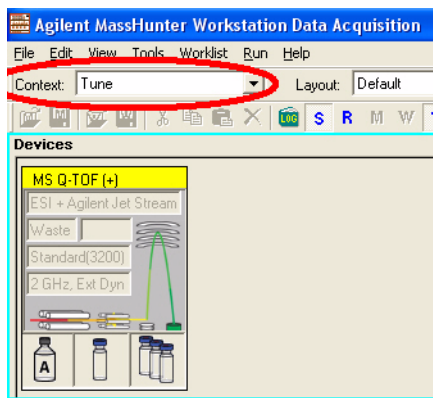


- 3 Turn on the detector.

The Instrument Status box turns from yellow (Not Ready) to green (Ready).



- 4 Select **Tune** in the Context list box, as shown in the following figure.

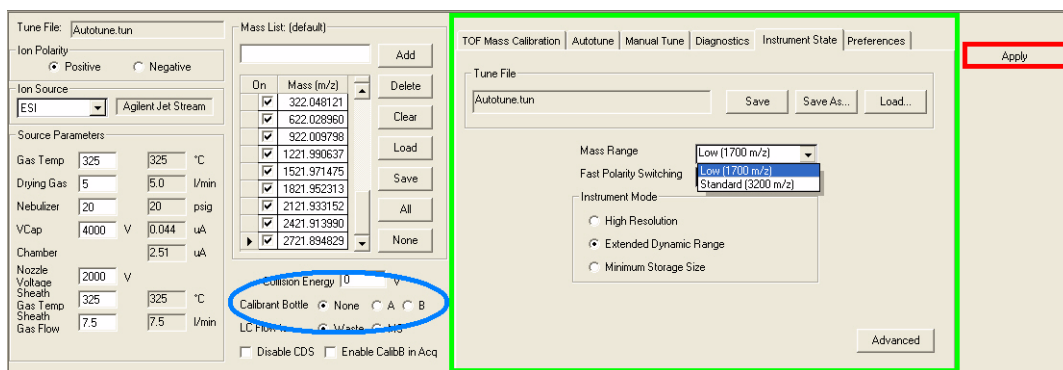


- 5 Set the mass and resolution parameters for your analysis in the Instrument State tab of the bottom panel.

Tip

- High Resolution (scan speed 4 GHz)
- Extended Dynamic Range (scan speed 2 GHz)
- Minimum Storage Size (scan speed 1 GHz)

- a Click **Apply** on the right.

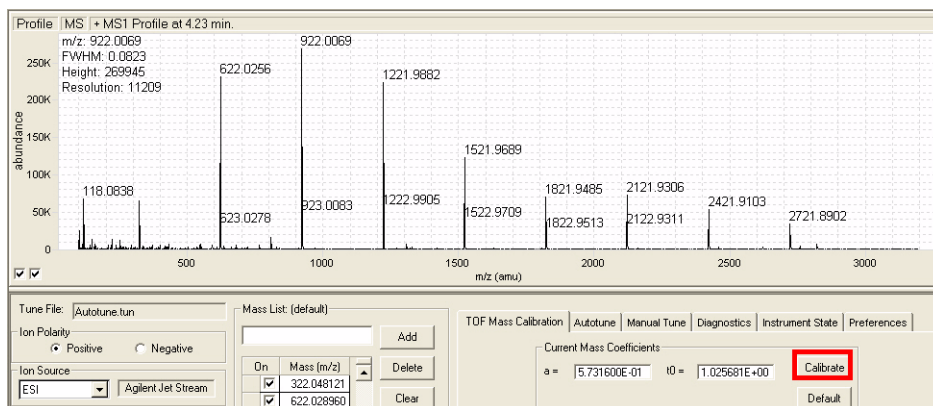


- 6 Calibrate the mass spectrometer.

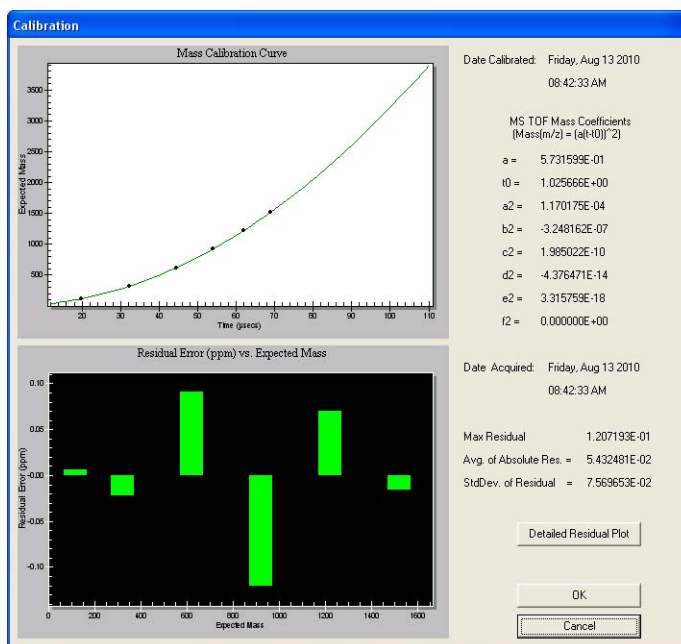
- a Set the location of the Calibrant Bottle (example: B), and wait for the mass-over-charge spectrum to stabilize.
- b Click **Calibrate**.

1 System Preparation

To prepare the mass spectrometer computer



- c When the Calibration results window appears, check that the calculated residual errors are satisfactory (for example < 2.0 ppm).



- d Click **OK** to close the results window.
- e Set the Calibrant Bottle flag back to **None**.

7 Select **Acquisition** in the Context list box.

If prompted, confirm that you want to operate under the modified Instrument State. ***DO NOT modify the Tune File.***

8 Click **File > Open > Method** to open a .m method or set parameters to create a method.

Methods for the RapidFire-MS System are stored in the **D:\MassHunter\methods\RapidFire** folder.

9 Set the parameters for your analysis on the **MS Q-TOF** tabs shown in the following example screens.

Sample | Properties | **MS Q-TOF**

Ion Source: ESI | Ion Polarity: Positive | Data Storage: Profile | LC Stream: MS

Agilent Jet Stream

Stop Time: ☐ No Limit/As Pump ☐ Stop Time 1 min

Cycle Time: 0.2 s

Time Segment and Experiment #	
Time (min)	Expt
0	1

Ion Polarity (Seg): ☒ Positive ☐ Negative ☐ Fast Polarity Switching

Data Storage (Seg): ☐ None ☐ Centroid ☐ Both ☒ Profile

Do not wait for setpoints (e.g. temperature) to equilibrate

LC Stream (Seg): ☒ MS ☐ Waste

Plot and Centroid Data Storage Threshold	
MS	MS/MS
Abs. threshold: 200	Abs. threshold: 5
Rel. threshold (%): 0.01	Rel. threshold (%): 0.01

Sample | Properties | **MS Q-TOF**

Ion Source: ESI | Ion Polarity: Positive | Data Storage: Profile | LC Stream: MS

Agilent Jet Stream

Stop Time: ☐ No Limit/As Pump ☐ Stop Time 1 min

Cycle Time: 0.2 s

Time Segment and Experiment #	
Time (min)	Expt
0	1

ESI (Seg): Gas Temp: 350 °C | 351 °C

Drying Gas: 7 l/min | 7.0 l/min

Nebulizer: 35 psig | 35 psig

Sheath Gas Temp: 400 °C | 403 °C

Sheath Gas Flow: 10 l/min | 10.0 l/min

ESI (Expt): VCap: 3500 V | Capillary: 0.044 uA

Chamber: 2.67 uA

MS TOF (Expt): Fragmentor: 140 V | Skimmer: 65 V | OCT 1 RF Vpp: 750 V

Nozzle Voltage (Expt): 2000 V

1 System Preparation

To prepare the mass spectrometer computer

Sample | Properties | **MS Q-TOF**

Ion Source: ESI | Ion Polarity: Positive | Data Storage: Profile | LC Stream: MS

Agilent Jet Stream

Stop Time: ☐ No Limit/As Pump ☐ Stop Time min

Cycle Time: s

Time Segment and Experiment #

Time (min) / Expt #

Mode: ☒ MS (Seg) ☐ Auto MS/MS (Seg) ☐ Targeted MS/MS (Seg)

TOF Spectra

Mass Range

Min Range: m/z

Max Range: m/z

Acquisition Rate/Time

Rate: spectra/s

Time: ms/spectrum

Transients/spectrum:

Sample | Properties | **MS Q-TOF**

Ion Source: ESI | Ion Polarity: Positive | Data Storage: Profile | LC Stream: MS

Agilent Jet Stream

Stop Time: ☒ No Limit/As Pump ☐ Stop Time min

Cycle Time: s

Time Segment and Experiment #

Time (min) / Expt #

Reference Mass Correction

☐ Enable

☒ Use bottle A

Auto Recalibration Parameters

Average: scans

Reference Mass

Detection Window: ppm

Minimum Height: counts

Reference Masses

On	M/Z
☐	121.0508
☒	922.0098
☒	149.02332

Sample | Properties | **MS Q-TOF**

Ion Source: ESI | Ion Polarity: Positive | Data Storage: Profile | LC Stream: MS

Agilent Jet Stream

Stop Time: ☒ No Limit/As Pump ☐ Stop Time min

Cycle Time: s

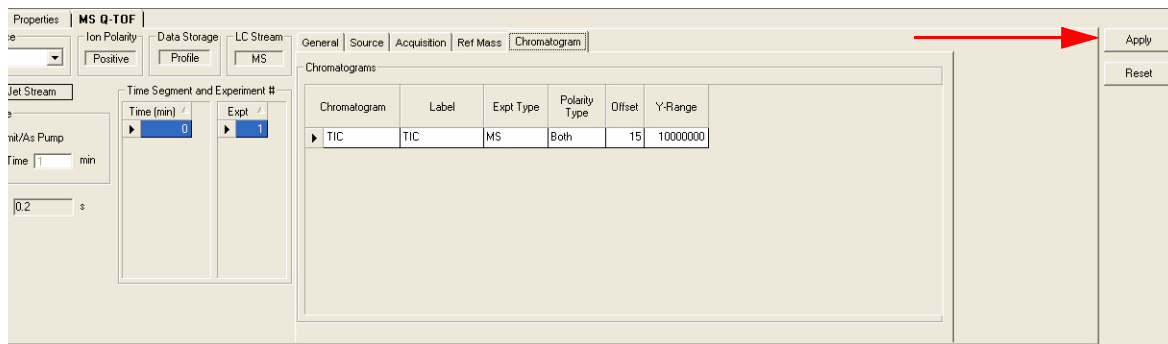
Time Segment and Experiment #

Time (min) / Expt #

Chromatograms

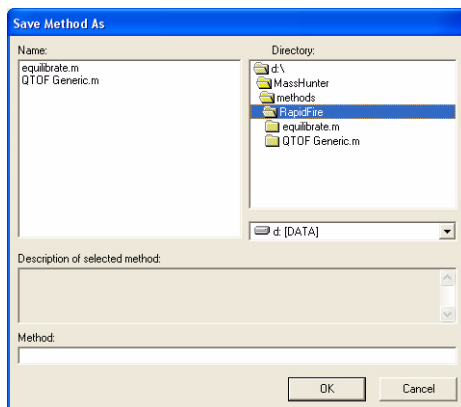
Chromatogram	Label	Expt Type	Polarity Type	Offset	Y-Range
TIC	TIC	MS	Both	15	10000000

10 When you have finished setting the parameters, click the **Apply** button on the right side of the screen.



11 Save the method.

Save all **.m** methods for use with RapidFire-MS System in the **D:\MassHunter\methods\ RapidFire** folder.



1 System Preparation

To turn off the system at the end of the day

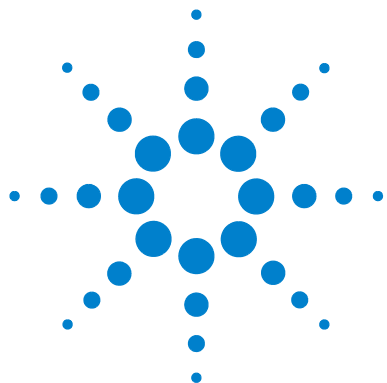
To turn off the system at the end of the day

Perform this procedure when you have finished using the RapidFire-MS System for the day.

NOTE

The instrument goes into stand-by mode at the end of each series of plates. This precaution ensures that all pumps are switched off at the end of a run.

- 1 Exit the RapidFire-MS System software:
 - a Disconnect the RapidFire-MS System user interface, then close its window.
 - b Stop the RapidFire-MS System Control Panel, then close its window.
- 2 After idling for about 20 minutes, most mass spectrometers will automatically go into stand-by mode. If that is not the case of your system, actively put it into stand-by mode by following the instructions in your mass spectrometer documentation.
- 3 Turn off the vacuum line.
- 4 If your samples are a high-salt high-protein or buffers, then:
 - a Flush the sipper to avoid the formation of precipitates as described in [“To flush the sipper tube”](#) on page 21.
 - b Clean the fluidics lines by running a few rows of methanol wells. A minimum of 50 wells is recommended.



2 Maintenance

- To prepare the instrument for daily use 30
- To maintain the system at the end of each day 30
- To maintain the system at the end of the week 30
- To turn off the system completely 31
- To resume operation after a power shutdown 31

This chapter contains procedures to help you maintain the RapidFire-MS System.



2 Maintenance

To prepare the instrument for daily use

To prepare the instrument for daily use

- 1 Replace solvents.
- 2 Flush the pumps.
- 3 Home the stages.
- 4 Check the status of the valves.
- 5 Change the cartridge.
- 6 Flush the sipper tube.

To maintain the system at the end of each day

- 1 Flush the sipper tube again as described in “[To flush the sipper tube](#)” on page 21.
- 2 Perform the shutdown procedures described in “[To turn off the system at the end of the day](#)” on page 28.

To maintain the system at the end of the week

- 1 Empty the waste containers (carboy, waste-from-pumps bottle, and vacuum flask).
- 2 Clean the mass spectrometer according to the instructions provided by the manufacturer.

To turn off the system completely

Perform the following tasks to turn off the RapidFire-MS System completely.

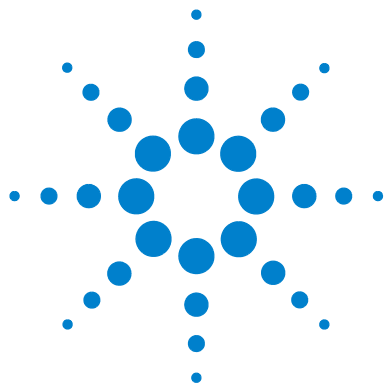
- 1 Exit the RapidFire-MS System software.
 - a Disconnect the RapidFire-MS System UI then close its window.
 - b Stop the RapidFire-MS System Control Panel then close its window.
- 2 Safely turn off the RapidFire-MS System computer.
- 3 Turn off the pumps and the Twister plate handler.
- 4 Turn off the UPS unit.

To resume operation after a power shutdown

- 1 Switch on the UPS unit.
- 2 Turn on the pumps and the Twister plate handler.
- 3 Turn on the RapidFire-MS System computer.
- 4 Open the RapidFire 360 High-throughput Mass Spectrometry System software.

2 Maintenance

To resume operation after a power shutdown



3 Operation in Plates Mode

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- To prepare the mass spectrometer computer 35
- To load plates manually 36
- To load plates using the Twister plate handler 37
- To set run parameters 38
- To start a run in Plates mode 41
- To pause a run 42
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- To make an emergency stop 43
- To maintain a log book of data 44

This chapter contains procedures to help you operate the RapidFire 360 High-throughput Mass Spectrometry System in Plates Mode.



3 Operation in Plates Mode

To prepare plates

To prepare plates

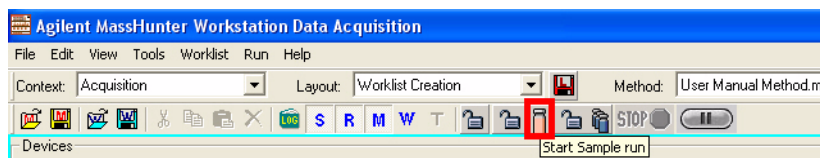
- 1 Completely thaw the sample plates.
- 2 Centrifuge the plates at 3000 rpm for 5 minutes.

Tip Spin down the plates, particularly if samples contain insoluble components, such as microsomes. This forces particulate material to the bottom of the wells where it is less likely to be aspirated into the system.

To prepare the mass spectrometer computer

- 1 Set up the mass spectrometer computer as described in “To prepare the mass spectrometer computer” on page 22.
- 2 On the **Sample Tab** of the Method Editor pane in the MassHunter Data Acquisition software:
 - a Enter the **Name** and **Path** for the data file.
 - b Set the Run Type to **Manual Start**.
 - c Set the Injection Volume to **-1 µL**. This value causes the system to use the injection volume set by the RapidFire injection loop (at V1P2-V1P5).

- 3 Click the **Start Sample** button.



When the source has equilibrated, the label of the MS Q-TOF device module turns blue in the Instrument Status pane.

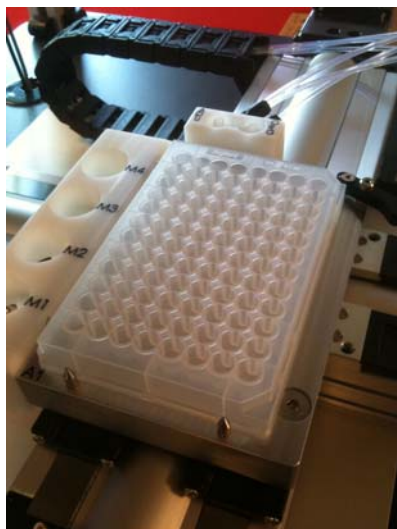
3 Operation in Plates Mode

To load plates manually

To load plates manually

You can either load plates manually as described here or using the Twister plate handler as described in the next topic.

- 1 Check that the sipper has been homed as described in [“To home the stages”](#) on page 11.
- 2 Securely position the plate on the holder in between the metal pins.



- 3 Close the front doors.

To load plates using the Twister plate handler

You can either load plates using the Twister plate handler as described here or manually as described in the previous topic.

- 1 On the main RapidFire-MS System window:
 - a Select the plate configuration (96- or 384-well).
 - b Mark the **Use Plate Handler** option.

The screenshot shows the 'Plate Info' and 'Miscellaneous Settings' sections of the RapidFire-MS System window. In the 'Plate Info' section, the 'Plate Configuration' dropdown menu is set to 'StandardPlate_96', indicated by a red arrow. In the 'Miscellaneous Settings' section, the 'Use Plate Handler' checkbox is checked, also indicated by a red arrow. Other settings include 'Plates Completed' (0), 'Input Stack' (NA), 'Output Stack' (NA), 'Current Column Position' (Unknown), 'Use Barcode Scanner' (unchecked), 'Mass Spec Standby After Run' (checked), 'Plates Between Flushes' (1 and 4), and 'Missed Sip Tolerance' (5 and 10).

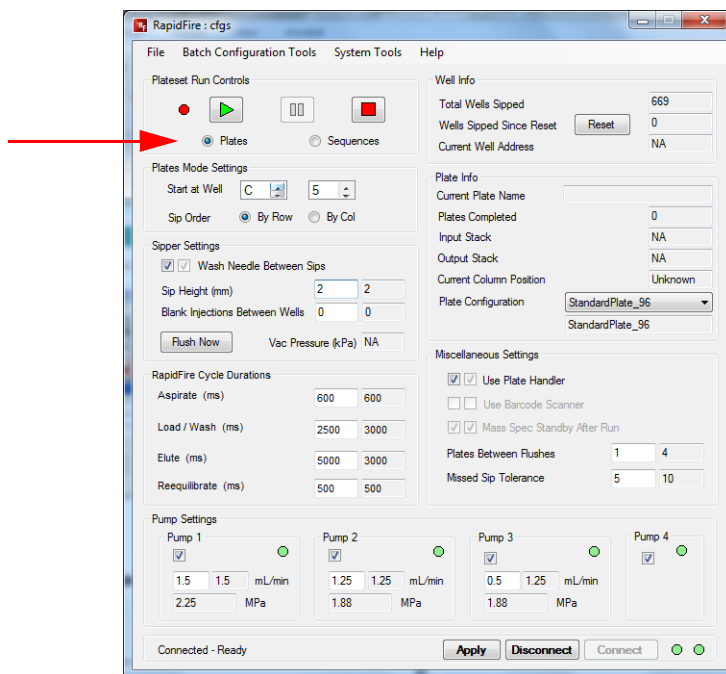
Plate Info	
Current Plate Name	
Plates Completed	0
Input Stack	NA
Output Stack	NA
Current Column Position	Unknown
Plate Configuration	StandardPlate_96

Miscellaneous Settings	
☒ Use Plate Handler	
☐ Use Barcode Scanner	
☒ Mass Spec Standby After Run	
Plates Between Flushes	1 4
Missed Sip Tolerance	5 10

- 2 Stack the plates to read in the input hotel.

To set run parameters

- 1 Click **System Tools > Column Changer**.
- 2 When the Column Changer dialog box appears:
 - a Open the column select list and select the solid-phase extraction (SPE) cartridge appropriate for your assay.
 - b Click **Go To**.
 - c Close the Column Changer window.
- 3 Set the parameters for your analysis on the RapidFire 360 High-throughput Mass Spectrometry System.
 - Be sure to select the **Plates** option.



- 4 In the **Plates Mode Settings** area:
 - a In the **Start at Well** field, type the position on the plate to start the run. The first position is **A1**.
 - b Select to read microtiter plates in *either* of the following ways:

- **By Row:** A1, A2, A3, ..., H11, H12,
 - **By Column:** A1, B1, C1, ..., G12, H12.
- 5** In the **Sipper Settings** area of the screen:
- a** Mark the **Wash Needle Between Sips** option to wash the sipper tube once after aspiration of the sample from each well (first in the aqueous then in the organic wash chimney, for 300 ms in each).
 - b** In the **Sip Height** field, type the number of millimeters from the *lowest position* of the sipper tube to the well bottom. Enter a value of 1.0 mm or greater. The sipper tube (in V1P3) travels down from Safe Z into the sample well until *either*:
 - The sip sensor (in V1P4) optically detects the presence of fluid and triggers the actuation of V1, which causes the transition between State # 1 (Aspiration) and State # 2 (Load/Wash), *or*
 - The z-position of the sipper tube reaches the set **Sip Height**.
 - c** Enter a value > 0 for **Blank Injections Between Wells** to have the system perform additional cycles in the organic wash station *between wells*, to further limit or prevent carryover between samples.
- 6** In the **RapidFire Cycle Durations** area, set the valve timing, as per assay protocol for States 1 - 4 (**Aspirate**, **Load/Wash**, **Elute**, and **Re-equilibrate**).
- Set the value of **Aspirate** to 600 ms for reliable sip sensor triggering.
- 7** In the **Well Info** area, you can view the following information:
- the number of wells sipped in the lifetime of your RapidFire-MS System
 - the number of wells sipped since the last reset
 - the location of the Current Well Address (such as [1,7] for position A7).
- 8** In the **Plate Info** area, select either **96 Well** or **384 Well** as the Plate Configuration.
- 9** In the **Miscellaneous Settings** area:
- a** Mark whether to:
 - **Use Plate Handler**
 - **Use Barcode Scanner**
 - Put the **Mass Spec in Standby After Run**
 - b** Set the **Plates Between Flushes** as follows:
 - For 96-well plates, use **4**.
The sipper tube flushes for 1 minute after *every four plates*.

3 Operation in Plates Mode

To set run parameters

- For 384-well plates, use **1**.
The sipper tube flushes for 1 minute after *every plate*.
- c** Set the **Missed Sips Tolerance** to a value > 0 to suspend RapidFire-MS System operation after the specified number of consecutive wells are found to be empty by the sip sensor.

10 In the **Pump Settings** area at the bottom of the screen, set pump flow rates for your assay.

11 Click **Apply**.

12 To save the parameter settings made in the previous steps for future use, click **File > Save RF Method As**.

To start a run in Plates mode

- 1 Click the **Play** button in the upper left area of the screen.



- 2 When prompted, enter the plate name with the keyboard or the hand-held barcode scanner, then click **OK**.
- 3 Click the **Play** button again.
- 4 Verify that the sipper tube aspirated the first samples.
- 5 Verify that signal is being received by the mass spectrometer.

Note that runs in Plates mode are *not* synchronized with the mass spectrometer.

CAUTION

Close the doors while operating the RapidFire-MS System to prevent possible injury.

-
- 6 If you are loading plates manually, then when the plate run is completed, you are prompted to load a new plate.

a If you have more plates to read, then:

- Remove the previous plate.
- Position your next plate on the deck as described in [“To load plates manually”](#) on page 36.
- Enter a name for the new plate using the keyboard or the hand-held barcode scanner, then click **OK**.

If you do not enter a plate name within 30 minutes, then a time-out feature automatically puts the RapidFire-MS System in stand-by mode to keep solvent from being wasted.

b If all plates in this set have been run, then click **Cancel**.

To pause a run

Use this procedure to suspend a run temporarily, such as when you change buffer solutions or do other routine maintenance.

- 1 Click the **Pause** button.



- The cycle of **Aspirate**, **Load/Wash**, **Elute**, and **Re-equilibrate** is completed for the last sample injected, then the RapidFire-MS System pauses operation.
- The mass spectrometer continues to collect "baseline" data.
- The RapidFire-MS System pumps continue to run.

- 2 To start operation after pausing, click the **Play** button.



- The system starts up where it left off and data is saved to the current data file.
- The remaining samples are run in the original order.

To stop a run

- 1 Click the **Stop** button.



- The cycle of **Aspirate**, **Load/Wash**, **Elute**, and **Re-equilibrate** is completed for the last sample injected, then the RapidFire-MS System stops operation.
- Data acquisition is stopped and the current data file is closed.

To make an emergency stop

Only use the following procedure in an emergency situation. Otherwise use either of these procedures to stop the system:

“To pause a run” on page 42, or

“To stop a run” on page 42.

- 1 Press the physical emergency stop button (labeled **E-STOP**), which cuts power to the entire system.



Opening an interlock door of the RapidFire-MS System also stops motion.

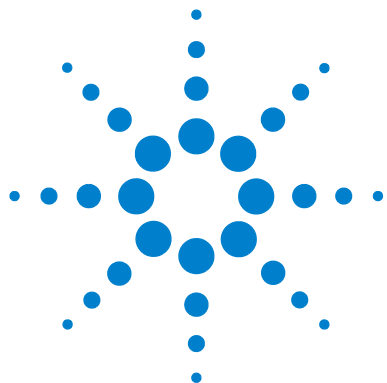
- 2 To restart the system, pull up the **E-STOP** button to reestablish power.

To maintain a log book of data

Create a log book to record information about the two sets of data that are stored in two independent systems (the mass spectrometer computer and the RapidFire-MS System computer) in Plates Mode. This record makes it easier to retrieve data and match corresponding data sets in Data Analysis.

Consider including the following information in the logbook, such as in a spreadsheet format:

- **Date**
Generated data is stored by date in the RapidFire-MS System computer. See the *Data Analysis* chapter for more information.
- **Assay description**
To relate to MS methods.
- **Sample name**
To relate to the .d data file from the MS.
- **Set of plates number** as assigned by RapidFire-MS System. See the *Data Analysis* chapter for more information.
- **Plate number** (in the current set of plates)
- **Comments**



4 Operation in Sequences Mode

- To prepare plates [46](#)
- To prepare the mass spectrometer computer [47](#)
- To load plates manually [48](#)
- To load plates using the Twister plate handler [49](#)
- To run plates [50](#)
- To set parameters in the RapidFire-MS System method [51](#)
- To edit the plate map [52](#)
- To edit the batch [54](#)
- To run a batch in Sequences mode [57](#)
- To pause a run [58](#)
- To stop a run [58](#)
- To make an emergency stop [59](#)

This chapter contains procedures to help you operate the RapidFire 360 High-throughput Mass Spectrometry System in Sequences Mode.



4 Operation in Sequences Mode

To prepare plates

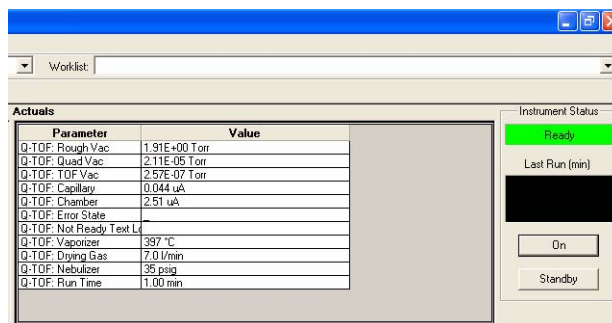
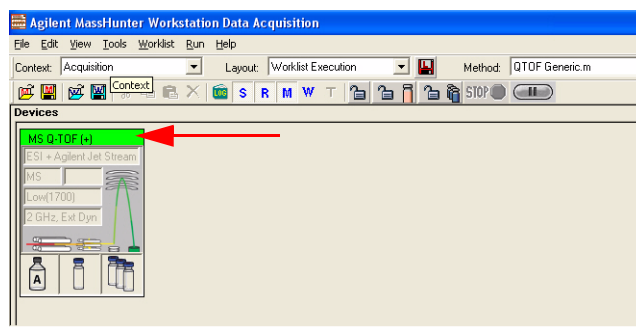
To prepare plates

- 1 Completely thaw the sample plates.
- 2 Centrifuge the plates at 3000 rpm for 5 minutes.

Tip Spin down the plates, particularly if samples contain insoluble components, such as microsomes. This forces particulate material to the bottom of the wells where it is less likely to be aspirated into the system.

To prepare the mass spectrometer computer

- 1 Set up the mass spectrometer computer as described in “To prepare the mass spectrometer computer” on page 22.
- 2 Check that the Instrument Status is Ready (green) in the MassHunter Data Acquisition software.



In Sequences mode, with synchronization between the RapidFire-MS System and the MS, data is recorded automatically in **D:\ MassHunter\ Data\ RapidFire**. Refer to the *Data Analysis Guide* for more information.

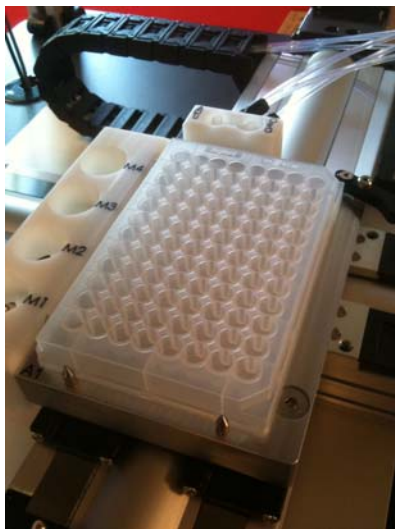
4 Operation in Sequences Mode

To load plates manually

To load plates manually

You can either load plates manually as described here or using the Twister plate handler as described in the next topic.

- 1 Check that the sipper has been homed as described in [“To home the stages”](#) on page 11.
- 2 Securely position the plate on the holder in between the metal pins.



- 3 Close the front doors.

To load plates using the Twister plate handler

You can either load plates using the Twister plate handler as described here or manually as described in the previous topic.

- 1 On the main RapidFire-MS System window:
 - a Select the plate configuration (96- or 384-well).
 - b Mark the **Use Plate Handler** option.

The screenshot shows the 'Plate Info' and 'Miscellaneous Settings' sections of the RapidFire-MS System window. In the 'Plate Info' section, the 'Plate Configuration' dropdown menu is set to 'StandardPlate_96', indicated by a red arrow. In the 'Miscellaneous Settings' section, the 'Use Plate Handler' checkbox is checked, also indicated by a red arrow. Other settings include 'Plates Completed' (0), 'Input Stack' (NA), 'Output Stack' (NA), 'Current Column Position' (Unknown), 'Use Barcode Scanner' (unchecked), 'Mass Spec Standby After Run' (checked), 'Plates Between Flushes' (1 and 4), and 'Missed Sip Tolerance' (5 and 10).

Plate Info	
Current Plate Name	
Plates Completed	0
Input Stack	NA
Output Stack	NA
Current Column Position	Unknown
Plate Configuration	StandardPlate_96

Miscellaneous Settings	
☒ Use Plate Handler	
☐ Use Barcode Scanner	
☒ Mass Spec Standby After Run	
Plates Between Flushes	1 4
Missed Sip Tolerance	5 10

- 2 Stack the plates to read in the input hotel.

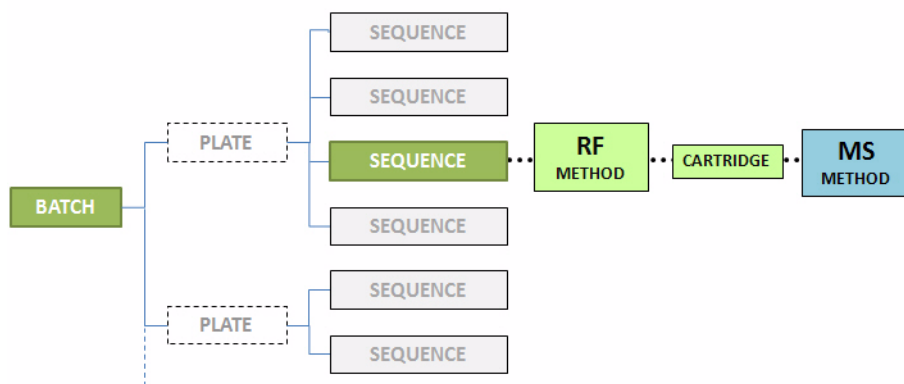
4 Operation in Sequences Mode

To run plates



To run plates

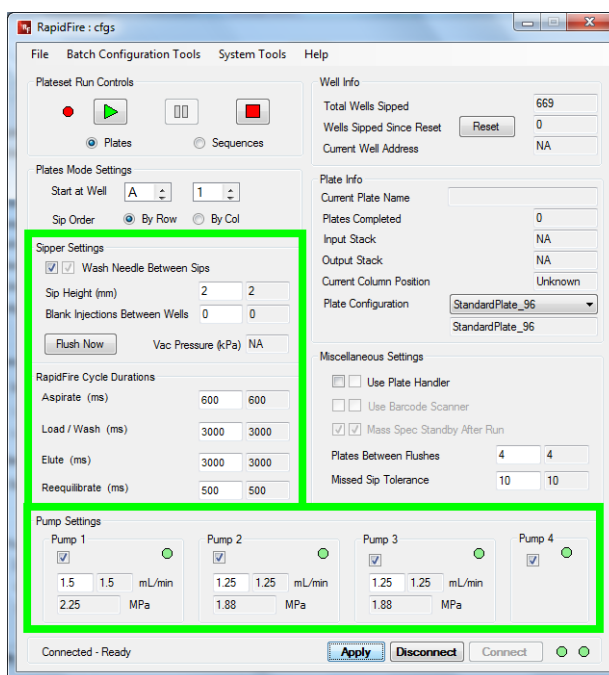
The following diagram illustrates the terminology use to define a batch of plates in Sequences mode.



To set parameters in the RapidFire-MS System method

- 1 Set the parameters for your analysis on the RapidFire 360 High-throughput Mass Spectrometry System.

The parameters outlined in green below make up an RapidFire-MS System method saved in a **.RFCFG** file.

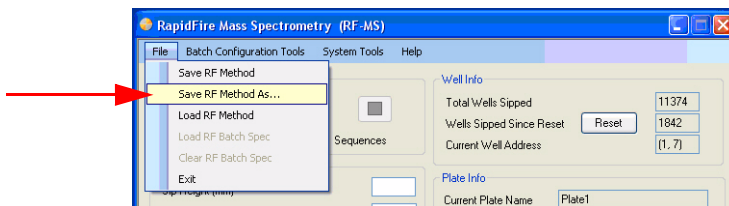


- 2 In the **Sipper Settings** area of the screen:
 - a Mark the **Wash Needle Between Sips** option to wash the sipper tube once after aspiration of the sample from each well (first in the aqueous then in the organic wash chimney, for 300 ms in each).
 - b In the **Sip Height** field, type the number of millimeters from the *lowest position* of the sipper tube to the well bottom. Enter a value of 1.0 mm or greater. The sipper tube (in V1P3) travels down from Safe Z into the sample well until *either*:

4 Operation in Sequences Mode

To edit the plate map

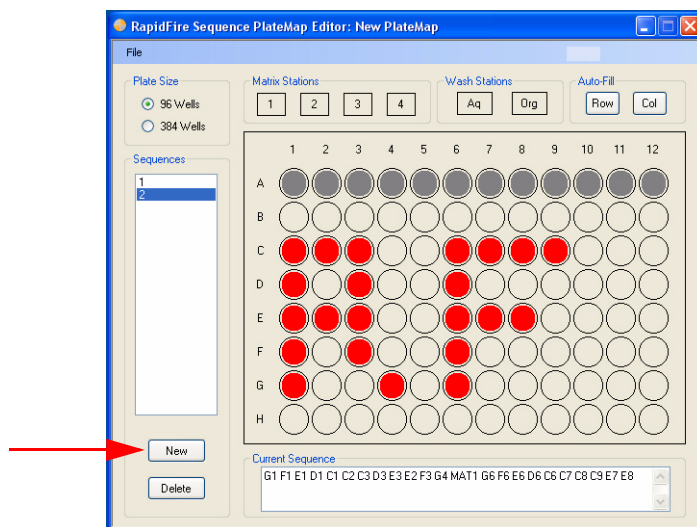
- The sip sensor (in V1P4) optically detects the presence of fluid and triggers the actuation of V1, which causes the transition between State # 1 (Aspiration) and State # 2 (Load/Wash), *or*
 - The z-position of the sipper tube reaches the set **Sip Height**.
- c** Enter a value > 0 for **Blank Injections Between Wells** to have the system perform additional cycles in the organic wash station *between wells*, to further limit or prevent carryover between samples.
- 3** In the **RapidFire Cycle Durations** area, set the valve timing, as per assay protocol for States 1 - 4 (**Aspirate**, **Load/Wash**, **Elute**, and **Re-equilibrate**).
- Set the value of **Aspirate** to 600 ms for reliable sip sensor triggering.
- 4** In the **Pump Settings** area at the bottom of the screen, set pump flow rates for your assay.
- 5** Click **Apply**.
- 6** To save the parameter settings made in the previous steps for future use, click **File > Save RF Method As**. The settings are stored in a **.rfcfg** file.



See Also Additional RapidFire-MS System method parameters are discussed in “[To set run parameters](#)” on page 56.

To edit the plate map

- 1** Click **Batch Configuration Tools > Plate Map Editor**.
- 2** For **Plate Size**, select 96- or 384-wells.
- 3** To create a sequence for a plate map, click the **New** button.

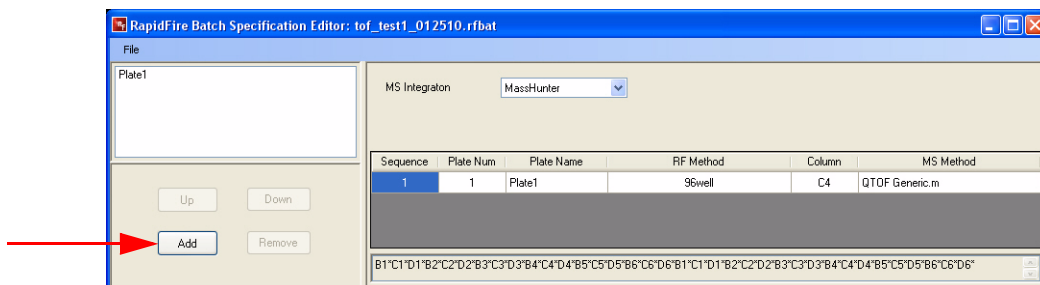


- 4 To create your sequence, click the following areas or buttons:
 - Well position in the plate diagram
 - Matrix station number (1-4)
 - Wash station (Aqueous or Organic)
- 5 To create another sequence for this plate map, repeat Steps 3 and 4.
 - A single plate map can contain several sequences, which are listed in the **Sequences** box on the left side of the window.
 - The **Current Sequence** is shown at the bottom of the window.
- 6 To save the settings made in the previous steps for future use, click **File > Save Platemap As**. The settings are stored in a **.rfmap** file.
- 7 (*Optional*) You can enter a special well designation for each sequence to insert a pause in RapidFire-MS System data acquisition. Enter this well number in the **Current Sequence** text box in the format **delay#**, where **#** is an integer that specifies the number of seconds of delay.

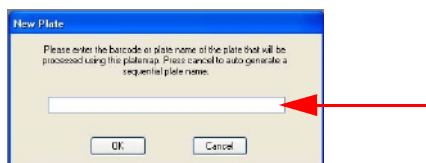
Example For a sequence "A1 A2 A3 A4 delay30" ..., after wells A1 through A4 are injected, the system pauses for 30 seconds before continuing with the next sequence listed in the Batch Editor.

To edit the batch

- 1 Click **Batch Configuration Tools > Batch Editor**.
- 2 To create a batch, click the **Add** button.



- 3 Select the plate map (**.RFMAP** file) to be added to this batch.
Plate maps are created as described in “[To edit the plate map](#)” on page 52.
- a When the New Plate window appears, enter the plate name or barcode for the plate.



- b Click **OK**.

Tip If you click **Cancel** without entering a plate name, then the plate is named Plate1, Plate2, Plate 3, and so on, by default.

- 4 Select the **MS Integration** software that the RapidFire-MS System run is to be synchronized with, such as MassHunter.
- 5 For each sequence (each line) of the batch:
 - a Double-click the cell in the **RF Method** column for the row, select the desired method (**.RFCFG** file), and click **Open**.
 - b Select the **Column** for each sequence. The column types must match the column types in the Column Changer dialog box.

	Type
Column 1	A or C4
Column 2	B or cyano
Column 3	C18
Column 4	HILIC
Column 5	E
Column 6	MyCartridge

- c Double-click the cell in the **MS Method** column for the row and type in the desired method (**.M file**).

The method must be present in the folder **D:\MassHunter\ methods\ RapidFire**.

Tip To save time:

- a Use **Ctrl + C** to copy a value from a selected cell.
 - b Highlight other cells that you want to have the same value.
 - c Use **Ctrl + V** to paste in the value.
- 6 Save this batch, so that it will be available for future use with other plates.

Tip To modify an existing batch:

- d Click **File > Load RF Batch Spec**.
- e Select the batch of interest (**.RFBAT file**).
- f Double-click the **Plate Name** you want to modify.
- g Modify the Plate Map and save the batch.

4 Operation in Sequences Mode

To set run parameters

To set run parameters

Verify that the current RapidFire-MS System method has the correct settings for the following parameters.

The screenshot shows a dialog box with two main sections. The top section, 'Plate Info', contains fields for 'Current Plate Name', 'Plates Completed' (0), 'Input Stack' (NA), 'Output Stack' (NA), 'Current Column Position' (Unknown), and a 'Plate Configuration' dropdown menu set to 'StandardPlate_96'. The bottom section, 'Miscellaneous Settings', is highlighted with a green border and contains checkboxes for 'Use Plate Handler' and 'Use Barcode Scanner' (both unchecked), a checked checkbox for 'Mass Spec Standby After Run', and two numeric input fields for 'Plates Between Flushes' (4) and 'Missed Sip Tolerance' (10). Red arrows point to the 'Plate Configuration' dropdown and the 'Miscellaneous Settings' section.

- 1 In the **Plate Info** area, confirm that the correct **Plate Configuration** is selected (96-well or 384-well).
- 2 In the **Miscellaneous Settings** area of the screen:
 - a Mark whether to:
 - **Use Plate Handler**
 - **Use Barcode Scanner**
 - Put the **Mass Spec on Standby After the Run** (not recommended for TOF applications).
 - b Set the **Plates Between Flushes** as follows:
 - For 96-well plates, use **4**.
The sipper tube flushes for 1 minute after *every four plates*.
 - For 384-well plates, use **1**.
The sipper tube flushes for 1 minute after *every plate*.
 - c Set the **Missed Sips Tolerance** to a value > 0 to suspend RapidFire-MS System operation after the specified number of consecutive wells are found to be empty by the sip sensor.
- 3 Click **Apply** to set the desired values.

To run a batch in Sequences mode

- 1 Click **File > Load RF Batch Spec.**
- 2 Click the **Play** button in the upper left area of the screen.



- a When prompted, enter the plate name with the keyboard or the hand-held barcode scanner, then click **OK**.
- b Click the **Play** button again.
- c Verify that the sipper tube aspirated the first samples.
- d Verify that signal is received by the mass spectrometer.

CAUTION

Close the doors while operating the RapidFire-MS System to prevent possible injury.

- 3 If you are loading plates manually, then when the plate run is completed, you are prompted to load a new plate.
 - a If you have more plates to read, then:
 - Remove the previous plate.
 - Position your next plate on the deck as described in [“To load plates manually”](#) on page 48.
 - Enter a name for the new plate using the keyboard or the hand-held barcode scanner, then click **OK**.

If you do not enter a plate name in the next 30 minutes, then a time-out feature automatically puts the RapidFire-MS System in stand-by mode to keep solvent from being wasted.
 - b If all plates in this set have been run, then click **Cancel**.

NOTE

In the **Well Info** area of the screen, you can view the following information:

- the number of wells sipped in the lifetime of your RapidFire-MS System
- the number of wells sipped since the last reset
- the location of the Current Well Address (such as [1,7] for position A7).

To pause a run

Use this procedure to suspend a run temporarily, such as when you change buffer solutions or do other routine maintenance.

- 1 Click the **Pause** button.



- The cycle of **Aspirate**, **Load/Wash**, **Elute**, and **Re-equilibrate** is completed for the last sample injected, then the RapidFire-MS System pauses operation.
- The mass spectrometer continues to collect "baseline" data.
- The RapidFire-MS System pumps continue to run.

- 2 To start operation after pausing, click the **Play** button.



- The system starts up where it left off and data is saved to the current data file.
- The remaining samples are run in the original order.

To stop a run

- 1 Click the **Stop** button.



- The cycle of **Aspirate**, **Load/Wash**, **Elute**, and **Re-equilibrate** is completed for the last sample injected, then the RapidFire-MS System stops operation.
- Data acquisition is stopped and the current data file is closed.

To make an emergency stop

Only use the following procedure in an emergency situation.

Otherwise use one of these procedures to stop the RapidFire-MS System:

[“To pause a run”](#) on page 58, or

[“To stop a run”](#) on page 58.

- 1 Press the physical emergency stop button (labeled **E-STOP**), which cuts power to the entire system.

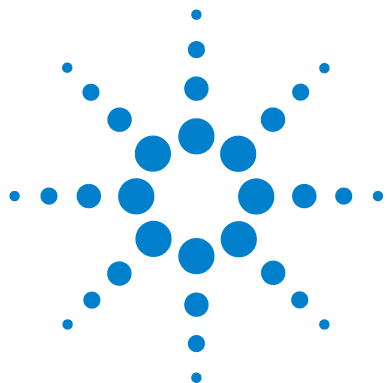


Opening an interlock door of the RapidFire-MS System also stops motion.

- 2 To restart the system, pull up the **E-STOP** button to reestablish power.

4 Operation in Sequences Mode

To make an emergency stop



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This chapter provides information about technical specifications, parts, and consumables for the RapidFire 360 High-throughput Mass Spectrometry System.



Technical specifications & installation requirements

Authorized Agilent Technologies field representatives will install your RapidFire 360 High-throughput Mass Spectrometry System in the location that you specify.

Pre-installation requirements

Before the installation, check that you have the following available:

- 2.5 x 2.5 meters (8 x 8 feet) of space in which to place the RapidFire 360 High-throughput Mass Spectrometry System, mass spectrometer, and computer controller
- A house vacuum or a stand-alone vacuum generator
- *One* of the following, depending on your location:
 - a dedicated 120 V, 15 A circuit (North America)
 - a dedicated 230 V, 10 A circuit (Europe)
 - a dedicated 100 V, 15 A circuit (Japan)
- Additional materials as recommended in the documentation for your mass spectrometer. Typically this included a 200 V, 20 A circuit and nitrogen at 100 PSI, 10 L/h)
- Redundant grounding connected to a separate source of protective earth from the main AC plug (Europe).

WARNING

The RapidFire machine weighs approximately 320 kg (700 lbs).

The RapidFire platform is not to be lifted. Instead, move the RapidFire machine by wheeling its platform.

During operation, be sure to lock down the casters of the RapidFire platform.

Electrical ratings

RapidFire 360 High-throughput Mass Spectrometry System is rated for operation:

in North America at:	in Europe at:	in Japan at:
100 /120 V	220 - 240 V	100 V
12 A	10 A	15 A
50-60 Hz	60 Hz	50-60 Hz

CAUTION

Route the main supply cable in such a way as to minimize the risk of a tripping hazard. Agilent recommends the use of mechanical protection, for instance a rubberized cable guard on the floor to cover and protect the main supply cable.

Environmental operating ranges

RapidFire-MS System should be used and stored at the following conditions:

- **Temperature:** 4°C to 35°C
- **Relative humidity:** 0% to 95%, non-condensing
- **Environment:**
 - non-explosive surroundings
 - indoor use only
 - laboratory use only
- **Altitude:** less than 3500 m (10,000 feet)

Recorded noise level for the RapidFire-MS System unit is below 70 dbA.

Warranty

The warranty for the RapidFire-MS System is for one year. Parts, labor, and travel are included.

The mass spectrometer is covered separately by its manufacturer's warranty.

System modifications

Do not modify the system.

Alterations of the instrument without approval from Agilent Technologies will void the manufacturer's warranty. Agilent Technologies is not responsible for mishaps that are caused by modifications to the RapidFire-MS System not made by its employees or authorized agents.

Safety information

When a hazard symbol and a hazard type appear by a chemical name or instrument hazard, see “[Safety](#)” on page 87 for the complete alert on the chemical or instrument.

Safety labels

The following may appear on Agilent Technologies instruments in combination with the safety symbols listed in “[Instrumentation Safety](#)” on page 88.

CAUTION! Moving parts. Crush/pinch hazard.

WARNING! If the RapidFire-MS System is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Materials

Agilent-supplied items

RapidFire-MS System contents:

- RapidFire 360 High-throughput Mass Spectrometry System instrument
- Mass spectrometer (Agilent may supply)
- Motion control computer
- Three digitally-controlled high-pressure fluidic pumps
- Degasser
- Digital peristaltic pump
- Uninterruptible power supply (UPS) for the RapidFire-MS System
- Sipper flush valve
- Barcode scanners
- Waste collection vessels
- Twister microplate handler
- Six-slot column changer
- Sip sensor

See “[RapidFire-MS System Parts and Consumables](#)” on page 67 for a comprehensive parts list.

Consumables:

Purification solid-phase extraction (SPE) cartridges.

Purchase assay-specific cartridges from Agilent.

See “[RapidFire-MS System Cartridges](#)” on page 67 for a cartridge selection guide.

Customer-supplied items

- Assay-specific solvents, HPLC grade, filtered by the manufacturer

CAUTION

Contact the manufacturer for material safety data sheets (MSDS) for the following materials.

- water
- methanol
- acetonitrile
- acetone
- formic acid
- TFA: trifluoroacetic acid
- TEA: triethylamine
- ammonium acetate
- isopropyl alcohol
- chloroform

-
- 1-L graduated cylinder
 - Pipettes and pipette tips
 - Sample 96- and 384-well plates with standard bar codes

RapidFire-MS System Parts and Consumables

Parts and consumables for the RapidFire-MS System are listed in the following tables:

- “[RapidFire-MS System Cartridges](#)” (below)
- “[Hardware and Electronics](#)” on page 68
- “[Liquid Handling Components](#)” on page 73
- “[Tubing](#)” on page 77
- “[Fittings](#)” on page 78

RapidFire-MS System Cartridges

Part Number	Type	Packing material
G9203-80103	A	C4
G9203-80104	B	Cyano
G9203-80105	C	C18
G9203-80106	D	Graphitic carbon
G9203-80107	E	C8
G9203-80108	F	Phenyl
G9203-80109	H1	HILIC
Custom		Custom
G9203-80111	O	Blank

Hardware and Electronics

-
- Aluminum and phenolic RapidFire-MS System frame
-
- RapidFire-MS System computer
-
- Mouse, keypad, and monitor
-
- KVM (Keyboard Video Mouse) switch



-
- Motion controller
-

- UPS (Uninterruptible Power Supply)



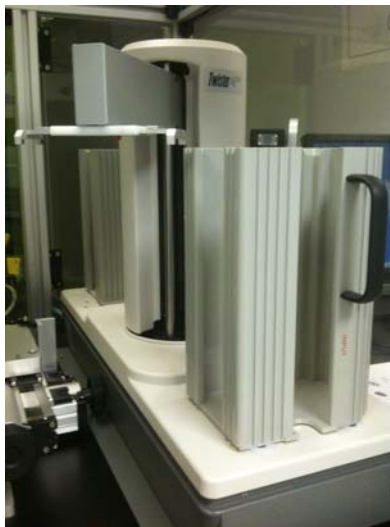
- Emergency stop button



5 Technical Specifications and Parts

Hardware and Electronics

- Twister plate handler



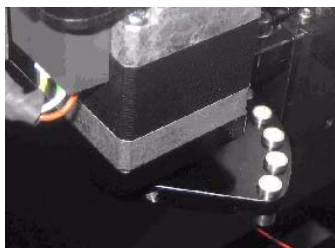
- X, Y, and Z translation stages and motors



- Barcode reader (pedestal)



- Cartridge changer



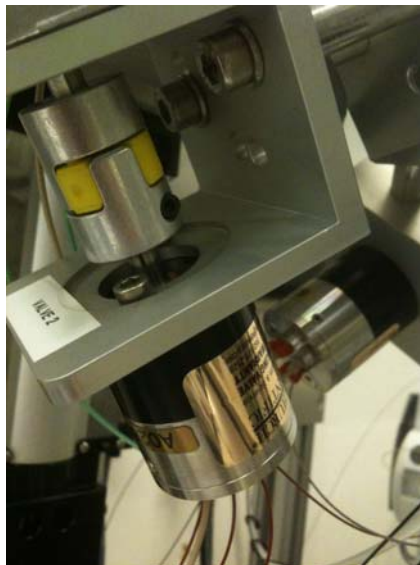
- Optical sensor module



5 Technical Specifications and Parts

Hardware and Electronics

- Three coupling shafts and rotors



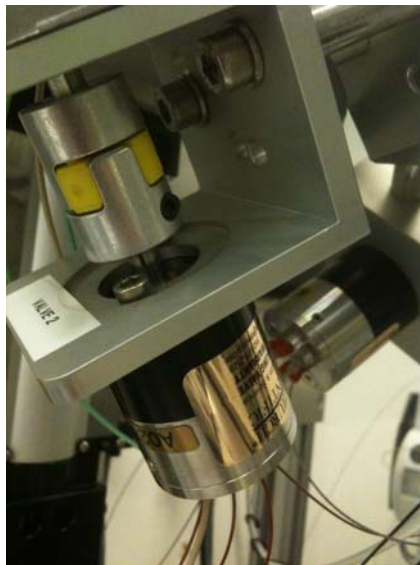
- Power strips

Liquid Handling Components

-
- Plate deck, wash and matrix stations



-
- Three fast rotary valves (six-port)



-
- Three digital high-pressure isocratic pumps
-

5 Technical Specifications and Parts

Liquid Handling Components

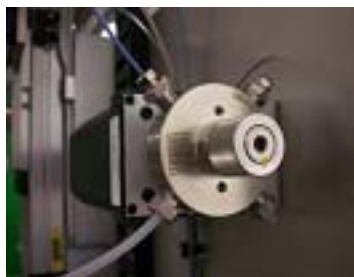
- One digital peristaltic pump



- Optical sip sensor window



- One sipper flushing valve (4-way)



- Solvent drawer



- Waste jerry can in secondary container



- 10- μ m filter stones



5 Technical Specifications and Parts

Liquid Handling Components

-
- SPE cartridges
 - Bottle caps for 1/8" OD tubing (x 5)
-



Tubing

-
- Vacuum tubing
 - PTFE tubing (OD 1/8")
-



-
- Tygon tubing (for peristaltic pump)
-



-
- PEEK tubing (OD 1/16" or OD 1/32")
-



Fittings

-
- Clear male barbed union ID 1/8"



-
- Green 1/4-28 for OD 1/8" tubing



-
- Beige 1/4-28 for OD 1/8" tubing



-
- Beige 10-32 for OD 1/16" tubing



-
- Beige 10-32 for OD 1/32" tubing



- Yellow for OD 1/8" tubing



- Metal and beige for OD 1/32" tubing



- Red 6-32 for OD 1/32" tubing



- Sipper protection needle guard



- Nut extenders



5 Technical Specifications and Parts

Fittings

-
- Wrench ¼"



-
- Beige adapter 10-32-female-to-6-32-male



-
- Reducers



RapidFire-MS System Flow Path

“State #1: Aspirate” on page 81

“State #2: Wash” on page 82

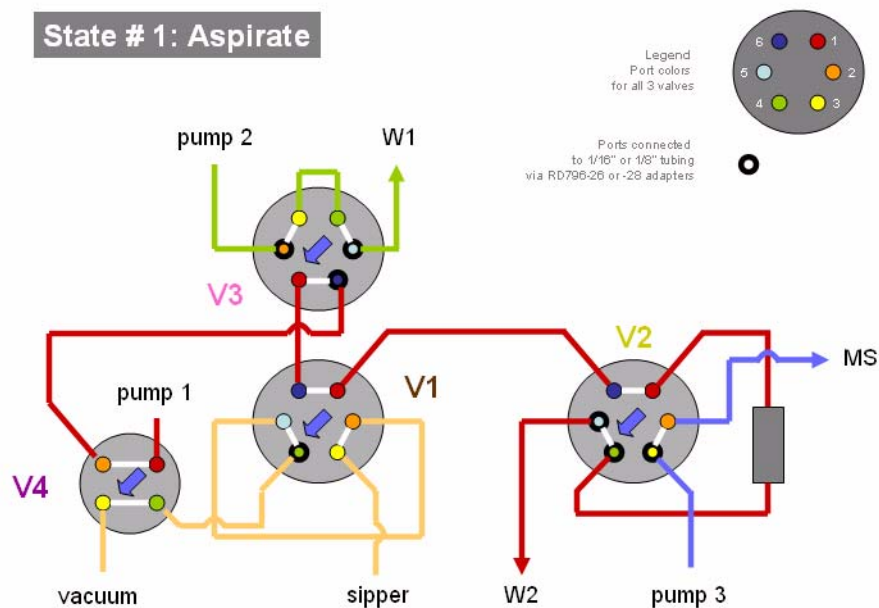
“State #3: Elute” on page 83

“State #4: Re-equilibrate” on page 84

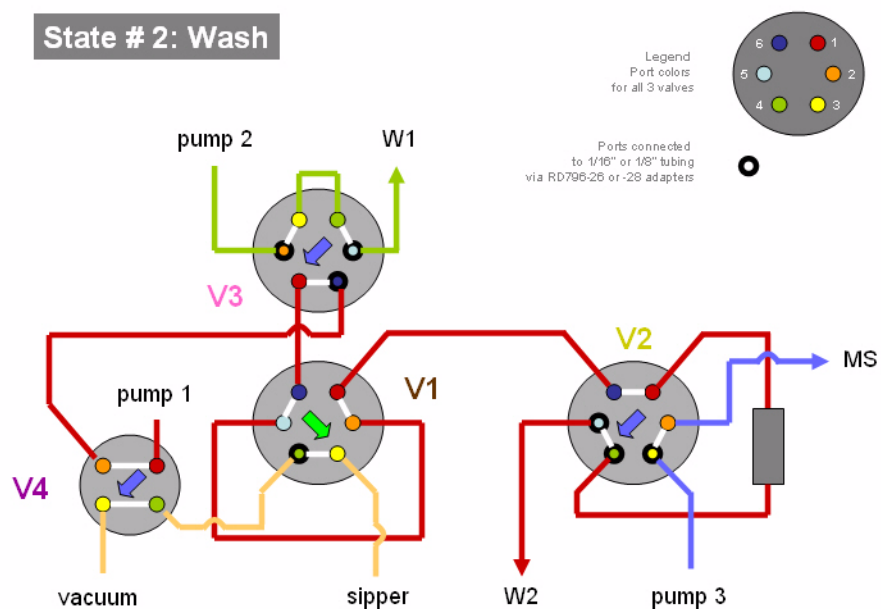
“Flush the sipper tube” on page 85

“Valve Positions Definition” on page 86

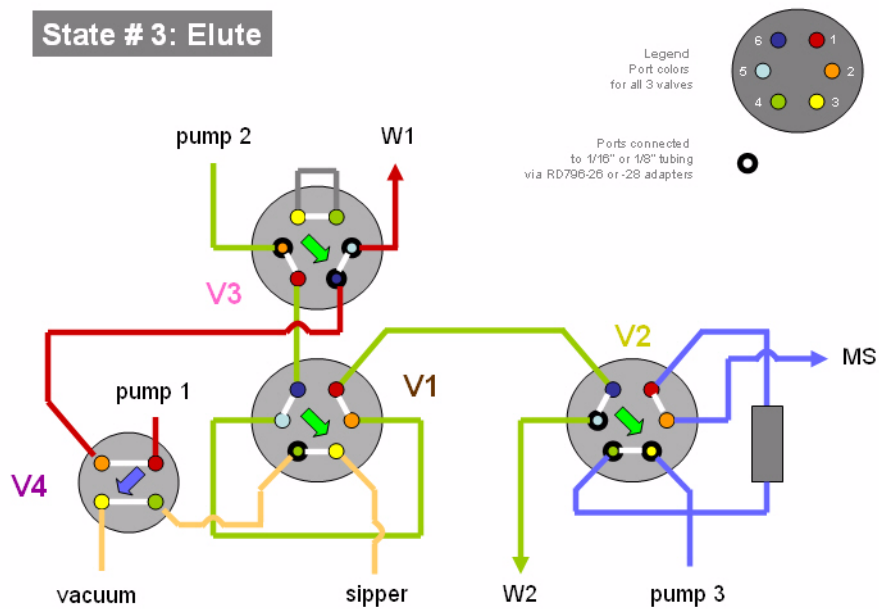
State #1: Aspirate



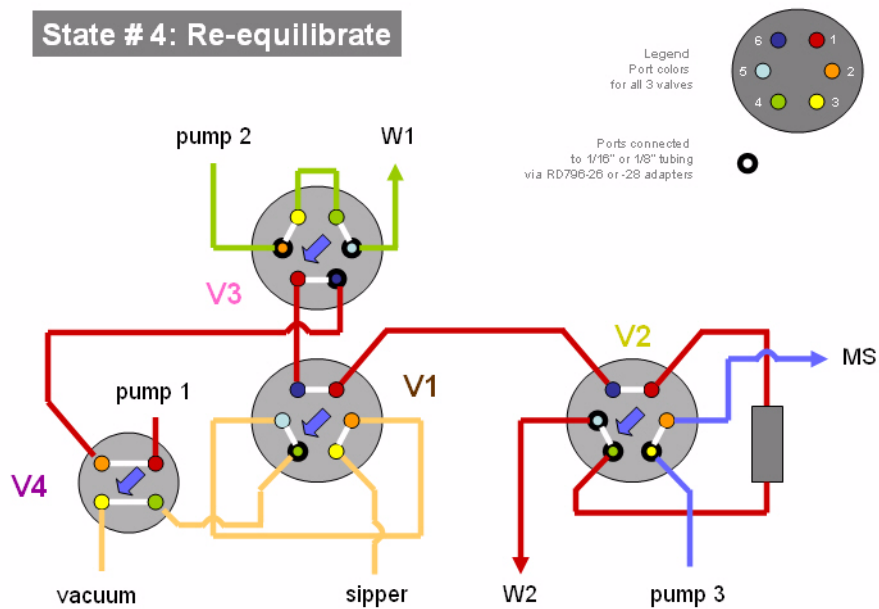
State #2: Wash



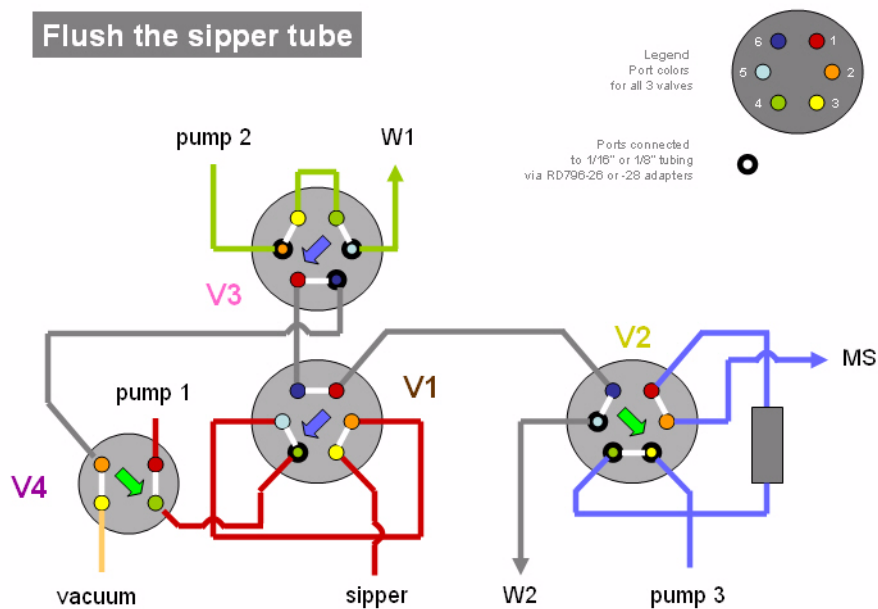
State #3: Elute



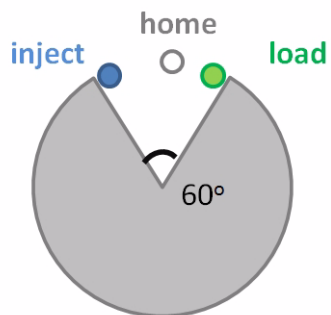
State #4: Re-equilibrate

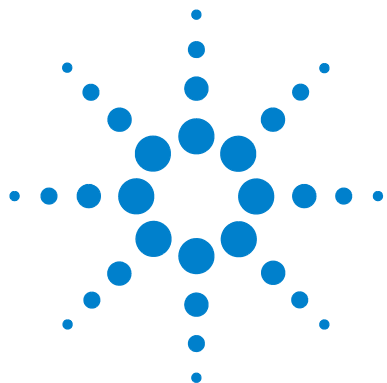


Flush the sipper tube



Valve Positions Definition





6 Safety

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This chapter provides safety information for the RapidFire 360 High-throughput Mass Spectrometry System.



Instrumentation Safety

Symbols on instruments

Electrical symbols

The following table describes the electrical symbols that may be displayed on the RapidFire 360 High-throughput Mass Spectrometry System instrument.

Symbol	Description
	Indicates the On position of the main power switch.
	Indicates the Off position of the main power switch.
	Indicates a standby switch by which the instrument is switched on to the Standby condition. Hazardous voltage may be present if this switch is on standby.
	Indicates the On/Off position of a push-push main power switch.
	Indicates a terminal that may be connected to the signal ground reference of another instrument. This is not a protected ground terminal.
	Indicates a protective grounding terminal that must be connected to earth ground before any other electrical connections are made to the instrument.
	Indicates a terminal that can receive or supply alternating current or voltage.
	Indicates a terminal that can receive or supply alternating or direct current or voltage.

Safety symbols

The following table describes the safety symbols that may be displayed on the RapidFire 360 High-throughput Mass Spectrometry System instrument. Each symbol may appear by itself or with text that explains the relevant hazard. These safety symbols may also appear next to DANGER, WARNING, or CAUTION.

Symbol	Description
	Indicates that you should consult the manual for further information and to proceed with appropriate caution.
	Indicates the presence of an electrical shock hazard and to proceed with appropriate caution.
	Indicates the presence of a laser inside the instrument and to proceed with appropriate caution.
	Indicates the presence of moving parts and to proceed with appropriate caution.
	Indicates the presence of a biological hazard and to proceed with appropriate caution.

General instrument safety

WARNING

PHYSICAL INJURY HAZARD: Use the RapidFire 360 High-throughput Mass Spectrometry System only as specified in this document. Using the system in a manner not specified by Agilent Technologies may result in personal injury or damage to the instrument.

Moving or lifting the system

CAUTION

PHYSICAL INJURY HAZARD: The RapidFire platform weighs approximately 320 kg (700 lbs). *The RapidFire-MS System platform is not to be lifted.*

To move the RapidFire-MS System, wheel it around.

When using the RapidFire-MS System, keep its casters in a locked position.

Operating the instrument

Ensure that anyone who operates the instrument has:

- Been given instructions on general safety practices for laboratory and specific safety practices for the instrument.
- Read and understood all material safety data sheets (MSDS) for chemicals handled.

Physical hazard safety

Moving parts

WARNING



PHYSICAL INJURY HAZARD: Moving parts can crush, puncture and cut. Keep hands clear of moving parts while operating the instrument and keep interlock doors closed.

Solvents

WARNING

PHYSICAL INJURY HAZARD: Always wear eye protection when working with solvents and chemicals.

Electrical safety

WARNING



ELECTRICAL SHOCK HAZARD - Severe electrical shock can result from operating the RapidFire-MS System without its panels in place.

Grounding circuit continuity is required for the safe operation of equipment.

Use properly configured and approved line cords for the voltage supply in your facility.

WARNING



ELECTRICAL HAZARD - Plug the RapidFire-MS System components into properly grounded receptacles with adequate current capacity.

CAUTION

The RapidFire-MS System disconnecting device should always be clear from clutter and accessible.

CAUTION

Be sure that the RapidFire-MS System main supply cable is routed in such a way as to minimize the risk of a tripping hazard. Agilent Technologies recommends the use of mechanical protection, such as a rubberized cable guard on the floor to cover and protect the main supply cable.



Barcode scanner safety

The barcode scanner incorporated in the RapidFire-MS System is a categorized as a Class 1 (I) laser.

Class 1 (I) lasers are low-power, visible lasers that are safe to the eyes.

Safety & electromagnetic compatibility (EMC)

The RapidFire-MS System platform has been fully tested and complies with the European safety standards listed below.



- CENELEC EN 61326-1:2006
- CENELEC EN 61010-1, 2nd Edition (2001),
- 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1: General Requirements'

Possible misuse of the RapidFire-MS System

WARNING

Take care to avoid the following situations:

Do not work inside the RapidFire-MS System unit without first disconnecting the main power supply cable and/or LOTO.

Do not sit or stand on the phenolic tabletop of the RapidFire-MS System platform.

Do not operate the RapidFire-MS System instrument unless its wheels are locked in the brake position.

The RapidFire-MS System unit is intended for use indoors, in a non-explosive, laboratory environment, as stipulated in “[Instrumentation Safety](#)” on page 88.

Do not modify, remove, alter, or change the machine in any way (electrically or mechanically). Any modifications to the RapidFire-MS System unit will void the warranty and the CE compliance of the instrument.

Do not use any substance, chemical, solvent, solution or any other material with or in the RapidFire-MS System machine, unless you have read and understood, and are able to comply with their material safety data sheets (MSDS).

Chemical Safety

General chemical safety

WARNING

CHEMICAL HAZARD: Before handling any chemicals, refer to the Material Safety Data Sheet (MSDS) provided by the manufacturer, and observe all relevant precautions.

To minimize the hazards of chemicals:

- Read and understand the MSDS provided by the manufacturer before you store, handle, or work with any chemicals or hazardous materials.
- Minimize contact with chemicals. Wear appropriate personal protective equipment when handling chemicals (for example, safety glasses, gloves, or protective clothing).
- Minimize the inhalation of chemicals. Do not leave chemical containers open. Use only with adequate ventilation (for example, fume hood).
- Check regularly for chemical leaks or spills. If either of those occurs, follow the manufacturer's cleanup procedures as recommended in the MSDS.
- Comply with all local, state/provincial, or national laws and regulations related to chemical storage, handling and disposal.

Chemical waste safety

CAUTION

HAZARDOUS WASTE: Refer to Material Safety Data Sheets and local regulations for handling and disposal.

WARNING

CHEMICAL WASTE HAZARD: Wastes produced by the RapidFire-MS System instrument are potentially hazardous and can cause injury, illness or death.

To minimize the hazards of chemical waste:

- Read and understand the MSDS provided by the manufacturers of the chemicals in the waste container before you store, handle, or dispose of chemical waste.
- Provide primary and secondary waste containers. Both containers must be compatible with the waste material and meet federal, state/provincial, and local requirements for container storage.
- Minimize contact with chemicals. Wear appropriate personal protective equipment when handling chemicals (for example, safety glasses, gloves, or protective clothing).
- Minimize the inhalation of chemicals. Do not leave chemical containers open.
- Handle chemical wastes in a fume hood.
- After emptying a waste container, seal it with the cap provided.
- Dispose of the contents of the waste tray and waste bottle in accordance with good laboratory practices and local, state / provincial, or national environmental and health regulations.
- Ensure that the RapidFire-MS System waste is stored, transferred, transported and disposed of according to all local, state / provincial, and/or national regulations.

Biological hazard safety

WARNING

BIOHAZARD: Biological samples have the potential to transmit infectious diseases. Follow all applicable local, state / provincial, and/or national regulations. Wear appropriate protective equipment. All work should be conducted in properly equipped facilities using the appropriate safety equipment.

Individuals should be trained and acquainted with the following:

- U.S. Department of Health and Human Services guidelines published in Biosafety in Microbiological and Biomedical Laboratories (bmbi.od.nih.gov)
- Occupational Safety and Health Standards, Bloodborne Pathogens (29 CFR 1910.1030; www.access.gpo.gov)
- Your company/institution's Biosafety Program protocols for working with or handling potentially infectious materials.

www.agilent.com

In This Book

This guide gives
information about how to
use the RapidFire 360
High-throughput Mass
Spectrometry System.

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