DIONEX

IP25 ISOCRATIC PUMP
OPERATOR'S MANUAL

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1 • Introduction

1.1 Overview

The IP25 Isocratic Pump is an integral part of a Dionex chromatography system. It is a microprocessor-based, dual-piston, variable-speed, isocratic delivery system designed to pump mobile phase components at precisely controlled flow rates. A Digital Signal Processor (DSP) provides high speed control of pump flow and pressure.

The IP25 can operate as a stand-alone product or with other Dionex modules as part of a complete chromatography system. It can also be used with non-Dionex modules that meet interface requirements for software, TTL, or relay control.

The IP25 can be controlled locally using the front panel keypad and display, or from a remote host computer with a Dionex DX-LAN™ interface installed and PeakNet software installed on the host computer. Limited remote control is also available from any device capable of providing compatible TTL signals to control the pump.

The pump's two basic modes of control, Direct control and Method control, enable it to operate with or without reference to time-based events.

The IP25 is available in four versions. An optional vacuum degas pump is available for all versions:

IP25 Isocratic Pump Version	With Degas Pump	Without Degas
Standard bore with PEEK components	P/N 054047	P/N 054046
Standard bore with stainless steel components	P/N 054422	P/N 054421
Microbore with PEEK components	P/N 054048	P/N 054049
Microbore with stainless steel components	P/N 054428	P/N 054423

1.2 About This Manual

Chapter 1, **Introduction**, introduces the product, the conventions used in the manual, and provides safety information.

Chapter 2, **Description**, is a description of the physical aspects of the pump, followed by a description of the operating features.

Chapter 3, **Operation and Maintenance**, discusses the operating features and methods, and presents several examples of how to run methods. Routine preventive maintenance requirements are included in this chapter.

Chapter 4, **Troubleshooting**, lists possible causes of problems and provides step-by-step procedures to isolate and eliminate their sources.

Chapter 5, **Service**, presents step-by-step instructions for service and parts replacement routines.

Appendix A, **Specifications**, contains the IP25 specifications and installation site specifications..

Appendix B, **Installation**, describes the installation steps necessary to place the IP25 Isocratic Pump into operation.

Appendix C, **User Interface**, illustrates and describes all front panel menus and screens.

Appendix D, **Relay and TTL Control**, describes the relay and TTL input and output functions and provides setup examples.

1.2.1 Typefaces

Typefaces are used in this manual as follows:

- Capitalized bold type indicates a front panel button:

  Press **Enter** to begin running the method.

- Upper-case bold type indicates the name of a screen, the name of a menu, or an on-screen entry:

  Go to the **METHOD** screen.

  Move the cursor to the **EDIT** field.

1.2.2 Safety Messages and Notes

The IP25 meets European, EMC, and safety requirements per Council Directives 73/23/EEC and 89/336/EEC, EN 61010-1:1993 (safety), EN 50082-1:1992 (susceptibility), and EN 55011:1991 (emissions). The TUV/CE and GS safety label on the IP25 attests to compliance with these standards.

The IP25 is designed for ion chromatography and HPLC applications and should not be used for any other purpose. If there is a question regarding appropriate usage, contact Dionex before proceeding.

This manual contains warnings and precautionary statements that, when properly followed, can prevent personal injury to the user and/or damage to the IP25. Safety messages appear in bold type and are accompanied by icons.

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Indicates that the function or process of the instrument may be impaired. Operation does not constitute a hazard.

Informational messages also appear throughout this manual. These are labeled NOTE and are in bold type:

NOTE
NOTES call attention to certain information. They alert the user to an unexpected result of an action, suggest how to optimize instrument performance, etc.

1.2.3 Symbols

The symbols below appear on the pump, or on pump labels.

Alternating current

Protective conductor terminal

Power supply is on

Power supply is off

1.3 Related Manuals

During installation and operation of the IP25, you may need to refer to one or more of the following manuals (depending on your system) for information about other modules and components included in a DX 500 system.

The following manuals are included with their respective modules or components:

- *AS40 Automated Sampler Operator's Manual* (Document No. 034970)
- *CD20 Conductivity Detector Operator's Manual* (Document No. 034854)
- *ED40 Electrochemical Detector Operator's Manual* (Document No. 034855)
- *E01 Eluent Organizer Installation Instructions* (Document No. 034582)
- *Pressurizable Reservoir Installation Instructions* (Document No. 034851)
- *LC10 Chromatography Organizer Operator's Manual* (Document No. 034858)
- *LC20 Chromatography Enclosure Operator's Manual* (Document No. 034859)
- *LC30 Chromatography Oven Operator's Manual* (Document No. 034860)

The following manual is included in the IP25 Ship Kit:

- *Installation of Dionex Ferrule Fittings* (Document No. 034213

2 • Description

The IP25 Isocratic Pump consists of two single-unit Dionex chromatography enclosures (see Figure 2-1). The upper unit houses the electronic components, and the lower unit houses the pump heads and other mechanical pump assemblies.

The IP25 is designed to have other single- or dual-unit modules stacked on top of it, to a maximum of four units. See Section B.5 for the recommended stacking configuration for Dionex chromatography systems.

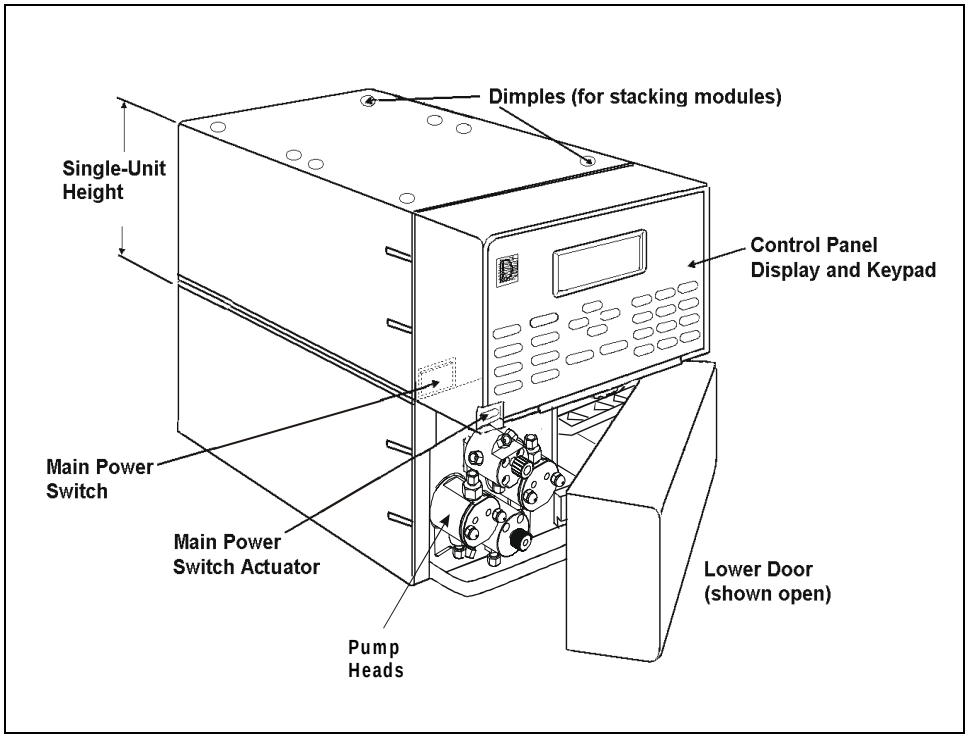

Figure 2-1. IP25 Enclosure

2.1 Front Control Panel

The control panel on the upper door of the IP25 enclosure contains the liquid crystal display (LCD), the membrane keypad, and the actuator for the main power switch (see Figure 2-2). The door opens to provide access to the electronics chassis, described in Section 2.2.

Screen Contrast

Information is displayed on the LCD, also called the *screen*. To adjust the screen contrast, use the knurled knob in the recess below the keypad (see Figure 2-2).

Tilt Panel

To maximize visibility, the front control panel can be tilted to four different positions. To tilt the panel, support the door at the left side (to prevent it from opening) and lift firmly on the tab in the middle of the recess below the keypad (see Figure 2-2). Push on the tab to return the panel to its vertical position.

Power Switches

The main power switch is on the bulkhead behind the upper door (see Figure 2-1). An actuator for the main power switch is on the outside of the front door, at the lower left corner (see Figure 2-2). The actuator functions only when the door is fully closed.

When the door is open, press the main power switch on the bulkhead, instead of the actuator, to turn the module off and on.

To prevent damage to the pump circuitry and components, always wait at least 15 seconds after powering down before turning on the power again.

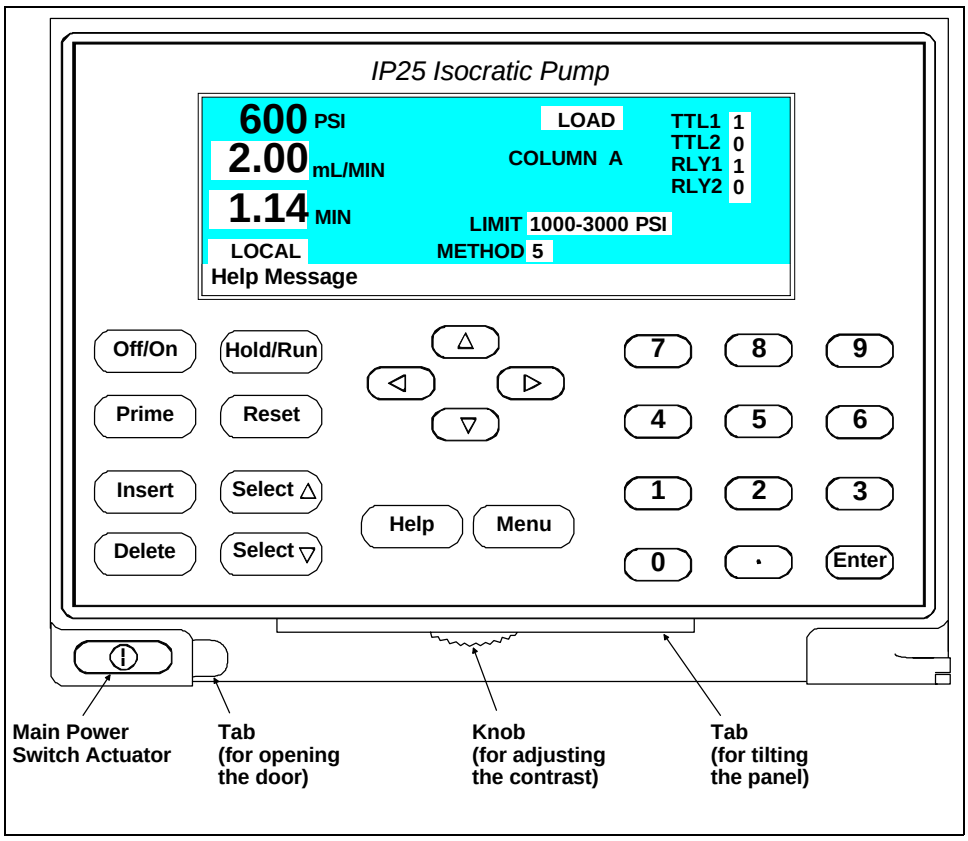

Figure 2-2. IP25 Display and Keypad Layout

2.1.1 Control Panel Keypad

The keypad is used to directly control pump operation, as well as to create and modify programmed series of timed events, called *methods*. In summary:

- Press **Menu** to display a list of available screens.
- In the screens, only the fields shown in reverse video can be edited. Other fields display information only.
- To edit a field, use the four directional arrow buttons to position the cursor in the reverse video fields. Use the numerical buttons to enter variable values. Use the

Select Δ and **Select** ∇ buttons to choose between predetermined options. Pressing a **Select** button increases (or decreases) a numerical value by one, while holding down a **Select** button increases (or decreases) a numerical value continuously.

- Press **Enter** or a cursor arrow button to execute the selected value.

A high-pitched beep sounds when you press a button. When an error occurs, this beep is lower in frequency. The beeps can be disabled from the **MODULE SET-UP** screen (see Section C.1.4).

Off/On

Turns the pump motor off and on.

In Direct control (see Section 2.8), turning on the motor causes it to pump using the displayed eluent and flow rate.

In Method control (see Section 2.8.2), turning on the motor causes it to pump using the eluent and flow rate for the elapsed time of the selected method, or at the initial conditions (when the method clock is at **INIT**).

Prime

This button is used when priming the pump heads. **Prime** causes the pump to run at maximum volume (2.5 mL/min, microbore; 10.0 mL/min standard bore). If the pump motor is off when you press **Prime**, the pump automatically turns on. To exit priming and return to the normal flow rate, press **Prime** again or press **Off/On** to turn the pump motor off. See Section B.3 for detailed priming instructions.

Insert

Inserts a new timed step into a method. This button functions only when the cursor is in a **TIME** field in the **METHOD** or **METHOD** extension screen.

1. Move the cursor to the **TIME** field and press **Insert**. The new step is added after the cursor position. Parameter values in the new step are blank.
2. Fill in the time value and press **Enter** or a cursor arrow button. If you move the cursor to a different field before entering the time value, the inserted step will be incomplete and will disappear. You can insert timed steps in any order. After you press **Enter**, they will be automatically organized in correct chronological order.

Delete

Removes the value from the current entry field, allowing entry of a new value. To restore the previous value, move the cursor from the field before entering the new value.

On the **METHOD** screen, pressing **Delete** when the cursor is in a step entry field "blanks" the step parameter value. When the cursor is moved from the field, the field remains blank (the previous value is not restored as in other screens). Blank step fields indicate there is no change from the previous step.

To use **Delete** to delete an entire method step:

1. Position the cursor in the method's time field and press **Delete**. The time is removed and the help line displays:

```
TO DELETE THIS STEP, PRESS DELETE AGAIN
```

2. Press **Delete** again to delete the step. If you do not want to delete the step, press any button except **Delete** or the decimal point and the original time and step parameters are then restored.

Hold/Run

Turns the method clock off (**Hold**) and on (**Run**). This button functions only when the pump is under Method control (see Section 2.8.2).

When the method clock is in Hold, pressing **Hold/Run**, starts the clock. The clock starts either at the initial step of a new method, or if resuming an interrupted method, at the time at which the clock was put in Hold.

When the method clock is in Run, pressing **Hold/Run**, stops the clock, thereby "holding" the method and freezing the current conditions.

Reset

Changes the method clock time to **INIT** and causes the initial conditions specified by the method to occur. This button functions only when the pump is in Method control.

If the method is running, it continues running. If the method is on hold, the method clock executes the initial conditions and holds.

Select Δ and **Select** ∇

When the cursor is positioned at a field that has predetermined parameters, these buttons cycle through the choices. In fields which have predetermined numeric values, **Select** Δ increases the value by one unit and **Select** ∇ decreases the value by one unit. Holding down the **Select** button increases (or decreases) the value continuously. Press **Enter** or a cursor arrow button to execute the new value.

←, ↑, →, and ↓

The four cursor directional buttons move the cursor, in the direction of the arrow, to the next entry field. If there is no changeable field in that direction, the cursor moves diagonally or remains where it is.

In most cases, after entering or selecting a new value in an entry field, pressing an arrow button saves and/or executes the new value. This performs the same function as pressing **Enter**.

Pressing **Enter** is still required in the following places:

- **DIAGNOSTIC TEST** screen fields
- **SAVE TO** and **RUN** fields on the **METHOD** screen
- Calibration screen fields
- menu fields

Help

Displays a help screen specific to the current entry field.

Menu

Displays one of three menus, depending on the current screen:

- From any operational screen, pressing **Menu** displays the **MENU of SCREENS.**
- From any diagnostic screen, pressing **Menu** displays the **DIAGNOSTIC MENU.** Pressing **Menu** again returns you to the **MENU of SCREENS.**
- From any calibration screen, pressing **Menu** displays the **CALIBRATION MENU**. Pressing **Menu** again returns you to the **DIAGNOSTIC MENU** and then to the **MENU of SCREENS.** See Figure C-1 for the IP25 screens and menu structure.

Numeric Buttons

Enters numeric values into the current entry field. The numeric buttons are 0 through 9 and the decimal.

Enter

Saves and/or executes changes made in entry fields. After pressing **Enter**, the cursor moves back to the left margin of the same field. It does not automatically move to the next entry field. In menu screens, pressing **Enter** opens the highlighted screen.

In the **METHOD** screen, pressing **Enter** saves entries to an edit copy only. To save the editing changes to a permanent method, move the cursor to the **SAVE TO** field, enter the method number, and press **Enter**.

2.1.2 Initial Display Screens

When the pump has powered-up and passed all diagnostic tests, the **POWER-UP** screen displays briefly (see Figure 2-3). After a few seconds, the **MAIN** screen displays (see Figure 2-4). If one of the diagnostic tests fails, the **DIAGNOSTIC TEST** screen displays instead of the **MAIN** screen. See Section C.2.8 if this occurs.

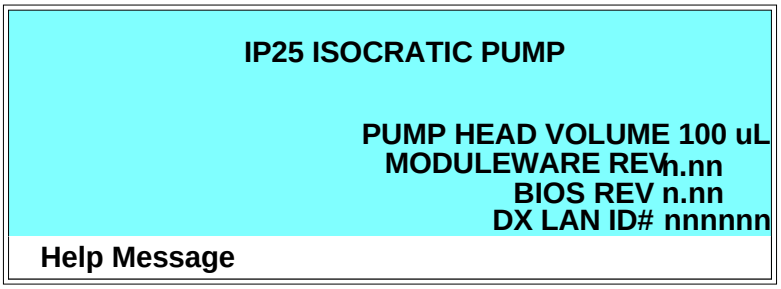

Figure 2-3. Power-Up Screen

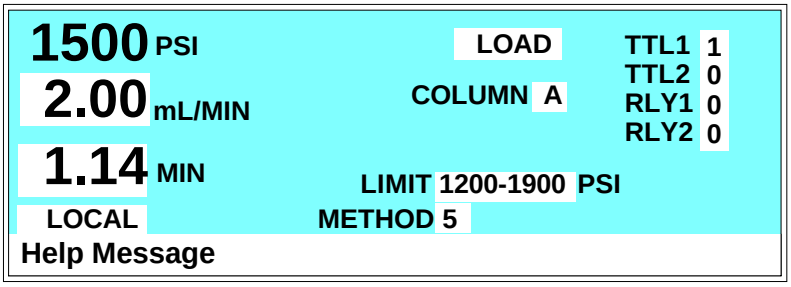

Figure 2-4. Main Screen

The **POWER-UP** screen can also be opened from the **DIAGNOSTIC MENU**, if you need to view the information at a later time.

The **MAIN** screen displays status information in enlarged characters to make viewing easier from a distance. From the **MAIN** screen you can set pump operating parameters such as the flow rate or the method number to run.

To access the remaining IP25 screens, press the **Menu** button to display the **MENU of SCREENS** (see Figure 2-5). From the menu, you can select individual operational screens, or the **DIAGNOSTIC MENU** screen. To open a screen, enter the screen number and press **Enter**, or move the cursor to the desired screen name and press **Enter**. See Appendix C for a description of each IP25 screen.

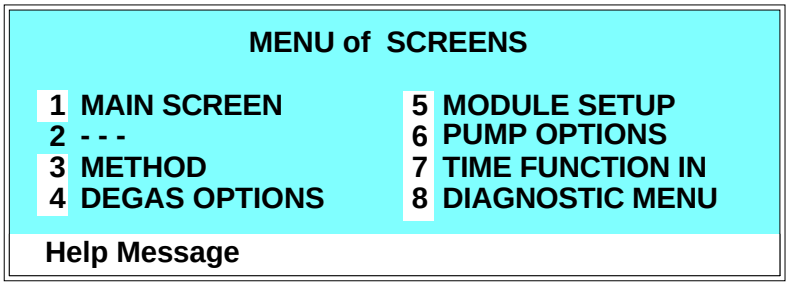

Figure 2-5. Menu of Screens

2.2 Electronics Chassis

The electronics chassis is located behind the upper door of the IP25 enclosure. The chassis includes several electronic cards (printed circuit boards) that are used to control the IP25. Connectors on the cards also allow communication between the IP25 and other Dionex modules. Figure 2-6 shows the electronics components with the upper door open. To open the door, pull on the tab located to the right of the main power actuator (see Figure 2-2).

CAUTION

Do not remove any of the electronics cards from the pump. There are no user-serviceable components on the cards. If servicing is required, it must be performed by qualified personnel and appropriate electrostatic discharge (ESD) handling procedures must be followed.

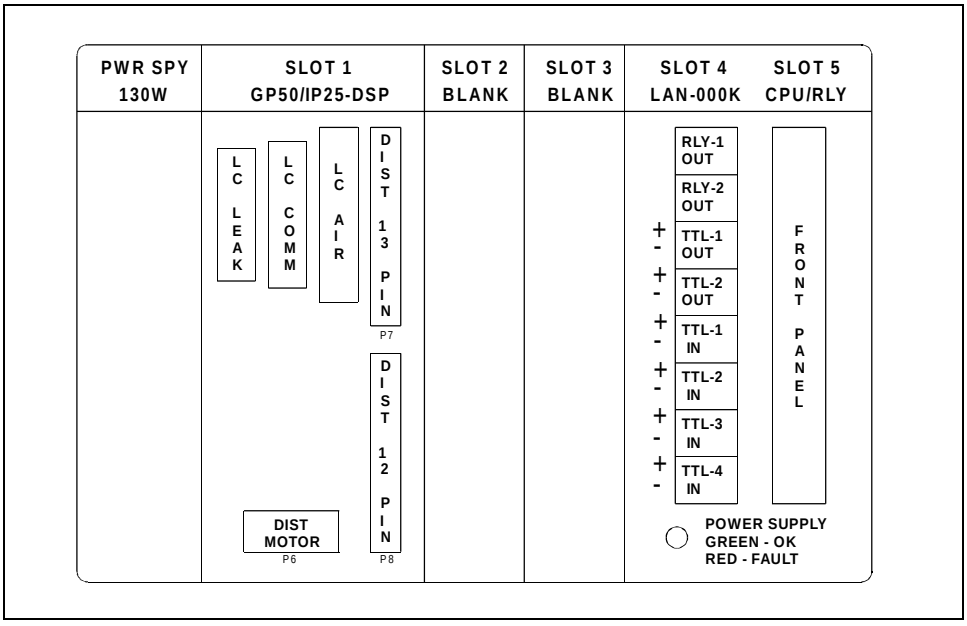

Figure 2-6. Electronics Chassis
(Located behind pump upper door)

2.2.1 Connectors

LC LEAK

The leak control cable from the LC20 Chromatography Enclosure or the LC10 Chromatography Organizer connects to the **LC LEAK** connector in slot 1. When a leak occurs in the LC10 or LC20, it is reported to the IP25.

The LC30 Chromatography Oven does not connect to the IP25 **LC LEAK** connector, because it has its own internal leak control electronics.

LC COMM

The LC30 Chromatography Oven's RJ-11 serial cable connects to the **LC COMM** connector in slot 1. When connected, the LC30 can be remotely controlled by the PeakNet workstation.

LC AIR

The cable from the air solenoid valves on the LC10, LC20, or LC30 connects to the **LC AIR** connector in slot 1. When connected, the IP25 can electrically actuate the solenoid valves which control the position of the injection valve in the LC10, LC20, and LC30.

Use the **MAIN** or **METHOD** screen to select the injection valve position.

TTL/Relay

A strip of eight relay and TTL connectors is located in slot 4. These connectors interface with Dionex and non-Dionex modules for relay and TTL control of the pump. Appendix D describes the relay and TTL functions and the connections between the IP25 and other modules.

2.2.2 Cards

Power Supply Card

Provides power for the pump electronics.

DSP (Digital Signal Processor) Card

Contains the digital circuitry to interface to the CPU.

CPU/Relay and DX-LAN Cards

The CPU logic and Relay I/O cards occupy slot 5 in the card cage. The Relay I/O card rides piggyback on the CPU card and extends over the front of slot 4. The card is short enough to allow the optional DX-LAN pump interface card (P/N 044195) to mount behind it in slot 4. The DX-LAN interface card is required for communication between the IP25 and PeakNet Software.

Control Moduleware and BIOS for the IP25 reside on the CPU card. A 60-pin ribbon cable links the CPU logic to the display and keypad.

The CPU logic monitors the internal power supply outputs, and reports the status on the multicolored LED at the bottom of slot 4.

- Green indicates normal operation.
- Red indicates a power fault. The module will enter its diagnostic state and inhibit all other controls until the fault is corrected. If this occurs, turn the power off for a few seconds and then turn it back on. If the problem persists, contact Dionex.

2.3 Mechanical Chassis

The mechanical chassis is housed in a pull-out drawer located behind the lower door of the IP25 enclosure. The front of the chassis contains the interior components described in Section 2.4. Other mechanical assemblies are located inside the chassis drawer. The drawer should be pulled out only for service procedures. For routine operation, push in the drawer and tighten the lock located on the lower right corner of the chassis.

Observe the warning label on the inside of the lower door. The arrows on the label indicate moving mechanical parts that present pinch hazards when the pump is on and the mechanical drawer is open. Do not operate the pump with the mechanical chassis drawer pulled out.

2.4 Interior Components

Figure 2-7 shows the interior components located behind the lower door. Figure 2-8 shows the flow path of eluent through the components.

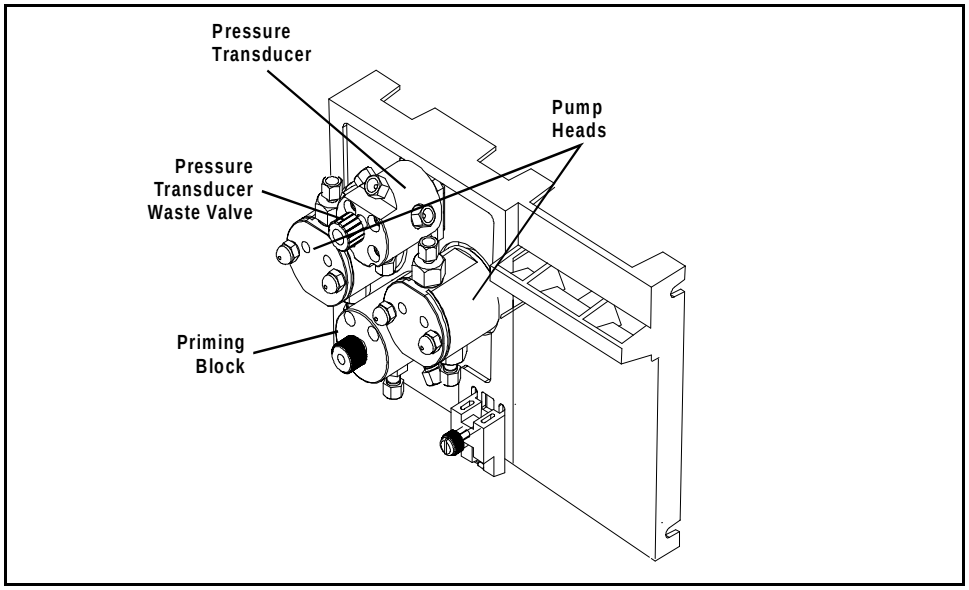

Figure 2-7. Interior Components

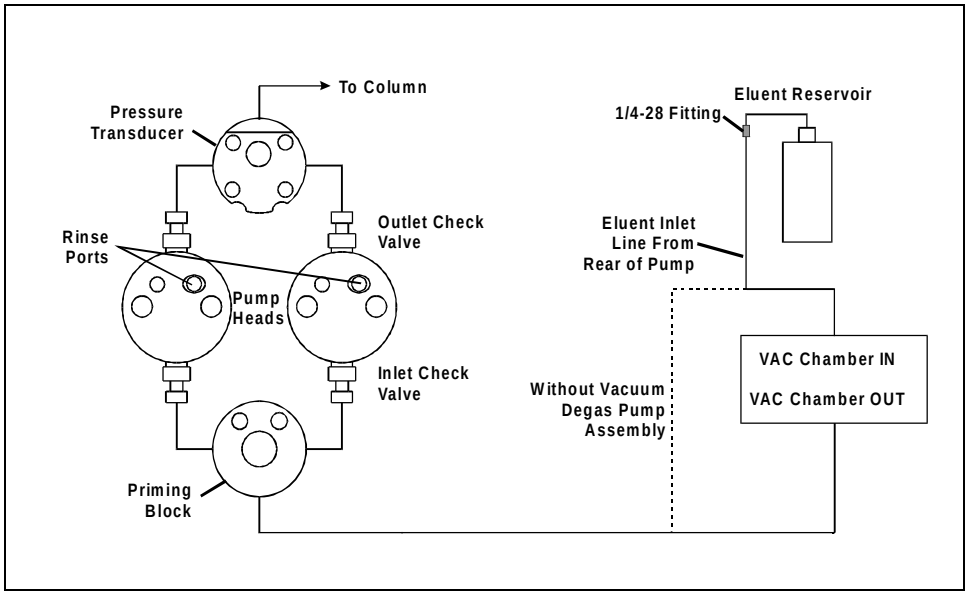

Figure 2-8. Eluent Flow Schematic

2.4.1 Pump Heads

There are two IP25 pump head configurations: standard bore and microbore. The table below summarizes the features of each type and the operating conditions for each configuration.

Pump Head Type	Piston Volume	Flow Rate (mL/min)*	Maximum Operating Pressure
Standard Bore	100 µL	0.04 – 10.0	35 MPa (5000 psi)
Microbore	25 µL	0.01 – 2.50	35 MPa (5000 psi)

*Flow rates are adjustable in increments of 0.01 mL/min.

NOTE

Although there is some overlap in flow rates between the two pump versions, continuous operation of the microbore pump at flow rates above 2.0 mL/min will decrease seal and pump life. For the best extended operation at 2.0 mL/min or above, a standard bore pump should be used.

See Figures 5-1 and 5-2 for an illustration of the pump heads and interconnecting lines.

2.4.2 Pump Priming Block

The priming block "tee" directs the flow of eluent from the eluent reservoir, the vacuum degas chamber (if installed), and into the pump heads (see Figure 2-8). The priming block is also used for rapid removal of air from the system.

Refer to Section B.3 for instructions on priming the pump heads.

2.4.3 Pressure Transducer

From the priming block, the liquid stream is directed to the inlet check valves on the pump heads, through the pump heads, and finally through the outlet check valves to the pressure transducer.

Flow paths from the outlet check valves on the pump heads are combined in the pressure transducer. The pressure transducer measures the system pressure at this point. The interactive constant-flow/constant-pressure control program on the DSP precisely controls the pump motor speed to assure flow rate accuracy.

A waste line exits from the bottom of the pressure transducer. Opening the waste valve diverts flow to the waste line, relieves system pressure, and forces air out of the pump.

Flow output from the pressure transducer is directed from the pump and throughout the chromatography system (injection valve, column, detector).

See Section B.2.5 in Appendix B for outlet line connections. Refer also to the manual for the module being used for specific interconnect information.

2.5 Vacuum Degas Pump Assembly (Optional)

The Dionex vacuum degas pump provides continuous in-line vacuum degassing of the eluent. If ordered, the assembly is installed in the pump at the factory. This assembly consists of:

- A single-channel degas chamber (with degas membranes) with 17 mL fluid path per channel
- A dual-stage diaphragm vacuum pump
- A solenoid valve
- An on-board vacuum sensor
- The electronics required to operate the vacuum pump
- Fittings, tubing, and other accessories

By default, at power-up, the degas pump turns on for 2 minutes. Thereafter, the pump turns on for 30 seconds at 10-minute intervals. The **DEGAS OPTIONS** screen allows you to change the cycle time and duration (see Section C.1.3). You can check the vacuum chamber pressure from the **DEGAS STATUS** screen (see Section C.3.4).

All components of the vacuum degas assembly are made of inert materials or corrosion-resistant materials. However, Dionex recommends that you thoroughly flush any chemicals out of the tubing with deionized water before shutdown to avoid crystallization in the membrane pores.

2.6 Eluent Reservoirs

Dionex strongly recommends degassing all eluents and storing them in reservoirs pressurized with helium. This helps prevent bubbles (resulting from eluent outgassing) from forming in the eluent proportioning valves, pump heads, and the detector cell. Degassed eluents and pressurized reservoirs are especially important when combining aqueous and non-aqueous components (e.g., water and acetonitrile). Pressurizable reservoirs allow eluents to be stored under a specific atmosphere.

The following reservoirs are available from Dionex:

- 1-liter glass reservoirs with shatterproof plastic coating (P/N 044126)
- 2-liter glass reservoirs with shatterproof plastic coating (P/N 044127)
- 1-liter plastic reservoirs (P/N 044128)
- 2-liter plastic reservoirs (P/N 044129)

Do not use the 2-liter plastic reservoir (P/N 044129) for off-line vacuum degassing of eluents. Repeated use for this purpose will cause the reservoir to collapse.

Refer to the *Pressurizable Reservoir Installation Instructions* (Document No. 034581) for installation details.

Two optional E01 Eluent Organizers (P/N 044125) can fit on top of the system enclosure. Each organizer can accommodate up to two reservoirs.

2.7 Rear Panel

The rear panel contains the main power receptacle with fuses, and a BNC connector for interfacing the IP25 with the PeakNet workstation via the optional DX-LAN. The rear panel is illustrated in Figure B-1 in Appendix B.

2.8 Functional Description

There are three ways to operate the IP25 pump:

- In Local mode, you use the front control panel buttons and screens to set operating parameters. See Section 2.8.1 for a description of Local mode.
- In Remote mode, you use PeakNet to send operating commands from the host computer via the DX-LAN. See Section 2.8.1 for a description of Remote mode.
- With TTL input, a controlling device, such as an integrator or another Dionex module, sends TTL signals to the pump. The TTL input signals can be used to turn the pump motor off and on, set the method clock to hold or run, or increase and decrease the method number. All other IP25 operating parameters must be set locally with the control panel. See Appendix D for a description of TTL control.

To select the operating mode:

1. Go to either the **MAIN** or **DETAIL** screen. The operating mode field displays either **LOCAL** or **REMOTE** (see Figure 2-9).
2. To change the mode, move the cursor to this field; press **Select** ∆ or **Select** ∇ to toggle to the desired mode and press **Enter** or a cursor arrow button. (For TTL input control, set the IP25 to Local mode.)

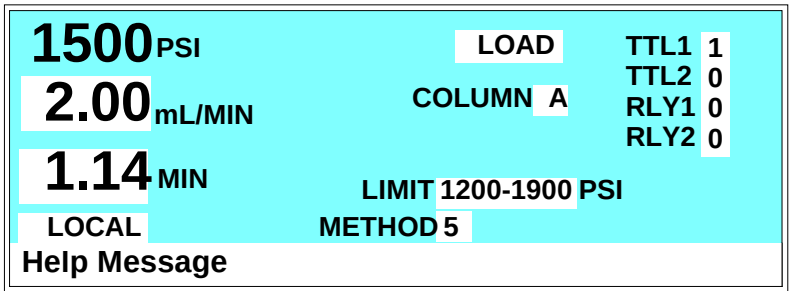

Figure 2-9. Main Screen

In addition to the operating modes, two pump control modes are available:

- In Direct control, commands are executed immediately when entered. Because there is no time-based program, the method clock is not used and **Hold/Run** and **Reset** do not operate.
- In Method control, commands are executed according to the timed steps in a programmed method. See Section 2.8.2 for details about Method control.

To select the control mode:

1. Go to either the **MAIN** or **DETAIL** screen. The control mode field displays either **DIRECT CNTRL** or **METHOD** (see Figure 2-9).
2. To change the mode, move the cursor to this field; press **Select** Δ or **Select** ∇ to toggle to the desired mode and press **Enter** or a cursor arrow button.

NOTE

If the IP25 is connected to a PeakNet workstation, the operating and control modes can be selected from the software.

Both Direct and Method control are available in either the Local mode or the Remote mode. The combination of available operating modes and control modes maximizes the flexibility of pump operation. The table below summarizes the different operating and control mode configurations:

Operating/Control Mode	Pump Operation
Local/Direct	Commands entered from the control panel and executed immediately after being entered
Local/Method	Commands entered from the control panel and executed by running a programmed method
Remote/Direct	Commands sent from PeakNet and executed immediately when received
Remote/Method	Commands sent from PeakNet and executed by running a programmed method

2.8.1 Operating Modes

Local Mode

When the pump is powered up, it is in Local mode (see Figure 2-9). In Local mode, the pump accepts operating commands from two sources:

- Direct input from the front panel keypad
- TTL inputs from a remote controller, such as an integrator or another Dionex module

Remote Mode

In Remote mode, the pump accepts operating commands from the PeakNet workstation, which are sent via the DX-LAN.

Remote control can be set to either normal Remote or Locked Remote:

- In normal Remote mode, all front panel buttons function except **Hold/Run**. Operating parameters can be changed,

providing they do not interfere with a method while it is running in remote control.

- In the Locked Remote mode, all operating changes from the IP25 front panel are disabled. Locked Remote mode can be selected only from PeakNet. It can be cleared either from PeakNet or by powering down the IP25. The IP25 always powers up in the Local mode.

If the pump is running a method when you change to the Remote mode, the computer will not interrupt the method unless you send an abort command from the computer.

2.8.2 Method Control

In Method control, commands are executed according to the time-based steps programmed in a method. Each step specifies the flow rate to be delivered by the pump at a given time, the TTL and Relay outputs, and the positions of the injection and column select valves.

Methods are programmed, saved, and edited from the **METHOD** screen (see Figure 2-10). See Section 3.3 for programming instructions.

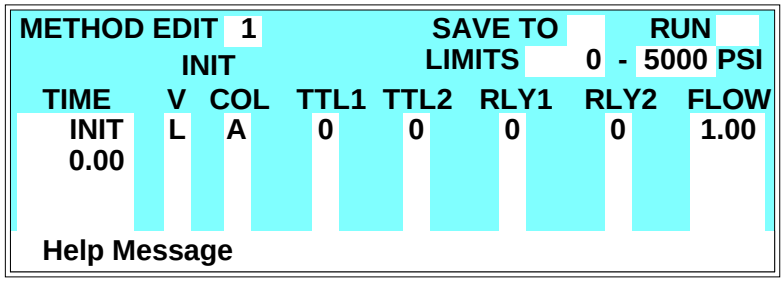

Figure 2-10. Method Screen

The following summarizes basic information about using methods.

- The pump can run under method control while you are entering or editing any method, even the one that is currently running.
- When saving changes to the currently running method, or switching to a different method, the method clock continues running unaffected. Only those parameter changes which affect the method after the current time will be implemented in the current run.
- The IP25 can store up to 100 separate methods (0 through 99) in memory. The actual number, which depends on the size of each method and the amount of available memory, is typically less than this.
- Methods are retained in memory even after the pump is powered down.
- Each method can have a maximum of 50 time-based steps. Step 1 always starts at **INIT** (initial conditions). Step 2 always starts at **TIME = 0.0**.
- After PeakNet downloads a method to the IP25, the computer sends a command to activate the method number and execute the **INIT** conditions step. If a method is running when the computer activates the new method, the old method is interrupted and the method clock is reset to the **INIT** conditions.

3 • Operation and Maintenance

3.1 Getting Ready to Run

3.1.1 Degas Eluents

Dionex strongly recommends degassing all eluents and storing them in reservoirs pressurized with filtered inert gas (see Section 3.1.3). This helps prevent bubbles due to eluent outgassing from forming in the pump heads and the detector cell. Degassed eluents and pressurized reservoirs are especially important when combining aqueous and non-aqueous components (e.g., water and acetonitrile).

The IP25 with the optional vacuum degas pump assembly continuously degasses eluents.

If the IP25 is not equipped with the vacuum degas assembly, manually vacuum-degas eluents daily, as described below, and store them in pressurized reservoirs.

Degassing Eluents Manually

1. Prepare the eluent required for your application. Pour it into a vacuum flask and attach the flask to a vacuum pump or water aspirator.
2. Vacuum-degas the eluent for 5 to 10 minutes in addition to shaking or sonication.
3. Remove the flask from the vacuum. **Do not allow water to flow from the aspirator back into the flask.**
4. Pour the degassed eluent into a pressurizable reservoir. Be careful not to shake the eluent.
5. Install end-line filters and pressurize the reservoirs (see Sections 3.1.2 and 3.1.3).

3.1.2 Filter Eluents

Always filter eluents with a 0.45 µ filter before use to remove small particulates that may contaminate the pump check valves and cause erratic flow rates or loss of prime. For additional protection, end-line filters (P/N 045987) are supplied in the pressurizable reservoir ship kits for filtering during operation.

Install an end-line filter on the end of the eluent line inside the reservoir. To prevent air from being drawn through the line, make sure that the end of the filter reaches the bottom of the eluent reservoir.

3.1.3 Pressurize Eluent Reservoirs

The IP25 Isocratic Pump can be operated with or without head pressure on the eluent reservoirs. Vacuum degassing of the eluent, however, is essential for optimum pump performance. If the eluent reservoirs are to be pressurized, use filtered inert gas, preferably helium. Refer to the *Pressurizable Reservoir Installation Instructions* for details.

1. Verify that a regulator (P/N 046594) is installed on the gas supply line to the reservoirs.
2. Turn on the gas supply and adjust the pressure to 55 KPa (8 psi).

Never pressurize the reservoirs above 69 KPa (10 psi).

3.1.4 Start-Up

1. Turn on the pump power. The **POWER-UP** screen (see Figure 2-3) displays briefly and a series of diagnostics tests is run. If the tests run successfully, the **MAIN** screen (see Figure 2-4) displays after a few seconds. If one or more of the tests fails, the **DIAGNOSTIC TEST** screen displays instead of the **MAIN** screen. See Section C.2.8 if this occurs.

   At power up, the injection valve is initialized to the Load position.

2. Press **Off/On** to start the pump flow.

3. Check the pressure reading on the **MAIN** screen. The IP25 display updates the pressure readout once per piston stroke. The reading from one stroke to the next should be within 3% of the total pressure reading.

   A variation of more than 3% may indicate that the pump is not primed. Refer to Section B.3 for priming instructions, or see Section 4.1 for other conditions which can cause the pump to lose prime.

NOTE

Wait at least 5 minutes (up to 20 minutes for low flow rates in a standard bore pump) after starting the pump or changing the flow rate before beginning an analysis. This allows the pump's real-time electronic pulse damping circuitry to stabilize the flow rate.

3.1.5 Selecting the Pressure Limits

The high and low pressure limits automatically stop the pump in the event of a system malfunction (e.g., overpressurizing because of a blockage, or low pressure caused by a leak downstream from the pump).

When running under Direct control, enter the pressure limits from the **MAIN** screen (see Figure 3-1).

When running under Method control, enter the limits from the **METHOD** screen as a part of each method. The limits are set in the **INIT** step and remain unchanged throughout the analysis. When a limit trip stops the pump, the method clock immediately stops and goes to Hold. The current status of the method that was running at the time is displayed on the front panel.

To select the limits:

1. Go to the **MAIN** or **METHOD** screen and move the cursor to the **LIMIT** field.
2. Enter a low pressure limit that is 2.1 to 3.4 MPa (300-500 psi) below the normal system operating pressure, as indicated by the pressure display on the front panel. This setting may vary depending on the system operating pressure. The low pressure limit is activated after 13 pump piston strokes of fluid is pumped through. Thirteen piston strokes equals 1.3 mL for the standard bore IP25 or 0.325 mL for the microbore IP25.
3. Enter a high pressure limit that is 2.8 to 3.4 MPa (400-500 psi) above the maximum normal system operating pressure. The pump is equipped with a pressure limiter that prevents operation above 35 MPa (5076 psi).

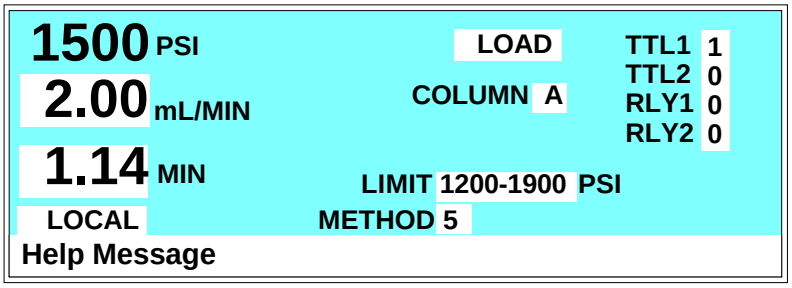

Figure 3-1. Main Screen: Setting Pressure Limits

3.2 Running Under Direct Control

In the Direct control operating mode, commands are carried out immediately after you enter them. Changes to operating parameters remain in effect until you issue other commands to change them. Because there are no time-based steps, the method clock is not used and the **Hold/Run** and **Reset** buttons do not operate.

To select Direct control, go to the **MAIN** screen.

- If **DIRECT CNTRL** is displayed, the pump is already in Direct control mode and no further action is necessary.
- If **METHOD** is displayed, move the cursor to **METHOD** and press **Select** ∆ or **Select** ∇ to toggle to **DIRECT CNTRL**. Press **Enter** or a cursor arrow button to activate the selection.

To issue commands from the keyboard or from TTL or relay input, the pump must be in Local control mode. Verify that the **MAIN** screen is displaying **LOCAL**. If **REMOTE** is displayed, move the cursor to **REMOTE**; press **Select** ∆ or **Select** ∇ to toggle to **LOCAL**, and press **Enter** or a cursor arrow button.

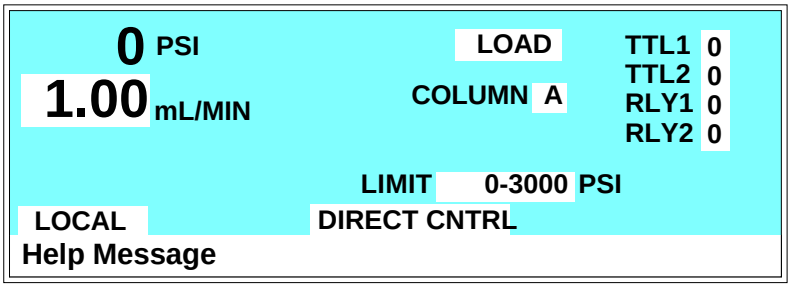

Figure 3-2. Main Screen: Direct Control Mode

3.3 Running Under Method Control

In the Method control operating mode, a series of programmed timed events, known as a *method*, controls the IP25. Methods are retained in memory even after the pump power has been turned off.

This section provides general instructions on how to create, edit, and run methods. Examples for creating a method and modifying an existing method are also included.

Use the following guidelines when entering time-based parameters in the **METHOD** screen:

- When setting method times, allow at least 15 left to right piston transitions after starting the pump or changing the flow rate before beginning an analysis. This allows the pump's real-time electronic pulse damping circuitry to stabilize the flow rate. The stabilization time is 10 minutes or more for medium to fast flow rates. For slow flow rates in a standard bore pump, the stabilization time could be as long as 30 minutes. You can monitor the left to right piston transitions from the **DSP STATUS** screen.
- In the **V** column, select the position of the injection valve, either **L** for load or **I** for inject (see Figure 3-3).
- In the **COL** column, select the position of the optional column switching valve (either **A** or **B**). The column switching valve is

an option installed in the LC20 Chromatography Enclosure, or the LC25 or LC30 Chromatography Oven.

- The **TTL** and **RLY** columns control functions in external devices that are connected to the IP25. To turn on a TTL or relay function, set the value to **1**. To turn off a function, set the value to **0**. For example, if TTL1 is connected to the load function on an autosampler, setting **TTL1** to **1**, sends the signal to the autosampler to start the load cycle. See Appendix D for details about TTL and relay control.
- In the **FLOW** column, enter the pump flow rate. Flow rates are adjustable in increments of 0.01 mL/min. See Section 2.4.1 for the available flow rate ranges. They vary, depending on the size of the pump head.

IMPORTANT

Continuous operation of the microbore pump heads at flow rates above 2.0 mL/min will decrease seal and pump life. For the best extended operation at 2.0 mL/min or above, a standard bore pump should be used.

- The **TIME** field is the only field in a method step that must have an entered value. A blank field in any other step indicates no change from the value set in the previous step.
- If a method contains more steps than can be displayed on one screen, they are scrolled off the screen. A small arrow down (v) next to the time entry at the bottom of the screen indicates there are additional steps below. A small arrow up (^) adjacent to the top time entry indicates there are additional steps above. Move the cursor to the bottom or top of the screen and then move one more line to view the additional steps.

3.3.1 Creating a New Method

You can create a new method when the method clock is in either **Hold** or **Run**.

1. Go to the **MAIN** screen.
2. Check that the pump is set to **LOCAL**. If **REMOTE** is currently set, move the cursor to the field; press **Select** Δ or **Select** ∇ to toggle to **LOCAL**, and press **Enter** or a cursor arrow button.
3. Go to the **METHOD** screen.
4. In the **EDIT** field, enter the number of the method to be created. You can enter the number of an unused method or the number of an existing method that you want to edit and save as a new method. If you enter the number of an unused method, the screen will look similar to the example screen in Figure 3-3.
5. In the **LIMITS** field, set the low and high pressure limits (see Section 3.1.5).

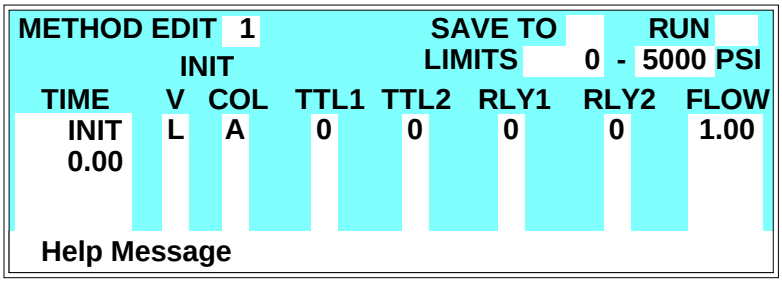

Figure 3-3. Method Screen: Creating a New Method

6. Each method starts out with two timed steps (see Figure 3-3). The first step is an initial conditions step with **INIT** in the **TIME** column. The second step is a time zero step with **0.00** in the **TIME** column. The parameters in each of these first two steps can be changed but the steps cannot be deleted. Enter the parameters for these two steps as required for the method.
7. To enter a new step, use one of the following methods:
   - Move the cursor to the empty **TIME** field below the last step and enter the elapsed time at which to start the new step.
   - Move the cursor to any of the **TIME** fields and press **Insert**. This adds a new step after the cursor position. Enter the elapsed time at which to start the new step.

   After you press **Enter** or a cursor arrow button, timed steps are automatically organized in chronological order.
8. Enter the remainder of the parameters for the new step.
9. After entering the time-based parameters, move the cursor to the **SAVE TO** field. If you are editing an existing method, enter a new number and press **Enter** to save the method to the new number. If the method number was previously unused, press **Enter** to save the method.

Example: Creating a Method

Run the pump at 2.0 mL/min for 5 minutes. At 5 minutes, inject the sample and lower the flow rate to 1.0 mL/min.

1. Go to the **METHOD** screen and enter a method number in the **EDIT** field (1, for example) and press **Enter**. The screen automatically changes the number in the **SAVE TO** field to the number of the method being edited.
   - If method 1 currently exists and you want to delete it, move the cursor to **TIME = INIT** and press **Delete** twice to delete the entire method.

- If you want to retain the original method 1, enter a new, unused, method number in the **EDIT** field.

2. Move the cursor down to **INIT** and then right to **V**. If necessary, press **Select** Δ to toggle to **L** (load), and press **Enter**. Move to **FLOW** and enter 2 to set the flow rate to 2.00 mL/min.

3. Position the cursor in the blank time step below **TIME = 0.00**. Enter a 5. Move to the **V** field and press **Select** Δ to toggle to **I** (inject). Move to **FLOW** and enter 1 to set the flow rate to 1.00 mL/min.

4. Move the cursor to **SAVE TO** and press **Enter** to save the method.

Figure 3-4 illustrates the **METHOD** screen as it will appear when the method is complete.

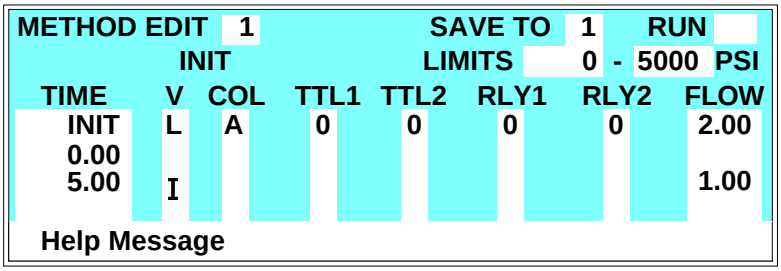

Figure 3-4. Method Screen: Example Method

3.3.2 Running a Method

1. If the pump motor is off, press **Off/On** to turn on the motor.

2. Go to the **MAIN** screen and, if necessary, toggle from **DIRECT CNTRL** to **METHOD** and from **REMOTE** to **LOCAL**.

3. In the **METHOD** field, enter the desired method number.

   You can also select the method number in the **METHOD** screen. Move the cursor to **RUN** and enter the desired method number.

- If the method clock is already running when you enter the method number, the method starts immediately.
- If the clock is in Hold, press **Hold/Run** to start the method.

4. The elapsed time on the method clock when the method begins determines where (at what step and parameters) the method begins running:
   - If the method clock is at **INIT** or time zero, the method begins running using the initial condition parameters.
   - If the method clock is greater than zero, the method begins running using the parameters specified in the step for that elapsed time. Press **Reset** to start the method at the initial conditions.

3.3.3 Controlling the Method Clock

The **Hold/Run** button, the **Reset** button, and the **MIN** fields in the **MAIN** screen control the method clock:

- To start and stop the method clock, press **Hold/Run**.
- To reset the clock to **INIT**, press **Reset**.
- To set the clock to a specific elapsed time, enter the time into the **MIN** field in the **MAIN** screen. The method will start (or continue) running using the method parameters specified for that time.

3.3.4 Editing a Method

After entering a method, you can modify it by changing, adding, or deleting steps and/or parameters. These changes can be made when the method clock is stopped, or while it is running. If the method you are editing is currently running, the changes are stored in memory and implemented when you save the method.

NOTE

After you save changes, there is no way to recall the original method. Therefore, if you plan to make experimental changes to a method but want to retain the original method in its unmodified form, save the modified method to a different method number.

Use the following basic steps to edit a method:

1. Go to the **METHOD** screen. In the **EDIT** field, enter the number of the method to be modified.
2. Make changes as needed:
   - **To change a field's value**, position the cursor in the field and enter the new value. This automatically deletes the previous value.
   - **To add a method step**, move the cursor to any of the **TIME** fields and press **Insert**, or move the cursor to the empty **TIME** field below the last step and enter the elapsed time at which to start the new step. After you press **Enter** or a cursor arrow button, the new step is automatically moved to the correct chronological position. Continue entering parameters for the new step.
   - **To delete a method step,** move the cursor to the step to be deleted and press **Delete** twice.
3. When changes are complete, move the cursor to the **SAVE TO** field. Press **Enter** to save the changes to the current method, or enter a new method number and press **Enter.**

   If you save changes to the currently running method, they are immediately incorporated in the run and executed at the programmed time. If, however, a change is made to an event that has already been executed, it cannot be incorporated as part of the current run. To run the changed version of the method, press **Reset** to restart the method at the **INIT**ial conditions.

Example: Editing a Running Method

This example describes how to make the following changes to the example created in Section 3.3.1:

- In the **INIT** step, set **TTL1** to 1, which starts the load cycle on an autosampler connected to the TTL1 output.
- In the **TIME = 0.00** step, set **TTL1** back to 0.
- Add a step at **TIME = 6.00** to switch the injection valve back to the load position.

Figure 3-5 illustrates the **METHOD** screen as it will appear when editing is complete.

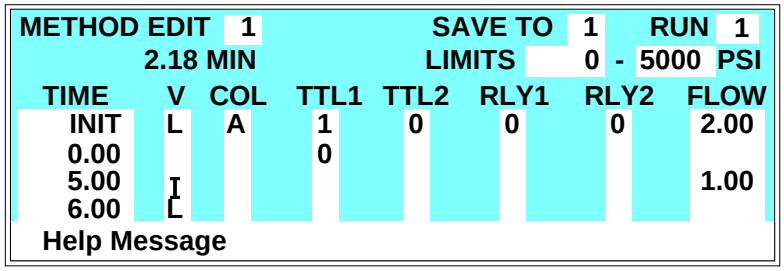

Figure 3-5. Method Screen: Editing a Running Method

This example assumes that the example method created in Section 3.3.1 is currently running.

1. Go to the **METHOD** screen and enter the method number (1 in the example) in the **EDIT** field. Press **Enter**.
2. Move the cursor to the **TTL1** field in the **INIT** step. Enter a **1**.
3. Move the cursor to the **TTL1** field in the **TIME = 0.00** step. Enter a **0**.
4. Move the cursor to the empty time step after **TIME = 5.00**. Enter a **6**. Move to the **V** field and press **Select** Δ to toggle to **L** (load).
5. Move the cursor to the **SAVE TO** field and press **Enter**.

6. Check the status of the method clock. The elapsed time is displayed below **METHOD EDIT** in the **METHOD** screen and in the **MAIN** screen.

   - If the elapsed time is less than 6 minutes, the injection valve will be switched back to the load position according to the changes made to the method.
   - If the elapsed time is greater than 6 minutes, none of the changes will be incorporated into this run. To implement the changes, press **Reset** to set the method clock back to the **INIT**ial conditions.

3.3.5 Deleting a Method

To delete an entire method, move the cursor on the **METHOD** screen to the **INIT** step, then press **Delete** twice.

3.3.6 Changing the Running Method

To change from the method currently running to a different method, enter the new method number in the **RUN** field on the **METHOD** screen, and press **Enter**. The new method begins running using the parameters specified in the step for the current elapsed time. Press **Reset** to start the method at the **INIT**ial conditions.

3.4 Routine Maintenance

- This section describes routine maintenance procedures that can be performed by the user. Any other maintenance procedures must be performed by qualified Dionex personnel.

3.4.1 Daily Maintenance

- When using a combination of eluents which contain both salt or base and solvent, rinse the piston frequently or continuously. Eluent tends to crystallize as the solvent evaporates; these crystals can abrade the piston and cause the main seal to leak. Rinse the piston before and after operation every day as described in the following steps.

  1. Open the lower pump door and locate the rinse ports on the front of each of the pump heads (see Figure 3-6).
  2. Install the two rinse waste tubes (P/N 054418) located in the IP25 Ship Kit onto each head as shown in Figure 3-6.

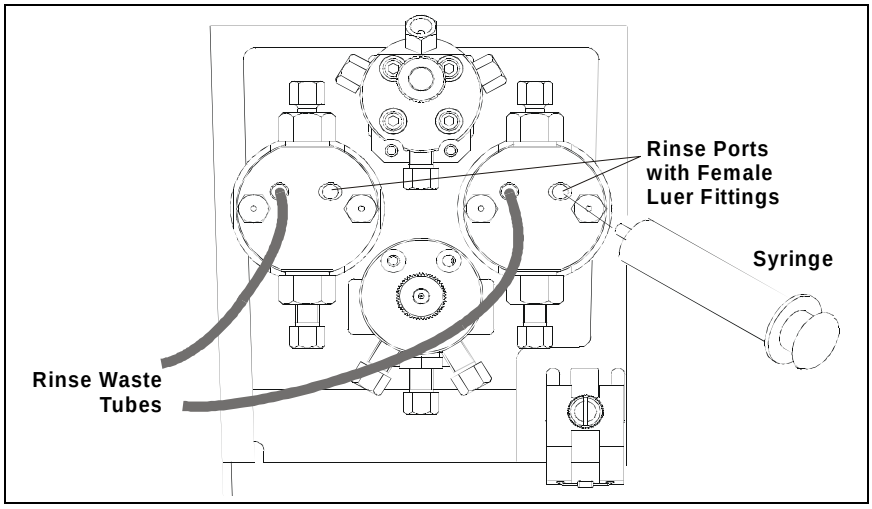

Figure 3-6. Rinsing the Pump Heads

3. Place the end of each rinse waste tube into a waste receptacle. Attach a small syringe containing 5 to 10 mL of deionized water to the rinse inlet female luer fitting on one of the pump heads.
4. Inject deionized water into the fitting to rinse the pump head.
5. Repeat Steps 2 and 3 for the other pump head.
6. Dispose of the waste water and close the door to the mechanical chassis.

- All components of the vacuum degas assembly are made of inert materials or corrosion-resistant materials. Dionex recommends that you thoroughly flush any chemicals out of the chambers and tubing with deionized water after each use to avoid crystallization in the membrane pores.
- Check the entire mechanical chassis for leaks from the rinse ports, the vacuum degas chamber, the eluent inlet fitting, and the eluent reservoir (see Figure 3-7). Tighten or replace any leaking fittings. Wipe up liquid spills and rinse dried reagents off the pump components with deionized water.

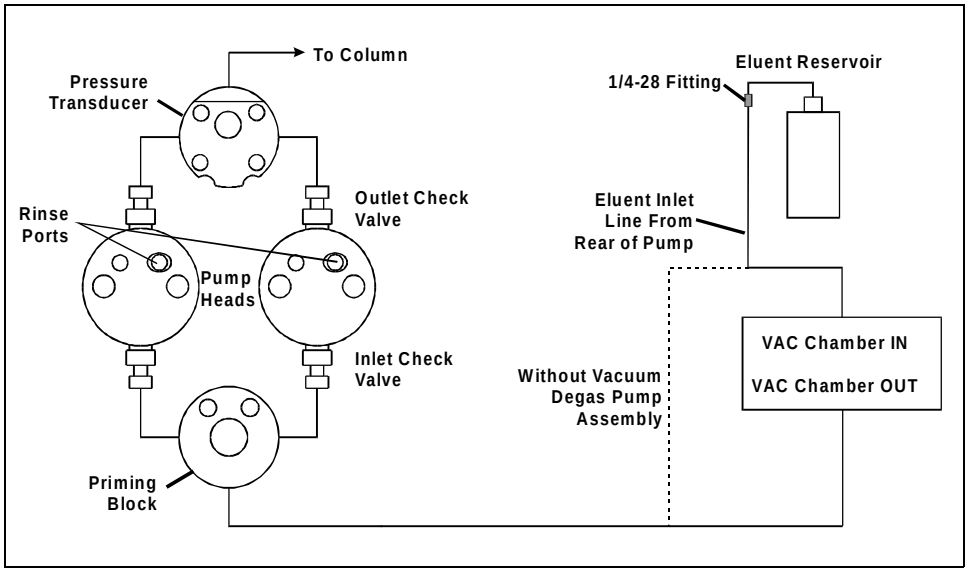

Figure 3-7. Eluent Flow Schematic

3.4.2 Periodic Maintenance

Replace both the primary piston seal and the rinse seal in each pump head approximately every 6 months (see Section 5.2). The seals may need to be replaced more often if you operate the pump continuously, or if you routinely run at high pressure or high flow rates. A drop of eluent trapped in the end of the drain tubes is normal, but eluent flowing from the tubing indicates a leak.

3.5 Shutdown

- Shutdown the pump by turning off the main power on the IP25.
- Rinse the pump pistons before and after daily operation to prevent build-up of salt crystals or other contaminants that can damage the piston seal (see Section 3.4.1).
- If the pump will not be used for three days or more, flush the system with deionized water to prevent contaminants from building up. Or, if this is not possible, maintain a continuous rinse through the system until you resume normal operation. Select a flow rate of 0.04 mL/min for standard pump heads or 0.01 mL/min for microbore pump heads.
- If the shutdown is for more than three days, reduce the pressure on the eluent reservoir(s) to approximately 21 KPa (3 psi).

4 • Troubleshooting

This chapter is a guide to troubleshooting problems that may occur while operating the IP25 Isocratic Pump. To use this guide, turn to the section that best describes the operating problem. There, you will find the possible causes of the problem listed in order of probability, along with the recommended courses of action. For additional help, refer to Appendix C for instructions on running the IP25 diagnostics program.

If you are unable to eliminate a problem, contact Dionex for help. In the U.S., call Dionex Technical Support at 1-800-346-6390. Outside the U.S., call the nearest Dionex office.

4.1 Left-Right Pump Head Pressure Fluctuations

The IP25 display updates the pressure readout once per piston stroke. A variation of more than 3% of the total pressure reading from one stroke to the next indicates a problem.

- **Pump out of prime; there is no eluent**

  1. Refill the eluent reservoir. Make sure that the eluent line extends to the bottom of the reservoir.
  2. Reprime the pump (see Section B.3).

- **Pump out of prime; eluent is improperly degassed**

  1. If the pump is not equipped with the optional degas pump assembly, degas the eluents manually (see Section 3.1.1). Reprime the pump (see Section B.3).
  2. If the pump is equipped with the optional degas pump assembly, test the degas pump:

     a. Open the **DEGAS STATUS** screen (press **Menu**, **8**, **8**, **3**). Press a **Select** button to toggle the **TEST** field to **RUN** and press **Enter**.

b. The pump should turn on and run for about 45 seconds. If it does not run, see Section 4.6.

- **Pump is out of prime; liquid line leak**

  Check for liquid leaks (see Section 4.4). Tighten fittings or replace lines.

- **Pump is out of prime; end-line filter is dirty or clogged**

  1. Replace the filter (P/N 045987).
  2. Reprime the pump (see Section B.3).

- **Pump is out of prime; blockages in inlet tubing**

  1. Check for kinked or clogged tubing and replace.
  2. Reprime the pump (see Section B.3).

- **Priming did not eliminate excessive pressure fluctuations; dirty or defective piston seal or check valves.**

  1. Follow these steps to isolate the cause:

     a. If the piston rinse tubing leaks, replace the piston seals (see Section 5.2).

     b. If no leaks are seen, replace the check valves (see Section 5.1). Dirty or defective check valves can be caused by impurities in the eluents. To prevent this, install an end-line filter (P/N 45987) on the end of the eluent line.

     c. Slide open the lower pump drawer. Verify that the pistons are moving when the pump flow is on. If not, one of the pistons may be broken. Replace the piston (see Section 5.3)

Observe the warning label on the inside of the lower door. The arrows on the label indicate moving mechanical parts that present pinch hazards when the pump is on and the mechanical drawer is open. Do not touch any parts within the mechanical chassis while the pump is on.

d. If the pistons move, then one or both may be scratched. In this case, turn off the main power switch, remove the pump head and examine the piston. If it is scratched, replace it (see Section 5.3).

e. If a piston moves slightly and then breaks contact with the rocker arm follower, replace the piston seal (see Section 5.2).

f. Push the mechanical chassis drawer back in place, making sure the cables are not pinched.

4.2 Pump Will Not Start

- **Flow rate is set to zero**

  Reset the flow rate (see Section 2.4.1).

- **While being primed, pump starts briefly, then stops because of high pressure limit**

  1. Check the high pressure limit setting (see Section 3.1.5).
  2. Replace any crimped or blocked tubing downstream from the pressure transducer. If there is none, go on to Step 2.
  3. Open the pressure transducer waste valve by turning the knob counterclockwise about two turns (see Figure 2-7). Check the pressure reading; if it is above 97 KPa (14 psi), recalibrate the pressure transducer (see Section C.3.6).
  4. Select a lower flow rate or, if it is safe to do so, increase the high pressure limit.

4.3 Pump Stops

- **Method or other remote input instructed the pump to stop**

  Check the display screen for error messages. If none are displayed, the pump was probably instructed to stop by the method, computer, or other remote signal source.

- **Electrical cables improperly installed**

  1. Place the pump in **LOCAL** mode, **DIRECT CONTROL**. Press **Off/On** to start the pump.
  2. If a non-zero flow rate is displayed and the **Off/On** LED indicates on, but the pump is not running, verify that the electrical cables in the mechanical chassis are properly installed.
     a. Turn off the main power switch.
     b. Using a 7-mm open-end wrench or your fingers, loosen the mechanical chassis drawer lock on the lower right side of the chassis (see the label on the inside of the lower door). Pull the drawer out a few inches.
     c. Check that all cables are seated properly in the connectors on the distribution card located on the top of the mechanical chassis.
     d. Push the mechanical chassis drawer back in place, making sure the cables are not pinched. Retighten the drawer lock. Turn on the main power switch.

- **Low pressure limit was tripped. The following message is displayed:**

```
Low Pressure Limit Violation
```

1. Check the low pressure limit setting (see Section 3.1.5).
2. Verify that eluent is present. If the eluent reservoir is empty, refill it. Prime the pump (see Section B.3) before resuming operation.
3. Make sure the waste valve on the pressure transducer is closed (i.e., turn the knob on the pressure transducer housing clockwise as shown in Figure 2-7).

Overtightening the pressure transducer waste valve may damage the valve and the pressure transducer housing.

4. Make sure there are no liquid leaks in the flow system.
5. Place the pump in **LOCAL** mode, **DIRECT CONTROL**. Press **Off/On** to start the pump. Verify that the pistons are moving and that you can hear the pump. If there is no sound from the pump, check the LED on the CPU card inside the door to the electronics chassis (see Figure 2-6). A red LED indicates a defective power supply. The power supply (P/N 046440) must be replaced. .
6. With the pump running, go to the **DSP STATUS** screen (press **Menu**, **8**, **3**) and note whether the left-right pressure varies by more than 3% between strokes. If it does, refer to Section 4.1. If it does not, either increase the flow rate or reduce the low pressure limit setting and continue operation.

- **High pressure limit was tripped. The following message is displayed:**

```
High Pressure Limit Violation
```

1. Check the high pressure limit setting (see Section 3.1.5).
2. Isolate segments of the flow path to determine the source of the high pressure. First, remove the pump inlet tubing from the injection valve. Turn on the pump and record the pressure reading. One at a time, add in each segment of the remaining flow path until the source of the high pressure is determined. Replace any tubing, fittings, and components necessary to resume standard operating pressure. If the source of the high pressure is the column, refer to the column manual for troubleshooting procedures.
3. Open the pressure transducer waste valve by turning the knob counterclockwise about two turns as shown in Figure 2-7. If the pressure reading is above 97 KPa (14 psi), recalibrate the pressure transducer (see Section C.3.6).

- **An error message beginning with "DSP" displays:**

  There are several messages related to Digital Signal Processor (DSP) errors; for example, "DSP communication fails" and "DSP does not acknowledge." These are all treated similarly:

  1. Turn off the main power switch. Verify that the DSP card is present and is properly installed in slot 1 of the electronics chassis card cage (see Figure 2-6).
  2. Turn on the pump main power. The DSP error message should not reappear; if it does, notify Dionex. The power supply (P/N 046440), DSP card (P/N 045369), or CPU card (P/N 046340) may need replacing.

IMPORTANT **Do not remove any of the electronic cards from the detector. There are no user-serviceable components on the cards. If servicing is required, it must be performed by qualified personnel and appropriate electrostatic discharge (ESD) handling procedures must be followed.**

The CPU card contains a lithium battery. If it is necessary to replace the CPU card, dispose of the used battery according to the manufacturer's instructions.

- **The following error message displays:**

```
Motor Drive Fails
```

  If the pump motor is in a runaway condition, the motor automatically shuts off and the above error message is displayed. Call Dionex.

- **The following error message displays:**

```
Encoder Index Not Found
```

1. Turn off the main power switch. Verify that the cables connected to the DSP card in the electronics chassis (see Figure 2-6) are seated properly.
2. Turn on the main power switch. If the error message reappears, notify Dionex.

4.4 Liquid Leaks/Leak Alarm

- **Leaks from the front rinse ports or rear of the pump head may indicate a defective piston seal**

  Replace the piston seal and rinse seal (see Section 5.2).

- **Leaks from any connection between the eluent reservoir and the pump heads indicate an eluent leak (see Figure 3-7)**

  Tighten the fitting connections just enough to stop the leak.

- **Pressure transducer leaks**

  Inspect the pressure transducer. If the leak is from the waste valve, replace the waste valve O-ring (see Section 5.4). If the leak is from the rear of the transducer, call Dionex.

- **Priming valve leaks**

  Tighten any leaking fittings just enough to stop the leak. Replace any defective tubing assemblies. If this does not stop the leak, the priming block assembly (P/N 054086, PEEK; 53807, SST) must be replaced. for assistance.

- **Interior mechanical chassis leaks.**

  Inspect the chassis for leaks. Tighten any leaking fittings and replace any damaged parts.

4.5 High-Pitched Noise From Pump Motor (or Motor Racing)

- **DSP (digital signal processing) card current limit has been exceeded.**

  A built-in current limiter on the card protects the motor and motor drive. Check the three small LEDs in the upper left corner of the DSP card bulkhead. (The DSP card is located in slot 1 of the electronics chassis card cage). If the bottom LED is flashing in time with the pump strokes, the current limiter is being activated.

  As the pump motor ages, it becomes less efficient and the current limit is activated more frequently. Activating the current limit is harmless, but if it occurs frequently, even at low speeds and/or pressures, the bottom plate assembly (P/N 045670) needs to be replaced. Call Dionex for assistance.

- **Pressure servo oscillation**

  Go to the **DSP STATUS** screen and verify that the correct pump head volume and head material are selected. If the settings are correct but the problem persists, notify Dionex.

- **Out of prime**

  Reprime the pump (see Section B.3).

4.6 Vacuum Degas Pump Does Not Run

- **DEGAS OPTIONS screen settings incorrect**

  Open the **DEGAS OPTIONS** screen (press **Menu**, and **4**) and make sure that the **DEGAS PUMP** field is not set to **ALWAYS OFF**. If it is, select **BY SETTING** and then enter the desired cycle duration and frequency times (see Section C.1.3). By default, the pump runs 2 min at start-up, and thereafter, every 10 min for 30 sec.

- **Electrical cables improperly installed**

  Manually test the degas pump.

  1. Open the **DEGAS STATUS** screen. Press a **Select** button to toggle the **TEST** field to **RUN** and press **Enter**.
  2. The pump should turn on and run for about 45 seconds. If it does not run, verify that the cables connected to the pump in the electronics chassis (see Figure 2-6) and in the mechanical chassis are properly connected.
     a. Turn off the main power switch.
     b. Using a 7-mm open-end wrench or your fingers, loosen the mechanical chassis drawer lock on the lower right side of the chassis (see the label on the inside of the lower door). Pull the drawer out a few inches.
     c. Check that all cables are seated properly in the connectors on the distribution card located on the top of the mechanical chassis.
     d. If the connections are correct, the distribution card may need to be replaced. Call Dionex for assistance.
     e. Push the mechanical chassis drawer back in place, making sure the cables are not pinched. Retighten the drawer lock.

4.7 Vacuum Degas Pump Calibration Fails

At the end of the degas calibration, the DEGAS READING value is less than 13000 and one of the following error message appears:

```
Degas vacuum pump is not present or degas
circuitry is malfunctioning.
```

```
Vacuum Degas Fails
```

Verify that the cable to the vacuum degas pump is connected to the distribution card in the mechanical chassis.

1. Turn off the main power switch.
2. Using a 7-mm open-end wrench or your fingers, loosen the mechanical chassis drawer lock on the lower right side of the chassis (see the label on the inside of the lower door). Pull the drawer out a few inches.
3. The distribution card is on the top of the mechanical chassis. Labels printed on the card identify the various cables plugged into it. The connector for the vacuum degas pump, labeled **VAC PUMP**, is near the right rear corner of the card. Check the connection.
4. Push the mechanical chassis drawer back in place, making sure the cables are not pinched. Retighten the drawer lock. Turn on the main power switch.
5. Retry the calibration. If the message reappears, notify Dionex.

4.8 Vacuum Degas Pump Low Vacuum

The IP25 monitors the degas vacuum once a minute. If the reading is 2000 counts or more lower than the degas calibration value, the following message displays:

```
LOW VACUUM ALARM!!
Check DEGAS OPTIONS settings or refer to
operator's manual
```

Open the **DEGAS OPTIONS** screen (press **Menu**, and **4**). Try increasing the **CYCLE DURATION** time and/or decreasing the **TIME BETWEEN CYCLES**. If adjusting these settings does not solve the problem, contact your Dionex office.

4.9 Inoperative Relay Control Function

- **Incorrectly installed cables**

  Make sure the cables between the appropriate relay function and the input or output unit are properly connected (see Appendix D).

- **Method programming error**

  Refer to Chapter 2 and Appendix C.

- **When attempting to set TTL2, the following message displays:**

```
TTL2 is set to indicate FLOW/NO FLOW.
```

  The **TTL2 OUTPUT USAGE** field on the **PUMP OPTIONS** screen is currently set to signal when pump flow stops (**0 FLOW**). This setting is used to control the power to a Self-Regenerating Suppressor (SRS™). To use TTL2 for another function, go to the **PUMP OPTIONS** screen and set the **TTL2 OUTPUT USAGE** field to **NORMAL**.

4.10 Poor Chromatographic Reproducibility

- **Liquid lines incompletely flushed after an eluent change**

  Attach a syringe to the priming block valve and draw at least 2.5 mL (20 mL if the vacuum degas assembly is installed) of the new eluent through the liquid lines before beginning operation.

- **Leaking piston seal**

  Check for liquid leaks at the rinse ports in the front of the pump heads (see Figure 3-6). Replace the piston seal on any head with a leak (see Section 5.2).

- **Equilibration time too short**

  Wait at least 10 minutes after starting the pump or changing the flow rate before beginning an analysis. This allows the pump's real-time electronic pulse damping circuitry to stabilize the flow rate.

5 • Service

This chapter describes routine service procedures to be performed by the user. Other service procedures must be performed by Dionex personnel.

NOTE

The pump's electronic components are not customer-serviceable. Repair of electronic components must be performed by Dionex.

NOTE

The CPU card contains a lithium battery. If it is necessary to replace the CPU card, dispose of the used battery according to the manufacturer's instructions.

Before replacing any part, refer to the troubleshooting information in Chapter 4 to isolate the cause of the problem. To contact Dionex, in the U.S., call 1-800-346-6390. Outside the U.S., call the nearest Dionex office.

Substituting non-Dionex parts may impair pump performance, thereby voiding the product warranty. Refer to the warranty statement in the Dionex Terms and Conditions for more information.

5.1 Cleaning and Replacing the Check Valves

A dirty check valve causes erratic flow rates and pressures and may cause the pump to lose prime and/or be difficult to reprime.

1. Turn off the main power switch, to prevent the pump from starting inadvertently.
2. Release the pressure from the eluent bottle.
3. Disconnect the tube fittings from the inlet and outlet check valve housings (see Figures 5-1 and 5-2).
4. Use a 12-mm wrench to loosen both check valve housings. Remove the check valve housings from the pump head. Carefully remove the check valve cartridges from the housing.
5. Place the check valve housings and cartridges in a beaker with methanol, and sonicate or agitate for several minutes.
6. Rinse each check valve housing and cartridge thoroughly with filtered deionized water.

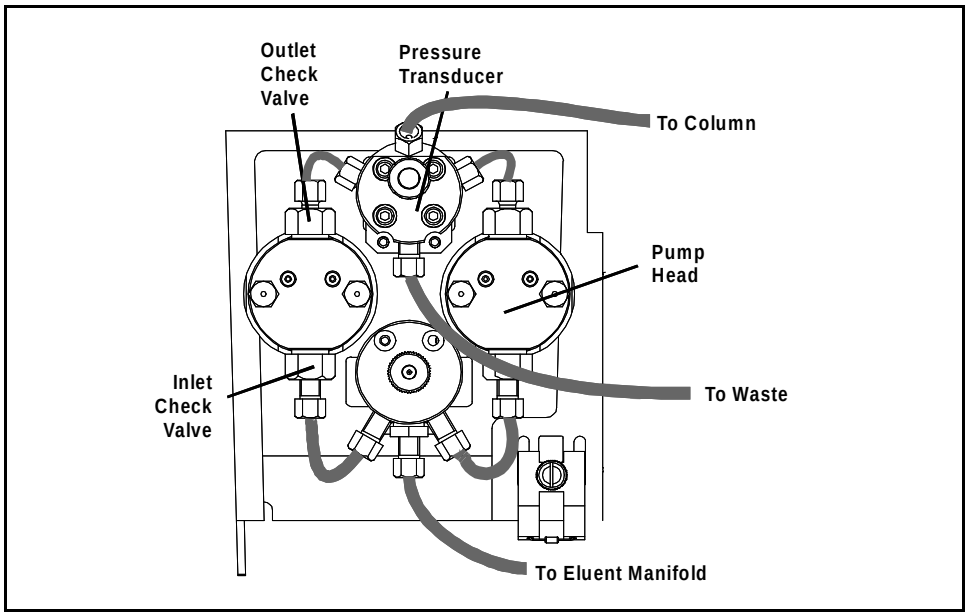

Figure 5-1. Pump Heads and Liquid Lines (PEEK)

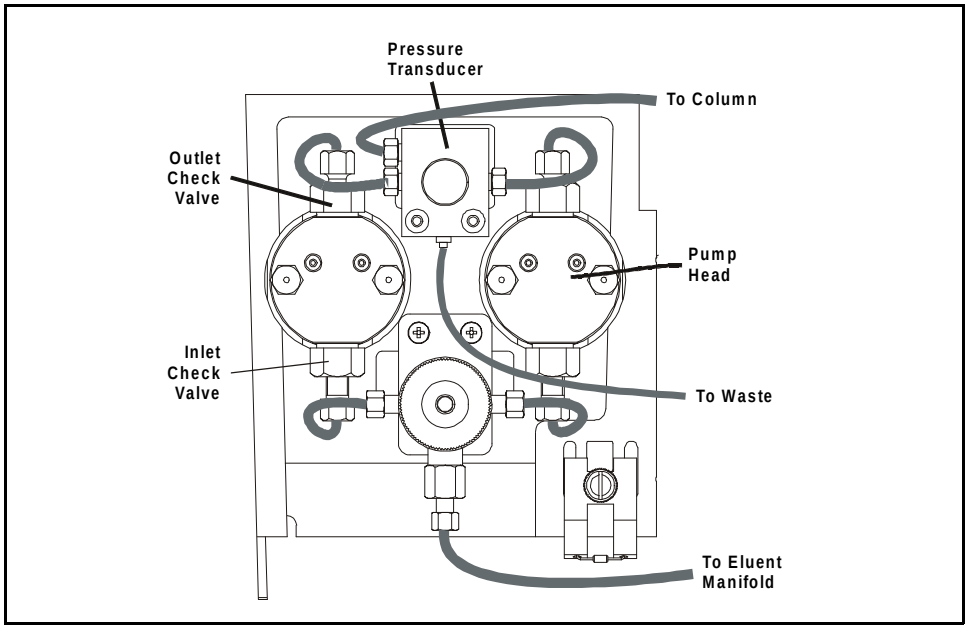

Figure 5-2. Pump Heads and Liquid Lines (SST)

7. The inlet check valve assembly housing has a 1/4-28 port on PEEK pumps and a 10/32 port on stainless steel pumps. Replace the cartridge in the inlet check valve housing; the double-hole end of the cartridge should be visible.

   The outlet check valve assembly housing has a 10-32 port on PEEK and stainless steel pumps. Replace the cartridge in the outlet check valve housing; the single-hole end of the cartridge should be visible. Liquid flows through the check valve in the large single hole and out the small double holes. The cartridges must be installed in the housings in the correct orientation for proper pump operation.

8. Reinstall the check valves. Make sure that the inlet check valve is installed on the bottom of the head and that the outlet check valve is installed on the top of the head. Tighten only enough to seat (25 in-lb torque). Tighten a little more only if it leaks.

Overtightening may damage the pump head and the check valve housing and crush the check valve seats.

9. Reconnect the liquid lines. Turn on the main power switch.
10. Prime the pump (see Section B.3). If the pump will not prime and all other possible causes of the problem have been eliminated, replace the check valve cartridge.

Check Valve Cartridge Type	Part Number
Standard Bore PEEK	047747
Standard Bore Stainless Steel	047755
Microbore PEEK	047748
Microbore Stainless Steel	048279

11. After replacing check valve cartridges, open the **ELAPSED TIME** screen (press **Menu**, **8**, **2**). Move the cursor to the **VALVES IN USE** field and press **Enter** to reset the field to 0 cycles.

5.2 Piston Seal Replacement

A damaged seal allows leakage past the piston and then through the rinse ports in the front of the pump heads. The pump may be difficult to prime; flow rates will not be stable, and baseline noise may be observed.

1. Turn off the main power switch.
2. Disconnect the tube fittings from the pressure transducer and the inlet check valve (see Figures 5-1 and 5-2).
3. Remove the two nuts from the pump head.
4. Carefully disengage the head from the piston by pulling the head straight off and away from its mounting guides.

Lateral motion while disengaging the head from the piston may break the piston.

5. Place the head (front end down) on a clean work surface and lift off the backup washer to expose the piston guide (see Figures 5-3 and 5-4).
6. The pistons are captured by a magnetic retention system and are not removed with the rest of the pump head assembly. After removing the pump head, apply just enough lateral force to overcome the magnetic field and release the pistons.

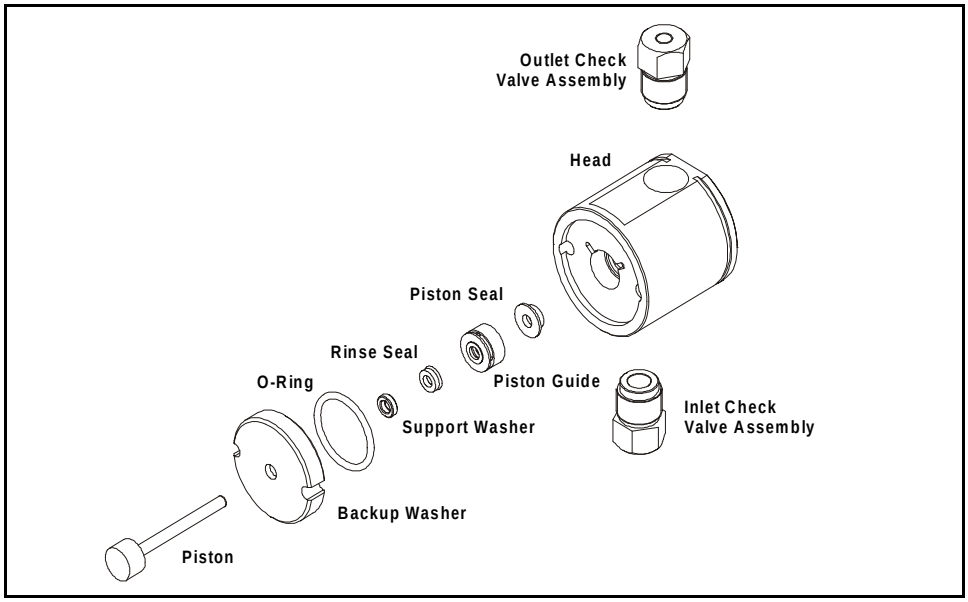

Figure 5-3. Pump Head Assembly

Component	Standard Bore/PEEK	Standard Bore/SST	Microbore/ PEEK	Microbore/ SST
Pump Head Assembly	054087	054096	054094	054095
Pump Head	054051	054050	054098	054099
Outlet Check Valve	047661	047665	047657	047663
Inlet Check Valve	047660	047664	047656	047662
Piston Seal	054400	054402	054401	054401
Piston Guide	045633	045633	045632	045632
Rinse Seal	048722	048722	048721	048721
Support Washer	050745	050745	050744	050744
O-Ring	014895	014895	014895	014895
Backup Washer	045630	045630	045631	045631
Piston	052840	052840	053584	053584

Table 5-1. Pump Head Assembly Part Numbers

7. To remove the piston guide and seal:

   a. Fill the head cavity with deionized water by injecting through either the piston opening or the inlet check valve.

   b. Reinsert the piston approximately 1/8 in into the seal (see Figure 5-4).

   c. Install a 10-32 fitting plug (P/N 042772) on the outlet check valve. Optionally, install a fitting plug, 1/4-28 for PEEK (P/N 037628) or 10-32 for SST, on the inlet check valve. Tighten.

   d. Push the piston into the head. This action will hydraulically unseat the seal and piston guide from the head. Remove the piston and pull off the guide and seal.

   e. If the piston guide and seal do not come out, make sure the fitting plug(s) is tight. Then, add more water and repeat Steps b and d.

   f. Remove the fitting plug(s).

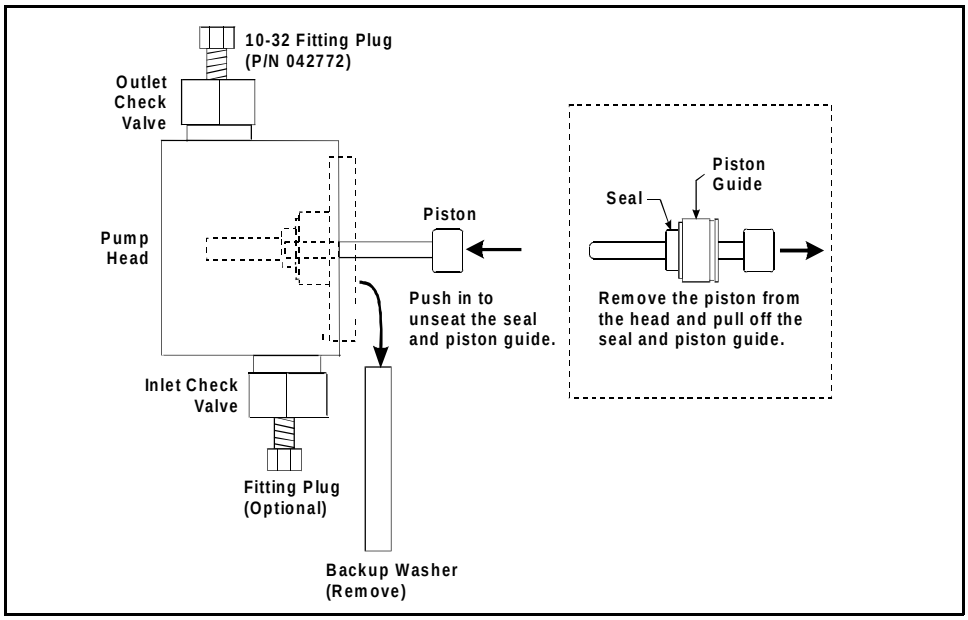

Figure 5-4. Removing the Piston Seal

8. To install the new seal and reinstall the piston guide:

   a. Push the piston through the piston guide and the new seal. Then insert the piston, piston guide, and seal into the pump head just until the seal makes contact with the bottom of the counterbore (see Figure 5-5, View A).

   b. Hold the piston guide and seal in place and remove the piston from the head (see Figure 5-5, View B).

   c. Seat the seal by pushing the piston guide into the head until it is flush with the head.

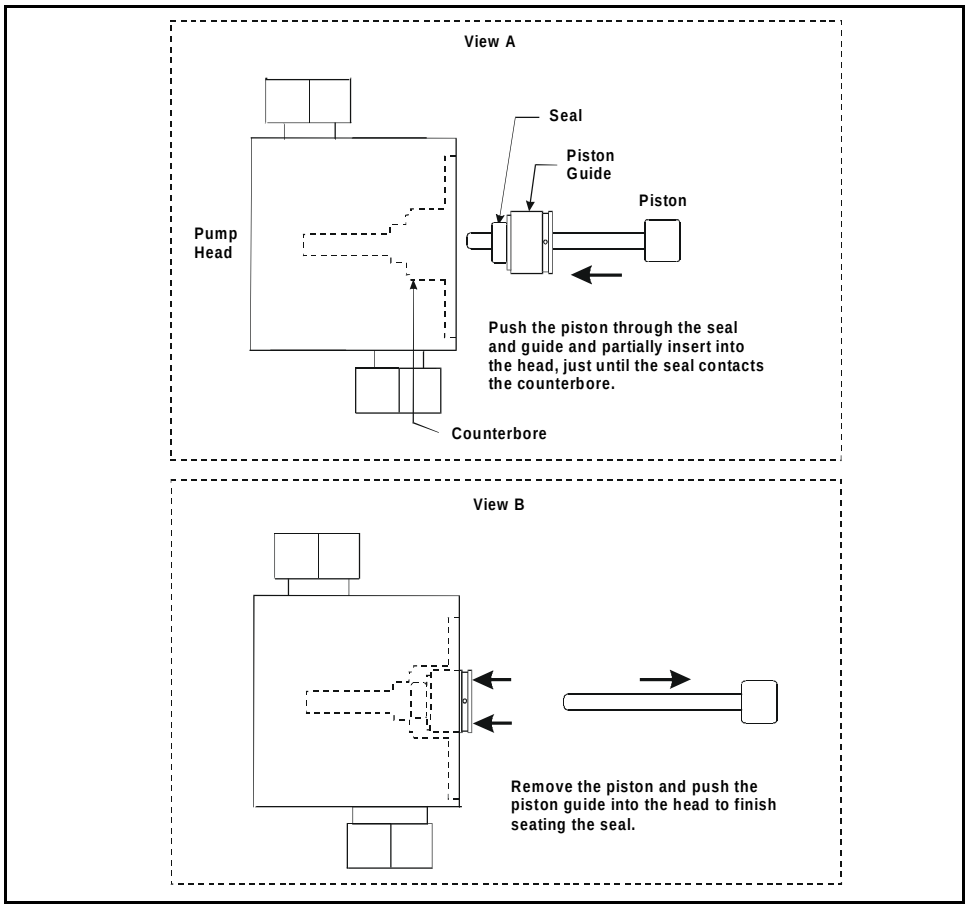

Figure 5-5. Installing the Piston Seal

9. Dionex recommends reinstalling the head and piston as a single assembly so that the piston will center itself. To do this, first press the backup washer into the head until it is flush with the indented surface of the head. Then, insert the piston *halfway* into the head. This ensures that the magnet in the follower picks up the piston. (The follower is the cylinder that holds the piston in place as it moves in and out of the pump head assembly.) Reinstall the head and piston assembly, using a wrench to tighten the nuts evenly (12 in-lb torque).
10. Reconnect the liquid line to the inlet check valve.
11. Reconnect the tube fittings to the pressure transducer.
12. Turn on the main power switch.
13. Open the **ELAPSED TIME** screen (press **Menu**, **8**, **2**). Press **Enter** to reset the **SEALS IN USE** field to 0 cycles. The pump is ready for normal operation.

5.3 Pump Piston Replacement

Continued leaking through the rinse ports after replacing the piston seal (assuming the head is tight) indicates a dirty, scratched, or broken piston.

1. Turn off the main power switch.
2. Disconnect the tube fittings from the pressure transducer and the inlet check valve (see Figures 5-1 and 5-2).
3. Remove the two acorn nuts from the pump head.

Lateral motion while disengaging the head from the piston may break the piston.

4. Slowly pull the head and allow it to separate from the housing. Carefully disengage the head from the piston by pulling the head straight off and away from the mounting guides.
5. The pistons are captured by a magnetic retention system and are not removed with the rest of the pump head assembly. After removing the pump head, apply just enough lateral force to overcome the magnetic field and release the pistons.
6. If the piston is broken, replace it as well as the piston seal (see Section 5.2) and the rinse seal.
7. Dionex recommends reinstalling the head and piston as a single assembly so that the piston will center itself. First press the backup washer into the head until it is flush with the indented surface of the head. Then, insert the piston *halfway* into the head. This ensures that the magnet in the follower picks up the piston. (The follower is the cylinder that holds the piston in place as it moves in and out of the pump head assembly.) Reinstall the head and piston, using a wrench to tighten the nuts evenly (12 in-lb torque).
8. Reconnect the liquid line to the inlet check valve.
9. Reconnect the tube fittings to the pressure transducer.
10. Turn on the main power switch and prime the pump (see Section B.3).

5.4 Pressure Transducer Waste Valve O-Ring Replacement

A damaged O-ring causes leakage around the base of the pressure transducer waste valve knob.

1. Turn off the main power switch.
2. Remove the valve from the pressure transducer housing by turning the knob counterclockwise until it comes loose from the housing.
3. Remove the O-ring (see Figure 5-6).
4. Carefully slide a new O-ring (P/N 046434) over the end of the valve and push it into the groove.
5. Reinstall the valve in the housing, turning the knob clockwise until the valve is seated.

CAUTION

Overtightening the valve may damage the pressure transducer housing.

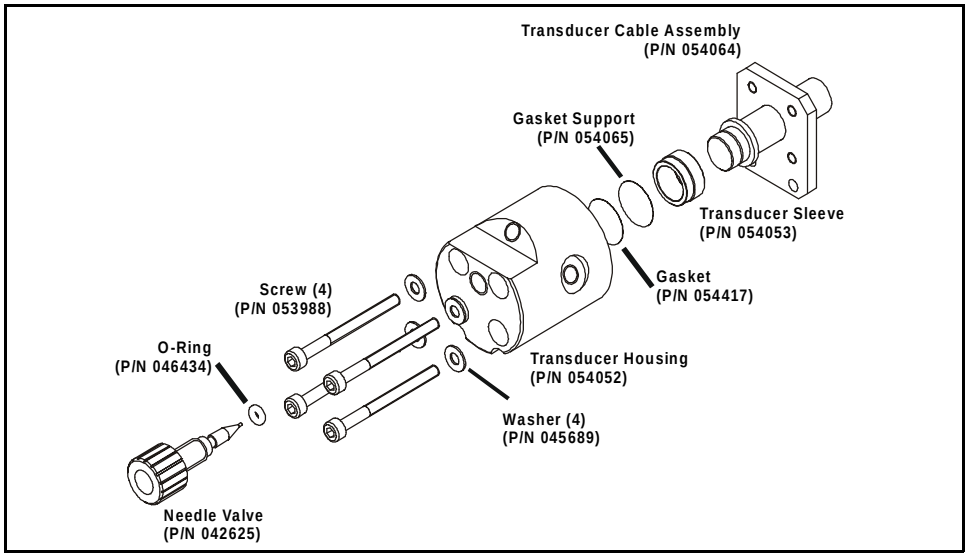

Figure 5-6. Pressure Transducer Assembly

5.5 Changing Main Power Fuses

1. Turn off the main power switch.

HIGH VOLTAGE—Disconnect the main power cord from its source and also from the rear panel of the IP25.

2. The fuse holder is part of the main power receptacle on the rear panel (see Figure 5-7). A recessed lock is located on each side of the fuse holder. Using a small screwdriver or your fingernails, push each lock toward the center to release it. The fuse holder pops out approximately 0.16 cm ($\frac{1}{16}$ in) when the locks release. When both locks are released, pull the fuse holder straight out of its compartment.
3. The holder contains two fuses. Replace these with new IEC127 fast-blow fuses rated 3.15 amps (P/N 954745). Dionex recommends replacing both fuses even though only one is open.
4. Reinsert the fuse holder into its compartment. The fuse holder is keyed to fit only in its proper orientation. Apply sufficient pressure evenly against the holder to engage the two locks. The holder is flush against the panel when both locks are engaged.
5. Reconnect the main power cord and turn on the power.

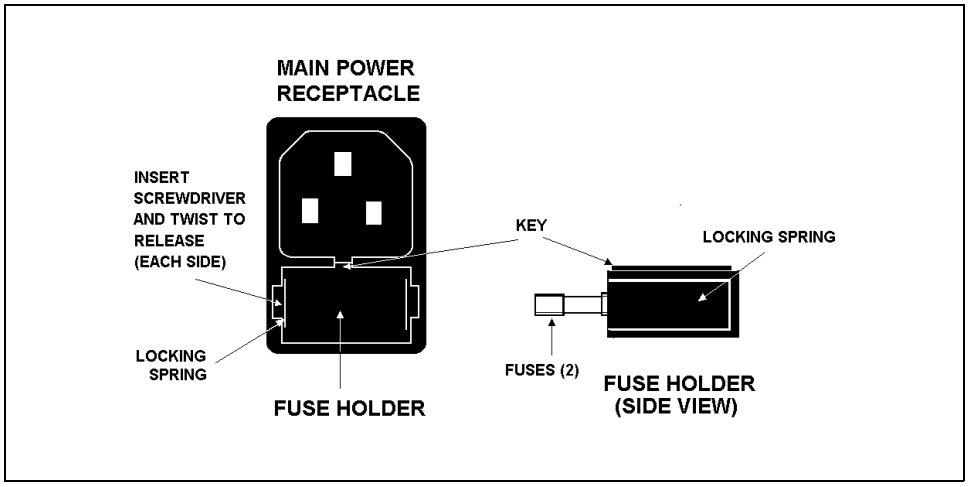

Figure 5-7. Main Power Fuse Holder

A • Specifications

A.1 Electrical

Main Power Requirements	100 to 240 Vac, 50/60 Hz; 2.5 amps. The IP25 power supply is main voltage auto-sensing and requires no adjustment.
Fuse Requirements	Two 3.15 amp fast-blow IEC127 fuses (P/N 954745)

A.2 Environmental

Operating Temperature	10 °C to 40 °C (50 °F to 104 °F)
Operating Humidity	5 to 95% relative humidity (non-condensing)

A.3 Physical

Dimensions	33.5 cm high x 22.5 cm wide x 42 cm deep (13.1 in x 8.9 in x 16.8 in) 6 cm (2.4 in) clearance required in back of the module
Weight	19 kg (42 lbs)
Decibel Level	60 db ("A WEIGHING" setting)

A.4 Display and Keypad

Display	Liquid crystal with adjustable backlighting
Keypad	26-button keypad for entering commands and numerical values for screen parameters

A.5 Hydraulics

Pump	Dual-piston, variable speed, 100 µL (standard bore), 25 µL (microbore) stroke; user-selectable constant pressure or constant flow feedback control
Flow Rate	Standard bore pump head: 0.04 to 10.0 mL/min, linearly variable in increments of 0.01 mL/min Microbore pump head: 0.01 to 2.50 mL/min, linearly variable in increments of 0.01 mL/min
Operating Pressure	35 MPa (5000 psi) maximum
Pressure Resolution	0.07 MPa (10 psi)
High Pressure Limit	0 to 35 MPa (0 to 5000 psi) in increments of 0.05 MPa (7.25 psi); trips instantaneously
Low Pressure Limit	0 to 35 MPa (0 to 5000 psi) in increments of 0.05 MPa (7.25 psi); trips after a time-out of 0.4 mL for the standard bore IP25 or 0.1 mL for the microbore IP25
Delay Volume	Approximately 700 µL for standard pump heads or 300 µL for microbore pump heads.

A.6 Method Control

Methods Stores up to 100 separate methods (00 to 99), each of which may contain up to 50 separate steps. The actual number of stored methods depends on the available memory.

Control The keypad is used to select the pump's operating parameters and to program methods.

Storage Non-volatile memory protects against the loss of programs during power-down or in the event of a power failure.

Remote Limited remote operation via TTL-Input logic level, and TTL-output and relay contact closures, or full remote programming and control through PeakNet software and the DX-LAN interface.

A.7 Vacuum Degas Assembly Option

Channels Single-channel membrane vacuum degas

Materials Wetted materials, PEEK, PTFE

B • Installation

B.1 Facility Requirements

- Make sure the IP25 installation site meets the electrical and environmental specifications listed in Appendix A
- Install the IP25 on a sturdy workbench with at least 6 cm (2.4 in) free space behind the module for connections and ventilation. Install the module at a height that ensures convenient viewing of the front panel display and access to the interior.

Use caution when lifting the module. Two or more persons should lift the module, which weighs 19 kg (42 lbs). Lift only from the bottom and side surfaces; lifting with the panel door will damage the door hinges.

- Provide a source of helium to pressurize the eluent and regenerant reservoirs. For details, refer to the *Pressurizable Reservoir Installation Instructions*. Pressurization of the eluent reservoirs is optional.
- Eluents must be vacuum degassed and housed a minimum of 8 in above the pump in an EO1 Eluent Organizer (P/N 44125) or in a built in organizer, such as the one provided with the LC25 Chromatography Oven.
- Always filter eluents to remove small particulates that may contaminate the pump. Install an end-line filter (P/N 045987) on the end of the eluent reservoir line. Filters are supplied in the pressurizable reservoir Ship Kits.

B.2 Installation Instructions

The IP25 Ship Kit contains items necessary for completing the installation.

IP25 Isocratic Pump Version	Ship Kit
Standard bore/Microbore with PEEK components	P/N 054621
Standard bore/Microbore with stainless steel components	P/N 054627

B.2.1 Power Connection

The power to the IP25 can be controlled from the main power switch on either the IP25 or the LC30 Chromatography Oven (if present). In either case, no adjustment is required to select the line voltage.

- For power on/off control from the IP25, connect the modular power cord (IEC 320 C13), from the main power receptacle on the rear panel (see Figure B-1) to a grounded, single-phase, power source.

The power supply cord is used as the main disconnect device. Ensure that the socket-outlet is located/installed near the module and is easily accessible.

- For power on/off control from the LC30 Chromatography Oven, connect the IEC jumper power cord (P/N 960748) provided in the LC30 Ship Kit from the main power receptacle on the IP25 rear panel to one of the four IEC auxiliary receptacles on the rear panel of the LC30. Leave the IP25 power switch on continuously and use the LC30 main power switch to turn the IP25 on and off. Other modules in the system can be connected to the LC30 in the same way, allowing the LC30 to function as the main power source for the system.

WARNING

SHOCK HAZARD—To avoid electrical shock, a grounded receptacle must be used. Do not operate or connect to AC power mains without an earthed ground connection.

CAUTION

Operation at AC input levels outside of the specified operating voltage range may damage the IP25.

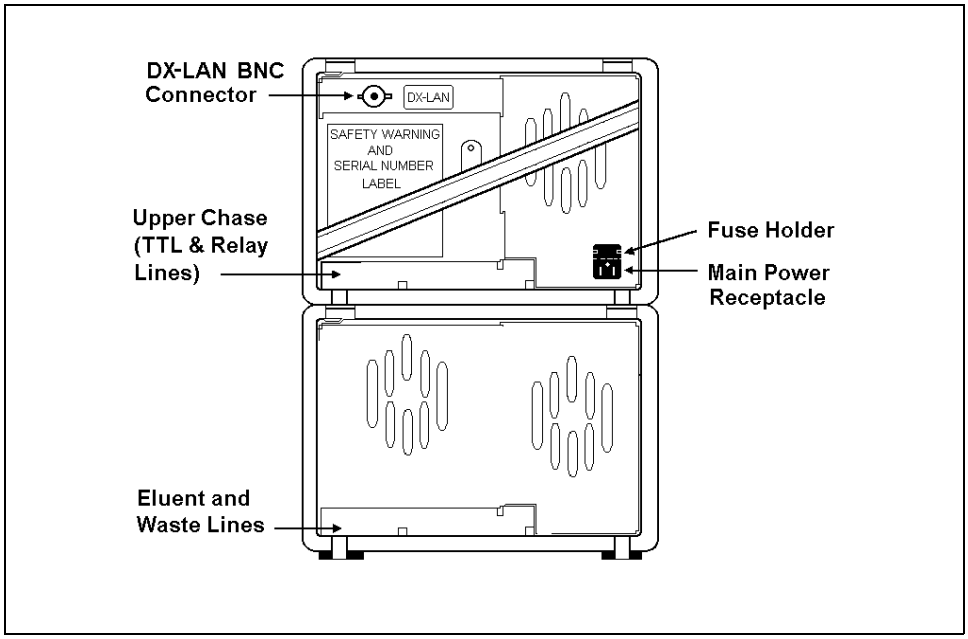

Figure B-1. IP25 Rear Panel

B.2.2 Electronics Chassis Connections

The electronics chassis connections vary based on which chromatography module is installed with the IP25.

LC10 or LC20 Connections

1. Route the leak sensor cable from the rear of the LC10 Chromatography Organizer or the LC20 Chromatography Enclosure through the IP25 upper chase (see Figure B-1). Connect the cable to the **LC LEAK** connector on the pump electronics chassis (see Figure B-2).
2. Route the solenoid valve cable from the rear of the LC10 or LC20 through the IP25 upper chase. Connect the cable to the **LC AIR** connector on the pump electronics chassis.

LC25 Connection

Route the electronic injection valve cable from the rear of the LC25 through the IP25 upper chase (see Figure B-1). Connect the cable to the **LC AIR** connector on the pump electronics chassis (see Figure B-2).

LC30 Connections

1. Route the RJ-11 serial cable from the rear of the LC30 Chromatography Oven through the IP25 upper chase (see Figure B-1). Connect the cable to the **LC COMM** connector on the pump electronic chassis (see Figure B-2).
2. Route the solenoid valve cable from the rear of the LC30 through the IP25 upper chase. Connect the cable to the **LC AIR** connector on the pump electronic chassis (see Figure B-2).

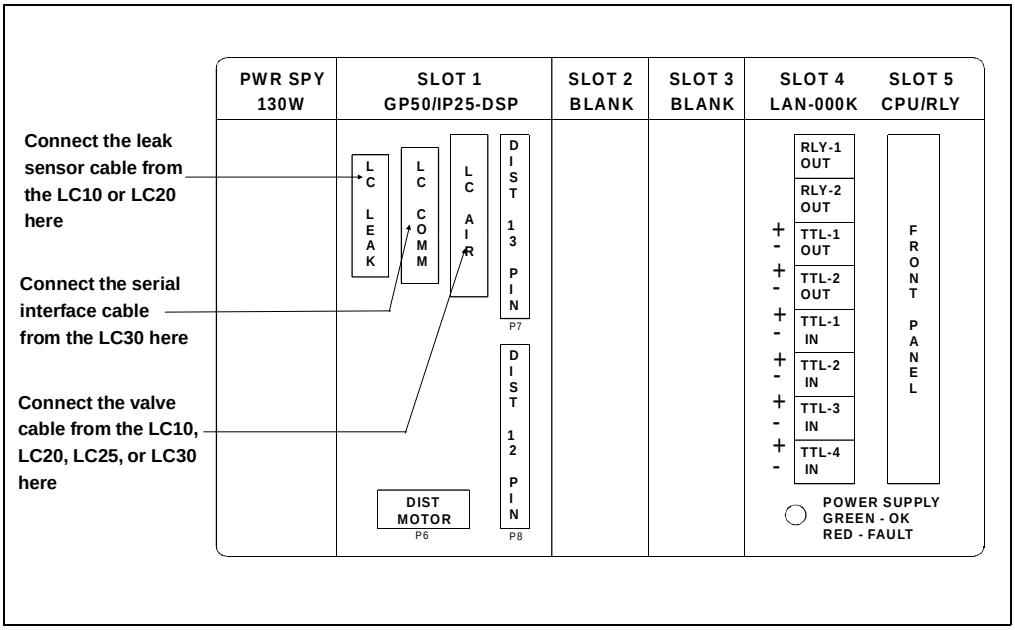

Figure B-2. IP25 Electronics Chassis
(Located behind pump upper door)

NOTE
Refer to Appendix D for TTL and relay installation instructions.

B.2.3 DX-LAN Network Connection (Optional)

For the IP25 to communicate with PeakNet software, a pump interface card (P/N 046341) must be installed in the IP25 and a DX-LAN cable (P/N 960405) must be connected to a DX-LAN BNC tee connector (P/N 921914) on the rear panel.

If you order an IP25 with the DX-LAN option, the card is installed at the factory. The tee connector and cable are shipped with the pump. Instructions for installing the tee connector and cable are in the next section.

If you order the DX-LAN later, the card, tee connector, and cable are included in a pump interface card kit (P/N 044195). Follow the steps below to install or replace a card.

Installing or Replacing a Pump Interface Card

IMPORTANT

STATIC—The IP25 electronics are not user-serviceable and the pump interface card should be installed by qualified personnel only. Observe standard anti-static procedures when installing the interface card or handling the CPU card.

To prevent damage to the pump, turn off the main power before installing the interface card. After confirming that the LED on the CPU card is off (not green or red), unplug the power from the mains. Do not rely on the front panel power switch.

1. If you are replacing a pump interface card, remove the hex nut securing the DX-LAN BNC connector to the pump rear panel (see Figure B-1).
2. Remove any TTL/Relay plugs from the connectors at slot 4 on the electronics chassis (see Figure B-2).
3. Disconnect the 60-pin ribbon cable from the inside of the front panel by first closing the tilt panel to expose the connector and its ejector latches. Remove the cable by opening the ejector latches.

4. Using a screwdriver as a lever, open the white ejector latch at the bottom of the CPU card. Remove the CPU card, cable, and Relay card as a single unit.
5. If you are replacing a card, remove the existing card from slot 4.
6. Insert the (new) pump interface card (P/N 046341) into slot 4. Slide the card to the rear. Verify that the BNC connector on the card is aligned with the opening at the rear and the card is aligned with the card connector. Press firmly on the card until it mates fully with the card connector on the rear panel. Pull on the card to verify that it cannot move.
7. Reinstall the CPU/Relay card. Press firmly until the CPU card is inserted into the connector on the rear panel.
8. Reconnect the ribbon cable to the 60-pin connector on the inside of the front panel. The header and connector are key-polarized near the center. The ejector latches should be partially open to accept the cable connector.
9. Install the BNC tee connector and DX-LAN cable (see the following section).

Installing the BNC Tee Connector and DX-LAN Cable

1. Install the BNC tee connector (P/N 921914):
   a. Note the two small locking pins on either side of the DX-LAN BNC connector on the rear panel (see Figure B-1).
   b. Push the tee connector onto the BNC connector on the rear panel and twist until the locking pins are fully engaged in the slots on the tee connector.
   c. Pull firmly on the tee connector to verify that it cannot move.
2. Install the DX-LAN cable (P/N 960405):
   a. Push the metal sleeve on the end of the DX-LAN cable onto one port of the BNC tee connector.
   b. Twist the metal sleeve until the locking pins on the tee are fully engaged in the slots on the cable's metal sleeve.
   c. Pull the end of the cable to verify that it cannot move.

IMPORTANT **The DX-LAN cable is a 50 ohm coaxial impedance cable. (Fifty ohm cables are imprinted with "RG-58U.") Do not substitute an inferior cable, such as a 75 ohm television coaxial cable. Failure to install the correct cable or to lock it into place on the BNC tee connector will cause the module to lose communication with PeakNet.**

3. If the pump is the last module in the network to be connected, install a terminator resistor plug (P/N 921034), shipped with PeakNet software, on the remaining port of the BNC tee connector. If this is not the last module, connect the cable from the next module to the BNC tee.

IMPORTANT **Terminator resistor plugs must be installed at each end of the DX-LAN network. Verify that both ends of the DX-LAN have terminator resistor plugs installed.**

B.2.4 Waste Lines

The IP25 requires two waste lines; one line from the pressure transducer assembly, and one from the leak drain. These lines are factory-installed and routed to the rear panel.

Place the free end of both waste lines into a single waste container positioned below the level of the IP25 to maintain a positive siphon (see Figure B-3).

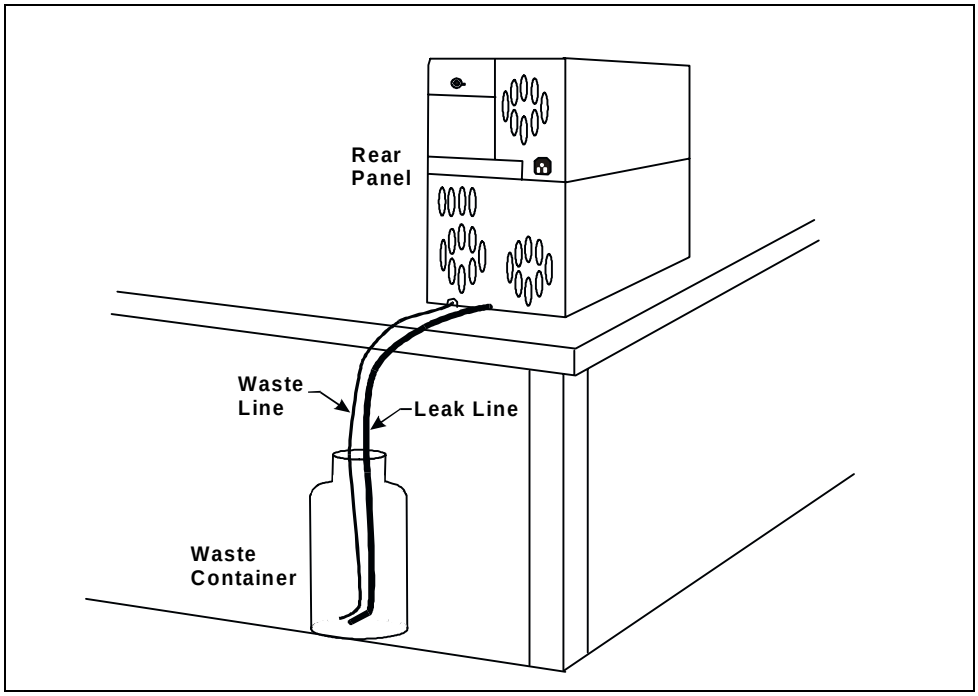

Figure B-3. Eluent Waste Lines

B.2.5 Eluent Outlet Line Connection

1. Connect the eluent outlet line exiting the pressure transducer to the injection valve.
2. Route the eluent outlet line through the chase and out the slot on the left side of the module.

B.2.6 Eluent Inlet Line Connection

1. Connect the eluent line from the eluent reservoir to the 1/8-in OD Teflon line coming from the rear of the pump. This line will have a 1/4-28 fitting on the end.
2. If the eluent reservoirs are going to be pressurized, verify that a regulator (P/N 046594) is installed on the gas supply line to the reservoir and turn on the gas supply. Adjust the pressure to 55 KPa (8 psi).

Never pressurize the reservoirs above 69 KPa (10 psi).

B.3 Priming the Pump

Two methods are available for priming the pump:

- Priming using the priming block
- Priming using the **Prime** button on the front panel

Priming Using the Priming Block

1. Press **Menu** and **Enter** to go to the **MAIN** screen. If **REMOTE** mode is currently selected, move the cursor to that field and press a **Select** button to toggle to **LOCAL** mode. Press **Enter** or a cursor arrow button. If **METHOD** control is currently selected, move the cursor to that field, toggle to **DIRECT CNTRL**, and press **Enter** or an arrow button.
2. Connect a 10 mL syringe (P/N 054578) to the luer port in the priming block valve (see Figure B-4). Turn the priming block valve counterclockwise about two turns.

NOTE
If the eluent is pressurized, liquid will flow into the syringe as soon as you open the priming block valve.

3. Turn on the pump.
4. If the eluent is not pressurized, be sure there is a vent from the eluent reservoir, or loosen the reservoir cap.
5. Draw the syringe back to pull eluent through the flow path. It may take several syringe draws to remove all air and/or previous eluent from the tubing. If the IP25 has a vacuum degas assembly installed, there is an additional 17 mL of eluent that must be drawn through the priming block.
6. When the pump has been primed thoroughly, turn the priming block valve clockwise until closed (see Figure B-4). Do not overtighten.

   The pump is now ready for operation.

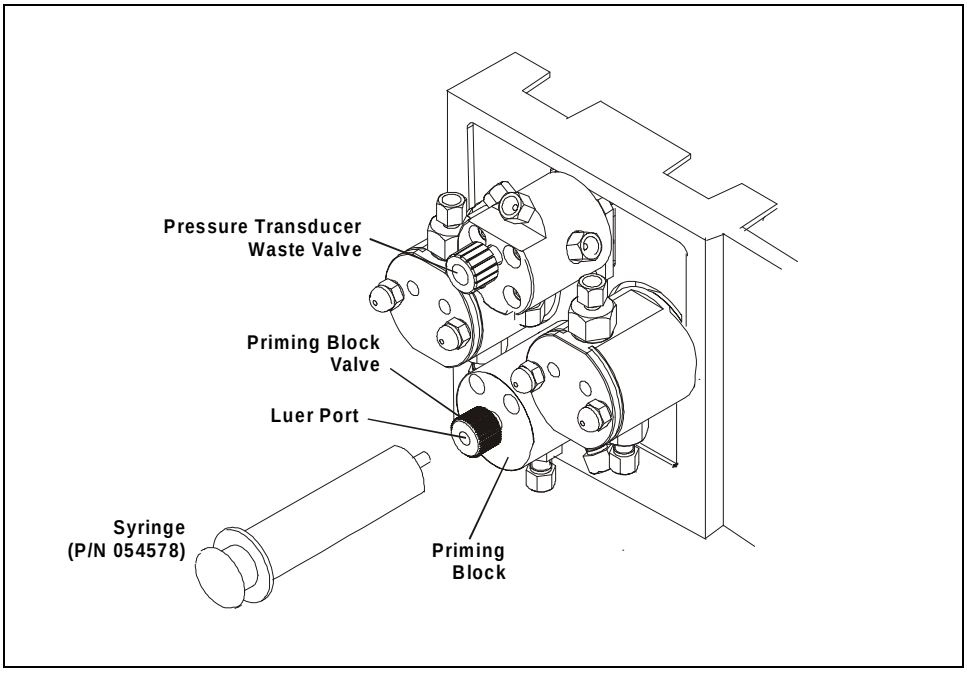

Figure B-4. Priming the Pump

Priming Using the Prime Button

1. Select **DIRECT CNTRL** and **LOCAL** from the **MAIN** screen.
2. Open the pressure transducer waste valve (see Figure B-4) by turning the knob counterclockwise one to two turns. This directs the eluent flow path to waste and eliminates backpressure.
3. Press **Prime** on the front panel. The pump will pump at 9.9 mL/min for a standard bore or 2.5 mL/min for a microbore.
4. Allow the pump to prime until all air and previous eluent are purged and no air bubbles can be seen exiting the waste line.

   If the IP25 has a vacuum degas assembly installed, there is an additional 17 mL of eluent that needs to be purged. Allow several extra minutes of priming to sufficiently purge air and previous eluent from the degas unit.
5. Press **Prime** again to return the flow to the normal rate.
6. Close the pressure transducer waste valve. The pump is now ready for operation.

NOTE

After priming, check the pressure reading on the MAIN screen. The IP25 display updates the pressure readout once per piston stroke. The reading from one stroke to the next should be within 3%. A variation of more than 3% indicates the pump is out of prime. If this is the case, go on to the following steps. Also refer to Section 4.1 for troubleshooting information.

Priming the Pump Heads with Isopropyl Alcohol

NOTE
Prime the pump heads with alcohol only if the standard procedures, described on the previous pages, are ineffective.

1. Connect a 10 mL syringe (P/N 054578) filled with alcohol to the luer port in the priming block valve (see Figure B-4).
2. Open the pressure transducer waste valve by turning the knob counterclockwise about two turns.
3. Turn the priming block valve counterclockwise about two turns (see Figure B-4).
4. Turn on the pump.
5. Use the syringe to slowly push 3 to 5 mL of alcohol through the pump. Avoid pushing any air trapped in the syringe through the pump. Verify that alcohol with no trapped bubbles is traveling down the waste line from the transducer.
6. Close the priming block valve. Do not overtighten.
7. Disconnect the syringe from the priming block. Keep the pressure transducer waste valve open.
8. Press **Prime**. This will purge the alcohol through the pump heads and flush the heads with the eluent.

Alcohol may damage some columns. Be sure to rinse the alcohol from the pump using the process described above.

9. Close the pressure transducer waste valve. The pump is now ready for operation.

B.4 Automatic SRS Power Control

TTL connections can be used to automatically switch off the power to a Self-Regenerating Suppressor (SRS). When set up for this option, the IP25 sends a TTL signal to the detector when the pump flow stops. After 5 minutes, the detector will shut off the SRS power. The 5-minute delay in shutoff allows momentary flow interruptions without disturbing the SRS.

1. Go to the IP25 **PUMP OPTIONS** screen and set **TTL2 OUTPUT USAGE** to **0 FLOW** (see Figure B-5).

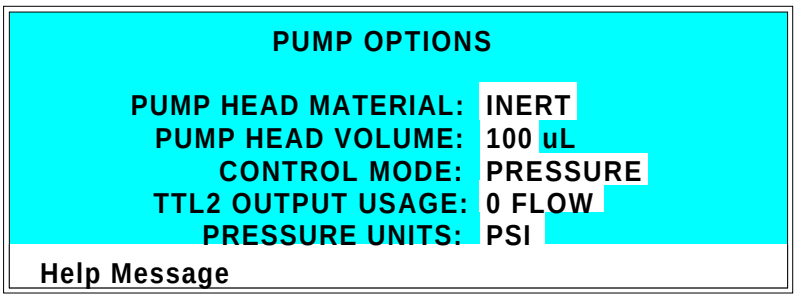

Figure B-5. Pump Options Screen

2. Go to the CD20 or ED40 detector **TIME FUNCTION IN** screen and assign TTL3 to **SRS OFF/ON**. Select the **NORMAL EDGE** mode.
3. To create a TTL cable, locate a pair of twisted black and red wires (P/N 043598) and two green TTL connector plugs (P/N 921019) in the IP25 Ship Kit.
4. Insert the wires into the plugs, placing the red wire on top and the black ground wire on the bottom.
5. Plug one end of the cable into **TTL2 OUT** on the IP25. (The TTL connectors are located behind the upper door). Route the cable out through the upper chase of the IP25 and into the CD20 or ED40 upper chase. Plug the other end into **TTL3 IN** on the detector (see Figure B-6). Make sure the red wire is on top and the black wire is on the bottom of each connection when it is plugged into the module.

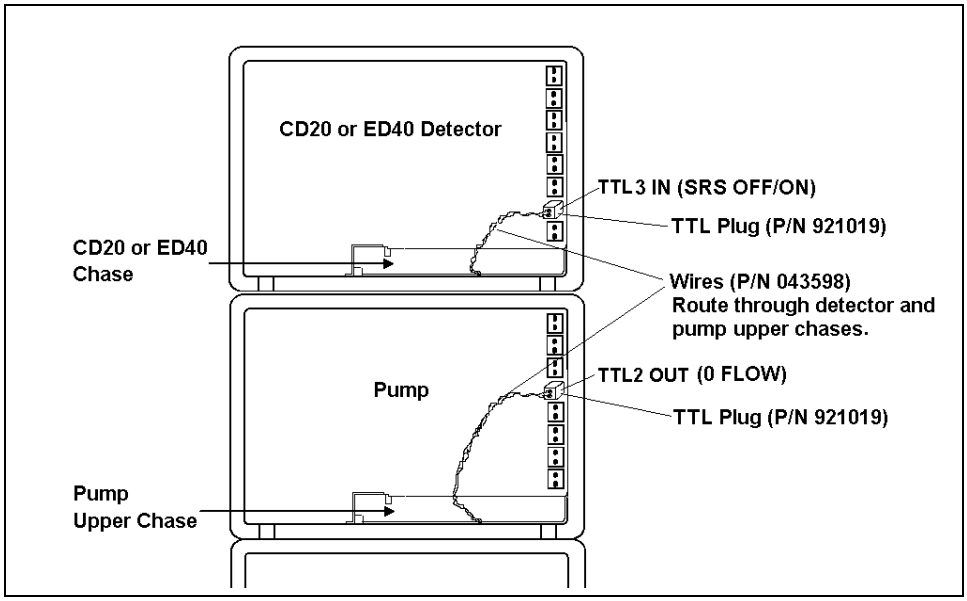

Figure B-6. TTL Connections for SRS Power Control (CD20/ED40 and IP25 Front Views without Front Doors)

NOTE

For correct operation, the CD20 or ED40 TTL3 input mode must be set to NORMAL EDGE. Select the mode from the TIME FUNCTION IN screen.

B.5 Stacking Modules

Dionex chromatography modules are designed to be stacked on top of each other up to a maximum height of four units. The pump is two units high and typically sits on the workbench with a single-unit or double-unit detector module stacked on top of it. Figure B-7 illustrates the recommended stacking configuration.

CAUTION

Use two persons when lifting the module and lift only from the bottom and side surfaces. Lifting with the panel door will damage the door hinges. Use caution when lifting the module; it weighs 19 kg (42 lbs).

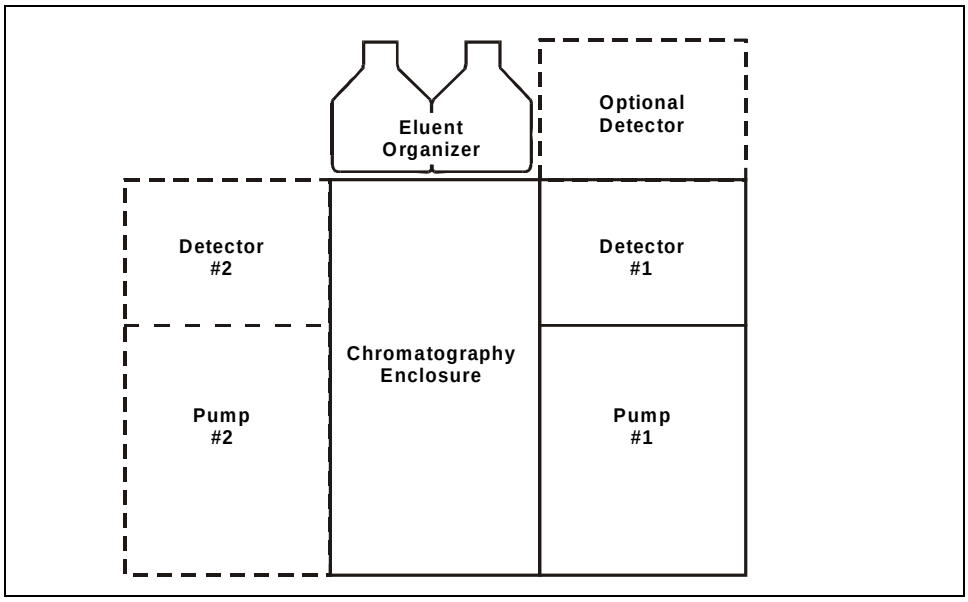

Figure B-7. Recommended Stacking of Modules

C • User Interface

This appendix illustrates and describes all of the screens available for display on the front panel of the IP25. There are three categories of screens: operational, diagnostic, and calibration (see Figure C-1).

- *Operational* screens allow you to create, edit, and run methods that control pump operation, and to select default pump parameters.
- *Diagnostic* screens provide access to IP25 diagnostic information and tests.
- *Calibration* screens allow you to calibrate various IP25 functions; for example, the flow rate and the pressure offset.

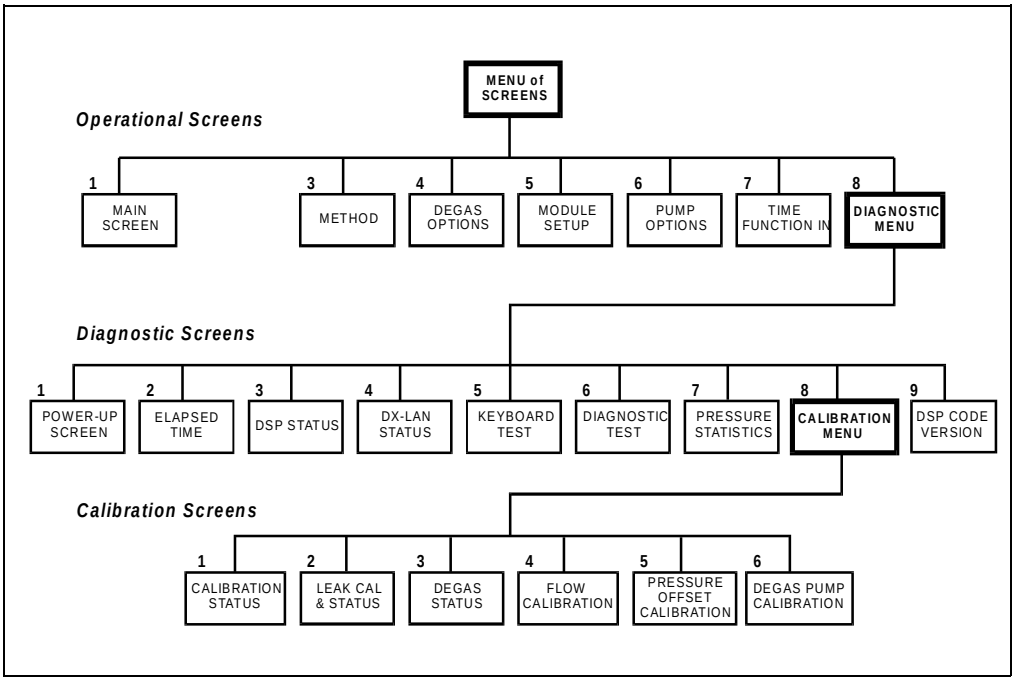

Figure C-1. IP25 Menu Structure

Menu of Screens

This screen provides top-level access to the IP25 operational screens and to the **DIAGNOSTICS MENU**. It is displayed when you press **Menu**.

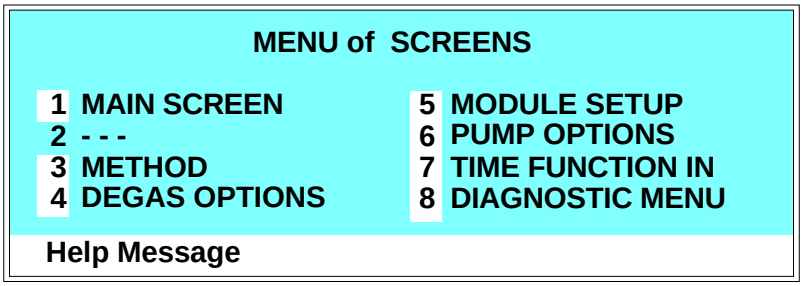

Figure C-2. Menu of Screens

There are two ways to select a screen from a menu:

1. Move the cursor to the field containing the screen number and press **Enter**.
2. Press the number button on the front panel keypad that corresponds to the screen number in the menu.

To display a brief description of each screen, press **Help.**

C.1 Operational Screens

C.1.1 Main Screen

Use this screen to select the mode of operation, the method number to run (when using Method control), and basic operating parameters (when using Direct control).

The **MAIN** screen displays active data in large characters .

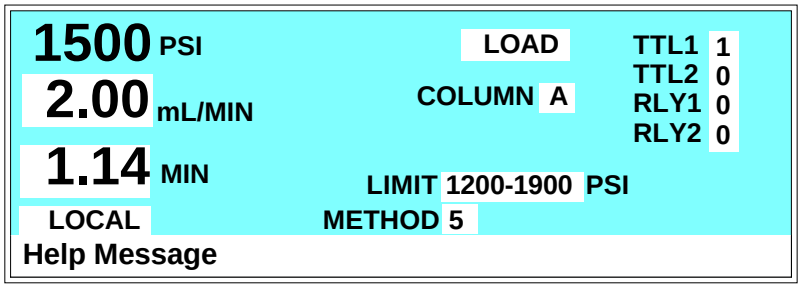

Figure C-3. Main Screen

PSI (MPa, BAR) — Displays the system backpressure in psi, MPa, or bar. Set the unit of measure from the **PUMP OPTIONS** screen.

mL/MIN — Displays the eluent flow rate in milliliters per minute. In Direct control, set the flow rate in this field. The flow rate is programmed in the Method when using Method control.

MIN — Displays the total elapsed time that the method clock has been running. The value can be changed. When you enter a new elapsed time, the method settings corresponding to the new time go into effect.

LOCAL/ REMOTE — Press either **Select** button to toggle between the **LOCAL** and **REMOTE** modes. Local mode is used for full front panel control when a PeakNet workstation is not configured. The pump will automatically switch to remote mode when a command is given from PeakNet. A command from the PeakNet can set the pump to **LOCKED RMT** to shut out operation from the keypad. The **LOCKED RMT** mode can be

	canceled only by a new command from PeakNet, or by turning off the pump and then turning it back on.
INJECT/LOAD	Selects the position of the injection valve. The choices are **INJECT** and **LOAD**.
COLUMN	Selects the active column (A or B) in the chromatography module. This field is functional only when a column switching valve is installed.
LIMIT	The pressure limit range value in psi, MPa, or bar (see Section 3.1.5).
METHOD #	Displays the number of the method currently running. When using local mode, enter the method number (1 to 99) to run. When PeakNet is running a method, 0 is displayed.
TTL1 **TTL2** **RLY1** **RLY2**	Provides TTL and relay control of other devices. In Direct control, select 1 (on) or 0 (off). In Method control, program the TTL and relay fields from the **METHOD** screen. Appendix D describes TTL and relay control.

C.1.2 Method Screen

Use this screen to select, edit, and save methods.

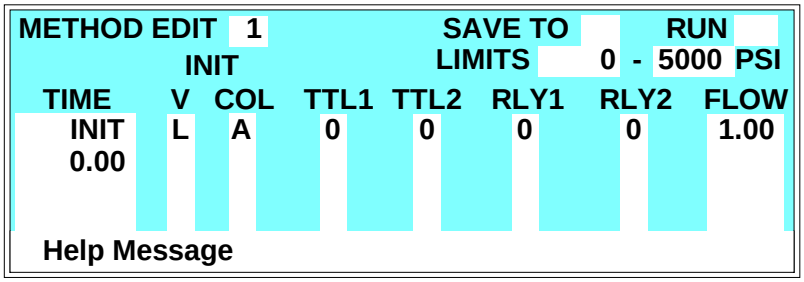

Figure C-4. Method Screen

NOTE
In the V, COL, TTL, RLY, and FLOW fields, a blank field indicates no change from the previous step.

METHOD EDIT — The method number (0 through 99) to edit.

SAVE TO — The method number (0 through 99) to save the current method to. It can be the same or different from the edit number.

RUN — The method number (0 through 99) to run. Entering a method number in this field does not affect the status of the method clock. The **Hold/Run** button on the front panel keypad controls the clock.

LIMITS — The low and high pressure limits (see Section 3.1.5), in psi, MPa, or bar. Select the unit of measure from the **PUMP OPTIONS** screen.

TIME — The elapsed time for each method step. Every method must begin with the **INIT** (initial) step, followed by the **TIME = 0.00** step. Each additional entry under **TIME** indicates the elapsed time at which the specified conditions (valve position, column selected, flow rate, etc.) occur.

V	The position of the injection valve, either Inject or Load.
COL	Selects the active column (A or B) in the LC10, LC20, or LC30 chromatography module. Column B is available only when a column switching valve is installed in the chromatography module.
TTL1 **TTL2** **RLY1** **RLY2**	Provides TTL and relay control of other devices. Select 1 (on) or 0 (off). Appendix D describes TTL and relay control.
FLOW	The flow rate through the pump in milliliters-per-minute.
v	A small "v" adjacent to the bottommost time entry indicates there are additional lines below the last line in the screen. Use the arrow buttons to scroll down to the additional lines.
^	A caret (^) adjacent to the topmost time entry indicates there are additional lines above the top line. The caret displays only when the screen is scrolled down additional lines. Use the arrow buttons to scroll up to the additional lines.

C.1.3 Degas Options

Use the **DEGAS OPTIONS** screen to set the duration and frequency of the degas pump cycles.

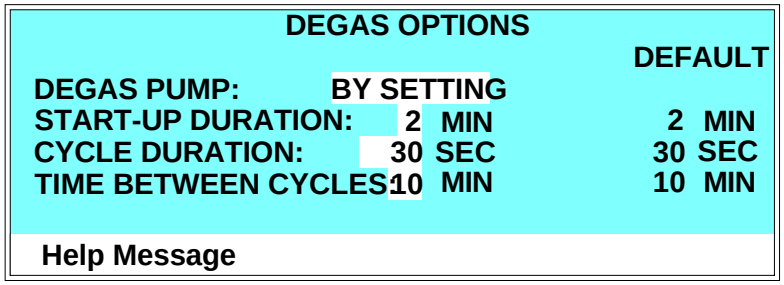

Figure C-5. Degas Options Screen

DEGAS PUMP — Selects operating options:
BY SETTING: The degas pump runs according to the selected degas options.
MONITOR: The IP25 checks the degas vacuum reading once a minute. If the reading falls 500 counts below the calibration threshold value, the degas pump turns on for the cycle duration time.
ALWAYS OFF: The pump is always off.
ALWAYS ON: The pump is always on. This setting is normally used only for testing the pump during servicing.

START-UP DURATION — The time the pump runs at power-up (2-5 min).

CYCLE DURATION — The time the pump runs during each cycle (0-120 sec).

TIME BETWEEN CYCLES — The time to wait between cycles (1-99 min).

NOTE

The DEGAS PUMP CALIBRATION screen displays the degas threshold value.

The IP25 monitors the degas vacuum reading once a minute. If the degas vacuum reading is 2000 or more lower than the degas calibration value, the following error message displays:

```
LOW VACUUM ALARM!!
Check DEGAS OPTIONS settings or refer to
service manual
```

If this occurs, try increasing the **CYCLE DURATION** time and/or decreasing the **TIME BETWEEN CYCLES**. If adjusting these settings does not solve the problem, contact Dionex.

C.1.4 Module Setup

Use this screen to adjust the display backlight, and to toggle the key actuation and error tones on or off. Adjustments made in this screen will be the default until new adjustments are made.

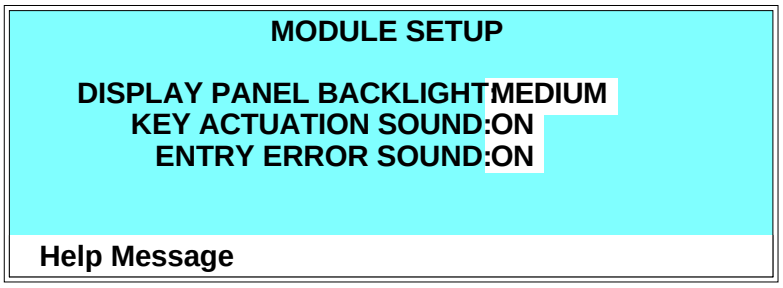

Figure C-6. Module Setup Screen

DISPLAY PANEL BACKLIGHT	Sets the backlight to **LOW, MEDIUM, HIGH**, or **OFF**.
KEY ACTUATION SOUND	Toggles the key actuation sound **ON** or **OFF**.
ENTRY ERROR SOUND	Toggles the error entry sound **ON** or **OFF**.

NOTE

If no keypad buttons are pressed within a two-hour period, the backlight automatically turns off. To turn the backlight back on, press any button on the keypad. Press the button again if you want to activate its function.

C.1.5 Pump Options

Use this screen to select the type of pump head installed and to set pump operation parameters.

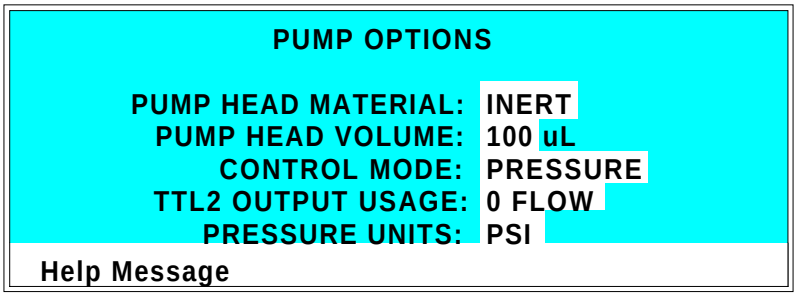

Figure C-7. Pump Options Screen

PUMP HEAD MATERIAL — Select **INERT** for PEEK pump heads or **SST** for stainless steel pump heads.

PUMP HEAD VOLUME — Select **100 µL** for standard bore pump heads, or **25 µL** for microbore pump heads.

CONTROL MODE — Sets the pump flow control mode to **PRESSURE** or **FLOW**. Pressure mode uses pressure as the primary source of feedback to maintain flow rate stability. Flow mode uses motor speed as the primary source of feedback to maintain stability.

TTL2 OUTPUT USAGE — Selects the active state of the TTL2 output signal. Select **0 FLOW** or **NORMAL**. To automatically switch off the power to a Self-Regenerating Suppressor when the pump flow stops, select the **0 FLOW** option, and connect TTL2 OUT on the pump to TTL3 IN on the CD20 or ED40 detector (see Section B.4 for detailed connection instructions). Select **NORMAL** to activate TTL2 as a standard TTL.

PRESSURE UNITS — Selects the unit of measure for pressure (**PSI**, **MPa**, or **BAR**).

C.1.6 Time Function In

This screen displays the pump functions that can be controlled with TTL input from another device. The **MODE** field selects the type of input signal the pump will respond to. The signal type can be changed to match the signal of the controlling device. See Appendix D for details.

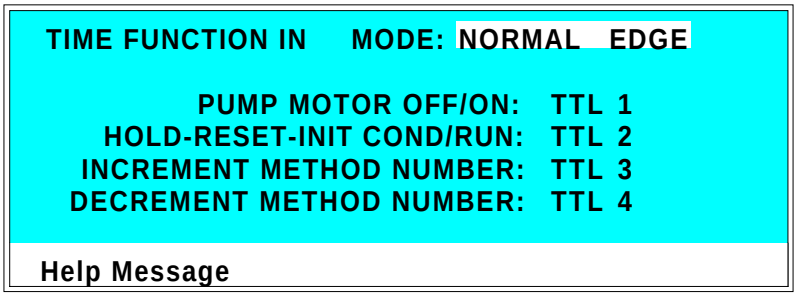

Figure C-8. Time Function In Screen

MODE Select **NORMAL EDGE, INVERTED EDGE, NORMAL PULSE**, or **INVERTED PULSE**. Normal edge, the default mode, is compatible with the TTL output signals provided by Dionex modules.

C.2 Diagnostic Screens

To access the pump diagnostics, select the **DIAGNOSTIC MENU** from the **MENU of SCREENS**. From a diagnostic screen, pressing **Menu** returns you to the **DIAGNOSTIC MENU**. From the **DIAGNOSTIC MENU**, pressing **Menu** returns you to the **MENU of SCREENS**.

C.2.1 Hexadecimal Entry Fields

Several diagnostic screens require entering values in hexadecimal format. While the cursor is on one of these fields, enter the hexadecimal digits A though F by pressing the decimal [.] button, followed by the number button 0 through 5. In this scheme, .0 enters the digit A, .1 enters B, .3 enters C, and so forth. The decimal button has no effect on any other button; the remaining buttons ignore the decimal function and perform as usual.

C.2.2 Diagnostic Menu

The **DIAGNOSTIC MENU** lists the available diagnostic screens. To display the diagnostics menu, press **Menu**, **8**.

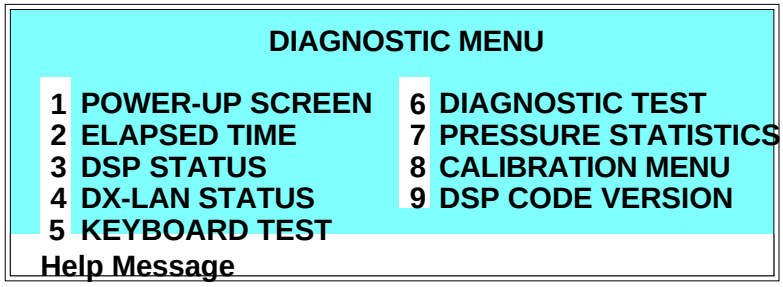

Figure C-9. Diagnostic Menu

C.2.3 Power-Up Screen

This screen is also displayed at power up. When the pump is connected to the DX-LAN network, the DX-LAN identification number displays.

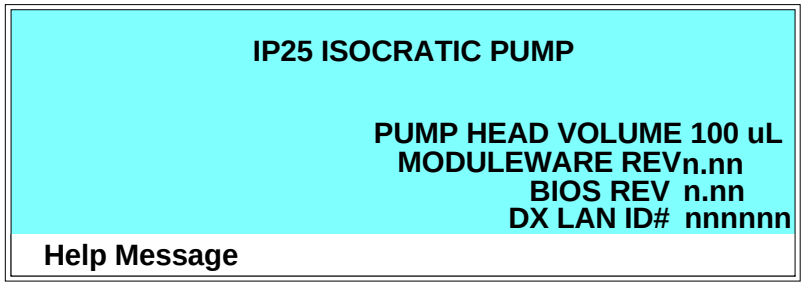

Figure C-10. Power-Up Screen

C.2.4 Elapsed Time

This screen reports for how long various IP25 components have been in use. The status of each parameter updates in real time.

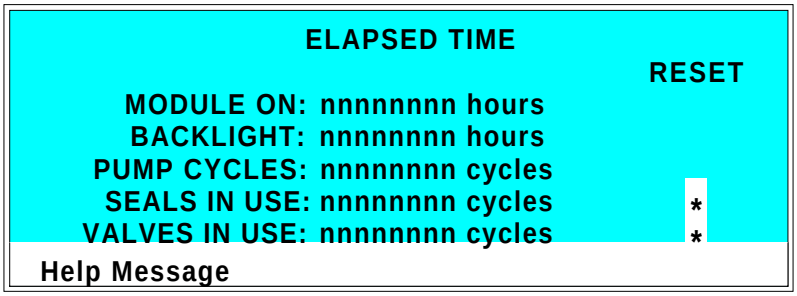

Figure C-11. Elapsed Time Screen

MODULE ON Reports the total time the module has been powered up in its lifetime.

BACKLIGHT Reports the total time the display backlight has been on in its lifetime.

PUMP CYCLES Reports the total cumulative number of pump cycles during the life of the motor. This field automatically resets to 0 after the pump motor is replaced.

SEALS IN USE Reports the total number of pump cycles since the last time the seals were replaced. Reset this field to 0 when the seals are replaced.

VALVES IN USE Reports the total number of pump cycles since the last time the check valves were serviced. Reset this field to 0 when the valves are serviced.

RESET Resets the **SEALS IN USE**, or **VALVES IN USE** counter to 0. Move the cursor to the corresponding asterisk (*****) field and press **Enter**. Always reset the seals and valves counters to 0 when they are replaced or serviced.

C.2.5 DSP Status

This screen reports the status of IP25 DSP (Digital Signal Processor) dynamic parameters. Status updates are in real time.

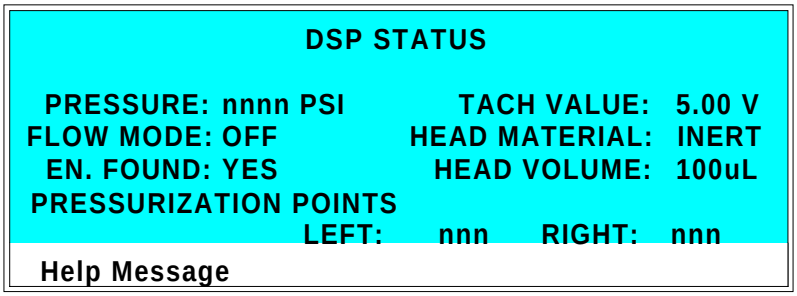

Figure C-12. DSP Status Screen

PRESSURE	Reports the current head pressure in psi, MPa, or bar.
TACH VALUE	Reports the current motor tachometer reading in volts.
FLOW MODE	Reports the flow mode as **ON** or **OFF**: **ON** = System is in constant flow mode. **OFF** = System is in pressure feedback mode.
HEAD MATERIAL	Reports the head material as set from the **PUMP OPTIONS** screen: **INERT** = PEEK heads **METAL** = Stainless steel heads
EN. FOUND	Reports when the encoder is found. Options are **YES** or **NO**.
HEAD VOLUME	Reports the head volume as set from the **PUMP OPTIONS** screen. The options are 100 µL for standard bore heads or 25 µL for microbore heads.
PRESSURIZATION POINTS	Reports the current pressurization point for the left and right pistons. The pressurization points are the points at which the pump speed is adjusted at each stroke to maintain a constant flow rate.

C.2.6 DX-LAN Status

The DX-LAN driver monitors several types of errors that may occur on the network.

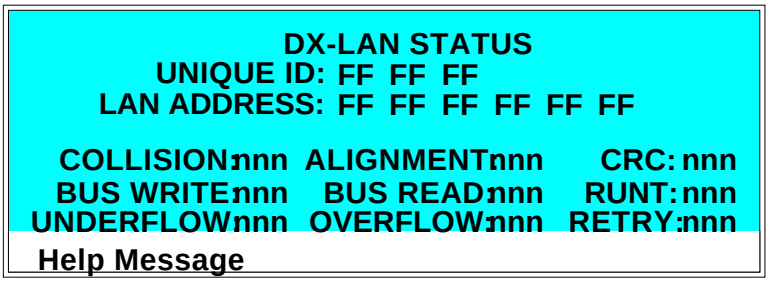

Figure C-13. DX-LAN Status Screen

UNIQUE DX-LAN ID — Displays the three-byte DX-LAN ID programmed into the pump Moduleware (in HEX).

DX-LAN ADDRESS — Displays the six-byte DX-LAN address assigned by the PC (in HEX). The first three bytes are the system assignment and the last three bytes are the assignment within the system.

COLLISION — Indicates that 16 unsuccessful transmissions of the same packet occurred, due to collisions.

BUS WRITE — Indicates that a ready response could not be issued within 2.4 microseconds after the WR signal was asserted. This occurs when the transmit buffer memory is full.

UNDERFLOW — Indicates that data from the transmit section of the hardware buffer memory is not available for serial transmission. The DX-LAN will continue to send out this data frame.

ALIGNMENT — Indicates that a packet was received with an alignment error, meaning that there were one to seven extra bits at the end of the packet. This is usually caused by a collision or a faulty transceiver.

BUS READ	Indicates that a ready response could not be issued within 2.4 microseconds after the ready signal was asserted. This occurs when reading an empty buffer.
OVERFLOW	Indicates that the DX-LAN hardware receive buffer became full and had to reject a packet for lack of space.
CRC	Indicates that a packet was received with a CRC error. This usually means that a collision has corrupted the packet.
RUNT	Indicates that a "runt" packet (one less than 15 bytes in length) was received. This usually occurs after a collision has truncated the original length.
RETRY	Indicates the number of retries required to transmit the last packet.

C.2.7 Keyboard Test

This screen allows you to conduct an interactive test of the front panel keypad buttons.

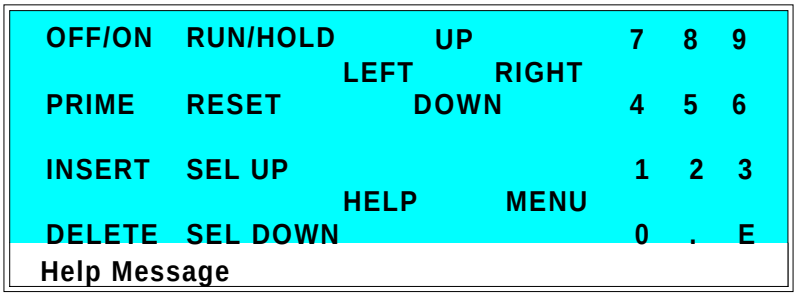

Figure C-14. Keyboard Test Screen

To test the buttons:

1. Press a button on the keypad. Its display changes to reverse video, confirming proper operation of that button.
2. Continue pressing all buttons in turn. Only the most recently pressed button shows in reverse video.
3. To end the test and return to the **DIAGNOSTIC MENU**, press **Menu** twice.

C.2.8 Diagnostic Test

This screen allows you to conduct a series of tests on the electronic components of the pump. At power-up, certain of these tests are run automatically. If any tests fail, the screen opens and displays the status of each test run.

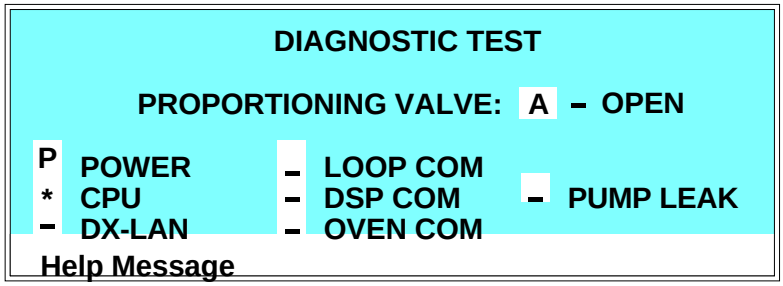

Figure C-15. Diagnostic Test Screen

To run one of the tests, position the cursor in the edit field next to the test, press a **Select** button to select the asterisk (*****), and press **Enter**. When the test is complete, the edit field displays either pass (**P**) or fail (**F**).

POWER Checks the +5, ±15, and +24 volt monitor on the Relay card.

CPU Checks the CPU internal configuration and the Moduleware checksum.

DX-LAN Checks the DX-LAN hardware configuration and loop back.

LOOP COM Checks the LC30 Chromatography Oven communication hardware. A “loop-back” cable must be plugged into the oven communication port. The pump then runs a loop-back test on the port.

DSP COM Checks communication between the pump CPU and the DSP (Digital Signal Processor) hardware by sending a command and waiting for the appropriate response.

PUMP LEAK	Checks the pump's leak sensor for a correct, open circuit, or short circuit condition.
EXTERNAL LEAK	Checks the external leak sensor for a correct, open circuit, or short circuit condition.

NOTE

Exiting the DIAGNOSTIC TEST screen clears the pass/fail indicators from the edit fields.

C.2.9 Pressure Statistics

This screen monitors the pressure transducer and reports pressure status values. The status values update while the screen is displayed.

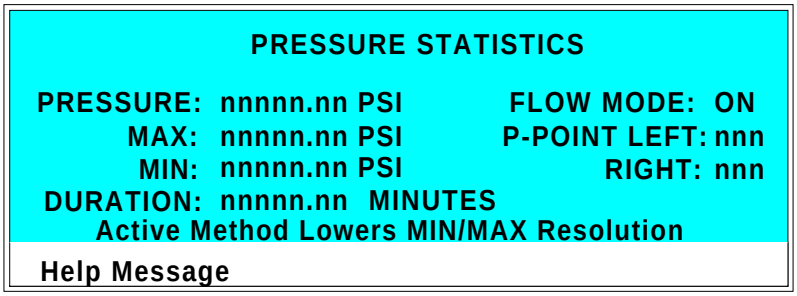

Figure C-16. Pressure Statistics Screen

If a method is running when you enter the **PRESSURE STATISTICS** screen, the following message displays:

```
Active Method Lowers MIN/MAX Resolution
```

For more accurate readings, abort the method, change to Direct control mode, and then reopen the screen.

PRESSURE — The measured pressure from the pressure transducer.

MAX — The maximum pressure value during the duration of the test.

MIN — The minimum pressure value during the duration of the test.

DURATION — The duration of the test. The test starts upon entering this screen and terminates upon exiting by pressing the **Menu** button. To restart the test, press **Reset**; the duration is set to 0 and all status values are set to the current pressure.

FLOW MODE — Reports the flow mode as **ON** or **OFF**:
ON = System is in constant flow mode.
OFF = System is in pressure feedback mode.

P-POINT LEFT RIGHT	Reports the current pressurization point for the left and right pistons. The IP25 updates the readout once per piston stroke.

C.2.10 DSP Code Version

Displays the current digital signal processor (DSP) code revision numbers.

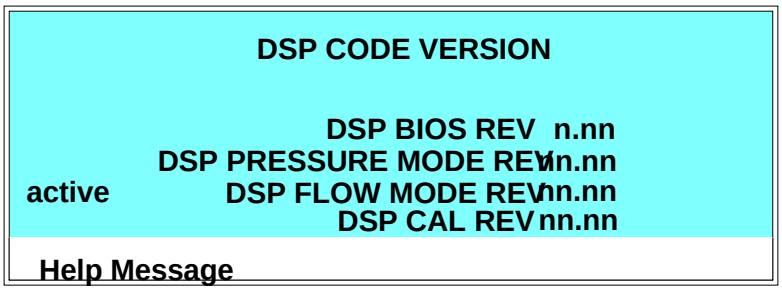

Figure C-17. DSP Code Version Screen

C.3 Calibration Screens

To go to the **CALIBRATION MENU**, press **Menu**, **8**, **8**.

C.3.1 Calibration Menu

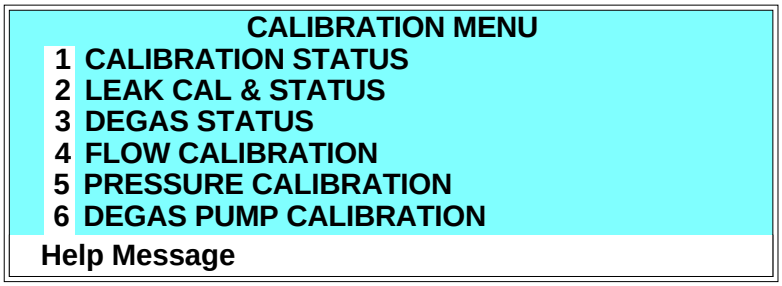

Figure C-18. Calibration Menu Screen

C.3.2 Calibration Status

This screen reports the status of calibration parameters in real time.

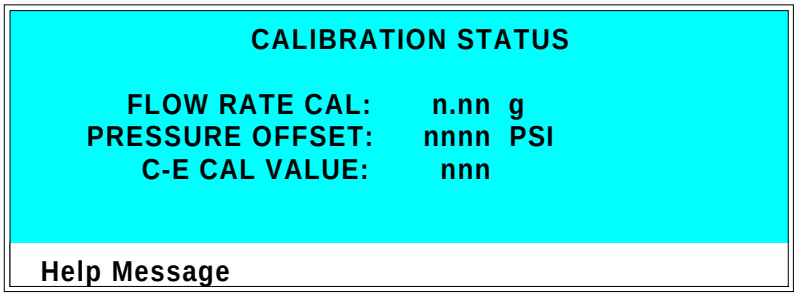

Figure C-19. Calibration Status Screen

FLOW RATE CAL — The current flow rate calibration value.

PRESSURE OFFSET — The pressure offset calibration value reported by the DSP.

C-E CAL VALUE — The current binary value for cam-encoder calibration reported by the DSP.

C.3.3 Leak Sensor Calibration and Status

This screen reports the status of leak sensor parameters. The **PUMP** column displays the status of the pump's internal leak sensor. The **EXTERNAL** column displays the status of the leak sensor in the chromatography module. If a chromatography module is not attached to the pump, the **EXTERNAL** fields display **NONE**.

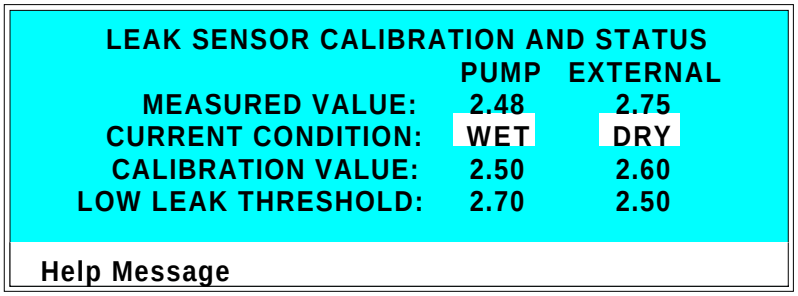

Figure C-20. Leak Sensor Calibration and Status

MEASURED VALUE — The current measured voltage from the sensor in volts.

CURRENT CONDITION — The current **WET**, **DRY**, or **ERR** (error) condition of the sensor. **ERR** indicates an open or short circuit. To calibrate a leak sensor, select **CAL** and press **Enter**. After calibration, the field will revert to **DRY** or **ERR**.

CALIBRATION VALUE — The value saved when the sensor was last calibrated.

LOW LEAK THRESHOLD — The threshold value below which a leak is indicated. This is based on the calibration value.

C.3.4 Degas Status

This screen reports the status of the vacuum degas pump calibration parameters in real time and allows testing of the degas pump.

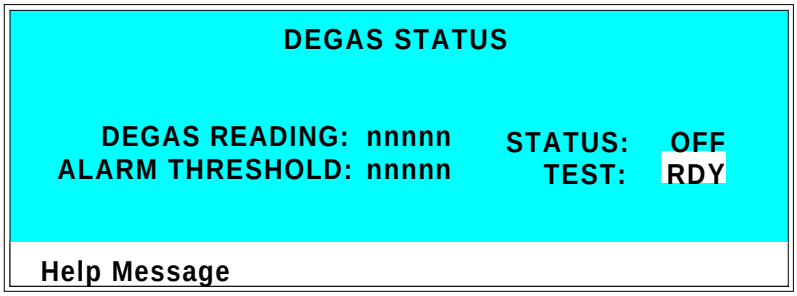

Figure C-21. Degas Status Screen

DEGAS READING — The reading from the degas pump pressure transducer.

STATUS — Reports whether the degas pump is on or off.

ALARM THRESHOLD — A degas reading value below this threshold value triggers the degas pump failure alarm.

TEST — Select **RUN** and press **Enter** to test the degas pump. The pump turns on, runs for 45 seconds, and turns off automatically. While the pump is running, the **STATUS** field indicates **ON**. **Note**: There may be a delay of several seconds before the on/off status is updated.

C.3.5 Flow Calibration

This screen reports the pump flow rate calibration and provides instructions for calibration.

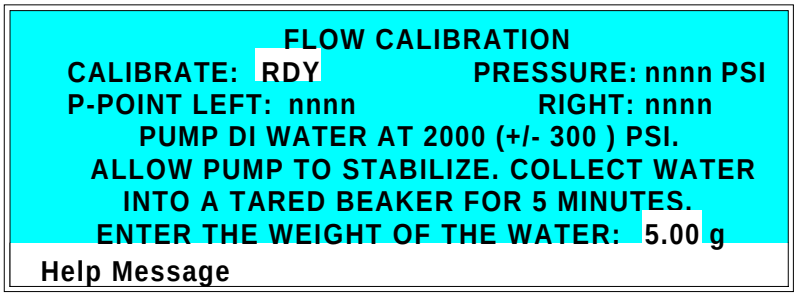

Figure C-22. Flow Calibration Screen

CALIBRATE — To calibrate the flow, select **CAL** and press **Enter**. The pump will use standard calibration parameters for pump control. When **RDY** is selected, the pump uses stored parameters from the last calibration.

After selecting **CAL**, follow the instructions on the screen for calibration. It takes 5 minutes to calibrate the standard bore heads and 20 minutes to calibrate the microbore heads.

PRESSURE — Displays the measured value from the pressure transducer.

P-POINT LEFT RIGHT — Displays the pressurization points for the left and right pump pistons.

WEIGHT OF THE WATER — After following the instructions for calibration, enter the measured weight of the water pumped into the beaker.

C.3.6 Pressure Calibration

Use this screen to calibrate the pump pressure offset and slope.

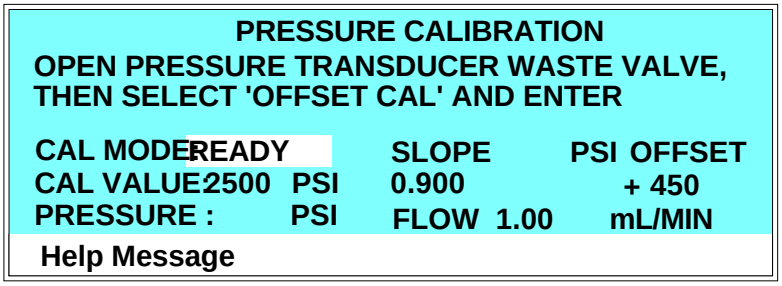

Figure C-23. Pressure Calibration Screen: Initial View

CAL MODE Selects the calibration mode.
- **READY** The pump is ready for calibration.
- **OFFSET CAL** Calibrate the offset.
- **SLOPE CAL** Calibrate the slope.
- **SLOPE DFLT** Use the default slope value.
- **EDIT** Enter known correct **SLOPE** and **OFFSET** values.

CAL VALUE Pressure value entered during the slope calibration procedure. Accepted values: 1 to 5000 psi, 1 to 340 bar, 0.1 to 34.0 MPa.

PRESSURE Current pressure reading from the transducer.

SLOPE Calibrated slope value. Accepted values: 0.7 to 1.3 (default=0.9).

PSI [MPa] OFFSET Calibrated offset value. Accepted values:
200 to 1000 psi (default=450)
14 to 68 bar (default=31)
1.4 to 6.8 MPa (default=3.1)

FLOW Current flow rate.

To calibrate:

1. Stop the pump flow.
2. Go to the **PRESSURE CALIBRATION** screen.
3. Open the pressure transducer waste valve by turning it counterclockwise two turns (see Figure 2-7).
4. When the pressure reaches zero, select **OFFSET CAL** and press **Enter**. The offset calibration begins. When calibration is complete, the screen displays the following:

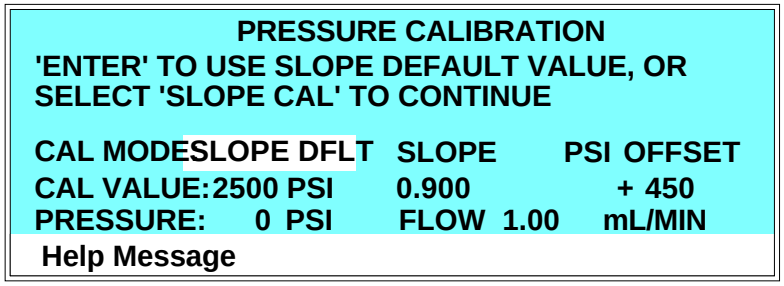

Figure C-24. Pressure Calibration Screen: Second View

The **PSI OFFSET** field displays the calibrated value. The **SLOPE** field does not change, and the **PRESSURE** field displays the new pressure based on the calibrated offset.

5. There are three choices for continuing the calibration:

   - Saving the psi offset and maintaining the current slope value:

     To finish the offset calibration and keep the current slope value, press **Menu** to exit the **PRESSURE CALIBRATION** screen. The new offset value will be put into effect. No slope calibration is performed.

   - Saving the psi offset calibration and saving the default slope value:

     To continue the calibration with a default slope value, press **Enter** to save the default slope value. The **SLOPE** field displays the default value. The **PRESSURE** field displays the new pressure based on the calibrated offset and the default slope.

   - Saving the psi offset calibration and calibrating the slope:

     To continue to the slope calibration procedure, select **SLOPE CAL** in the **CAL MODE** field and press **Enter**. The screen displays the following:

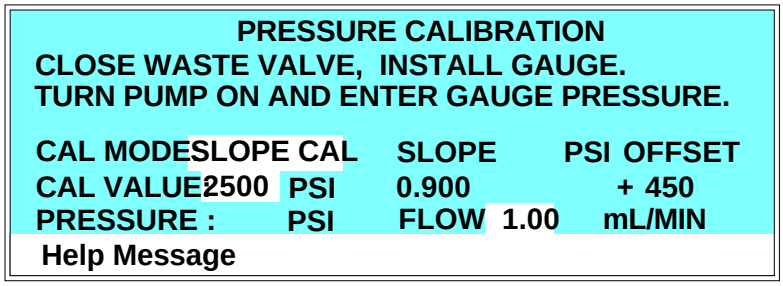

Figure C-25. Pressure Calibration Screen: Third View

6. Close the waste valve.
7. Install a pressure test gauge between the pressure transducer outlet and either a length of backpressure tubing, or a column (see Figure C-26). A pressure gauge assembly (P/N 046175), which includes a gauge with an accuracy rating of ±0.25%, required fittings, and backpressure tubing, is available for this purpose.
8. In the **FLOW** field, enter the flow rate normally used for your application.
9. Turn on the pump. The pressure will begin increasing. Allow the pressure gauge reading to stabilize.

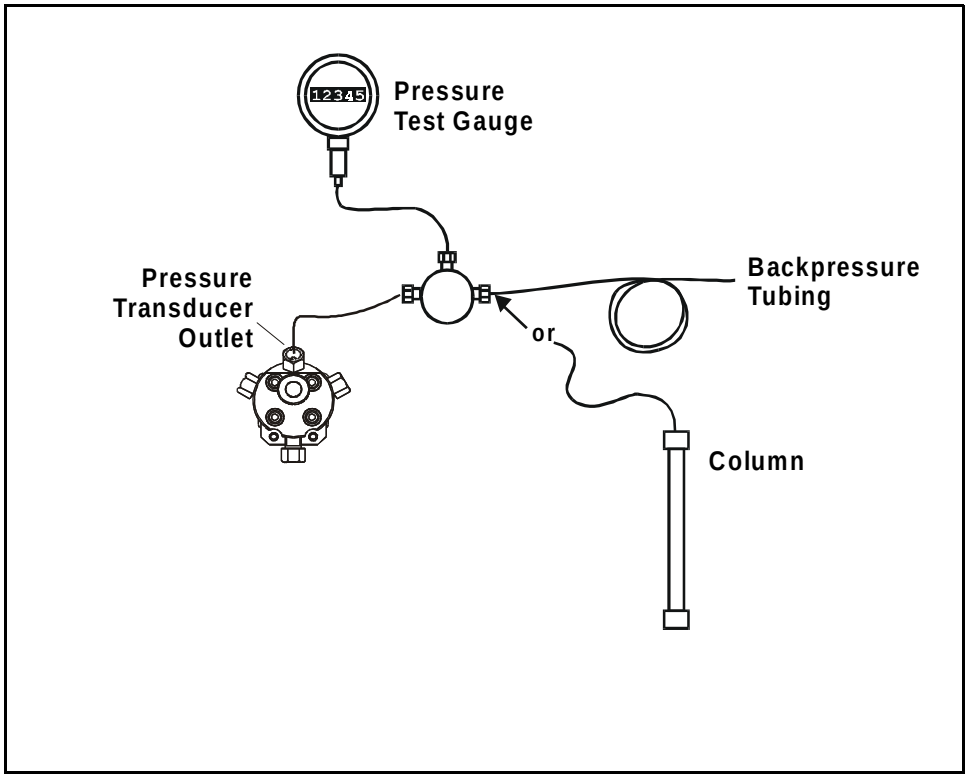

Figure C-26. Pressure Gauge Installation

10. This step depends on whether backpressure tubing or a column is installed:

    - Backpressure Tubing

      If backpressure tubing is installed, the recommended pressure for calibration is 17.25 ±0.17 MPa (2500 ±25 psi). If necessary, add additional backpressure tubing or adjust the flow rate to bring the pressure to the recommended value. Increasing the flow rate increases the pressure; decreasing it decreases the pressure. When the gauge reading has stabilized at the recommended value, enter the reading in the **CAL VALUE** field.

    - Column

      If a column is installed, the application flow rate and the type of column installed determine the pressure for calibration. After allowing the gauge pressure to stabilize, enter the reading in the **CAL VALUE** field.

      NOTE

      The pressure gauge readings may fluctuate slightly as the left and right pump heads alternate piston strokes. You can ignore variations of about ±0.03 MPa (±5 psi) or less. Larger fluctuations generally indicate that the pump is out of prime. If this occurs, prime the pump heads (see Section B.3) and then repeat Step 10.

11. Press **Enter**. The slope calibration begins. When calibration is complete, the screen fields display the following:

    - The **SLOPE** field displays the new slope value.
    - The **PRESSURE** field displays the same value as the **CAL VALUE**.

C.3.7 Degas Pump Calibration

This screen allows calibration of the degas pump.

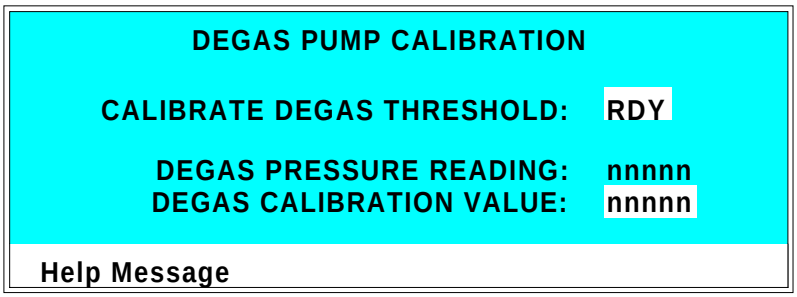

Figure C-27. Degas Pump Calibration Screen

CALIBRATE DEGAS THRESHOLD	To calibrate, select **CAL** and press **Enter**. After calibration is complete the entry reverts to **RDY**. **RDY** indicates no selection has been made and calibration will not occur.
DEGAS PRESSURE READING	Reports the current degas pressure reading.
DEGAS CALIBRATION VALUE	Reports the calibration value recorded during the last calibration.

D • TTL and Relay Control

The strip of eight 2-pin connectors on the IP25 electronics chassis provides two relay outputs, two TTL outputs, and four TTL inputs (see Figure D-1).

- Connect the outputs to the TTL or relay inputs of a Dionex or non-Dionex device to control functions in the connected device. The devices must be compatible with the IP25's TTL and relay signals.
- Connect the inputs to a Dionex or non-Dionex device to control four pump functions: pump motor on/off, method clock on/off, method number increment, and method number decrement.

Connection instructions and examples are in Section D.3.

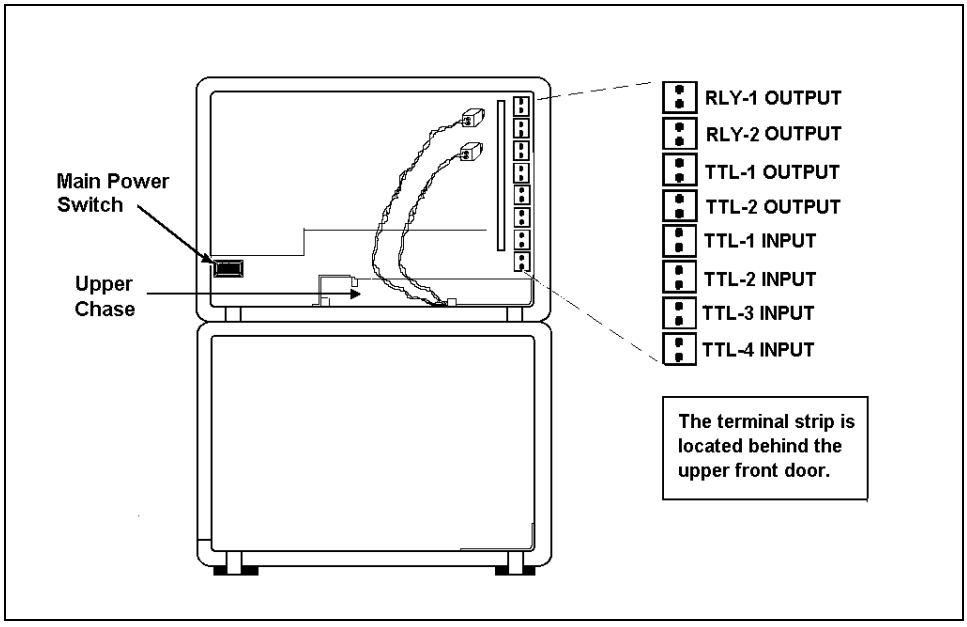

Figure D-1. TTL Connector Strip (IP25 Front View without Upper Door)

D.1 TTL and Relay Output Operation

The IP25 provides two TTL outputs and two relay contacts to control functions in external devices such as an integrator, autosampler, or other Dionex module.

After connecting the TTL and Relay outputs (see Section D.3), toggle the output states on and off from either the **MAIN** screen or the **METHOD** screen. The **METHOD** screen allows programming of the output states in method steps for timed operation (see Figure C-4 in Appendix C).

- To turn on a TTL or relay output, set the corresponding output field in the **MAIN** screen or **METHOD** screen to **1** (closed).
- To turn off a TTL or relay output, set the corresponding output field to **0** (open).

For example, if TTL1 is connected to the Load relay on the AS40 Autosampler, setting **TTL1** to 1, as shown in Figure D-2, sends the signal to the AS40 to start the load cycle.

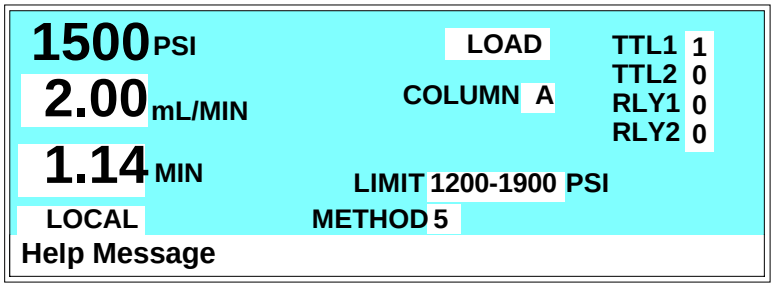

Figure D-2. Main Screen

D.2 TTL Input Operation

The four TTL inputs can be connected to devices capable of providing TTL input signals. The signal from the connected devices can control up to four specific functions in the IP25.

- **TTL input 1** turns the pump motor off and on.
- **TTL input 2** controls the pump method clock. A signal from the controlling device can turn the method clock on (Run) and off (Hold/Reset). Hold/Reset resets the method clock to zero and executes **INIT** conditions. The method will not run unless the pump motor is already on.
- **TTL input 3** increases the method number by one. Each additional signal increases the method number by one more.

  When the method clock is zero (or **INIT**), increasing the method number executes the **INIT** conditions of the new method. When the method clock is greater than zero, increasing the method number begins running the new method at the current elapsed method clock time. This has the same result as selecting a new method number when the pump is in Local mode.
- **TTL input 4** decreases the method number by one. The operation is as described under TTL input 3 above, except that method numbers decrease instead of increase.

D.2.1 TTL Input Signal Modes

The IP25 TTL inputs respond to four types of signals to accommodate different types of device output signals. The default signal mode, *normal edge*, is compatible with the output signals provided by Dionex modules. If the device connected to the IP25 outputs a different signal type, select appropriate signal mode from the **TIME FUNCTION IN** screen (see Figure D-3).

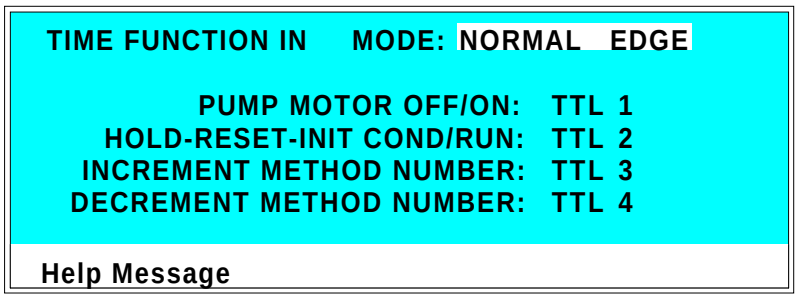

Figure D-3. Time Function In Screen

The four input signal modes are:

- *Normal Edge*: In normal edge operation, the negative (falling) edge of a signal turns on the function and the positive (rising) edge turns off the function (see Figure D-4). For example, a negative edge sent to TTL1 turns on the pump motor and a positive edge turns off the motor.

- *Inverted Edge*: The inverted edge mode works identically to the normal edge mode except that the positive and negative edges are reversed in function.

- *Normal Pulse*: In normal pulse operation, the negative (falling) edge of the TTL signal is the active edge and the positive (rising) edge is ignored. For example, applying a negative pulse to TTL1 when the pump motor is off turns the motor on. This has the same result as pressing the **Off/On** button on the front panel keypad.

  The minimum pulse width guaranteed to be detected is 50 ms. The maximum pulse width guaranteed to be ignored as noise or invalid is 4 ms. The action of the IP25 is undefined for pulses less than 50 ms or greater than 4 ms.

- *Inverted Pulse*: The inverted pulse mode operates identically to the normal pulse mode except that the positive and negative edges are reversed in function.

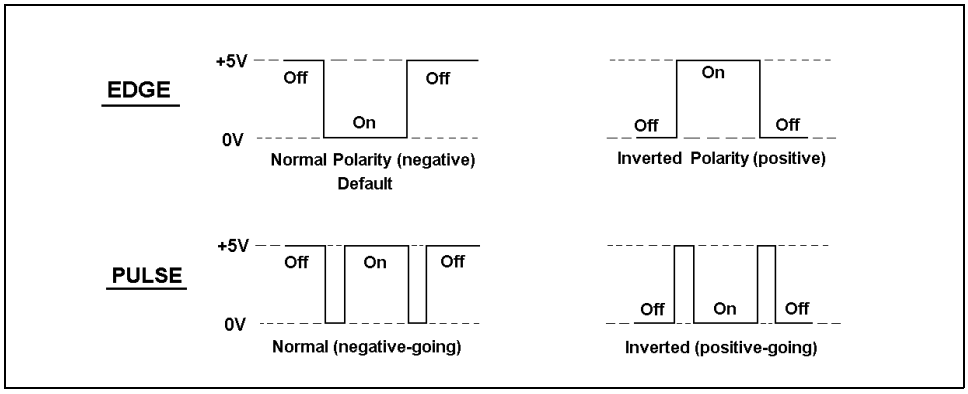

Figure D-4. TTL and Relay Input Signal Modes

D.3 TTL and Relay Connections

The TTL/relay connector strip is located on the electronics chassis behind the upper door (see Figure D-1). Each two-pin connector includes a signal pin and a ground pin.

1. Twisted pairs of wires (P/N 043598) and two-pin connector plugs (P/N 921019) are provided in the IP25 Ship Kit. Attach a two-pin plug to both ends of each twisted pair of wires to be connected. The signal wire goes on top and the ground wire goes on the bottom of each plug.
2. Connect these plugs to the TTL or relay connectors on the IP25 and the other module(s) as needed for your application. Check the polarity of each connection. Connect signal wires to signal (+) pins and ground wires to ground (-) pins. If necessary, remove wires from the two-pin plugs and reinsert them in the correct positions. Section D.3.1 shows example connections.
3. Route the wires from the IP25 electronics chassis through the upper chase to the rear panel.

D.3.1 Example Connections

Figure D-5 shows an example of TTL/relay connections for a DX-500 system connected to an AS40 Automated Sampler. Refer to the AS40 operator's manual for details.

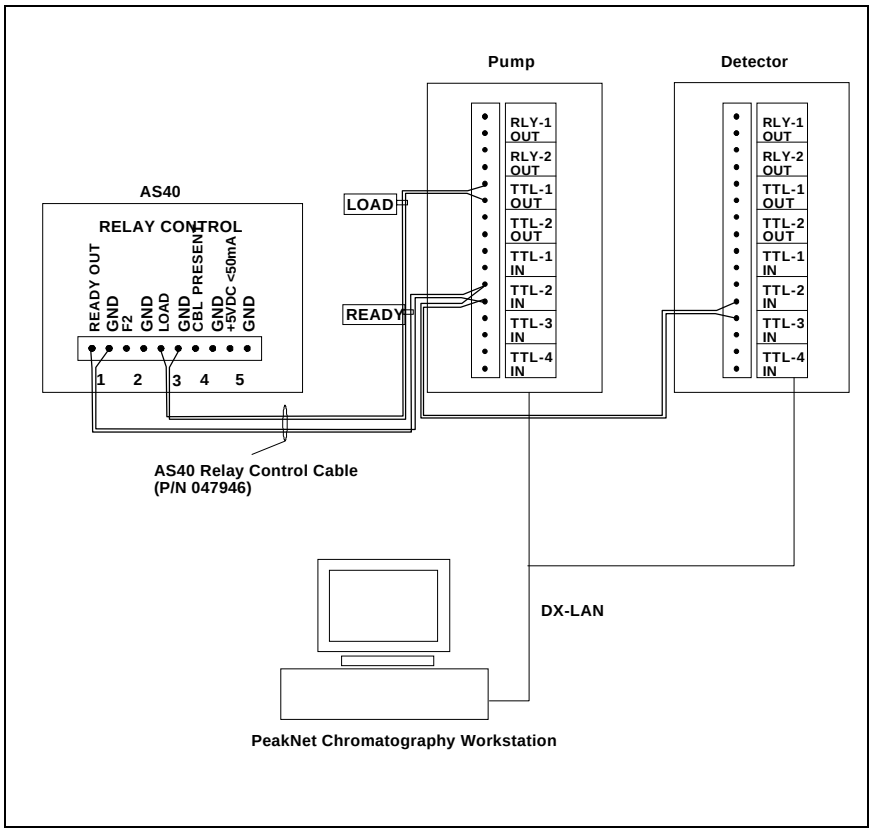

Figure D-5. Example TTL and Relay Connections: AS40

Figures D-6 and D-7 show two different TTL/relay connections for a DX-500 system connected to an AS3500 Autosampler:

- Setup 1 starts running each DX-500 module timed events method when the autosampler makes an injection.
- Setup 2 starts running each DX-500 module method before the autosampler makes an injection. The method then controls when the autosampler injection occurs.

Refer to the *PeakNet AS3500 Autosampler User's Guide* for details.

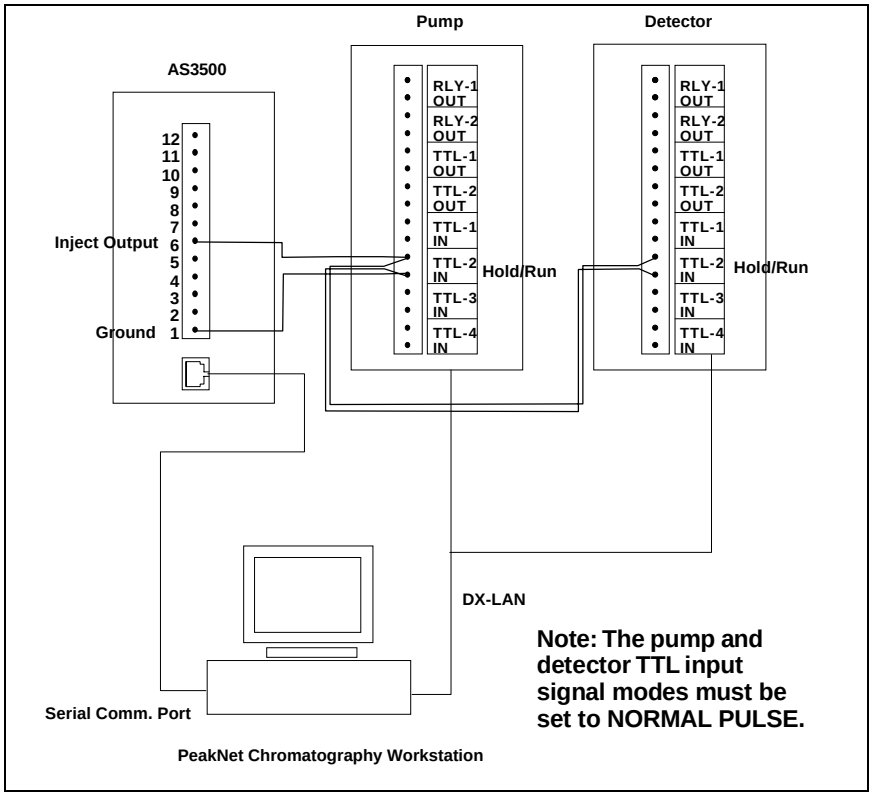

Figure D-6. Example TTL and Relay Connections: AS3500 Setup 1

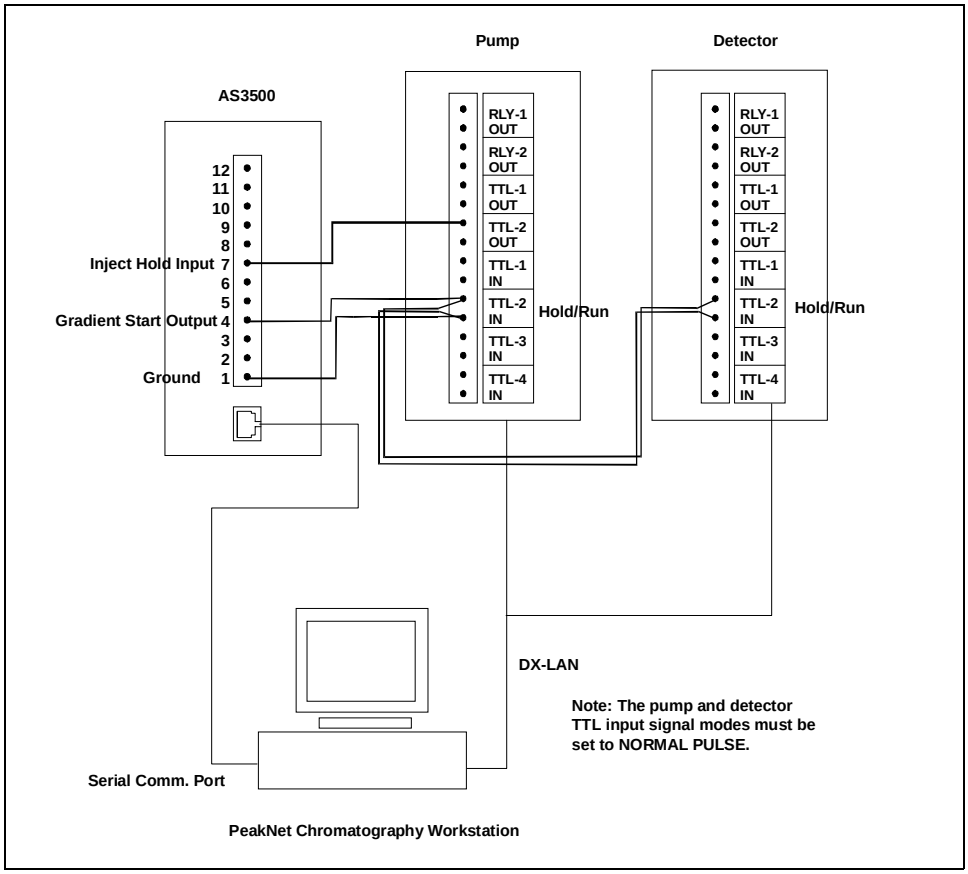

Figure D-7. Example TTL and Relay Connections: AS3500 Setup 2

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