SP8800/8810 LC Pump
Operators Manual

Spectra-Physics

Part Number
A0099-235 9/88 D

SP8800/8810 HPLC Pump Consumables and Spare Parts

RECOMMENDED SPARE PARTS

	Part Number
Maintenance Kit	A3197-010
(Contains all the items that may be necessary to maintain the pump in normal usage for one year.) Includes:	
Chrome Pistons (2)	A2964-010
Piston Seals (6)	A2962-010
Inlet Check Valve	A1595-020S
Outlet Check Valve	A1590-020S
Crossover Tube Assembly	A2945-010S
Transducer Tube Assembly	A3118-010S
Kel-F Seals (6)	A2973-010
Inlet Filters (3)	A0574-010
Piston Seals (pack of 10)	A3070-010
Helium Sparger	A0369-010
Pump Spring	A2993-010

OPTIONS

Inlet Liquid End	A2981-010S
Outlet Liquid End	A2982-010S
Sapphire Piston Kit	
Includes 2 Sapphire Pistons, plus:	
Piston Seals (2)	A2962-010
Backup Seals (2)	A2963-010
Solvent Tray	A3190-010
Semi Prep Kit	A3091-010
(above includes Inlet and Outlet Liquid Ends and Check Valves)	
Column Bypass Valve with Bracket	A3112-010
RS-232-C Module	A3115-010
System Organizer	A3180-010
Accessory Kit to Organizer	A3189-010
SP8800 or SP8810 Inert Titanium Pump	

SP8800/8810 Operators Manual
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Section 1
Installation

INTRODUCTION

The SP8800 Series Pumps have been designed for ease of use and unsurpassed performance. They can be used as standalone pumps or as modules in a totally automated LC system. The SP8800 offers low pressure ternary mixing that provides accurate proportioning of binary or ternary mobile phase compositions in either the gradient or isocratic mode. The Isocratic SP8810 Pump offers all of the features and performance of the SP8800, except that the ternary proportioning valve, associated electronic circuitry and software are not included.

These pumps permit as many as 40 lines of programming in each of 10 method files, which are sufficient for even the most complex of gradient profiles.

The built-in Startup File can be used to transform the pumps into true turn-key systems. The Startup File remains resident in the unit even with the power switched off, and is automatically reloaded whenever the power switch is turned on. Simply turn the pump power switch on and press [INITIALIZE] and [ENTER] for chromatography to begin. Information on "Proper Use of the Startup File" is presented in Section 3 for the SP8810 and Section 4 for the SP8800).

The pumps are engineered for reliability and ease of maintenance. These pumps are designed to make proper maintenance of the pump easier than ever to ensure that your chromatography results are accurate and remain accurate. A built-in Maintenance Log (refer to Section 6) allows you to follow the lifespan and wear of specific parts (seals, pistons, and check valves) and alerts you whenever routine maintenance is scheduled.

Another standard feature is the ability to automatically initiate a Cleanup File (refer to Section 3 for the SP8810 and Section 4 for the SP8800) at the end of the run to flush out the system and clean the column. Should service ever be required, the resident

diagnostics and modular design of these pumps will reduce down-time to the absolute minimum. The simplicity and durability of the pumps translate into fewer service calls and a minimum of spare parts that need to be kept on hand.

The Flow Stability Test, described under "Monitoring the Pump Performance in Section 3 (for the SP8810) and Section 4 (for the SP8800), greatly enhances your ability to track the pump performance. The test can be run either continuously or automatically prior to each injection with the results documented on every integrator report.

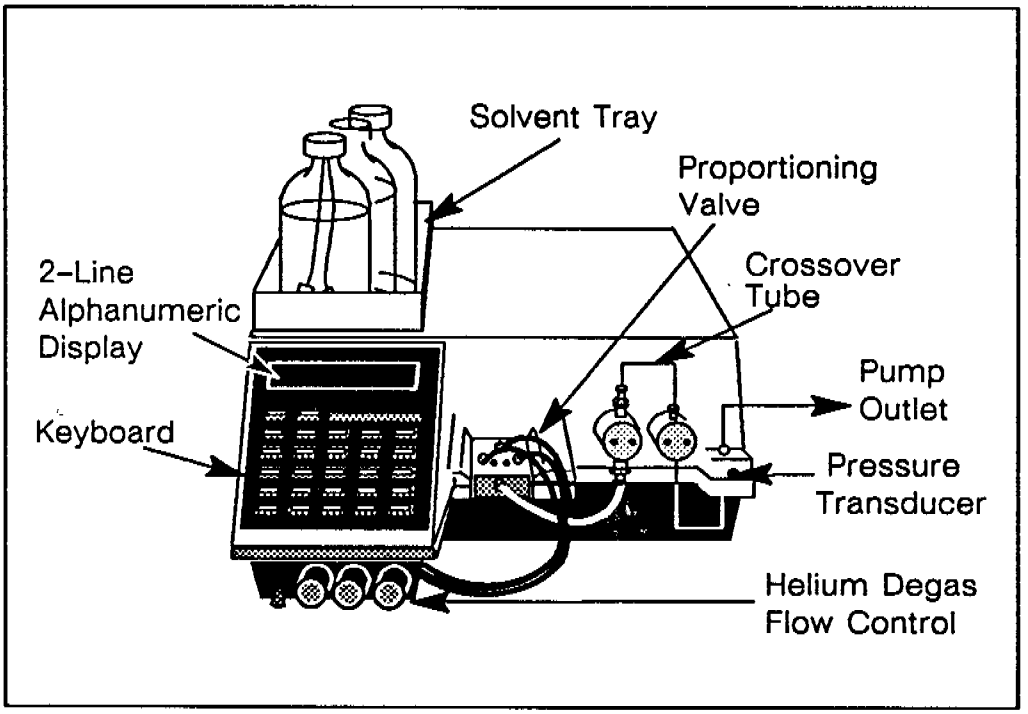

Fig. 1.1 The SP8800
Ternary LC Solvent Delivery System

INSPECT YOUR INSTRUMENT

When you receive your pump, inspect the package for evidence of damage. If any is found, have the carrier note this condition on both the delivery receipt and the freight bill. The carrier is responsible for damage incurred during shipment.

After unpacking, inspect your pump and its accessories for parts shortages and/or physical damage. If damage is found, notify both the carrier and your Spectra-Physics representative. Please DO NOT return any goods without prior authorization (either a Re-

turned Goods Authorization or Returned Materials Authorization number) from a Spectra-Physics representative.

Accessory Kit

An accessory kit is supplied with each pump and includes the following tools and parts.

Parts included in Both SP8800 and SP8810 Kits

Quantity	Description
1	SP8800/8810 Operators Manual
1	External Function Plug
1	20 mL Priming Syringe
1	Luer-Lock Syringe Adapter
1	Hex/Ball Wrench
1	Stainless Steel Nut and Ferrule
1	Power Cord
1	Fuse (The power cord and fuse are specific for regional power requirements.)

Additional Parts in SP8800 Kit

3	1-liter Solvent Bottles
3	Solvent Bottle Cap and Tubing Assemblies
1	Plastic Spiral Wrapping for Solvent Tubes
1	Solvent Bottle Tray
1	Column Bypass Valve (center port)
1	Filter/Mixer
1	Bypass/Filter Mounting Bracket
2	6 1/2 inch Stainless Steel 1/16-inch OD (.02-inch ID) LC Tubing
1	10 1/2 inch Stainless Steel 1/16-inch OD (.02-inch ID) LC Tubing
2	Cap Screws
2	Phillips Head Screws, 3/8 inch
2	Split Lock Washers
2	Piston Seals
2	Kel-F Seals
1	10-feet, 1/16-inch Teflon Tubing

Additional Parts in SP8810 Kit

1	Solvent Tube and Inlet Filter

Options Available

The chrome-plated stainless steel pistons shipped standard in SP8800 Series Pumps have been exhaustively tested and found to perform better than sapphire pistons for most LC applications. However, the optional Sapphire Pistons Kit provides alternative pistons for specialized applications. The kit should be used if you are experiencing short seal or piston life due to highly buffered or low pH mobile phases.

The backup seal included in the Sapphire Pistons Kit need only be used when buffered solvents are in use. This seal provides a means of keeping the low pressure side of the piston seal wet. This prevents buffer salts from crystallizing on the piston surface and forming a ridge, which can cause piston seal failure within a short period of time.

NOTE: Backup seals are not available for the chrome-plated stainless steel pistons. The chrome-plated pistons cannot be backflushed.

The sparge tubing, provided as a standard item for the gradient pump, is available as a degasing option for the isocratic pump.

Spectra-Physics supplies a variety of options for your SP8800 Series LC Pump and accessories for all your LC needs. For a partial listing of available options for your pump, please refer to Appendix B or contact your Spectra-Physics representative.

VERIFY VOLTAGE SETTING

The pumps are configured from the factory for either 115 or 230 VAC operation depending upon the country of destination. Check the label on the rear of the instrument to ensure the proper voltage setting for your area (Fig. 1.2). If the indicated voltage setting on the rear label is not consistent with your area, DO NOT CONNECT THE POWER CABLE! Contact your Spectra-Physics representative.

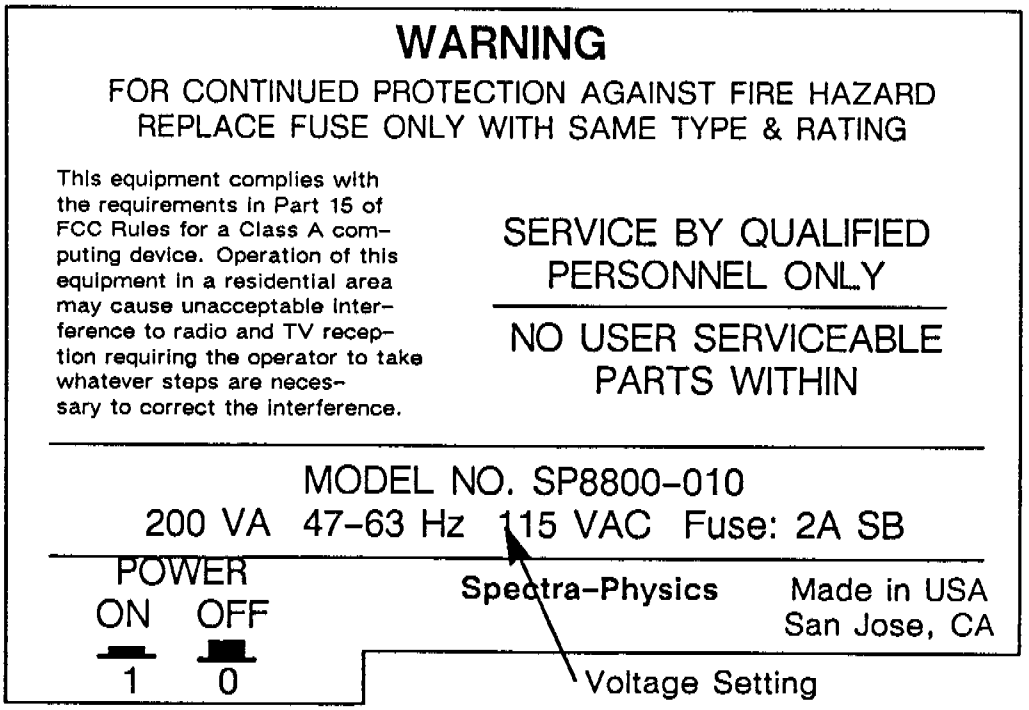

Fig. 1.2 Label Indicating Voltage Setting

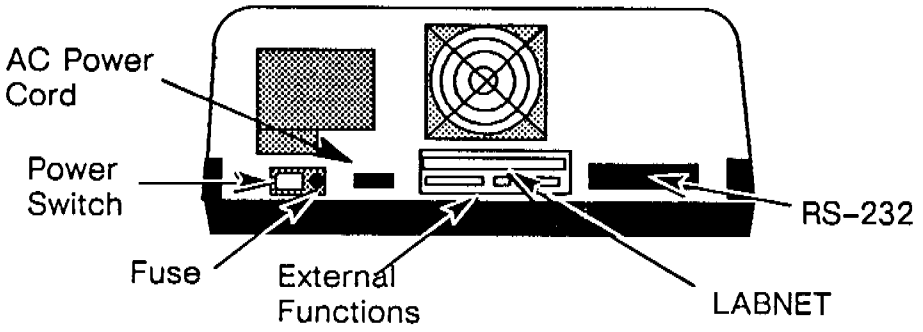

Fig. 1.3 Rear Panel of SP8800/8810

CHECK INITIAL RESPONSE TO POWER ON

Place the pump on a level surface leaving enough room behind the instrument for good air flow and access to electrical connections. Locate the AC power cord and attach it to the AC power connector on the rear of the instrument (Fig. 1.3). Plug the power connector into an appropriately grounded power outlet.

WARNING: For safe operation and optimum performance, the pump must be connected to a properly grounded power receptacle.

"Turn the power on by pressing the Power Switch (refer to Fig. 1.3). The fan starts and the display on the keyboard show:

SP8800 FILE 1 LOADED UNIT 1

or for the Isocratic version:

SP8810 FILE 1 LOADED UNIT 1

In some versions the UNIT 1 designation may be omitted.

This screen indicates that the Startup File was activated when the unit power was turned on and then loaded into File 1. Subsequent Startup Files are loaded into the files from which they were saved (see Section 3 for "PROPER USE OF THE STARTUP FILE"). Pressing any of the function keys clears this message.

If these messages do not appear as written, contact your Spectra-Physics representative.

NOTE: If the pump has been turned off for an extended period of time, the fluorescent display may require 2 hours warmup to regain full brightness, which is typical for fluorescent displays.

CONNECTION AND PREPARATION OF SOLVENTS

General

The pump is shipped with methanol in the pump heads and connecting tubings. Your desired solvent *must* be miscible with methanol or the pump *must* first be flushed with an intermediary solvent (refer to the table on solvent miscibility in Section 6).

SP8810 Isocratic Pump

NOTE: The following two steps apply only to the isocratic pump:

1) **Connect the Solvent Bottle**

Find a safe, convenient place to set the solvent bottle. The top of the pump may be used, since it is constructed of materials which are highly resistant to solvent attack. However, to protect against spillage or bottle breakage, the solvent bottle should be placed in an appropriate secondary container and properly secured. Insert the solvent tube and inlet filter into your solvent bottle.

2) **Degas the Solvent**

All solvents used in high performance liquid chromatography should be filtered through a 2-micron (or less) fluorocarbon filter and degassed before use to prevent dissolved gases from coming out of solution and disturbing the chromatographic performance.

Fill the solvent bottle with the desired solvent. The initial degas of the solvent can be done in any of three ways.

- Air can be removed by sparging the solvent with helium (which is an inert gas) – refer to "Helium Sparging" later in this section.
- The solvent bottle filled with solvent can be placed in an ultra–sonic bath while pulling a slight vacuum from a water faucet aspirator for approximately 5 minutes.
- A 0.5–micron sintered glass vacuum filter can be used. This technique ensures that the solvent is properly filtered as well as degassed.

To continue installation of the isocratic pump, please refer to "PRIME THE PUMP" further in this section.

SP8800 Ternary Pump

NOTE: The three steps below apply only to the gradient pump unless the Degassing option is purchased for installation on the isocratic pump. In this case, the first two steps also apply to isocratic pump installation.

1) **Connect the Helium Sparging Tubing**

The sparge tubing (Fig. 1.4) attaches to the quick-connect fittings on the gas manifold on the underside of the front of the pump (Fig. 1.5). Remove the solvent bottles and solvent tubing assemblies from the Accessory Kit and position the pump and solvent bottles in their desired locations. Fasten the helium sparge line from each solvent bottle to the corresponding helium manifold extender tube. Tighten end coupling firmly by hand. DO NOT use a wrench on this type of fitting. The extender couplers are marked for ease of identification. Attach the helium supply line and its extension in the same manner.

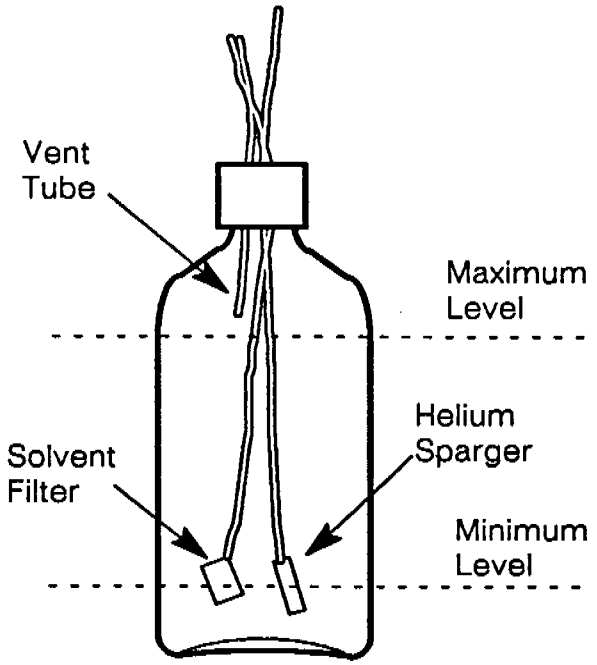

Fig. 1.4 Solvent Bottle and Cap Assembly

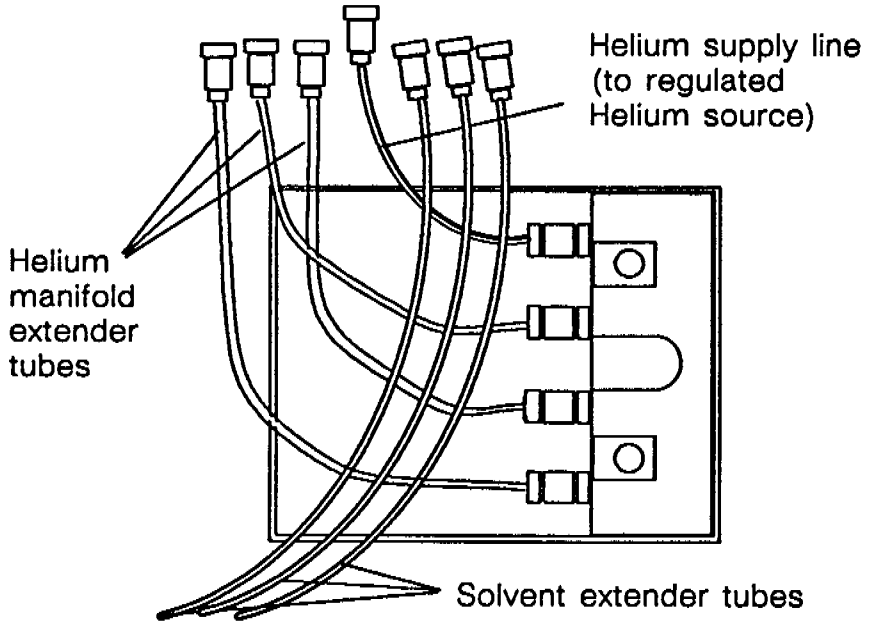

Fig. 1.5 Helium Connections to the Gas Manifold (on underside of pump)

Attach the other end of the helium supply line to a helium source regulated at about 10 psi and turn on the gas supply. The helium

supply to each bottle can now be controlled from the front of the pump as shown in Fig. 1.6.

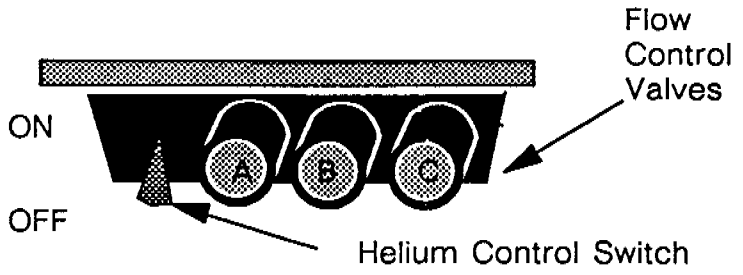

Fig. 1.6 Gas Manifold Valve Controls

WARNING: DO NOT USE THE HELIUM CONTROL VALVES to turn off the helium sparging. Use the helium control switch. The switch automatically vents the helium sparge lines and thereby prevents solvent from diffusing into the helium sparging tubing.

Place the three solvent bottles in a safe, convenient location at or above the elevation of the pump. The top of the pump may be used since it is constructed of materials that are highly resistant to solvent attack. However, to protect against spillage or bottle breakage, the solvent bottle should be placed in an appropriate secondary container and properly secured. The use of the solvent tray shown in Fig. 1.1 is recommended, since it prevents the bottles from accidentally tipping over and retains the spillage if a bottle is broken.

Fill each bottle with the desired solvent and secure the bottle cap. Attach the A, B, or C label to each solvent bottle cap to identify it. Each solvent line must be attached to its corresponding extender tube, which is connected to the appropriate ternary mixing valve port: A, B, or C. Pass the extender tubes through the slot underneath the keyboard alongside of the helium sparging tubing.

2) **Start Helium Sparging**

With solvent in the bottles and the sparge tubing connected, turn on the helium supply and set the tank pressure regulator to 10 psi. Push up the helium control switch (refer to Fig. 1.6) on the front of the gas manifold. To start helium flowing, turn the appropriate

knobs (A, B, or C) counter-clockwise until the solvent is bubbling vigorously (approximately 20 – 30 mL/min). Sparge at this high helium rate for about 10 minutes to purge all the air form the bottles, then reduce the flow to a trickle (approximately 5 mL/min).

NOTE: The solvent bottle caps should be checked periodically to ensure that a tight fit is maintained. To prevent air from diffusing back into the bottles, use a small, positive helium flow and make sure that all vent lines are in place. (Preferably, the end of the vent lines should be lower than the bottle.) Placing the vent line ends in a small amount of liquid allows easy verification of positive helium flow.

3) Install Filter/Mixer, Bracket, and Column Bypass Valve

Included with your gradient pump is an in–line filter/mixer and column bypass valve. They are conveniently mounted using the bracket provided. The bracket mounts easily and allows unrestricted access to pump heads and fluid connections. Pump maintenance is not hampered in any way. Use of the bypass valve allows you to easily prime and purge the pump at a high rate without putting your column at risk. Solvent reservoir changes can be made quickly and easily.

The in–line filter/mixer provides downstream protection of injectors and columns while further increasing the pump's mixing capabilities. The 2–micron filter element is easily replaced when needed.

Installation

a. Install the column clip onto the bracket using the 1/2–inch screws supplied. Press the filter/mixer into position on the column clip (Fig. 1.7). Note that the larger end (inlet) faces toward the right rear of the pump when installed.

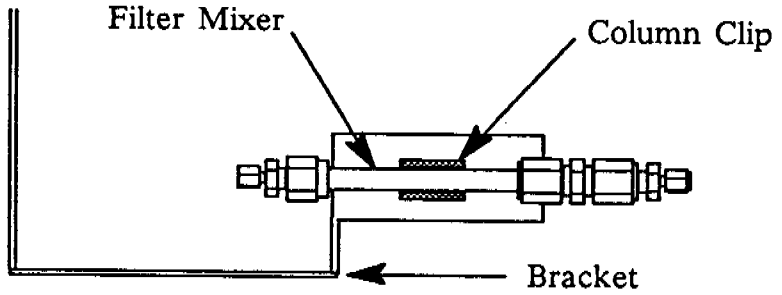

Fig. 1.7 Filter/Mixer Clip with Filter/Mixer Installed

b.. Attach the bracket to the front bezel of your pump using the supplied phillips-head screws and split-lock washers (Fig. 1.8).

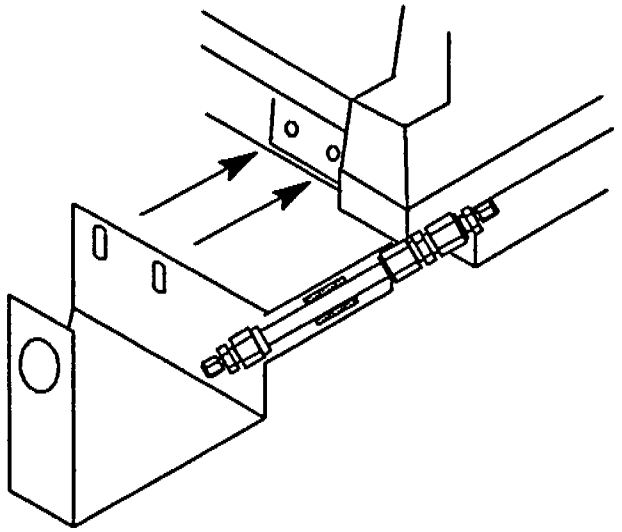

Fig. 1.8 Attaching Bracket

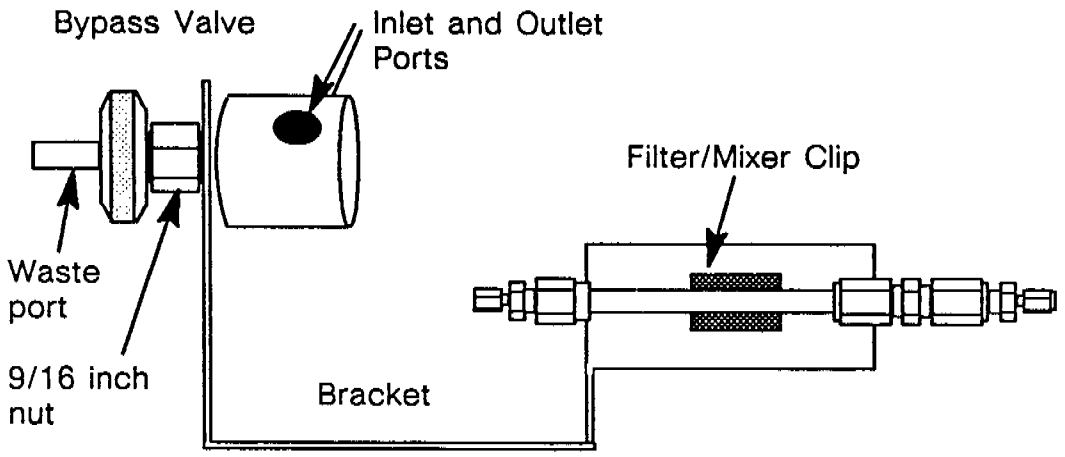

Fig. 1.9 Components Mounted on the Bypass Valve Bracket

c. Loosen the 9/16-inch valve nut.
d. Place the bypass valve into the bracket with the inlet and outlet ports facing up (Fig. 1.9) and attach it securely by tightening the 9/16-inch nut.

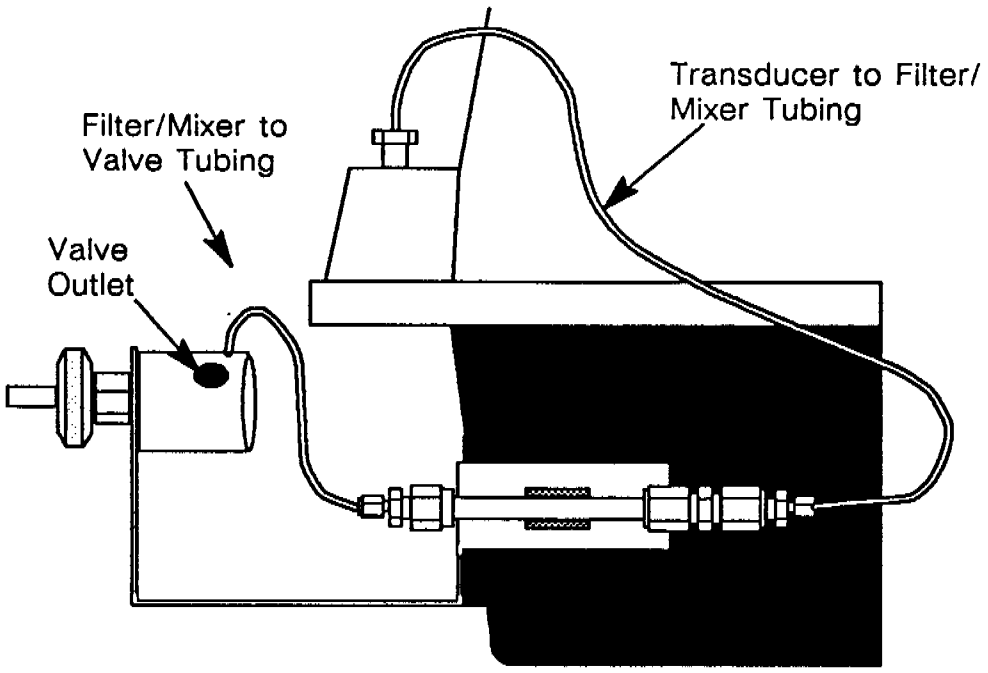

Fig. 1.10 Routing of the Tubing

Make Tubing Connections

e. Place the 1/16-inch male compression fitting with ferrule onto the piece of 10 1/2-inch stainless steel tubing supplied (1/16-inch OD). Insert them into the outlet of the pressure transducer. Tighten the compression fitting initially 3/4 turn after fingertight to make a leakfree connection.

f. Connect the other end of the tubing from the pressure transducer to the inlet of the filter mixer (the end furthest from the front of the pump), making the connection as described in step e. above.

g. Use one piece of the 6 1/2-inch tubing to connect the outlet of the filter mixer (the end closest to the Bypass valve) to the inlet of Bypass valve (upper left opening).

h. Use the second piece of 6 1/2-inch tubing to connect from the outlet of the bypass valve to the next device in your LC system.

Use of the Bypass Valve

a. To bypass solvent flow from your column or to prime the pump, open the valve one turn counter clockwise.
NOTE: Unless you are using a syringe to prime your pump (see Fig. 1.11), you will need to connect a waste line to the

waste port as described under *Purging the Pump (with Column Bypass Valve Installed)*.

b. To allow solvent to flow through the column, close the valve by turning clockwise until the valve stem seats. Do not overtighten the valve. A light touch is all that is necessary.

PRIMING AND PURGING PUMPS

Priming the Pump (with Column Bypass Valve Installed)

NOTE: This procedure applies only to pumps which have a column bypass valve installed.

Connect the 20 cc luer tip priming syringe to the waste/prime port of the column bypass valve (Fig. 1.11). Position a beaker nearby to collect the syringe discharge, since two or three syringe volumes may be needed to fully prime the pump. Create a pump Edit File that contains equal proportions of all solvent lines connected (A, B, and/or C); refer to the "Brief Instructions on Creating a Run File" in Section 4 (SP8800) for more detailed instructions. Make sure that the syringe is fully depressed and that the connections are air tight.

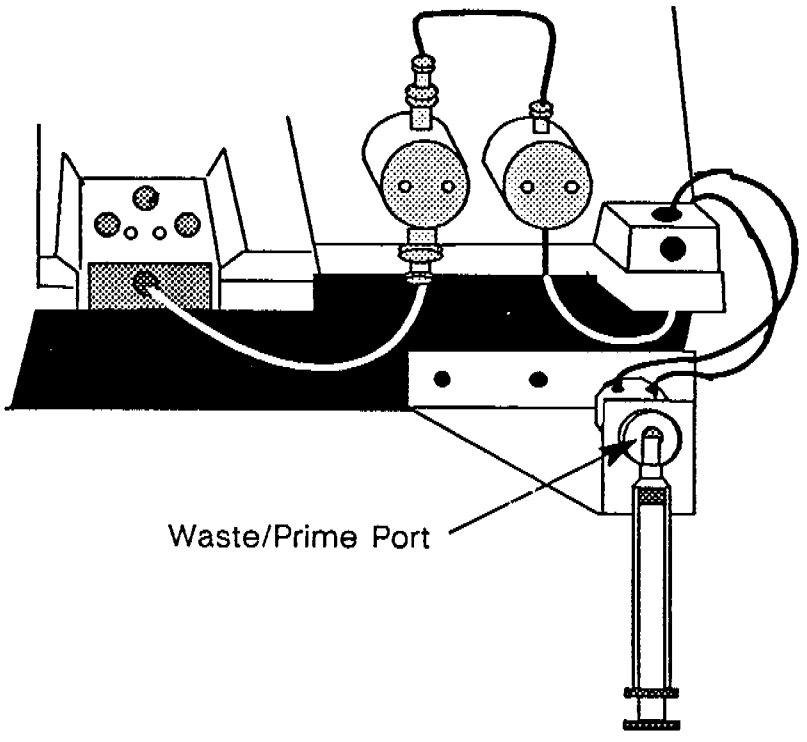

Fig. 1.11 Priming the Pump

Open the bypass valve by turning the knob one turn counterclockwise. Press [PURGE], enter the created file number, then press [ENTER] to initiate a purge cycle on the pump for the desired file.

CAUTION: The pump's proportioning valve will not allow solvents to flow when the pump is stopped. Initialize or purge a file to allow solvent flow.

Slowly draw back on the syringe to create a small vacuum on the solvent lines to draw the solvent from the solvent bottles into the pump heads. If the syringe fills with air prior to the solvents reaching the pump head, then the syringe must be temporarily disconnected at the luer-lock fitting, emptied into the nearby beaker, and reconnected to finish drawing the solvents into the pump head.

Purging The Pump (with Column Bypass Valve Installed)

Once the pump has been primed, close the column bypass valve gently and disconnect the syringe. Install the waste tubing using the luer–lock adapter and 1/16–inch Teflon tubing. Route the tubing to an appropriate waste container. Open the bypass valve 1 turn and allow the pump to purge until all air has been removed from the solvent lines leading into the ternary valve (if gradient) and the pump heads. Typically about 10 mL or about 1 minute is enough. The solvent inlet filters inside each solvent bottle should be in a vertical position to ensure that air within the filter will not be trapped. Stop the pump and continue with the installation procedure.

Priming the Pump (without the Column Bypass Valve)

Remove the crossover tube from both liquid ends (Fig. 1.12). Connect the 20 cc priming syringe fitted with the luer-lock adapter (provided in the Accessory Kit) to the outlet from the LC pump outlet check valve (see Fig. 1.12). Position a beaker nearby to collect the syringe discharge, since two or three syringe volumes may be needed to fully prime the pump. Create a pump Edit File that contains equal proportions of all solvent lines connected (A, B, and/or C); refer to the "Brief Instructions on Creating a Run File" in Section 3 for more detailed instructions. Make sure that the syringe is fully depressed and that the connections are air tight.

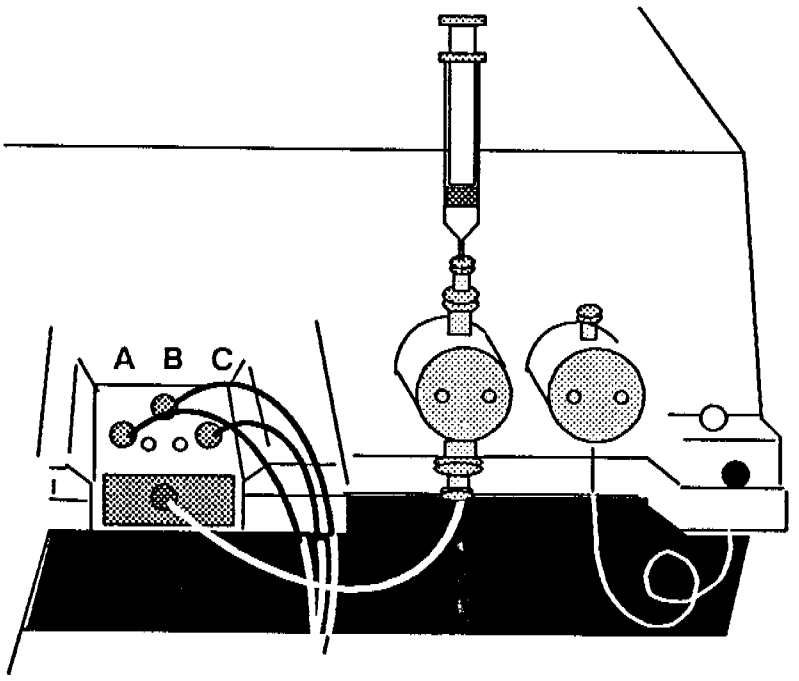

Fig. 1.12 Priming the Pump (without Bypass Valve)

Press PURGE, enter the created file number,then press ENTER to initiate a purge cycle on the pump for the desired file. Slowly draw back on the syringe to create a small vacuum on the solvent lines to draw the solvent from the solvent bottles into the pump heads. After one of the solvent lines has circulated through the pump head, the pump should be able to finish priming the remaining lines by itself. If the syringe fills with air prior to the solvents reaching the pump head, then the syringe must be temporarily disconnected at the luer-lock fitting, emptied into the nearby beaker, and reconnected to finish drawing the solvents into the pump head.

Purging the Pump (without the Column Bypass Valve)

Once the pump has been primed, disconnect the syringe from the outlet check valve and reconnect the crossover tube. Tighten the fitting finger-tight, the 1/4 turn pat finger-tight using a 1/4-inch open-end wrench. Allow the pump to purge into a beaker until all air has been removed from the solvent line leading into the pump heads. Typically about 10 mL or about 1 minute is enough. The solvent inlet filters inside each solvent bottle should be in a vertical

position to ensure that the trapped air within the filter is removed. Stop the pump and continue with the installation procedure.

SYSTEM INSTALLATION KIT

A System Installation kit is available that provides all the necessary tubings and fittings for the proper connection of the various components in your HPLC system. An *LC Systems Manual* is included with the kit which shows recommended system configurations.

NOTE: Overtightening an LC fitting will deform the fitting and cause a leak. A standard LC fitting, consisting of a nut and ferrule, should be tightened finger-tight, then tightened an additional 1/4 turn using an appropriately sized wrench.

Installation of a Dynamic Mixer (Gradient Pump Only)

For the majority of applications, a dynamic mixer is NOT needed. The pump stroke on the SP8800 is only 60 microliters and is designed to provide efficient mixing for the microliter volumes proportioned with its ternary proportioning system. However, for some applications, a dynamic mixer may be required. Connection to your system should be in accordance with the assembly instructions included with the mixer, or refer to Appendix B.

Installation of the Injection Valve

Using the precut tubing provided in the accessory kit, follow the manufacturer's instructions for the proper connection of the LC pump to your manual injection valve or to your autosampler. If the tube length provided is too short, any LC tubing with an internal diameter of .020 inches or less could be substituted. However, care must be taken to ensure that the tubing ends are properly cut and polished. For small-bore or short-column applications, we recommend purchasing precut lengths of LC tubing. Contact your local Spectra-Physics representative for information on the variety of precut lengths and internal diameters available.

Connecting the Column

The trend toward shorter columns with smaller packing diameters places very stringent requirements upon the types of fittings and tubings used. Special care should be taken to ensure that all fittings and tubing have very low dead volume to prevent peak broadening

as the sample enters or leaves the column, and that the tubing is properly cut and fitted into the connectors. Always connect the column with the eluant flow in the direction indicated on the column label; not all columns are reversible. Spectra-Physics has a variety of columns available with different packings, internal diameters and lengths. (Contact your local Spectra-Physics representative.)

SYSTEM CONFIGURATION

The pumps have external function controls, RS-232-C and LAB-NET (Spectra-Physics local area network) communications capabilities to enable the inclusion of the pump into a Spectra-Physics Modular LC System or any system of your choice. For more details, please refer to Section 8.

Spectra-Physics' Universal System Organizer (part number A3180-010) can be used to generate many custom system layouts of your choice. The Organizer adjusts in height, has an optional sliding bracket capable of mounting all popular manual injector or bypass valves, and can be stacked. The system shown in Fig. 1.13 contains an SP8800 Ternary Proportioning Pump, SP8780 Autosampler, SP4270 or SP4290 Computing Integrator, SP8450 Variable Wavelength UV-Vis Detector, and SP8790 Column Oven Controller, all in 44 inches of linear bench space.

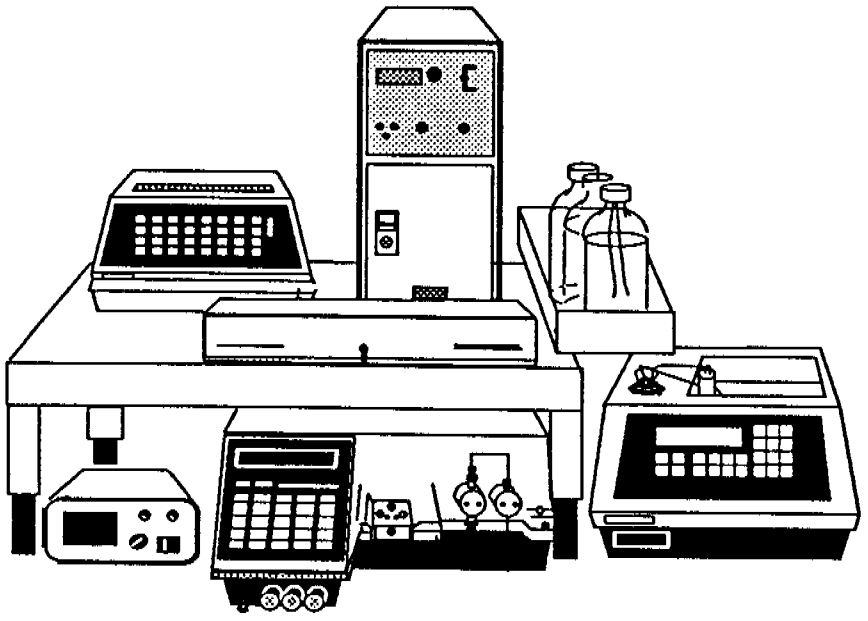

Fig. 1.13 A Spectra-Physics Modular LC System

Section 2
Keyboard Overview