MOLECULAR SPECTROSCOPY

LiquidExpress System

User's Guide

PerkinElmer®

Release History

Part Number	Release	Publication Date
L1050090	B	February 2011

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Contents

Introduction

About this Manual

This manual contains the following sections:

- Introduction.
- Warnings and Safety Information.
- Unpacking and Installation.
- Routine Maintenance and Troubleshooting.
- Index.

Using this Guide

This guide tells you how to install and maintain the LiquidExpress System; we recommend that you use it as follows:

1. Read *Warnings and Safety Information* on page 23 and this section before using your LiquidExpress System.
2. Read *The LiquidExpress System* on page 10, to learn about the analyzer.
3. Follow the procedures in *Unpacking and Installation* on page 37.
4. Read the *Maintenance Schedule* on page 72 to learn what maintenance the LiquidExpress System requires.

You should use this guide in conjunction with the documentation supplied with your spectrometer.

Conventions

Conventions Used in this Manual

Normal text is used to provide information and instructions.

Bold text refers to text that is displayed on the screen.

UPPERCASE text refers to keys on the PC keyboard. '+' is used to show that you have to press two keys at the same time, for example, ALT+F.

Part Numbers

All eight-digit numbers are PerkinElmer part numbers unless stated otherwise.

Notes, Warnings and Cautions

Three terms, in the following standard formats, are also used to highlight special circumstances and warnings.

NOTE: A note indicates additional, significant information that is provided with some procedures.

CAUTION	*We use the term **CAUTION** to inform you about situations that could result in **serious damage to the instrument** or other equipment. Details about these circumstances are in a box like this one.*
D	***Caution (Achtung)*** *Bedeutet, daß die genannte Anleitung genau befolgt werden muß, um einen **Geräteschaden** zu vermeiden.*
DK	***Caution (Bemærk)*** *Dette betyder, at den nævnte vejledning skal overholdes nøje for at undgå en **beskadigelse af apparatet**.*
E	***Caution (Advertencia)*** *Utilizamos el término **CAUTION** (ADVERTENCIA) para advertir sobre situaciones que pueden provocar **averías graves en este equipo** o en otros. En los recuadros como éste se proporciona información sobre este tipo de circunstancias.*
F	***Caution (Attention)*** *Nous utilisons le terme **CAUTION** (ATTENTION) pour signaler les situations susceptibles de provoquer de **graves détériorations de l'instrument** ou d'autre matériel. Les détails sur ces circonstances figurent dans un encadré semblable à celui-ci.*
I	***Caution (Attenzione)*** *Con il termine **CAUTION** (ATTENZIONE) vengono segnalate situazioni che potrebbero arrecare **gravi danni allo strumento** o ad altra apparecchiatura. Troverete informazioni su tali circostanze in un riquadro come questo.*
NL	***Caution (Opgelet)*** *Betekent dat de genoemde handleiding nauwkeurig moet worden opgevolgd, om **beschadiging van het instrument** te voorkomen.*
P	***Caution (Atenção)*** *Significa que a instrução referida tem de ser respeitada para evitar a **danificação do aparelho**.*

*We use the term **WARNING** to inform you about situations that could result in **personal injury** to yourself or other persons. Details about these circumstances are in a box like this one.*

D

Warning (Warnung)
*Bedeutet, daß es bei Nichtbeachten der genannten Anweisung zu einer **Verletzung** des Benutzers kommen kann.*

DK

Warning (Advarsel)
*Betyder, at brugeren kan blive **kvæstet**, hvis anvisningen ikke overholdes.*

E

Warning (Peligro)
*Utilizamos el término **WARNING** (PELIGRO) para informarle sobre situaciones que pueden provocar **daños personales** a usted o a otras personas. En los recuadros como éste se proporciona información sobre este tipo de circunstancias.*

F

Warning (Danger)
*Nous utilisons la formule **WARNING** (DANGER) pour avertir des situations pouvant occasionner des **dommages corporels** à l'utilisateur ou à d'autres personnes. Les détails sur ces circonstances sont données dans un encadré semblable à celui-ci.*

I

Warning (Pericolo)
*Con il termine **WARNING** (PERICOLO) vengono segnalate situazioni che potrebbero provocare **incidenti alle persone**. Troverete informazioni su tali circostanze in un riquadro come questo.*

NL

Warning (Waarschuwing)
*Betekent dat, wanneer de genoemde aanwijzing niet in acht wordt genomen, dit kan leiden tot **verwondingen** van de gebruiker.*

P

Warning (Aviso)
*Significa que a não observância da instrução referida poderá causar um **ferimento** ao usuário.*

The LiquidExpress System

Figure 1 The LiquidExpress System

The PerkinElmer LiquidExpress System (Figure 1) is a bench-top instrument that provides all the following in one self-contained unit:

- A spectrometer, fitted with a sample shuttle.

NOTE: The spectrometer may be a Frontier IR System, Spectrum 100 or 400 Series, or Spectrum One instrument. For full details on how to install and use your spectrometer, refer to the documentation supplied with your instrument.

- A Liquid Autosampler designed to analyze up to 60 samples an hour.
- A wide range of possible flowcells, made of various materials and with various path lengths.

The system is controlled by dedicated LiquidExpress software resident on a PC.

Power Switch and Communications Ports

The power switch, AC power cable connector, and communications ports are on the rear of the spectrometer. The power switch is marked I/O (on/off).

The power switch, AC power cable connector, and communications ports are located on the left-hand side of the Autosampler (see Figure 2).

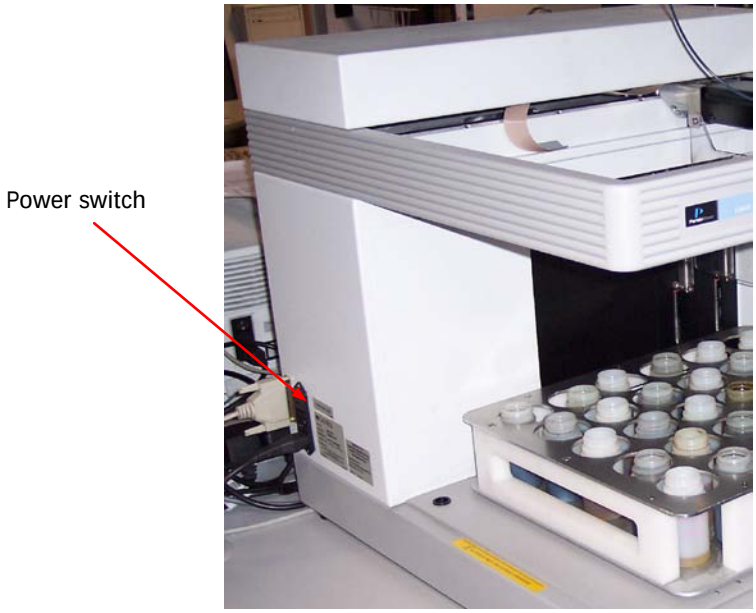


Figure 2 Location of the Autosampler power switch

The spectrometer is connected to a PC, either point-to-point or over a network.

The Liquid Autosampler module is connected to the same PC via an RS232 link.

The Liquid Autosampler

The LiquidExpress System uses a Liquid Autosampler to enable the rapid sampling of up to 60 samples per hour. Figure 3 shows a general view of the Liquid Autosampler.

The Liquid Autosampler provides:

- Minimal sample carry-over by flushing the needle and flowcell with solvent.
- A 2-port flowcell. A wide range of possible flowcells are available, made of various materials and with various path lengths.
- Flexible sample presentation: a rack that holds 30 sample bottles, or test tube racks with a capacity of 240.
- Solvent bottle.
- Two high-resolution syringe pumps to provide robust, reliable liquid handling.

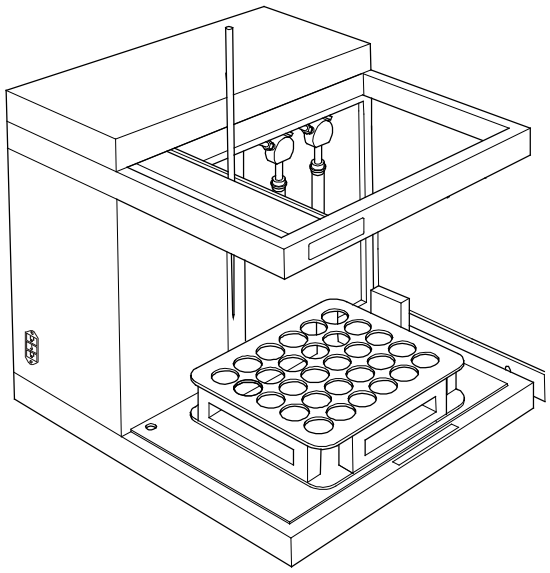


Figure 3 The liquid autosampler

X-Y-Z Arm

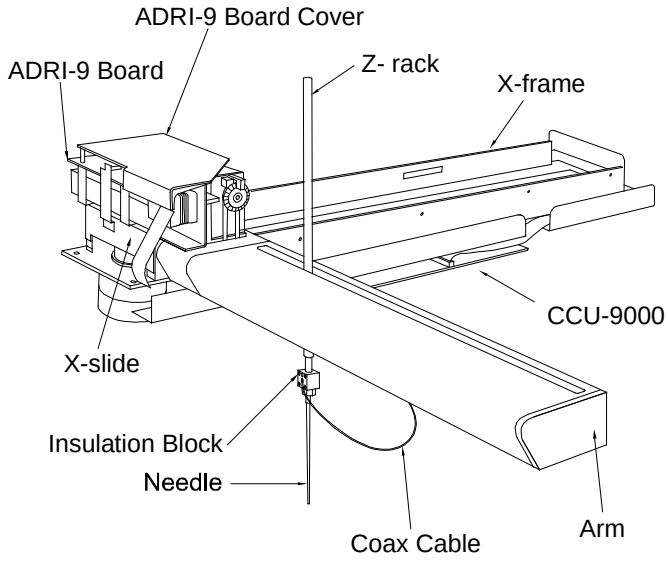


Figure 4 X-Y-Z arm mechanism

The X-Y-Z arm movements are controlled by stepper motors linked by drive belts.

Pumps

The Autosampler uses two syringe pumps. These pumps are located on the back panel of the auto stepper motor driven syringe pump (Figure 5). The pump consists of a syringe drive, a valve drive, and control electronics. The head of the syringe is attached to the valve assembly that controls the input and output of the fluid path. The plunger of the syringe is attached to the syringe drive that moves the plunger up and down.

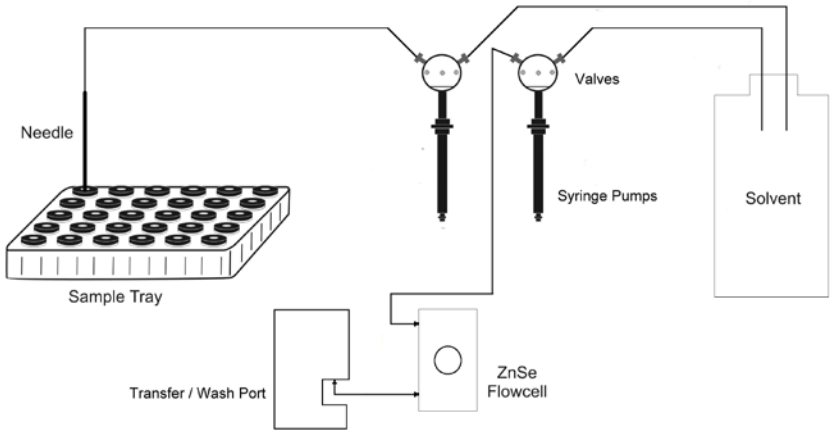


Figure 5 The sample pump

Sample Injection / Wash Port

The Sample Injection/Wash Port (Figure 6 and Figure 7) consists of a waste transfer and port. After completion of a liquid handling function, the excess sample is discarded in the waste port. The probe is then moved to the wash port for cleaning. Washing is accomplished by pumping wash fluid through the probe. The fluid then flows around the outside of the probe and overflows into the waste port. The waste fluid then travels by gravity out of the waste tubing to a waste reservoir located below the instrument.

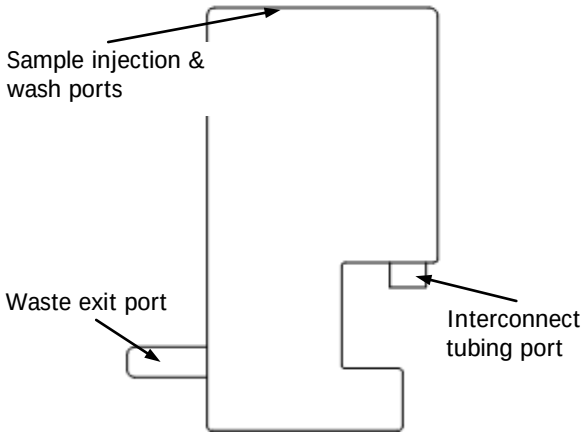


Figure 6 Sample injection and wash ports (side view)

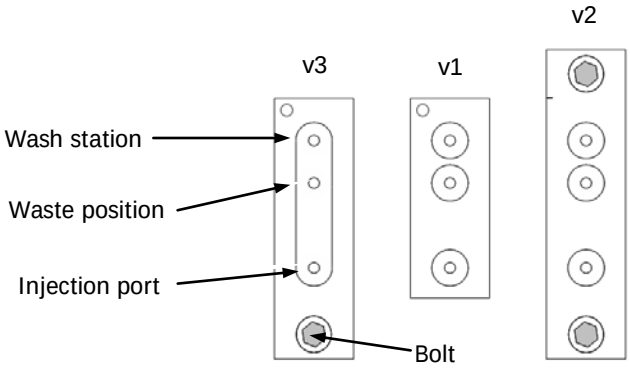


Figure 7 Sample injection and wash ports (top view)

The transfer port is used to transfer the sample to the flowcell located in the sample compartment of the spectrometer. The transfer port consists of a nylon fitting into which the sample probe is lowered.

Sampling Probe / Needle

The sample is drawn through the stainless steel needle and delivered to the flowcell via the transfer port. The needle is cleaned in the wash port: the solvent flows down inside the needle, and then is forced up around the outside and to waste.

Sample Rack

A 30-bottle sample rack is supplied as shown in Figure 8.

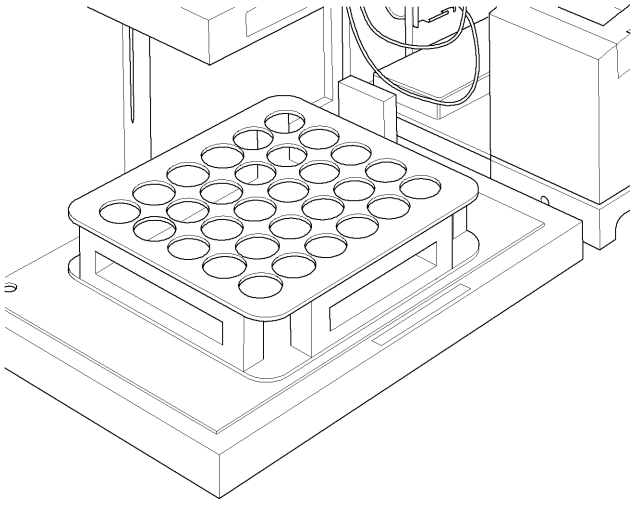


Figure 8 Autosampler sample rack

Solvent Bottle

WARNING

In the event of a solvent spillage, isolate the power to the LiquidExpress System immediately and then clean up the solvent spill. The system can then be powered up but the spectrometer should be allowed to stabilize for at least two hours before measurements are taken.

The solvent used will vary, depending upon the type of sample being analyzed. The solvent should be aspirated from a supply adhering to laboratory safety standards that advise on its safe storage, handling, use and disposal.

If using the solvent bottle supplied with the LiquidExpress System (Figure 9), the following is recommended:

- For flammable solvents, the solvent bottle should be re-filled away from the LiquidExpress System, in a well-ventilated area, and precautions should be taken against static discharge.
- The bottle lid should be used at all times. The solvent bottle lid should be correctly fitted to the bottle during operation of the LiquidExpress System.
- The bottle should be stored to the rear of instrumentation at a location where it will not be knocked accidentally.

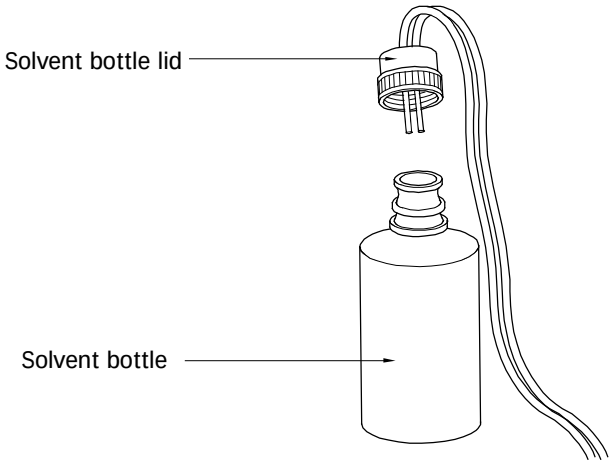


Figure 9 Solvent bottle

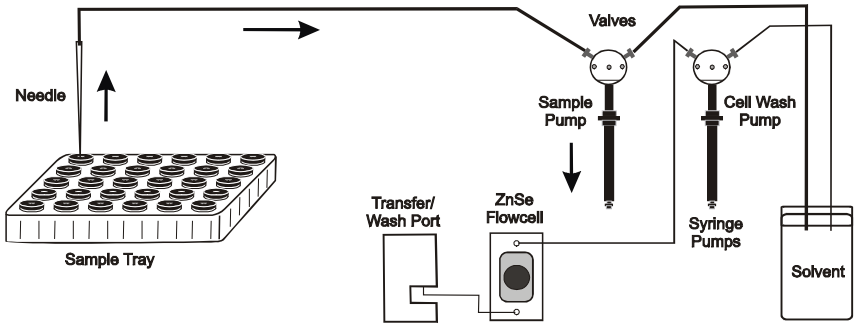
Overview of the Sampling Procedure

1. At the start of an analysis, the wash volume of solvent is drawn up by each pump.

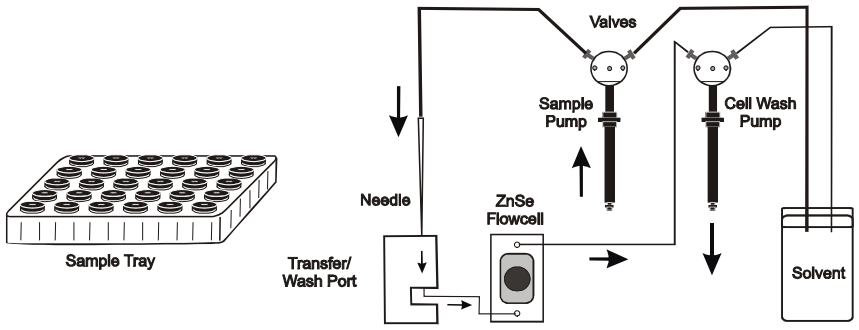
2. The sample pump valve switches to the needle and the cell pump switches to the cell, and the solvent is dispensed.

3. The needle is lowered into the sample and the sample is aspirated by the drawing down of the sample pump.

   The default volume aspirated is 3.5 ml.



4. The needle then moves to the transfer port.



5. The sample pump dispenses the sample to the cell.

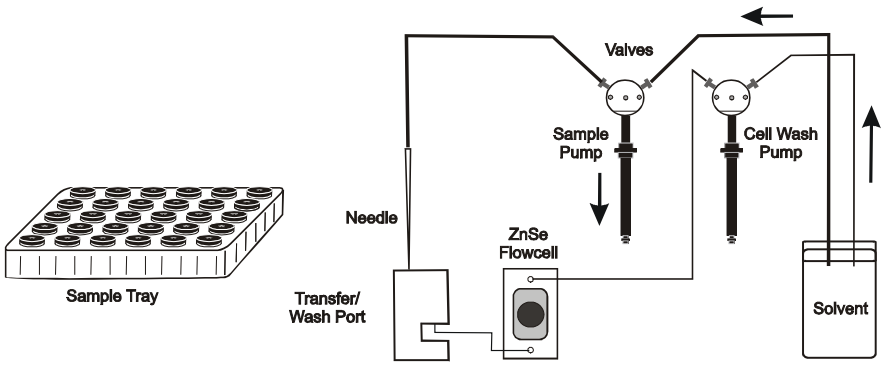
   Only 2.1 ml of sample is dispensed to the cell.

   To aid the transfer of the viscous liquid and prevent pressure build up, the cell pump is simultaneously drawn back by the same volume.

6. The LiquidExpress software performs a sample detection.

7. When the sample has been successfully detected the needle moves to the waste port to dispense the remaining sample.

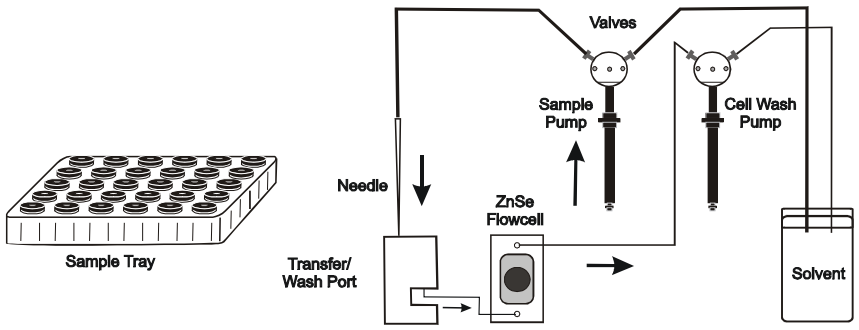
8. The sample pump valve switches position so that the pump is connected to the solvent reservoir.



9. The pump aspirates the solvent.

10. The sample pump valve then switches back to the needle.

11. The needle moves and lowers into the wash port.



12. The sample pump dispenses the solvent to flush out the tubing and the needle.
    When the needle has been flushed the next sample can be aspirated.

13. When LiquidExpress has completed scanning the sample, the cell pump valve switches to the cell and the pump moves to push the sample back through the cell and back through the transfer port where it then flows to the adjacent wash port.

14. The cell pump valve switches to the reservoir and aspirates solvent.

15. The cell pump valve then switches back to the cell and the pump moves up to flush the cell and the tubing.
    Waste from this process flows back through the cell and the transfer port to waste.

Analyzer Measurement

Analyzer Sample Compartment

WARNING	*DO NOT use the LiquidExpress System when the sample compartment lid is fitted. Flammable vapor may seep through instrument seals and gaskets and accumulate under the lid, where it could cause a fire or explosion hazard.*

CAUTION	*The sample compartment windows may be composed of a hygroscopic material, such as KBr; which, although coated, can be damaged by high levels of humidity. Refer to the documentation supplied with your spectrometer for details.* *If you spill liquid in the sample compartment, wipe it up quickly.*

CAUTION	*Relative humidity higher than 80% can damage the windows of the sample compartment.*

The sample compartment (Figure 10) is located at the front of the instrument.

Figure 10 Sample compartment of a Frontier IR System

- The infrared beam enters the compartment through an aperture on the left. After passing through the sample, it enters the detector area through an aperture on the right side of the sample compartment.

- A sample shuttle is installed in the sample compartment. The sample shuttle is used to move the flowcell of the Liquid Autosampler in and out of the beam.

2-Port Flowcell

The 2-port flowcell (Figure 11) is used in a sample shuttle so that a background spectrum can be collected regularly if sampling times are long, or to compensate for changing environmental conditions. The sample shuttle moves the flowcell in and out of the beam between collecting a background and sample spectrum.

Figure 11 The 2-port flowcell

Each flowcell is fitted with two ZnSe windows; other window materials may be used, depending upon the type of sample being analyzed.

Filling and emptying the flowcell

In the 2-port flowcell, the sample enters the flowcell at the bottom of the cell. When the cell is emptied, the sample is pushed back out of the bottom of the flowcell, up through the transfer port and evacuates to waste by gravity.

Rinsing the flowcell

When the flowcell is rinsed, the solvent enters the flowcell at the top of the cell, and leaves it at the bottom, then passes through the transfer/wash port to waste.

FT-IR Liquid Autosampler: Specifications

Sample Viscosity Range	4–1000 cSt (centiStokes)
Sample Throughput	Approximately 50 per hour for 200 cSt samples
Sample Carry-over	<0.1%
Wash Solvent Carry-over	1% typical
Capacity	30 × 4 oz bottles / 240 × 16 mm vials
Minimum Sample Volume	4 ml
Flowcell	Flow-through transmission

Warnings and Safety Information

LiquidExpress System Safety Summary

The PerkinElmer LiquidExpress System has been designed to comply with a wide variety of international standards governing the safety of laboratory equipment. In routine use, the LiquidExpress System poses virtually no risk to you. If you take some simple, common sense precautions, you can make sure that you maintain the continued safe operation of the LiquidExpress System.

DO make sure that the LiquidExpress System is properly connected to the electrical supply; in particular make sure that the ground (earth) is securely connected.

DO take care with volatile and flammable solvents. Remove the solvent bottle and move it away from the LiquidExpress System before you fill it. Always keep the lid on the solvent bottle.

DO disconnect the electrical power cable before opening the main cover of the spectrometer.

DO keep the LiquidExpress System dry. Avoid spilling liquid into the LiquidExpress System. Clean all external spills immediately. If anything that is spilled enters the main body of the LiquidExpress System, switch off the power and call a PerkinElmer Service Engineer.

DO NOT stare into the laser beam. The spectrometer contains a low power, visible (red) laser; momentary exposure to the beam is not dangerous, but deliberate, direct viewing of the beam along its axis could damage your eye.

DO NOT use the LiquidExpress System when the sample compartment lid is fitted. Flammable vapor under the lid could be a fire or explosion hazard.

DO NOT use a flammable gas to purge the spectrometer. The spectrometer contains a hot source, and a fire or explosion will result. Only use clean, dry, oil-free nitrogen or air to purge the instrument.

DO NOT place hands beyond the line at the front of the Autosampler enclosure whilst operating the LiquidExpress System.

Read the more detailed information on warnings and safety in the following pages, and in the documentation supplied with your spectrometer, to ensure the safe operation of the instrument.

General Safety

The LiquidExpress System has been designed and tested in accordance with PerkinElmer specifications and in accordance with the safety requirements of the International Electrotechnical Commission (IEC). The spectrometer conforms to IEC publication 61010-1 (“Safety requirements for electrical equipment for measurement, control, and laboratory use”) as it applies to IEC Class 1 (earthed) appliances and therefore meets the requirements of EC low voltage directive 2006/95/EC.

If the instrument is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired. Only use the LiquidExpress System indoors and under the following conditions:

Temperature: 15 °C to 35 °C
Relative Humidity: 80% maximum (non–condensing)

If possible, avoid any adjustment, maintenance and repair of the opened, operating instrument. If any adjustment, maintenance and repair of the opened, operating instrument is necessary, this must only be done by a skilled person who is aware of the hazard involved.

Whenever it is likely that the LiquidExpress System is unsafe make it inoperative. The LiquidExpress System may be unsafe if it:

- Shows visible damage.
- Fails to perform the intended measurement.
- Has been subjected to prolonged storage in unfavorable conditions.
- Has been subjected to severe transport stresses.

WARNING

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

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

The LiquidExpress System has been designed to be safe under the following environmental conditions:

- Indoor use.
- Altitude up to 2000 m (above mean sea level).
- Ambient temperatures of 5 °C to 40 °C.
- A maximum ambient relative humidity of 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40 °C.
- Mains supply fluctuations not exceeding ±10% of the nominal voltage.

Location and Ventilation

To allow for adequate cooling, the LiquidExpress System should not be sited near to room heating equipment, for example, central heating radiators.

During operation, there should be a minimum gap of:

- 6 inches (15 cm) between any surface and the cooling louvers at the rear of the spectrometer.
- 3 inches (7 cm) between the LiquidExpress System and adjacent equipment.
- 1 inch (2.5 cm) between any wall or obstructing surface and the ventilation panel on the back of the Autosampler.

WARNING

Make sure that the switches at the electrical supply inlet on the rear and side of the LiquidExpress System are not obstructed.

Mechanical Hazards

WARNING

Whenever the autosampler is in operation there is the risk of injury from moving mechanical parts. The autosampler is designed for automatic hands-off operation only. Never reach into the autosampler workspace when the autosampler is in operation.

Electrical Safety

- Connect both units comprising the LiquidExpress System to a power supply line that includes a switch or other means of disconnection from the electricity supply.
- Only plug the LiquidExpress System into an electricity supply socket that is provided with a protective earth connection.
- When fuses need replacing, use only those with the required current rating and of the specified type. Do not use makeshift fuses and do not short-circuit fuse holders. On the Autosampler, replace both fuses if one blows as the second one will be weakened.
- When the LiquidExpress System is connected to its electricity supply, terminals may be live and the removal of covers other than those that can be removed by hand is likely to expose live parts.
- Capacitors inside the LiquidExpress System may still be charged even if the instrument has been disconnected from all voltage sources.

- The LiquidExpress System must be disconnected from all voltage sources before it is opened for any adjustment, replacement and maintenance, or cleaning up of any major liquid spills.

- Do not touch any switches or outlets with wet hands.

WARNING

Any interruption of the protective earth conductor inside or outside of any components comprising the LiquidExpress System or disconnection of the protective earth terminal can make the instrument dangerous.

The LiquidExpress System has:

- An IEC Pollution Degree 2 classification – usually only non-conductive atmospheric pollution of the equipment occurs; occasionally, however, a temporary conductivity caused by condensation must be expected.

- An IEC Insulation class I rating for external circuits – only connect equipment that meets the requirements of IEC 61010-1, IEC 60950 or equivalent standards.

The instrument is designed to be safe under transient overvoltages typically present on the MAINS supply.

NOTE: The normal level of transient overvoltages is impulse withstand (Overvoltage) category II of IEC 60364-4-443.

Samples and Waste

Samples

When using the flowcell, to ensure that the sample will flow through the flowcell the maximum particle diameter must not exceed 50 µm.

Solvent

If you are using flammable solvents, observe the warnings in *Use of Flammable Solvents and Samples* on page 32.

Waste

DO position the waste container on a surface that is at least 90 cm (36 inches) below the bench on which the LiquidExpress System is located because the flow of waste relies on gravity.

DO NOT immerse the ends of the tubes in the waste.

Disposal of waste

Observe local and national regulations when disposing of waste from the LiquidExpress System.

Laser Safety Regulations

The LiquidExpress System is a CDRH Class I, BS EN 60825-1/IEC 60825-1 Class 1 laser product as defined by IEC 60825-1. The optical module contains a Class 2 Helium Neon (HeNe) laser, which emits visible, continuous wave radiation at a wavelength of 633 nm and has a maximum output power of 1 mW. Some diffuse HeNe laser radiation, within Class 1 limits, emerges from:

- The window in the left hand side of the sample compartment when an internal beampath is selected.
- An external beam port when the beam port cover is removed, no accessory is fitted at the port, and the beampath to the port is selected.

WARNING

Do not stare into any laser beam. Staring into a laser beam (intrabeam viewing) can cause permanent damage to your eyes.

The laser is automatically shut down when the main cover of the instrument is raised.

WARNING

Do not attempt to override or modify the interlock system.

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

The instrument complies with the following laser safety regulations:

1. 21 CFR Part 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50 dated 24 June 2007. Administered by the Center for Devices and Radiological Health, U.S. Department of Health and Human Services.
2. EN 60825-1:2007 – “Safety of laser products – Part 1: Equipment classification and requirements”.

For further information on the safe use of your spectrometer, refer to the documentation supplied with the instrument.

Warning Labels

When this label is attached to an instrument it means refer to the manual in order to find out the nature of the potential hazard and any actions which have to be taken.

Autosampler Labels

Labels are fixed to the Autosampler in the locations shown in Figure 12 & Figure 13.

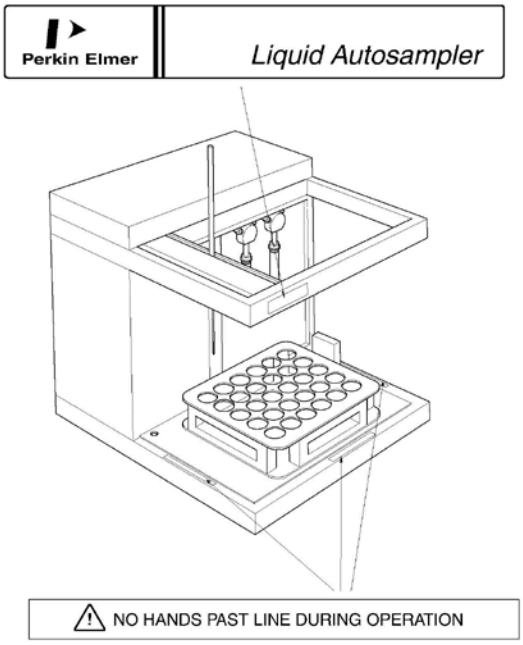


Figure 12 Autosampler labels (front)

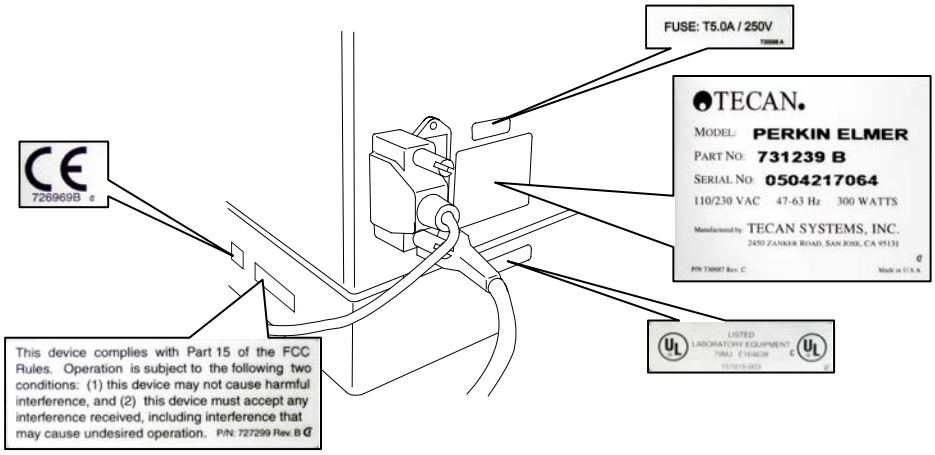


Figure 13 Autosampler labels (rear and left side)

Warning Signs on the Instrument

Caution, hot surface.

Caution, risk of electric shock.

Caution, laser radiation hazard.

Caution risk of danger.

Refer to accompanying documents in all cases where this symbol is used to find out the nature of the potential HAZARD and any actions which have to be taken.

EMC Compliance

EC Directive

The LiquidExpress System has been designed and tested to meet the requirements of the EMC Directive 2004/108/EC. The LiquidExpress System complies with the EMC standard EN 61326 (EMC standard for electrical equipment for measurement, control and laboratory use).

FCC Rules and Regulations

This product is classified as a digital device used exclusively as industrial, commercial, or medical test equipment. It is exempt from the technical standards specified in Part 15 of the FCC Rules and Regulations, based on Section 15.103 (c).

Use of Flammable Solvents and Samples

WARNING

The spectrometer contains a hot source and contact with flammable vapors may cause an explosion. When working with flammable solvents or samples, particularly during unattended operation with flow-cells, it is recommended that the instrument optics area should be continuously purged with dry air or nitrogen to maintain a positive pressure and prevent flammable vapor entering the instrument.

WARNING

DO NOT use the LiquidExpress System when the sample compartment lid is fitted. Flammable vapor may seep through instrument seals and gaskets and accumulate under the lid, where it could cause a fire or explosion hazard.

WARNING

If flammable solvents or samples are spilled on the instrument and there is any possibility that they have entered the interior (by coming into contact with cover gaskets for example) then the instrument must be switched off immediately and disconnected from the power supply. The optics area should then be thoroughly purged with dry air or nitrogen, or the main cover should be opened to thoroughly ventilate the optics area before proceeding.

WARNING

Flammable solvents or samples should not be stored on or near the instrument. Handling of such materials during preparation should be performed in a safe area away from the instrument such as a fume cabinet.

WARNING

Some chemicals used with this instrument may be hazardous or may become hazardous after completion of an analysis. The responsible body (for example, the Laboratory Manager) must take the necessary precautions to make sure that the surrounding workplace is safe and that the instrument operators are not exposed to hazardous levels of toxic substances (chemical or biological) as defined in the applicable MSDS (Material Safety Data Sheets) or OSHA (Occupational Safety and Health Administration (United States), ACGIH (American Conference of Governmental Industrial Hygienists [United States]), or COSHH (Control Of Substances Hazardous to Health [United Kingdom]) documents. Venting for fumes and disposal of waste must be in accordance with all national, state and local health and safety regulations and laws.

WARNING

The use of highly flammable solvents presents no hazard during routine use of your LiquidExpress System, but:

- *DO clean up leakages and spillages immediately and thoroughly.*
- *DO move the solvent bottle away from the LiquidExpress System before you fill it.*
- *DO always keep the lid on the solvent bottle.*
- *DO NOT allow the syringe pumps to run dry; make sure that there is always sufficient solvent in the solvent bottle.*
- *DO ensure that you are fully aware of any health and safety issues associated with the particular solvent you are using. Consult your local Health and Safety Officer for details.*

WARNING

DO make sure that the waste tubing is not blocked and that it outlets to a suitable waste container which stands on a surface at least 90 cm below the bench on which the LiquidExpress System is located.

The end of the waste tubing should not be immersed in the waste material.

DO read and observe the information supplied with the solvent.

Flowcell Windows

Zinc Selenide (ZnSe)

WARNING

During routine use of your LiquidExpress System, the ZnSe windows in the flowcell presents no hazard, but:

- *DO wear protective gloves when handling the windows.*
- *DO NOT use acids to wash the windows because they react to emit H_2Se, which is very toxic and irritating.*
- *Avoid contact of the windows with oxidizers.*

ZnSe is highly toxic by ingestion.

Cleaning ZnSe windows

Avoid contact of the windows with oxidizers and acids. ZnSe can be cleaned in pure dry acetone or methanol using a soft, lint-free cloth and drying in a current of warm air so that there is no possibility of condensation forming on the window. Other suitable solvents are petroleum ether and hexane. The windows may also be cleaned in some commercial laboratory detergents, but they must be neutral. Alkaline solutions will slightly etch the surface, and acids will severely attack the material. A final rinse in distilled water and drying in a current of warm air is recommended.

Material Safety Data Sheets

WARNING

Some of the materials described in these procedures are hazardous. Appropriate safety equipment and clothing should be used when handling them. See the Materials Safety Data Sheets (MSDS) supplied by your local Safety Officer for details.

They must be disposed of with care, following your laboratory procedures.

You can search for up-to-date copies of safety data sheets on materials, such as ZnSe, used in PerkinElmer products that are known to have safety issues from the Technical Resources section of the PerkinElmer website. The MSDS information is available in a range of languages, and includes data items required in specific national, supra-national and state jurisdictions.

To obtain a safety data sheet for a particular compound, follow the steps described below.

NOTE: To read MSDS .pdf files you will need Adobe Reader 5.0 or later. An installation of this software is available on the *Software Utilities CD*.

1. Launch your web browser and navigate to the PerkinElmer web site:
   www.perkinelmer.com
   If you are not redirected automatically you may have to select the home page appropriate to your location.

2. Search for the term MSDS using the search box located at the top of the home page.
   The **Search for Material Safety Data Sheets (MSDS)** page is displayed.

3. Enter the key words for the compound, in the **Product name** box, and then click **Go**.
   A full list of all MSDS documents that refer to the compound is displayed.

4. Select the MSDS document you want to view.

Unpacking and Installation

Overview

Installation of the LiquidExpress System and LiquidExpress software will be performed by a PerkinElmer Service Engineer. The installation procedure is summarized below.

- Unpack the Autosampler.
- Unpack and install the sample shuttle in your spectrometer.
- Connect the Autosampler.
- Install Liquid Express software.
- Configure the LiquidExpress system.
- Calibrate the LiquidExpress system.

NOTE: For details of how to unpack and install your spectrometer, please refer to the documentation supplied with your instrument.

Instrument Requirements

NOTE: Read the warnings and safety information at the start of this manual before installing the LiquidExpress System. They contain important information.

Electrical requirements

- The LiquidExpress System can operate on electricity supplies of 50 or 60 Hz and on voltage ranges of between 100 and 120 V or between 220 and 240 V.
- The line supply must be within 10% of the nominal voltage.
- The power rating of the Autosampler is 300 W.
- If possible, do not connect the LiquidExpress System to circuits that have heavy-duty equipment, such as large motors, connected.
- If possible, do not use photocopiers, discharge lamps, radio transmitters, and other equipment with large or frequent transient loads on the same supply circuit.

Environment

To obtain the best performance from your LiquidExpress System:

- Place the LiquidExpress System in an environment that is relatively dust-free.
- Make sure that the bench top is free from vibrations or mechanical shocks.
- Do not place the LiquidExpress System or the PC near to room heating equipment, for example, central-heating radiators.
- Leave at least 7 cm (3 inches) from any vertical obstacle to the sides of the LiquidExpress System, to permit an adequate flow of cooling air.
- Make sure that there are no overhanging shelves, and no water pipes or faucets that could leak onto the LiquidExpress System.
- The area near the PC must be free of strong magnetic fields, direct sunlight, and heating or cooling units or ducts.

Unpacking

Unpacking the Autosampler

WARNING

The Autosampler is a heavy instrument with a basic weight of approximately 30 kg, so two people are required for safe handling.

Consult the local codes of practice issued by safety advisors before attempting to lift it.

Take care not to injure yourself or others, or to drop the Autosampler.

- When you receive the instrument, look at the exterior of the container for possible shipping damage. Check for the following items:
  - Water damage or discoloration.
  - Cuts or gashes.
  - Collapsed corners.
  - Crushed top or sides.
  - Other physical damage.

NOTE: If any of the above items are found, contact PerkinElmer and the shipping agent immediately.

Before unpacking the Autosampler, make sure that there is sufficient space to lay out the instrument and accessories. This makes checking the contents of the box against the packing list easier. Follow the steps below to prevent damage to the instrument:

1. Remove the plastic shrink-wrap.
2. Cut the two (2) bands.
3. Lift off the top of the shipping carton.
4. Empty the small accessories from the end sections of the carton.
5. Gently lift the entire upper portion of the inner container and set it aside.
6. Remove the styrofoam cushions on top of the instrument.
7. Remove instrument from the shipper and place it on a work surface.

Do not lift the Autosampler by its arm guard.

CAUTION

8. Inspect instrument for any physical damage.

9. Open the box of accessories and place the contents on an open surface.

10. Check to make sure that all parts have been received.

NOTE: If any parts are missing from the packing list, contact PerkinElmer immediately.

Unpacking and Installing the Sample Shuttle

The sample shuttle accessory can be simply installed into the sample compartment of the spectrometer.

1. Unpack the sample shuttle from its box.

2. Rest the back of the sample shuttle accessory on the ledge in the sample area and slide it into position.

   Push it firmly home to ensure that the multiway connector on the rear of the sample shuttle accessory mates properly with the spectrometer connector.

WARNING

When the sample shuttle locks into place it aligns itself, which means that the slide holder may move. Be careful that your fingers, tie, etc. are not trapped by the movement.

Figure 14 Installing the sample shuttle accessory

NOTE: To remove the sample shuttle accessory, release the accessory by pulling the blue handle under its baseplate, and then slide the accessory towards you and out of the sample compartment.

Positioning the LiquidExpress System

1. Position the Liquid Autosampler on the bench as shown below (Figure 15).

   Leave a gap of 0.5–1 cm between the Autosampler and the spectrometer. Ensure that you have space for the PC either to the right side of the spectrometer, or to the left side of the Autosampler.

Figure 15 The LiquidExpress System positioned for use

2. Align the Autosampler and the spectrometer so that the rear of the injection wash port and the sample shuttle are parallel.

   The spectrometer protrudes approximately 5 cm in front of the Autosampler when correctly aligned.

   Make sure that there is access to power and a waste container.

3. Place the PC in a suitable location.

4. Remove the Velcro straps and plastic cable ties around the Z-rack.

5. Remove any additional packaging and support from the Autosampler and make sure that the arm is able to move freely on all axes.

Installing the Liquid Autosampler

Electrical Connections

Power cord

1. Make sure that the Autosampler is switched off.

2. Fit the molded socket of the mains cable into the plug on the side panel of the Autosampler (Figure 16).

3. Plug the power cord into the appropriate mains electrical supply.

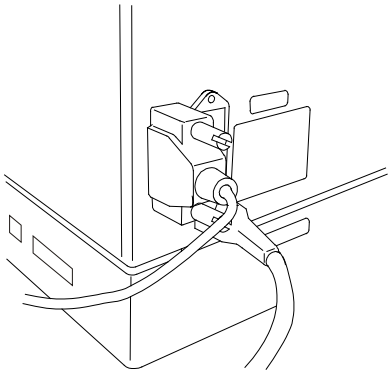


Figure 16 The side panel of the autosampler

Cable to PC

1. Attach the male connector into the DB25 receptacle on the left side of the Autosampler (Figure 16), and tighten the screws.

2. Attach the female connector of the cable to the DB9 SERIAL COMM 1 port on the back of the PC, and tighten the screws.

   If the computer has a DB25 connector, an adapter is required.

Installing the Fluid Line Support Arm

Insert the fluid line support arm into the liquid connector block on the right of the autosampler.

Figure 17 Fluid line support arm

NOTE: The Arm Shield is not installed until the remainder of the installation, including software installation and calibration has been completed.

Installing Racks (if ordered)

1. Remove and unwrap rack.
2. Place the sample rack on the pins as shown in Figure 18.

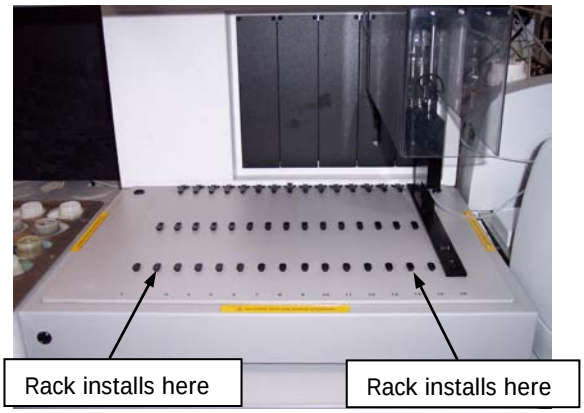


Figure 18 Installing the sample rack

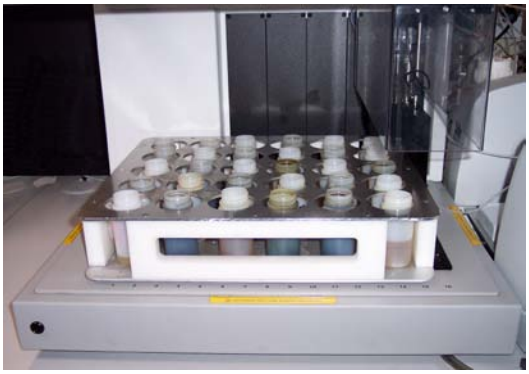


Figure 19 Sample rack

Autosampler Tubing Connections

Fluid Tubing System

1. Remove the reagent tubing (L1200556) from the accessory bag. Route the ends with the fitting through the black grommet hole on the right panel of the autosampler. Install fitting on the right valve port of each of the syringe pumps. Tighten the fitting finger tight and then tighten an additional quarter turn with a wrench.

2. Remove the interconnect tubing (L1200585) from the accessory bag. Route one end of the tubing through the black grommet hole on the right panel. Install the fitting on one end to the left valve port of the right syringe pump. Connect the fitting on the other end to the top of the 2-port flowcell. Tighten fittings as above.

3. Remove the needle tubing (L1200587) from the accessory bag. Install the end with the fitting into the left valve port of the left syringe pump. Insert the other end through the fluid line support arm (Figure 17), and then through the top of the Z-rack until it extends approximately one inch out from the lower end (Figure 21).

4. Remove the interconnect tubing (L1200557) from the accessory bag. Install the fitting on one end to the bottom of the injection\wash port (Figure 6) and the other to the bottom of the 2-port flowcell. Tighten the fitting finger-tight and then tighten an additional quarter turn with a wrench.

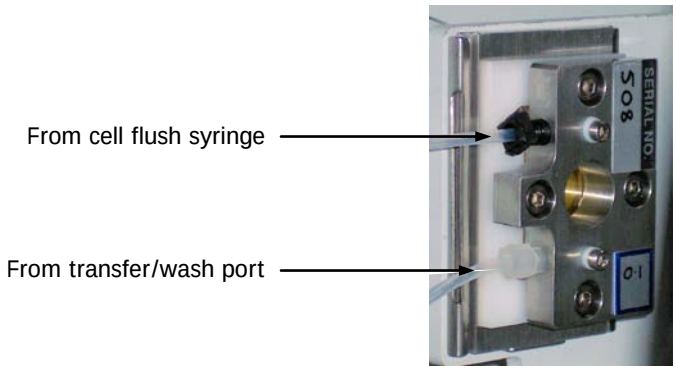


Figure 20 Connecting tubing to the 2-port flowcell

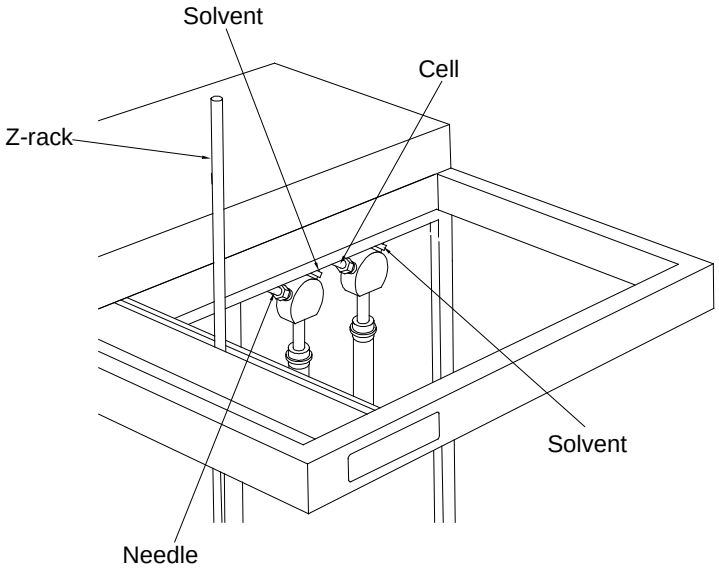


Figure 21 Tubing connections from the pumps to the 2-port flowcell

5. Remove the needle from the accessory bag. Loosen the slotted screw in the insulation block, and then insert the shorter end of the needle through the sleeve in the insulation block as far as the collar. Retighten the screw.

CAUTION	*Electrostatic discharge to the sampling probe may cause damage to the ALIDUM liquid level detector (see* Inspecting the Insulation Block/ALIDUM Cable Assembly *on page 78).*

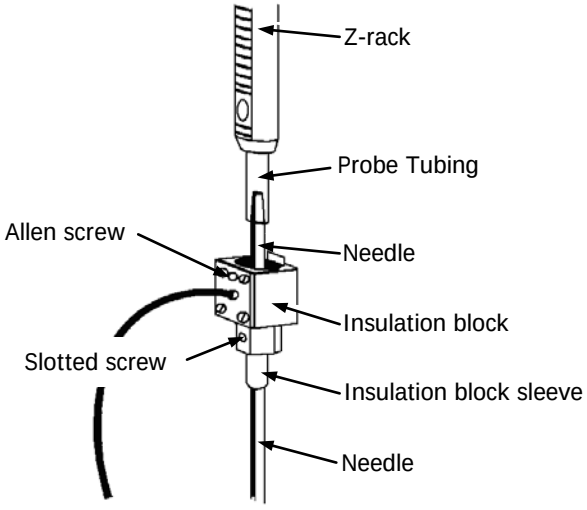


Figure 22 Connecting the needle tubing to needle

6. Push the needle tubing over the shorter end of the needle (to a minimum of 25 mm, 1 inch).

7. Loosen the Allen screw on the insulation block. Install the insulation block on the Z-rack with the insulation block sleeve facing down and the insulation block (black coax) cable on the left side. Ensure that the insulation block cable is not twisted.

8. Push the insulation block onto the Z-rack until firmly seated.

9. With an Allen wrench, tighten the insulation block set screw until it makes contact with the flat portion of the Z-rack. Do not overtighten the setscrew.

Connecting the tubing to the solvent bottle

1. Thread the tubing from top to bottom through the cap of the wash bottle as shown in Figure 23.

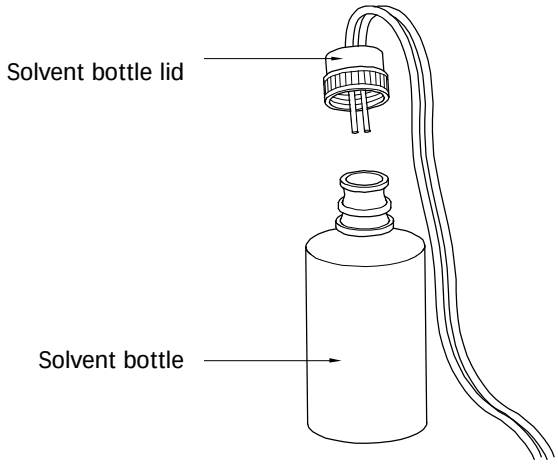


Figure 23 Connecting the solvent tubing

2. Fill the solvent bottle with solvent.

3. Screw the cap on to the solvent bottle securely.

4. Position the bottle safely, behind the instrumentation at a location where it will not be accidentally knocked.

Installing the Flowcell in the Sample Shuttle

WARNING

DO NOT use the LiquidExpress System when the sample compartment lid is fitted. Flammable vapor may seep through instrument seals and gaskets and accumulate under the lid, where it could cause a fire or explosion hazard.

1. Unpack the flowcell.
2. Slide the flowcell into the sample shuttle (Figure 24).
3. Make sure that the tubing cannot obstruct the optical beampath.

Figure 24 Sample shuttle accessory and flowcell fitted

Waste Container

We recommend that you use a waste container that is larger than the solvent bottle. Then, if you empty the waste container whenever you refill the solvent bottle, the waste container will not overflow.

The waste drains into the container by gravity, so the container should stand on a surface that is at least 90 cm below the bench on which the LiquidExpress System is located.

Fitting waste tubing

1. Attach the waste tubing to the hose connector at the rear of the transfer/wash port.
2. Insert the waste tubing into the hole on the rear right-hand side of the base plate of the Autosampler.
3. Adjust the routing of the tubing so that it is not kinked.
4. Place the other end of the waste tubing in the waste container.
   Ensure that the end will not be immersed in the waste.

CAUTION

Make sure that the ends of the tubing do not become immersed in the waste or the operation of the analyzer will be impaired.

Installing the Syringe

The syringes cannot be installed until the Spectrum software has been installed.

1. Switch on the Autosampler.
2. Start the AutoSampler Utilities.
   Select **Start**, **All Programs**, **PerkinElmer Applications**, **LiquidExpress** and then click **AutoSampler Utilities**.
3. Log in as an Administrator.
   The User Name is **Administrator** and the Password is **Administrator**.
4. Select **Pump Diagnostics** from the File menu.
5. Click **Change Syringe**.
6. Assemble the syringe (L1200552) by placing the plunger in syringe barrel and putting the syringe clamp over the Luer lock fitting.
7. Unscrew the pin from the plunger shaft.
8. Mount the syringe plunger on the plunger shaft. Line up the barrel with the Luer lock fitting. Screw the barrel onto the valve fitting while pushing upward slightly.

CAUTION	*When mounting the syringe on the valve, you must assist the Luer lock threads by pushing upward. Otherwise they may become stripped.*

9. Replace the plunger pin.
10. Rotate the syringe clamp clockwise then tighten the clamp screw.
11. Replace the plunger screw at the base of the syringe plunger.

PC Hardware and Software Requirements

This section details the minimum hardware and software requirements for the PC. To ensure successful installation of the software, please check these requirements before starting the installation.

if all of these criteria are met should you start to install the LiquidExpress software (see *Installing the LiquidExpress* Software on page 52)

Software Requirements

The minimum requirements for the LiquidExpress System are:

- Windows 7 (32-bit), Windows Vista, or Windows XP with Service Pack 2 must be installed, and you must be logged on at Administrator level.
- Internet Explorer 5.01 or later must be installed.
- Spectrum software must be installed, as described in the documentation supplied with your spectrometer on the *IR & Raman Manuals CD* (L1050002).

Hardware Requirements

The PC you install the software on must meet the following minimum specification:

- Intel® Pentium 4 processor with 500 MHz or greater clock speed.
- At least 256 MB of Random Access Memory (RAM).
- The capability of displaying at least High Color (16 bit) at 1024 × 768 SVGA.
- 10 GB Hard disk with at least 1 GB free space as an NTFS drive.
- CD-ROM drive.
- Ethernet network connection.
- A keyboard and PS/2®-style mouse.
- A serial port, for autosampler connection.

Installing the LiquidExpress Software

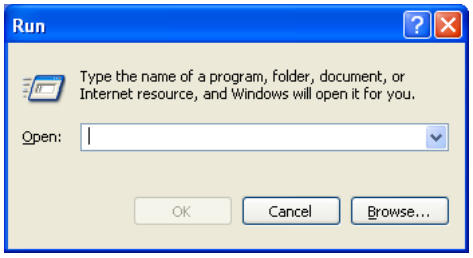
The Liquid AutoSampler software CD contains an Installation Wizard to help you install LiquidExpress on your PC.

NOTE: The Spectrum software must be installed *before* LiquidExpress. Consult the documentation supplied with your spectrometer, on the *IR & Raman Manuals CD* (L1050002) for details.

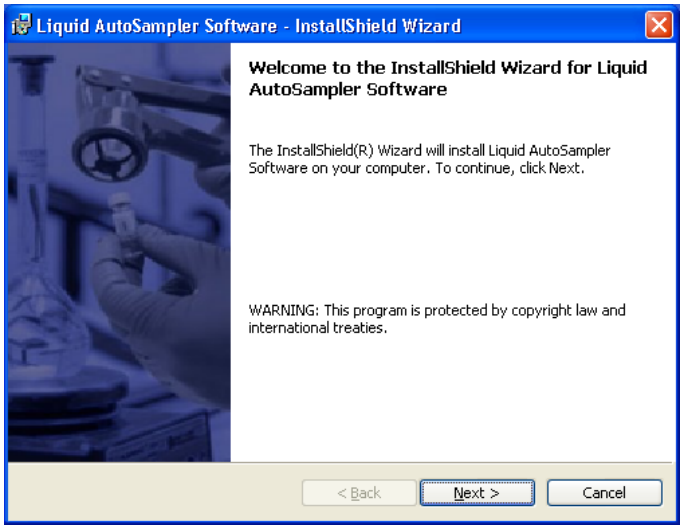
Once the Spectrum software has been installed, details of how to administer it can be found in the *Spectrum Administrator's Guide* (L1050095), which is also provided on the *IR & Raman Manuals CD*.

To install LiquidExpress:

1. Place your Liquid AutoSampler software CD into your CD drive.
2. If the CD does not auto-run, select **Run** from the Start menu.
   The Run dialog is displayed.

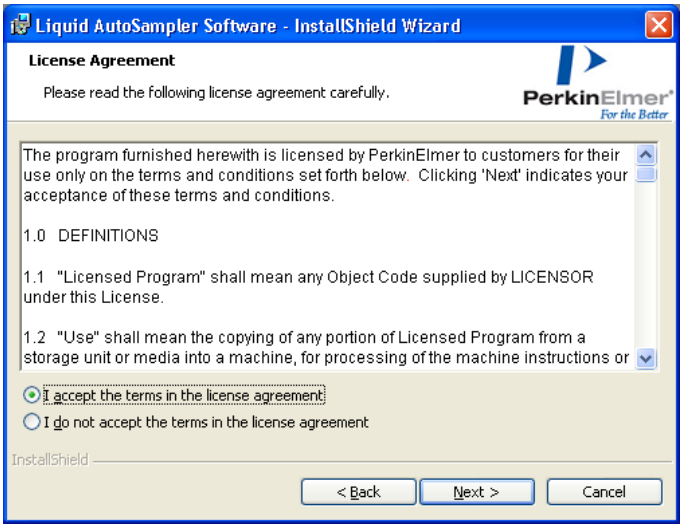


3. Enter **d:\Setup.exe** and click **OK**.
   Replace **d:** with the drive letter for your CD.
   After preparing to install, the InstallShield Wizard Welcome dialog is displayed.



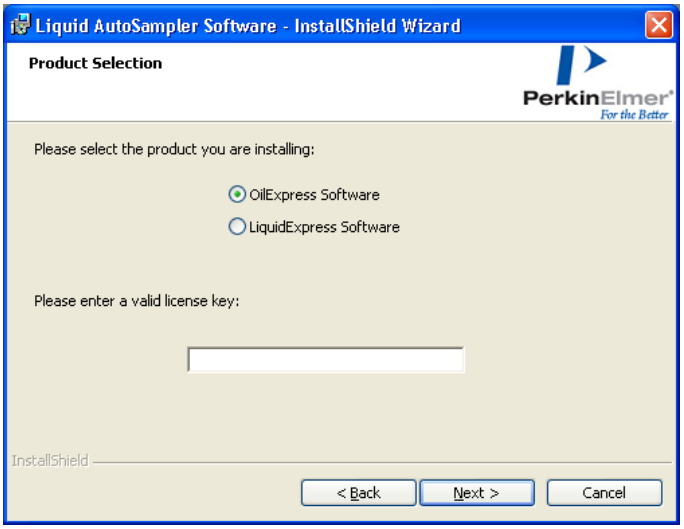
4. Click **Next**.

   The License Agreement dialog is displayed.

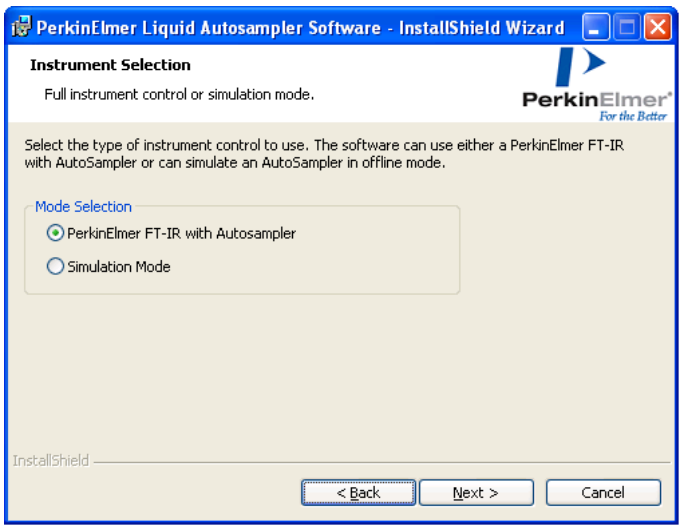


5. Read the agreement, select **I accept the terms in the license agreement**, and then click **Next**.

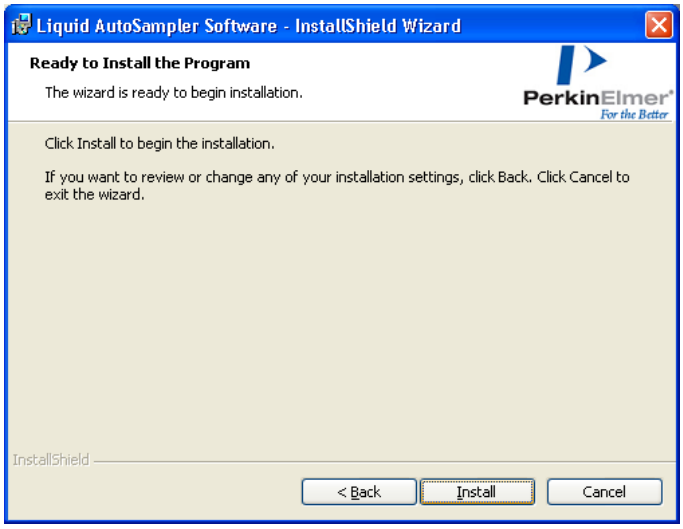
   The Product Selection dialog is displayed.



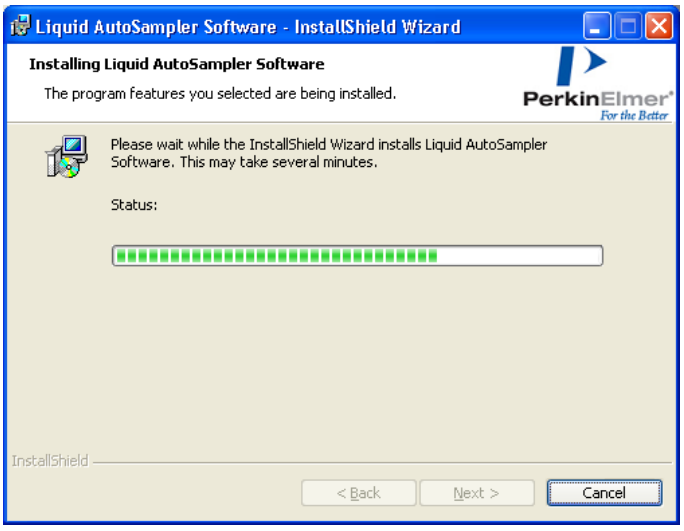
6. Select the **LiquidExpress** option and enter your license key; then click **Next**.
   The Instrument Selection dialog is displayed.



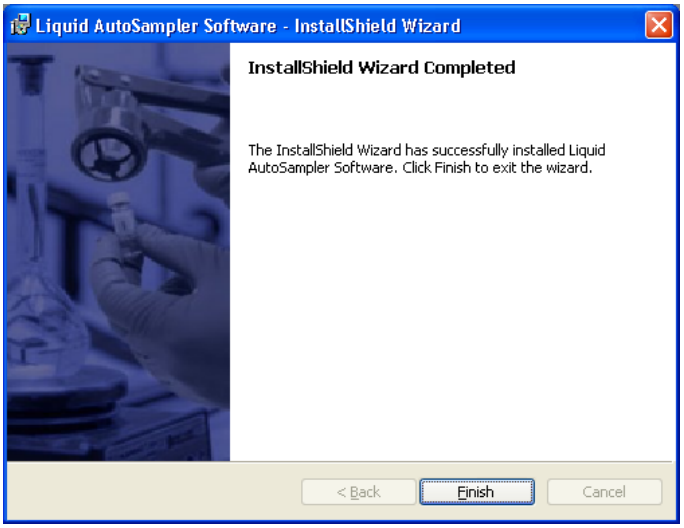
7. Select **PerkinElmer FT-IR with Autosampler** and click **Next**.
   Your software can now be installed.



8. Click **Install**.
   The installation will start.



When the installation is complete, the following dialog will be displayed:



9. Click **Finish**.

Default Users for LiquidExpress

The default passwords for the default user groups in LiquidExpress are the same as the name of the group, as follows:

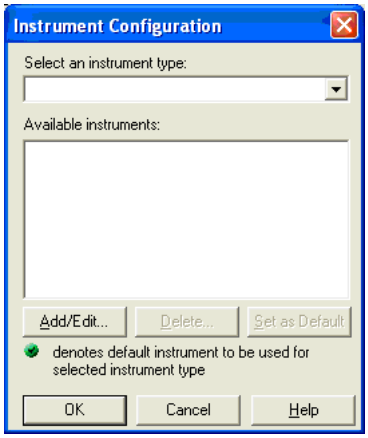
Login Name	Password
Administrator	administrator
Advanced Analyst	advanced analyst
Analyst	analyst
Supervisor	supervisor

You should immediately change these passwords to stop any unauthorized access to the software.

For further information see *Setup Users and Groups* in the on-screen Help.

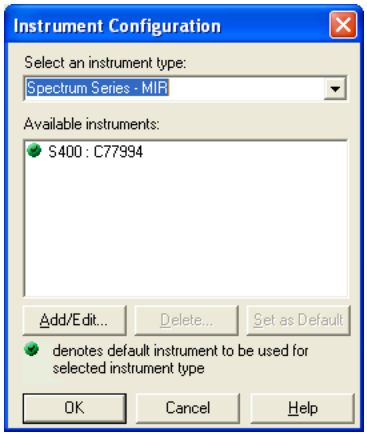
Configuring your Instrument and Starting LiquidExpress

The first time you start the LiquidExpress system, if you have not already installed instruments using the Spectrum software, the Instrument Configuration dialog is displayed.



Use the **Add/Edit** button to add one or more instruments. See the on-screen help for details.

NOTE: Subsequently, if you want other instruments to be made available, you can use the menu option **System Settings, Instruments Settings, Configure Instrument**.



Click **OK**.

NOTE: If you make more than one instrument available for use with LiquidExpress, or a single instrument capable of operating in both near- and mid-infrared, you are prompted to select which instrument and mode is to be used each time you start LiquidExpress.

Calibration

Before using the LiquidExpress System two calibration tasks must be performed:

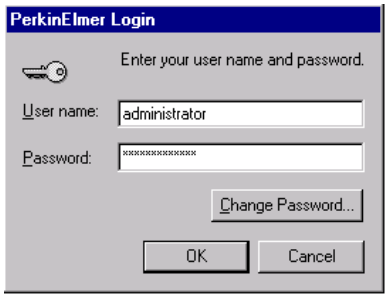
- Calibrate the Autosampler.
- Calibrate the flowcell.

Calibrating the Autosampler

The Autosampler must be calibrated to correct for any differences in the X-Y-Z zero alignment and any differences in the injection/wash port positioning.

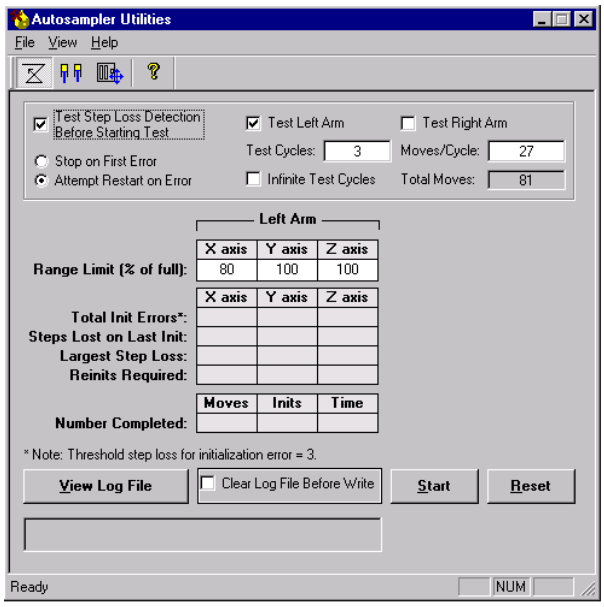
1. From the **Start** menu select: **Programs, PerkinElmer Applications, LiquidExpress, Autosampler Utilities**.

   The login screen (PerkinElmer or Windows, as appropriate) is displayed.

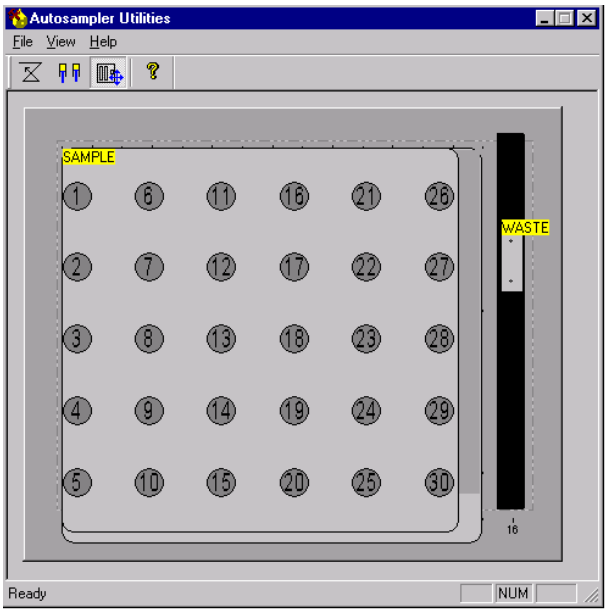


2. Enter a User name and Password.

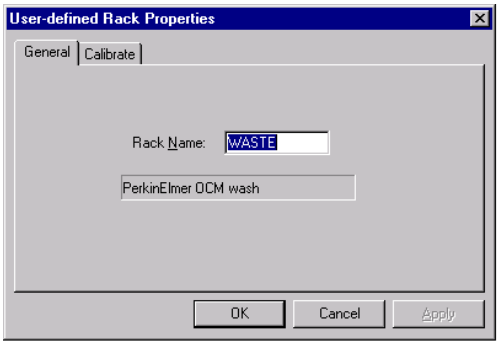
   The Autosampler Utilities dialog is displayed.



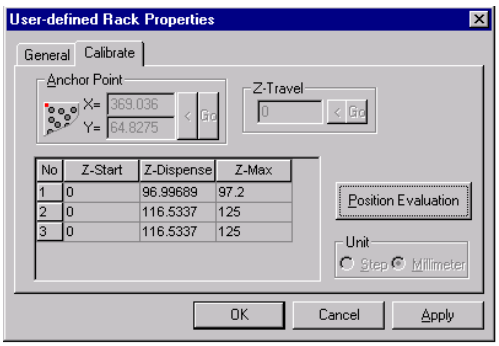
3. From the File menu select **WorkTable Editor**.
   The following dialog is displayed.



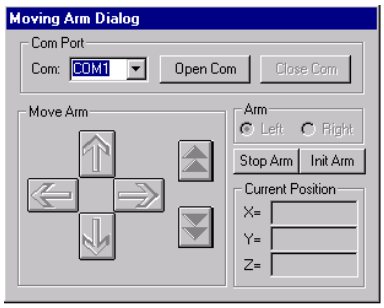
4. Right-mouse click on the **Waste Port**, and from the drop-down menu displayed select **Properties**.
   The following dialog is displayed.



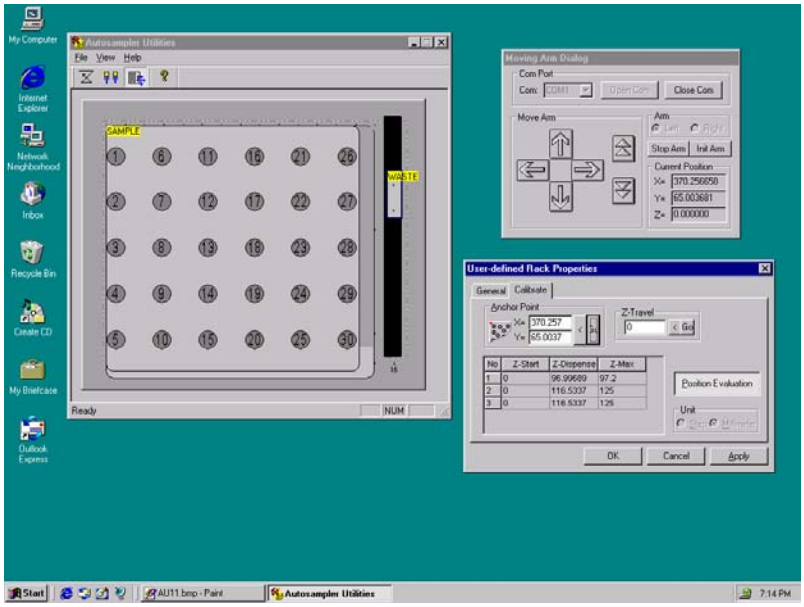
5. Select the **Calibrate** tab.



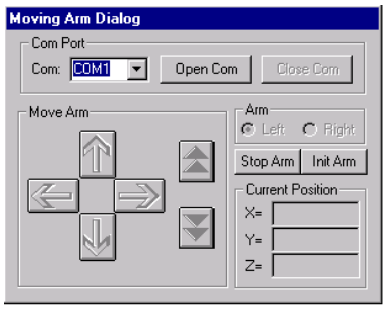
6. Click **Position Evaluation**.
   The following dialog is displayed.



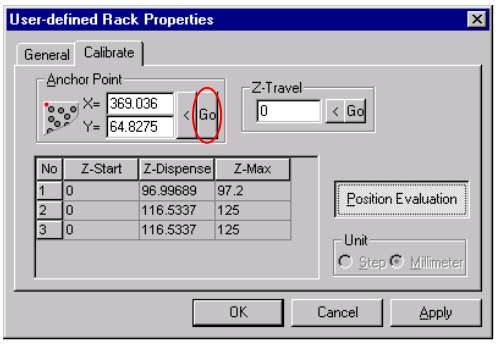
7. Separate the three dialogs on your desktop as shown below.



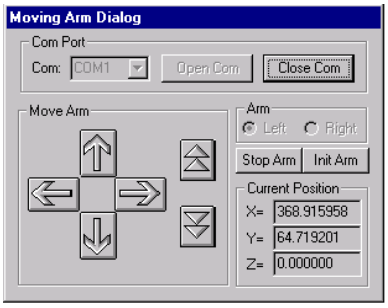
8. On the Moving Arm Dialog click **Open Com**.
   The Autosampler initializes.



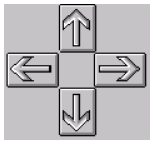
9. In the Anchor Point section of the User-defined Rack Properties dialog, click **Go**.



10. Click the down button  on the Moving Arm Dialog to lower the needle so that it is as close as possible to the top of the injection/wash port without actually touching it.



CAUTION	*Do not constantly press*  *as this will cause the needle to accelerate.* *Take care not to ram the needle into the injection/wash port as this may cause the needle to bend.*

11. Use the left and right arrow buttons  to move the needle so that it is at the anchor point.

The anchor point depends on the version of your wash station. Examine the injection/wash port fitted, then use the appropriate needle position anchor point, as shown in Figure 25.

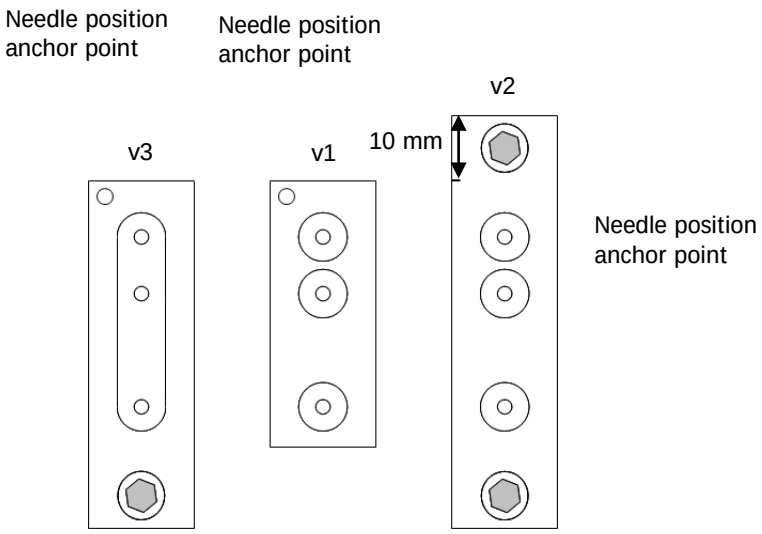
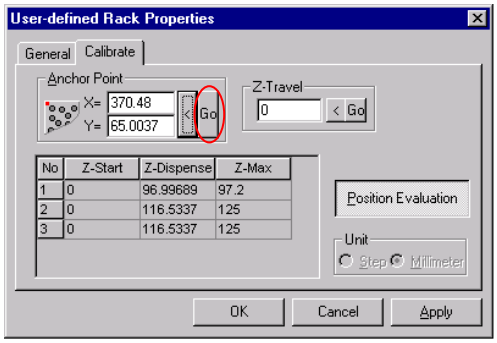


Figure 25 Injection wash port anchor positions

12. Once the needle has been aligned with the anchor point, click the Anchor Point Insert button  .



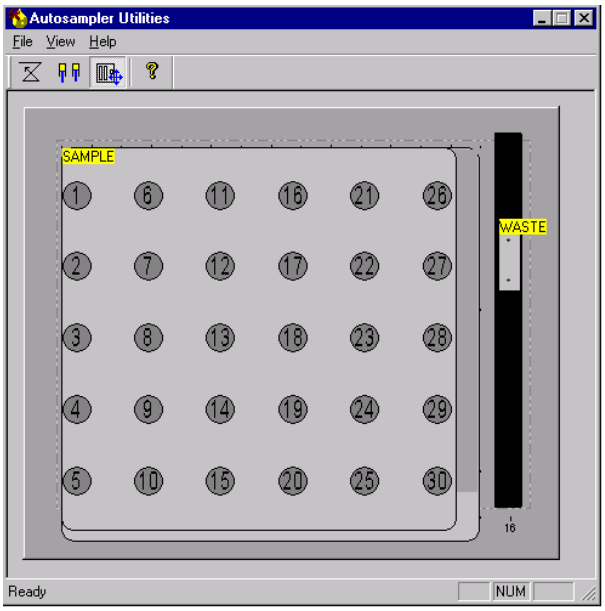
The new numbers appear in the **X=** and **Y=** fields.

13. Record the **Anchor Point X** and **Y** values in your laboratory notebook as the numbers can be used in the calibration of other worktables.

14. Click **OK**.

15. Right-mouse click within the worktable area of the Autosampler Utilities dialog and from the menu select **Save Worktable**.

NOTE: The worktable changes are not automatically saved. If you do not select **Save Worktable**, the changes will be lost.



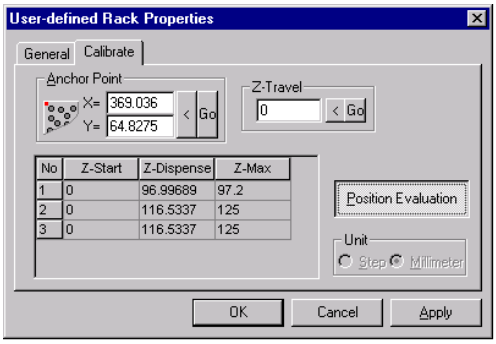
NOTE: The procedure described above must be repeated for all worktables used by the LiquidExpress software as anchor points are not applied universally. Follow steps 16 to 20 to calibrate all additional worktables.

16. Right-mouse click within the worktable area of the Autosampler Utilities dialog and from the menu select **Load Existing Worktable**.

17. Select the required worktable, **PerkinElmer BOTTLES** or **PerkinElmer VIALS**.

18. Repeat steps 4 to 7.

19. Enter the values you previously recorded in your laboratory notebook into the **X=** and **Y=** fields of the User-defined Rack Properties dialog.



20. Repeat steps 14 and 15.

21. If the syringes have not yet been installed, complete the hardware installation on page 50.

Calibrating the Pathlength of the Flowcell

Because the pathlengths of flowcells are so short, the true pathlength may be significantly different from the nominal pathlength. It is therefore necessary to calibrate the pathlength, in order to avoid a loss of accuracy.

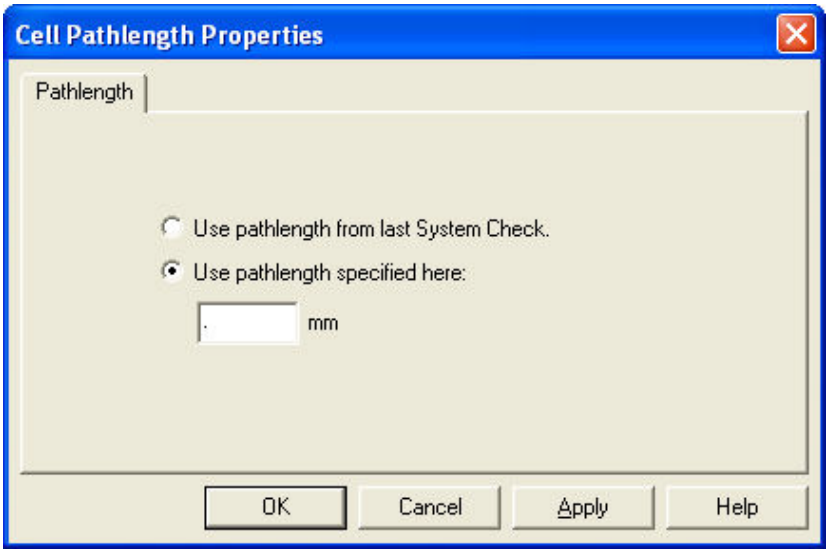
There are two ways of calibrating the length of a flowcell:

- Manually, by observing wavenumbers of interference fringes, performing a calculation based on the observations, and then entering the calculated value into the LiquidExpress software.
- Automatically, using a Quant+ model.

Manual Calibration using Interference Fringes

1. Log in to Spectrum and measure the background spectrum with a clear beam path.
2. Place a clean, dry cell in the beam path and measure the sample spectrum. Interference fringes should be clearly visible in the transmittance spectrum.
3. Select a small region of the spectrum containing about ten fringes. Do this by clicking and dragging in the graph window to create a red box and then double-clicking inside the box.
4. Click **Cursor** on the Graph Toolbar and drag the cursor until it is positioned over the peak or trough of the leftmost fringe in the zoomed display. Write down the corresponding wavenumber (in cm^{-1}) as v_1. Move the cursor N (about 10) peaks or troughs to the right and write down the corresponding wavenumber as v_2.
5. Calculate the pathlength in millimeters, l, of the cell as $l = \frac{10N}{2(\nu_1 - \nu_2)}$
6. Log in to LiquidExpress.
7. Select **System Settings, Instrument Settings, Pathlength**.

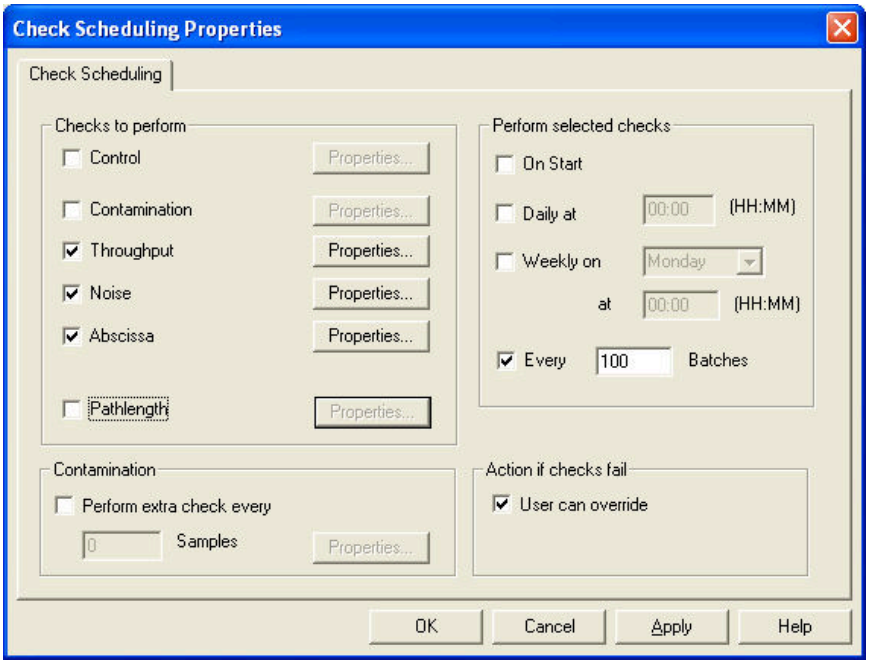
The Cell Pathlength Properties dialog is displayed.



8. Select the **Use pathlength specified here** option and then enter your calculated pathlength, in millimeters.

9. Click **OK**.

10. Select **System Settings, Instrument Settings, System Checks Setup**.
    The Check Scheduling Properties dialog is displayed.



11. Ensure that the **Pathlength** option is unchecked.

NOTE: For details of the other options provided by this dialog, see the on-screen help.

12. Click **OK**.

Automatic Calibration using Quant+ Model

In this calibration method you use spectra taken using the flush solvent in a flowcell fitted with a range of different spacers to create a Quant+ model.

You should try and obtain a reasonable range of pathlengths around the nominal pathlength of your flowcell. For example, if your flowcell is nominally 0.1 mm, you may use 0.05, 0.075, 0.1, 0.125 and 0.15 mm spacers. For each configuration, you should make at least two completely independent measurements, by disassembling and reassembling the cell.

Follow the steps described below.

1. Begin by measuring the pathlength of your flowcell using the manual interference fringe calibration method described on page 64.

2. Fill the flowcell with the flush solvent, as described below.

NOTE: Always use flush solvent of high purity. Otherwise, variations between batches may cause the pathlength check to fail in use.

   a. Remove the PTFE stoppers from the two flowcell ports.

   b. Lay the cell on a flat surface with one end propped up slightly, for example, by resting it on a pencil.

   c. Fit plastic syringe fittings to the input port of the flowcell.
   Suitable fittings are available from Cole Parmer (catalog number EW-45500-66).
   See http://www.coleparmer.com.

   d. Draw about 0.5 ml of sample into a 1 ml syringe and insert the syringe into the plastic fitting.

   e. Gently depress the plunger and watch the liquid fill the cell. Use slightly more (about 0.2 ml) sample than required to cover the opening.

Figure 26 Filling a flowcell

f. Carefully, with a twisting motion, insert a PTFE stopper into the output port of the cell (if liquid fills the fitting, remove it first with tissue paper).

g. Remove the syringe and insert a PTFE stopper into the input port of the cell.

3. Log in to Spectrum and measure the background spectrum with a clear beam path.

4. Measure the absorbance spectrum of your flowcell filled with flush solvent.

5. Disassemble, clean and then reassemble the flowcell with the same spacer.

6. Repeat steps 2 to 4, so as to obtain a second, independent, spectrum.

7. Repeat the entire process with a range of flowcell spacers.
   It is recommended that a total of at least eight spectra be obtained.

8. Log in to Spectrum Quant+ and follow the instructions in the on-screen help to create a PLS1 or PCR+ model for the pathlength.
   The guidelines below should be followed:

   - Be sure to select a wavelength range or ranges corresponding to peaks in the solvent spectrum that do not have excessive absorbance, ideally not exceeding 2 absorbance units.

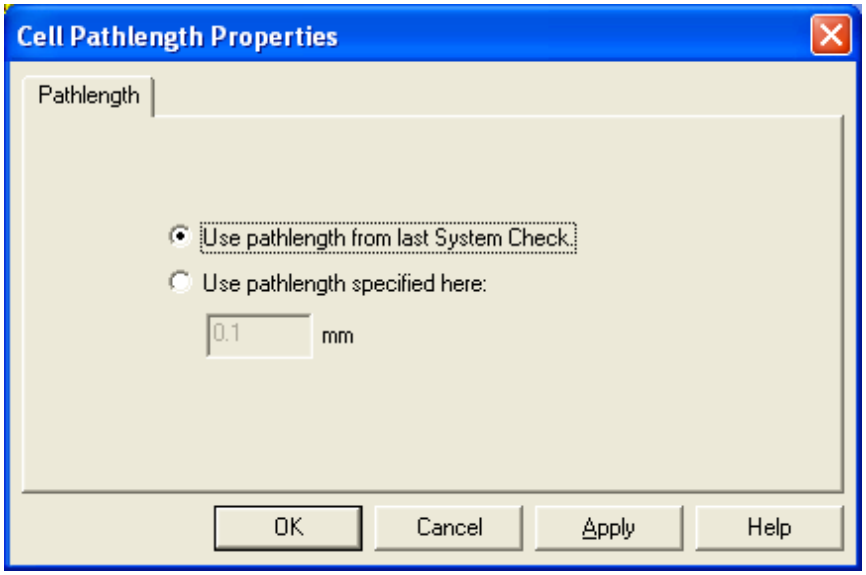
   - This application should require only one or two principal components/latent variables. If more than that are suggested there is a risk that some of your spectra were contaminated.

   - Use full cross-validation or an independent validation set to validate the model. The validation SEP is an estimate of the error that will be encountered in use of the model: evaluate whether this represents a satisfactory pathlength uncertainty for your application. The Validation Estimated vs Specified plot gives a good graphical representation of the quality of the model.

9. Log in to LiquidExpress.

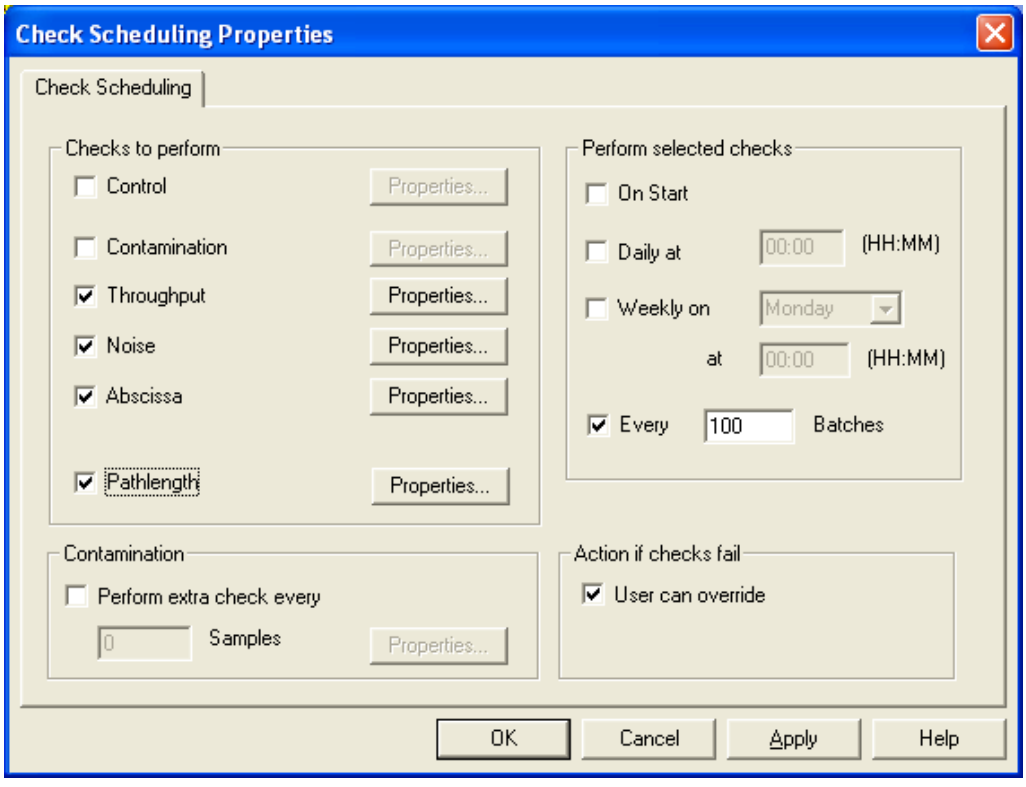
10. Select **System Settings, Instrument Settings, Pathlength**.

The Cell Pathlength Properties dialog is displayed.

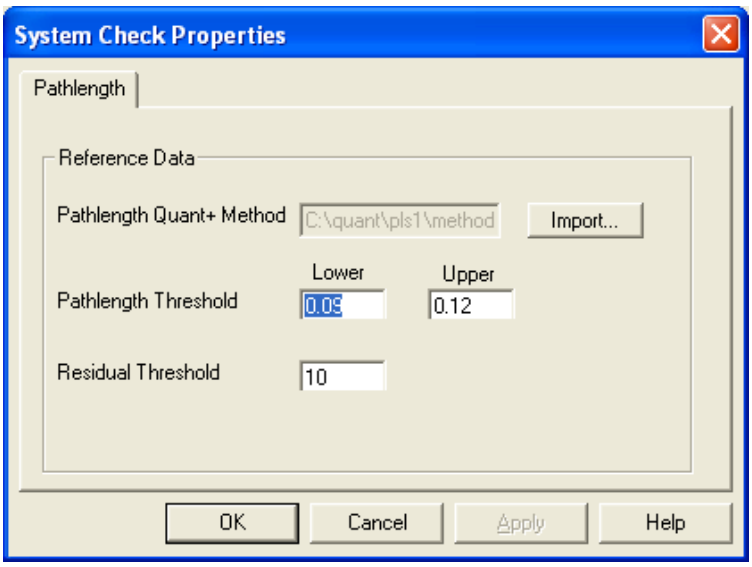


11. Select the **Use pathlength from last System Check** option and then click **OK**.

12. Select **System Settings, Instrument Settings, System Checks Setup**.
The Check Scheduling Properties dialog is displayed.



13. Ensure that the **Pathlength** option is checked and then click on the **Properties** button.
    The Pathlength dialog is displayed.



NOTE: For details of the other options provided by this dialog, see the on-screen help.

14. Use the **Import** button to browse and select the Quant+ method you have created for your flowcell.
    You can also set upper and lower pathlength threshold values and a residual threshold.

15. Click **OK** to return to the Check Scheduling Properties dialog.

16. Click **OK**.

Installing the Arm Shield

1. Remove the clear rectangular arm shield from the accessory box.
2. Remove the three screws (Figure 27).
3. Position the arm shield under the arm and adjust the shield so that the holes in the shield are aligned with the screw holes on the side of the arm cover.
4. Insert the socket head screws through the holes and tighten by turning the screw clockwise.

CAUTION

Do not over tighten the screws as this may crack the plastic shield.

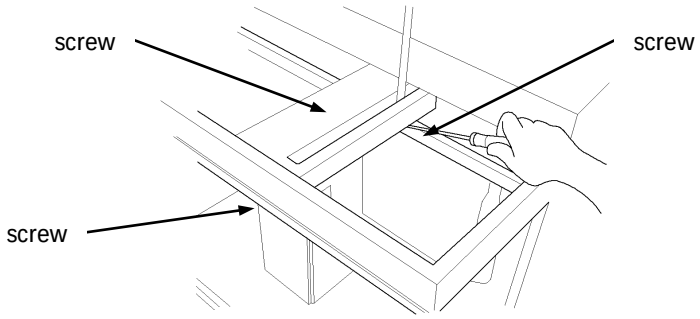


Figure 27 Installing the arm shield

Routine Maintenance and Troubleshooting

Maintenance Schedule

Maintenance must be performed on a regular basis in order to maintain the accuracy and precision of the LiquidExpress System. The schedule below outlines the proper intervals to check or replace components of the instrument.

NOTE: For information on maintaining your spectrometer, refer to the documentation supplied with the instrument.

Item	Daily	Weekly	6 Months
ALIDUM Cable	-	X (p.75)	R (p.78)
Sampling Probe	C/X (p.73)	C/X (p.73)	R (p.76)
Z-Rack	-	C (p.73)	-
Splash Guard	-	C (p.74)	-
Transfer/Wash Port	-	C (p.73)	-
Syringe	C (p.73)	C (p.73)	S (p.76)
Syringe Seal	C (p.73)	-	R (p.76)
Sample Rack	C (p.73)		
Sampling Probe	C (p.73)	-	R (p.75)
X/Y/Z Mechanism	-	-	X (p.74)
X/Y/Z Lubrication	-	-	S (p.80)
Tubing	-	-	S (p.81)

Key:

C = Clean this item
R = Replace component
X = Perform service
- = No action necessary
S = Special case

Autosampler Maintenance Procedures

Flushing the Syringe Pump

1. Do not allow the pump to run dry for more than a few cycles.
2. Inspect the pump for leaks, and correct any problems immediately.
3. Wipe up all spills on and around the pump immediately.

Cleaning the Syringe Seal

1. Clean the seal with solvent.
2. Check for cracks in the PTFE coating.

Cleaning the Sampling Probe

CAUTION *Electrostatic discharge to the sampling probe may damage the ALIDUM.*

1. Turn off power to the Autosampler.
2. Clean the needle by wiping gently with a lint-free cloth dampened with solvent.

Cleaning the Sample Rack

We recommend that you clean the sample rack daily with detergent or degreasant to remove dust and oil.

Cleaning the Injection and Wash Port

Residues from samples may be deposited in the injection/wash-port. We recommend that you remove the lid occasionally and rinse it with a suitable detergent if necessary.

Cleaning the Z-Rack

The Z-Rack must be cleaned weekly.

NOTE: Do not use alcohol or solvents when cleaning the Z-Rack.

1. Turn off the power to the Autosampler.
2. With a lint-free cloth, wipe the Z-Rack thoroughly.
   If necessary, use a toothbrush to remove dust or dirt from the teeth of the Z-Rack.

Cleaning the Splash Guard/Safety Shields

The Splash Guard/Safety Shields must be cleaned weekly.

1. Turn off the power to the Autosampler.
2. With a lint-free cloth, wipe the splashguards thoroughly.

Cleaning the Lead Screw and Lead Screw Encoder

If the pump is used in a dusty environment, the lead screw encoder should be cleaned periodically with air. The lead screw should be lubricated:

- If the pump is making a "screeching" noise.
- If the syringe is stalling frequently.

NOTE: Only PerkinElmer lubricant (part number L1200559) should be used for lubricating the lead screw. Lubrication is usually only needed after 1 million syringe strokes (or every 6 months). If the pump appears to need lubrication more frequently, suspect another problem.

Cleaning X-Y-Z Mechanism

The X-Y-Z mechanism should be cleaned every six months. However, if the instrument is operated in a dusty or humid environment, it must be cleaned every three months. Follow the instructions to prevent damage to the instrument.

CAUTION	*Use only isopropyl alcohol and a lint-free cloth to clean the Autosampler. Other cleaning agents may affect the performance of the instrument. Never clean the X-Y-Z axis guide rails or Z-Rack with alcohol or solvent. Serious damage to the instrument may occur.*

1. Turn off the power to the Autosampler.
2. Clean the Z-Rack.
3. Clean the needle.
4. Wipe the arm using a lint-free cloth dampened with isopropyl alcohol to remove any residual dust.
5. Wipe the inside of the flex cable channel using a lint-free cloth dampened with isopropyl alcohol.

CAUTION	*Do not wipe the X-axis guide rails. The guide rails are lubricated with a grease that does not require removal unless found to be "extremely" dirty.*

6. Wipe the inside of the X-frame with a lint-free cloth dampened with isopropyl alcohol, ensuring that the lubricant on the X-axis guide rails is not removed.

7. Wipe the square shaft pinion located underneath the arm using a lint-free cloth dampened with isopropyl alcohol.

CAUTION *When cleaning the square shaft pinion, ensure no alcohol enters the Z-bearing or is wiped on the Y-axis guide rails.*

Inspecting the Insulation Block/ALIDUM Cable Assembly

The insulation block/cable assembly must be inspected weekly and replaced every six months. Examine the cable where it connects to the insulation block. If there is any residue, liquid, or if the cable is cracked at this connection, replace the assembly.

NOTE: Instructions on how to replace the insulation block cable can be found in *Replacing the Insulation Block/ALIDUM Cable Assembly* on page 78.

Checking the Fluid Path (Tubing)

Check that all the tubing is clean and free of crimps. Refer to *Replacing the Tubing* on page 81 for procedures to change tubing.

Replacing the Sample Probe/Needle

1. Turn the power off to the Autosampler.

2. Loosen the sampling probe set screw using a flat screwdriver.

3. Loosen the insulation block set screw using an Allen wrench.

4. Gently pull downward on the insulation block until the system tubing is approximately 1 inch below the Z-Rack.

CAUTION *Electrostatic discharge to the needle may damage the ALIDUM detector.*

5. While holding the needle, remove the system tubing.

6. Remove the needle from the bottom of the insulation block.

7. To reinstall the needle, refer to *Sampling Probe/Needle* on page 14.

NOTE: If the needle has been bent, it should be replaced.

Replacing the Syringe Seal

The syringe seal will need to be replaced periodically. How often will depend on the duty cycle of the pump, the type of fluids being run through the system, the size of the syringe and how well the instrument is maintained. If the syringe seal becomes worn and is not replaced, the following problems may occur:

- Poor precision and accuracy.
- Variable or moving air gaps.
- Fluid leaks from the bottom of the syringe.
- The tip of the plunger breaks through the seal and scratches the inside of the syringe barrel. If this happens, the entire syringe will need to be replaced.

Replacing a Syringe

1. Refer to *Installing the Syringe* on page 50.
2. Remove the plunger pin at the base of the syringe plunger.
3. Release the syringe clamp and carefully unscrew the syringe barrel from the Luer lock fitting (about 1½ turns) while pulling downward slightly. Then slide the syringe plunger from the plunger shaft.
4. To install a syringe, place the plunger over the plunger shaft. Line up the barrel with the Luer lock fitting. Screw the barrel onto the fitting while pushing upward slightly.

CAUTION	*You must assist the Luer lock threads by pushing upward, otherwise they may become stripped.*

5. Replace the plunger screw at the base of the syringe plunger.

Replacing the Reagent Syringe Seal

1. Refer to *Installing the Syringe* on page 50.
2. Remove the plunger pin at the base of the syringe plunger.
3. Release the syringe clamp and carefully unscrew the syringe barrel from the Luer lock fitting (about 1½ turns) while pulling downward slightly. Then slide the syringe plunger from the plunger shaft.
4. Remove the syringe plunger.

5. Remove the seal from the plunger tip using a pair of pliers and gripping the seal approximately one third of the way down (Figure 28).

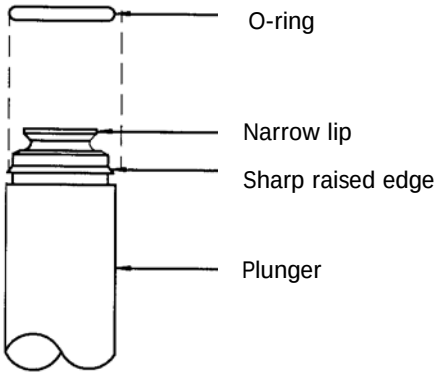


Figure 28 Plunger and O-ring configuration

CAUTION	*The 10.0 ml syringe has an O-ring beneath the seal. Be careful not to damage the O-ring. If it is necessary to replace the O-ring, simply slip the new one over the narrow lip on the plunger. It may be necessary to use needle nose pliers to assist in removing the O-ring from the plunger.*

6. Wet the plunger tip and the O-ring with distilled or de-ionized water.

7. Place the seal on a flat surface with the open end facing up. Press the plunger tip firmly into the hole until it snaps into position.

8. Lay the plunger on a flat tabletop. Position the plunger so that the seal (from the O-ring up) hangs over the edge (Figure 29). Slowly roll the plunger along the table edge, pressing firmly on the portion of the seal below the O-ring. Rotate the plunger three complete turns. This is necessary for the sharp, raised edge of the plunger to bite into the seal for a secure fit.

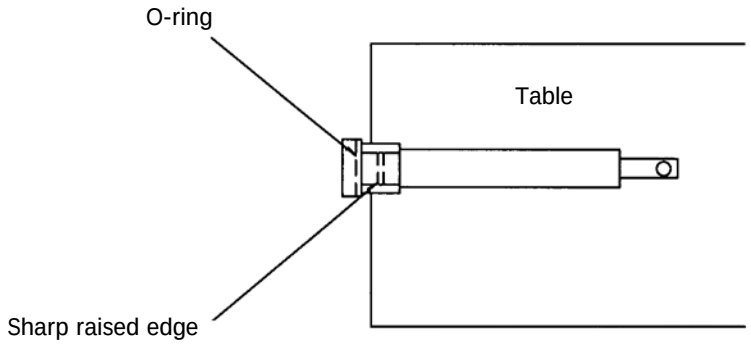


Figure 29 Seal installation

9. Wet the seal and replace the plunger in the barrel.

10. Replace the syringe.

Replacing the 3-port Valve

1. Remove the syringe as described in *Replacing a Syringe* on page 76.
2. Power down the Analyzer.
3. Remove the aspirate tubing, reagent tubing and syringe.
4. Remove the valve by loosening the two screws on the valve.
5. Install the new valve by aligning the "D" coupler on the valve stem with the "D" hole in the encoder.
6. Rotate the valve body so that the Luer fitting is oriented toward the bottom of the pump.
7. Gently push the valve in place ensuring the locating pins on the frame side of the valve body fit in the holes on the XL 3000 frame and replace the screws.
8. Replace the syringe.
9. Power up the Autosampler.

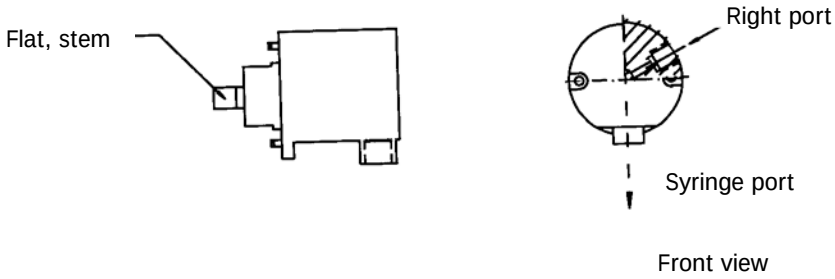


Figure 30 CAVRO 3-port valve

Replacing the Insulation Block/ALIDUM Cable Assembly

1. Turn off the power to the Autosampler.
2. Remove two (2) screws on the back of the top cover.
3. Remove the top cover of the instrument by lifting both sides.
4. Remove the sampling probe.
5. Remove the plastic cable strap underneath the arm, which is holding the insulation block cable.

NOTE: Use a small wire cutter to remove the plastic cable binder. A new cable binder is included with each spare replacement insulation block.

6. Push the insulation block cable through the back end of the arm until the gold connector is visible.

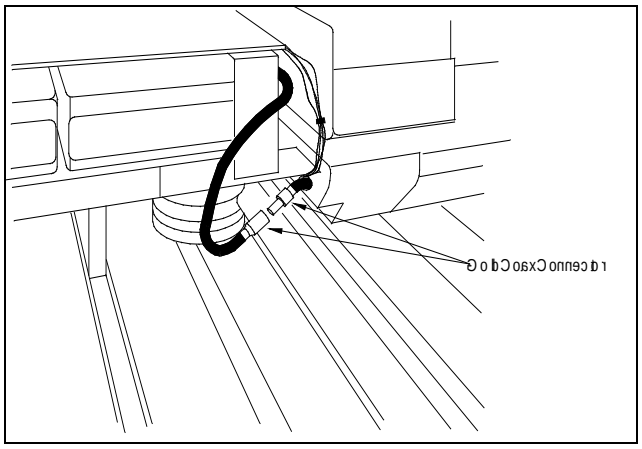


Figure 31 Disconnecting the insulation block cable

7. Disconnect the insulation block cable from the connector.
8. Carefully pull the insulation block cable back out through the back of the arm.
9. Remove the new insulation block cable and the plastic cable strap from the packaging.
10. Feed the gold connector of the insulation block cable through the back of the arm.
11. Attach the gold connector to the matching connector on the ALIDUM cable. Be sure that the connectors are firmly seated.
12. Adjust the ALIDUM cable until all of the slack is removed from behind the arm.

CAUTION

Make sure the insulation block cable is not twisted or kinked.

13. Fasten the insulation block cable to the arm using the new plastic cable binder.
14. Reinstall the sampling probe.
15. Replace the top cover and retaining screws.

Lubrication

The Autosampler does not require lubrication under normal operating conditions. If the lubricant applied at the factory should be wiped away or if the X/Y axis guide rails become dirty, cleaning and lubrication is necessary. Follow the instructions below when applying lubricants.

1. Turn off the power to the Autosampler.
2. Move the arm to the far right side of the X-frame.
3. Clean the X-axis guide rails using a lint-free cloth and isopropyl alcohol.
4. While moving the arm to the left side of the X-frame, clean the three roller bearings mounted to the base of the X-slide.
5. Wipe the section of the X-axis guide rail that was covered by the arm.
6. Using a fingertip, apply a thin film of lubricant to both X-axis guide rails.
7. If the Y-axis guide rails are dirty, follow steps 2 through 6.

Changing the Autosampler Fuses

Two 5A fuses are fitted to the Autosampler.

1. Switch off the Autosampler and disconnect the mains electrical supply.
2. Disconnect the mains electrical supply lead from the side of the Autosampler.
3. Insert a small screwdriver into the slot above the fuse drawer and lever the fuse drawer out.
4. Remove both fuses from the fuse drawer.

NOTE: If a fuse blows, it is recommended that both fuses be replaced.

5. Fit the replacement fuses.
6. Push the fuse drawer back into the Autosampler, and switch on the Autosampler.

WARNING

For continued protection against risk of fire, only replace fuses which meet the following specified types and current rating.

The following fuse must be used when operating the Autosampler:

Name	Location	Type
Main Fuse	Power Entry Module	T5.0 A/250 V × 2

Replacing the Tubing

It is important that all tubing is kept clean and free of crimps. Tubing that has become dirty, blocked or crimped can result in poor accuracy and precision, loss of air gap, or syringe stalls. Replace the tubing if necessary. Frequency of replacement will be dependent on duty cycle, reagents and maintenance.

WARNING

Switch off the Autosampler before replacing any tubing.

Replacing Reagent and Needle or Cell Tubing

Removing the old reagent tubing

1. Unscrew the connector from the right hand side of the valve (reagent tubing).
2. Pull the tubing clear of the Autosampler.

Installing the new reagent tubing

1. Route the end of the tubing with the fitting through the black grommet hole on the right panel.
2. Install fitting on the right valve port of the syringe pump.
3. Finger-tighten the fitting.

Removing the old needle tubing

1. Unscrew the connector from the left hand side of the left hand syringe pump.
2. Remove the insulation block from the Z-drive.
3. Pull the tubing from the needle end.
4. Withdraw the tubing from the Z-drive and tubing support.

Installing the new needle tubing

1. Route the end of the tubing with the fitting through the black grommet hole on the right panel.
2. Install the end of the tubing with the fitting into the left valve port of the left syringe pump.
3. Route the other end of the tubing through the tubing support and down the Z-drive.
4. Push the end of the tubing over the end of the needle and replace the insulating block onto the Z-drive.

Replacing Waste Tubing

Removing the old waste tubing

CAUTION	*Before removing the waste tubing, be sure the fluidic system/wash station is dry.*

- Disconnect the waste tubing from the wash station and remove the tubing from the Autosampler.

Installing the new waste tubing

1. Attach the waste tubing to the hose connector at the rear of the transfer/wash port.
2. Insert the waste tubing into the hole on the rear right-hand side of the base plate of the Autosampler.
3. Adjust the routing of the tubing so that it is not kinked.
4. Place the other end of the waste tubing in the waste container.
   Ensure that the end will not be immersed in the waste.

Maintenance of the Flowcell

In normal use of the LiquidExpress System, the cleaning utilities provided by the Spectrum software ensure that the flowcell is routinely kept clean and free of contaminants. Select **Autosampler Control** from the View menu and then click **Wash**.

Additionally, we recommend that you regularly flush the system with solvent to avoid the build-up of contaminants.

If, however, the flowcell does become contaminated, it may be carefully dismantled for cleaning using lens tissues and solvent, then re-assembled. Contamination of the flowcell may be detected during calibration (see *Troubleshooting* on page 88).

Cleaning the Flowcell

WARNING

If the flowcell material is toxic, for example zinc selenide (ZnSe), you should wear gloves when dismantling.

NOTE: A torque driver with a range of at least 10–25 cNm and a 3 mm hexagonal bit, for example part numbers L9003631 and L9003632, must be used to reassemble the flowcell. It is not recommended to start disassembling unless you have such a torque driver to-hand.

1. Using a 3 mm hexagonal wrench, undo and remove the three hexagonal screws.
2. Remove the parts of the flowcell in the following order:
   - The front of the cell.
   - The PTFE gasket.
   - The front window.
   - The PTFE spacer (if this is wedge shaped, you should note which is the thicker end as you dismantle the flowcell).
   - The former.
   - The back window (this window has no holes in it).
   - The neoprene gasket.

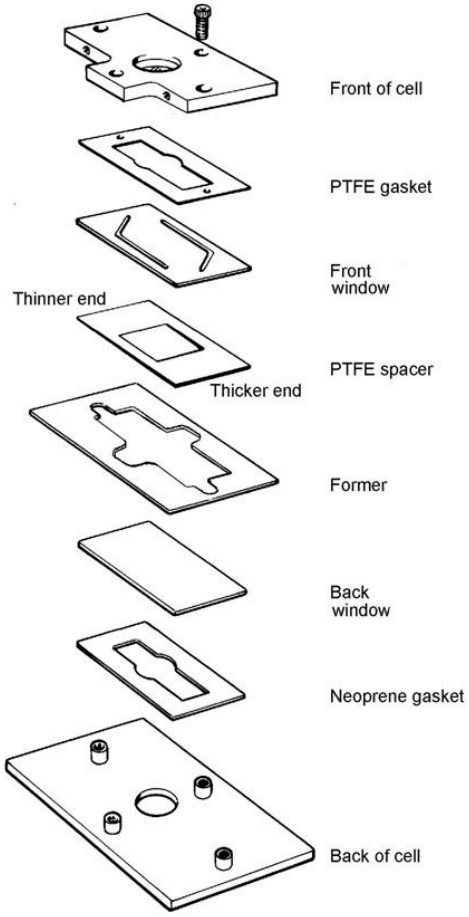


Figure 32 Dismantling or assembling the flowcell

3. When the flowcell is dismantled, use a lens tissue and a suitable solvent to clean the flowcell.

WARNING

Do not use acid to clean ZnSe windows, as toxic fumes will be given off.

Take care not to crease the wedged PTFE spacer during cleaning as this may reduce its effectiveness at suppressing interference fringes, and may also alter the pathlength.

4. Refit the parts of the cell in the following order:
   - The neoprene gasket.
   - The back window.
   - The former.
   - The PTFE spacer (with the thin edge of the wedge towards the top of the cell, if appropriate).
   - The front window.
   - The PTFE gasket.

5. Align the two holes in the PTFE gasket with the two holes at the ends of the channels in the front window.

6. Lay the front of the cell on top of the gasket.

7. Align the hole in the front of the cell with the holes in the gasket and front window.

CAUTION *The windows in the flowcell are brittle and easily broken. Be careful that you do not tighten the screws holding the flowcell together too tightly.*

8. Insert and tighten the four screws using a hexagonal wrench until the screws just touch the front of the cell.

9. Use a torque driver to tighten the screws, in the sequence shown, until a torque value of 10 cNm is reached.

NOTE: The sequence in which you tighten the screws is important. The sequence shown below is designed to prevent unequal pressure being applied to the liquid cell, and thereby help prevent any damage being caused.

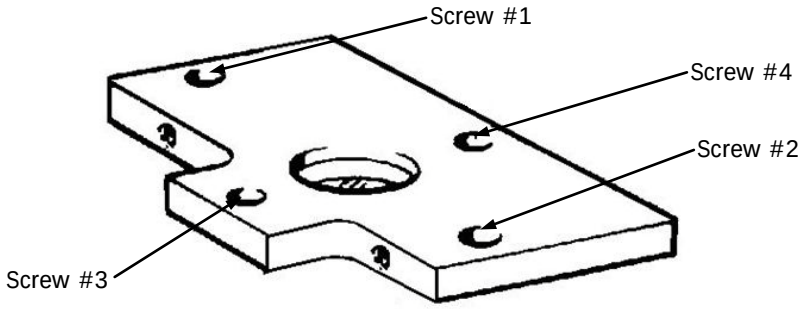


Figure 33 Flowcell securing sequence

10. Repeat step 9 until a torque value of 16 cNm is reached; and then again, until you reach a final torque value of 24 cNm.

CAUTION *Do not overtighten, as this can cause irreversible damage to the flowcell.*

11. Recalibrate the flowcell pathlength after dismantling and reassembling it.

NOTE: It is essential that the pathlength of the flowcell is recalculated after the cell has been dismantled. Failing to carry out this procedure will seriously affect the results obtained using the LiquidExpress System.

Warranty Exclusions and Limitations

The following consumable items are excluded from the warranty agreement. See *Autosampler Spares and Consumables* on page 87 for details of part numbers and suppliers.

- Flowcell Windows.
- Tubing.
- Fuses.
- Syringes.
- Syringe piston noses.

WARNING

Any attempts to perform installation or maintenance operations that are not detailed in this manual are at the user's own risk.

If a user-attempted service results in a visit by a PerkinElmer Service Engineer, the visit will not be covered by the instrument warranty.

Damage caused by the following is not covered by the warranty:

- Not maintaining the solvent level.
- Failure to flush the system adequately after use.
- Blockage of tubing, the transfer/wash port, needle or flowcell.
- Failure to observe the precautions described in this manual.

Autosampler Spares and Consumables

Item	PerkinElmer Part Number
Sample Rack (4 oz)	L1200551
Syringe (10 ml)	L1200552
Seal Kit (10 ml) for syringe plunger	L1200553
Valve 3-port	L1200554
Needle	L1200555
Pump to Solvent Tubing (2)	L1200556
Injection/Wash Port to Cell Tube	L1200557
Lubrication Kit	L1200559
Waste Tubing	L1200560
Plunger Screw	L1200571
Syringe Clamp	L1200574
RS232 Cable	L1200576
Wash Station Mounting Plate	L1200577
Protective Shield	L1200579
Consumables Kit	L1200581
Injection Port	L1200586
Solvent Bottle and Cap (drilled)	L1195019
Syringe Pump to Cell Tubing	L1200585
Syringe Pump to Needle Tubing	L1200587
Pack of 6, 16-position Racks for Test tube Vials	L1200589
Torque Driver 10 – 120 cNm	L9003631
Hex Bit 3.0 mm (for use with L9003631)	L9003632

Troubleshooting

NOTE: Troubleshooting as described in this chapter should be performed only by a qualified service engineer.

Problem	Possible Cause	Corrective Action
During Analysis		
The results obtained for one or more properties are unacceptable.	The sample type entered during 'Prepare Run' is incorrect.	Ensure the correct sample type has been entered.
	The cell pathlength may not be correct.	Calibrate the flowcell (see *Calibrating the Pathlength of the Flowcell* on page 64).
	The flowcell may be dirty or have a build-up of material on the windows.	Clean the flowcell (see *Cleaning the Flowcell* on page 83) and record a spectrum of the empty cell to ensure that it is clean. Ensure the pathlength is calculated correctly.
Syringe Pump and Tubing		
Syringe pump is not pumping or stalls.	Syringe pump or tubing is blocked.	Flush out the syringe pump (see *Flushing the Syringe Pump* on page 73).
		Flush out the fluid system, (see *Checking the Fluid Path (Tubing)* on page 75).
	Loss of air gap due to tubing blocked, kinked or split.	Replace the defective tubing (see *Replacing the Tubing* on page 81).
	Lead Screw Encoder may be dirty.	Clean Lead Screw Encoder with air (see *Cleaning the Lead Screw and Lead Screw Encoder* on page 74).

Problem	Possible Cause	Corrective Action
Needle and Wash Port		
Cannot align needle.		Call for a PerkinElmer Service Engineer.
Needle dirty or blocked.	Residues from samples may be deposited in the needle.	Flush the needle using the Autosampler controls in the LiquidExpress software.
Sample spraying above transfer/wash port.	The needle is not aligned.	Align the needle (see *Calibrating the Autosampler* on page 58).
	The waste tubing is in the waste, causing a back-pressure.	Empty the waste container and/or raise the tubing out of the waste (see *Checking the Fluid Path (Tubing)* on page 75).
Sample/Solvent		
Solvent is not being drawn through.	The solvent bottle is empty.	Re-fill the solvent bottle and empty the waste container at the same time.
	A vacuum has built up in the solvent bottle, sucking the sides of the bottle inwards.	Make sure that there is a gap around the tubing through the lid of the wash bottle.
Sample/solvent is not being drawn through.	The tubing is split or leaking.	Examine it and change it if necessary (see *Replacing the Tubing* on page 81).
Solvent is leaking out.	Connections are loose.	Check all the connections to valves and pumps.
	The tubing is split or leaking.	Change the tubing (see *Replacing the Tubing* on page 81).
	The nut on the flange of the tube is not fitted correctly.	Refit the tubing and hand-tighten the nut at the end of the tubing.

During data collection		
The message **Sampler not responding** is displayed.	The Autosampler is switched off.	Make sure that the Autosampler is switched on.
	The Autosampler is not connected to the PC.	Make sure that the Autosampler is connected to the PC (see *Cable to PC* on page 43).
	The Autosampler cable is connected to the wrong COMM port on the PC.	Make sure that the Autosampler is connected to the PC using the correct COMM port (default is COMM 1) (see *Cable to PC* on page 43).
Sampling rate is slow.	Air is leaking into the system.	Check all the connections to valves and pumps, the tube-end fittings, and the connection to the top of the needle.
Sampling rate is getting slower.	The waste tubing is in the waste, causing a back-pressure.	Empty the waste container and/or raise the tubing out of the waste.
No spectrum was obtained during the run.	The sample was not present or the cell is not filling correctly.	Check all connections.
	The cell is not installed in the sample shuttle.	Install the cell in the front of the sample shuttle (see *Figure 24* on page 49).
Air bubbles in the sample.	Connections are loose or leaking.	Check all the connections to valves, flowcell and pumps, the tube-end fittings, and the connection to the top of the needle.
	The screws in the flowcell are loose.	Tighten the screws to correct torque (see *Cleaning the Flowcell* on page 83).
Sample flow is poor.	Air is leaking into the system.	Check all the connections to valves and pumps, and the connection to the top of the needle.
	The tubing is worn.	Change the tubing (see *Replacing the Tubing* on page 81).

During data collection (cont.)		
Bubbles are present in the flowcell.	Connections to the flowcell are reversed.	Make sure that the connections are correct.
Spectra are weak.	The energy reaching the detector is low because the tubing in the sample compartment is in the beampath.	Move the tubing out of the beampath.
Waste is not draining properly.	The waste tubing is immersed in the waste.	Empty the waste container and/or raise the tubing out of the waste.
General Autosampler mechanical failures:		
No movement on arm or pumps.	Flex cable defective.	Call for a PerkinElmer Service Engineer.
LED on Autosampler does not come on.	Main fuses blown.	Replace fuses. Call customer support (see *Changing the* Autosampler Fuses on page 80).
	Mechanical movement blocked.	Check movement mechanism for obstructions.
	CCU-9000 defective.	Call for a PerkinElmer Service Engineer.
Autosampler X, Y or Z-axis failures.		Call for a PerkinElmer Service Engineer.

If any of these problems persist, or if there are any other problems that you cannot correct, contact your local PerkinElmer office or agent.

Appendices

Appendix 1: Decontamination

Before using any cleaning or decontamination methods except those specified by PerkinElmer, users should check with PerkinElmer that the proposed method will not damage the equipment.

Customers wishing to return instrumentation and/or associated materials to PerkinElmer for repair, maintenance, warranty or trade-in purposes are advised that all returned goods must be certified as clean and free from contamination.

The customer's responsible body is required to follow the "Equipment Decontamination Procedure" and complete the "Certificate of Decontamination". These documents are available on the PerkinElmer public website:

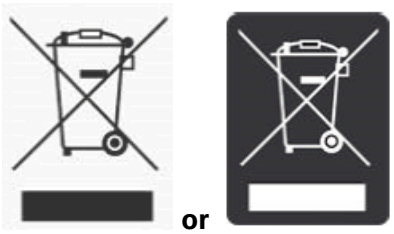
http://las.perkinelmer.com/OneSource/decontamination.htm

Alternatively, if you do not have access to the internet contact Customer Care:

Customer Care USA:	1-800-762-4000	(inside the USA)
(8:30 a.m. – 7 p.m. EST)	(+1) 203-925-4602	(outside the USA)
Customer Care Canada:	800-561-4646	
Customer Care EU:	0800 40 858	(Brussels)
	0800 90 66 42	(Monza)

If you are located outside of these regions, please call your local PerkinElmer sales office for more information.

Appendix 2: WEEE Instructions for PerkinElmer Products



A label with a crossed-out wheeled bin symbol and a rectangular bar indicates that the product is covered by the Waste Electrical and Electronic Equipment (WEEE) Directive and is not to be disposed of as unsorted municipal waste. Any products marked with this symbol must be collected separately, and in accordance with the regulatory guidelines in your area.

The objectives of this program are to preserve, protect and improve the quality of the environment, protect human health, and utilize natural resources prudently and rationally. Specific treatment of WEEE is indispensable in order to avoid the dispersion of pollutants into the recycled material or waste stream. Such treatment is the most effective means of protecting the customer's environment.

The requirements for waste collection, reuse, recycling, and recovery programs are set by the regulatory authority in your location. Contact your local responsible person (such as your laboratory manager) or authorized representative for information regarding applicable disposal regulations. Contact PerkinElmer at the web site listed below for information specific to PerkinElmer products.

Web address:

http://las.perkinelmer.com/OneSource/Environmental-directives.htm

Customer Care USA:	1-800-762-4000 (inside the USA) (+1) 203-925-4602 (outside the USA)
Customer Care EU:	0800 40 858 (Brussels) 0800 90 66 42 (Monza)

Products from other manufacturers may also form a part of your PerkinElmer system. These other manufacturers are directly responsible for the collection and processing of their own waste products under the terms of the WEEE Directive. Please contact these manufacturers directly before discarding any of their products.

Consult the PerkinElmer web site (above) for manufacturer's names and web addresses.

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