General Information

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We seriously consider every customer comment we receive. You can reach us at tech_comm@waters.com.
Contacting Waters

Contact Waters® with enhancement requests or technical questions regarding the use, transportation, removal, or disposal of any Waters product. You can reach us via the Internet, telephone, or conventional mail.

Waters contact information:

<table>
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<tbody>
<tr>
<td>Telephone and fax</td>
<td>From the USA or Canada, phone 800 252-4752, or fax 508 872 1990. For other locations worldwide, phone and fax numbers appear in the Waters Web site.</td>
</tr>
</tbody>
</table>
| Conventional mail  | Waters Corporation  
34 Maple Street  
Milford, MA 01757  
USA |

Safety considerations

Some reagents and samples used with Waters instruments and devices can pose chemical, biological, or radiological hazards (or any combination thereof). You must know the potentially hazardous effects of all substances you work with. Always follow Good Laboratory Practice, and consult your organization’s standard operating procedures.

Considerations specific to the system

See also: For additional safety information about ACQUITY® components used with the PATROL UPLC® Production Process Analysis system, consult the system documentation CD.
Laser radiation hazard

**Warning:** To avoid exposure to laser radiation, use caution when performing maintenance operations involving the process sample manager’s internal bar-code reader, which operates using a Class II laser.

High voltage hazard

**Warning:** To avoid electric shock, do not remove the instrument’s top and side protective panels. The components they cover are not user-serviceable.

To avoid shock, use extreme caution when working in areas where this electrical hazard symbol appears.

Pressure

**Warning:** To avoid damage to the “online” sampling system of the process sample manager, limit the inlet pressure from the process source to 6895 kPa (68,948 mbar, 1000 psi) maximum.

Biohazard warning

This warning applies to Waters instruments capable of processing material that can contain biohazards, which are 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).*
Safety advisories

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

Disposal

Do not dispose of system components in municipal waste.

Dispose of system components according to local, state, provincial, federal, and international regulations.

Contact Waters with questions regarding the transportation, removal, or disposal (consistent with the WEEE Directive) of any Waters product.

FCC radiation emissions notice

Changes or modifications not expressly approved by the party responsible for compliance, could void the users authority to operate the equipment. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canada spectrum management emissions notice

This class A digital product apparatus complies with Canadian ICES-001. Cet appareil numérique de la classe A est conforme à la norme NMB-001.

Electrical power safety notice

Do not position the instrument so that it is difficult to operate the disconnecting device.

Warning: To avoid skin contact with toxic or biologically hazardous materials, wear clean, chemical-resistant, powder-free gloves when handling tubing and other parts of the system that come into contact with solvents.
Safety hazard symbol notice

Documentation needs to be consulted in all cases where the symbol is used to find out the nature of the potential hazard and any actions which have to be taken.

Equipment misuse notice

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Safety advisories

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

Operating the system

When operating the PATROL UPLC Production Process Analysis system, follow standard quality control (QC) procedures and the guidelines presented in this section.
Applicable symbols

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<tr>
<td><img src="image" alt="Manufacturer" /></td>
<td>Manufacturer</td>
</tr>
<tr>
<td><img src="image" alt="EC REP" /></td>
<td>Authorized representative of the European Community</td>
</tr>
<tr>
<td><img src="image" alt="CE" /></td>
<td>Confirms that a manufactured product complies with all applicable European Community directives</td>
</tr>
<tr>
<td><img src="image" alt="ETL US" /></td>
<td>Confirms that a manufactured product complies with all applicable United States and Canadian safety requirements</td>
</tr>
<tr>
<td><img src="image" alt="i" /></td>
<td>Consult instructions for use</td>
</tr>
<tr>
<td><img src="image" alt="Electrical and electronic equipment with this symbol may contain hazardous substances and should not be disposed of as general waste. For compliance with the Waste Electrical and Electronic Equipment Directive (WEEE) 2012/19/EU, contact Waters Corporation for the correct disposal and recycling instructions." /></td>
<td>Electrical and electronic equipment with this symbol may contain hazardous substances and should not be disposed of as general waste. For compliance with the Waste Electrical and Electronic Equipment Directive (WEEE) 2012/19/EU, contact Waters Corporation for the correct disposal and recycling instructions.</td>
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Audience and purpose

This document is for personnel who work in a process design or process optimization laboratory environment. It includes procedures for operating and maintaining the PATROL UPLC Production Process Analysis system as process optimization tool.

Intended use of the system

Waters designed the PATROL UPLC Production Process Analysis system for process-development laboratories and manufacturing facilities that pursue
Quality by Design (QbD) initiatives. The systems enable scientists to evaluate the need for enhancing existing processes.

Specifically, the system performs these tasks:

• QC and QA analyses
• Real-time, quantitative analyses of raw, in-process, and final-production samples
• Analyses of control processes, ensuring they yield high-quality products

The PATROL UPLC Production Process Analysis system is not intended for use in diagnostic applications.

**Warning:** To avoid potentially severe injury, do not use the PATROL UPLC Production Process Analysis system in a manner not specified in this guide or that is otherwise inconsistent with the system’s design. Doing so could defeat or impair the function of various integral systems and devices designed to protect the operator from personal injury.

**Calibrating**

To calibrate LC systems, follow acceptable calibration methods using at least five standards to generate a standard curve. The concentration range for standards must include the entire range of QC samples, typical specimens, and atypical specimens.

**Quality control**

Routinely run three QC samples that represent subnormal, normal, and above-normal levels of a compound. If sample trays are the same or very similar, vary the location of the QC samples in the trays. Ensure that QC sample results fall within an acceptable range, and evaluate precision from day to day and run to run. Data collected when QC samples are out of range might not be valid. Do not report these data until you are certain that the instrument performs satisfactorily.
ISM classification

ISM Classification: ISM Group 1 Class A

This classification has been assigned in accordance with IEC CISPR 11 Industrial Scientific and Medical (ISM) instruments requirements. Group 1 products apply to intentionally generated and/or used conductively coupled radio-frequency energy that is necessary for the internal functioning of the equipment. Class A products are suitable for use in commercial (that is, nonresidential) locations and can be directly connected to a low voltage, power-supply network.

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1 PATROL UPLC Production Process Analysis System

The system automatically or manually runs samples for analysis, drawing them from one or more process sources.

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<td>20</td>
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</tbody>
</table>

**Warning:** To avoid injury, do not deviate from this configuration.

The system includes the following components:

- Process sample manager (PSM)
- One of these solvent managers:
  - Binary solvent manager (BSM)
  - Quaternary solvent manager (QSM) with degasser kit
  - Bio-quaternary solvent manager (bio-QSM) with degasser kit
- Column manager with active preheating (CM-A)
- An optional auxiliary column manager (CM-AUX), which provides as many as two additional columns
- One of these detectors:
  - Tunable Ultraviolet (TUV) optical detector
  - Photodiode Array (PDA) detector
  - Extendable λ Photodiode Array (eλPDA) detector
• Workstation on which Empower® software, ACQUITY UPLC® Console software, and PATROL software are loaded

The system is fully enclosed, to restrict access to only authorized users.

See also: For information about operating and maintaining each module, refer to the PATROL UPLC Production Process Analysis system documentation CD.

System enclosure

The system’s enclosure comprises three adjoining compartments: instrument, solvent and waste, and options. To prevent unauthorized access to portions of the system, each compartment is fitted with a separate lock.

PATROL UPLC Production Process Analysis system configuration:

- Instrument compartment
  - Sample access door
  - Touch screen
  - Detector (TUV, PDA, or eλ PDA)
  - Auxiliary column manager (optional)
  - Column manager with active preheating (CM-A)
  - Process sample manager
  - Binary solvent manager (BSM) or quaternary solvent manager (QSM)

- Options compartment
  - Light tower
  - Emergency off switch
  - Computer workstation

- Solvent and waste compartment
  - Solvent tray
  - Waste

Not shown: Ethernet switch
Slide-out drawers permit access to each module. When the compartment door is fully open, you can withdraw each module to access panels and connections.

A light tower atop the system enclosure communicates the system’s status to those working in the vicinity. Also fitted atop the system are a cooling-air exhaust vent, an Ethernet connection, and an ac power outlet.

**Instrument compartment**

The instrument compartment houses the system’s modules, including (from top to bottom) the detector, optional auxiliary column manager, column manager with active preheating, process sample manager, and the solvent manager.

⚠️ **Warning:** To avoid injury, when the compartment’s access door for the process sample manager is open, do not exert a downward force on it that exceeds the weight of one computer keyboard (about 1 kilogram).

**Solvent and waste compartment**

The solvent and waste compartment contains the fresh solvent supply, which flows to the system, and the waste solvent, which flows into the compartment from the instrument compartment. You place bottles of fresh solvent in the compartment’s top drawer and waste containers on its bottom shelf. In each case, built-in, secondary receptacles capture any spillage, protecting the system.
Rule: You must use only the combinations of solvent bottle sizes listed in the table below.

**Solvent reservoir bottle sizes:**

<table>
<thead>
<tr>
<th></th>
<th>Binary Solvent Manager Reservoir</th>
<th>Quaternary Solvent Manager Reservoir</th>
<th>Configuration A Volumes</th>
<th>Configuration B Volumes</th>
<th>Configuration C Volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvent A1</td>
<td>Solvent A</td>
<td>2000 mL</td>
<td>5000 mL</td>
<td>5000 mL</td>
<td></td>
</tr>
<tr>
<td>Solvent A2</td>
<td>Solvent B</td>
<td>2000 mL</td>
<td>N/A</td>
<td>5000 mL</td>
<td></td>
</tr>
<tr>
<td>Solvent B1</td>
<td>Solvent C</td>
<td>2000 mL</td>
<td>5000 mL</td>
<td>1000 mL</td>
<td></td>
</tr>
<tr>
<td>Solvent B2</td>
<td>Solvent D</td>
<td>2000 mL</td>
<td>N/A</td>
<td>1000 mL</td>
<td></td>
</tr>
<tr>
<td>Diluent</td>
<td>Diluent</td>
<td>1000 mL</td>
<td>1000 mL</td>
<td>1000 mL</td>
<td></td>
</tr>
<tr>
<td>Seal Wash</td>
<td>Seal Wash</td>
<td>500 mL</td>
<td>500 mL</td>
<td>500 mL</td>
<td></td>
</tr>
</tbody>
</table>

⚠️ **Warning:** To avoid spills, ensure that the waste container is large enough to contain the total volume of all solvents in use on the system.

⚠️ **Warning:** To avoid igniting solvents, do not use an electrical stirrer inside the enclosure.

An ancillary laboratory device, for example an pneumatic stir plate, can be operated using compressed, instrument air. The instrument air supply is 758 kPa/100 psig (7.58 bar) pressure. For more information, see the *PATROL UPLC Process Analysis Site Preparation Guide*.

**Options compartment**

The options compartment houses the system computer, circuit breakers, input/output panel, and DC power supply. The light tower is above the compartment. It clearly indicates system status, enabling anyone to report undesirable statuses.
Top of enclosure:

At the front of the system, directly below the light tower, is an emergency stop button. Pressing it powers off the system.

Forced-air convention manages temperatures within the system enclosure. An air intake vent is at the bottom of the enclosure, and an exhaust vent is at the top. The ventilation system helps maintains temperature and helps remove vapors that can accumulate within the enclosure.

<table>
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<tr>
<th>Light color</th>
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<tbody>
<tr>
<td>Red</td>
<td>Error: Processing of the current sample set is aborted and the system goes offline.</td>
</tr>
<tr>
<td>Yellow</td>
<td>Warning: A maintenance counter threshold has been reached or a sample vial has been rejected.</td>
</tr>
<tr>
<td>Green</td>
<td>Normal operation: The system is ready for or is processing samples.</td>
</tr>
</tbody>
</table>
Removing system modules

To remove modules:

1. Unlock and open the instrument compartment door.

   **Warning:** To avoid an electrical shock and to prevent damage to electrical parts, never disconnect an electrical assembly while power is applied to a system module.

   To completely interrupt power to a module:
   
   • Set the power switch to OFF.
   • Unplug the power cord from the rear of the module.
   • After power is removed, wait 10 seconds thereafter before you disconnect an assembly.

2. If required for maintenance or removal, power-off the module.

   **Warning:** To avoid solvent or waste spillage and to prevent damage to system modules, ensure that any tubing connections between the components of modules are removed before sliding a drawer forward.

3. If removing the process sample manager, disconnect tubing connections to solvent and waste.

4. Press the release mechanism for the desired drawer, and slowly pull the platform forward until it stops.

5. Remove the power and Ethernet cables from the rear of the module.

   **Warning:** To avoid injury when removing a system module:
   
   • Ensure that the sliding drawer is pulled completely forward.
   • Use an appropriate scissor-lift table to support and transport the module from the enclosure.

6. Perform the intended maintenance or removal.

System modules

The system (as a minimum) includes a process sample manager, a solvent manager, a column manager with active preheating, and a detector. The computer workstation runs the control software.
**Process sample manager**

The process sample manager accepts samples in two ways. You can place sample in a vial, and insert it in one of 32 slots in the process sample manager carousel. Alternatively, the process sample manager can draw sample directly from a process source. The system accepts commands from any OPC-based software, enabling full automation. Regardless of sampling method, the process sample manager tests samples according to the configured Empower method.

**Solvent manager**

All three solvent managers that can operate in the system are optimized for sub-2 µm particle liquid chromatography and use reduced fluid volumes.

**Binary solvent manager**

The binary solvent manager delivers solvent compositions for isocratic and binary gradient methods at 0.01 to 2.0 mL per minute. By managing pressure, you can run higher flow rates and faster cycle times, to accelerate chromatography, while maintaining the integrity of the separation.

**Quaternary solvent manager**

The quaternary solvent manager is a low-pressure-mixing, high-pressure pump. It provides steady (pulse-free) solvent flow at analytical flow rates to 1 mL/min at 103,421 kPa (1034 bar, 15,000 psi) and to 2 mL/min, at reduced pressures, to 62,053 kPa (621 bar, 9000 psi). The quaternary solvent manager can pump four degassed solvents simultaneously using a gradient proportioning valve to dynamically create a specified composition.

**Bio-quaternary solvent manager**

The bio-quaternary solvent manager is specifically designed for life-science and biopharmaceutical analyses. Its wetted path is composed of biocompatible materials, primarily titanium alloys and MP35N® alloy. It can pump four degassed solvents simultaneously using a gradient proportioning valve to dynamically create a specified composition.
Column manager with active preheating

The column manager with active preheating ensures reliable and robust separations. It can regulate the temperature of columns from 4 to 90 °C. When cooling, the lowest temperature set point must be < 25 °C below ambient temperature.

The column manager’s troughs can accommodate columns of internal diameter as large as 4.6-mm I.D. and as long as 150-mm length, depending on the configuration. It also offers a bypass channel and programmable switching between columns.

The active preheater conditions solvent as it enters the column. The preheater raises the temperature of the incoming mobile phase and injected sample to the same set point as the column compartment.

Auxiliary column managers (optional)

An auxiliary column manager is an option that permit the adding of columns. The auxiliary column manager can regulate the temperature of columns from 4 to 90 °C. Its troughs can accommodate columns of 2.1-mm to 4.6-mm (I.D.) and 50-mm to 150-mm (length), depending on the configuration. Each of the two column troughs can condition one 15-cm column (with filter).

Column technology

ACQUITY UPLC columns are packed with 1.7-µm, bridged, ethylsiloxane, hybrid or 1.8-µm, high-strength silica particles that can mechanically endure high-pressure conditions. The column hardware and the matched outlet tubing can withstand as much as 103,421 kPa (1034 bar, 15,000 psi).

Although the system works with any analytical HPLC column, specially designed ACQUITY UPLC columns maximize its high-pressure capabilities. Compared with traditional HPLC columns, ACQUITY UPLC columns deliver superior resolution and sensitivity in the same run time or equivalent resolution, greater sensitivity, and faster run times.
Detector

The optical sensors of the tunable ultraviolet (TUV), photodiode array (PDA), and extendable wavelength photodiode array (e\(\lambda\)PDA) optical detectors collect data from small-particle chromatography at fast rates while controlling bandspreading. Data from these detectors provide accurate peak measurement.

Control software

<table>
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<tr>
<td>Empower</td>
<td>Create method and sample sets to direct sample analysis.</td>
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<td>PATROL</td>
<td>Configure sample insertion to the process sample manager, and select the Empower method to use.</td>
</tr>
<tr>
<td>ACQUITY UPLC Console</td>
<td>Monitor and configure system settings, such as temperature and pressure, during each run.</td>
</tr>
</tbody>
</table>
PATROL UPLC Production Process Analysis System
Optimizing Performance

You can employ various means to increase the efficiency of a system.

Working with high viscosity samples

Testing highly viscous samples (>1.6 cP) can require tubing of slightly larger internal diameter than standard tubing. The Waters viscous sample tube kit contains two lengths of tubing, one of 0.008 inches interior diameter (ID) and one of 0.009 inches ID.

A Waters field service engineer installs the kit, replacing the tubing connecting the injection tower to the injector. After installation, you must generate new calibration curves. The modified system will need to be re-qualified.

Note: A dilution factor of 1 (no dilution) will not be accurate in calibration curves for samples analyzed in vials.

Accelerating analysis with Direct Injection

The Direct Injection feature minimizes the time between injections by accelerating the sampling and loading process.

During the current injection, the process pump draws sample volume for the next injection. The needle and dilution loop are filled with sample up to the injection valve and through the injection valve to waste.
At the beginning of the next run, the injection valve turns, the injection loop is filled, and then the injection valve turns again to make the injection.

You select the Direct Injection feature in the instrument method of the process sample manager. When you select Direct Injection, the system responds as follows:

- Sample Ahead is enabled. The process sample manager draws the next sample even as the sample that precedes it is analyzed. The needle then injects next sample immediately after its predecessor’s analysis is complete.
- Wash cycles are disabled.
- Needle cleaning is not performed.
- The dilution factor is set to 1.0 (no dilution).
- The needle fill value in the method editor is disabled.

Using external pumps

To pump sample long distances, you can use an external pump controlled with a contact closure to push a sample to the process sample manager. The external pump replaces the process pump within the process sample manager.

⚠️ Warning: To prevent solvent spillage, you must disable the process pump. If you do not disable the process pump, solvent will continue to pump into tubing that was disconnected from the inlet of the transducer.

See also: “Disable the process pump” on page 30.

Restrictions:

- The external pump cannot be used with the Direct Injection feature.
- Do not switch the ac line of the external pump with the process sample manager contact closure.

The external pump you use must,

- include a contact closure;
- include its own power source.
Install an external process pump

**Warning:** To avoid personal contamination with biohazards, compounds that are toxic or corrosive, or the residues of such compounds, wear clean, chemical-resistant, powder-free gloves when handling tubing and other parts of the system that come into contact with solvents.

To connect the external process pump to the process sample manager:

1. Remove the top front panel from the process sample manager.
2. Disconnect the T12 tubing at the inlet (left-hand side) of the process pump pressure sensor.
3. Connect the tubing from the external pump to the inlet (left-hand side) of the process pump pressure sensor.

4. Disconnect the T-11 tubing from the outlet (right-hand side) of the process pump pressure sensor.
5. Disconnect the T8-1 tubing from port 3 of the process valve.  
   **Note:** The process valve is the valve on the right-hand side below the inject valve.

6. Connect the T8-1 tubing from step 5 to the outlet (right-hand side) of the process pump pressure sensor.

**Result:** In console, a pressure trace will now appear for the external process pump.

7. Replace the process sample manager top, front panel.
Disable the process pump

To disable the process pump in the process sample manager:

1. From the ACQUITY UPLC Console system tree, select process sample manager.
   
   See also: “ACQUITY UPLC Console software” on page 37.

2. From the Configure menu, select Configure process pump.

3. Select Disable.

4. When prompted, shut down the process sample manager.

5. Power-on the process sample manager.

Set an external process pump

⚠️ Caution: To prevent damage to the transducer, do not run the external pump at pressures at or above 1000 psi.

To set an external pump in the instrument method:

1. From the Empower Run Samples dialog box, select the process sample manager instrument method.

2. On the General tab, click Advanced.

3. In the Contact Closure area, enter a time, in seconds, for “Sample time on” and “Needle time on”.
   • “Sample time on” is the time required for the external pump to pump sample through the process sample manager and push it out as waste through the sample valve. This cleanses the line.
   • “Needle time on” is the time required for the external pump to pump sample to fill the injection needle. The sample exits the process sample manager through the injection tower waste line.
**Sampling from multiple process sources**

**Caution:** High pressure combined with high fluidic capacitance might result in a fitting failure. Ensure all fittings are properly secured before operating the process sample manager.

Use the external selector valve to specify the process source from which to draw sample.

You can use a 7-port, 6-position selector valve, providing lines for six samples, or an 11-port, 10-position selector valve, providing lines for ten samples.

**7-Port, 6-position process valve:**

After installation of the external selector valve, configure the valve, then create methods for each valve position in the instrument method editor of the column manager. Each valve position will correspond to a sample pulled from a specific source.

**To configure the external selector valve:**

1. From the ACQUITY UPLC Console system tree, select column manager.
2. From the Configure menu, select Operating Mode.
3. In the Operating Mode Configuration dialog box, select Column Selection.
4. For External 1, select the number of positions on your valve, 6 or 10.
To select the valve position corresponding to a sample when creating an instrument method:

1. From the Empower Run Samples dialog box, select instrument method of the column manager.

2. Select the Column Selection mode.

3. On the General tab, for External Valve 1, select the valve position that corresponds to the sample.
Preparing the System

You must perform certain tasks before you can operate the system.

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</table>

Preparing system hardware

Powering-on the system

Powering-on the system entails starting the system workstation, system modules, and software. Each device or instrument beeps three times and runs a series of startup tests.

**Tip:** The power switch on each module is located on its top, left-hand side.

**See also:** For the meaning of the LED indicator colors, see “Monitoring the LEDs of system modules” on page 34.

To power-on the system:

1. If needed, plug the Ethernet connection to the network.
2. Plug the power cord into the outlet. The Ethernet switch will power-on.
   
   **See also:** Site Preparation Guide
3. Power-on the system workstation.
   
   **Tip:** If the start-up tests indicate a malfunction, contact your local Waters field service engineer.
4. Power-on the solvent manager, column manager, and the process sample manager.

   **Note:** The auxiliary column managers are automatically powered-on when you power-on the column manager.

   **Tip:** The process sample manager can take five minutes to initialize.

5. After the power LEDs on the solvent manager, column manager, and process sample manager are steady green, press the power switch on the detector.

   **Tip:** To prevent initialization errors, power-on the detector only when the flow cell is wetted.


   **Tip:** Monitor the ACQUITY UPLC Console for messages and LED indications.

   **See also:** “ACQUITY UPLC Console software” on page 37.

---

### Monitoring the LEDs of system modules

LED lights on each module indicate its status.

#### Power LED

A power LED is located on the front panel of each module. When the power LED is green, power is applied to the module. When the power LED is off, the power is off.

#### Status LEDs

Status LEDs are located on the right-hand side of each power LED. Status light colors and modes are specific to each module and are summarized in the table below.

**Recommendation:** If a status LED is steady red, power-off, and then power-on the module. If the status is still red, contact Waters for assistance.
Enabling the leak sensors

To enable the leak sensors:

1. Verify leak sensors have been installed.
2. In the ACQUITY UPLC Console, from the Control menu, select Leak Sensors.
   
   **See also:** “ACQUITY UPLC Console software” on page 37.

3. To enable the leak sensor for an individual module, click the status on the left-hand side of the module's description.
   
   **Tip:** To enable all leak sensors, click Enable All.

Before connecting to the process source

**Caution:** High pressure combined with high fluidic capacitance might result in a fitting failure. Ensure all fittings are properly secured before operating the process sample manager.
Starting up the system

To start the system in normal conditions:

1. In the ACQUITY UPLC Console, from the Control menu, select Start up system.
   
   See also: “ACQUITY UPLC Console software” on page 37.

2. In the Start up system dialog box, review the solvent lines selected, and select different solvent lines, if necessary.
   
   Result: The system primes the selected solvent lines, and then primes the process sample manager. Finally, it ignites the detector lamp.

To start the system after an emergency:

Requirement: If the emergency-stop button was pushed or electrical power was lost, you must press the power button on all modules to switch them off. This ensures the modules do not restart automatically.

1. Verify that all system modules are powered off.
   
   Tip: The power LED, located on the front, left panel of each module, is unlit.

2. If the system was shut down by means of the emergency-stop button, reset the button by rotating it clockwise.
   
   Result: Power is restored.

3. Set the circuit breakers to the “on” position.

4. If needed, power-on the system PC.

5. Power-on all system modules, except the process sample manager.
   
   Tip: The power LED on each module will turn green, to indicate that it is powered-on.


7. Power-on the process sample manager.

8. Log on to Empower.

9. Enable the leak sensors.
   
   See also: “Enabling the leak sensors” on page 35.
The ACQUITY UPLC Console is a software application that provides a convenient way to configure settings, monitor performance, run diagnostic tests, and maintain the system and its modules. It replaces the keypads and small-screen displays traditionally found on the fronts of system modules. The ACQUITY UPLC Console functions independently of data applications and does not recognize or control them.

From the ACQUITY UPLC Console’s interface, you can quickly navigate to visual representations of each module and its components. You can also navigate to interactive diagrams, which show interconnections and provide diagnostic tools for troubleshooting problems.

Starting the ACQUITY UPLC Console

To start the console from Empower software:

1. In the Run Samples dialog box, click in the process sample manager control panel.

Control panels

You can monitor control panels for the process sample manager, solvent manager, column manager, and detector from Empower or from ACQUITY UPLC Console.

- In Empower, control panels appear at the bottom of the Run Samples dialog box.
- In the console, control panels appear at the bottom of the PATROL page. To access the PATROL page, select PATROL from the system tree.

Tip: If the PATROL screen saver is enabled, the PATROL page appears automatically when the computer is idle.
When the system is idle, you can edit parameters in the control panel by clicking the underlined value.

Restriction: You cannot edit parameters while the system is running samples.

Control panels:

**Process sample manager control panel**

Control panel parameters for the process sample manager:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run LED</td>
<td>The module’s status. The color and meaning is identical to that shown on the front panel of the module. See also: “Monitoring the LEDs of system modules” on page 34.</td>
</tr>
<tr>
<td>Status</td>
<td>The current operation’s status.</td>
</tr>
<tr>
<td>Current sample compartment temperature</td>
<td>The current sample compartment temperature to 0.1 °C resolution.</td>
</tr>
</tbody>
</table>

![Process sample manager control panel diagram]
Control panels

Control panel parameters for the process sample manager:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample compartment set point</td>
<td>The sample compartment temperature set in the method.</td>
</tr>
<tr>
<td>Display Console</td>
<td>When selected, the ACQUITY UPLC Console appears.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> This does not appear on the PATROL page.</td>
</tr>
</tbody>
</table>

Additional functions can be accessed by right-clicking in the process sample manager control panel.

Additional functions available in the control panel for the process sample manager:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime</td>
<td>Displays the Prime dialog box.</td>
</tr>
<tr>
<td>Reset PSM</td>
<td>Resets the process sample manager.</td>
</tr>
<tr>
<td>Help</td>
<td>Launches the ACQUITY UPLC Console online Help.</td>
</tr>
</tbody>
</table>

Solvent manager control panel

Example solvent manager control panel:

![Solvent manager control panel](image)
### Control panel parameters for the solvent manager:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| Flow LED           | The module’s status. The color and meaning is identical to that shown on the front panel of the module.  
See also: “Monitoring the LEDs of system modules” on page 34. |
| Status             | The current operation’s status.                                            |
| System pressure    | System pressure, in kPa, bar, or psi. See also: To set pressure units, see the ACQUITY UPLC Console online Help. |
| Solvent composition| Percent of solvent to be drawn from the solvent lines. Composition values range from 0.0 to 100.0%. |
| Stop flow          | When selected, immediately stops all flow from the solvent manager. |
| Flow rate          | Solvent flow rate through all lines of the solvent manager.                |

You can access additional functions by right-clicking in the solvent manager control panel.

### Additional functions available in the control panel for the solvent manager:

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start up system</td>
<td>Brings the system to operational conditions after an extended idle period or when switching to different solvents.</td>
</tr>
<tr>
<td>Prime solvents</td>
<td>Displays the Prime Solvents dialog box.</td>
</tr>
<tr>
<td>Prime seal wash</td>
<td>Starts priming the seal wash.</td>
</tr>
<tr>
<td>Wash plungers</td>
<td>Initiates the plunger wash sequence, which fills and then slowly empties the primary and accumulator chamber (with the current solvent composition) while performing a high speed/volume seal wash.</td>
</tr>
<tr>
<td>Launch ACQUITY UPLC Console</td>
<td>Launches the ACQUITY UPLC Console.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> This does not appear on the PATROL page.</td>
</tr>
</tbody>
</table>
Control panels

Additional functions available in the control panel for the solvent manager:

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reset QSM</td>
<td>Resets the solvent manager.</td>
</tr>
<tr>
<td>Reset BSM</td>
<td></td>
</tr>
<tr>
<td>Help</td>
<td>Launches the ACQUITY UPLC Console online Help.</td>
</tr>
</tbody>
</table>

Column manager control panel

Control panel parameters for the column manager:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run LED</td>
<td>The module's status. The color and meaning is identical to that shown on the front panel of the module. <strong>See also:</strong> “Monitoring the LEDs of system modules” on page 34.</td>
</tr>
<tr>
<td>Column</td>
<td>Column currently in use.</td>
</tr>
<tr>
<td>Temperature set point</td>
<td>The column compartment temperature set in the method.</td>
</tr>
<tr>
<td>Current temperature</td>
<td>Current column compartment temperature to 0.1 °C resolution.</td>
</tr>
</tbody>
</table>
Additional functions can be accessed by right-clicking in the column manager control panel.

**Additional functions available in the control panel for the column manager:**

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reset CM</td>
<td>Resets the column manager.</td>
</tr>
<tr>
<td>Help</td>
<td>Launches the ACQUITY UPLC Console online Help.</td>
</tr>
</tbody>
</table>

**Detector control panel**

**Example detector control panel:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamp On/Off LED</td>
<td>The module’s status. The color and meaning identical to that shown on the front panel of the module. <strong>See also: “Monitoring the LEDs of system modules” on page 34.</strong></td>
</tr>
<tr>
<td>Status</td>
<td>The current operation’s status.</td>
</tr>
<tr>
<td>Absorbance</td>
<td>Absorbance units. If “Closed” appears, the shutter is closed, and light is prevented from reaching the photodiode.</td>
</tr>
<tr>
<td>Value of wavelength A</td>
<td>If the detector is in dual wavelength mode, the value of wavelength B also appears.</td>
</tr>
</tbody>
</table>
Adding solvents and emptying waste

Control panel parameters for the detector:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamp on</td>
<td>The lamp is ignited.</td>
</tr>
<tr>
<td>Lamp off</td>
<td>The lamp is extinguished.</td>
</tr>
</tbody>
</table>

Additional functions can be accessed by right-clicking in the detector control panel.

Additional functions available in the control panel for the detector:

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autozero</td>
<td>Resets the absorbance value to 0.</td>
</tr>
<tr>
<td>Reset TUV</td>
<td>Resets the detector.</td>
</tr>
<tr>
<td>Reset eλPDA</td>
<td></td>
</tr>
<tr>
<td>Help</td>
<td>Launches the ACQUITY UPLC Console online Help.</td>
</tr>
</tbody>
</table>

Adding solvents and emptying waste

In the PATROL UPLC Production Process Analysis system, you place the solvent and waste bottles inside the solvent and waste compartment. This compartment is in the bottom, right of the enclosure. You also can store solvent reserves in a secondary containment receptacle in the upper-most sliding drawer.

Warning: To prevent personal contact with bio-hazards and toxic or corrosive chemicals, wear clean, chemical-resistant, powder-free gloves when working with solvents or waste.

To replace an empty solvent bottle with a full bottle:

1. Identify the solvent line that goes to the bottle you are replacing.
2. Secure the end of the tubing to prevent any spills.
3. Swap in the new bottle of solvent.
4. Attach the tubing to the new solvent bottle.

**To replace a full waste container with an empty container:**
1. Secure the end of the tubing to prevent any spills.
2. Swap in the empty container.
3. Dispose of waste in accordance with your laboratory’s safety policies and local regulations.
A Safety Advisories

Waters instruments display hazard symbols designed to alert you to the dangers of operating and maintaining the instruments. The 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.

Note: Not all of the warnings and advisories listed in Appendix A are applicable to the process sample manager.

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</table>
A Safety Advisories

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, or operate any Waters instrument or device. Waters accepts no liability in cases of injury or property damage resulting from the failure of individuals to comply with any safety precaution when installing, repairing, or operating any of its instruments or devices.

The following symbols warn of risks that can arise when you operate or maintain a Waters instrument or device, or a component of an instrument or device. When one of these symbols appear in a manual’s narrative sections or procedures, an accompanying statement identifies the applicable 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 sharp-point puncture injury.)

⚠️ **Warning:** (Risk of hand crush injury.)

⚠️ **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 symbols

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

⚠️ **Warning:** (Risk of tipping.)

⚠️ **Warning:** (Risk of explosion.)

⚠️ **Warning:** (Risk of eye injury.)

**Specific warnings**

The following warnings (both symbols and text) can appear in the user manuals of particular instruments and devices and on labels affixed to them or their component parts.

**Burst warning**

This warning applies to Waters instruments and devices fitted with nonmetallic tubing.

⚠️ **Warning:** To avoid injury from bursting, nonmetallic tubing, heed these precautions when working in the vicinity of such tubing when it is pressurized:

- 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, significantly reducing the pressure at which the tubing can rupture.
Biohazard warning

The following warning applies to Waters instruments and devices that can process material containing biohazards, which are substances that contain biological agents capable of producing harmful effects in humans.

Warning: To avoid infection with potentially infectious, human-sourced products, inactivated microorganisms, and other biological materials, assume that all biological fluids that you handle are infectious.

Specific precautions appear in the latest edition of the US National Institutes of Health (NIH) publication, *Biosafety in Microbiological and Biomedical Laboratories* (BMBL).

Observe Good Laboratory Practice (GLP) at all times, particularly when working with hazardous materials, and consult the biohazard safety representative for your organization regarding the proper use and handling of infectious substances.

Biohazard and chemical hazard warning

This warning applies to Waters instruments and devices that can process biohazards, corrosive materials, or toxic materials.

Warning: To avoid personal contamination with biohazards, toxic materials, or corrosive materials, you must understand the hazards associated with their handling.


Observe Good Laboratory Practice (GLP) at all times, particularly when working with hazardous materials, and consult the safety representative for your organization regarding its protocols for handling such materials.
Caution advisory

Caution advisories appear where an instrument or device can be subject to use or misuse that can damage it or compromise a sample’s integrity. The exclamation point symbol and its associated statement alert you to such risk.

⚠️ **Caution:** To avoid damaging the instrument’s case, do not clean it with abrasives or solvents.
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:** qualsiasi modifica o alterazione apportata a questa unità e non espressamente autorizzata dai responsabili per la conformità fa decadere il diritto all'utilizzo dell'apparecchiatura da parte dell'utente.

**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。

**주의:** 규정 준수를 책임지는 당사자의 명백한 승인 없이 이 장치를 개조 또는 변경할 경우, 이 장치를 운용할 수 있는 사용자 권한의 효력을 상실할 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、本装置のユーザー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 précaution:

• 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 diméthylsulfoxyde 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: fare attenzione quando si utilizzano tubi in materiale polimerico sotto pressione:

• Indossare sempre occhiali da lavoro protettivi nei pressi di tubi di polimero pressurizzati.
• Spegnere tutte le fiamme vive nell'ambiente circostante.
• Non utilizzare tubi eccessivamente logorati o piegati.
• Non utilizzare tubi non metallici con tetraidrofurano (THF) o acido solforico o nitrico concentrati.
• Tenere presente che il cloruro di metilene e il dimetilsolfossido provocano rigonfiamenti nei tubi non metallici, riducendo notevolmente la pressione di 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 tetraidrofurano (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。
• 不要使用已經被壓瘪或嚴重彎曲管線。
• 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。
Warnings that apply to all Waters instruments and devices

- Warning: When handling plastic tubing under pressure, pay attention to the following points:
  - When near plastic tubing, always wear protective eyewear.
  - Extinguish all nearby flames.
  - Do not use tubing that has been crushed or seriously bent.
  - Do not use plastic tubing with tetrahydrofuran or concentrated nitric or sulfuric acid.
  - Be aware that dichloromethane and dimethyl sulfoxide can cause plastic tubing to expand, greatly reducing the tubing's pressure resistance.

경고: 가압 폴리머 튜브로 작업할 경우에는 주의하십시오.
  - 가압 폴리머 튜브 근처에는 항상 보호 안경을 착용하십시오.
  - 근처의 화기를 모두 쫓으십시오.
  - 심하게 변형되거나 꼬인 튜브는 사용하지 마십시오.
  - 비금속(Nonmetallic) 튜브를 테트라하يد로프랑(Tetrahydrofuran: THF) 또는
    농축 질산 또는 황산과 함께 사용하지 마십시오.
  - 염화 메티렌(Methylene chloride) 및 디메틸 су로사이드(Dimethyl sulfoxide)는
    비금속 튜브를 부풀려 튜브의 파열 압력을 크게 감소시킬 수 있으므로 유의하십시오.

警告：圧力のかかったポリマーチューブを扱うときは、注意してください。
  - 加圧されたポリマーチューブの付近では、必ず保護メガネを着用してください。
  - 近くにある火を消してください。
  - 著しく変形した、または折れ曲がったチューブは使用しないでください。
  - 非金属チューブには、テトラヒドロフラン(THF)や高濃度の硝酸または硫酸などを流
    さないでください。
  - 塩化メチレンやジメチルスルホキシドは、非金属チューブの膨張を引き起こす場合が
    あり、その場合、チューブは極めて低い圧力で破裂します。

January 2, 2014, 715004355 Rev. A
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 défectueuse.

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

Attenzione: si rende noto all'utente che l'eventuale utilizzo dell'apparecchiatura secondo modalità non previste dal produttore può compromettere la protezione offerta dall'apparecchiatura.

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: 使用者必须非常清楚如果設備不是按照製造廠商指定的方式使用，那麼該設備所提供的保護將被消弱。

警告: 使用者必須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削弱。

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

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

警告: 使用者必須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削弱。
Warnings that address the replacing of fuses

The following warnings pertain to instruments equipped with user-replaceable fuses.

If the fuse types and ratings appear on the instrument:

**Warning:** To protect against fire, replace fuses with those of the type and rating printed on panels adjacent to instrument fuse covers.

**Attention:** pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués sur le panneau à proximité du couvercle de la boîte à fusible de l'instrument.

**Vorsicht:** Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert auf den Tafeln neben den Sicherungsabdeckungen des Geräts gedruckt sind.

**Attenzione:** per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate sui pannelli adiacenti alla copertura fusibili dello strumento.

**Advertencia:** Para evitar incendios, sustituir los fusibles por aquellos del tipo y características impresos en los paneles adyacentes a las cubiertas de los fusibles del instrumento.

**警告:** 為了避免火災, 更換保險絲時, 請使用與儀器保險絲蓋背面板上所印刷之相同類型與規格的保險絲。

**警告:** 為了避免火災, 应更换与仪器保险丝盖旁边面板上印刷的类型和规格相同的保险丝。

**경고:** 화재의 위험을 막으려면 기기 퓨즈 커버에 가까운 패널에 인쇄된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오。

**警告:** 火災予防のために、ヒューズ交換では機器ヒューズカバー脇のパネルに記載されているタイプおよび定格のヒューズをご使用ください。
A Safety Advisories

If the fuse types and ratings do not appear on the instrument:

**Warning:** To protect against fire, replace fuses with those of the type and rating indicated in the "Replacing fuses" section of the Maintenance Procedures chapter.

**Attention:** pour éviter tout risque d'incendie, remplacez toujours les fusibles par d'autres du type et de la puissance indiqués dans la rubrique "Remplacement des fusibles" du chapitre traitant des procédures de maintenance.

**Vorsicht:** Zum Schutz gegen Feuer die Sicherungen nur mit Sicherungen ersetzen, deren Typ und Nennwert im Abschnitt "Sicherungen ersetzen" des Kapitels "Wartungsverfahren" angegeben sind.

**Attenzione:** per garantire protezione contro gli incendi, sostituire i fusibili con altri dello stesso tipo aventi le caratteristiche indicate nel paragrafo "Sostituzione dei fusibili" del capitolo "Procedure di manutenzione".

**Advertencia:** Para evitar incendios, sustituir los fusibles por aquellos del tipo y características indicados en la sección "Sustituir fusibles".

**警告:** 為了避免火災，更換保險絲時，應使用「維護步驟」章節中「更換保險絲」所指定之相同類型與規格的保險絲。

**경고:** 화재의 위험을 막으려면 유지관리 절차 단원의 “퓨즈 교체” 절에 설명된 것과 동일한 타입 및 정격의 제품으로 퓨즈를 교체하십시오.

**警告:** 火災予防のために、ヒューズ交換ではメンテナンス項目の「ヒューズの交換」に記載されているタイプおよび定格のヒューズをご使用ください。
**Electrical symbols**

The following electrical symbols and their associated statements can appear in instrument manuals and on an instrument’s front or rear panels.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Image" /></td>
<td>Electrical power on</td>
</tr>
<tr>
<td><img src="image2" alt="Image" /></td>
<td>Electrical power off</td>
</tr>
<tr>
<td><img src="image3" alt="Image" /></td>
<td>Standby</td>
</tr>
<tr>
<td><img src="image4" alt="Image" /></td>
<td>Direct current</td>
</tr>
<tr>
<td><img src="image5" alt="Image" /></td>
<td>Alternating current</td>
</tr>
<tr>
<td><img src="image6" alt="Image" /></td>
<td>Protective conductor terminal</td>
</tr>
<tr>
<td><img src="image7" alt="Image" /></td>
<td>Frame, or chassis, terminal</td>
</tr>
<tr>
<td><img src="image8" alt="Image" /></td>
<td>Fuse</td>
</tr>
</tbody>
</table>
Handling symbols

The following handling symbols and their associated statements can appear on labels affixed to the packaging in which instruments, devices, and component parts are shipped.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="symbol" /></td>
<td>Keep upright!</td>
</tr>
<tr>
<td><img src="image2" alt="symbol" /></td>
<td>Keep dry!</td>
</tr>
<tr>
<td><img src="image3" alt="symbol" /></td>
<td>Fragile!</td>
</tr>
<tr>
<td><img src="image4" alt="symbol" /></td>
<td>Use no hooks!</td>
</tr>
</tbody>
</table>
A Waters field service engineer unpacks and installs your PATROL UPLC® Production Process Analysis system.

**Requirement:** If you must transport a system module, or remove it from service, contact Waters Technical Service for recommended cleaning, flushing, and packaging procedures.

⚠️ **Warning:** To avoid muscle and skeletal injuries, do not attempt to lift the system modules without assistance.

---

**System tubing connections**

The system’s external tubing connections for solvent flow and drainage are shown below.
Tubing connections for a PATROL UPLC Production Process Analysis system with a binary solvent manager:

Legend:
- SNW = White for sample wash
- WNW = Orange for diluent wash
- A1 = Yellow
- A2 = Blue
- B1 = Red
- B2 = Green

= Drip tray
= Bottle tray

Flow cell → Back pressure regulator

Detector

Auxiliary Column Manager

Column Manager

Process Sample Manager

Binary Solvent Manager

System tubing route

To system waste or recycle

Clear line

Directly to system waste

Needle wash waste

Needle wash

Inject valve in

Inject valve out

Switching valve in

Switching valve out

Tubing

System tubing route

Diluent wash pump

Sample wash pump

Tee/Mixer

Pump seal

Sample wash

Diluent wash

Diluent manager waste

Binary solvent manager waste

Legend:
- SNW = White for sample wash
- WNW = Orange for diluent wash
- A1 = Yellow
- A2 = Blue
- B1 = Red
- B2 = Green

Clear line
Tubing connections for a PATROL UPLC Production Process Analysis system with a quaternary solvent manager:

Detector
- Flow cell → Back pressure regulator

Auxiliary Column Manager
- Columns
  - Switching valve out
  - Switching valve in

Column Manager
- Process Sample Manager
- Diluent wash pump → Sample wash pump
- Tee/Mixer
- WNW
- SNW

Quaternary Solvent Manager
- To degassers

Legend:
- SNW = Sample wash
- WNW = Diluent wash

Legend:
- = Drip tray
- = Bottle tray

System tubing route
- To system waste or recycle
Instrument wiring connections

The rear panel connections for the PATROL UPLC system are shown below.

PATROL UPLC Production Process Analysis system electrical wiring connections:
Signal connections

Making signal connections

Refer to the signal connection location shown on the silk-screened label affixed to the rear panel of each system module.

Required materials:

- 9/32-inch nut driver
- Flat-blade screwdriver
- Connector
- Signal cable

To make signal connections:

1. Insert the connector into the connector port on the back of the module.
2. Using the flat-blade screwdriver, attach the positive and negative leads of the signal cable to the connector.

3. Fit the grounding cable’s fork terminal on the rear panel grounding stud, and secure the terminal with the locking nut.

**Tip:** Use the 9/32-inch nut driver to tighten the locking nut until the fork terminal does not move.
Signal connections in the process sample manager

The rear panel of the process solvent manager includes two connectors that hold terminals for I/O signal cables.

The lower connector can be used to install an external pump.

See also: “Using external pumps” on page 26.

I/O signal connectors in the process sample manager:

Signal connectors for other devices

Refer to the documentation CD that came with the PATROL UPLC Production Process Analysis system.
Connecting to the electricity source

The ac cord supplied by Waters exceeds the electrical needs of the PATROL UPLC Production process analysis system. System-level grounding is accomplished through this three-wire AC plug.

If international adaptation is needed, you or an electrician can remove the supplied ac plug and attach one suitable for your country.

Each module requires a separate, grounded power source. The ground connection in all power outlets must be common and physically close to the system.

Warning: Avoid electrical shock:
- Use the SVT-type power cord in the United States and the HAR-type or better in Europe. For other countries’ requirements, contact your local Waters distributor.
- Power-off and unplug each system module before performing any maintenance operation on the module.
- Connect each system module to a common ground.

To connect to the electricity source:

Recommendation: Use a line conditioner and uninterruptible power supply (UPS) for optimum, long-term, input voltage stability.

Connect the power cord from the cabinet to a suitable wall outlet.
Client and Workstation Configurations

The PATROL UPLC Production Process Analysis system can be configured as an individual workstation, where all functionality is available. Alternatively, the system can be controlled on a client. In this case, selected functions are disabled.

Contents:

<table>
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<th>Page</th>
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<tr>
<td>Comparison of Client and Workstation Functionality</td>
<td>68</td>
</tr>
</tbody>
</table>

Client Configuration

Disabled buttons

The following buttons are disabled in the client configuration on the PATROL page. Access the PATROL page by selecting PATROL from the ACQUITY UPLC Console system tree.

- Load Samples
- Tech

Disabled menu selections

The following menu selections are disabled on the Process Sample Manager page. Access the Process Sample Manager page by selecting Process Sample Manager from the ACQUITY UPLC Console system tree.

- Maintain > Replace Pumps/ Valves
- Maintain > Calibrate Seal
C Client and Workstation Configurations

- Maintain > Leak Test
- Maintain > Upgrade Firmware

On the PATROL page, the following menu selections are disabled.
- Configure > System

## Comparison of Client and Workstation Functionality

In the following tables, if a check mark appears, the function is available. If “Disabled” appears, the function is not available.

### Controls:

<table>
<thead>
<tr>
<th>Control</th>
<th>Function</th>
<th>Client</th>
<th>Workstation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Samples</td>
<td>Opens the process sample manager door so a sample vial can be inserted.</td>
<td>Disabled</td>
<td>✓</td>
</tr>
<tr>
<td>Tech</td>
<td>Provides access to the carousel for inserting or removing vials.</td>
<td>Disabled</td>
<td>✓</td>
</tr>
</tbody>
</table>

### PATROL page functions:

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>Client</th>
<th>Workstation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control &gt; Run</td>
<td>Runs the selected sample set.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Control &gt; Abort</td>
<td>Immediately aborts the sample set.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Control &gt; Stop</td>
<td>Stops the sample set after completing the injection.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Control &gt; Resume</td>
<td>Resumes the sample set.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Control &gt; Calibrate</td>
<td>Runs the sample set for calibration.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Control &gt; Line Flush</td>
<td>Runs the sample set to equilibrate the system.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Control &gt; Start</td>
<td>Runs the sample set.</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
## PATROL page functions:

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>Client</th>
<th>Workstation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control &gt; System Check</td>
<td>Runs the sample set for a control.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Control &gt; Lock</td>
<td>Sets the system so automatic processing of samples and standards in vials cannot occur.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Control &gt; Unlock</td>
<td>Turns off the Lock mode.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Configure &gt; System</td>
<td>Enables you to configure automatic sampling.</td>
<td>Disabled</td>
<td>✓</td>
</tr>
<tr>
<td>Configure &gt; View Sample Status</td>
<td>Opens the Sample Status dialog box.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Help &gt; ACQUITY UPLC Console help</td>
<td>Opens online Help.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Help &gt; About ACQUITY UPLC Console</td>
<td>Opens the About dialog box, which lists the driver versions for each module.</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

## Process Sample Manager page functions:

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>Client</th>
<th>Workstation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control &gt; Prime</td>
<td>Opens the Prime dialog box, where you set the parameters for priming the system.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Control &gt; Reset PSM</td>
<td>Resets the process sample manager.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Configure &gt; View module information</td>
<td>Provides a list of firmware and instrument control software versions.</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
C  Client and Workstation Configurations

### Process Sample Manager page functions:

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>Client</th>
<th>Workstation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configure &gt; Volumes</td>
<td>Opens to the Volume Configuration dialog box, where you select the volume of a newly installed sample loop.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Configure &gt; Configure carousel</td>
<td>Opens the Carousel Configuration dialog box, where you specify the lowest number of empty vial positions that can be available.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Configure &gt; Timeouts</td>
<td>Opens the Timeout Configuration dialog box, where you set the time limit for inserting or removing a vial.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Configure &gt; Solvent volumes</td>
<td>Opens the Volume Configuration dialog box, where you set the warning levels for solvent and waste.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Configure &gt; Configure Process Pump</td>
<td>Opens the Configure Process Pump dialog box, where you enable or disable an external process pump.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Configure &gt; Plot properties</td>
<td>Opens the Plot Properties dialog box, where you specify plot settings.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Maintain &gt; Replace Pumps/ Valves</td>
<td>Opens the Replace Pumps/Valves dialog box, where you select a valve to replace.</td>
<td>Disabled</td>
<td>✓</td>
</tr>
<tr>
<td>Maintain &gt; Reset injection count</td>
<td>Opens the Reset Injection Count dialog box, where you reset the injection counter to zero.</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Maintain &gt; Calibrate Seal</td>
<td>Opens the Calibrate Seal dialog box, where you start and view the step-by-step progress of seal calibration.</td>
<td>Disabled</td>
<td>✓</td>
</tr>
<tr>
<td>Maintain &gt; Leak Test</td>
<td>Opens the Volume Configuration dialog box, where you set the parameters for a leak test.</td>
<td>Disabled</td>
<td>✓</td>
</tr>
</tbody>
</table>
### Process Sample Manager page functions:

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
<th>Client</th>
<th>Workstation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain &gt; Upgrade Firmware</td>
<td>Opens the Upgrade dialog box, where you start the installation of a firmware upgrade.</td>
<td>Disabled</td>
<td>√</td>
</tr>
<tr>
<td>Maintain &gt; Create log entry</td>
<td>Opens the Create Log Entry dialog box, where you record events and service.</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Troubleshoot &gt; Save plot file</td>
<td>Opens the Save Plot File dialog box, where you specify the data to save.</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Troubleshoot &gt; Print plot</td>
<td>Prints the plot currently displayed.</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Troubleshoot &gt; Service mode</td>
<td>Provides access for Waters field service engineers.</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Troubleshoot &gt; Save service profile</td>
<td>Creates a Zip file containing detailed system information that can be sent to Waters.</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Help &gt; ACQUITY UPLC Console help</td>
<td>Opens Connections INSIGHT™ monitoring software.</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Help &gt; About ACQUITY UPLC Console</td>
<td>Opens the About dialog box, which lists the driver versions for each module.</td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>
C Client and Workstation Configurations