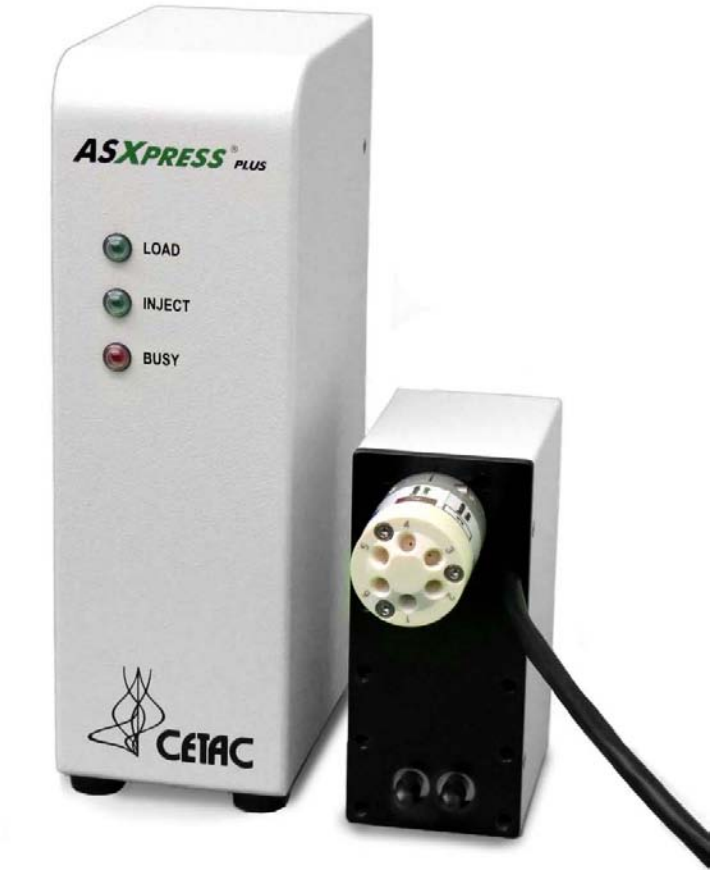
CETAC *ASXPRESS® PLUS*
Rapid Sample Introduction System



Operator's Manual

Manual Part Number **480167** Rev 6

480167 Rev 6 , October, 2011

CETAC Technologies
Customer Service & Support
14306 Industrial Road
Omaha, Nebraska 68144, USA
Phone (800) 369-2822 (USA only)
Phone (402) 733-2829
Fax (402) 733-1932
E-mail custserv@cetac.com

REVISIONS

CETAC Technologies strives to provide the scientific community with an unparalleled combination of effective technology and continuing value. Modular upgrades for existing instruments will continue to be a prime consideration as designs progress.

CETAC Technologies reserves the right to revise this document and/or improve products described herein at any time without notice or obligation.

TRADEMARK ACKNOWLEDGEMENTS

Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

iTEVA is a trademark of Thermo Fisher Scientific Inc.

WinLab32 is a trademark of PerkinElmer Instruments LLC.

ICP-MS Expert is a trademark of Bruker Corporation.

ChemStation is a trademark of Agilent Technologies.

PharMed and Tygon are registered trademarks of Saint-Gobain Performance Plastics.

DuPont™, Kapton®, Tefzel® and Viton® are trademarks or registered trademarks of E.I. du Pont de Nemours and Company.

All other marks are the property of their respective owners.

Contents

1 Introduction

Overview

The CETAC Technologies *ASXPRESS® PLUS* Rapid Sample Introduction System is designed to increase autosampler throughput by reducing the sample delivery, stabilization, and washout time (See Figure 1-1 and Figure 1-2 for cycle diagrams). The CETAC *ASXPRESS PLUS* uses a combination of a metal-free 6-port injection valve with an inert high-speed vacuum pump to enable rapid sample loading and probe wash out.

The *ASXPRESS PLUS* system is comprised of two main components: an electronics module and a valve/pump module. The separate electronics and valve/pump modules provide the smallest possible injection valve size to allow the valve to be placed close to the instrument's nebulizer.

The complete *ASXPRESS PLUS* system is comprised of these main components:

- The *ASX*press valve/pump module
- The ASXpress Plus electronics module
- An external rinse pump
- A power supply
- An autosampler
- Windows-based software to configure and coordinate the system

The *ASXPRESS PLUS* electronics module executes a macro automatically when the probe is placed into the sample. The macro ends when the probe is lifted out of the rinse station.

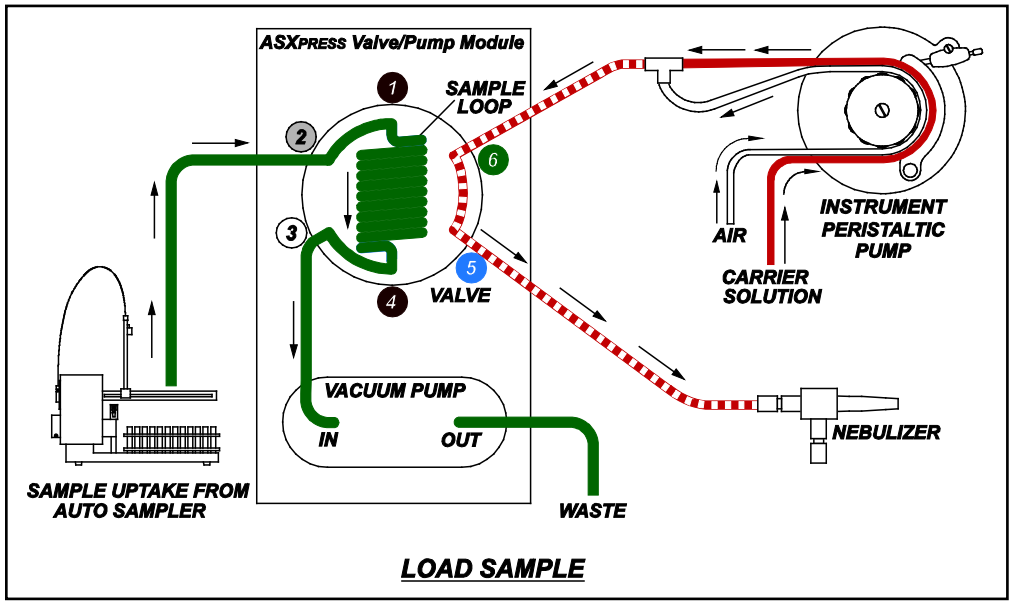


Figure 1-1 "Load Sample" Cycle Diagram

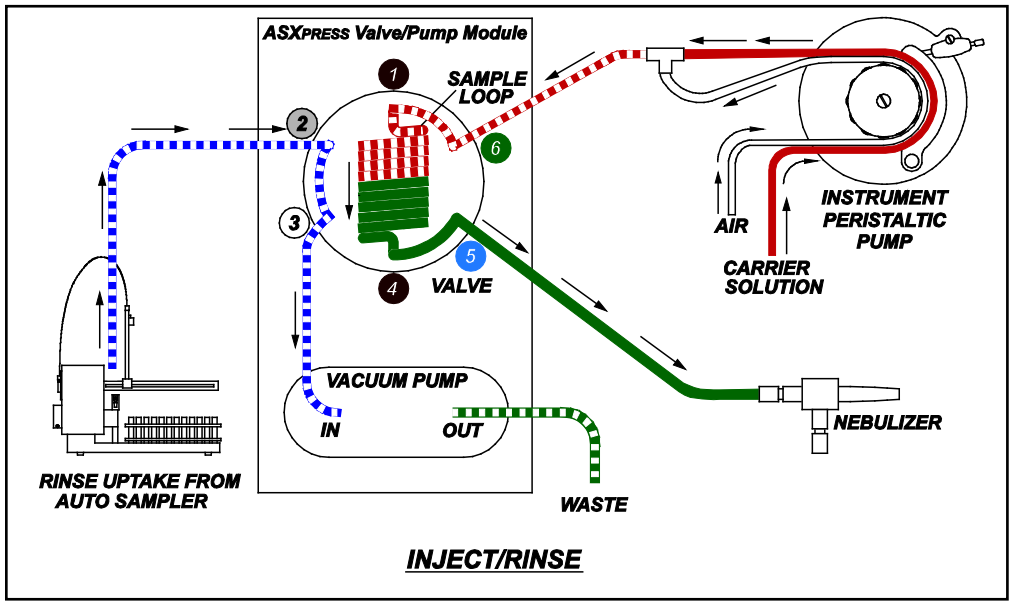


Figure 1-2 "Inject/Rinse" Cycle Diagram

About This Book

This manual describes the procedures for installing, using, and maintaining the CETAC *ASXPRESS PLUS* Rapid Sample Introduction System. It also provides information about troubleshooting minor problems and describes the design of the rapid sample introduction system.

Who Should Read This Book

The primary audience for the *ASXPRESS PLUS Rapid Sample Operator's Manual* consists of analytical chemists and lab technicians. To use this manual effectively, you should have a basic knowledge of chemistry, a basic knowledge of electronic sampling equipment, at least a beginning level of computer experience, and working knowledge of the analytical instrument used with the sample introduction system.

Supported Autosamplers

The CETAC *ASXPRESS PLUS* Rapid Sample Introduction System works with many autosamplers including:

- CETAC ASX-260
- CETAC ASX-500 (contact CETAC for supported models)
- CETAC ASX-510 (contact CETAC for supported models)
- CETAC ASX-520
- CETAC ASX-520HS
- CETAC ASX-520/520HS with EXR-8 extended rack
- CETAC ASX-1400
- CETAC ASX-1600
- PerkinElmer S10
- Agilent SPS-3

Tubing connection information for some autosamplers is in the corresponding *Quick Installation Guide*.

Updates

Updated versions of this manual may be available on the CETAC Web site: www.cetac.com under Service & Support – Service Documents.

Rapid Sample Introduction System Standard Components

The *ASXPRESS PLUS* Rapid Sample Introduction System module cases are made of a high-strength aluminum alloy with an epoxy powder coating finish. The 6-port injection valve is constructed of polyphenylene sulphide (PPS), an inert and dimensionally stable material. The tubing is all inert PTFE (waste tubing materials may vary by application).

The *ASXPRESS PLUS* system operates reliably under a wide variety of conditions. Components in the sample flow path are inert, non-metallic materials; when used at temperatures less than 135°C, they can withstand repeated exposure to the following substances:

- Predominantly aqueous solutions of strong acids (less than 40%).
- Common organic solvents such as acetone, alcohols, ethyl acetate, Methylethylketone (MEK), petroleum oils and derived fuels, tetrachloroethylene, toluene, and xylene.

CAUTION

Prolonged or repeated exposure to temperatures greater than 135°C and to the following substances can cause failure of the flow path components:
• Solutions of concentrated acids (greater than 40%).
• Partially halogenated hydrocarbons or extremely aggressive organic solvents (chloroform, methylene dichloride, 1,1,2-trichloroethane).

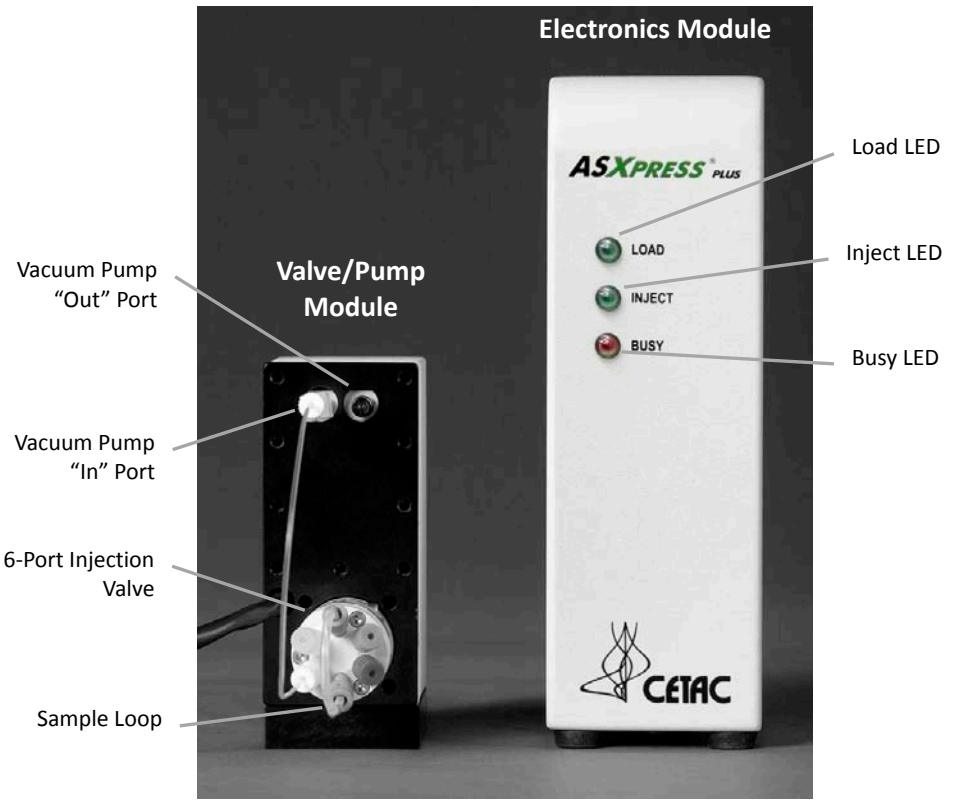


Figure 1-3 *ASXPRESS PLUS* Rapid Sample Introduction System—Front View

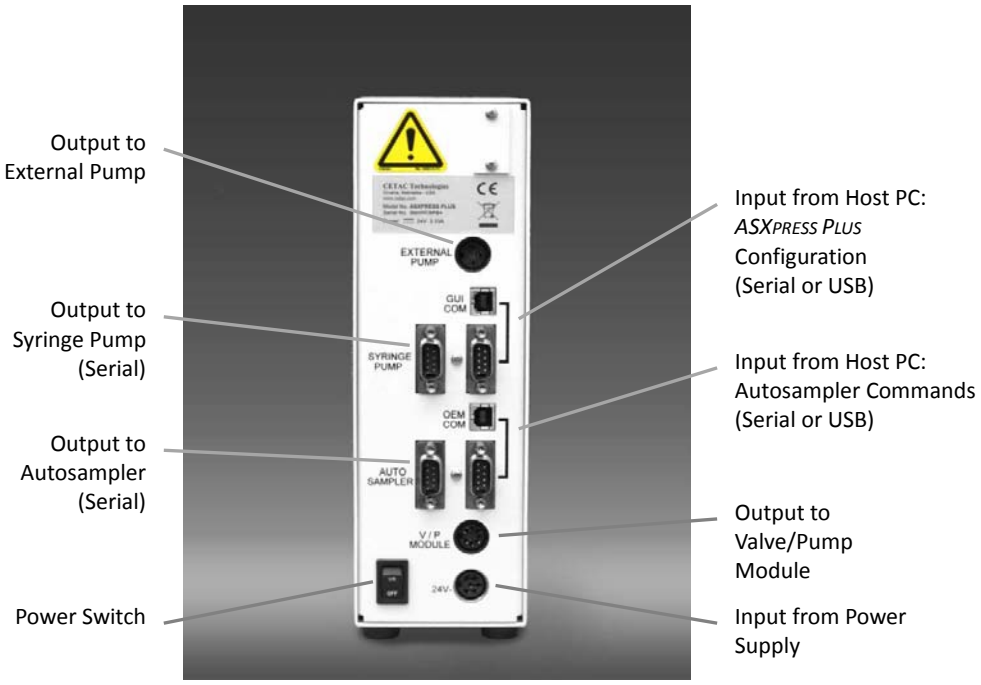


Figure 1-4 *ASXPRESS PLUS* Electronics Module—Back View. Some connectors will not be used, depending on the system configuration.

The following standard components are also shipped with the *ASXPRESS PLUS* system:

- **Power Supply.** A desktop power supply powers the electronics module and valve/pump module.
- **Sample Loops.** For aqueous applications, the following standard sized sample loops are provided: 0.7 mL, 1.00 mL, 1.50 mL, 2.00 mL, 2.50 mL, 3.00 mL, and 4.00 mL. For oils applications, the sample loops provided are: 0.91 mL, 1.02 mL, 1.14 mL, 1.25 mL, 1.36 mL, and 1.48 mL. Additional loops are available.
- **1.0mm Sample Probe**. A 1.0mm ID sample probe must be used on the connected CETAC autosampler to operate properly with the *ASXPRESS PLUS* system. For the ASX-1400 autosampler, a sample probe/stirrer holder block is supplied to fit the new sample probe.
- **Xpress Rinse Station.** The Xpress rinse station is specially designed to accommodate rapid flow of rinse solution through the probe. The Xpress rinse station will be included in the kit, and *must* be installed.
- **Communication Cables.** Two A-B USB cables and two female-female DB-9 RS-232 cables are included.
- ***ASXpress* CD**. The CD contains:
  - Xpress Configuration Tool software
  - C-Term software (terminal program)
  - USB device drivers
  - Firmware
  - This manual
  - Quick Installation Guide
  - Spare parts catalog
  - Other application-specific information

Supplied components depend on the application and autosampler. See the packing list in the shipping container to see exactly which components are supplied.

Optional Accessories/Components

Refer to the *ASXPRESS PLUS Rapid Sample Introduction System Accessories and Supplies Catalog* for a full listing of accessories and spare parts.

- **Articulating Mounting System.** This mounting system allows for stable and secure, close proximity placement and mounting of the Valve/Pump Module near the instrument nebulizer.
- **Alternate Sample Loops.** Alternate sample loop sizes are available as spares. Available sizes for aqueous applications include:
  - 0.70 mL
  - 1.0 mL
  - 1.25 mL
  - 1.5 mL
  - 2.0 mL
  - 2.5 mL
  - 3.0 mL
  - 3.5 mL
  - 4.0 mL
  - 4.5 mL
  - 5.0 mL

  Available sizes for oils applications include:
  - 0.91 mL
  - 1.02 mL
  - 1.14 mL
  - 1.25 mL
  - 1.36 mL
  - 1.48 mL.
  - 2.0 mL
  - 2.5 mL
  - 3.0 mL

NOTE

Please refer to the *ASXPRESS PLUS Rapid Sample Introduction System Accessories and Supplies Catalog* or contact CETAC Technologies if you need additional accessories not listed, need added features to integrate the *ASXPRESS PLUS* Rapid Sample Introduction System into your analytical system, or have unique requirements. Research and development of new features and accessories for the *ASXPRESS PLUS* Rapid Sample Introduction System, often inspired by customer requests, is a continuing activity of CETAC Technologies.

Additional Equipment Required

In addition to the provided equipment, you will need:

- A host computer which has been configured with the ICP software. This computer must have an additional free USB or serial port beyond the ports required to control the autosampler, spectrometer, and other system components.

Where to Go for More Information

In addition to this manual, you can refer to the following resources:

- The ASXpress Plus *Quick Installation Guide* (In many cases, a version specific to your autosampler will be included with the installation kit.)
- The software manual for the ICP/ICP-MS instrument you are using
- The operator's manual for the autosampler you are using
- The CETAC Technologies Web site: www.cetac.com
- CETAC Technologies Customer Service and Support:

  1 (800) 369-2822

  1 (402) 733-2829

  1 (402) 733-1932 (Fax)

  E-mail: custserv@cetac.com

Installation Overview

In most cases, a CETAC representative will assist with the installation of the *ASXPRESS PLUS* Rapid Sample Introduction System.

The following chapters describe how to install the *ASXPRESS PLUS* Rapid Sample Introduction System:

1. Select a location and unpack the *ASXPRESS PLUS* Rapid Sample Introduction System. (Chapter 2, page 15)
2. Set up your autosampler.

   This procedure depends on which autosampler and pump you are using.
3. Install the valve/pump module. (Chapter 6, page 67)

   Connect tubing from the autosampler to the valve/pump module, then to the nebulizer.
4. Install the electronics module. (Chapter 7, page 77)

   Connect the electronics module to a power source and to the valve/pump module, then set up the electronics module to intercept communications between the ICP host computer and the autosampler.
5. Install the software. (Chapter 8, page 87)
6. Configure timing parameters. (Chapter 9, page 99)
7. Begin using the *ASXPRESS PLUS* Rapid Sample Introduction System. (Chapter 10, page 107)

2 Preparing for Installation

Installing the *ASXPRESS PLUS* system requires preparation. Before you install the *ASXPRESS PLUS* Rapid Sample Introduction System, you should evaluate the physical arrangement of the laboratory to choose a suitable location which allows placement of the *ASXPRESS PLUS* valve/pump module as close to the nebulizer as possible. Once you choose a location, you must carefully unpack the system prior to beginning the installation.

This chapter discusses what requirements must be met when you choose a location for the *ASXPRESS PLUS* Rapid Sample Introduction System. It also describes how to unpack the system before installation.

Choosing a Location

Choosing a location for the system involves evaluating the lab environment for the availability of space, liquid waste routing and power. For the system to function optimally, the location you select must meet specific requirements associated with each of these items. The following sections discuss space, water, and power requirements.

Space Requirements

Most analytical applications benefit from utilizing the shortest sample flow path. Therefore, you should place the valve/pump module in close proximity to the nebulizer of the analytical instrument. The required space for *ASXPRESS PLUS* system installation includes separate accommodations for both the valve/pump module and for the electronics module as follows:

	Valve/Pump Module	Electronics Module
Height	12.8 cm	25.4 cm
Width	5.8 cm	8.3 cm
Depth	21.7 cm	20.0 cm
Weight	1.3 kg (2.9 lbs)	1.4 kg (3.0 lbs)

Table 2-1: Physical Characteristics

The above listed dimensions allows for space to accommodate the sample loop and connection tubing, as well as cabling.

In most cases, you will also need to allow space just behind or beside the autosampler for an external rinse pump (approximately 14x10x10 cm).

Liquid Waste Routing Requirements

Ensure that there is a liquid waste receptacle within two meters of the *ASXPRESS PLUS* valve/pump module. The waste receptacle inlet should be at least 30 to 60 centimeters lower than the *ASXPRESS PLUS* Rapid Sample Introduction System vacuum pump outlet and set up so that the rinse drain tubing drops directly into the waste receptacle with no coiling and without being submerged below the liquid level of the waste receptacle.

Power Requirements

The *ASXPRESS PLUS* electronics module receives power through the connection to the external desktop power supply. Place the *ASXPRESS PLUS* electronics module within 3 meters of a power outlet.

WARNING

SHOCK AND FIRE HAZARD
Use only the provided power supply. The power supply must be plugged into an outlet which has a protective ground connection.

The *ASXPRESS PLUS* system is intended to operate from DC power supplied through the provided power supply. The power supply is provided power through an AC power source that will not apply more than 240VAC between the supply conductors and ground. A protective ground connection by way of the grounding connector in the power cord is required for safe operation.

Ensure that you position the electronics module so that the location where the power supply cord plugs into it is easily accessible (is not blocked) and it can be quickly disconnected if needed.

The power supply socket is on the back of the electronics module next to the power switch. Connect the power supply to the electronics module first and then connect a line cord to the power supply. Do not apply power to the power supply until ready to operate the autosampler.

The valve/pump module receives power from the electronics module.

In case of hazard, the autosampler should be disconnected from the power source as well as from the *ASXPRESS PLUS* system.

Unpacking the *ASXPRESS PLUS* Rapid Sample Introduction System

Inspect external packaging upon receipt for signs of shipping damage. Inspect all items during unpacking and notify the carrier immediately of any concealed damage. Check for kinked tubing in the sample loops or other tubing.

If the system is shipped or removed from storage during cold weather, allow the packaged equipment to equilibrate to room temperature before opening and exposing to warm, humid air. It is usually sufficient to provide four to eight hours for this purpose.

CAUTION

If condensation forms on or inside the *ASXPRESS PLUS* Rapid Sample Introduction System, allow it to dry thoroughly before connecting it to a power source and operating it. Failure to do so may cause equipment damage.

Remove the packing checklist from the shipping container, and check off items against it. Leave accessories in the packing until you are ready to install them.

NOTE

Keep the factory packaging for use in case the product ever needs to be returned or shipped to another location.

This page is intentionally blank.

3 Preparing an ASX-500/510 Autosampler

To work properly with the *ASXPRESS PLUS* Rapid Sample Introduction System, an ASX-500 or ASX-510 autosampler will require:

- Upgraded firmware (on an EPROM chip, if CETAC determines that it is needed for your autosampler)
- Xpress rinse station
- External pump (required to achieve adequate sample and rinse flow rate) and associated plumbing
- 1.0mm ID sample probe

WARNING

INJURY HAZARD
Ensure that AC power to the autosampler is off before proceeding with installation. If power to the autosampler is not turned off, the autosampler could begin moving while you are working on it.

CAUTION

The plumbing connections should be made without using tools. In fact, using tools such as screwdrivers or pliers to perform installation tasks may result in a damaged or unusable instrument. Do not tighten fittings with anything other than your fingers.

Upgrade the Firmware

In some cases, it may be necessary to upgrade the firmware in the autosampler. If you are unsure whether to upgrade the firmware, contact CETAC Technologies for advice.

Up-to-date firmware is required to allow the autosampler to respond correctly to the *ASXPRESS PLUS* Rapid Sample Introduction System.

The ASX-500/510 firmware is stored on an EPROM chip.

Checking the Firmware Version

If you think the autosampler might already have the correct firmware, check the version before replacing the EPROM:

1. Connect the autosampler to the host computer.
2. Establish communication using C-TERM or another terminal program.

   See "Operating a CETAC Autosampler Using a Terminal Program" on page 137 for instructions.
3. Enter the VER command.

   If the firmware version is the same as the provided EPROM chip, upgrading is not required.

Upgrading the EPROM

1. Follow the instructions in the document *Firmware Change Procedure for ASX-510* supplied on the CD-ROM.

   The document is also available in the service documents section of the CETAC Technologies Web site, www.cetac.com.
2. Do not reinstall the rinse station, as you will need to replace the rinse station anyway.

Install the Xpress Rinse Station and Rinse Tubing

An Xpress rinse station (Figure 3-1) and associated modified tubing arrangement is required to accommodate the design requirements of the *ASXPRESS PLUS* system. If you are connecting the ASXpress Plus system to an ASX-500/510 autosampler with a standard rinse station installed, then you will need to replace it with the Xpress rinse station (supplied with the upgrade kit), and make the tubing modifications as described in this section.

The Xpress rinse station is smaller than the one provided with the autosampler. This smaller rinse station allows the rinse solution to flow efficiently at the high flow rate used by the *ASXPRESS PLUS* system.

Figure 3-1 Xpress Rinse Station for ASX-500/510 Autosamplers

Removing the Existing Rinse Station

1. Verify that the autosampler is turned off and unplugged, and that no hazardous materials are present in the rinse station or tubing.
2. Turn the rinse station ¼ turn counter-clockwise while pulling up.
3. Note how the rinse tubing is threaded underneath the autosampler.
4. Remove the tubing connecting the rinse station to the peristaltic pump.
5. Remove the tubing connecting the rinse station to the drain/waste container.

   Set the rinse station and all tubing aside, as those items will not be reinstalled. You may wish to store the rinse station in a labeled plastic bag, in case the autosampler ever needs to be restored to its original state.

Installing the Xpress Rinse Station

1. Connect the Y-tubing assembly to the lowest fitting of the supplied Xpress rinse station (both provided in the upgrade kit), and to the discharge ports of the peristaltic pump.
2. Connect one end of the supplied drain tubing to the drain/overflow fitting (highest fitting) of the rinse station.

3 Thread both tubes under the autosampler.

4 Connect the drain tube from the rinse station to a suitable waste container, ensuring that the end of the drain tube does not become submerged below the waste liquid level, as that condition will impede proper drainage. Note: This length of tubing may be cut to accommodate your specific position/arrangement.

5 Gently push the modified rinse station into place onto the rinse station holder block (mounted on the autosampler front cover) and turn it ¼ turn clockwise.

6 Replace the screw to secure the rinse station.

7 Do not connect the tubing to the peristaltic pump on the autosampler. Instead, a higher-speed external pump will be used.

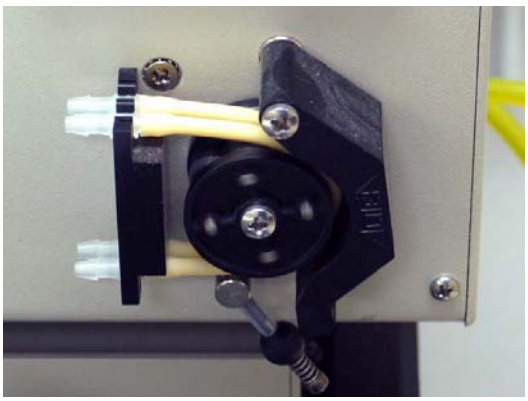


Figure 3-2 Leave the Peristaltic Pump Disconnected

Install the External Rinse Pump

An external peristaltic pump, which is faster than the one built into the autosampler, must be used to supply the rinse station.

The pump will be powered by the *ASXPRESS PLUS* electronics module.

CAUTION Use only the pump provided with the *ASXPRESS PLUS* system.

1 If you have not already done so, remove any tubing connected to the built-in pump and set it aside.

2 Find the Y-tubing assembly which is attached to the rinse station. Attach both free ends to the output of the two pump channels. See Figure 3-4.

3 Attach a length of tubing to the input of both one channel.

4 Place the other end of this tubing assembly into the container of rinse solution.

5 Leave the input of the other pump channel disconnected (open to the atmosphere).

This will allow air to be drawn in through one channel, while rinse solution is drawn in through the other channel, bringing air bubbles into the rinse station.

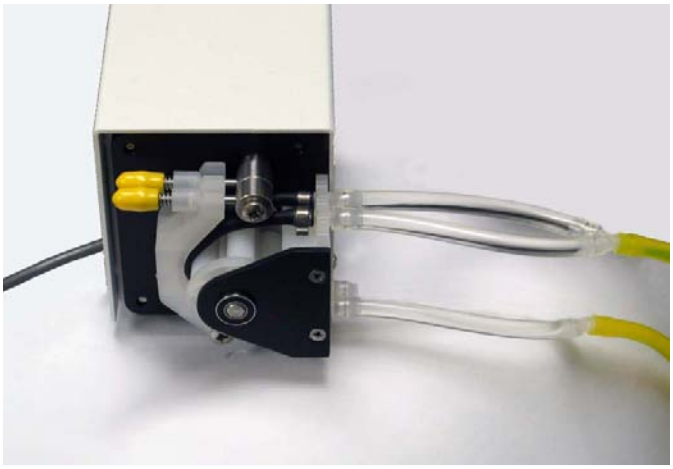


Figure 3-3 External Rinse Pump

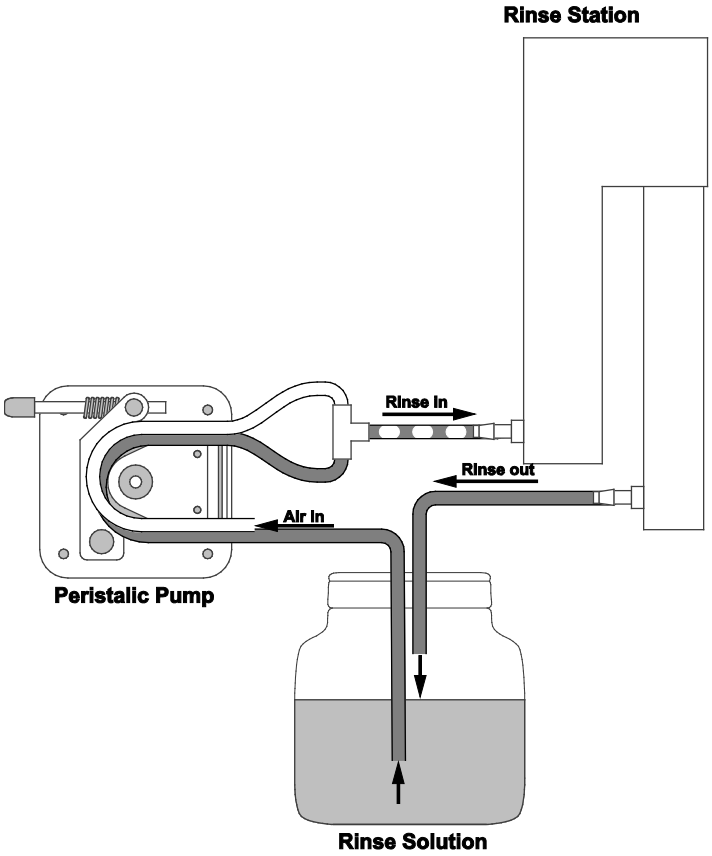


Figure 3-4 Rinse Tubing Diagram

Install the 1.0mm ID Sample Probe on the Autosampler

A 1.0mm ID sample probe (Figure 3-5) is provided for use with the CETAC autosampler for proper operation with the ASXpress *PLUS* system. Follow the autosampler Operator Manual Instructions to replace the probe with the 1.0mm sample probe, which is attached to the *ASXPRESS PLUS* 6-port valve at Port #2.

> **NOTE**
>
> The 1.0mm I.D. sample probe must be installed on the autosampler or the *ASXPRESS PLUS* Rapid Sample Introduction System will not perform properly. It is identified by double blue bands (Figure 3-5) installed on the probe tubing.

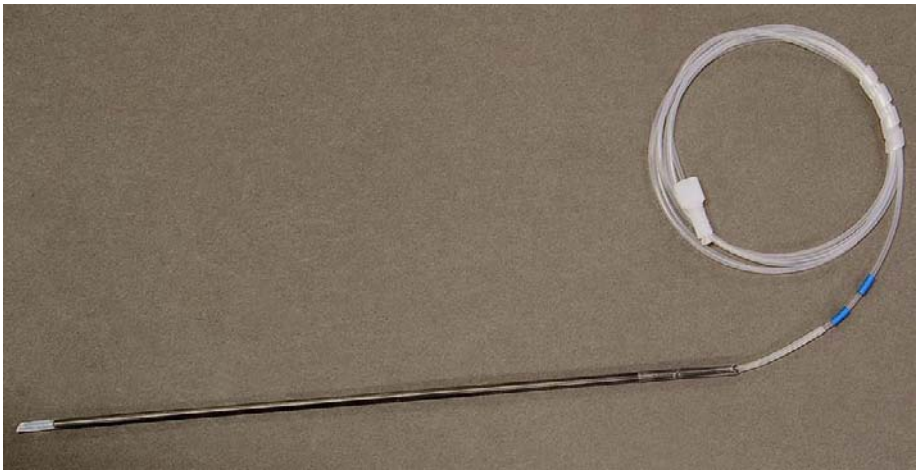


Figure 3-5 Double Blue Bands Identify the 1.0mm I.D. Sample Probe (*carbon fiber probe is shown*)

4 Preparing an ASX-260 or ASX-520 Autosampler

To work properly with the *ASXPRESS PLUS* Rapid Sample Introduction System, an *ASX-520, ASX-520HS,* or *ASX-260* autosampler will require:

- Xpress rinse station
- Rinse pump configuration (several options are described in this chapter)
- 1.0mm ID sample probe

> **Note:**
>
> The *ASXPRESS PLUS* is compatible with the EXR-8 autosampler. Since the EXR-8 utilizes the ASX-520 or ASX-520HS head, this manual will refer to the ASX-520 or ASX-520HS rather than the EXR-8. See the *Upgrade for EXR-8 Autosamplers Installation Guide* for specific instructions.

Identifying the Peristaltic Pump

Over time, several kinds of 2-channel peristaltic rinse pumps have been built into CETAC autosamplers. If the pump on your autosampler looks like the one in Figure 4-1, then it is considered to be a "new" pump for the purposes of this chapter. Any other pump is considered to be an "older" pump.

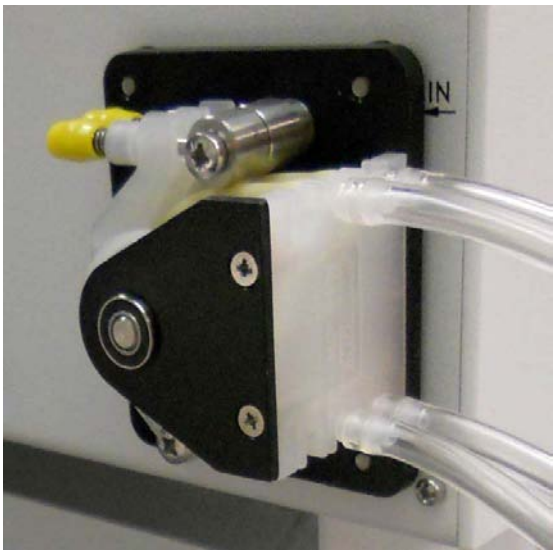


Figure 4-1 "New" Built-In Peristaltic Pump

Rinse Pump Configurations

Several options are available for pumping rinse solution through the rinse station:

Table 2 Rinse Pump Configurations for ASX-260 and ASX-520 Series Autosamplers

Rinse Configuration	Pumps Used	When to Use	See Page
Gravity drain with built-in pump	"New" built-in pump	Recommended option if your autosampler has a "new" pump.	
Gravity drain with external pump	External pump*	Recommended option if your autosampler has an "older" pump.	
Pumped drain with external pump input	External pump* and built-in pump**	Use when greater flow of rinse solution is required.	
Pumped drain with built-in pump input	External pump* and built-in pump**	Use when greater flow of rinse solution is required.	

* A 2-channel external pump is provided in the upgrade kit. This pump is significantly faster than the autosampler's built-in pump.

** When used in conjunction with the external pump, the speed of the internal pump must be increased to its maximum setting. This requires setting a jumper inside the autosampler.

Other Setup Tasks

This chapter also includes a summary of the instructions for upgrading the autosampler firmware, if that should become necessary.

Several optional tasks require opening up the autosampler:

- Upgrading the autosampler firmware
- Adjusting the speed of the built-in peristaltic pump (if you will be using the external 3-channel peristaltic pump)

Installing the Xpress Rinse Station

An Xpress rinse station (Figure 3-1) and associated modified tubing arrangement is required to accommodate the design requirements of the *ASXPRESS PLUS* system.

The Xpress rinse station allows the rinse solution to flow efficiently at the high flow rate used by the *ASXPRESS PLUS* system.

Figure 4-2 Xpress Rinse Station for ASX-500/510/520 Autosamplers

Removing the Existing Rinse Station

1. Verify that the autosampler is turned off and unplugged, and that no hazardous materials are present in the rinse station or tubing.
2. Turn the rinse station ¼ turn counter-clockwise while pulling up.
3. Note how the rinse tubing is threaded underneath the autosampler.
4. Remove the tubing connecting the rinse station to the peristaltic pump.
5. Remove the tubing connecting the rinse station to the drain/waste container.

   Set the rinse station and all tubing aside, as those items will not be reinstalled. You may wish to store the rinse station in a labeled plastic bag, in case the autosampler ever needs to be restored to its original state.

Installing the Xpress Rinse Station

1. Gently push the Xpress rinse station into place onto the rinse station holder block (mounted on the autosampler front cover) and turn it ¼ turn clockwise.
2. Replace the screw to secure the rinse station.

Installing the Gravity Drain with Built-in Pump

This is the preferred rinse pump configuration if if your autosampler has a "new" built-in peristaltic pump.

1. Connect a container of rinse solution to one input of the built-in pump, and let the other input take in air.
2. Connect the outputs of the pump via a Y connector and then to the inlet port of the rinse station.
3. Connect the outlet of the rinse station to a waste container through a gravity drain.

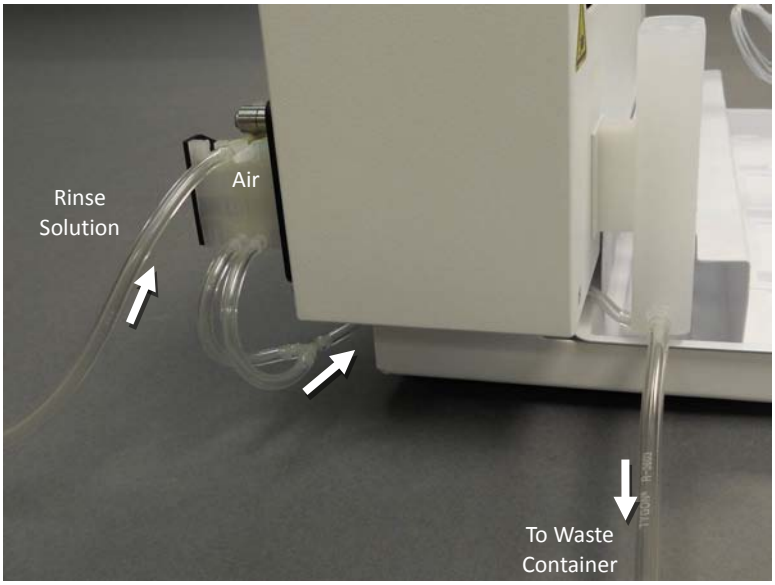


Figure 4-3 Gravity Drain with Built-in Pump

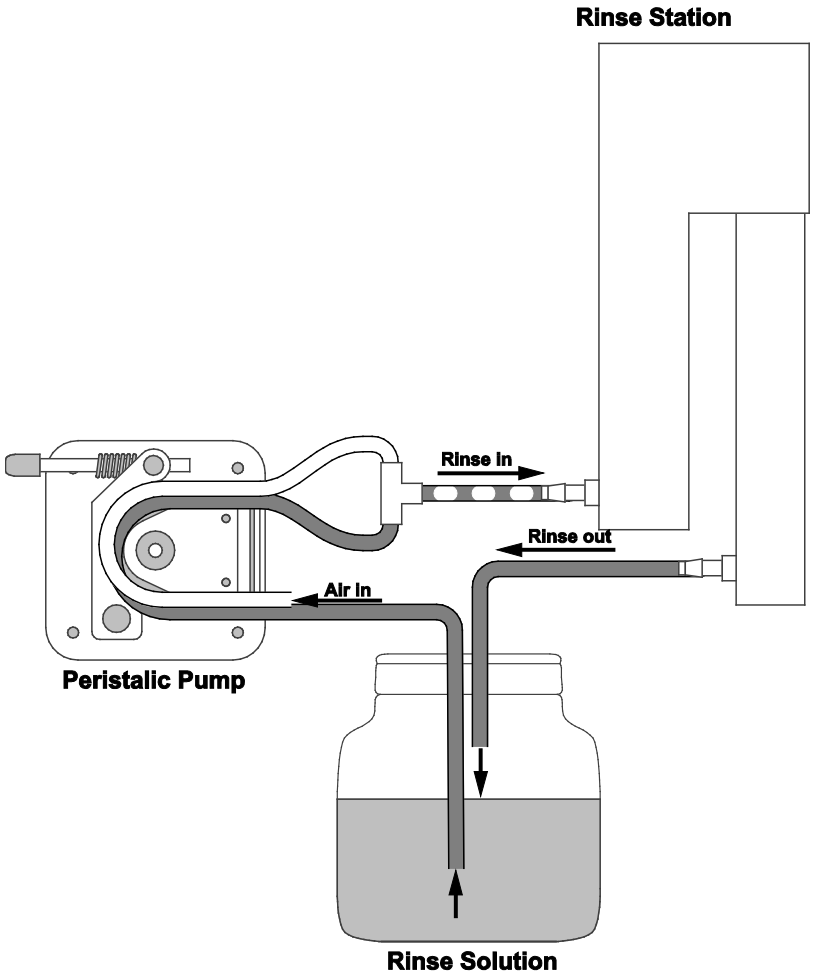


Figure 4-4 Rinse Tubing Diagram for Built-In or External 2-Channel Pump with Gravity Drain

Notes

Check the direction of pump rotation. Some peristaltic pumps have the input at the top, and some at the bottom.

The air bubbles help scrub the tubing.

Rinse solution may be recycled by directing the waste tube into the rinse solution container, if appropriate for your application. Replace the rinse solution on a schedule appropriate for the application.

Make sure that the end of the waste tube is above the surface of the liquid in the container.

A short length of 1/4" OD tubing is used as an intake "straw."

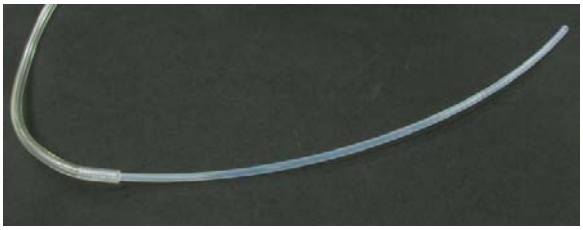


Figure 4-5 Rinse Intake Tube

Installing the Gravity Drain with External Pump

If your autosampler has an "older" built-in peristaltic pump, it is not fast enough to provide an adequate flow of rinse solution when the *ASXPRESS PLUS* system is used. An external peristaltic pump, which is faster than the one built into the autosampler, must be used to supply the rinse station.

The pump is powered by the *ASXPRESS PLUS* electronics module.

CAUTION Use only the pump provided with the *ASXPRESS PLUS* system.

1. Connect a container of rinse solution to one input of the external pump, and let the other input take in air.
2. Connect the outputs of the pump via a Y connector and then to the inlet port of the rinse station.
3. Connect the outlet of the rinse station to a waste container through a gravity drain.
4. Connect the power cord of the pump to the EXTERNAL PUMP connector on the *ASXPRESS PLUS* electronics module.

Notes

The air bubbles help scrub the tubing.

Rinse solution may be recycled by directing the waste tube into the rinse solution container, if appropriate for your application.

Make sure that the end of the waste tube is above the surface of the liquid in the container.

A short length of 1/4" OD tubing is used as an intake "straw."

The built-in peristaltic pump is not used, because it is not fast enough to keep up with the *ASXPRESS PLUS* system.

Alternatively, one channel of the external peristaltic pump can feed rinse solution into the rinse station, while the other channel drains the rinse station.

A short length of 5/16" OD tubing can be connected to the output port of the rinse station, then connected with an adapter to the 1/4" OD tubing. This makes it easier to remove the tubing from the rinse station.

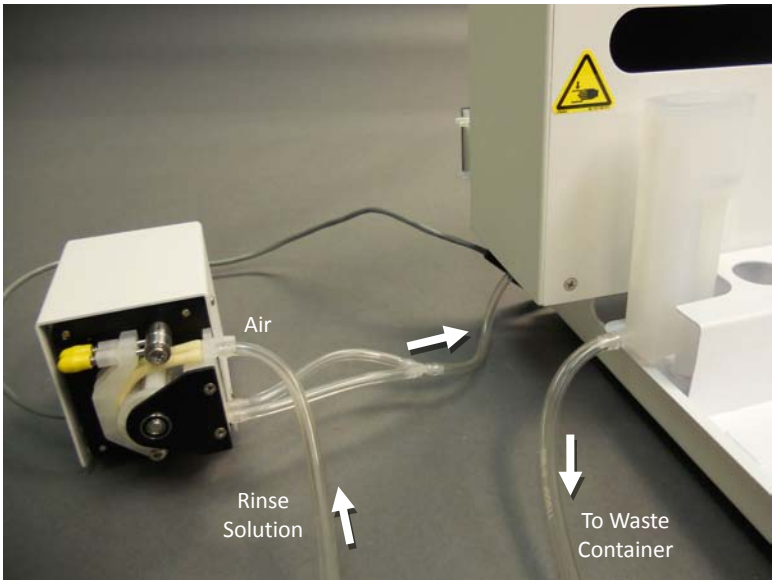


Figure 4-6 Gravity Drain with External Peristaltic Pump

Installing a Pumped-Drain Rinse Arrangement with Both Pumps

If greater flow is required through the rinse station, you may use the external 2-channel peristaltic pump to supply the rinse station, and use the built-in 2-channel pump to drain the rinse station. Many variations of this configuration are possible, such as using the built-in pump for the supply and using the external pump for the drain.

For the EXR-8 extended rack, see the *CETAC ASXPRESS PLUS Rapid Sample Introduction SystemUpgrade for EXR-8 Autosamplers Installation Guide.*

The external pump is powered by the *ASXPRESS PLUS* electronics module.

CAUTION For the external pump, use only the pump provided with the *ASXPRESS PLUS* system.

1. Connect a container of rinse solution to one input of the external pump, and let the other input take in air.
2. Connect the outputs of the pump via a Y connector and then to the inlet port of the rinse station.
3. Connect the outlet of the rinse station to a Y connector and then to the inputs of the built-in pump.
4. Connect the outputs of the built-in pump to waste container.
5. Connect the power cord of the external pump to the EXTERNAL PUMP connector on the *ASXPRESS PLUS* electronics module.

Notes

Leave one input of the external pump disconnected (open to the atmosphere). The bubbles in the rinse solution improve the cleaning action of the rinse station.

Rinse solution may be recycled by directing the waste tube into the rinse solution container, if appropriate for your application.

Make sure that the end of the waste tube is above the surface of the liquid in the container.

A short length of 1/4" OD tubing is used as an intake "straw."

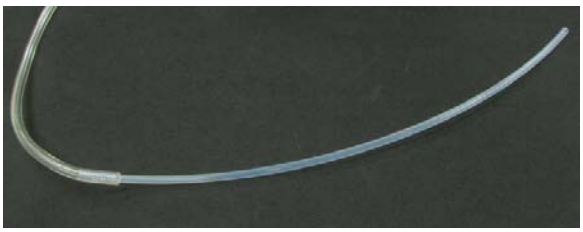


Figure 4-7 Rinse Intake Tube

A short length of 5/16" OD tubing can be connected to the output port of the rinse station, then connected with an adapter to the 1/4" OD tubing. This makes it easier to remove the tubing from the rinse station.

The peristaltic pump built into the autosampler removes rinse solution. To avoid overflowing the rinse station, both channels of the pump should be used, and the pump must be running at its fastest speed. To set the pump speed, open up the autosampler (page 34) then set the pump speed jumper (page 42).

If using an EXR-8 extended rack, tubing between the autosampler and stationary objects (the external pump and rinse container) should run through the "chain." Tubing on the autosampler should be secured using the tray and clips, to prevent it from shifting as the autosampler moves. Bend the waste line in a "U" shape so that it can be clipped in place, but be careful not to kink the tubing.

The following photos show how the tubing might be arranged:

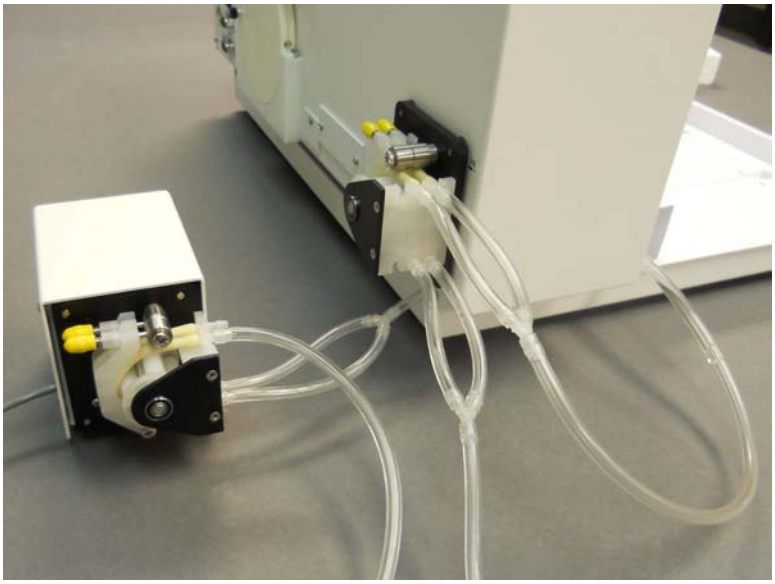


Figure 4-8 Pumped-Drain Arrangement with External Peristaltic Pump as Supply and Built-In Pump as Drain

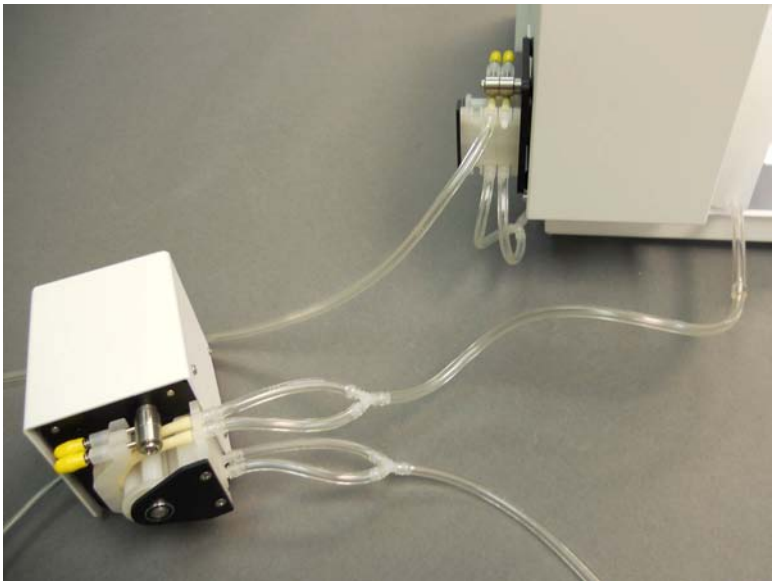


Figure 4-9 Pumped-Drain Arrangement with External Peristaltic Pump as Drain and Built-In Pump as Supply

Installing the 1.0mm ID Sample Probe

A 1.0mm ID sample probe (Figure 3-5) is provided for use with the CETAC autosampler for proper operation with the ASXpress *PLUS* system. Refer to the autosampler *Operators Manual* to replace the probe with the 1.0mm sample probe, which is attached to the *ASXPRESS PLUS* 6-port valve at Port #2.

> **NOTE**
>
> The 1.0mm I.D. sample probe must be installed on the autosampler or the *ASXPRESS PLUS* Rapid Sample Introduction System will not perform properly. It is identified by double blue bands (Figure 3-5) installed on the probe tubing.

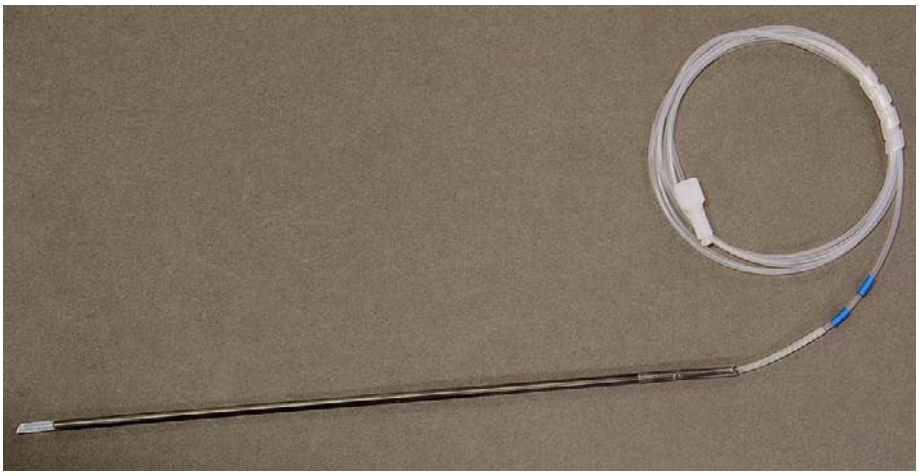


Figure 4-10 Double Blue Bands Identify the 1.0mm I.D. Sample Probe (*carbon fiber probe shown is standard equipment*)

Accessing the Interior of the Autosampler

In most cases, you do not need to open up the autosampler. However, you may need to open up the autosampler to:

- Upgrade the autosampler firmware
- Adjust the speed of the built-in peristaltic pump

> **NOTE**
>
> Your equipment may differ in appearance from what is shown in the photos. The photos represent typical CETAC instruments from a range of eras and applications. Most of the photos depict a standard ASX-520 with a standard rinse station; note that for the EXR-8, the standards rack is attached to autosampler and not integrated into the tray.

1. Place the autosampler on a flat surface and ensure that the unit is powered off.
2. Remove the two Kynar thumbscrews from the Y-axis home block.

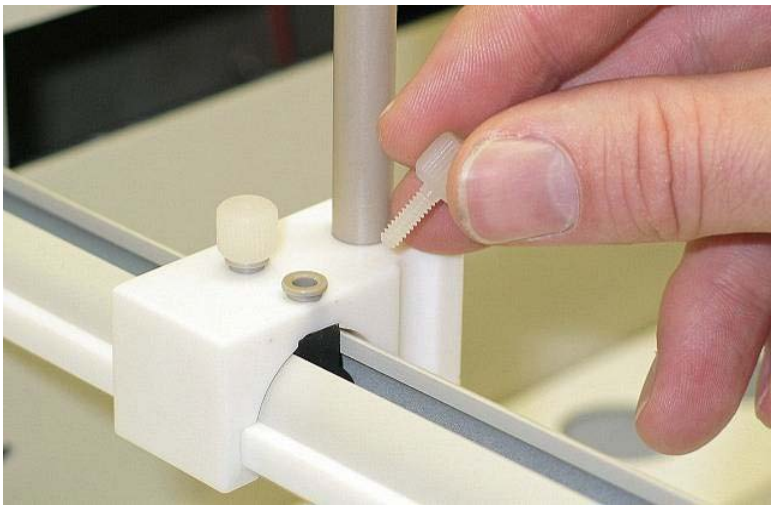


Figure 4-11 Y-Axis Home Block with Kynar Thumbscrews

3 Remove the entire Z-drive assembly from the Y-arm by pulling the Z-drive assembly forward and off of the autosampler arm as shown (Figure 4-12).

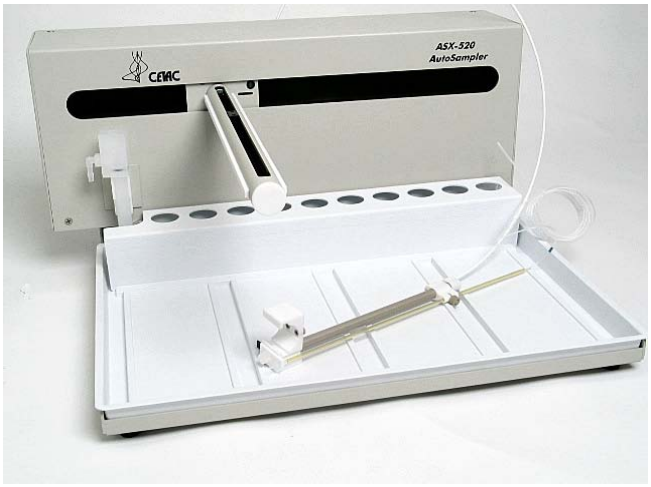


Figure 4-12 Z-Drive Removed from Arm Assembly. (*Photo shows standard ASX-520 tray with integral standards rack.*)

4 Once the Z-drive assembly is removed, remove the rinse station (Figure 4-13). Turn the rinse station ¼ turn counter-clockwise while pulling it upward. Also, the tubing located at the bottom of rinse station will have to be disconnected from the pump at the rear of the autosampler.

Figure 4-13 Rinse Station

5 If the autosampler has a standards rack which is attached to the front of the autosampler, remove the standards rack. Remove the three screws and pull it forward.

Figure 4-14 Removing the Standards Rack

6 Remove the autosampler tray. Lift up the tray and pull out (Figure 4-15).

Figure 4-15 Removing the Tray (*ASX-520*)

7 Next, the front cover is to be removed. Remove the four corner screws (Figure 4-16).

Figure 4-16 Front View of *ASX-520* Autosampler Showing Front Cover Screws

8 The front cover is removed by lifting it slightly and pulling forward (Figure 4-17).

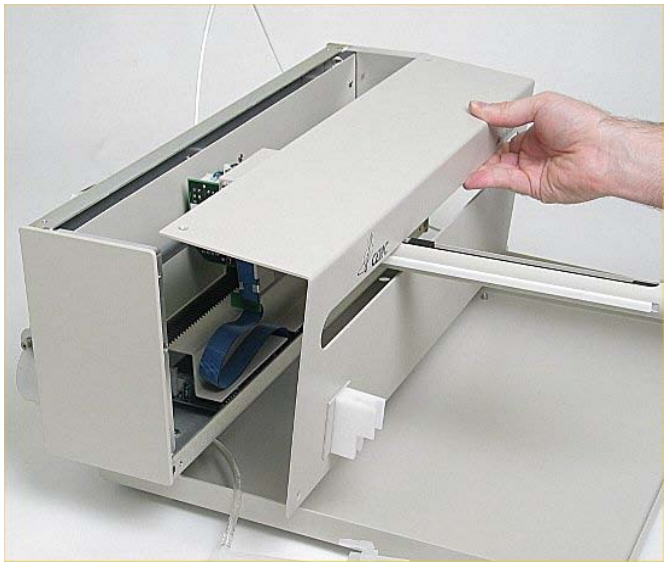


Figure 4-17 *ASX-520* Autosampler with the Front Cover Being Removed

9 The screws that hold the inner shield must be removed. Move the Y-axis assembly all the way to the left (Figure 4-18 shows screw locations). Your autosampler may have a newer style shield with splashguard. These are removed in a similar manner.

Figure 4-18 View of Inner Shield Inside the *ASX-520* Autosampler

10 The inner shield can be removed by moving the arm to the right or left then lifting it up while pulling forward.(Figure 4-19).

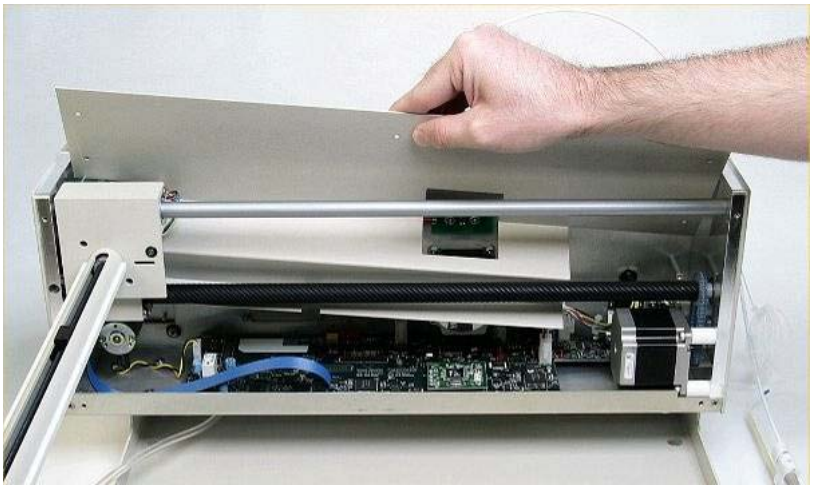


Figure 4-19 Removal of Inner Shield (*ASX-520*)

11 If you have a newer shield/splash guard combination proceed as follows. Locate and remove the 5 screws holding the shield in place.

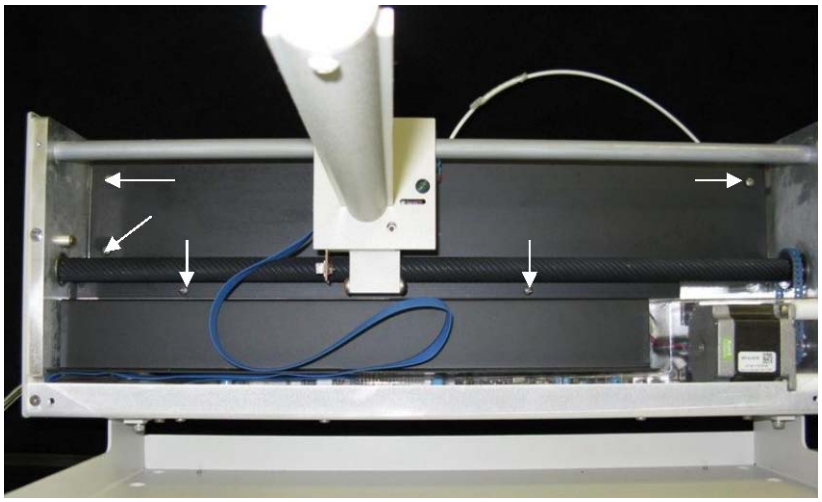


Figure 4-20 New Shield and Splashguard Inside the ASX-520

12 Remove the two shield pieces. Notice that the splashguard goes under the chassis on the top and over the chassis on the bottom. When you replace the splashguard, ensure it is oriented in this manner.

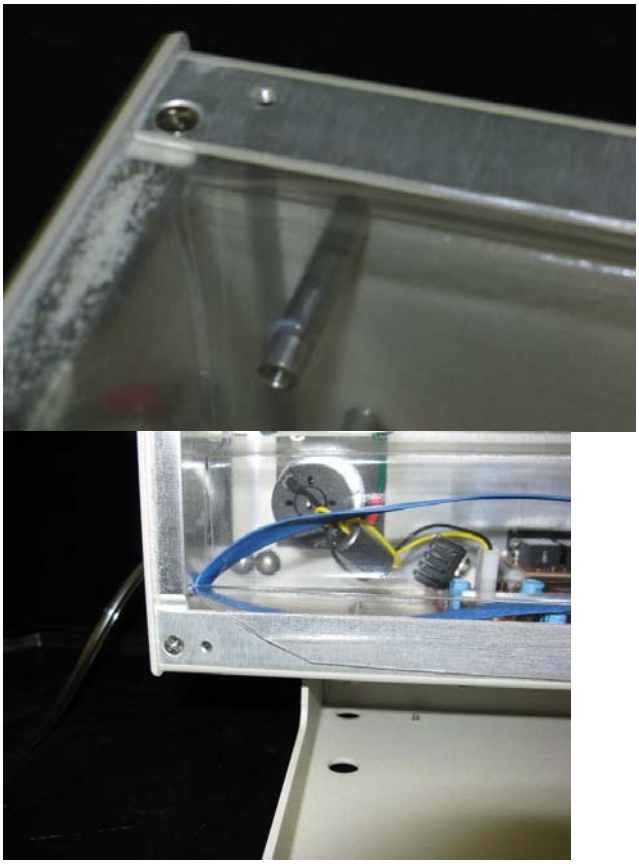


Figure 4-21 Splashguard Placement

13 Remove the splashguard by pulling it out from one side. It may be necessary to reach under the guard and remove it from the support standoffs.

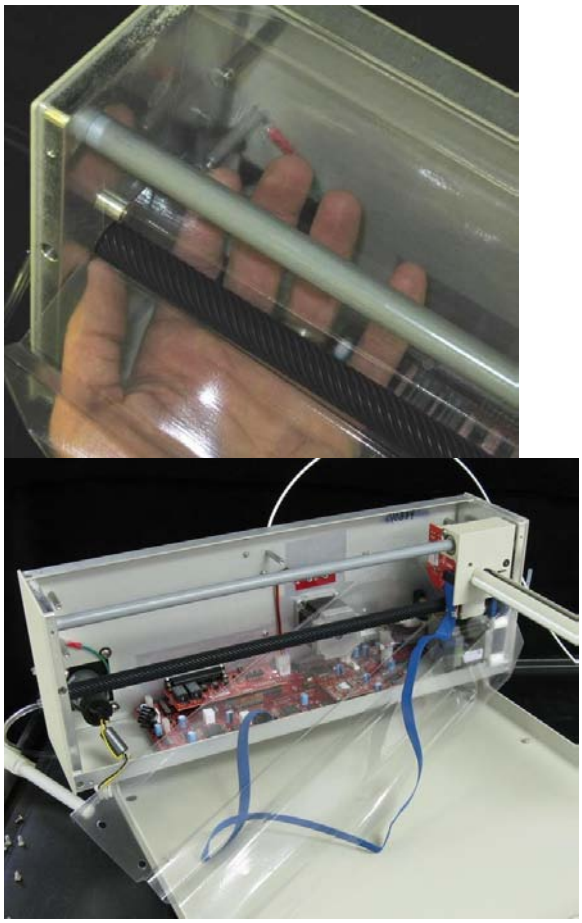


Figure 4-22 Splashguard Removal

Setting the Pump Speed Jumper (*ASX-520/ASX-520HS/EXR-8*)

1. Locate the block of pump speed pins on the left side of the main circuit board
2. Move the jumper from its existing position to the position marked "Max RPM" (Figure 4-23).

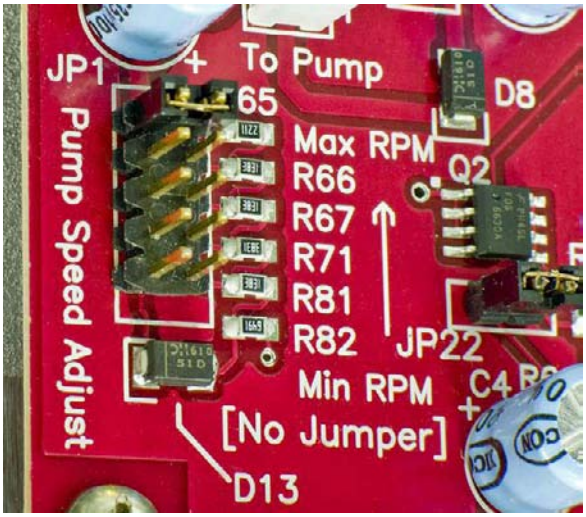


Figure 4-23 Jumper Position Utilized to Increase Pump Speed (*ASX-520*)

> **Note:**
>
> ASX-520/ASX520HS main boards of differing eras/versions may have varying orientation of jumper positions. Follow the label on the circuit board for proper jumper positioning.

Upgrading the Firmware

In most cases, a firmware upgrade is not required. If you do need to upgrade the autosampler firmware, do it now, before reassembling the autosampler.

The CETAC autosampler requires a firmware version which is compatible with the *ASXPRESS PLUS* system. If an upgrade is necessary, you can purchase a Rabbit processor module with firmware pre-loaded. This Rabbit processor module should be installed in the autosampler to be upgraded, replacing the existing module.

A compatible firmware version and Rabbit Firmware Utility (RFU) Upgrade program is included on the software CD provided with the *ASXPRESS PLUS* upgrade kit. Complete instructions for loading the firmware are also provided on the CD. Follow the provided instructions to upgrade the firmware on the autosampler. See the CETAC Autosampler Operator Manual for any further instructions on autosampler setup.

Supported Firmware Versions

The *ASXPRESS PLUS* Rapid Sample Introduction System is compatible with the following firmware versions:

- ASX-520/ASX-520HS: firmware version 2.00 or later.

Where to Get the Firmware

The software needed to upgrade the firmware on the autosampler and the firmware upgrade file can be downloaded from the CETAC web site. To download the software and the firmware, go to http://www.cetac.com/downloads/download.html and select Autosampler Firmware Update. You will be presented with a form that asks for basic contact information. Upon completion, you will be e-mailed a web site address, a login ID and a password that will allow you to download any new firmware upgrade that may be available for your autosampler along with the necessary software to perform the upgrade.

You can upgrade the firmware by setting some switches and using a firmware update utility, or by replacing the processor module ("Rabbit module") in the autosampler. Contact CETAC to determine which method is most appropriate for your autosampler. Since upgrading firmware requires access to the inside of the autosampler, be sure to perform the upgrade while the covers are still off when you change the pump speed jumper.

Instructions for updating the firmware are on page 42; complete instructions are also included with the firmware update utility.

The following guide describes the necessary steps for upgrading the firmware on the ASX-260/520 and ASX-520HS autosamplers.

Autosampler Programming Configuration

The autosampler's Rabbit processor module must be configured to receive the firmware. This is achieved by moving jumpers on the main board to place the system into "programming mode". Follow the instructions in the following section to complete the firmware upgrade.

1. Ensure that the autosampler is powered off, and that all covers are removed.
2. On the *ASX-520*/520HS board, move jumper JP3 and JP4 to JP5 and JP6 (Figure 4-24 shows jumpers).

> **NOTE:**
>
> Main boards of different versions may have varying locations/positions/quantities of available jumper positions. Follow nomenclature present on the board for proper jumper positioning.

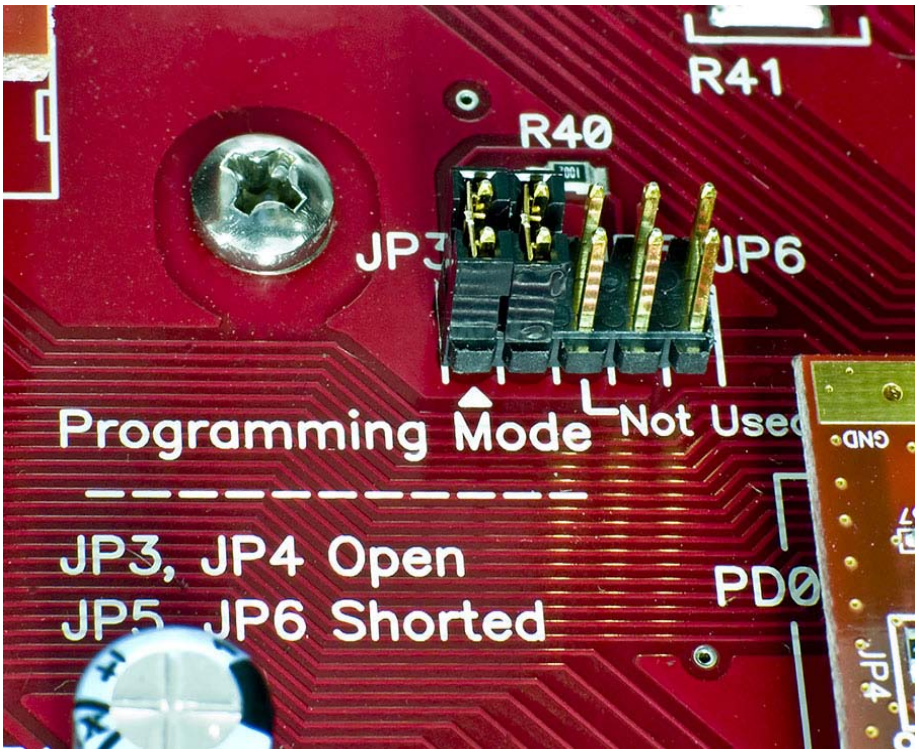


Figure 4-24 Jumpers on Board in Normal Position (*ASX-520*)

3 On the *ASX-260* board, move jumper JP2 to JP4 and leave JP3 in place (Figure 4-25 shows jumpers).

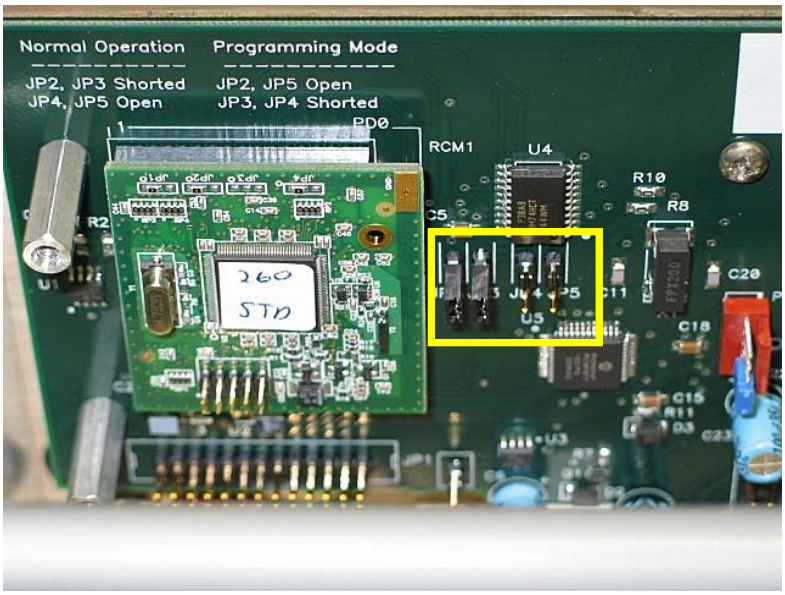


Figure 4-25 Jumpers on Board in Normal Position (*ASX-260*)

Loading the Firmware Upgrade

The software required to upgrade/load the firmware on the autosampler and the firmware upgrade files are located on the installation CD provided with the *ASXPRESS PLUS* system.

Establish Communications

1. Ensure that the Z-drive assembly is properly installed on the autosampler Y-arm.
2. Connect the power cord to the autosampler power supply, connect the serial cable to the host computer and turn the autosampler on.
3. Start a terminal emulator program, as described in "Operating a CETAC Autosampler Using a Terminal Program" on page 137.
4. Enter the VERSS command. The system will respond with the current firmware version.

   Note it here._____
5. Enter HOME. This is to verify that the system is communicating.
6. Close the terminal emulator program.

Setup of Rabbit Utility

7. Run the Rabbit Field Utility application, RFU.exe, from the CD provided (Figure 3-62). On a Windows XP equipped PC, this may be accessed via the path:
   1. Start»My Computer
   2. Right click on the drive letter containing the CD, and select open
   3. Select the folder named "ASX Firmware for *ASXPRESS*"
   4. Select "RFU" (This is the Rabbit Field Utility)

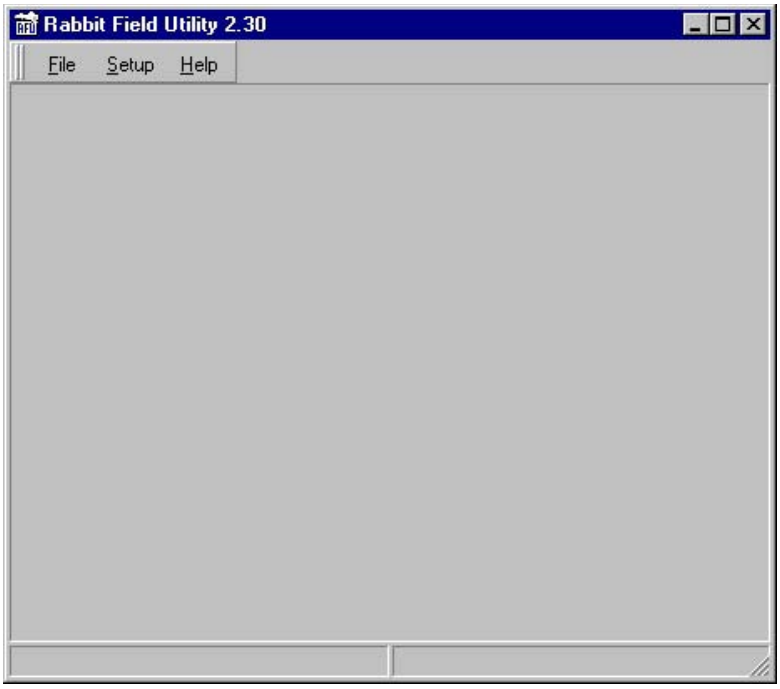


Figure 4-26 Rabbit Field Utility Application

8 When the Rabbit Field Utility has opened, select "Setup", and then "Communications".

9 In the Communications Options window, in the "Comm Port" field, select the COM port on the computer that is connected to the autosampler. Click the OK button.

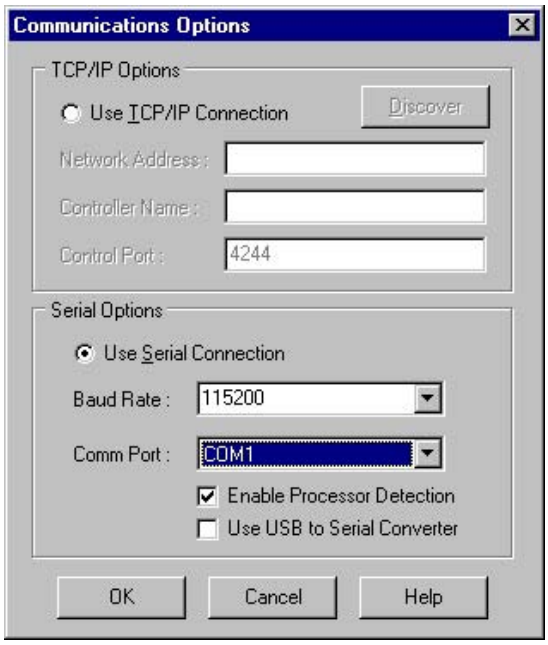


Figure 4-27 "Communications Options Window"

10 From the Rabbit Field Utility main window, select "Setup" again, and then "File Locations".

11 The "Choose File Locations" window will appear.

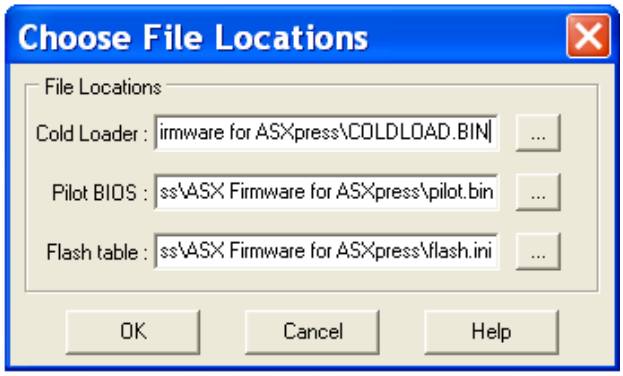


Figure 4-28 "Choose File Locations" Window

12 Fill in each of the three fields by selecting the "browse" button to the right of each field (denoted by [...], Figure 4-28), and then selecting the correct file from the CD as depicted in Figure 3-65. The correlating file names for each field will be:

Cold Loader: (drive letter where CD is loaded):\ASX Firmware for ASXpress\COLDLOAD.BIN

Pilot BIOS: (drive letter where CD is loaded):\ASX Firmware for ASXpress\pilot.bin

Flash table: (drive letter where CD is loaded):\ASX Firmware for ASXpress\flash.ini

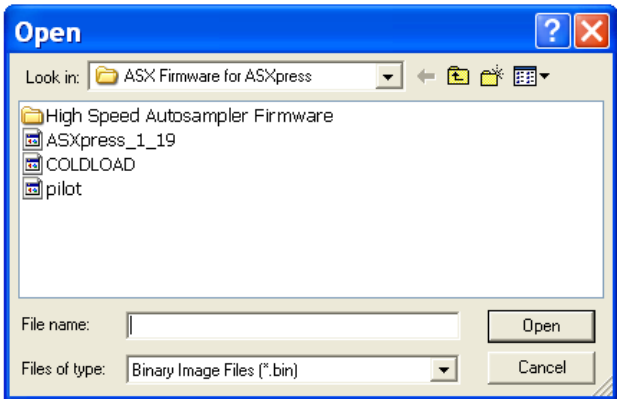


Figure 4-29 "Open" Window

Note:

The .bin file name in Figure 4-29 (i.e. ASXpress_1_19) will vary depending on which era *ASXpress* FW is being loaded. CETAC Technologies makes every effort to update the firmware as needed to ensure that the most beneficial functionality is provided to the customer.

As of December 2009, the most current firmware version file name for standard speed autosamplers is "ASXpress_1_19" and for high speed autosamplers is "ASXpress_HS_1_19.

Also note that firmware is not the same for standard and high speed autosampler models. Be sure to load the correct firmware for your autosampler. Contact CETAC Technologies with any questions.

13 Click OK. Leave the "Rabbit Field Utility" open.

Upgrading (loading) the Firmware

1 Ensure that the autosampler is still powered on.

2 In the Rabbit Field Utility, select "File", and then "Load Flash Image".

3 The "Choose Flash Image" window will appear.

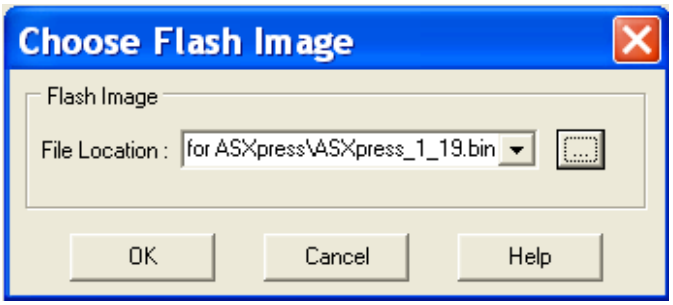


Figure 4-66 "Choose Flash Image" Window.

4 Select the firmware file by filling in the field by selecting the "browse" button to the right of the field (denoted by [...]) (Figure 3-66), and then selecting the correct file from the CD as depicted in Figure 3-67 or Figure 3-68. The correlating file name for the field is:

5 For *ASX-520*, *ASX-260* Autosampler

File Location/Name: (drive letter where CD is loaded):\ASX Firmware for ASXpress\ASXpress_1_19.bin

6 For *ASX-520HS* (High Speed) Autosampler

File Location/Name: (drive letter where CD is loaded):\ASX Firmware for ASXpress\High Speed Autosampler Firmware\ASXpress_HS_1_19.bin

Note:

Ensure that the correct firmware file (applying to your specific autosampler) is selected, to ensure correct interface/operation of the *ASXPRESS* system and autosampler.

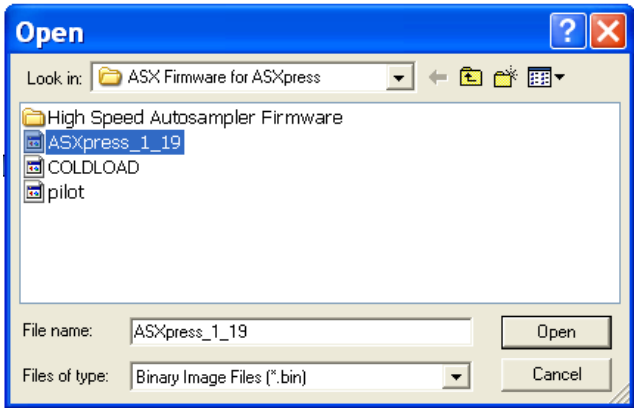


Figure 4-30 "Open" Window (*ASX-260*, *ASX-520*)

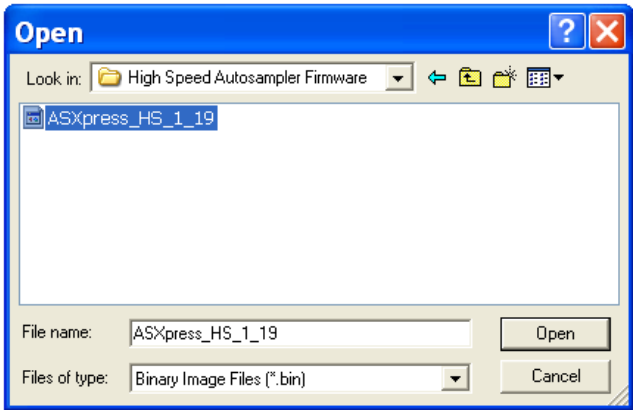


Figure 4-31 "Open" Window (*ASX-520HS*)

7 Click the Open button to select the appropriate file (Figure 3-67 and Figure 3-68). The "Choose Flash Image" window reappears.

8 Click the OK button (Figure 3-66). A progress bar will appear indicating loading of the selected firmware file.

> **NOTE:**
>
> The .bin file name shown in Figure 3-63 (i.e. ASXpress_1_19 or ASXpress_HS_1_19) will vary depending on which era *ASXPRESS* FW is being loaded. CETAC Technologies makes every effort to update the firmware as needed to ensure that the most beneficial functionality is provided to the customer.
>
> As of December 2009, the most current firmware version file name is "ASXpress_1_19" for standard speed autosamplers or "ASXpress_HS_1_19" for High Speed autosamplers.

9 When the status bar completes its movement, indicating completion of the firmware load to the rabbit module within the autosampler, the Rabbit Field Utility can be closed.

Returning the Autosampler to Normal (Non-Programming Mode) Configuration

1 Turn off the autosampler.

2 On the *ASX-520*/520HS board, move jumper JP5 and JP6 back to JP3 and JP4, or On the *ASX-260* board, move jumper JP4 back to JP2 and leave JP3 in place.

3 Turn the autosampler back on. The autosampler should go to the home position.

Verification of Firmware Upgrade

1. Start a terminal emulator program.
2. Enter VERSS. The system should respond with the new firmware version.

Closing Up the Autosampler

Once the firmware has been upgraded and the pump speed has been set, you can close up the autosampler.

- **Reinstall all shields**
- **Reinstall the front cover**
- **Reinstall the standards rack**

  Try to align the standards rack to its original position. Use the marks left on the rack by the screws as a guide.
- **Reinstall the Z-drive assembly**

This page is intentionally blank.

5 Preparing an ASX-1400/1600 Autosampler

To work properly with the *ASXPRESS PLUS* system, an ASX-1400 or ASX-1600 autosampler will require:

- Adequate sample and rinse flow rate
- Xpress rinse station
- Modified rinse tubing arrangement
- Xpress stirrer/probe block
- 1.0mm ID sample probe

The ASX-1400/1600 autosampler firmware does *not* need to be upgraded to work with the *ASXPRESS PLUS* Rapid Sample Introduction System.

WARNING	**INJURY HAZARD** **Ensure that AC power to the autosampler is off before proceeding with installation. If power to the autosampler is not turned off, the autosampler could begin moving while you are working on it.**

CAUTION	The plumbing connections should be made without using tools. Using tools such as screwdrivers or pliers to perform installation tasks may result in a damaged or unusable instrument. Do not tighten fittings with anything other than your fingers.

Install the Xpress Rinse Station and Modified Rinse Tubing Arrangement

An Xpress rinse station and associated modified tubing arrangement is required to accommodate the design requirements of the *ASXPRESS PLUS* system. Please note the following considerations:

- Some ASX-1400 autosamplers come standard with the Xpress rinse station.
- If you are connecting the *ASXPRESS PLUS* system to an autosampler which does not have an Xpress rinse station installed, then you will need to replace it with the Xpress rinse station (supplied with the upgrade kit) and make the tubing modifications, as described in this section.

The ports in the Xpress rinse station are smaller than the ones in the standard rinse station provided with the autosampler. This smaller rinse station porting allows the rinse solution to flow efficiently at the high flow rate used by the *ASXPRESS PLUS* system.

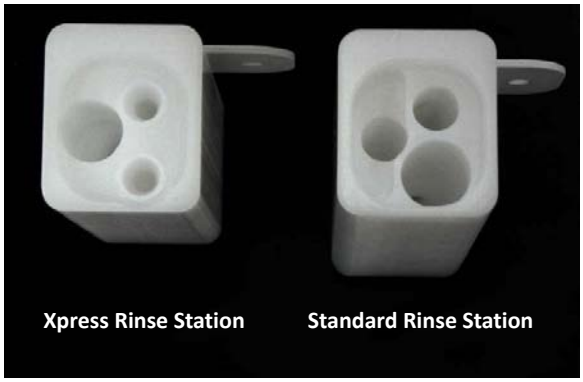


Figure 5-1 Xpress Rinse Station

The modified tubing arrangement provides for the injection of air bubbles which will more rapidly flush the tubing between samples.

To retrofit the Xpress rinse station on an *ASX-1400*:

1. Verify that the autosampler is turned off and unplugged, and that no hazardous materials are present in the rinse station or tubing.
2. Remove the screw to the right of the rinse station.

Figure 5-2 Removing the Rinse Station Screw

3 Gently tilt the rinse station away from the autosampler the pull it out.

Figure 5-3 Removing the Rinse Station

4 Remove the tubing connecting the rinse station to the peristaltic pump.

5 Remove the tubing connecting the rinse station to the drain/waste container. Set the rinse station and all tubing aside, as those items will not be reinstalled.

Figure 5-4 Removing the Rinse Tubing

6 Assemble the rinse intake tubing, using one of the options described later in this chapter.

7 Thread the rinse intake tubing and the drain tubing under the autosampler.

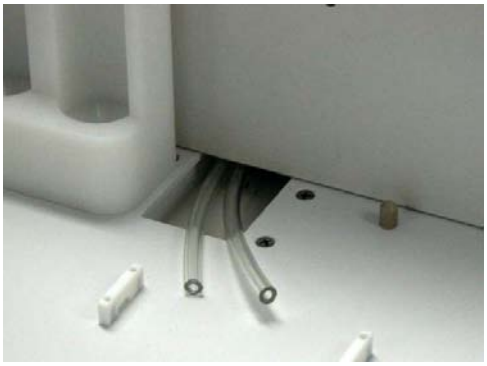


Figure 5-5 Rinse Station Tubing

8 Connect the rinse intake tubing to the "rinse in" fitting of the rinse station.

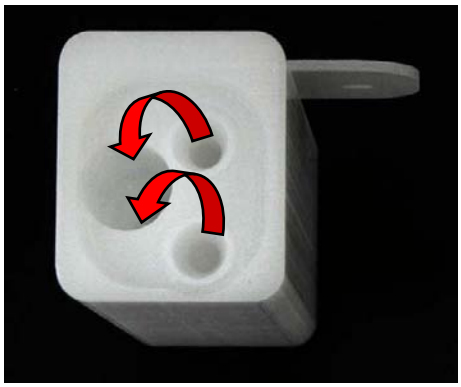


Figure 5-6 Rinse Solution Flow

As seen from above, rinse solution flows into the rinse station through the two holes for the stirrer and probe, then out through the single drain hole.

9 Connect the drain tubing to the "rinse out" fitting of the rinse station.

10 Connect the drain tube from the rinse station to the recycled rinse solution container or to a suitable waste container. Make sure that the end of the drain tube does not become submerged below the waste liquid level, as that condition will impede proper drainage. The drain tubing may be cut to accommodate your specific position/arrangement.

11 Gently push the rinse station into place onto the rinse station holder block (mounted on the autosampler front cover).

12 Replace the screw to secure the rinse station.

Connecting the Rinse Tubing

A diaphragm pump provides the required rinse solution flow rate.

Two channels of the autosampler's built-in peristaltic pump add room air to create bubbles, which help scrub the tubing.

Recommended tubing: Air lines – PharMed™; Rinse solution – Viton™, Tygon™ Fuel and Lubricant, or Superthane™.

1 Place the diaphragm pump near the autosampler.

The pump is included in the upgrade kit.

2 Connect the pump to the EXTERNAL PUMP connector on the *ASXPRESS PLUS* electronics module.

3 On the back of the autosampler, turn both the Auxiliary and Main Pump Speed knobs to their maximum settings.

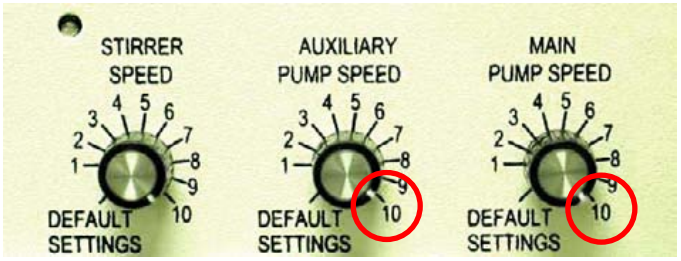


Figure 5-7 Pump Speed

4 Connect the rinse station to the built-in peristaltic pump, the diaphragm pump, and the rinse solution container as shown in the following diagrams.

Install a filter and a check valve before each intake of the diaphragm pump.

The rinse station may be gravity drained if the waste receptacle inlet is at least 30 to 60 centimeters lower than the *ASXPRESS PLUS* Rapid Sample Introduction System vacuum pump outlet (see Figure 5-8). If that is not possible, or if the rinse station is overflowing, contact CETAC Technologies.

Set up so that the rinse drain tubing drops directly into the waste receptacle with no coiling and without being submerged below the liquid level of the waste receptacle.

The figures show a single container which recycles rinse solution. Due to the high flow rate of rinse solution, this is the most practical configuration for many applications. Separate containers for clean and contaminated rinse solution may be used if necessary.

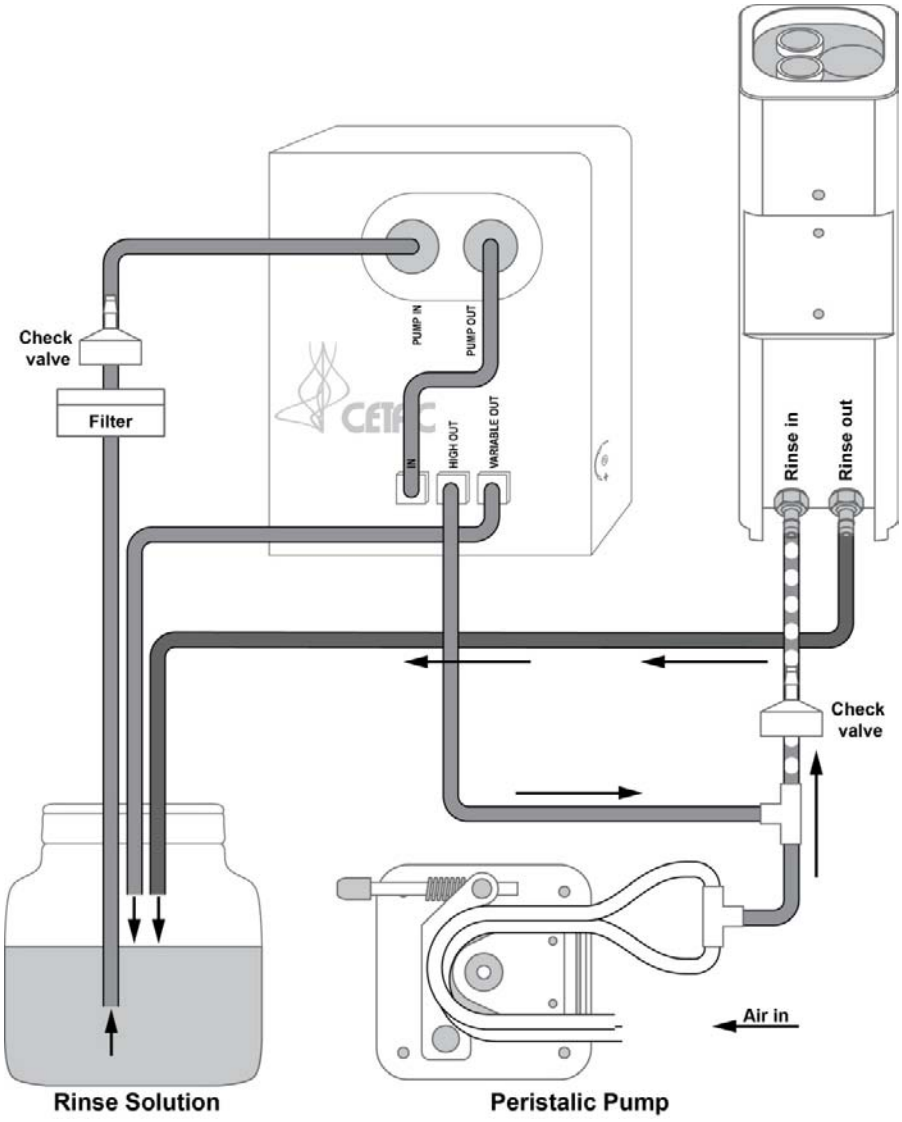


Figure 5-8 Typical Rinse Connections for an ASX-1400/1600 Autosampler with Diaphragm Pump and Gravity Drain. This configuration is recommended for most applications.

Rinse Connections Using the Existing Peristaltic Pump

For some applications, it may be possible to use the existing peristaltic pump on an ASX-1400/1600 without an additional diaphragm pump.

In order to provide the necessary additional flow rate at the rinse station, the pump speed must be increased.

1 On the back of the autosampler, turn the Main Pump Speed knob to its maximum setting. See Figure 5-9.

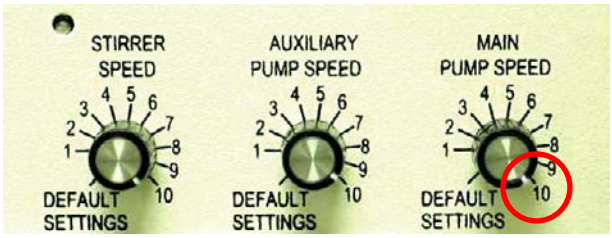


Figure 5-9 Pump Speed

If you find the flow rate to be inadequate to keep up with the *ASXPRESS PLUS* Rapid Sample Introduction System, an additional pump may be required. Contact CETAC Technologies for recommendations.

Remember to use Viton tubing (not PharMed) for the peristaltic pump tubing if the rinse solution is kerosene.

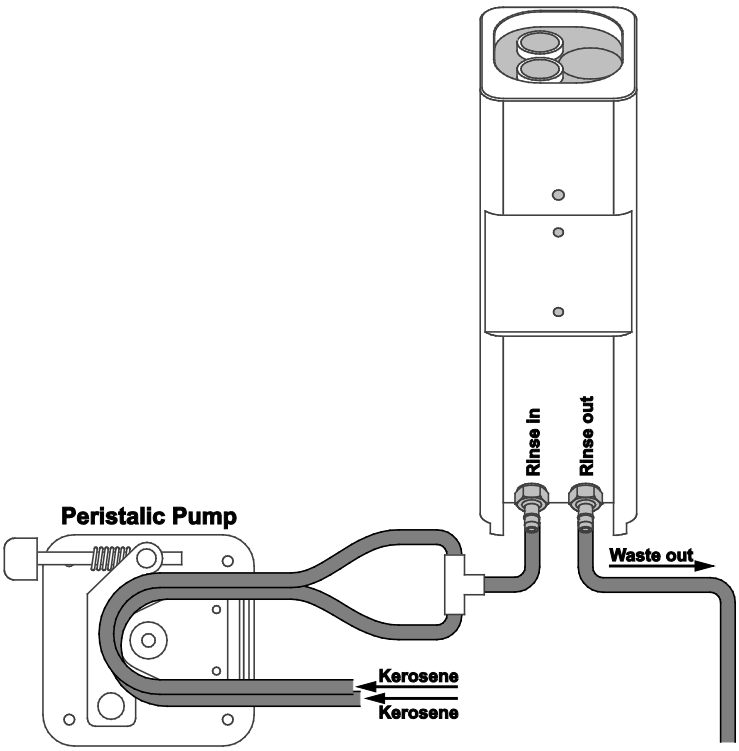


Figure 5-10 Rinse Tubing: ASX-1400 Autosampler with Built-In Peristaltic Pump

Installing the 1.0mm ID Sample Probe on the Autosampler

A 1.0mm ID sample probe is provided for use with the CETAC autosampler for proper operation with the *ASXPRESS PLUS* system. The sample probe/stirrer holder block must also be replaced, to accommodate the larger sample probe.

You will need the following equipment:

- Sample probe (supplied)
- Holder block (supplied)
- Phillips screwdriver

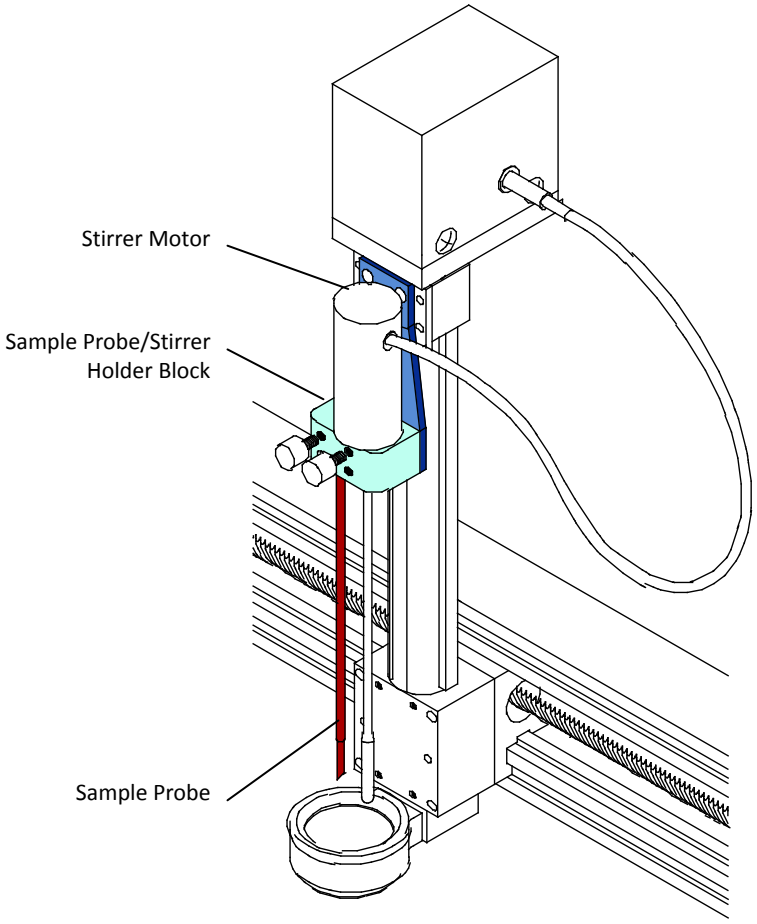


Figure 5-11 ASX-1400/1600 Z-Drive Assembly

NOTE

The 1.0mm I.D. sample probe must be installed on the autosampler or the *ASXPRESS PLUS* Rapid Sample Introduction System will not perform properly. It is identified by double blue bands (Figure 5-12) installed on the probe tubing.

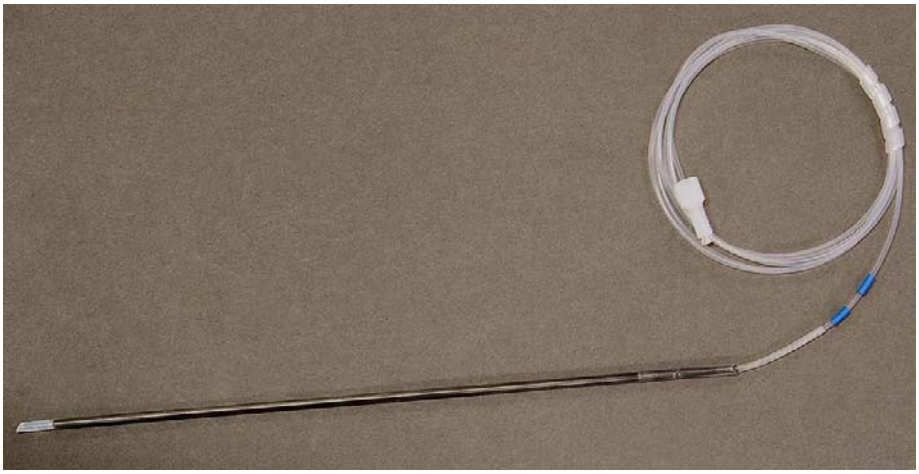


Figure 5-12 Double Blue Bands Identify the 1.0mm I.D. Sample Probe (*carbon fiber probe shown is standard equipment*)

Figure 5-13 Sample Probe/Stirrer Holder Block for 1.0mm I.D. Sample Probe

Removing the Sample Probe

1 Remove the thumbscrew and pull the sample probe straight out and put it aside.

Figure 5-14 Loosening the Thumbscrew

Removing the Stirrer Assembly

1. With the power off, manually push the stirring assembly ¾ of the way down.
2. Remove the thumbscrew and pull the stirring assembly straight up.

Figure 5-15 Lifting Out the Stirring Assembly

Replacing the holder block

1. Remove the 4 screws which hold the plate to the Z-drive assembly.

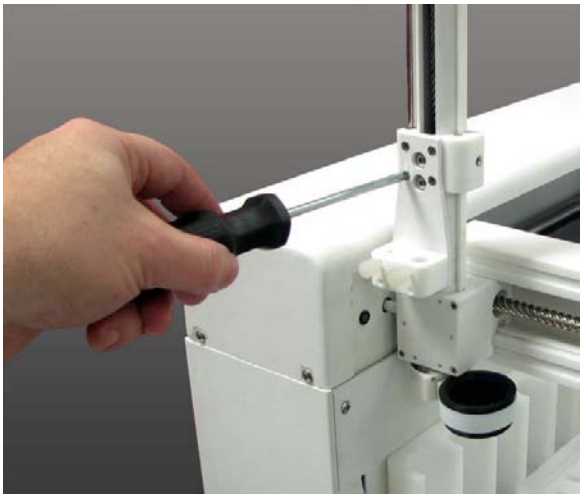


Figure 5-16 Removing the Plate

2 Remove the 4 screws which hold the block to the plate.

Figure 5-17 Removing the Block from the Plate

3 Put the old block aside. Label it so it is clear which block to use in case the autosampler ever needs to be configured for use without the *ASXPRESS PLUS* system.

4 Replace the 4 screws which hold the block to the plate.

5 Replace the 4 screws which hold the plate to the Z-drive assembly.

Reinstalling the Stirrer Assembly

1 Push the stirrer probe straight down.

2 Install and tighten the thumbscrew.

Installing the Sample Probe

1. Push the probe straight down.
2. Make sure the bottom of the sample probe is even with the end of the stirring paddle, then tighten the thumbscrew.

   Follow the autosampler Operator Manual Instructions to replace the probe with the 1.0mm sample probe. The probe will be attached to the *ASXPRESS PLUS* 6-Port Valve at port #2.

This page is intentionally blank.

6 Installing the Valve/Pump Module

Once the autosampler is prepared for use, the *ASXPRESS PLUS* valve/pump module should be connected to the autosampler and to the nebulizer of your spectrometer.

All tubing (except the sample loop and probe) is pre-connected to the *ASXPRESS PLUS* valve/pump module to allow convenient inter-connection to the autosampler and to the nebulizer per Figure 6-1. The 6-Port valve ports are numbered, color coded, and labeled with a descriptive definition providing clear identification of port functionality. The only connection required at the *ASXPRESS PLUS* 6-Port Valve is the customer-selected sample loop. All other *ASXPRESS PLUS* plumbing is prepared to be connected to the autosampler and ICP/ICP-MS as received in the shipping packaging.

NOTE

All fitting connections on the 6-Port Valve are to be finger tightened only to prevent damage to the valve and tubing. Do not overtighten.

The plumbing connections should be made without using tools. In fact, using tools such as screwdrivers or pliers to perform installation tasks may result in a damaged or unusable instrument. Do not tighten fittings with anything other than your fingers.

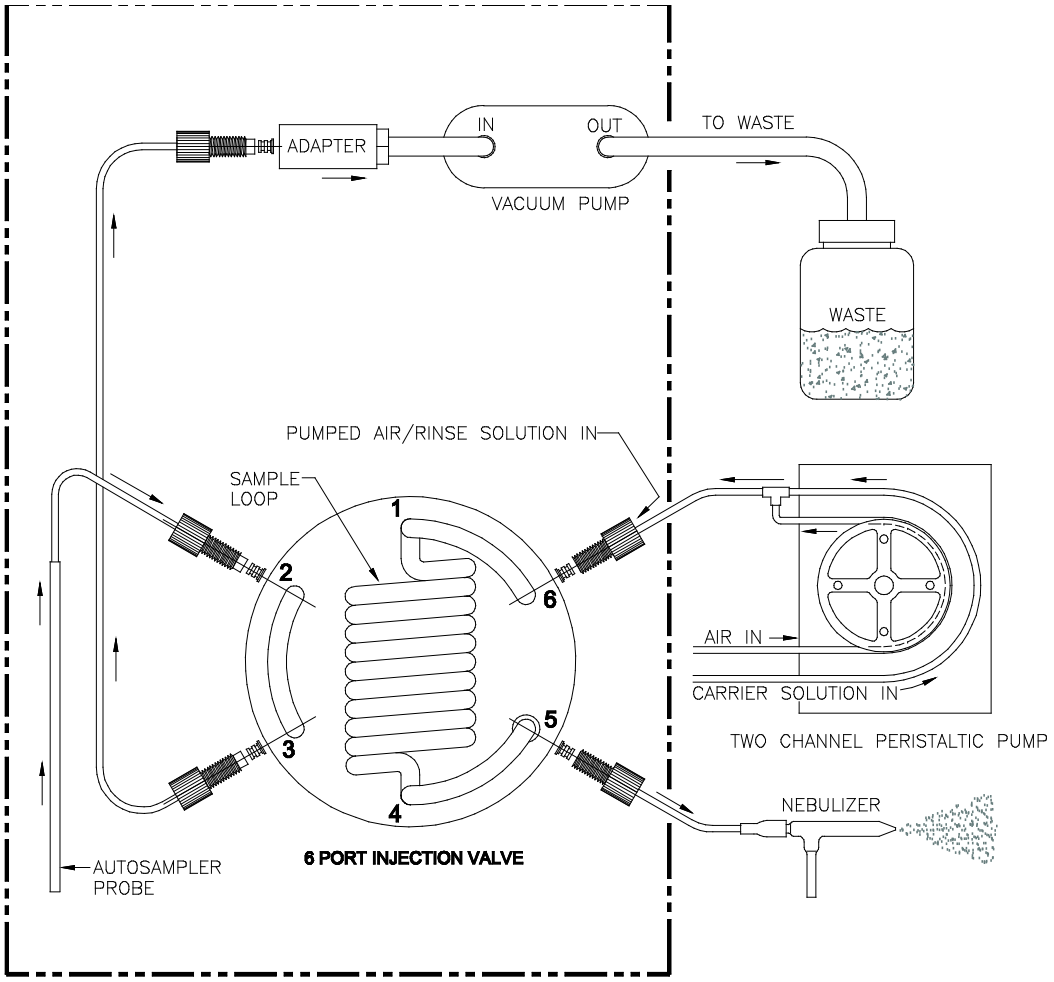


Figure 6-1 *ASXPRESS PLUS* Valve/Pump Module Tubing Connections

Install the 6-Port Valve

If the 6-port valve is not already installed on the valve/pump module, you need to install it as described in this section. If the 6-port valve is already installed, you may need to change its orientation (see "Replacing or Reorienting the 6-Port Valve" on page 121).

It is important to minimize the length of the tubing between the valve/pump module and the instrument's nebulizer.

You can place the valve/pump module so that the valve is toward the top, or toward the bottom, as needed.

CAUTION

During operation, the valve/pump module must be placed on one of its ends. The valve/pump module is not hermetically sealed. Placing it with the valve facing up may result in the introduction of liquid into the electronics of the box.

1. Place the valve/pump module on its back.
2. Insert the valve at the desired angle. Rotate it so that the nebulizer port will be as close as possible to the nebulizer.
3. Press down on the valve so that it is completely seated.
4. Inspect the valve to verify that there is no gap between the valve and the collar on the valve/pump module.

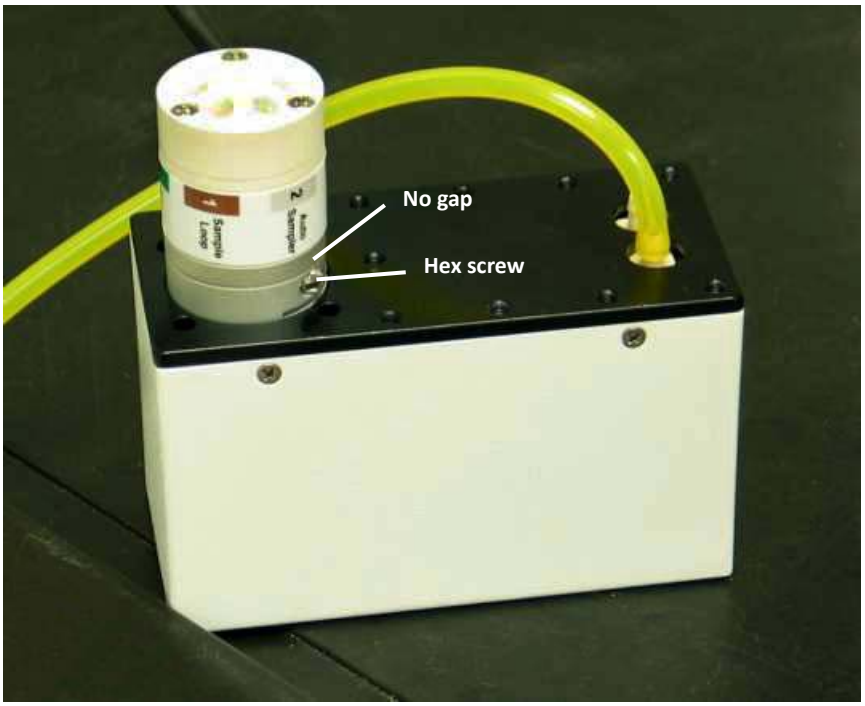


Figure 6-2 Reseating the 6-Port Valve

5 Tighten the hex screw.

6 Place the valve/pump module into position near the instrument's nebulizer.

> **NOTE**
>
> After you connect the electronics module and install the Xpress Config software, don't forget to home the valve as described on page 98.

If you later need to rotate the valve, see "Replacing or Reorienting the 6-Port Valve" on page 121.

Install the Sample Loop

1 Remove the plugs from ports #1 and #4 of the 6-port valve.

2 Install a sample loop between ports #1 and #4 of the 6-port valve (as labeled on the valve). *Use caution to prevent kinking the loop!*

Connect the Autosampler Probe to the Valve/Pump Module

1. Install the autosampler probe in the autosampler per the instructions included with the autosampler.
2. Connect the tube from the probe to port #2 of the 6-port valve.

Connect the Valve/Pump Module to the Nebulizer

1. Ensure that the 60" length of 1/8" tubing (which is pre-connected to the "out" port of the vacuum pump) is inserted into a waste container. *Cut this length to fit your specific setup, ensuring that the discharge end is not placed so that it may become submerged below the liquid level of the waste container.*

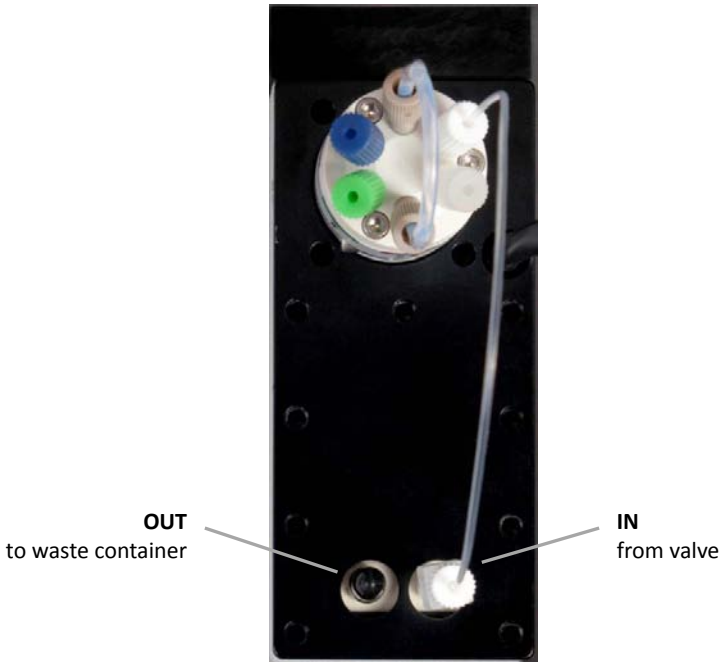


Figure 6-3 Location of Vacuum Ports on the Valve/Pump Module

2. Connect the 14" length of 0.030" x 0.062" tubing (which is pre-installed to the green connector at port #6 of the 6-port valve) to the ICP / ICP-MS peristaltic pump. This length of tubing is fitted with a tee on its end which is intended to be connected to two individual output (discharge) channels of the ICP / ICP-MS peristaltic pump. The input (suction) ports of this peristaltic pump are connected as follows:

   - One channel to carrier/rinse solution
   - The other channel open to air

   This plumbing configuration is crucial to the proper operation of the *ASXPRESS PLUS* system and must be followed. The air bubbles help to clean the tubing and prevent carryover from one sample to the next.

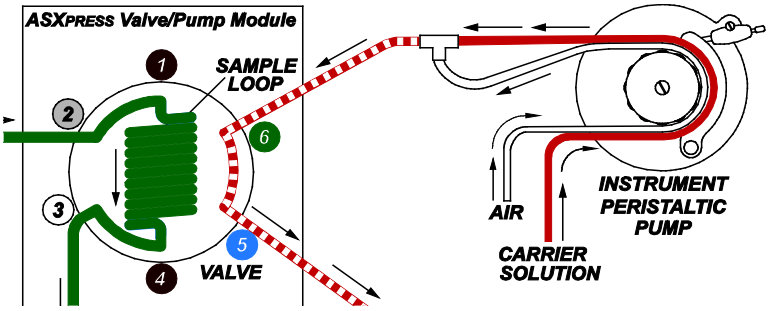


Figure 6-4 Connection Between Instrument Peristaltic Pump and *ASXPRESS PLUS* Valve/Pump Module

3 Connect the 14" length of 0.030" x 0.062" tubing (which is pre-installed to the blue connector at port #5 of the 6-port valve) to the nebulizer.

Place the *ASXPRESS PLUS* valve/pump module as close to the nebulizer as is possible, and cut the tubing to the shortest length possible which will allow connection of port #5 to the nebulizer without any kinking. Keeping this tubing short provides the greatest time savings while operating the *ASXPRESS PLUS* system.

Figure 6-5 Nebulizer Connected to Port #5

NOTE

The *ASXPRESS PLUS* system is designed to operate and interface with many manufacturers' instruments. To allow for the closest proximity placement of the *ASXPRESS PLUS* valve/pump module to the instruments nebulizer, CETAC Technologies offers a modular articulating support stand, which allows for stable mounting and flexible positioning of the valve/pump module. Contact CETAC Technologies for technical and ordering information.

Optional: Installing an Internal Standard Addition Mixing Tee

The optional internal standard addition mixing tee provides a practical and consistent way to dose each sample with an internal standard. This technique is commonly used to correct for a variable matrix or plasma-related effects.

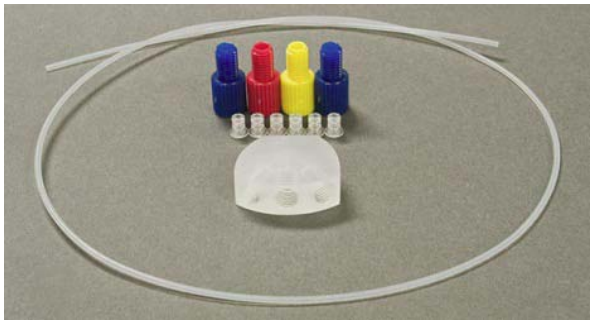


Figure 6-6 Internal Standard Addition Mixing Tee

1. Connect short lengths of tubing to the fittings.

   You may need to experiment with the tubing lengths. Be careful to minimize the length of tubing between the output of the 6-port valve and the instrument's nebulizer.

Figure 6-7 Tubing for the Standard Addition Mixing Tee

2. Connect the yellow line to the internal standard reservoir. Do not connect the yellow fitting to anything yet.
3. Connect the red line to the nebulizer.
4. Connect the blue line to port #5 of the 6-port valve.
5. Screw the blue fitting into one of the outside ports of the tee.
6. Screw the red fitting into the center port of the tee.
7. Screw the yellow fitting into the remaining outside port of the tee.

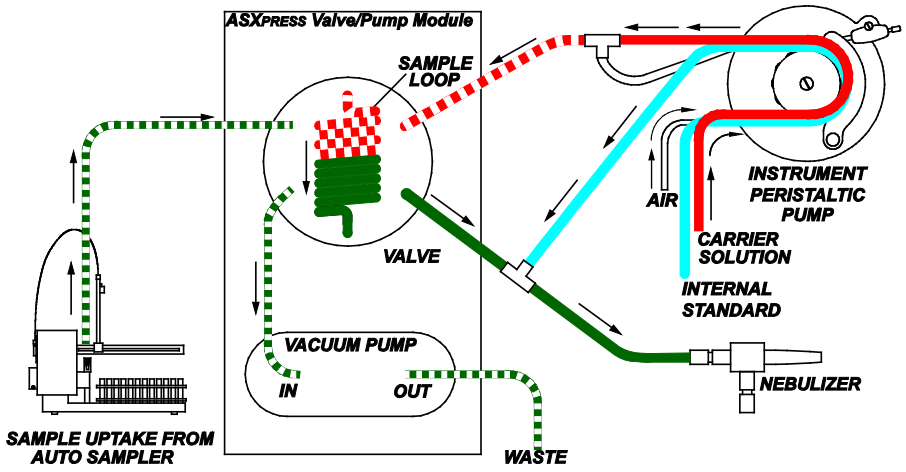


Figure 6-8 Flow Diagram with Internal Standard and Passive Bubbling Tee (Carrier Solution Bubbles Added After the Instrument's Peristaltic Pump)

Optional: Installing a Passive Bubbling Tee

Adding bubbles to the carrier solution helps clean the tubing and reduces carryover between samples.

If four channels are available on the instrument's peristaltic pump, air bubbles can be incorporated into the flow by adding a tee fitting between the pump and the sample loop. (One channel each for carrier solution, air, internal standard, and waste from the spray chamber.)

If only three channels are available, air can be incorporated without using an additional pump channel by installing the optional passive bubbling tee.

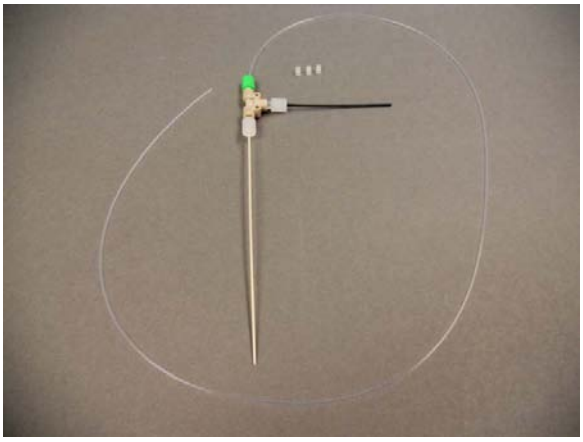


Figure 6-9 Passive Bubbling Tee

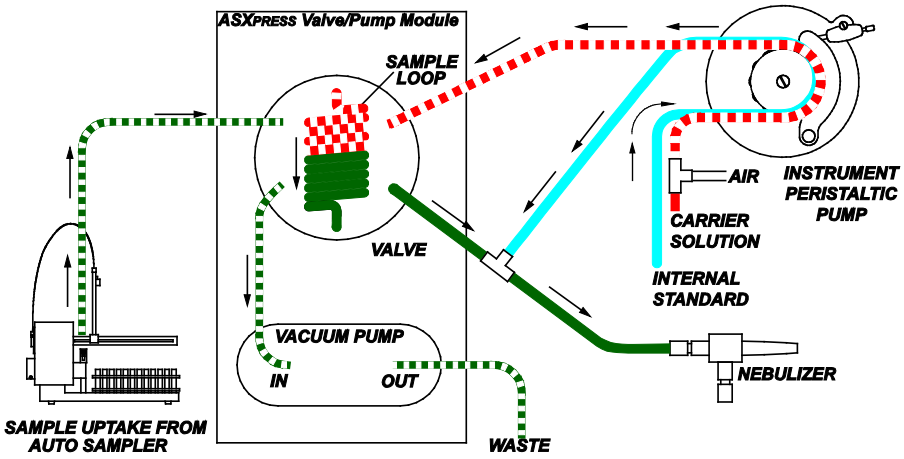


Figure 6-10 Flow Diagram with Internal Standard and Passive Bubbling Tee (Carrier Solution Bubbles Added Before the Instrument's Peristaltic Pump)

1 Attach a short length of tubing to the green fitting which comes with the valve/pump module.

2 Connect the green fitting to port #6 of the valve/pump module.

3 Connect the other end of this line to the output of the carrier solution output of the instrument's peristaltic pump.

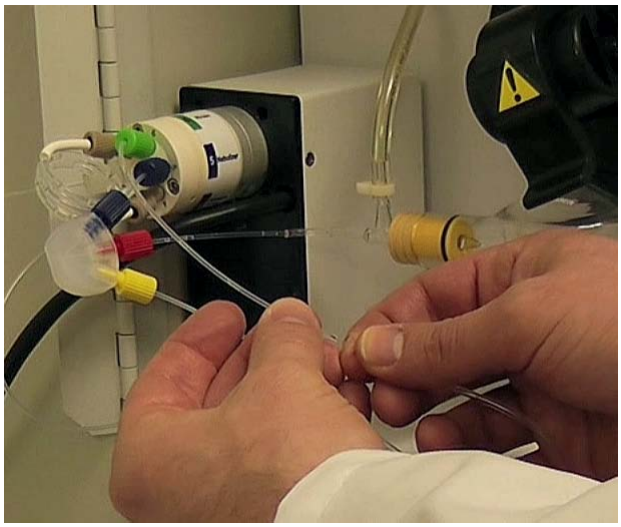


Figure 6-11 Connecting the Output of the Instrument Peristaltic Pump to the Valve

4 Place the white tube of the bubbling tee in the hole of the bottle of rinse/carrier solution.

Figure 6-12 Passive Bubbling Tee in Rinse Solution Bottle

5 Connect the clear tubing of the bubbling tee to the input of the instrument's peristaltic pump.

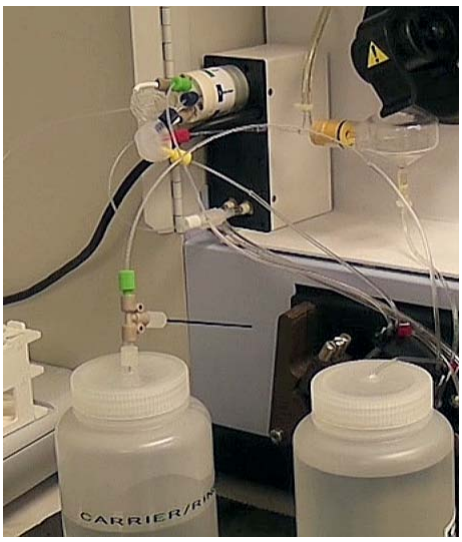


Figure 6-13 Fully Connected Passive Bubbling Tee

6 Makes sure that all of the tubing connections are tight.

7 Installing the Electronics Module

The *ASXPRESS PLUS* electronics module needs to be connected to the power supply, to the *ASXPRESS PLUS* valve/pump module, to the autosampler, and to the host computer.

The electronics module needs *two* connections to the host computer:

GUI COM: This connection allows the Xpress Configuration Tool software to configure timing and other parameters in the electronics module.

OEM COM: This connection intercepts commands as they are sent from the ICP software on the host computer to the autosampler. Commands to inject a sample cause a program (the "macro") to run, which synchronizes the flow from the autosampler with operation of the valve. Other commands are simply passed on to the autosampler.

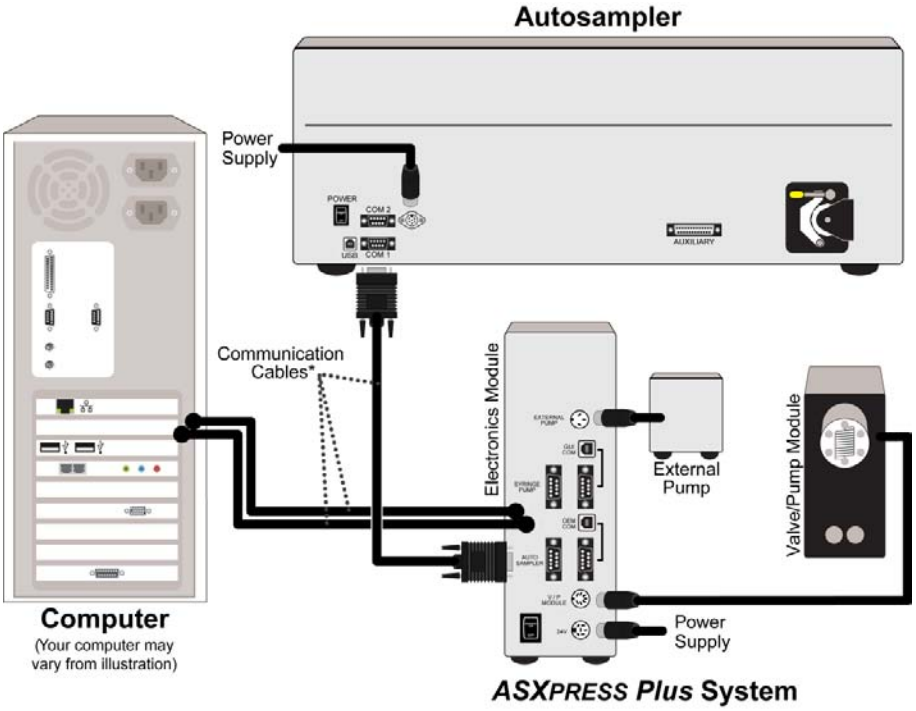


Figure 7-1 Overview of *ASXPRESS PLUS* Electrical Connections

Connecting the Electronics Module to the Power Supply

1. Turn the power switch on the electronics module OFF.
2. Check the plug on the power cord to verify that it is of the correct type for your country.
3. Plug the power cord into a power outlet.
4. Plug the power cord into the power supply.
5. Plug the power supply into the 24V connector on the electronics module.

It is important to use the appropriate power cord for your country. See

➢ "Power requirements" on page 148.
➢ "Power Cord Set Requirements" on page 150.

Connecting the Electronics Module to the Valve/Pump Module

The *ASXPRESS PLUS* valve/pump module connects to the electronics module via its integrated cable with DIN style connector as shown in Figure 7-2.

1 Plug the valve/pump module's cable connector into the electronics module's VP MODULE connector.

Figure 7-2 Connecting *ASXPRESS PLUS* Valve/Pump Module to Electronics Module

Connecting the Electronics Module to the External Rinse Pump

If the plumbing configuration includes an external rinse pump, connect it now. The *ASXPRESS PLUS* valve/pump module connects to the electronics module via its integrated cable with DIN style connector as shown in Figure 7-2.

1 Plug the pump's cable connector into the electronics module's EXTERNAL PUMP connector.

Figure 7-3 Connecting the External Pump to the Electronics Module

Connecting the Electronics Module to the Autosampler

The *ASXPRESS PLUS* electronics module connects to the autosampler via an RS-232C serial connection.

WARNING

INJURY HAZARD FROM UNEXPECTED MOTION
Ensure that AC power to the autosampler is off before proceeding with installation.

1. Locate the appropriate port on the autosampler.

   Use the port to which the host PC would normally connect; for most autosamplers, this is the COM 1 port.

2. Plug the serial cable into the autosampler.
3. Plug the serial cable into the electronics module.
4. Secure the connections with the integrated jackscrews.

Connecting the Electronics Module to the Host Computer

A host computer is used to configure and direct the operation of the autosampler and *ASXPRESS PLUS* system. An "OEM COM" connection controls the autosampler and a "GUI COM" connection controls the *ASXPRESS PLUS* system.

NOTE

The connection between the electronics module and the host computer is a little different from connections to many other devices such as printers:

- Two distinct connections are required.
- You can use either serial (RS-232C) or a USB connections.
- The USB connections behave like virtual COM ports. The cables cannot be moved around from one port to another without changing the software configuration.

Establishing an OEM COM Connection (RS-232)

The OEM COM connection conveys autosampler commands from the ICP software on the host PC to the electronics module. These commands are then re-issued, if appropriate, through the AUTOSAMPLER serial port.

The serial interface kit provided with the CETAC autosampler includes a serial cable equipped with two female DB9 connectors. Use the interface kit to establish a serial communications interface with the host computer. To do so, complete the following steps:

1. Plug one end of the cable into the host computer's serial (COM) port selected for autosampler communications.

   Make sure that the COM port you select matches the port selected in the host computer's ICP software.

2. Finger-tighten both screws of the cable adapter.
3. Connect the other end of the cable to the *ASXPRESS PLUS* OEM COM port.
4. Finger tighten both screws of the cable adapter.

NOTES

If a host computer serial port with a DB9F, a DB25M, or a DB25F connector (9 pin D-submini receptacle or 25 pin D-submini plug or receptacle) must be used, use the mating connector from the CETAC Technologies universal port adapter kit. You can order the adapter kit from CETAC Technologies or purchase an adapter locally to convert the serial port to a DB9M. **Do not use a "null modem" adapter.**

When interconnecting any computing devices, keep the communications cables away from sources of electromagnetic or radio frequency (RF) interference, such as electric motors, transformers, fluorescent light ballasts, or RF energy sources. Limit cable runs for RS-232C to less than 16 meters. If these conditions cannot be satisfied, use low-impedance, fully shielded cables to provide satisfactory operation. The cables are available from many sources, but you will need to specify the correct mating connectors and "straight-through" (DTE-DCE) wiring.

Establishing an OEM COM Connection (USB)

If the host computer does not have an available RS-232 port, you can use a USB port instead.

A USB cable is supplied. Alternatively, an "A-B" USB cable may be obtained from any computer store.

1 Power up both the computer and the *ASXPRESS PLUS* electronics module.

2 Plug one end of the cable into the host computer's USB port and the other end to the *ASXPRESS PLUS* system 's OEM COM USB port.

The computer screen should display a "New Hardware Found" window. A USB driver must be installed to make the USB port emulate an RS-232 COM port, and the installation must be repeated for each USB connection.

The exact procedure for installing the driver depends on the version of the host computer's operating system. The instructions which follow show installation on the Windows XP operating system.

NOTE FOR WINDOWS 7

For the Microsoft Windows 7 operating system, the driver may not be found automatically. You may need to navigate to on the CD-ROM to "\program files\CETAC Technologies\Xpress Config\USB Drivers for CETAC Devices" to find the driver file named "ftdiport.inf". The hardware will be identified as an "FT 232R USB UART" and then as a "USB Serial Converter."

3 Allow the Windows Found New Hardware Wizard to use Windows Update to search for a driver.

In most cases, the driver will be found online and installed automatically. This process may take several minutes.

4 If a driver is not found, click Back to begin installation from the CD-ROM.

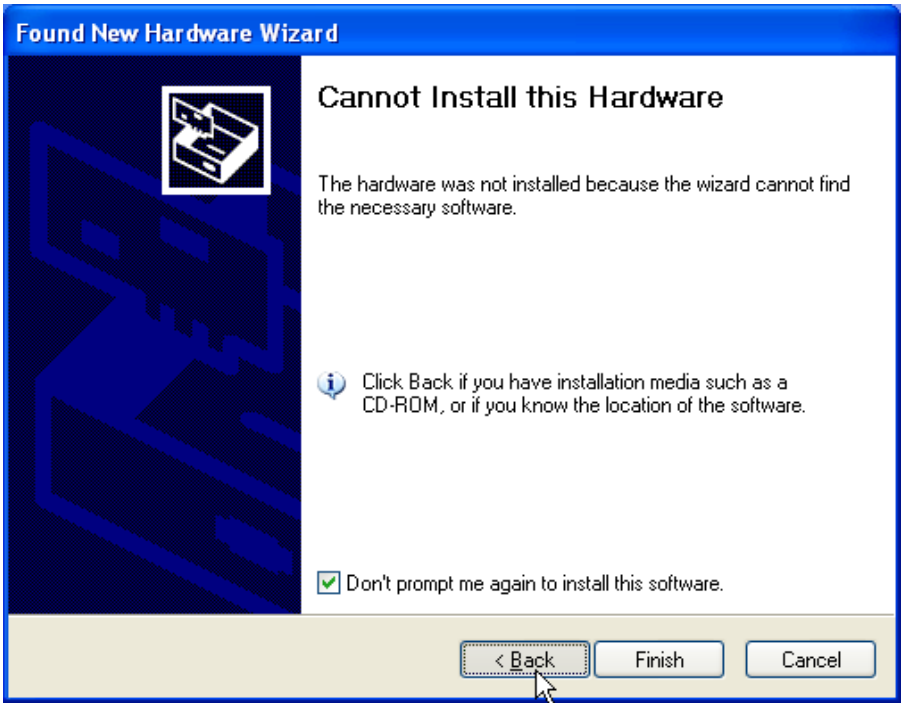


Figure 7-4 Message showing that a driver was not found

a. Insert the CD-ROM.

b. Select Install from a specific location and click Next.

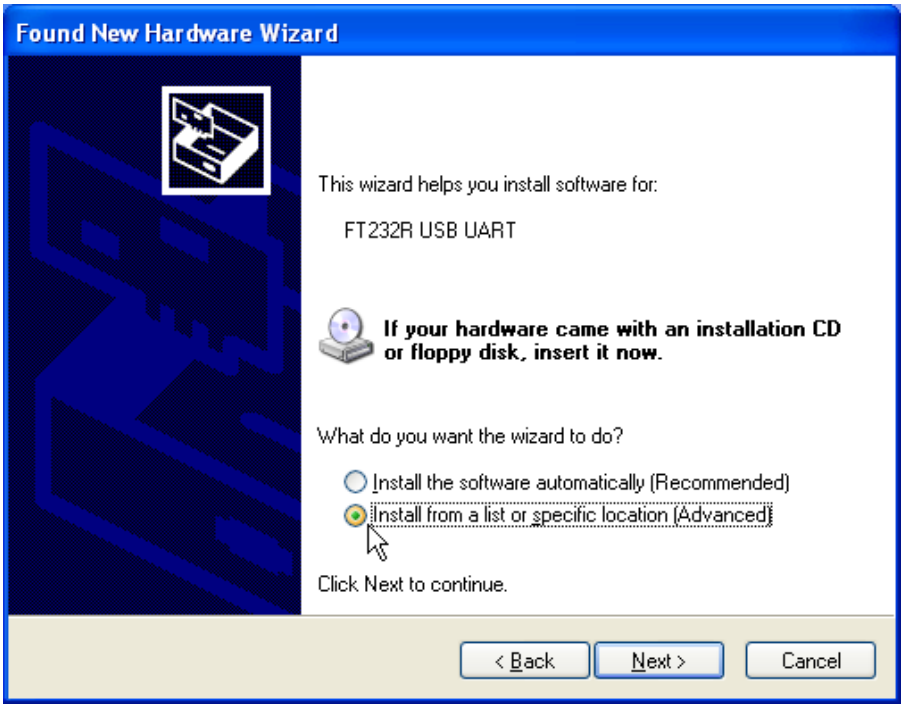


Figure 7-5 Choosing to Install USB Driver from a CD

c. Select Search removable media.

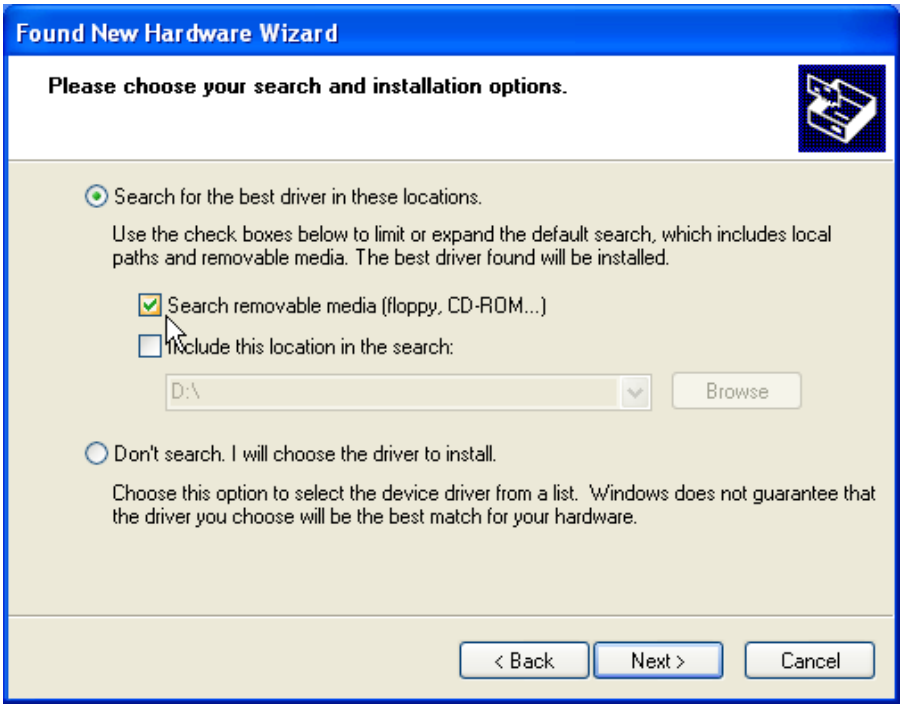


Figure 7-6 Choosing to Install USB Driver from a CD

d. Wait while the computer searches the CD.

Figure 7-7 Searching the CD

e. When the driver is found, select it and click Next.

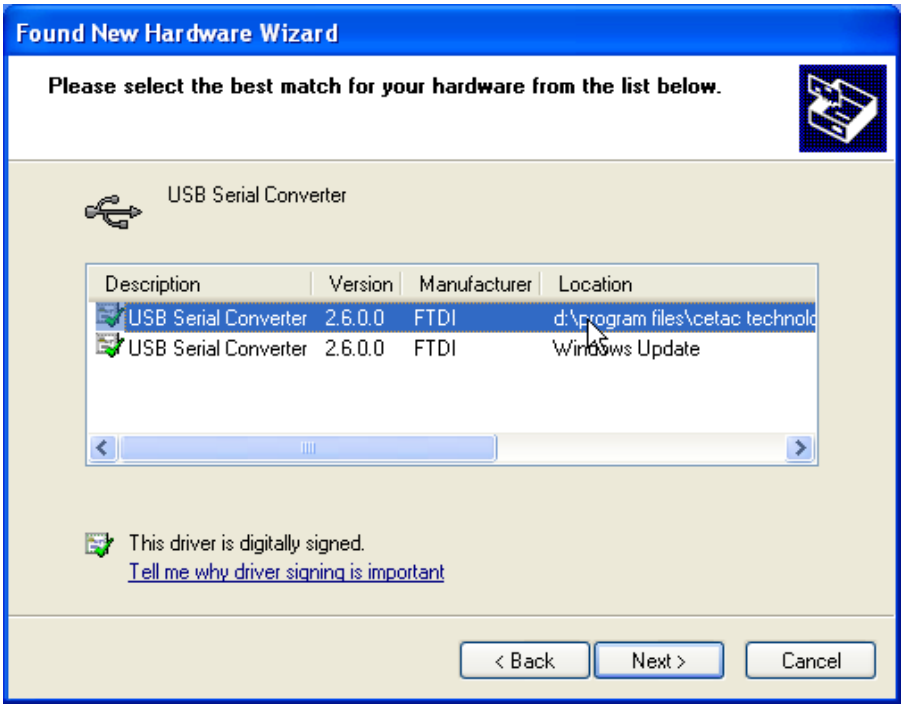


Figure 7-8 Selecting the Driver

f. The driver installation is complete.

Figure 7-9 Driver Installation is Complete

If a message is displayed showing which COM port number was chosen (look for a "bubble" in the lower-right corner of the screen), make a note of it.

5 Confirm that the COM port selected for the USB matches the port selected in the host computer's ICP software.

Establishing a GUI COM Connection (RS-232)

1 Connect a serial cable from a port on the host computer to the GUI COM serial port on the electronics module, following the same procedure as for the OEM COM port.

Note the number of the COM port on the host computer. You will need to provide the correct COM port when you use the Xpress Configuration Tool software.

Establishing a GUI COM Connection (USB)

1 Connect a USB cable from a port on the host computer to the GUI COM USB port on the electronics module, following the same procedure as for the OEM COM port.

You will need to install the USB driver, even if you already installed the driver for the OEM COM port.

Note the number of the COM port on the host computer. You will need to provide the correct COM port when you use the Xpress Configuration Tool software.

8 Installing the Software

The Xpress Configuration Tool software is used to enable/disable and configure the autosampler and its control of the *ASXPRESS PLUS* system, as well as providing access to manual functions of the *ASXPRESS PLUS* system and autosampler. The *ASXPRESS PLUS* system is controlled by the autosampler, which executes a macro automatically when the probe is placed into the sample.

> **NOTE**
>
> The procedures given in this chapter are for use in a Windows 2000/XP/Vista/Windows 7 environment.

Installing the Xpress Configuration Tool

1 Load the Xpress Configuration Tool software onto the host computer from the CD provided.

The software will autorun when the disc is loaded into the CD-ROM drive of the host computer. If it does not, use Windows Explorer to open the drive letter containing the disc, then select “Setup Launcher” (Figure 8-1) to begin the software installation.

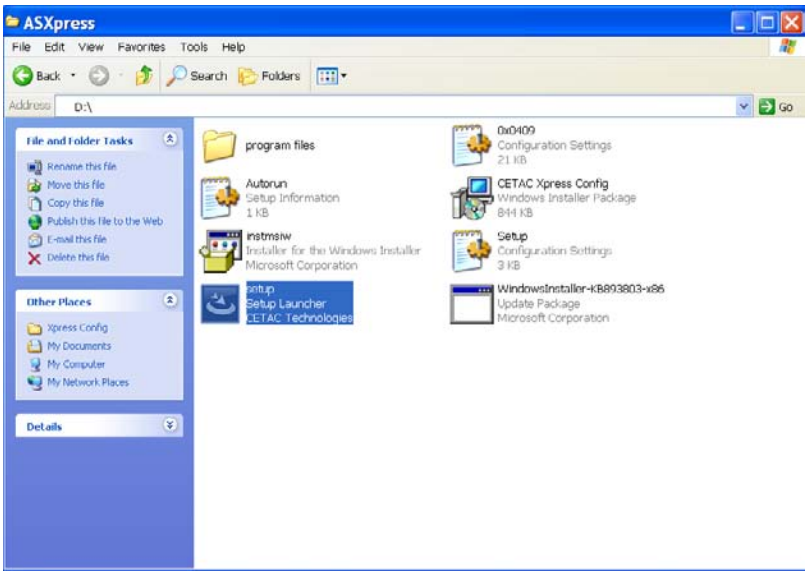


Figure 8-1 *ASXPRESS PLUS* Setup Launcher

Follow the prompts of the Installation Wizard to complete the installation of the Xpress Configuration Tool software package as follows:

2 When the Xpress Config Installation Wizard window opens, click Next to begin the software installation process (Figure 8-2).

Figure 8-2 Xpress Config Installation Wizard

3 Click "I accept the terms in the license agreement" if you agree, then click Next (Figure 8-3).

Figure 8-3 License Agreement

4 Reviewing the README information, then click Next (Figure 8-4).

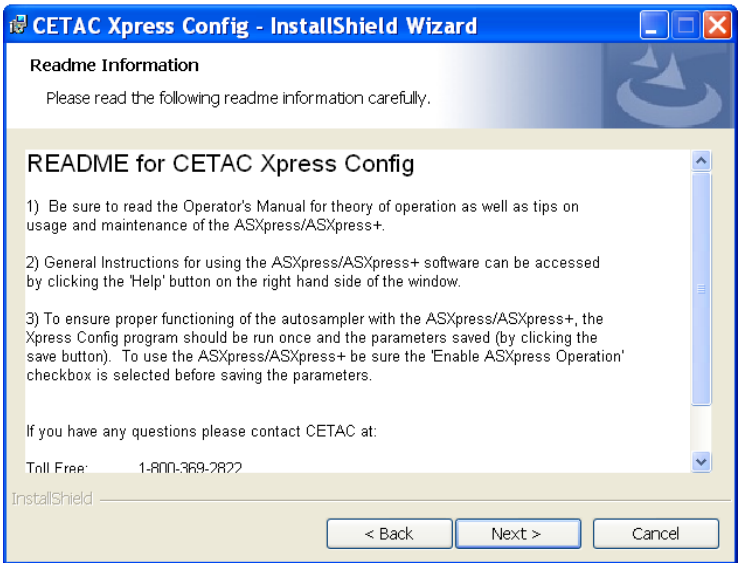


Figure 8-4 Readme Information Window

5 Click Next to select the default location, or click Change to modify the folder name.

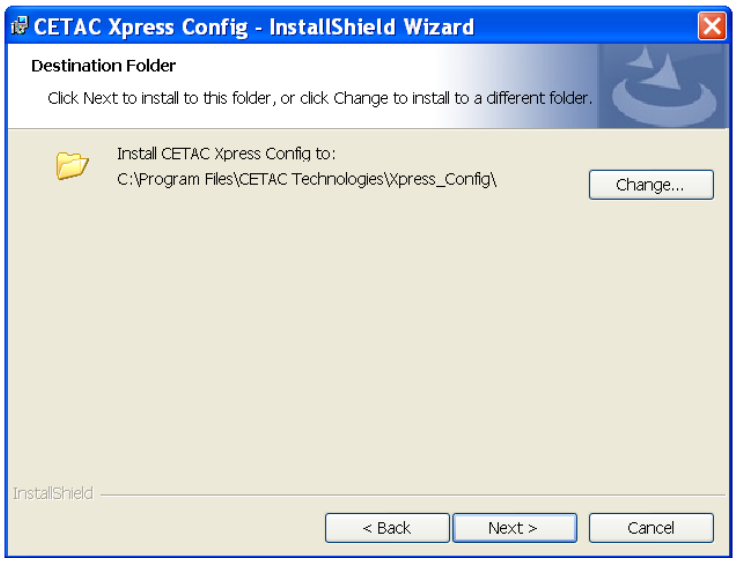


Figure 8-5 Destination Folder Window

6 Review the selected settings. Click Back to change any selected settings. Click Install to begin the installation process with the selected settings.

Figure 8-6 "Ready to Install the Program" Window

7 The "InstallShield Wizard Completed" window appears (Figure 8-7). Select the "Launch the program" box and then click Finish to complete the installation and launch the program.

Figure 8-7 "InstallShield Wizard Completed" Window

The Xpress Configuration Tool loads and the main window appears. (Figure 8-8). The parameter labels, fields and select buttons will be grayed-out as shown until after the *ASXPRESS PLUS*/autosampler system is "queried".

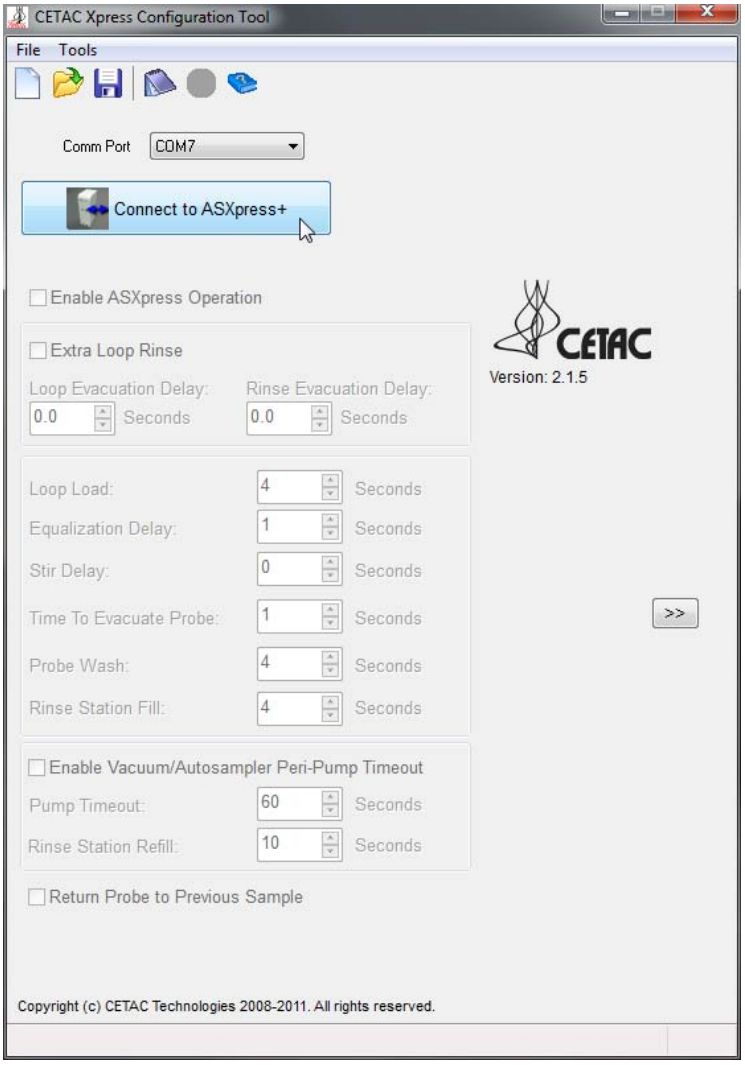


Figure 8-8 Configuration Tool Software Window (before connecting)

Running the Xpress Configuration Tool for the First Time

Inspecting the *ASXPRESS PLUS* System Components

It is important to verify that all system components are in good working order and are undamaged prior to operation of the *ASXPRESS PLUS* system. It is unlikely that the liquid carrying components will be damaged during shipping. However, as part of standard operation procedure, you should regularly inspect all components for damage prior to operating the rapid sample introduction system.

> **NOTE**
>
> Visually inspect the six port injection valve, three port valve, vacuum ports, and all other components, such as cabling, enclosure, tubing, etc., for any signs of damage. Pay special attention to all tubing to ensure that no kinks exist. Kinked tubing will impair performance of the *ASXPRESS PLUS* system by reducing flow rates.

If you detect a leak or other damage to any *ASXPRESS PLUS* component, you must replace it. For more information, refer to the appropriate section in Chapter 11, "Maintaining the ASXpress Plus Rapid Sample Introduction System."

Making sure the system is ready

Verify that:

- The equipment is positioned so that you can quickly disconnect power if something goes wrong.
- All tubing connections are secure.
- The rinse solution intake tube is submerged in the rinse container, and the waste tube is well above the surface of the liquid in the waste container.
- The valve/pump module is plugged into the electronics module.
- The electronics module is connected to the host computer, the autosampler, and the power supply.
- The autosampler is set up and turned on.
- The electronics module is turned on.

Setting the communication port

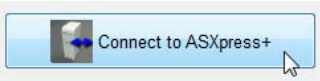
1 The Xpress Configuration Tool window should still be open from when you installed the software. If not, double-click the tool icon.

2 Click the Comm Port field and select the serial or USB port where you connected the GUI COM cable.

Remember, if you use a USB connection, it will emulate a serial connection, and the serial port emulation is tied to a specific USB port.

Verifying communication

1 Click the Connect to ASXpress+ button.



The software will read the current configuration and the software controls will become active. If the software cannot read the parameters, see "Communications Interface Problems" on page 130.

NOTE

Whenever you start the Xpress Configuration Tool, most of the controls will be grayed out and inoperable until you click Connect to ASXpress+.

This should be done *after* the *ASXPRESS PLUS* system is connected to the autosampler, and the autosampler is powered on. Clicking the button reads the parameters that are stored in the electronics module (the default settings will be read the first time the query is performed), and displays them in the Configuration Tool parameter fields.

More information regarding use of the Xpress Configuration Tool can be found in “Configuring the ASXpress Plus System” beginning on page 99.

Figure 8-9 shows the Xpress Config Tool window appearance after connecting.

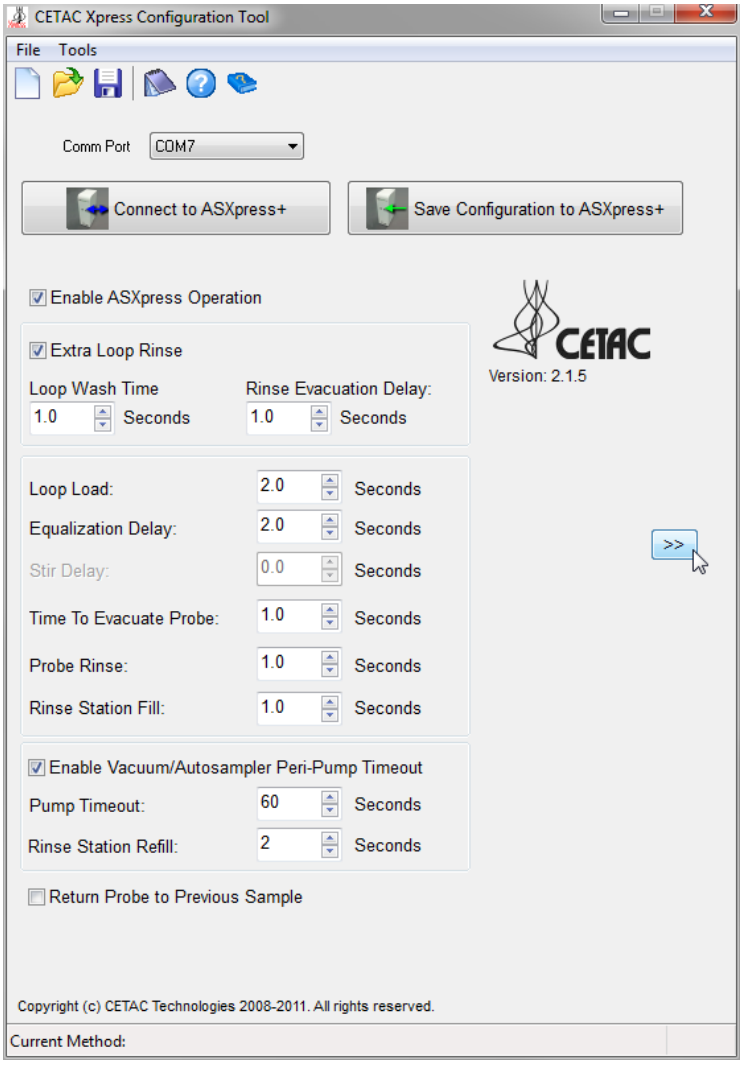


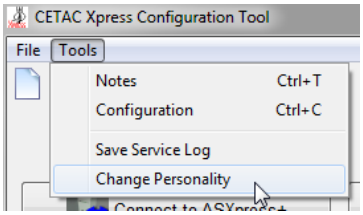
Figure 8-9 Configuration Tool Software Window (after connecting)

Configuring the personality

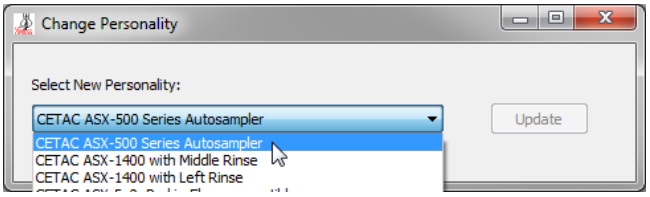
The *ASXPRESS PLUS* Rapid Sample Introduction System responds to autosampler commands which it intercepts. Since different autosamplers have different command languages, it is necessary to configure the *ASXPRESS PLUS* electronics module.

Several different configurations, or personalities, are built into the *ASXPRESS PLUS* Rapid Sample Introduction System.

1 On the Tools menu, select Change Personality.



2 Select your autosampler from the list.



3 Click Update.

4 Turn the *ASXPRESS PLUS* electronics module off then on again. Wait a few seconds for the BUSY LED on the front of the electronics module to turn off.

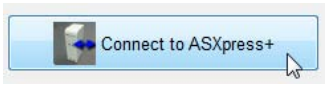
5 Restart the Xpress Configuration Tool.

> **NOTE**
>
> The list of available personalities, as well as more detailed instructions, can be found in the *CETAC ASXPRESS PLUS Rapid Sample Introduction System Guide to Configuring Firmware Personalities* available on the CD or at www.cetac.com.
>
> The list of available personalities is updated frequently, so if you do not see the personality you need in the version on CD, please check the version on the Web site.

Performing some basic communication tests

Once installation of the *ASXPRESS PLUS* Rapid Sample Introduction System is complete, it is important to verify that the system components are communicating correctly, so that it functions as intended. Attempting to use it before ensuring that it is installed correctly may result in damage.

1 Click the Connect to ASXpress+ button.



Remember, you need to click the button to reconnect to the *ASXPRESS PLUS* every time you start the Xpress Configuration Tool.

2 Click the expand button to reveal the manual controls.

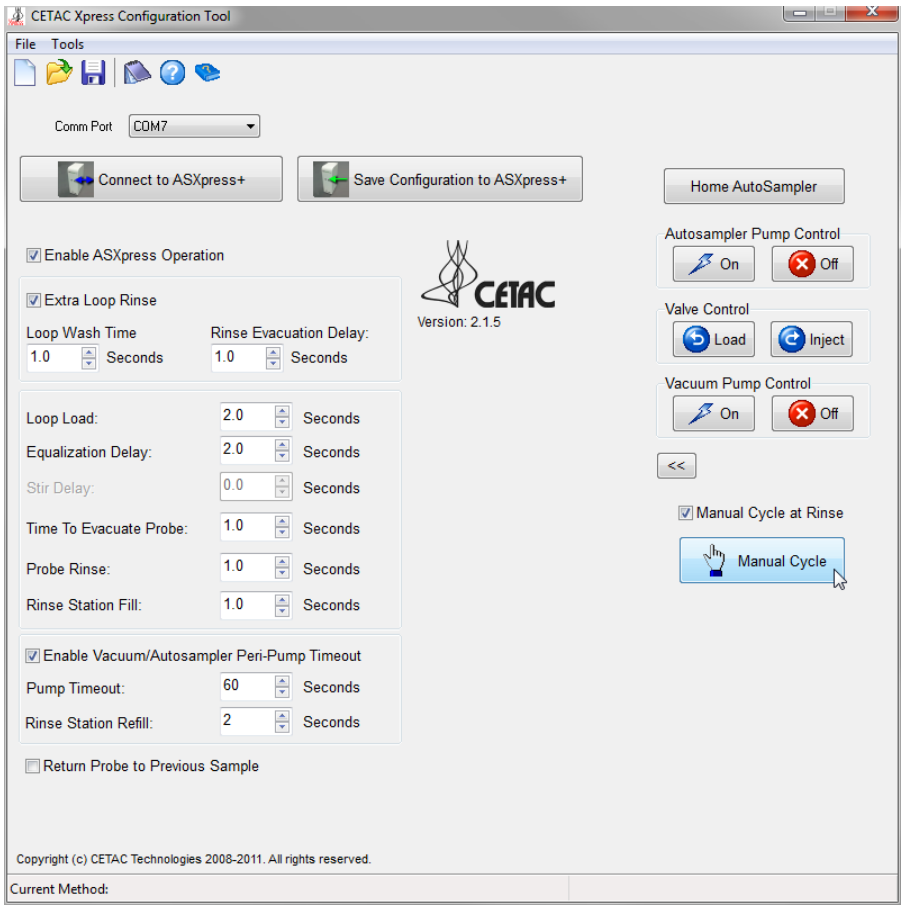


Figure 8-10 Config Tool Software Window--Expanded

First, test communication with the *ASXPRESS PLUS* valve/pump module:

3 Click the "Load" button.

This positions the *ASXPRESS PLUS* 6-port valve into the mode which loads the sample loop, and illuminates the "Load" LED on the front panel of the *ASXpress* electronics module (no autosampler operation takes place at this time).

4 Click the "Inject" button.

This positions the *ASXPRESS PLUS* 6-port valve into the mode in which sample injection into the ICP takes place (via the peristaltic pump on the ICP), and illuminates the "Inject" LED on the front panel of the *ASXPRESS PLUS* electronics module (no autosampler operation takes place at this time).

5 Click the "Save Configuration to ASXpress+" button once.

This will load an initial set of timing parameters into the *ASXPRESS PLUS* electronics module.

6 Click the "Manual Cycle" button.

This performs one complete cycle of system operation, operating each component on the *ASXPRESS PLUS* system and autosampler, using the saved or

queried parameters of the Xpress Configuration Tool software settings. This is also a useful function for loading the tubing and priming the rinse pump.

7 Turn the vacuum pump on and off several times.

Next, test communication with the autosampler:

8 Click Home AutoSampler and verify that the probe moves to the home position.

9 Turn the autosampler pump on and off several times.

Home the valve

1 Power down the *ASXPRESS PLUS* electronics module, unplug any USB cables from the electronics module, and wait a few seconds.

2 Power up the electronics module and plug in the USB cables.

3 Start the Xpress Configuration Tool and make sure it is communicating with the electronics module.

4 Expand the GUI using the arrow button on the right side of the window.

5 Repeatedly click Load then Inject to switch the valve between each state.

6 If the valve is out of sync, the switching noise will start out longer, but then get shorter when the valve is synced up properly.

9 Configuring the *ASXPRESS PLUS* System

NOTE

After changing any parameters, you must click the "Save Configuration to ASXpress+" button to copy the parameters to the electronics module. Adjusting a value in the Xpress Configuration Tool window does *not* immediately change the value used by the *ASXPRESS PLUS* system.

Timing Parameters

The following chart lists the available user-adjustable parameter fields within the Xpress Configuration Tool.

Parameter	Function
Loop Wash Time	The amount of time to evacuate the loop with air (without Extra Loop Rinse) or rinse solution (with Extra Loop Rinse enabled) before moving to the next sample. This time setting provides delay time before the next sample is loaded. The 6-port valve is retained in the “load” position. In Air Purge mode, the probe remains in the up position while the vacuum pump is running. This delay time allows for additional purging of the sample loop and uptake path.
Rinse Evacuation Delay	In Extra Loop Rinse mode, the time taken to remove rinse solution from the loop before moving to the next sample. The Loop Wash time plus the Rinse Evacuation Delay comprise the total delay time before the next sample is loaded (the pre-load delay). Not used when Extra Loop Rinse is disabled.
Loop Load	After a command is processed by the autosampler to move to a sample position, the 6-port valve is switched to the “load”

	position, the vacuum pump is turned on and the Loop Load timer begins. The sample loop is loaded with sample for the time duration selected.
Equalization Delay	Time from when the vacuum pump switches off to when the valve switches. Allows pressure equilibrium to establish and prevents sample out-gassing.
Stir Delay	For autosamplers with a stirrer: Additional stirring time for the next sample (with stirrer and probe down and pump off). This parameter is grayed out if the autosampler personality does not include a stirrer.
Time to Evacuate Probe	Time to evacuate the probe side of the sample before moving to the rinse station. The default time of 1 second works well for most applications.
Probe Rinse	With the expiration of the Loop Load time, the 6-port valve is switched to the "inject/rinse" position, the vacuum pump is turned off, and the sample, which has been loaded into the loop, is pumped (pushed) to the nebulizer by the ICP/ICP-MS peristaltic pump. At the same time, the autosampler probe is moved to the rinse station to be washed and the vacuum pump is turned on for the amount of time set in the software for Probe Rinse time.
Rinse Station Fill	With the expiration of the Probe Rinse time, the autosampler probe is raised and the *ASXPRESS PLUS* vacuum pump continues to run. The autosampler peristaltic pump also continues to run and fills the rinse station for the amount of time set for Rinse Station Fill. When this time expires, the autosampler peristaltic pump and *ASXPRESS PLUS* vacuum pump are turned off and the system waits for a command to move to the next sample.
Pump Timeout	This setting controls how long the vacuum pump (in the valve/pump module) runs. Set this to a value greater than the sample analysis time to ensure that sample flow is maintained. The timer is reset whenever an autosampler command is issued by the ICP software. The minimum value is 60 seconds.
Rinse Station Refill	When the probe is returned to the rinse station, the vacuum pump will pull rinse solution through the probe. This can result in the rinse station being emptied. Rinse Station Refill specifies the amount of time to allow the rinse station to refill once the vacuum pump stops.

In most cases, the timing parameters will have been configured by a CETAC representative during installation. Make a note of those initial values before making any changes.

See "Developing a Method" on page 113 for tips on finding the right values for these parameters.

Always configure timing so that sample times do not overlap. In other words, make sure the "BUSY" LED on the front of the electronics module has gone out before sending the next autosampler command.

Operation Controls

Enable ASXpress Operation

Enable ASXpress operation for normal operation.

Disable ASXpress operation if you want to test how the autosampler responds to commands, as if the autosampler were connected directly to the host PC without the *ASXPRESS PLUS* system. (Note that a different tubing arrangement is required to run the autosampler without the *ASXPRESS PLUS* system.)

Extra Loop Rinse

Controls whether the probe and sample loop should take in air or rinse solution between samples. The default setting (disabled, with a 1.0 second purge delay) works well for most applications.

Enable Vacuum/Autosampler Peri-Pump Timeout

When this timeout is not enabled, the vacuum pump and autosampler peristaltic pump will continue running indefinitely after sampling has stopped. This introduces wear which can reduce the lifespan of the pumps. Enable the timeout to specify a limit for how long the pumps should continue running.

Return Probe to Previous Sample

Controls whether the probe should automatically be returned to the position of the previous sample, or remain at the rinse station. Depending on the method, this selection can allow more efficient movement of the probe.

Manual Controls

Click the expand button to reveal the manual controls.

Valve Control

"Load" positions the *ASXPRESS PLUS* 6-port valve into the mode which loads the sample loop, and illuminates the "Load" LED on the front panel of the *ASXPRESS PLUS* electronics module.

"Inject" positions the *ASXPRESS PLUS* 6-port valve into the mode in which injects the sample into the ICP (via the peristaltic pump on the ICP), and illuminates the "Inject" LED.

These controls do not trigger any operation of the autosampler.

Vacuum Pump Control

Turns the vacuum pump in the *ASXPRESS PLUS* electronics module on and off.

Autosampler Pump Control

Turns the rinse pump on and off. This control affects both the autosampler's built-in peristaltic pump and any pump which is connected to the electronics module's EXTERNAL PUMP connector.

Manual Cycle

This performs one complete cycle of system operation, operating each component on the *ASXPRESS PLUS* system and autosampler. This is also a useful function for loading the tubing and priming the rinse pump.

If you are using Manual Cycle to test the parameters you have set in the Xpress Configuration Tool, remember that you must click Save Configuration to ASXpress+ to copy the parameters to the *ASXPRESS PLUS* electronics module.

Manual Cycle at Rinse

Moves the autosampler probe to the rinse station before performing a manual cycle.

Home AutoSampler

Moves the sample probe to the home position. The home position is usually the rinse station, but some autosampler personalities may define the home position as a particular sample or standard vial.

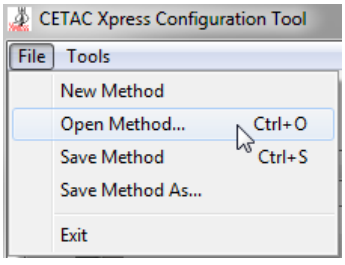
Save Configuration to ASXpress+

Copies the parameters you see in the Xpress Configuration Tool into the *ASXPRESS PLUS* electronics module. The parameters will be saved in nonvolatile memory, and will be used for all operations until explicitly changed again.

Saving Methods

Different experiments often require different *ASXPRESS PLUS* timing parameters. The New Method, Open Method, Save Method, and Save Method As… selections on the File menu allow you to save all of the parameters as a file on the host PC, then recall them when needed.

The data files use the .DSAM file name extension.



Additional Xpress Configuration Tool Features

Built-In Help

For general instructions, click the Help icon:

For help on an individual field, click the What's This help icon, then "hover" the mouse over the field of interest:

Comm Port

Sets the USB or serial port used to communicate with the *ASXPRESS PLUS* system. This port corresponds to the cable between the host PC and the GUI COM port on the electronics module. See page 93 for more information.

Note that the port used to communicate with the autosampler is always controlled through the ICP software , regardless of whether or not the *ASXPRESS PLUS* system is used.

Change Personality

To configure the *ASXPRESS PLUS* system to work with a particular autosampler model, select Change Personality from the Tools menu. See page 95 for more information.

Notes Window

You can display a very simple note-taking window alongside the Xpress Configuration Tool.

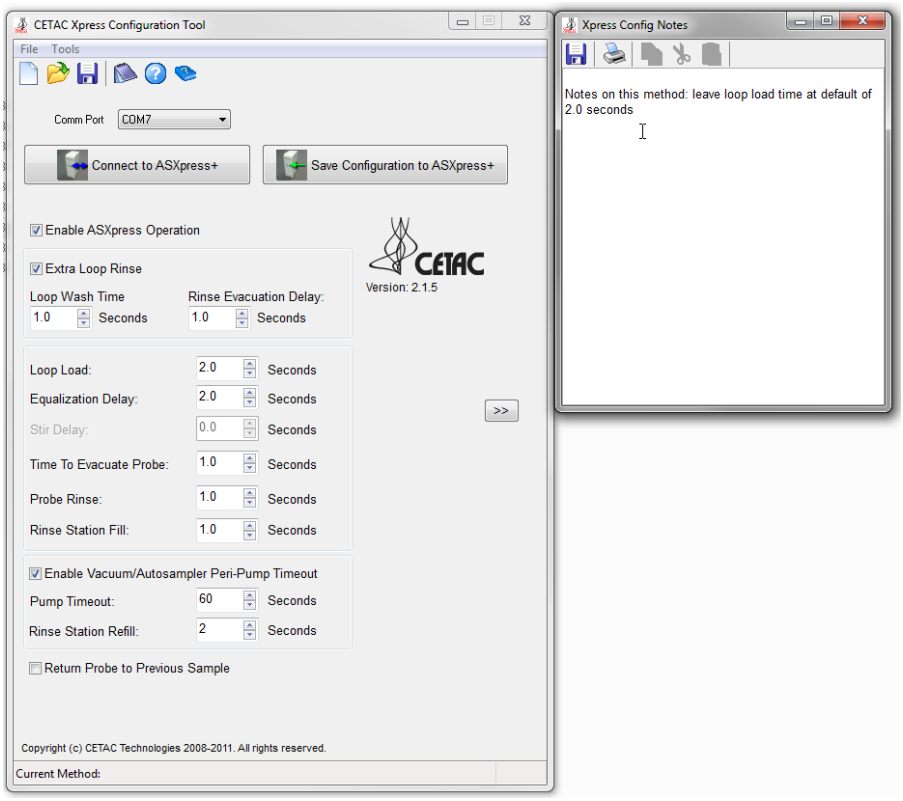


Figure 9-1 Notes Window

Use the Notes window if:

- You would like to see the notes every time the Xpress Configuration Tool window is opened.
- You would like to dock the Notes window so it is always visible next to the Xpress Configuration Tool window.
- Use a word processor or text editor instead of the Notes window if:
- You need advanced editing features.
- You need to use the notes somewhere else (email, in a report, etc.).
- You need several different notes files.

To display the Notes window:

1. On the Tools menu, click Notes.
2. Resize the Notes window.
3. Drag the Notes window to the right edge of the Xpress Configuration Tool window to dock it.

   To save the notes:

4. Click the floppy disk icon at the top of the Notes window.

   The notes will be saved to a predefined file.

Service Log

This feature can be used during troubleshooting, at the request of CETAC Service & Support.

To save a service log:

1. On the Tools menu, click Save Service Log.
2. Select the name of the file.

   The file is saved in a proprietary format (.XPSRZ).
3. Email the file to CETAC Service & Support.

This page is intentionally blank.

10 Using the Rapid Sample Introduction System

The *ASXPRESS PLUS* Rapid Sample Introduction System is both reliable and easy to use. Before using it, however, ensure that your lab environment provides operating conditions that will prolong the life of the *ASXPRESS PLUS* system. Once the proper operating conditions are met, you can operate the rapid sample introduction system. When you finish using the *ASXPRESS PLUS* system, it may be necessary to flush the rinse station and flow path before shutting the system down.

This chapter explains how to create the proper operating conditions for using the *ASXPRESS PLUS* Rapid Sample Introduction System. It also explains how to start and shut down the system, and how to flush the rinse station and flow path.

Establishing Optimal Operating Conditions

The *ASXPRESS PLUS* Rapid Sample Introduction System operates reliably under virtually the same operating conditions described in the autosampler Operator's Manual. However, it is *not* indestructible. Malfunction or damage can occur if specific operating conditions are not met. Meeting these conditions requires that you create the proper lab environment, replace *ASXPRESS PLUS* Rapid Sample Introduction System components that wear out under normal use, and purchase the appropriate supplies. The following sections explain how to meet these conditions.

NOTE

Damage or malfunction that results from exposure to inappropriate operating conditions may constitute misuse and abuse and be excluded from warranty coverage.

Creating the Lab Environment

To create satisfactory operating conditions in your lab environment, follow these guidelines:

- Operate the *ASXPRESS PLUS* Rapid Sample Introduction System in a conventional lab environment where the temperature is 55°F to 85°F (13°C to 30°C), the humidity is 0% to 60% non-condensing and the unit is not exposed to excessive flammable or corrosive materials.
- Avoid rough handling of the *ASXPRESS PLUS* Rapid Sample Introduction System. If possible, do not expose the system to vibration or shock.
- Protect the system from long-term exposure to condensation, corrosive materials, solvent vapor, continual standing liquids, or any spills into the system cabinet. Exposures of this type can damage the internal mechanism components as well as the electronics.
- Observe the same general electrostatic discharge precautions as with any other integrated circuit electronic devices. Low humidity environments, especially when combined with static-generating materials, require the use of maximum care.

WARNING

Discharge static buildup and ground to the *ASXPRESS PLUS* Rapid Sample Introduction System base or cabinet before performing any maintenance. Do not touch or short-circuit bare contacts.

Avoid using the *ASXPRESS PLUS* Rapid Sample Introduction System if strong electromagnetic interference, radio frequency interference, or radioactivity is present. Interference fields can cause erratic system behavior. The *ASXPRESS PLUS* Rapid Sample Introduction System will not function properly if the level of radioactivity is above background.

Replacing Rapid Sample Introduction System Components

The following *ASXPRESS PLUS* Rapid Sample Introduction System components wear out under normal use and must be replaced periodically. These components are consumables and replacement is not covered under warranty. The lifecycle of these components varies considerably depending upon the application and solids content of the sample being transported. Approximate lifecycle estimates are listed as follows:

- 6-Port Injection Valve (100K cycles – depending on solids levels)
- Vacuum Pump (500K cycles – depending on solids levels)
- Tubing (depends on application)
- Sample Loop (depends on application)

When these components begin to deteriorate, the system will not function properly. For information about replacing components, see Chapter 11, "Maintaining the ASXpress Plus Rapid Sample Introduction System."

Purchasing Supplies

When you need to purchase additional supplies, it is extremely important that you choose the appropriate sizes and materials.

To order additional supplies, refer to the *CETAC Accessories and Supplies Catalog* for the *ASXPRESS PLUS* Rapid Sample Introduction System.

Starting the System

To start the *ASXPRESS PLUS* Rapid Sample Introduction System, complete the following steps:

1. Ensure that the *ASXPRESS PLUS* system is connected to the autosampler and host instrument equipment.

   Ensure that all fluid delivery tubing, etc., is connected. Also be sure that the *ASXPRESS PLUS* electronics module is connected to the valve/pump module, autosampler, and power supply.

2. Ensure that the autosampler and host instrument are powered on.

3. Power on the electronics module.

   It does not matter in what order the autosampler, instrument, and electronics module are powered on, as long as they are running before any commands are sent to the autosampler.

4. Launch the Xpress Configuration Tool program.

   Configure the settings as per the specific laboratory application requirements (See note below). The system is now ready to operate.

5. Operate/run the Method at the ICP/ICP-MS

   The methods, through trial and adjustment, shall be modified for maximum performance, which is afforded by the utilization of the *ASXPRESS PLUS* Rapid Sample Introduction System (See note below).

> **NOTE**
>
> Each laboratory analytical process is uniquely specific to the method utilized, sample under analysis, and laboratory conditions under which the *ASXPRESS PLUS*/Autosampler/host instrument system operates. Therefore, the settings utilized within the *ASXPRESS PLUS* and ICP software packages will require determination through a series of trials, or test runs, to fully provide the maximum optimization benefit to the user and method utilized. Time taken to fully assess and "tune" the settings to the actual process will yield the maximum benefit of the *ASXPRESS PLUS* Rapid Sample Introduction System's ability to affect positive impact on laboratory productivity. Contact CETAC Technologies for further information regarding optimal setup and operation of the *ASXPRESS PLUS* system and associated parameters.

Shutting Down the System

To shut down the *ASXPRESS PLUS* Rapid Sample Introduction System, complete the following steps:

1. Drain the system by removing the rinse solution uptake tubing from the rinse solution sources (autosampler and ICP/ICP-MS). Operate the autosampler peristaltic pump and *ASXPRESS PLUS* vacuum pump by operating the "manual cycle" function or by using the manual function for operating the autosampler peristaltic pump (both from within the Xpress Configuration Tool software) and manually running the ICP/ICP-MS peristaltic pump until all solution drains from the tube attached to the rinse station outlet, the vacuum pump waste discharge, and from the ICP/ICP-MS nebulizer drain.

   NOTE

   If using a rinse solution other than deionized water, flush the rinse system with deionized water before shutting down and/or draining the *ASXPRESS PLUS* discrete Sampling Accessory. For more information, see the following section, "Flushing the Rinse Station and Flow Path".

2. Turn off the power switch on the back of the electronics module.

3. Turn off the power switches on the autosampler and instrument.

Flushing the Rinse Station and Flow Path

The rinse station and flow path should be flushed in the following circumstances:

- Initial startup

  Flushing the rinse system during initial startup of the *ASXPRESS PLUS* Rapid Sample Introduction System removes any contaminants that could cause interference during sample analysis.

- After using strong rinse agents

  Flushing the rinse system after using strong rinse agents prolongs the life of the flow path components.

- After samples containing solids which may build up (such as proteins)

  Flushing the rinse system after such samples prolongs the life of the flow path components, including pumps and the 6-port valve.

To flush the rinse station and flow path, complete the following steps:

1. Insert the rinse uptake tubing (autosampler sample probe) and the ICP/ICP-MS Peristaltic pump uptake tubing into a deionized water source.
2. With the autosampler/ *ASXPRESS PLUS* system powered on, open the Xpress Config software, utilizing the time settings for Loop Load, Probe Wash, and Rinse Station Fill that are normal operating parameters specific to your own process.
3. Click on the "Connect to ASXpress+" button, and then click on the "Manual Cycle" button. This will run the *ASXPRESS PLUS* system through a complete cycle of operation, including "load" and "inject" modes.
4. Allow the host instrument Peristaltic pump to run throughout this process. Doing so will rinse the "inject" flow path.
5. Repeat this process three to five times to ensure a complete flushing of the system.
6. Return all systems to normal configuration.

> **NOTE**
>
> If you are flushing the rinse system during initial startup, first use a 2% nitric acid solution as the rinse agent, followed by deionized water.

Once you flush the rinse system, you can proceed with the sampling sequence, as dictated by your specific laboratory circumstance/method, or drain the rinse system as part of the shutdown procedure. For information about running the sampling sequence, see "Starting the System" on page 110. For more information about draining the rinse system, see the previous section, "Shutting Down the System" on page 111.

Developing a Method

This is an outline for method development which has worked well for many laboratories. If you need further assistance, CETAC Technologies is happy to help.

1. Determine the approximate volume of sample to be consumed during analysis and at what pump speed.
2. Choose a loop of appropriate size.
3. Adjust the *ASXPRESS PLUS* parameters to completely fill the loop. The loop should be overfilled slightly. This can be seen as some sample going into the restrictor line just before the valve switches. For a description of each function and parameter, see "Timing Parameters" on page 99.
4. The loop evacuation delay, probe rinse and rinse station refill parameters can all be set to 1.0 initially.
5. The rinse pump speed is approximately half of what it would be without the *ASXPRESS PLUS* system, because two channels are to be used (air and carrier) effectively doubling the flow rate.
6. In the ICP software, turn any rinse parameters off and adjust the "effective read delay." OEM software platforms call these parameters by different names.
7. In the ICP software, turn off any fast flush parameters or plasma stabilization times so that only one pump speed and one read delay is to be dealt with, at least at first. On rare occasions, a fast flush option may be used.
8. In the ICP software, incrementally adjust the read delay. Usually, a significant amount of time can be cut from this parameter, perhaps a quarter at first. After this, make fine adjustments to delay timing and or pump speed, making sure to have the spray chamber wet with sample on the front side of integration for about 5-9 seconds.
9. On the back side of the analysis, make sure that the loop has not been depleted of sample before the integration is complete. It is important to use the worst case sample for this purpose. Some OEM software platforms perform preshots and then adjust integration times depending upon the information that is obtained during this process. For some OEM instruments, the lowest concentrated samples take the most time, but for others, the most highly concentrated ones, and some use user-specified integration times no matter what the concentration.
10. After the instrumentation is set up as described, look to the RSD's to make fine adjustments. One second of read delay or a very slight change in pump speed can yield major differences in precision.
11. Finally, adjust the configuration parameters of probe rinse and refill to a higher number. *Make sure that the overall* ASXPRESS PLUS *macro time is less than the instrument's analysis time.* If this condition is not met, samples will be skipped and the system will appear to not function correctly.

This page is intentionally blank.

11 Maintaining the *ASXPRESS PLUS* Rapid Sample Introduction System

Routine maintenance of the *ASXPRESS PLUS* Rapid Sample Introduction System consists of daily and weekly cleaning of specific components. Routine maintenance also includes checking *ASXPRESS PLUS* components for leaks or other damage. Additional periodic maintenance tasks may be required, including replacement of the following components: peristaltic pump tubing, rinse tubing, and sample probe.

This chapter explains how to clean the *ASXPRESS PLUS* Rapid Sample Introduction System, inspect it for leaks, and replace damaged components.

WARNING

Discharge static buildup and ground to the *ASXPRESS PLUS* Rapid Sample Introduction System base or cabinet before performing any maintenance. Do not touch or short-circuit bare contacts, COM, USB, or auxiliary ports.

Regular Inspection of *ASXPRESS PLUS* Components

It is important to verify that all system components are in good working order and are undamaged prior to operation.

Visually inspect these components:

- Valve/pump module:
  - 6-port valve
  - Vacuum pump ports
- Electronics module
- Peristaltic pump on the autosampler
- Tubing— pay special attention to all tubing to ensure that no kinks exist, as this condition will impair proper performance of the *ASXPRESS PLUS* system by reducing flow rates. Check that tubing is not rubbing against moving parts.
- Cables

If you detect a leak or other damage to any *ASXPRESS PLUS* Rapid Sample Introduction System component, you must replace it.

Cleaning the System

Cleaning the *ASXPRESS PLUS* Rapid Sample Introduction System is the primary maintenance task you perform. Failure to do so regularly causes increased wear and reduces the system's life.

You must clean the *ASXPRESS PLUS* Rapid Sample Introduction System both daily and weekly to protect the instrument, prevent damage and extend its life. It is especially important to clean up spills which may infiltrate the instrument case/cabinet whereby damage to components may result. It may also be necessary to chemically neutralize spills. The following sections explain daily and weekly cleaning procedures.

Daily External Cleaning

The *ASXPRESS PLUS* Rapid Sample Introduction System is often operated in environments where spills and exposure to vapors is common. Good maintenance requires that you clean the system daily. To do so, complete the following steps:

1. Unplug the *ASXPRESS PLUS* Rapid Sample Introduction System power/signal cable from the autosampler.
2. Wipe the cabinets (electronics module and valve/pump module) using a clean-room wipe dampened with deionized water.

   Avoid scratching the cover while drying. The *ASXPRESS PLUS* system must be thoroughly dry before you turn the power on again.

Cleaning the Filters

If your configuration includes a diaphragm pump, the in-line filters before the pump intakes require periodic cleaning or replacement. If the flow of rinse solution is reduced, or if the rinse station isn't filling completely, it is time to clean or replace the filters.

Most configurations use disposable in-line 75-micron filters. See the *ASXPRESS PLUS Rapid Sample Introduction System Accessories and Supplies Catalog* for information on ordering replacements.

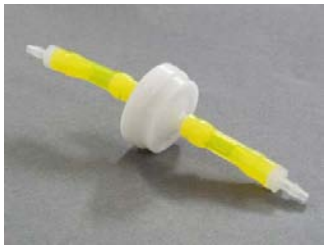


Figure 11-1 Disposable In-Line Filter

A few systems may use a larger filter which can be opened for cleaning. To clean the filter:

1. Turn off the autosampler and the *ASXPRESS PLUS* electronics module.

2 Take whatever precautions are necessary to protect yourself and the work area from splashes of the rinse solution.

3 Twist the filter enclosure and pull it open.

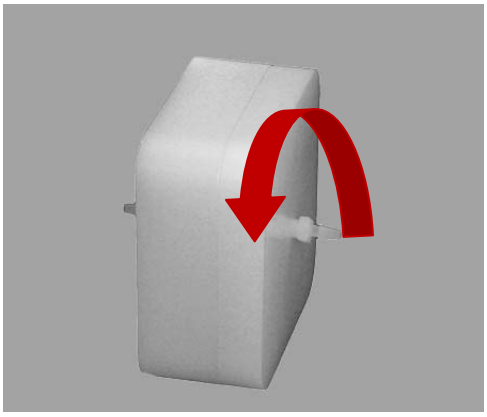


Figure 11-2 Opening the Filter

Figure 11-3 Filter After Opening

4 Rinse the filter media in clean rinse solution.

5 Reassemble the filter and turn the system back on.

Cleaning the 6-Port Valve

It will be necessary to periodically disassemble the 6-port valve and clean the inside to prolong the life of the valve. Cleaning must be done in a clean area to prevent contamination of the valve.

> **NOTE**
>
> It is recommended to clean the 6-port valve every 20,000 cycles, or approximately every 1-2 weeks. However, the frequency of cleaning interval will vary depending on application.

Materials required:

- dust-free work surface
- hex key wrench (provided)
- lint-free clean room wipes
- low-pressure compressed clean air (such as a canned air duster product)

To clean the valve, complete the following steps:

1. Turn off and unplug the *ASXPRESS PLUS* Rapid Sample Introduction System.
2. Remove all tubing and connectors from the 6-port valve.
3. Use the hex key wrench provided to remove the three screws on the front of the 6-port valve

   Do *not* remove the valve body from the actuator as it will lose its position and will require retraining if removed. Valve retraining will be discussed in detail on page 121.
4. Note the orientation of valve body components prior to removal.
5. Gently remove the stator of the valve.
6. Use a clean-room wiper to gently clean the channels and surfaces of the stator and rotor of any debris.
7. Use low-pressure, canned clean air to blow the channels and ports free of any remaining debris.
8. Very carefully replace the stator of the valve, in the proper orientation noted in step 4, and tighten the three screws to set firmly in place.
9. Reinstall all tubing and check for leaks using the Xpress Configuration Tool to "Manual Cycle" the *ASXPRESS PLUS* system as described on page 120.

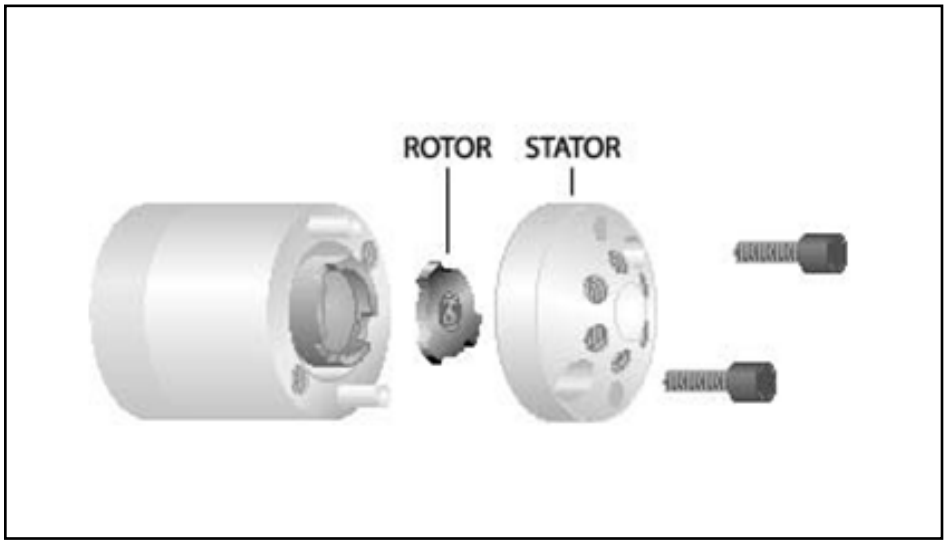


Figure 11-4 6-Port Valve Assembly — Exploded View of Components

Checking for Leaks

The tubing has a finite lifespan, and will wear out under normal use. Standard maintenance procedures require that you periodically check for leaks. To do so, complete the following steps:

1. Turn off and unplug the *ASXPRESS PLUS* Rapid Sample Introduction System.
2. Visually inspect all tubing and valves for leaks or signs of deterioration.
3. Visually inspect the surfaces below all tubing for signs of liquid.

If you detect a leak or other damage to any component, you must replace it. For more information, see the appropriate section in this chapter.

Replacing the Tubing

To replace the tubing, complete the following steps:

1. Turn off and unplug the *ASXPRESS PLUS* Rapid Sample Introduction System.
2. Remove and replace all tubing as necessary, using care to remove/replace tubing at barb fittings and at compression type fittings without damaging those fittings to which they connect.

   For more information on how to install the rinse tubing, see the appropriate "Preparing the Autosampler" chapter in this manual.

Replacing or Reorienting the 6-Port Valve

The 6-Port valve assembly has a finite lifespan that is dependent upon the conditions and sample media to which it is exposed. Exposure to higher sample solids levels reduces the valve lifespan.

To determine whether the 6-port valve requires replacement, inspect the unit for these conditions:

- Valve dripping or leaking from the overflow hole behind port #4 at bottom of the valve body.
- With no other apparent problems, air is present in the lines (indicating a leak or poor seal).

The valve can also be reoriented so that the nebulizer port is as close as possible to the nebulizer.

Note that any time the 6-port valve body is removed from its actuator, the valve will require retraining (reinitialization).

To replace or reorient the 6-port valve:

1. Unplug the valve/pump module cable from the electronics module.

   Leave the electronics module powered on.

2. Remove the tubing/connectors on the 6-port valve.

3. Using the provided hex key, loosen the hex screw on the locking collar which secures the base of the valve to the body of the valve/pump module.

Figure 11-5 Locking collar with hex screw loosened

4. Place the pump/valve module on its back, on a tabletop.

5. Firmly but carefully pull the valve straight up.

   Now, before you reinstall the valve, retrain the valve actuator:

6. Start the Xpress Configuration Tool and make sure it is communicating with the electronics module.

7. Expand the GUI using the arrow button on the right side of the window.

8 In the Xpress Config software, select the "Load" button then the "Inject" button. Do this twice. This will tell the electronics that the valve needs to be re-homed.

9 Plug the valve/pump module cable back into the electronics module.

10 In the Xpress Config software, select the "Load" button then the "Inject" button.

Now you are ready to reinstall the valve:

11 Insert the new valve, or reinsert the existing valve, at the desired angle. Rotate it so that the nebulizer port will be as close as possible to the nebulizer.

12 Press down on the valve so that it is completely seated.

13 Inspect the valve to verify that there is no gap between the valve and the collar on the valve/pump module.

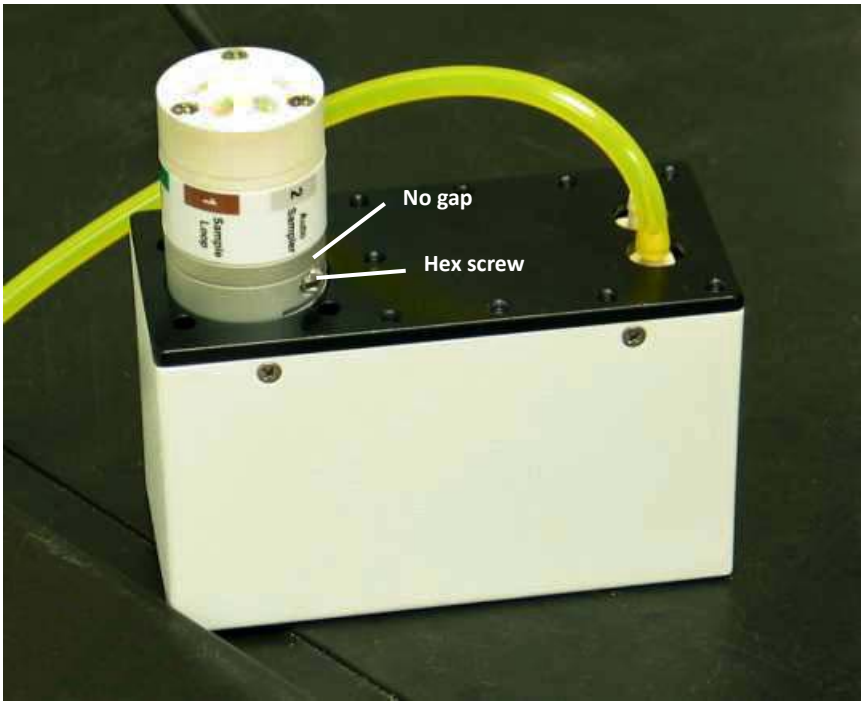


Figure 11-6 Reseating the 6-Port Valve

14 Power down the *ASXPRESS PLUS* electronics module, unplug any USB cables from the electronics module, and wait a few seconds.

15 Power up the electronics module and plug in the USB cables.

16 Start the Xpress Configuration Tool and make sure it is communicating with the electronics module.

17 Expand the GUI using the arrow button on the right side of the window.

18 Repeatedly cycle the actuator via the software "Load" and "Inject" buttons.

Keep toggling until an error window opens. At this time the valve has lost its home position.

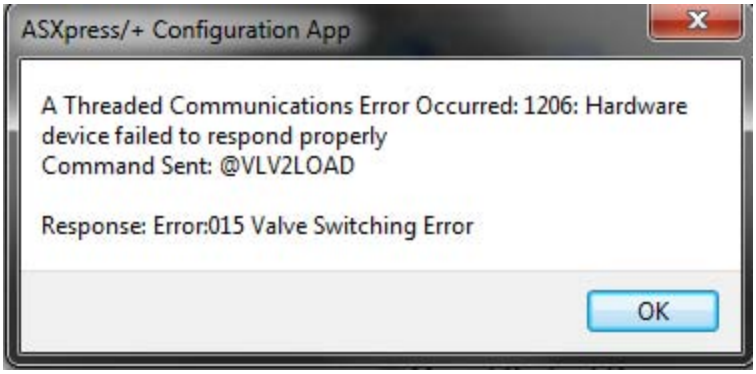


Figure 11-7 Error message displayed when the valve is ready to re-home

19 Tighten the hex screw on the locking collar.

20 Toggle the valve between Load and Inject once again.

For the next few cycles the valve will operate at half its normal speed (noted by a long, low pitch sound emitted as the actuator moves) while the "smart" electronics locates the internal valve stops. Once it determines the proper stroke, the actuator will return to normal speed (when the valve is fully "trained," the sound emitted will be short "chirps" of a higher pitch).

NOTE

Error messages might pop up while trying to home the valve. The first couple are normal. If the errors continue, make sure the locking collar is fully tightened.

21 Return the valve/pump module to its operating position.

22 Reconnect all tubing.

23 Check for leaks using the Xpress Config Tool to "Manual Cycle" the system.

Replacing the Battery

The battery in the electronics module is used to store data in SRAM memory.

When the battery is low, an error message will be displayed by the Xpress Configuration Tool.

CAUTION Replace only with a CR2032 (3.0V, non-rechargeable lithium coin cell) or equivalent battery. Using an incorrect battery may cause equipment damage.

1. Turn off the power switch on the back of the *ASXPRESS PLUS* electronics module.
2. Unplug the electronics module from the power supply.
3. Disconnect all of the various serial and other cables that normally attach to its back.
4. Remove the 4 screws that hold the cover to the case.

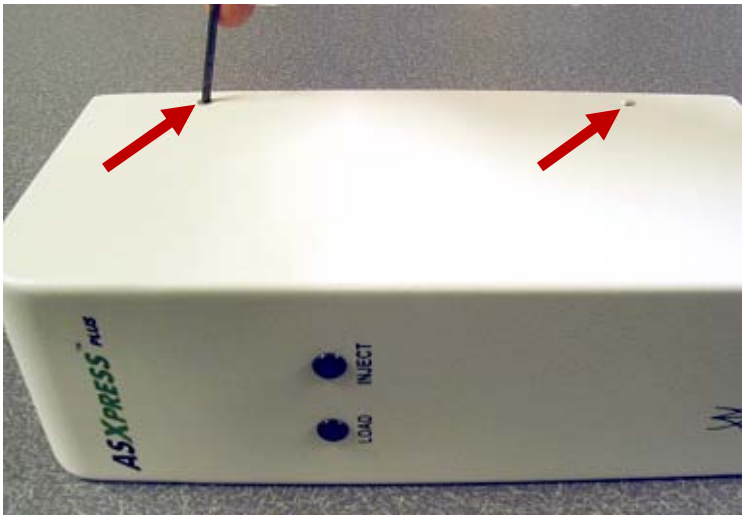


Figure 11-8 Removing the Cover Screws

5. Carefully pull the cover from the case. A paperclip or small tool will be useful in separating the cover from the case. Pull the cover off just far enough to access the battery. Do not break the wires which connect the LEDs in the cover to the circuit board in the case.

Figure 11-9 Separating the Cover

Figure 11-10 Location of the Battery

6 Note the orientation of the battery, then pull it out.

7 Insert the new battery.

8 Replace the cover.

9 Reconnect the power cord and turn on the power switch.

10 Run the Xpress Configuration Tool.

A low battery message will be displayed the first time you run the software.

11 Check the method settings then click the "Save Configuration to ASXpress+" button.

12 Recycle or dispose of the battery in accordance with local regulations.

Updating Firmware

You may need to update the firmware in the electronics module in order to use the *ASXPRESS PLUS* Rapid Sample Introduction System with a different autosampler or to take advantage of new features.

A firmware update program and instructions (*Upgrading Firmware for the CETAC ASXPRESS PLUS Rapid Sample Introduction System*) are installed along with the Xpress Configuration Tool software, and are also provided with the firmware update.

Updating the firmware involves opening the case of the electronics module. For instructions, see *Upgrading Firmware for the CETAC ASXPRESS PLUS Rapid Sample Introduction System*.

12 Troubleshooting the Rapid Sample Introduction System

In the event that the *ASXPRESS PLUS* Rapid Sample Introduction System does not function properly, isolate the problem to determine if it originates in the host computer, the analytical instrument, or the *ASXPRESS PLUS* Rapid Sample Introduction System. If you determine the problem is in the *ASXPRESS PLUS* system, check the power system, communications interface, or software to find the cause of the problem and resolve it.

This chapter explains how to troubleshoot *ASXPRESS PLUS* Rapid Sample Introduction System problems. If you cannot solve a problem using the steps given in this chapter, you should contact CETAC Technologies Customer Service and Support.

If the Valve/Pump Module Does Not Appear to be Operating

1. Check that “Enable ASXpress Operation” is enabled in the Xpress Configuration Tool.
2. Check for power system problems (See “Power System Problems” on page 129.)
3. Check for communication problems. (See “Communications Interface Problems” on page 130.)
4. If you can manually control the valve, but when it does not operate when sampling, check that the firmware personality is set correctly. (See "Configuring the personality" on page 95.)

If the 6-Port Valve Is In the Wrong Position (Re-Homing)

It is possible for the 6-port valve to become rotated away from its proper position. If this happens, follow these steps to re-home the valve:

1. Power down the *ASXPRESS PLUS* electronics module, unplug any USB cables from the electronics module, and wait a few seconds.
2. Power up the electronics module and plug in the USB cables.
3. Start the Xpress Configuration Tool and make sure it is communicating with the electronics module.
4. Expand the GUI using the arrow button on the right side of the window.
5. Repeatedly click Load then Inject to switch the valve between each state.
6. If the valve is out of sync, the switching noise will start out longer, but then get shorter when the valve is synced up properly.

See also "Replacing or Reorienting the 6-Port Valve" on page 121.

If Some Samples are Missed

If the autosampler skips some of the samples, it is likely that the time required to execute the *ASXPRESS PLUS* macro is greater than the analysis time. The *ASXPRESS PLUS* electronics module does not buffer commands. Therefore, if the host PC issues autosampler commands too quickly, some of those commands may be lost.

Always configure timing so that sample times do not overlap. In other words, make sure the "BUSY" LED on the front of the electronics module has gone out before sending the next autosampler command. You may need to adjust the *ASXPRESS PLUS* timing parameters, or you may need to adjust timing parameters in the ICP software.

For a description of each function and parameter, see “Timing Parameters” on page 99.

If There are Data Quality Problems / QC Failure

1. Verify that the loop is being completely filled.
2. If the loop is not loading correctly, re-home the valve.
3. If problem persists dismantle and clean the 6-port valve and check tubing for blockages. Replace the tubing if necessary.
4. If the replicate readings have a large RSD value, inspect the peristaltic pump tubing and replace if necessary.
5. Verify that the nebulizer is free-flowing and misting correctly.

6 If using an internal standard, verify that there are no bubbles in the tee and inspect the peristaltic pump tubing and replace if necessary.

7 If QC continues to fail, the ICP/ICP-MS might need troubleshooting.

Power System Problems

A possible cause of *ASXPRESS PLUS* Rapid Sample Introduction System malfunction is a problem in the power system. If the system is not functional, it is possible that it is not receiving power. If this is the case, both of the LED status indicator lights will be off. To troubleshoot this problem, complete the following steps in sequence until the problem is solved:

1 Check that the power switches on the autosampler and *ASXPRESS PLUS* electronics module are both turned on.

2 Check that the power cords are plugged in firmly between the power input on the *ASXPRESS PLUS* electronics module and the external power supply and also between the power supply and the wall outlet.

If the cable is plugged in, ensure that it is not damaged in any way.

3 Ensure that the *ASXPRESS PLUS* valve/pump module cable is connected to the *ASXPRESS PLUS* electronics module.

If the cable is plugged in, ensure that it is tightened properly and not damaged in any way.

4 Check that the autosampler is plugged in.

5 Check the external power supply (autosampler). The green LED on the power supply should be illuminated.

a. **If the power supply LED is not illuminated, check the wall outlet:**

- Using a Volt-Ohm meter or equivalent, check the wall outlet for 100-240VAC, +/- 10%, 50/60 Hz.
- The power supply has a green LED which should be lit if the power supply is plugged into a wall outlet that is active.

b. **If the voltage is acceptable, the cord is plugged in properly and the external power supply green LED is still not illuminated, unplug the external power supply from the autosampler, but leave it plugged into the wall.**

- If the green LED is not lit, the power supply is faulty and requires replacement.
- If the green LED is lit when unplugged from the autosampler but turns off when plugged into the autosampler, the autosampler may have an internal short and requires repair.

6 If the external power supply LED is illuminated while plugged into the autosampler, cycle the autosampler power switch. The autosampler sample

probe should move up and the autosampler should initialize. After initialization, the status LED on the front of the autosampler should light up.

- If the cords are properly connected, power is available, the external power supply is good, and the unit still does not initiate, continue troubleshooting.

Communications Interface Problems

Operation of the *ASXPRESS PLUS* system is directed by the host computer. A malfunction of the *ASXPRESS PLUS* Rapid Sample Introduction System can indicate a problem with the RS-232 or USB cable (connected between the host computer and the electronics module) or with the configuration of the software on the host computer. The following sections explain how to troubleshoot these problems.

RS-232 Cable Problems

The first step in troubleshooting communications interface problems is to check the RS-232 cable. To do so, complete the following steps (See Autosampler manual for further troubleshooting information):

1. Check the RS-232 cable to ensure it is plugged in to the COM1 port on the Autosampler.

   If the cable is plugged in, ensure that it is tightened properly and not damaged in any way.

2. Check the host computer to ensure that the RS-232 cable is connected to the appropriate COM port.

   If the cable is plugged in, ensure that it is tightened properly and not damaged in any way.

USB cable Problems

An option to using RS-232 communications protocol is to use USB protocol. The USB port located on the back of the autosampler is an alternate connection protocol option to the RS-232 port at Com 1. Either RS-232 or USB may be used at that port, but not both at once. To troubleshoot a problem with the USB cable, complete the following steps:

1. Check the USB cable to ensure it is plugged in to the COM1 port on the Autosampler.

   If the cable is plugged in, ensure that it is connected properly and not damaged in any way.

2. Check the host computer to ensure that the USB cable is connected to the appropriate USB port.

   If you move the USB cable to a new USB port, remember that it is necessary to reconfigure the connection (see page 86).

   If the cable is plugged in, ensure that it is connected properly and not damaged in any way.

3 Check the host computer to ensure that the USB drivers are installed for USB operation of the autosampler.

Load the proper USB drivers to the host computer from the CD that was provided with the autosampler.

Software Configuration Problems

If the cords are connected properly and the system is still not functioning, ensure that the software is communicating correctly with the autosampler and *ASXPRESS PLUS* system. To do so, verify proper operation of all manual functions by completing the following steps:

1 Operate manual features of the Xpress Configuration Tool software.

With the *ASXPRESS PLUS* system connected to the autosampler/ICP/ICP-MS systems, the autosampler "queried", and the manual functions showing in the Xpress Configuration Tool window:

- Click the "Manual Cycle" button. The ASXpress Plus system should run through a complete cycle ("Load" and "Inject"), operating the autosampler peristaltic pump and the ASXpress Plus components (6-Port Valve and Vacuum Pump). The "BUSY" LED on the front of the electronics module should flicker on and off, indicating when the electronics module has intercepted and is acting upon an autosampler command.
- Click the "Load" button. The ASXpress Plus system should move the 6-Port Valve to the "Load" position (no other apparatus operates).
- Click the "Inject" button. The ASXpress Plus system should move the 6-Port Valve to the "Inject" position (no other apparatus operates).
- Click the "On" (autosampler pump control) button. The autosampler peristaltic rinse pump should turn on (no other apparatus operates).
- Click the "Off" (autosampler pump control) button. The autosampler peristaltic rinse pump should turn off (no other apparatus operates).
- Click the "On" (ASXpress Plus vacuum pump control) button. The ASXpress Plus vacuum pump should turn on (no other apparatus operates).
- Click the "Off" (*ASXPRESS PLUS* vacuum pump control) button. The *ASXPRESS PLUS* vacuum pump should turn off (no other apparatus operates).

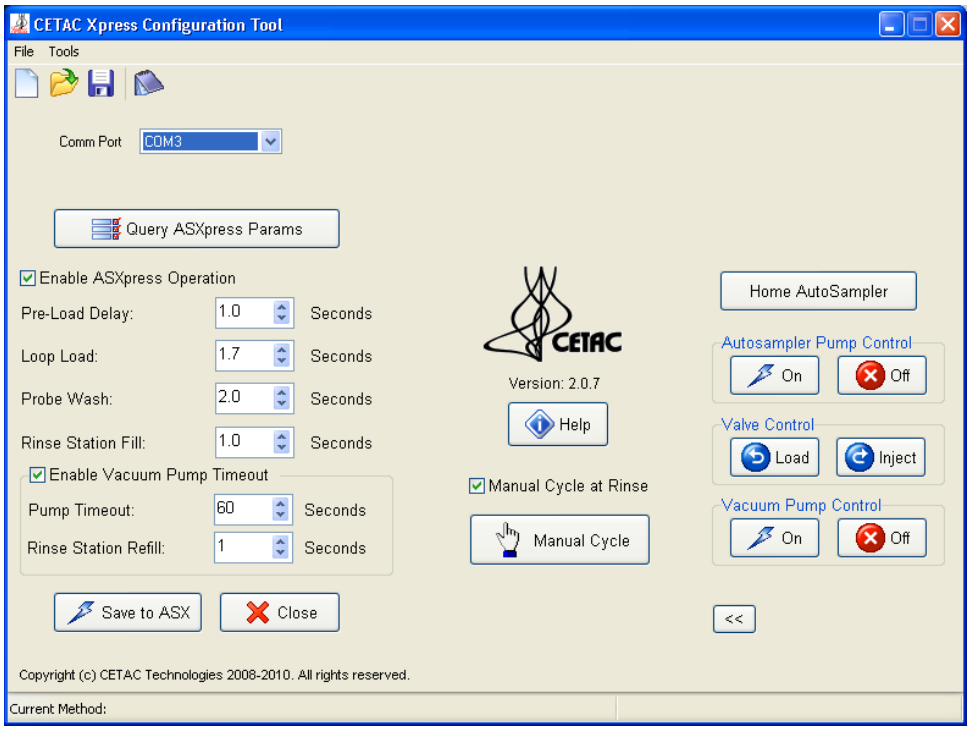


Figure 12-1 Xpress Configuration Tool—Expanded to access manual functions

2 Check that the "Enable ASXpress Operation" box in the Xpress Configuration Tool is checked.

Unchecking this box would allow the autosampler to run independently of the *ASXPRESS PLUS* system, as if the autosampler were connected directly to the host PC. (Note that a different tubing arrangement would be required to run the autosampler without the *ASXPRESS PLUS* system.)

3 Ensure that ICP software is not conflicting with *ASXPRESS PLUS* system operation.

Disable ICP software and run the *ASXPRESS PLUS* system from host computer. If conflict is no longer present, troubleshoot ICP software per its own troubleshooting procedure.

Returning the Product to CETAC for Service

Refer to the following information if you need to return the product to CETAC Technologies for service.

Shipping the Product

Follow these guidelines when shipping the product:

- **Use the original packing materials.** If the original shipping materials are not available, place a generous amount of shock-absorbing material around the instrument and place it in a box that does not allow movement during shipping. Seal the box securely.
- Contact CETAC Technologies before shipping the product.
- Pre-pay all shipping expenses including adequate insurance.
- Write the following information on a tag and attach it to the product:
  - Name and address of the owner
  - Product model number and serial number
  - Description of service required or failure indications
- Mark the shipping container as FRAGILE.
- In all correspondence, refer to the instrument by model name or number and full serial number.
- **Do not return products which are contaminated by radioactive materials, infectious agents, or other materials constituting health hazards to CETAC employees.**

Product Warranty Statement

NOTE

Contact CETAC Technologies or refer to the warranty card which came with your product for the exact terms of your warranty. The following copy is provided for your convenience, but warranty terms may be different for your purchase or may have changed after this manual was published.

CETAC TECHNOLOGIES warrants automation instruments for (2) two years from the date of shipment. Any CETAC manufactured unit sold directly to the End-User found in reasonable judgment of CETAC to be defective in material or workmanship will be repaired by CETAC without charge for parts and labor. Only CETAC manufactured automation instruments are covered by the (2) two year warranty. For a complete listing of our Automation products please visit our web site at www.cetac.com and follow the Automation link.

The unit, including any defective part, must be returned to CETAC within the warranty period. The expense of returning the unit to CETAC for warranty service will be paid for by the buyer. CETAC's responsibility in respect to warranty claims is limited to making the required repairs or replacements, and no claim of breach of warranty shall be cause for cancellation or recession of the contract of sale of any unit.

Products may not be returned which are contaminated by radioactive materials, infectious agents or other materials constituting health hazards to CETAC employees.

This warranty does not cover any unit that has been subject to misuse, neglect, negligence or accident. The warranty does not apply to any damage to the unit that is the result of improper installation or maintenance, or to any unit that has been operated or maintained in any way contrary to the operating or maintenance instructions as specified in the CETAC Instruction and Operations Manual. The warranty does not cover any unit that has been altered or modified so as to change its intended use. Any attempt to repair or alter any CETAC unit by anyone other than by CETAC authorized personnel or agents will void this warranty.

In addition, the warranty does not extend to the repairs made necessary by the use of parts, accessories, or fluids which are either incompatible with the unit or adversely affect its operation, performance or durability.

CETAC reserves the right to change or improve the design of any unit without assuming any obligation to modify any unit previously manufactured.

THE FOREGOING EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

CETAC'S OBLIGATION UNDER THIS WARRANTY IS STRICTLY AND EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF DE-FECTIVE PARTS, AND CETAC DOES NOT ASSUME OR AUTHORIZE ANYONE TO ASSUME FOR THEM ANY OTHER OBLIGATION.

CETAC ASSUMES NO RESPONSIBILITY FOR INCIDENTAL CONSEQUENTIAL OR OTHER DAMAGES (EVEN IF ADVISED OF SUCH POSSIBILITY), INCLUDING BUT NOT LIMITED TO, LOSS OR DAMAGE OF PROPERTY, LOSS OF REVENUE, LOSS OF USE OF THE UNIT, LOSS OF TIME, OR INCONVENIENCE.

This warranty and all matters arising pursuant of it shall be governed by the laws of the State of Nebraska, United States.

Returned Product Procedures

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. CETAC must be notified within ninety (90) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from CETAC. No replacements will be provided, nor repairs made, for products returned without such approval. Any returned product must be accompanied by a return authorization number. The expense of returning the unit to CETAC for service will be paid by the buyer. The status of any product returned later than thirty (30) days after issuance of a return authorization number will be subject to review. Shipment of repaired products will generally be made forty-eight (48) hours after the receipt.

Do not return products which are contaminated by radioactive materials, infectious agents, or other materials constituting health hazards to CETAC employees.

Returned Product Warranty Determination

After CETAC's examination, warranty or out of warranty status will be determined. If a warranted defect exists, the product will be repaired at no charge and shipped prepaid back to the buyer. If the buyer desires an air freight return, the product will be shipped collect. Warranty repairs do not extend the original warranty period.

If an out of warranty defect exists, the buyer shall be notified of the repair cost. At such time the buyer must issue a valid purchase order to cover the cost of repair and freight, or authorize the products to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number approval within fifteen (15) days of notification will result in the products being returned as is, at the buyer's expense.

This page is intentionally blank.

13 Operating a CETAC Autosampler Using a Terminal Program

The *ASXPRESS PLUS* system, along with all CETAC autosamplers, can be controlled using a serial communications protocol. You can use any terminal emulation program, including:

- **C-Term.** This program is installed with the Xpress Configuration Tool software, and runs on Windows 2000 and later. (recommended)
- **HyperTerminal.** This program was supplied with versions of the Windows operating system through Windows XP.

This chapter explains how to operate a CETAC autosampler using either of the two programs.

Using C-Term™

C-Term is a simple terminal program developed to validate the installation and functionality of various CETAC devices. C-Term communicates through a serial (RS-232) port on the host computer. If the device is connected to a USB port, the device driver will create a virtual serial port.

C-Term is provided on the CETAC software CD and is automatically installed with the Xpress Configuration Tool software.

Starting C-Term

1 Check that the communication port connectors are properly attached between the host computer and the CETAC device.

If the communications interface between the CETAC device and the host computer is not established correctly, the device will not function.

2 On the Start Menu, click All Programs, then CETAC Xpress Config, then Support Tools, then C-Term.

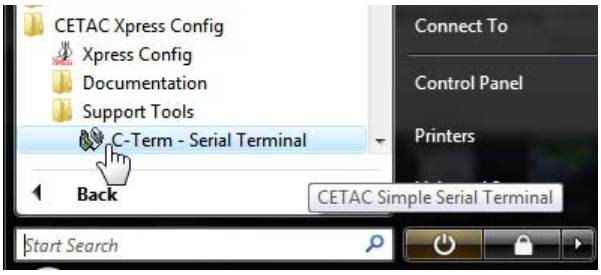


Figure 13-1 Starting C-Term

Overview of the C-Term Window

Once C-Term is loaded, the window shown in Figure 13-2 will open. The majority of C-Term's functions are available from this window.

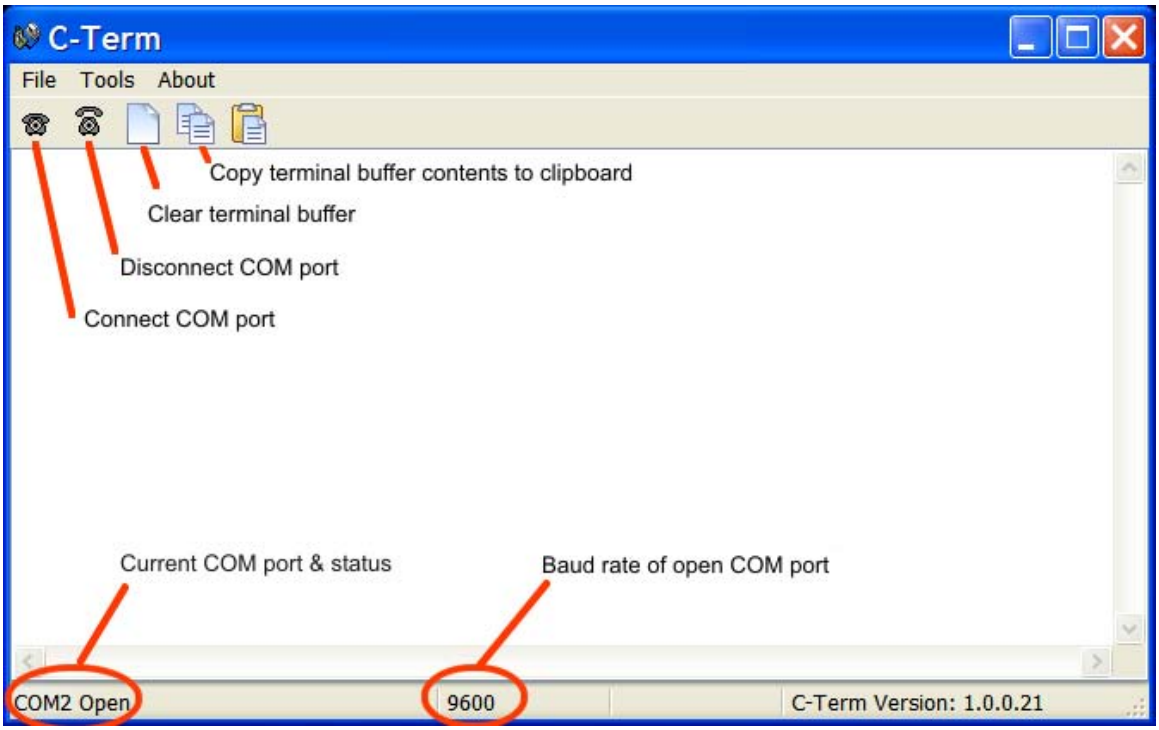


Figure 13-2 C-Term Window

By default, typed commands are sent to the CETAC device connected to the opened port. The typed commands will appear in light green in the terminal buffer. Responses from the device will appear in red. Non-printing characters such as carriage returns will appear as ASCII hexadecimal numbers surrounded by square brackets, for example, **[0D]** is the carriage return character.

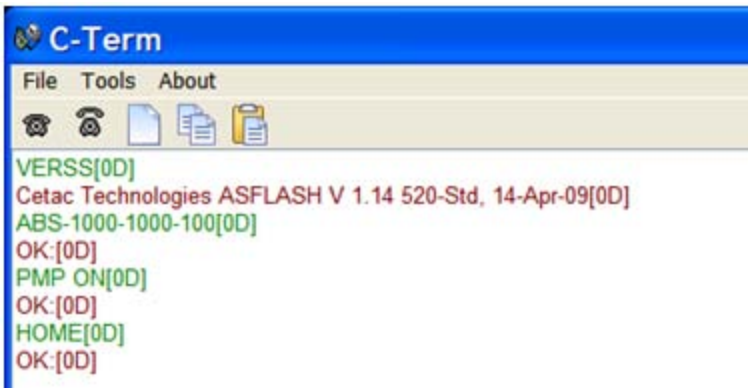


Figure 13-3 Outgoing Commands Shown in Green and Incoming Responses Shown in Red

Configuring C-Term

By default, C-Term attempts to open COM1 the first time it is executed. If the COM port that the CETAC device is connected to is not the default (COM1), then it will be necessary to configure C-Term to use the desired port.

The default communications configuration is appropriate for use with the vast majority of CETAC devices. Exceptions are the ASX-8000 which requires a baud rate change and the AS300 emulator which uses non-printing characters are part of its command protocol. Modifying the default settings is described below.

> **NOTE**
>
> If COM1 (or the currently selected COM port) is in use by another program or is otherwise unavailable, a warning dialog box will pop up when C-Term starts stating that the COM port could not be opened.

1 On the Tools menu, click Setup Serial Port.

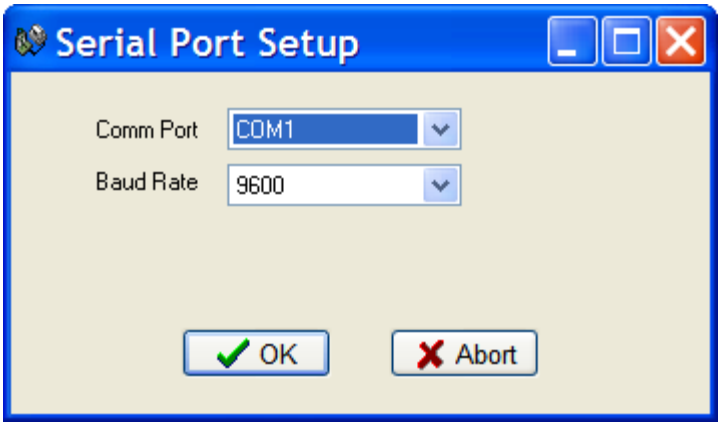


Figure 13-4 Serial Port Setup Window

2 Select the desired COM port and, if necessary, the Baud rate used by the connected device then click OK.

The window will close and the settings will be saved. These new settings will be applied immediately and used thereafter unless changed again.

NOTE

Except for the ASX-8x00, all CETAC devices communicate at 9600 baud (which is the default.)

NOTE

Only installed COM ports, including USB virtual COM ports, will appear in the **Comm Port** menu.

Setting Preferences

If desired, the size of the scrollback buffer or the color of the outgoing and incoming texts can be changed (to work around color blindness, for example).

1 On the Tools menu, click Preferences.

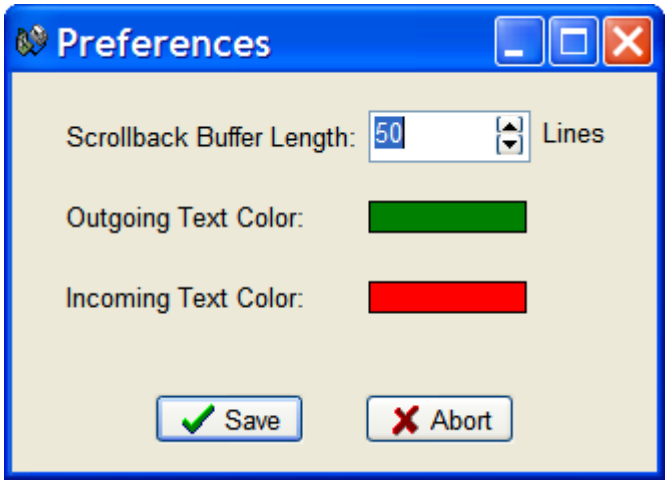


Figure 13-5 Preferences Window

To change the Scrollback Buffer Length, either type the new value in the field or use the arrows adjust the value up or down.

To change text color, click on the color bar and a color selection dialog box will appear. Select the new color and click **OK.**

2 Click Save to apply your settings and close the window.

Using HyperTerminal

1 Using a serial cable, connect the CETAC autosampler with the computer. Plug each end of the serial cable into the COM 1 port of the autosampler and the computer, respectively.

2 Turn on the computer and select the Accessories folder. Select the HyperTerminal folder and then the HyperTerminal program.

3 A window will appear as in Figure 13-6. Enter COM 1 in the name box. Press the OK button.

Figure 13-6 "Connection Description" Window

4 In the Connect To window, set Connect Using to COM 1, then click OK.

Figure 13-7 "Connect To" Window

5 In the Properties window, set Bits per second to 9600 and Flow control to None.

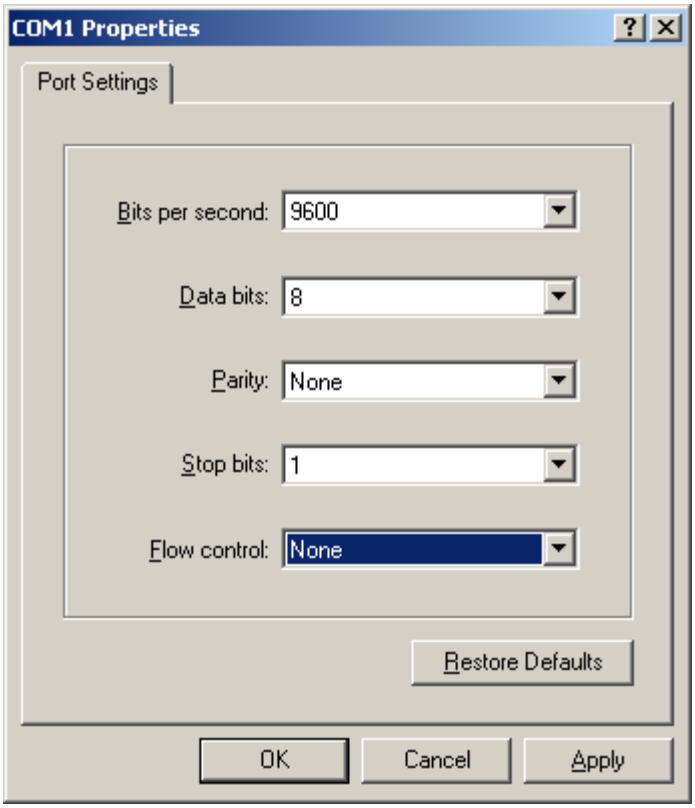


Figure **13-8** "COM1 Properties" Window

6 Click OK.

The HyperTerminal window will open.

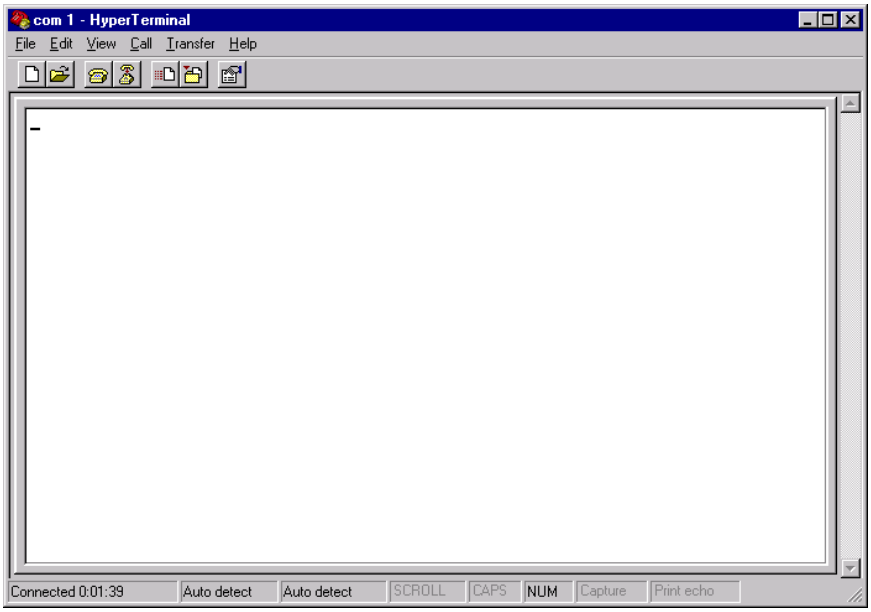


Figure 13-9 "Com 1 Hyperterminal" Window

7 On the File menu, click Properties.

8 On the Settings tab, click ASCII Setup

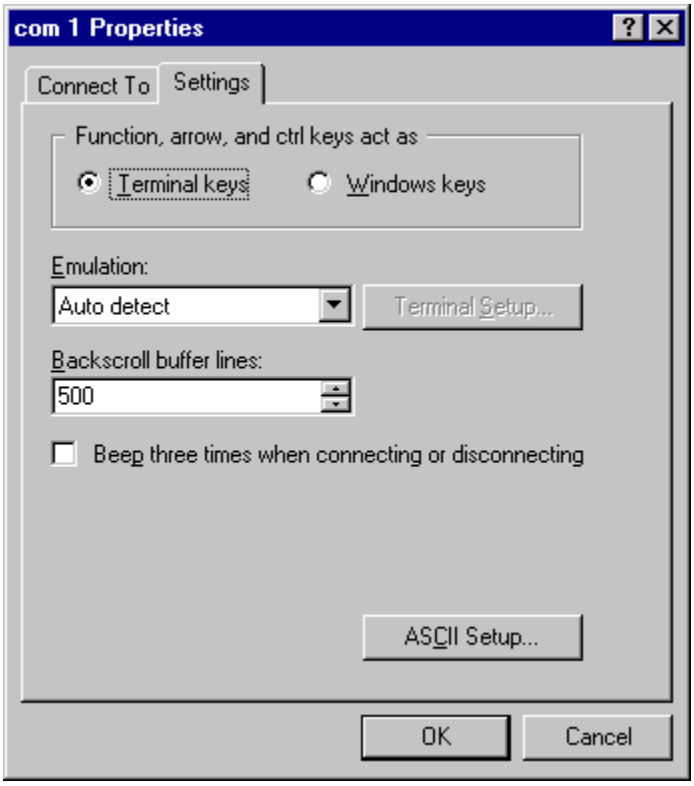


Figure 13-10 "Com 1 Properties" Window

9 Click ASCII Setup.

10 Enable "Echo typed characters locally" and "Append line feeds to incoming line ends," then click OK.

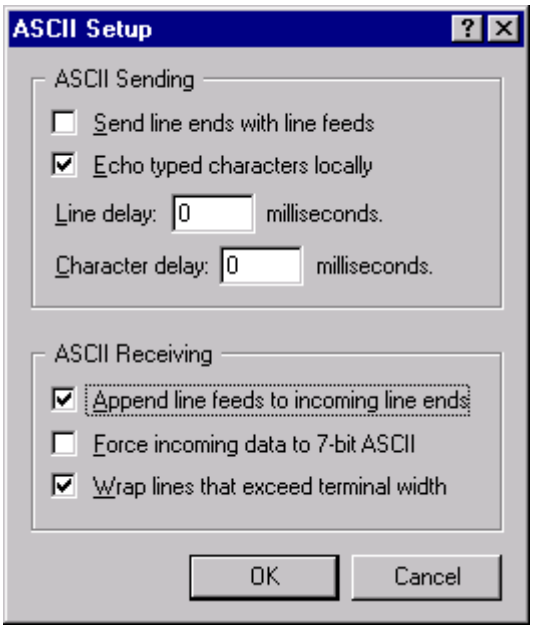


Figure 13-11 "ASCII Setup" Window

11 Turn on the autosampler.

The HyperTerminal window should display an OK.

Autosampler Commands

The following commands will produce various responses of the autosampler.

Command	Description
`Ver`	Returns firmware version.
`Home`	Returns all axis to home position, same as power up.
**`Tray=`*`n`*	Defines tray size and *n*= #of positions. Legal values are 21, 24, 40, 60, and 90.
**`Tube=`*`row-col-down`*	Tube=row-column-down as defined by tray command. Example: `Tube=3-4-150`
`Pmp on`	Pump on if unit has a pump.
`Pmp off`	Pump off if unit has a pump.
`Rinse`	Moves sipper to the rinse position, extends and retracts the sipper 3 times and starts rinse pump. Stays in down position with pump running. `up,pmp off` stops the pump.
**`Down=`*`n`*	Moves the z-axis down by the parameter(*n*) in mm. Do not run `Down` command if sipper is not all the way up on up position or damage may occur to sipper or z-axis.
`Up`	Moves z-axis to upper most postion.

Table 13-1 Autosampler Commands

You can use these commands to determine if the CETAC autosampler is communicating and functioning properly. If more assistance is needed, please contact CETAC customer service.

ASXPRESS PLUS Commands

The *ASXPRESS PLUS* Rapid Sample Introduction System can be controlled through the same serial interface as the autosampler. *ASXPRESS PLUS* commands are prefixed with the "@" symbol.

Command	Description
@VER	Returns firmware version.
@SET_PERS-*n*	Sets the personality (autosampler compatibility) to *n*. See the note on the CD or on www.cetac.com for a list of personality numbers.

Table 13-2 *ASXPRESS PLUS* commands

This page is intentionally blank.

14 Safety and Regulatory Information

Review this product and related documentation to familiarize with safety markings and instructions before you operate the instrument.

Characteristics

Environmental Characteristics

Operating Temperature	+13° C to +30° C (+55° F to +85° F)
Non-Operating Temperature	+0° C to +55° C (+32° to +131° F)
Operating Altitude	Up to 2,000 m (6,562 ft)
Relative Humidity	0% to 60% non-condensing
Pollution Degree	Pollution Degree 2 Normally no pollution or only dry, non-conductive pollution occurs. The pollution has no influence. Occasionally, however, a temporary conductivity caused by condensation may be expected.

Table 14-1: Environmental Characteristics

For indoor use only.

Avoid sudden, extreme temperature changes which could cause condensation on circuit boards in the product.

See page 10 for information on chemical compatibility.

Electrical Characteristics

Power requirements

Power Supply	**Input:** AC Voltage, Frequency, and Current 100-240 V ~ 47-63 Hz 1.9 A Installation Category: CAT II (Line voltage in appliance and to wall outlet) **Output:** 24 V DC, 3.3 A
Electronics Module	**Input:** DC Voltage and Current ⎓ 24 V 3.3 A Installation Category: CAT I (Mains isolated) Use only with the provided power supply. **Output:** Connector for the valve/pump module.
Valve/Pump Module	**Input:** Use only with the provided electronics module. Installation Category: CAT I (Mains isolated)

Table 14-2: Power Requirements

Input and output connectors

All terminals allow a maximum current of 500MA @ 24VDC, unless otherwise noted.

External Pump	Reserved for future use. Connect only to a pump provided by CETAC Technologies for this purpose. (0-24 V DC power and control signals for an external peristaltic pump.)
Syringe Pump	Reserved for future use. Connect only to a pump provided by CETAC Technologies for this purpose. (0-24 V DC power and control signals for an external syringe pump.)
GUI COM (USB)	USB connection to a controller PC.
GUI COM (Serial)	RS-232 serial connection to a controller PC.
OEM COM (USB)	USB connection to a controller PC.
OEM COM (Serial)	RS-232 serial connection to a controller PC.
AUTOSAMPLER	RS-232 serial connection to an autosampler.

V/P Module	Control and 0-24 V DC power for the valve/pump module. Connect only to the provided CETAC valve/pump module, using the provided cable.

Table 14-3: Electrical Input and Output Connectors on the Electronics Module

Battery

CAUTION Replace only with a battery of the same type.

Battery description: CR2032 (3.0V, non-rechargeable lithium coin cell)

Safety Notices

WARNING	**If the equipment is used in a manner not specified by CETAC Technologies, the protection provided the equipment may be impaired.**

Repair or service that this not covered in this manual should only be performed by qualified personnel.

Power Cord Set Requirements

The power cord set supplied with your instrument meets the requirements of the country where you purchased the instrument. Power is supplied to the *ASXPRESS PLUS* through the included 24v power supply.

Power Cord Safety Maintenance

The operator should check the power/signal supply cord condition. The equipment should not be operated if the mains inlet is cracked or broken. Any obvious damage to the case (from a drop or fall) should be checked by service personnel for loose or damaged parts. See individual parts lists for approved replacement parts

Mains Disconnect

Power mains disconnect is accomplished by unplugging the power cord at the power supply or at the wall outlet. Ensure the power cord is easily accessible and removable, in the event of an emergency which requires immediate disconnection.

WARNING	**SHOCK HAZARD** **Ensure that power cord is disconnected before removal of any covers.**

Cleaning Instructions

For additional cleaning information, see "cleaning" in the index.

To clean the exterior surfaces of the instrument, complete the following steps:

1. Shut down and unplug the instrument.
2. Wipe the instrument exterior surfaces only using a towel dampened with a lab-grade cleaning agent.
3. Repeat step 2, using a towel dampened with clear water.
4. Dry the instrument exterior using a dry towel.

WARNING

SHOCK HAZARD
Do not allow any liquid to enter the instrument cabinet other than as intended through the specified tubing, or come into contact with any electrical components. The instrument must be thoroughly dry before you reconnect power, or turn the instrument on.

Operating Environment

WARNING

SHOCK HAZARD
To reduce the risk of fire hazard and electrical shock, do not expose the unit to rain or humidity. To reduce the risk of electrical shock, do not open the cabinet. All maintenance is to be performed by an Authorized CETAC Service Provider.
Protection provided by the equipment may be impaired if the equipment is used in a manner not specified by the manufacturer.

WARNING

SHOCK HAZARD
Equipment is not intended for wet locations. Miscellaneous liquids in the equipment could cause hazardous conditions.

WARNING

EXPLOSION HAZARD
Do not operate in an explosive atmosphere.

Explanation of Caution and Warning Notices

Warning symbol marked on equipment. This symbol means "Attention! Refer to the manual."

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

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

Avertissements en Français

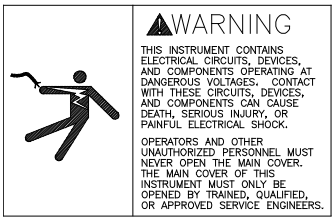
This section provides French translations of notices which may appear on the instrument or on other instruments used as part of the measurement system.

WARNING
FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE ONLY WITH FUSES OF THE SPECIFIED TYPE AND CURRENT RATING.

FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE ONLY WITH FUSES OF THE SPECIFIED TYPE AND CURRENT RATING.

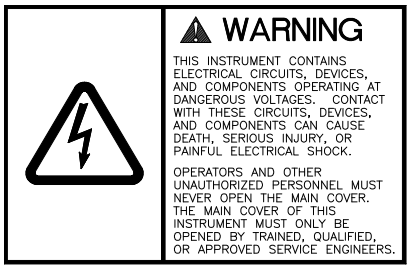
⚠ AVERTISSEMENT
POUR UNE PROTECTION CONTINUÉ CONTRE LES RISQUES D'INCENDIE, REMPLACER UNIQUEMENT PAR DES FUSIBLES DE MÊME TYPE ET AMPÈRAGE.

⚠ AVERTISSEMENT
TOUT CONTACT AVEC LES HAUTES TENSIONS PEUT ENTRAINER LA MORT OU DES BLESSURES SÉVÈRES. CE PANNEAU NE DOIT ÊTRE ENLEVE QUE PAR UN RÉPARATEUR QUALIFIÉ.



⚠ AVERTISSEMENT
TOUT CONTACT AVEC LES HAUTES TENSIONS PEUT ENTRAINER LA MORT OU DES BLESSURES SÉVÈRES. CE PANNEAU NE DOIT ÊTRE ENLEVE QUE PAR UN RÉPARATEUR QUALIFIÉ.

⚠ AVERTISSEMENT
TOUT CONTACT AVEC LES HAUTES TENSIONS PEUT ENTRAINER LA MORT OU DES BLESSURES SÉVÈRES. CE PANNEAU NE DOIT ÊTRE ENLEVE QUE PAR UN RÉPARATEUR QUALIFIÉ.



⚠ AVERTISSEMENT
TOUT CONTACT AVEC LES HAUTES TENSIONS PEUT ENTRAINER LA MORT OU DES BLESSURES SÉVÈRES. CE PANNEAU NE DOIT ÊTRE ENLEVE QUE PAR UN RÉPARATEUR QUALIFIÉ.

⚠ **WARNING**
HIGH LEAKAGE CURRENT
ENSURE PROPER GROUNDING

⚠ AVERTISSEMENT
COURANT DE FUITE ÉLEVÉ — FORNIR UNE MISE À LA TERRE EFFICACE.

Electromagnetic Interference

FEDERAL COMMUNICATIONS COMMISSION (FCC) NOTICE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential environment is likely to cause harmful interference, in which case the user will be required to correct the interference at his expense.

MODIFICATIONS

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by CETAC Technologies may void the user's authority to operate the equipment.

CABLES

Connections to this device must be made with shielded cables with metallic RFI/EMI connector hoods to maintain compliance with FCC Rules and Regulations.

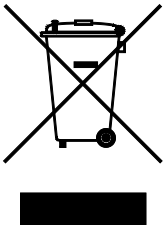
CANADIAN NOTICE

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus" ICES-001 of the Department of Communications.

AVIS CANADIEN

Cet appareil numerique respecte les limites de bruits radioelectriques applicables aux appareils numeriques de Classe A prescrites dans la norme sur le materiel brouilleur: "Appareils Numeriques," NMB-001 edictee par le ministre des Communications.

Explanation of Regulatory Marks



Do not dispose in domestic household waste.

The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste, in compliance with the European Waste Electrical and Electronic Equipment Directive (WEEE, 2002/96/EC).

For instructions on how to return end-of-life equipment, producer-supplied electrical accessories, or auxiliary items for proper disposal please contact the supplier or importer. In the event a supplier cannot be reached, contact CETAC Technologies customer service department at 1 (800) 369 2822.

CE

The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives.

15 Glossary

Analytical Instrument: The instrument, typically an ICP or ICP-MS, to which the *ASXPRESS PLUS* Rapid Sample Introduction System is connected.

ETFE: Ethylenetetraflouroethylene (Tefzel®).

FEP: Fluorinated Ethylene Propylene.

Host Computer:The computer that controls operation of the ICP / ICP-MS instrument to which the CETAC autosampler is attached, and through which the ASXPRESS PLUS is controlled.

Hz: Hertz

I/O Auxiliary Port: The connector used for establishing communication and power between the *ASXPRESS PLUS* system and the autosampler.

ICP/ICP-MS: Inductively Coupled Plasma/Inductively Coupled Plasma-Mass Spectrometer.

ICP Software: The measurement automation software on the host computer which controls the measurement system. In addition to controlling the spectrometer, this software sends commands to the autosampler so that samples are introduced at the right time. “ICP” in this context can refer to both Instrument Control Program and Inductively Coupled Plasma spectroscopy. Examples of ICP software include iTEVA™, WinLab32™, ICP-MS Expert™, and ChemStation™.

ID: Inside Diameter.

LED: Light-Emitting Diode.

Macro: The software in the electronics module which intercepts and acts upon autosampler commands.

Peristaltic Pump: An on-board pump controlling the movement of the rinse solution to the rinse station o the autosampler.

PPS: Polyphenylene sulphide.

PTFE: Polytetraflouroethylene.

Rinse Solution: The solution used to clean the sample probe.

Sample Loop: The loop of tubing, of predetermined length/volume, which holds the precise sample volume specific to the users unique analytical system requirements.

Sample Probe: The tube that moves the analyte from the sample vial to the sample transfer tubing.

Rabbit Board: The Rabbit-branded microcontroller board inside the electronics module.

Rinse Station: The autosampler component used to clean the sample probe with a rinse solution.

Six-Port Valve: The valve which provides the switching action between "Load Sample" and "Inject/Rinse" modes of the *ASXPRESS PLUS* Rapid Sample Introduction System.

UHMW-PE: Ultra-High Molecular Weight PolyEthylene.

Vacuum Pump: The pump by which the sample is drawn into the sample loop, and by which rinse solution is passed through the sample loop and associated tubing.

VDC: Volts Direct Current.

Index

Manual Part Number **480167** Rev 6

Printed in USA

14306 Industrial Road, Omaha, NE 68144 U.S.A
Tel: 1.800.369.2822 or 1.402.733.2829; Fax: 1.402.733.5292
Email: sales@cetac.com; website www.cetac.com