Waters System Fluidics Organizer

Operator's Guide

71500135002 / Revision A

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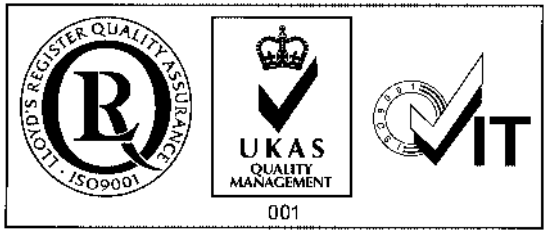


Safety considerations

Some reagents and samples used with Waters instruments can pose chemical, biological, and radiological hazards. Be sure you are aware of the potentially hazardous effects of all substances you work with. Always follow Good Laboratory Practice, and consult your organization's safety representative for guidance.

When you develop methods, follow the "Protocol for the Adoption of Analytical Methods in the Clinical Chemistry Laboratory," *American Journal of Medical Technology*, 44, 1, pages 30–37 (1978). This protocol addresses good operating procedures and the techniques necessary to validate system and method performance.

Safety advisories

See Appendix A for a comprehensive list of warning and caution advisories.

Operating this device

When operating this device, follow standard quality control procedures and the guidelines in this section.

Intended use

Waters® designed the System Fluidics Organizer to manage fluidic connections to analytical- and preparative-scale columns and provide analytical-to-preparative flow path switching and column regeneration under MassLynx™ software control with the FractionLynx™ Application Manager.

Warning: While some of the modules in the AutoPurification System may carry IVDD labels, the system as a whole is unintended for clinical use.

Table of Contents

1 Introduction

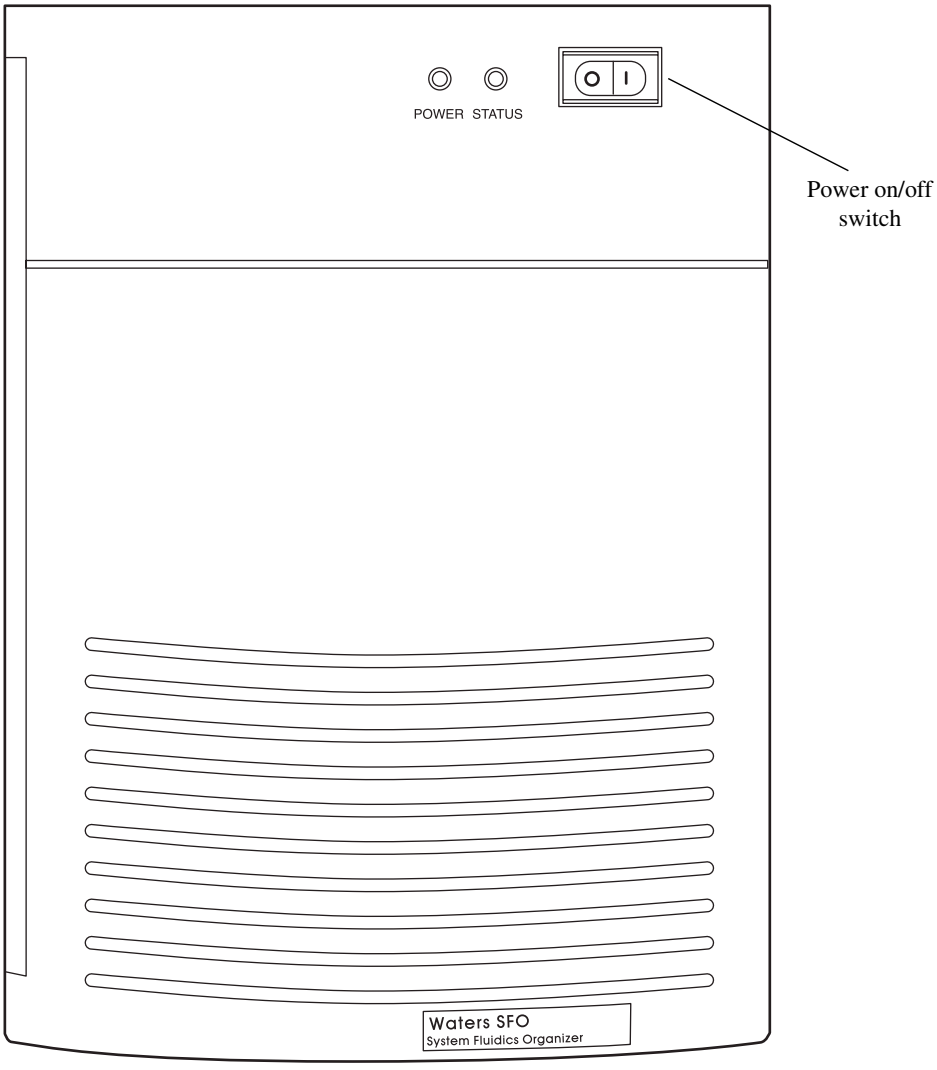
Contents:

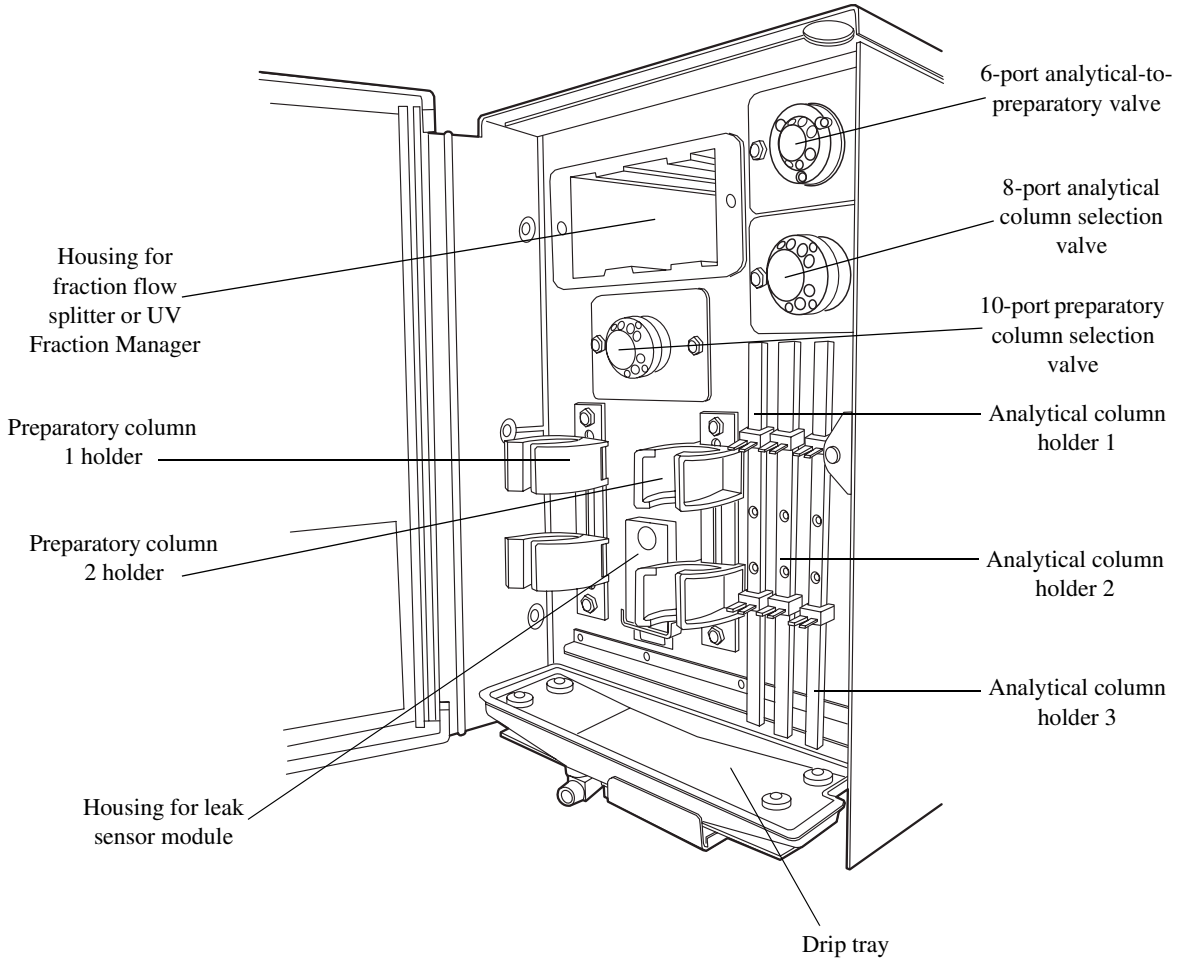
Learning about the Waters System Fluidics Organizer

As part of the Waters AutoPurification™ System, the Waters System Fluidics Organizer manages external inlet devices and up to three 515 pumps through a pump control module (PCM); houses an Ethernet switch box, or hub, to manage additional external devices; and switches among two preparative columns and up to three analytical columns to make fluidic connections.

The System Fluidics Organizer provides analytical-to-preparative flow path switching and column regeneration under MassLynx™ software control with the FractionLynx™ Application Manager. MassLynx, which communicates with the System Fluidics Organizer through the unit's rear-panel Ethernet connection, controls the positions of the unit's three electrically activated rotary valves. The 6-port analytical-to-prep valve provides switching between analytical and preparative analysis. The 8- and 10-port column selection valves provide parallel regeneration and analysis using two preparatory columns and three analytical columns.

The System Fluidics Organizer also has a compartment for a fraction flow splitter (mass directed) or the Waters UV Fraction Manager (UV directed), as well as optional accommodations for system-level leak detection of up to eight modules in the AutoPurification System.


POWER
STATUS
O
I
Power on/off switch
Waters SFO
System Fluidics Organizer

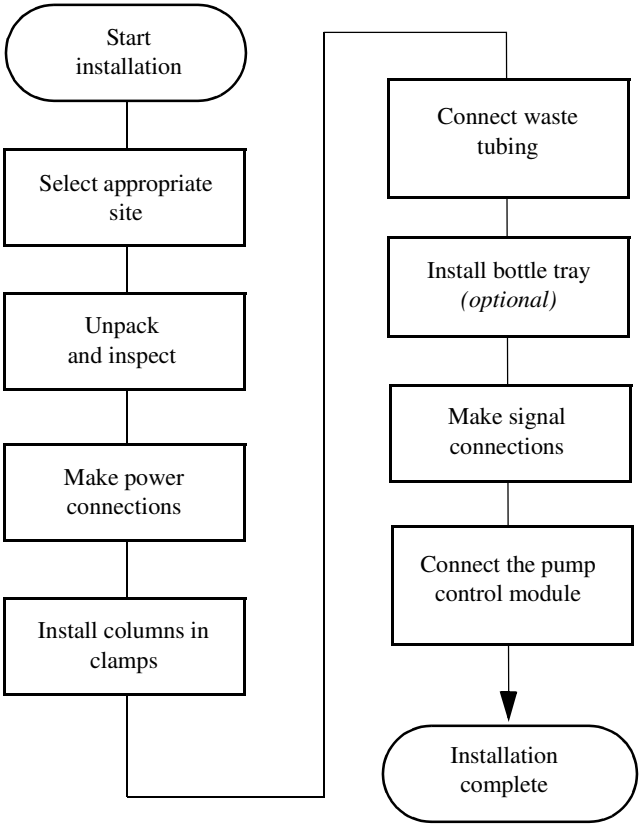

6-port analytical-to-preparatory valve
8-port analytical column selection valve
10-port preparatory column selection valve
Analytical column holder 1
Analytical column holder 2
Analytical column holder 3
Housing for fraction flow splitter or UV Fraction Manager
Preparatory column 1 holder
Preparatory column 2 holder
Housing for leak sensor module
Drip tray

2 Unpacking and installing the System Fluidics Organizer

Contents:

Requirement: To install the System Fluidics Organizer, you should know how to handle solvents as well as set up and operate general laboratory instruments and computer-controlled devices.

Primary steps in installing the System Fluidics Organizer:



Selecting a site

Required materials

To install the System Fluidics Organizer, you need the Startup Kit and the following tools:

- 1/4-inch open-end wrench
- 5/16-inch open-end wrench
- 4-mm Allen wrench
- Small flat-blade screwdriver
- Tubing cutter

Once you install the System Fluidics Organizer, proceed to Chapter 3.

Site requirements

Installation site requirements:

Factor	Requirement
Internal cooling	DC-powered fans that provide internal cooling by pulling air through the bottom of the System Fluidics Organizer and exhausting it out the rear of the unit
Airflow requirements	Air enters the bottom of the System Fluidics Organizer so instruments can be placed side by side
Clearance	At least 6 inches (15.24 cm) between the System Fluidics Organizer and the wall to allow for electrical connections and fan exhaust
Operating temperature	4 to 40°C (39.2 to 104°F)
Humidity	20% to 80%, noncondensing
Instrument-generated acoustic noise	<56 dBA (at idle state)
Height	16.75 inches (42.6 cm)
Width	11.17 inches (28.4 cm)
Depth (without cables connected at the rear)	20.82 inches (52.9 cm)
Weight	22 pounds (9.98 kg) without columns or bottles
Line voltage	100 to 240 Vac ±10%
Frequency	50/60 Hz
Current requirements	1.8 A
Fuse	3.15 A, 5 x 20 mm, fast-blow, IEC type
Power consumption	80 W

Warning: System configurations are designed to meet safety and performance standards. All systems must adhere to a model in which any one "base" Waters module (i.e., the System Fluidics Organizer, the 2545 Binary Gradient Module, or the 3100 Mass Spectrometer) supports no more than two vertically oriented "accessory" Waters modules (e.g., 515 pumps, photodiode array detectors, evaporative light scattering detectors, dual wavelength absorbance detectors). Configuring modules in such a way that fails to meet said design is neither recommended nor supported by Waters Corporation. When configurations require module stacking outside the noted parameters, the customer assumes liability.

Unpacking and installing

The System Fluidics Organizer ships in one carton.

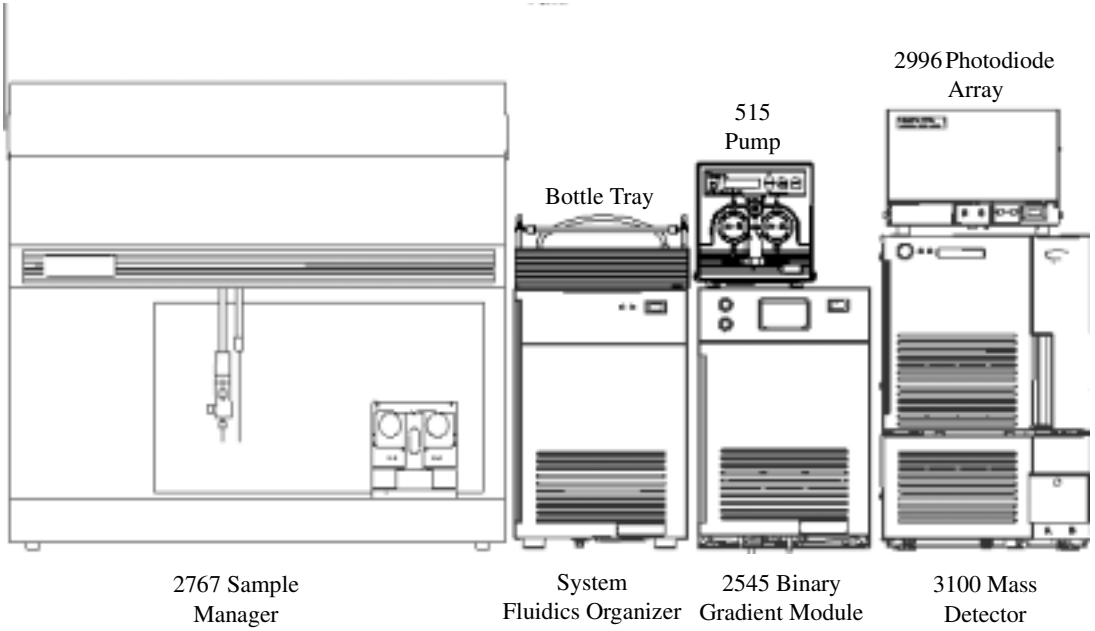
To unpack and install the device:

1. Ensure you have enough space for the device.
2. Inspect the carton for damage. If you detect any, see Section 3 of the *Waters Licenses, Warranties, and Support* document.
3. Remove the plastic wrap, if any, and the bands securing the carton to the pallet.
4. Remove the carton's top and sides and the packing material.
5. Remove the device from the bottom styrofoam cushion and box bottom.

Caution: To prevent damage, lift the device from the bottom.

6. Place the device on a level, clean surface, leaving room for the other AutoPurification System components.

Sample AutoPurification system



7. Measure the voltage at the receptacle, and verify that it is between 100 and 240 Vac.

   Note: If you detect any discrepancy in the order and you are in the United States or Canada, contact Waters Technical Service at 800-252-4752. If you are elsewhere, call your local Waters subsidiary, your local Waters Technical Service Representative, or Waters corporate headquarters in Milford, MA (U.S.A.).

Making power connections

Attention: Do not power on the System Fluidics Organizer until you make all plumbing and signal connections.

Proper operation of the device requires that the:

- Correct fuse is installed. (See the following "Installing or replacing the power supply fuse" section for a view of the System Fluidics Organizer rear panel.)
- ac power supply is grounded and shows no abrupt voltage fluctuations.

Installing or replacing the power supply fuse

Required material

- Fuse, 3.15 A, 250 Vac, 5 x 20 mm, IEC

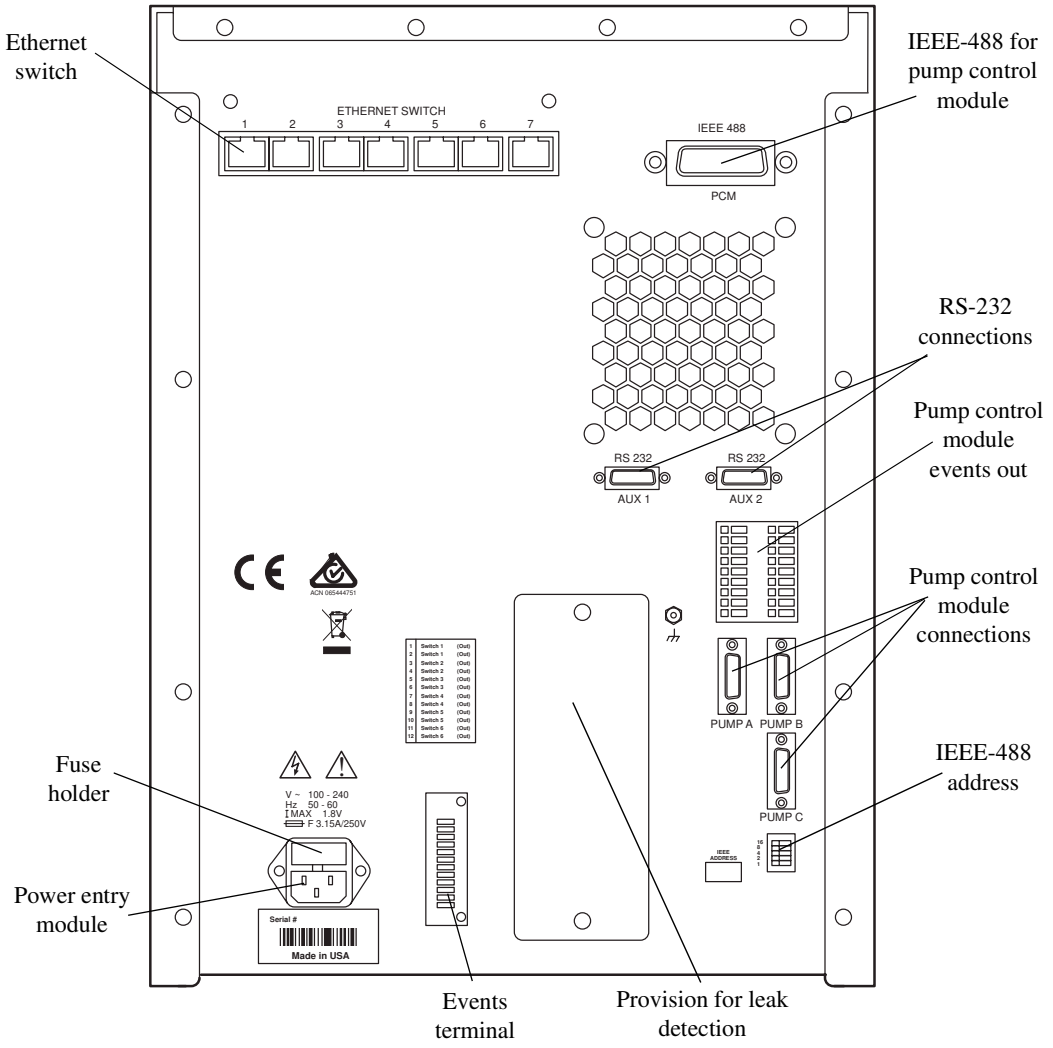
The System Fluidics Organizer ships with two IEC fuses installed. Two other IEC-type fuses are included in the Startup Kit as spares.

Warning: To avoid electrical shock and possible injury, remove the power cord from the device's rear panel *before* performing this procedure.

To install or replace the device's power supply fuse:

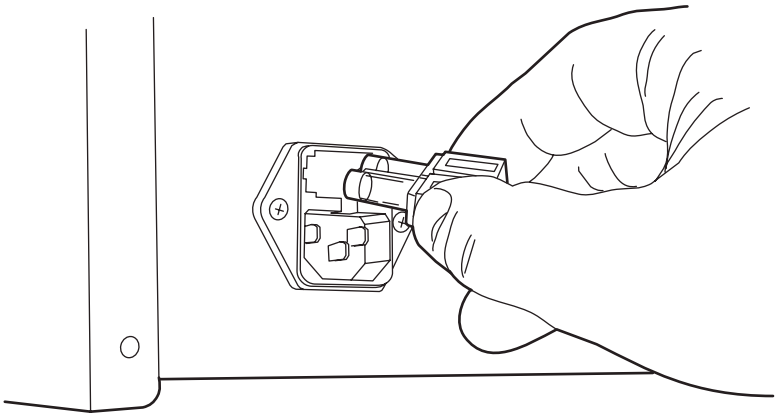
1. On the front of the device, ensure that the power switch is in the Off (0) position.
2. On the rear of the device, open the fuse holder door.

Rear panel of the System Fluidics Organizer



3. Exerting minimal pressure, pull the spring-loaded fuse holder, and remove it from the rear panel.

Removing the fuse



4. Discard the old fuse.
5. Make sure the new fuse is rated for your requirements.
6. Insert the new fuse in the fuse holder.
7. Insert the fuse holder in the receptacle, and gently push until it locks into position.
8. Connect the power cord to the rear-panel power-entry module.

Making the power connection

For proper operation, the System Fluidics Organizer requires a grounded ac power supply with no abrupt voltage fluctuations. The unit automatically adjusts for ac input voltages of 100 to 240 Vac, 50/60 Hz.

To connect the device to the power source:

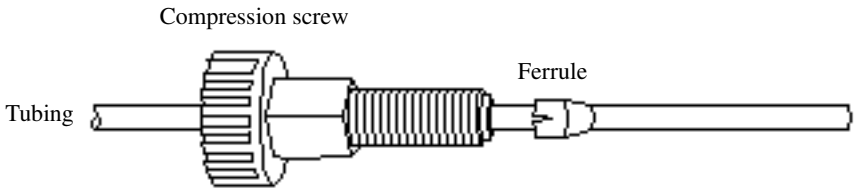
1. On the front of the device, ensure that the power switch is in the Off (0) position.
2. On the rear of the device, connect the female end of the power cord to the power-entry module.
3. Insert the male end of the power cord in a grounded power receptacle.
4. Move the power switch to the On (1) position, and ensure the power LED is illuminated.

Connecting fittings

To make plumbing connections for PEEK tubing at the device's valves:

1. Measure the tubing needed for the connection.
2. Insert the tubing into the 1/16-inch diameter hole of the tubing cutter, making sure the tubing that extends from the metal side of the cutter is the correct length.
3. Insert the razor blade into the cutter, and press downward to cut the tubing. Make sure the cut end is straight and free of burrs.
4. Slide a compression screw over one end of the tubing, followed by a ferrule with its tapered end facing away from the tubing end.

Fitting



5. Firmly seat the tubing end in the inlet on the valve, and then finger-tighten the compression screw.

Caution: To avoid damaging the ferrule, do not overtighten the compression screw.

Mounting columns in the clamps

You can mount up to five chromatographic columns on the device's inside panel. Analytical columns and 10-mm preparative columns mount in the small clamps on the right side of the panel. All other preparative columns mount in the large clamps on the panel's left side.

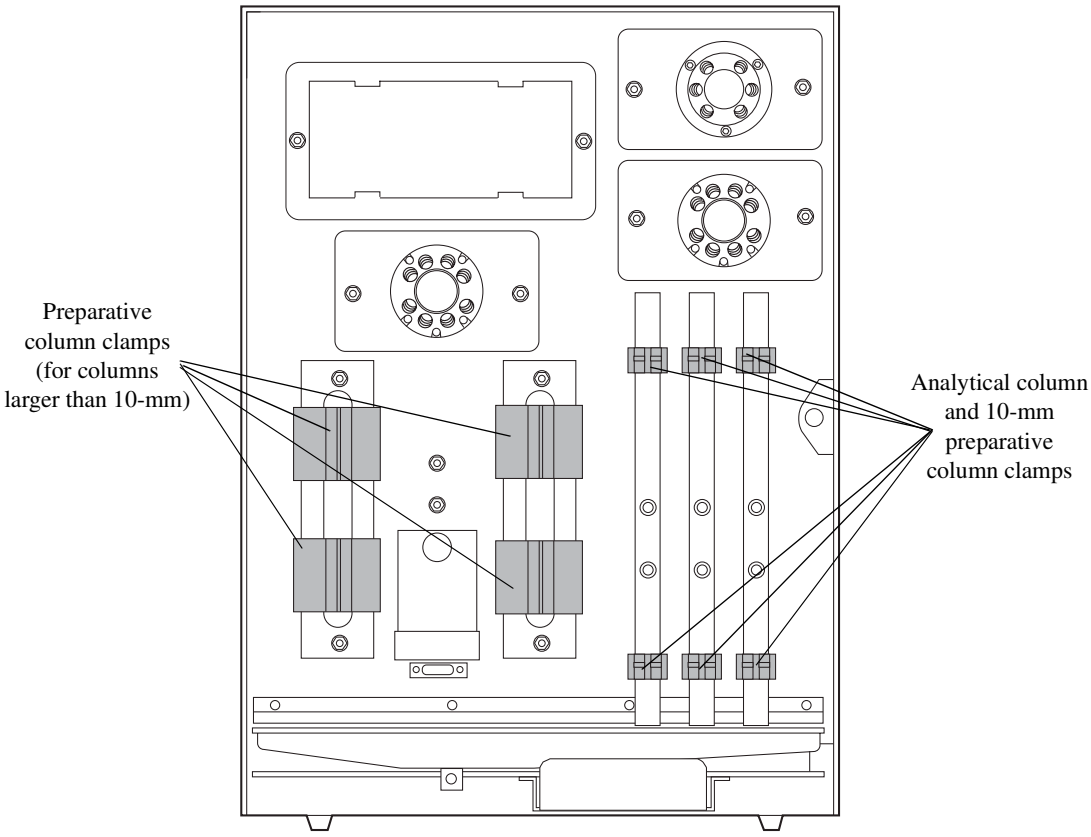
Recommended columns for analytical and preparative runs: .

Quantity	Column Type (Scale)	Size
1	Analytical	2.1 to 4.6 mm ID, up to 150 mm long
2	Analytical	2.1 to 4.6 mm ID, up to 150 mm long
3	Analytical	2.1 to 10 mm ID, up to 150 mm long
1	Preparatory	10 to 30 mm ID, up to 150 mm long
2	Preparatory	10 to 30 mm ID, up to 150 mm long

Caution: To prevent column damage, use extreme care whenever changing any system parameter, including pressure, flow rate, solvent type, and solvent.

Caution: To prevent the device from tipping, use columns no larger than those described here.

Clamp placement in the rear panel



Adjusting columns in the clamps

You must adjust each clamp to accommodate the column you are mounting.

Required materials

- 4-mm Allen wrench
- Columns

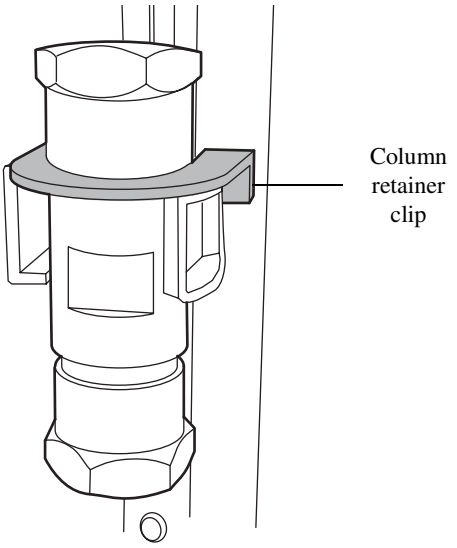
To adjust preparatory columns in the clamps:

1. Using the Allen wrench, loosen the clamp's retaining screw.

Caution: Avoid loosening the retaining screw to the point at which it detaches from its retaining nut. When the screw detaches, the nut and its washer slide down behind the clamp bracket.

2. Slide the clamp up or down, as appropriate.
3. Tighten the retaining screw.
4. Insert the column in both clamps.

   Tip: Use the column retainer clip to give heavy columns added support.



Connecting the waste tubing

To connect the waste tubing:

1. Push the tubing over the barb on the drip tray fitting, and cut the tubing to the appropriate length.

2. Ensure that liquid can drain freely down the drain tube and into an appropriate waste container.

Caution: To drain waste fluid properly, ensure that the waste tube does not crimp or bend. Crimps and bends can prevent flow from reaching the waste container.

Proper tubing placement

Making signal connections

The rear panel of the System Fluidics Organizer has connection terminals and communication ports for operation with external devices. The signal connections you must make depend on the instruments and devices in your AutoPurification System. This section describes the input/output (I/O) and digital signal connections you can make from the terminal strips.

Required materials

- Ethernet cable
- Event output cables
- 9-pin to 6-pin Molex connector for the 515 pump
- IEEE cable

Connecting all Ethernet-controlled devices

To connect an Ethernet-controlled device:

1. Connect one end of the Ethernet cable to an empty socket on the Ethernet switch of the System Fluidics Organizer.

2. Connect the other end of the Ethernet cable to an RJ-45 connector of an Ethernet-controlled device.
3. Repeat steps 1 and 2 for each Ethernet-controlled device to be connected.

Making the IEEE-488 connection

The IEEE-488 cable transmits digital data between the integrated Pump Control Module II of the System Fluidics Organizer and the busLAC/E card. Observe IEEE cabling and connection requirements, and follow IEEE specifications when adding the Pump Control Module II to existing IEEE-488 connections.

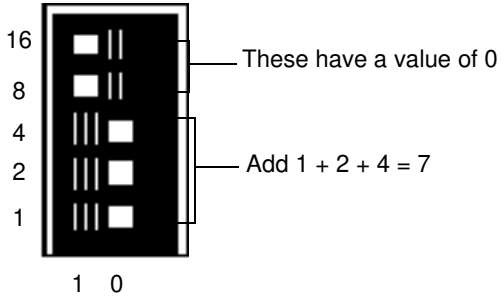
To make the IEEE-488 connection:

1. Insert one end of the IEEE-488 cable in the IEEE-488 port on the rear of the System Fluidics Organizer, and tighten both thumbscrews.
2. Insert the other end of the cable in the IEEE-488 connection on the GPIB PCB card in the computer, and tighten both thumbscrews.

   Tip: You may daisy-chain IEEE-488 cables.

   Tip: Each device on the IEEE communications bus requires a unique IEEE-488 address. The address for the Pump Control Module II must be a unique number from 2 to 29.
3. Set a unique IEEE-488 address on the rear panel of the System Fluidics Organizer by moving the appropriate switches from 0 to 1 (see the following table). For example, to obtain an address of 7, add the numbers of the switches in the 1 position.

IEEE-488 address



Switch settings:

IEEE-488 Address	Switch Settings				
	1	2	4	8	16
2	0	1	0	0	0
3	1	1	0	0	0
4	0	0	1	0	0
5	1	0	1	0	0
6	0	1	1	0	0
7	1	1	1	0	0
8	0	0	0	1	0
9	1	0	0	1	0
10	0	1	0	1	0
11	1	1	0	1	0
12	0	0	1	1	0
13	1	0	1	1	0
14	0	1	1	1	0
15	1	1	1	1	0
16	0	0	0	0	1
17	1	0	0	0	1
18	0	1	0	0	1
19	1	1	0	0	1
20	0	0	1	0	1
21	1	0	1	0	1
22	0	1	1	0	1
23	1	1	1	0	1
24	0	0	0	1	1
25	1	0	0	1	1
26	0	1	0	1	1
27	1	1	0	1	1
28	0	0	1	1	1
29	1	0	1	1	1

Connecting the pumps

Caution: To avoid damaging the integrated Pump Control Module II of the System Fluidics Organizer, power off the pumps before connecting them to, or disconnecting them from, the System Fluidics Organizer.

To connect the pumps:

1. Connect one end of the 9-pin pump cable to one of the three pump connectors on the rear of the System Fluidics Organizer.
2. Connect the other end of the cable to the external controller connector on the rear of the 515 pump.

   Tip: To prepare a 515 pump to receive a remote run signal, ensure that the pump is in remote mode, and then press Run/Stop on the pump display to place the pump in Run - Rem mode (see the *Waters 515 HPLC Pump Operator's Guide)*.
3. Repeat steps 1 and 2 for each added pump.

Connecting the events cables

Recommendation: To meet the regulatory requirements of immunity from external electrical disturbances that may affect module performance, use cables no longer than 9.8 feet (3 meters) when connecting screw-type barrier terminal strips. In addition, ensure you always connect the shield of the cable to chassis ground at one instrument only.

Event cables transmit trigger signals between the integrated Pump Control Module II of the System Fluidics Organizer and such peripheral devices as column select valves and column switching valves. The Pump Control Module II can trigger any device requiring a contact closure.

To start a gradient run when using a manual injector, deliver a contact closure signal at an event in port. Otherwise, the pumps remain in their initial condition states.

Working with terminal strips

Tip: All event out connections are of the relay type.

Event in and event out signals correspond to the terminal strip positions in the following tables. Terminal strips are removable to facilitate cable connections.

Left Connector	Description	I/O Type
SW 1 (two)	Relay 1	Out
SW 2 (two)	Relay 2	Out
SW 3 (two)	Relay 3	Out
GND		Ground
INJECT START	Active Low	Input
GND		Ground

Right Connector	Description	I/O Type
SW 4 (two)	Relay 4	Out
SW 5 (two)	Relay 5	Out
SW 6 (two)	Relay 6	Out
GND		Ground
STOP FLOW	Active Low	Input
GND		Ground

Connecting event cables

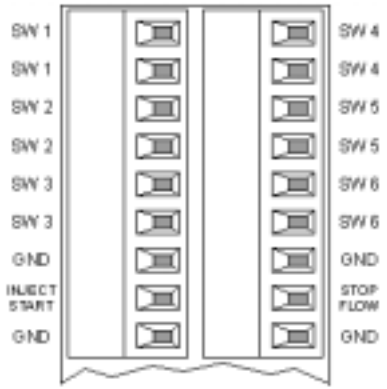
Tip: To avoid damaging peripheral devices, power them off before connecting them to, or disconnecting them from, the System Fluidics Organizer.

To connect event cables:

1. To remove a terminal strip from the System Fluidics Organizer, grab one end, and then pull out each end separately.
2. Connect the two space connectors at the two-wire end of a shielded event cable to one of the following:
   - Manual injector, for an event in signal
   - Device to be triggered, for an event out signal
3. Cut the spade connectors from the red and black leads on the three-wire end, and then strip 0.5 in. (1.3 cm) from the ends.
4. Connect the stripped leads to the appropriate connections on the terminal strip with the correct polarity:
   - Black to negative
   - Red to positive
5. Tighten the screws with a small, slot-head screwdriver.
6. Repeat steps 2 through 5 for added event out connections.
7. Replace the terminal strip by positioning it carefully, and then snapping in each side.
8. Connect the white wire to the ground stud on the upper-left corner of the unit's rear panel.

Understanding event in connections

To signal the System Fluidics Organizer when an injection occurs, connect a shielded event cable to the INJECT START and GND connections on the left terminal strip at the rear of the unit.



Tip: When a manual injector is used, the System Fluidics Organizer requires a contact closure signal to start a gradient run.

To stop the flow of the pumps connected to the unit, connect a shielded event cable to the STOP FLOW and GND connection on the right terminal strip, and connect the red and black cables to carry positive and negative signals, respectively. A contact closure will signal the System Fluidics Organizer to stop the flow.

Understanding event out connections

You can trigger up to six external devices. For each device, connect a shielded event cable to the SW 1 through SW 6 event out connections on the terminal strips.

To stop the flow for the pumps attached to the System Fluidics Organizer, connect a shielded event cable to the STOP FLOW connection on the right terminal strip.

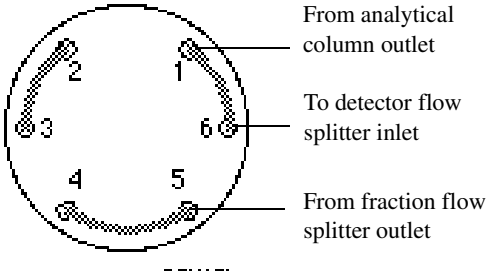
Program the event out signals using the Instrument Method Editor for the module in your MassLynx software.

Reviewing valve schematics

The schematics in this section show how the analytical-to-prep and column-selection valves route fluid streams when switching to varied positions.

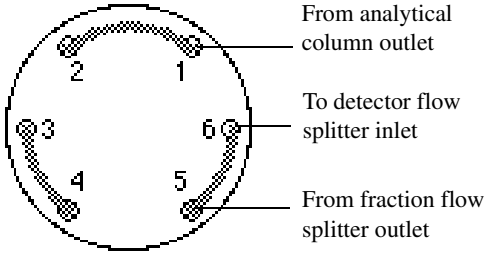
6-port analytical-to-prep valve in the analytical position

The following schematic shows the 6-port analytical-to-prep valve in the analytical position.



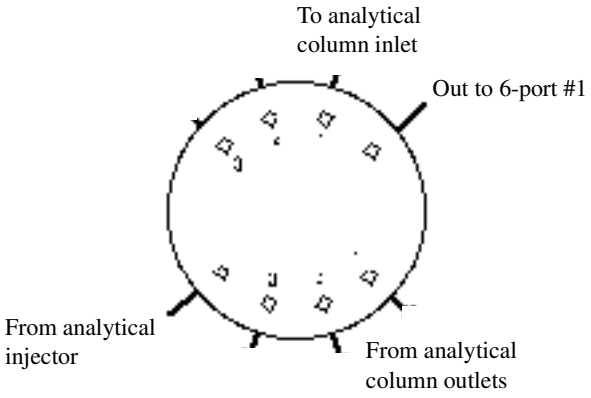
6-port analytical-to-prep valve in the preparative position

The following schematic shows the 6-port analytical-to-prep valve in the preparative position.



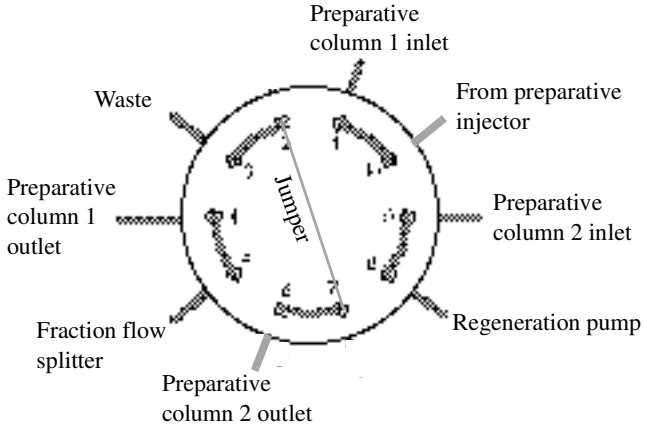
8-port analytical column selection valve

The following schematic shows the 8-port analytical column selection valve.



10-port preparatory column selection valve

The following schematic shows the 10-port preparatory column selection valve.



Using the UV Fraction Manager

The Waters UV Fraction Manager is available for use with UV-directed AutoPurification systems. See the instruction sheet supplied with the UV Fraction Manager for further information.


Caution: You *must* use the UV Fraction Manager with the provided shield.

Enabling leak detection

The optional system-level AutoPurification leak sensing consists of liquid sensors with mounting brackets, tubing, and a control module in the System Fluidics Organizer. A Waters Field Service Engineer installs the control module and places sensors where leaks are most likely to occur, such as in the drip trays of the following components:

- System Fluidics Organizer
- 2545 Binary Gradient Module
- Detectors

Requirement: Sensors must be mounted in brackets to operate properly.

When a leak occurs, the component's drip tray collects solvent and directs that solvent through tubing to a sensor. The sensor signals the control module, which signals the pump to stop the solvent flow.

Tip: A green light on the sensor indicates proper function (no leak detected). A red light indicates a leak.

Tip: Make sure that liquid can drain properly through the tubing and that the tubing lacks air traps.


Caution: When waste tubes have air traps (vapor locks), they will drain inadequately, and fluid might spill from the drip trays.

The optional leak sensor module requires no scheduled maintenance.

Installing a leak detection sensor

To install a leak detection sensor:

1. Slide the sensor module mounting bracket onto the two plastic mounting pins on the drip tray.
2. Align the projections in the sensor body with the notches of the mounting brackets, and slide until you feel a click.

Caution: When installing the sensor, always grasp the sensor body.

Tip: Mount the sensor in the brackets properly. The light on an improperly mounted sensor remains red, indicating a leak.

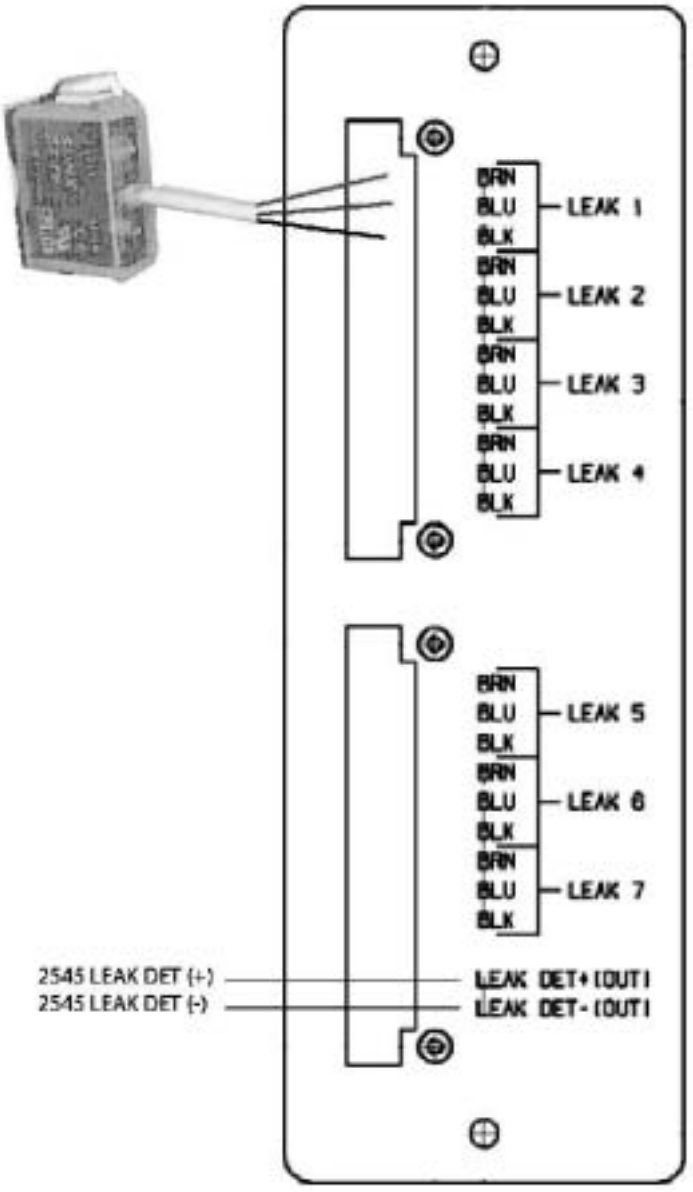
Connecting additional leak detection sensors

Caution: Power to the System Fluidics Organizer must be off before connecting or disconnecting any sensor leads.

To connect additional leak detection sensors:

1. Connect the wires at the ends of the sensor module cables to the terminal strips at the rear of the instrument as shown in the following diagram.

Rear panel sensor connections



2. Route the remaining leak sensor leads to the proper instrument drip trays, and install the brackets and sensors in the drip trays as described in the preceding "Installing a leak detection sensor" section.
3. Open the front panel of the System Fluidics Organizer to access the leak detection module switches.
4. Lift the small rubber cover from the front of the sensor module.

   Tip: Positions are numbered to match connector locations.
5. To activate the installed sensors, position the corresponding toggle switch to the left (ON).

Connecting a leak detection sensor to the system to stop flow

1. Connect a signal lead cable from the System Fluidics Organizer LEAK DET Out (+) and the LEAK DET (-) to the 2545 Binary Gradient module LEAK DET (+) and (-) terminals.

Addressing a leak

To address a leak:

1. Remove the sensor.

Caution: Never pull the cable to remove the sensor from the bracket.

2. Wipe the sensor dry, or blow it dry with nitrogen gas.

   Tip: To return the sensor to green-light status (no leak detected), be sure to dry the drip tray around the sensor bracket.

3 Configuring the System Fluidics Organizer

This chapter explains how to configure the System Fluidics Organizer. Before you can perform a run, you must set parameters so that MassLynx can control the components of your Waters AutoPurification System.

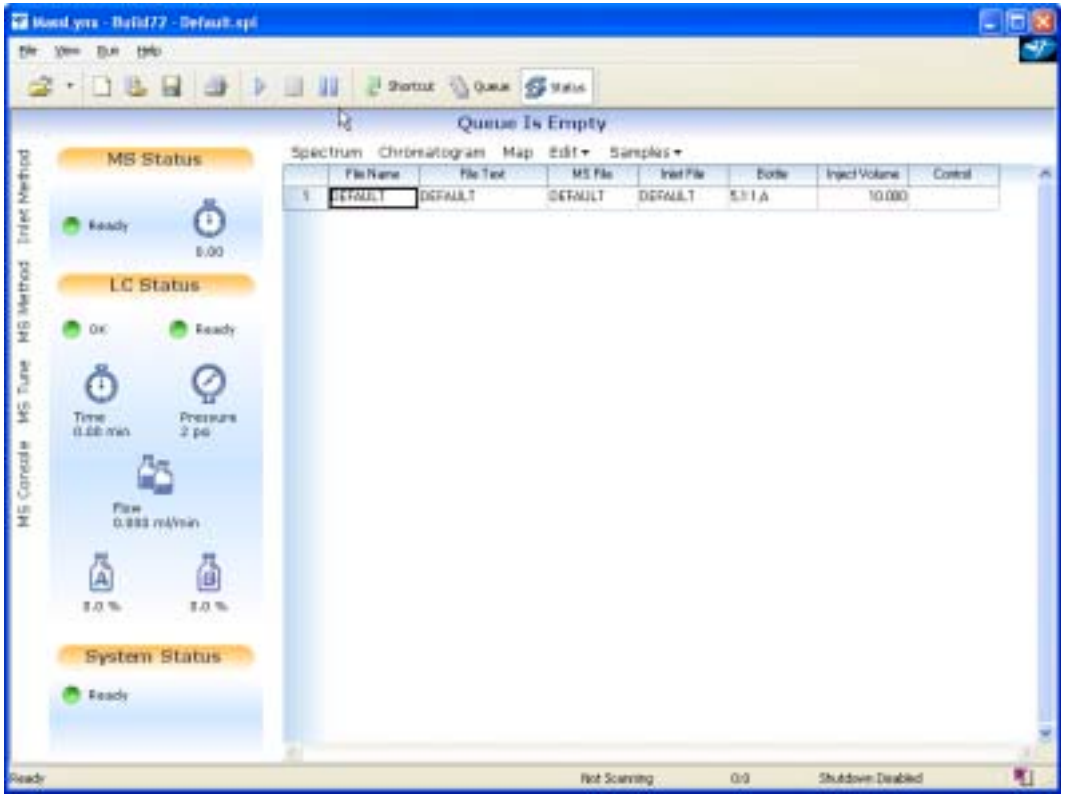
Contents:

Configuring instruments

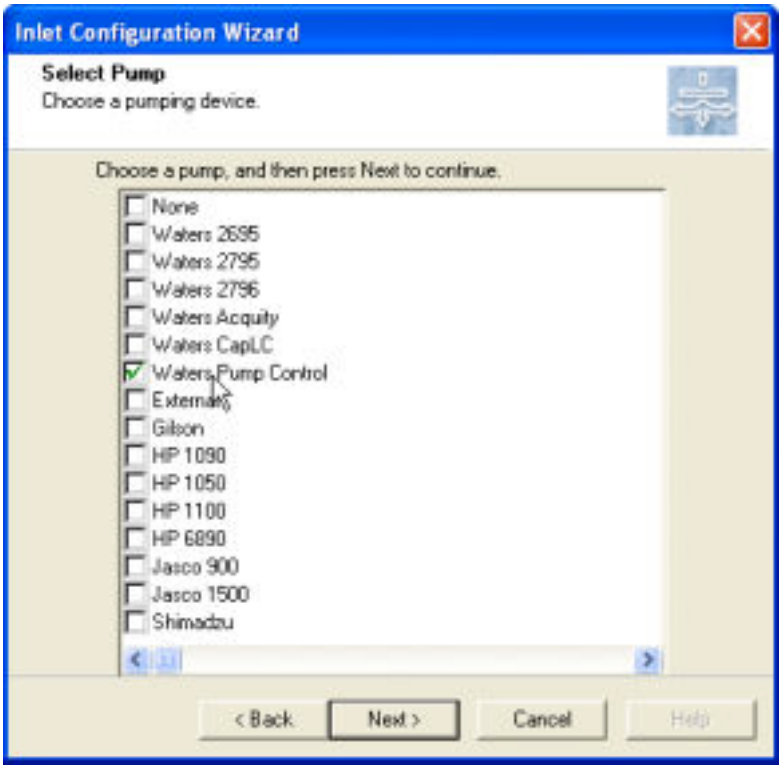
When you first set up the System Fluidics Organizer, you must configure the accompanying MassLynx software to electronically include device in the AutoPurification System. You can then scan all instruments connected to the AutoPurification System to ensure they are communicating with the system. Scanning also retrieves connected instruments' serial number information.

To enable instruments and retrieve serial numbers:

1. From the PC's main menu, click Start > Programs > MassLynx > MassLynx, or double-click the MassLynx icon on the desktop.

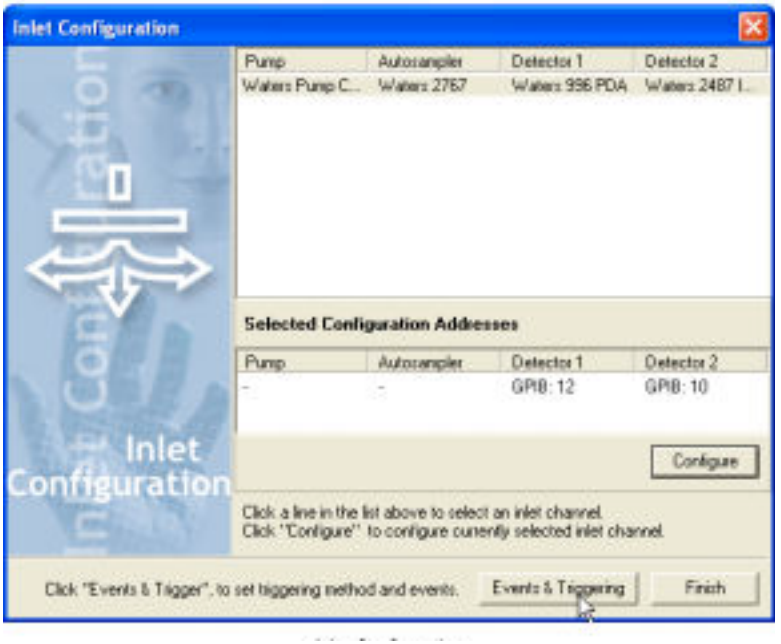


2. Click the Inlet Method tab.
3. From the Tools menu, select Instrument Configuration.
4. Click Configure to open the Inlet Configuration wizard.
5. Click Next.



6. On the Select Pump page, click the pumps to configure (Waters Pump Control).

7. Click Next.
8. On the Select Auto Sampler page, click to select an autosampler device.
9. Click Next.
10. On the Select Detectors page, click to select the detectors to configure.
11. Click Next.
12. From the drop-downs on the Configure Communications page, choose a detector address and an IEEE address.
13. Click Next.
14. Click Finish.



15. Click Events & Triggering.

16. In the Events and Triggering wizard, click Next.

    Tip: Event options appear only when the AutoPurification System has a mass spectrometry device connected. Otherwise, they gray out.

17. For mass-directed systems, on the Choose Events page select the input/output events.

18. Click Next.

19. On the Choose Triggering Method page, choose triggering methods recommended for basic installations.

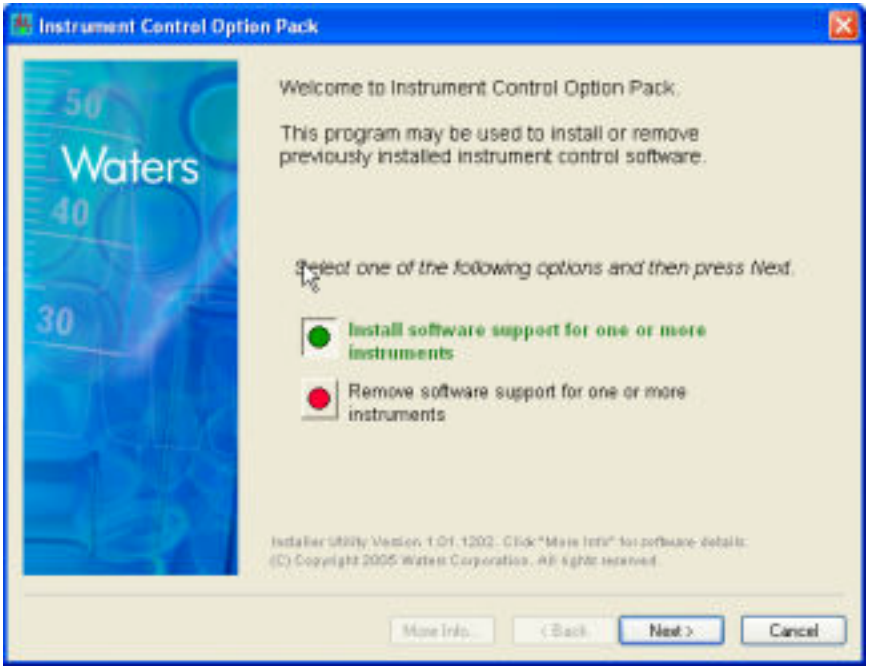
    Tip: By default, triggering is by software. Other applications may require other combinations.

20. Click Next.

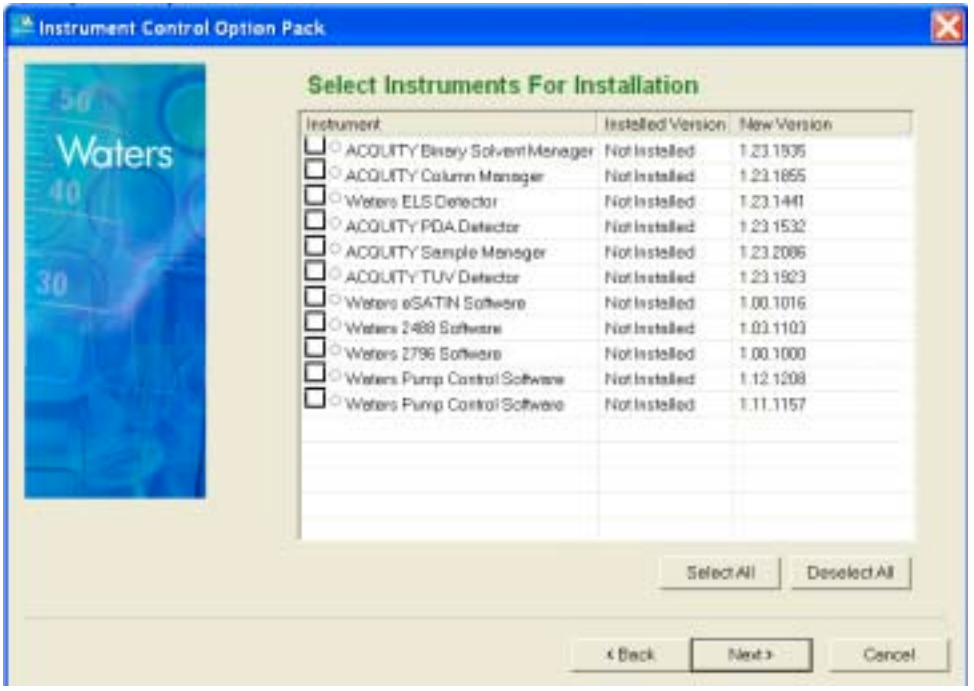
21. Click Finish.

22. Click Finished.

    Tip: The following screen appears only when modules require the Instrument Control Option Pack.

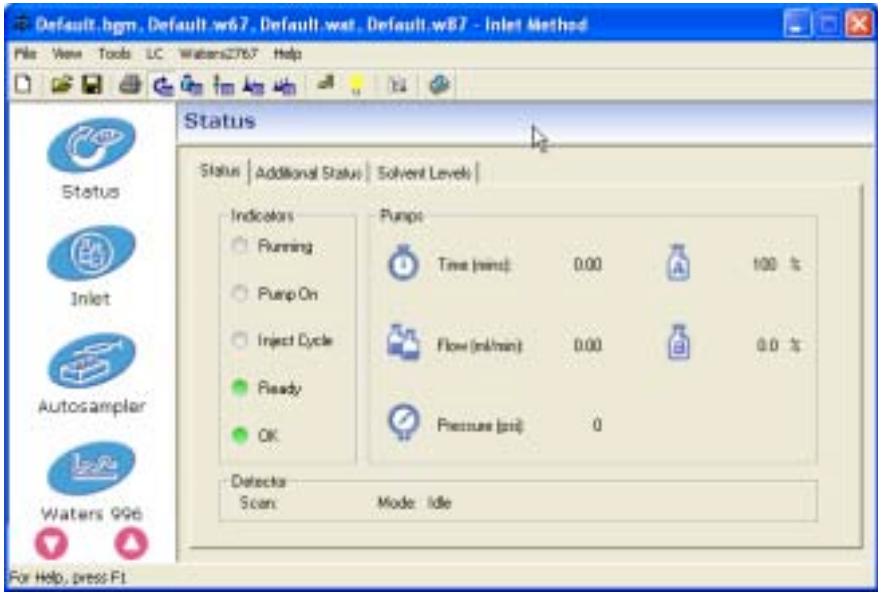


23. Click Next.

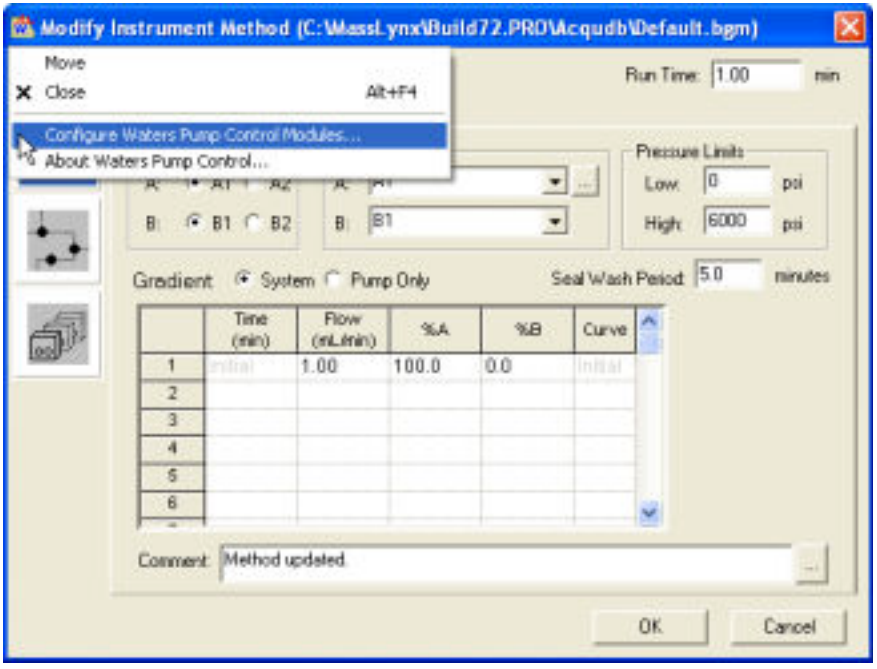


24. Click to select the instruments for installation.
25. Click Next.
26. Click Yes.

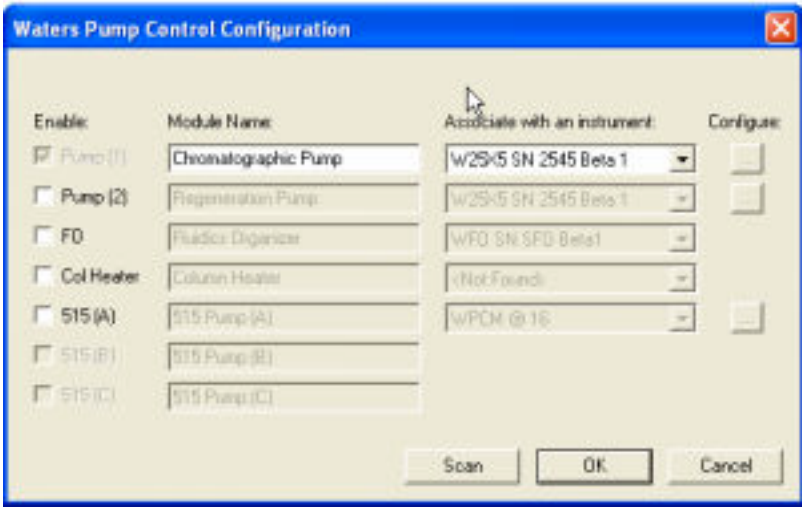
27. Click Finish.



28. Click the Inlet lozenge.



29. In the upper-left corner of the title bar, click the Waters icon, and click Configure Waters Pump Control Modules....



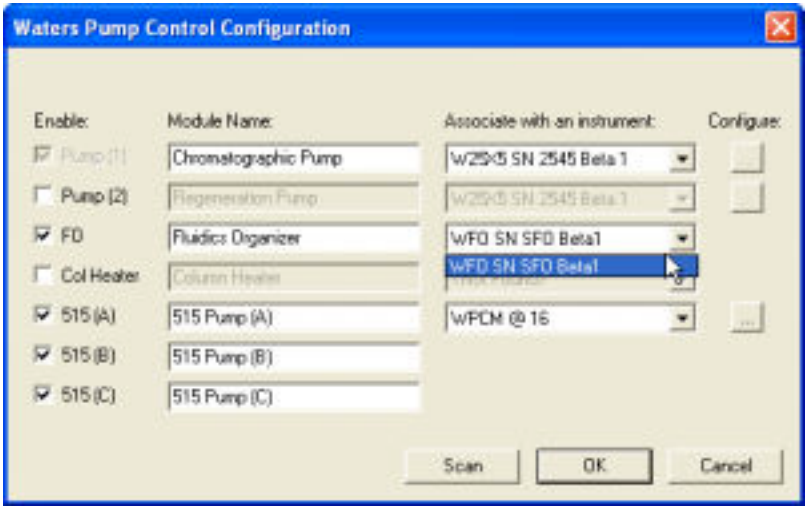
30. Click Scan.

    Tip: Allow all devices to scan in before proceeding.

31. Click Close.

32. From the drop-downs, click the system components.

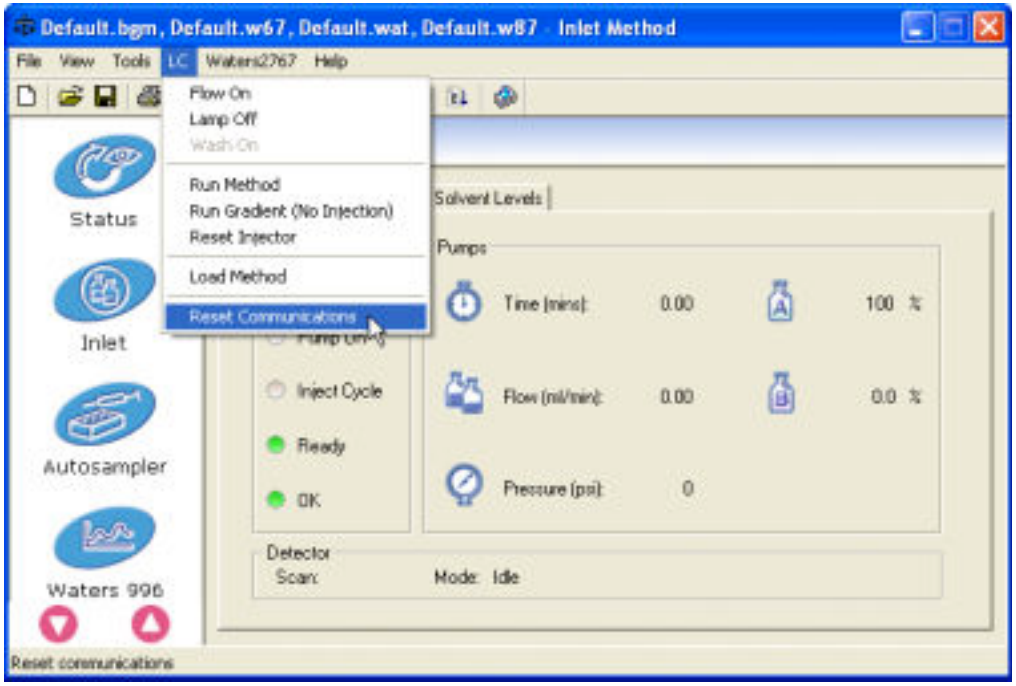
    Tip: Be sure to select the appropriate serial numbers for each instrument.



33. To select a head size for proper flow rate, click the Configure button to the right of the drop-down list.

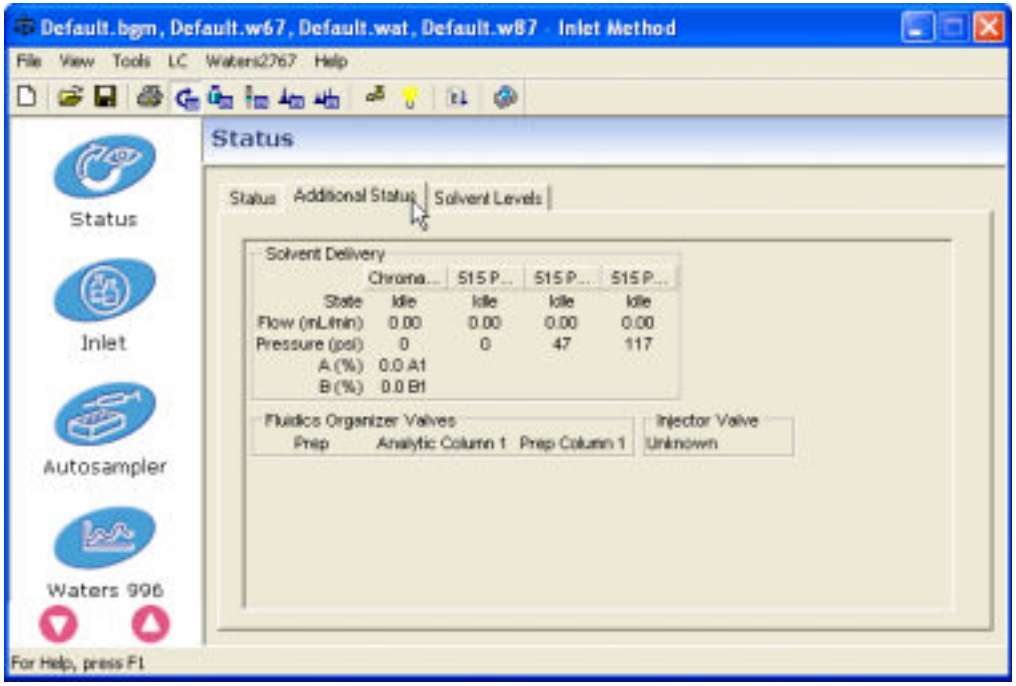
34. Click OK.

35. To reset communications, click OK.



36. In the Inlet Method Editor, from the LC menu click Reset Communications.

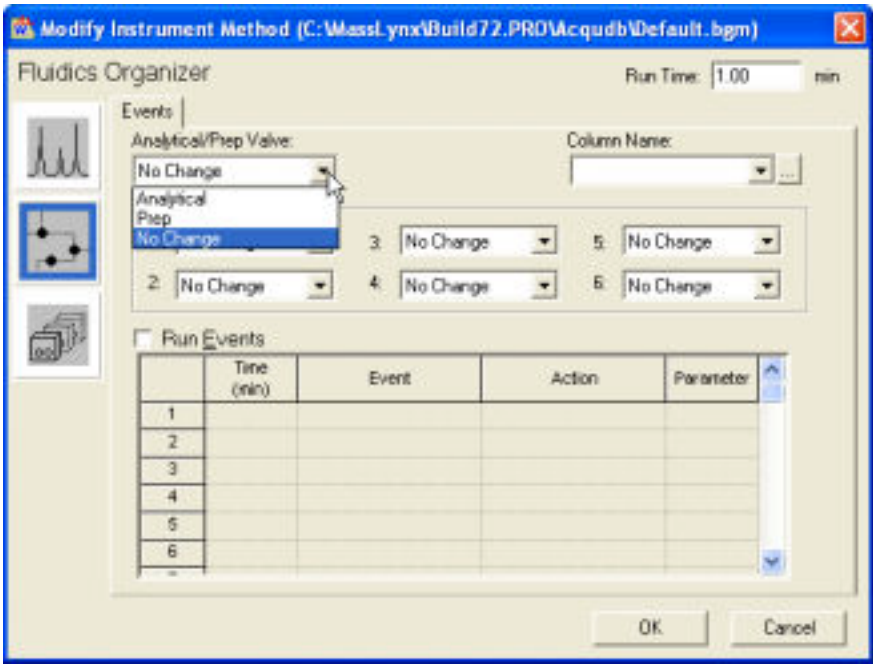
37. Click Additional Status. The Inlet Method Editor shows system status.



Entering events information

To enter events information:

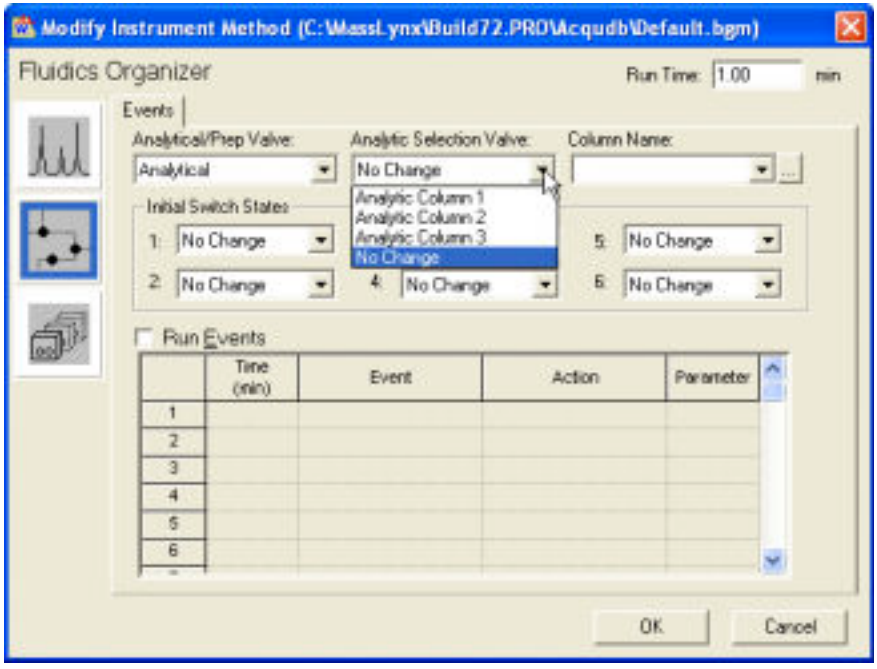
1. In the Inlet Method Editor, click the System Fluidics Organizer icon.



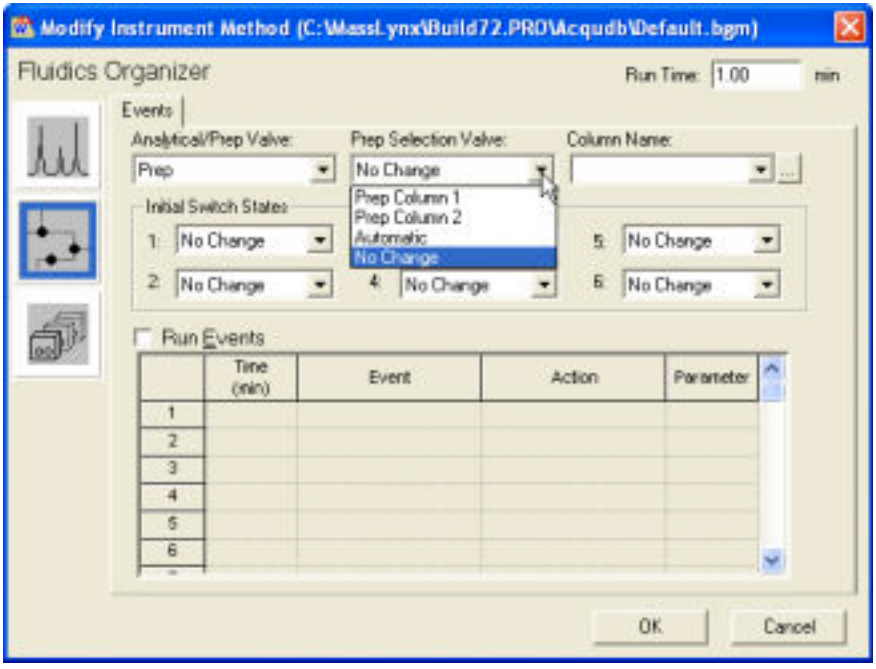
2. From the Analytical/Prep Valve drop-down box, select a valve type (Analytical or Prep).

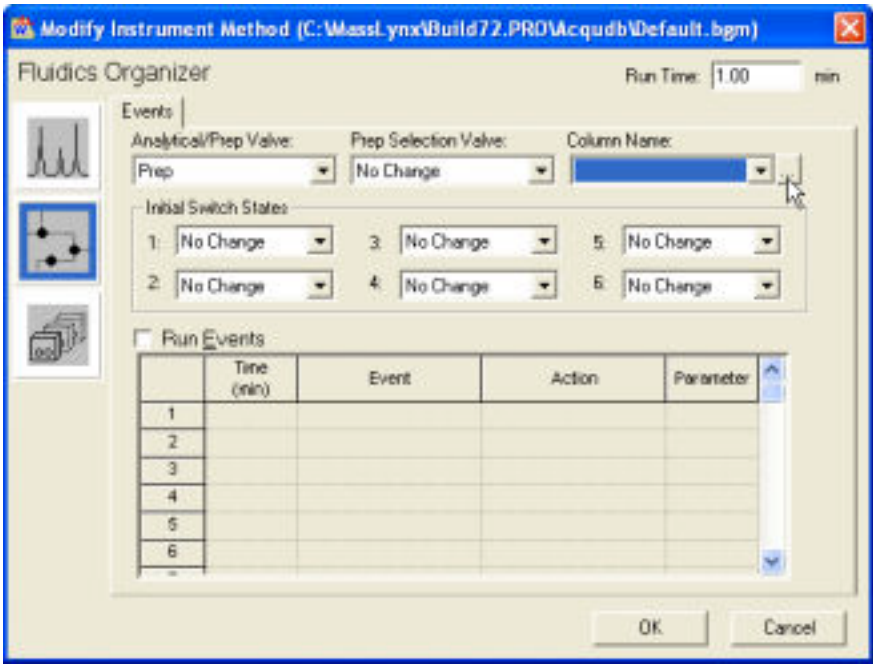
   Tip: Your selection in the Analytical/Prep Valve drop-down box drives subsequent options.

When you select Analytical from the Analytical/Prep Valve drop-down box, in the Analytic Selection Valve drop-down box you can choose from the System Fluidics Organizer's three analytical columns.

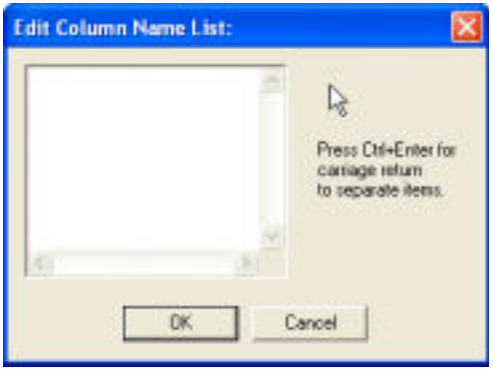


When you select Prep from the Analytical/Prep Valve drop-down box, in the Prep Selection Valve drop-down box you can choose from the System Fluidics Organizer's two preparatory columns.





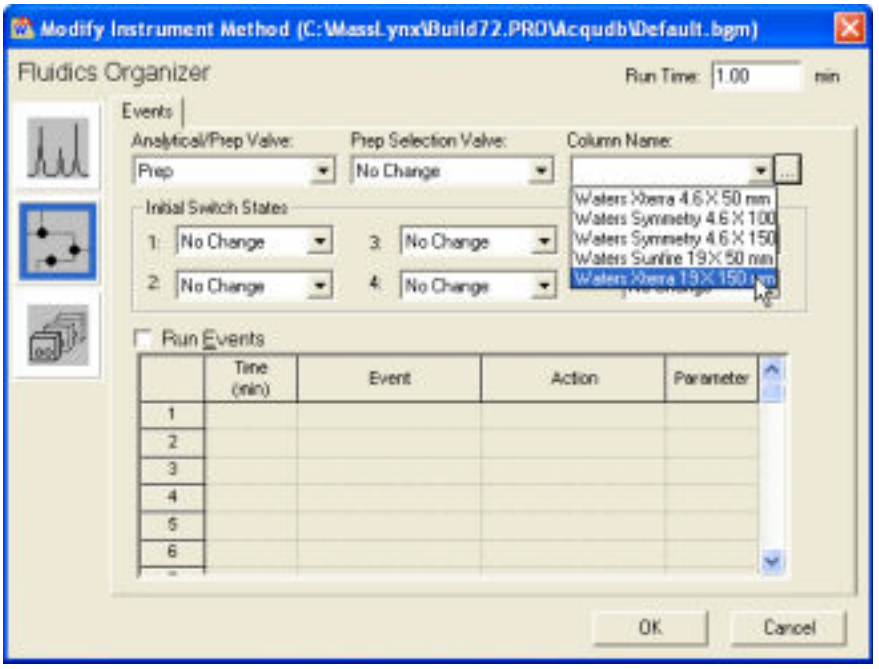
3. To the right of the Column Name drop-down box, click the ellipsis.



4. Click in the text box, and enter a column name.

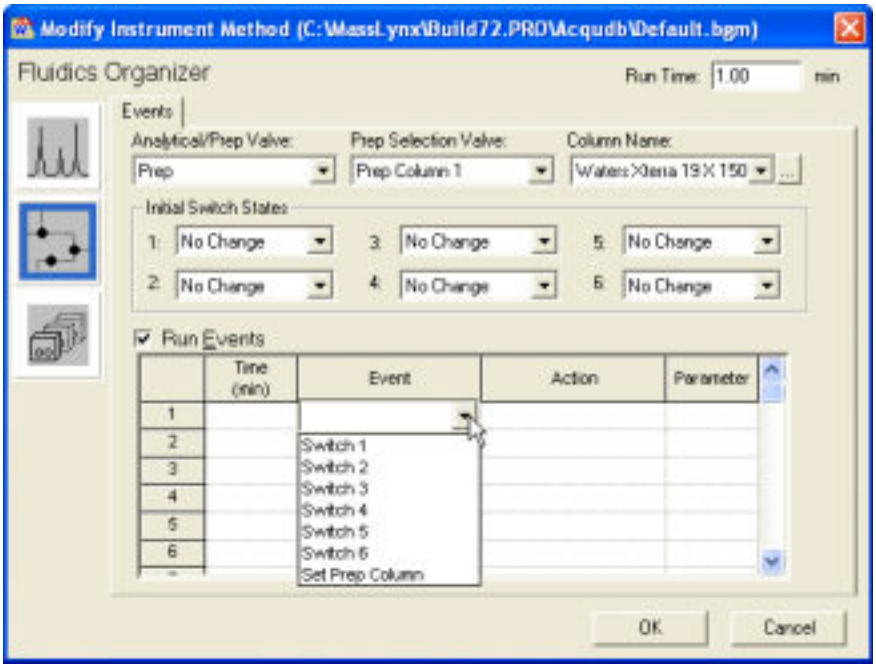
   Tip: The text you enter here defines the columns you selected in the preceding steps, so use descriptive names.

5. Click OK.



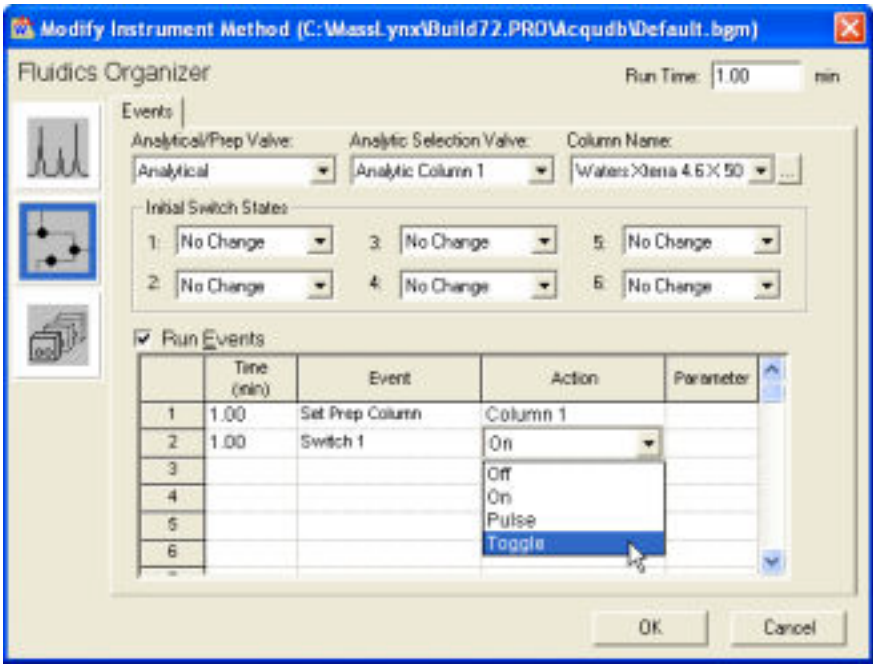
6. From the Column Name drop-down box, select the column name you entered.

7. Click OK.



8. Ensure the Run Events checkbox is selected when running events.

9. From the Event drop-down box, choose events.



10. From the Action drop-down box, choose an action.
11. Click OK.

4 Maintaining the System Fluidics Organizer

This chapter presents routine maintenance procedures you can perform to ensure the System Fluidics Organizer consistently provides accurate results.

Contents:

Identifying maintenance considerations

Safety and handling

Warning: To prevent injury, always observe good laboratory practices when you handle solvents, change tubing, or operate the System Fluidics Organizer. Know the physical and chemical properties of the solvents you use. See the Material Safety Data Sheets for the solvents in use.

Warning: To avoid electric shock, do not open the System Fluidics Organizer side panel. No user-serviceable parts are inside.

Spare parts

Waters recommends that you replace only parts mentioned in this document. For spare parts details, see the Waters Quality Parts Locator on the Waters Web site's Services/Support page.

Outlining maintenance procedures

Perform the procedures in this section when you discover a problem with a component in the solvent delivery device. For information about isolating problems in the solvent delivery device, see Chapter 5.

Warning: To prevent injury, always observe good laboratory practices when handling solvents, changing tubing, or operating the System Fluidics Organizer. Know the physical and chemical properties of the solvents you use. See the Material Safety Data Sheets for the solvents in use.

Maintaining the System Fluidics Organizer involves replacing the valve rotors and stator faces.

Replacing the valve rotors and stator faces

Tip:: For information on isolating problems in the System Fluidics Organizer, see Chapter 5.

This procedure involves replacing the valve rotors and stator faces.

Required materials

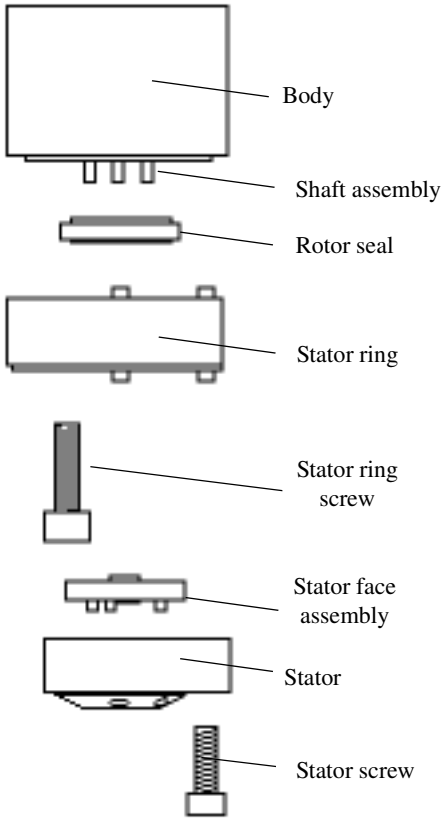
- Rebuild kit, 6-port
- Rebuild kit, 8-port
- Rebuild kit, 10-port
- Squeeze bottle with 100% alcohol (isopropanol recommended)
- Hex key

To replace the valve rotors and stator faces:

1. Remove the three stator screws with the hex key.

   Tip:: The stator screws are 9/64-inch for the 6-port valve and 3/32-inch for the 10-port valve.

Assembly

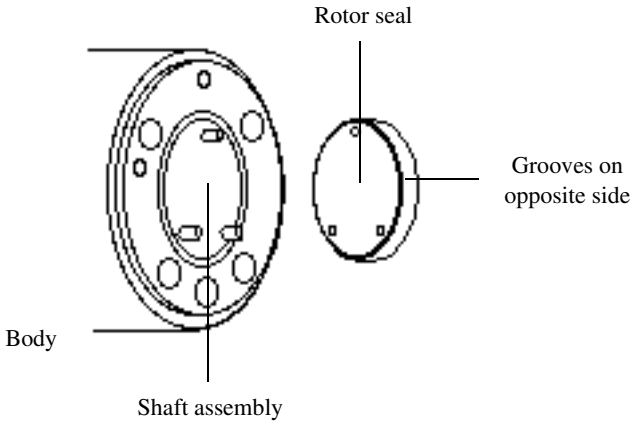


2. Remove the stator and stator face assembly from the stator ring (the stator face assembly may remain on the stator).
3. Remove the stator ring screws, if needed.

   Tip: The stator ring screws are 9/64-inch for the 6-port valve and 3/32-inch for the 10-port valve.
4. Remove the stator ring.
5. Pull the rotor seal off the pins.

6. Mount the new rotor seal with the grooves facing the stator. The three pins on the shaft assembly fit into the mating holes in the rotor seal only one way.

Rotor seal



7. Replace the stator ring so that the two short pins on the ring enter the mating holes in the body.
8. Replace the stator ring screws, if needed.
9. Mount the new stator face assembly on the stator. The pins on the assembly fit into the mating holes in the stator only one way.
10. Replace the stator and stator face assembly on the valve so that the pin in the stator ring enters the mating hole in the stator.
11. Replace the three stator screws in the stator. Tighten each screw so it is finger-tight, and then tighten it another half-turn.

Reviewing diagnostics and configuration

The diagnostic functions of the MassLynx software include the ability to identify which System Fluidics Organizer is communicating with the diagnostics interface.

Diagnostics menu options:

Menu Option	Description
Manual Control	Provides direct control to System Fluidics Organizer components (e.g., valves) and event switches
Reset SFO	Resets the System Fluidics Organizer
Set Serial Number	Sets the serial number

Menu Option	Description
System Information	Displays firmware release information and installed valve configurations

5 Troubleshooting

Contents:

Proper operating procedures

To keep your System Fluidics Organizer operating properly, follow the operating procedures and guidelines described in Chapter 4.

Spare parts

Waters recommends that you replace only parts mentioned in this document. For spare parts details, see the Waters Quality Parts Locator on the Waters Web site's Services/Support page.

Safety and handling

Warning: To prevent injury, always observe good laboratory practices when you handle solvents, change tubing, or operate the System Fluidics Organizer. Know the physical and chemical properties of the solvents you use. See the Material Safety Data Sheets for the solvents in use.

System troubleshooting

To perform system troubleshooting, follow these basic steps:

1. Examine the system, first considering likely causes of the problem. Unresponsive instruments might mean that power or signal cables are disconnected or improperly connected. Similarly, a fluid or vacuum leak might indicate defective plumbing connections.
2. Compare current system operation with the way the system operated before the problem arose. To identify normal operating conditions, maintain a daily log, noting overall system performance. Specifically, measure the performance of individual instruments using known samples, preferably the ones used for instrument acceptance.

   To help identify normal system-operating conditions, take these actions:

   - Create a map of your liquid chromatography system (tubing and electrical connections).
   - Keep a daily log, tracking system parameters and chromatography results during normal operation. When your system is installed, and each time you develop a new method, record system conditions.
   - Run test chromatograms regularly.
3. Identify, in the following order, the symptom that varies from normal system operation:

   - System pressure (high, low, or erratic)
   - Baseline (irregularities can arise from problems with the fluid path or detector electronics)
   - Changes in peak retention time (incorrect or changing over time)
   - Loss of peak resolution

- Abnormal peak shape (smaller than expected, broad, tailing, and so on)
- Incorrect qualitative or quantitative results

4. For each symptom, identify a list of suspected causes. For suggested troubleshooting procedures, see the following “Troubleshooting hardware” section.
5. Run the performance tests for each chromatographic instrument to quickly determine whether a system instrument has a problem.
6. See the troubleshooting information in the following “Troubleshooting Hardware” section, which is organized according to the parameters in step 3 and helps you narrow the possible causes of a symptom and find suggested corrective actions.
7. If you isolate a problem to another system component, see that component’s operator's guide.

When to call Waters Technical Service

Many problems are easily corrected. If you are located in the USA or Canada, report malfunctions or other problems to Waters Technical Service (800-252-4752). If you are located anywhere else, phone Waters’ corporate headquarters in Milford, Massachusetts (USA), or contact your local Waters subsidiary. Our Web site includes phone numbers and e-mail addresses for Waters locations worldwide. Go to www.waters.com, and click About Waters > Worldwide Offices.

However you contact Waters, be prepared to provide this information:

- Completed normal operation checklist for the method you are using
- Nature of the symptom
- Waters System Fluidics Organizer serial number
- Flow rate(s)
- Operating pressure(s)
- Mobile phase(s)
- Detector settings
- Type(s) and serial number(s) of column(s)
- Sample type

- Control mode (MassLynx software, FractionLynx software, No interaction, or other)
- Software version and serial number

Troubleshooting hardware

The following table offers suggestions for solving hardware problems in the System Fluidics Organizer. When these suggestions fail to solve a problem, see the “When to call Waters Technical Service” section earlier in this chapter.

Symptom	Possible Cause	Corrective Action
Unit does not power on.	Power cord not connected.	Check power cord.
	No power at outlet.	Check line voltage.
	Power supply fuse blown or missing.	Replace power supply fuse.
Front panel LED not functioning.	Power cord not connected.	Check power cord.
	No power at outlet.	Check line voltage.
	Power supply fuse blown or missing.	Replace power supply fuse.
Startup diagnostics fail.	Internal problem with controller board, solvent management system, sample management system.	Check rear panel cable connections. Power off and on again. If failure persists, call Waters Technical Service.
Fans not running.	Unit not powered on.	Power on unit.
	Fan wiring or fan motor problem.	Call Waters Technical Service.
	Power supply not working.	Call Waters Technical Service.

(Continued)

Symptom	Possible Cause	Corrective Action
Analytical-to-prep valve does not move.	Missing power or signal connector.	Check the power and signal connections. Check the fuse and replace, if needed.
	Defective power supply.	Call Waters Technical Service.
	Defective personality PCB.	Call Waters Technical Service.
	Defective valve.	Call Waters Technical Service.
	Worn rotor causing high friction.	Rebuild valve.
Analytical-to-prep valve appears blocked.	Rotor seal clogged.	Rebuild valve.
Analytical-to-prep valve leaks.	Stator screws are loose.	Tighten stator screws.
	Defective rotor seal.	Rebuild valve.
Analytical-to-prep valve has high pressure, which prompted AutoPurification System shutdown.	Clogged rotor.	Rebuild valve.
Column selection valve does not move.	Missing power or signal connector.	Check the power and signal connections. Check the fuse and replace, if needed.
	Defective power supply.	Call Waters Technical Service.
	Defective personality PCB.	Call Waters Technical Service.
	Defective valve.	Call Waters Technical Service.
	Worn rotor causing high friction.	Rebuild valve.

(Continued)

Symptom	Possible Cause	Corrective Action
Column selection valve appears blocked.	Rotor seal clogged.	Rebuild valve.
Column selection valve leaks.	Stator screws are loose.	Tighten stator screws.
	Defective rotor seal.	Rebuild valve.
Column selection valve has high pressure, which prompted AutoPurification System shutdown.	Clogged rotor seal.	Rebuild valve.
Connection tubing is leaking.	Worn fitting.	Replace fitting or tubing.
Connection tubing is blocked.	System not thoroughly flushed out.	Replace tubing.
Intermittent errors or erratic behavior.	Loose cable connection or damaged cable.	Check and fix any loose cable connections.
The 515 pump fails to pump.	The 515 pump is not in Remote mode.	Set the 515 pump to Remote at the front panel.
	The 515 pump is not in Run mode.	Set the 515 pump to Run at the front panel.

A Safety advisories

Waters instruments display hazard symbols designed to alert you to the hidden dangers of operating and maintaining the instruments. Their corresponding user guides also include the hazard symbols, with accompanying text statements describing the hazards and telling you how to avoid them. This appendix presents all the safety symbols and statements that apply to the entire line of Waters products.

Contents

Warning symbols

Warning symbols alert you to the risk of death, injury, or seriously adverse physiological reactions associated with an instrument's use or misuse. Heed all warnings when you install, repair, and operate Waters instruments. Waters assumes no liability for the failure of those who install, repair, or operate its instruments to comply with any safety precaution.

Task-specific hazard warnings

The following warning symbols alert you to risks that can arise when you operate or maintain an instrument or instrument component. Such risks include burn injuries, electric shocks, ultraviolet radiation exposures, and others.

When the following symbols appear in a manual's narratives or procedures, their accompanying text identifies the specific risk and explains how to avoid it.

Warning: (General risk of danger. When this symbol appears on an instrument, consult the instrument's user documentation for important safety-related information before you use the instrument.)

Warning: (Risk of burn injury from contacting hot surfaces.)

Warning: (Risk of electric shock.)

Warning: (Risk of fire)

Warning: (Risk of needle puncture.)

Warning: (Risk of injury caused by moving machinery.)

Warning: (Risk of exposure to ultraviolet radiation.)

Warning: (Risk of contacting corrosive substances.)

Warning: (Risk of exposure to a toxic substance.)

Warning: (Risk of personal exposure to laser radiation.)

Warning: (Risk of exposure to biological agents that can pose a serious health threat.)

Warnings that apply to particular instruments, instrument components, and sample types

The following warnings can appear in the user manuals of particular instruments and on labels affixed to them or their component parts.

Burst warning

This warning applies to Waters instruments fitted with nonmetallic tubing.

Warning: Pressurized nonmetallic, or polymer, tubing can burst. Observe these precautions when working around such tubing:

- Wear eye protection.
- Extinguish all nearby flames.
- Do not use tubing that is, or has been, stressed or kinked.
- Do not expose nonmetallic tubing to incompatible compounds like tetrahydrofuran (THF) and nitric or sulfuric acids.
- Be aware that some compounds, like methylene chloride and dimethyl sulfoxide, can cause nonmetallic tubing to swell, which significantly reduces the pressure at which the tubing can rupture.

Biohazard warning

This warning applies to Waters instruments that can be used to process material that might contain biohazards: substances that contain biological agents capable of producing harmful effects in humans.

Warning: Waters's instruments and software can be used to analyze or process potentially infectious human-sourced products, inactivated microorganisms, and other biological materials. To avoid infection with these agents, assume that all biological fluids are infectious, observe good laboratory practices and, consult your organization's biohazard safety representative regarding their proper use and handling. Specific precautions appear in the latest edition of the US National Institutes of Health (NIH) publication, *Biosafety in Microbiological and Biomedical Laboratories* (BMBL).

Chemical hazard warning

This warning applies to Waters instruments that can process corrosive, toxic, flammable, or other types of hazardous material.

Warning: Waters instruments can be used to analyze or process potentially hazardous substances. To avoid injury with any of these materials, familiarize yourself with the materials and their hazards, observe Good Laboratory Practices (GLP), and consult your organization's safety representative regarding proper use and handling. Guidelines are provided in the latest edition of the National Research Council's publication, *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals.*

Caution symbol

The caution symbol signifies that an instrument's use or misuse can damage the instrument or compromise a sample's integrity. The following symbol and its associated statement are typical of the kind that alert you to the risk of damaging the instrument or sample.

Caution: To avoid damage, do not use abrasives or solvents to clean the instrument's case.

Warnings that apply to all Waters instruments

When operating this device, follow standard quality control procedures and the equipment guidelines in this section.

Attention: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Important: Toute modification sur cette unité n'ayant pas été expressément approuvée par l'autorité responsable de la conformité à la réglementation peut annuler le droit de l'utilisateur à exploiter l'équipement.

Achtung: Jedwede Änderungen oder Modifikationen an dem Gerät ohne die ausdrückliche Genehmigung der für die ordnungsgemäße Funktionstüchtigkeit verantwortlichen Personen kann zum Entzug der Bedienungsbefugnis des Systems führen.

Avvertenza: eventuali modifiche o alterazioni apportate a questa unità e non espressamente approvate da un ente responsabile per la conformità annulleranno l'autorità dell'utente ad operare l'apparecchiatura.

Atencion: cualquier cambio o modificación efectuado en esta unidad que no haya sido expresamente aprobado por la parte responsable del cumplimiento puede anular la autorización del usuario para utilizar el equipo.

注意：未經有關法規認證部門允許對本設備進行的改變或修改，可能會使使用者喪失操作該設備的權利。

注意：未经有关法规认证部门明确允许对本设备进行的改变或改装，可能会使使用者丧失操作该设备的合法性。

주의 : 기기 검교정 담당자의 승인 없이 무단으로 기기를 변경 또는 수정하는 경우에는, 그 기기 운영에 대한 허가가 취소될 수 있습니다.

注意：規制機関から明確な承認を受けずに本装置の変更や改造を行うと、本装置のユーザとしての承認が無効になる可能性があります。

Warning: Use caution when working with any polymer tubing under pressure:

- Always wear eye protection when near pressurized polymer tubing.
- Extinguish all nearby flames.
- Do not use tubing that has been severely stressed or kinked.
- Do not use nonmetallic tubing with tetrahydrofuran (THF) or concentrated nitric or sulfuric acids.
- Be aware that methylene chloride and dimethyl sulfoxide cause nonmetallic tubing to swell, which greatly reduces the rupture pressure of the tubing.

Attention: Manipulez les tubes en polymère sous pression avec precaution:

- Portez systématiquement des lunettes de protection lorsque vous vous trouvez à proximité de tubes en polymère pressurisés.
- Eteignez toute flamme se trouvant à proximité de l'instrument.
- Evitez d'utiliser des tubes sévèrement déformés ou endommagés.
- Evitez d'utiliser des tubes non métalliques avec du tétrahydrofurane (THF) ou de l'acide sulfurique ou nitrique concentré.
- Sachez que le chlorure de méthylène et le diméthylesulfoxyde entraînent le gonflement des tuyaux non métalliques, ce qui réduit considérablement leur pression de rupture.

Vorsicht: Bei der Arbeit mit Polymerschläuchen unter Druck ist besondere Vorsicht angebracht:

- In der Nähe von unter Druck stehenden Polymerschläuchen stets Schutzbrille tragen.
- Alle offenen Flammen in der Nähe löschen.
- Keine Schläuche verwenden, die stark geknickt oder überbeansprucht sind.
- Nichtmetallische Schläuche nicht für Tetrahydrofuran (THF) oder konzentrierte Salpeter- oder Schwefelsäure verwenden.
- Durch Methylenchlorid und Dimethylsulfoxid können nichtmetallische Schläuche quellen; dadurch wird der Berstdruck des Schlauches erheblich reduziert.

Attenzione: prestare attenzione durante l'utilizzo dei tubi di polimero pressurizzati:

- Indossare sempre occhiali da lavoro protettivi nei pressi di tubi di polimero pressurizzati.
- Estinguere ogni fonte di ignizione circostante.
- Non utilizzare tubi soggetti che hanno subito sollecitazioni eccessive o son stati incurvati.
- Non utilizzare tubi non metallici con tetraidrofurano (THF) o acido solforico o nitrico concentrato.
- Tenere presente che il cloruro di metilene e il dimetilsolfossido provocano rigonfiamento nei tubi non metallici, riducendo notevolmente la resistenza alla rottura dei tubi stessi.

Advertencia: se recomienda precaución cuando se trabaje con tubos de polímero sometidos a presión:

- El usuario deberá protegerse siempre los ojos cuando trabaje cerca de tubos de polímero sometidos a presión.
- Si hubiera alguna llama las proximidades.
- No se debe trabajar con tubos que se hayan doblado o sometido a altas presiones.
- Es necesario utilizar tubos de metal cuando se trabaje con tetrahidrofurano (THF) o ácidos nítrico o sulfúrico concentrados.
- Hay que tener en cuenta que el cloruro de metileno y el sulfóxido de dimetilo dilatan los tubos no metálicos, lo que reduce la presión de ruptura de los tubos.

警告：當在有壓力的情況下使用聚合物管線時，小心注意以下幾點：

- 當接近有壓力的聚合物管線時一定要戴防護眼鏡。
- 熄滅附近所有的火焰。
- 不要使用已經被壓癟或嚴重彎曲管線。
- 不要在非金屬管線中使用四氫呋喃或濃硝酸或濃硫酸。
- 要了解使用二氯甲烷及二甲基亞楓會導致非金屬管線膨脹，大大降低管線的耐壓能力。

警告：当在有压力的情况下使用管线时，小心注意以下几点：

- 当接近有压力的聚合物管线时一定要戴防护眼镜。
- 熄灭附近所有的火焰。
- 不要使用已经被压瘪或严重弯曲的管线。
- 不要在非金属管线中使用四氢呋喃或浓硝酸或浓硫酸。
- 要了解使用二氯甲烷及二甲基亚枫会导致非金属管线膨胀，大大降低管线的耐压能力。

경고: 폴리머재질의 튜빙을 압력하에서 사용할 때는 다음 사항에 유의하십시오.

- 압력을 받은 폴리머 튜빙 부근에서는 반드시 보호안경을 착용할 것
- 모든 화기의 접근을 금함
- 눌리거나 뒤틀린 튜빙은 사용하지 말 것
- 비금속 튜빙을 테트라히드로퓨란(THF)이나 염산 및 황산과 함께 사용하지 말 것
- 디클로로메탄(methylene chloride)와 디메틸설폭시드(dimethyl sulfoxide)는 비금속 튜빙을 팽창시켜 쉽게 파열되므로 주의할 것

警告：ポリマーチューブに圧力をかけて取り扱う場合は、次のように注意してください。

- 加圧したポリマーチューブの付近では、常に保護めがねを着用してください。
- 付近の火はすべて消してください。
- 激しい応力やねじれを受けたチューブは使用しないでください。
- テトラヒドロフラン（THF）、濃硝酸、あるいは濃硫酸には、非金属製のチューブを使用しないでください。
- ジクロロメタンやジメチルスルホキシドは非金属製のチューブを膨張させ、チューブの破断圧力を大幅に低下させますので、注意してください。

Warning: The user shall be made aware that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Attention: L'utilisateur doit être informé que si le matériel est utilisé d'une façon non spécifiée par le fabricant, la protection assurée par le matériel risque d'être défectueuses.

Vorsicht: Der Benutzer wird darauf aufmerksam gemacht, dass bei unsachgemäßer Verwenddung des Gerätes unter Umständen nicht ordnungsgemäß funktionieren.

Attenzione: l'utente deve essere al corrente del fatto che, se l'apparecchiatura viene usta in un modo specificato dal produttore, la protezione fornita dall'apparecchiatura potrà essere invalidata.

Advertencia: el usuario deberá saber que si el equipo se utiliza de forma distinta a la especificada por el fabricante, las medidas de protección del equipo podrían ser insuficientes.

警告：使用者必須非常清楚如果設備不是按照制造廠商指定的方式使用，那么該設備所提供的保護將被消弱。

警告: 使用者必须非常清楚如果设备不是按照制造厂商指定的方式使用, 那么该设备所提供的保护将被消弱

경고 : 제조사가 지정한 것 이외의 방법으로 기기를 사용하는 경우에는, 사용자가 위험으로부터 보호될 수 없는 경우가 발생할 수 있음에 유념하십시오.

警告: ユーザは製造業者が指定していない方法で装置を使用した場合は装置が提供する保護が損なわれることがあるということを承知しているものとします。

Warning: To protect against fire hazard, replace fuses with those of the same type and rating.

Attention: Remplacez toujours les fusibles par d'autres du même type et de la même puissance afin d'éviter tout risque d'incendie.

Vorsicht: Zum Schutz gegen Feuergefahr die Sicherungen nur mit Sicherungen des gleichen Typs und Nennwertes ersetzen.

Attenzione: per una buona protezione contro i rischi di incendio, sostituire i fusibili con altri dello stesso tipo e amperaggio.

Advertencia: sustituya los fusibles por otros del mismo tipo y características para evitar el riesgo de incendio.

警告：為了避免火災的危險，應更換同种類型及規格的保險絲。

警告: 为了避免火灾的危险, 应更换同种类型及规格的保险丝。

경고 : 화재를 방지하기 위해서는 퓨즈 교체 시 같은 종류, 같은 등급의 것을 사용하십시오.

警告: 火災の危険防止のために、ヒューズの交換は同一タイプおよび定格のもので行なってください。

Warning: To avoid possible electrical shock, disconnect the power cord before servicing the instrument.

Attention: Afin d'éviter toute possibilité de commotion électrique, débranchez le cordon d'alimentation de la prise avant d'effectuer la maintenance de l'instrument.

Vorsicht: Zur Vermeidung von Stromschlägen sollte das Gerät vor der Wartung vom Netz getrennt werden.

Attenzione: per evitare il rischio di scossa elettrica, scollegare il cavo di alimentazione prima di svolgere la manutenzione dello strumento.

Precaución: para evitar descargas eléctricas, desenchufe el cable de alimentación del instrumento antes de realizar cualquier reparación.

警告：要避免觸電，請在修理或保養器材前把電源線拔出。

警告：为避免可能引起得触电危险，在修理前请切断电源连接。

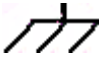
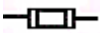
경고: 전기 충격의 가능성을 피하기 위해서는, 기기를 수리하기 이전에 전원 코드를 차단하십시오.

警告：感電の危険性を避けるために、装置の保守を行う前には装置の電源コードを引き抜いてください。

Electrical and handling symbols

Electrical symbols

These can appear in instrument user manuals and on the instrument's front or rear panels.

	Electrical power on
	Electrical power off
	Standby
	Direct current
	Alternating current
	Protective conductor terminal
	Frame, or chassis, terminal
	Fuse
	Recycle symbol: Do not dispose in municipal waste.

Handling symbols

These handling symbols and their associated text can appear on labels affixed to the outer packaging of Waters instrument and component shipments.

	Keep upright!
	Keep dry!
	Fragile!
	Use no hooks!

B Specifications

Contents:

Physical specifications

Item	Specification
Height	16.75 inches (42.6 cm)
Depth (without cables connected at rear)	20.82 inches (52.9 cm)
Width	11.17 inches (28.4 cm)
Weight	22 pounds (9.98 kg) without columns or bottles
Wetted surface materials	316 stainless steel, PEEK, Tefzel

Environmental specifications

Item	Specification
Operating temperature	4 to 40 °C (39.2 to 104 °F).
Humidity	20 to 80%, noncondensing.
Instrument-generated acoustic noise	<56 dBA.
Solvent compatibility	Solvents consistent with materials of construction. Salts and buffers can reduce seal life, especially at pressures over 3,000 psi.
Internal cooling	DC-powered fans provide internal cooling by pulling air through the System Fluidics Organizer and exhausting it out the rear of the unit.
Airflow requirements	Air enters the front bottom of the System Fluidics Organizer so systems can be placed side by side.
Clearance	At least 6 inches between the System Fluidics Organizer and the wall to allow for electrical connections and fan exhaust.

Electrical specifications

Item	Specification
Current requirements	1.8 A
Line voltage	100 to 240 Vac ±10%
Frequency	50/60 Hz
Fuse	3.15 A, 5 x 20 mm, fast-blow, IEC type
Time or user-controllable switch closures S1 to S6	Six controllable contact closures (two terminals per closure) Maximum allowable current = 0.5 A per contact Maximum allowable voltage = 30 Vac Contact resistance = 0.2 ohms Outputs can be controlled from the I/O Events table or directly from the front panel Two modes available from front panel and I/O Events table: On = contact closed Off = contact open Additional modes in the I/O Events table: Pulse = single contact closure for programmable period Toggle = changes the current state
Ground terminals	Connected to signal ground and used as reference for outputs

Instrument control and communication specifications

Item	Specification
Ethernet	Control from external PC
RS-232	Reserved for future use
RS-232 auxiliary	Reserved for future use

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