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Dionex Integral Process Analytical Systems Operator's Manual

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Revision history: Revision 01 released 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
Revision 05 released May 2018; references to Velcro and Dionex Reference Library removed; manufacturing location and Dionex Technical Support phone number updated
Revision 06 released March 2020; Chromeleon 7 Process Analyzer support added
Revision 07 released May 2022; AE Purge Kit discontinued, safety and regulatory compliance information updated

The Dionex Integral system components are intended for use as General Laboratory Equipment (GLE) only. They are not intended 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* (see Figure 1-1) is configured to perform a specific analysis. A system typically 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. The 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™ 7 Process Analyzer software running under Microsoft® Windows® 10 Enterprise or Windows® 10 Pro.

Chromeleon 7 Process Analyzer software (Chromeleon 7 PA software, for short), incorporates a user interface that provides an industry-standard approach to process monitoring, industrial I/O, and process control. Chromeleon 7 PA software instrument control capabilities include:

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

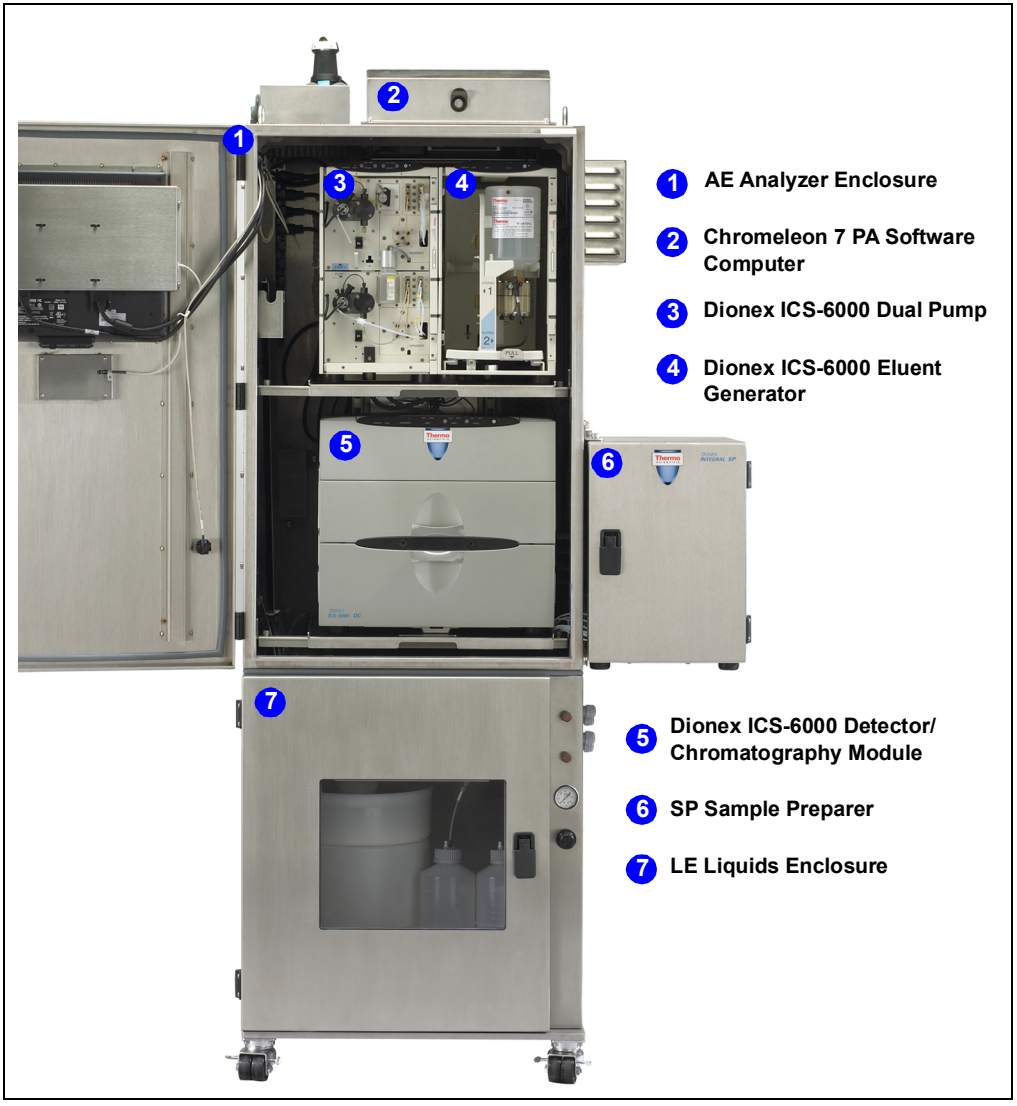


Figure 1-1. Example Dionex Integral System

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 mounted on a wall, on top of an LE Liquids Enclosure (see below), or on another appropriate support structure.

LE Liquids Enclosure

The LE provides an enclosure for housing standard and reagent bottles, as well as NOWPak® containers (for eluents and solvents). The LE includes a gas supply control panel. The LE can provide a rolling base for an AE Analyzer Enclosure (see above).

SP Sample Preparer

The SP contains the valves and pumps required for sample and standard preparation. Electronics built into the SP are used to control the SP components. The SP is available in three versions (see Section 3.1).

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 either be returned to the process or directed to waste.

1.1.2 Chromatography Systems Supported

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

- Thermo Scientific™ Dionex™ ICS-6000 Ion Chromatography Systems
- Thermo Scientific™ Dionex™ UltiMate™ 3000 Rapid Separation (RS) HPLC Systems
- Thermo Scientific™ Dionex™ UltiMate™ 3000 Standard (SD) HPLC Systems

1.1.3 Dionex Integral System Control

Dionex Integral systems are controlled by a computer configured with Chromeleon 7 PA software. The software is an extended version of the Thermo Scientific™ Dionex™ Chromeleon™ 7 Chromatography Data System.

Chromeleon 7 PA software integrates Chromeleon 7 software with a client program called Analyzer. The Analyzer user interface provides access to several functions, including all analyzer-level configuration, analyzer control, results display, and results reporting.

Use Chromeleon 7 PA software to perform these tasks:

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

Use Chromeleon 7 software to perform these tasks:

- Create and control instrument systems
- Acquire and manage data

Chromeleon 7 software can control a total of four systems configured in up to four analyzers. Chromeleon 7 software allows four instrument systems per server. Figure 1-2 shows a system configured in one analyzer.

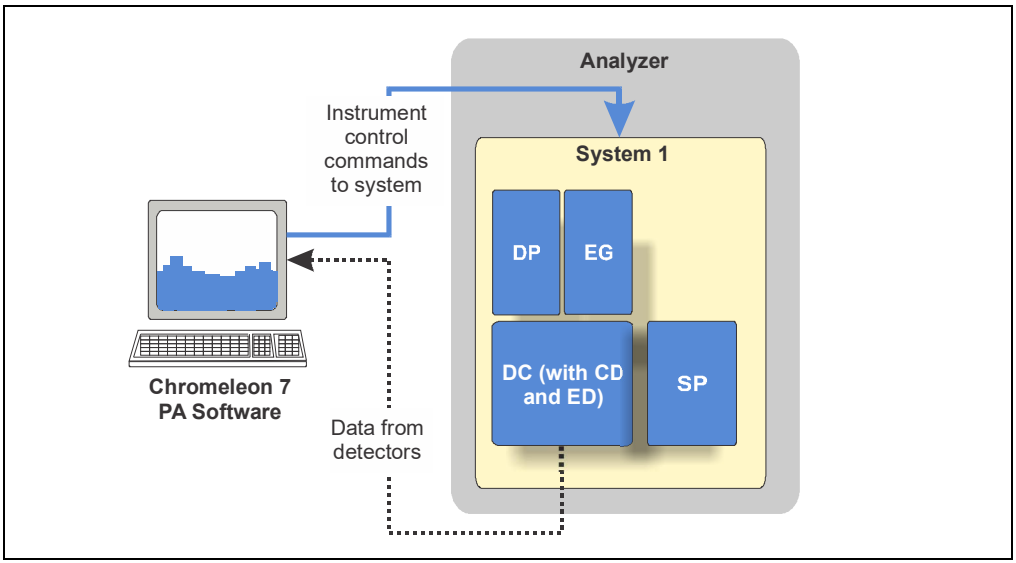


Figure 1-2. Example Analyzer Configuration

1.2 Dionex Integral System Operator's Manual

The electronic version of the Dionex Integral system operator's manual is an Adobe® PDF (Portable Document Format) file. The file includes numerous hypertext links to locations within the file. These links include:

- Table of contents entries
- Cross-references (underlined in blue) to sections, figures, and tables
- Index entries

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 an illustration of a typical Dionex Integral system configuration.
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 for 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 7 software audit trail error messages (with possible causes and corrective actions). Lists minor problems that may occur during operation, along 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 Peristaltic Pump Installation Instructions	Provides instructions for installing a peristaltic pump on the SP panel.
Appendix E Liquid Level Sensor Installation Instructions	Provides instructions for installing a liquid level sensor on a liquid reservoir or NOWPak Bag-in-a-Bottle container.
Appendix F Thermal Options Installation Instructions	Provides instructions for installing a vial cooler and a heated dilution vessel 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 modules from being powered up.

1.3 Related Documentation

User manuals are available for download from the Thermo Fisher Scientific website or by contacting your local office. Manuals for Chromeleon 7 software are available on the software DVD, also.

Hardware Products

Additional documentation includes the following:

- *Dionex ICS-6000 Ion Chromatography System Operator's Manual* (includes the DP/SP, DC, CD, and ED) (Document No. 22181-97002)
- Manuals for the Dionex™ UltiMate™ 3000 RS and SD series modules

Consumable Products

For information about analytical columns, suppressors, EluGen cartridges, and other consumables, refer to the appropriate product manual.

Software Products

Additional documentation includes the following:

- For installation instructions for Chromeleon 7 PA software, refer to *Chromeleon 7.3 Installation Guide* (Document No. 7329.0003).
- For information about how to set up and use Chromeleon 7 PA software, refer to the Chromeleon 7 PA software Help. For information about how to use Chromeleon 7 software, refer to the Chromeleon 7 software Help. Both Help systems are installed with Chromeleon 7 PA software.

1.4 Safety Information

Dionex Integral systems are manufactured for Thermo Fisher Scientific at the following location:

Thermo Finnigan LLC
355 River Oaks Parkway
San Jose, CA 95134-1991 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 or damage to the equipment. Under certain circumstances, especially when the end user has used a product for something other than its intended purpose, Thermo Fisher Scientific may choose not to honor the terms of a warranty by declaring it void.

Modifications made to the equipment, unless expressly approved by Thermo Fisher Scientific, could void the user's authority to operate the equipment.

If there is a question regarding appropriate usage, contact Technical Support for Dionex products before proceeding:

- In the U.S. and Canada, call 1-800-532-4752 and select **option 2**.
- 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. For example, they may alert you to an unexpected result of an action or suggest how to optimize instrument performance.

1.4.2 Safety Symbols

These symbols appear on Dionex Integral modules or on labels affixed to Dionex Integral modules.

Symbol	Meaning
	Alternating current
	Primary protective conductor terminal
	Secondary protective conductor terminal
	Power supply is on
	Power supply is off
	Indicates a potential hazard. Refer to the operator's manual for an explanation of the hazard and how to proceed.
	Pinch hazard
	USB 2.0 port

1.4.3 Safety Practices

General Precautions

- Periodically check all liquid lines for leaks. Clean up spills appropriately 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 waste 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 to 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 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, be 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 Sample Preparer panel contains a piston-drive mechanism with moving parts. Before servicing the pump, turn off the main power switch and unplug the power cable. (A stepper motor pump is always used as the dilution pump. Depending on the SP configuration, one or two stepper motor pumps are installed for use as sample loading pumps.)

Electrical Precautions

- Replace blown fuses with the size and rating stipulated for each component.
- Verify that the selected operating voltage for the analyzers is 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.

1.5 Regulatory Information

Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations. When the system is delivered to you, it meets all pertinent electromagnetic compatibility (EMC) and safety standards.

Changes that you make to your system may void compliance with one or more of these EMC and safety standards. Changes to your system include replacing a part or adding components, options, or peripherals not specifically authorized and qualified by Thermo Fisher Scientific. To ensure continued compliance with EMC and safety standards, replacement parts and additional components, options, and peripherals must be ordered from Thermo Fisher Scientific or one of its authorized representatives.

These symbols appear on Dionex Integral modules or on labels affixed to Dionex Integral modules.

Symbol	Meaning
	TUV Rheinland North America Safety Approval
	Conformité Européenne
	United Kingdom Conformity Assessment
	China RoHS Use Period

1.6 Compliance Information

1.6.1 Declarations of Conformity for the SP and SS

The regulatory symbols on the SP and SS model/data labels indicate that they are in compliance with the following EMC and safety standards.

Reference	Description
Safety Specifications	IEC/EN 61010-1:2010 with Amend. 1:2019; IEC/EN 61010-2-010:2019; IEC/EN 61010-2-051:2019; IEC/EN 61010-2-081:2019; UL 61010-1, ed. 3.1; UL 61010-2-010:2019; UL 61010-2-051:2019; UL 61010-2-081:2019 CAN/CSA C22.2 No. 61010-1-2012 (R2017); CAN/CSA C22.2 No. 61010-2-010:19; CAN/CSA C22.2 No. 61010-2-051:19; CAN/CSA C22.2 No. 61010-2-081:19
EMC Specifications	EN 61326-1:2013; US FCC Part 15; Canada ISED
RoHS Specifications	EN 63000:2010

The CE mark on the SP and SS model/data labels indicates that they are in compliance with the following European Union (EU) Directives as is evidenced by compliance to the associated standard where appropriate. The EU Declaration of Conformity can be downloaded from the Thermo Fisher Scientific website.

Reference	Description
Low Voltage Directive	2014/35/EU by conforming to IEC/EN 61010-1:2010
EMC Directive	2014/30/EU by conforming to EN 61326-1:2013
RoHS Directive	2011/65/EU amended by 2015/863/EU by conforming to EN 63000:2018 (RoHS)

1.6.2 Declarations of Conformity for the AE and LE

The regulatory symbols on the AE and LE model/data labels indicate that they are in compliance with the following EMC and safety standards.

Reference	Description
Safety Specifications	IEC/EN 61010-1:2010 with Amend. 1:2019; IEC/EN 61010-2-010:2019; IEC/EN 61010-2-051:2019; IEC/EN 61010-2-081:2019; UL 61010-1, ed. 3.1; UL 61010-2-010:2019; UL 61010-2-051:2019; UL 61010-2-081:2019 CAN/CSA C22.2 No. 61010-1-2012 (R2017); CAN/CSA C22.2 No. 61010-2-010:19; CAN/CSA C22.2 No. 61010-2-051:19; CAN/CSA C22.2 No. 61010-2-081:19
EMC Specifications	EN 61326-1:2013; US FCC Part 15; Canada ISED
RoHS Specifications	EN 63000:2010

The CE mark on the AE and LE model/data labels indicates that they are in compliance with the following European Union (EU) Directives as is evidenced by compliance to the associated standards where appropriate. The EU Declaration of Conformity can be downloaded from the Thermo Fisher Scientific website.

Reference	Description
Low Voltage Directive	2014/35/EU by conforming to EN 61010-1:2010 with Amend. 1:2019; EN 61010-2-010:2019; EN 61010-2-051:2019; EN 61001-2-081:2019
EMC Directive	2014/30/EU by conforming to EN 61326-1:2013
RoHS Directive	2011/65/EU amended by 2015/863/EU by conforming to EN 63000:2018 (RoHS)

1.6.3 FCC/IC Notices

This device complies with Part 15 of the FCC Rules and Industry Canada ICES-003 for a Class A device. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

NOTE This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

1.6.4 AVIS FCC/IC

Cet appareil numérique de la classe A est conforme à la partie 15 des règles de la FCC et à la norme NMB-003 du Canada.

Le fonctionnement de cet appareil est soumis à la deux conditions suivantes:

1. Ce dispositif ne doit pas causer d'interférences nuisibles, et

2. Cet appareil doit accepter toute interférence reçue, y compris les interférences qui peuvent causer un mauvais fonctionnement.

NOTE Il s'agit d'un produit de classe A. Dans un environnement domestique, ce produit peut provoquer des interférences radio, auquel cas l'utilisateur peut être tenu de prendre des mesures adéquates.

1.6.5 China EEP Hazardous Substances Information

(产品中有害物质的名称及含量)
China EEP Hazardous Substances Information

部件名称 Component Name	有害物质 Hazardous Substances									
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)	邻苯二甲酸二(2-乙基己基)酯 (DEHP)	邻苯二甲酸丁苄酯 (BBP)	邻苯二甲酸二丁酯 (DBP)	邻苯二甲酸二异丁酯 (DIBP)
(Translation) Cable Assemblies	x	o	o	o	o	o	o	o	o	o
(Translation) Display	x	o	o	o	o	o	o	o	o	o
(Translation) Electromechanical Assemblies	x	o	o	o	o	o	o	o	o	o
(Translation) Fasteners	o	o	o	o	o	o	o	o	o	o
(Translation) Lamps	o	o	x	o	o	o	o	o	o	o
(Translation) Machined Parts	o	o	o	o	o	o	o	o	o	o
(Translation) Molded Parts	o	o	o	o	o	o	o	o	o	o
(电路板) PCBA's	x	o	x	o	o	o	o	o	o	o
(电源供应器) Power Supply	x	o	o	o	o	o	o	o	o	o
(Translation) Sheetmetal	o	o	o	x	o	o	o	o	o	o
(Translation) Tubing	o	o	o	o	o	o	o	o	o	o

(本表格依据SJ/T11364的规定编制) This table is compiled according to SJ/T 11364 standard.

O:(表示该有害物质在该部件所有均质材料中的含量均在GB/T26572规定的限量要求以下)
Indicates that the concentration of the hazardous substance in all homogeneous materials for the part is below the relevant threshold of the GB/T 26572 standard.

X:(表示该有害物质至少在该部件的其一均质材料中的含量超出GB/T26572规定的限量要)
Indicates that the concentration of the hazardous substance in at least one homogenous material of the part is above the relevant threshold of the GB/T 26572 standard.

For each assembly/component Row, enter "O" or "X" (upper case) into the cell for each hazardous substance using the criteria below:
Criteria for "O" - The concentration of the hazardous substance in all homogenous materials of the assembly is below the thresholds in Figure 1
Criteria for "X" - The concentration of the hazardous substance in at least one homogenous material of the assembly is above the thresholds in Figure 1
NOTE: If it has been indicated on the BOM that an ROHS exemption for a component has been taken, mark an "X" on the table for the assembly/component type that the part reports to.

1.6.6 Notice on Lifting and Handling of Thermo Scientific Instruments

For your safety, and in compliance with international regulations, the physical handling of this Thermo Scientific instrument requires a team effort to lift and/or move the instrument. This instrument is too heavy and/or bulky for one person alone to handle safely.

1.6.7 Notice on the Proper Use of Thermo Scientific Instruments

In compliance with international regulations: Use of this instrument in a manner not specified by Thermo Fisher Scientific could impair any protection provided by the instrument.

1.6.8 WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EU. It is marked with the following symbol:

This symbol indicates that the equipment must not be thrown into general waste and should be collected separately and processed in accordance with local and state requirements.

Conformité DEEE

Ce produit est conforme avec la directive européenne (2012/19/EU) des Déchets d'Equipements Electriques et Electroniques (DEEE). Il est marqué par le symbole suivant:

Ce symbole indique que l'équipement ne doit pas être jeté avec les déchets ordinaires, mais doit être collecté séparément et traité conformément aux règlementations locales et nationales.

WEEE Konformität

Dieses Produkt entspricht der EU Waste Electrical & Electronic Equipment (WEEE) Richtlinie 2012/19/EU. Es ist mit dem folgenden Symbol gekennzeichnet:

Instrumente mit diesem Zeichen sind nicht für den normallen Abfall bestimmt; Entsorgung soll den lokalen Vorschriften entsprechend ausgeführt werden.

2 • Dionex Integral System Configurations

The modular design of Dionex Integral systems allows you to configure a system that meets your sampling, analytical, and environmental requirements. This chapter describes two of the most common configurations of the analytical system modules, sampling modules, and enclosures.

2.1 Example Configurations

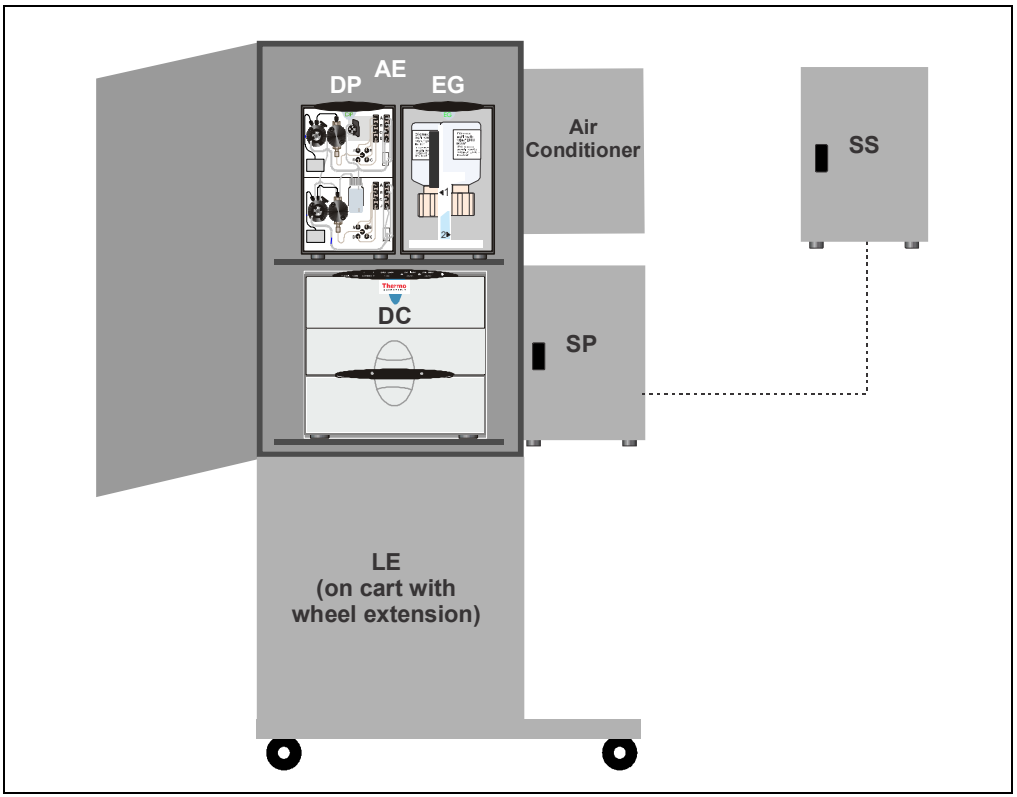


Figure 2-1. Example Dionex Integral System Configuration: Dionex ICS-6000 Dual RFIC™ System, AE, LE, Air Conditioner, External SP, and External SS

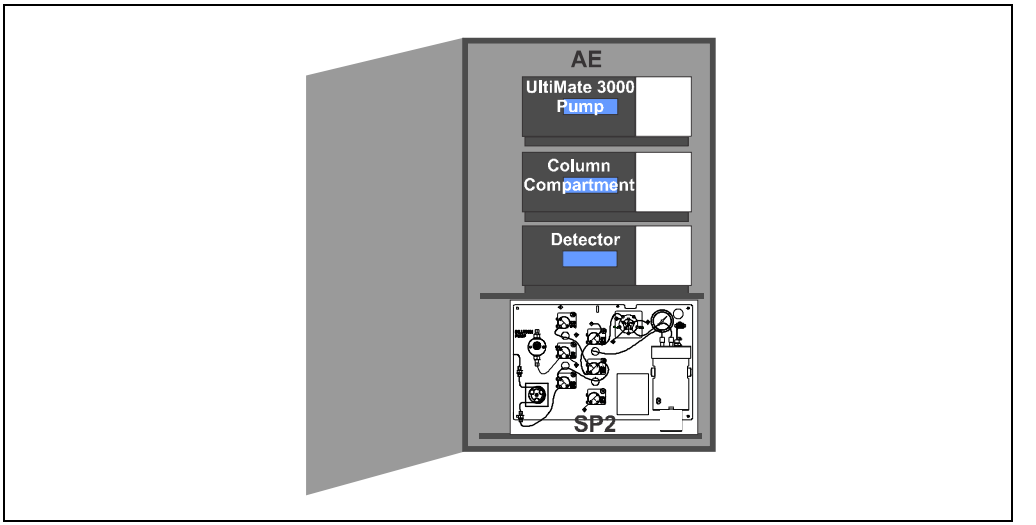


Figure 2-2. Example Dionex Integral System Configuration: UltiMate 3000 System, AE, and Internal SP

3 • SP Sample Preparer Description

3.1 SP Overview

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

- The *SP1* is preconfigured with the components required for applications that use sample concentration or direct injection.
- The *SP2* is preconfigured 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 either HPLC applications or for 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.
- The *internal* enclosure is installed inside an AE.

Any SP version (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 is an example of an installation with an external enclosure.

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

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 (see Table 3-1).

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

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

Table 3-1. NEMA Enclosure Types

NEMA 4X 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 Types (Continued)

NOTE **The information above 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 3-2).

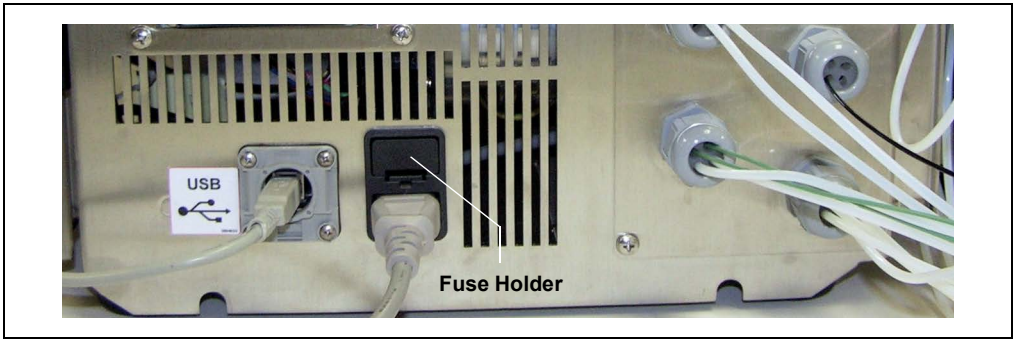


Figure 3-2. SP USB and Power Receptacles (Vertical Enclosure Shown)

Fuse Holder and Power Receptacle

The fuse cartridge contains two fast-blow IEC 60127 fuses rated 3.15 A (P/N 954745). For fuse replacement instructions, see Section 10.11.

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 the outside of 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 outside of an AE or installed inside an AE, the AE power cord is the main disconnect device. In addition, the AE main power switch (see Figure 5-7) and **Emergency Off** switch (see Figure 5-2) can be used to control the power to the SP.

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

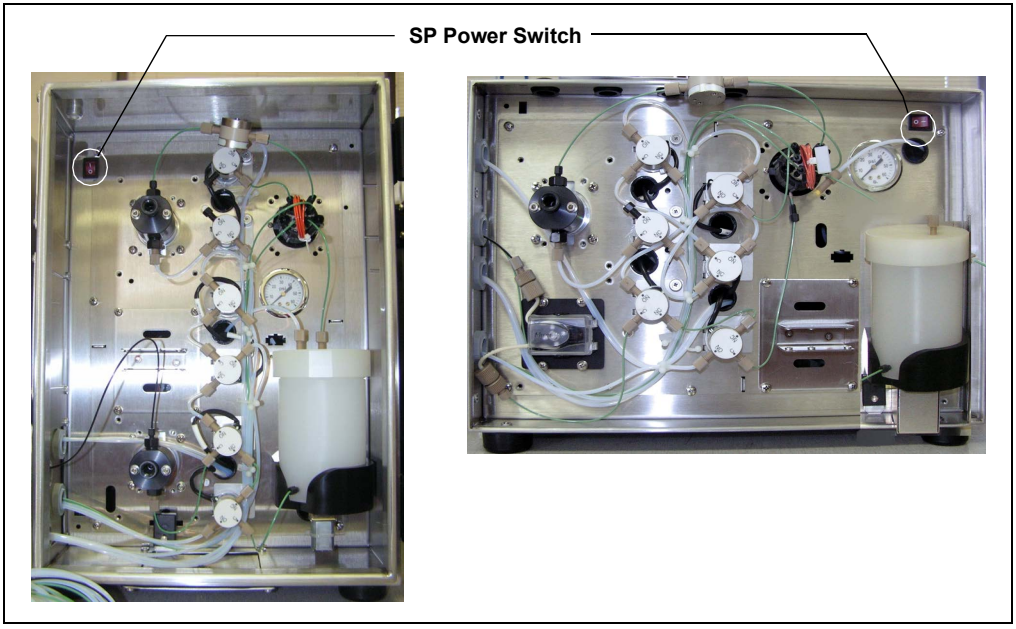


Figure 3-3. SP Power Switch

Software Communication

The USB (Universal Serial Bus) receptacle (a Type-B connector) (see Figure 3-2) allows connection to the computer on which Chromeleon 7 PA software is installed.

The SP Ship Kit (SP1, P/N 069085; SP2, P/N 069086) includes one USB cable (P/N 960779). The cable is 5 m (16 ft) long.

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 7 software and an error message is displayed in the software audit trail.

An auxiliary leak sensor (P/N 067728) can be installed in the AE drip tray and connected to the main SP electronics board.

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 the drain port, if you want.

3.5 SP Component Descriptions

This section describes the components (including valves, pumps, and dilution vessels) that can be installed on an SP panel. To control an installed component, use one of the following methods:

- Enter commands in the instrument method in Chromeleon 7 software.

  Commands for the SP (and SS) must be added in the Script Editor view in the Instrument Method Editor.

  Commands for other Dionex Integral system components can be added in the Instrument Method Wizard.

- Use the controls on the SP ePanel in Chromeleon 7 software.

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 electrically-activated, two-position valve is available in PEEK™ (P/N 068556) or stainless steel (P/N 068557). The SP1 and SP2 include a PEEK valve. For custom SP configurations, either valve model can be ordered.

A 100 µL sample loop is included with the metering valve. If you need a loop with a different volume, follow the instructions in Section 7.2.5 to create and calibrate a standard loop.

Figure 3-4 shows the liquid flow path through the valve ports at each valve position. Figure 3-5 shows the tubing connections to each valve port on an SP1 and SP2, as well as the functions performed at each valve position.

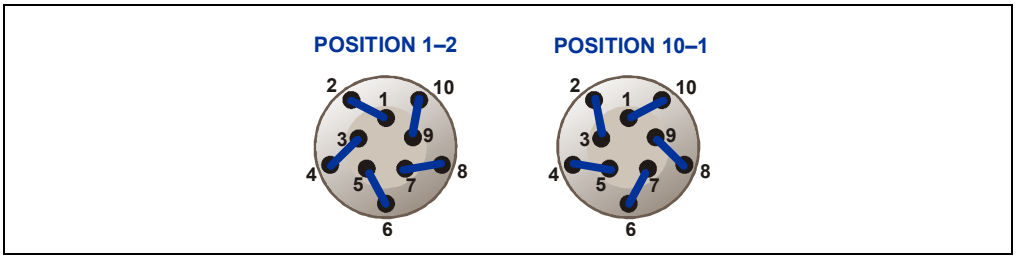


Figure 3-4. 10-Port High-Pressure Valve Flow Schematics

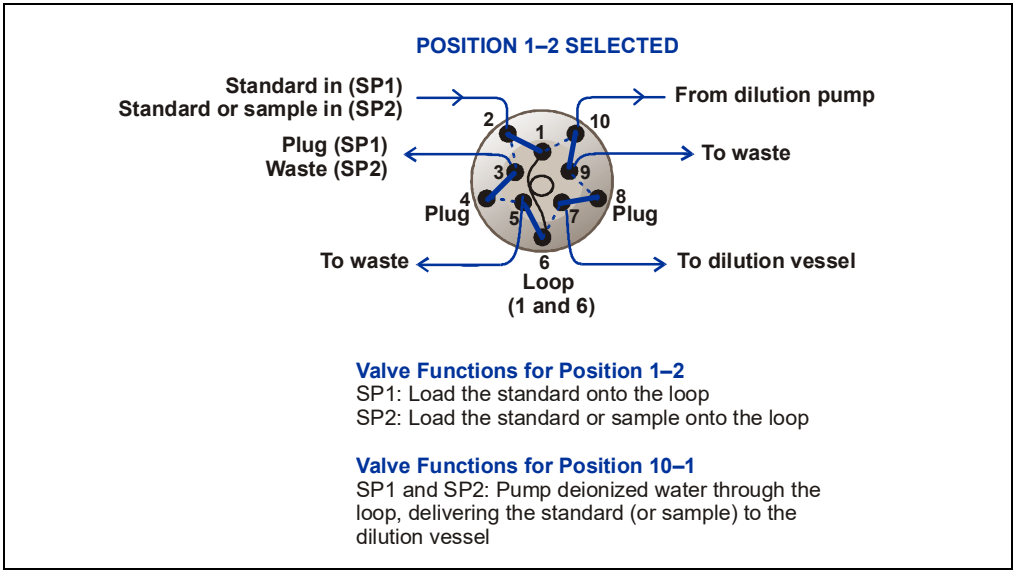


Figure 3-5. 10-Port High-Pressure Valve Connections (SP1 and SP2)

3.5.2 Dilution Vessels

A dilution vessel is used to prepare calibration standards in an SP1 and SP2. In an SP2, it is also used to dilute samples.

There are two types of dilution vessels:

- An unheated dilution vessel (P/N 069208) with a capacity of 250 mL is standard for both the SP1 and SP2.
- A heated dilution vessel (P/N 068524) with a capacity of 50 mL is available as an option. For installation instructions, see Appendix F.

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).

NOTE If the pressure reaches 340 kPa (50 psi), a pressure relief valve opens.

Dilution Vessel Mixer

Both types of dilution vessels are equipped with a mixer and a PTFE (polytetrafluoroethylene) stir bar. Specify the default mixer speed (from 0% to 100% of maximum) on the **Pumps/Motors** page in the Instrument Configuration Manager (in Chromeleon 7 software).

The **Mixer Stir Bar Auto-Recovery** option (also 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 briefly before being restarted at a speed 5% slower than before the auto-recovery occurred. To disable auto-recovery, select **No** for this option.

You can use the controls on the SP ePanel in Chromeleon 7 software to turn the mixer on and off and set the speed.

Heated Dilution Vessel (Option)

The temperature of the heated dilution vessel can be set to between 15 °C and 40 °C. Specify the temperature in Chromeleon 7 software, in either

the Instrument Configuration Manager (on the **Temperature** page) or the instrument method.

3.5.3 Dilution Pump

The dilution pump (P/N 068561) (see Figure 3-6) 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). You can change the default flow rate on the **Pumps**/**Motors** page in the Instrument Configuration Manager (in Chromeleon 7 software).

Figure 3-6. Dilution Pump

Enter commands for control of the pump in Chromeleon 7 software, either in the instrument method or on the SP ePanel.

3.5.4 Loading Pumps

The following pumps are available for loading sample to the injection valve:

- A stepper motor loading pump (P/N 068561) is standard for an SP1. (A stepper motor pump is used as the dilution pump, also.)
- A peristaltic loading pump (P/N 069045) is standard for an SP2.
- For custom SP configurations, either type of loading pump can be ordered.

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. Select the flow rate on the **Pumps/Motors** page in the Instrument Configuration Manager (in Chromeleon 7 software).

Enter the volume of sample to deliver (0.1 mL to 1000.0 mL) in Chromeleon 7 software, either in the instrument method or on the SP ePanel.

Peristaltic Loading Pump

A peristaltic pump (see Figure 3-7) is available for applications in which the sample is delivered to a sample loop installed on the injection valve.

When a peristaltic pump is installed, a solenoid valve connector (typically **SV9**) on the main SP electronics board is assigned to control the peristaltic pump instead of a solenoid valve.

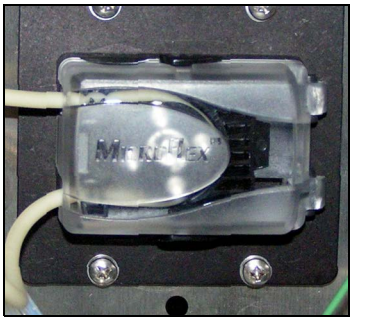


Figure 3-7. Peristaltic Pump

- To turn the pump on and off, set the position of the solenoid valve on and off in Chromeleon 7 software, either in the instrument method or on the SP ePanel.
- To adjust the pump speed, use the potentiometer on the main SP electronics board (see Section 10.9).
- The Peristaltic Pump Kit (P/N 068558) includes a peristaltic pump and the parts required to install it. For instructions on how to install and configure the pump, see Appendix D.

3.5.5 Solenoid Valves

Each SP is equipped with several solenoid valves (see Figure 3-8) 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 3-8. Solenoid Valve

The three-way solenoid valves provide on/off control of liquid flow in two directions (see Figure 3-9).

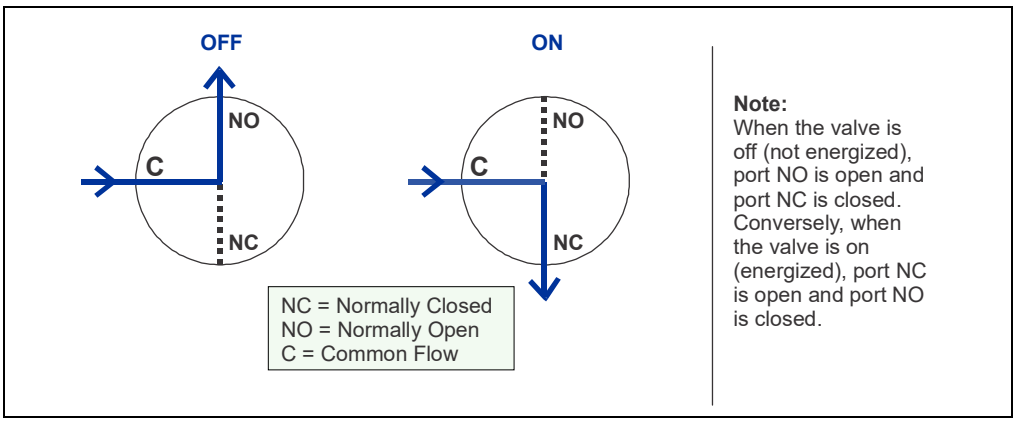


Figure 3-9. Three-Way Solenoid Valve Flow Schematics

3.5.6 Vial Cooler (Option)

A vial cooler (P/N 068566) (see Figure 3-10) can be installed on the SP panel (see Section F.2). The vial cooler temperature can be set to between 4 °C and 15 °C (the default is 4 °C). Select the temperature in Chromeleon 7 software, in either the Instrument Configuration Manager (on the **Temperature** page) or the instrument method.

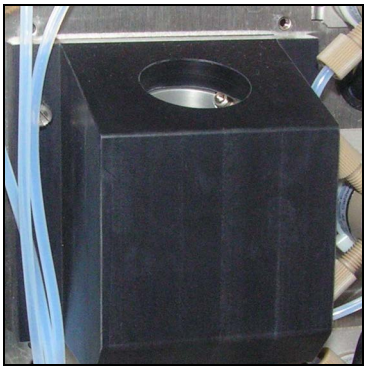


Figure 3-10. Vial Cooler

Use any standard 20 mL scintillation vial in the vial cooler.

When 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 3-11) to the vial.

3.6 SP Panel Configurations

3.6.1 SP1 for Concentration or Direct Injection

The SP1 configuration is intended for:

- Trace ion applications in which samples are concentrated on a concentrator column before chromatographic analysis
- Applications in which 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

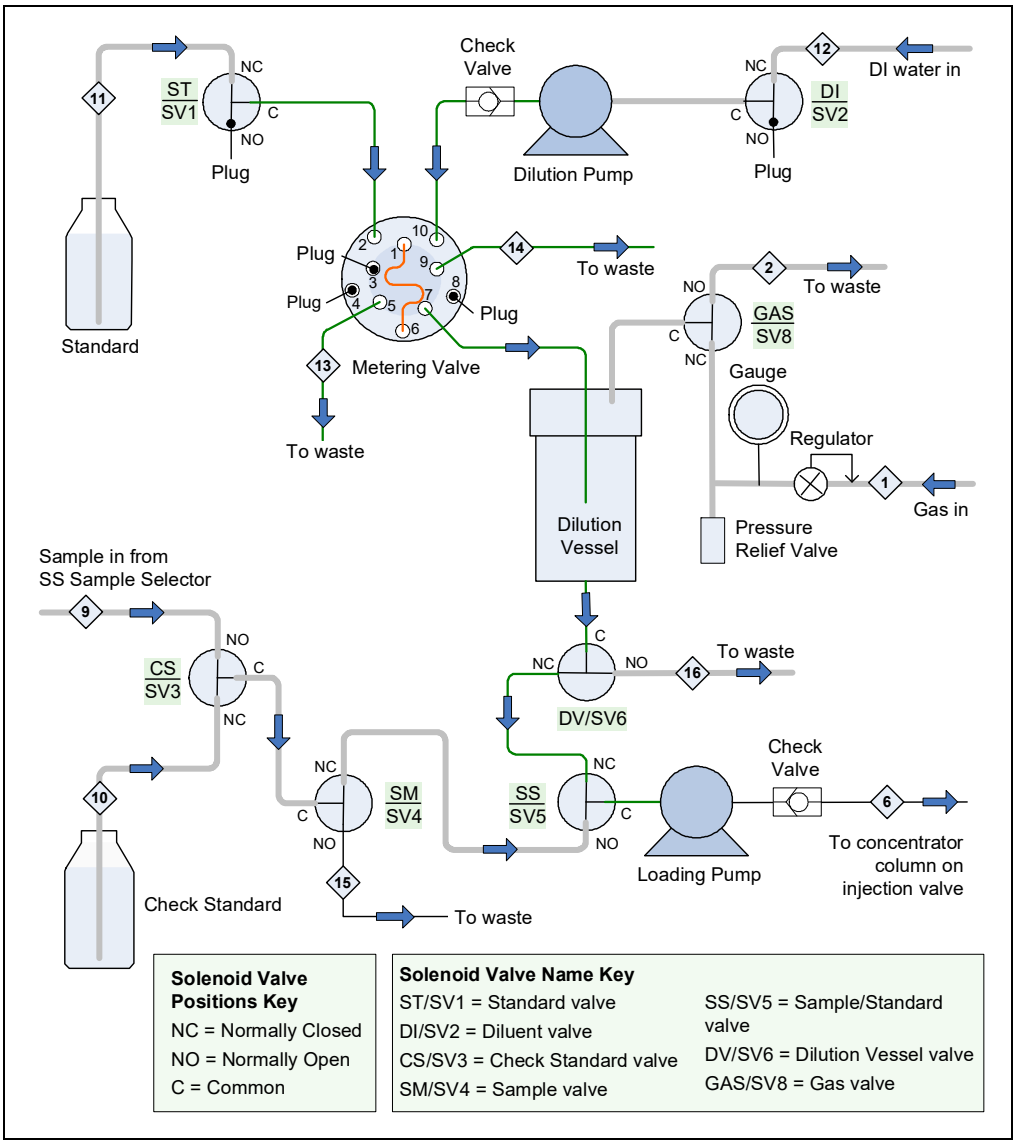


Figure 3-11. SP1 Component Flow Path

NOTE **The numbered diamonds in Figure 3-11 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 loop for delivery to dilution vessel
Dilution Vessel	Pressurized container	Used to prepare calibration standards
Gas Valve (SV8)*	3-way solenoid valve	On: Pressurizes dilution vessel Off: Vents 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 3-13 shows the layout of the SP1 components when they are installed in the vertical orientation.

Figure 3-12 shows the layout of the SP1 components when they are installed in the horizontal orientation.

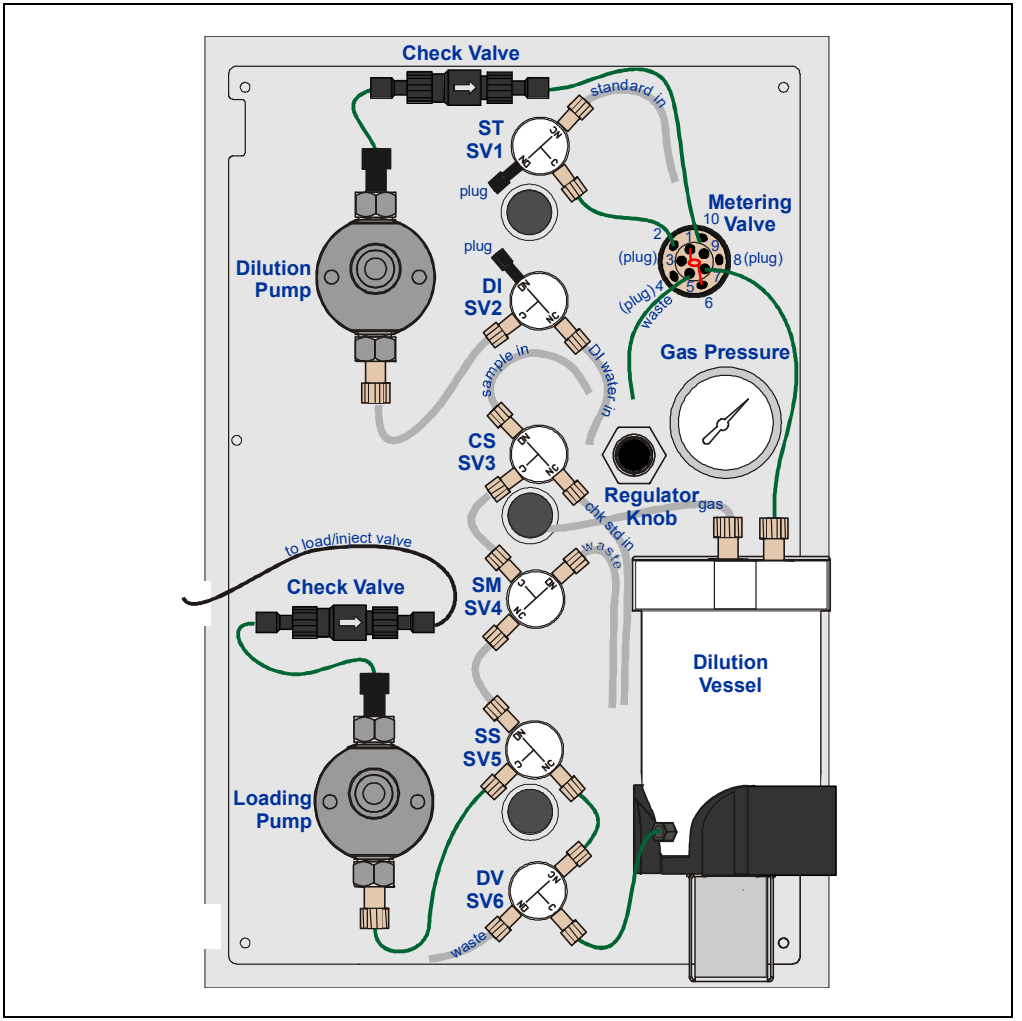


Figure 3-12. SP1 Component Layout: Vertical Orientation

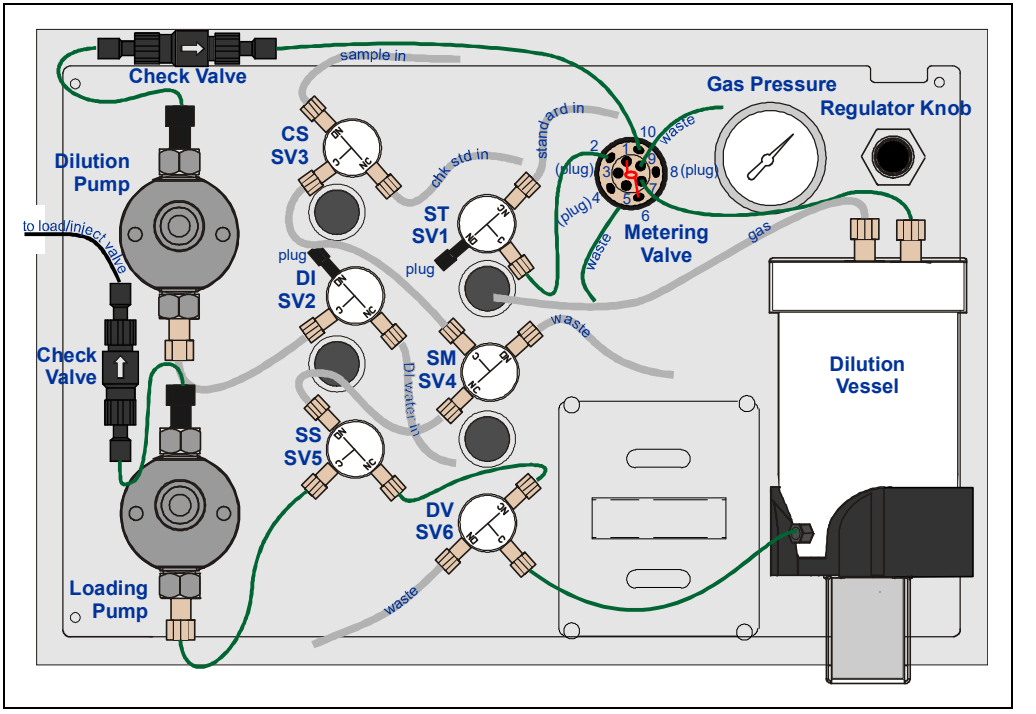


Figure 3-13. SP1 Component Layout: Horizontal Orientation

3.6.2 SP2 for Dilution or Direct Injection

The SP2 configuration is intended for:

- Applications in which samples must be diluted before chromatographic analysis
- Applications in which 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

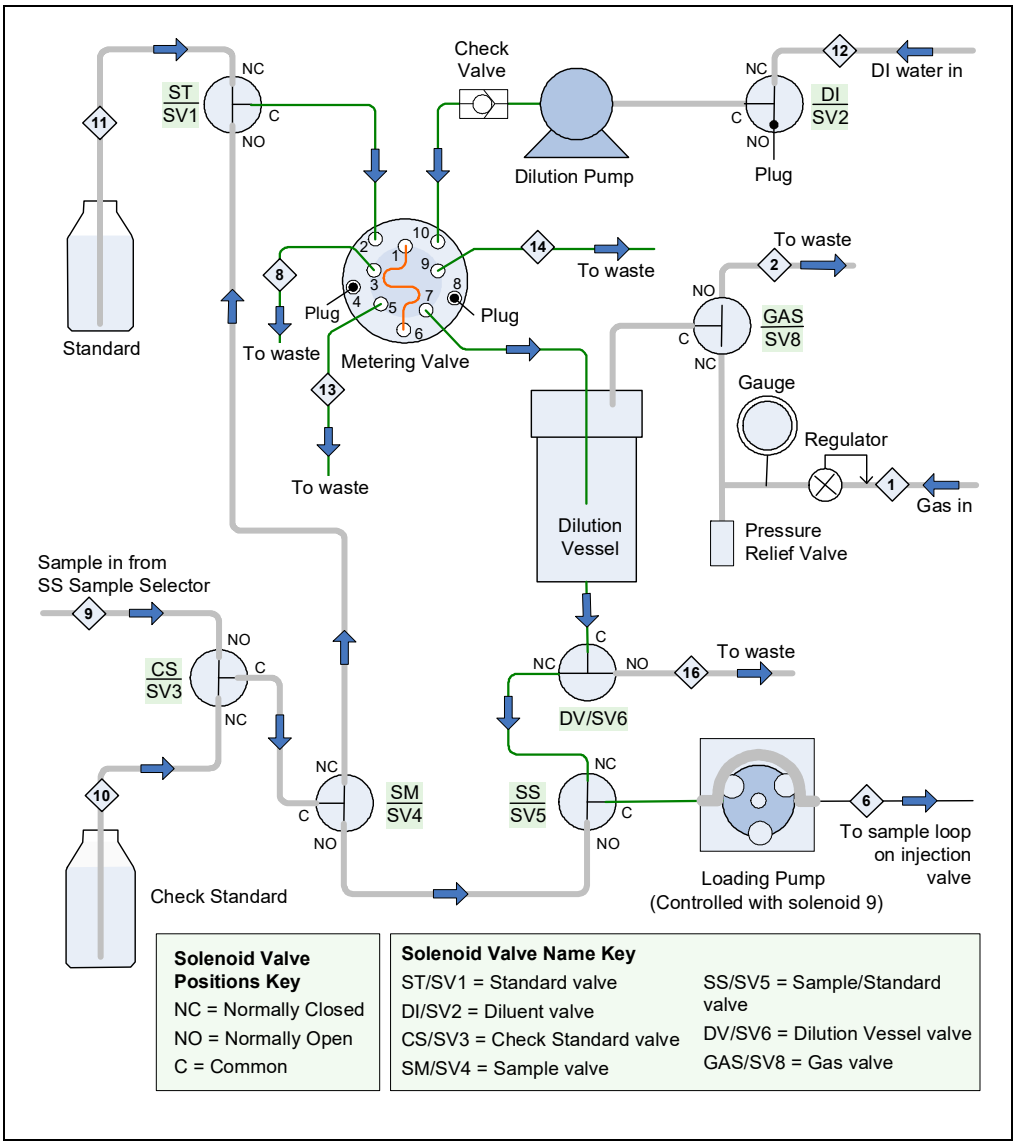


Figure 3-14. SP2 Component Flow Path

NOTE The numbered diamonds in Figure 3-14 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 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 dilution vessel Off: Vents 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 3-15 shows the layout of the SP2 components when they are installed in the vertical orientation.

Figure 3-16 shows the layout of the SP2 components when they are installed in the horizontal orientation.

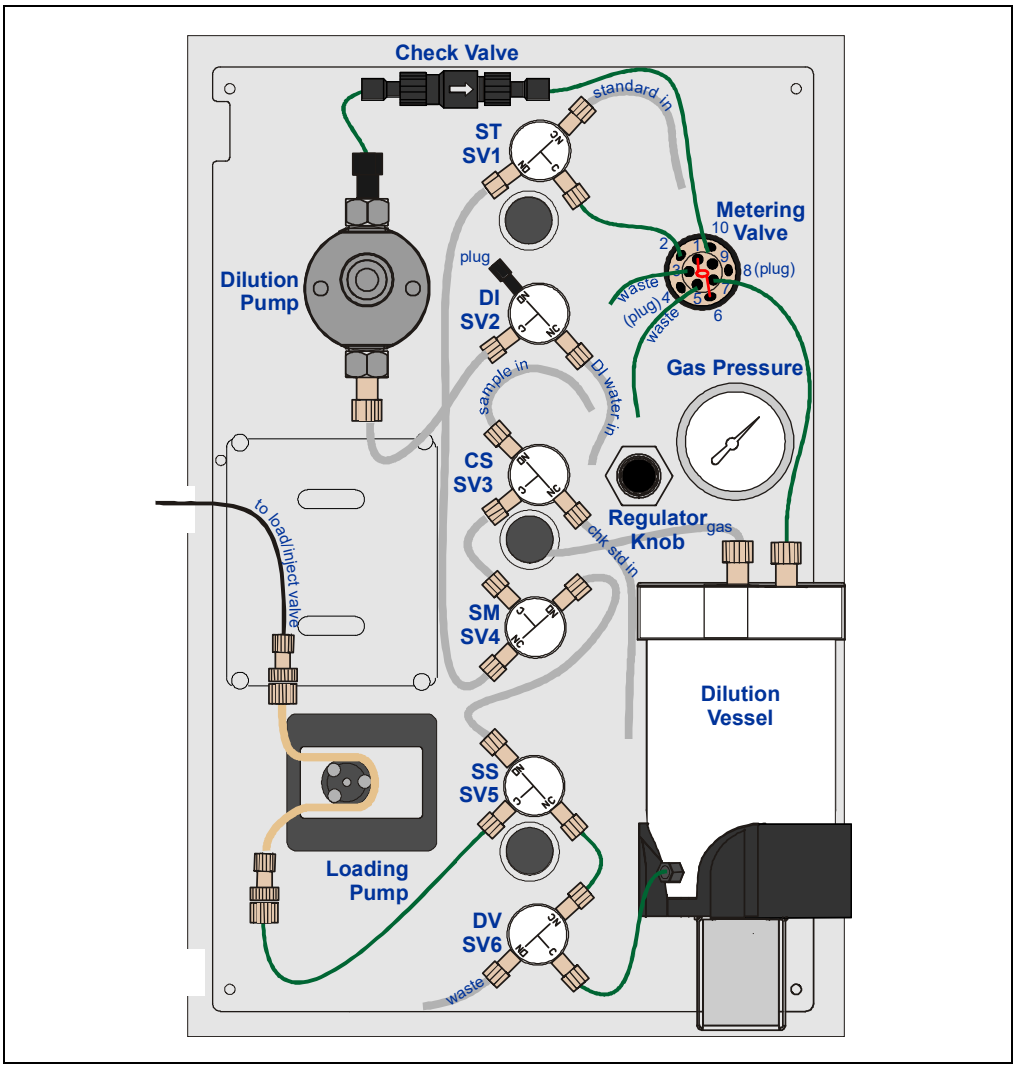


Figure 3-15. SP2 Component Layout: Vertical Orientation

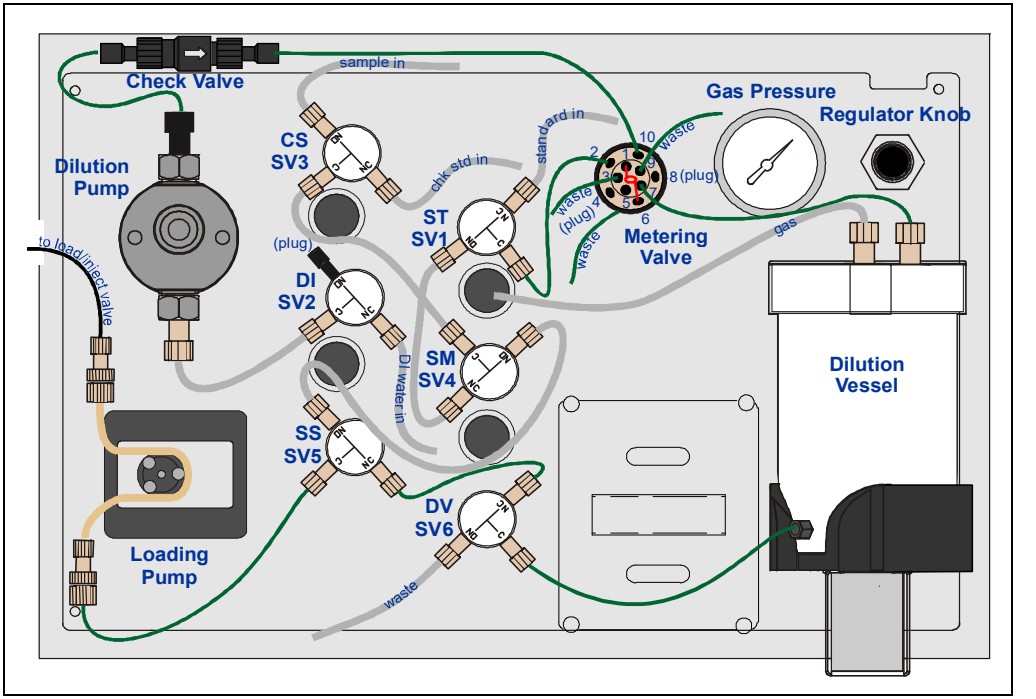


Figure 3-16. SP2 Component Layout: Horizontal Orientation

3.6.3 Flow Paths and Valve Positions for 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:

- Step 1: Filling the loop on the metering valve with stock standard (see Figure 3-17).
- Step 2: Sending the loop contents and deionized water (the diluent) to the dilution vessel (see Figure 3-18).
- Step 3: Purging the diluted standard from the dilution vessel and loading it to the injection valve (see Figure 3-19).

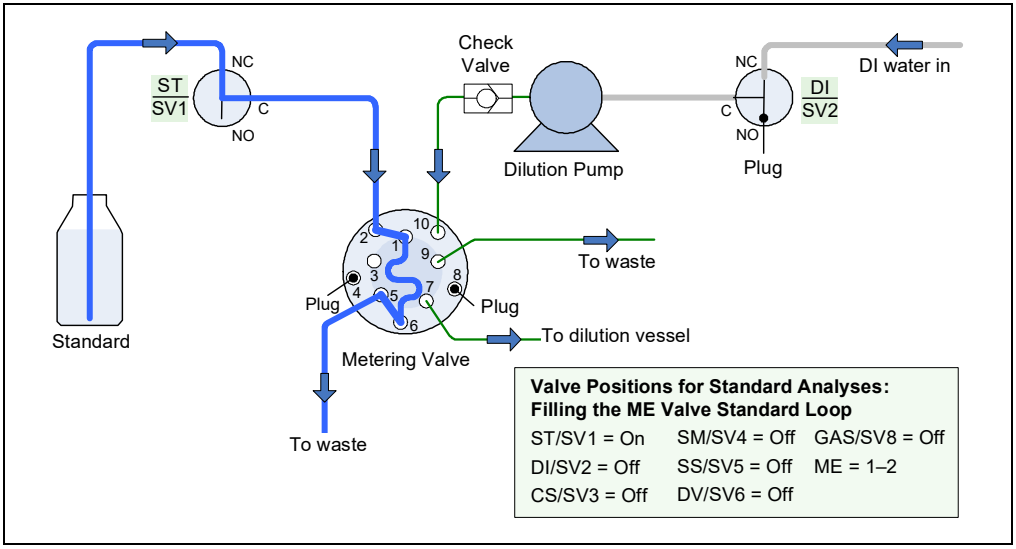


Figure 3-17. Analyzing Calibration Standards
Step 1: Filling the Metering Valve Loop with Standard

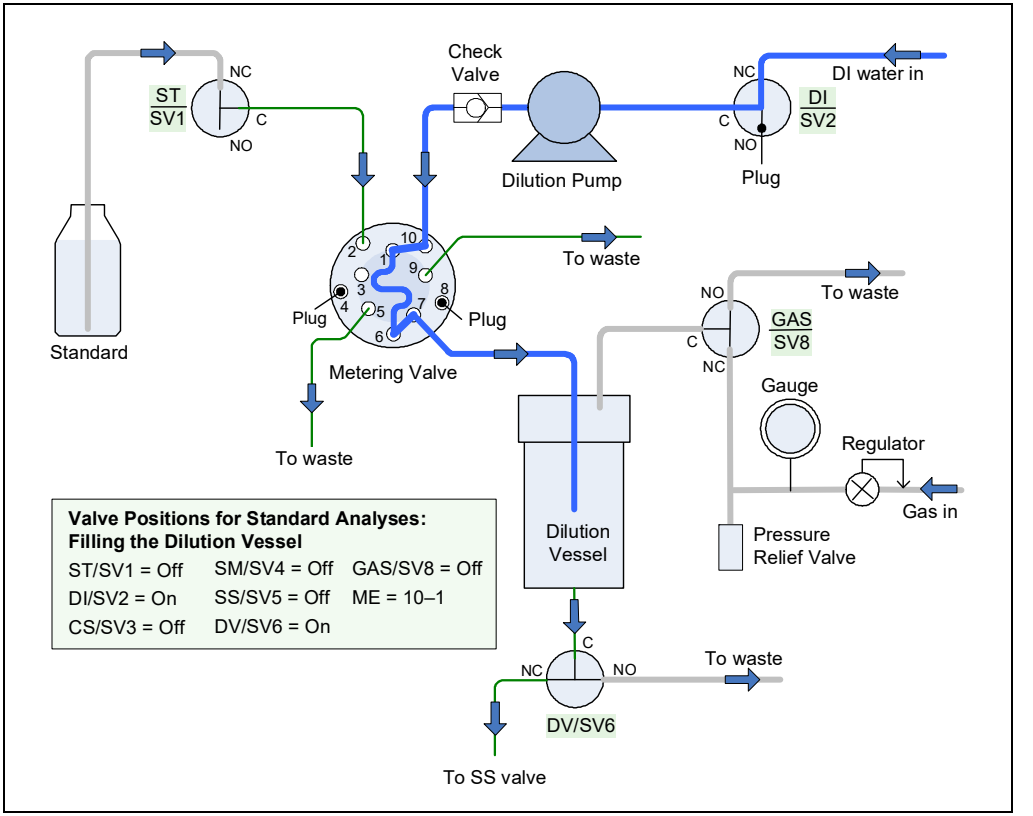


Figure 3-18. Analyzing Calibration Standards
Step 2: Filling the Dilution Vessel

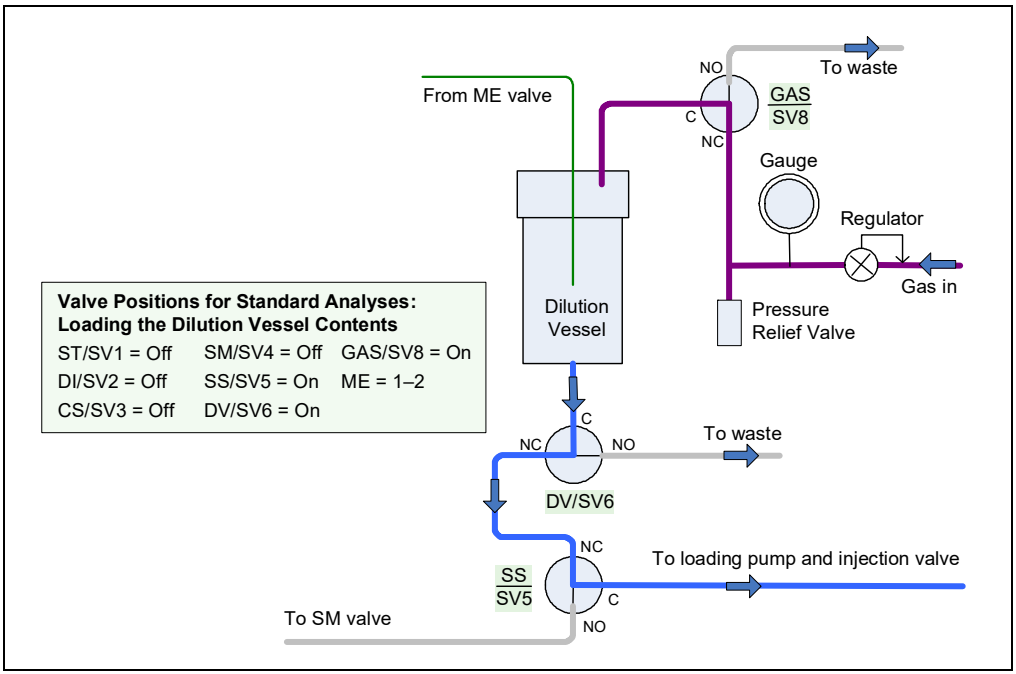


Figure 3-19. Analyzing Calibration Standards
Step 3: Loading the Dilution Vessel Contents

Flow Path and Valve Positions for Analyzing Check Standards

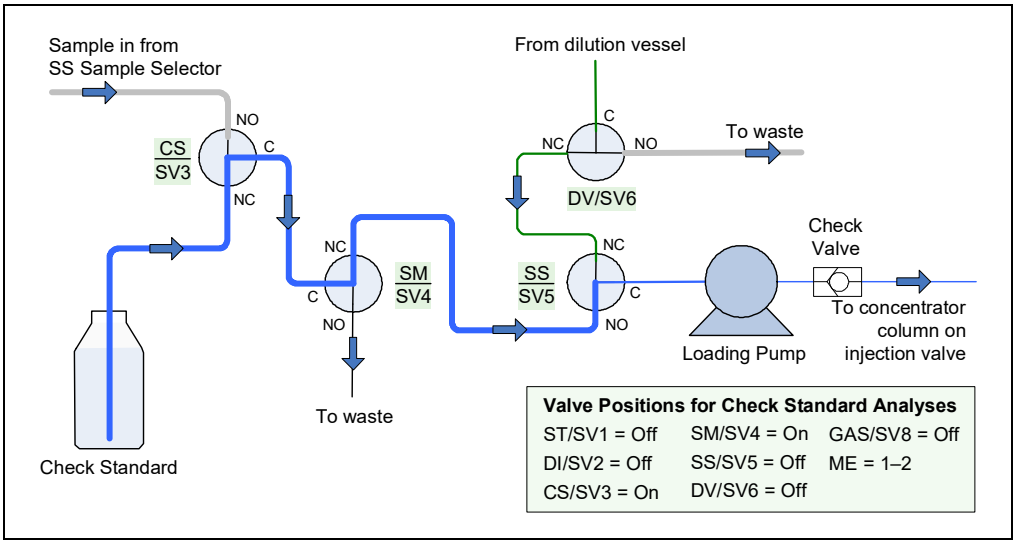


Figure 3-20. Analyzing Check Standards: SP1

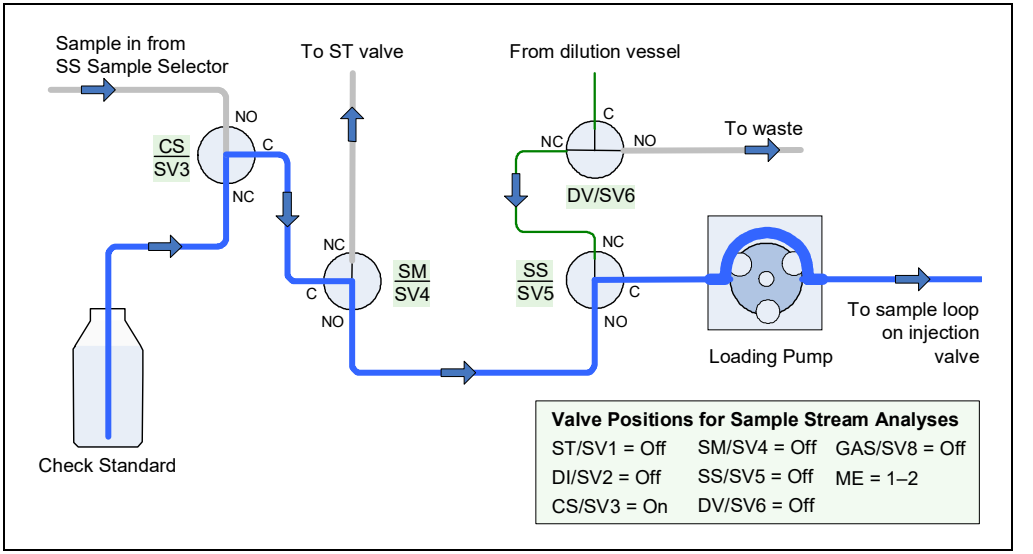


Figure 3-21. Analyzing Check Standards: SP2

Flow Path and Valve Positions for Analyzing Sample Streams

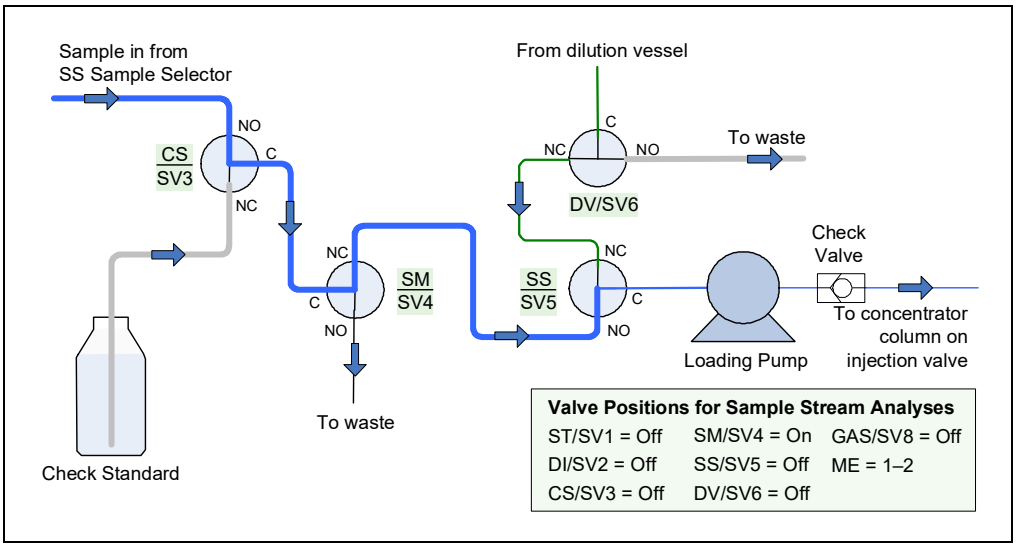


Figure 3-22. Analyzing Sample Streams: SP1

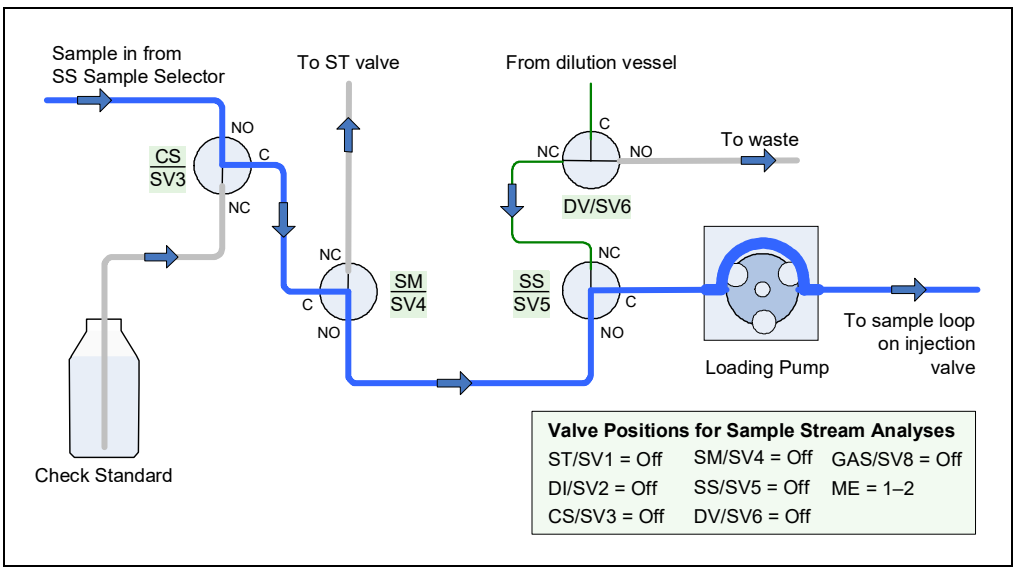


Figure 3-23. Analyzing Sample Streams: SP2 Direct Injection

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 3-24).
- Step 2: Sending the loop contents and deionized water (the diluent) to the dilution vessel. This step is also performed when the calibration standard is analyzed (see Figure 3-18).
- Step 3: Purging the diluted sample from the dilution vessel and loading it to the injection valve. This step is also performed when the calibration standard is analyzed (see Figure 3-19).

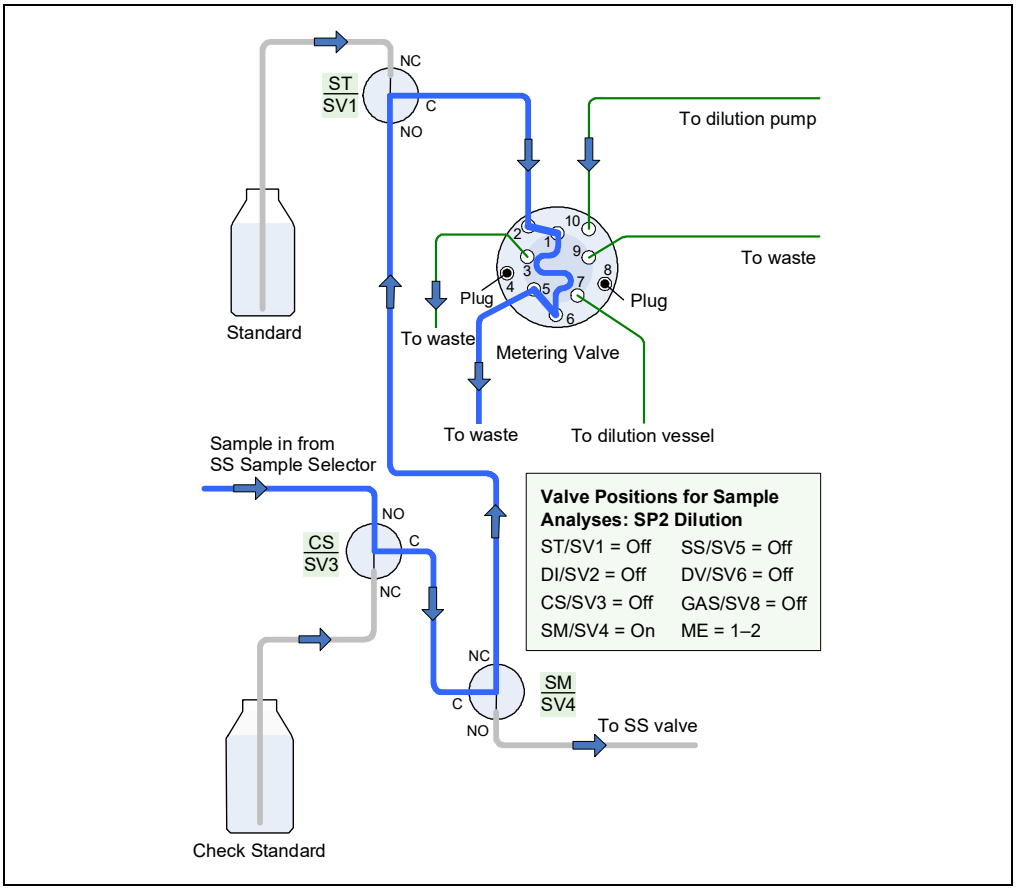


Figure 3-24. Analyzing Sample Streams: SP2 Dilution Step 1: Filling the Metering Valve Loop with Sample

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 3-25 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 3-11 (for the SP1) or Figure 3-14 (for the SP2).

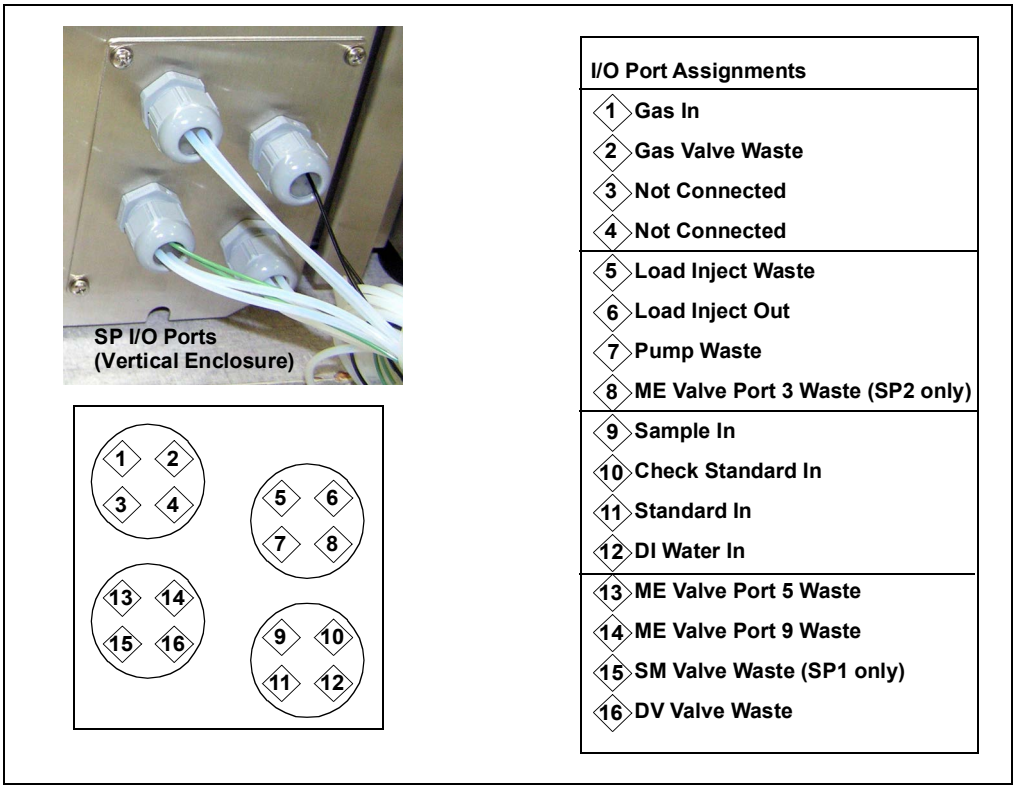


Figure 3-25. SP1 and SP2 I/O Lines and Port Assignments

3.7 Analog Inputs

The main SP electronics board provides four analog inputs. The SP Ship Kit (SP1, P/N 069085; SP2, P/N 069086) includes an analog input cable (P/N 070171) for connection of an analog input to an external device. If you need more than one analog input, 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.
2. Disconnect the power cord.
3. Follow the instructions in Section 10.7 to access the main SP electronics board.
4. Locate the analog input connectors in the lower-left corner of the main SP electronics board (see Figure 3-26).

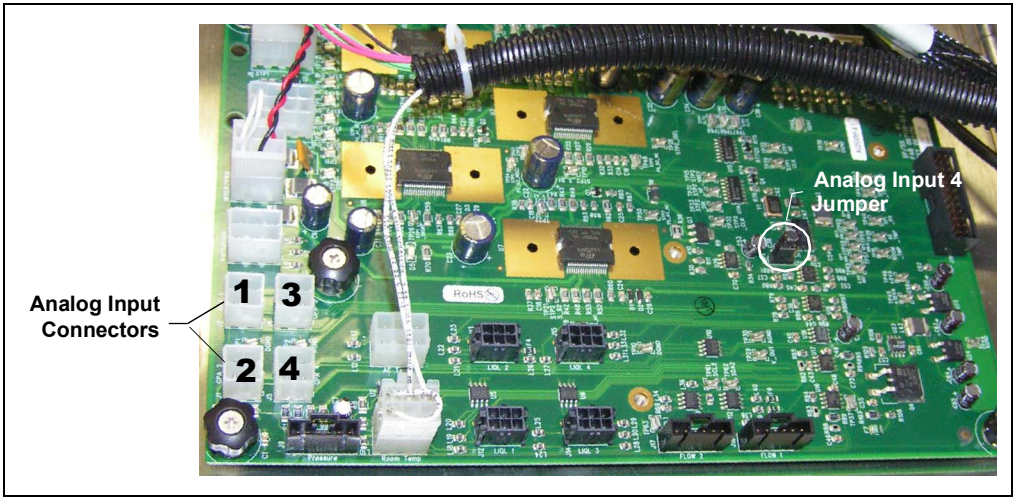


Figure 3-26. Main SP Electronics Board: Analog Input Connectors

5. Plug the analog input cable (P/N 070171) into an analog input connector on the main SP electronics board.

   NOTE **Analog Input 4 is usually reserved for monitoring of the stir bar in the dilution vessel mixer (see Section 3.5.2). To use the input for a different function, simply change the position of the jumper on the main SP electronics board (see "To change the position of the Analog Input 4 jumper" on page 52).**

6. 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.

7. Route the cable to the other device, and then connect the free ends of the wires to the appropriate connector pins on the device.
8. Close and secure the SP service door.
9. If you removed the SP from the AE rear panel:
   a. Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE rear panel, and hang the SP on the rails.
   b. Replace any modules that were removed from the lower shelf of the AE.
   c. Replace the two access panels on the exterior of the AE.
10. Plug in the power cord and turn on the power.
11. Open the Instrument Configuration Manager (in Chromeleon 7 software).
12. Open the SP Properties dialog box. The check box for the connected analog input is enabled on the **Analog Inputs** page. The name assigned to the input corresponds to the number of the connector on the main SP electronics board.
13. Save the configuration.
14. Calibrate the analog input (see Section 10.10).

To change the position of the Analog Input 4 jumper

1. Turn off the SP power.
2. Disconnect the power cord.
3. Follow the instructions in Section 10.7 to access the main SP electronics board.
4. Locate the jumper in the lower-right corner of the main SP electronics board, at position **JMP1** (see Figure 3-27).

   The jumper selects two out of three pins (either pins 1 and 2 *or* pins 2 and 3). See Figure 3-28 for the function assigned to each jumper position.

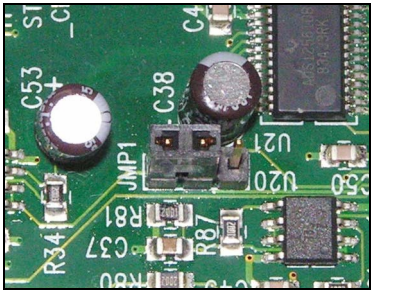


Figure 3-27. Analog Input 4 Jumper (Default Position)

5. 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.

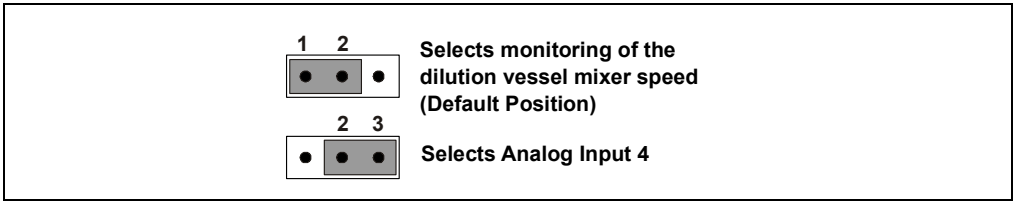


Figure 3-28. Analog Input 4 Jumper Position Functions

Analog Input 4 can now be connected to an external device. For instructions on how to connect the analog input cable to the main SP electronics board and the external device, see "To connect the analog input" on page 50.

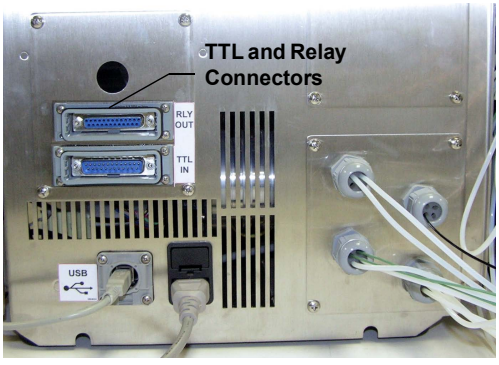
3.8 SP TTL and Relay Control (Option)

When the optional SP TTL and Relay 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 SP TTL and Relay Kit is installed on an external SP enclosure, the TTL and relay connectors are installed on the side of the enclosure (see Figure 3-29).

When the SP is installed inside an AE or mounted on the side of an AE, two connectors are installed on top of the AE (see Figure 3-29). This configuration requires installation of the AE TTL and Relay Kit (P/N AAA-068548), in addition to the SP TTL and Relay Kit.



TTL/Relay Connectors on External SP

TTL/Relay Connector on Top of AE

Figure 3-29. TTL/Relay Connectors on SP and AE

For installation instructions for the SP TTL and Relay Kit and the AE TTL and Relay Kit, see Appendix C.

3.8.1 Relay Output Control

The relay outputs are normally open (NO). This means that each 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, see Section C.3.

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

- To program the relay's state change in an instrument method, add the control commands in the Instrument Method Editor (in the Script Editor view) in Chromeleon 7 software.

  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.

  Always include a command that opens (turns off) the relay at the beginning of the instrument method. Include the command in all methods that are used with the system.

- To configure the relay's state change as a function of an alarm condition or a TTL input state change in Chromeleon 7 PA software, see "Configuring TTL Input Responses (Actions)" on page 55.

- To change the relay's state immediately (direct control), use the controls on the SP ePanel in Chromeleon 7 software.

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)

Select the preferred response (action) for each connected TTL input in Chromeleon 7 PA software. Observe these guidelines:

- When a relay output is configured to change states with an alarm event, do not configure it in an instrument method to control devices.
- Always include a command that opens (turns off) the relay at the beginning of the instrument method. Include the command in all methods that are used with the system.

For more information, refer to the Chromeleon 7 PA software Help.

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. (For example, 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 sensor status is displayed on the SP ePanel in Chromeleon 7 software.

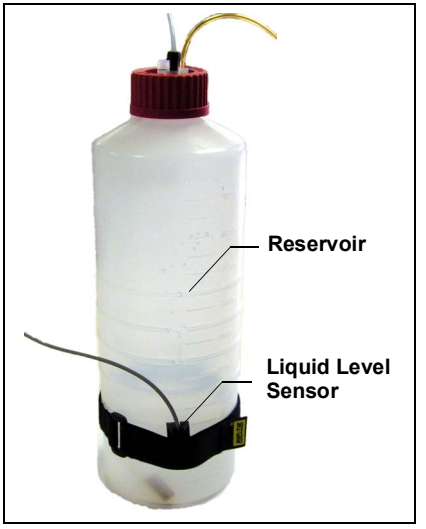


Figure 3-30. Liquid Level Sensor Installed

Up to four liquid level sensors can be connected to the SP. The sensors are enabled on the **Sensors** page in the Instrument Configuration Manager (in Chromeleon 7 software). For installation instructions, see Appendix E.

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 SP ePanel in Chromeleon 7 software.

The sensor can measure flow from 0.2 to 5.0 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. Up to two flow sensors can be installed in the SP.

Set high and low limits for the flow rate in the Instrument Configuration Manager (in Chromeleon 7 software). If the flow rate is outside the specified range, the flow sensor reports the error to Chromeleon 7 software and an error message is displayed in the software audit trail.

To install the flow sensor

1. Turn off the SP power.
2. Disconnect the power cord.
3. Using the screws and washers included in the Flow Sensor Kit, attach the flow sensor to the mounting plate as shown in Figure 3-31. Make sure the nylon washers are installed between the board on the flow sensor and the mounting plate.

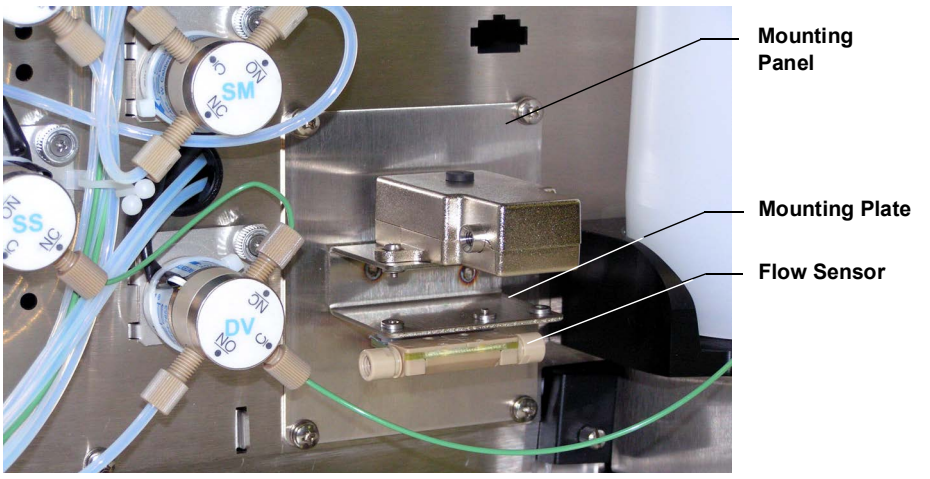


Figure 3-31. Flow Sensor

4. Thread the flow sensor cable through the slot in the mounting panel.
5. Follow the instructions in Section 10.7 to access the main SP electronics board.
6. Plug the flow sensor cable into the connector labeled **FLOW 1** (or **FLOW 2**, if this is the second sensor) in the bottom center of the main SP electronics board (see Figure 3-32).

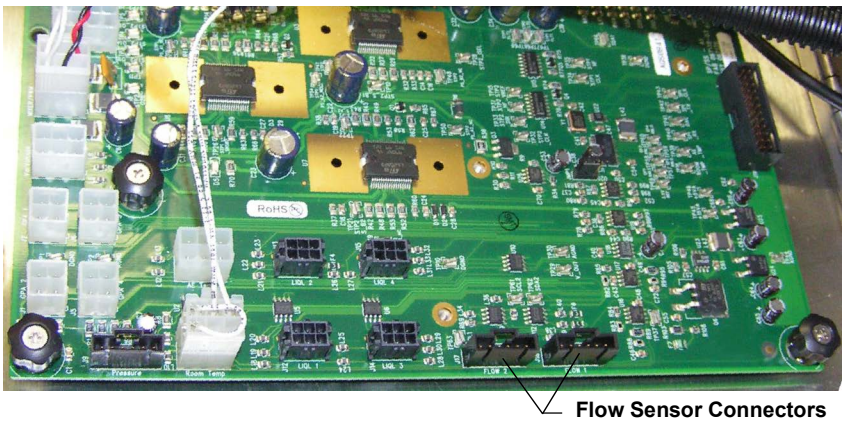


Figure 3-32. Main SP Electronics Board: Flow Sensor Connectors

7. Using the tubing and fittings included in the kit, connect an inlet line and outlet line to the flow sensor. (There is no prescribed flow direction; liquid can enter and leave the flow sensor from either side.)
8. Close and secure the SP service door.
9. If you removed the SP from the AE rear panel:
   a. Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE rear panel, and hang the SP on the rails.
   b. Replace any modules that were removed from the lower shelf of the AE.
   c. Replace the two access panels on the exterior of the AE.
10. Plug in the power cord and turn on the power.
11. Open the Instrument Configuration Manager (in Chromeleon 7 software).

12. Open the SP Properties dialog box. On the **Sensors** page, select the appropriate check box (**Flow Sensor_1** or **Flow Sensor_2**) and enter the low and high flow limits.
13. Save the configuration.
14. Calibrate the flow sensor (see Section 10.10).

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 Chromeleon 7 software in two locations: in the **Command** window (under the SP device) and on the SP ePanel.

NOTE Pressure transducers for other pressure ranges are also available from Thermo Fisher Scientific.

To install the pressure transducer

1. Turn off the SP power.
2. Disconnect the power cord.
3. Thread the pressure transducer's cable through the upper slot in the mounting panel (see Figure 3-33).
4. Using the screws and washers included in the Pressure Sensor Kit, attach the pressure transducer to the mounting plate as shown in Figure 3-33.

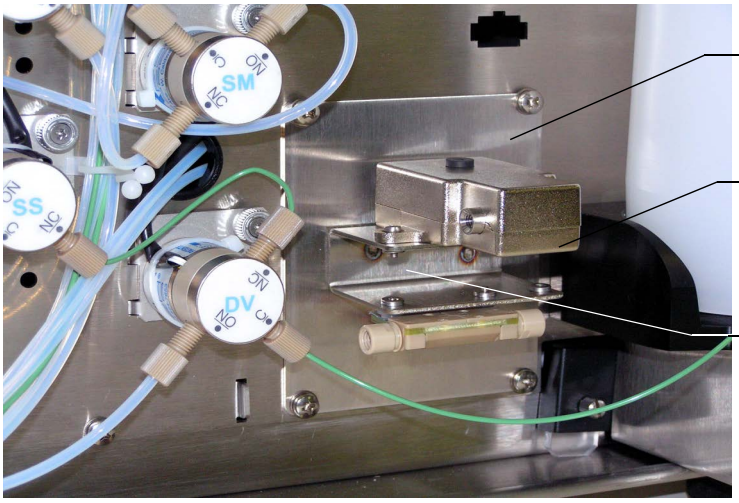


Figure 3-33. Pressure Transducer

5. Follow the instructions in Section 10.7 to access the main SP electronics board.
6. Locate the connector labeled **Pressure** in the lower-left corner of the main SP electronics board (see Figure 3-34).

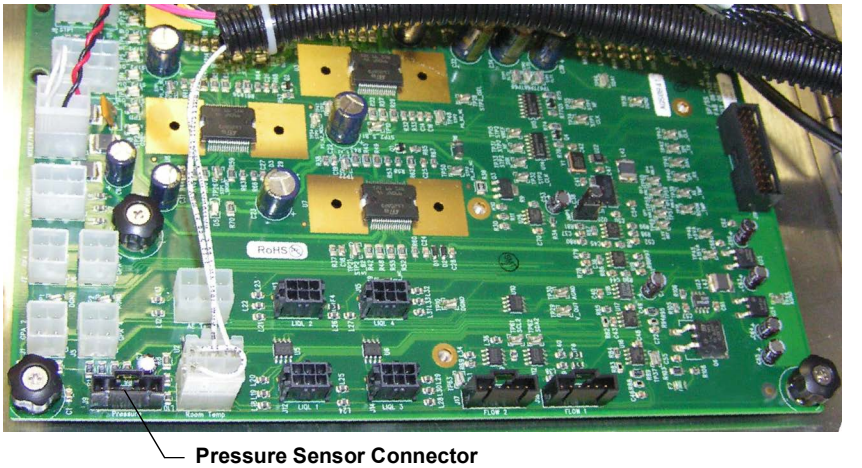


Figure 3-34. Main SP Electronics Board: Pressure Transducer Connector

7. Plug the cable into the **Pressure** connector on the main SP electronics board.
8. Plumb the pressure transducer inlet and outlet ports as required for the application. (There is no prescribed flow direction; liquid can enter and leave the pressure transducer from either side.)
9. Close and secure the SP service door.
10. If you removed the SP from the AE rear panel:
    a. Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE rear panel, and hang the SP on the rails.
    b. Replace any modules that were removed from the lower shelf of the AE.
    c. Replace the two access panels on the exterior of the AE.
11. Plug in the power cord and turn on the power.
12. Open the Instrument Configuration Manager (in Chromeleon 7 software).
13. Open the SP Properties dialog box. The **Pressure Transducer** check box is enabled on the **Pumps/Motors** page.
14. Save the configuration.
15. Calibrate the pressure transducer (see Section 10.10).

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 in Chromeleon 7 software, either in the instrument method or on the SP ePanel.

To connect a device to the DC voltage control option

1. Turn off the SP power.
2. Disconnect the power cord.
3. Follow the instructions in Section 10.7 to access the main SP electronics board.
4. Locate the connector labeled **VarVoltage** on the left side of the main SP electronics board (see Figure 3-35).

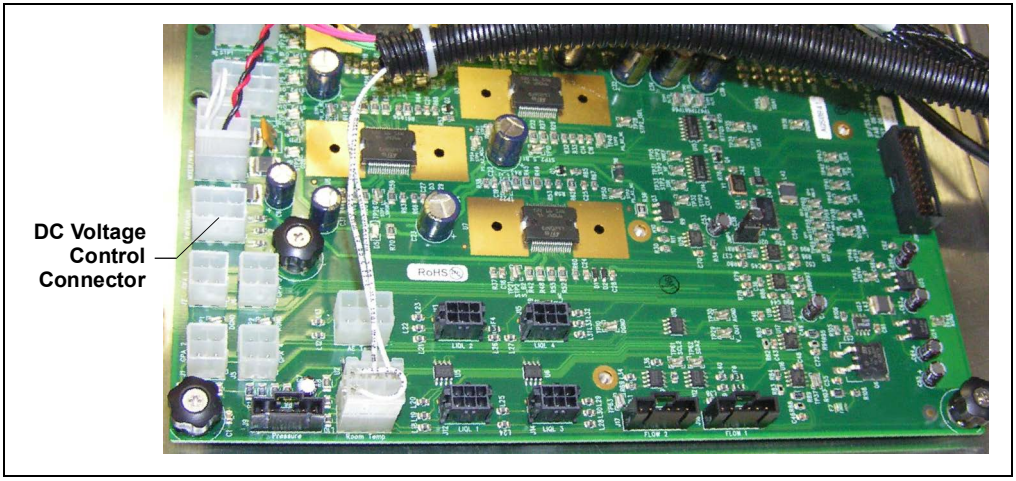


Figure 3-35. Main SP Electronics Board: DC Voltage Control Connector

5. Plug the DC voltage control cable (P/N 070181) into the **VarVoltage** connector on the main SP electronics board.
6. 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.

7. Route the cable to the device to be controlled, and then connect the free ends of the wires to the appropriate connector pins on the device.
8. Close and secure the SP service door.
9. If you removed the SP from the AE rear panel:
   a. Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE rear panel, and hang the SP on the rails.
   b. Replace any modules that were removed from the lower shelf of the AE.
   c. Replace the two access panels on the exterior of the AE.
10. Plug in the power cord and turn on the power.
11. Open the Instrument Configuration Manager (in Chromeleon 7 software).
12. Open the SP Properties dialog box. The **DC Voltage Control** check box is enabled on the **Pumps/Motors** page. Enter the default voltage level to use when the DC voltage control is on.
13. 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 typically used to control the dilution vessel mixer (see Section 3.5.2).

If the dilution vessel mixer is not required, you can use the PWM power output for another function. Thermo Fisher Scientific offers a PWM power output cable (P/N 070180) 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 the Chromeleon 7 software commands typically used to control the dilution vessel mixer to turn the power output on and off and to control the amount of power delivered to the device (from 0% to 100% of maximum). These commands are available in the **Command** window (under the SP device) and on the SP ePanel.

To connect a device to the PWM power output

1. Turn off the SP power.
2. Disconnect the power cord.
3. Follow the instructions in Section 10.7 to access the main SP electronics board.
4. Locate the connector labeled **Mixer/PWM** on the left side of the main SP electronics board (see Figure 3-36).

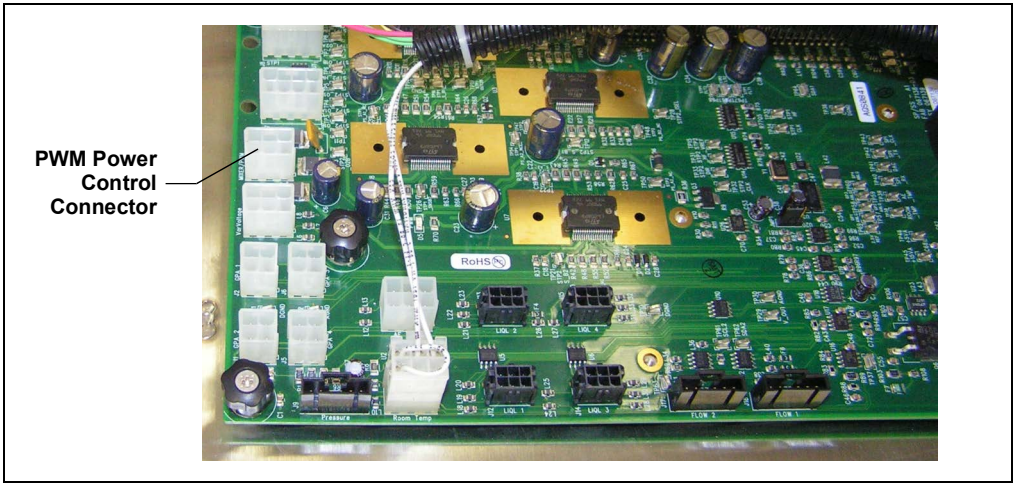


Figure 3-36. Main SP Electronics Board: PWM Power Control Connector

5. Plug the PWM power output cable (P/N 070180) into the **Mixer/PWM** connector on the main SP electronics board.
6. On the other end of the power output cable, attach two wires to the 3-position connector plug. Connect the wires to the positions required for the voltage range:
   - For a range of 0 to 24 V, attach wires to the **24V** and **PWM** connectors.
   - For a range of 0 to 5 V, 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.

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

9. If you removed the SP from the AE rear panel:
    a. Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE rear panel, and hang the SP on the rails.
    b. Replace any modules that were removed from the lower shelf of the AE.
    c. Replace the two access panels on the exterior of the AE.
10. Plug in the power cord and turn on the power.
11. Open the Instrument Configuration Manager (in Chromeleon 7 software).
12. Open the SP Properties dialog box. The **Mixer Motor** check box is enabled on the **Pumps/Motors** page. Enter the default percentage of power (from 0% to 100% of maximum) delivered when the PWM power output is on.
13. 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. Each valve can be 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.

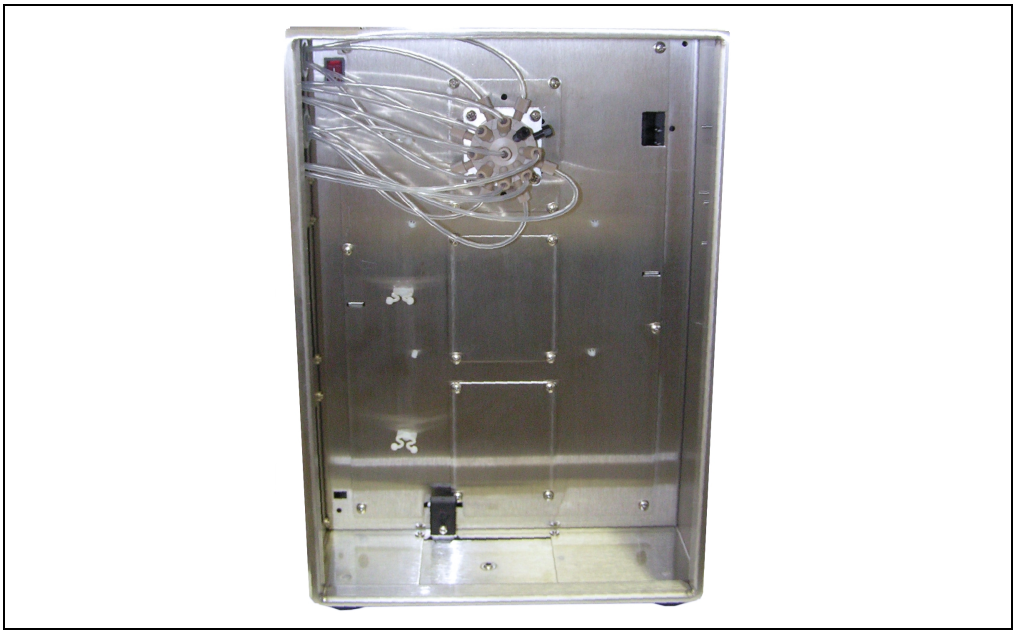


Figure 4-1. SS Stream Selector with One Stream Selection Valve

4.2 Stream Selection

SS stream selection valves are 17-port, 8-position valves 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 exit the SS through the side fittings.

NOTE 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 3-11 for the SP1 flow path; see Figure 3-14 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.

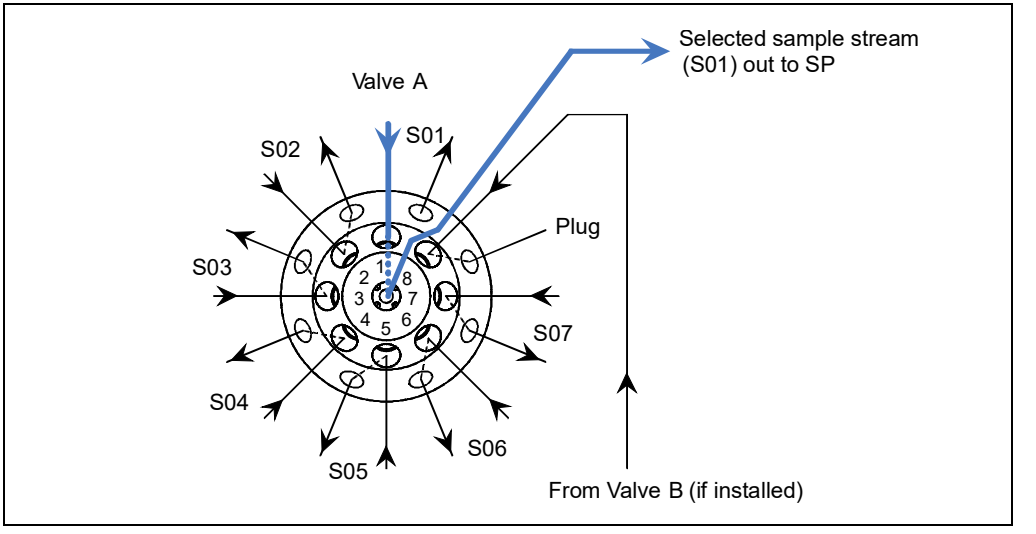


Figure 4-2. SS Stream Selection Valve A: Stream 1 Selected

Streams that are not selected flow continuously out of the valves and exit the SS. These 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, you can plug the outlet ports on the stream selection valves with 1/4-28 fittings, provided that the incoming sample pressure does not exceed 0.34 MPa (50 psi).

4.3 SS Enclosures

The SS is available in two enclosure types:

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

Both 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, the ventilation openings are exposed to the environment. This meets NEMA 12 requirements.
- When the external SS enclosure is mounted on the side of an AE, the ventilation openings are inside the AE and are not exposed to the environment. This meets NEMA 4X requirements.

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

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

NOTE If the USB Extension Kit is installed and the SS is more than 5 m (16 ft) away from the SP, allow additional time for sampling. This ensures 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).

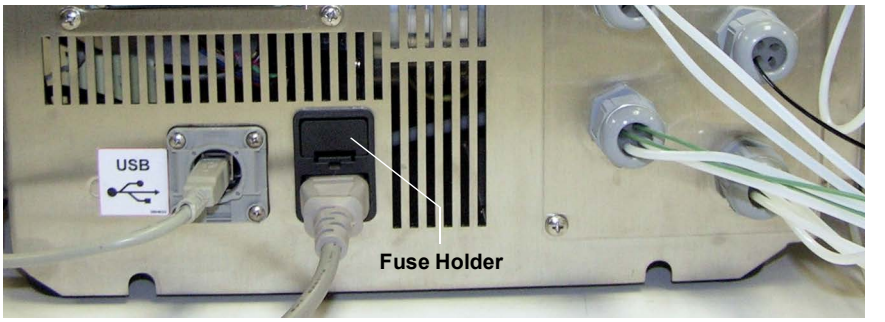


Figure 4-3. SS USB and Power Receptacles

Fuse Holder and Power Receptacle

The fuse cartridge contains two fast-blow IEC 60127 fuses rated 3.15 A (P/N 954745). For fuse replacement instructions, see Section 10.11.

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 the side of 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 an AE or installed inside the AE, the AE power cord is the main disconnect device. In addition, the AE main power switch (see Figure 5-7) and **Emergency Off** switch (see Figure 5-2) can be used to control the power to the SS.

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.

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

Software Communication

The USB (Universal Serial Bus) receptacle (a Type-B connector) (see Figure 4-3) allows connection to the computer on which Chromeleon 7 PA software is installed.

The SS Ship Kit (P/N 069088) includes one USB cable (P/N 960779). The cable is 5 m (16 ft) long.

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 7 software and an error message is displayed in the software audit trail (see Section 9.2).

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 (see Figure 4-4). A drain line can be connected to this port, if you want.

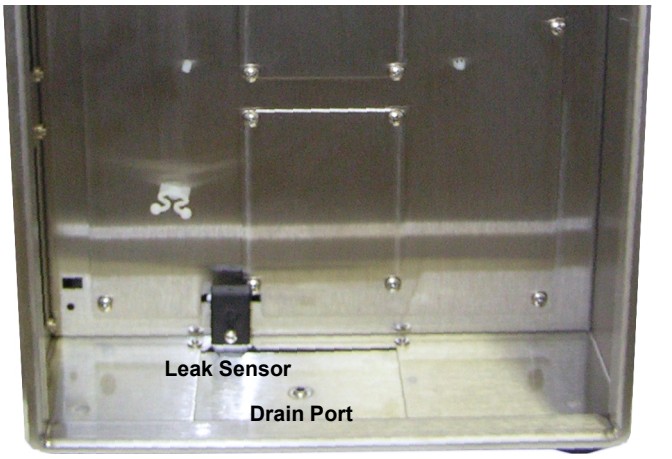


Figure 4-4. SS Leak Sensor and Drain Port

5 • AE Analyzer Enclosure Description

5.1 AE Overview

The AE Analyzer Enclosure provides housing for the modules in a Dionex Integral system, including the chromatography system modules and Dionex Integral SP and SS enclosures.

The AE can be mounted on top of the LE Liquids Enclosure, as shown in Figure 5-1, or on a wall or other appropriate support structure.

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

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

Figure 5-1. AE Mounted on an LE

5.2 AE Exterior Features

Figure 5-2 shows the exterior of the AE.

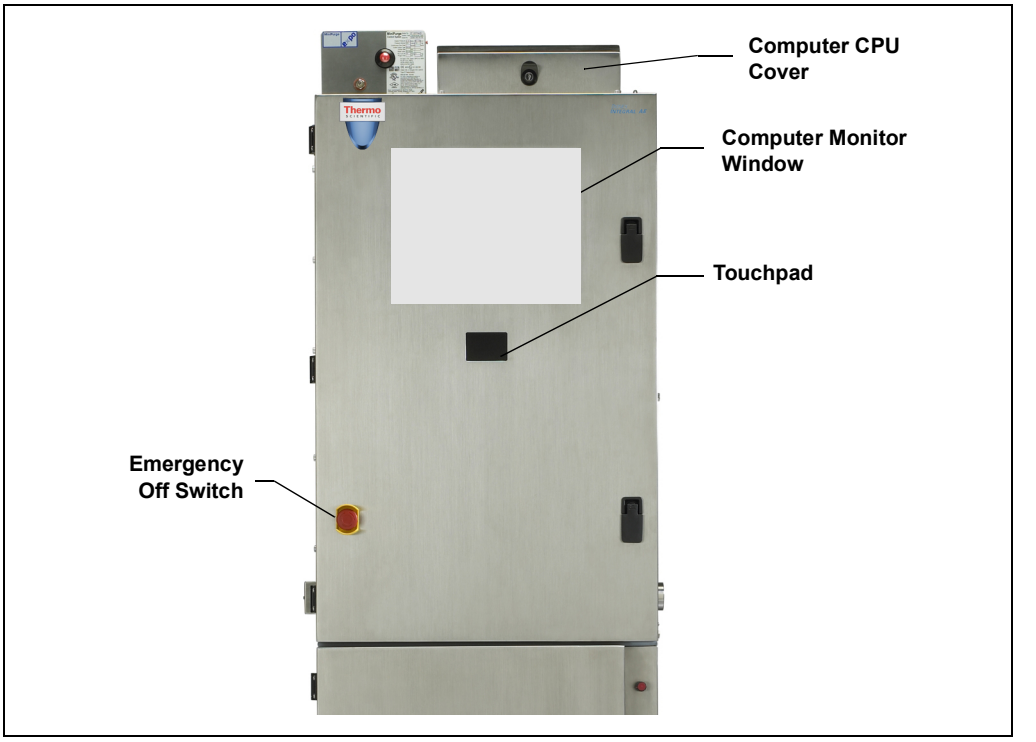


Figure 5-2. AE Front Exterior

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

When the optional Computer Control Installation Kit (P/N 069094) is installed, a computer monitor is mounted on the inside of the enclosure door. The monitor is viewable through the window in the door.

5.3 AE Interior Features

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

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 as needed to accommodate a variety of 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.

CAUTION

When sliding shelves forward or backward, be careful not to pinch your fingers between the shelf and the metal tabs (see Figure 5-4) protruding from each shelf support.

MISE EN GARDE

Lorsque vous faites glisser les étagères vers l'avant ou vers l'arrière, veillez à ne pas vous pincer les doigts entre l'étagère et les languettes métalliques (voir la figure 5-4) qui dépassant de chaque support d'étagère.

VORSICHT

Achten Sie beim Vorwärts- oder Rückwärtsschieben der Regale darauf, dass Sie sich nicht die Finger zwischen dem Regal und den Metalllaschen (siehe Abbildung 5-4) einklemmen, die aus jeder Regalstütze herausragen.

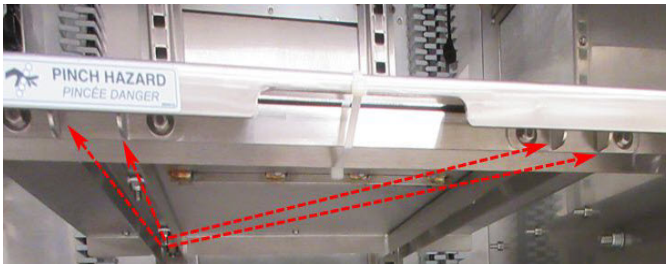


Figure 5-4. AE Shelf Tabs

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 inside the AE (see Figure 5-3), in the rear-left corner. Power cords from all components installed inside the AE or mounted on the side of the AE (including the SP, detector, pump, and air conditioner) are connected to these outlets. This allows the AE main power switch (see Figure 5-7) 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 you want.

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 auxiliary leak sensor becomes wet, the leak is reported to Chromeleon 7 software and an error message is displayed in the software audit trail (see Section 9.2).

5.4 AE Power and Computer Connections

Power Receptacle

The power in receptacle on the top of the AE (see Figure 5-5) provides a connection to the AE main power.

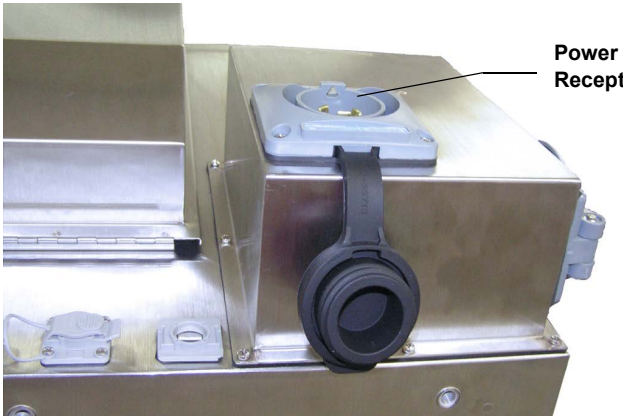


Figure 5-5. AE Power In Receptacle

Use the power cord included in the AE Ship Kit (P/N 069066) to connect the power in receptacle to a grounded, single-phase power source.

The power cord is configured with a NEMA L5-20P plug (125 Vac/20 A twist-lock) (see Figure 5-6) for connection to facility power terminated as a NEMA L5-20R wall receptacle. The connections must provide proper grounding of the Dionex Integral system.

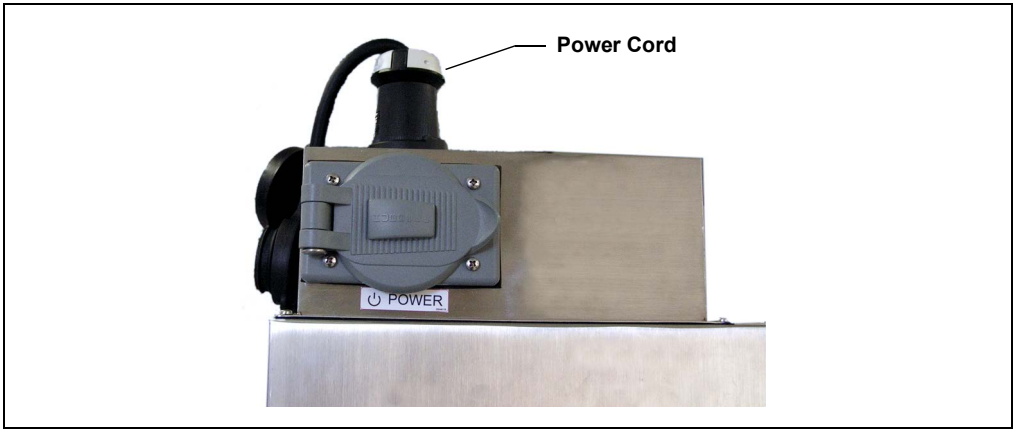


Figure 5-6. AE Power Cord Connected

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.

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.

Main Power Switch

A power input box is located in the upper-left rear corner of the AE (see Figure 5-7). The power switch on the box is the main power switch for the AE.

The main power switch controls the power to all components connected to the AE (including the chromatography system modules, blower, and air conditioner). The main power switch is also the circuit breaker that provides protection against current above the electrical specifications of the enclosure (see Section A.2).

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

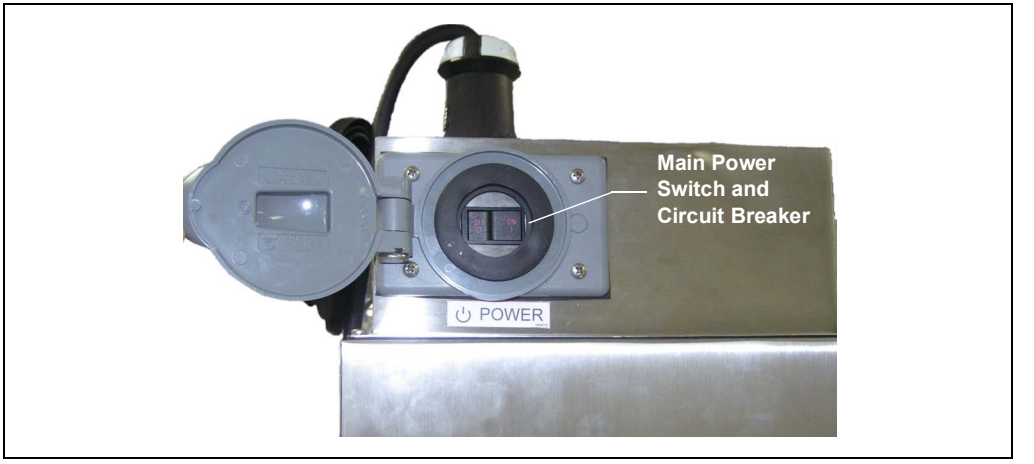


Figure 5-7. Main Power Switch on Top of the AE

Computer Connections

The top of every AE includes one USB (Universal Serial Bus) receptacle (a Type-B connector) (see Figure 5-8) for connection to the computer on which Chromeleon 7 PA software is installed.

Locations for three additional USB receptacles and one LAN (local area network) receptacle (RJ-45 connector) are provided. Receptacles are not installed in these locations unless the optional Computer Control Installation Kit (P/N 069094) is installed.

A USB hub inside the AE connects the chromatography modules installed in the AE to the network.

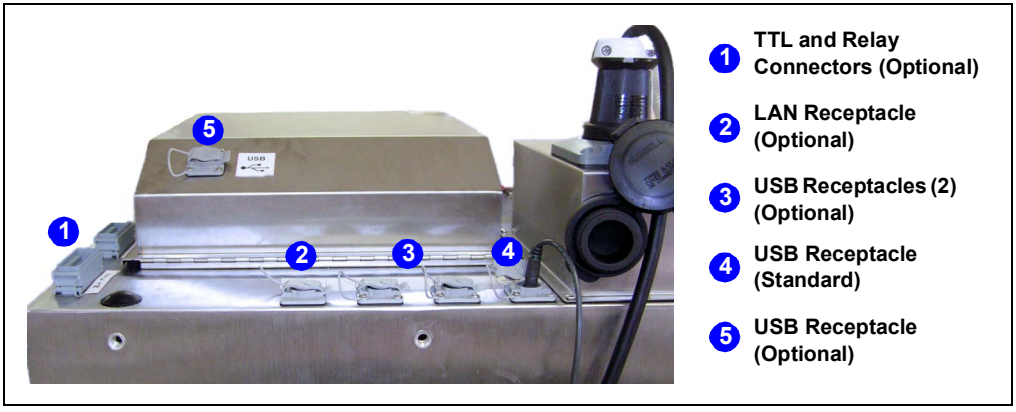


Figure 5-8. Communication Connectors on Top of the AE

5.5 AE TTL and Relay Connectors (Option)

Two TTL and relay connectors are provided on the top of the AE (see Figure 5-8). These connectors are not functional unless the AE TTL and Relay Kit (P/N AAA-068548) and the SP TTL and Relay Kit (P/N 068573) are installed.

For details about TTL and relay control, see Section 3.8.

For installation instructions for the TTL and Relay Kits, see Appendix C.

5.6 AE Ventilation Fan (Option)

The optional ventilation fan (P/N 068544) can be mounted on the side of the AE. The fan runs continuously unless the AE power is turned off. (The fan is not controlled by Chromeleon 7 PA software.) When the fan is installed, the AE meets NEMA 12 requirements.

NOTE The AE ventilation fan cannot be installed if a NEMA 4X-equivalent enclosure is required. For definitions of the NEMA enclosure types, see Table 3-1.

Refer to *Installation Requirements and Customer Responsibilities: Process Analytical Systems* (Document No. 070186) for mounting and connection instructions.

5.7 AE Air Conditioner/Heater (Option)

The optional air conditioner/heater (115 Vac, P/N 068545; 230 Vac, P/N 069093) can be mounted on the right side of the AE. The 240 Vac 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.

Refer to *Installation Requirements and Customer Responsibilities: Process Analytical Systems* (Document No. 070186) for mounting and connection instructions.

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

5.8 AE Tower Light (Option)

When 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 side (see Figure 5-9).

Figure 5-9. AE Tower Light

If the analyzer includes an SP with the optional SP TTL and Relay Kit (P/N 068573), the SP relays can be used to turn the tower lights on and off. Each tower light color is controlled by a different relay output.

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

You can also configure the lights to turn on whenever a particular error occurs. Use the following methods to control the tower light relays:

- In Chromeleon 7 PA software, 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. For example, have the red light turn on if a fatal hardware alarm occurs.
- In Chromeleon 7 PA software, 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. For example, have the yellow light turn on if the retention time of the chloride peak exceeds 3.225.
- In Chromeleon 7 software, control the relays in the instrument method. Enter commands for controlling the relays in the Instrument Method Editor (in the Script Editor view).

See Appendix C for installation instructions for the AE Tower Light Kit and the SP TTL and Relay Kit.

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/heater), an extension must be installed on the LE (see Figure 2-1).

6.2 LE Containers

The LE accommodates the containers described below.

- Plastic bottles for standards or reagents

  The system is shipped with 2-liter bottles (P/N 044129). If 1-liter bottles (P/N 044128) are needed, they must be ordered separately.

- NOWPak containers for mobile phase (eluent or solvent)

  Either 20-liter NOWPak Bag-in-a-Bottle containers (P/N AAA-068551) or 20-liter stainless steel NOWPak II containers (P/N 052882) can be used. NOWPak containers must be ordered separately.

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

6.3 LE Control Panel

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

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.

- The pressure gauge indicates the pressure applied to the reservoirs and NOWPak containers. The recommended operating pressure is 20 to 34 kPa (3 to 5 psi).

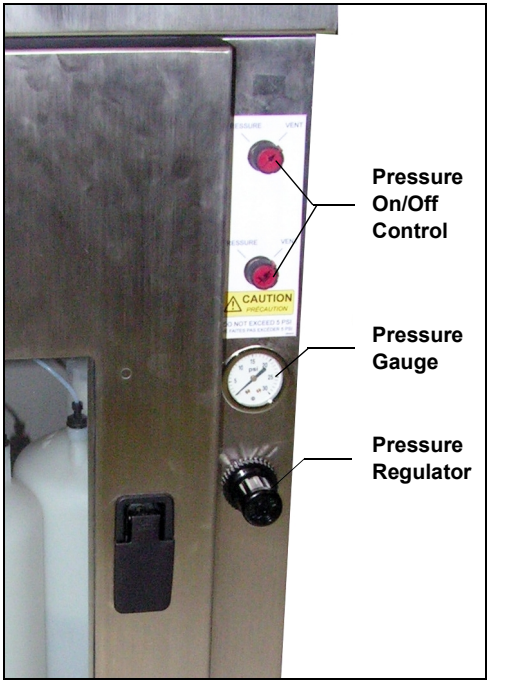


Figure 6-1. LE Control Panel

- 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.
- The knobs provide on/off control of gas pressure to the reservoirs and 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.

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.

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 press-fit fitting.

6.5 LE Pneumatic Requirements

All 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.

To maintain the required pressure, install the reservoirs within 3 m (10 ft) of the AE enclosure and no more than 0.5 to 1 m (2 to 3 ft) below the bottom of the enclosure.

After pressurizing the reservoirs and NOWPak containers, wait 15 to 30 minutes before checking 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.

NOTE It may take several hours for the pressure to stabilize, depending on how much liquid is in the NOWPak container.

7 • Startup, Operation, and Shutdown

7.1 Initial Startup Checklist

Complete the following installation steps before initial operation of the Dionex Integral system.

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, and SS).

   Refer to *Installation Requirements and Customer Responsibilities: Process Analytical Systems* (Document No. 070186) for appropriate locations and distances.

2. Provide the facilities specified in the installation requirements. Also refer to the installation requirements for the 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.)

   NOTE 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 that 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 for the drain 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 the 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 or sample source. Refer to the installation requirements for correct pressures and flow rates.
3. If an SS is installed, connect it to the sample panel. Refer to the installation requirements 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, and SS).
3. If the Dionex Integral system includes an AE, close the AE door and twist the knob on the **Emergency Off** switch (see Figure 5-2) clockwise to set the knob to the out position.

7.2.2 Set Up Chromeleon 7 PA Software and Configure the System

- For installation instructions for Chromeleon 7 PA software, refer to *Chromeleon 7.3 Installation Guide* (Document No. 7329.0003).
- For instructions on how to configure the system, refer to the Chromeleon 7 PA software Help.

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 Bag-in-a-Bottle containers (P/N AAA-068551) for filling instructions.
5. Open water supplies to each system.
6. Manually actuate the SP valves to flush the lines with water, diluent, sample, and standards.
7. 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 soak the vessel overnight) in order to remove trace contaminants.
8. Before installing consumable components (see Section 7.2.4):
   a. Set the analytical pump flow rate to 0.25 mL/min (for a microbore pump) or 1.0 mL/min (for a standard bore pump).
   b. 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.
   c. While pumping through the chromatography flow path, verify that the total backpressure remains below 690 kPa (100 psi).

7.2.4 Install Consumable Components

Install the columns, the suppressor (if used), and any other consumables as instructed in the product manuals.

7.2.5 Calibrate the System

Pump Calibration

Always calibrate the dilution pump and stepper motor loading pump after replacing any component in the pump flow path that changes the system backpressure. The purpose of pump calibration is to accurately determine the pump stroke volume, using the same hardware components (tubing, fittings, columns, and so on) used for routine analysis.

1. Open the SP ePanel in Chromeleon 7 software.
2. Click the button for the procedure to be performed (for example, click **Dilution Pump Calibration**). A window appears.
3. Follow the calibration instructions in the window.

NOTE The peristaltic loading pump, if installed, does not require calibration. Adjusting the pump speed delivers the required flow rate (see Section 10.9).

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 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.

- For instructions on how to make a loop with a different volume, see "To make a standard loop" on page 93.
- For instructions on how to calibrate a new loop, see "To calibrate a standard loop" on page 93.

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.

To calibrate a standard loop

1. Install a plug (P/N 042772) in one end of a black coupler (P/N 042627). Install the coupler on one end of the standard loop.
2. Repeat Step 1 on the other end of the loop.
3. Weigh the loop, on an analytical balance, to the nearest 0.001 gram. Record the weight.
4. Remove the loop from the balance.

5. Remove the plugs from the couplers.
6. 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.*
7. Reinstall the plug on the end of the coupler from which the water exited.
8. Remove the syringe and luer adapter from the other end of the loop and install the plug in it.
9. Examine the outside of the loop for water droplets. **Carefully** dry any water, and then weigh the loop to the nearest 0.0001 gram, if possible.
10. Subtract the weight of the empty loop (Step 3) from the weight of the filled loop (Step 9); the difference is the weight of the water in the standard loop.
11. Repeat Step 9 and Step 10 until four to five consecutive weighings ±0.009 are achieved.
12. 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

13. 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 for instructions.

Detector Calibration

Calibrate the detector, if required. Refer to the detector manual for instructions.

7.2.6 Set Up the Dionex Integral Analyzers in the Software

Use Chromeleon 7 software to perform these tasks:

- Create instrument methods and processing methods for each Dionex Integral system.
- Run a standard, and then edit component information for the method.

- Calibrate the method for the first time. (Subsequent calibrations can be done in Chromeleon 7 PA software.)

Notes

- Commands for the SP and SS must be added in the Script Editor view in the Instrument Method Editor. Commands for other Dionex Integral system components can be added in the Instrument Method Wizard.
- To ensure that sample preparation works correctly, method commands must be grouped into one block of commands for the SP and another block for the SS. The **BeginSPSamplePrep** command must be the first command in the block. The **EndSPSamplePrep** command must be the last command. For more information, refer to the Chromeleon 7 software Help.

Use Chromeleon 7 PA software to perform these tasks:

- Configure the Dionex Integral analyzers, instruments, and streams. Refer to the Chromeleon 7 PA software Help for detailed instructions.

7.3 Routine Startup and Operation

Routine operation consists of first confirming that all hardware is operating properly, and then running the instrument methods and sequences required to control sample analysis. Refer to the Chromeleon 7 PA software Help for detailed operating instructions.

7.3.1 Routine Startup

1. Verify that the power is on for all system components.
2. Verify that the computer is on.
3. Verify that the server for Chromeleon 7 software is running.
4. Verify that all water and gas utilities are on and that they are adjusted to their proper pressures.
5. Verify that all mobile phases, standards, and reagents are supplied.
6. Start Chromeleon 7 PA software.

7. Load an appropriate sequence.
8. 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. If necessary, adjust the flow rate.
   - Check the dilution vessel for liquid. If necessary, follow these steps to drain the dilution 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. If necessary, see Chapter 9 for troubleshooting assistance.
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 system performance.

7.4 Shutdown

7.4.1 Short-Term Shutdown

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

1. In Chromeleon 7 PA software, select the analyzer to be shut down.
2. Place the selected analyzer in the standby state.
3. Exit Chromeleon 7 PA software.
4. Shut down the computer.
5. Turn off the main power switch on the AE.

   –or–

   If the analyzer does not include an AE, turn off the power to all analyzer components separately.
6. Turn the LE gas controls to **VENT**.
7. Shut off the water and gas facilities to each system.
8. Leave the columns installed and filled with mobile phase.
9. 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 7 PA software, select the analyzer to be shut down.
2. Place the selected analyzer in the standby state.
3. Exit Chromeleon 7 PA software.
4. Shut down the computer.
5. Empty and rinse the mobile phase, standard, and reagent bottles.
6. Prepare the columns, suppressors, and EluGen cartridges for long-term storage as instructed in the product manuals.

7. Flush the pumps, valves, post-column system, and interconnecting tubing with deionized water. Blow out the lines with high-purity nitrogen or helium.
8. Turn the LE gas controls to **VENT**.
9. Shut off the water and gas facilities to each system.
10. Turn off the main power switch on the AE.

    –or–

    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 users can perform for the Dionex Integral system. All other maintenance procedures must be performed by a Technical Support Representative for Dionex products.

Establish a routine maintenance program based on the guidelines here, as well as information in the user manuals for other system components (including the analytical pump, detector, and columns). 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 as needed. 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	Check that all lines flow freely.

Component or Feature	Action
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, EluGen cartridge	Check for leaks. If the suppressor is operating in AutoSuppression mode, check that bubbles are flowing from the suppressor regenerant outlet line.
Chromatography	Check chromatograms for trending problems (for example, missed peaks).
Printer	Check that 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.
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	Check Chromeleon 7 software for the lifetime remaining value. Replace the cartridge, if necessary.

9 • Troubleshooting

This chapter is a guide to troubleshooting minor issues that may arise during operation of the Dionex Integral system.

- For general troubleshooting strategies, see Section 9.1.
- For descriptions of error messages and suggestions for how to troubleshoot them, see Section 9.2.
- For descriptions of various operating problems and suggestions for 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 1-800-532-4752 and select **option 2**.
- 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. Although this manual cannot address every possible symptom and failure, 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 (for example, when eluents are prepared and when columns are changed). 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. Keep 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 periodically checks the status of certain parameters. When a problem is detected, it is reported to Chromeleon 7 software and logged in the software 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. Although the instrument can continue running (or can be started), Thermo Fisher Scientific recommends that you take appropriate action to remedy the situation.
	Error	A message is displayed in the audit trail or the Ready Check results. The system attempts to correct the problem (sometimes by using an alternative parameter) but the current run is not interrupted. If the error occurs during the Ready Check, the queue will not be started until the error is resolved.
	Abort	A message is displayed in the audit trail and the running queue is aborted.

The table below lists the most frequently observed error messages and the default severity level for each message. (For most modules, you can change the severity level assigned to a problem whenever appropriate.) For troubleshooting assistance, go to the page indicated in the table.

Audit Trail Error Message	Default Severity Level	See
BeginSamplePrep command and/or EndSamplePrep command are specified more than once	Error	page 109
BeginSPSamplePrep command is not specified	Error	page 109
BeginSPSamplePrep command must occur before any Integral SP sample preparation commands	Error	page 110
BeginSPSamplePrep command must occur before EndSPSamplePrep command	Error	page 110
BeginSPSamplePrep, EndSPSamplePrep, and commands in between do not have the same instrument method time	Error	page 110
DelaySP command must occur within BeginSPSamplePrep/ EndSPSamplePrep command block	Error	page 111
Dilution pump driver is over current	Abort	page 111
Dilution pump home sensor not detected	Abort	page 112
Dilution pump lost count	Warning	page 112
Dilution pump stopped or lost more than 20 steps	Abort	page 112
EndSPSamplePrep command is not specified	Error	page 113
Flow sensor 1 flow rate is higher than limit Flow sensor 2 flow rate is higher than limit	Warning	page 113
Flow sensor 1 flow rate is lower than limit Flow sensor 2 flow rate is lower than limit	Warning	page 114
Flow sensor 1 offset calibration value is out of range Flow sensor 2 offset calibration value is out of range	Abort	page 114
Flow sensor 1 slope calibration value is out of range Flow sensor 2 slope calibration value is out of range	Abort	page 115
Leak sensor 1 wet Leak sensor 2 wet	Warning	page 115
Loading pump driver is over current	Abort	page 117
Loading pump home sensor not detected	Abort	page 117
Loading pump lost count	Warning	page 118

Audit Trail Error Message	Default Severity Level	See
Loading pump stopped or lost more than 20 steps	Abort	page 118
Mixer motor speed is higher than expected	Warning	page 118
Pressure offset calibration value is out of range	Abort	page 119
Pressure slope calibration value is out of range	Abort	page 119
Pump volume command must occur within BeginSPSamplePrep/EndSPSamplePrep command block	Abort	page 119
Rotary valve 1 error Rotary valve 2 error Rotary valve 3 error	Abort	page 120
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 120
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 121
Vessel heater over safe temperature	Abort	page 121
Vessel heater temperature calibration offset or slope is out of range	Abort	page 122
Vessel heater temperature calibration setting is too close	Abort	page 122
Vial cooler over safe temperature	Abort	page 122
Vial cooler temperature calibration offset or slope is out of range	Abort	page 123
Vial cooler temperature calibration setting is too close	Abort	page 123

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

This error occurs if the sample preparation command block in an instrument method includes more than one beginning and/or ending command. See "Notes" on page 96 for more information.

To troubleshoot:

Remove all duplicate commands from the sample preparation command block.

BeginSPSamplePrep command is not specified

This error occurs if the sample preparation command block in an instrument method includes the **EndSPSamplePrep** command, but not the **BeginSPSamplePrep** command.

–or–

This error occurs if **BeginSPSamplePrep** is not the first command in the sample preparation command block.

See "Notes" on page 96 for more information.

To troubleshoot:

1. Open the instrument method.
2. In the Script Editor view, 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 an SP sample preparation command appears in an instrument method before the sample preparation command block. See "Notes" on page 96 for more information.

To troubleshoot:

Move the SP sample preparation command to after the **BeginSPSamplePrep** command in the instrument method.

–or–

Delete the SP sample preparation command from the instrument method.

BeginSPSamplePrep command must occur before EndSPSamplePrep command

This error occurs if the **EndSPSamplePrep** command appears in an instrument method before the **BeginSPSamplePrep** command. See "Notes" on page 96 for more information.

To troubleshoot:

1. Open the instrument method.
2. In the Script Editor view, add the **BeginSPSamplePrep** command before the first sample preparation command.

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

This error occurs if not all commands in the sample preparation command block of an instrument method have the same retention time. See "Notes" on page 96 for more information.

To troubleshoot:

Remove retention times from the commands in the sample preparation command block.

–or–

If a sample preparation command is assigned a specific retention time, position the command outside the sample preparation command block.

DelaySP command must occur within BeginSPSamplePrep/ EndSPSamplePrep command block

This error occurs if the **DelaySP** command in an instrument method is not inside the sample preparation command block. See "Notes" on page 96 for more information.

To troubleshoot:

Move the command inside the sample preparation command block.

–or–

Delete the sample preparation command from the instrument method.

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. Press the SP power switch to turn off the power.
3. After a brief pause, turn on the SP power again.
4. Restart the pump flow.
5. If the problem persists, contact Technical Support for Dionex products for assistance.

Dilution pump home sensor not detected

This error occurs if the dilution pump electronics are unable 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 the tubing downstream from the pump (for the SP1 flow schematic, see Figure 3-11; for the SP2 flow schematic, see Figure 3-14).
2. If no blockage is found, turn off the pump flow.
3. Press the SP power switch to turn off the power.
4. After a brief pause, turn on the SP power again.
5. Restart the pump flow.
6. If the problem persists, contact Technical Support for Dionex products for assistance.

Dilution pump lost count

This is a warning message; the pump will continue to function and no action is required.

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 the tubing downstream from the pump (for the SP1 flow schematic, see Figure 3-11; for the SP2 flow schematic, see Figure 3-14).
2. If no blockage is found, turn off the pump flow.
3. Press the SP power switch to turn off the power.

4. After a brief pause, turn on the SP power again.
5. Restart the pump flow.
6. If the problem persists, contact Technical Support for Dionex products for assistance.

EndSPSamplePrep command is not specified

This error occurs if the sample preparation command block in an instrument method includes the **BeginSPSamplePrep** command, but not the **EndSPSamplePrep** command. See "Notes" on page 96 for more information.

To troubleshoot:

1. Open the instrument method.
2. In the Script Editor view, add the **EndSPSamplePrep** command after the last sample preparation command.

Flow sensor 1 flow rate is higher than limit

-or-

Flow sensor 2 flow rate is higher than limit

This error occurs if the flow rate of the sample stream being monitored by the flow sensor exceeds the upper limit.

To troubleshoot:

1. Use an external measuring device to verify the flow rate. If the flow rate is normal, calibrate the flow sensor (see Section 10.10).
2. If the message reappears, the sensor may need to be replaced. Contact Technical Support for Dionex products for assistance.

Flow sensor 1 flow rate is lower than limit

-or-

Flow sensor 2 flow rate is lower than limit

This error occurs if the flow rate of the sample stream being monitored by the flow sensor drops below the lower limit.

To troubleshoot:

1. Use an external measuring device to verify the flow rate. If the flow rate is normal, calibrate the flow sensor (see Section 10.10).
2. If the message reappears, the sensor may need to be replaced. Contact Technical Support for Dionex products for assistance.
3. If the problem persists, contact Technical Support for Dionex products 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 outside the expected range during calibration of the flow sensor.

To troubleshoot:

1. Review the calibration procedure, and then rerun the calibration (see Section 10.10).
2. If the problem persists, contact Technical Support for Dionex products 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 outside the expected range during calibration of the flow sensor.

To troubleshoot:

1. Review the calibration procedure, and then rerun the calibration (see Section 10.10).
2. If the problem persists, contact Technical Support for Dionex products 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 if liquid has accumulated in the drip tray in the bottom of the SP, or if the leak sensor is not connected.

The **Leak sensor 2 wet** error occurs if liquid has accumulated 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 you find a leak, tighten fittings (or replace tubing and fittings) as required. See Section 9.3 for detailed troubleshooting of various types of leaks.
3. After fixing the leak, dry the drip tray and leak sensor thoroughly.

   NOTE If the leak sensor is not dry, it will remain activated and will continue to report a leak to the software.

4. If no leak is found, check the leak sensor's electrical connection on the main SP electronics board:
   - Follow the instructions in Section 10.7 to access the main 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).

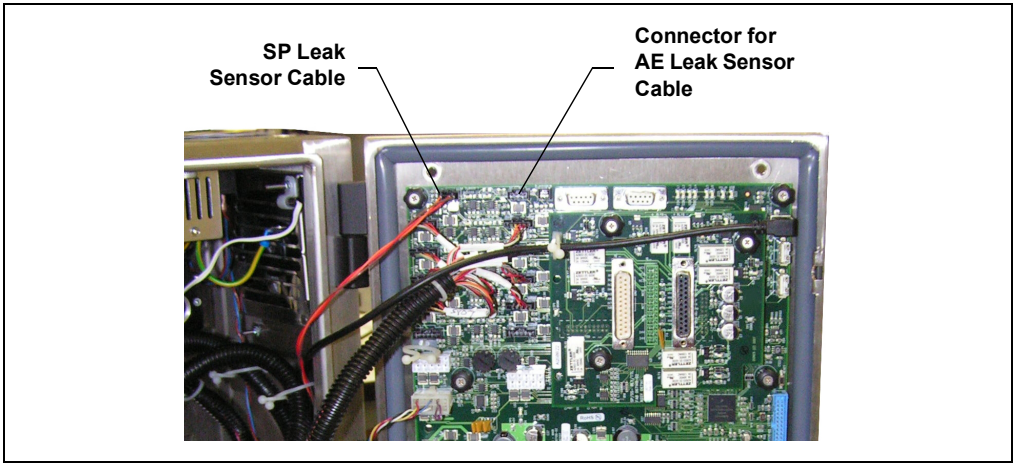


Figure 9-1. Main SP Electronics Board (Vertical Enclosure Shown)

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. Press the SP power switch to turn off the power.
3. After a brief pause, turn on the SP power again.
4. Restart the pump flow.
5. If the problem persists, contact Technical Support for Dionex products for assistance.

Loading pump home sensor not detected

This error occurs if the loading pump electronics are unable 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 (for the SP1 flow schematic, see Figure 3-11; for the SP2 flow schematic, see Figure 3-14).
2. If no blockage is found, turn off the pump flow.
3. Press the SP power switch to turn off the power.
4. After a brief pause, turn on the SP power again.
5. Restart the pump flow.
6. If the problem persists, contact Technical Support for Dionex products for assistance.

Loading pump lost count

This is a warning message; the pump will continue to function and no action is required.

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 the tubing downstream from the pump (for the SP1 flow schematic, see Figure 3-11; for the SP2 flow schematic, see Figure 3-14).
2. If no blockage is found, turn off the pump flow.
3. Press the SP power switch to turn off the power.
4. After a brief pause, turn on the SP power again.
5. Restart the pump flow.
6. If the problem persists, contact Technical Support for Dionex products for assistance.

Mixer motor speed is higher than expected

The **Mixer Stir Bar Auto-Recovery** option in the Instrument Configuration Manager (in Chromeleon 7 software) uses Analog Input 4 to monitor the mixer stir bar (see Section 3.5.2). If the stir bar is in an out-of-control state, the mixer motor is stopped briefly before being restarted at a speed 5% slower than before the auto-recovery occurred.

To troubleshoot:

This is a warning message; no action is required.

Pressure offset calibration value is out of range

This error occurs if the offset value is outside the expected range during calibration of the pressure.

To troubleshoot:

1. Review the calibration procedure, and then rerun the calibration (see Section 10.10).
2. If the problem persists, contact Technical Support for Dionex products for assistance.

Pressure slope calibration value is out of range

This error occurs if the slope value is outside the expected range during calibration of the pressure.

To troubleshoot:

1. Review the calibration procedure, and then rerun the calibration (see Section 10.10).
2. If the problem persists, contact Technical Support for Dionex products for assistance.

Pump volume command must occur within BeginSPSamplePrep/EndSPSamplePrep command block

This error occurs if the command specifying the volume to be delivered by the dilution pump or loading pump is outside the sample preparation command block in the instrument method. See "Notes" on page 96 for more information.

To troubleshoot:

Move the command (for example, **DilutionPump.DeliverVolume = 0.1 [mL]**) to inside the sample preparation command block.

–or–

Delete the command from the instrument method.

Rotary valve 1 error

-or-

Rotary valve 2 error

-or-

Rotary valve 3 error

This error occurs if the rotary valve does not 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 SP ePanel in Chromeleon 7 software.
2. Press the SP power switch to turn off the power.
3. After a brief pause, turn on the SP power again.
4. Click the rotary valve control on the ePanel. If this does not toggle the valve position, contact Technical Support for Dionex products 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 outside the expected range during calibration of the analog input.

To troubleshoot:

1. Review the calibration procedure, and then rerun the calibration (see Section 10.10).
2. If the problem persists, contact Technical Support for Dionex products 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 outside the expected range during calibration of the analog input.

To troubleshoot:

1. Review the calibration procedure, and then rerun the calibration (see Section 10.10).
2. If the problem persists, contact Technical Support for Dionex products for assistance.

Vessel heater over safe temperature

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

To troubleshoot:

This error may indicate a problem with the vessel heater electronics. Contact Technical Support for Dionex products for assistance.

Vessel heater temperature calibration offset or slope is out of range

This error occurs if either the offset or slope value is outside the expected range during calibration of the vessel heater.

To troubleshoot:

1. Review the calibration procedure, and then rerun the calibration (see Section 10.10).
2. If the problem persists, contact Technical Support for Dionex products 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 during calibration of the vessel heater.

To troubleshoot:

Make sure the set points are at least 5 °C apart, and then rerun the calibration (see Section 10.10).

Vial cooler over safe temperature

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

To troubleshoot:

This error may indicate a problem with the vial cooler electronics. Contact Technical Support for Dionex products for assistance.

Vial cooler temperature calibration offset or slope is out of range

This error occurs if the offset or slope value is outside the expected range during calibration of the vial cooler.

To troubleshoot:

1. Review the calibration procedure, and then rerun the calibration (see Section 10.10).
2. If the problem persists, contact Technical Support for Dionex products for assistance.

Vial cooler temperature calibration setting is too close

This error occurs if the difference between the two calibration temperature set points is less than 5 °C during calibration of the vial cooler.

To troubleshoot:

Make sure the set points are at least 5 °C apart, and then rerun the calibration procedure (see Section 10.10).

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 software.

- **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.

  –or–

  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.

  –or–

If it is not possible to replace the tubing, damaged SS liquid lines can be patched. To do so, cut out the bad section and insert a new piece of tubing with a coupler (P/N 040240) on each end.

NOTE Do not routinely patch tubing; doing so 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**

  1. Make sure all fittings are tightened securely.
  2. If the dilution vessel contains excess liquid (partially diluted sample or standard from a previous analysis), purge the vessel as follows:
     a. Verify that the **DV** (**SV6**) valve is off.
     b. Turn on the **GAS** (**SV8**) valve for 1 to 3 minutes.
  3. The pressure applied to the dilution vessel may be insufficient to empty it. Make sure the high-purity gas supply is regulated to 170 to 240 kPa (25 to 35 psi).
  4. If the unheated dilution vessel is installed, make sure that no more than 250 mL of liquid is pumped into the vessel. (The unheated dilution vessel is standard for both the SP1 and SP2.)

     If the heated dilution vessel is installed, make sure that no more than 50 mL is pumped into the vessel.
  5. In the normally open (default) position, the **DV** (**SV6**) valve purges the dilution vessel to waste. Check the instrument method used for system control to verify that the valve remains open while the dilution pump is running.

- **Leaking pump check valve fittings**

  1. Tighten the inlet and outlet check valve fittings just until the leak stops.
  2. When a check valve fitting that is securely tightened allows leaks, it indicates that the valve is defective. Replace the check valve (see Section 10.3).

- **Leaking pump head**

  1. Tighten the pump fitting connections. Dry the components.
  2. If the pump head continues to leak, the main seal may be defective. Replace the main seal and backup seal (see Section 10.4). Thermo Fisher Scientific recommends always replacing *both* seals at the same time.

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 you find the leak.

NOTE Do not use Snoop or other dilute soap solutions for leak detection; these will contaminate the tubing. Water may be used.

- **Leaking fitting**

  1. If the fitting is stripped, cross-threaded, or otherwise damaged, replace it.
  2. If the fitting is not damaged, securely tighten it.
  3. 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 occurs, 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 5-5) to the main power receptacle.

- **AE main power turned off**

  1. Make sure the power switch on the top of the AE is on (see Figure 5-7).
  2. Make sure the **Emergency Off** switch on the AE front door (see Figure 5-2) is not pushed in. If necessary, 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 an 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 an AE, use the main power switch on the top of the AE (see Figure 5-7) 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 (see Figure 5-7). 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 Technical Support for Dionex products 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 in the SP or SS (see Section 10.11).

If the fuse continues to blow, the circuit may be shorted or overloaded. Disconnect all power and contact Technical Support for Dionex products 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 service and repair procedures that users can perform. 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 1-800-532-4752 and select **option 2**.
- Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

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

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

10.1 Eliminating a Fluid System Restriction

A restriction in the fluid system (for example, crimped tubing) 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 typically used.
2. Refer to the appropriate flow schematic (for the SP1, see Figure 3-11; for the SP2, see Figure 3-14). 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 the Pump Check Valve Cartridges

These instructions apply to the dilution pump and the stepper motor loading pump (P/N 068561, both pumps).

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 both check valve cartridges. If new cartridges are not available, clean the cartridges currently installed (see "To clean the check valves" on page 132).

To replace the check valve cartridges

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

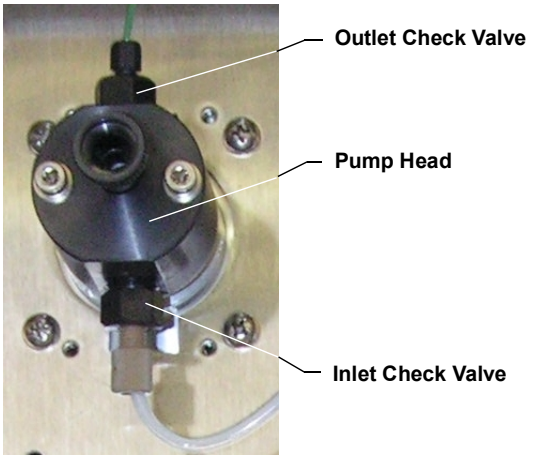


Figure 10-1. Pump Head

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).**

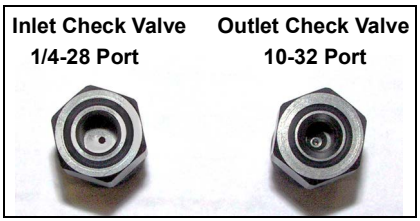


Figure 10-2. Check Valve Ports

6. Remove the old check valve cartridges from the inlet and outlet check valve housings.
7. 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).
8. 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).

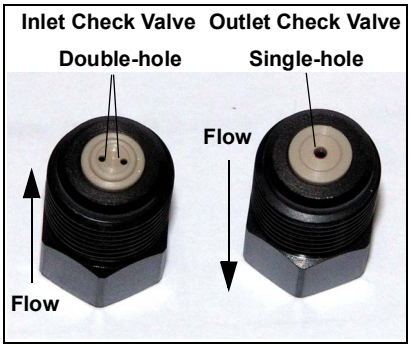


Figure 10-3. Check Valve Assemblies

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 through the small double holes.**

9. 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.
10. Tighten the check valves finger-tight, 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.

11. Reconnect the liquid lines.

12. Reconnect the power cord and turn on the main power.
13. 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.
14. With the pump still running, check for leaks from the check valves. Tighten a check valve a *little more* only if it leaks.
15. Turn off the pump.

To clean the check valves

1. Follow Step 1 through Step 6 in the check valve cartridge replacement procedure to remove the 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 and deionized water.
4. Follow Step 7 through Step 14 in the check valve cartridge replacement procedure to reinstall the check valves.

10.3 Replacing the Pump Check Valves

These instructions apply to the dilution pump and the stepper motor loading pump (P/N 068561, both pumps).

A check valve fitting that allows leaks (assuming that the fitting is securely tightened) is defective and should be replaced.

Follow the instructions in Section 10.2 to remove the defective check valve, clean the new check valve (inlet check valve assembly, P/N 047660; outlet check valve assembly, P/N 047661), and install the new check valve.

10.4 Replacing the Pump Main Seal and Backup Seal

These instructions apply to the dilution pump and the stepper motor loading pump (P/N 068561, both pumps).

A damaged seal allows leakage past the piston. The pump may be difficult to prime and flow rates may be unstable. Thermo Fisher Scientific recommends always replacing the main seal and the backup seal at the same time.

To prepare for the procedure

1. Rinse the pump flow path with deionized water by 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.

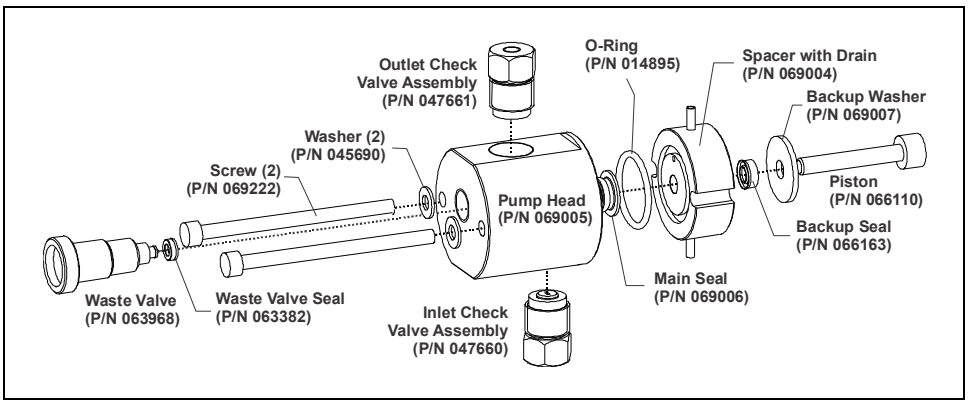


Figure 10-4. Pump Head

To remove the pump head and piston

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

5. 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.

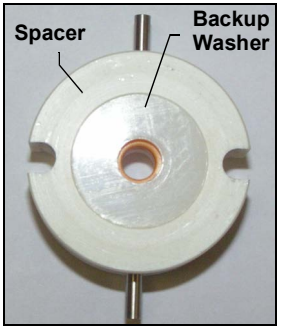
VORSICHT

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

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

To install the new backup seal

1. Lift the spacer off the pump head.
2. Remove the backup washer from the spacer, using one of the following methods:

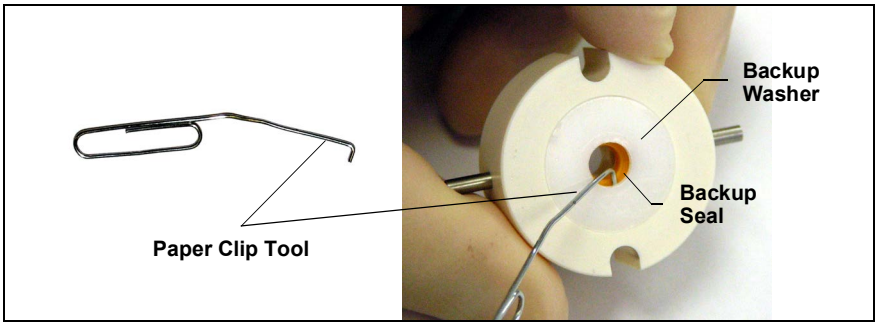


   - With the backup washer facing up, cup the spacer in your hand and blow clean laboratory air at the spacer to dislodge the washer.

     –or–

   - If clean laboratory 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**.

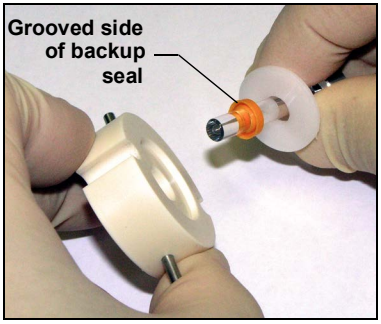


3. To remove the old backup seal from the spacer, insert the shaft of the piston through the center hole in the spacer, and then pull out the piston. The seal will be removed with the piston.

4. To install the new backup seal:

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

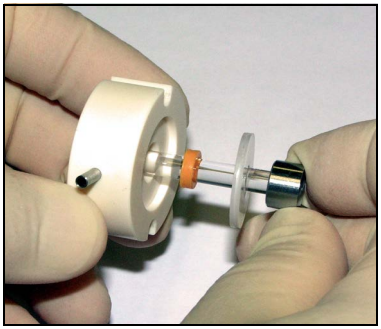
   b. Hold the backup seal (P/N 066163) with the grooved side facing away from the washer. Then, insert the shaft of the piston through the seal.



   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.

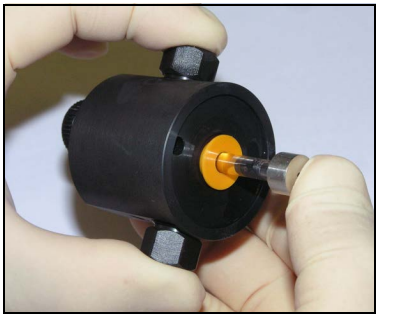
   e. While holding the backup washer in place with your thumb, slowly remove the piston.



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

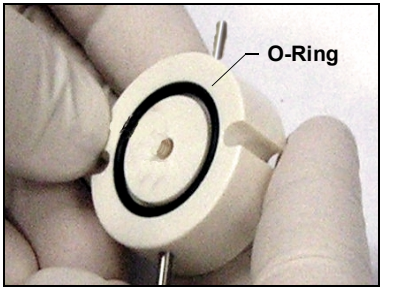
1. Plug the outlet check valve with your finger, and then inject deionized water through the piston opening to fill the head cavity with liquid.
2. While plugging the outlet check valve tightly, push the piston into the head. This should hydraulically unseat the main seal from the head.



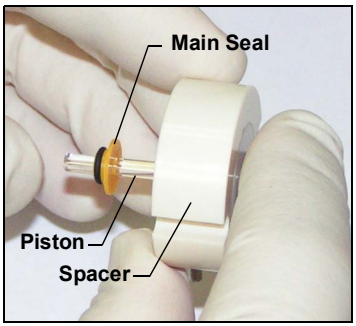
3. Remove the piston and pull off the main seal.
4. If the procedure above does not remove the main seal, follow these steps:
   a. (Optional) Install a 10-32 fitting plug (P/N 042772) on the outlet check valve.
   b. Add more water, make sure the head contains no air bubbles, and repeat Step 2 and Step 3.
   c. Remove the 10-32 fitting plug (if used).

To install the new main seal

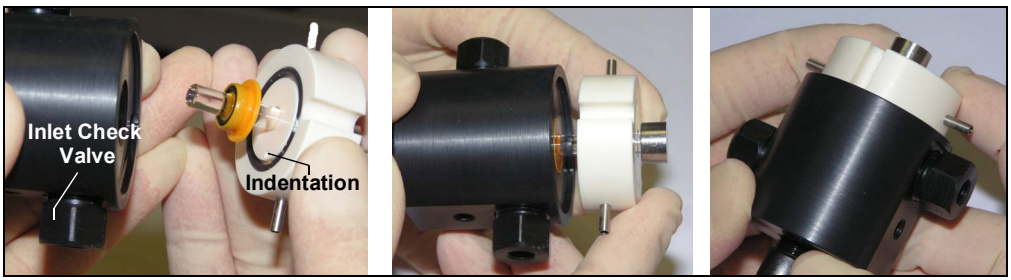
1. Open the waste valve knob by turning the knob one-half turn counterclockwise.
2. Before continuing, verify that the O-ring is installed in the spacer.



3. Lubricate the new main 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 seal.
5. Orient the spacer so that the small indentation on the spacer aligns with the inlet check valve. Then, insert the piston and seal into the pump head.



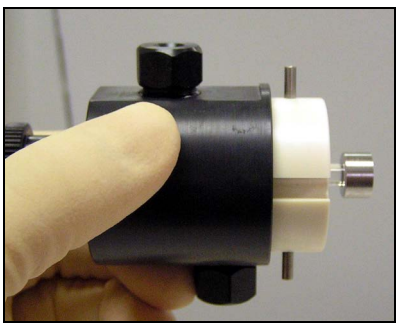
6. To seat the seal, push down on the spacer until it is flush with the head. Listen for the clicking sound that indicates that the seal is correctly seated.



To reinstall the pump 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.
5. Continue running the pump until no more bubbles can be seen exiting the waste line. Close the waste valve.
6. Turn off the pump.

10.5 Replacing the Pump Piston

These instructions apply to the dilution pump and the stepper motor loading pump (P/N 068561, both pumps).

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

If this occurs, follow the instructions in Section 10.4 to install a new piston (P/N 066110), main seal (P/N 069006), and backup seal (P/N 066163) in the pump. Thermo Fisher Scientific recommends always replacing *both* seals at the same time.

10.6 Replacing the Pump Waste Valve Seal

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

These instructions apply to the dilution pump and the stepper motor loading pump (P/N 068561, both pumps).

1. Turn off the main power.
2. Disconnect the power cord.
3. 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.

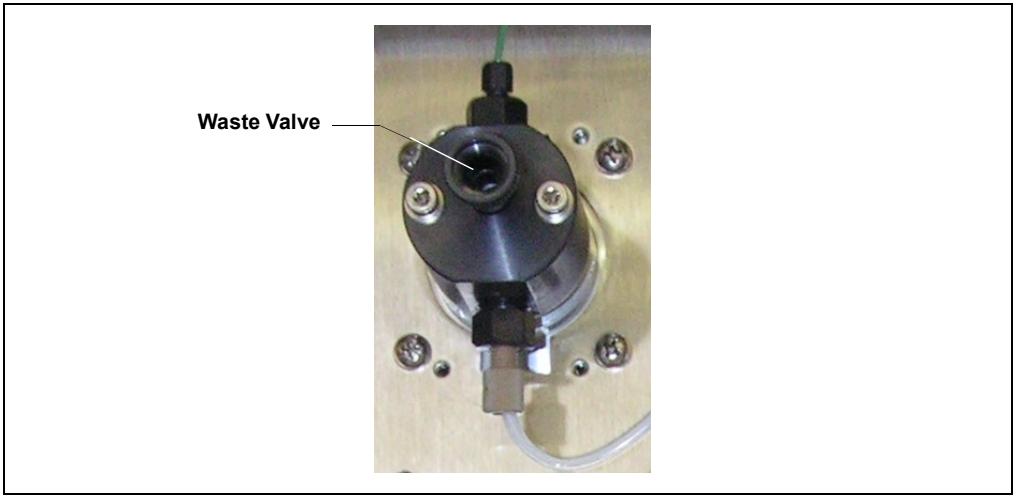


Figure 10-5. Waste Valve

4. If the waste valve seal is removed with the valve knob in Step 3, 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.**

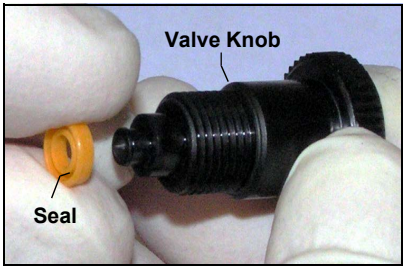


Figure 10-6. Waste Valve Seal Replacement

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

5. Orient the new waste valve seal (P/N 063382) with the grooved side away from the valve. Then, slide the seal over the end of the valve.
6. Insert the valve with the new seal into the pump head opening. Turn the knob clockwise, and then tighten finger-tight.
7. Plug in the power cord and turn on the SP power switch.

8. 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.
9. Continue running the pump until no more bubbles can be seen exiting the waste line. Close the waste valve.
10. Turn off the pump.

10.7 Accessing the Main SP Electronics Board

This section is provided as a reference when performing any procedure that requires access to the main SP electronics board. The instructions for accessing the board vary slightly, depending on the type of SP enclosure:

- If the SP is an external enclosure, go to page 140.
- If the SP is mounted inside the AE, go to page 141.

To access an SP that is an external enclosure

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

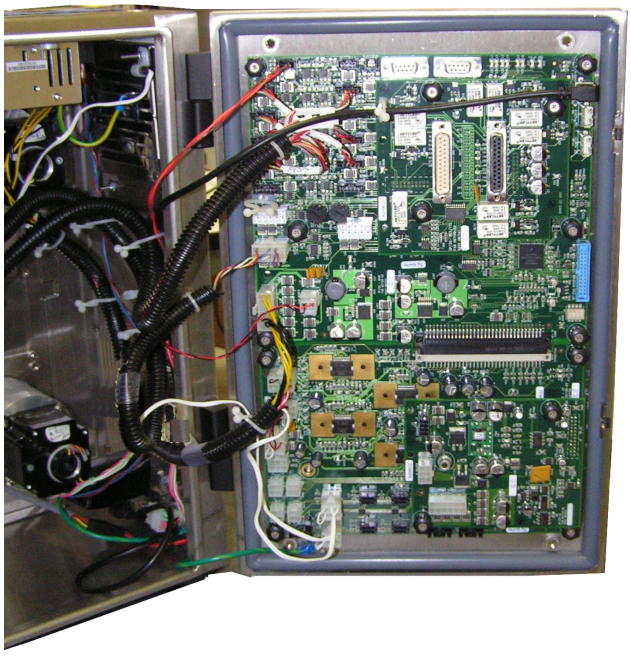


Figure 10-7. SP External Enclosure: Service Door Open

To access an SP mounted inside the AE (on the rear panel)

1. Turn off the SP power.
2. Disconnect the power cord.
3. Open the AE front door.
4. 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.

NOTE The following step requires lifting the SP, which weighs 21 kg (46 lb).

5. Grasp the SP with both hands and lift it up enough to remove it from the mounting rails on the AE rear panel. Then, pull the SP straight out from the rear panel and set it on the AE shelf.
6. On the exterior of the AE, remove the two service access panels on the left side of the AE (see Figure 10-8).
7. Loosen the thumbscrews on the service door of the SP and lower the door. The main SP electronics board is mounted on the inside of the door (see Figure 10-9).

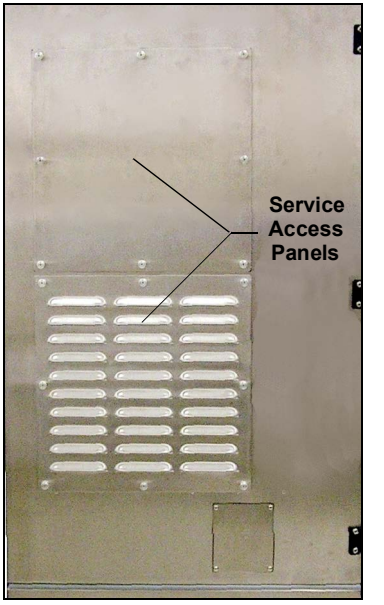


Figure 10-8. AE Left Side Exterior

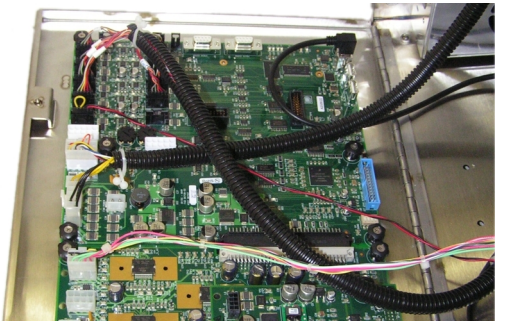


Figure 10-9. SP Horizontal Enclosure: Service Door Open

10.8 Replacing an SP Solenoid Valve

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

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

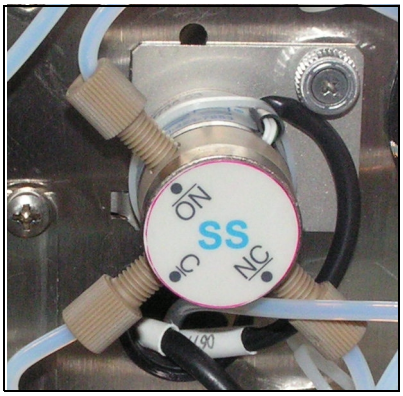


Figure 10-10. Solenoid Valve (SS Valve Shown as an Example)

4. Follow the instructions in Section 10.7 to access the main SP electronics board.
5. The solenoid valve cables are plugged into connectors in the upper-left corner of the main SP electronics board (see Figure 10-11).

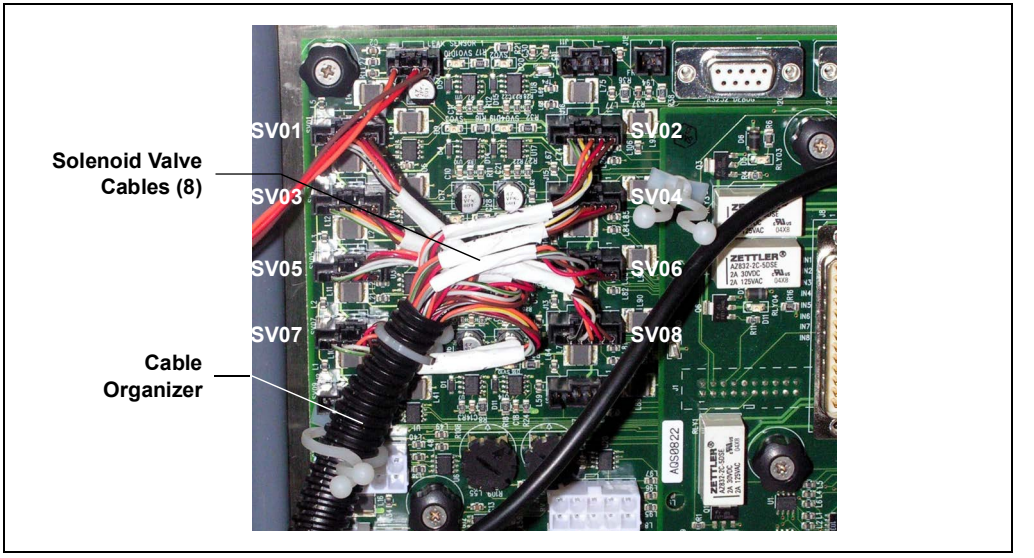


Figure 10-11. Main SP Electronics Board: Solenoid Valve Cable Connections

6. A label on the valve mounting plate identifies the number of the valve. Disconnect the valve cable from its corresponding connector on the main SP electronics board (see Figure 10-11).

   For example, the SS valve is **SV5**. When replacing an SS valve, disconnect the cable from connector **SV05**.

7. Remove the cable from the cable organizer.
8. Loosen the captive thumbscrew on the valve mounting plate and remove the valve from the SP panel.
9. Carefully pull the cable out through the front of the SP.
10. Thread the cable from the new solenoid valve (P/N 068554) through the opening on the SP panel and route the cable to the main SP electronics board.
11. Insert the two tabs on the new valve mounting plate into the slots on the SP panel.
12. While holding the valve mounting plate firmly against the SP, tighten the captive thumbscrew.
13. Plug the valve connector into the main SP electronics board (see Figure 10-11). Secure the cable in the cable organizer.

14. Close and secure the SP service door.
15. If you removed the SP from the AE rear panel:
    a. Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE rear panel, and hang the SP onto the rails.
    b. Replace any modules that were removed from the lower shelf of the AE.
    c. Replace the two access panels on the exterior of the AE.
16. Reconnect the liquid lines and fitting plugs that were removed from the old valve.
17. Plug in the power cord and turn on the power.

10.9 Changing the Peristaltic Loading Pump Speed

When a peristaltic loading pump is installed in the SP (see Appendix D), one of the solenoid valve connectors (typically **SV9**) on the main SP electronics board is assigned to control the peristaltic pump rather than a solenoid valve.

A cable from the peristaltic pump plugs into the main SP electronics board. 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.
2. Disconnect the power cord.
3. Follow the instructions in Section 10.7 to access the main SP electronics board.
4. Locate the two potentiometers on the left side of the main 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.
5. Adjust the pump speed as follows:
    - To increase the pump speed, turn the potentiometer counterclockwise.
    - To decrease the pump speed, turn the potentiometer clockwise.

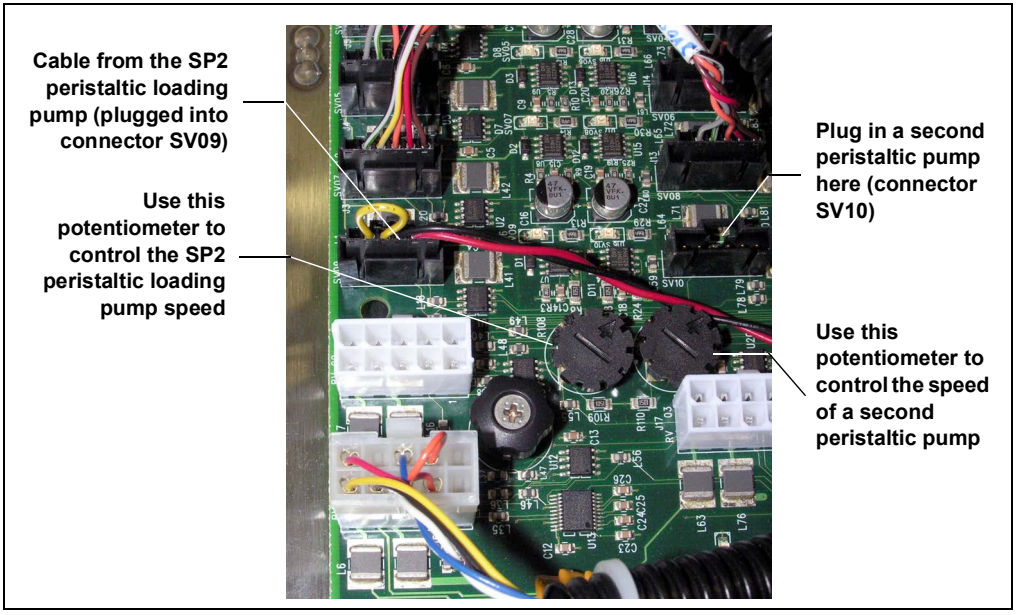


Figure 10-12. Main SP Electronics Board: Cable Connections and Potentiometers for Peristaltic Pumps

6. When two peristaltic loading pumps are installed in the SP, the cable for the second pump is plugged into position **SV10** on the main SP electronics board (see Figure 10-12). The potentiometer on the right (at position **R107** on the board) controls the speed of the second pump. Adjust the pump speed as required (see Step 4).
7. After setting the pump speed, close and secure the SP service door.
8. If you removed the SP from the AE rear panel:
   a. Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE rear panel, and hang the SP onto the rails.
   b. Replace any modules that were removed from the lower shelf of the AE.
   c. Replace the two access panels on the exterior of the AE.
9. Plug in the power cord and turn on the power.

10.10 Calibrating Components

Calibration commands for the components in a Dionex Integral system are available in Chromeleon 7 software.

1. Open the ePanel in Chromeleon 7 software.
2. Click the button for the calibration to be performed (for example, click **Dilution Pump Calibration**). A window appears.
3. Follow the calibration instructions in the window.

NOTE The peristaltic loading pump, if installed, does not require calibration. Adjusting the pump speed delivers the required flow rate (see Section 10.9).

10.11 Replacing 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 from the rear panel of the SP or 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: Process Analytical Systems* (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 60127 fuses rated 3.15 A (P/N 954745). Thermo Fisher Scientific recommends always replacing *both* fuses.
7. Insert the fuse drawer into the rear panel and press until the drawer snaps into place.

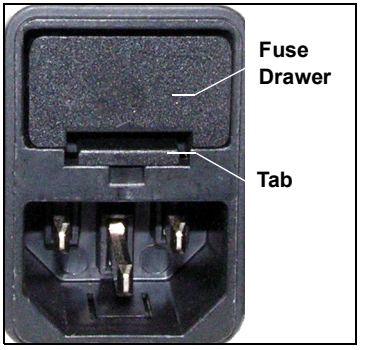


Figure 10-13. Fuse Drawer

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 60127 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
044128	Bottle, 1 liter
044129	Bottle, 2 liters
069094	Computer Control Installation Kit
052882	NOWPak II container
052885	NOWPak II container, PTFE liner
AAA-068551	NOWPak Bag-in-a-Bottle container
068549	Tower Light Kit, AE
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 m (16 ft)
068524	Dilution vessel, heated, 50 mL
069208	Dilution vessel, unheated, 250 mL
068564	Flow Sensor Kit
954745	Fuse, IEC 60127, 3.15 A
067728	Leak sensor, auxiliary
AAA-068563	Liquid Level Sensor Kit
068567	Pressure Sensor Kit
068558	Pump, peristaltic
068561	Pump, stepper motor

Part Number	Item
066163	Pump (stepper motor) backup seal
047747	Pump (stepper motor) check valve cartridge
047660	Pump (stepper motor) inlet check valve assembly
069006	Pump (stepper motor) main seal
047661	Pump (stepper motor) outlet check valve assembly
066110	Pump (stepper motor) piston
063382	Pump (stepper motor) waste valve seal
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, PEEK (for SS)
068540	Valve, 17-port, stainless steel (for SS)
068554	Valve, solenoid, 3-way
068566	Vial cooler

C • TTL and Relay Installation

This appendix provides installation instructions for the optional kits and components listed in the table below.

NOTE **Installation of the SP TTL and Relay Kit (P/N 068573) is a prerequisite for installation of any other option in the table.**

Part Number	Option	Description
AAA-068548	AE TTL and Relay Kit	Includes connectors, cables, and protective hoods for installation of TTL and relay connectors on the AE.
068549	AE Tower Light Kit	Includes a tower of four LED lights for installation on top of the AE enclosure.
068573	SP TTL and Relay Kit	Includes a controller board, connectors, and cables for addition of TTL and relay control to the SP.
069071 069072	SP TTL Breakout Board SP Relay Breakout Board	Includes interfaces for connection of SP TTL/relay controller board connectors to other devices.

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 needed to add TTL and relay control functions to the SP. The kit includes the parts listed in the table below.

Part Number	Item	Quantity
045796	Screw, Phillips, stainless steel	8
067141	Controller board, TTL/relay	1
068174	Connector, female-to-female, DB25	1
068176	Connector, male-to-male, DB25	1
069586	Standoff, 6 mm hex	3
60-067039	Panel, TTL/relay	1
60-067746	Cable, TTL, female-to-female, 46 cm (18 in)	1
60-067835	Cable, relay, male-to-male, 46 cm (18 in)	1

Additional item needed

Phillips screwdriver

C.1.2 Installing the SP TTL and Relay Kit

These are the main steps in the installation procedure:

- Attaching the TTL/relay controller board to the main SP electronics board
- For a stand-alone SP only: Installing the TTL/relay panel on the SP and connecting the cables

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

1. Turn off the SP power.
2. Disconnect the power cord.
3. Follow the instructions in Section 10.7 to access the main SP electronics board.
4. Disconnect the cable in the upper-right corner of the main SP electronics board (see Figure C-1).
5. Screw the three standoffs into the main SP electronics board at the locations indicated in Figure C-1.

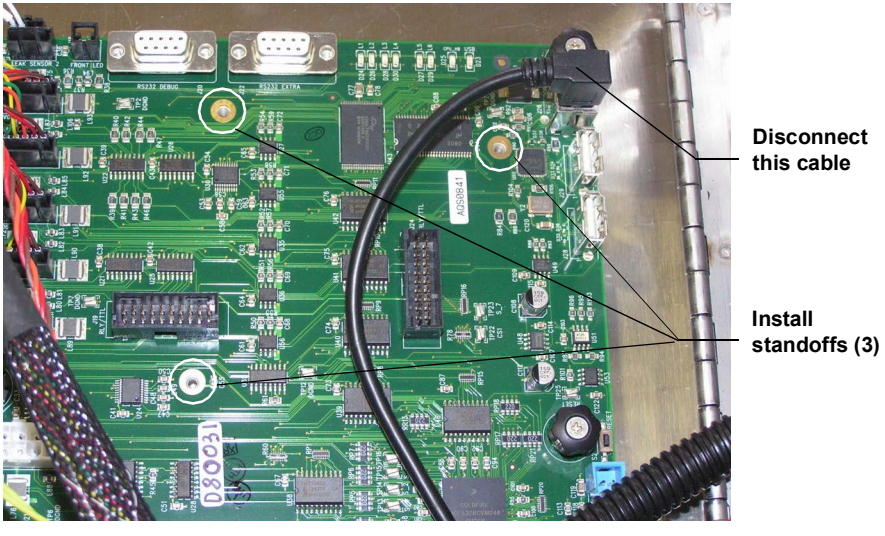


Figure C-1. Main SP Electronics Board (Horizontal SP Enclosure Shown)

6. Orient the TTL/relay controller board with the component side facing up and the notched corner on the lower-right side (see Figure C-2).
7. Align the two connectors on the back of the TTL/relay controller board with the connectors labeled **J19 RLY/TTL** and **J24 RLY/TTL** in the upper-right area of the main SP electronics board.

8. Press the TTL/relay controller board firmly onto the main SP electronics board. Tighten the three thumbscrews on the TTL/relay controller board.
9. Reconnect the cable that was disconnected in Step 4.

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

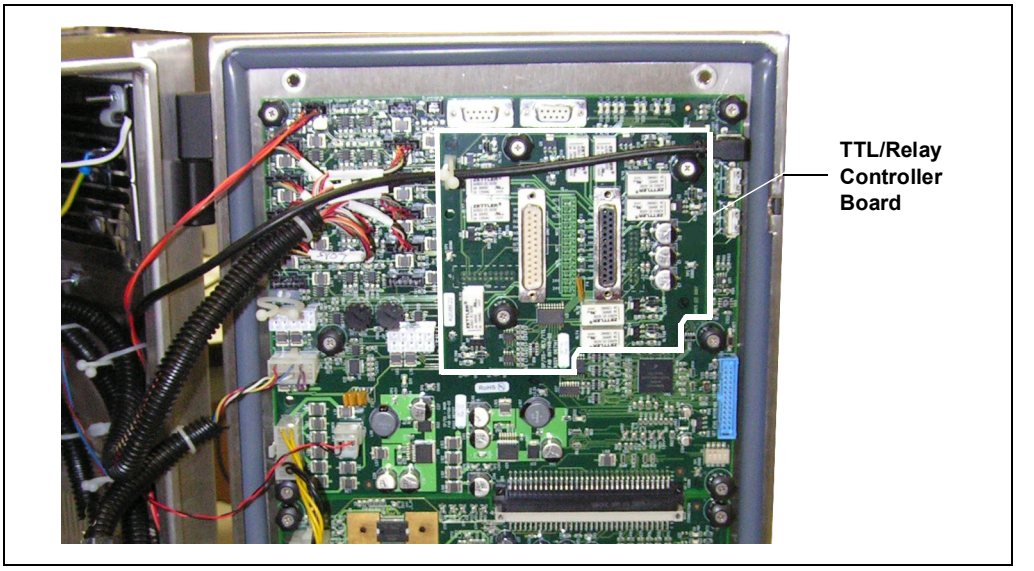


Figure C-2. Main SP Electronics Board: TTL/Relay Controller Board Installed (Vertical SP Enclosure Shown)

If you are installing a stand-alone SP, go on 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. Remove the cover plate from the side of the SP (see Figure C-3).

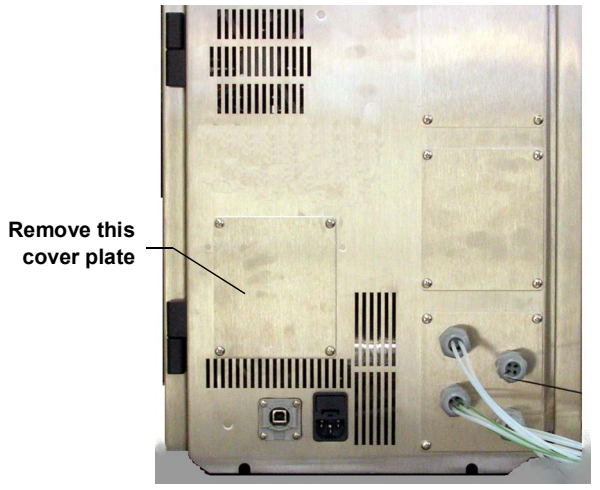


Figure C-3. Side of SP: TTL/Relay Panel Not Yet Installed

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).

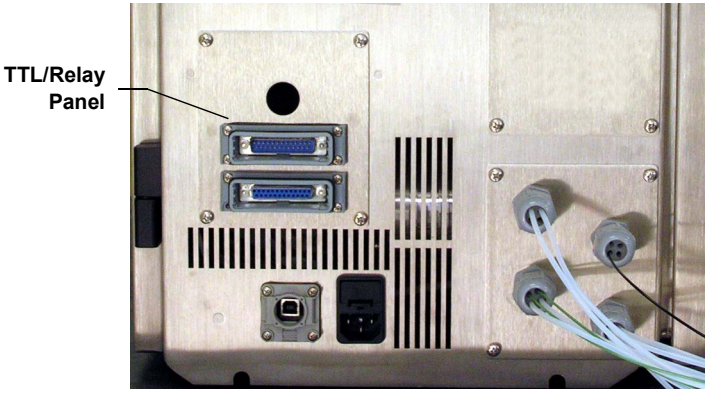


Figure C-4. Side of SP: TTL/Relay Panel Installed

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 relay cable into the male connector on the TTL/relay controller board.

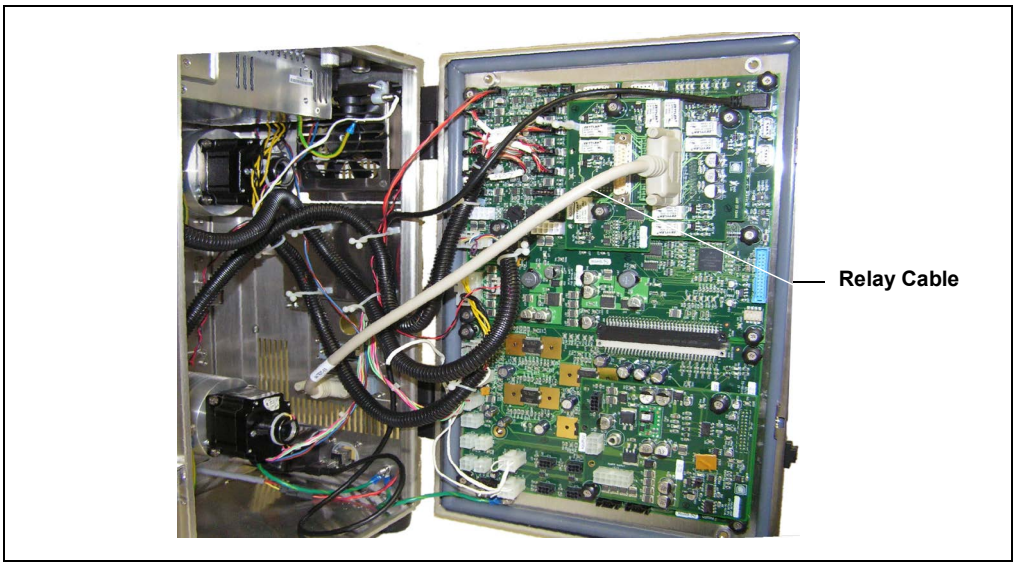


Figure C-5. Cable Plugged Into Relay Connectors on the SP TTL/Relay Panel and SP TTL/Relay Controller Board

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 TTL 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 starting 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 needed to install TTL and relay connectors onto the top of the AE and connect them to the TTL/relay controller board in the SP. The kit includes the parts listed in the table below.

Part Number	Item	Quantity
045796	Screw, Phillips, stainless steel	8
068177	Hood, DB25 connector	2
069010	Cable, TTL, female-to-female, 1.8 m (6 ft)	1
069011	Cable, relay, male-to-male, 1.8 m (6 ft)	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 item needed

Phillips screwdriver

C.2.2 Installing the AE TTL and Relay Kit

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/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. Secure the insert with screws. Figure C-7 shows the relay connector insert installed.
4. Repeat Step 1 through Step 3 for the other connector insert.

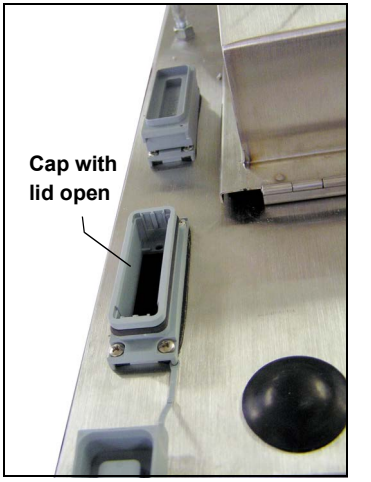


Figure C-6. Top of the AE: TTL and Relay Openings with Caps

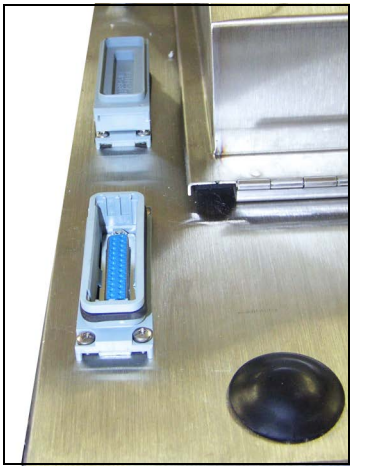


Figure C-7. Connector Insert Installed

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).

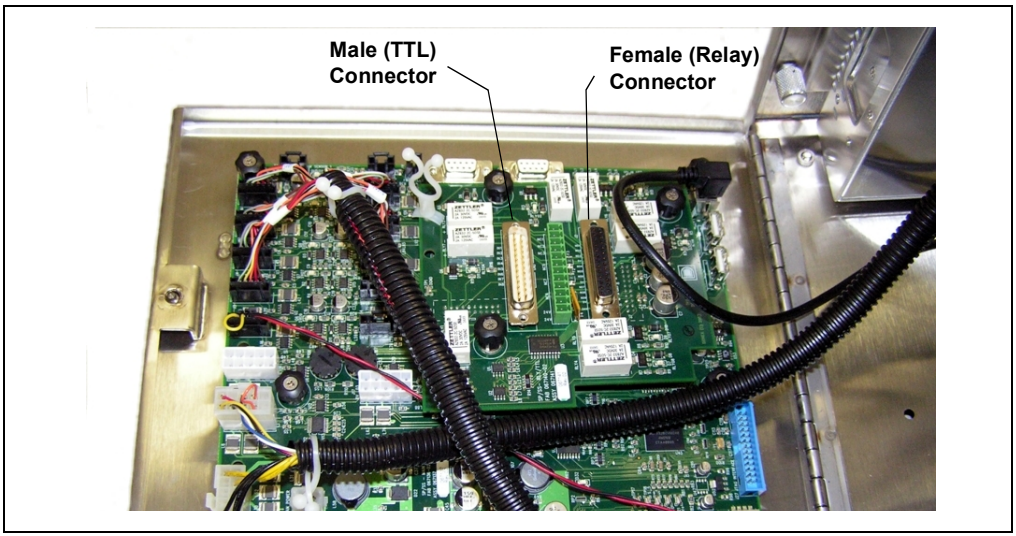


Figure C-8. TTL/Relay Controller Board Installed on Main SP Electronics Board

2. Route the relay 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 relay cable into the 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 rear panel:
   a. Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE rear panel, and hang the SP onto the rails.
   b. Replace any modules that were removed from the lower shelf of the AE.
   c. Replace the two access panels on the exterior of the AE.

C.3 Installing the TTL and Relay Breakout Boards

NOTE Before starting 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 an AE, install the AE TTL and Relay Kit (see Section C.2), also.

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
- (Optional) Assigning TTL input control types

Additional items needed

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

NOTE 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 not all pins are required, you can use cables with fewer than 25 conductors (for example, 12-conductor cables).

C.3.2 Installing the TTL and Relay Breakout Boards

Connect Wires to the TTL and Relay Breakout Boards

1. Check the following tables to determine which pins on the TTL connector (see Table C-1) and relay connector (see Table C-2) are required for your installation. For example:
   - TTL input 1 requires pins 13 and 25 on the TTL connector.
   - Relay output 1 requires pins 1 and 14 on 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 (for specifications, see Section C.3.1).
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 (for the TTL board, see Figure C-9; for the relay board, see Figure C-10). When connecting a 25-conductor cable, you can connect wires to all of the positions.

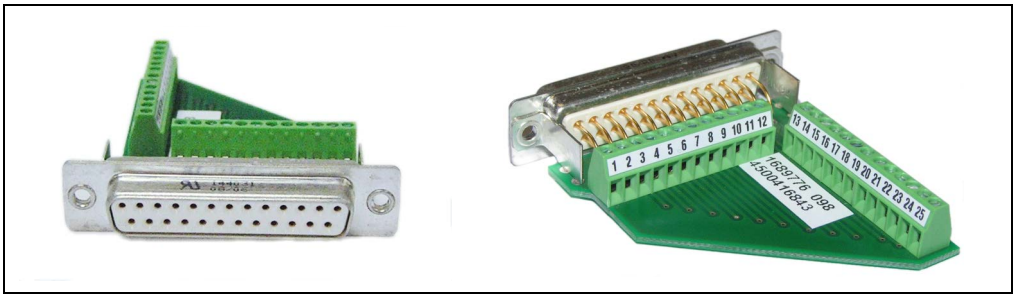


Figure C-9. TTL Breakout Board

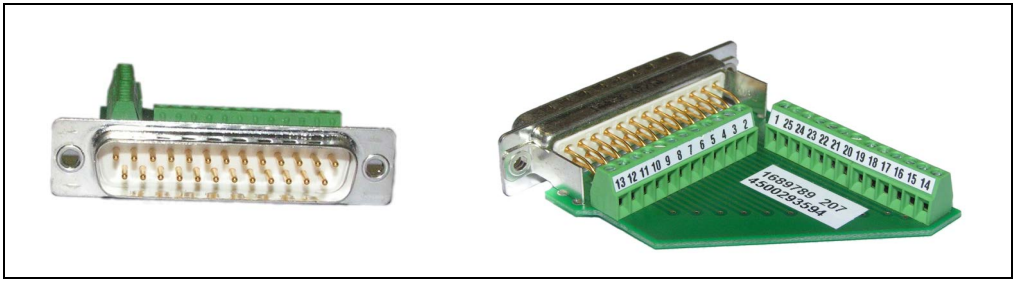


Figure C-10. Relay Breakout Board

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

CAUTION

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-11 shows an example of two pairs of wires connected to a relay breakout board.

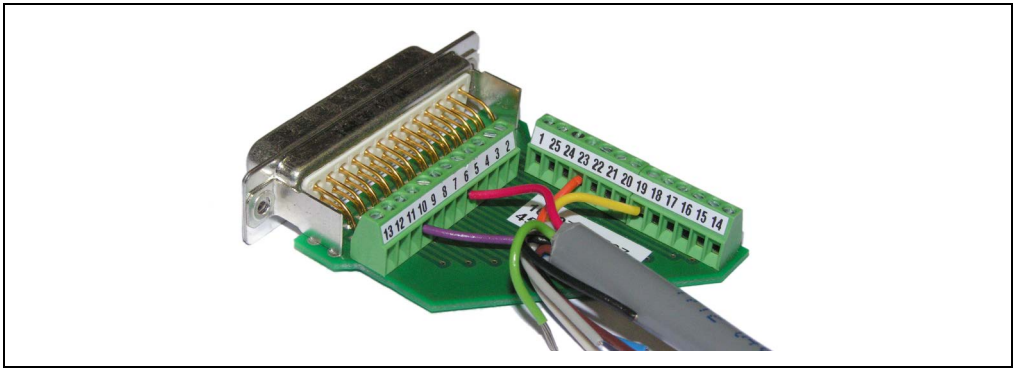


Figure C-11. Example Relay Breakout Board with Wires Connected

Plug In the Breakout Boards

- **To connect to an external SP**

  a. Plug the breakout boards into their corresponding connectors on the side of the SP (see Figure C-12).

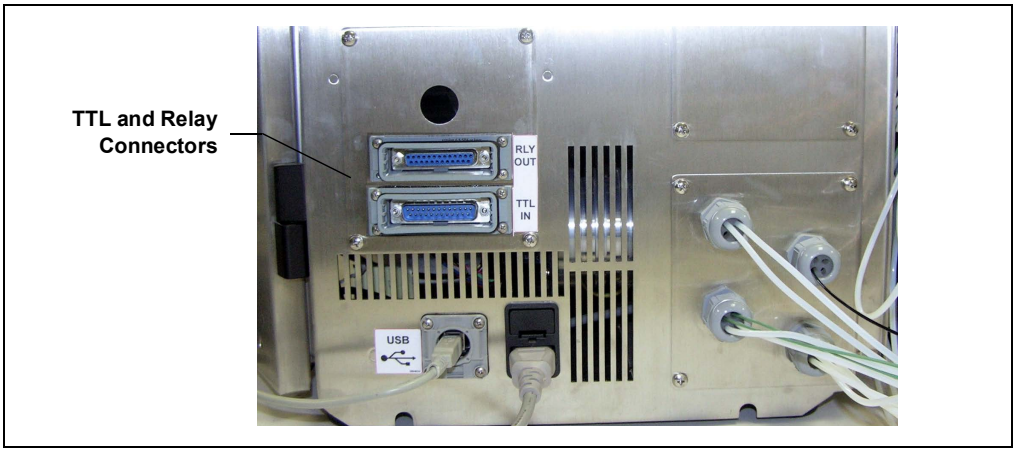


Figure C-12. TTL and Relay Connectors on Side of External SP

  b. 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 directly to the SP TTL/relay controller board**

  a. Plug the breakout boards into their corresponding connectors on the board (see Figure C-8).

  b. 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, as well as the pin number to which it is connected. You will need this information when connecting the cable to other devices.

b. Thread the unconnected end of the cable through the rectangular opening in the AE connector hood. (The hood is included 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).

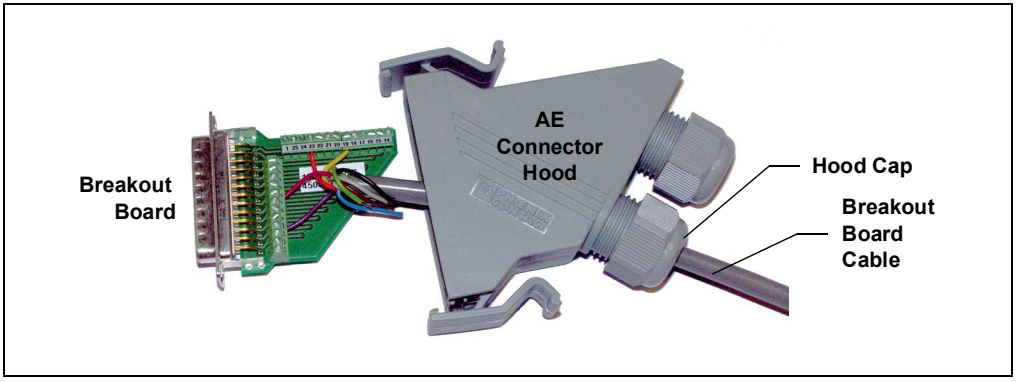


Figure C-13. Installing the Breakout Board in the AE Connector Hood

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

e. Pull the cable(s) 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).

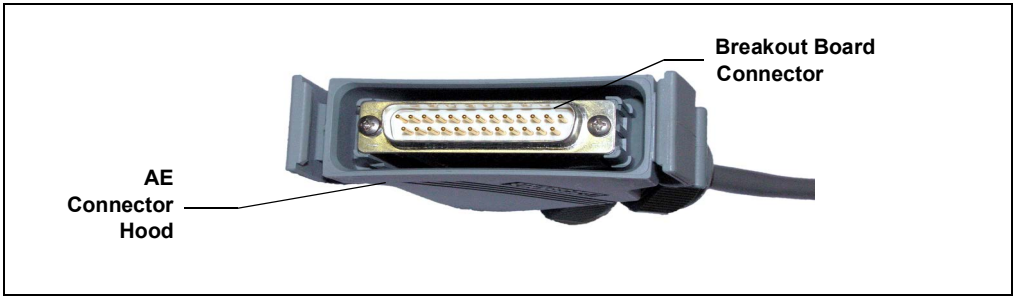


Figure C-14. Breakout Board Installed in the AE Connector Hood

g. To ensure a watertight seal around the cable, finger-tighten the nut on the hood cap. 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).

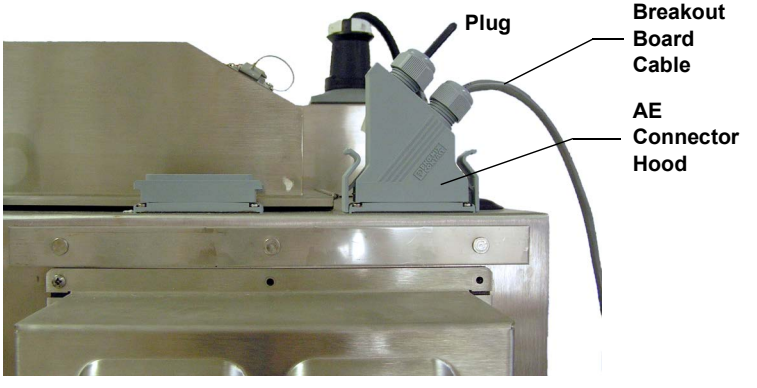


Figure C-15. AE Connector Hood with Breakout Board and Cable Installed

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. If necessary, change the settings.

The SP TTL inputs respond to four types of signals. The default control type, normal edge, is compatible with the output signals provided by Dionex modules.

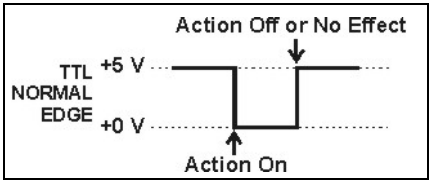
If the device connected to the SP does not send a normal edge signal, follow the steps below to select the appropriate control type. To determine the control type, refer to the documentation provided with the controlling device, as well as the information in "TTL Input Control Types" on page 173.

To select an input control type

1. Open the Instrument Configuration Manager (in Chromeleon 7 software).
2. Double-click the SP icon under the instrument name. The Properties dialog box appears.
3. Click the **TTL Inputs** tab.
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** and click **OK**.

TTL Input Control Types

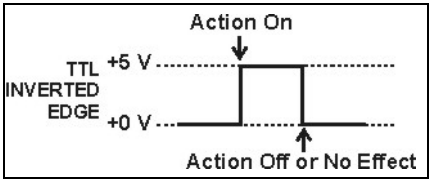
- *Normal Edge*: In normal edge operation, the negative (falling) edge of a signal turns on the action.



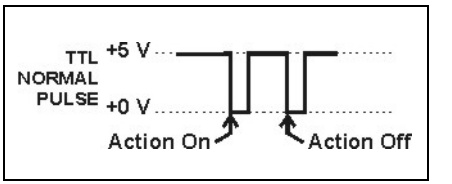
  The function of the positive (rising) edge depends on the action. For actions that have two options (for example, on/off), the rising edge turns off the action. For functions with only one option, the rising edge has no effect.

  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. 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 in the same way as the normal edge mode except that the positive and negative edges are reversed in function.

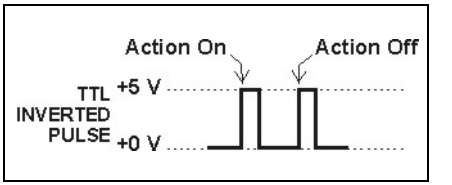


- *Normal Pulse*: In normal pulse operation, the negative (falling) edge of the TTL signal is the active edge and the positive (rising) edge is ignored.



  A pulse width of 50 ms or more is guaranteed to be detected, while 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 in the same way as the normal pulse mode except that the positive and negative edges are reversed in function.



C.4 Installing the AE Tower Light Kit

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

C.4.1 Overview

The AE Tower Light Kit (P/N 068549) provides the parts needed to mount a tower with four LED lights onto the top of the AE enclosure. The kit includes the parts listed in the table below.

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

C.4.2 Installing the AE Tower Light Kit

These are the main steps in the installation procedure:

- Mounting the tower light onto the AE
- Connecting the extension 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-16).

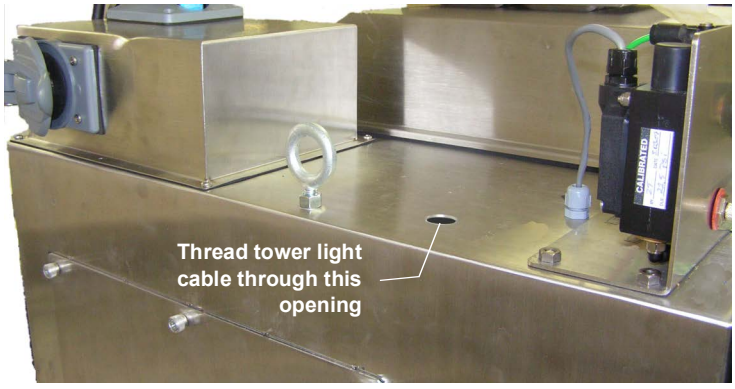


Figure C-16. Opening for Tower Light on Top of the AE

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-17).

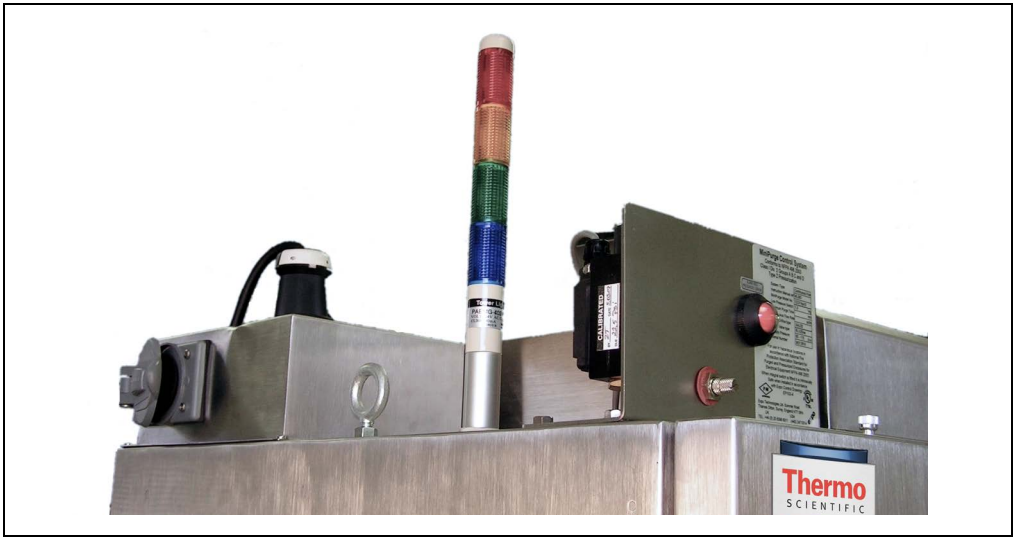


Figure C-17. Tower Light Installed

Connect the Cable

1. Connect the extension cable to the tower light cable.
2. Route the extension cable to the inside of the SP enclosure.
3. If you have not done so already, access the main SP electronics board (for instructions, see Section 10.7).
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-18).
5. Close and secure the SP service door.

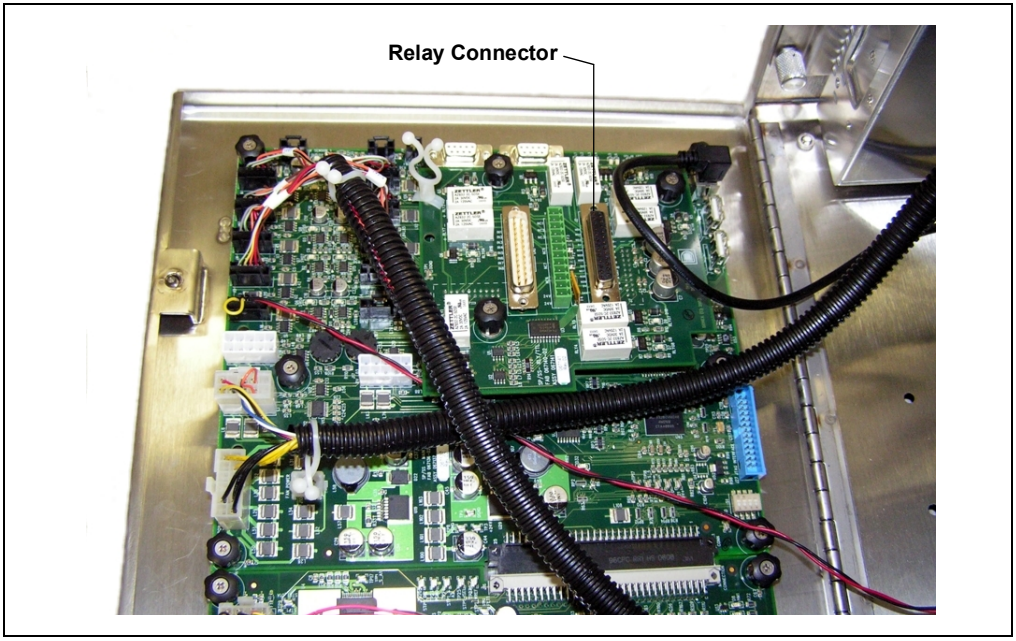


Figure C-18. TTL/Relay Controller Board on SP Service Door (Horizontal SP Enclosure Shown)

6. If you previously removed the SP from the AE rear panel:
   a. Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE rear panel, and hang the SP on the rails.
   b. Replace any modules that were removed from the lower shelf of the AE.
   c. Replace the two access panels on the exterior of the AE.
7. Plug in the power cord and turn on the power.

For AE tower light control instructions, see Section 5.8.

D • Peristaltic Pump Kit Installation

D.1 Overview

The Peristaltic Pump Kit (P/N 068558) provides the parts needed to install a peristaltic pump on the SP panel. The kit includes the parts listed in the table below.

Part Number	Item	Quantity
045689	Washer	4
045938	Screw, Phillips	4
063268	Tubing, 0.159-mm ID x 3.175-mm OD (0.063-in ID x 0.125-in OD), PharMed®	91.44 cm (36 in)
069045	Pump, peristaltic	1
069103	Panel, pump/valve mounting, SP	1
069324	Adapter set, tubing, peristaltic	1
60-068125	Cable assembly, peristaltic pump	1

Additional item needed

- Phillips screwdriver

D.2 Installing the Peristaltic Pump

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 Instrument Configuration Manager (in Chromeleon 7 software)

D.2.1 Installing the Pump on the SP Panel

1. Turn off the SP power.
2. Disconnect the power cord.
3. Orient the peristaltic pump on the pump mounting panel as shown in Figure D-1. Attach the pump to the mounting panel, using the four washers and Phillips screws included in the Peristaltic Pump Kit.

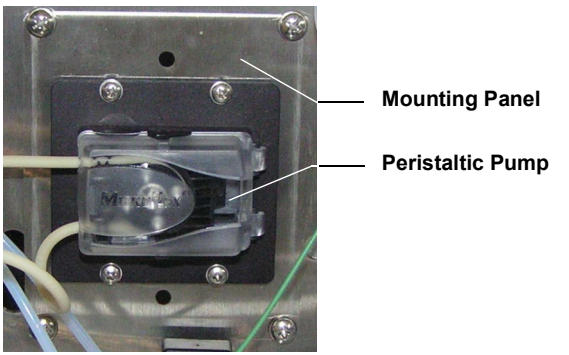


Figure D-1. Peristaltic Pump on SP Panel

4. Slide the body of the pump through the opening on the SP panel. Attach the pump mounting panel to the SP panel as shown in Figure D-1.

D.2.2 Connecting the Pump Cable

1. Plug the peristaltic pump cable into the connector on the rear of the pump.
2. Follow the instructions in Section 10.7 to access the main SP electronics board.
3. Plug the free end of the peristaltic pump cable into the main SP electronics board at the appropriate position:
   - When installing the first (or only) peristaltic pump, plug in the cable at position **SV09**.

- When installing a second peristaltic pump, plug in the cable at position **SV10**.

See Figure D-2 and Figure D-3 for the locations of **SV10** and **SV09**.

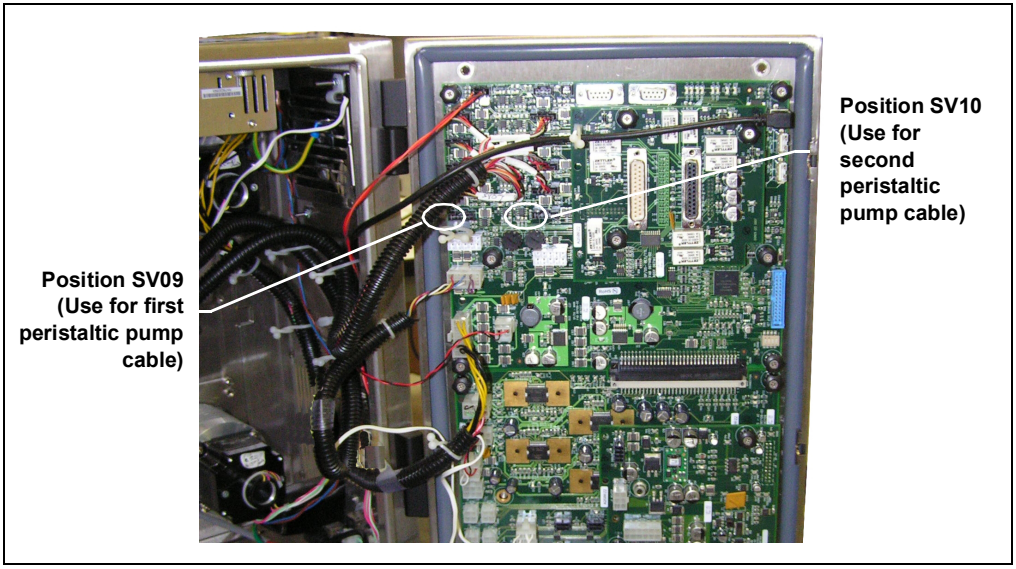


Figure D-2. SP Vertical Enclosure: Service Door Open

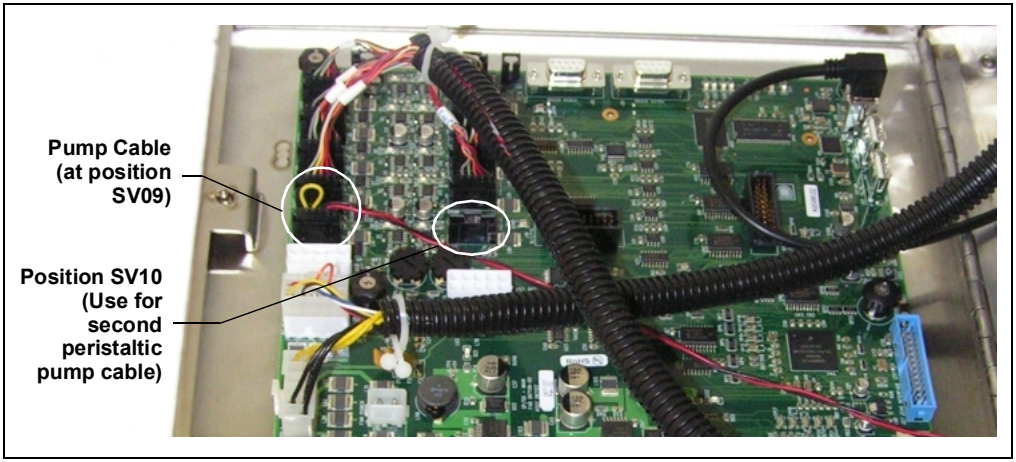


Figure D-3. SP Horizontal Enclosure: Service Door Open

4. Close and secure the SP service door.

D.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 D-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 D-4).

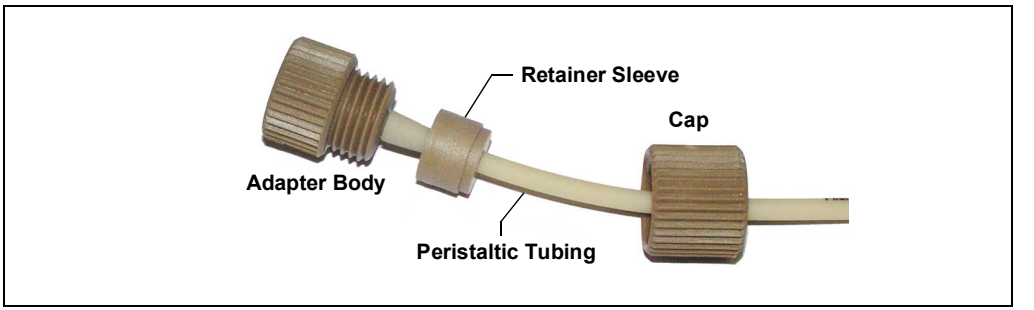


Figure D-4. Peristaltic Tubing Adapter Connections

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. To open the tubing clamp, squeeze the two tabs on the top and bottom of the clamp and slide the clamp to the right (see Figure D-5).

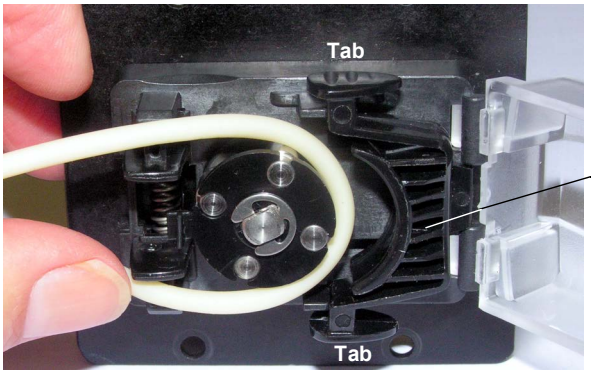


Figure D-5. Peristaltic Tubing Installation

7. Wrap the tubing loosely around the pump head rollers (see Figure D-5). The ends of the tubing should extend approximately equally from the pump.
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 D-6).

Figure D-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 D-7).

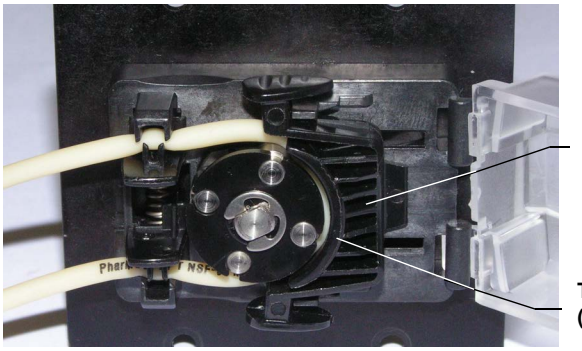


Figure D-7. Peristaltic Tubing Installation Completed

10. Close the tubing clamp by pushing it to the left until the tabs lock into place (see Figure D-7).
11. Close the pump door, making sure that both tabs are outside the door (see Figure D-8).

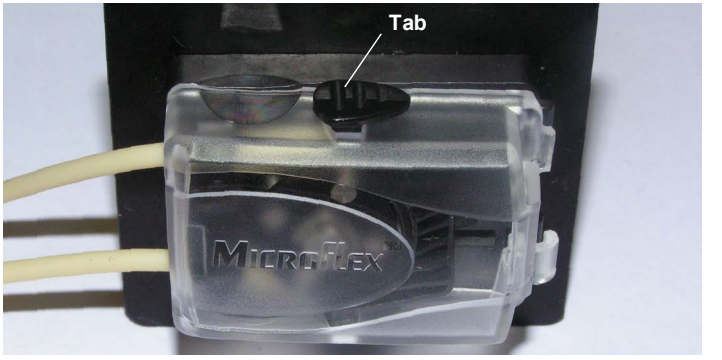


Figure D-8. Peristaltic Pump with Door Closed

12. Connect plumbing lines to the peristaltic tubing fittings as required for your application. Use the fitting nuts and ferrules provided with the peristaltic tubing adapter set. Install the nut and ferrule on the tubing as shown in Figure D-9.

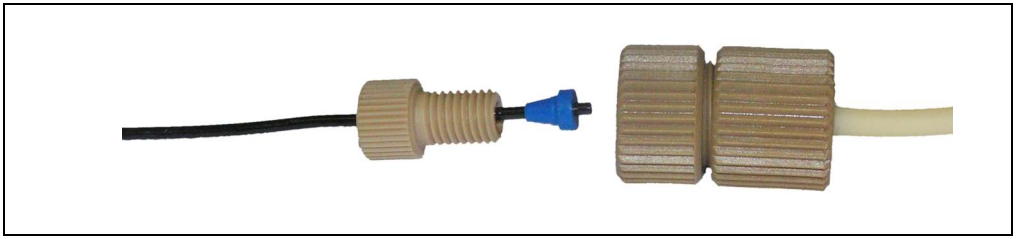


Figure D-9. Fitting Nut and Ferrule for Peristaltic Tubing Connections

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

D.2.4 Configuring the Pump

1. Start the Instrument Configuration Manager (in Chromeleon 7 software).
2. Double-click the SP icon under the instrument name. The Properties dialog box appears.
3. Click the **Solenoids** tab.
4. Select **SV9** (when configuring the first or only pump) or **SV10** (when 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 main SP electronics board is now assigned to control the peristaltic pump rather than a solenoid valve.
6. Save the configuration.

E • Liquid Level Sensor Installation

E.1 Overview

The Liquid Level Sensor Kit (P/N 068563) provides the parts needed to install a liquid level sensor on either a reservoir or a NOWPak Bag-in-a-Bottle container (P/N AAA-068551). The kit includes the parts listed in the table below.

NOTE The liquid level sensor cannot be installed on a stainless steel NOWPak II container (P/N 052882).

Part Number	Item	Quantity
064634	Tape, dual-lock	4
60-067739	Cable assembly, liquid level sensor	1
60-069318	Tie, hook-and-loop cinch strap, 45 cm (18 in); for use with 1-liter reservoir	1
60-069319	Tie, hook-and-loop cinch strap, 61 cm (24 in); for use with 2-liter reservoir	1
60-069320	Tie, hook-and-loop cinch strap, 122 cm (48 in); for use with NOWPak Bag-in-a-Bottle container	1

E.2 Liquid Level Sensor Installation

These are the main steps in the installation procedure:

- Attaching the liquid level sensor to the reservoir or NOWPak Bag-in-a-Bottle container
- Plugging the liquid level sensor cable into the main SP electronics board

E.2.1 Installing the Liquid Level Sensor

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

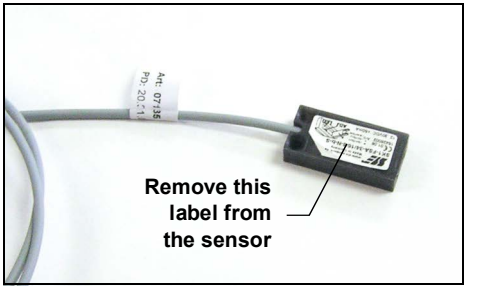


Figure E-1. Sensor with Label

2. Remove the paper backing from a piece of dual-lock tape. Press the tape onto the sensor, where the label used to be (see Figure E-2).

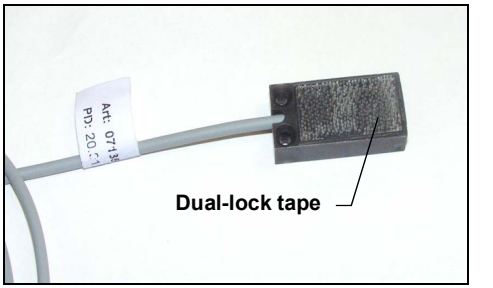


Figure E-2. Sensor with Dual-Lock Tape

3. Wrap the appropriate cinch strap around the reservoir or NOWPak Bag-in-a-Bottle container and loosely secure it. Then, slide the cinch strap off the reservoir or NOWPak container.

4. Remove the paper backing from a piece of dual-lock tape. Press the tape onto the back of the cinch strap, near the buckle (see Figure E-3).

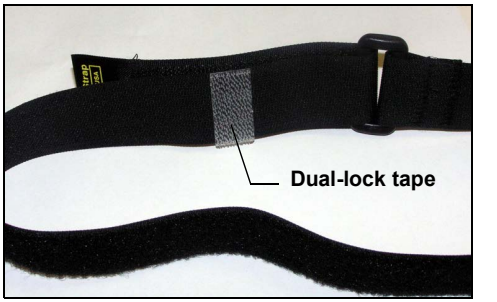


Figure E-3. Cinch Strap with Dual-Lock Tape

5. Slide the cinch strap back onto the reservoir or NOWPak Bag-in-a-Bottle container. Position the strap at the location where you plan to install the sensor.

6. Insert the liquid sensor between the reservoir or NOWPak Bag-in-a-Bottle container and the cinch strap (see Figure E-4).
7. To secure the sensor onto the cinch strap, press together the two pieces of dual-lock tape (on the sensor and the cinch strap).
8. Tighten the strap around the reservoir or NOWPak Bag-in-a-Bottle container.

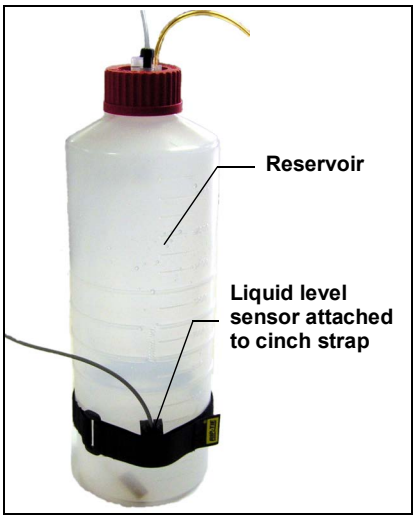


Figure E-4. Sensor Installed on Reservoir

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

1. Turn off the SP power.
2. Disconnect the power cord.
3. Follow the instructions in Section 10.7 to access the main SP electronics board.
4. Route the liquid level sensor cable to the main SP electronics board.
5. Locate the four connectors for the liquid level sensors in the lower-left corner of the main SP electronics board (see Figure E-5).
6. Plug the liquid level sensor cable into the corresponding connector. For example, plug the cable from sensor 1 into connector 1 (see Figure E-5).

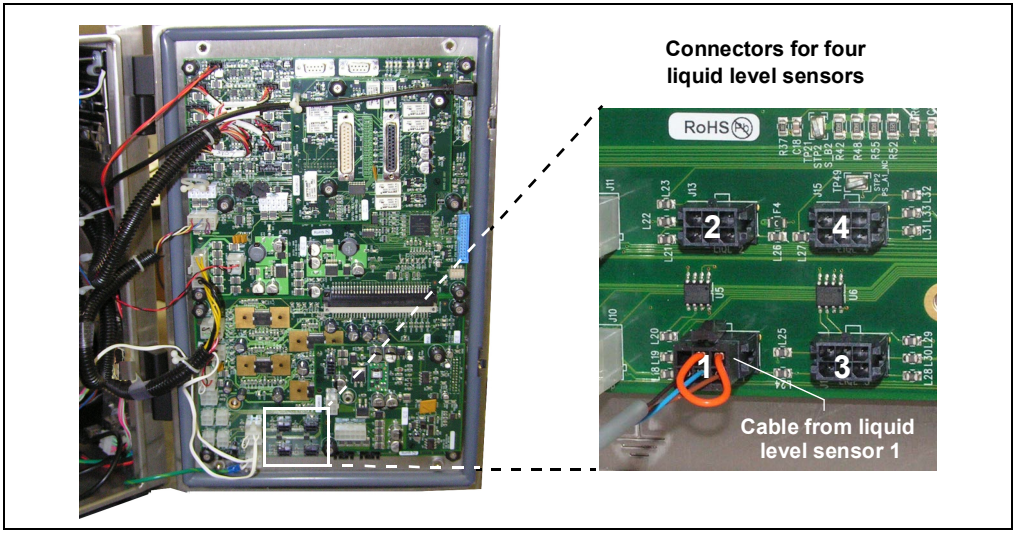


Figure E-5. Main SP Electronics Board (Vertical Enclosure Shown): Liquid Level Sensor Connectors

7. Close and secure the SP service door.
8. If you removed the SP from the AE rear panel:
   a. Lift up the SP, align the four hooks on the rear of the SP with the mounting rails on the AE rear panel, and hang the SP on the rails.
   b. Replace any modules that were removed from the lower shelf of the AE.
   c. 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 Instrument Configuration Manager (in Chromeleon 7 software).
11. Open the SP Properties dialog box. On the **Sensors** page, select the appropriate check box (**LiquidLevelSensor_1**, for example).
12. Save the configuration.

F • Thermal Options Installation

This appendix provides installation instructions for the optional kits and components listed in the table below.

NOTE Installation of the Thermal Control Board Kit (P/N 068572) is a prerequisite for installation of any other option in the table.

Part Number	Option	Description
068524	Heated Dilution Vessel, 50 mL	Includes a dilution vessel with heater and stir bar.
068566	Vial Cooler	Includes a vial cooler, cable, and mounting hardware.
068572	Thermal Control Board Kit	Includes a thermal control board and cables.

F.1 Installing the Thermal Control Board Kit

F.1.1 Overview

The Thermal Control Board Kit (P/N 068572) provides the parts needed to add a thermal control board to the main SP electronics board. The kit includes the parts listed in the table below.

Part Number	Item	Quantity
067143	Control board assembly, thermal	1
60-067727	Cable assembly, DC power	1
60-067744	Cable assembly, heated dilution vessel, extension	1
60-069589	Standoff, hex, 6 mm	2

F.1.2 Installing the Thermal Control Board

1. Turn off the SP power.
2. Disconnect the power cord.
3. Follow the instructions in Section 10.7 to access the main SP electronics board.
4. Screw the two standoffs into the main SP electronics board at the locations indicated in Figure F-1.

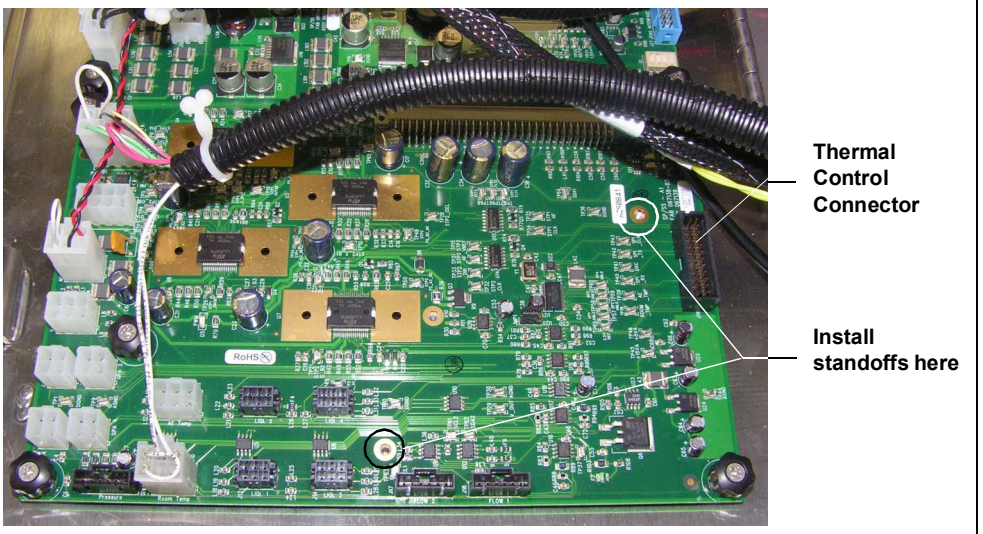


Figure F-1. Main SP Electronics Board (Horizontal SP Enclosure Shown)

5. Orient the thermal control board with the component side facing up.
6. Align the connector on the back of the thermal control board with the corresponding connector near the lower-right corner of the main SP electronics board (see Figure F-1).
7. Press the thermal control board firmly onto the main SP electronics board. Tighten the two thumbscrews on the thermal control board.

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

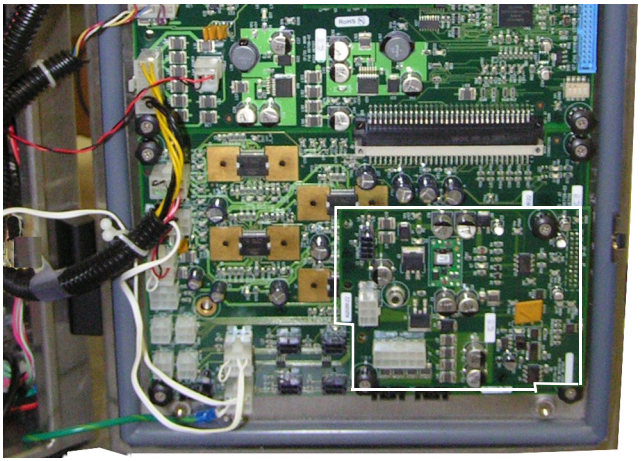


Figure F-2. Main SP Electronics Board: Thermal Control Board Installed (Vertical SP Enclosure Shown)

8. Locate the connector labeled **POWER SUPPLY** on the thermal control board (see Figure F-3).

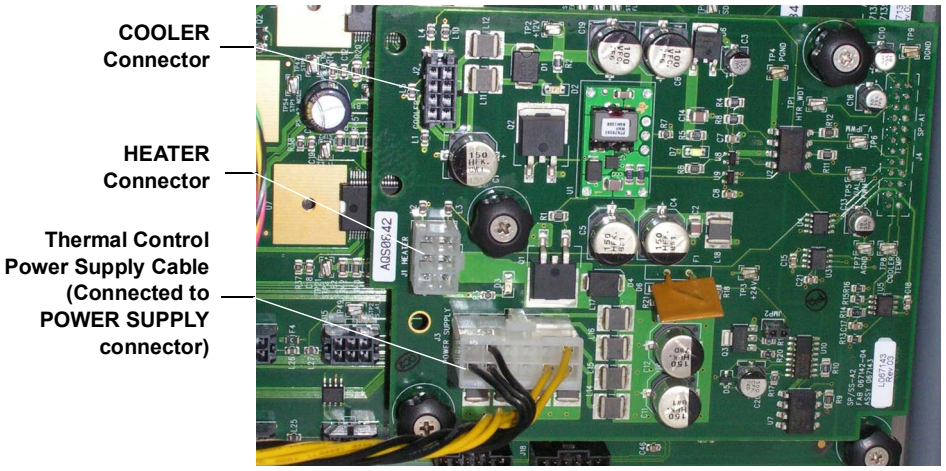


Figure F-3. Main SP Electronics Board: Thermal Control Power Supply Cable Installed

9. Plug the cable from the SP power supply into the **POWER SUPPLY** connector on the thermal control board.

F.2 Installing the Vial Cooler

NOTE Before starting this procedure, install the Thermal Control Board Kit (see Section F.1).

F.2.1 Overview

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

- Installing the vial cooler on the SP panel
- Connecting the vial cooler cable

F.2.2 Installing the Vial Cooler

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

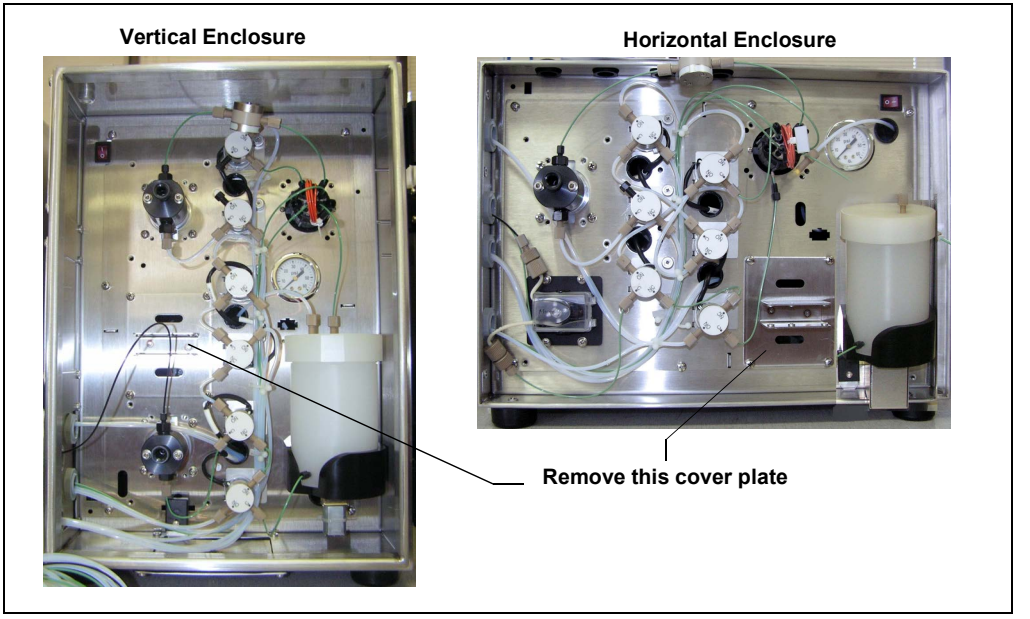


Figure F-4. SP Panel: Remove Cover Plate

2. Thread the vial cooler cable through the opening in the SP panel.
3. Attach the vial cooler mounting panel to the SP panel.

4. Locate the connector labeled **COOLER** on the thermal control board (see Figure F-3).
5. Plug the vial cooler cable into the **COOLER** connector on the thermal control board.

F.3 Installing the Heated Dilution Vessel

NOTE Before starting this procedure, install the Thermal Control Board Kit (see Section F.1).

F.3.1 Overview

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

- Connecting the heated dilution vessel extension cable to the thermal control board
- Installing the heated dilution vessel on the SP panel
- Connecting the cable from the heated dilution vessel to the SP panel
- Connecting the liquid and gas lines

F.3.2 Installing the Heated Dilution Vessel

1. Plug the heated dilution vessel extension cable into the connector labeled **HEATER** on the thermal control board (see Figure F-3).
2. Align the notch on the rear of the heated dilution vessel (see Figure F-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 F-6).

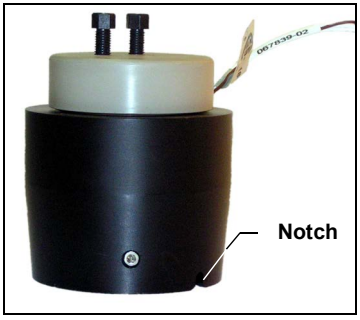
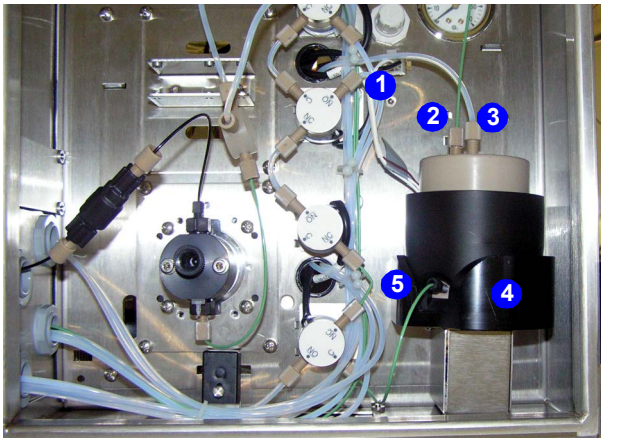


Figure F-5. Heated Dilution Vessel



1. Heated Dilution Vessel Cable
2. Line from Metering Valve
3. Line from Gas Valve
4. Dilution Vessel Holder
5. Line from DV Valve

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

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 (for the SP1, see Figure 3-11; for the SP2, see Figure 3-14).
6. Connect the liquid line from the DV valve to the bottom of the heated dilution vessel.

G • Lockout Instructions for the AE, SP, or SS

This appendix provides instructions for installation of a lockout device on the AE, SP, or SS. The lockout device ensures that the module cannot be powered up until the lockout device is removed.

For standard power plugs, Thermo Fisher Scientific recommends the Hubbell HLDMP lockout device shown in Figure G-1. Bigger power plugs may require the Hubbell HLD or Hubbell HLD2 lockout device. For more information, refer to the Hubbell website.

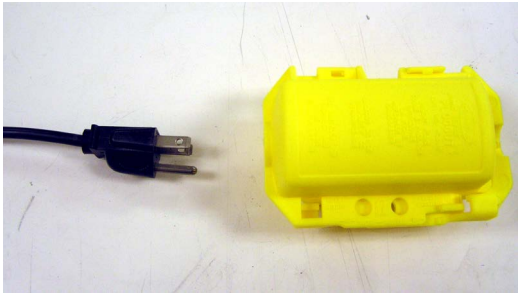


Figure G-1. Lockout Device and Molded Power Cable

G.1 Installing the Lockout Device

G.1.1 Getting Ready

1. Notify all affected persons of the intended lockout.
2. Turn off the power to the module to be locked out by moving the power switch to the off (O) position.
   - Figure G-2 shows the location of the SP/SS power switch. For details about the SP/SS power connections, see Section 3.3.
   - Figure G-3 shows the location of the AE/LE power switch. For details about the AE/LE power connections, see Section 5.4.

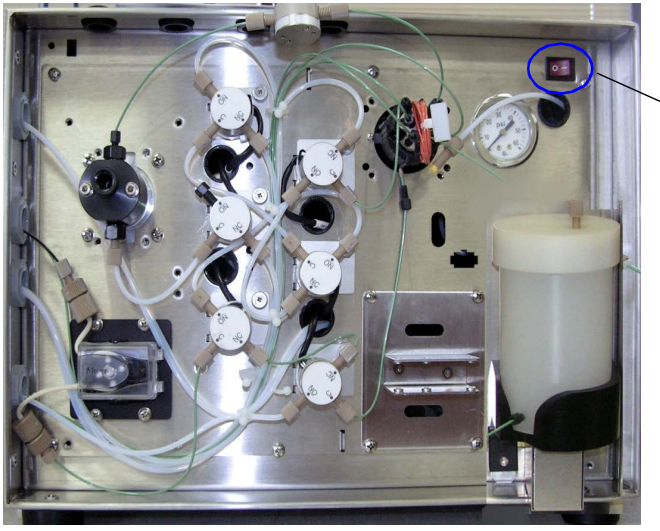


Figure G-2. SP/SS Power Switch

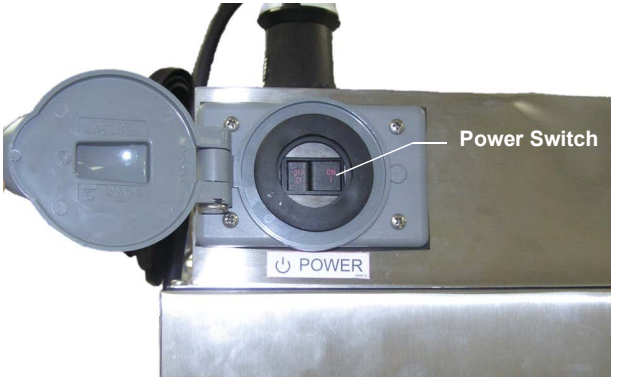


Figure G-3. AE Power Switch

G.1.2 Installing a Lockout Device

1. Open the lockout device.
2. Insert the power connector into the lockout device (see Figure G-4).

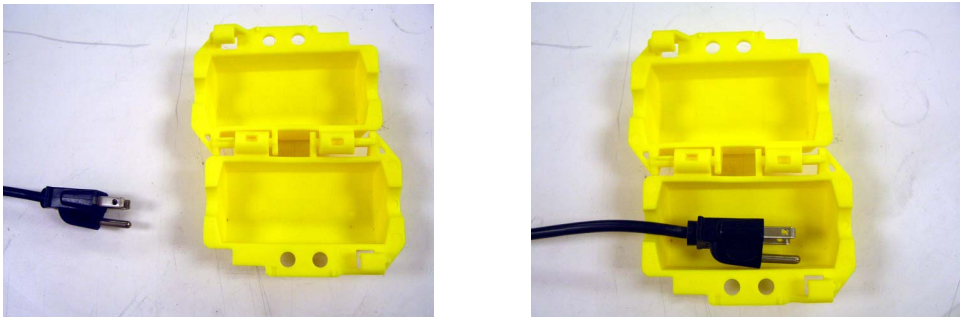


Figure G-4. Insert Power Connector into Lockout Device

3. Close the lockout device.
4. Slide the cover of the lockout device so that the padlock holes are lined up between the cover and the base (see Figure G-5, View A).
5. Insert a padlock (see Figure G-5, View B). (You can use more than one padlock.)

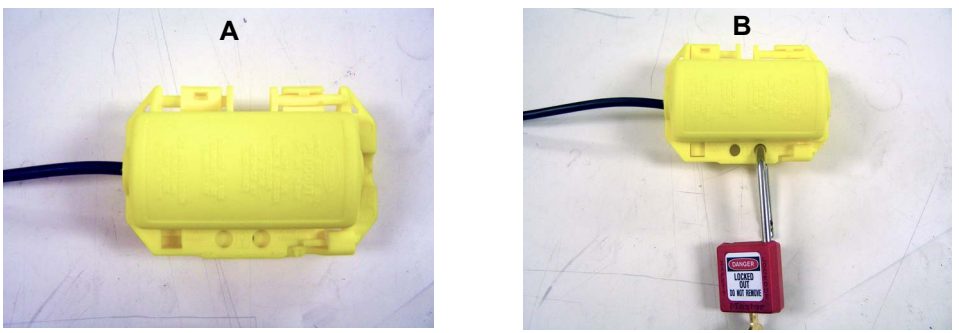


Figure G-5. Close Lockout Device and Attach Padlock

6. Secure the padlock as shown in Figure G-6.

Figure G-6. Lock Padlock and Remove Keys

7. Lock the padlock and remove the keys.

G.1.3 Re-energizing a Module

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

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