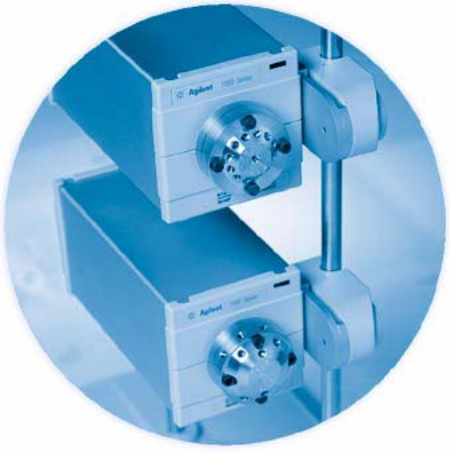

Agilent 1100 Series Valves

User's Guide

Agilent Technologies

Notices

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In This Guide...

The Agilent 1100 Series valves provide the user a comprehensive solutions for more flexibility through solvent selection and column selection. They offer new automation capabilities for sample preparation as well as higher sample throughput with alternating column regeneration. The Agilent 1100 Series valves are fully integrated in the CAN environment (control area network) of the Agilent 1100 HPLC system and can be controlled by the Agilent ChemStation Software. The following types of valves will be described in this manual:

- G1157A Agilent 1100 Series 2 Position/10 Port Valve
- G1158A Agilent 1100 Series 2 Position/ 6 Port Valve
- G1159A Agilent 1100 Series 6 Position Selection Valve
- G1160A Agilent 1100 Series 12 Position/13 Port Selection Valve
- G1162A Agilent 1100 Series 2 Position/ 6 Port Micro Valve
- G1163A Agilent 1100 Series 2 Position/10 Port Micro Valve

These valves and the corresponding capillary kits for alternating column regeneration, sample enrichment, sample clean-up, column selection or solvent selection will allow you to implement these applications easily.

Chapter 1, “Installation and Configuration,” starting on page 1 will describe how to install and configure the 1100 Series valves.

Chapter 2, “Operation,” starting on page 11 will describe the Agilent ChemStation valve interface and how to setup the valves in your analytical method.

Chapter 3, “Maintenance, Repair, and Troubleshooting,” starting on page 19 will describe recommended maintenance and repair procedures as well as troubleshooting tools.

Chapter 4, “Valve Applications,” starting on page 33 will describe common application, e.g. alternating column regeneration, and how to setup your valves for these applications.

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Installation and Configuration

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Site Requirements

The requirements for the Agilent 1100 Series Valves are displayed Table 1 and Table 2 on page 2. The 24 Volts DC power can be supplied by an external power supply (0950-4422) or by one of the following Agilent 1100 Series modules with DC CAN adapter.

- Agilent 1100 Series Preparative Pump (G1361A)
- Agilent 1100 Series Fraction Collector (G1364A, G1364B, G1364C, G1364D)
- Agilent 1100 Series Well-Plate Autosampler (G1367A)
- Agilent 1100 Series Micro Well-Plate Autosampler (G1377A)
- Agilent 1100 Series Dual Loop Autosampler (G2258A)

Table 1 Site Requirements for Agilent 1100 Series Valves

Type	Specification
• Weight	1.9 Kg (4.2 lbs)
• Dimensions • (height x width x depth)	92 x 84 x 200 mm (9.2 x 3.3 x 8.0 inches)
• Power supply	24 Volts DC (1.7 amps)
• Ambient operating temperature	4 to 55°C (39 to 131°F)
• Humidity	< 95%, non-condensing

Table 2 System Requirements

	Revision
• Agilent 1100 Firmware	A.05.04 and higher
• Control Module Firmware G1323B	B.03.11 and higher
• Agilent ChemStation Software	A.09.03 and higher

Unpacking the 1100 Series Valve

Damaged Packaging

If the delivery packaging shows signs of external damage, please call your Agilent Technologies sales and service office immediately. Inform your service representative that the 1100 Series Valve may have been damaged during shipment.

CAUTION If there are signs of damage, please do not attempt to install the valve.

Delivery Checklist

Ensure all parts and materials have been delivered with the 1100 Series Valve. The delivery checklists are displayed in Table 3 (for G1157A, G1158A, G1159A, G1160A) and in Table 4 (for G1162A, G1163A). Please report missing or damaged parts to your Agilent Technologies sales and service office.

Table 3 Delivery checklist for Agilent 1100 Series valves G1157A, G1158A, G1159A and G1160A

Quantity	Description	Part Number
1	1100 Series Valve	
1	Declaration of conformity	
1	Rail assembly for Column Organizer	5065-4450
1	**Accessory kit containing**	
1	• CAN Cable, 1m long	5181-1519
1	• DC-CAN cable	5181-1533
10	• Fitting Screw long	5065-4454
12	• Fitting Screw extra long	G1156-22402
1	• Hex Key 9/64" T-handle	8710-2394

Table 3 Delivery checklist for Agilent 1100 Series valves G1157A, G1158A, G1159A and G1160A (continued)

Quantity	Description	Part Number
1	• Hex Key 3/32"	
1	• wrench	8710-0510
1	• socket wrench (Rheotool) 1/4	8710-2391

Table 4 Delivery checklist for Agilent 1100 Series micro valves G1162A and G1163A

Quantity	Description	Part Number
1	1100 Series Micro Valve	
1	Declaration of conformity	
1	Rail assembly for Column Organizer	5065-4450
6/10	M4 micro valve fittings	5022-2186
1	M4 micro valve plug	5022-2187
1	**Accessory kit containing**	
1	• CAN Cable, 1m long	5181-1519
1	• DC-CAN cable	5181-1533
1	• Hex Key 9/64" T-handle	8710-2394
1	• Hex Key 3/32"	
1	• wrench	8710-0510
1	• socket wrench (Rheotool) 1/4	8710-2391

The M4 micro valve fittings support the Agilent PEEK coated fused silica capillaries (O.D. 0.8mm or 1/32"). The M4 micro valve plug is supplied for pressure (leak) testing.

For a list of recommended Agilent PEEK coated fused silica capillaries can be found in the chapter "Capillaries and Fittings for micro valves" on page 51.

Hardware Installation

The Agilent 1100 Series External Valves can be installed in two different ways. They can either be placed on free bench space near the Agilent 1100 Series HPLC system or they can be mounted on the Agilent G1383A Column Organizer as displayed in Figure 1. The column organizer should be located on the right side of the 1100 Series stack, which includes the autosampler.

Figure 1 Agilent 1100 Series Column Organizer G1383A

In order to install a valve on the G1383A Column Organizer the Organizer Rail Assembly must be installed on the two mounting poles using the clips from the Organizer Rail Assembly. All External Valves have a bracket on the side which slides over the metal part of the Organizer Rail Assembly.

Two CAN connectors and one DC-CAN connector are located at the back panel of the 1100 Series Valve Assemblies as displayed in Figure 2.

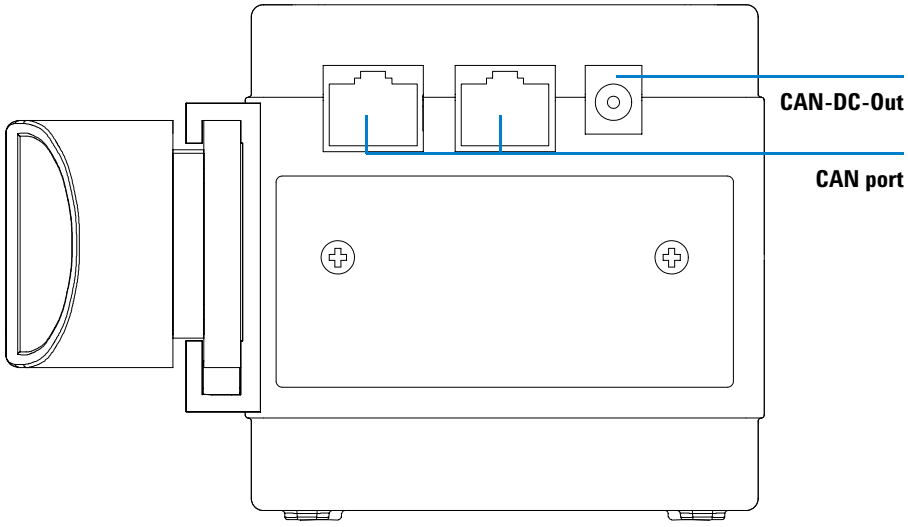

Figure 2 Back Panel of the Agilent 1100 Series Valves

Setting up the CAN connection

Connect the CAN-Cable (PN 5181-1519) to one of the CAN ports at back panel of the 1100 Series valve and to a free CAN-Port on another Agilent 1100 Series module. The second CAN-Port can be used to add additional valves or modules to the HPLC system.

Setting up the power connection to other Agilent 1100 Series Modules

The power for the Agilent 1100 Series External Valves can be supplied by one of the following 1100 Series modules:

- **Agilent 1100 Series Preparative Pump (G1361A)**
- **Agilent 1100 Series Fraction Collector (G1364A, G1364B, G1364C, G1364D)**
- **Agilent 1100 Series Well-Plate Autosampler (G1367A)**
- **Agilent 1100 Series Micro Well-Plate Autosampler (G1377A)**
- **Agilent 1100 Series Dual Loop Autosampler (G2258A)**

Connect the DC-CAN Cable (PN 5181-1533) to the DC-CAN connector at the back panel of the valve and to the DC-CAN connector on one of the Agilent 1100 Series modules listed above.

Setting up the power connection to the external power supply

If none of the Agilent 1100 Series modules from the list above is part of your HPLC system, you have to supply the power through an external power supply (P/N 0950-4422). Plug the DC-CAN adapter from the power supply into the DC-CAN connector on the back panel of your 1100 Series External Valve.

Software Configuration

The 1100 Series Valves can be controlled by the Agilent ChemStation Rev. A.09.03 or higher.

CAUTION

The maximum number of all modules (including CAN-slave valves) in your Agilent 1100 Series LC system must not exceed 13.

Contact your local sales and service representative to verify, if your configuration is supported. This is especially important, if the number of module is close to 13.

To configure the 1100 Series Valves

Step	Note
1 Start the Agilent ChemStation Software.	
2 Select **Configure 1100 Access** in the **Instrument** menu.	
3 In the upcoming **Configuration** dialog box select one or multiple valves and click **Add.**	The selected green valve icon now moves from the left **Available Modules** panel to the right **Configured Modules** panel as displayed in Figure 3 on page 9.
4 Click **OK** to leave the Configuration dialog box.	
5 After a **Restart** the Agilent ChemStation Software a new menu item **Setup Valve** now appears in the **Instrument** menu.	

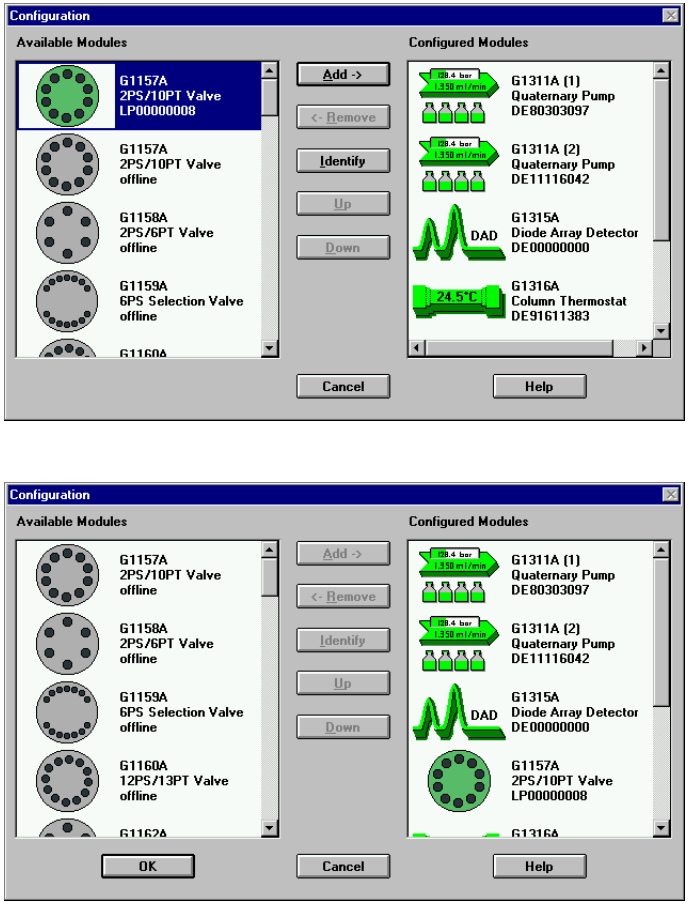

Figure 3 Valve configuration

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Operation

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Operating the Valve using Agilent ChemStation

After the Agilent 1100 Series Valves have been installed and configured, the valve parameters can be edited in the Agilent ChemStation. Choose **Setup Valve** from the **Instrument** menu to open the valve dialog box as displayed in Figure 4.

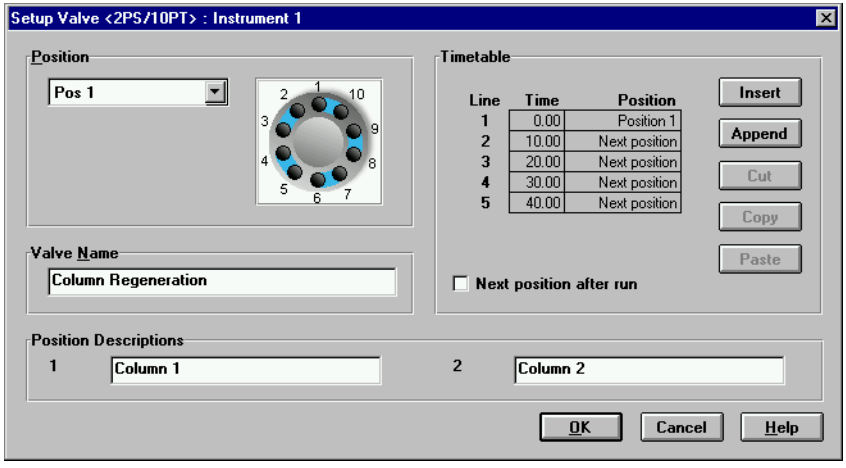

Figure 4 Valve Setup dialog box

NOTE The example displays the valve setup for the 2 position/10 port valve (G1157A). The interface for the other valves are similar.

Position

When loading a method the valve is switched to the position, that is displayed in the **Position** dropdown box. If you select **Use Current**, the valve remains in the current position, when a new method is loaded.

If you select a new position in the dropdown box and click **OK**, the Setup Valve dialog box will be closed and the valve switches to the new position.

After the run is finished, the valve always switches to the starting position. If “Use current” is selected, the valve remains in the current position after the run. This behavior is exhibited in Figure 5 on page 13.

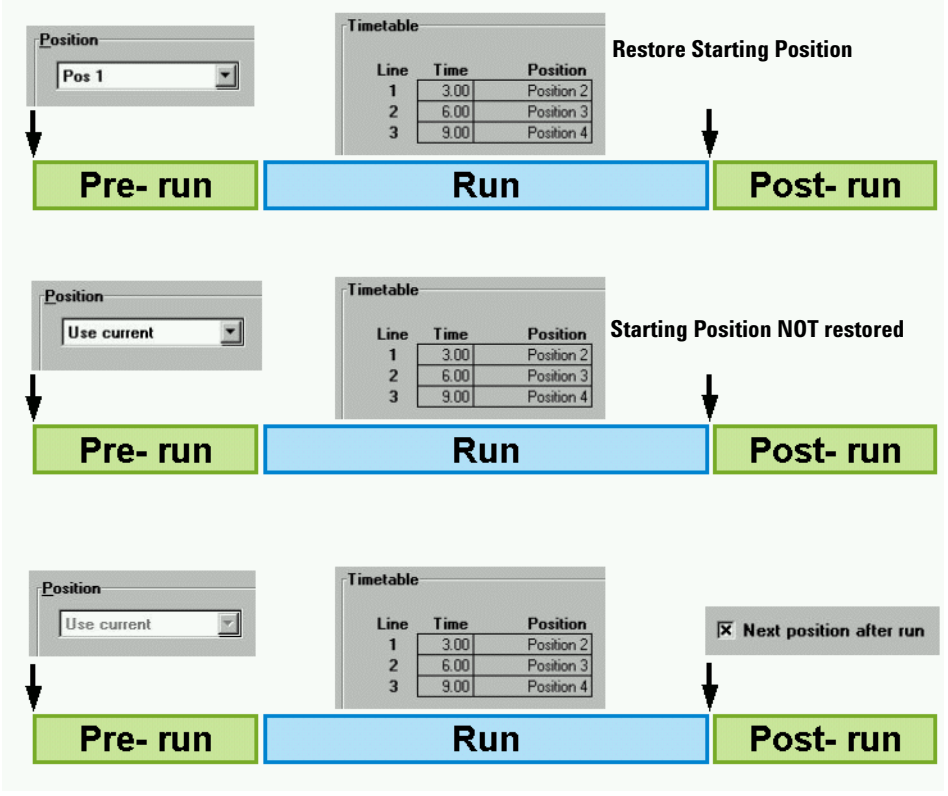

Figure 5 Valve Control

Valve Name

Define the **Valve Name** that is used for the method report and the **Instrument actuals**. The **Valve Name** is limited to 20 characters.

Position Descriptions

Define the **Position Description** that is used for the method report and the instrument actuals. The Position Description is limited to 19 characters.

Table 5 Available valve positions

Valve Description	Product Number	# of Positions Descriptions
2 position / 10 port valve	G1157A / G1163A	2
2 position / 6 port valve	G1158A / G1162A	2
6 position selection valve	G1159A	6
12 position / 13 port selection valve	G1160A	12

Time Table

The **Time Table** can be used to edit and run a valve program during a sequence of sample runs. The Time Table contains 3 columns (**Line, Time and Position**). The Time Table is limited to 20 lines. The number of selection in the Position column depends on the valve that has been configured.

Position X switches the valve to the selected position. The number of available positions for the 1100 series valves is displayed in Table 5.

Next Position switches to the next available position. If the valve is on the highest position it will switch to position 1.

Insert Inserts a line in the **Time Table** above the selected position.

Append Appends a line at the end of the **Time Table**.

Cut Cuts the selected line(s) out of the **Time Table** and saves it to the clipboard.

Copy Copies the selected line(s) from the table to the clipboard.

Paste Pastes line(s) from the Clipboard to the **Time Table**.

Next position after run

If **Next position after run** is checked, the valve will switch to the next available position after the run is completed and remains there for the next run. For this selection the **Position** field is greyed out (see Figure 5 on page 13).

Display instrument actuals

In order to display the current status of your 1100 Series Valve choose **Instrument Actuals** form the **View** menu in the Agilent ChemStation to open the Valve Status dialog box (Figure 6).

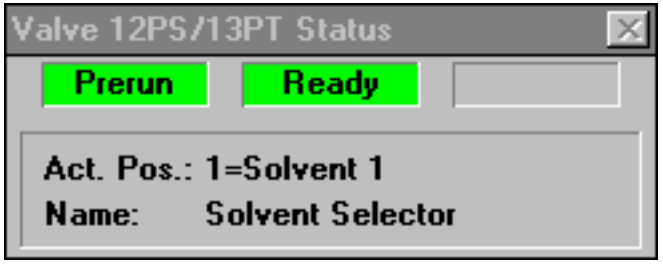

Figure 6 Instrument Actuals

Handheld Controller functions

With firmware revision B.03.11 or higher the following valve functions with the Agilent 1100 Series handheld controller G1323B are available. Complete control of an 1100 Series Valve during an LC analysis requires ChemStation Revision A.09.03 or higher.

Switching the Valve

1 From the startup screen of the 1100 Series Handheld Control Module select **System (F5)**

2 Select **Control (F5)** and then **Valve** to open the screen that is displayed in Figure 7. Use the arrow keys (up and down) to switch the valve to the next position.

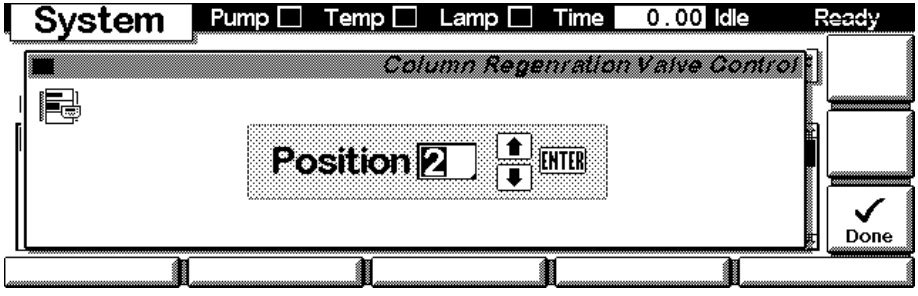

Figure 7 Switching the 1100 Series Valve

Valve Synchronization

1 From the startup screen of the 1100 Series Handheld Control Module select **System (F5)**

2 Select **Tests (F3)** and **Valve** to open the Synchronization screen as displayed in Figure 8.

3 Press **Synchronize (F7)** and select the position for the valve synchronization. Please also read the section "Valve Synchronization" on page 32.

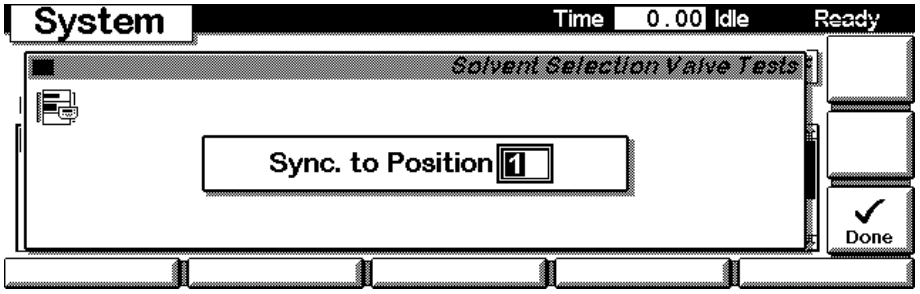

Figure 8 Valve Synchronization

Setting the EMF limit and switch counter

1 From the startup screen of the Agilent 1100 Series Handheld Control Module select **System (F5)**

2 Select **Records (F4)** and scroll through the displayed module list and select the Agilent 1100 Series Valve.

3 Press **EMF (F1)** and then select **1 Setup Limits.**

4 In the upcoming dialog (Figure 9) edit the EMF limit. If this limiting number of switches has been reached, you will get an `Early Maintenance Feedback` signal on your Handheld controller and in the Graphical User Interface of the Agilent ChemStation Software. After you have done an maintenance action, press **Reset (F7)** to reset the switch counter. Also refer to the section "Early Maintenance Feedback (EMF)" on page 27.

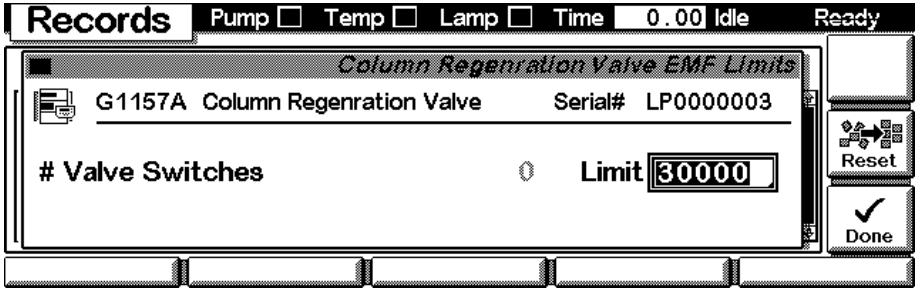

Figure 9 Early Maintenance Feedback (EMF) Screen

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Maintenance, Repair, and Troubleshooting

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Status Indicators

The instrument status indicator indicates one of four possible instrument conditions:

- When the status indicator is *OFF*, the instrument is in a *prerun* condition, and is ready to begin an analysis.
- A *green* status indicator indicates the instrument is performing an analysis (*run* mode).
- A *yellow* status indicator indicates a *not-ready* condition. The instrument is in a not-ready state when it is waiting for a specific condition to be reached or completed, or while a self-test procedure is running. The next programmed injection will be inhibited until the not-ready condition has been cleared.
- An *error* condition is indicated when the status indicator is *red*. An error condition indicates the instrument has detected an internal problem which affects correct operation of the instrument. Usually, an error condition requires attention (for example, leak, defective internal components). An error condition always interrupts the analysis and prevents the next run after the current run is finished.
- A *flashing red* status indicator indicates a severe error during the *startup* procedure of the module. Call your local service provider for assistance upon observing this error condition.

Maintenance and Repair

The maintenance of the Agilent 1100 Series valves (G1157A, G1158A, G1159A, G1160A) includes the exchange of the stator face and the rotor seal. In addition it might be necessary to exchange the stator head, if the threads are worn out or if a fitting is broken and cannot be removed from the stator head.

In contrast to the valves for standard flow rates, the valve head assemblies of the Agilent 1100 Series micro valves (G1162A and G1163A) don't contain a stator face. Only the rotor seal needs to be exchanged during maintenance.

The valve head assemblies are displayed in Figure 10 on page 22, Figure 11 on page 23 and Figure 12 on page 24. Part numbers of the rebuild kits, rotor seals and stator heads are listed in Table 6 on page 25.

CAUTION Always rinse the valve with water after using aqueous buffers or salt solutions to prevent crystal formation which may damage the valve.

Replacing the stator face and the rotor seal for standard valves (G1157A, G1158A, G1159A, G1160A)

Disassembling the valve head

1 Use the Hex Key to remove the Stator Screws (1) from the Stator Head (2).

2 Disassemble the Stator Head and Stator Face (5) from the Stator Ring (4). The Stator Face usually remains on the Stator Head.

3 Remove the three Stator Ring Screws (3) and take off the Stator Ring (4).

4 Remove the Rotor Seal(6) from the Valve Body(7). The Rotor Seal is mounted on three pins, and can be pulled off.

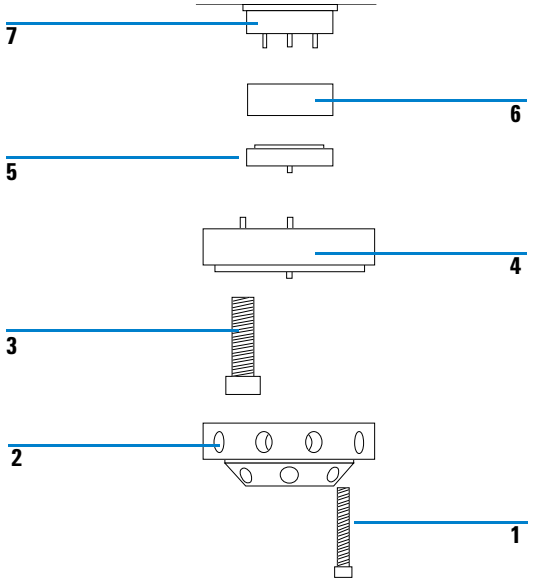


Figure 10 Valve head assembly

Reassembling the valve head

1 Mount the new Rotor Seal (6) with the slots facing the Stator Head (2). The three pins (8) on the Shaft Assembly fit into the matching holes(9) in the Rotor Seal only one way.

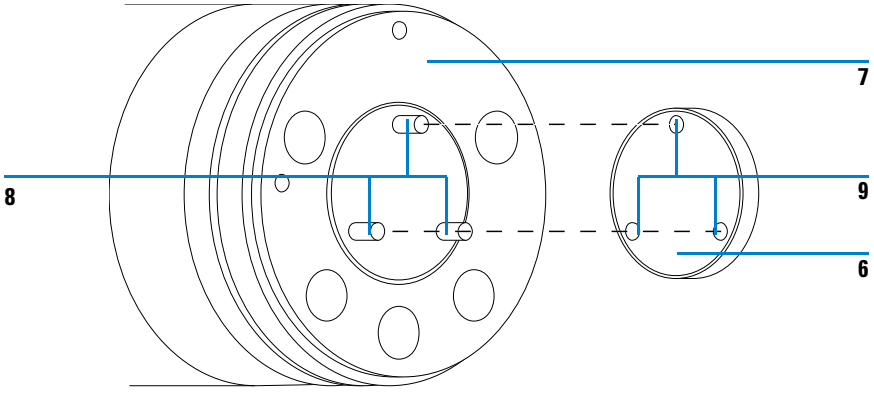


Figure 11 Valve body (7) and Rotor seal (6)

2 Align the Stator Ring (4) that the two short pins on the ring enter the matching holes in the body (7).

3 Insert the three Stator Ring Screws (3). Turn each of the screws an equal amount until the they are finger-tight, then tighten them another half turn.

4 Mount the new Stator Face (5) onto the Stator Head (2). The pins on the Stator face must fit into the matching holes of the Stator Head.

5 Assemble the Stator Head (2) and Stator Face(5) that the pin in the Stator Ring enters the matching hole in the Stator Head.

6 Insert the Stator Screws (1). Turn each of the screws an equal amount until the they are finger-tight, then tighten them another half turn.

Replacing the rotor seal for micro valves (G1162A and G1163A)

Disassembling the valve head

1. Use the Hex Key to remove the Stator Screws (1) from the Stator Head (2).
2. Disassemble the Stator Head (2)
3. Remove the three Stator Ring Screws (3) and take off the Stator Ring (4).
4. Remove the Rotor Seal (5) from the Valve Body (6). The Rotor Seal is mounted on three pins.

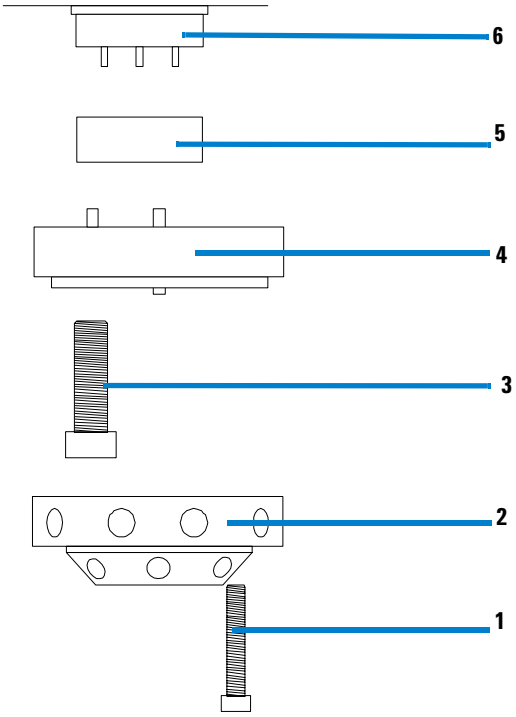


Figure 12 micro valve head assembly

Reassembling the valve head

1 Mount the new Rotor Seal (5) with the grooves facing the Stator Head (2). The three pins on the Shaft Assembly fit into the matching holes in the Rotor Seal only one way.

2 Mount the Stator Ring on the Shaft Assembly that the two pins fit to the matching holes on the Valve body.

3 Assemble the Stator Head (2) that the pin in the Stator Ring fits to the matching hole in the Stator Head.

4 Insert the Stator Screws (1). Turn each of the screws an equal amount until the they are finger-tight, then tighten them another half turn.

Table 6 Rebuild kits and repair parts for Agilent 1100 Series Vales

Description		part number
• Rebuilt kits and rotor seals	Rebuild kit for G1157 (2 position/10 port valve)	0101-1359
	Rebuild kit for G1158 (2 position/6 port valve)	0101-1358
	Rebuild kit for G1159 (6 position selection valve)	0101-1290
	Rebuild kit for G1160 (12 position/13 port valve)	0101-1288
	Rotor seals for G1158 (2 position/6 port valve)	0100-1855 (Vespel) 0100-1854 (Tefzel) 0100-2233 (PEEK)
	Rotor seal for G1162A (2 position/6 port micro valve)	0100-2087
	Rotor seal for G1163A (2 position/10 port micro valve)	0101-1361

Table 6 Rebuild kits and repair parts for Agilent 1100 Series Vales (continued)

Description		part number
• Stator heads	Stator head for G1157 (2 position/10 port valve	0101-1362
	Stator head for G1158 (2 position/6 port valve)	0100-1850
	Stator head for G1159 (6 position selection valve)	0101-1364
	Stator head for G1160 (12 position/13 port valve)	0101-1365
	Stator head for G1162A (2 position/6 port micro valve)	0100-2089
	Stator head for G1163A (2 position/10 port micro valve)	0101-1363

Early Maintenance Feedback (EMF)

Depending on the application the valve will perform many thousands of actuations without any visible signs of wear. In order to minimize downtime the Agilent ChemStation offers *Early Maintenance Feedback (EMF)* for the 1100 Series Valves. EMF monitors the number of switches of the 1100 Series valves, and provides feedback when a user-settable limit is exceeded. The visual feedback in the graphical user interface provides an indication, that the exchange of the stator face and/or the rotor seal should be scheduled.

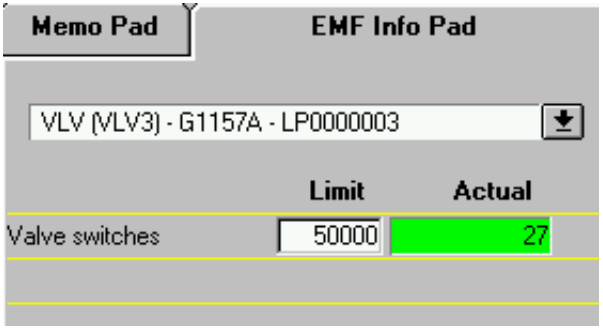


Figure 13 Early Maintenance Feedback (EMF)

In the **Diagnostics** view you can define, after how many valve switches the stator face and/or the rotor seal should be replaced. The setting for the EMF limit depends on analytical conditions, e.g. use of buffer solutions. Hence the setting should be optimized over one or two maintenance cycles.

Setting the EMF limit

1. Switch to the **Diagnostics** View of the ChemStation.
2. Click on the **EMF** icon. The **EMF Info Pad** (Figure 13) will appear on the right panel of the user interface.
3. Select a valve on the dropdown list of the **EMF Info Pad.**
4. Enter the EMF limit and click on the **Send Changes** button.

Resetting the EMF counter

1 Switch to the **Diagnostics** View of the ChemStation.

2 Select **Valve** from the **Maintenance** menu.

3 In the upcoming dialog box click on **Reset Counter** (see also Figure 18 on page 32).

The procedure to reset the EMF counter with the 1100 Series handheld controller is described on page 17.

System Errors and Troubleshooting

System Errors

No line power

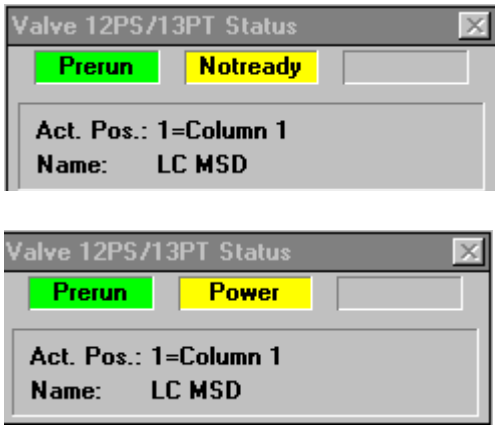


Figure 14 Display of instrument actuals at a no line power state

Error Cause If the 24 volt DC line power is not available, the yellow **Notready** status is displayed in the instrument actuals. If you try to switch the valve, this status changes to **Power**.

Actions

1 Check power cable to external power supply or to another 1100 Series module

2 If the valve power is supplied by another 1100 module, check if this particular module is switched on.

3 Restart the ChemStation

CAN failure

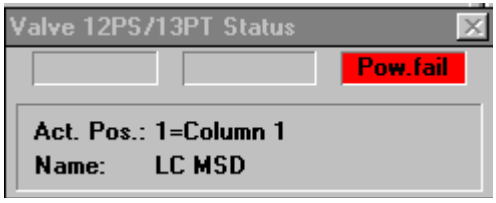


Figure 15 CAN failure

Error Cause If the red **Pow. fail** status is visible the CAN communication is interrupted.

Actions

1. Check the CAN connection at the valve and at all other modules.
2. Check that the maximum number of 13 Agilent 1100 Series modules (including CAN slaves) is not exceeded.
3. Restart the ChemStation.

Switch failure

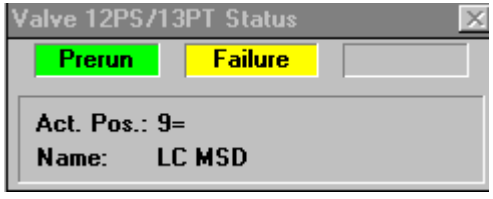


Figure 16 Switch failure

Error Cause The yellow failure status indicates, that the valve didn't switch correctly

Actions

1. Synchronize the valve as described on page 32
2. Restart the ChemStation
3. Disconnect and replug the CAN cable

Unknown Position

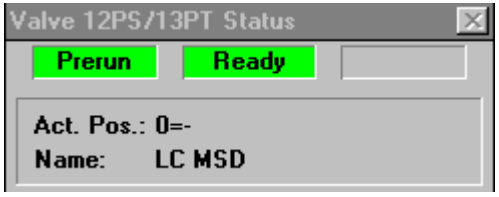


Figure 17 Unknown Position

Error Cause An unknown position is indicated **Act. Pos.: 0=-**

Actions

1 Synchronize the valve as described on page 32.

2 Restart the ChemStation.

3 Disconnect and replug the CAN cable.

Valve Synchronization

If the valve failed to switch or if the current position of the valve is unknown, it might be necessary to synchronize the valve.

To synchronize the valve

Step	Note
1 Switch to the **Diagnostics** view.	
2 Select **Valve** from the **Maintenance** menu.	The valve should now display the **Current Position** as displayed in Figure 18. If the current position is 0, it is unknown
3 To synchronize the valve, choose any position from the **Synchronize to position** dropdown list and click **OK.**	

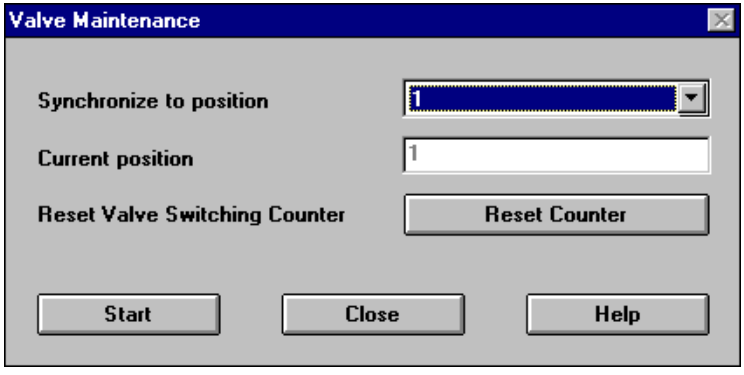


Figure 18 Valve Synchronization

4
Valve Applications

Alternating Column Regeneration 34
Sample enrichment and Sample stripping 38
Column Selection 42
Solvent Selection 44

In this chapter selected applications for the Agilent 1100 Series Valves will be described. This description will contain:

- short description
- flow diagrams
- part numbers of capillaries, fittings and capillary kits

Alternating Column Regeneration

Alternating column regeneration is a convenient way to increase the sample throughput. The Agilent 1100 Series 2 position/ 10 port valve (G1157A) can be used in combination with the Agilent LC and LC/MS modules to increase the efficiency in laboratories running large amounts of samples.

Gradient elution is a common technique for separation of complex samples in liquid chromatography, which requires column regeneration before the subsequent run is started. Using alternating column regeneration valuable time for the analysis is saved. Core of the alternating column regeneration is the 1100 Series 2 position / 10 port valve, which allows simultaneous analysis on one column while a second identical column is flushed and equilibrated. The schematic setup is displayed in Figure 19.

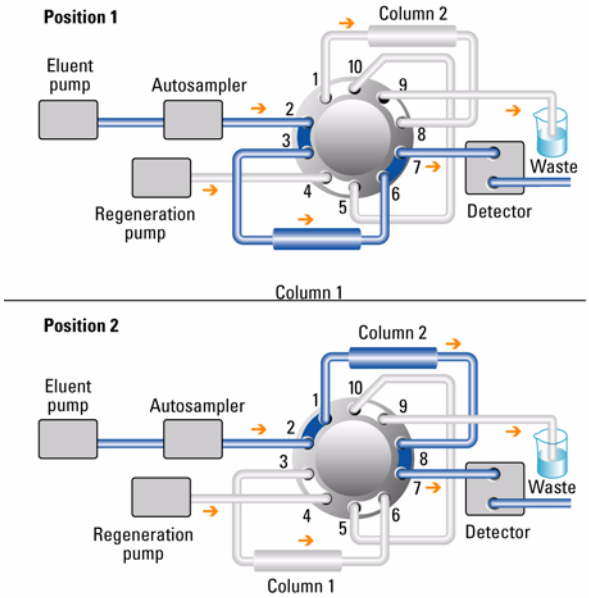


Figure 19 Alternating Column Regeneration (schematic setup)

If the valve is switched to position 1 the eluent pump delivers the mobile phase through the injection loop of the autosampler into port 2 of the 1100 Series Valve. The sample is separated on column 1 and analyzed by the detector. Simultaneously a second regeneration pump flushes and equilibrates column 2.

After the analysis of the sample is finished on column 1, column 2 is prepared for an immediate injection. The 2 position/ 10 port valve is switched and the sample can be injected and analyzed. While the analysis is running on column 2, column 1 is now regenerated and will be ready to use immediately after the sample run on column 2 is finished.

The advantage of this technique is visualized in Figure 20, where the time of analysis with sequential column regeneration is compared to time of analysis using alternating column.

A detailed description how to setup alternating column regeneration with an 1100 Series LC system is provided in the application notes with the publication numbers 5988-7831EN and 5988-7895EN.

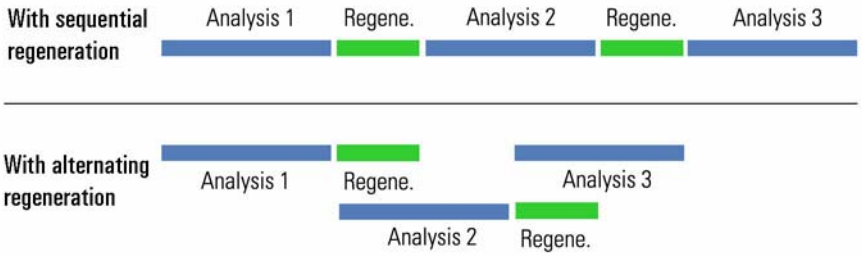


Figure 20 Alternating column regeneration (time scheme)

We recommend to use the Agilent Technologies Capillary kits for Alternating Column Regeneration. These kits contain all capillaries, fittings and ferrules that are required for the setup displayed in Figure 19 on page 34. Agilent Technologies offers one kit for analytical scale applications (flow rates < 10 ml/min), that contain the capillaries listed in Table 7 on page 36 and fittings listed in Table 8 on page 36. Another kit is suited for preparative scale applications (flow rates < 100 ml/min). Its capillaries are listed in Table 9 on page 37 and its fitting are listed in Table 10 on page 37.

Capillary Kit (G1156-68711) for alternating column regeneration with G1157A (analytical scale)

Table 7 Capillaries

From	To	ID/mm	Length/mm	part number
Injector/Autosampler	Valve (port 2)	0.17	500	G1328-87600
Valve (port 3)	Column 1	0.17	600	5021-1819
Column 1	Valve (port 6)	0.17	400	5065-9933
Valve (port 7)	Detector	0.17	600	5065-9933
Valve (port 8)	Column 2	0.17	400	5021-1819
Column 2	Valve (port 1)	0.17	600	5065-9933
Valve (port 5)	Valve (port 10)	0.17	105	5021-1816
Regeneration Pump	Valve (port 4)	0.25	800	5065-9930
Valve (port 9)	Waste	0.6 (PTFE)	2000	0890-1713

Table 8 Fittings, screws, and ferrules

Description	Qty	part number
1/16” fittings and ferrules 10/pk	1	5062-2418
fingertight fitting (long)	1	5062-8541 (10/pk)
fitting screw (long)	10	5065-4454 (10/pk)
fitting screw (extra long)	4	G1156-22402
front ferrule 10/pk	1	5180-4108
back ferrule 10/pk	1	5180-4114
ZDV fitting	1	0100-0900
0.18 ID PEEK tubing (1.5 m)	1	0890-1763
Plastic tubing cutter	1	8710-1930

Capillary Kit (G1156-68713) for alternating column regeneration with G1157A (preparative scale)

Table 9 Capillaries

From	To	ID/mm	Length/mm	part number
Injector/Autosampler	Valve (port 2)	0.5	600	G2260-87300
Valve (port 3)	Column 1	0.5	600	G2260-87301
Column 1	Valve (port 6)	0.5	400	G2260-87300
Valve (port 7)	Detector	0.5	600	G2260-87300
Valve (port 8)	Column 2	0.5	400	G2260-87301
Column 2	Valve (port 1)	0.5	600	G2260-87300
Valve (port 5)	Valve (port 10)	0.5	105	5065-9927
Regeneration Pump	Valve (port 4)	0.5	800	5065-9926
Valve (port 9)	Waste	0.6 (PTFE)	2000	0890-1713

Table 10 Fittings, screws, and ferrules

Description	Qty	part number
1/16” fittings and ferrules 10/pk	1	5062-2418
fingertight fitting (long)	1	5062-8541 (10/pk)
fitting screw (long)	10	5065-4454 (10/pk)
fitting screw (extra long)	4	G1156-22402
front ferrule 10/pk	1	5180-4108
back ferrule 10/pk	1	5180-4114
Union Prep	1	5022-2133
0.5 ID PEEK tubing (1.5 m)	1	0890-1761
Plastic tubing cutter	1	8710-1930

Sample enrichment and Sample stripping

Sample enrichment and sample stripping methods can be used to separate samples from complex matrices, such as biological fluids, food extracts or wastewater. This might be necessary to avoid interference of the matrix during separation and detection or even damage of the column. You can use the 1100 Series 2 position/ 6 port valve (G1158A) to automate these techniques for LC and LC/MS analysis.

Sample enrichment

Sample enrichment is used to increase the sensitivity and to remove the sample matrix. The technique is displayed in Figure 21 on page 38. This technique allows the injection of large volumes onto the precolumn, where the sample matrix is separated from the analytes in order to increase sensitivity.

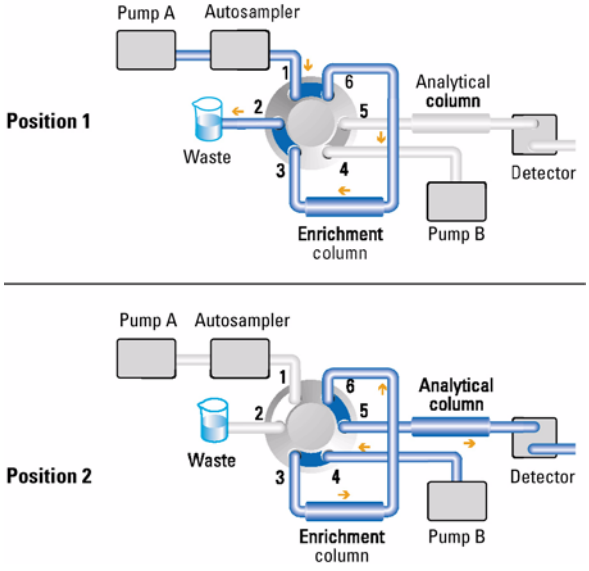


Figure 21 Sample enrichment (schematic setup)

For the sample enrichment phase the valve is switched to position 1. The eluent Pump A transfers the injected sample onto the enrichment column. The sample is retained and enriched on this column, whereas the sample matrix is flushed into the waste. At the same time the second eluent pump B is equilibrating the analytical column.

After the valve is switched to position 2 pump B is backflushing the sample on the analytical column for separation and subsequent detection by LC/MS or optical detectors.

Agilent Technologies offers capillary kit for sample enrichment and sample stripping. The content is listed in Table 11 on page 40 and Table 12 on page 41.

Sample stripping

Sample stripping is another method to remove complex sample matrices. In difference to sample enrichment the matrix is trapped on the pre-column while the analytes pass through onto the analytical column.

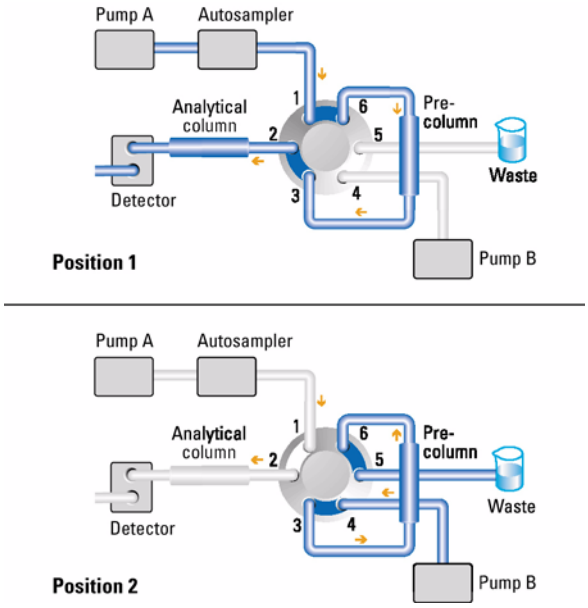


Figure 22 Sample stripping (schematic setup)

Figure 22 on page 39 illustrates how the Agilent 1100 Series 2 position/ 6 port valve can be used for sample stripping. In valve position 1 Pump A transfers the complete sample matrix onto the pre-column 1, where the matrix is trapped while the analytes are eluted and flushed to column 2 for analysis. Then the valve switches to position 2. Now pump B backflushes the matrix to the waste, while pump A continues to deliver solvent to the analytical column, where the analytes are separated and analyzed.

Agilent Technologies offers a capillary kit for sample enrichment and stripping as displayed in Table 11 on page 40 and Table 12 on page 41.

Capillary kit for sample enrichment/stripping (G1156-68714) with G1158A (analytical scale)

Table 11 Capillaries

From	To	ID/mm	Length/mm	part number
Sample Enrichment				
Injector/Autosampler	Valve (port 1)	0.17	500	G1328-87600
Valve (port 2)	Waste	0.6 (PTFE)	2000	0890-1713
Valve (port 3)	Enrichment Column	0.17	400	5021-1819
Enrichment Column	Valve (port 6)	0.17	600	5065-9933
Pump B	Valve (port 4)	0.25	800	5065-9930
Valve (port 5)	Analytical Column	0.17	400	5021-1819
Analytical Column	Detector	0.17	600	5065-9933
Stripping				
Injector/Autosampler	Valve (port 1)	0.17	500	G1328-87600
Valve (port 2)	Analytical Column	0.17	400	5021-1819
Analytical Column	Detector	0.17	600	5065-9933
Valve (port 3)	Pre-Column	0.17	400	5021-1819
Pre-Column	Valve (port 6)	0.17	600	5065-9933
Pump B	Valve (port 4)	0.25	800	5065-9930
Valve (port 5)	Waste	0.6 (PTFE)	2000	0890-1713

Table 12 Fittings, screws, and ferrules

Description	Qty	part number
1/16″ fittings and ferrules 10/pk	1	5062-2418
fingertight fitting (long)	1	5062-8541 (10/pk)
fitting screw (long)	5	5065-4454 (10/pk)
front ferrule 10/pk	1	5180-4108
back ferrule 10/pk	1	5180-4114
ZDV fitting	1	0100-0900
0.18 ID PEEK tubing (1.5 m)	1	0890-1763
Plastic tubing cutter	1	8710-1930

Column Selection

With the Agilent 1100 Series 6 position selection valve (G1159A) and the capillary kit for Column Selection (Table 13 and Table 14 on page 43) you can set up your Agilent 1100 Series LC or LC/MS system for use with up to 6 columns as displayed in Figure 23. Or you can use the system with 5 columns and one flow path for flow injection analysis or for flushing the system. This setup allows you to switch between these columns for faster method development or method validation. The multi-column setup might also be used, if several operators are using the LC or LC/MS system.

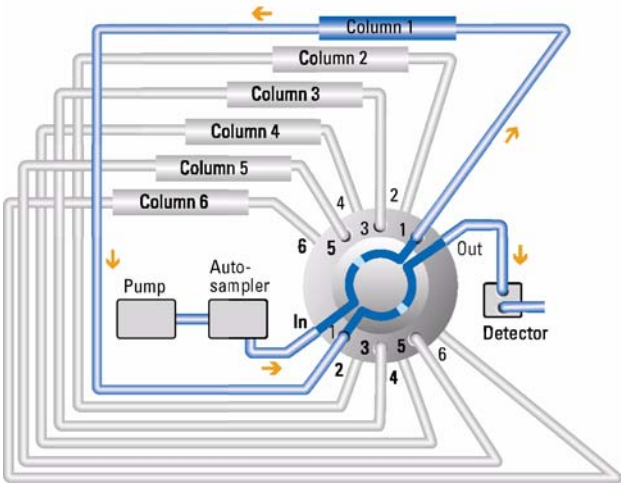


Figure 23 Column selection (schematic setup)

Capillary Kit (G1156-68712) for column selection with G1159A (analytical scale)

Table 13 Capillaries

From	To	Qty.	ID/mm	Length/mm	part number
Injector/Autosampler	Valve (IN)	1	0.17	500	G1328-87600
Valve (X)	Column X	6	0.17	400	5021-1819
Column X	Valve (X')	6	0.17	400	5021-1819
Valve (OUT)	Detector	1	0.17	600	G1328-87600

Table 14 Fittings, screws, and ferrules

Description	Qty	part number
1/16" fittings and ferrules 10/pk	2	5062-2418
fitting screw (long)	15	5065-4454 (10/pk)
front ferrule 10/pk	1	5180-4108
back ferrule 10/pk	1	5180-4114
ZDV fitting	1	0100-0900
0.18 ID PEEK tubing (1.5 m)	1	0890-1763
Plastic tubing cutter	1	8710-1930

Solvent Selection

The 1100 Series 12 position / 13 port valve can be used for solvent selection (flow rate < 10 ml/min) as illustrated in Figure 24. It offers automated access to 12 different eluents.

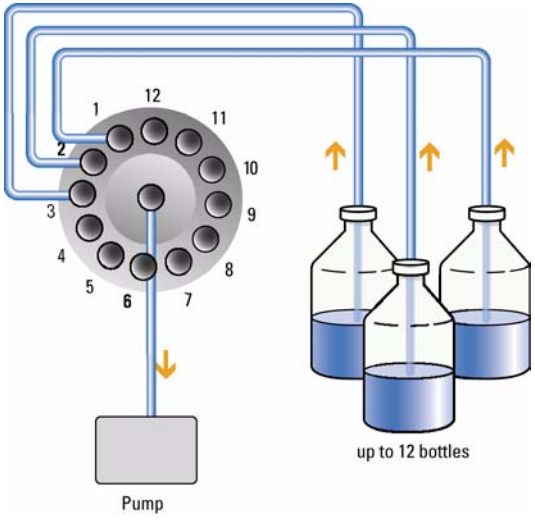


Figure 24 Solvent selection (schematic setup)

Tubing Kit (G1160-68706) for solvent selection (4 solvents) with G1160A, degasser and isocratic pump (flow rate < 10 ml/min)

Table 15 Tubing

From	To	Qty.	ID/mm	Length/mm	part number
Solvent Bottle	Degasser	4	1.5	1000	G1311-60003
Degasser	Valve (pos.1-12)	4	1.5	600	G1160-67300
Valve (OUT)	Pump Inlet	1	1.5	600	G1160-67300

Table 16 Finger-tight fittings

Description	Qty	part number
Adapter, PEEK int. 1/4-28 to ext.10-32	5	0100-2298

5
Parts

General Parts 48
Capillaries and Fittings for analytical and preparative flow rates 50
Capillaries and Fittings for micro valves 51

In this chapter you will find part numbers and part descriptions for maintenance and repair.

General Parts

Table 17 General parts

Description	part number
• CAN cable, 1m long	5181-1519
• DC-Can cable	5181-1533
• External Power Supply	0950-4422
• Rail assembly for Column Organizer	5065-4450

Table 18 Exchange valve assemblies

Description	part number
• 2 position/10 port valve	G1157-60001
• 2 position/6 port valve	G1158-60001
• 6 position selction valve	G1159-60001
• 12 position/13 port selection valve	G1160-60001
• 2 position/6 port micro valve	G1162-60001
• 2 position/10 port micro valve	G1163-60001

Table 19 Rebuild kits and repair parts for Agilent 1100 Series Valves

Description		part number
• Rebuilt kits and rotor seals	Rebuild kit for G1157A (2 position/10 port valve)	0101-1359
	Rebuild kit for G1158A (2 position/6 port valve)	0101-1358
	Rebuild kit for G1159A (6 position selection valve)	0101-1290
	Rebuild kit for G1160A (12 position/13 port valve)	0101-1288
	Rotor seals for G1158A (2 position/6 port valve)	0100-1855 (Vespel) 0100-1854 (Tefzel) 0100-2233 (PEEK)
	Rotor seal for G1162A (2 position/6 port micro valve)	0100-2087
	Rotor seal for G1163A (2 position/10 port micro valve)	0101-1361
• Stator heads	Stator head for G1157A (2 position/10 port valve)	0101-1362
	Stator head for G1158A (2 position/6 port valve)	0100-1850
	Stator head for G1159A (6 position selection valve)	0101-1364
	Stator head for G1160A (12 position/13 port valve)	0101-1365
	Stator head for G1162A (2 position/6 port micro valve)	0100-2089
	Stator head for G1163A (2 position/10 port micro valve)	0101-1363

Capillaries and Fittings for analytical and preparative flow rates

Table 20 Capillary and tubing kits

Description	part number
• Capillary kit: alternating column regeneration (analytical) for valve G1157A (for details see Table 7 and Table 8 on page 36)	G1156-68711
• Capillary kit alternating column regeneration (preparative) for valve G1157A (for details see Table 9 and Table 10 on page 37)	G1156-68713
• Capillary kit: alternating Sample enrichment/stripping (analytical) for valve G1158A (for details see Table 11 and Table 12 on page 41)	G1156-68714
• Capillary kit: column selection (analytical) for 6 columns with valve G1159A (for details see Table 13 and Table 14 on page 43)	G1156-68712
• Tubing kit: solvent selection for 4 solvents (< 10 ml/min) for valve G1160A (for details see Table 15 and Table 16 on page 45)	G1156-68706

Table 21 Part Numbers for flexible SST capillaries without fittings (volume in parentheses)

length in mm	0.12 mm ID	0.17 mm ID	0.25 mm ID	0.50 mm ID
105	5021-1820 (1.2µl)	5021-1816 (2.4µl)		5065-9927 (20.6µl)
150	5021-1821 (1.7µl)	5021-1817 (3.4µl)		5022-6509 (29.5µl)
200		5065-9931 (4.6µl)		
280	5021-1822 (3.2µl)	5021-1818 (6.4µl)	5062-6508 (13.8µl)	5022-6510 (55.0µl)
400	5021-1823 (4.5µl)	5021-1819 (9.1µl)		G2260-87301 (78.5µl)
500		G1328-87600 (11.4µl)		
600		5065-9933 (13.6µl)		G2260-87300 (117.8µl)
700		5065-9932 (15.9µl)		
800			5065-9930 (39.3µl)	5065-9926 (157µl)

Capillaries and Fittings for micro valves

For the operation of the Agilent 1100 Series Micro Valves we recommend the following fittings and PEEK coated fused silica capillaries as listed in Table 22, Table 23 and Table 24.

Table 22 Fittings and Ferrules for micro valves

Fitting Type	Name	Description	Units of measure	Part number
A	Swagelok	1/16″ SST fitting, front and back ferrule	10/pk	5062-2418
B	Lite Touch	1/16″ SST fitting male, wrench size 4	10/pk	5063-6593
B	Lite Touch	1/32″ SST ferrule and lock ring	10/pk	5065-4423
C	Rheodyne	M4 PEEK fitting	6 fitt/2 plug	5065-4410
D	Finger Tight	Double winged nuts and 1/32″ ferrules	10/pk	5065-4422
E	Lite touch Detector	1/16″ SST fitting male, wrench size 4	10/pk	5063-6593
E	Lite touch Detector	SST ferrule	10/pk	5063-6592

Table 23 Fitting Types

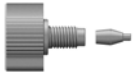
Fittings and ferrules	Fitting type
	A
	B
	C
	D

Table 24 PEEK coated fused silica capillaries for micro valves

i.D./µm	Length/mm	Volume/µl	Fitting type*	Part number
100	150	1.178	B/C	G1375-87317
100	200	1.570	B/C	G1375-87312
100	220	1.728	B/B	G1375-87305
100	550	4.320	B/C	G1375-87306
100	1100	8.639	B/D	G1375-87315
100	1100	8.639	B/B	G1375-87303
75	400	1.767	D/E	G1375-87308
75	500	3.209	C/D	G1375-87311
75	700	3.092	E/-	G1315-68708
50	150	0.295	B/C	G1375-87300
50	200	0.392	B/C	G1375-87302

Table 24 PEEK coated fused silica capillaries for micro valves (continued)

i.D./µm	Length/mm	Volume/µl	Fitting type*	Part number
50	220	0.432	B/B	G1375-87301
50	280	0.550	C/D	G1375-87309
50	400	0.785	E/D	G1315-68703
50	500	0.982	C/D	G1375-87304
50	550	1.080	B/C	G1375-87310
25	100	0.049	C/D	G1375-87320
25	220	0.108	D/D	G1375-87321
25	350	0.172	C/D	G1375-87322
25	550	0.270	C/D	G1375-87323
25	700	0.344	C/D	G1375-87324

* see Table 23 on page 52

5 Parts

6
Specifications

G1157A Agilent 1100 Series 2 position / 10 port valve 56
G1158A Agilent 1100 Series 2 position / 6 port valve 56
G1159A Agilent 1100 Series 6 position selection valve 56
G1160A Agilent 1100 Series 12 position/ 13 port selection valve 57
G1162A 1100 Series 2 position/ 6 port micro valve 57
G1163A 1100 Series 2 position/ 10 port micro valve 57

In this chapter you will find the specifications of the 1100 Series valves.

Table 25 G1157A Agilent 1100 Series 2 position / 10 port valve

Liquid contacts:	Stainless Steel and PEEK
Port size:	Accepts 10-32 male threaded fittings
Flow passage diameters:	Stator and stator face assembly 0.6-mm (0.024″), rotor seal 0.6-mm (0.024″)
Volume in flow passage:	Stator (includes stator face seal) 2.1 µl/hole, rotor seal 0.7 µl/groove
Maximum pressure:	41 MPa (408 bar, 6000 psi)
Recommended flow range:	0.2 - 100 ml/min

Table 26 G1158A Agilent 1100 Series 2 position / 6 port valve

Liquid contacts:	Stainless steel, PEEK, and alumina ceramic
Port size:	Accepts 10-32 male threaded fittings
Flow passage diameters:	Stator and stator face assembly 0.4-mm (0.015″), rotor seal 0.5-mm (0.018″)
Volume in flow passage:	Stator (includes stator face seal) 0.7 µl/hole, rotor seal 0.3 µl/groove
Maximum pressure:	41 MPa (408 bar, 6000 psi)
Recommended flow range:	0.2 - 100 ml/min

Table 27 G1159A Agilent 1100 Series 6 position selection valve

Liquid contacts:	Stainless steel and PEEK
Port size:	Accepts 10-32 male threaded fittings
Flow passage diameters:	Stator 0.6-mm (0.024″), stator face assembly and rotor seal 0.4-mm (0.015″)
Volume in flow passage	Angled ports 1, 2, 5 (15.6 µl) Radial ports 2, 4, 6 (18,8 µl)
Maximum pressure:	35 MPa (345 bar, 5000 psi)
Recommended flow range:	0.3 - 40 ml/min*

* The G1159A 1100 Series 6 positions selection valve can be used at flow rates up to 100 ml/min, but without valve switching. In most cases e.g. column selection the valve switches during the postrun or prerun, when the flow can be reduced.

Table 28 G1160A Agilent 1100 Series 12 position/ 13 port selection valve

Liquid contacts:	Stainless steel and PEEK
Port size:	Accepts 10-32 male threaded fittings
Flow passage diameters:	1.0-mm (0.040")
Volume in flow passage:	Stator (includes stator face seal) 6.4 µl/hole, rotor seal 4.0 µl/groove
Maximum pressure:	21 MPa (207 bar, 3000 psi)
Recommended flow range:	0.2 - 100 ml/min (at high pressures, after the pump) 0.2 - 10 ml/min (at low pressures, in front of the pump)

Table 29 G1162A 1100 Series 2 position/ 6 port micro valve

Liquid contacts:	DuraLife processed stainless steel (stator) and vespel (rotor seal)
Port size:	Accepts M4 male threaded fittings
Flow passage diameters:	0.20 mm (0.008")
Volume in flow passages:	70 nl port to port
Maximum pressure:	41 MPa (408 bar, 6000 psi)
Recommended flow range:	0.1 - 100 µl

Table 30 G1163A 1100 Series 2 position/ 10 port micro valve

Liquid contacts:	DuraLife processed stainless steel (stator) and vespel (rotor seal)
Port size:	Accepts M4 male threaded fittings
Flow passage diameters:	0.20 mm (0.008")

Table 30 G1163A 1100 Series 2 position/ 10 port micro valve (continued)

Volume in flow passages:	Stator (20° ports)27.2 nl, (45° ports) 30.5 nl, rotor seal 25.0 nl/groove
Maximum pressure:	41 MPa (408 bar, 6000 psi)
Recommended flow range:	0.1 - 100 µl

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Safety Information

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General Safety Information

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Aligent Technologies assumes no liability for the customer's failure to comply with these requirements.

General

This is a Safety Class I instrument (provided with terminal for protective earthing) and has been manufactured and tested according to international safety standards.

Operation

Before applying power, comply with the installation section. Additionally the following must be observed.

Do not remove instrument covers when operating. Before the instrument is switched on, all protective earth terminals, extension cords, auto-transformers, and devices connected to it must be connected to a protective earth via a ground socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in serious personal injury. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any intended operation.

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, and so on) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

Some adjustments described in the manual, are made with power supplied to the instrument, and protective covers removed. Energy available at many points may, if contacted, result in personal injury.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible. When inevitable, this should be carried out by a skilled person who is aware of the hazard involved. Do not

attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present. Do not replace components with power cable connected.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not install substitute parts or make any unauthorized modification to the instrument.

Capacitors inside the instrument may still be charged, even though the instrument has been disconnected from its source of supply. Dangerous voltages, capable of causing serious personal injury, are present in this instrument. Use extreme caution when handling, testing and adjusting.

Safety Symbols

Table 31 shows safety symbols used on the instrument and in the manuals.

Table 31 Safety Symbols

Symbol	Description
	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.

WARNING **A warning alerts you to situations that could cause physical injury or damage to the equipment. Do not proceed beyond a warning until you have fully understood and met the indicated conditions.**

CAUTION A caution alerts you to situations that could cause a possible loss of data. Do not proceed beyond a caution until you have fully understood and met the indicated conditions.

Lithium Batteries Information

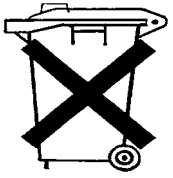
WARNING **Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Lithium batteries may not be disposed-off into the domestic waste.**

Transportation of discharged Lithium batteries through carriers regulated by IATA/ICAO, ADR, RID, IMDG is not allowed. Discharged Lithium batteries shall be disposed off locally according to national waste disposal regulations for batteries.

WARNING **Lithiumbatteri - Eksplosionsfare ved fejlagtic handtering. Udskiftning ma kun ske med batteri af samme fabrikat og type. Lever det brugte batteri tilbage til leverandoren.**

WARNING **Lithiumbatteri - Eksplosionsfare. Ved udskiftning benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres appararleverandoren.**

NOTE Bij dit apparaat zijn batterijen geleverd. Wanneer deze leeg zijn, moet u ze niet weggooien maar inleveren als KCA.



Radio Interference

Never use cables other than the ones supplied by Aligent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

Test and Measurement

If test and measurement equipment is operated with equipment unscreened cables and/or used for measurements on open set-ups, the user has to assure that under operating conditions the radio interference limits are still met within the premises.

Sound Emission

Manufacturer's Declaration

This statement is provided to comply with the requirements of the German Sound Emission Directive of 18 January 1991.

This product has a sound pressure emission (at the operator position) < 70 dB.

- Sound Pressure Lp < 70 dB (A)
- At Operator Position
- Normal Operation
- According to ISO 7779:1988/EN 27779/1991 (Type Test)

Solvent Information

Observe the following recommendations on the use of solvents.

Solvents

Brown glass ware can avoid growth of algae.

Always filter solvents, small particles can permanently block the capillaries. Avoid the use of the following steel-corrosive solvents:

- Solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on).
- High concentrations of inorganic acids like nitric acid, sulfuric acid especially at higher temperatures (replace, if your chromatography method allows, by phosphoric acid or phosphate buffer which are less corrosive against stainless steel).
- Halogenated solvents or mixtures which form radicals and/or acids, for example:

  $2CHCl_3 + O_2 \rightarrow 2COCl_2 + 2HCl$

  This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol.
- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- Solutions of organic acids (acetic acid, formic acid, and so on) in organic solvents. For example, a 1-% solution of acetic acid in methanol will attack steel.
- Solutions containing strong complexing agents (for example, EDTA, ethylene diamine tetra-acetic acid).
- Mixtures of carbon tetrachloride with 2-propanol or THF.

Agilent Technologies on Internet

For the latest information on products and services visit our worldwide web site on the Internet at:

http://www.agilent.com

Select “Products” - “Chemical Analysis”

It will provide also the latest firmware of the Agilent 1100 series modules for download.

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In This Book

This User's Guide describes common applications as well as installation, operation and maintenance of the following Agilent 1100 series valves:

- G1157A Agilent 1100 Series 2 Position/10 Port Valve
- G1158A Agilent 1100 Series 2 Position/ 6 Port Valve
- G1159A Agilent 1100 Series 6 Position Selection Valve
- G1160A Agilent 1100 Series 12 Position/13 Port Selection Valve
- G1162A Agilent 1100 Series 2 Position/ 6 Port Micro Valve
- G1163A Agilent 1100 Series 2 Position/10 Port Micro Valve

In addition parts and specifications of these valves are listed.

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