Thermo SCIENTIFIC

Dionex Integral Process Analytical Systems Operator's Manual

Document No. 065250
Revision 04
October 2012

Revision history: Revision 01 December 2008; initial release of system
Revision 02 released May 2010; lockout instructions added
Revision 03 released January 2012; Thermo Fisher Scientific transition
Revision 04 released October 2012; new part numbers assigned

For Research Use Only. Not for use in diagnostic procedures.

Contents

1 • Introduction

1.1 Dionex Integral Process Analytical Systems

Thermo Scientific Dionex™ Integral™ Process Analytical Systems are designed for reliability, accuracy, low maintenance, and regulatory compliance. Their IC (ion chromatography) and HPLC (high-performance liquid chromatography) capabilities allow determination of species that are not possible with other process analytical techniques. Multicomponent characterization of a sample can be performed in a single analysis and multiple samples can be scheduled for automatic analysis.

A Dionex Integral *system* is configured to perform a specific analysis. A system normally contains an analytical pump, a detector, and an SP Sample Preparer.

A Dionex Integral *analyzer* consists of from one to four systems combined to operate in parallel. An analyzer is configured to sequentially monitor up to 21 samples. An SS Stream Selector can be used to select a sample from multiple sample streams.

Dionex Integral analyzers are controlled by Thermo Scientific Dionex Chromeleon™ PA software running under Microsoft® Windows Vista® or Windows® XP.

Chromeleon PA incorporates a user interface that provides an industry-standard approach to process monitoring, industrial I/O, and process control. Chromeleon PA instrument control capabilities include:

- Scheduled sampling
- Synchronized operation of multiple systems
- Automatic alarm handling, using preprogrammed conditional responses

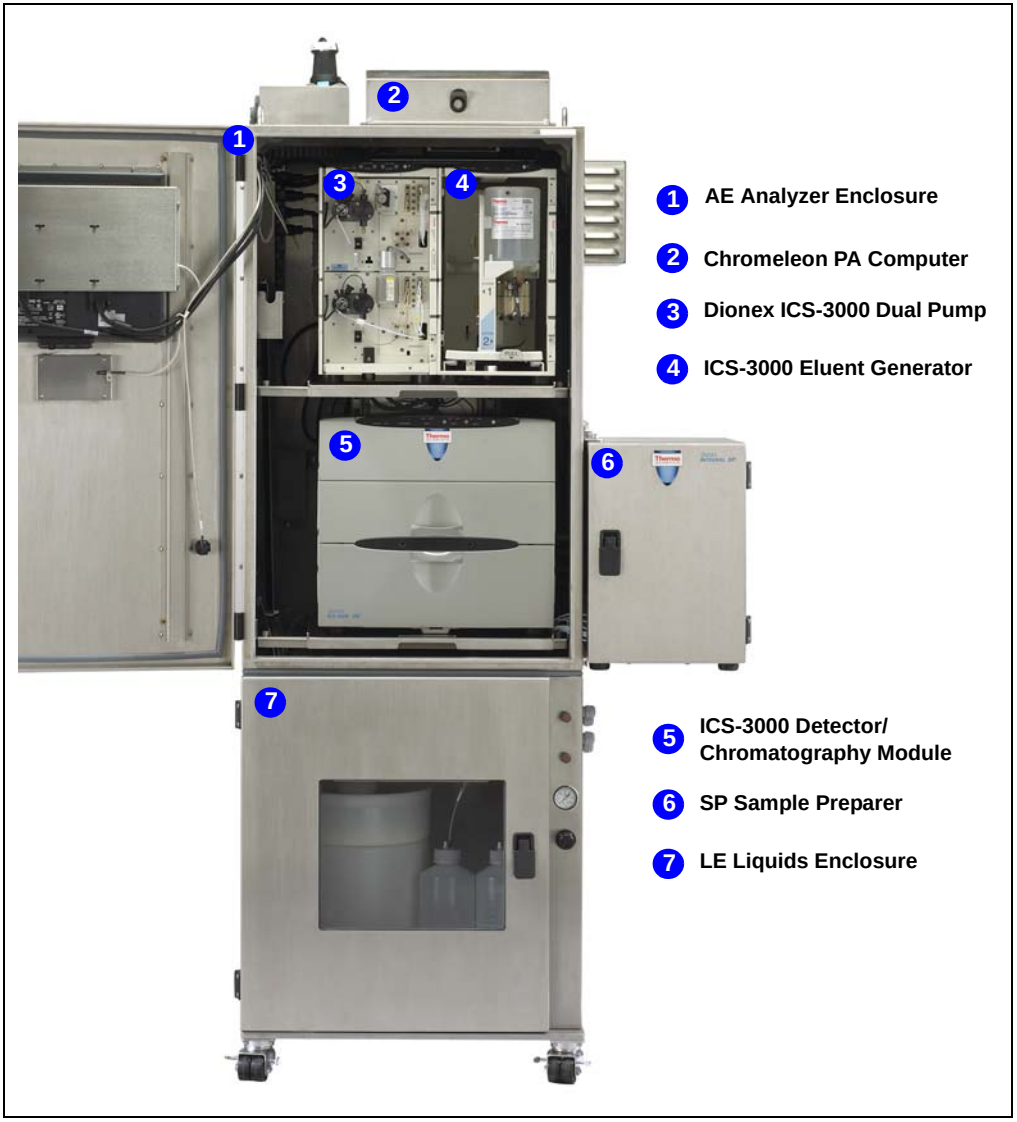


Figure 1-1. Example Dionex Integral System

1.1.1 Dionex Integral System Components

The Dionex Integral Process Analytical Systems product line includes the following components:

- AE Analyzer Enclosure
- LE Liquids Enclosure
- SP Sample Preparer
- SS Stream Selector

AE Analyzer Enclosure

The AE provides the liquid and gas connections, electrical connections, electrical emissions shielding, and environmental protection often needed in a process environment. The AE must be either mounted on a wall, on top of an LE Liquids Enclosure, or on another appropriate support structure.

LE Liquids Enclosure

The LE provides an enclosure for housing standard and reagent bottles and NOWPak® containers (for eluents and solvents). The LE includes a gas supply control panel. The LE also provides a rolling base for an AE Analyzer Enclosure.

SP Sample Preparer

The SP contains the valves and pumps used to perform standard and sample preparation. Electronics built into the SP are used to control the SP components. The SP is available in different versions.

SS Stream Selector

The SS can select one of 7, 14, or 21 sample streams, depending on the number of valves installed inside the enclosure. Sample streams can be continuously flushing or static, and can be returned to the process or to waste.

1.1.2 Chromatography Systems Supported

The following Thermo Scientific Dionex chromatography systems can be configured in a Dionex Integral system:

- Dionex ICS-3000 Ion Chromatography Systems
- Dionex UltiMate™ 3000 Analytical Systems
- Dionex ICS-2000 Ion Chromatography Systems

1.1.3 Dionex Integral System Control

Dionex Integral systems are controlled by a computer configured with Chromeleon PA. Chromeleon PA is an extended version of the Thermo Scientific Dionex Chromeleon Chromatography Management System (Chromeleon). Chromeleon PA integrates Chromeleon with a client program called Analyzer. This adds several process monitoring functions to Chromeleon (including stream selection, sample preparation, alarm configuration, and component data trending).

Figure 1-1 shows the Chromeleon PA Analyzer **Run** page.

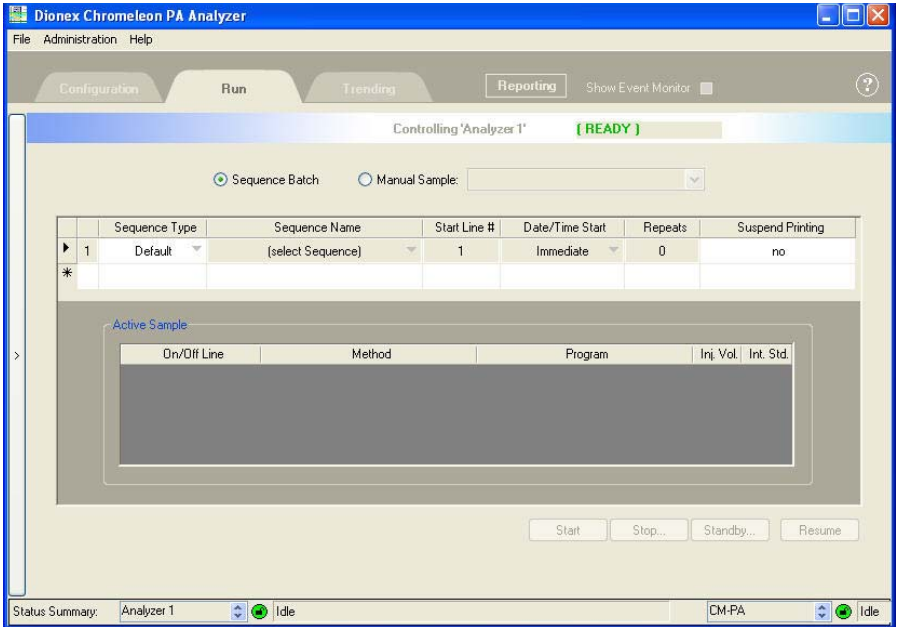


Figure 1-2. Chromeleon PA Analyzer Run Page

Use Chromeleon PA Analyzer to:

- Specify the instrument server.
- Specify the datasource.
- Create analyzers and associate instrument systems (timebases) with analyzers.
- Create analyzer sequences.
- Specify default and alarm sequences.
- Configure alarm conditions and responses.

Use Chromeleon to:

- Create and control instrument systems.
- Acquire and manage data.
- Create reports for each system.

Chromeleon PA can control a total of four systems configured in up to four analyzers. Chromeleon allows four instrument systems per server. Figure 1-3 shows two systems configured in one analyzer.

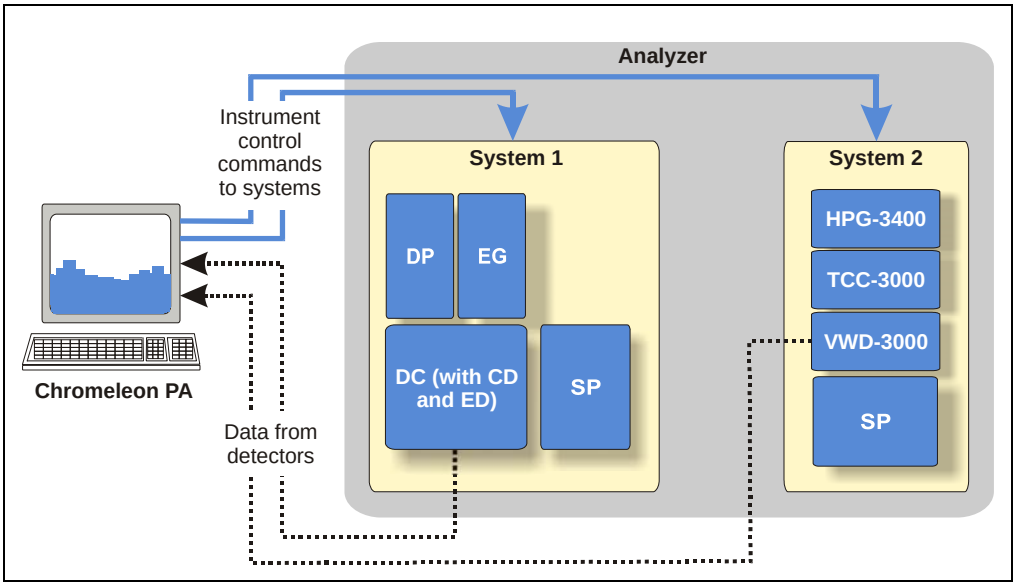


Figure 1-3. Example Analyzer Configuration

1.2 The Dionex Integral System Operator's Manual

Chapter 1 Introduction	Provides an overview of Dionex Integral Process Analytical Systems; includes brief descriptions of Dionex Integral system components, the software required for operation, and the user manuals.
Chapter 2 System Configurations	Provides illustrations of various Dionex Integral system configurations.
Chapter 3 SP Sample Preparer Description	Describes SP components and operating features.
Chapter 4 SS Stream Selector Description	Describes SS components and operating features.
Chapter 5 AE Analyzer Enclosure Description	Describes AE components and operating features.
Chapter 6 LE Liquids Enclosure Description	Describes LE components and operating features.
Chapter 7 Startup, Operation, and Shutdown	Lists tasks to be performed before beginning operation of the Dionex Integral system. Provides instructions for routine operation of the Dionex Integral system, and short-term and long-term shutdown procedures.
Chapter 8 Maintenance	Provides routine preventive maintenance procedures for the Dionex Integral system.
Chapter 9 Troubleshooting	Lists Chromeleon Audit Trail error messages, with their possible causes and corrective actions to take. Also, lists minor problems that may occur during operation, with procedures for how to isolate and eliminate the cause of each problem.

Chapter 10 Service	Provides routine service and parts replacement procedures the user can perform.
Appendix A Specifications	Lists specifications and installation site requirements for the Dionex Integral system.
Appendix B Reordering Information	Lists spare parts for the Dionex Integral system.
Appendix C TTL and Relay Installation Instructions	Provides instructions for installing TTL and relay control functions in the SP and AE.
Appendix D AE Purge Kit Installation Instructions	Provides instructions for installing a purge system in the AE.
Appendix E Peristaltic Pump Installation Instructions	Provides instructions for installing a peristaltic pump on the SP panel.
Appendix F Liquid Level Sensor Installation Instructions	Provides instructions for installing a liquid level sensor on a liquid reservoir.
Appendix G Thermal Options Installation Instructions	Provides instructions for installing a heated dilution vessel and a vial cooler on the SP panel.
Appendix G Lockout Instructions for AE, SP, and SS	Provides instructions for locking out the AE, SP, and SS power connectors to prevent power up of the modules.

1.3 Other Documentation

Every effort has been made to provide complete and accurate user documentation for Dionex Integral Process Analytical Systems. Refer to the following sections for the types of information available and where to find it.

1.3.1 Chromatography System Hardware Documentation

For information about how to operate the chromatography system modules configured in Dionex Integral systems, refer to the module manuals shipped on the Thermo Scientific Reference Library CD-ROM (P/N 053891).

The CD-ROM is included in the Ship Kit of each module. The manuals are provided in Adobe® PDF format.

If you need details about the ...	Refer to ...
ICS-3000 Ion Chromatography System	*ICS-3000 Ion Chromatography System Operator's Manual* (includes the DP/SP, DC, CD, ED, and TC)
UltiMate 3000 System	UltiMate 3000 series module manuals: • *UltiMate 3000 Series Pump Operating Instructions* • *UltiMate 3000 Series Thermostatted Column Compartments Operating Instructions* • *UltiMate 3000 Series Photodiode Array Detectors Operating Instructions* • *UltiMate 3000 Series Variable Wavelength Detectors Operating Instructions*
ICS-2000 Ion Chromatography System	*ICS-2000 Ion Chromatography System Operator's Manual* (Document No. 031857)
ICS-Series Photodiode Array Detector	*ICS-Series Photodiode Array Detector Operator's Manual* (Document No. 065147)
ICS-Series Variable Wavelength Detector	*ICS-Series Variable Wavelength Detector Operator's Manual* (Document No. 065141)

1.3.2 Consumable Product Documentation

For information about Thermo Scientific Dionex columns, suppressors, EluGen cartridges, and other consumable products, refer to the appropriate product manual. These manuals are provided on the Thermo Scientific Reference Library CD-ROM (P/N 053891).

1.3.3 Software Documentation

For information about how to use Chromeleon PA Analyzer, refer to the Chromeleon PA Analyzer Help. For information about how to use Chromeleon, refer to the Chromeleon Help. Both Help systems are installed with Chromeleon PA.

For information about how to set up Chromeleon PA, refer to *Setting Up Chromeleon PA* (Document No. 065262). The manual is included on the Thermo Scientific Reference Library CD-ROM (P/N 053891).

1.4 Safety and Regulatory Information

Dionex Integral systems are manufactured by Thermo Fisher Scientific at the following location: 527 Lakeside Drive, Sunnyvale, CA 94088-3603 U.S.A. Dionex Integral systems are designed for IC (ion chromatography) and HPLC (high-performance liquid chromatography) applications and should not be used for any other purpose. Operation of a Dionex Integral system in a manner not specified by Thermo Fisher Scientific may result in personal injury. If you have a question regarding appropriate usage, contact Technical Support for Dionex products before proceeding. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

1.4.1 Safety Messages and Notes

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

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. Also used to identify a situation or practice that may seriously damage the instrument, but will not cause injury.

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

Messages d'avertissement en français

Signale une situation de danger immédiat qui, si elle n'est pas évitée, entraînera des blessures graves à mortelles.

Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures graves à mortelles.

Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures mineures à modérées. Également utilisé pour signaler une situation ou une pratique qui pourrait gravement endommager l'instrument mais qui n'entraînera pas de blessures.

Warnhinweise in Deutsch

Bedeutet unmittelbare Gefahr. Mißachtung kann zum Tod oder schwerwiegenden Verletzungen führen.

Bedeutet eine mögliche Gefährdung. Mißachtung kann zum Tod oder schwerwiegenden Verletzungen führen.

Bedeutet eine mögliche Gefährdung. Mißachtung kann zu kleineren oder mittelschweren Verletzungen führen. Wird auch verwendet, wenn eine Situation zu schweren Schäden am Gerät führen kann, jedoch keine Verletzungsgefahr besteht.

Notes

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 you to an unexpected result of an action, suggest how to optimize instrument performance, etc.

1.4.2 Safety Symbols

The symbols below appear on Dionex Integral modules or Dionex Integral module labels:

Alternating current

Primary protective conductor terminal

Secondary protective conductor terminal

Power supply is on

Power supply is off

Indicates a potential hazard. Refer to this operator's manual for an explanation of the hazard and how to proceed.

1.4.3 Declaration of Conformity

DIONEX

MANUFACTURERS
DECLARATION OF CONFORMITY

Product Identification

Product:	Integral Systems
Brand:	Dionex
Model:	AE, LE, SP, SS

Manufacturer

Dionex Corporation
1228 Titan Way
Sunnyvale, California 94088
USA

Representative

Larry McNary
Dionex Corporation
1228 Titan Way
Sunnyvale, CA, USA 94085

Function: Director, Engineering

Means of conformity
The product is in conformity to the listed directives and standards:

Low Voltage/Safety Directive:	2006/95/EEC
EMC Directive:	2004/108/EEC
Safety Standards:	EN 61010-1:2001 UL 61010-1:2004 CAN/CSA-C22.2 No. 61010.1:2004 SEMI S2-0706
EMC Standards:	EN 61326 –1:2006
Serial numbers	08079921 thru 24010000

Signature of Representative: Larry McNary

Name:	Larry McNary
Place:	Sunnyvale, CA, USA
Date:	Oct 15, 2009

1.4.4 Safety Practices

General Precautions

- Periodically check all liquid lines for leaks. Clean up spills and use DI (deionized) water to rinse dried reagents off system components.
- Make sure that gas and liquid lines cannot become kinked, punctured, or otherwise damaged.
- Do not allow liquid wastes to accumulate. Follow a regulated, approved waste disposal program. Never dispose of wastes containing organic solvents through the municipal sewage system. Neutralize all acidic and caustic wastes before disposal.

Compressed Gas or Liquid Cylinder Precautions

- Periodically check all pressure regulators and verify that pressure settings are within the recommended limits.
- Compressed gas cylinders are initially pressurized at 14 to 15 MPa (2200 to 2500 psi). Use a regulator to reduce the delivered air pressure to 0.3 to 0.5 MPa (50 to 75 psi).
- Fasten all cylinders securely to an immovable structure.
- Do not store or move a cylinder unless the safety cap is in place.
- Store or move cylinders in a vertical position only. Do not move the cylinders with regulators attached.
- Store cylinders in a well-ventilated area, away from heat or ignition sources.
- Clearly label the cylinder with the contents.
- Use only approved regulators and tubing connections of the appropriate material and purity.
- The Dionex Integral system does not use any potentially poisonous or injurious gases. If such gases are used by other devices in the system, make sure to follow all necessary safety practices.

Mechanical Precautions

- The analytical pump contains a piston-drive mechanism with moving parts. Before servicing, turn off the main power switch and unplug the power cable.
- Each stepper motor pump on the SP SamplePreparer panel contains a piston-drive mechanism with moving parts. Before servicing the pump, turn off the main power switch and unplug the power cable.

Electrical Precautions

- Replace blown fuses with the size and rating stipulated for each component.
- Verify that the selected operating voltage for the analyzers are the same as the actual power line voltage.

The power supply cord is used as the main disconnect device. Make sure the socket-outlet is located near the module and is easily accessible.

Le cordon d'alimentation principal est utilisé comme dispositif principal de débranchement. Veillez à ce que la prise de base soit située/installée près du module et facilement accessible.

Das Netzkabel ist das wichtigste Mittel zur Stromunterbrechung. Stellen Sie sicher, daß sich die Steckdose nahe am Gerät befindet und leicht zugänglich ist.

2 • Dionex Integral System Configurations

The modular design of Dionex Integral Process Analytical Systems allows you to configure a Dionex Integral system that meets your sampling, analytical, and environmental requirements. This chapter describes several of the more common configurations of analytical system modules, sampling modules, and enclosures that make up a Dionex Integral system.

2.1 Example Configurations

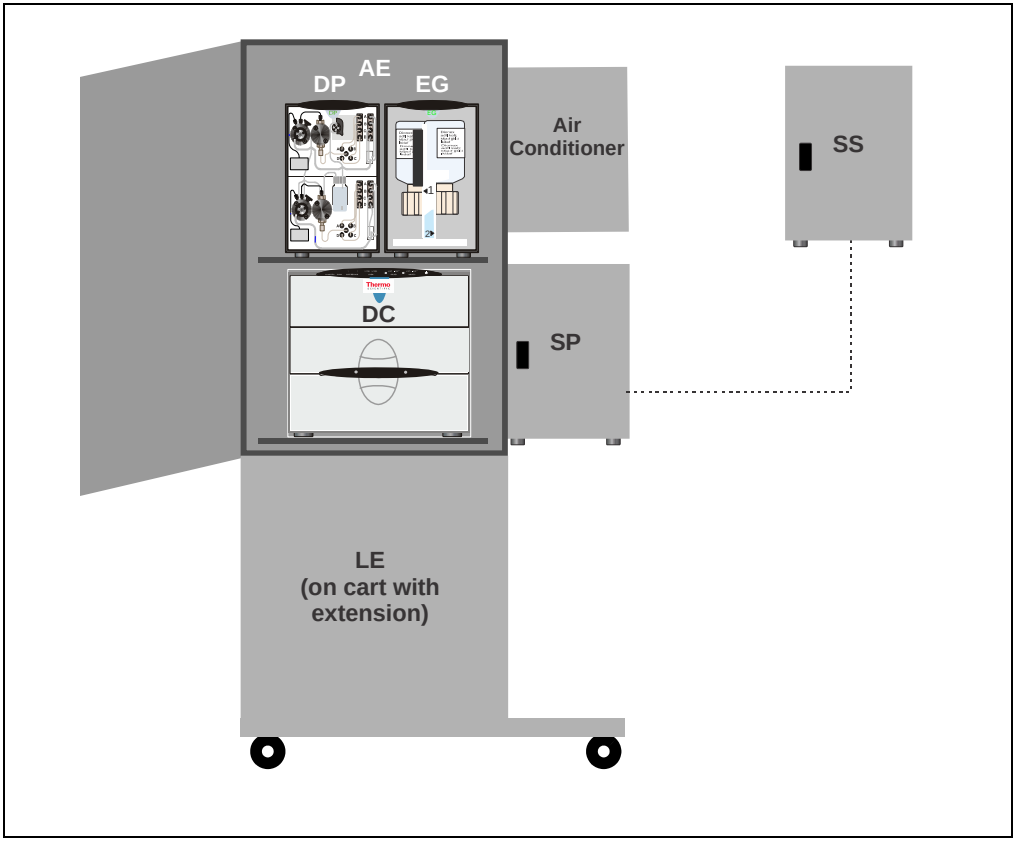


Figure 2-1. Example Dionex Integral System Configuration: ICS-3000 Dual RFIC™ System, AE, LE, Air Conditioner, External SP, and External SS

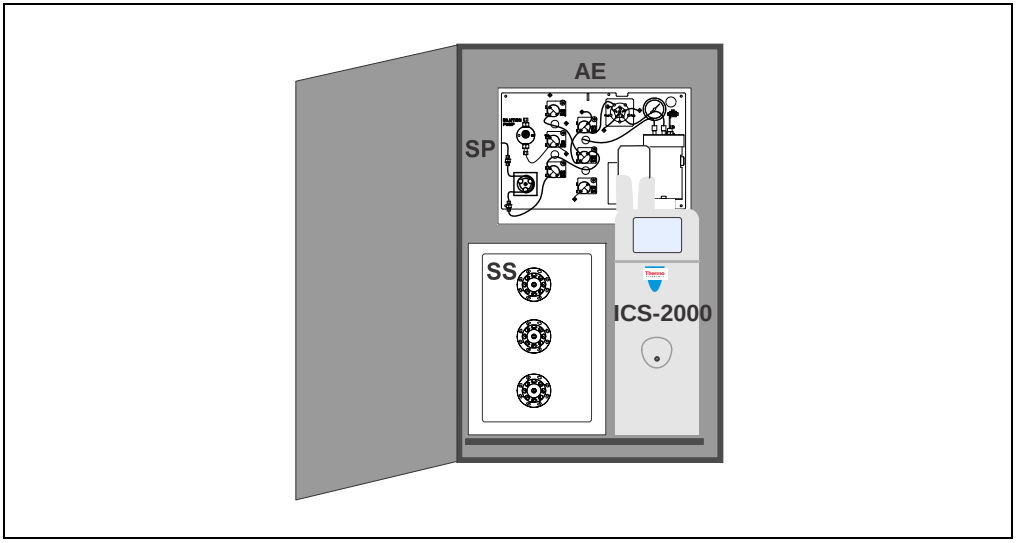


Figure 2-2. Example Dionex Integral System Configuration: ICS-2000 System, AE, Internal SP, and Internal SS

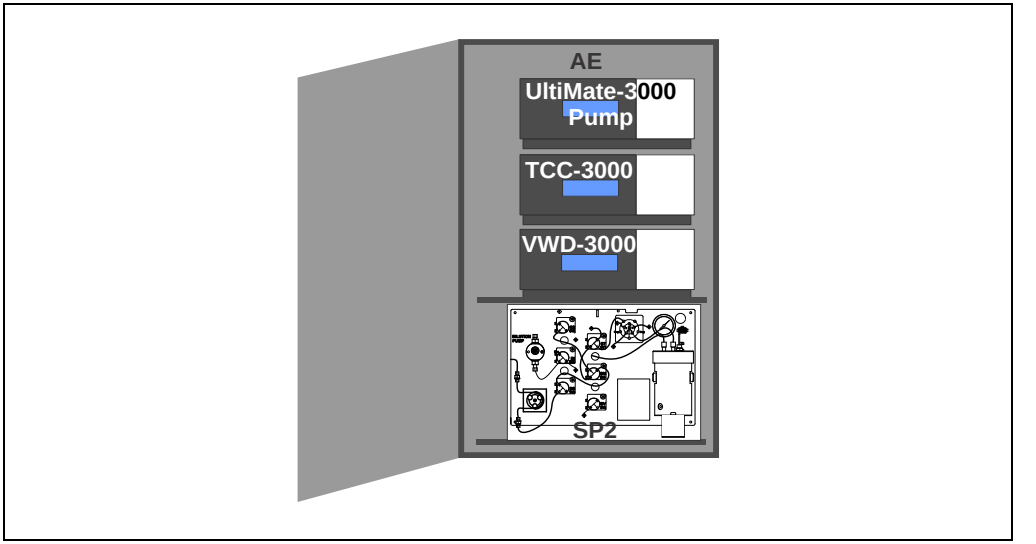


Figure 2-3. Example Dionex Integral System Configuration: UltiMate 3000 System, AE, and Internal SP

3 • SP Sample Preparer Description

3.1 SP Overview

The SP Sample Preparer is equipped with pumps, valves, and other components required to prepare samples and standards for analysis. The following SP versions are available:

- The *SP1* is pre-configured with the components required for applications that use sample concentration or direct injection.
- The *SP2* is pre-configured with the components required for applications that use sample dilution or direct injection.
- The generic *SP* can be customized with pumps, valves, and other components as required for HPLC applications, or IC applications that use other sample preparation techniques (for example, dilution with reagent addition).

3.2 SP Enclosures

The SP is available in two enclosure types:

- The external enclosure sits on the lab bench or is mounted on the outside of an AE (see Figure 3-1)
- The internal enclosure is installed inside an AE (see Figure 3-2)

Any of the SP versions (SP1, SP2, or generic) can be housed in any enclosure type. The type of enclosure required depends on the other modules configured in the Dionex Integral system.

Figure 3-1. SP Sample Preparer: External Enclosure Installations

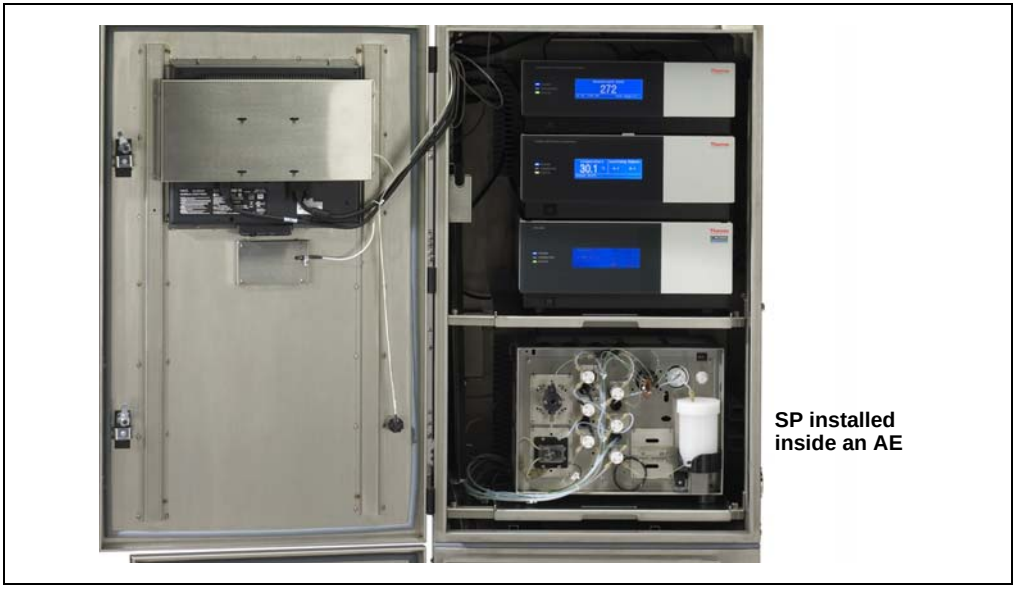


Figure 3-2. SP Sample Preparer: Internal Enclosure Installation

The SP enclosures are designed for use in nonhazardous locations. The external SP enclosure is designed to meet either NEMA 12 or NEMA 4X requirements, depending on the installation:

- When the external SP enclosure is installed as a stand-alone enclosure, it meets NEMA 12 requirements (because the ventilation openings are exposed to the environment).
- When the external SP enclosure is mounted onto the side of an AE, it meets NEMA 4X requirements (because the ventilation openings are inside the AE and are not exposed to the environment).

Enclosure Type	Intended Location	External SP Enclosure Version
NEMA 12 equivalent	Intended for use primarily to provide a degree of protection against dust, falling dirt, and dripping noncorrosive liquids.	Stand-alone
NEMA 4X/IP65 equivalent	Intended for use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water.	Mounted on AE

Table 3-1. NEMA Enclosure Type Descriptions

NOTE **The information in this table is not intended to be a complete representation of National Electrical Manufacturers Associations (NEMA) standards for enclosures nor those of the Electrical and Electronic Manufacturers Association of Canada (EEMAC).**

3.3 SP Power and Computer Connections

Receptacles for connecting a power cord and USB (Universal Serial Bus) cable are on the left side of the SP (see Figure 3-3).

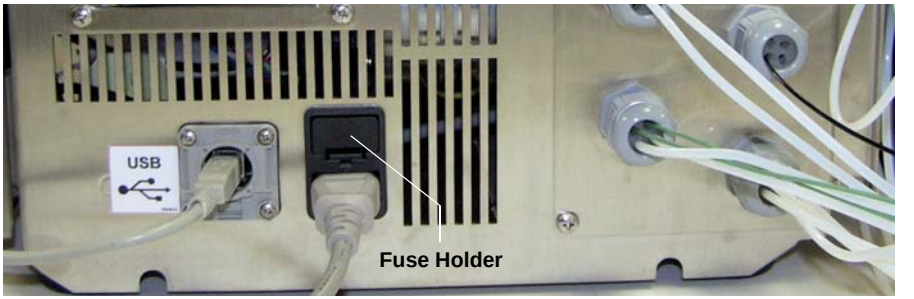


Figure 3-3. SP USB and Power Receptacles (Vertical Enclosure Shown)

Fuse Holder and Power Receptacle

The fuse cartridge contains two fast-blow IEC 127 fuses rated 3.15 A (P/N 954745). For instructions on how to change the fuses, see Section 10.10.

The power cord plugs into the IEC 320 three-prong receptacle. Connect the power cord from this receptacle to a grounded power source. If the SP is mounted on an AE or installed inside an AE, connect the power cord to the power outlet strip inside the AE (see Section 5.3.2). The AE power outlet strip is a grounded receptacle.

When the SP is mounted on the side of the AE or installed inside the AE, the AE power cord is the main disconnect device. In addition, the AE main power switch (see Figure 5-6) and **Emergency Off** switch (see Figure 5-2) can be used to control the power to the SP.

WARNING

SHOCK HAZARD—If a grounded receptacle is not used, a shock hazard may result. Do not operate or connect to AC power mains without earthed ground connections.

CAUTION

The power supply cord is used as the main disconnect device. Make sure the socket-outlet is located near the module and is easily accessible.

MISE EN GARDE

DANGER D'ÉLECTROCUTION—Pour éviter toute électrocution, il faut utiliser une prise de courant avec prise de terre. Ne l'utilisez pas et ne le branchez pas au secteur C.A. sans utiliser de branchement mis à la terre.

MISE EN GARDE

Le cordon d'alimentation principal est utilisé comme dispositif principal de débranchement. Veillez à ce que la prise de base soit située/installée près du module et facilement accessible.

WARNUNG

STROMSCHLAGGEFAHR—Zur Vermeidung von elektrischen Schlägen ist eine geerdete Steckdose zu verwenden. Das Gerät darf nicht ohne Erdung betrieben bzw. an Wechselstrom angeschlossen werden.

VORSICHT

Das Netzkabel ist das wichtigste Mittel zur Stromunterbrechung. Stellen Sie sicher, daß sich die Steckdose nahe am Gerät befindet und leicht zugänglich ist.

Power Switch

The SP power switch is located on the SP panel in the top-left corner of a vertical panel, or in the top-right corner of a horizontal panel (see Figure 3-4). Turn on the power switch before initial operation and leave it on unless instructed to turn it off (for example, before performing a service procedure).

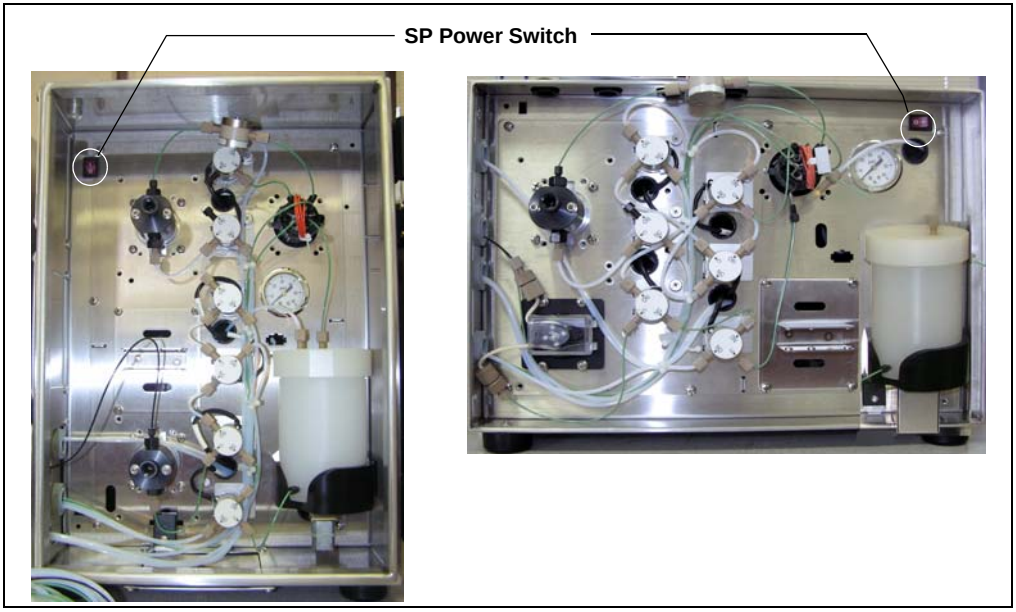


Figure 3-4. SP Power Switch

Software Communication

The USB (Universal Serial Bus) receptacle ("B" type connector) (see Figure 3-3) allows connection to the computer on which Chromeleon PA is installed.

One 5-meters (16-feet) USB cable (P/N 960779) is provided in the SP Ship Kit (SP1, P/N 069085; SP2, P/N 069086).

3.4 SP Liquid Leak Sensor and Drain

A leak sensor is located inside the SP enclosure, in the bottom front of the enclosure. If the leak sensor becomes wet, it reports the leak to Chromeleon and an error message is displayed in the Audit Trail.

An optional auxiliary leak sensor (P/N 067728) can be connected to the SP electronics board and installed inside the AE.

Any liquid that collects in the bottom of the SP exits through the drain port in the tray at the front of the SP enclosure. A drain line can be connected to this port, if desired.

3.5 SP Component Descriptions

This section describes the components (valves, dilution vessels, pumps, etc.) that can be installed on an SP panel. To control an installed component, enter commands in a Chromeleon instrument control program or use the controls on a Chromeleon Control panel. Figure 3-5 shows the Control panel for an SP1.

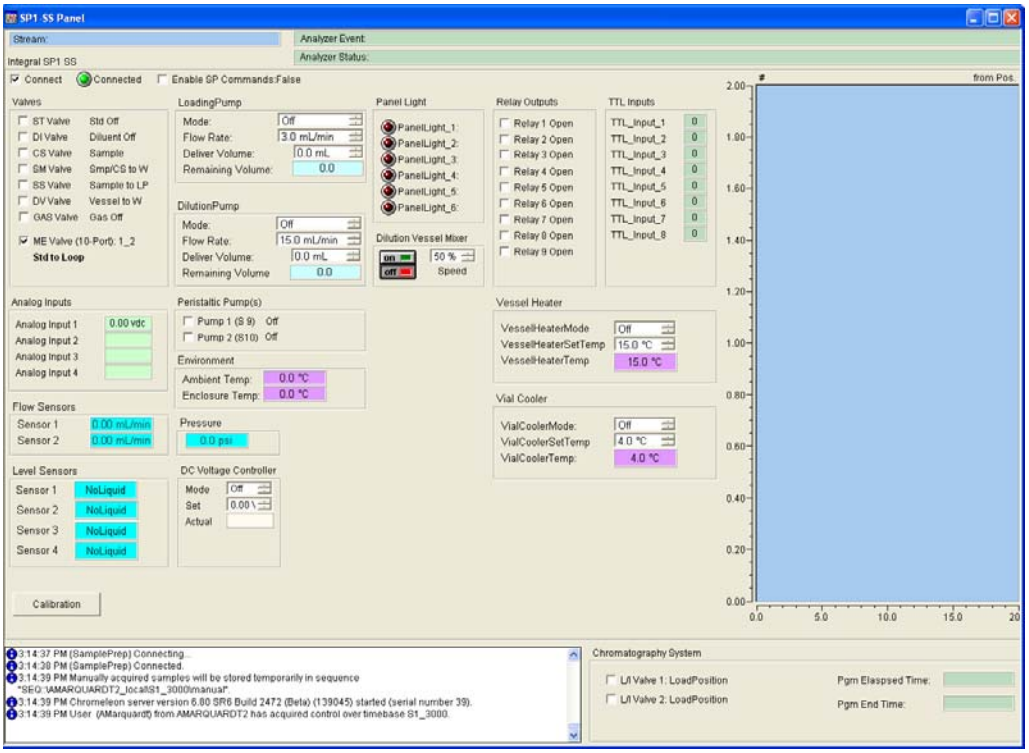


Figure 3-5. SP1 Control Panel

3.5.1 Metering Valve (Rotary Valve)

The metering valve is a 10-port high-pressure rotary valve that measures sample or standard for delivery to a dilution vessel. The valve is available in two models: PEEK™ (P/N 068556) and stainless steel (P/N 068557). Both models are electrically-activated, two-position valves. A PEEK valve is included in the SP1 and SP2. Both valve versions can be ordered separately for custom SP configurations.

A 100 µL sample loop is included with the valve. For information about making a different volume loop and for instructions on calibrating the loop, see Section 7.2.5.

Figure 3-6 shows the liquid flow path through the valve ports at each valve position. Figure 3-7 shows the tubing connections to each valve port on an SP1 and SP2 and the functions performed at each valve position.

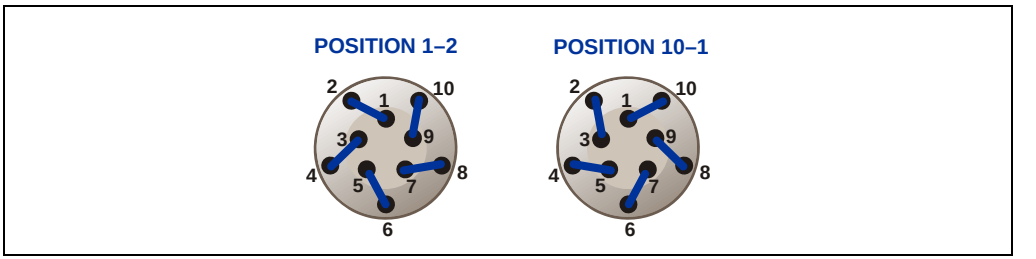


Figure 3-6. 10-Port High-Pressure Valve Flow Schematics

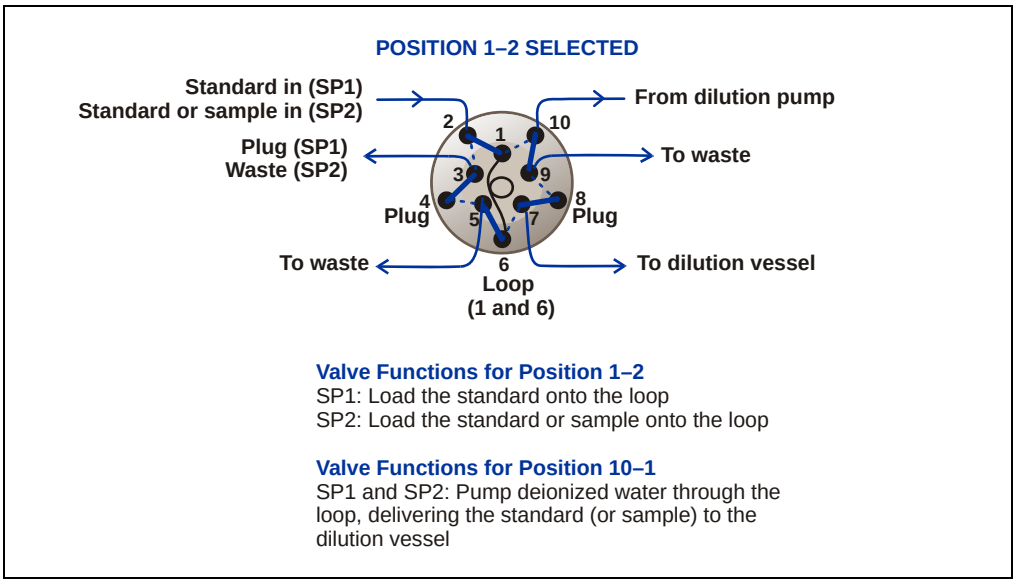


Figure 3-7. 10-Port High-Pressure Valve Connections (SP1 and SP2)

3.5.2 Dilution Vessels

A dilution vessel is used to prepare calibration standards in an SP1 and SP2, and also to dilute samples in an SP2. Two versions of the dilution vessel are available:

- 250-mL unheated dilution vessel (P/N 069208) (standard with the SP1 and SP2)
- 50-mL heated dilution vessel (P/N 068524) (option)

Pressurize either dilution vessel with high-purity nitrogen or helium (filtered, dry, and oil-free) regulated to 170 to 240 kPa (25 to 35 psi). If the pressure reaches 340 kPa (50 psi), a pressure relief valve opens.

Dilution Vessel Mixer

Both dilution vessels are equipped with a mixer and a PTFE (polytetrafluoroethylene) stir bar. Specify the default mixer speed (from 0% to 100% of maximum) in the Chromeleon Server Configuration program on the **Pumps/Motors** page (see Figure 3-8).

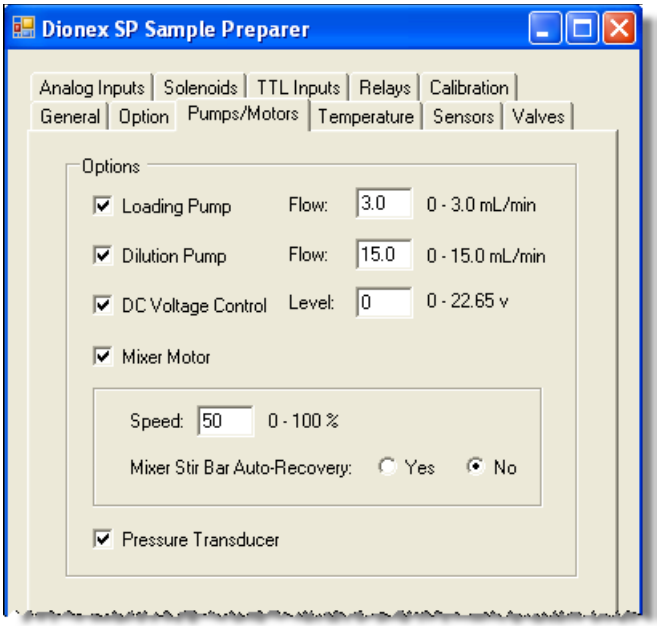


Figure 3-8. Chromeleon Server Configuration: Pumps/Motors Page

The **Mixer Stir Bar Auto-Recovery** option on the **Pumps/Motors** page uses Analog Input 4 to monitor the mixer stir bar. If the stir bar is in an out-of-control state, the mixer motor is stopped and then restarted at a 5% slower speed than before the auto-recovery occurred. To disable auto-recovery, select **No** for this option.

You can use the controls on the Chromeleon Control panel (see Figure 3-5) to turn the mixer on and off and set the speed.

Heated Dilution Vessel Option

The temperature of the 50-mL heated dilution vessel can be set to between 15 °C and 40 °C. Specify the temperature of the vessel in the Chromeleon Server Configuration program on the **Temperature** page (see Figure 3-9) or in the Chromeleon instrument control program.

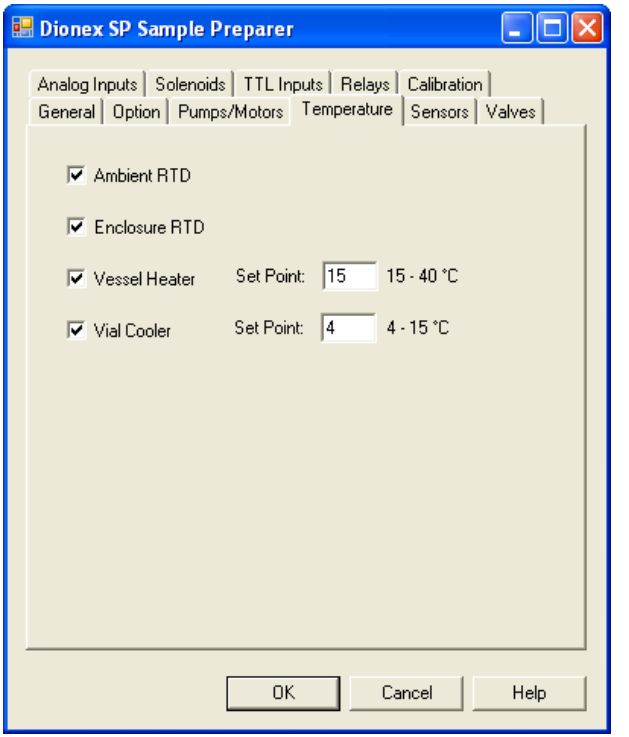


Figure 3-9. Chromeleon Server Configuration: Temperature Page

For installation instructions for a heated dilution vessel, refer to Appendix G.

3.5.3 Dilution Pump

The dilution pump (P/N 068561) (see Figure 3-10) uses a stepper motor to precisely deliver diluent (typically deionized water) through the metering valve to the dilution vessel. The pump can deliver from (0.1 mL to 250.0 mL).

The pump flow rate can be set to between 0.0 mL/min and 15.0 mL/min (the default is 15.0 mL/min). Specify the default flow rate in the Chromeleon Server Configuration program on the **Pumps/Motors** page (see Figure 3-8).

Figure 3-10. Dilution Pump

Enter commands for controlling the pump in the Chromeleon instrument control program and on the Chromeleon Control panel (see Figure 3-5).

3.5.4 Loading Pumps

Two types of pumps are available for loading sample to the injection valve. A stepper motor loading pump (P/N 068561) (the same as the dilution pump) is standard on an SP1. A peristaltic loading pump (P/N 068558) is standard on an SP2. For custom SP configurations, both loading pump types can be ordered separately.

Stepper Motor Loading Pump

A stepper motor pump is available for applications in which the sample is delivered to a concentrator column installed on the injection valve.

The flow rate can be set to between 0.0 mL/min and 3.0 mL/min (the default is 3.0 mL/min). Use a flow rate appropriate for delivering sample to a concentrator column. Specify the default flow rate in the Chromeleon Server Configuration program on the **Pumps/Motors** page (see Figure 3-8).

Enter the volume of sample to deliver (0.1 mL to 1000.0 mL) and other pump commands in the Chromeleon instrument control program or on the Chromeleon Control panel (see Figure 3-5).

Peristaltic Loading Pump

A peristaltic pump (see Figure 3-11) can be used for applications in which the sample is delivered to a sample loop installed on the injection valve.

When a peristaltic pump is installed in the SP, one of the solenoid valve connectors on the SP electronics board (typically SV9) is assigned to control the peristaltic pump (instead of controlling a solenoid valve).

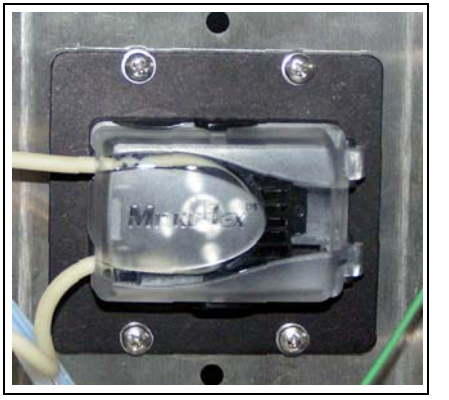


Figure 3-11. Peristaltic Pump

To turn the pump on and off, set the position of the solenoid valve on and off in the Chromeleon instrument control program or on the Chromeleon Control panel (see Figure 3-5).

To adjust the pump speed, use the potentiometer on the SP electronics board. For instructions, see Section 10.8. For instructions on installing and configuring a peristaltic pump, refer to Appendix E.

3.5.5 Solenoid Valves

Each SP is equipped with several solenoid valves (see Figure 3-12) that direct liquid flow throughout the SP flow path. For valve locations and functions for the SP1, see Section 3.6.1; for the SP2, see Section 3.6.2. For custom SP configurations, order solenoid valves (P/N 068554) separately.

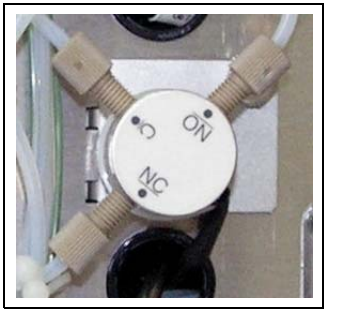


Figure 3-12. Solenoid Valve

The solenoid valves are three-way valves that provide on/off control of liquid flow in two directions. Figure 3-13 shows the flow schematic for the valves.

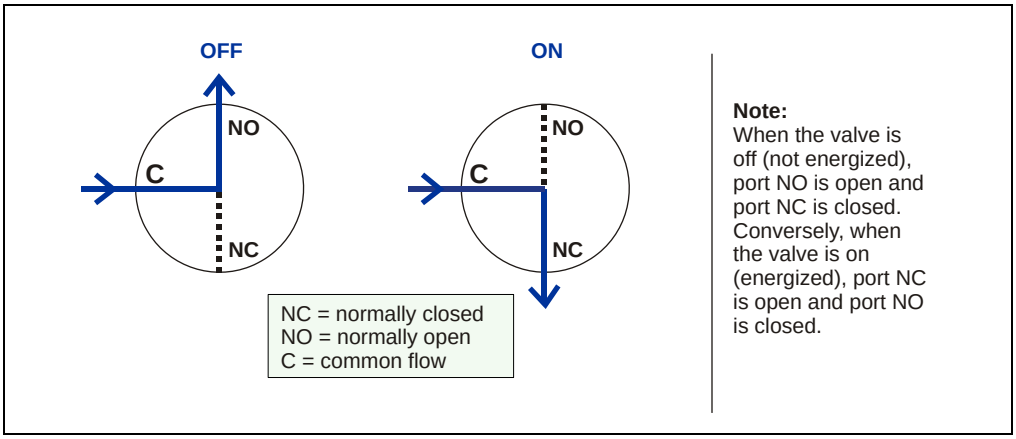


Figure 3-13. Three-Way Solenoid Valve Flow Schematics

3.5.6 Vial Cooler (Option)

A vial cooler (P/N 068566) (see Figure 3-14) can be installed on the SP panel. The cooler temperature can be set to between 4 °C and 15 °C (the default is 4 °C). Specify the temperature of the vial cooler either in the Chromeleon Server Configuration program (see Figure 3-9) or in the Chromeleon instrument control program.

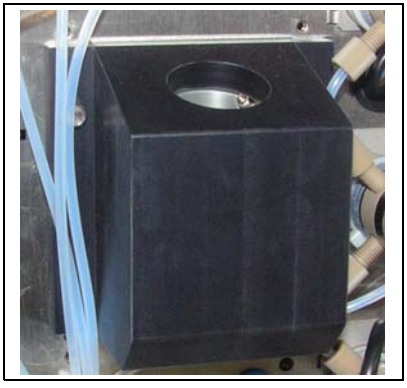


Figure 3-14. Vial Cooler

Use a 20-mL scintillation vial in the vial cooler.

If you are using the vial cooler to cool a standard, set the standard vial in the cooler and direct the line from the ST valve (see Figure 3-15) to the vial.

3.6 SP Panel Configurations

3.6.1 SP1 for Concentration or Direct Injection

The SP1 configuration is used for the following:

- Trace ion applications in which the samples are concentrated on a concentrator column before chromatographic analysis
- Applications in which the samples are loaded directly into the sample loop before chromatographic analysis

All materials in the flow paths are of the highest purity and permit trace ion analysis even at the low part-per-trillion (ppt) level.

SP1 Component Flow Path

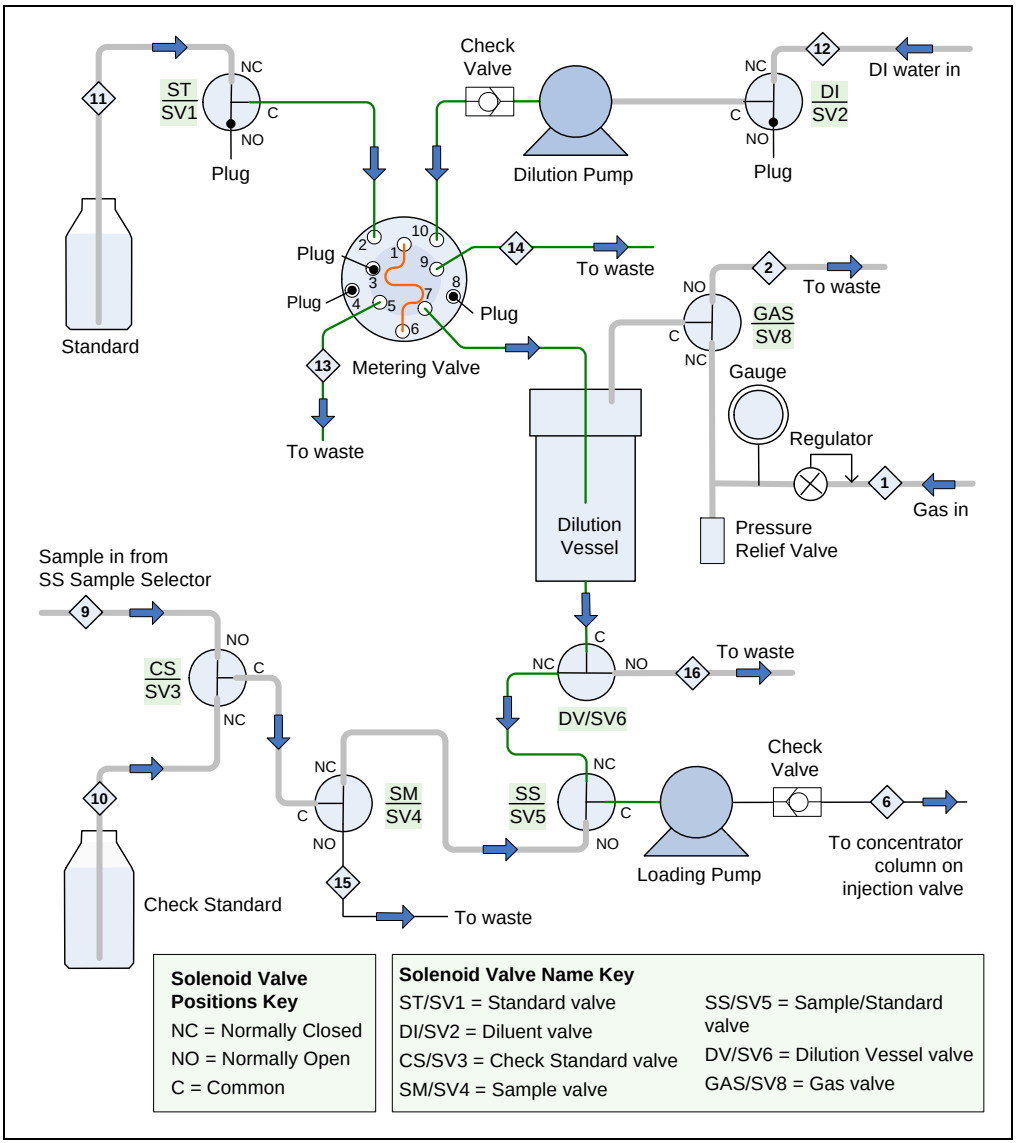


Figure 3-15. SP1 Component Flow Path

NOTE The numbered diamonds on Figure 3-15 indicate gas and liquid input and output (I/O) lines. For I/O line port assignments, see Section 3.6.4.

SP1 Component Functions

Component	Description	Function
Standard Valve (ST/SV1)	3-way solenoid valve	On: Directs stock standard to metering valve (for calibration standard preparation) Off: Stops flow of stock standard
Diluent Valve (DI/SV2)	3-way solenoid valve	On: Directs diluent to dilution pump Off: Stops flow of diluent
Check Standard Valve (CS/SV3)	3-way solenoid valve	On: Directs check standard to sample valve Off: Directs sample to sample valve
Sample Valve (SM/SV4)	3-way solenoid valve	On: Directs sample or check standard to SS valve and loading pump for analysis. Off: Directs sample or check standard to waste
Sample/Standard Valve (SS/SV5)	3-way solenoid valve	On: Directs calibration standard to loading pump Off: Directs sample to loading pump
Dilution Vessel Valve (DV/SV6)	3-way solenoid valve	On: Directs calibration standard to SS valve Off: Purges dilution vessel to waste
Metering Valve (ME)	10-port, 2-position valve	Position 10–1: Delivers diluent and loop contents to dilution vessel Position 1–2: Loads stock standard into the loop for delivery to dilution vessel
Dilution Vessel	Pressurized container	Used to prepare calibration standards
Gas Valve (SV8)*	3-way solenoid valve	On: Pressurizes the dilution vessel Off: Vents the dilution vessel
Dilution Pump	Stepper motor pump	Delivers diluent to dilution vessel
Loading Pump	Stepper motor pump	Loads samples or standards to concentrator column or sample loop on injection valve
Regulator/Valve Manifold	3-way gas valve manifold	Regulates flow of high-purity gas (typically helium) to dilution vessel

Table 3-2. SP1 Components for Concentration or Direct Injection

* The regulator for the gas valve is on the SP panel. The valve is behind the panel.

SP1 Component Layouts

Figure 3-17 shows the layout of the SP1 components when they are installed in the vertical orientation. Figure 3-16 shows the layout when the SP components are installed in the horizontal orientation.

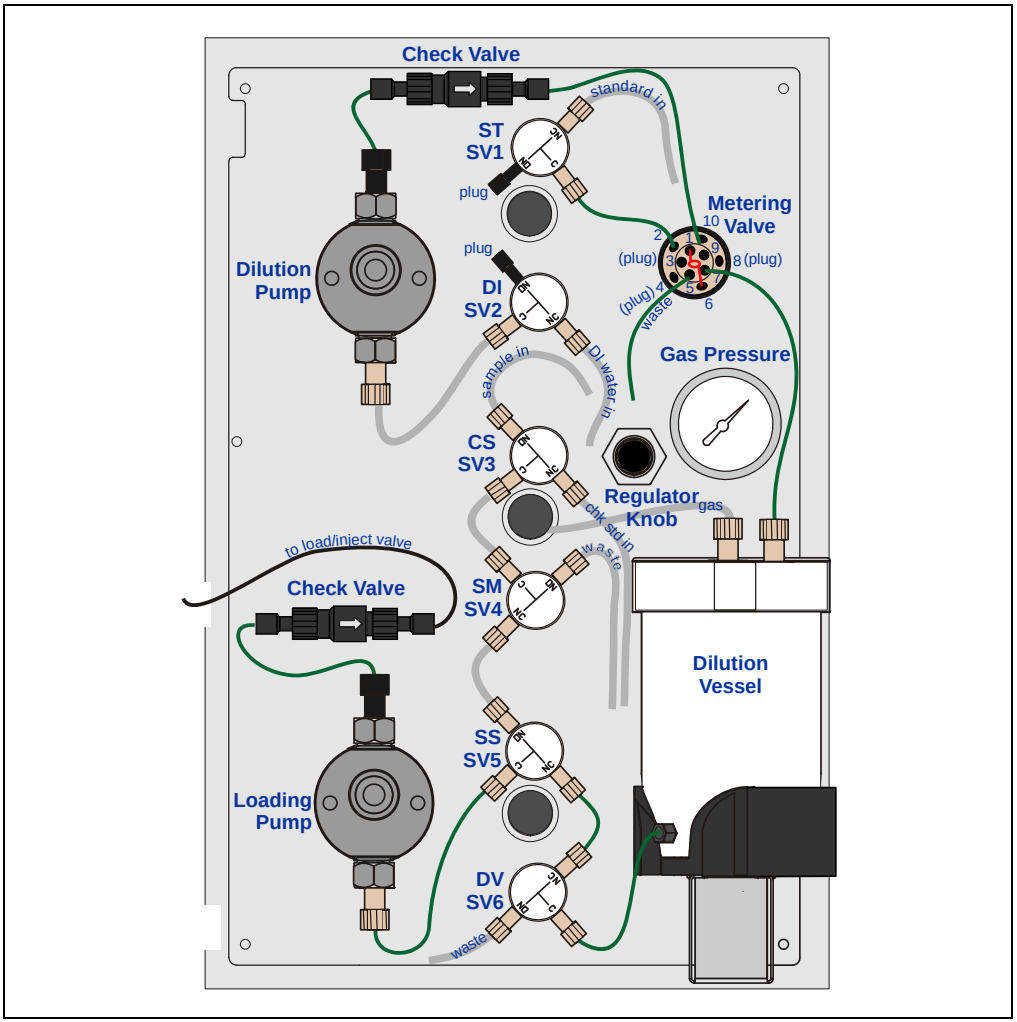


Figure 3-16. SP1 Component Layout: Vertical Orientation

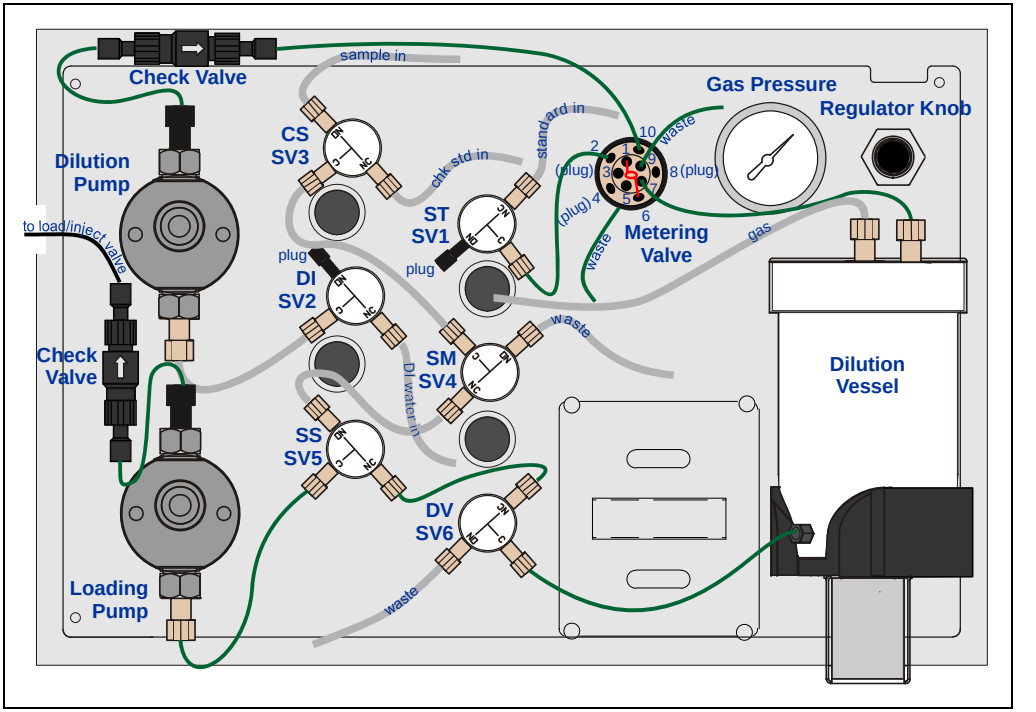


Figure 3-17. SP1 Component Layout: Horizontal Orientation

3.6.2 SP2 for Dilution or Direct Injection

The SP2 configuration is used for the following:

- Applications in which the samples must be diluted before chromatographic analysis
- Applications in which the samples are loaded directly into the sample loop before chromatographic analysis.

A system configured for dilution is often used when assaying process samples for major constituents. Dilution factors up to 1/25,000 can be achieved.

SP2 Component Flow Path

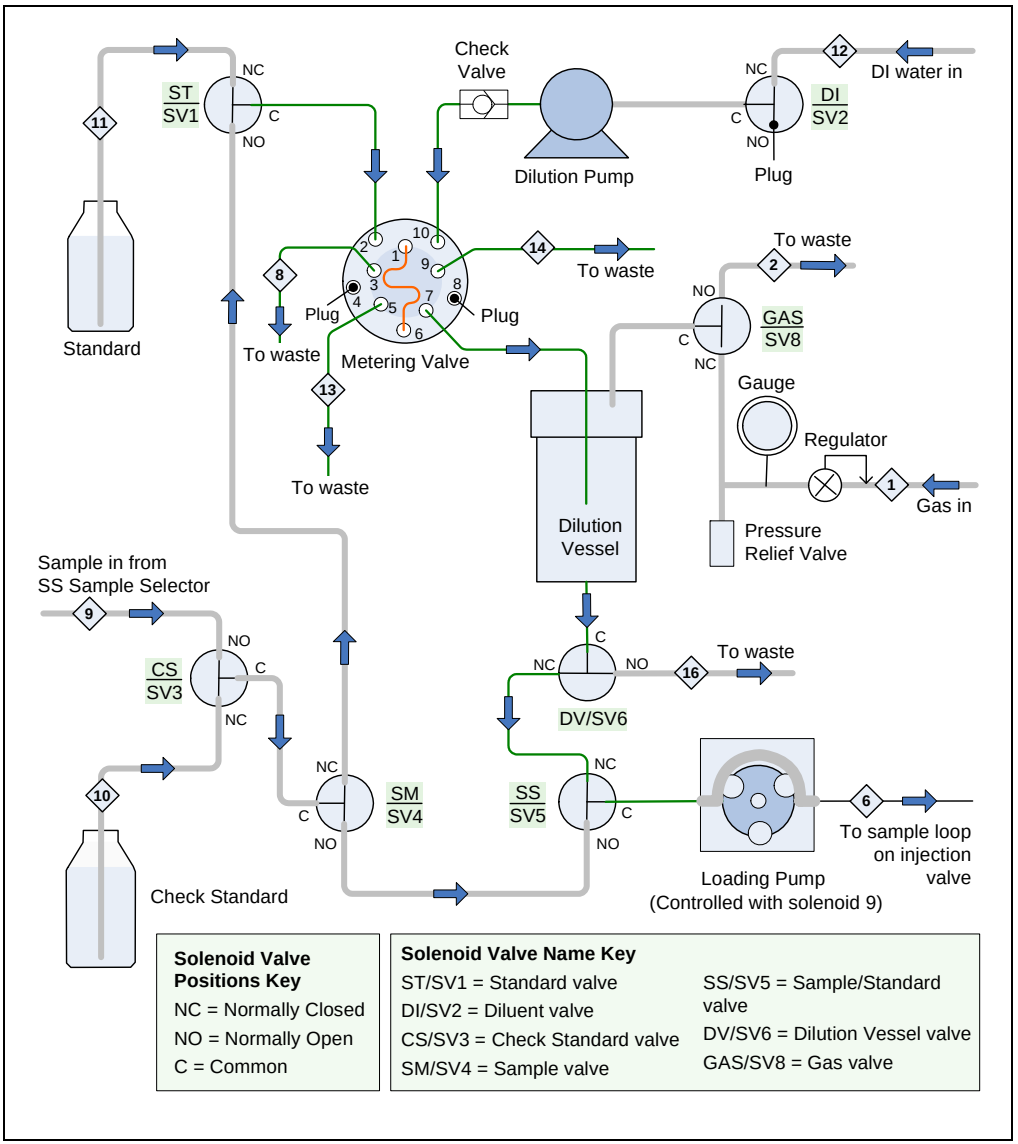


Figure 3-18. SP2 Component Flow Path

NOTE The numbered diamonds on Figure 3-18 indicate gas and liquid input and output (I/O) lines. For I/O line port assignments, see Section 3.6.4.

SP2 Component Functions

Component	Description	Valve Position and/or Function
Standard Valve (ST/SV1)	3-way solenoid valve	On: Directs stock standard to metering valve (for calibration standard preparation) Off: Directs sample to metering valve (for sample dilution)
Diluent Valve (DI/SV2)	3-way solenoid valve	On: Directs diluent to dilution pump Off: Stops flow of diluent
Check Standard Valve (CS/SV3)	3-way solenoid valve	On: Directs check standard to sample valve Off: Directs sample to sample valve
Sample Valve (SM/SV4)	3-way solenoid valve	On: Directs sample or check standard to ST valve Off: Directs sample or check standard to SS valve
Sample/Standard Valve (SS/SV5)	3-way solenoid valve	On: Directs diluted sample or calibration standard to loading pump Off: Directs undiluted sample or check standard to loading pump
Dilution Vessel Valve (DV/SV6)	3-way solenoid valve	On: Directs diluted sample/standard to SS valve Off: Purges dilution vessel to waste
Metering (ME) Valve	10-port, 2-position valve	Position 10–1: Delivers diluent and loop contents to dilution vessel Position 1–2: Loads sample or standard into the loop for delivery to dilution vessel
Dilution Vessel	Pressurized container	Used to prepare calibration standards and to dilute samples.
Gas Valve (SV8)*	3-way solenoid valve	On: Pressurizes the dilution vessel Off: Vents the dilution vessel
Dilution Pump	Stepper motor pump	Delivers diluent to dilution vessel.
Loading Pump (SV9)	Peristaltic pump	Loads samples or standards to sample loop on injection valve.
Regulator/Valve Manifold	3-way gas valve manifold	Regulates flow of high purity gas (typically helium) to dilution vessel.

Table 3-3. SP2 Components for Dilution of Direct Injection

* The regulator for the gas valve is on the SP panel. The valve is behind the panel.

SP2 Component Layouts

Figure 3-19 shows the layout of the SP2 components when they are installed in the vertical orientation. Figure 3-20 shows the SP2 layout when the components are installed in the horizontal orientation.

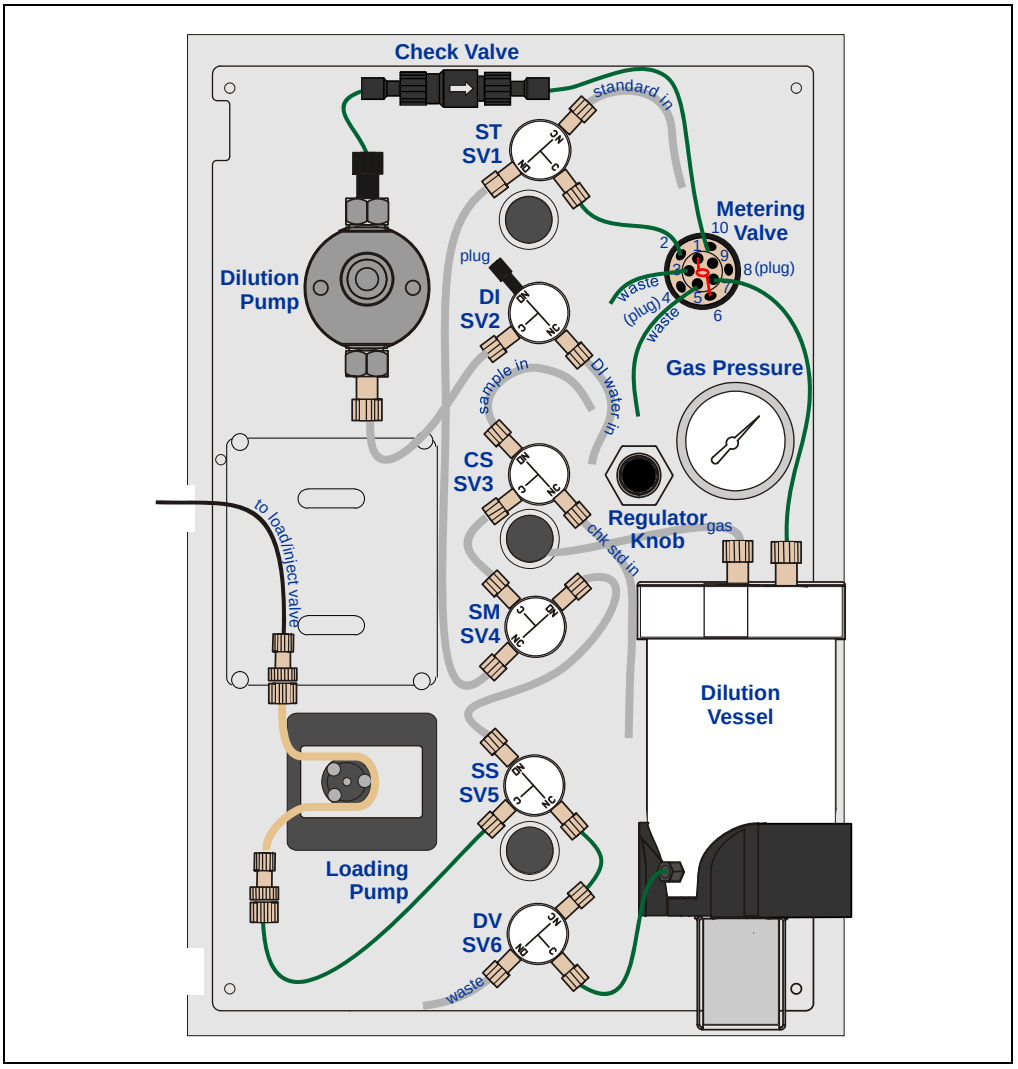


Figure 3-19. SP2 Component Layout: Vertical Orientation

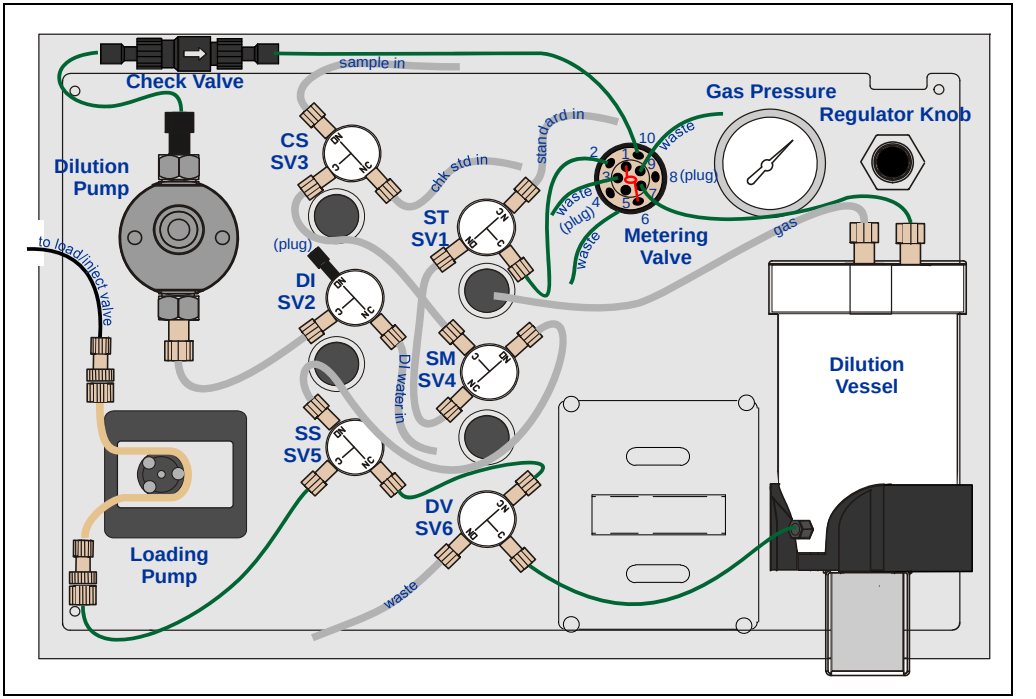


Figure 3-20. SP2 Component Layout: Horizontal Orientation

3.6.3 Flow Paths and Valve Positions Used During Analyses

This section describes the flow paths and valve positions used to analyze calibration standards, check standards, and sample streams.

Flow Paths and Valve Positions for Analyzing Calibration Standards

Analyzing a calibration standard consists of three main steps:

- Filling the loop on the metering valve with stock standard (see Figure 3-21)
- Sending the loop contents and deionized water (the diluent) to the dilution vessel (see Figure 3-22)
- Purging the diluted standard from the dilution vessel and loading it to the injection valve (see Figure 3-23)

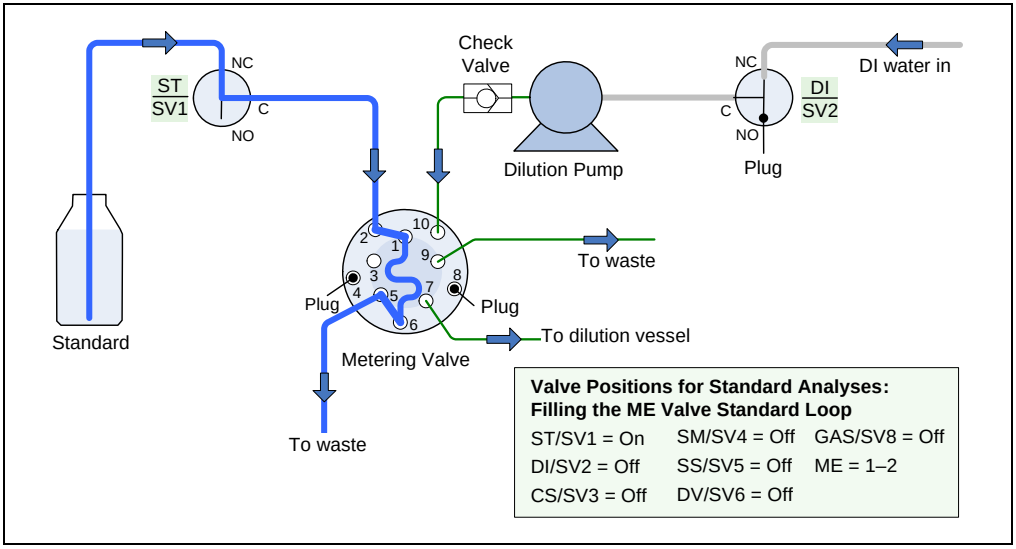


Figure 3-21. Analyzing Calibration Standards
Step 1: Filling the Metering Valve Loop with Standard

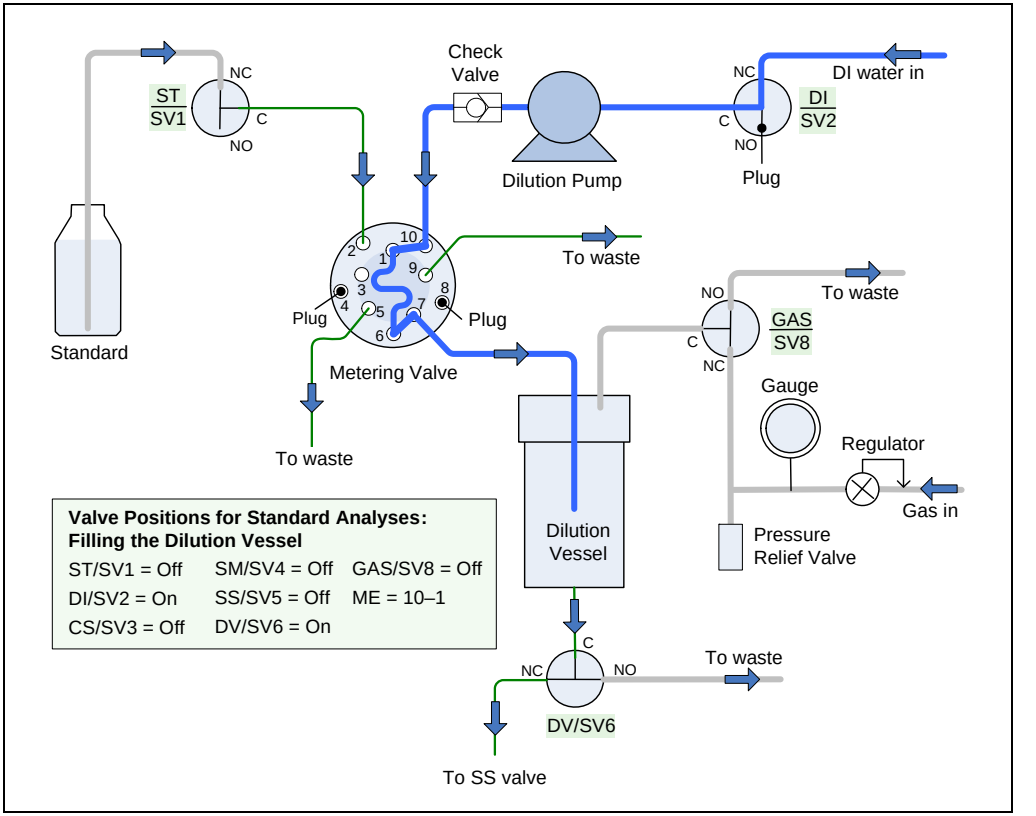


Figure 3-22. Analyzing Calibration Standards
Step 2: Filling the Dilution Vessel

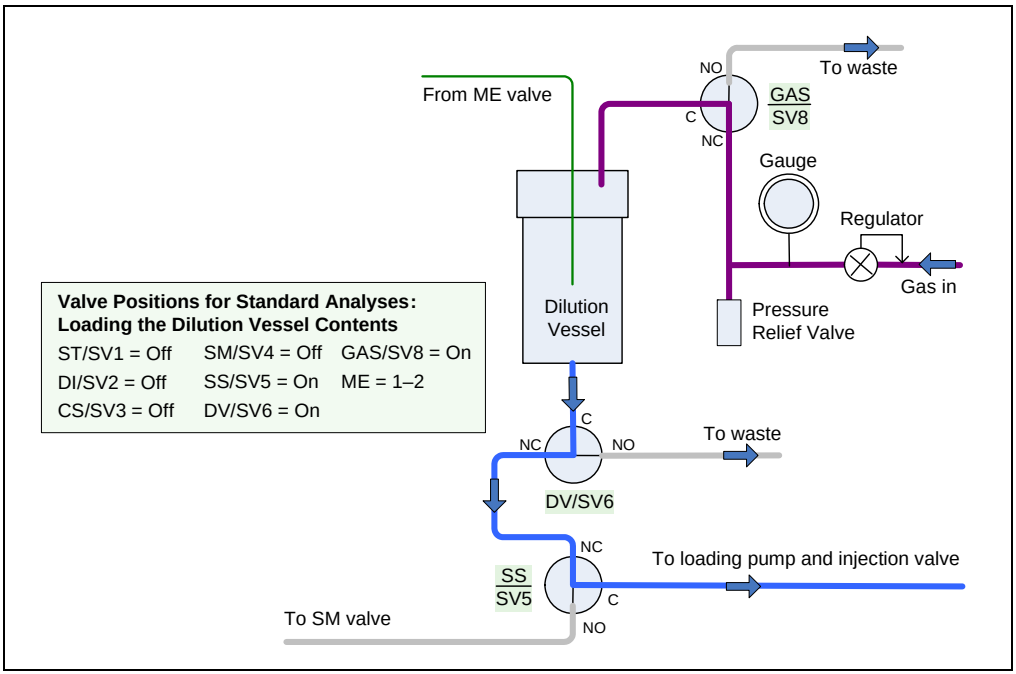


Figure 3-23. Analyzing Calibration Standards
Step 3: Loading the Dilution Vessel Contents

Flow Path and Valve Positions for Analyzing Check Standards

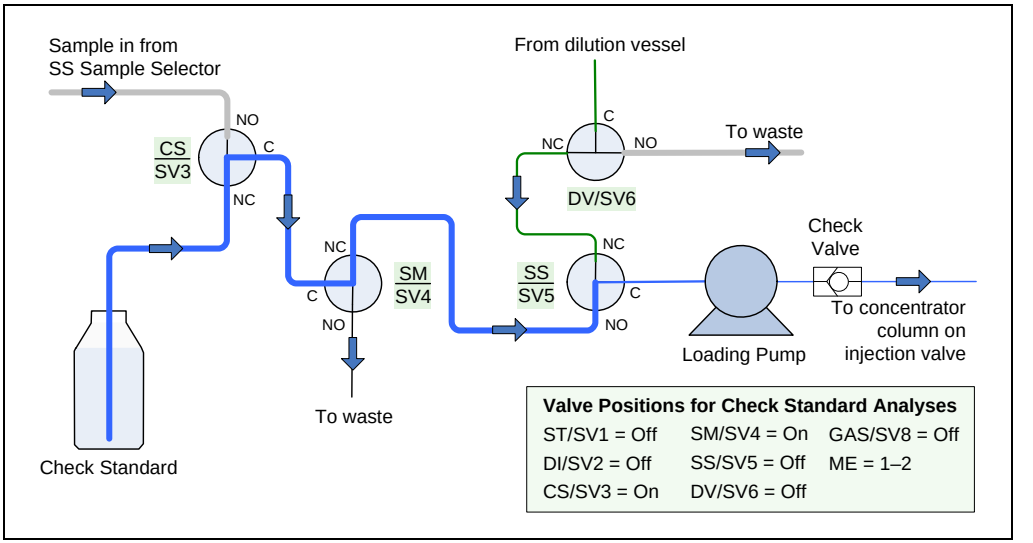


Figure 3-24. Analyzing Check Standards: SP1

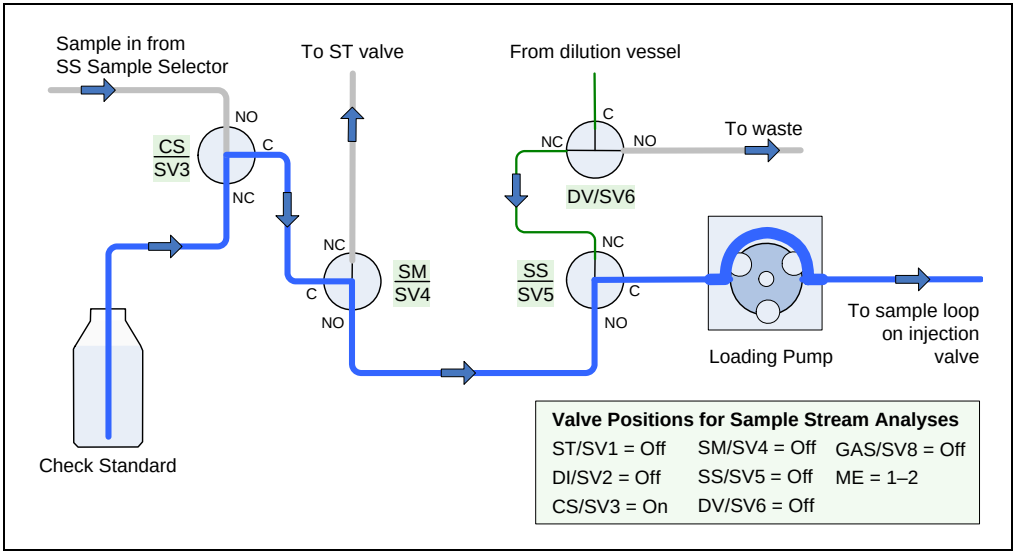


Figure 3-25. Analyzing Check Standards: SP2

Flow Path and Valve Positions for Analyzing Sample Streams

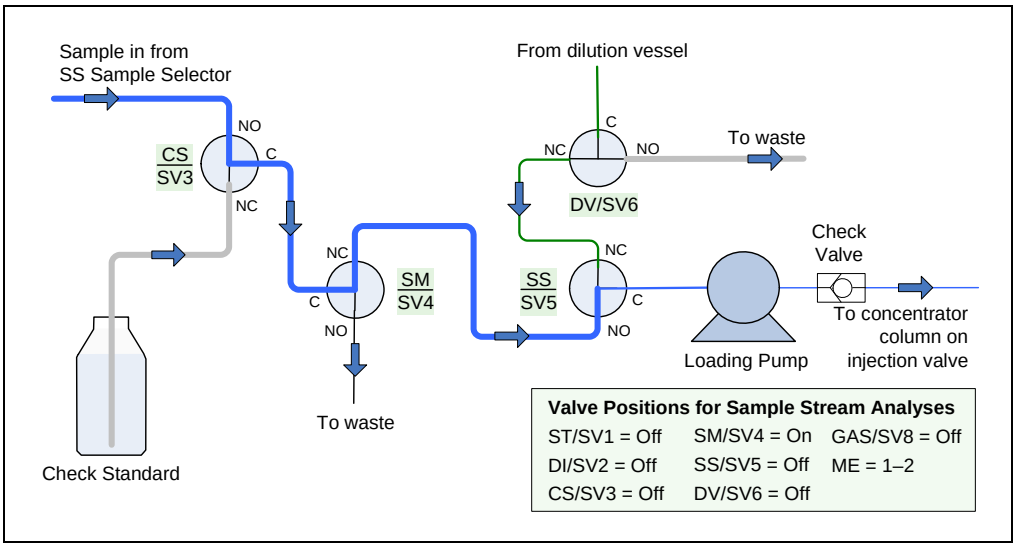


Figure 3-26. Analyzing Sample Streams: SP1

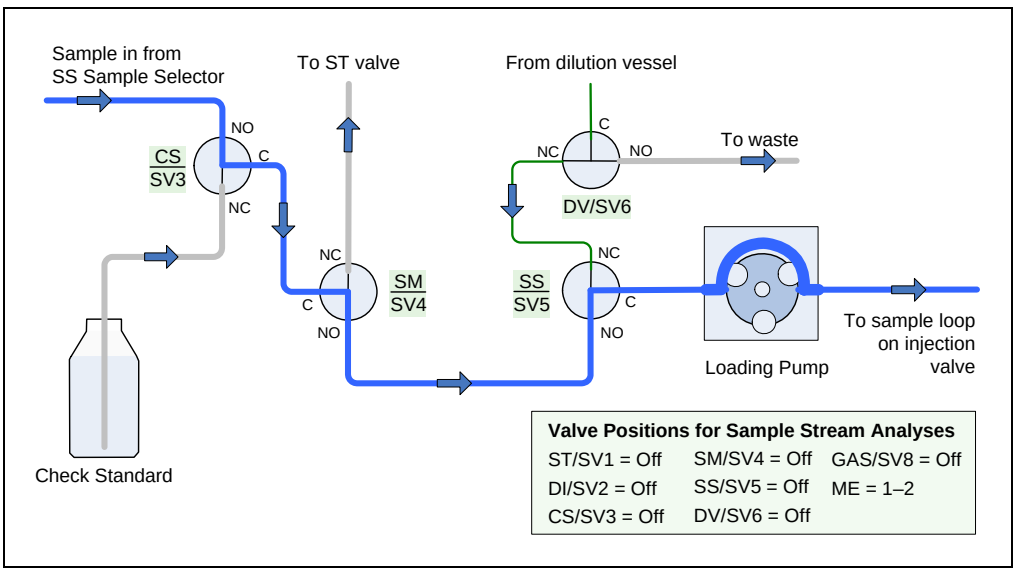


Figure 3-27. Analyzing Sample Streams: SP2 Direct Injection

Analyzing a sample stream for dilution with the SP2 consists of three main steps:

- Step 1: Filling the loop on the metering valve with sample (see Figure 3-28).
- Step 2: Sending the loop contents and deionized water (the diluent) to the dilution vessel. This step is the same as in analyzing the calibration standard (see Figure 3-22).
- Step 3: Purging the diluted sample from the dilution vessel and loading it to the injection valve. This step is the same as in analyzing the calibration standard (see Figure 3-23).

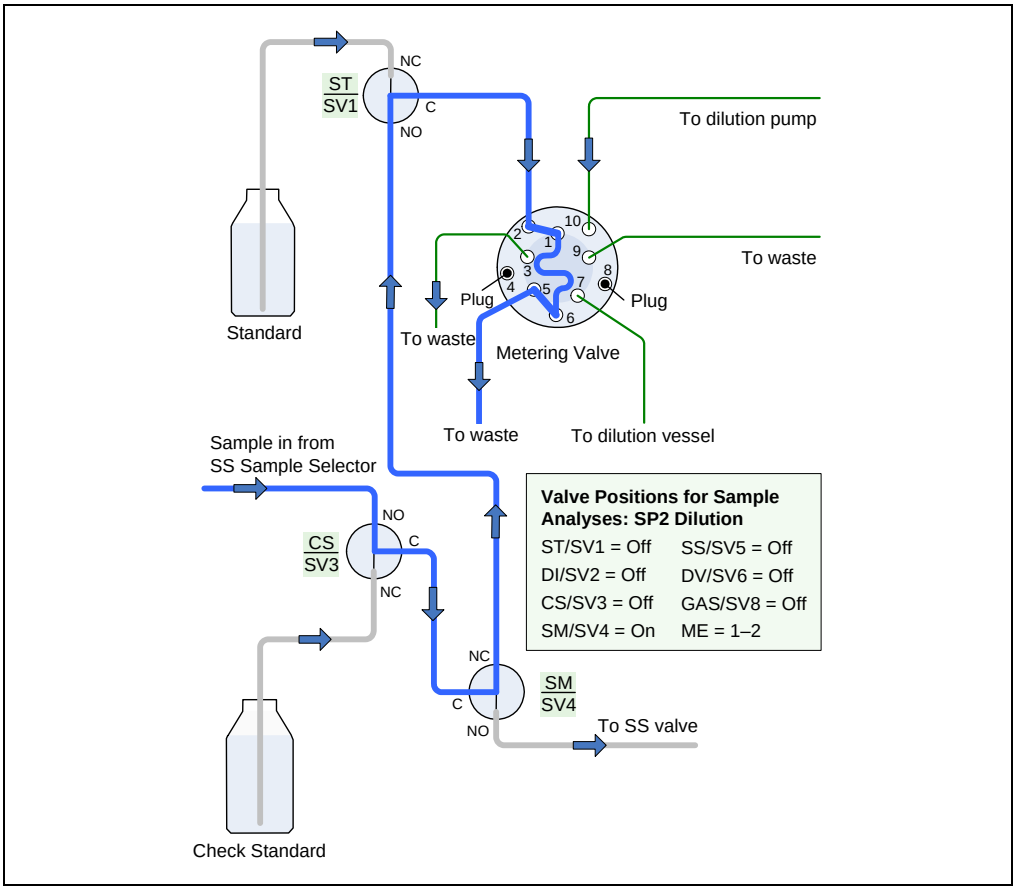
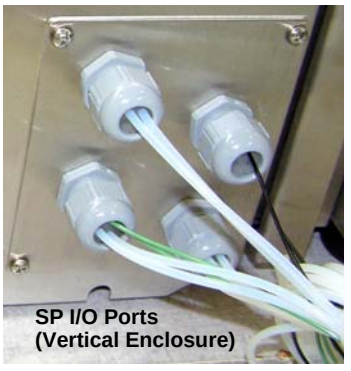
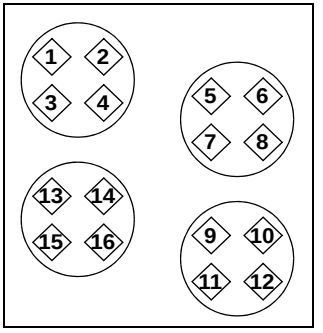


Figure 3-28. Analyzing Sample Streams: SP2 Dilution Step 1: Filling the Metering Valve Loop with Sample

3.6.4 SP Gas and Liquid Input and Output Lines

Gas and liquid input and output (I/O) lines from the SP components exit through ports on the side of the SP. Figure 3-29 identifies the I/O port assignments for the SP1 and SP2. For the location of each I/O line in the flow path, see Figure 3-15 (for the SP1) or Figure 3-18 (for the SP2).





I/O Port Assignments	
1	Gas In
2	Gas Valve Waste
3	Not Connected
4	Not Connected
5	Load Inject Waste
6	Load Inject Out
7	Pump Waste
8	ME Valve Port 3 Waste (SP2 only)
9	Sample In
10	Check Standard In
11	Standard In
12	DI Water In
13	ME Valve Port 5 Waste
14	ME Valve Port 9 Waste
15	SM Valve Waste (SP1 only)
16	DV Valve Waste

Figure 3-29. SP1 and SP2 I/O Lines and Port Assignments

3.7 Analog Inputs

The SP electronics board includes four analog inputs. A cable (P/N 070171) is provided in the SP Ship Kit (P/N 069085, SP1; P/N 069086, SP2) for connecting an analog input to an external device. If more than one analog input is required, order additional cables separately.

The input voltage range for each input is 0 to 10 V (maximum). The sampling rate is 3 Hz and the resolution is 24 bits.

To connect the analog input:

1. Turn off the SP power and unplug the power cord.
2. Follow the instructions in Section 10.6 to access the SP electronics board. The analog input connectors are in the bottom left corner of the board (see Figure 3-30).
3. Plug the analog input cable into an analog input connector on the board.

NOTE **Analog Input 4 is normally reserved for monitoring the dilution vessel mixer stir bar (see Section 3.5.2). It can be used for another function by changing the position of a jumper on the SP electronics board (see Figure 3-30). Instructions for changing the jumper position are on page 48.**

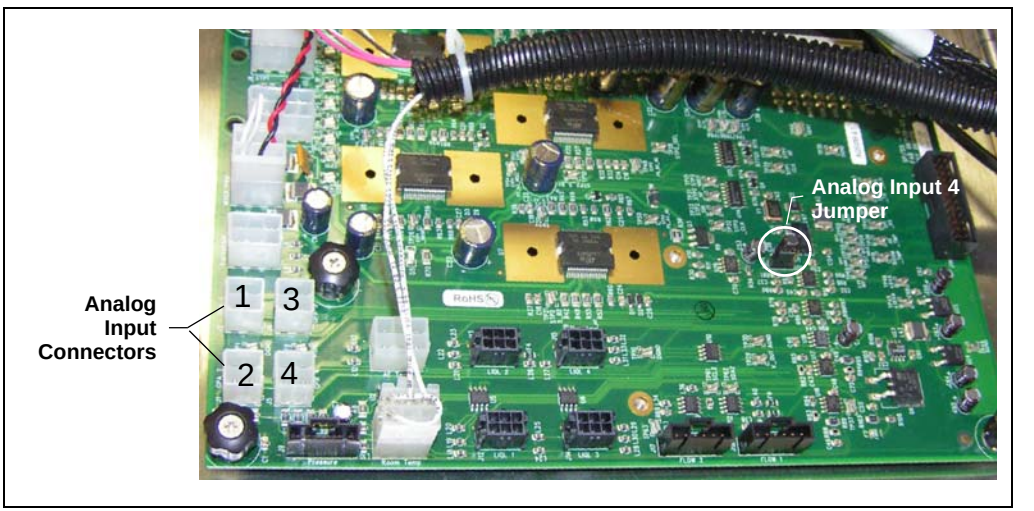


Figure 3-30. SP Electronics Board: Analog Input Connectors

4. Attach wires to the 2-position connector plug on the other end of the cable. To attach a wire to the plug, strip the end of the wire, insert it into the plug, and use a screwdriver to tighten the locking screw.

When attaching wires to the connector plug, be careful not to allow stray strands of wire to short to an adjoining position on the connector.

5. Route the cable to the other device and connect the free ends of the wires to the appropriate connector pins on the device.
6. Close and secure the SP service door.
7. If you removed the SP from the AE back panel:
   - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP on the rails.
   - Replace any modules that were removed from the lower shelf of the AE
   - Replace the two access panels on the exterior of the AE.
8. Plug in the power cord and turn on the power.
9. Open the Chromeleon Server Configuration program and open the SP **Properties** dialog box. On the **Analog Inputs** page, the check box for the connected analog input is enabled (see Figure 3-31). The name assigned to the

input corresponds to the number of the connector on the SP electronics board (see Figure 3-30).

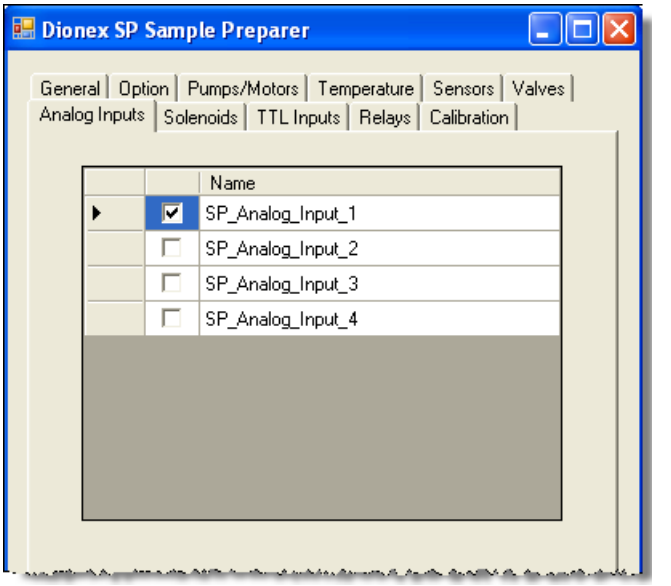


Figure 3-31. Chromeleon Server Configuration: Analog Inputs Page

10. Calibrate the analog input (see Section 10.9).

To change the position of the Analog Input 4 jumper:

1. Turn off the SP power and unplug the power cord.
2. Follow the instructions in Section 10.6 to access the SP electronics board. The jumper is in the bottom right area of the board (see Figure 3-30), at position **JMP1** (see Figure 3-32).

   The jumper selects two out of three pins (either pin 1 and pin 2 or pin 2 and pin 3). Refer to Figure 3-33 for the function assigned to each jumper position.

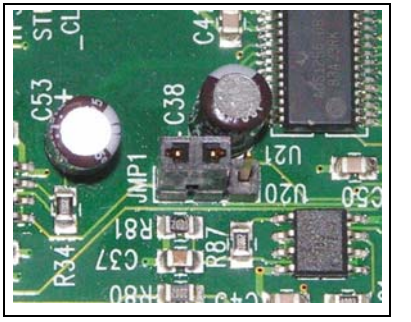


Figure 3-32. Analog Input 4 Jumper (Default Position)

3. To change the position of the jumper, slide the jumper up and off the pins and then slide it back onto the pins in the other position.

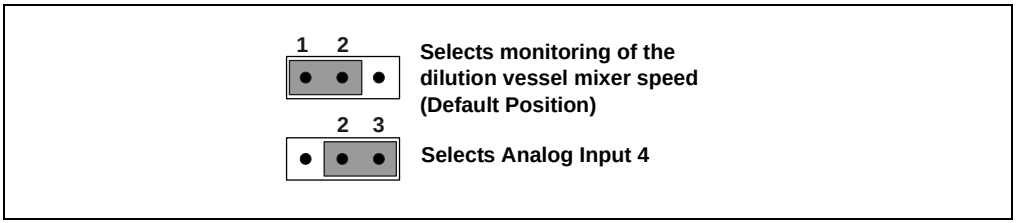


Figure 3-33. Analog Input 4 Jumper Position Functions

Analog Input 4 can now be connected to an external device. Follow the instructions in "To connect the analog input:" on page 46 to connect the analog input cable to the SP electronics board and the external device.

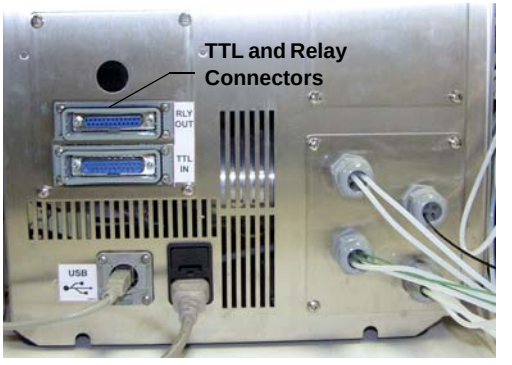
3.8 SP TTL and Relay Control (Option)

When the optional SP TTL and Relay Control Kit (P/N 068573) is installed, the SP provides nine relay outputs and eight TTL inputs.

- The relay outputs allow the SP to control actions in other devices (see Section 3.8.1).
- The TTL inputs allow other devices to control various analyzer actions (see Section 3.8.2).

When the TTL and Relay Control Kit is installed on an external SP enclosure, the TTL and relay connectors are installed on the side of the SP enclosure (see Figure 3-34).

If the SP is installed either inside an AE or mounted on the side of an AE, two connectors are installed on top of the AE (see Figure 3-34). This configuration requires installation of the AE TTL and Relay Kit (P/N AAA-068548), in addition to the SP TTL and Relay Control Kit.



TTL/relay connectors on external SP

TTL/relay connector on top of AE

Figure 3-34. TTL/Relay Connectors on SP and AE

For installation instructions for the SP TTL and Relay Control Kit and the AE TTL and Relay Control Kit, refer to Appendix C.

3.8.1 Relay Output Control

The relay outputs are normally open (NO). This means that the relay is open when it is off (not energized) and closed when it is on (energized).

The relays can be programmed to switch any low-voltage device. Switched current must be no more than 2 A at 24 Vdc. For connection instructions, refer to Section C.3

To control relay outputs, use any of the following methods:

- Change the relay's state immediately (direct control) (see below).
- Program the relay's state change in a Chromeleon instrument control program (see page 52).
- Configure the relay's state change as a function of an alarm condition or a TTL input state change (see page 53).

Controlling Relay Outputs Directly

To directly control the relay outputs, go to the SP Control panel in Chromeleon (see Figure 3-35).

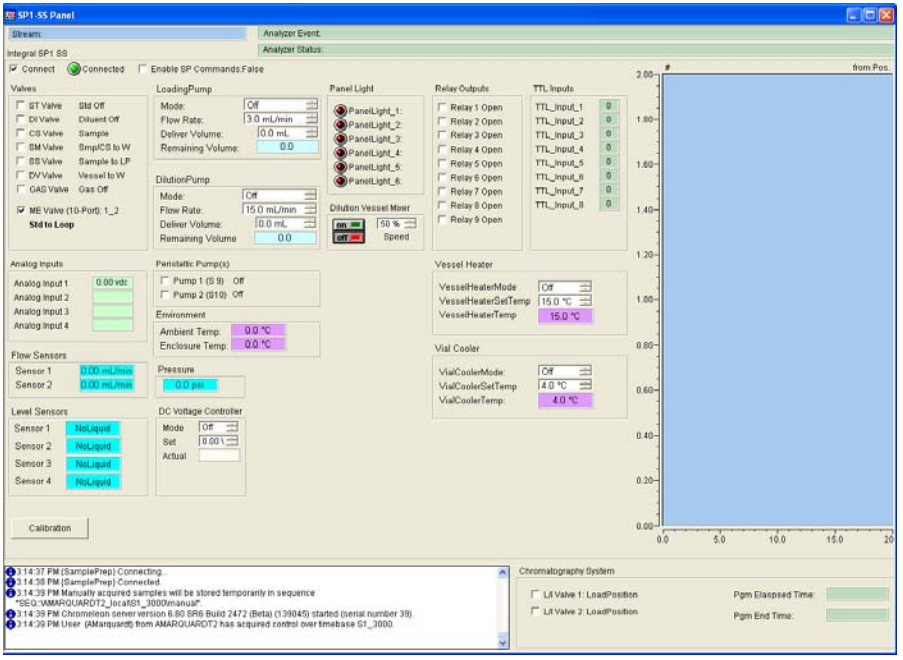


Figure 3-35. SP1 Control Panel

Controlling Relay Outputs in a Program

To control the relay outputs in a program, add the control commands on the **Relay and State Devices Options** page of the Chromeleon Program Wizard (see Figure 3-36).

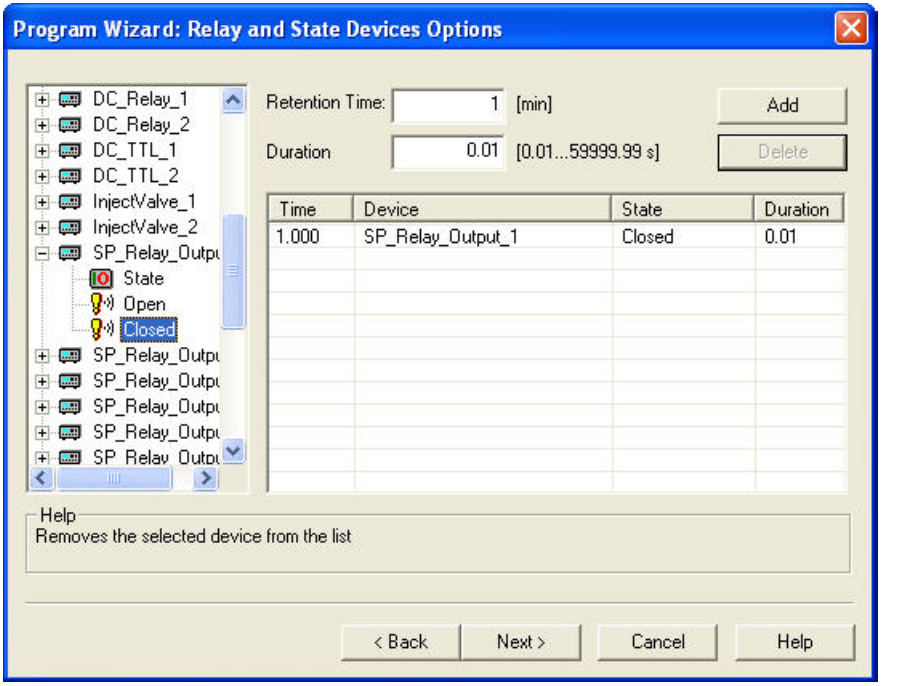


Figure 3-36. Chromeleon Program Wizard: Adding Relay Output Commands

Notes:

If a relay output is configured to change states with an alarm event (see Section 3.8.2), do not program the relay output to control devices. Also, always include a command that opens (turns off) the relay at the beginning of the program. Include the command in all programs used with the system.

3.8.2 TTL Input Control

The eight TTL inputs allow an external device to trigger one or more of the following responses (actions):

- Shut down the system
- Put the system in standby
- Bypass an injection from a specified sample stream
- Turn on an SP panel light
- Turn on an SP relay

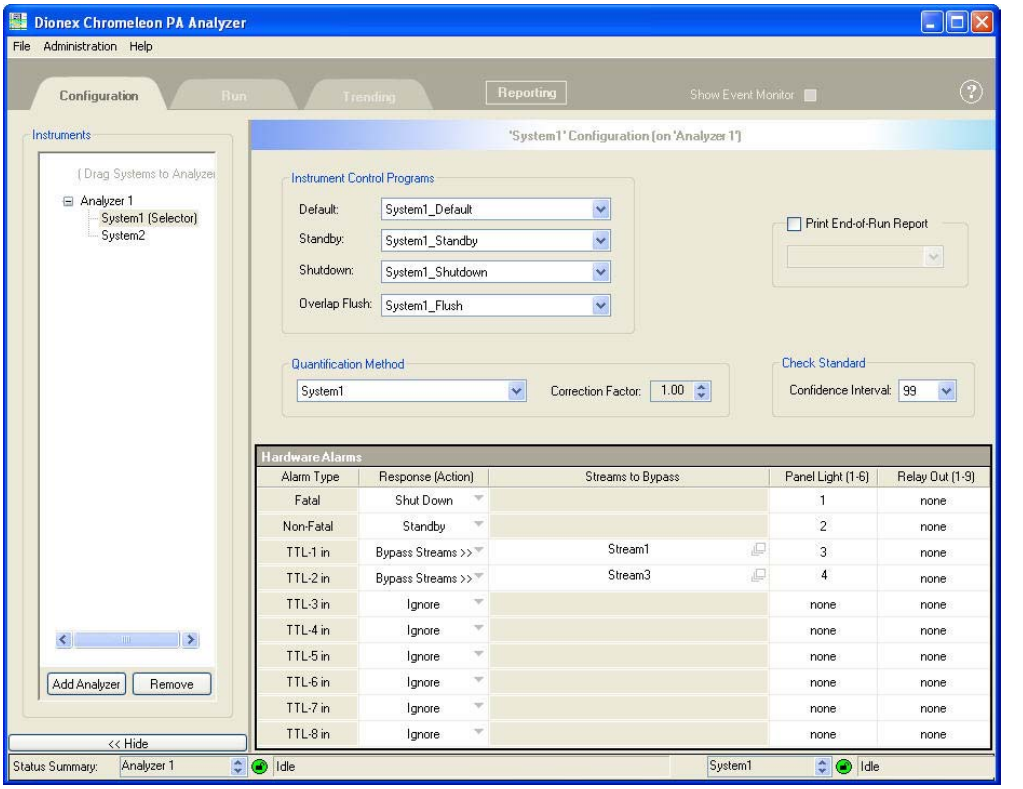
For example, you can connect a flow sensor on a sample pipe to one of the TTL inputs. If the sample stops flowing, the sensor signals the TTL and the system bypasses that sample stream.

Configuring TTL Input Responses (Actions) in Chromeleon PA

NOTE Refer to the Chromeleon PA Analyzer user's guide or Help for details about how to configure analyzers.

1. Start Chromeleon PA Analyzer.
2. Click the **Configuration** tab.

The **Configuration** page is displayed.



3. On the tree control in the left pane, select the system name.
4. On the **Hardware Alarms** table in the right pane, select the desired **Response (Action)** for each connected TTL input:
   - **Shutdown** (to shut down the system)
   - **Ignore** (to ignore the TTL)
   - **Standby** (to place the system in standby)
   - **Bypass Streams** (to skip an injection from one or more sample valves). If you select this response, the **Streams to Bypass** option is enabled. Click **select Streams** and select the streams to bypass.

5. Under **Panel Light (1-6)**, enter a number to turn on the corresponding panel alarm light when the TTL input is triggered. Enter **none** if you do not want a panel alarm light turned on.
6. Under **Relay Out (1-9)**, enter a number to turn on the corresponding relay output when the TTL input is triggered. Enter **none** if you do not want a relay output turned on.

   Notes:

   If a relay output is configured to change states with an alarm event, do not configure it in a program to control devices. Also, always include a command that opens (turns off) the relay at the beginning of the program (see "Controlling Relay Outputs in a Program" on page 52). Include the command in all programs used with the system.

3.9 Liquid Level Sensor (Option)

The optional Liquid Level Sensor Kit (P/N AAA-068563) provides a sensor that signals when the level of liquid in a reservoir reaches the sensor. The sensor can be installed on a waste container to signal when the container is almost full or on a standards or mobile phase reservoir to signal when the reservoir is almost empty. The status of the liquid sensor is displayed on the Chromeleon Control panel (see Figure 3-5).

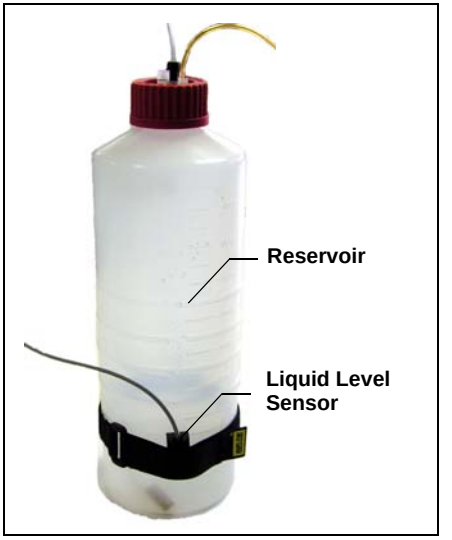


Figure 3-37. Liquid Level Sensor Installed on Reservoir

Up to four sensors can be connected to the SP. For installation instructions, see Appendix F.

When liquid level sensors are connected, they are enabled on the **Sensors** page of the Chromeleon Server Configuration program (see Figure 3-38).

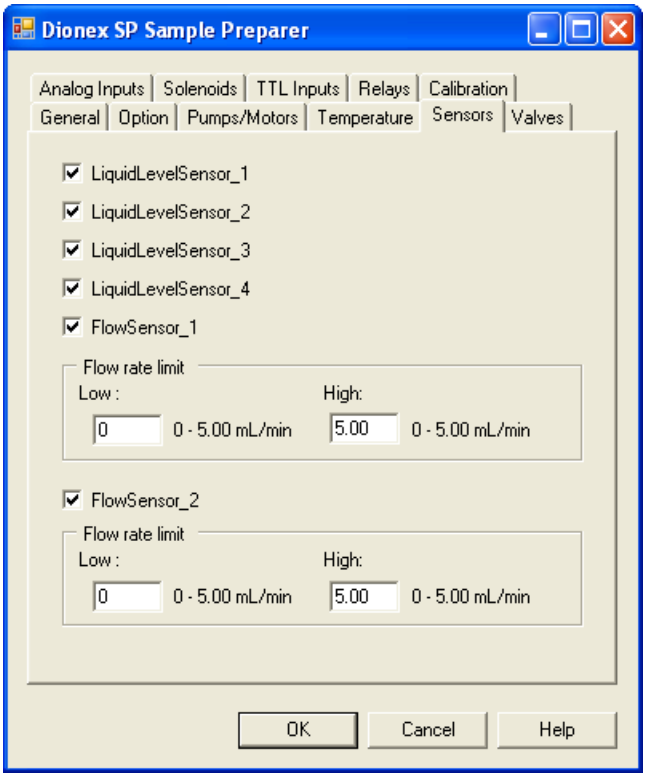


Figure 3-38. Chromeleon Server Configuration: Sensors Page

3.10 Flow Sensor (Option)

The optional Flow Sensor Kit (P/N 068564) provides a sensor for measuring the liquid flow rate in a stream. Flow rate readings from the sensor are displayed on the Chromeleon Control panel (see Figure 3-5). If the flow rate goes above or below the low or high limits entered in the Chromeleon Server Configuration program, an error is reported in the Chromeleon Audit Trail. Up to two flow sensors can be installed in the SP.

The sensor can measure flow from 0.2 to 5 mL/min. The operating pressure for the flow sensor must be less than 0.28 MPa (40 psi). The resolution of data is 16 bits and the accuracy is 5% of the measured value.

To install the flow sensor:

1. Turn off the SP power and unplug the power cord.
2. Using the screws and washers provided in the Flow Sensor Kit, attach the flow sensor to the mounting plate, as shown in Figure 3-39. Make sure the nylon washers are installed between the electronics board on the flow sensor and the mounting plate.

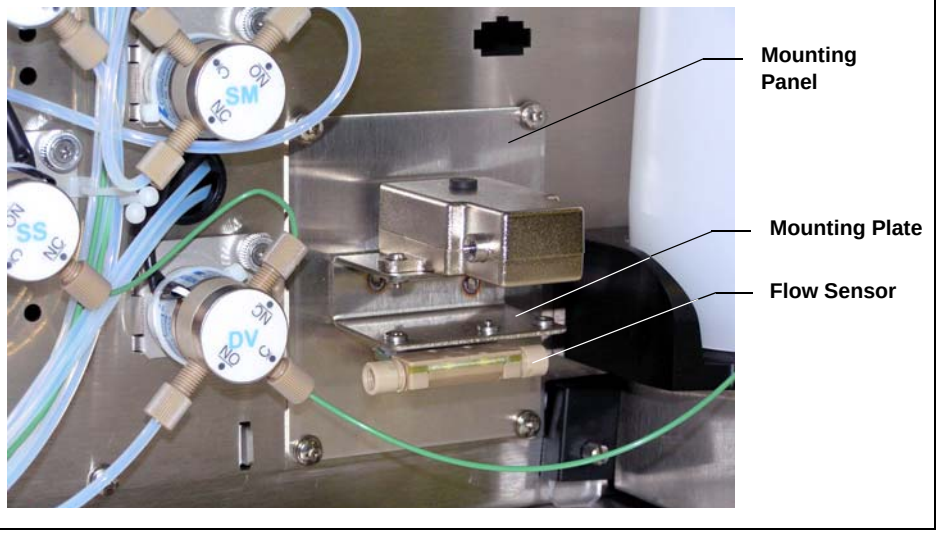


Figure 3-39. Flow Sensor

3. Thread the flow sensor's cable through the slot in the mounting panel.

4. Follow the instructions in Section 10.6 to access the SP electronics board.
5. Plug the cable into the connector labeled **FLOW 1** (or **FLOW 2**, if this is the second sensor) in the bottom center of the SP electronics board (see Figure 3-40).

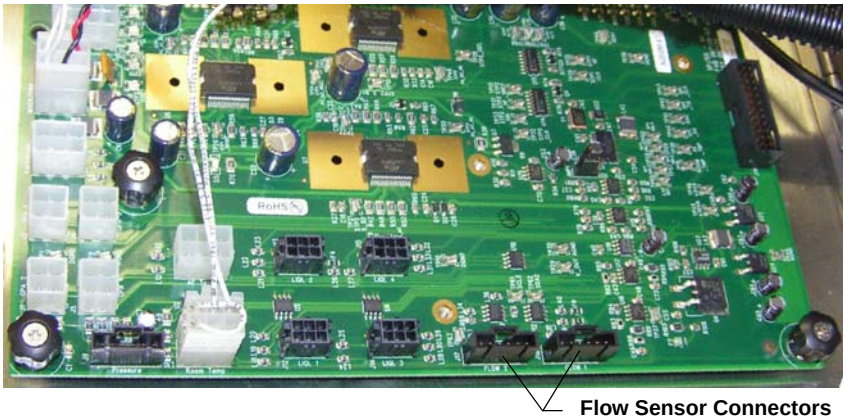


Figure 3-40. SP Electronics Board: Flow Sensor Connectors

6. Use the tubing and fittings provided in the kit to connect an inlet line and outlet line to the flow sensor. The flow sensor does not have a prescribed flow direction; liquid can enter and leave from either side.
7. Close and secure the SP service door.
8. If you removed the SP from the AE back panel:
   - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP on the rails.
   - Replace any modules that were removed from the lower shelf of the AE.
   - Replace the two access panels on the exterior of the AE.
9. Plug in the power cord and turn on the power.
10. Open the Chromeleon Server Configuration program and open the SP **Properties** dialog box. The **Flow Sensor_1** (or **Flow Sensor_2**) check box is enabled on the **Sensors** page (see Figure 3-38). Enter the low and high flow limits. Save the configuration.
11. Calibrate the flow sensor (see Section 10.9).

3.11 Pressure Sensor (Option)

The optional Pressure Sensor Kit (P/N 068567) provides a pressure transducer that can measure pressure from 0 to 6.9 MPa (1000 psi). Pressure reading accuracy is ± 1% at the calibration point. The pressure reading is displayed in the Chromeleon **Commands** dialog box under the SP device (see Figure 3-41) and on the Chromeleon Control panel (see Figure 3-5).

NOTE Pressure transducers for other pressure ranges are also available.

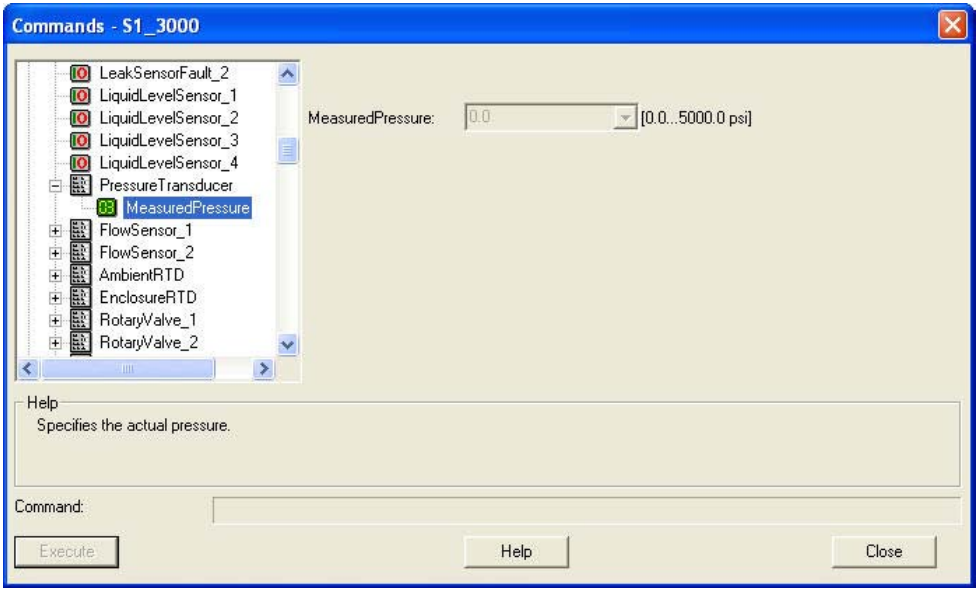


Figure 3-41. Pressure Transducer Readings in Chromeleon

To install the pressure transducer:

1. Turn off the SP power and unplug the power cord.
2. Thread the pressure transducer's cable through the upper slot in the mounting panel (see Figure 3-42).
3. Using the screws and washers provided in the Pressure Sensor Kit, attach the pressure transducer to the mounting plate, as shown in Figure 3-42.

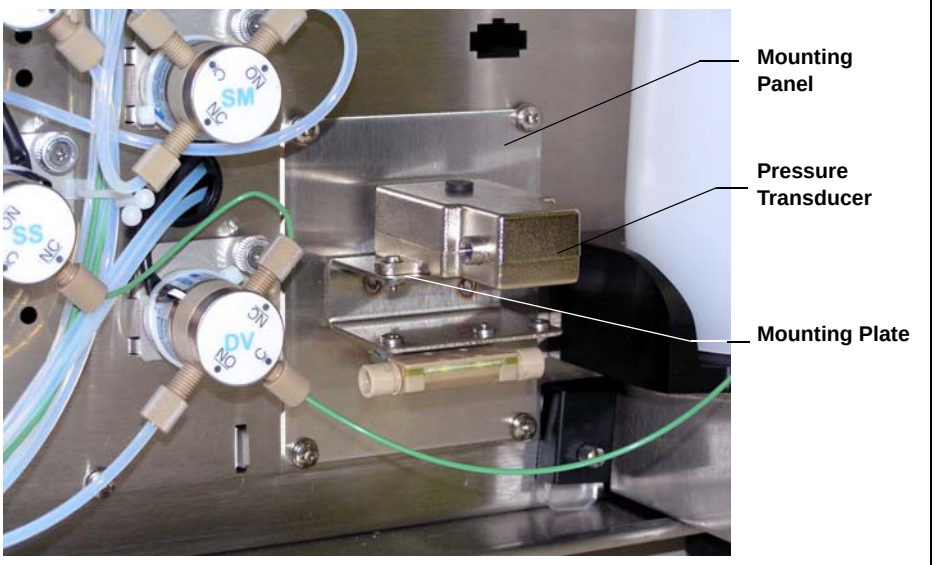


Figure 3-42. Pressure Transducer

4. Follow the instructions in Section 10.6 to access the SP electronics board.

5. Plug the cable into the connector labeled **Pressure** in the bottom left of the SP electronics board (see Figure 3-40).

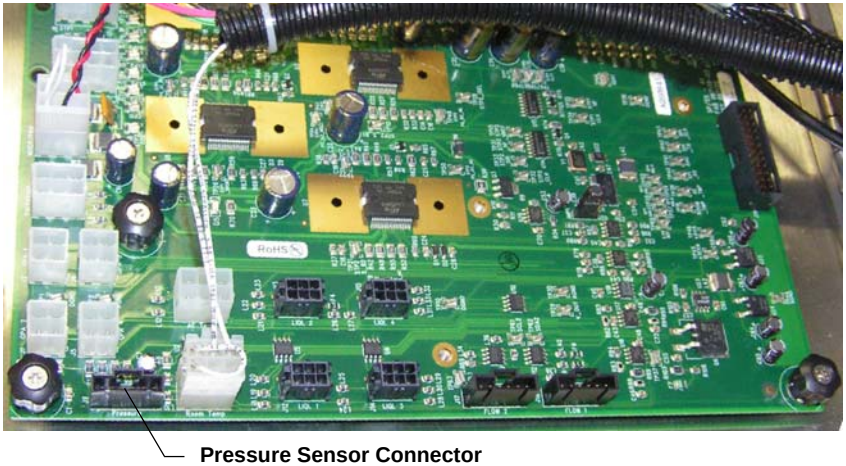


Figure 3-43. SP Electronics Board: Pressure Transducer Connector

6. Plumb the pressure transducer inlet and outlet ports as required for the application. The pressure transducer does not have a prescribed flow direction; liquid can enter and leave from either side.
7. Close and secure the SP service door.
8. If you removed the SP from the AE back panel:
   - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP on the rails.
   - Replace any modules that were removed from the lower shelf of the AE
   - Replace the two access panels on the exterior of the AE.
9. Plug in the power cord and turn on the power.

10. Open the Chromeleon Server Configuration program and open the SP **Properties** dialog box. The **Pressure Transducer** check box is enabled on the **Pumps/Motors** page (see Figure 3-44).

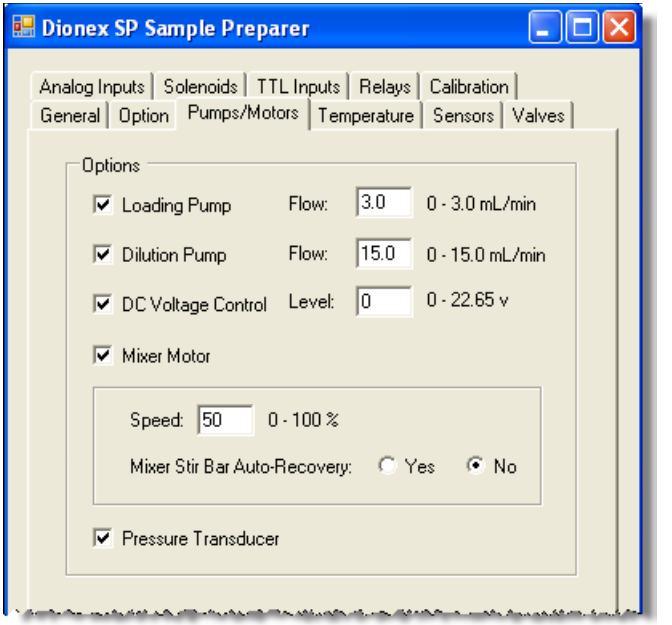


Figure 3-44. Chromeleon Server Configuration: Pumps/Motors Page

11. Save the configuration.
12. Calibrate the pressure transducer (see Section 10.9).

3.12 DC Voltage Control (Option)

The DC voltage control option provides an adjustable steady voltage of 0 to 22.65 Vdc, with a DAC output resolution of 16 bits. The option can be used to control a low current (32 mA maximum) voltage-controlled device. After connecting a device to the DC voltage control option, specify the voltage amount and turn the voltage on and off on the Chromeleon Control panel, or add commands to the Chromeleon instrument control program.

To connect a device to the DC voltage control option:

1. Turn off the SP power and unplug the power cord.
2. Follow the instructions in Section 10.6 to access the SP electronics board.
3. Plug the DC voltage control cable (P/N 070181) into the connector labeled **VarVoltage** on the left side of the SP electronics board (see Figure 3-40).

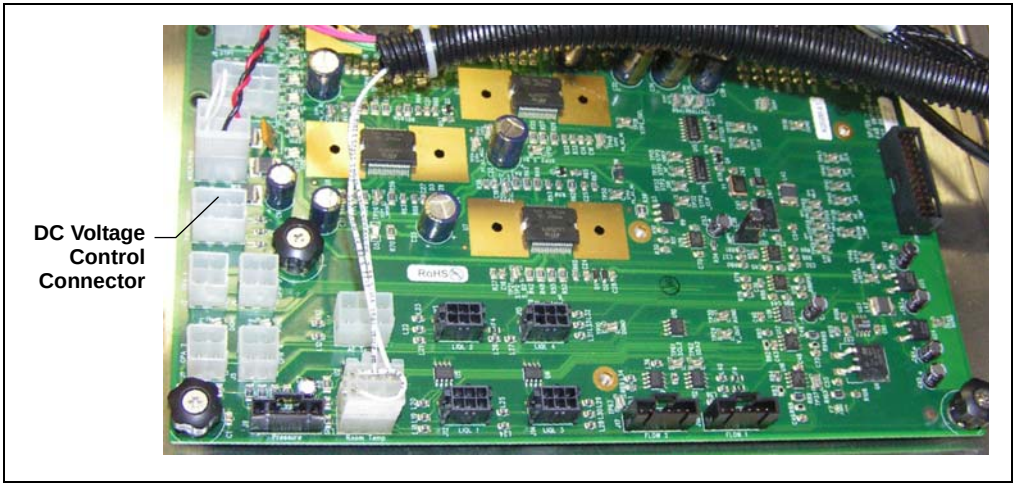


Figure 3-45. SP Electronics Board: DC Voltage Control Connector

4. Attach wires to the 2-position connector plug on the other end of the cable. To attach a wire to the plug, strip the end of the wire, insert it into the plug, and use a screwdriver to tighten the locking screw.

CAUTION

When attaching wires to the connector plug, be careful not to allow stray strands of wire to short to an adjoining position on the connector.

5. Route the cable to the device to be controlled and connect the free ends of the wires to the appropriate connector pins on the device.
6. Close and secure the SP service door.
7. If you removed the SP from the AE back panel:
   - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP on the rails.
   - Replace any modules that were removed from the lower shelf of the AE
   - Replace the two access panels on the exterior of the AE.
8. Plug in the power cord and turn on the power.
9. Open the Chromeleon Server Configuration program and open the SP **Properties** dialog box. The **DC Voltage Control** check box is enabled on the **Pumps/Motors** page (see Figure 3-44). Enter the default voltage level to use when the DC voltage control is on.
10. Save the configuration.

3.13 PWM Power Output (Option)

A Pulse Width Modulation (PWM) power output is included with the SP. The PWM power output is normally used to control the dilution vessel mixer (see Section 3.5.2). However, if the dilution vessel mixer is not required, you can use the PWM power output for another function. A PWM power output cable (P/N 070180) is available that allows connection from the SP PWM power output to an external device.

The PWM power output provides a choice of two maximum voltage ranges:

- 0 to 24 volts DC maximum
- 0 to 5 volts DC maximum

The current levels can be up to 0.5 A.

The PWM power output averages the voltage delivered as a percentage of the controlled range. The PWM power outputs produce a rapid duty cycle of 0 to full scale voltage for a percentage of time. The pulse cycle time for this output is 140 ms.

After connecting a device to the PWM power output, you can use Chromeleon commands to turn the output on and off and control the amount of power delivered to the device (from 0% to 100% of maximum). Use the Chromeleon commands normally used for controlling the dilution vessel mixer. The commands are available on the Control panel (see Figure 3-5) and in the **Commands** dialog box under the SP device (see Figure 3-46).

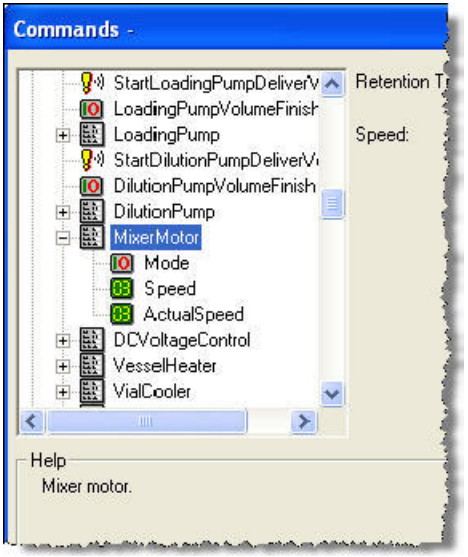


Figure 3-46. Mixer Motor/PWM Commands in Chromeleon

To connect a device to the PWM power output:

1. Turn off the SP power and unplug the power cord.
2. Follow the instructions in Section 10.6 to access the SP electronics board.
3. Plug the PWM power output cable (P/N 070180) into the connector labeled **Mixer/PWM** on the left side of the SP electronics board (see Figure 3-40).

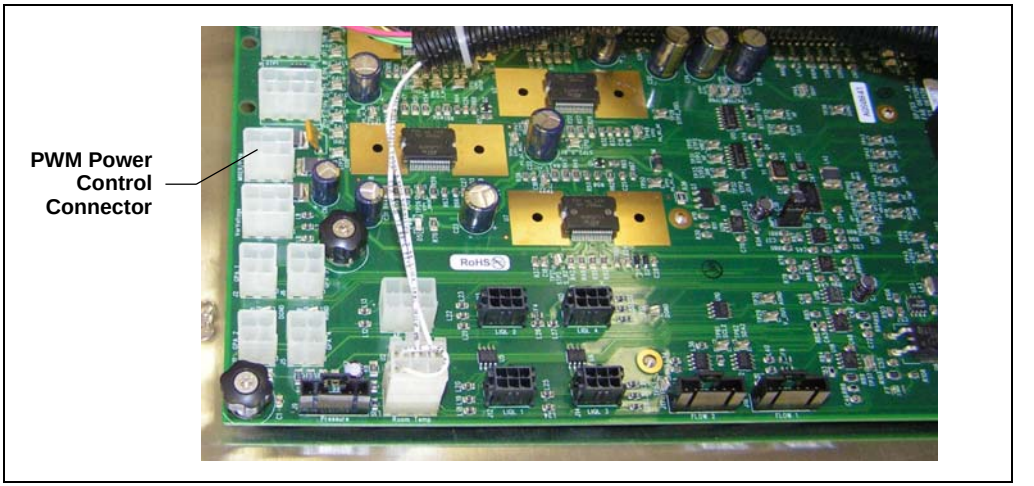


Figure 3-47. SP Electronics Board: PWM Power Control Connector

4. On the other end of the cable, attach two wires to the 3-position connector plug. Connect to the two positions required for the voltage range:
   - For the 0 to 24 V range, attach wires to the **24V** and **PWM** connectors.
   - For the 0 to 5 V range, attach wires to the **5V** and **PWM** connectors.

   To attach a wire to the plug, strip the end of the wire, insert it into the plug, and use a screwdriver to tighten the locking screw.

CAUTION

When attaching wires to the connector plug, be careful not to allow stray strands of wire to short to an adjoining position on the connector.

5. Route the cable with attached wires to the device to be controlled and connect the free ends of the wires to the appropriate connector pins on the device.
6. Close and secure the SP service door.

7. If you removed the SP from the AE back panel:
   - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP on the rails.
   - Replace any modules that were removed from the lower shelf of the AE
   - Replace the two access panels on the exterior of the AE.
8. Plug in the power cord and turn on the power.
9. Open the Chromeleon Server Configuration program and open the SP **Properties** dialog box. The **Mixer Motor** check box is enabled on the **Pumps/Motors** page (see Figure 3-44). Enter the default percentage of power (from 0% to 100% of maximum) delivered when the PWM power output is on.
10. Save the configuration.

4 • SS Stream Selector Description

4.1 SS Overview

The SS Stream Selector (see Figure 4-1) allows selection of a sample from multiple sample streams. The SS can be configured with up to three stream selection valves, with each valve connected to up to seven sample streams. This allows sampling from one of 7, 14, or 21 streams, depending on the number of valves installed in the SS.

Figure 4-1. SS Stream Selector with One Stream Selection Valve

4.2 Stream Selection

SS stream selection valves are 17-port, 8-position valves, available in either PEEK (P/N 068535) or stainless steel (P/N 068540). Sample stream inlet lines enter the SS through fittings on the side of the SS and connect to inlet ports on the

stream selection valves. Sample stream outlet lines connect to outlet ports on the valves and then exit the SS through the side fittings. Refer to the label inside the SS door to identify each stream inlet and outlet line.

One sample stream at a time is selected for analysis. Flow from the selected stream is diverted to the common sample outlet line, which is connected to the center port on valve A (see Figure 4-2). After exiting the SS, the common sample outlet line connects to the CS valve on the SP (see Figure 3-15 for the SP1 flow path or Figure 3-18 for the SP2 flow path). If a stream from valve B or C is selected, the selected stream is cascaded to the common sample outlet line on valve A.

Streams that are not selected flow continuously out of the valves and exit the SS. Continuously flowing streams can be directed to waste or returned to the process. The continuous flow ensures that all samples are fresh when selected and that a representative sample is delivered to the analyzer.

NOTE **If continuous flow is not required, the outlet ports on the stream selection valves can be plugged with 1/4-28 fittings, provided that the incoming sample pressure does not exceed 0.34 MPa (50 psi).**

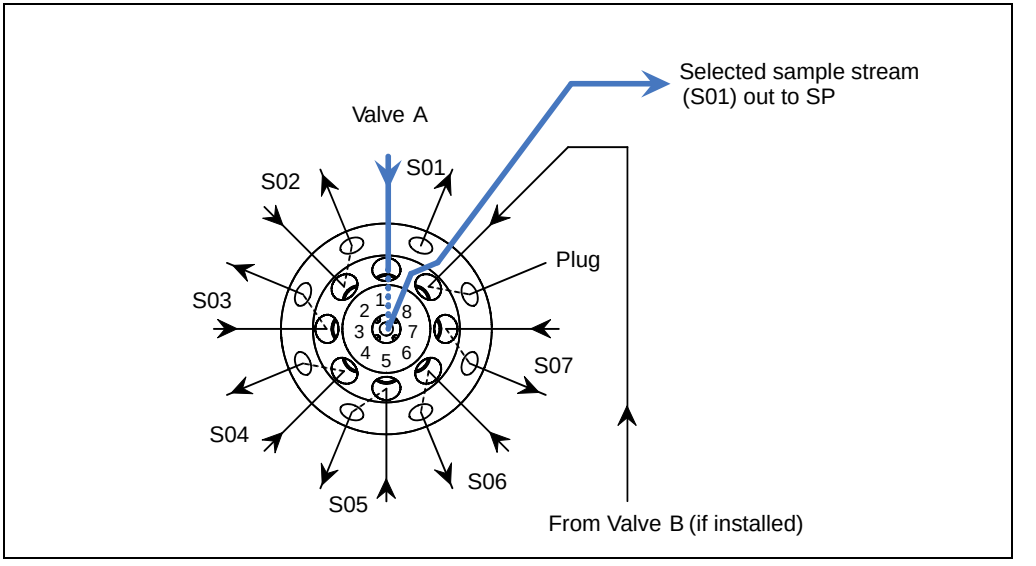


Figure 4-2. SS Stream Selection Valve A: Stream 1 Selected

4.3 SS Enclosures

The SS is available in two enclosure types:

- The internal enclosure is installed inside an AE.
- The external enclosure can be placed on a lab bench or on the floor, or it can be mounted on the side of an AE or on a wall.

The SS enclosures are designed for use in nonhazardous locations. The external SS enclosure meets either NEMA 12 or NEMA 4X requirements, depending on the installation:

- When the external SS enclosure is installed as a stand-alone enclosure or mounted on a wall, it meets NEMA 12 requirements (because the ventilation openings are exposed to the environment).
- When the external SS enclosure is mounted onto the side of an AE, it meets NEMA 4X requirements (because the ventilation openings are inside the AE and are not exposed to the environment).

For definitions of the NEMA enclosure types, refer to Table 3-1.

To accommodate the control cable length, the SS must be located within 5 meters (16 feet) of the SP, unless a USB Extension Kit (P/N 069608) is installed. The kit allows the SS to be located up to 46 meters (150 feet) from the SP.

NOTE **If the USB extension is used and the SS is further than 5 meters away from the SP, additional time is required in sampling to ensure that the dead volume of the sample line between the SS and the system is completely flushed.**

4.4 SS Power and Computer Connections

Receptacles for connecting a power cord and USB cable are on the side of the SS (see Figure 4-3).

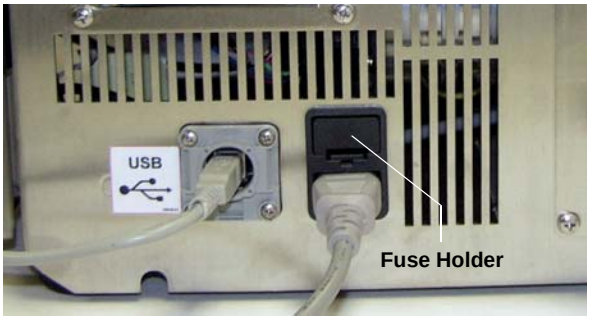


Figure 4-3. SS USB and Power Receptacles

Fuse Holder and Power Receptacle

The fuse cartridge contains two fast-blow IEC 127 fuses rated 3.15 A (P/N 954745). For instructions on how to change the fuses, see Section 10.10.

The power cord plugs into the IEC 320 three-prong receptacle. Connect the power cord from this connector to a grounded power source. If the SS is mounted on an AE or installed inside an AE, connect the power cord to the power outlet strip inside the AE (see Section 5.3.2). The AE power outlet strip is a grounded receptacle.

When the SS is mounted on the side of the AE or installed inside the AE, the AE power cord is the main disconnect device. In addition, the AE main power switch (see Figure 5-6) and **Emergency Off** switch (see Figure 5-2) can be used to control the power to the SS.

SHOCK HAZARD—If a grounded receptacle is not used, a shock hazard may result. Do not operate or connect to AC power mains without earthed ground connections.

The power supply cord is used as the main disconnect device. Make sure the socket-outlet is located near the module and is easily accessible.

DANGER D'ÉLECTROCUTION—Pour éviter toute électrocution, il faut utiliser une prise de courant avec prise de terre. Ne l'utilisez pas et ne le branchez pas au secteur C.A. sans utiliser de branchement mis à la terre.

Le cordon d'alimentation principal est utilisé comme dispositif principal de débranchement. Veillez à ce que la prise de base soit située/installée près du module et facilement accessible.

STROMSCHLAGGEFAHR—Zur Vermeidung von elektrischen Schlägen ist eine geerdete Steckdose zu verwenden. Das Gerät darf nicht ohne Erdung betrieben bzw. an Wechselstrom angeschlossen werden.

Das Netzkabel ist das wichtigste Mittel zur Stromunterbrechung. Stellen Sie sicher, daß sich die Steckdose nahe am Gerät befindet und leicht zugänglich ist.

Power Switch

The SS power switch is located inside the enclosure on the valve panel. Turn on the power switch before initial operation and leave it on unless instructed to turn it off (for example, before performing a service procedure).

Software Communication

The USB (Universal Serial Bus) receptacle (“B” type connector) (see Figure 4-3) allows connection to the computer on which Chromeleon PA is installed.

One 5-meters (16-feet) USB cable (P/N 960779) is provided in the SS Ship Kit (P/N 069088).

4.5 SS Leak Sensor and Liquid Drain

A leak sensor is located inside the SS enclosure in the bottom front of the enclosure (see Figure 4-4). If the sensor becomes wet, it reports a leak to Chromeleon and an error message is displayed in the Audit Trail.

Any liquid that collects in the bottom of the SS exits through the drain port in the tray at the front of the SS enclosure. A drain line can be connected to this port, if desired.

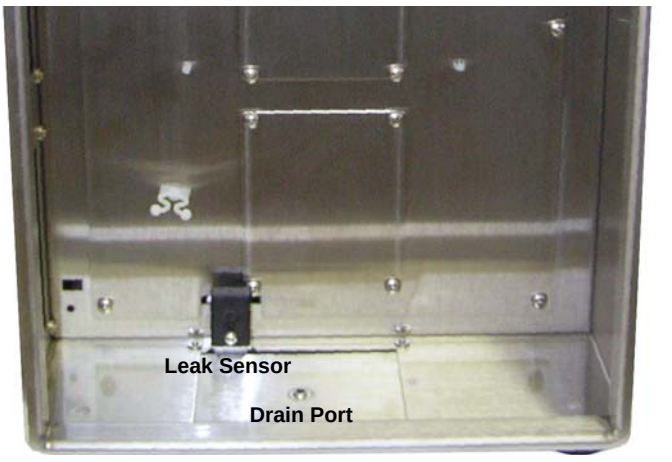


Figure 4-4. SS Leak Sensor and Drain Port

5 • AE Analyzer Enclosure Description

5.1 AE Overview

The AE Analyzer Enclosure provides housing for the modules in a Dionex Integral system, including chromatography system modules and Dionex Integral SP and SS enclosures. For examples of various chromatography module and Dionex Integral enclosure configurations, refer to Chapter 2.

The AE is designed for use in nonhazardous locations and provides the following levels of NEMA environments:

- When the AE is equipped with a blower, it meets NEMA 12 requirements (because it has ventilation openings exposed to the environment).
- When the AE is not equipped with a blower, it meets NEMA 4X requirements (because it does not have ventilation openings).

For definitions of the NEMA enclosure types, refer to Table 3-1.

The AE can be mounted on top of the LE Liquids Enclosure (see Figure 5-1) or on a wall or other appropriate support structure.

Figure 5-1. AE Mounted on LE

5.2 AE Exterior Features

Figure 5-2 shows the exterior of the AE.

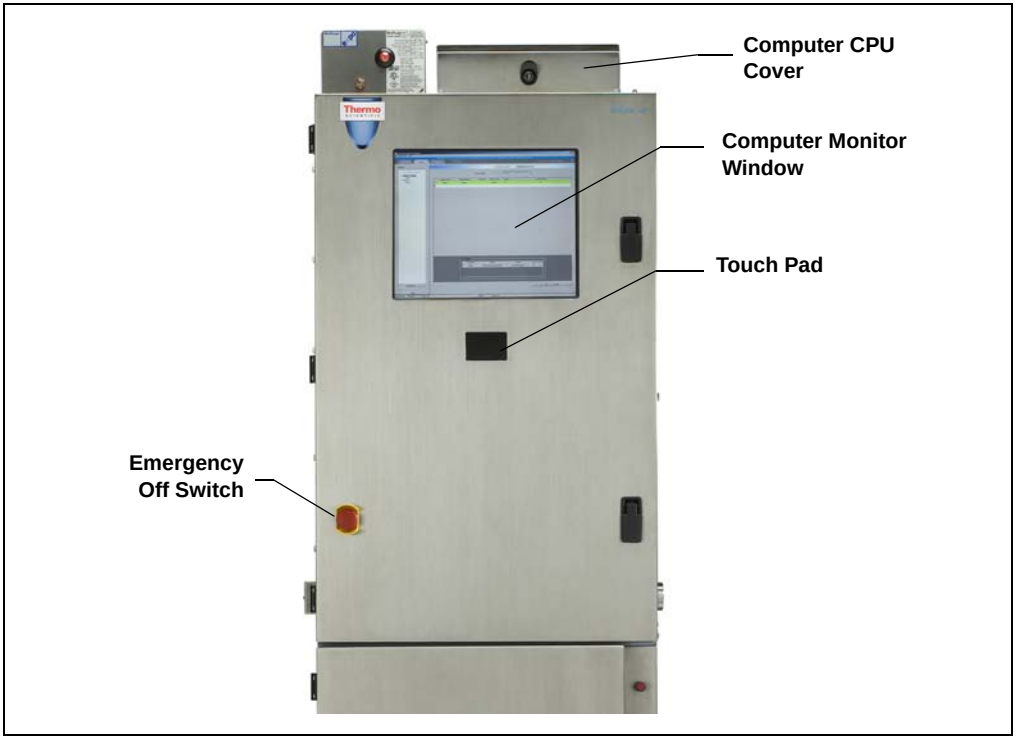


Figure 5-2. AE Front Exterior

Emergency Off Switch

The red **Emergency Off** switch on the AE front door shuts off the power to all components connected to the power outlets inside the AE (see Section 5.3.2).

IMPORTANT **If an emergency occurs, turn off the power by pushing the knob on the Emergency Off switch completely in. After resolving the situation, twist the knob on the Emergency Off switch clockwise and pull out to return the knob to the on position and restore power.**

Handles

To unlatch the enclosure door, lift up on each door handle and turn it to the left. To latch the door, turn each handle to the right and push in.

SHOCK HAZARD—A shock hazard exists inside the AE enclosure when the door is opened.

Various types of chemicals are used in the Dionex Integral system, depending on the application that is being performed. Follow all appropriate hazardous materials and safety guidelines for chemicals when operating the Dionex Integral system.

DANGER D'ÉLECTROCUTION—Un danger d'électrocution existe dans l'enceinte lorsque la porte est ouverte.

Différents types de produits chimiques sont utilisés dans le Dionex Integral, selon l'application à effectuer. Respectez toutes les directives de sécurité sur les matières dangereuses pour les produits chimiques lors de l'utilisation du Dionex Integral.

STROMSCHLAGGEFAHR—Bei geöffneter Tür besteht im Gehäuseinnern Gefahr durch elektrischen Schlag.

Je nach Anwendung, die gerade läuft, werden im Dionex Integral verschiedenartige Chemikalien verwendet. Beachten Sie beim Betrieb des Dionex Integral alle entsprechenden Sicherheitsrichtlinien bezüglich gefährlicher Stoffe für die verwendeten Chemikalien.

Computer Monitor Window

If the optional Computer Control Installation Kit (P/N 069094) is installed, the window on the enclosure door allows you to view the computer monitor, mounted on the inside of the door.

5.3 AE Interior Features

Figure 5-3 shows the features of the AE interior.

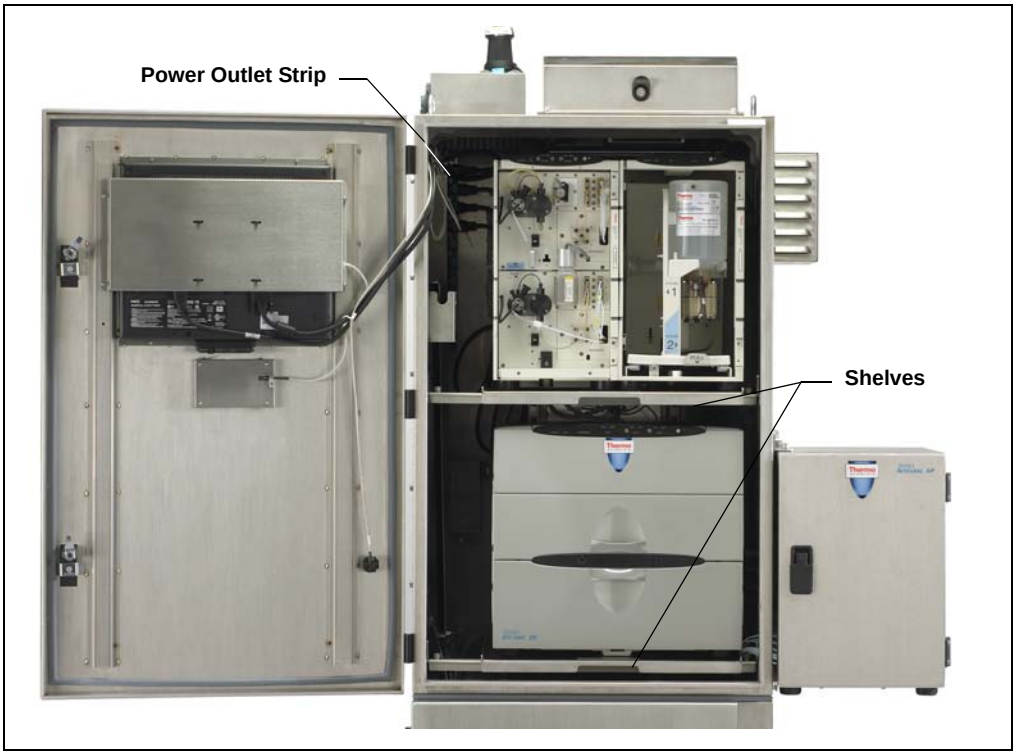


Figure 5-3. AE Interior

5.3.1 Shelves

The two shelves inside the AE are on brackets that attach to a rail system. The shelves can be moved to different positions on the rails to accommodate various module sizes and combinations. The shelves slide forward about 10 cm (4 in) to allow easier access to the modules installed on the shelves. To pull a shelf forward, use the handle in the center of the shelf.

The opening on the left side of each shelf can be used to route plumbing lines and cables. The smaller opening on the front of each shelf can be used to route plumbing lines between chromatography modules.

5.3.2 Power Outlet Strip

A power outlet strip with 10 AC outlets is installed in the back left corner inside the AE (see Figure 5-3). Power cords from all components (SP, detector, pump, air conditioner, etc.) installed inside the AE or mounted on the side of the AE are connected to these outlets. This allows the AE main power switch (see Figure 5-6) and **Emergency Off** switch (see Figure 5-2) to control the power to all connected components.

5.3.3 Drip Tray and Liquid Drain

The drain lines from all modules installed inside the AE can be routed to the AE drip tray. The drip tray collects any liquid that drains from these lines, as well as any liquid that drains from other components in the AE. The liquid in the drip tray exits the AE through the drain port. A drain line can be connected to this port if desired.

5.3.4 Liquid Leak Sensing

The leak sensors in the individual modules inside the AE provide leak detection.

If the Dionex Integral system is equipped with an SP, an auxiliary leak sensor (P/N 067728) can be installed in the AE drip tray and connected to the SP electronics. If the leak sensor becomes wet, it reports the leak to Chromeleon and an error message is displayed in the Audit Trail.

5.4 AE Power and Computer Connections

Power Receptacle

The power in receptacle on the top of the AE (see Figure 5-4) provides a connection to the AE main power. Connect the power cord (provided in the AE Ship Kit, P/N 069066) from this connector to a grounded, single-phase power source.

Figure 5-4. AE Power In Receptacle

The power cord is configured with a NEMA L5-20P plug (125 Vac/20 A twist-lock) (see Figure 5-5) for connection to facility power terminated as a NEMA L5-20R wall receptacle. Other wall plugs or hard-wired connections may be used, provided that arrangements are made with the Thermo Fisher Scientific

representative before installation. The connections must provide proper grounding of the Dionex Integral system.

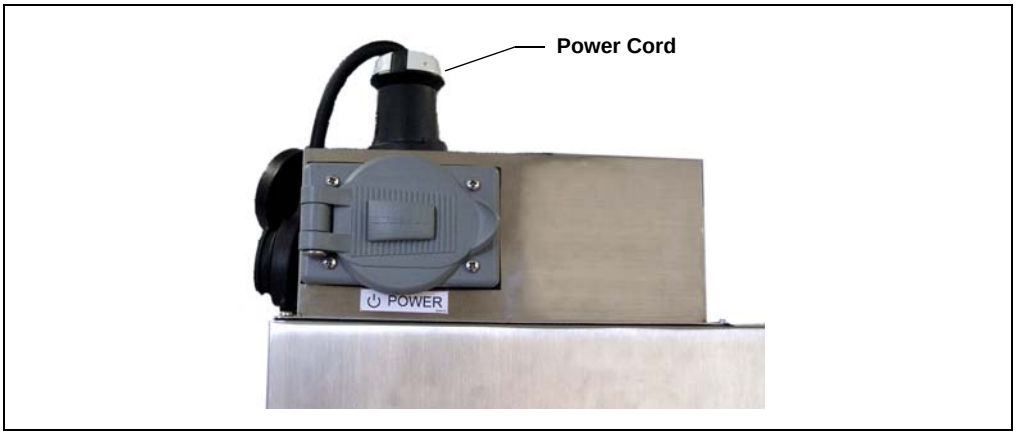


Figure 5-5. AE Power Cord Connected

SHOCK HAZARD—If a grounded receptacle is not used, a shock hazard may result. Do not operate or connect to AC power mains without earthed ground connections.

The power cord is used as the main disconnect device. Make sure the outlet is located near the enclosure and is easily accessible.

DANGER D'ÉLECTROCUTION—Pour éviter toute électrocution, il faut utiliser une prise de courant avec prise de terre. Ne l'utilisez pas et ne le branchez pas au secteur C.A. sans utiliser de branchement mis à la terre.

Le cordon d'alimentation principal est utilisé comme dispositif principal de débranchement. Veillez à ce que la prise de base soit située/installée près du Dionex Integral et facilement accessible.

STROMSCHLAGGEFAHR—Zur Vermeidung von elektrischen Schlägen ist eine geerdete Steckdose zu verwenden. Das Gerät darf nicht ohne Erdung betrieben bzw. an Wechselstrom angeschlossen werden.

VORSICHT

Das Netzkabel ist das wichtigste Mittel zur Stromunterbrechung. Stellen Sie sicher, daß sich die Steckdose nahe am Gerät befindet und leicht zugänglich ist.

Main Power Switch

The power switch on the power input box (see Figure 5-6) is the main power switch for the AE. The power input box is on the upper left rear corner of the AE. This switch controls the power to all components connected to the AE (chromatography system modules, blower, air conditioner, etc.). The main power switch is also the circuit breaker that provides protection against current above the electrical specification of the enclosure (see Section A.2).

Turn on the main power switch before initial operation and leave the switch on unless instructed to turn it off (for example, before performing a service procedure).

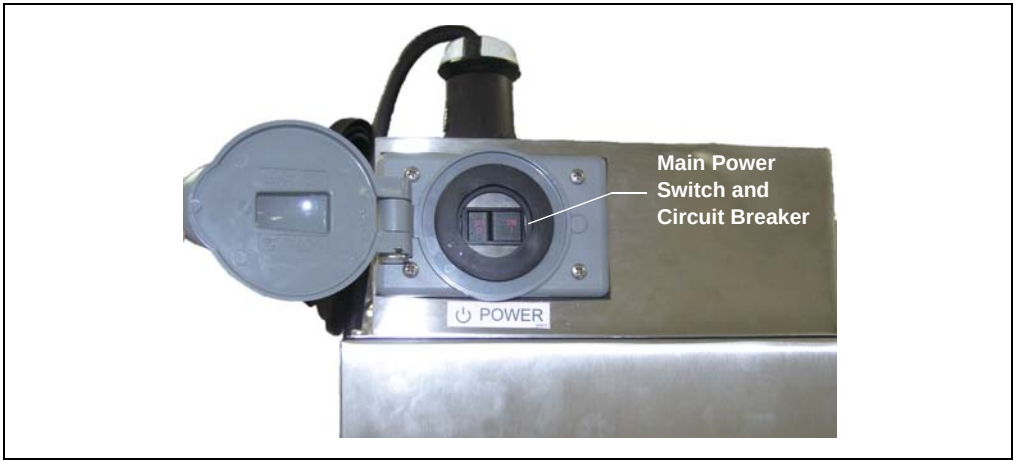


Figure 5-6. Main Power Switch on Top of AE

Computer Connections

The top of every AE includes one USB (Universal Serial Bus) receptacle ("B" type connector) (see Figure 5-7) for connection to the computer on which Chromeleon PA is installed.

In addition, locations for three more USB receptacles and one LAN (Local Area Network) receptacle (RJ-45 connector) are provided. Receptacles are installed in these additional locations only when the optional Computer Control Installation Kit (P/N 069094) is installed.

A USB hub is located inside the AE for connecting the chromatography modules installed in the AE to the network.

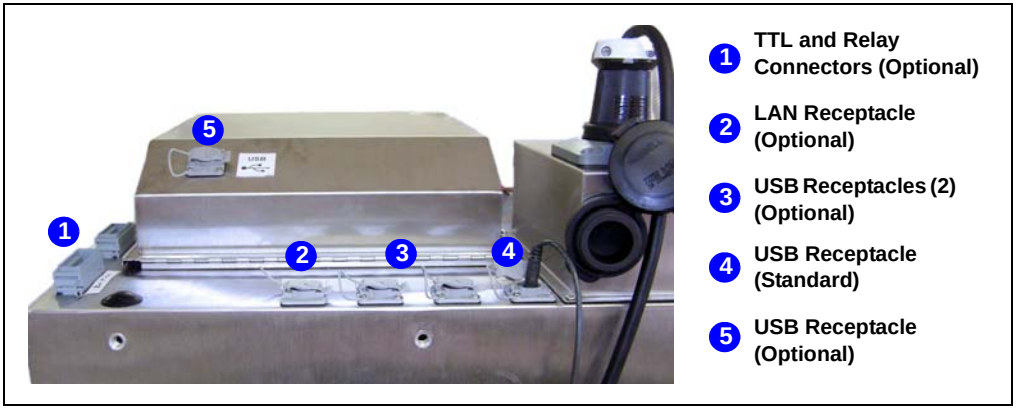


Figure 5-7. Communication Connectors on Top of AE

5.5 AE TTL and Relay Connectors (Option)

Two TTL and relay connectors are provided on the top of the AE (see Figure 5-7). These connectors are functional only if the AE TTL and Relay Control Kit (P/N AAA-068548) and the SP TTL and Relay Control Kit (P/N 068573) are installed. For details about TTL and relay control, see Section 3.8. For installation instructions, see Appendix C.

5.6 AE Ventilation Fan (Option)

An optional ventilation fan (P/N 068544) mounts on the side of the AE. When the fan is installed, the AE meets NEMA 12 requirements. The fan cannot be installed if a NEMA 4X equivalent enclosure is required. Refer to *Installation Requirements and Customer Responsibilities* (Document No. 070186). The fan runs continuously unless the AE power is turned off. It is not controlled by Chromeleon PA.

5.7 AE Air Conditioner/Heater (Option)

An optional air conditioner/heater (P/N 068545; 115 Vac, P/N 069093;230 Vac) can be mounted on the right side of the AE. Refer to *Installation Requirements and Customer Responsibilities* (Document No. 070186) for mounting and connection instructions. The air conditioner/heater provides closed system controlled air circulation for the AE and the LE (if included). The air conditioner/heater has a capacity of 3000 BTU per hour. When the air conditioner/heater is installed, a control box is located inside the AE, on the upper wall.

To operate the air conditioner/heater, turn on the power switch on the control box. The blower turns on and runs continuously unless the power is turned off. The air conditioner/heater controller is set at the factory with a high set point temperature and hysteresis to minimize short-term temperature cycling from the air conditioner (which can adversely affect the baseline). The air conditioner/heater controller turns the air conditioner or heater on and off at the following temperatures:

- The air conditioner turns on when the internal AE temperature reaches 35 °C.
- The air conditioner remains on until the internal AE temperature reaches 20 °C. The air conditioner then turns off and remains off until the internal AE temperature again reaches 35 °C.
- If the ambient temperature is colder than typical and the internal AE temperature reaches 15 °C, the heater turns on. The heater is used to regulate the temperature between 15 °C and 17 °C until the ambient temperature is high enough to maintain the internal AE temperature above 17 °C.

These set points are designed for optimal performance of the air conditioner/heater. If adjustment of the temperature set points is required, contact Technical Support for Dionex products for assistance.

5.8 AE Purge System (Option)

When the installation site is a Class 1, Division 2 location requiring intrinsically safe equipment, a purge system is installed in the AE. The purge system uses purge gas (compressed air or nitrogen) to maintain a positive pressure inside the enclosure.

The purge system consists of the following features (see Figure 5-8):

- A control unit with pressure regulator and alarm indicator ball. The alarm indicator ball is green when the pressure inside the AE is adequate and red when the pressure is low.
- A relief valve.
- An orifice that allows a fixed flow of gas through the AE.

IMPORTANT **This purge configuration does not include electrical interlocks. The user is responsible for ensuring that all supplemental safety requirements are met.**

Figure 5-8. AE Purge System Features

5.9 AE Tower Light (Option)

If the optional Tower Light Kit (P/N 068549) is installed, a tower with four lights is mounted on the top of the enclosure on the left hand side (see Figure 5-9).

Figure 5-9. AE Tower Light

To control the lights, the analyzer must include an SP with the optional SP TTL and Relay Control Kit (P/N 068573). The SP relays are used to turn the lights on and off. The lights can be configured to turn on when errors occur. For example, you can configure the red light to turn on if a fatal error occurs on a system. Refer to Appendix C for installation instructions for both kits.

Each tower light color is controlled by a different relay output. Refer to the following table:

Tower Light Color	Controlled By
Blue	Relay Out 1
Red	Relay Out 2
Yellow	Relay Out 3
Green	Relay Out 4

Use the following methods to control the tower light relays:

- In Chromeleon PA Analyzer, specify a relay to turn on a tower light if a hardware alarm occurs. Specify the relay in the **Hardware Alarms** table on the **System Configuration** page (see Figure 5-10). For example, to turn on the red light when a fatal hardware alarm occurs, enter **2** under **Relay Out (1-9)** in the **Fatal** row.

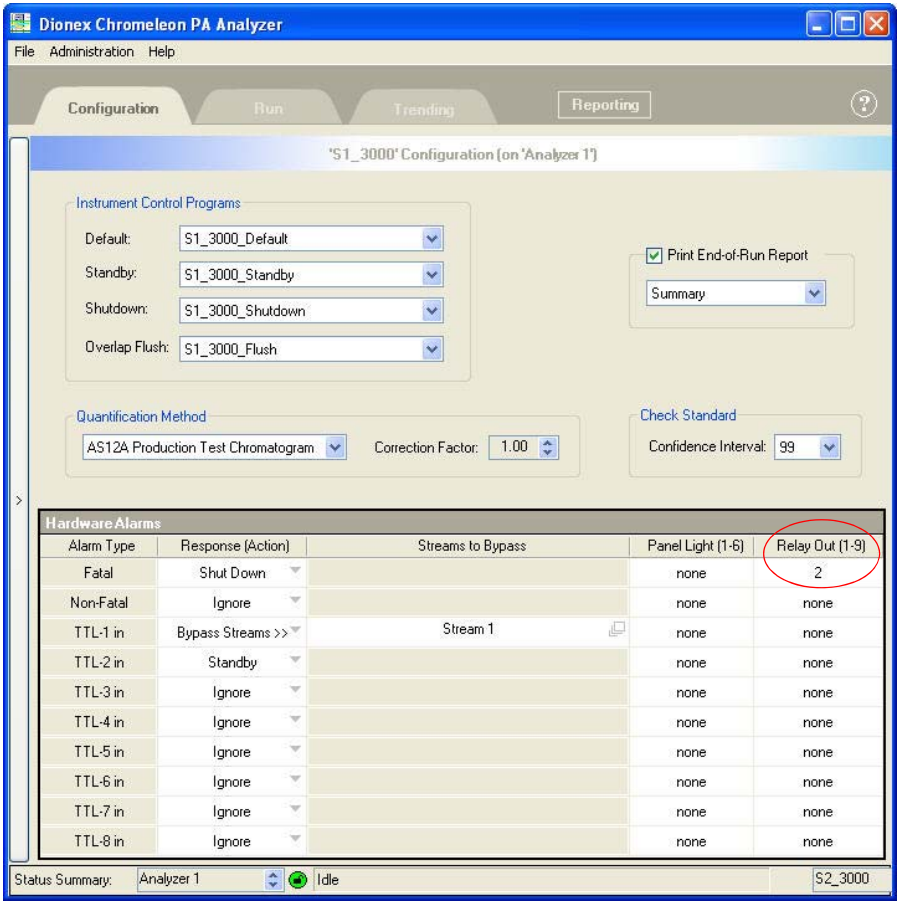


Figure 5-10. Chromeleon PA Analyzer System Configuration Page

- In Chromeleon PA Analyzer, specify a relay to turn on a tower light when a result-based event occurs. Specify the relay on the **Result-Based Events** page

in the analyzer configuration (see Figure 5-10). For example, to turn on the yellow light when a result-based event occurs, enter **3** under **Relay Out (1-9)**.

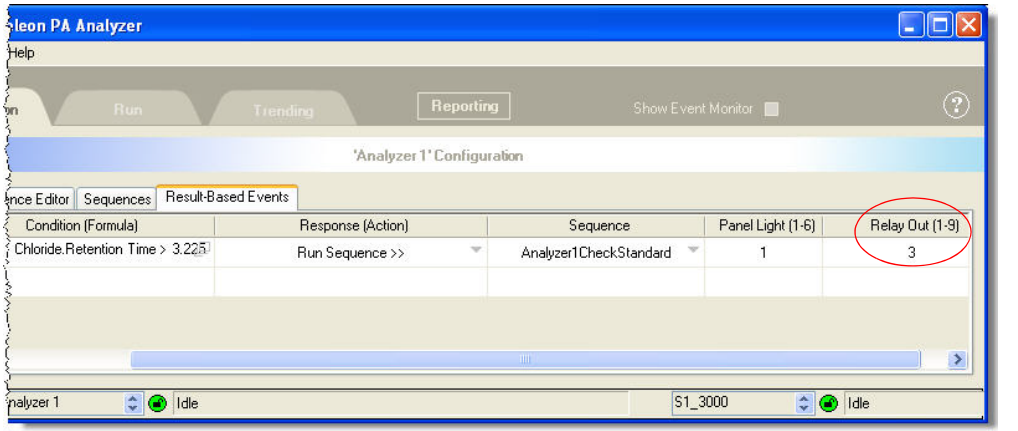
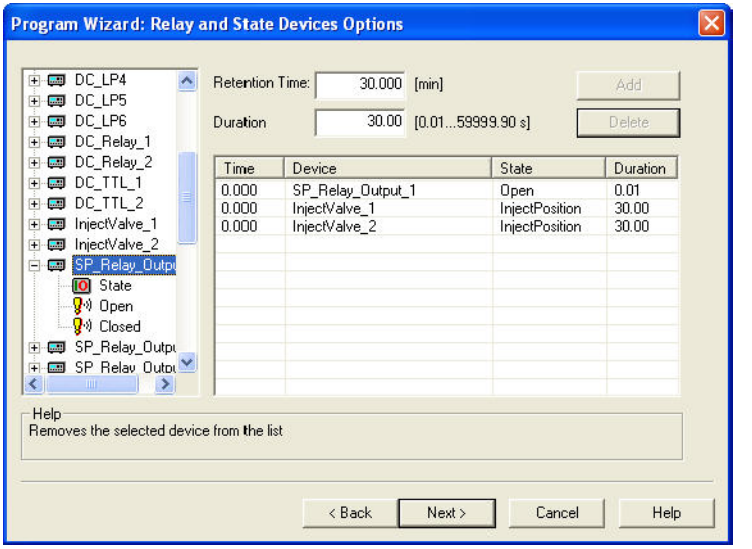


Figure 5-11. Chromeleon PA Analyzer Result-Based Events Page

- In Chromeleon, control the relays in the instrument control program. Enter commands for controlling the relays on the **Relays and State Devices Options** page of the Program Wizard (see Figure).



Chromeleon Program Wizard: Relay and State Devices Options

6 • LE Liquids Enclosure Description

6.1 LE Overview

The LE Liquids Enclosure houses mobile phase, standard, and reagent containers. The LE is installed below the AE (see Figure 5-1).

For increased stability when the AE includes side-mounted options (SP or air conditioner), an extension must be installed on the LE.

6.2 LE Containers

The LE accommodates the following containers:

- Plastic bottles for standards or reagents. The system is shipped with 2-L bottles (P/N 044129); 1-L bottles (P/N 044128) can be ordered.
- NOWPak containers for the mobile phase (eluent or solvent). Either 20-L NOWPak Bag-in-a-Bottle containers (P/N AAA-068551) or 20-L stainless steel NOWPak II containers (P/N 052882) can be used. NOWPak containers must be ordered separately.

  The NOWPak II container has a PTFE liner and a spring-loaded check valve that prevents overpressurization of the container. The PTFE liner (P/N 052885) can be reused if it is refilled with the same solution. However, if contamination is suspected or if the NOWPak container cannot be pressurized, replace the liner.

6.3 LE Control Panel

The LE control panel (see Figure 6-1) includes a pressure regulator, a pressure gauge, and knobs for controlling the gas pressure.

- The pressure gauge indicates the pressure applied to the reservoirs and the NOWPak containers. The recommended operating pressure is 20 to 34 kPa (3 to 5 psi).
- Pressurizing gas is directed to the pressure regulator. A pressure relief valve behind the control panel is designed to open at 100 kPa (15 psi). If the valve opens during operation, turn off the pressure momentarily to allow the valve to reset itself.

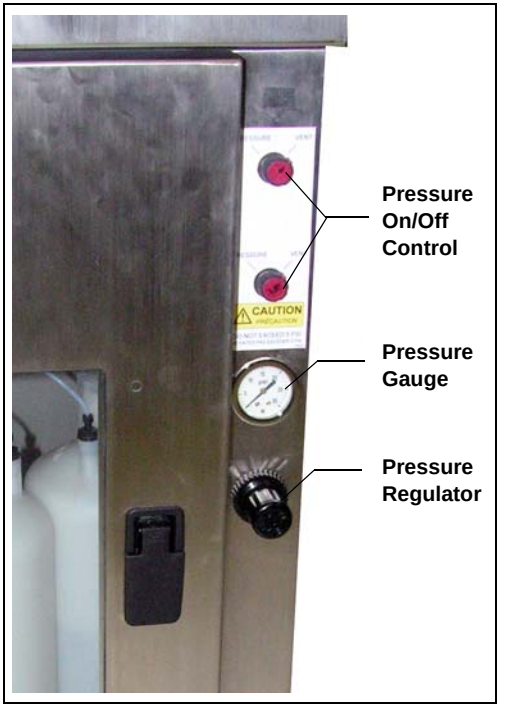


Figure 6-1. LE Control Panel

- The knobs provide on/off control of gas pressure to the reservoirs and the NOWPak containers. To apply pressure, turn the knob to the **PRESSURE** position. To turn off the gas, turn the knob to the **VENT** position.

CAUTION

The pressure relief valve prevents overpressurization of the LE containers, which might damage the containers and injure the user. Never operate the LE without the relief valve.

MISE EN GARDE

La soupape de détente empêche la surpression des conteneurs du LE, surpression qui pourrait endommager les conteneurs et blesser l'utilisateur. N'utilisez jamais le LE sans la soupape de détente.

VORSICHT

Das Überdruckventil verhindert einen Überdruck in den Behältern des LE. Überdruck kann die Behälter beschädigen und zu Verletzungen des Anwenders führen. Betreiben Sie den LE daher niemals ohne Überdruckventil.

A second, identical control panel can be installed for applications (such as transition metals) that require two gas supplies (one for reagents and one for standards and mobile phases). This prevents cross-contamination between reagents such as nitric acid and ammonium acetate buffered PAR.

6.4 LE Liquid and Gas Connections

- All liquid connections are made with 3-mm (1/8-in) OD PTFE tubing and 10-32 ferrule fittings.
- The gas connection uses a 1/4-in pressfit fitting.

6.5 LE Pneumatic Requirements

The reagent and standard reservoirs and NOWPak mobile phase containers require a pressurized supply of nitrogen or helium regulated to between 20 and 34 kPa (3 to 5 psi). The gas purity should be appropriate for the application.

After pressurizing the reservoirs and NOWPak containers, wait 15 to 30 minutes and then check the LE pressure gauge and the supply tanks (if used); if the pressure is not between 20 and 34 kPa (3 to 5 psi), reset it. It may take several hours for the pressure to stabilize, depending on how much liquid is in the NOWPak container.

To maintain the desired pressure, install the reservoirs within 3 meters (10 feet) of the AE enclosure and no more than 0.5 to 1 meter (2 to 3 feet) below the bottom of the enclosure.

7 • Startup, Operation, and Shutdown

7.1 Initial Startup Checklist

Complete the following installation steps before operating the Dionex Integral system for the first time.

7.1.1 Prepare the Site and Facilities

1. At the installation site, select the location for the Dionex Integral system components (chromatography system modules, SP, SS). Refer to *Installation Requirements and Customer Responsibilities* (Document No. 070186) for appropriate locations and distances.
2. Provide the facilities specified in the installation requirements document. Refer to the document for appropriate voltages, currents, pressures, and flow rates.

7.1.2 Connect the Facilities

1. Connect electrical power to the Dionex Integral system components and the computer. A power cord is provided with each component. If the Dionex Integral system includes an AE, the wall receptacle must be a NEMA L5-20R receptacle.
2. Confirm that LE regulators are turned down and valves are turned to the **VENT** position. Connect gas sources to the system components. Close the shutoff valve for each of the gas inlets.
3. Connect water sources to each system. Close the shutoff valve for each of the sample inlets.
4. Direct the waste lines into the drain. Refer to the installation requirements document for location.

7.1.3 Connect the Communications Cables

1. Connect the USB cables to the computer and to each Dionex Integral system component.
2. Connect TTL and relay cables (if used).

7.1.4 Connect the Sample Inlet Line

1. Locate the sample inlet line for each system. If multiple systems are configured with the analyzer, route a 3-mm (1/8-in) OD line from the system farthest from the sample source and install a 3-way manifold from this line at each remaining system.
2. Connect the sample line from the analyzer systems to the SS Stream Selector or sample source. Refer to the installation requirements document for correct pressures and flow rates.
3. If an SS is installed, connect it to the sample panel. Refer to the installation requirements document for correct pressures and flow rates.

7.2 Initial Startup

7.2.1 Turn On the Power

1. If the Dionex Integral system includes an AE, turn on the main power switch on top of the AE.
2. Turn on the power switches for the other Dionex Integral system components (chromatography system modules, SP, SS).
3. Close the AE door, twist the knob on the **Emergency Off** switch clockwise to set the knob to the out position.

7.2.2 Set Up Chromeleon PA and Configure the System

Follow the instructions in *Setting Up Chromeleon PA* (Document No. 065262) to install the software and configure the system.

7.2.3 Flush the Flow Path

1. Open the gas inlet valves.
2. Adjust the pressure of the regulator on the SP panel to 170 kPa (25 psi).
3. Set the LE controls to **VENT**. Adjust the pressure of the regulator on the LE to 34 kPa (5 psi).
4. Prepare mobile phases, standards, and reagents (if used). Fill containers and pressurize to the appropriate pressures. Refer to the NOWPak documentation provided with the NOWPak Installation Kit (P/N AAA-068551) for details about filling these containers. Open water supplies to each system.
5. Manually actuate the SP valves to flush the lines with water, diluent, sample, and standards.
6. Fill the dilution vessel with water or diluent and then drain the liquid. Depending on the application, it may be necessary to repeat this process several times or to soak the vessel overnight in order to remove trace contaminants.
7. Before installing consumable components (see Section 7.2.4), set the analytical pump flow rate to 0.25 mL/min (for a microbore pump) or 1 mL/min (for a standard bore pump). Prime and start the pump to flush the chromatography flow path. If a suppressor is being used with external water for regenerant, flush these lines, also.
8. While pumping through the chromatography flow path (without consumables), confirm that the total backpressure remains below 690 kPa (100 psi).

7.2.4 Install Consumable Components

Install the columns, suppressor (if used), and any other consumable components according to the product manuals.

7.2.5 Calibrate the System

Pump Calibration

The dilution pump and stepper motor loading pump must be calibrated after you replace any component in the pump flow path that changes the system backpressure, including columns, sample loops, and tubing. The purpose of the pump calibration is to accurately determine the pump stroke volume, using the same hardware components (tubing, fittings, columns, etc.) used for routine analysis.

1. To calibrate a pump, open the Chromeleon Control panel and click the **Calibration** button.
2. Click the button for the calibration to be performed (for example, click **DP Cal** to calibrate the dilution pump).
3. Follow the instructions in the window to complete the calibration.

NOTE The peristaltic loading pump does not require calibration. If this pump is installed, adjust the speed of the pump to deliver the desired flow rate. See Section 10.2 for instructions.

Standard Loop Calibration

Before running the initial analysis, calibrate the fixed-volume standard (sample) loop on the metering (ME) valve. Calibration of the standard loop (and the dilution pump) will determine the correct calibration standard concentration and ensure accurate analytical results.

Standard loops are usually made from 0.5-mm (0.020-in) ID PEEK tubing with Thermo Scientific Dionex 10-32 ferrule fittings. For analyses in the ppm to ppb concentration range, use a loop with a volume of 20 to 100 µL. For analyses of 10 to 100 ppb, use a loop with a volume of 100 to 250 µL.

A standard loop with a nominal volume of 100 µL is included with the ME valve. To use a different volume loop, follow the instructions below to make the loop. To calibrate the loop, follow the instructions starting on page 97.

To make a standard loop:

1. The table below indicates the tubing length for several standard loop sizes. *These values are approximations* because tubing IDs vary. After checking the table, cut a piece of tubing to the suggested length. Be very careful to cut the end square to the axis of the tubing, with no angle. Tubing that is poorly cut will cause fittings to leak.

Loop Size	Tubing Length (cm)
10	4.93
25	12.33
50	24.67
100	49.34
150	74.01
200	98.68
250	123.35
500	246.70
1000	493.40

2. Install a 10-32 PEEK bolt (P/N 043275) and a PEEK ferrule fitting (P/N 043276) on both ends of the tubing cut in Step 1.

To calibrate the standard loop:

1. Install a plug (P/N 042772) in one end of a black coupler (P/N 042627), and then install the coupler on one end of the standard loop. Repeat on the other end of the loop.
2. Weigh the loop, on an analytical balance, to the nearest 0.001gram. Record the weight. Remove the loop from the balance and remove the plugs from the couplers.
3. Using a syringe (P/N 016640) and a luer adapter (P/N 24305), fill the standard loop with deionized water. *Do not introduce any air into the loop.*
4. Reinstall the plug on the end of the coupler from which the water exited. Remove the syringe and luer adapter from the other end of the loop and install the plug in it.

5. Examine the outside of the loop for water droplets. **Carefully** dry any water and then weigh the loop to the nearest 0.0001gram, if possible.
6. Subtract the weight of the empty loop (Step 2) from the weight of the filled loop (Step 5); the difference is the weight of the water in the standard loop.
7. Repeat Step 5 and Step 6 until four to five consecutive weighings ± 0.009 are achieved.
8. Multiply the weight of the water by 1000 to obtain the standard loop volume in microliters (µL). The table below lists examples of dilution factors and final concentrations of the diluted standard.

Standard Loop Size (µL)	Dilution Volume (mL)	Dilution Factor	Calibration Standard Concentration (mg/L)	Diluted Standard Concentration (µg/L)
10	50	5000	10	2
20	50	2500	10	4
25	50	2000	10	5
50	50	1000	10	10
100	50	500	10	20
150	50	33	10	30
200	50	250	10	40
250	50	250	10	40
250	25	100	10	100

Calculate the diluted standard concentration as follows:

$$V_1C_1 = V_2C_2$$

$$C_2 = \frac{V_1C_1}{V_2}$$

$$D_f = \frac{V_1}{V_2}\ \frac{25\,\mu L}{50\,mL} = 2000$$

where:
Standard loop = V_1
Dilution volume = V_2
Dilution factor = D_f
Calibration standard concentration = C_1
Diluted standard concentration = C_2

9. Install the loop between ports 1 and 6 of the metering (ME) valve.

Analytical Pump Calibration

Calibrate the analytical pump if required (refer to the pump manual).

Detector Calibration

Calibrate the detector if required (refer to the detector manual).

7.2.6 Set Up the Dionex Integral Analyzers in Chromeleon PA

In Chromeleon:

- Create programs, quantification methods, and reports for each Dionex Integral system.
- Run a standard, and then edit component information for the method.
- Calibrate the method for the first time (the method can subsequently be calibrated in Chromeleon PA Analyzer).

In Chromeleon PA Analyzer:

- Configure the Dionex Integral analyzers, systems, and streams.

Refer to *Setting Up Chromeleon PA* (Document No. 065262) for detailed instructions.

7.3 Routine Startup and Operation

Routine operation consists of first confirming that all hardware is operating properly and then running programs and sequences to control sample analysis. Refer to the Chromeleon PA Help for detailed operating instructions.

7.3.1 Routine Startup

1. Confirm that the power is on for all system components.
2. Confirm that the computer is on.
3. Check that the Chromeleon Server is running.
4. Confirm that all water and gas utilities are on and adjusted to their proper pressures.
5. Confirm that all mobile phases, standards, and reagents are supplied.

6. Start Chromeleon PA Analyzer and load an appropriate sequence.

   Verify the following:

   - The mobile phase flow rates are correct.
   - The detector cell is on and the suppressor (if used) is powered.

Always turn on the flow to the suppressor (from the analytical pump) before turning on the detector. Operating the suppressor with no flow going to it will damage the suppressor.

   - The post-column flow rate is correct. Adjust the flow rate, if required.
   - Check the dilution vessel for liquid. If the vessel contains liquid, follow the steps below to drain the vessel:

     1. Verify that the **DV** (**SV6**) valve is off.
     2. Turn on the **GAS** (**SV8**) valve for 1 to 3 minutes.

   - Let each system stabilize for 20 to 30 minutes. Verify that the detector background has stabilized before beginning the analysis.

7.3.2 Routine Operation

After each system has stabilized and the sequence has been started, use the following checklist to monitor operation.

1. Check for alarms and errors, and if necessary, refer to Chapter 9 for troubleshooting information.
2. Check for any liquid or gas leaks. Isolate and eliminate any leaks.
3. Check fluid levels for all mobile phases, standards, and reagents. Replenish them as needed.
4. Use a check standard in the sequence to monitor and trend system performance.

7.4 Shutdown

7.4.1 Short-Term Shutdown

Follow these steps to shut down the Dionex Integral analyzer for two weeks or less.

1. In Chromeleon PA Analyzer, click the **Run** tab. In the tree control in the left pane, select the analyzer to be shut down. Click the **Standby** button for this analyzer.
2. Exit the software and shut down the computer.
3. Turn off the main power switch on the AE. If the analyzer does not include an AE, turn off the power to all analyzer components separately.
4. Turn the LE gas controls to **VENT**.
5. Shut off the water and gas facilities to each system.
6. Leave the columns installed and filled with mobile phase.
7. Empty standards bottles if stability is questionable.

7.4.2 Long-Term Shutdown

Follow these steps to shut down the Dionex Integral analyzer for more than two weeks.

1. In Chromeleon PA Analyzer, click the **Run** tab. In the tree control in the left pane, select the analyzer to be shut down. Click the **Standby** button for this analyzer.
2. Exit the software and shut down the computer.
3. Empty and rinse the mobile phase, standard, and reagent bottles.
4. Prepare the columns, suppressors, and EluGen cartridges for long-term storage as instructed in the product manuals.
5. Flush the pumps, valves, post-column system, and interconnecting tubing with deionized water. Blow out the lines with high-purity nitrogen or helium.
6. Turn the LE gas controls to **VENT**.

7. Shut off the water and gas facilities to each system.
8. Turn off the main power switch on the AE. If the analyzer does not include an AE, turn off the power to all analyzer components separately.

8 • Maintenance

This chapter describes routine maintenance procedures that the user can perform. All other maintenance procedures must be performed by qualified Thermo Fisher Scientific personnel.

Establish a routine maintenance program based on the guidelines here, as well as information in the user manuals for other system components (analytical pump, detector, columns, etc.). Following a strict maintenance schedule ensures proper operation of the Dionex Integral system.

NOTE **Thermo Fisher Scientific recommends recording the date on which each routine maintenance procedure is performed. Besides ensuring that these procedures are accomplished, a maintenance log is very helpful when troubleshooting the system.**

8.1 Daily Maintenance

Completion Time: 10-15 min for a dual-system analyzer

Component or Feature	Action
Gas pressure	Check house pressure; the cylinder must have enough pressure to supply gas for the day. LE regulator = 34 kPa (5 psi) Helium pressure for dilution vessel = 170 kPa (25 psi)
Reagent supplies	Check all liquid levels and replenish if necessary. Eluent for the day = 1 L minimum (2 L recommended) Stock standard solution for the day = 1 L minimum Regenerant water pressure = 100 kPa (15 psi) Deionized water pressure to enclosure = 100 to 140 kPa (15 to 20 psi) Sample line pressures = 70 to 140 kPa (10 to 20 psi) minimum; 100 kPa (15 psi) recommended)
Sample and waste lines	Make sure all lines flow freely.
Air and liquid lines	Check for leaks or spills. Isolate and repair leaks; clean up spills. Rinse dried chemicals from components with deionized water. Check for crimping; replace damaged lines.
All pumps	Check for piston seal leaks; replace defective seals.
Conductivity detector	Record the total conductivity readings at the beginning of a run.
Suppressor, EGC	Check for leaks. If the suppressor is operating in Autosuppression mode, check that bubbles are flowing from the suppressor regenerant outlet line.
Chromatography	Check trend plots and chromatograms for trending problems (missed peaks, etc.).
Printer	Make sure there is paper. Check the ink or toner cartridge.

8.2 Weekly Maintenance

Completion Time: 30-40 min for a dual-system analyzer

Component or Feature	Action
Standard solutions	Prepare new solutions for the check standard and calibration standard.
Analytical pump	Replace the piston seal wash solution, if used. Record pump pressure when the load/inject valve is in the load position.
SS valves	Check for leaks.
Gas and drain connections	Check all connections, including the drain manifold and the fluid connection panels. Check for accumulated liquid on the inside bottom of enclosures. Fix leaks promptly.
Power and signal connections	Visually inspect all connections and cables. Secure loose connections; move pinched or strained cables.

8.3 Biweekly Maintenance

Completion Time: 1-2 hrs for a dual-system analyzer

Component or Feature	Action
Reagent reservoirs	Thoroughly rinse all reagent reservoirs with deionized water to remove precipitates.
Eluents, reagent	Prepare new eluents and reagents.
Eluent trap columns (if used)	Replace trap columns (may be required weekly).

8.4 Monthly Maintenance

Completion Time: 1-2 hrs for a dual-system analyzer

Component or Feature	Action
In-line filters	Replace all in-line filters.
Guard columns	If the eluent pressure increases by 1.4 MPa (200 psi), replace the bed support in the guard column inlet. If the pressure does not return to near the original for this column, replace the guard column.
Air filter	Clean with warm water whenever a fine layer of dust or lint is visible. Establish a cleaning schedule, taking local air quality into account.
Enclosures	Clean with a mild soap solution and then rinse with water.

8.5 Quarterly Maintenance

Completion Time: 1-2 hrs for a dual-system analyzer

Component or Feature	Action
Pump seals	Replace pump seals.
Rotary valves	Replace rotors and stators in the load/inject (LI) valve and metering (ME) valve.
Analytical pump	Calibrate flow and pressure.
EluGen cartridge	Replace if necessary. Check the software for the lifetime remaining value.

9 • Troubleshooting

This chapter is a guide to troubleshooting minor issues that may arise during operation of Dionex Integral Process Analytical Systems.

- For troubleshooting strategies, see Section 9.1.
- For descriptions of error messages and how to troubleshoot them, see Section 9.2.
- For descriptions of various operating problems and how to resolve them, see Section 9.3 through Section 9.5.

If you are unable to resolve a problem by following the instructions here, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office. Please have this chapter at hand when talking with Technical Support personnel.

9.1 Troubleshooting Strategies

For any system, the initial troubleshooting objective is to isolate the source of the problem to a specific system component or to an aspect of the analysis. Once this has been done, corrective action can be taken. This manual cannot address every possible symptom and failure; however, the techniques discussed here can be applied to problem solving throughout the Dionex Integral system.

A solid understanding of system operation is necessary for troubleshooting. Rather than immediately assuming that a problem exists, first check the user manuals to verify that correct operating procedures are being followed.

Also, it is essential that users keep a log of all maintenance-related activities (when eluents are prepared, when columns are changed, etc.). You can use the **EluentChanged** and **ConsumableChanged** commands to record these events in the Chromeleon Audit Trail. Tracking these events can provide valuable insights. For example, if the chromatogram on an anion system seems to have undergone a radical and sudden change, check the log or Audit Trail for the date that the latest batch of eluent was placed in service. If the problem was first observed with the new batch, verify that the eluent was properly prepared. Maintaining a written

record of problems and their resolution can help solve similar problems in the future.

In summary, an effective troubleshooting strategy requires that users:

1. Understand the operation of the entire system.
2. Maintain a maintenance log.
3. Isolate the problem to either the hardware or chemistry.
4. Refer to the troubleshooting and service sections of the appropriate user manual.

9.2 Audit Trail Error Messages

The instrument control firmware installed in the SP Sample Preparer periodically checks the status of certain parameters. If a problem is detected, it is reported to Chromeleon and logged in the Audit Trail. Each error message is preceded by an icon that identifies the seriousness of the underlying problem (see the table below).

Icon	Severity Level	Description
	Warning	A message is displayed in the Audit Trail, but the current run is not interrupted.
	Error	A message is displayed in the Audit Trail, and the system attempts to correct the problem (sometimes by using an alternative parameter). An Error never interrupts the current analysis; however, if it occurs during the Ready Check, the analysis will not be started.
	Abort	A message is displayed in the Audit Trail, and the running batch is aborted.

The table below lists the most frequently observed error messages and their default severity levels. For troubleshooting assistance, refer to the page indicated in the table.

Audit Trail Error Message	Default Severity Level	See
BeginSPSamplePrep command is not specified	Error	page 111
BeginSPSamplePrep command must occur before EndSPSamplePrep command	Error	page 111
BeginSPSamplePrep command must occur before any Integral SP Sample Preparation commands	Error	page 112
BeginSPSamplePrep, EndSPSamplePrep and commands in between do not have the same PGM time	Error	page 112
BeginSamplePrep command and/or EndSamplePrep command are specified more than once	Error	page 112
DelaySP command must occur within BeginSPSamplePrep/ EndSPSamplePrep command block	Error	page 113
Dilution pump home sensor not detected	Abort	page 113
Dilution pump driver is over current	Abort	page 113
Dilution pump lost count	Warning	page 114
Dilution pump stopped or lost more than 20 steps	Abort	page 114
EndSPSamplePrep command is not specified	Error	page 115
Flow sensor 1 flow rate is lower than limit Flow sensor 2 flow rate is lower than limit	Warning	page 115
Flow sensor 1 flow rate is higher than limit Flow sensor 2 flow rate is higher than limit	Warning	page 115
Flow sensor 1 offset calibration value is out of range Flow sensor 2 offset calibration value is out of range	Abort	page 116
Flow sensor 1 slope calibration value is out of range Flow sensor 2 slope calibration value is out of range	Abort	page 116
Leak sensor 1 wet Leak sensor 2 wet	Warning	page 117
Loading pump home sensor not detected	Abort	page 118
Loading pump driver is over current	Abort	page 119
Loading pump lost count	Warning	page 119
Loading pump stopped or lost more than 20 steps	Abort	page 119

Audit Trail Error Message	Default Severity Level	See
Mixer motor speed is higher than expected	Warning	page 120
Pressure offset calibration value is out of range	Abort	page 120
Pressure slope calibration value is out of range	Abort	page 120
Pump volume command must occur within BeginSPSamplePrep / EndSPSamplePrep command block	Abort	page 121
User analog input 1 offset calibration value is out of range User analog input 2 offset calibration value is out of range User analog input 3 offset calibration value is out of range User analog input 4 offset calibration value is out of range	Abort	page 122
User analog input 1 slope calibration value is out of range User analog input 2 slope calibration value is out of range User analog input 3 slope calibration value is out of range User analog input 4 slope calibration value is out of range	Abort	page 122
Vessel heater over safe temperature	Abort	page 123
Vessel heater temperature calibration setting is too close	Abort	page 123
Vessel heater temperature calibration offset or slope is out of range	Abort	page 123
Vial cooler over safe temperature	Abort	page 123
Vial cooler temperature calibration setting is too close	Abort	page 124
Vial cooler temperature calibration offset or slope is out of range	Abort	page 124

9.2.1 Notes About SP Sample Preparation Commands

- For the SP to perform sample preparation overlap, the sample preparation commands must be grouped into a block of commands. The **BeginSPSamplePrep** command must be the first command in the block and the **EndSPSamplePrep** command must be the last command. During sample preparation overlap, the SP executes the commands in the sample preparation block for the next sample, while the current sample is being analyzed.
- To reduce program errors, use the Chromeleon Program Wizard to create new programs for Dionex Integral systems. Using the wizard ensures that the required SP sample preparation commands are present and appear in the correct order.
- The program can include certain sample preparation commands that are not part of the sample preparation commands block (and are therefore not included in sample preparation overlap). These commands can be assigned specific retention times.

BeginSPSamplePrep command is not specified

BeginSPSamplePrep command must occur before EndSPSamplePrep command

These errors occur if a program includes an **EndSPSamplePrep** command but not a **BeginSPSamplePrep** command. Refer to Section 9.2.1 for more information about sample preparation commands.

To troubleshoot:

Open the program. In the Commands dialog box, add the **BeginSPSamplePrep** command before the first sample preparation command.

BeginSPSamplePrep command must occur before any Integral SP Sample Preparation commands

This error occurs if a program includes an SP sample preparation command before the sample preparation block of commands. Refer to Section 9.2.1 for more information about sample preparation commands.

To troubleshoot:

Move the sample preparation command after the **BeginSPSamplePrep** command or delete it from the program.

BeginSPSamplePrep, EndSPSamplePrep and commands in between do not have the same PGM time

This error occurs if the commands in the sample preparation block do not all have the same retention time. Refer to Section 9.2.1 for more information about sample preparation commands.

To troubleshoot:

- Remove retention times from the commands in the sample preparation commands block. When the Chromeleon Program Wizard is used to create the program, the commands in the sample preparation block are not assigned retention times.
- If a sample preparation command is assigned a specific retention time, position it outside of the block.

BeginSamplePrep command and/or EndSamplePrep command are specified more than once

This error occurs if the sample preparation commands block contains more than one beginning and/or ending command. Refer to Section 9.2.1 for more information about sample preparation commands.

To troubleshoot:

Remove all duplicate commands.

DelaySP command must occur within BeginSPSamplePrep/ EndSPSamplePrep command block

This error occurs if the program includes a **DelaySP** command, but the command is not inside the sample preparation commands block. Refer to Section 9.2.1 for more information about sample preparation commands.

To troubleshoot:

Move the command inside the sample preparation commands block or delete it from the program.

Dilution pump home sensor not detected

This error occurs if the dilution pump electronics fails to detect when the pump reaches the home position. This can be caused by high pressure in the flow path.

To troubleshoot:

1. Check for a blockage in the pump outlet tubing or in tubing downstream from the pump (see Figure 3-15 for the SP1 flow schematic or Figure 3-18 for the SP2 flow schematic).
2. If no blockage is found, turn off the pump flow.
3. Turn off the SP power briefly by pressing the SP power switch.
4. Turn on the SP power again and restart the pump flow.
5. If the problem persists, contact Thermo Fisher Scientific for assistance.

Dilution pump driver is over current

This error may indicate a problem in the dilution pump electronics.

To troubleshoot:

1. Turn off the pump flow.
2. Turn off the SP power briefly by pressing the SP power switch.

3. Turn on the SP power again and restart the pump flow.
4. If the problem persists, contact Thermo Fisher Scientific for assistance.

Dilution pump lost count

This is a warning only. The pump is still functioning and no action is needed.

Dilution pump stopped or lost more than 20 steps

This error can be caused by high pressure in the flow path.

To troubleshoot:

1. Check for a blockage in the pump outlet tubing or in tubing downstream from the pump (see Figure 3-15 for the SP1 flow schematic or Figure 3-18 for the SP2 flow schematic).
2. If no blockage is found, turn off the pump flow.
3. Turn off the SP power briefly by pressing the SP power switch.
4. Turn on the SP power again and restart the pump flow.
5. If the problem persists, contact Thermo Fisher Scientific for assistance.

EndSPSamplePrep command is not specified

This error occurs if a program includes a **BeginSPSamplePrep** command but not an **EndSPSamplePrep** command. Both commands are required to define the sample preparation commands block. Refer to Section 9.2.1 for more information about sample preparation commands.

To troubleshoot:

Open the program. In the Commands dialog box, add the **EndSPSamplePrep** command after the last sample preparation command.

Flow sensor 1 flow rate is lower than limit

-or-

Flow sensor 2 flow rate is lower than limit

This message occurs if the flow rate of the sample stream being monitored by flow sensor 1 (or flow sensor 2) drops below the lower limit.

To troubleshoot:

1. Verify the flow rate using an external measuring device. If the flow rate is normal, calibrate the flow sensor (see Section 10.9).
2. If the message reappears, the sensor may need to be replaced. Contact Thermo Fisher Scientific for assistance.

Flow sensor 1 flow rate is higher than limit

-or-

Flow sensor 2 flow rate is higher than limit

This message occurs if the flow rate of the sample stream being monitored by flow sensor 1 (or flow sensor 2) rises above the upper limit.

To troubleshoot:

1. Verify the flow rate using an external measuring device. If the flow rate is normal, calibrate the flow sensor (see Section 10.9).

2. If the message reappears, the sensor may need to be replaced. Contact Thermo Fisher Scientific for assistance.

Flow sensor 1 offset calibration value is out of range

-or-

Flow sensor 2 offset calibration value is out of range

This error occurs if the offset value is out of the expected range when the flow sensor is being calibrated.

To troubleshoot:

- Review the calibration procedure and then rerun the calibration (see Section 10.9).
- If the problem persists, contact Thermo Fisher Scientific for assistance.

Flow sensor 1 slope calibration value is out of range

-or-

Flow sensor 2 slope calibration value is out of range

This error occurs if the slope value is out of the expected range when the flow sensor is being calibrated.

To troubleshoot:

- Review the calibration procedure and then rerun the calibration (see Section 10.9).
- If the problem persists, contact Thermo Fisher Scientific for assistance.

Leak sensor 1 wet

-or-

Leak sensor 2 wet

If leaking liquid creates a hazard, stop the leak immediately by turning off the flow at the source.

Si une fuite de liquide crée un danger, arrêtez immédiatement la fuite en fermant l'écoulement à la source.

Wenn eine Gefährdung durch austretende Flüssigkeit besteht, stoppen Sie die Leckage unmittelbar, indem Sie den Fluß an der Quelle abstellen.

The **Leak sensor 1 wet** error occurs when liquid accumulates in the drip tray in the bottom of the SP, or when the leak sensor is not connected. The **Leak sensor 2 wet** error occurs when liquid accumulates in the drip tray in the bottom of the AE.

To troubleshoot:

1. Locate the source of the leak by visually inspecting tubing, fittings, and components in the SP or AE.
2. If a leak is found, tighten fittings (or replace tubing and fittings) as required. Refer to Section 9.3 for detailed troubleshooting of various types of leaks.
3. After fixing the leak, dry the drip tray and leak sensor thoroughly. If the leak sensor is not dry, it will remain activated and will continue to report a leak to the Audit Trail.

4. If no leak is found, check the leak sensor's electrical connection on the SP electronics board. Follow the instructions in Section 10.6 to access the SP electronics board. The cables for the leak sensors plug into the connectors on the top edge of the board on the left side (see Figure 9-1).

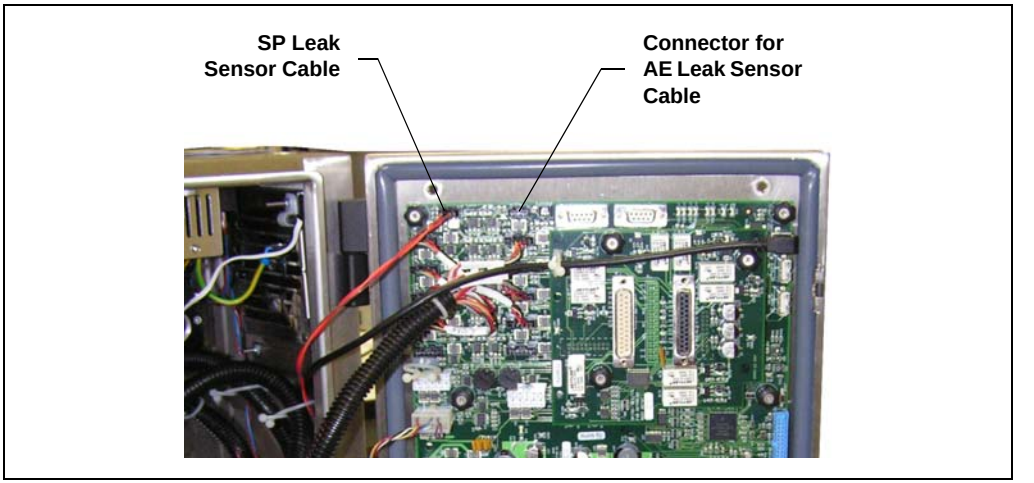


Figure 9-1. SP Electronics Board (Vertical Enclosure Shown)

Loading pump home sensor not detected

This error occurs if the loading pump electronics fails to detect when the pump reaches the home position. This can be caused by high pressure in the flow path.

To troubleshoot:

1. Check for a blockage in the pump outlet tubing or in tubing downstream from the pump (see Figure 3-15 for the SP1 flow schematic or Figure 3-18 for the SP2 flow schematic).
2. If no blockage is found, turn off the pump flow.
3. Turn off the SP power briefly by pressing the SP power switch.
4. Turn on the SP power again and restart the pump flow.
5. If the problem persists, contact Thermo Fisher Scientific for assistance.

Loading pump driver is over current

This error occurs if the driver current is above the allowed value.

To troubleshoot:

1. Turn off the pump flow.
2. Turn off the SP power briefly by pressing the SP power switch.
3. Turn on the SP power again and restart the pump flow.
4. If the problem persists, contact Thermo Fisher Scientific for assistance.

Loading pump lost count

This is a warning only. The pump is still functioning and no action is needed.

Loading pump stopped or lost more than 20 steps

This error can be caused by high pressure in the flow path.

To troubleshoot:

1. Check for a blockage in the pump outlet tubing or in tubing downstream from the pump (see Figure 3-15 for the SP1 flow schematic or Figure 3-18 for the SP2 flow schematic).
2. If no blockage is found, turn off the pump flow.
3. Turn off the SP power briefly by pressing the SP power switch.
4. Turn on the SP power again and restart the pump flow.
5. If the problem persists, contact Thermo Fisher Scientific for assistance.

Mixer motor speed is higher than expected

The **Mixer Stir Bar Auto-Recovery** option on the Chromeleon Server Configuration program **Pumps/Motors** page (see Section 3.5.2) uses Analog Input 4 to monitor the mixer stir bar. If the stir bar is in an out-of-control state, the mixer motor is stopped and then restarted at a 5% slower speed than before the auto-recovery occurred.

To troubleshoot:

This is a warning message only and no action is necessary. If you do not want this auto-recovery function to occur, you can disable the option (see Section 3.5.2).

Pressure offset calibration value is out of range

This error occurs if the offset value is out of the expected range when the pressure is being calibrated.

To troubleshoot:

- Review the calibration procedure and then rerun the calibration (see Section 10.9).
- If the problem persists, contact Thermo Fisher Scientific for assistance.

Pressure slope calibration value is out of range

This error occurs if the slope value is out of the expected range when the pressure is being calibrated.

To troubleshoot:

- Review the calibration procedure and then rerun the calibration (see Section 10.9).
- If the problem persists, contact Thermo Fisher Scientific for assistance.

Pump volume command must occur within BeginSPSamplePrep / EndSPSamplePrep command block

This error occurs if the program includes a command that specifies a volume for either the dilution pump or the loading pump (for example, **DilutionPump.DeliverVolume = 0.1 [mL]**), but the command is not inside the sample preparation commands block. Refer to Section 9.2.1 for more information about sample preparation commands.

To troubleshoot:

Move the command inside the sample preparation commands block or delete it from the program.

Rotary valve 1 error

-or-

Rotary valve 2 error

-or-

Rotary valve 3 error

This error occurs if a rotary valve fails to switch position within 1 second of being toggled.

To troubleshoot:

1. If a sequence is being executed, terminate the sequence by selecting **Stop** on the Chromeleon Control panel.
2. Turn off the SP power briefly by pressing the SP power switch.
3. Turn on the SP power again.
4. Try to toggle the valve position by clicking its control on the Control panel.
5. If the problem persists, contact Thermo Fisher Scientific for assistance.

User analog input 1 offset calibration value is out of range

-or-

User analog input 2 offset calibration value is out of range

-or-

User analog input 3 offset calibration value is out of range

-or-

User analog input 4 offset calibration value is out of range

This error occurs if the offset value is out of the expected range when the analog input is being calibrated.

To troubleshoot:

- Review the calibration procedure and then rerun the calibration (see Section 10.9).
- If the problem persists, contact Thermo Fisher Scientific for assistance.

User analog input 1 slope calibration value is out of range

-or-

User analog input 2 slope calibration value is out of range

-or-

User analog input 3 slope calibration value is out of range

-or-

User analog input 4 slope calibration value is out of range

This error occurs if the slope value is out of the expected range when the analog input is being calibrated.

To troubleshoot:

- Review the calibration procedure and then rerun the calibration (see Section 10.9).
- If the problem persists, contact Thermo Fisher Scientific for assistance.

Vessel heater over safe temperature

This error occurs if the dilution vessel heater temperature is higher than the maximum allowed (120 °C).

To troubleshoot:

This error may indicate a problem with the vessel heater electronics. Contact Thermo Fisher Scientific for assistance.

Vessel heater temperature calibration setting is too close

This error occurs if the difference between the two calibration temperature set points is not at least 5 °C when calibrating the vessel heater.

To troubleshoot:

Make sure the set points are at least 5 °C apart and rerun the calibration (see Section 10.9).

Vessel heater temperature calibration offset or slope is out of range

This error occurs if the offset or slope value is out of the expected range when the calibrating the vessel heater.

To troubleshoot:

- Review the calibration procedure and then rerun the calibration (see Section 10.9).
- If the problem persists, contact Thermo Fisher Scientific for assistance.

Vial cooler over safe temperature

This error occurs if the vial cooler temperature is higher than the maximum allowed.

To troubleshoot:

This error may indicate a problem with the vial cooler electronics. Contact Thermo Fisher Scientific for assistance.

Vial cooler temperature calibration setting is too close

This error occurs if the difference between the two calibration temperature set points is not at least 5 °C when calibrating the vial cooler.

To troubleshoot:

Make sure the set points are at least 5 °C apart and rerun the calibration (see Section 10.9).

Vial cooler temperature calibration offset or slope is out of range

This error occurs if the offset or slope value is out of the expected range when the vial cooler is being calibrated.

To troubleshoot:

- Review the calibration procedure and then rerun the calibration (see Section 10.9).
- If the problem persists, contact Thermo Fisher Scientific for assistance.

9.3 Liquid Leaks/Leak Alarm

If leaking liquid creates a hazard, stop the leak immediately by turning off the flow at the source.

Si une fuite de liquide crée un danger, arrêtez immédiatement la fuite en fermant l'écoulement à la source.

Wenn eine Gefährdung durch austretende Flüssigkeit besteht, stoppen Sie die Leckage unmittelbar, indem Sie den Fluß an der Quelle abstellen.

NOTE When cutting tubing and preparing fittings, avoid crimping the tubing. Crimped tubing is a common cause of high backpressure.

NOTE After eliminating the source of a leak, always dry the leak sensor thoroughly. If the leak sensor is not dry, it will remain activated and will continue to report a leak to the Audit Trail.

- **Leaking fitting**

  Locate the source of the leak. Tighten or, if necessary, replace the liquid line connection.

- **Broken or damaged liquid line**

  Cut the tubing at the break and install a new fitting. If cutting the tubing would make it too short, replace it. The new tubing must be the same type, and have the same internal diameter, as the tubing it replaces.

  If replacement is not possible, damaged SS liquid lines can be patched. Patch the tubing by cutting out the bad section and inserting a new piece of tubing with a coupler (P/N 040240) on each end.

  NOTE Routinely patching tubing increases the possibility of leaks.

- **Blocked or improperly installed waste line**

  Make sure waste lines are not crimped or otherwise blocked, and are not elevated at any point after they exit the AE or other enclosure. Waste lines should be clear and open to the atmosphere.

- **Dilution vessel leaking**

  Make sure all fittings are tightened securely.

  Make sure the dilution vessel does not contain excess liquid:

  - The dilution vessel may contain partially diluted sample or standard from a previous analysis. Purge the vessel as follows:

    1. Verify that the DV (SV6) valve is off.
    2. Turn on the GAS (SV8) valve for 1 to 3 minutes.

  - The pressure applied to the dilution vessel may be insufficient to empty it. Make sure the high-purity gas supply isregulated to 170 to 240 kPa (25 to 35 psi).

  - Make sure that no more than 250 mL of liquid is pumped into the dilution vessel. If the smaller dilution vessel is installed, make sure no more than 50 mL is pumped into the vessel. In the normally open (default) position, the DV (SV6) valve purges the dilution vessel to waste. Check the Chromeleon program used for controlling the system and verify that the valve remains open while the dilution pump is running.

- **Leaking pump check valve fittings**

  Tighten the inlet and outlet check valve fittings just until the leak stops. If the leaking check valve fitting is securely tightened but allows leaks despite this, the valve is defective. Replace the check valve (see Section 10.2).

- **Leaking pump head**

  Tighten the pump fitting connections. Dry the components. If the pump head continues to leak, the piston seal may be defective. Replace the piston seal (see Section 10.3).

9.4 Air and Gas Leaks

Air leaks, which can cause excessive air consumption, are usually audible. Gas leaks cause sluggish liquid delivery, unreliable pump operation, and excessive gas consumption.

Minor gas leaks can sometimes be felt, while major gas leaks are usually audible. To detect a minor gas leak, shut off the gas at the source and then check the pressure gauge for a drop in pressure. Repeat as often as necessary until the leak is found.

NOTE Do not use Snoop or other dilute soap solutions for leak detection. This will contaminate the tubing. Water may be used, if desired.

- **Leaking fitting**

  If the fitting is stripped, cross-threaded, or otherwise damaged, replace it. If the fitting is not damaged, securely tighten it.

  If the leak continues, cut the tube off the fitting and replace the fitting.

- **Leaking standard or reagent reservoir**

  Sluggish liquid delivery is usually due to a helium or nitrogen leak from a reservoir. Follow the strategy above to eliminate leaks at fittings and caps.

- **Damaged tubing**

  Over time, gas tubing can become compromised by chemical fumes (for example, eluent vapor in the air lines to the NOWpak containers). If this happens, replace the tubing.

9.5 System or System Component Does Not Power Up

Electrical system circuits carry dangerous voltages. Disconnect all power before working on them.

Les circuits du système électriques ont des tensions dangereuses. Débranchez toute l'alimentation électrique avant de travailler sur les circuits.

Elektrische Schaltkreise führen gefährliche Spannungen. Entfernen Sie alle Stromversorgungen, ehe Sie daran arbeiten.

- **AE main power cord not connected**

  Make sure the power cord is connected from the power in connector (on top of the AE) (see Figure 5-4) to the main power receptacle.

- **AE main power turned off**

  Make sure the power switch on top of the AE is on (see Figure 5-6).

  Make sure the **Emergency Off** switch on the AE front door is not pushed in. Twist the knob on the switch clockwise and pull out to return the switch to the on position and restore power.

- **System component power cord not connected**

  Make sure the component's power cord is connected to the appropriate AC outlet. The power strip inside the AE (see Figure 5-3) provides AC outlets for components installed inside an AE or mounted on the side of the AE.

- **System component power switch is off**

  Make sure the component's power switch is in the on position. Leave the switch on unless instructed to turn it off (for example, before performing a service procedure). If the component is installed inside an AE or mounted on the side of the AE, use the AE main power switch to control power to all connected components.

- **AE circuit breaker tripped**

  The circuit breaker is the main power switch for the AE. The switch is located on the top of the AE enclosure (see Figure 5-6). To reset the circuit breaker, flip the switch to the on position.

If the breaker continues to trip, the circuit may be shorted or overloaded. Disconnect all power and contact Thermo Fisher Scientific for assistance.

Si le disjoncteur continue de sauter, le circuit peut être court-circuité ou surchargé. Débranchez toute l'alimentation électrique et contactez Thermo Fisher Scientific pour obtenir de l'aide.

Wenn der Unterbrecherschalter kontinuierlich auslöst, kann es sein, daß die Schaltung kurzgeschlossen oder überlastet ist. Entfernen Sie alle Stromversorgungen und wenden Sie sich an Thermo Fisher Scientific.

- **Blown fuse in an SP or SS**

  Replace both fuses (see Section 10.10).

If the fuse continues to blow, the circuit may be shorted or overloaded. Disconnect all power and contact Thermo Fisher Scientific for assistance.

Si le fusible continue de sauter, le circuit peut être court-circuité ou surchargé. Débranchez toute l'alimentation électrique et contactez Thermo Fisher Scientific pour obtenir de l'aide.

Wenn die Sicherung weiterhin durchbrennt, kann es sein, daß die Schaltung kurzgeschlossen oder überlastet ist. Ziehen Sie den Netzstecker und wenden Sie sich an Thermo Fisher Scientific.

10 • Service

This chapter describes Dionex Integral Process Analytical Systems service and repair procedures that users may perform. All procedures not included here, including electronics-related repair procedures, must be performed by Thermo Fisher Scientific personnel. For assistance, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

Before replacing any part, refer to the troubleshooting information in Chapter 9 to correctly identify the cause of the problem.

IMPORTANT **Substituting non-Dionex/Thermo Fisher Scientific parts may impair the performance of the Dionex Integral system, thereby voiding the product warranty. Refer to the warranty statement in the Dionex Terms and Conditions for more information.**

10.1 Eliminating a Fluid System Restriction

A restriction in the fluid system (crimped tubing, etc.) can cause excessive system backpressure. This, in turn, may cause leaks or irreparable damage to system components.

1. Begin pumping mobile phase through the system (including the columns) at the flow rate normally used.
2. Refer to the appropriate flow schematic (see Figure 3-15 for the SP1 or Figure 3-18 for the SP2). Work backward through the system, beginning at the cell exit. One at a time, loosen each fitting and check the pressure. The connection at which the pressure drops indicates the point of restriction.
3. Remove the restriction, either by flushing or by replacing the section of tubing.

10.2 Replacing Pump Check Valves

A dirty check valve causes erratic flow rates and pressures. In addition, it may cause the pump to lose prime and/or be difficult to reprime. If possible, replace dirty check valves. If new check valves are not available, follow the instructions for cleaning on page 134.

To replace the check valves:

1. Turn off the SP power and disconnect the power cord.
2. To prevent contamination of pump parts, put on a pair of powder-free gloves before disassembling the pump head.
3. Disconnect the tube fittings from the inlet and outlet check valve assemblies on the pump head (see Figure 10-1).
4. Use a 1/2-inch wrench to loosen both check valve assemblies. Remove the check valve assemblies from the pump head.

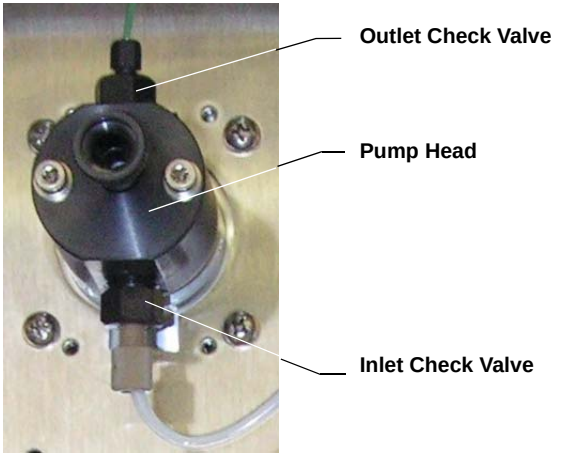


Figure 10-1. Pump Head

NOTE The *inlet* check valve housing has a 1/4-28 port. The *outlet* check valve housing has a 10-32 port (see Figure 10-2).

Figure 10-2. Check Valve Ports

5. Remove the old check valve cartridges from the inlet and outlet check valve housings.
6. With the double-hole end of a new cartridge (P/N 047747) facing up, drop the cartridge into the *inlet* check valve housing (see Figure 10-3).
7. With the single-hole end of a new cartridge (P/N 047747) facing up, drop the cartridge into the outlet check valve housing (see Figure 10-3).

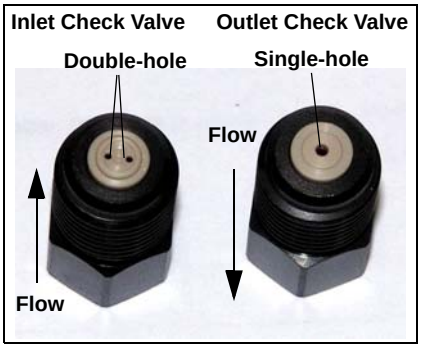


Figure 10-3. Check Valve Assemblies

NOTE The pump will not operate properly unless the check valve cartridges are installed in the housings in the correct orientation. Liquid flows into the cartridge through the large single hole and out the small double holes.

8. Install the inlet check valve assembly on the bottom of the pump head. Install the outlet check valve assembly on the top of the head. Tighten the check valves fingertight, and then use a wrench to tighten an additional one-quarter to one-half turn.

CAUTION

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

9. Reconnect the liquid lines and the power cord. Turn on the Dionex Integral main power.

10. Open the waste valve and turn on the pump. Allow the pump to run until no more bubbles can be seen exiting the waste line. Close the waste valve.
11. With the pump still running, check for leaks from the check valves. Tighten a check valve a *little more* only if it leaks. Turn off the pump.

To clean the check valves:

1. Follow Step 1 through Step 5 in the check valve replacement procedure to remove the check valve cartridges from the valve housings.
2. Place the check valve housings and cartridges in a beaker with methanol. Sonicate or agitate the parts for several minutes.
3. Rinse each check valve housing and cartridge thoroughly with filtered deionized water.
4. Follow Step 6 through Step 11 in the check valve replacement procedure to reinstall the check valves.

10.3 Replacing a Pump Piston Seal and Backup Seal

A damaged seal allows leakage past the piston. The pump may be difficult to prime and flow rates may be unstable.

Follow these instructions to replace seals in the dilution pump and the stepper motor loading pump (P/N 068561, both pumps).

Preparation:

1. Rinse the pump flow path with deionized water turning the waste valve knob (see Figure 10-1) one-half turn counterclockwise. This opens the waste valve and directs the flow to waste.
2. After rinsing, close the waste valve.
3. To prevent contamination of pump parts, put on a pair of powder-free gloves before disassembling the pump head.

   Refer to Figure 10-4 when disassembling and reassembling the pump head.

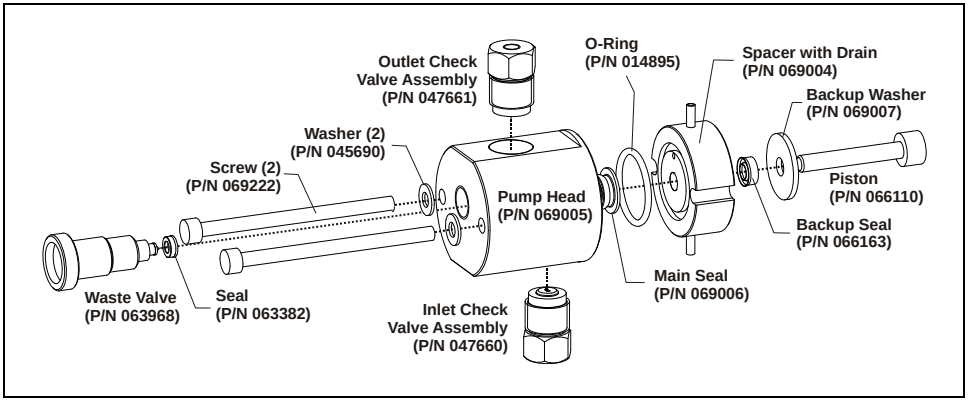


Figure 10-4. Pump Head

To remove the head and piston:

1. Turn off the SP power and disconnect the power cord.
2. Disconnect all tubing connections to the pump head.
3. Using a 7/64-in hex key (P/N 068227), loosen the two screws on the pump head. Remove the screws and washers.

4. Carefully remove the pump head from the SP by pulling the head straight off and away from the SP panel.

CAUTION

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

MISE EN GARDE

Un mouvement latéral pendant la séparation de la tête et du piston peut casser le piston.

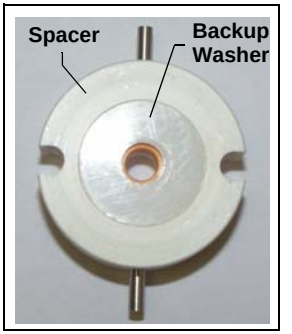
VORSICHT

Vermeiden Sie Seitwärtsbewegungen, wenn Sie den Pumpenkopg vom Kolben lösen. Andernfalls kann der Kolben brechen.

5. Place the head on a clean work surface
6. The piston does not come off as part of the pump head assembly because it is captured by a magnetic retention system. After removing the pump head, hold the shaft of the piston (near the base), tilt the piston slightly, and pull the piston away from the pump.

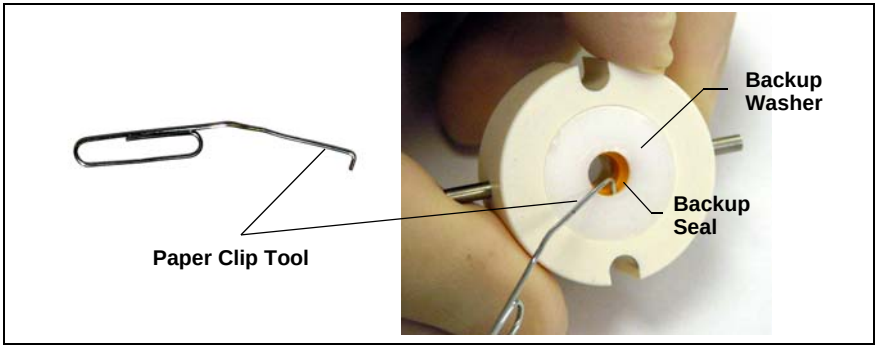
To install the new backup seal:

1. Lift the spacer off the pump head.
2. To remove the backup washer from the spacer, use one of the following methods:



   - With the backup washer facing up, cup the spacer in your hand and blow clean laboratory air at the spacer to dislodge the washer.
   - If air is not available, create a removal tool by using a pair of pliers to sharply bend the end of a paper clip (see the following photo). Carefully

insert this bent end between the washer and the orange backup seal. Lift off the washer. **Be careful not to scratch the washer**.

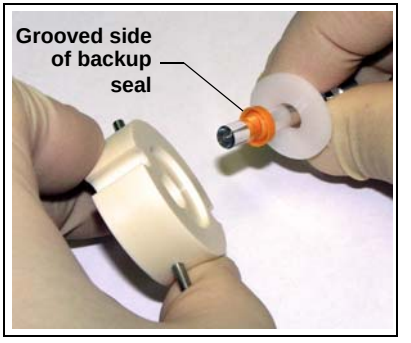


3. To remove the old backup seal from the spacer, insert the shaft of the piston through the center hole in the spacer and then pull out the piston. The seal will be removed with the piston.

4. To install the new backup seal:

   a. Insert the shaft of the piston through the backup washer.

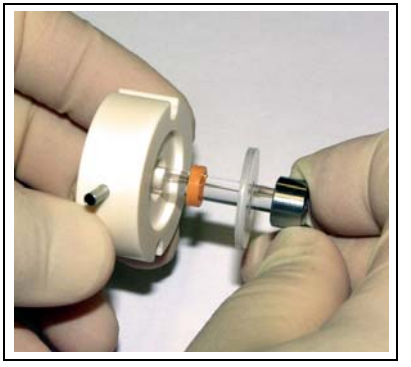
   b. Hold the new backup seal (P/N 066163) with the grooved side facing away from the washer and insert the shaft of the piston through the seal.



   c. Insert the piston into the center hole in the spacer.

   d. Push the piston into the spacer until it stops and the top of the backup washer is flush with the spacer.

   e. While holding the backup washer in place with your thumb, slowly remove the piston.



IMPORTANT **The backup seal is made of soft plastic. Do not press on the seal with anything hard or sharp, including your fingernail. If the seal is nicked or gouged, it will not seal properly and may result in leaks.**

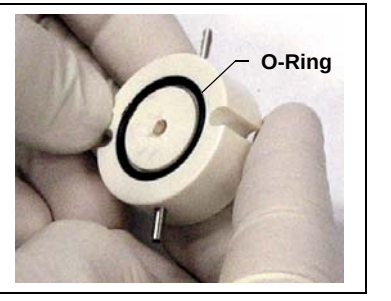
To remove the old main seal from the head:

1. Plug the outlet check valve with your finger and then inject deionized water through the piston opening to fill the head cavity with liquid.
2. While still plugging the check valve, push the piston into the head. (This should hydraulically unseat the seal from the head.)
3. Remove the piston and pull off the seal.

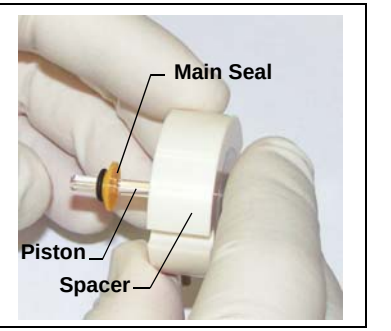
If the main seal is not removed, make sure the outlet check valve is plugged tightly when inserting the piston. If desired, you can install a 10-32 fitting plug (P/N 042772) on the outlet check valve. Add more water and make sure the head contains no air bubbles. Then, repeat Step 2 and Step 3. Remove the 10-32 fitting plug, if used.

To install the new main seal:

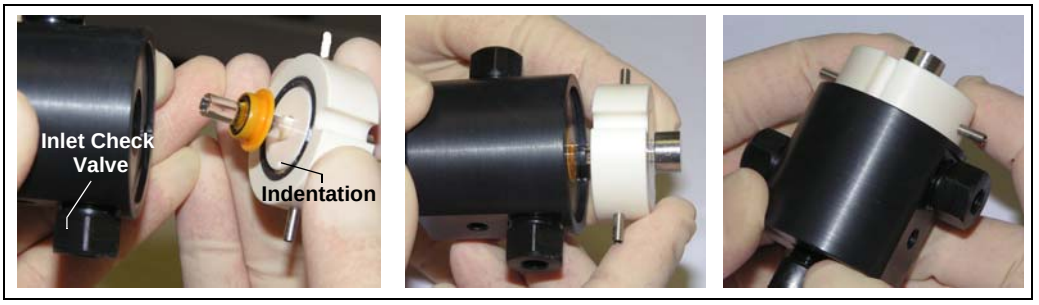
1. Open the waste valve knob by turning the knob one-half turn counterclockwise.
2. Before continuing, verify that the O-ring is installed in the spacer.



3. Lubricate the seal (P/N 069006) and the pump head opening with a small amount of isopropyl alcohol to facilitate insertion.
4. Push the piston through the spacer and then through the new piston seal.



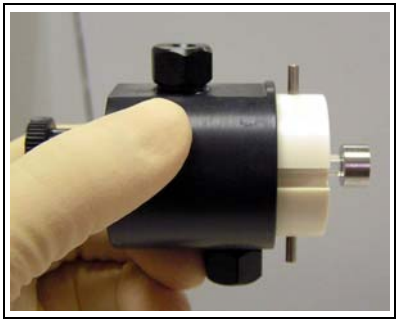
5. Orient the spacer so that the small indentation on the spacer aligns with the inlet check valve and then insert the piston and seal into the pump head.
6. To seat the seal, push down on the spacer until it is flush with the head. A clicking sound indicates that the seal is correctly seated.



To reinstall the head and piston:

Thermo Fisher Scientific recommends reinstalling the head and piston as a single assembly, so that the piston centers itself onto the magnetic follower inside the pump housing.

1. Pull the piston partially out of the spacer so that about 1/2 cm (1/4 in) of the shaft is exposed. This ensures that the magnetic follower picks up the piston when the head is reinstalled.
2. Reinstall the head and piston assembly onto the SP panel. Replace the washers and screws and tighten the screws evenly.



To complete the procedure:

1. Reconnect all liquid lines to the pump head.
2. Close the waste valve.
3. Plug in the power cord and turn on the SP power switch.
4. Open the waste valve and turn on the pump. Allow the pump to run until no more bubbles can be seen exiting the waste line. Close the waste valve. Turn off the pump.

10.4 Replacing a Pump Piston

Continued leaking of the piston seal after installation of a new seal (assuming the pump head is tight) indicates a dirty, scratched, or broken piston.

Follow the instructions in Section 10.3 to install a new piston (P/N 066110) and piston seal (P/N 069006). Always replace the piston seal when replacing a piston.

10.5 Replacing the Waste Valve Seal

A damaged seal causes leakage around the base of the waste valve knob.

1. Turn off the main power and disconnect the power cord.
2. To remove the waste valve from the pump head (see Figure 10-5), turn the knob counterclockwise until it is loose, and then pull the knob straight out of the cavity in the pump head.

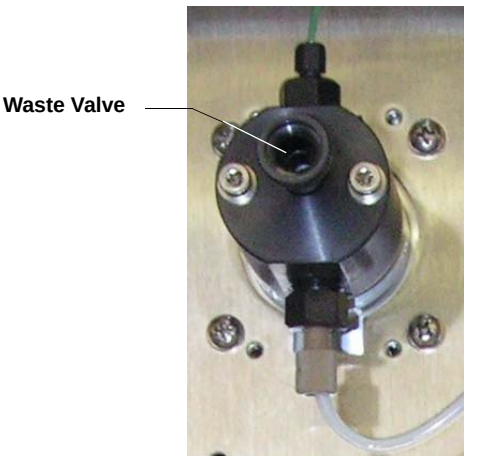


Figure 10-5. Waste Valve

3. If the seal is removed with the valve knob in Step 2, pull the seal off the end of the knob (see Figure 10-6). If the seal is not removed with the valve knob, insert a thin object (for example, the straightened end of a paper clip) into the cavity in the pump head and carefully pull out the seal. **Do not scratch the cavity.**

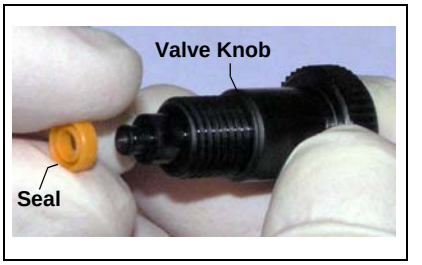


Figure 10-6. Waste Valve Seal Replacement

IMPORTANT **Scratches in the cavity will cause leaks around the base of the knob while the pump is being primed.**

4. Orient the new seal (P/N 063382) with the grooved side away from the valve, and then slide the seal over the end of the valve.
5. Insert the valve with the new seal into the pump head opening. Turn the knob clockwise and then tighten fingertight.
6. Turn on the SP power.
7. Open the waste valve and turn on the pump. Allow the pump to run until no more bubbles can be seen exiting the waste line. Close the waste valve.

10.6 Accessing the SP Electronics Board

NOTE This section is provided as a reference when performing service procedures that require accessing the SP electronics board.

To access the SP electronics board, follow the instructions below for the type of SP enclosure.

If the SP is an external enclosure:

1. Turn off the SP power and disconnect the power cord.
2. Unlatch the two handles on the service door of the SP and open the door. The SP electronics board is mounted on the inside of the door (see Figure 10-7).

Figure 10-7. SP External Enclosure: Service Door Open

If the SP is mounted inside the AE on the back panel:

1. Turn off the SP power and disconnect the power cord.
2. Open the AE front door.
3. Remove the modules (chromatography modules and/or SS) from the shelf on the bottom of the AE enclosure and set them next to the AE on a workbench. This will allow you to temporarily move the SP to the shelf.
4. **Note:** This step requires lifting the SP, which weighs 21 kg (46 lb). Grasp the SP with both hands and lift it up enough to remove it from the mounting rails on the AE back panel. Then, pull the SP straight out from the back panel and set it on the AE shelf.
5. On the exterior of the AE, remove the two service access panels on the left side of the AE (see Figure 10-8).
6. Loosen the thumbscrews on the service door of the SP and lower the door. The SP electronics board is mounted on the inside of the door (see Figure 10-9).

Figure 10-8. AE Left Side Exterior

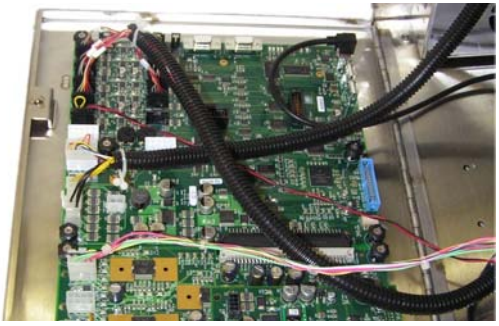


Figure 10-9. SP Horizontal Enclosure: Service Door Open

10.7 Replacing an SP Solenoid Valve

These instructions apply to solenoid valves installed on the SP panel.

1. Turn off the SP power and disconnect the power cord.
2. Disconnect each liquid line on the valve to be replaced (see Figure 10-10) and remove any fitting plugs installed in the valve ports.

Figure 10-10. Solenoid Valve (SS Valve Shown as an Example)

3. Follow the instructions in Section 10.6 to access the SP electronics board. The solenoid valve cables are plugged into connectors on the top left corner of the board (see Figure 10-11).

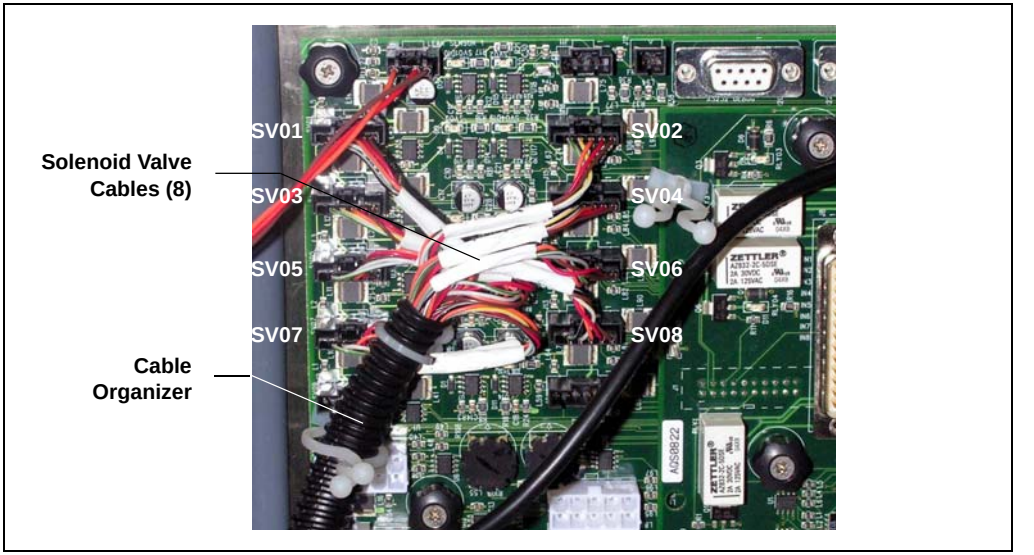


Figure 10-11. SP Electronics Board: Solenoid Valve Cable Connections

4. A label on the valve mounting plate identifies the number of the valve (for example, the SS valve is **SV5**). Disconnect the valve cable from its corresponding connector on the board (see Figure 10-11). For example, if you are replacing an SS valve, disconnect the cable from connector **SV05** on the board.
5. Remove the cable from the cable organizer.
6. Loosen the captive thumbscrew on the valve mounting plate and remove the valve from the SP panel.
7. Carefully pull the cable out through the front of the SP.
8. Thread the cable from the new valve (P/N 068554) through the opening on the SP panel and route the cable to the SP electronics board.
9. Insert the two tabs on the new valve mounting plate into the slots on the SP panel.
10. While holding the valve mounting plate firmly against the SP, tighten the captive thumbscrew.
11. Plug the valve connector into the SP electronics board (see Figure 10-11). Secure the cable in the cable organizer.
12. Close and secure the SP service door.
13. If you removed the SP from the AE back panel:
    - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP onto the rails.
    - Replace any modules that were removed from the lower shelf of the AE.
    - Replace the two access panels on the exterior of the AE.
14. Reconnect the liquid lines and fitting plugs that were removed from the old valve.
15. Plug in the power cord and turn on the power.

10.8 Changing the Peristaltic Loading Pump Speed

When a peristaltic pump is installed in the SP, one of the solenoid valve connectors on the SP electronics board (typically SV9) is assigned to control the peristaltic pump (instead of controlling a solenoid valve). A cable from the pump plugs into the SP electronics board (see Figure 10-12). Turning the associated potentiometer changes the voltage to the pump, and thus, the pump speed and flow rate.

To change the peristaltic pump speed:

1. Turn off the SP power and disconnect the power cord.
2. Follow the instructions in Section 10.6 to access the SP electronics board.
3. Locate the two potentiometers on the left side of the SP electronics board (see Figure 10-12). The potentiometer farthest to the left (at position **R108** on the board) controls the speed of the peristaltic loading pump installed in an SP2.
   - To increase the pump speed, turn the potentiometer counterclockwise.
   - To decrease the pump speed, turn the potentiometer clockwise.

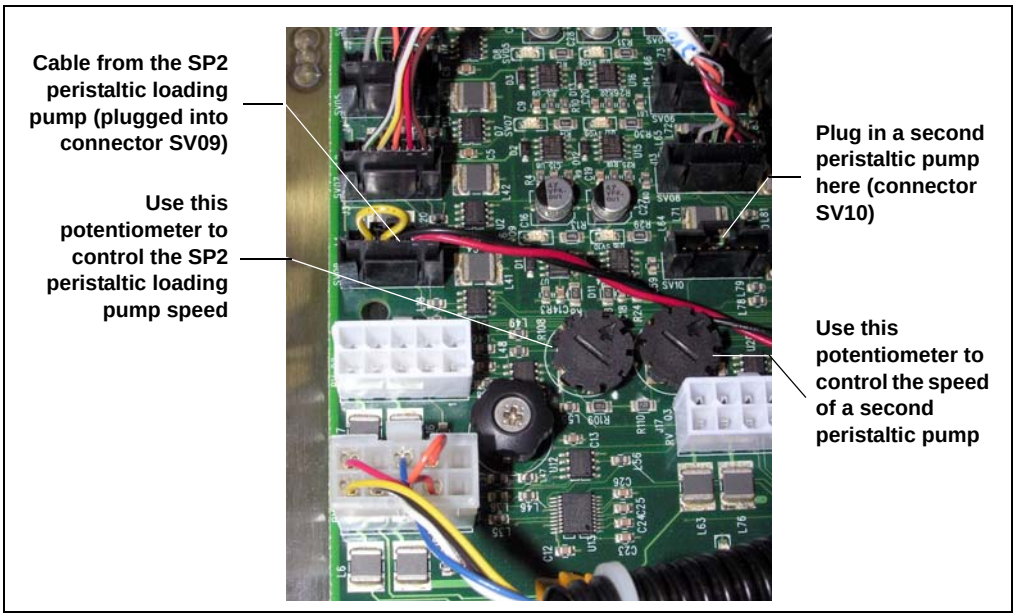


Figure 10-12. SP Electronics Board: Cable Connections and Potentiometers for Peristaltic Pumps

NOTE If two peristaltic loading pumps are installed in the SP, the cable for the second pump is plugged into position SV10 on the board (see Figure 10-12). The potentiometer on the right (at position R107 on the board) controls the speed of the second pump.

4. After setting the pump speed, close and secure the SP service door.
5. If you removed the SP from the AE back panel:
   - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP onto the rails.
   - Replace any modules that were removed from the lower shelf of the AE and
   - Replace the two access panels on the exterior of the AE.
6. Plug in the power cord and turn on the power.

10.9 Calibrating Components

Chromeleon provides commands for calibrating the components in a Dionex Integral system.

1. To calibrate a component, open the Chromeleon Control panel and click the **Calibration** button.
2. Click the button for the calibration to be performed (for example, click **DP Cal** to calibrate the dilution pump).
3. Follow the instructions in the window to complete the calibration.

10.10 Changing the SP or SS Main Power Fuses

1. Turn off the SP or SS power switch.
2. Disconnect the power cord.

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

HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau arrière du SP/SS.

HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf der Rückseite des SP/SS.

3. If the SP or SS is mounted on the side of an AE, remove the enclosure from the AE to access the fuse drawer. For instructions, refer to *Installation Requirements and Customer Responsibilities* (Document No. 070186).
4. The fuse drawer is located above the power receptacle (see Figure 10-13). A small tab locks the fuse drawer in place. Using a small screwdriver, press the tab *in* and *then up* to release the fuse drawer.
5. Pull the fuse drawer out of the rear panel and remove the old fuses.
6. Replace the two fuses with new fast-blow IEC 127 fuses rated 3.15 A (P/N 954745). Thermo Fisher Scientific recommends always replacing *both* fuses.

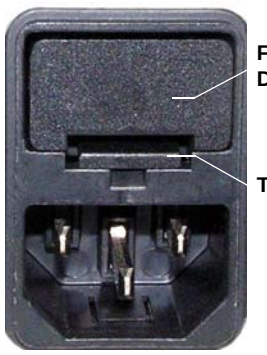


Figure 10-13. Fuse Drawer

7. Insert the fuse drawer into the rear panel and press until the drawer snaps into place.
8. Reconnect the main power cord and turn on the power.

A • Specifications

A.1 Environmental (All Analyzer Components)

Operating Temperature	10 to 40 °C (50 to 104 °F)
Humidity	5% to 95% relative humidity, noncondensing

A.2 AE Analyzer Enclosure and LE Liquids Enclosure

A.2.1 Electrical

AE Main Power	100 to 240 Vac, 50/60 Hz (Auto-sensing power supply; no manual voltage or frequency adjustment required) Typical input power: 10 W (AE only, without other devices connected) Line draw: Actual current draw depends on the devices installed in the enclosure; total current not to exceed 20 A at 120 Vac
AE Circuit Breaker	20 A
Short Circuit Current Rating	5 kA

A.2.2 Physical

Dimensions

AE only
Height: 102 cm (40 in)
Width: 64 cm (25 in)
Depth: 66 cm (26 in)

AE and LE
Height: 188 cm (74 in)
Width: 64 cm (25 in); 97 cm (38 in) with the LE extension
Depth: 66 cm (26 in)

Weight

AE
Weight: 70 kg (155 lbs) (empty)

LE
Weight: 75 kg (166 lbs) (empty)

A.3 SP Sample Preparer and SS Stream Selector

A.3.1 Electrical

Main Power 100 to 240 Vac, 50/60 Hz (Auto-sensing power supply; no manual voltage or frequency adjustment required)
Typical input power: 100 W
Line draw: 2 A maximum at 120 Vac

Fuses Two fast-blow IEC 127 fuses rated 3.15 A (P/N 954745)

Short Circuit Current Rating 5 kA

A.3.2 Physical

Dimensions Height: 43 cm (17 in)
Width: 29 cm (11.5 in)
Depth: 36 cm (14 in)

Weight 21 kg (46 lbs)

A.3.3 Pumps

Dilution Pump

Type Stepper motor

Operating Pressure 0.28 to 5.5 kPa (40 to 800 psi)

Flow Rate 15.0 mL/min, maximum

Loading Pumps

Type Stepper motor

Operating Pressure 0.28 to 17 MPa (40 to 2500 psi)

Flow Rate 3.0 mL/min, maximum

Type Peristaltic

Operating Pressure <0.34 MPa (<50 psi)

Flow Rate Dependent on tubing ID

A.3.4 Valves

Solenoid Valves

Type 3-way, electrically-actuated liquid solenoid valve

Operating Pressure 0.7 MPa (100 psi), maximum

Metering Valve

Type 10-port, 2-position, electrically-actuated liquid valve

Operating Pressure 30 MPa (4000 psi), maximum

Stream Selection Valves

Type 17-port, 8-position, electrically-actuated valve

Operating Pressure 5.5 MPa (800 psi), maximum

A.3.5 Dilution Vessels

Unheated Dilution Vessel

Capacity 250 mL

Operating Pressure 170 to 240 kPa (25 to 35 psi)

Pressure Relief Valve Opens at 340 kPa (50 psi)

Heated Dilution Vessel

Capacity 50 mL

Operating Temperature 15 to 40 °C (59 to 104 °F)

Operating Pressure 170 to 240 kPa (25 to 35 psi)

Pressure Relief Valve Opens at 340 kPa (50 psi)

A.4 Air Conditioner/Heater

A.4.1 Electrical

Main Power 115 Vac, 60 Hz (P/N 068545)
Line draw: 11.3 A maximum at 115 V

230 Vac, 50 Hz (P/N 069093)
Line draw: 4.6 A maximum at 230 V

A.4.2 Physical

Dimensions Height: 53 cm (21 in)
Width: 30.5 cm (12 in)
Depth: 32 cm (12.5 in)

Weight 34 kg (76 lbs)

B • Reordering Information

Part Number	Item
	AE/LE
068545	Air conditioner/heater, 115 Vac
069093	Air conditioner/heater, 230 Vac
044129	Bottle, 2-L
044128	Bottle, 1-L
069094	Computer Control Installation Kit
AAA-068551	NOWPak Bag-in-a-Bottle container
052882	NOWPak II container
052885	NOWPak II container, PTFE liner
068546	Purge Kit
068549	Tower Light Kit
AAA-068548	TTL and Relay Kit, AE
068544	Ventilation fan
	SP/SS
070171	Cable, analog input
070181	Cable, DC voltage control
070180	Cable, PWM power output
960779	Cable, USB, 5-meters (16-feet)
068524	Dilution vessel, heated, 50-mL
069208	Dilution vessel, unheated, 250-mL
068564	Flow Sensor Kit
954745	Fuse, IEC 127, 3.15 A
067728	Leak sensor, auxiliary
AAA-068563	Liquid Level Sensor Kit
068567	Pressure Sensor Kit
068558	Pump, peristaltic

Part Number	Item
068561	Pump, stepper motor
047747	Pump cartridge, stepper motor
069006	Pump seal, stepper motor
066163	Pump backup seal, stepper motor
066110	Pump piston, stepper motor
068572	Thermal Control Board Kit
068573	TTL and Relay Kit, SP
069608	USB Extension Kit, SS
068556	Valve, 10-port, high-pressure rotary, PEEK
068557	Valve, 10-port, high-pressure rotary, stainless steel
068535	Valve, 17-port, SS, PEEK
068540	Valve, 17-port, SS, stainless steel
068554	Valve, solenoid, 3-way
068566	Vial cooler vessel

C • TTL and Relay Installation Instructions

This appendix contains installation instructions for the following optional kits and components:

Part Number	Kit/Component	Description
068573	SP TTL and Relay Kit	Provides a controller board, cables, and connectors for adding TTL and relay control to the SP. This kit is also required if you are adding TTL and relay connectors to an AE, or if you are installing the AE Tower Light Kit.
AAA-068548	AE TTL and Relay Kit	Provides connectors, cables, and protective hoods for installing TTL and relay connectors on the AE.
069071 069072	SP TTL Breakout Board SP Relay Breakout Board	Provides interfaces for connecting the connectors on the SP TTL and relay controller board to other devices.
068549	AE Tower Light Kit	Provides a tower of four LED lights, which mounts on top of the AE. Requires installation of the SP TTL and Relay Kit.

Install the SP TTL and Relay Kit first before installing any other kit or the breakout boards.

For TTL and relay control instructions, refer to Section 3.8. For AE tower light control instructions, refer to Section 5.9.

C.1 Installing the SP TTL and Relay Kit

C.1.1 Overview

The SP TTL and Relay Kit (P/N 068573) provides the parts necessary for adding TTL and relay control functions to the SP. The kit includes the following parts:

Part Number	Item	Quantity
045796	Screw, Phillips, stainless steel	8
067039	Panel, TTL/relay	1
067141	Controller board, TTL/relay	1
067746	Cable, TTL, 46 cm (18 in), female-to-female	1
067835	Cable, relay, 46 cm (18 in), male-to-male	1
068174	Connector, female-to-female, DB25	1
068176	Connector, male-to-male, DB25	1
069586	Standoff, 6 mm hex	3

Additional item needed: Phillips screwdriver

C.1.2 SP TTL and Relay Kit Installation Procedure

These are the main steps in the installation procedure:

- Attaching the TTL/relay controller board to the main SP electronics board
- Installing the TTL/relay panel on the SP and connecting the cables (required for stand-alone SP only)

Attach the TTL/Relay Controller Board to the Main SP Electronics Board

1. Turn off the SP power and unplug the power cord.
2. To access the SP electronics board, follow the instructions in Section 10.6.

3. Disconnect the cable at the top right corner of the SP electronics board (see Figure C-1).
4. Screw the three standoffs into the SP electronics board at the locations indicated on Figure C-1.

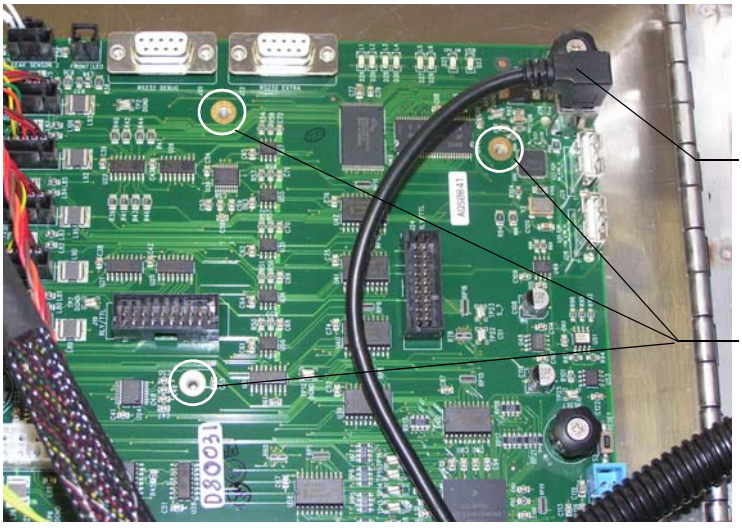


Figure C-1. SP Electronics Board (Horizontal SP Enclosure Shown)

5. Orient the TTL/Relay controller board with the component side facing up and the notched corner on the lower right-hand side (see Figure C-2).
6. Align the two connectors on the back of the TTL/Relay controller board with the corresponding connectors on the main SP electronics board. The connectors on the SP electronics board are in the top right area of the board and are labeled **J19 RLY/TTL** and **J24 RLY/TTL**.
7. Press the TTL/Relay controller board firmly onto the SP electronics board. Tighten the three thumbscrews on TTL/Relay controller board.
8. Reconnect the cable that you disconnected in Step 3.

Figure C-2 shows the TTL/Relay controller board (outlined in white) attached to the SP electronics board.

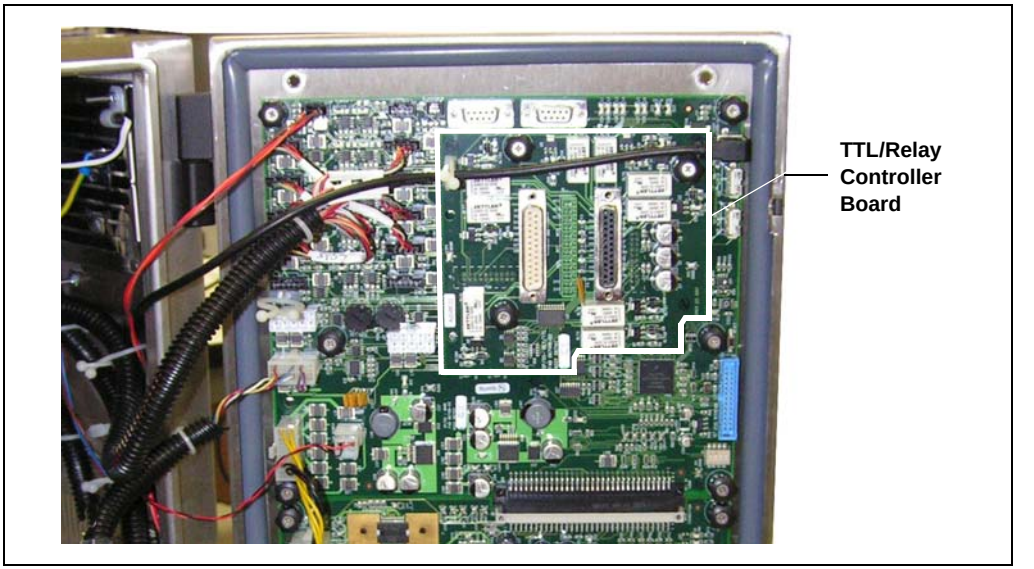


Figure C-2. SP Electronics Board: TTL/Relay Controller Board Installed (Vertical SP Enclosure Shown)

- If you are installing a stand-alone SP, continue to the next section.
- To install the AE TTL and Relay Kit, go on to Section C.2.
- To install the AE Tower Light Kit, go on to Section C.4.

Install the SP TTL/Relay Panel and Connect the Cables

Complete this section only if you are installing a stand-alone SP.

1. On the side of the SP, remove the cover plate indicated in Figure C-3.

Figure C-3. Side of SP: TTL/Relay Panel Not Yet Installed

2. Orient the TTL/relay panel with the TTL and relay connectors at the bottom of the panel and then install the panel where the cover plate was removed (see Figure C-4).

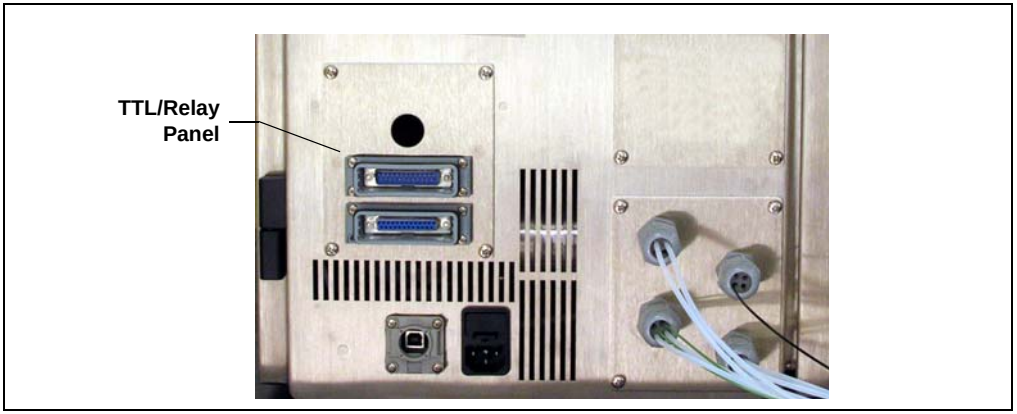


Figure C-4. Side of SP: TTL/Relay Panel Installed

3. Plug one end of the male-to-male relay cable into the male connector on the rear of the TTL/relay panel (inside the SP enclosure) (see Figure C-5).
4. Plug the other end of the cable into the male connector on the TTL/relay controller board.

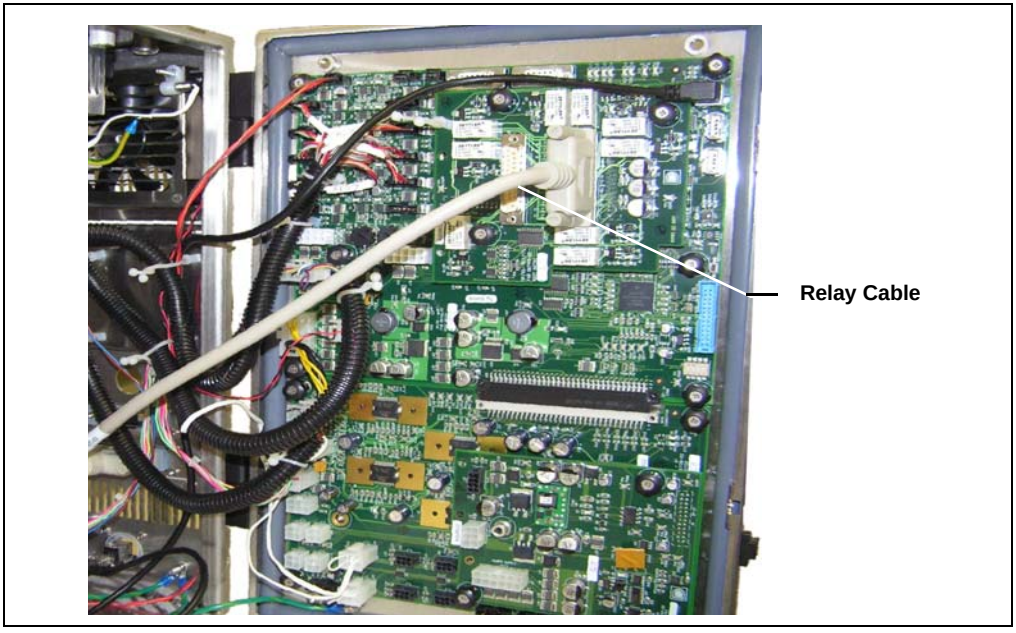


Figure C-5. Cable Plugged Into Relay Connectors on the SP TTL/Relay Panel and SP TTL/Relay Controller Board

5. Plug one end of the female-to-female TTL cable into the female connector on the rear of the TTL/relay panel.
6. Plug the other end of the cable into the female connector on the TTL/relay controller board.
7. Close and latch the SP service door.

C.2 Installing the AE TTL and Relay Kit

NOTE Before completing this procedure, install the SP TTL and Relay Kit (see Section C.1).

C.2.1 Overview

The AE TTL and Relay Kit (P/N AAA-068548) provides the parts necessary for installing TTL and relay connectors onto the top of the AE and connecting them to the TTL and relay controller board in the SP. The kit includes the following parts:

Part Number	Item	Quantity
045796	Screw, Phillips, stainless steel	8
068177	Hood, DB25 connector	2
069010	Cable, TTL, 1.8 m (6 ft), female-to-female	1
069011	Cable, relay, 1.8 m (6 ft), male-to-male	1
069067	Cap nut, with seal	4
069068	Plug, cap nut	2
069071	Insert, 25-pin D-sub connector, female (for relay)	1
069072	Insert, 25-pin D-sub connector, male (for TTL)	1

Additional items needed: Phillips screwdriver

C.2.2 AE TTL and Relay Kit Installation Procedure

These are the main steps in the installation procedure:

- Installing the 25-pin D-sub connector inserts (female and male) in the TTL and relay openings on the top of the AE.
- Connecting the cables between the TTL and relay connectors on the AE and the connectors on the SP TTL and relay controller board.

Install the 25-Pin D-Sub Connector Inserts

1. Lift the lid on the cap that covers one of the two TTL and Relay openings on the top of the AE (see Figure C-6).
2. Remove the screws that attach the cap to the AE and remove the cap.
3. Install either the female (relay) or male (TTL) 25-pin D-sub connector insert into the empty TTL and relay opening and secure it with screws. Figure C-7 shows the relay connector insert installed.
4. Repeat Step 1 through Step 3 for the other connector insert.

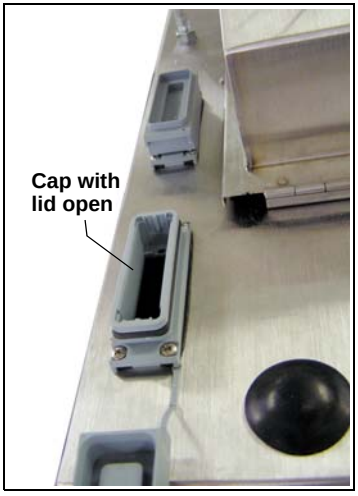


Figure C-6. Top of AE: TTL and Relay Openings with Caps

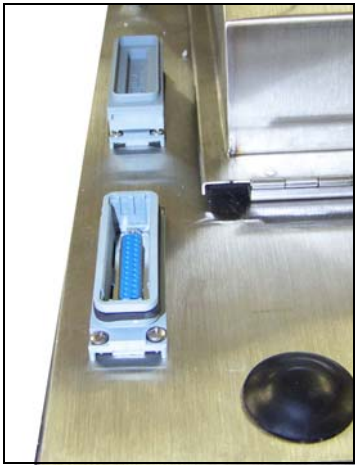


Figure C-7. Connector Insert Installed

Connect the Cables

1. Plug one end of the male-to-male relay cable into the male connector on the TTL/relay controller board on the SP door (see Figure C-8).

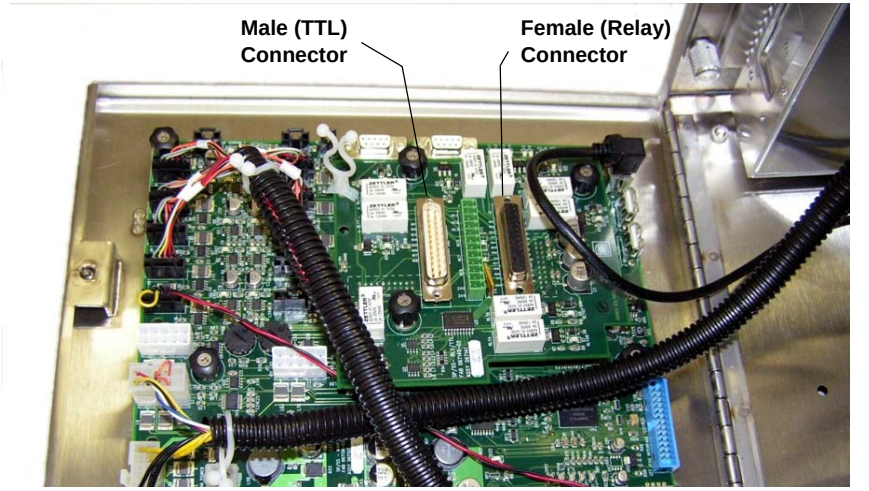


Figure C-8. TTL/Relay Controller Board Installed on SP Electronics Board

2. Route the cable to the inside of the AE. For the horizontal SP enclosure, you can route the cable through the interior of the SP and out through the horizontal slot on top of the SP.
3. Plug the free end of the cable intothe male connector insert inside the AE.
4. Repeat Step 1 through Step 3 for the female cable and connector.
5. Close and secure the SP service door.
6. If you previously removed the SP from the AE back panel:
   - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP onto the rails.
   - Replace any modules that were removed from the lower shelf of the AE.
   - Replace the two access panels on the exterior of the AE.

C.3 Installing the TTL and Relay Breakout Boards

NOTE Before completing this procedure, install the SP TTL and Relay Kit (see Section C.1). If the SP is installed inside an AE or is mounted on the side of the AE, also install the AE TTL and Relay Kit (see Section C.2).

C.3.1 Overview

These are the main steps in the installation procedure:

- Connecting wires to the TTL and relay breakout boards
- Plugging the breakout boards into their respective connectors on the SP or AE
- Assigning TTL input control types (optional)

Additional items needed:

- Phillips screwdriver
- Multiconductor cables (see the specifications below) or individual 24 AWG or 22 AWG (0.51 mm or 0.65 mm) wires

  Multiconductor cables are required for connections to the hooded TTL and relay connectors on top of the AE.

Multiconnector Cable Specifications	
Number of conductors	25 (or fewer, depending on installation requirements)
Size of conductors	24 AWG or 22 AWG (0.51 mm or 0.65 mm)
Outside diameter of cable	0.2 in to 0.5 in (5 mm to 12 mm)
Number of cables	To connect to all pins: For each 25-pin D-sub connector use one 25-conductor cable or two 14-conductor cables. If all pins are not required, you can use cables with fewer than 25 conductors (for example, 12-conductor cables).

C.3.2 TTL and Relay Breakout Board Installation Procedure

Connect Wires to the TTL and Relay Breakout Boards

1. Refer to the following tables to determine which pins on the TTL and relay connectors are required for your installation. For example, for TTL input 1, pins 13 and 25 on the TTL connector are required. For relay output 1, pins 1 and 14 on the relay connector are required. Refer to Table C-1 for the TTL connector and Table C-2 for the relay connector.

Function	Pin	Function	Pin
TTL in 1	13	Ground	25
TTL in 2	12	Ground	24
TTL in 3	11	Ground	23
TTL in 4	10	Ground	22
TTL in 5	9	Ground	21
TTL in 6	8	Ground	20
TTL in 7	7	Ground	19
TTL in 8	6	Ground	18
Unused	5-1	Unused	17-14

Table C-1. SP TTL Connector Pin Functions

Function	Pin	Function	Pin
Relay 1 NO	1	Relay 1 COM	14
Relay 2 NO	2	Relay 2 COM	15
Relay 3 NO	3	Relay 3 COM	16
+5V	4	Ground	17
Relay 4 NO	5	Relay 4 COM	18
Relay 5 NO	6	Relay 5 COM	19
Relay 6 NO	7	Relay 6 COM	20
+5V	8	Ground	21
Relay 7 NO	9	Relay 7 COM	22
Relay 8 NO	10	Relay 8 COM	23
Relay 9 NO	11	Relay 9 COM	24
+5V	12	Ground	25
+24V	13		

Table C-2. SP Relay Connector Pin Functions

2. Obtain the wires or cables required for your installation (see the specifications on page 167.)
3. Strip the covering from the end of the cable (if used) and strip the ends of the wires.

4. Insert the wires into the connectors on the breakout board in the positions required for the installation. Refer to Figure C-9 for the TTL board and Figure C-10 for the relay board. If you are connecting a 25-conductor cable to the board, you can connect wires to all of the positions, if desired.

   Use a screwdriver to tighten the locking screws on the connectors.

When attaching wires to the connectors on the breakout board, be careful not to allow stray strands of wire to short to an adjoining position on the connector.

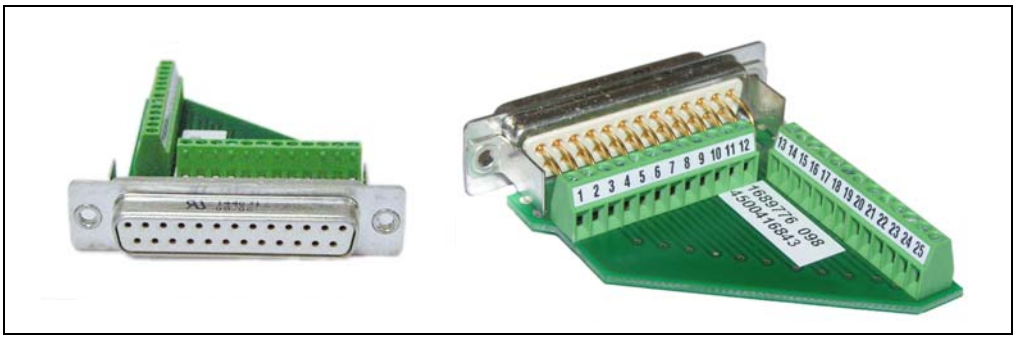


Figure C-9. TTL Breakout Board

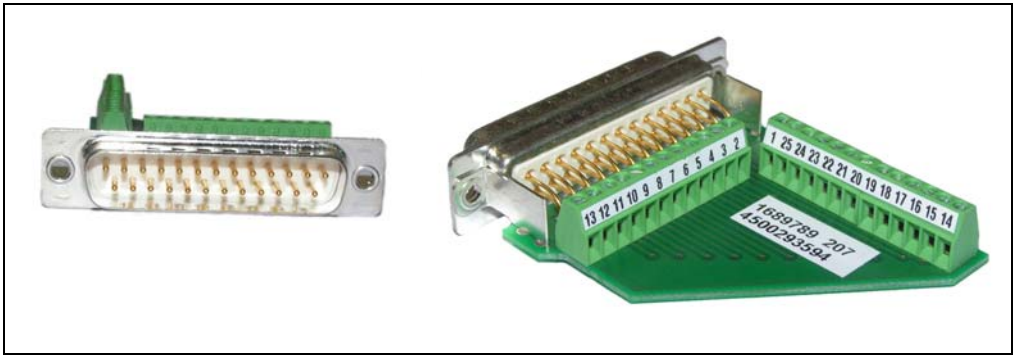


Figure C-10. Relay Breakout Board

Figure C-11 shows an example of a relay breakout board with two pairs of wires connected.

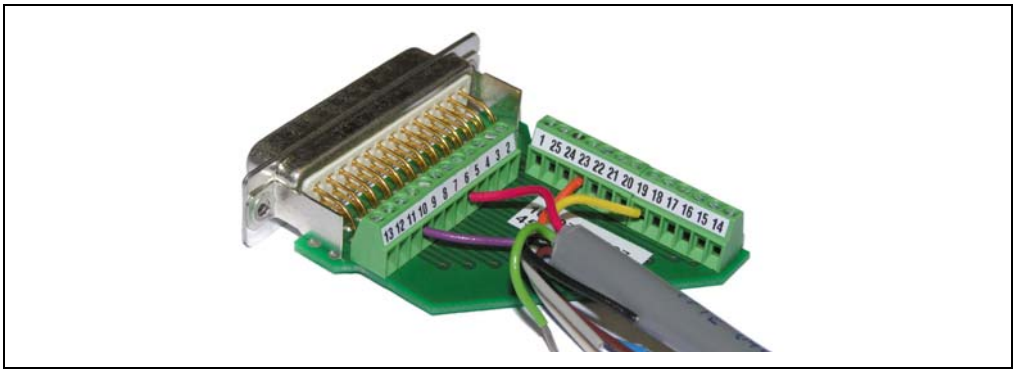


Figure C-11. Example Relay Breakout Board with Wires Connected

Plug In the Breakout Boards

- **To connect to an external SP:** Plug the breakout boards into their corresponding connectors on the side of the SP (see Figure C-12).

  Connect the free ends of the wires to the appropriate connector pins on other devices. Refer to the documentation for the devices for connection details.

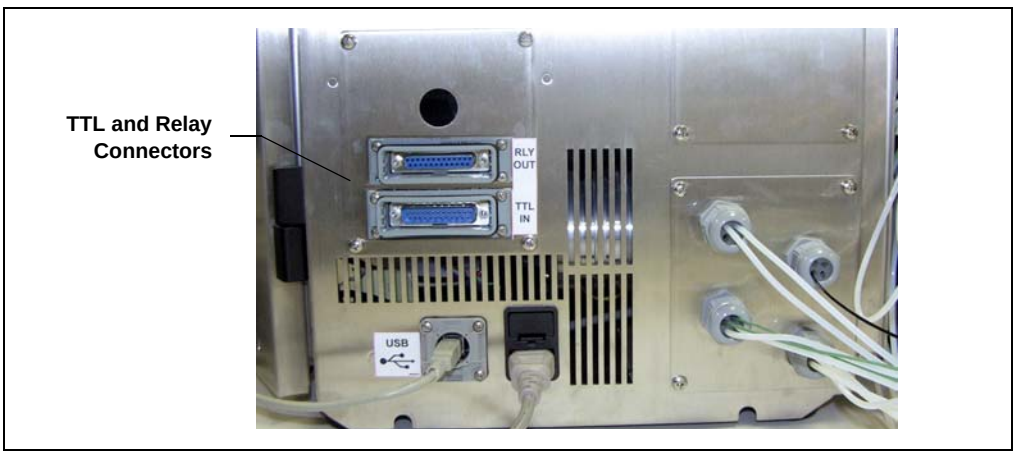


Figure C-12. TTL and Relay Connectors on Side of External SP

- **To connect directly to the SP TTL/Relay Controller Board:** Plug the breakout boards into their corresponding connectors on the board (see Figure C-8).

  Connect the free ends of the wires to the appropriate connector pins on other devices. For connection details, refer to the documentation for the devices.

- **To connect to an AE:**

  Follow the steps below for each breakout board.

  a. Note the color of each connected wire and the pin number to which it is connected. You will need this information when you connect the cable to other devices.

  b. Thread the unconnected end of the cable through the rectangular opening in the AE connector hood (supplied in the AE TTL and Relay Kit).

  c. Continue threading the cable through one of the hood caps on the top of the hood (see Figure C-13).

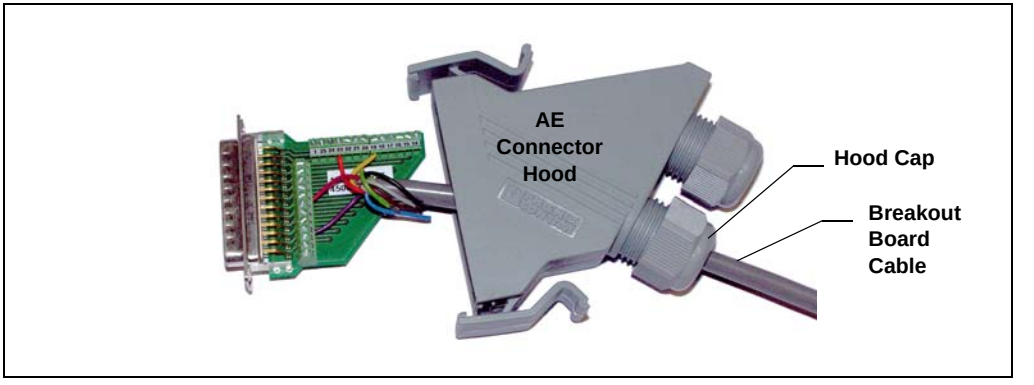


Figure C-13. Installing the Breakout Board in the AE Connector Hood

  d. If you connected two cables to this breakout board, thread the second cable through the other hood cap.

  e. Pull the cable or cables through the hood until the breakout board is inside the connector hood.

f. Secure the breakout board connector with two screws (see Figure C-14).

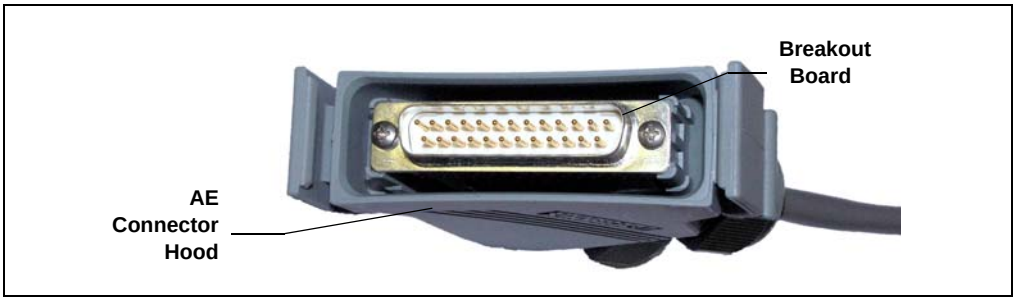


Figure C-14. Breakout Board Installed in the AE Connector Hood

g. Fingertighten the nut on the hood cap to ensure a watertight seal around the cable. Repeat for the second hood cap if used.

h. If the other opening on the hood is unused, insert a plug into the empty cap and tighten the nut.

i. Plug the assembled connector hood into the corresponding TTL or relay connector on the top of the AE (see Figure C-15).

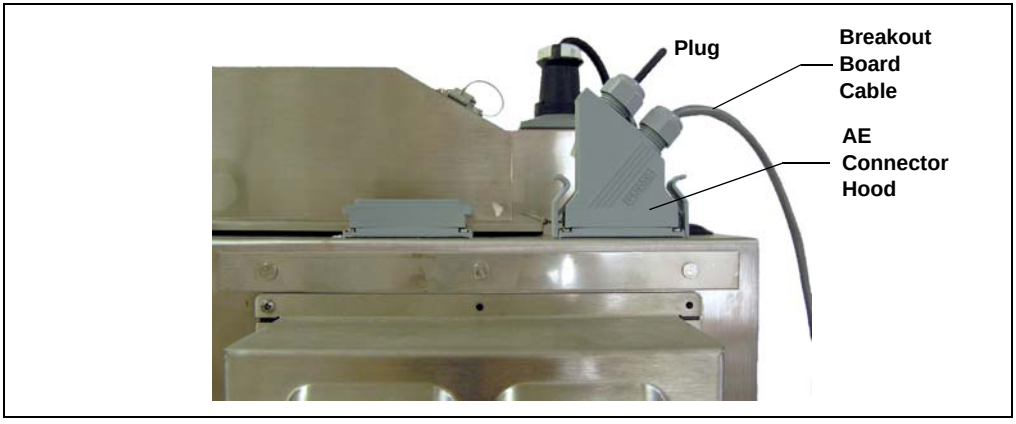


Figure C-15. AE Connector Hood with Breakout Board and Cable Installed

j. Connect the wires from the free end of the cable to the appropriate connector pins on other devices. For connection details, refer to the documentation for the devices.

Assign TTL Input Control Types (Optional)

If you connected a TTL input, verify that the correct input action and control type are selected. Select different settings, if necessary.

The SP TTL inputs respond to four types of signals. The default control type, **Normal Edge**, is compatible with the output signals provided by Thermo Scientific Dionex modules.

If the device connected to the SP does not send a normal edge signal, follow the steps below to select the appropriate control type. To determine the correct type, refer to the documentation provided with the controlling device and to the information in "TTL Input Control Types" on page 176.

To select an input control type:

1. Open the Chromeleon Server Configuration program.
2. Double-click the SP icon under the system (timebase) name (see Figure C-16).

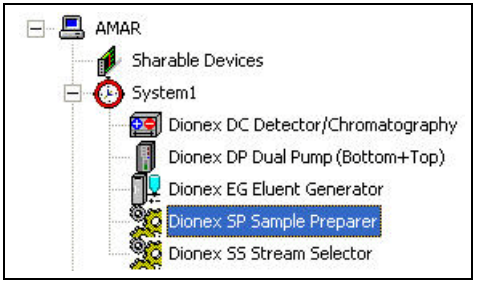


Figure C-16. Chromeleon Server Configuration

3. Select the **TTL Inputs** tab (see Figure C-17).

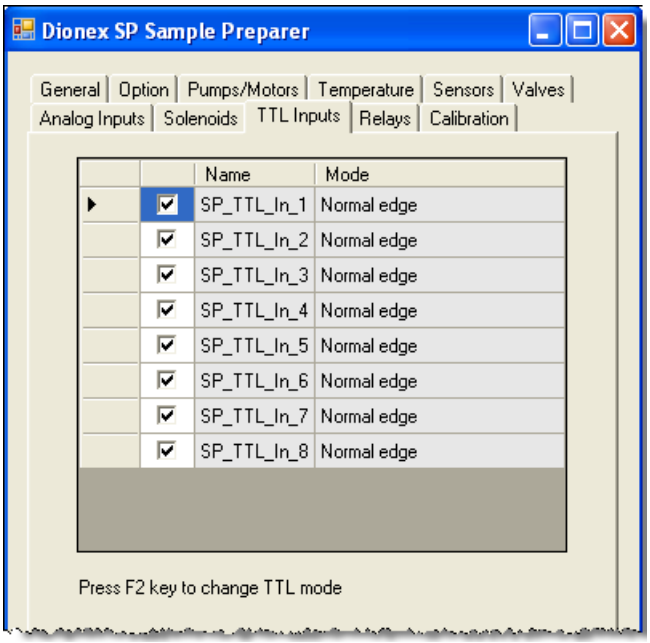


Figure C-17. SP Server Configuration Properties: TTL Inputs

4. Select the name of the input and press the **F2** key. The Device Configuration dialog box for the TTL input appears.
5. Select the **Mode** (see Figure C-16) and click **OK**.

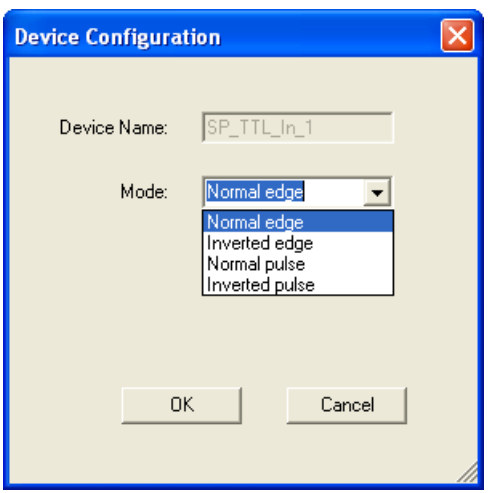
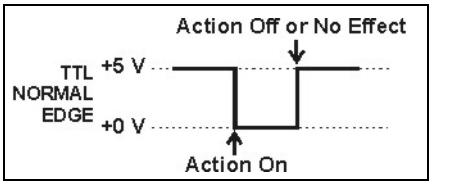


Figure C-18. Selecting TTL Input Modes

TTL Input Control Types

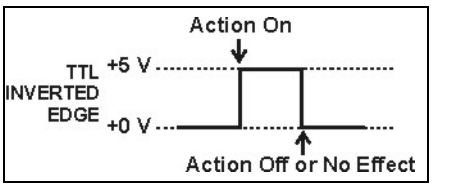
- *Normal Edge*: In normal edge operation, the negative (falling) edge of a signal turns on the action.



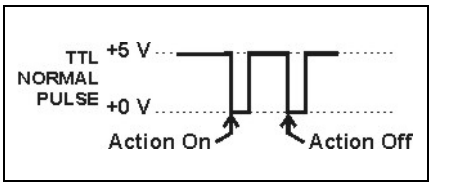
  The function of the positive (rising) edge depends on the action: For on/off or other actions that have two options, the rising edge turns off the action. However, for functions with only one option, the rising edge has no effect.

  For example, for the **Bypass Streams**, **Panel Light**, and **Relay Out** actions, the action remains on as long as the TTL input is low. If the input returns to high, the action is turned off. For example, if an external device triggers a panel light, the light remains on as long as the input is at 0 V (open). When the input returns to +5 V (closed), the alarm turns off. For the **Shutdown** and **Standby** actions, returning the TTL to high has no effect.

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

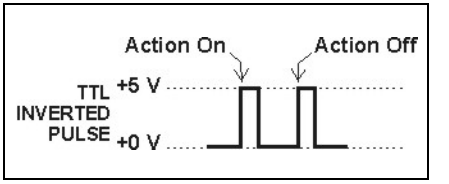


- *Normal Pulse*: In normal pulse operation, the negative (falling) edge of the TTL signal is the active edge and the positive (rising) edge is ignored.



  A pulse width of 50 ms or more is guaranteed to be detected. A pulse width of 4 ms or less is guaranteed to be ignored. The action for pulse widths that are greater than 4 ms and less than 50 ms is undefined.

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



C.4 Installing the AE Tower Light Kit

C.4.1 Overview

The AE Tower Light Kit (P/N 068549) provides parts for mounting a tower with four LED lights onto the top of the AE enclosure. The kit includes the following parts:

Part Number	Item	Quantity
069062	Light, tower, LED, 24 Vdc, red, yellow, green, blue	1
069198	Cable, extension, tower light	1

Additional item needed: Phillips screwdriver

NOTE Before completing this procedure, install the SP TTL and Relay Kit (see Section C.1).

C.4.2 AE Tower Light Kit Installation Procedure

These are the main steps in the installation procedure:

- Mounting the tower light onto the AE
- Connecting the cable

Mount the Tower Light onto the AE

1. Unscrew the ring from the bottom of the tower light and slide the ring off the tower light cable.

2. From the top of the AE, thread the tower light cable through the round opening in the front left corner of the AE (see Figure C-20).

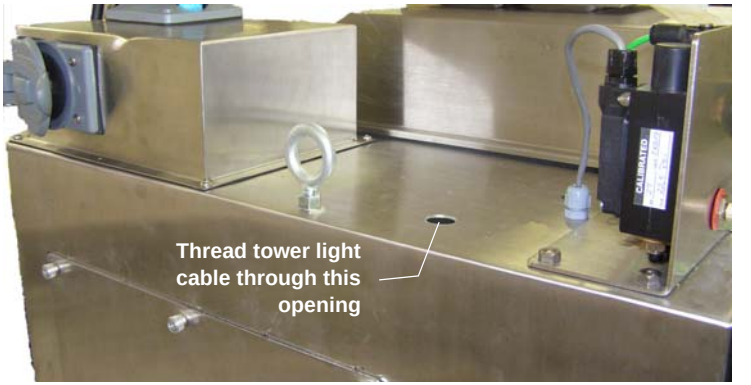


Figure C-19. Opening for Tower Light on Top of AE

3. On the inside of the AE, slide the ring back onto the tower light and tighten the ring to secure the tower light to the top of the AE (see Figure C-20).

Figure C-20. Tower Light Installed

Connect the Cable

1. Connect the extension cable to the tower light cable.
2. Route the cable to the inside of the SP enclosure.
3. If you have not done so already, access the SP electronics board (for instructions, refer to Section 10.6).
4. Plug the other end of the extension cable into the relay connector on the TTL/relay controller board on the SP service door (see Figure C-21).
5. Close and secure the SP service door.

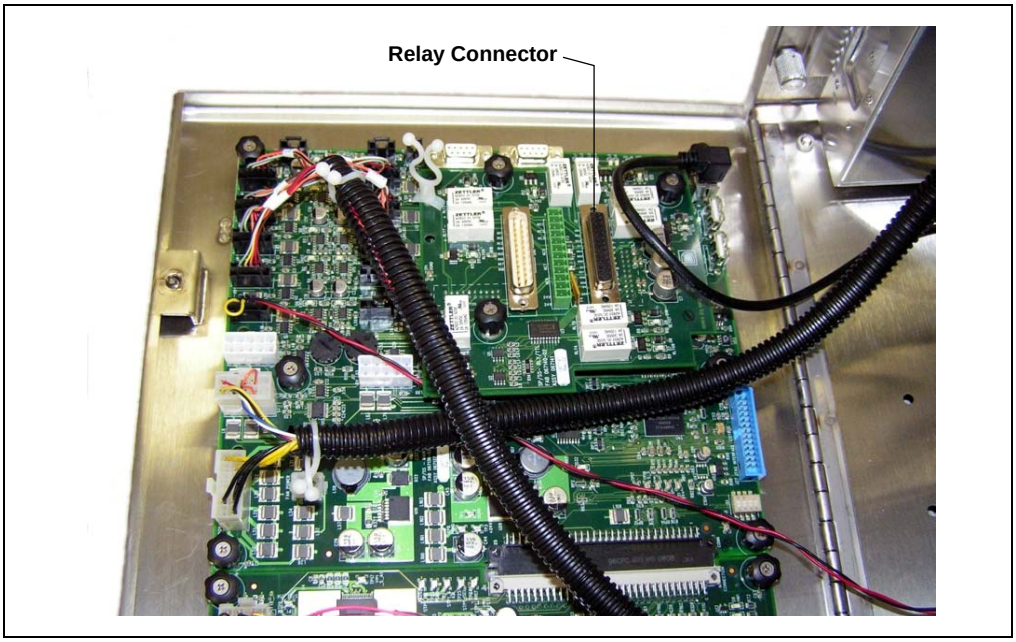


Figure C-21. TTL/Relay Controller Board on SP Service Door (Horizontal SP Enclosure Shown)

6. If you previously removed the SP from the AE back panel:
   - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP on the rails.

- Replace any modules that were removed from the lower shelf of the AE.
- Replace the two access panels on the exterior of the AE.

7. Plug in the power cord and turn on the power.

D • AE Purge Kit Installation Instructions

NOTE **These instructions supplement the information in the manual provided with the purge system. Please refer to the purge system manual for detailed installation requirements and operating instructions.**

D.1 Overview

The AE Purge Kit (P/N 068546) provides the parts necessary for installing a purge system in the AE Analyzer Enclosure. The kit includes the following parts:

Part Number	Item	Quantity
012845	Screw, Phillips, SST	4
067023	Panel, access, AE	1
067024	Panel, cover, A/C	1
067044	Gasket, panel, small	2
067053	Panel, purge, relief valve	1
067054	Panel, purge, orifice	1
067064	Gasket, access panel, AE	1
067066	Gasket, A/C panel	1
068469	Cable assembly, purge control, AE	1
069061	Fitting, seal, gray	1
069091	Purge, control system, Mini Z	1
069597	Rod, fitting plug	2
069598	Plug, drain, SP	1

Additional item needed:

- A source of gas regulated to between 0.41 MPa and 0.79 MPa (60 psi and 115 psi). The gas purity should be appropriate for the application.
- Tubing and fittings for the gas connection. Use tubing with the following minimum specifications: 4 mm (0.16 in) ID X 6 mm (0.25 in) OD.
- Phillips screwdriver.

D.2 AE Purge Kit Installation Procedure

These are the main steps in the installation procedure:

- Installing the purge control unit
- Installing the purge orifice and the pressure relief valve
- Sealing all openings on the enclosures

D.2.1 Installing the Purge Control Unit

1. Turn off the power and unplug the power cord.
2. On the top of the AE, remove the cover plate on the left front corner.
3. With the pressure indicator ball facing toward the front of the AE, install the purge control unit where the cover plate was removed (see Figure D-1).

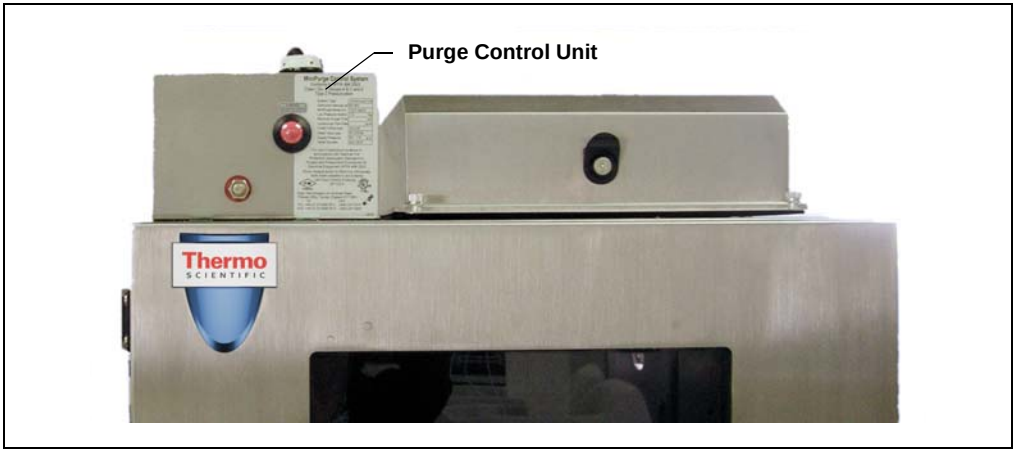


Figure D-1. Purge Control Unit Installed on Top of AE

4. Remove the nut from the gray fitting and insert the fitting into the opening behind the purge control unit.

5. On the inside of the AE, tighten the nut onto the fitting (see Figure D-2).

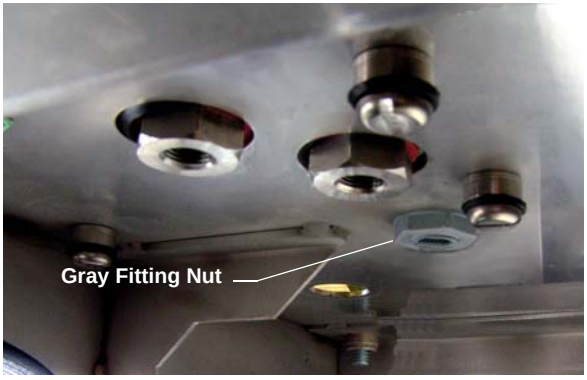


Figure D-2. AE Interior: Gray Fitting Nut Installed

6. On the inside of the AE, thread the red and black wires of the purge control cable through the gray fitting nut (see Figure D-3) and out to the top of the AE.

Figure D-3. AE Interior: Purge Control Cable

7. On the top of the AE, remove the cover on the purge control unit's black box by removing two Phillips screws (see Figure D-4).

Figure D-4. Remove Cover on Black Box

8. Thread the purge control cable through the fitting on the black box cover (see Figure D-5).

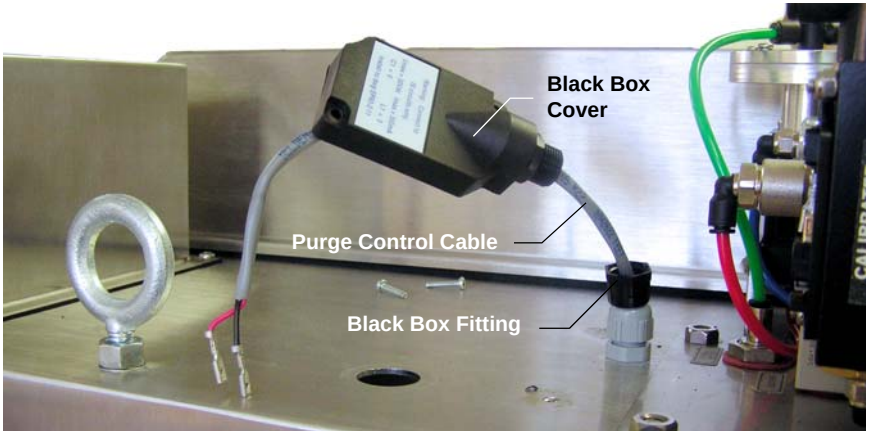


Figure D-5. Install the Purge Control Cable

9. On the purge control unit, plug the red and black wires on the purge control cable into the connectors on the black box. Plug the black wire into the middle connector and the red wire into the outside connector (see Figure D-6).

Figure D-6. Purge Control Cable Connections

10. Reinstall the cover on the purge control unit black box (see Figure D-7) and tighten its fitting.

Figure D-7. Purge Control Unit Installed (Rear View)

11. Tighten the gray fitting.

12. Inside the AE, locate the connectors on the top left side. Remove the jumper from the second connector from the left (see Figure D-9). To remove the jumper, squeeze the front of the jumper and pull down.

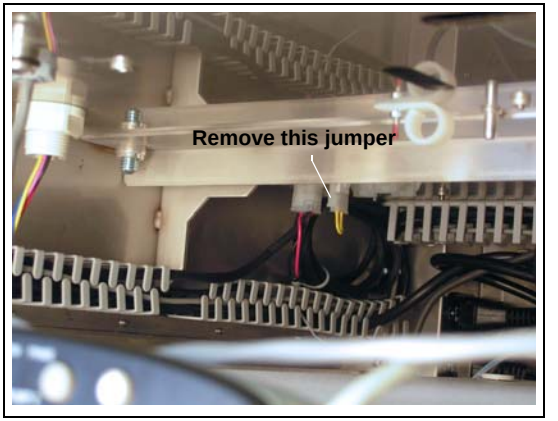


Figure D-8. AE Interior: Remove Jumper

NOTE Save the jumper. It must be reinstalled if the purge control cable is not connected.

13. Plug the purge control cable into the connector where the jumper was removed (see Figure D-9).

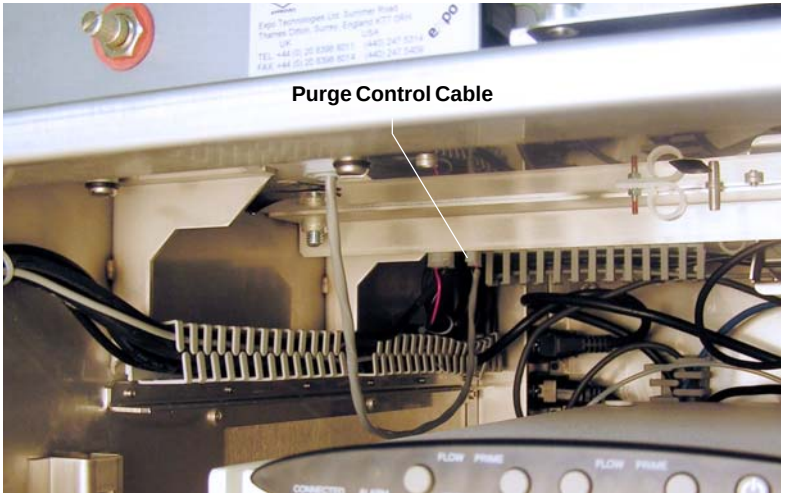


Figure D-9. AE Interior: Purge Control Cable Connection

D.2.2 Installing the Purge Orifice/Spark Arrestor and the Pressure Relief Valve

1. Follow the instructions in the manual provided with the purge control system to install the purge orifice in the spark arrestor. Use the smallest orifice provided with the purge control system.
2. Attach the assembled orifice/spark arrestor to its mounting panel (see Figure D-10, View A).
3. Attach the pressure relief valve to its mounting panel (see Figure D-10, View B).

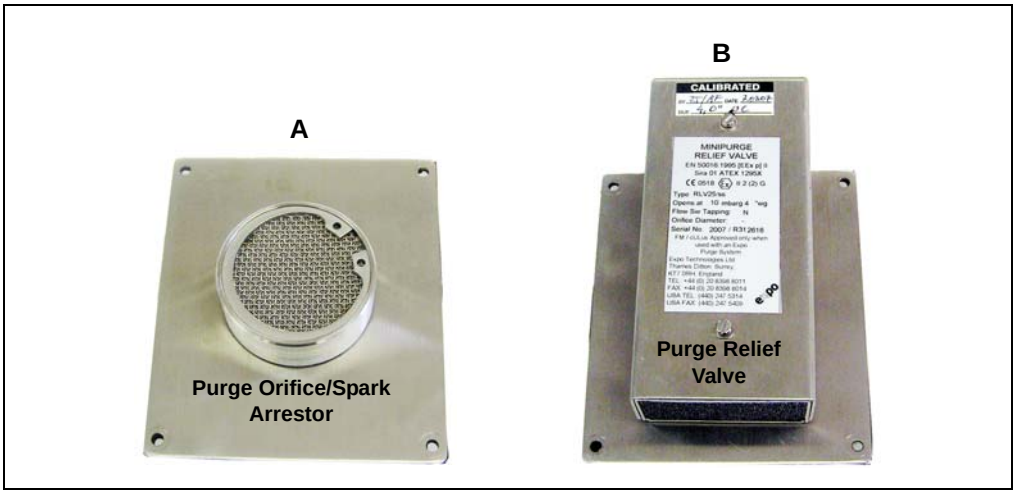


Figure D-10. Purge Orifice and Relief Valve on Mounting Panels

4. Remove the cover plates from any two small rectangular openings on the AE, LE, or SP enclosures. The available locations depend on the configuration of enclosures installed in the system.

   NOTE If the AE is mounted on the wall and an SP is mounted on the right side of the AE, install the orifice/spark arrestor on the bottom of the SP or on the bottom rear of the AE.

5. Install the purge orifice/spark arrestor and the pressure relief valve in the two openings. In the example installation shown in Figure D-10,

the purge orifice/spark arrestor and relief valve are installed on the right side of an LE.

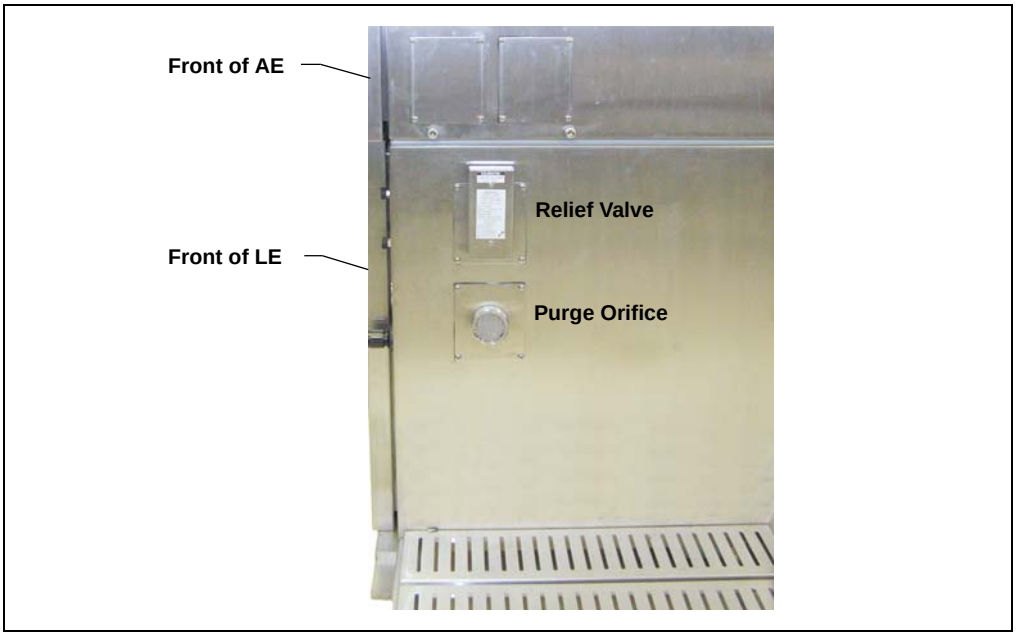


Figure D-11. Purge Orifice and Relief Valve Installed on Right Side of LE (Example Configuration)

D.2.3 Sealing All Openings on the Enclosures

To prevent air leaks when the purge system is in operation, seal all openings on the Dionex Integral system enclosures, including the following:

- Replace any vented panels on the enclosures and cover larger openings with the solid panels included in the AE Purge Kit. Install the included gaskets to ensure airtight seals.
- On the top of the AE, install screws with seals in the open screw holes (see Figure D-12) and install a gray fitting in the larger round opening. Insert a rod into the top of the gray fitting and tighten the fitting nut.

Figure D-12. Openings to Be Sealed on Top of the AE

- If the AE is not mounted on a wall, install screws with seals in the six mounting holes on the rear of the AE.

- If an SP is installed, insert a plug in the drain inside the SP (see Figure D-13).

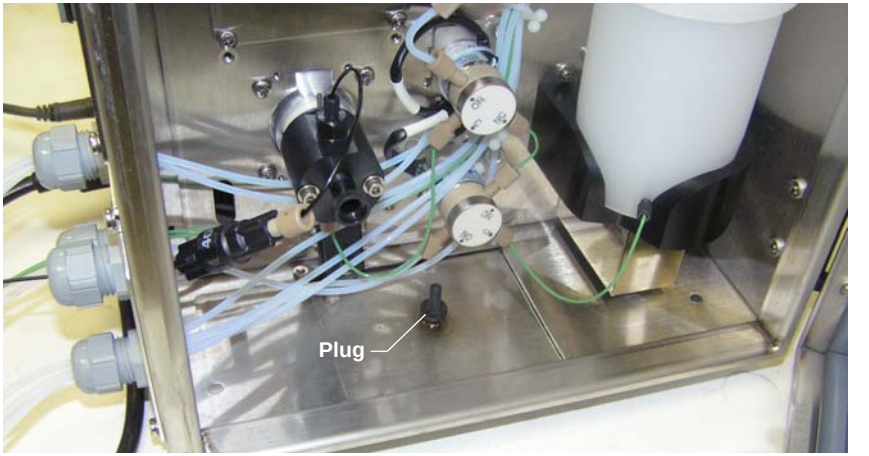


Figure D-13. Plug in SP Drain

- If the AE is mounted on the wall, install a plug in the drain under the AE (see Figure D-14)

Figure D-14. Plug in AE Drain (Under the AE on the Left Side)

E • Peristaltic Pump Kit Installation Instructions

E.1 Overview

The Peristaltic Pump Kit (P/N 068558) provides the parts necessary for installing a peristaltic pump on the SP Sample Preparer panel. The kit includes the following parts:

Part Number	Item	Quantity
045689	Washer	4
045938	Screw, Phillips	4
063268	Tubing, 0.159-mm ID x 3.175 OD (0.063-in ID x 0.125-in OD), PharMed®	36 in
068125	Cable assembly, peristaltic pump	1
069045	Pump, peristaltic	1
069103	Panel, pump/valve mounting, SP	1
069324	Adapter set, tubing, peristaltic	1

Additional item needed:

- Phillips screwdriver

E.2 Peristaltic Pump Installation Procedure

These are the main steps in the installation procedure:

- Installing the pump on the SP panel
- Connecting the pump cable
- Assembling the peristaltic tubing and fittings
- Installing the peristaltic tubing in the pump
- Configuring the pump in the Chromeleon Server Configuration program

E.2.1 Installing the Peristaltic Pump on the SP Panel

1. Turn off the SP power and disconnect the power cord.
2. Orient the peristaltic pump on the mounting panel as shown in Figure E-1 and attach the pump to the mounting panel using the four washers and Phillips screws supplied in the kit.

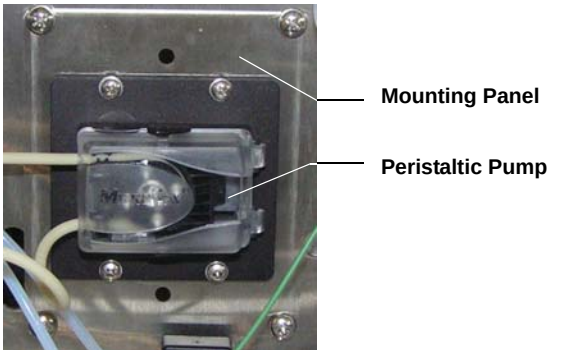


Figure E-1. Peristaltic Pump on SP Panel

3. Slide the body of the pump through the opening on the SP panel. Attach the pump mounting panel to the SP panel as show in Figure E-1.

E.2.2 Connecting the Pump Cable

1. Plug the pump cable into the connector on the rear of the pump.
2. The other end of the cable connects to the SP electronics board, which is installed on the SP service door. To access the SP electronics board, follow the instructions in Section 10.6.
3. Plug the free end of the peristaltic pump cable into the SP electronics board at the following position:
   - If you are installing the first or only peristaltic pump, plug in the cable at position **SV09**.
   - If you are installing a second peristaltic pump, plug in the cable at position **SV10**.

See Figure E-2 and Figure E-3 for the location of **SV09** and **SV10** on the SP electronics board.

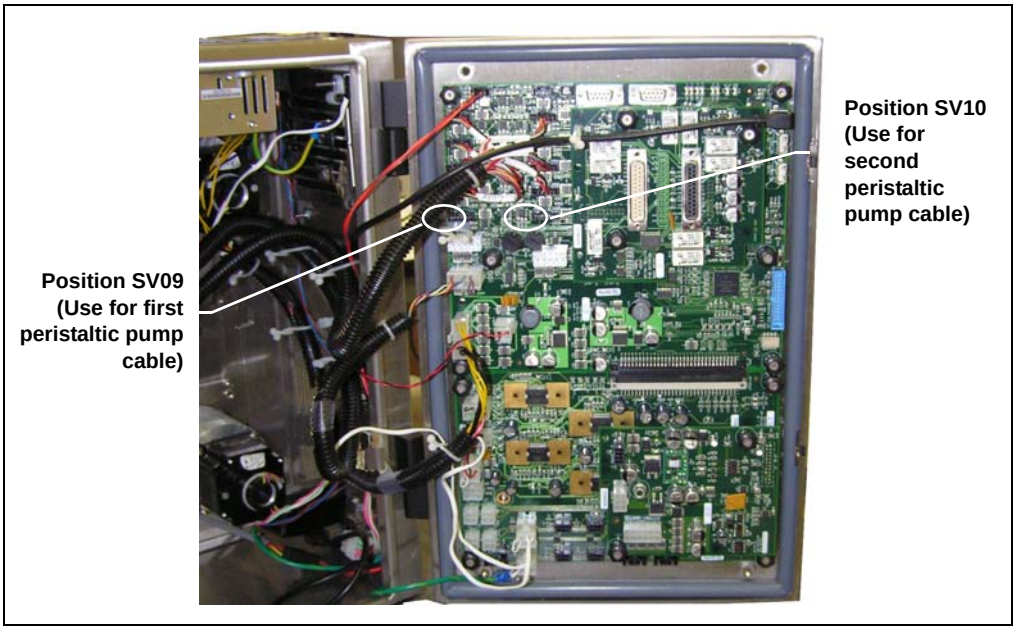


Figure E-2. SP Vertical Enclosure: Service Door Open

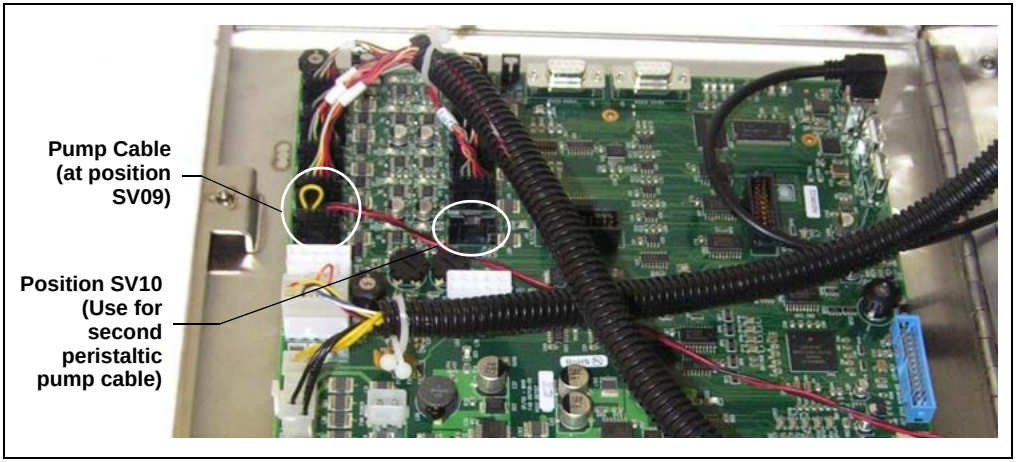


Figure E-3. SP Horizontal Enclosure: Service Door Open

4. Close and secure the SP service door.

E.2.3 Assembling the Peristaltic Tubing and Fittings

1. Install the peristaltic tubing adapter parts on the PharMed tubing in the order and orientation shown in Figure E-4. Use the retainer sleeve with an inside diameter that is closest in size to the outside diameter of the tubing.
2. Push the point of the adapter body into the tubing until the tubing is flush with the adapter body (see Figure E-4).

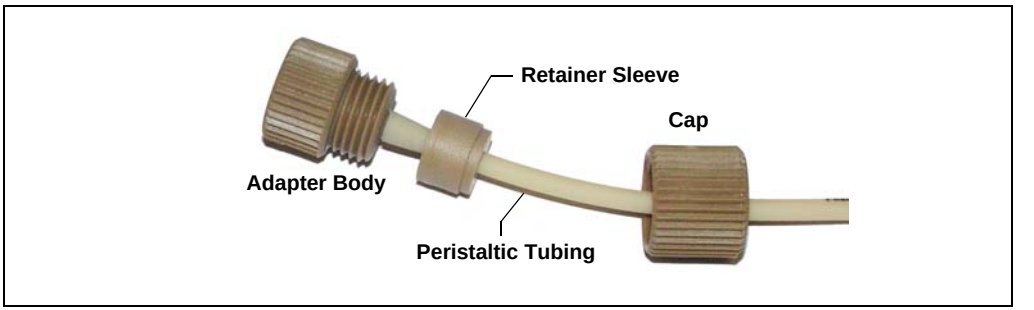


Figure E-4. Peristaltic Tubing Adapter Connections

3. Slide the cap over the retainer sleeve and tighten the cap onto the body.
4. Repeat Step 1 through Step 3 to install the tubing adapter on the other end of the tubing.
5. Lift open the door of the peristaltic pump.

6. Squeeze the two tabs on the top and bottom of the tubing clamp and slide the clamp to the right. This opens the clamp (see Figure E-5).
7. Wrap the tubing loosely around the pump head rollers (see Figure E-5), allowing the ends to extend approximately equally from the pump.

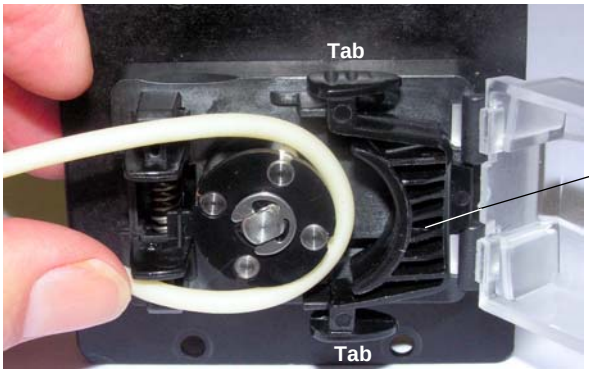


Figure E-5. Peristaltic Tubing Installation

8. Push down on the top tubing clip to open it, insert the tubing into the clip opening, and then release the clip (see Figure E-6).

Figure E-6. Peristaltic Tubing Installation (Continued)

9. Wrap the tubing snugly around the pump head rollers. Lift up the bottom tubing clip to open it, insert the tubing into the clip opening, and then release the clip (see Figure E-7).
10. Close the tubing clamp by pushing it to the left until the tabs lock into place (see Figure E-7).

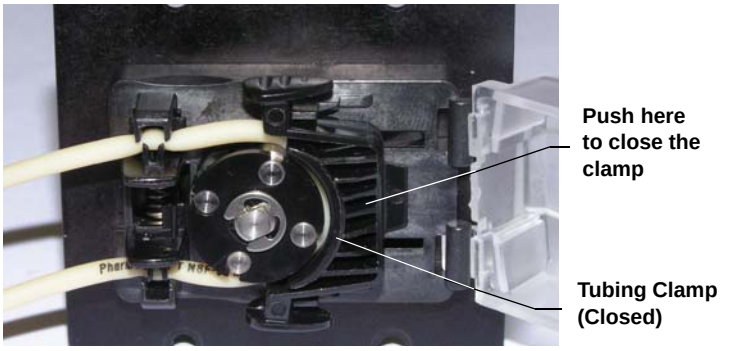


Figure E-7. Peristaltic Tubing Installation Completed

11. Close the pump door, making sure both tabs are outside the door (see Figure E-7).

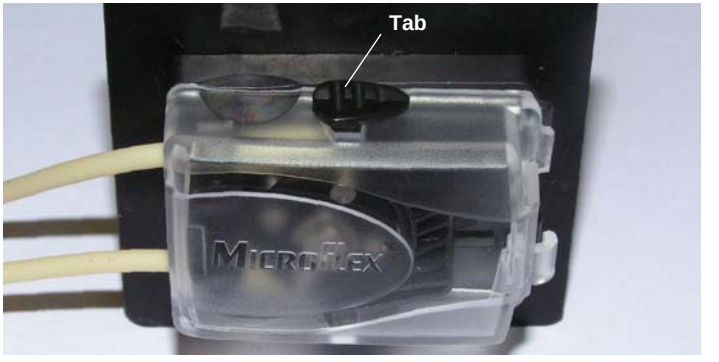


Figure E-8. Peristaltic Pump with Door Closed

12. Connect plumbing lines to the peristaltic tubing fittings as required for your application. Use the fitting nuts and ferrules supplied with

the peristaltic tubing adapter set. Install the nut and ferrule on the tubing as shown in Figure E-9.

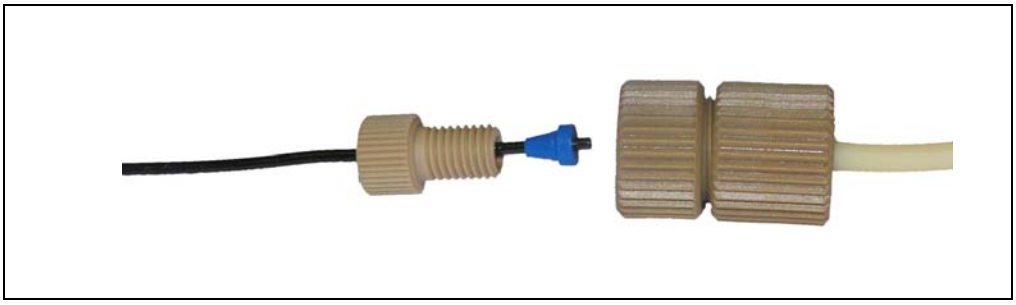


Figure E-9. Fitting Nut and Ferrule for Peristaltic Tubing Connections

13. If you removed the SP from the AE back panel during this installation procedure:
    - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP on the rails.
    - Replace any modules that were removed from the lower shelf of the AE.
    - Replace the two access panels on the exterior of the AE.
14. Plug in the power cord and turn on the power.

E.2.4 Configuring the Pump in Chromeleon

1. Start the Chromeleon Server Configuration program.
2. Double-click the **SP** icon under the system (timebase) name (see Figure E-10).
3. On the **Properties** dialog box, click the **Solenoids** tab.

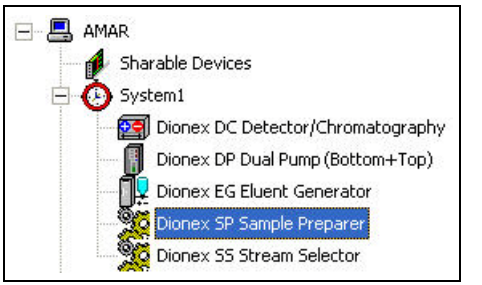


Figure E-10. Chromeleon Server Configuration

4. Select **SV9** (or **SV10** if you are configuring a second pump) and press **F2**.
5. In the **Device Configuration** dialog box, under **Mode**, select **DeviceControl** and click **OK**. The solenoid valve 9 (or 10) connector on the SP electronics board is now assigned to control the peristaltic pump (not a solenoid valve) (see Figure E-11).

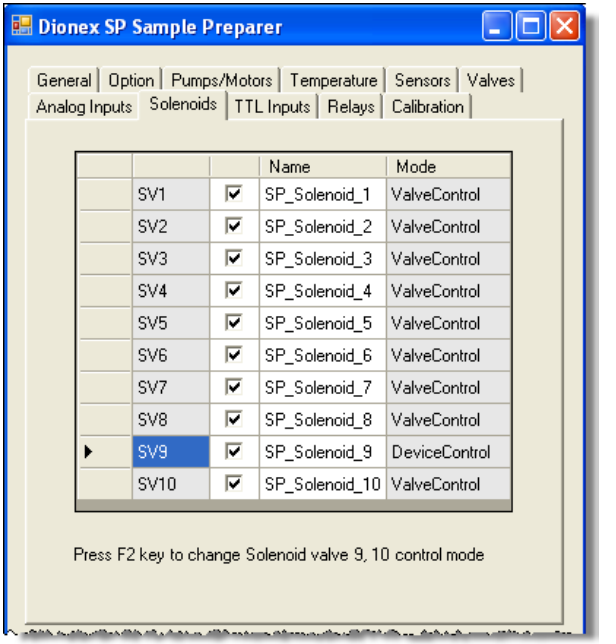


Figure E-11. Chromeleon Server Configuration: Solenoids Page

6. Save the configuration.

F • Liquid Level Sensor Installation Instructions

F.1 Overview

The Liquid Level Sensor Kit (P/N AAA-068563) provides the parts necessary for installing a liquid level sensor on a plastic or glass liquid reservoir. The kit includes the following parts:

Part Number	Item	Quantity
064634	Tape, dual-lock	4
067739	Cable assembly, liquid level sensor	1
069318	Tie, Velcro® cinch strap, 45 cm (18 in)	1
069319	Tie, Velcro cinch strap, 61 cm (24 in)	1
069320	Tie, Velcro cinch strap, 122 cm (48 in)	1

NOTE The liquid level sensor cannot be used with a stainless steel NOWPak container.

F.2 Liquid Level Sensor Installation Procedure

These are the main steps in the installation procedure:

- Installing the liquid level sensor on the reservoir
- Plugging the liquid level sensor cable into the SP electronics board

F.2.1 Installing the Liquid Level Sensor on the Reservoir

1. Remove the label from the back of the liquid level sensor (see Figure F-1).

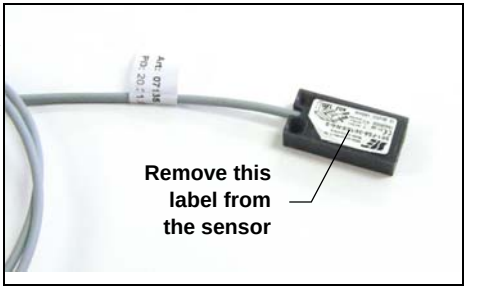


Figure F-1. Sensor with Label

2. Remove the paper backing from a piece of dual-lock tape and press the tape onto the sensor where the label was removed (see Figure F-2).

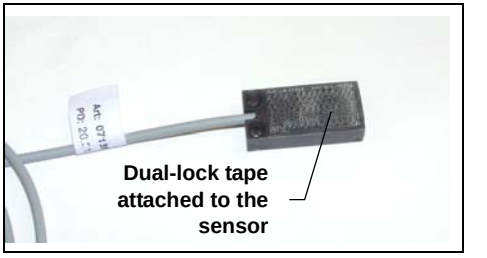


Figure F-2. Sensor with Dual-Lock Tape

3. The three lengths of cinch strap provided in the kit are designed to fit a 2 L reservoir, a 4 L reservoir, and a 20 L NOWPak container. Select the length of cinch strap required.
4. Wrap the cinch strap around the reservoir and loosely secure it. Then, slide the cinch strap off the reservoir.
5. Remove the paper backing from a piece of dual-lock tape and press the tape onto the back of the cinch strap, near the buckle (see Figure F-3).

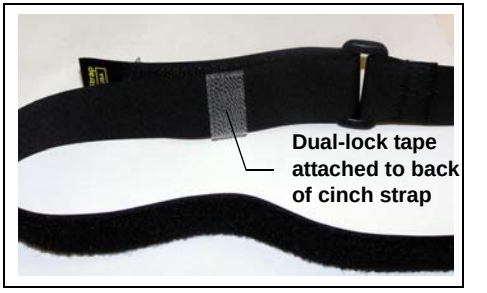


Figure F-3. Cinch Strap with Dual-Lock Tape Attached

6. Slide the cinch strap back onto the reservoir and position it at the location on the reservoir where you want to install the sensor.
7. Insert the liquid sensor between the reservoir and the cinch strap (see Figure F-4).
8. To secure the sensor onto the cinch strap, press together the two pieces of dual-lock tape (on the sensor and the cinch strap).
9. Tighten the strap around the reservoir.

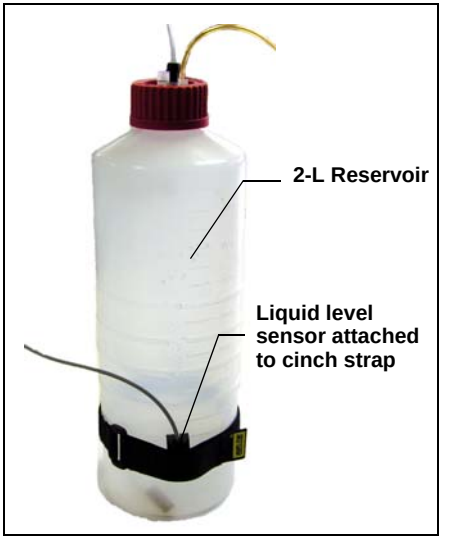


Figure F-4. Sensor Installed on Reservoir

F.2.2 Plugging the Liquid Level Sensor Cable into the SP Electronics Board

1. Turn off the SP power and disconnect the power cord.
2. Follow the instructions in Section 10.6 to access the SP electronics board installed on the SP service door.

3. Route the liquid level sensor cable to the SP electronics board. Four connectors for the liquid level sensors are located on the bottom left corner of the board (see Figure F-5).
4. Plug the cable into the corresponding connector on the board. For example, plug the cable from sensor 1 into connector 1 (see Figure F-5).

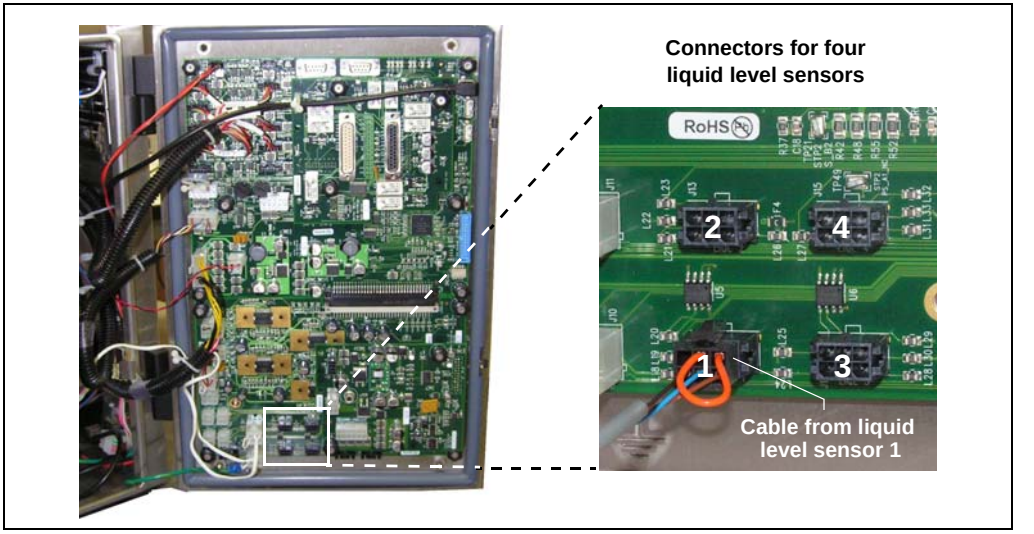


Figure F-5. SP Electronics Board (Vertical Enclosure Shown): Liquid Level Sensor Connectors

5. Close and secure the SP service door.
6. If you removed the SP from the AE back panel:
   - Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE back panel, and hang the SP on the rails.
   - Replace any modules that were removed from the lower shelf of the AE.
   - Replace the two access panels on the exterior of the AE.
7. Plug in the power cord and turn on the power.
8. Open the Chromeleon Server Configuration program and open the SP **Properties** dialog box. The **LiquidLevelSensor_1** (or

LiquidLevelSensor_2, etc.) check box is enabled on the **Sensors** page (see Figure F-6).

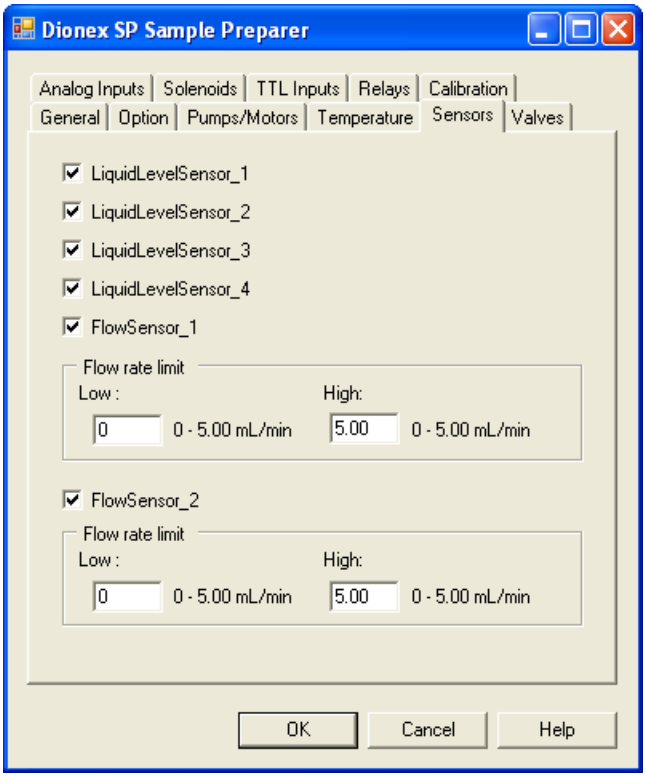


Figure F-6. Chromeleon Server Configuration: Sensors Page

9. Save the configuration.

G • Thermal Options Installation Instructions

This appendix provides instructions for installing the following components in an SP Sample Preparer:

Part Number	Option	Description
068572	Thermal Control Board Kit	Provides a thermal control board and cables (this kit is required for operation of both the heated dilution vessel and the vial cooler)
068524	Heated Dilution Vessel	Provides a 50 mL dilution vessel with heater and stir bar
068566	Vial Cooler	Provides a vial cooler, cable, and mounting hardware

Install the Thermal Control Board Kit first before installing the heated dilution vessel or vial cooler.

G.1 Installing the Thermal Control Board Kit

G.1.1 Overview

The Thermal Control Board Kit (P/N 068572) provides the parts necessary for adding a thermal control board to the main SP electronics board. The kit includes the following parts:

Part Number	Item	Quantity
067143	Control board assembly, thermal	1
067744	Cable assembly, heated dilution vessel, extension	1
067727	Cable assembly, DC power	1
069589	Standoff, 6 mm hex	2

G.1.2 Thermal Control Board Installation Procedure

1. Turn off the SP power and unplug the power cord.
2. To access the SP electronics board, follow the instructions in Section 10.6.
3. Screw the two standoffs into the SP electronics board at the locations indicated on Figure G-1.
4. Orient the thermal control board with the component side facing up.
5. Align the connector on the back of the thermal control board with the corresponding connector on the bottom right side of the main SP electronics board (see Figure G-1).

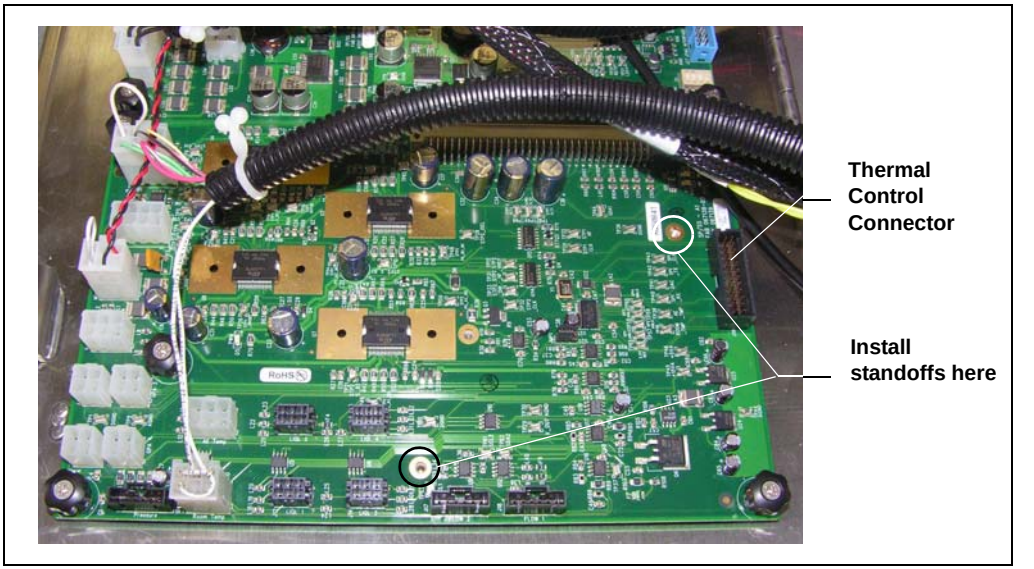


Figure G-1. SP Electronics Board (Horizontal SP Enclosure Shown)

6. Press the thermal control board firmly onto the SP electronics board. Tighten the two thumbscrews on the thermal control board.

Figure G-2 shows the thermal control board (outlined in white) attached to the SP electronics board.

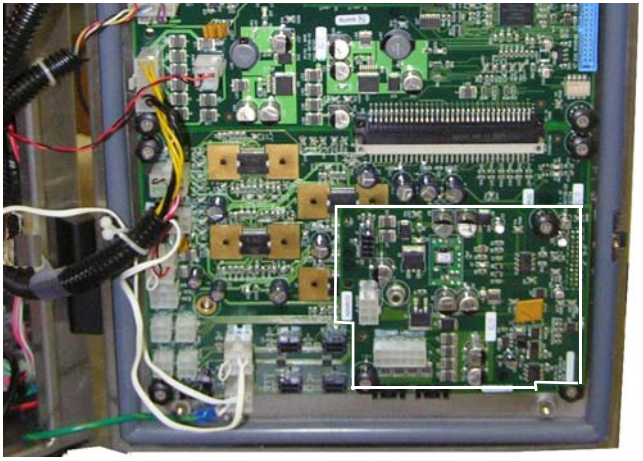


Figure G-2. SP Electronics Board: Thermal Control Board Installed (Vertical SP Enclosure Shown)

7. Plug the cable from the SP power supply into the connector labeled **POWER SUPPLY** on the thermal control board (see Figure G-3).

Figure G-3. SP Electronics Board: Thermal Control Power Supply Cable Installed

G.2 Installing the Vial Cooler

G.2.1 Overview

These are the main steps in the installation procedure for the vial cooler vessel (P/N 068566):

- Installing the Thermal Control Board Kit (see Section G.1 for instructions)
- Installing the vial cooler on the SP panel
- Connecting the cable

G.2.2 Vial Cooler Installation Procedure

1. On the SP panel, remove the cover plate shown in Figure G-4.

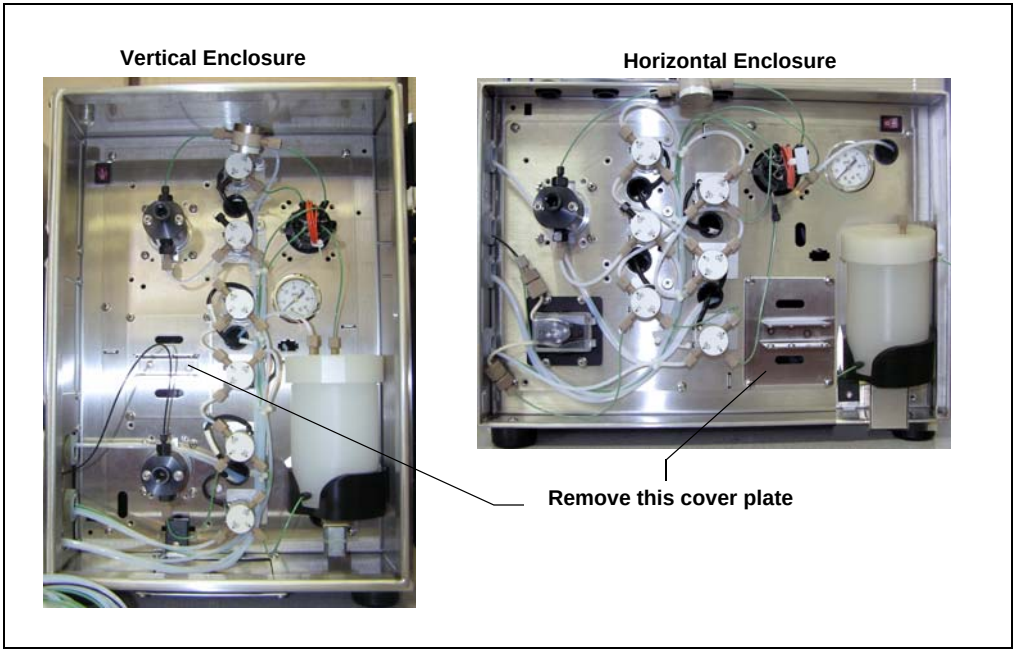


Figure G-4. SP Panel: Remove Cover Plate

2. Thread the cable from the vial cooler through the opening in the SP panel.
3. Attach the vial cooler mounting panel to the SP panel.
4. Plug the vial cooler cable into the connector labeled **COOLER** on the thermal control board (see Figure G-3).

G.3 Installing the Heated Dilution Vessel

G.3.1 Overview

These are the main steps in the installation procedure for the heated dilution vessel (P/N 068524):

- Installing the Thermal Control Board Kit (see Section G.1 for instructions)
- Connecting the heated dilution vessel extension cable to the thermal control board
- Installing the heated dilution vessel on the SP panel
- Connecting the cable
- Connecting the liquid and gas lines

G.3.2 Heated Dilution Vessel Installation Procedure

1. Plug the heated dilution vessel extension cable into the connector labeled **HEATER** on the thermal control board (see Figure G-3).
2. Align the notch on the rear of the heated dilution vessel (see Figure G-5) with the pin on the dilution vessel holder on the SP panel.
3. Install the heated dilution vessel assembly onto the holder (see Figure G-6).

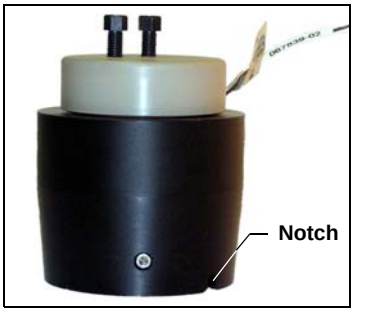


Figure G-5. Heated Dilution Vessel

4. Plug the cable from the heated dilution vessel assembly into the connector on the SP panel.
5. Connect the lines from the metering valve and the gas valve to the top of the heated dilution vessel (refer to Figure 3-15 for the SP1 flow schematic and Figure 3-18 for the SP2 flow schematic).
6. Connect the liquid line from the DV valve to the bottom of the heated dilution vessel.

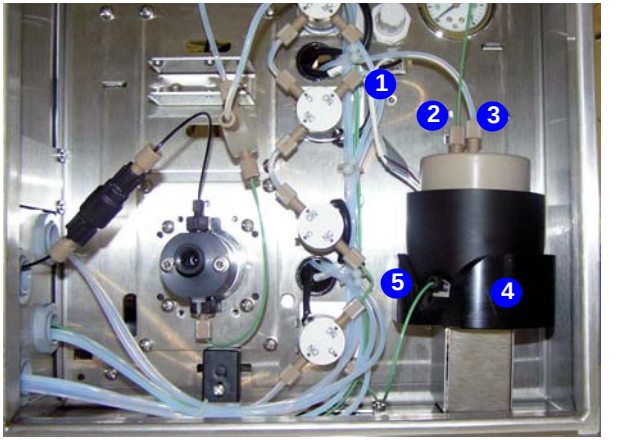


Figure G-6. Heated Dilution Vessel Installed on SP Panel (Vertical SP Enclosure Shown)

H • Lockout Instructions for AE, SP, and SS

1. Notify all affected and other persons of intended lockout.
2. Turn off the power to the module being locked out by moving the power switch to the off (O) position.

   Figure H-1 shows the power switch located in the SP/SS. For details about SP/SS power connections, refer to Section 3.3. Figure H-2 shows the power switch location on the AE/LE. For details about AE/LE power connections, refer to Section 5.4.

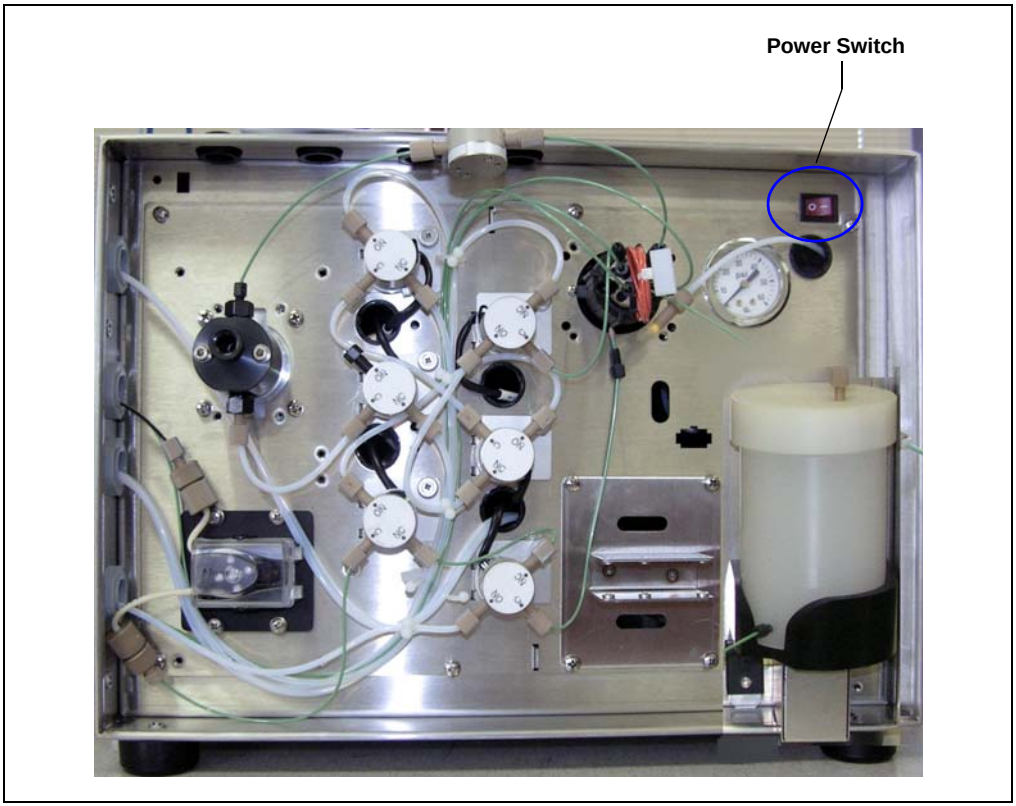


Figure H-1. SP/SS Power Switch

Figure H-2. AE Power Switch

3. To protect the module from being powered up, follow the steps below:

   a. Use a lockout device similar to the one shown in Figure H-3. For a standard-size plug, use HUBBELL P/N HLDMP, as shown in Figure H-3. The cable shown in Figure H-3 is a molded power cable used as an example.

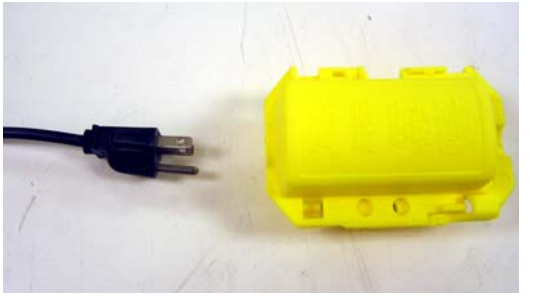


Figure H-3. Lockout Device

b. Open the lockout device and insert the power connector into the device (see Figure H-4).

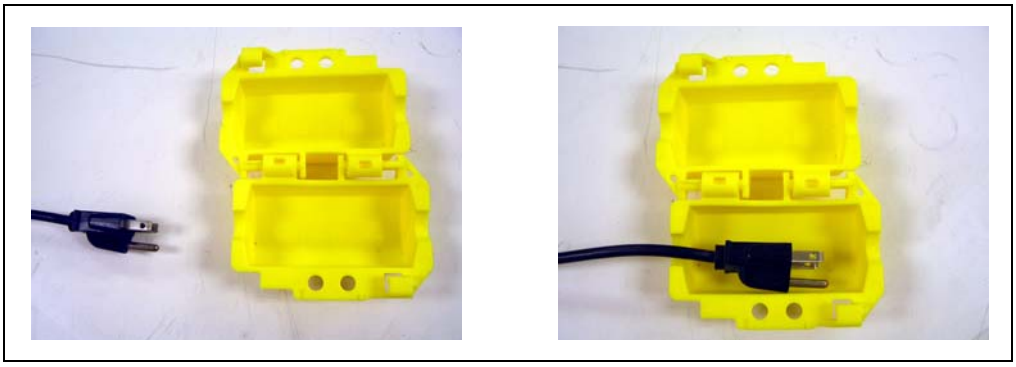


Figure H-4. Insert Power Connector into Lockout Device

c. Close the lockout device and slide the cover so that the padlock holes are lined up between the cover and the base (see Figure H-5, view A). Insert a padlock (see Figure H-5, view B).

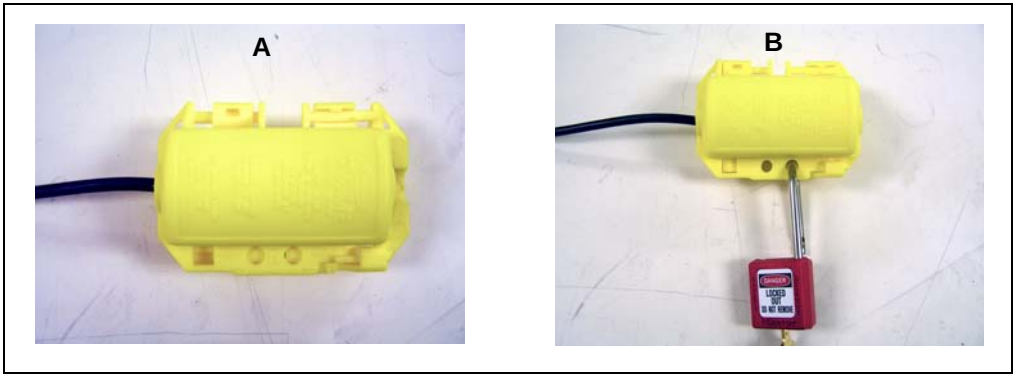


Figure H-5. Close Lockout Device and Attach Padlock.

d. Secure the padlock as shown in Figure H-6. Lock the padlock and remove the keys.

Figure H-6. Lock Padlock and Remove Keys

Notes

- More than one padlock can be used.
- For different power plugs, other lockout devices are available from HUBBELL.
- The standard plug uses P/N HLDMP. Bigger power plugs may use P/N HLD, or HLD2, also available from HUBBELL.
- For more information, go to: http://www.hubbellcatalog.com/wiring/

Re-energizing the Module

1. Unlock the padlock on the lockout device and remove the padlock.
2. Open the lockout device and remove the power connector.
3. Connect the power connector and turn on the power to the module.

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