

Surveyor Plus

Getting Connected Guide

60053-97101 Revision F January 2009

DOCUMENTATION
SURVEY

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Regulatory Compliance

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 as described in the next section or sections by product name.

Changes that you make to your system might 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.

This section contains regulatory compliance information for the following devices of the Surveyor Plus family of LC instruments:

- [Surveyor LC Pump Plus](#)
- [Surveyor MS Pump Plus](#)
- [Surveyor Autosampler Plus](#)
- [Surveyor UV/Vis Plus Detector](#)
- [Surveyor PDA Plus Detector](#)
- [Surveyor FL Plus Detector](#)
- [Surveyor RI Plus Detector](#)

Surveyor LC Pump Plus

EMC Directive 89/336/EEC amended by 92/31/EEC and 93/68/EEC

EMC compliance has been evaluated by Underwriters Laboratories Inc.

EN 55011	1998	EN 61000-4-3	2002
EN 61000-3-2	1995, A1; 1998, A2; 1998, A14; 2000	EN 61000-4-4	1995, A1; 2001, A2; 2001
IEC 61000-3-2	2000	EN 61000-4-5	1995, A1; 2001
EN 61000-3-3	1995	EN 61000-4-6	1996, A1; 2001
IEC 61000-3-3	1994	EN 61000-4-11	1994, A1; 2001
EN 61326-1	1997		
EN 61000-4-2	1995 A1; 1998 A2; 2001	CISPR 11	1999, A1; 1999, A2; 2002
FCC Class A, CFR 47 Part 15 Subpart B: 2004			

Low Voltage Safety Compliance

Low voltage safety compliance has been evaluated by TUV Rheinland of North America, Inc. This device complies with Low Voltage Directive 73/23/EEC and harmonized standard EN 61010-1:2001.



Surveyor MS Pump Plus

EMC Directive 89/336/EEC amended by 92/31/EEC and 93/68/EEC

EMC compliance has been evaluated by Underwriters Laboratories Inc.

EN 55011	1998	EN 61000-4-3	2002
EN 61000-3-2	1995, A1; 1998, A2; 1998, A14; 2000	EN 61000-4-4	1995, A1; 2001, A2; 2001
IEC 61000-3-2	2000	EN 61000-4-5	1995, A1; 2001
EN 61000-3-3	1995	EN 61000-4-6	1996, A1; 2001
IEC 61000-3-3	1994	EN 61000-4-11	1994, A1; 2001
EN 61326-1	1997		
EN 61000-4-2	1995 A1; 1998 A2; 2001	CISPR 11	1999, A1; 1999, A2; 2002
FCC Class A, CFR 47 Part 15 Subpart B: 2004			

Low Voltage Safety Compliance

Low voltage safety compliance has been evaluated by TUV Rheinland of North America, Inc. This device complies with Low Voltage Directive 73/23/EEC and harmonized standard EN 61010-1:2001.

Surveyor Autosampler Plus

EMC Directive 89/336/EEC amended by 92/31/EEC and 93/68/EEC

EMC compliance has been evaluated by Underwriters Laboratories Inc.

EN 55011	1998	EN 61000-4-3	2002
EN 61000-3-2	1995, A1; 1998, A2; 1998, A14; 2000	EN 61000-4-4	1995, A1; 2001, A2; 2001
IEC 61000-3-2	2000	EN 61000-4-5	1995, A1; 2001
EN 61000-3-3	1995	EN 61000-4-6	1996, A1; 2001
IEC 61000-3-3	1994	EN 61000-4-11	1994, A1; 2001
EN 61326-1	1997		
EN 61000-4-2	1995 A1; 1998 A2; 2001	CISPR 11	1999, A1; 1999, A2; 2002
FCC Class A, CFR 47 Part 15 Subpart B: 2004			

Low Voltage Safety Compliance

Low voltage safety compliance has been evaluated by TUV Rheinland of North America, Inc. This device complies with Low Voltage Directive 73/23/EEC and harmonized standard EN 61010-1:2001.



Surveyor UV/Vis Plus Detector

EMC Directive 89/336/EEC amended by 92/31/EEC and 93/68/EEC

EMC compliance has been evaluated by Underwriters Laboratories Inc.

EN 55011	1998	EN 61000-4-3	2002
EN 61000-3-2	1995, A1; 1998, A2; 1998, A14; 2000	EN 61000-4-4	1995, A1; 2001, A2; 2001
IEC 61000-3-2	2000	EN 61000-4-5	1995, A1; 2001
EN 61000-3-3	1995	EN 61000-4-6	1996, A1; 2001
IEC 61000-3-3	1994	EN 61000-4-11	1994, A1; 2001
EN 61326-1	1997		
EN 61000-4-2	1995 A1; 1998 A2; 2001	CISPR 11	1999, A1; 1999, A2; 2002
FCC Class A, CFR 47 Part 15 Subpart B: 2004			

Low Voltage Safety Compliance

Low voltage safety compliance has been evaluated by TUV Rheinland of North America, Inc. This device complies with Low Voltage Directive 73/23/EEC and harmonized standard EN 61010-1:2001.

Surveyor PDA Plus Detector

EMC Directive 89/336/EEC amended by 92/31/EEC and 93/68/EEC

EMC compliance has been evaluated by Underwriters Laboratories Inc.

EN 55011	1998	EN 61000-4-3	2002
EN 61000-3-2	1995, A1; 1998, A2; 1998, A14; 2000	EN 61000-4-4	1995, A1; 2001, A2; 2001
IEC 61000-3-2	2000	EN 61000-4-5	1995, A1; 2001
EN 61000-3-3	1995	EN 61000-4-6	1996, A1; 2001
IEC 61000-3-3	1994	EN 61000-4-11	1994, A1; 2001
EN 61326-1	1997		
EN 61000-4-2	1995 A1; 1998 A2; 2001	CISPR 11	1999, A1; 1999, A2; 2002
FCC Class A, CFR 47 Part 15 Subpart B: 2003			

Low Voltage Safety Compliance

Low voltage safety compliance has been evaluated by TUV Rheinland of North America, Inc. This device complies with Low Voltage Directive 73/23/EEC and harmonized standard EN 61010-1:2001.



Surveyor FL Plus Detector

EMC Directive 89/336/EEC amended by 92/31/EEC and 93/68/EEC

EMC compliance has been evaluated by TUV Rheinland of North America, Inc.

EN 61326-1	1997; A1, 1998; A2, 2001; A3, 2003	EN 61000-4-4	1995, A1; 2001, A2; 2001
EN 61000-3-2	2000	EN 61000-4-5	2001
EN 61000-3-3	1995; A1, 2001	EN 61000-4-6	2003
EN 61000-4-2	2001	EN 61000-4-8	2001
EN 61000-4-3	2002	EN 61000-4-11	2001

FCC Class A, CFR 47 Part 15 Subpart B: 2005

Low Voltage Safety Compliance

Low voltage safety compliance has been evaluated by TUV Rheinland of North America, Inc. This device complies with Low Voltage Directive 73/23/EEC and harmonized standard EN 61010-1:2001, IEC 61010-1:2002, UL 61010 A-1:2004, CAN/CSA 22.2 61010-1:2004.

Surveyor RI Plus Detector

EMC Directive 89/336/EEC amended by 92/31/EEC and 93/68/EEC

EMC compliance has been evaluated by TUV Rheinland of North America, Inc.

EN 61326-1	1997; A1, 1998; A2, 2001; A3, 2003	EN 61000-4-4	1995, A1; 2001, A2; 2001
EN 61000-3-2	2000	EN 61000-4-5	2001
EN 61000-3-3	1995; A1, 2001	EN 61000-4-6	2003
EN 61000-4-2	2001	EN 61000-4-11	2001
EN 61000-4-3	2002		

FCC Class A, CFR 47 Part 15 Subpart B: 2005

Low Voltage Safety Compliance

Low voltage safety compliance has been evaluated by TUV Rheinland of North America, Inc. This device complies with Low Voltage Directive 73/23/EEC and harmonized standard EN 61010-1:2001, IEC 61010-1:2002, UL 61010 A-1:2004, CAN/CSA 22.2 61010-1:2004.

FCC Compliance Statement

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. 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 UNDESIRE OPERATION.



CAUTION Read and understand the various precautionary notes, signs, and symbols contained inside this manual pertaining to the safe use and operation of this product before using the device.

Notice on Lifting and Handling of Thermo Scientific Instruments

For your safety, and in compliance with international regulations, the physical handling of this Thermo Fisher 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.

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.

Notice on the Susceptibility to Electromagnetic Transmissions

Your instrument is designed to work in a controlled electromagnetic environment. Do not use radio frequency transmitters, such as mobile phones, in close proximity to the instrument.

For manufacturing location, see the label on the instrument.

WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:



Thermo Fisher Scientific has contracted with one or more recycling or disposal companies in each European Union (EU) Member State, and these companies should dispose of or recycle this product. See www.thermo.com/WEEERoHS for further information on Thermo Fisher Scientific's compliance with these Directives and the recyclers in your country.

WEEE Konformität

Dieses Produkt muss die EU Waste Electrical & Electronic Equipment (WEEE) Richtlinie 2002/96/EC erfüllen. Das Produkt ist durch folgendes Symbol gekennzeichnet:



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Conformité DEEE

Ce produit doit être conforme à la directive européenne (2002/96/EC) des Déchets d'Equipements Electriques et Electroniques (DEEE). Il est marqué par le symbole suivant:



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Preface

This guide describes how to connect the communication cables, the system interconnect cable, the power lines, and the solvent lines for the Surveyor Plus™ LC system. This guide also describes how to connect the system interconnect cable to a Thermo Fisher Scientific mass spectrometer.

Related Documentation

In addition to this guide, Thermo Fisher Scientific provides the following documents for the Surveyor Plus system:

- *Surveyor Plus Preinstallation Requirements Guide*
- *Surveyor Plus Getting Started with ChromQuest Guide*
- *Surveyor Plus Getting Started with Xcalibur Guide*
- *Surveyor Autosampler Plus Hardware Manual*
- *Surveyor LC Pump Plus Hardware Manual*
- *Surveyor MS Pump Plus Hardware Manual*
- *Surveyor UV/Vis Plus Detector Hardware Manual*
- *Surveyor PDA Plus Detector Hardware Manual*
- *Surveyor FL Plus Detector Hardware Manual*
- *Surveyor RI Plus Detector Hardware Manual*

Safety and Special Notices

Make sure you follow the precautionary statements presented in this guide. The safety and other special notices appear in boxes.

Safety and special notices include the following:



CAUTION Highlights hazards to humans, property, or the environment. Each CAUTION notice is accompanied by an appropriate CAUTION symbol.

IMPORTANT Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or might contain information that is critical for optimal performance of the system.

Note Highlights information of general interest.

Tip Helpful information that can make a task easier.

Contacting Us

There are several ways to contact Thermo Fisher Scientific for the information you need.

❖ To contact Technical Support

Phone	800-532-4752
Fax	561-688-8736
E-mail	us.techsupport.analyze@thermofisher.com
Knowledge base	www.thermokb.com

Find software updates and utilities to download at mssupport.thermo.com.

❖ To contact Customer Service for ordering information

Phone	800-532-4752
Fax	561-688-8731
E-mail	us.customer-support.analyze@thermofisher.com
Web site	www.thermo.com/ms

❖ To copy manuals from the Internet

Go to mssupport.thermo.com and click **Customer Manuals** in the left margin of the window.

❖ To suggest changes to documentation or to Help

- To provide us with comments about this document, click the link below. Thank you in advance for your help.



- Send an e-mail message to the Technical Publications Editor at techpubs-lcms@thermofisher.com.

The Surveyor Plus LC System

The Surveyor Plus™ LC is available in two formats: the Surveyor Plus Modular LC system and the Surveyor Plus Integrated LC/MS system. The Surveyor Plus Modular LC system provides optimal performance for the chromatographer and is controlled from the ChromQuest chromatography data system. The Surveyor Plus Integrated LC/MS system provides optimal performance for the mass spectroscopist and is controlled from the Xcalibur™ data system.

Contents

- [Surveyor Plus Modular LC System](#)
- [Surveyor Plus Integrated LC/MS System](#)

Surveyor Plus Modular LC System

The Surveyor Plus Modular LC system is controlled from the ChromQuest chromatography data system and consists of the Surveyor LC Pump Plus, either the Surveyor Autosampler Plus or the Surveyor Autosampler Plus Lite, and one or more of the Surveyor family of LC detectors.

The Surveyor family of LC detectors consists of the Surveyor UV/Vis Plus Detector, the Surveyor PDA Plus Detector, the Surveyor FL Plus Detector, and the Surveyor RI Plus Detector. The Surveyor UV/Vis Plus Detector is a time programmable, dual wavelength detector capable of monitoring the wavelength range from 190 nm to 800 nm. The Surveyor PDA Plus Detector is a photodiode array detector capable of scanning the UV-Vis range from 190 to 800 nm. The Surveyor FL Plus Detector is a time programmable fluorescence detector capable of monitoring the emission spectrum from 250 to 900 nm. The Surveyor RI Plus Detector is a refractive index detector that allows you to detect compounds with poor absorption in the UV range.

When you install the Surveyor Plus Modular LC system, set aside a bench top in a clean, well ventilated area. With a UV/Vis, RI, or PDA detector, the footprint of the stack is 35 cm × 43 cm ($w \times d$). With the fluorescence detector, the footprint of the stack is 75 cm × 43 cm ($w \times d$). Allow at least 114 cm (45 in.) of vertical height for the stack with the pump, autosampler, detector, solvent platform, and standard 1-L solvent bottles. This height provision will allow sufficient access to the 1-L solvent bottles in the solvent platform. If you plan to use larger solvent containers, allow more vertical space. Allow at least 15 cm (6 in.) of

space between the back of the instrument stack and any wall or obstruction. This provides access to the back-panel connectors and allows sufficient room for the ventilation of electronic components.

Set up the Surveyor Plus Modular LC system as shown in [Figure 1](#). Place the analytical pump is located on the bottom of the instrument stack. Place the autosampler on top of the pump. If your system contains a PDA detector, UV/Vis detector, or RI detector, place the detector on top of the autosampler. If your system contains a Surveyor FL Plus Detector, place the detector to the right of the stack containing the pump, autosampler, and solvent platform. If your system contains an RI detector in addition to a UV/Vis or PDA detector, place the UV/Vis or PDA detector on the top of the autosampler, and place the RI detector to the right of the stack. The Solvent Platform, containing the solvent reservoir bottles and the wash bottle, is located on the top of the stack.



CAUTION Placing the fluorescence detector on top of the autosampler would create a potential hazard in case of earthquakes.



CAUTION Do not connect high-pressure tubing, a backpressure regulator, or another detector to the OUT port of the RI detector. Connect the outlet tubing (0.060 in. × 1/16 in. OD, Teflon® tubing) for the RI detector directly to waste.

Four 1/8 in. OD, FEP solvent lines carry solvent from the reservoir bottles down to the vacuum membrane degasser built into the LC pump. With each piston stroke, four high-precision valves in the LC pump proportion the solvents to create the requested mobile phase composition.

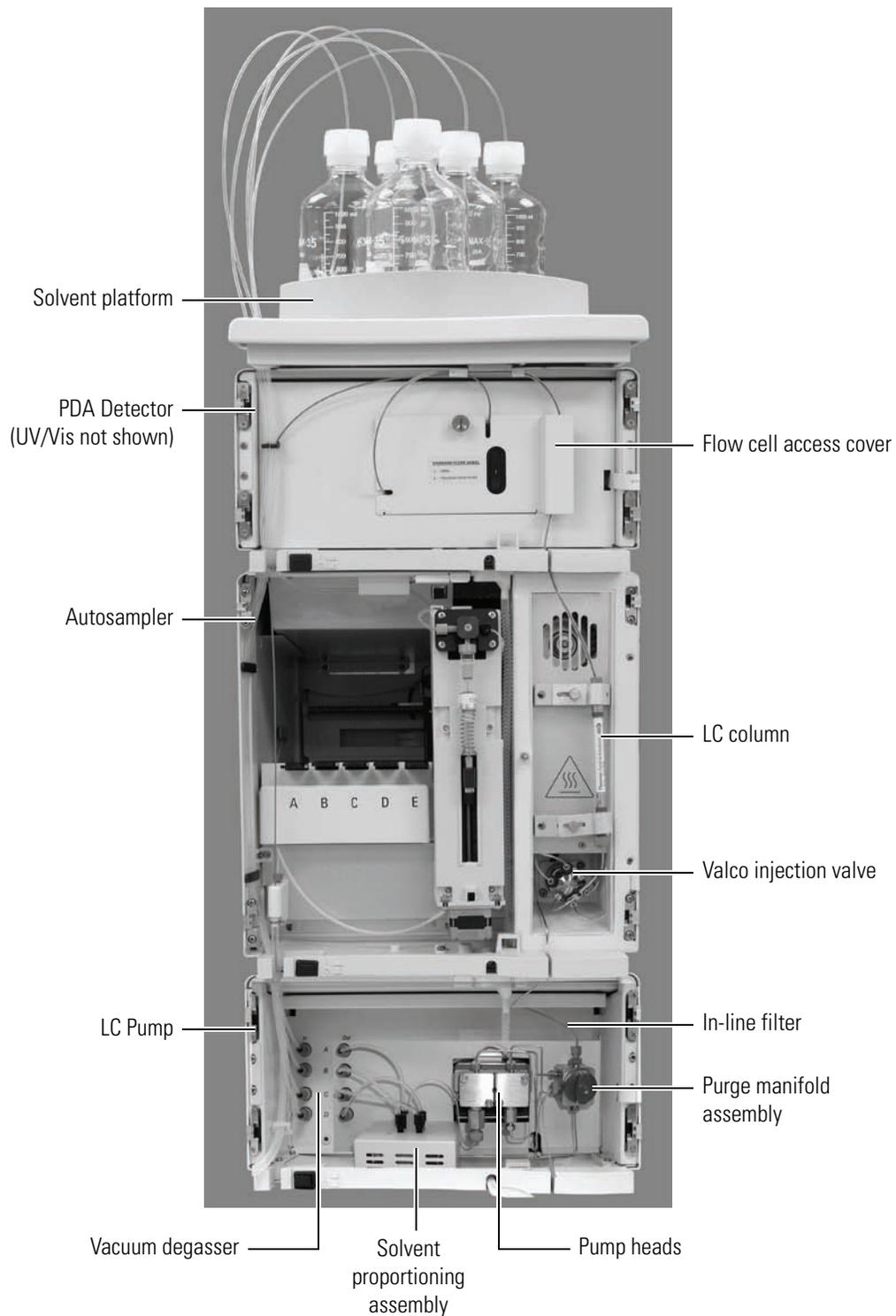
The LC pump is a dual head reciprocating piston pump. The inlet check valve controls solvent flow into the primary pump head. The outlet check valve prevents backflow into the primary pump head from the crossover tube connecting the primary pump head to the secondary pump head. The outlet tube connects the secondary pump head to the purge manifold assembly where a pressure sensor monitors the backpressure of the system.

To minimize the pump pulsation, the mobile phase is routed through the purge valve assembly into a pulse dampener. As the mobile phase exits the pulse dampener, it is routed back into the purge manifold assembly. At this point, depending on the position of the drain valve knob, the mobile phase can be directed out the top of the purge manifold assembly or it can be diverted to waste. As the mobile phase passes out the top of the purge manifold assembly to the autosampler, particulate matter is captured by an in-line filter frit.

The Surveyor Autosampler Plus draws a specified volume of sample from a sample vial and delivers it to an isolated sample loop of stainless steel tubing attached to the autosampler injection valve. The injection valve is actuated, which places the sample loop in line between the pump and column. Mobile phase backflushes the sample from the sample loop onto the LC column.

Compounds eluting from the LC column pass through a short length of 0.005 in. ID, PEEK™, red tubing into the flowcell of the detector. This inlet tubing is coated with a layer of insulation to prevent fluctuations in the temperature of the mobile phase as it passes between the column and the flowcell. In the flowcell, each component in turn absorbs light according to its molar absorptivity and concentration. The detector measures the reduction in light intensity due to the absorbance of the component and the absorbance is reported as a function of wavelength.

Figure 1. Surveyor Plus Modular LC system



Surveyor Plus Integrated LC/MS System

The Surveyor Plus Integrated LC/MS System consists of the Surveyor Plus LC system and a Thermo Fisher Scientific mass spectrometer, both of which are controlled by the Xcalibur data system. The Surveyor Plus LC system consists of an analytical pump, an autosampler, and an optional PDA detector.

Two analytical pumps are available: the Surveyor MS Pump Plus and the Surveyor LC Pump Plus. The MS pump is suitable for the low flow rate ranges required for LC/MS applications: 1 to 2000 $\mu\text{L}/\text{min}$. The LC pump is suitable for the flow rate ranges required for high-performance liquid chromatography: 10 to 9999 $\mu\text{L}/\text{min}$.

Two autosampler models are available: the Surveyor Autosampler Plus and the Surveyor Autosampler Plus Lite. The Surveyor Autosampler Plus Lite has the same features as the Surveyor Autosampler, except that it lacks tray temperature and column oven control.

Set up the LC/MS Plus system as shown in [Figure 2](#). As illustrated in the photograph, the Surveyor Plus LC system stands to the left of the mass spectrometer with the analytical pump located on the bottom of the instrument stack. Above the analytical pump is the autosampler followed by the PDA detector. The Solvent Platform, containing the solvent reservoir bottles, is located on the top of the stack.

Four 1/8 in. OD, FEP solvent lines carry solvent from the reservoir bottles down to the vacuum membrane degasser built into the MS pump. Four high-precision solenoid valves in the MS pump proportion the solvents to create the requested mobile phase composition. The Liquid Displacement Assembly delivers the mobile phase to the inlet port on the autosampler injection valve.

The Surveyor Autosampler Plus draws a specified volume of sample from a sample vial and delivers it to an isolated sample loop of stainless steel tubing attached to the autosampler injection valve. The injection valve is actuated, which places the sample loop in line between the pump and column. Mobile phase backflushes the sample from the sample loop onto the LC column.

Compounds eluting from the LC column pass through a short length of 0.005 in. ID, PEEK, red inlet tubing into the Surveyor PDA Plus flowcell. This inlet tubing is coated with a layer of insulation to prevent fluctuations in the temperature of the mobile phase as it passes between the column and the LightPipe flowcell. In the flowcell, each component in turn absorbs light according to its molar absorptivity and concentration. The detector measures the reduction in light intensity due to the absorbance of each component, and the absorbance is reported as a function of wavelength.

The components then travel through another length of 0.005 in. ID, red tubing (supplied in the accessory kit for the MS detector) from the PDA to the mass spectrometer. Here, mobile phase is nebulized and removed by vacuum; the component is ionized, separated according to its mass-to-charge ratio (m/z), and detected by a conversion dynode / electron multiplier detector. The abundance of the ions is subsequently reported as a function of the mass-to-charge ratio of the ions.

Figure 2. Surveyor Plus LC system with a Surveyor MSQ Plus MS detector



A personal computer controls the entire system and collects information from the Xcalibur data system.

Connecting the Power Lines

Before you can operate the Surveyor Plus modules, you must connect them to line power.

The Surveyor Plus modules are shipped with power cords appropriate to their shipping destination.

Table 1. Power cords

Description	Part Number
Power cord (U.S.A.)	6003-0160
Power cord (Europe)	6003-0330
Power cord (Switzerland)	6003-0620
Power cord (United Kingdom)	6003-0810

Contents

- [Power Entry Modules](#)
- [Power Cords](#)

Power Entry Modules

Except for the Surveyor PDA Plus Detector and the Surveyor UV/Vis Plus Detector, the modules of the Surveyor Plus family of LC instruments have autosensing power supplies.

Figure 3 shows the power entry module for the Surveyor Autosampler Plus, Surveyor LC Pump Plus, and the Surveyor MS Pump Plus.

Figure 3. Power entry module for the autosampler, LC pump, and MS pump

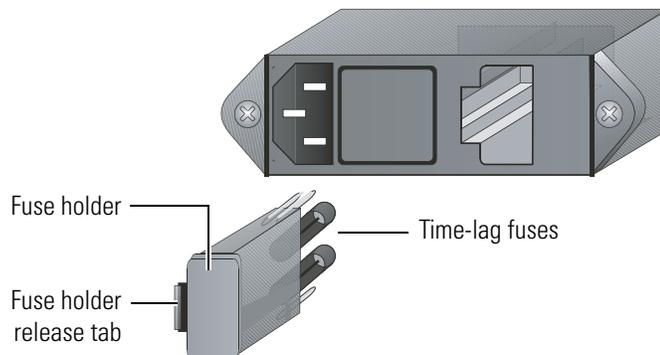


Figure 4 and Figure 5 show the power entry modules of the RI detector and the FL detector, respectively.

Figure 4. Power module of the Surveyor RI Plus Detector

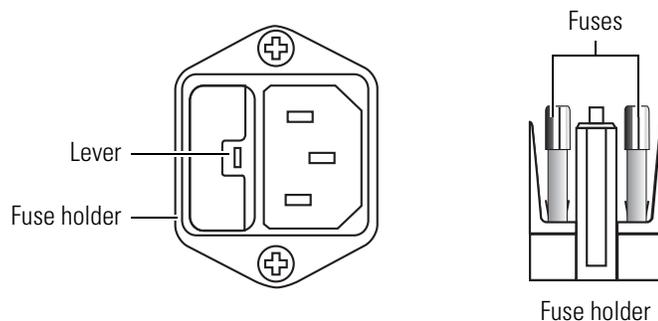
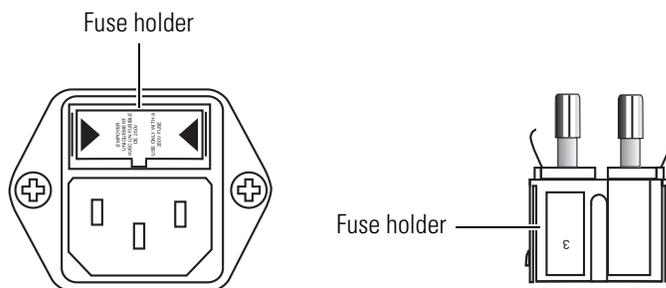


Figure 5. Power module of the Surveyor FL Plus Detector



To protect against power surges, the Surveyor Plus devices with autosensing power supplies use the fuses listed in [Table 2](#).

Table 2. Fuses usage based on power supply voltage

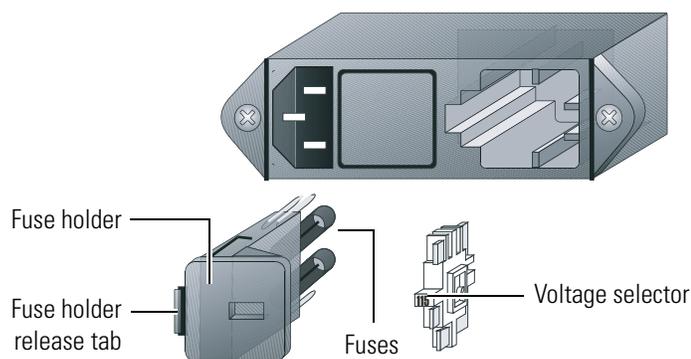
Device	115 V	230 V
Surveyor LC Pump Plus	two 3.15 A, 5 × 20 mm, time-lag, 250 V	two 1.6 A, 5 × 20 mm, time-lag, 250 V
Surveyor MS Pump Plus	two 2.0 A, 5 × 20 mm, time-lag, 250 V	two 1.0 A, 5 × 20 mm, time-lag, 250 V
Surveyor Autosampler Plus	two 5.0 A, 5 × 20 mm, time-lag, 250 V	two 2.5 A, 5 × 20 mm, time-lag, 250 V
Surveyor FL Plus Detector	two 5.0 A, 5 × 20 mm, time-lag, 250 V	two 2.5 A, 5 × 20 mm, time-lag, 250 V
Surveyor RI Plus Detector	two 3.15 A, 5 × 20 mm, time-lag, 250 V	two 1.6 A, 5 × 20 mm, time-lag, 250 V

The power entry module of the Surveyor PDA Plus Detector or the Surveyor UV/Vis Plus Detector contains a voltage selector that can be set to either 115 V or 230 V. The detector is shipped with the appropriate fuses and voltage setting for your location as follows:

- 3.15 A fuse for 115 V operation
- 1.6 A fuse for 230 V operation

Before you connect the detector to line power, check the setting of the voltage selector by looking through the cut-out window on the power entry module.

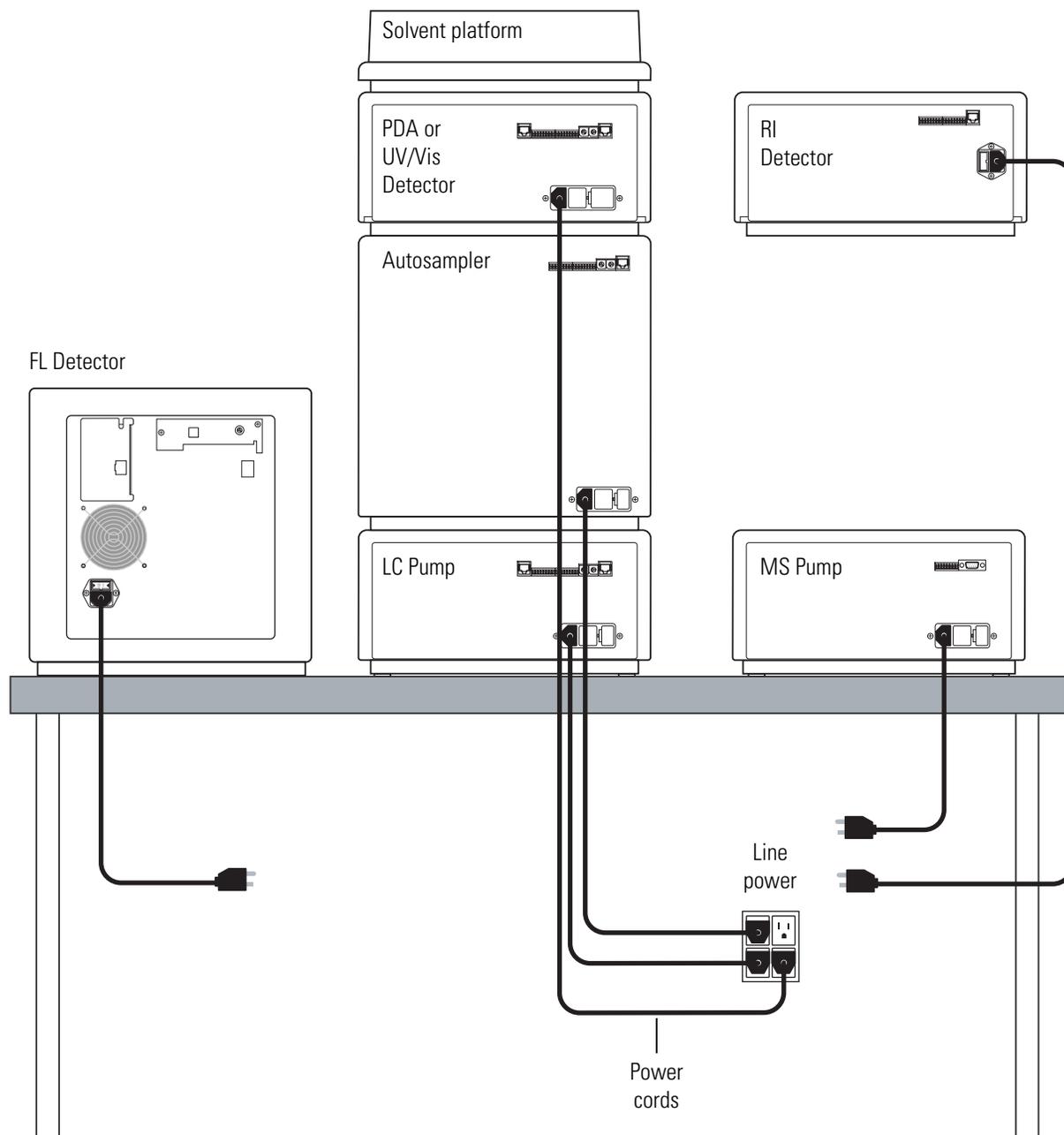
Figure 6. Power entry module for the Surveyor UV/Vis Plus Detector and the Surveyor PDA Plus Detector



Power Cords

The Surveyor Plus modules ship with power cords appropriate to their shipping destination. Attach the female plug of the cord to the power entry module and the other end of the cord to line power. See [Figure 7](#).

Figure 7. Connecting the Surveyor Plus modules to line power



Connecting the Communication Cables

To download methods to and upload status information from an instrument module, a communication link must be set up between the data system and the module. The communication links for the Surveyor devices are as follows:

- For the Surveyor LC Pump Plus, the Surveyor Autosampler Plus, the Surveyor UV/Vis Detector, the Surveyor PDA Plus Detector, and the Surveyor RI Plus Detector, communication with the data system is established through an Ethernet connection.
- For the Surveyor FL Plus Detector communication with the data system is established through a USB connection.
- For the Surveyor MS Pump Plus, communication with the data system is established through an RS232 connection.

For information on connecting the communication cables to your Thermo Fisher Scientific mass spectrometer, see the Getting Connected manual for your mass spectrometer.

Contents

- [Connecting the Ethernet Cables](#)
- [Connecting the FL Detector with a USB Cable](#)
- [Connecting the Surveyor MS Pump with an RS232 Cable](#)

Table 3 lists the parts you need to make these communication connections.

Table 3. Parts required to make the communication connections

Description	Part Number
CAT-5 Ethernet cable, shielded, 2 m (7 ft.)	70111-63302
USB cable, shielded (for the Surveyor FL Plus Detector), 3 m length	00302-99-00014
Ethernet switch	00825-01-00024
RS232 9-pin serial cable (for the Surveyor MS Pump)	72011-63008

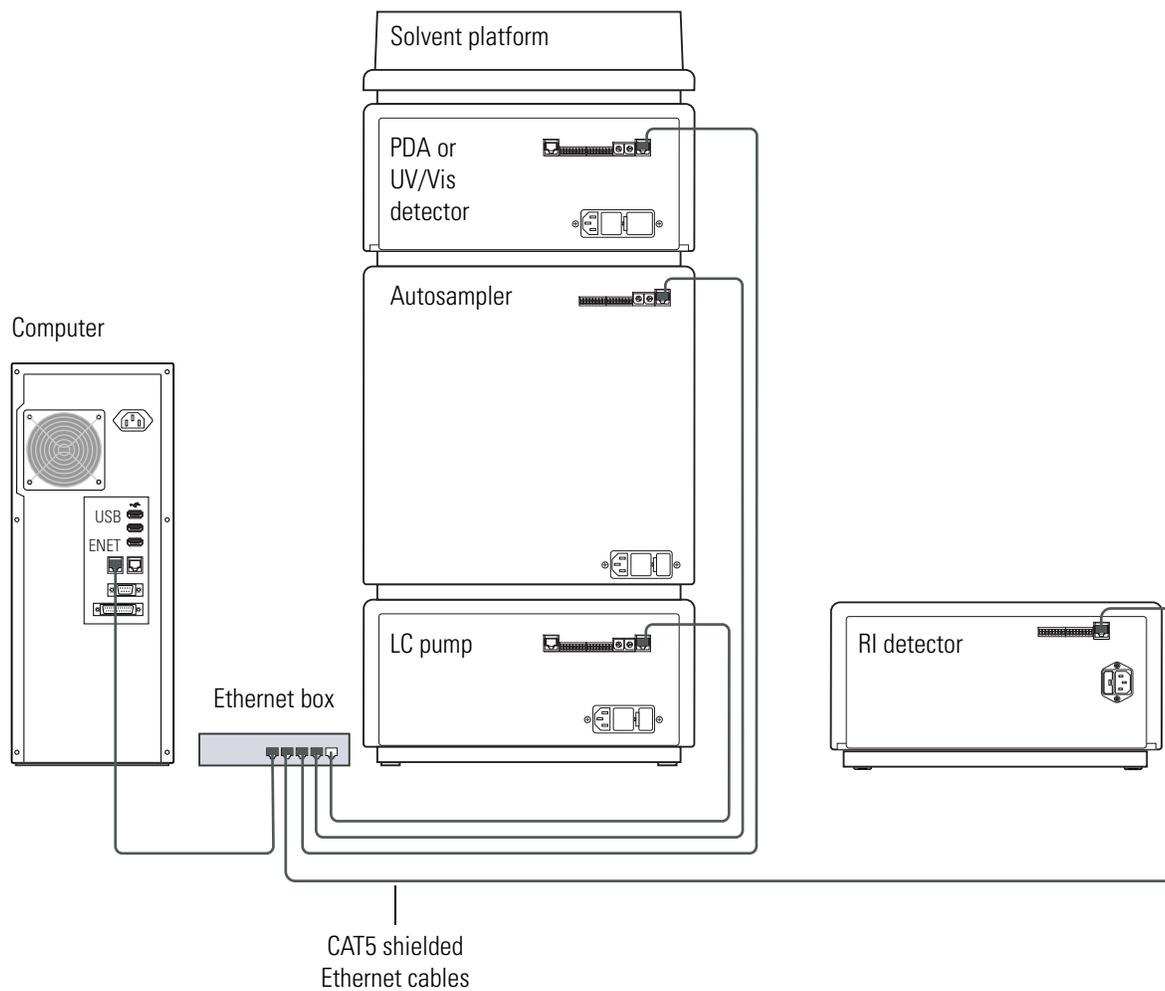
Connecting the Ethernet Cables

The Surveyor LC Pump Plus, Surveyor Autosampler Plus, Surveyor UV/Vis Plus Detector, Surveyor RI Plus Detector, and Surveyor PDA Plus Detector communicate with the data system through an Ethernet connection as shown in [Figure 8](#).

❖ To connect the Ethernet cables

1. Using a shielded, RJ-45, CAT-5, 2 m (7 ft.) Ethernet cable, connect a 5-port Ethernet switch to the 3Com 3C905-TX Ethernet card of the data system computer:
 - a. Connect one end of the Ethernet cable to port 1 of a 5-port Ethernet switch.
 - b. Connect the other end of the Ethernet cable to the Ethernet card dedicated to the Surveyor Plus LC system.
2. Using a shielded, RJ-45, CAT-5, 2 m (7 ft.) Ethernet cable, connect the detector to the Ethernet switch:
 - a. Connect one end of the cable to the Ethernet connection on the back panel of the detector
 - b. Connect the other end of the cable to the Ethernet switch.
3. Using a shielded, RJ-45, CAT-5, 2 m (7 ft.) Ethernet cable, connect the autosampler to the Ethernet switch:
 - a. Connect one end of the cable to the Ethernet connection on the back panel of the autosampler
 - b. Connect the other end of the cable to the Ethernet switch.
4. Using a shielded, RJ-45, CAT-5, 2 m (7 ft.) Ethernet cable, connect the Surveyor LC Pump Plus to the Ethernet switch:
 - a. Connect one end of the cable to the Ethernet connection on the back panel of the pump.
 - b. Connect the other end of the cable to the Ethernet switch.

Figure 8. Ethernet connections



3 Connecting the Communication Cables

Connecting the FL Detector with a USB Cable

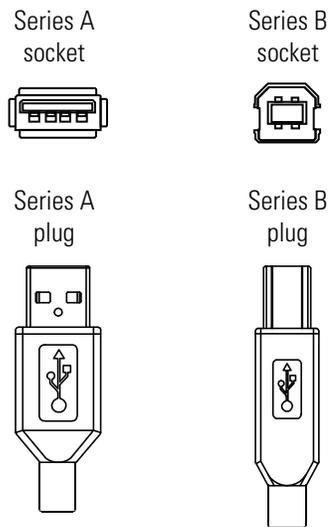
Connecting the FL Detector with a USB Cable

The Surveyor FL Detector communicates with the ChromQuest data system through a USB cable.

❖ To connect the USB cable

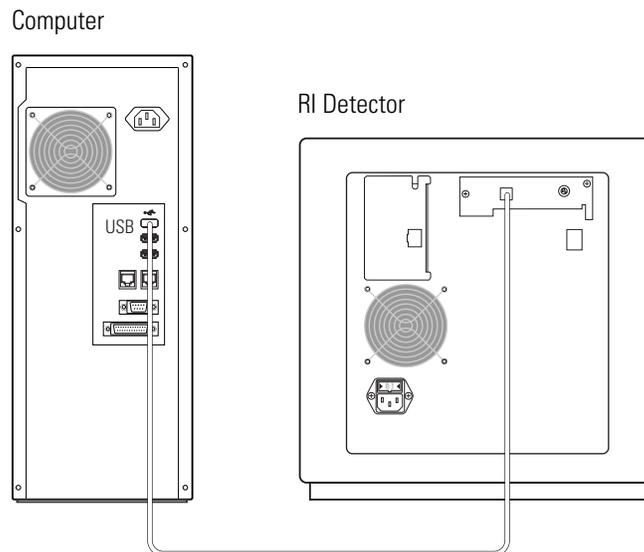
1. Locate the USB cable, consisting of series A plug linked to a series B plug. See [Figure 9](#).

Figure 9. USB cable connection plugs



2. Connect the series B plug to the port marked **USB** on the back of the Surveyor FL Plus Detector.
3. Connect the series A plug to a USB slot on the computer. See [Figure 10](#).

Figure 10. USB communication link between the computer and the Surveyor FL Plus Detector



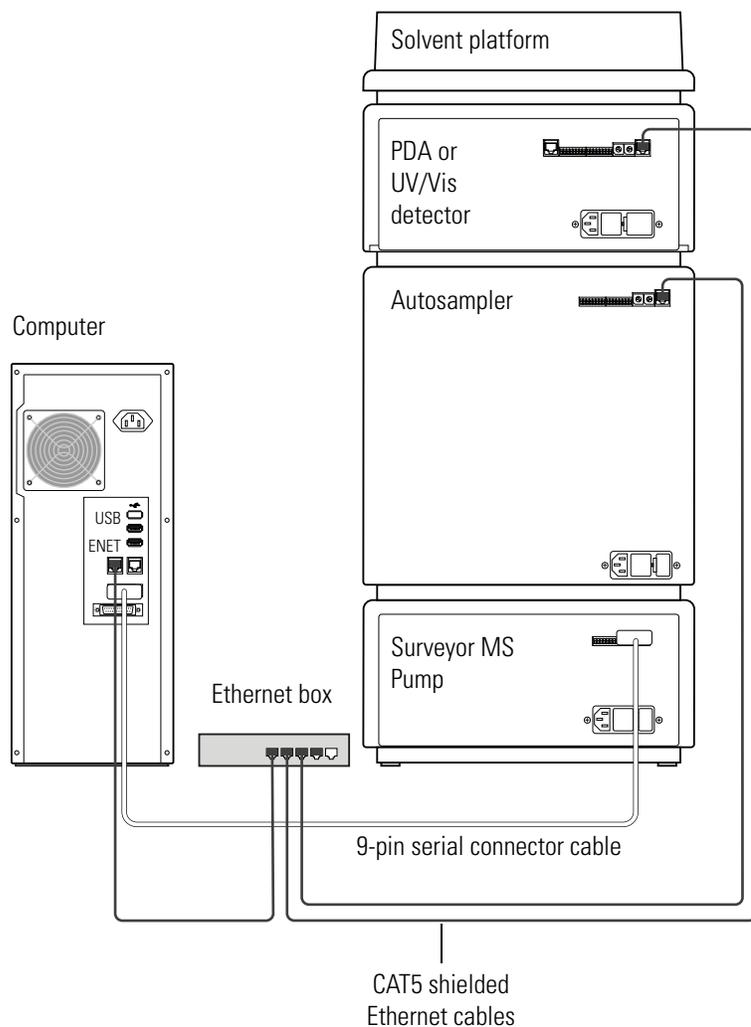
Connecting the Surveyor MS Pump with an RS232 Cable

The Surveyor MS Pump Plus communicates with the Xcalibur data system by way of an RS232 serial connection. A serial communication cable (P/N 72011-63008) that has two female connectors is included in the accessory kit for the MS pump.

❖ **To connect the Surveyor MS Pump Plus to the data system computer**

1. Connect one end of the serial communication cable to an available serial port (typically COM1) on the host computer.
2. Connect the other end of the cable to the RS232 I/O port found on the back panel of the Surveyor MS Pump Plus.

Figure 11. Connecting the Surveyor MS Pump to the data system



Configuring the Serial COM Port for the Surveyor MS Pump

❖ To configure the serial COM port from the Windows XP operating system

1. From the Windows XP taskbar, choose **Start > Control Panel**.
2. Open the Device Manager:
 - a. From the Control panel, double-click the System icon to open the System Properties dialog box.
 - b. Click the **Hardware** tab.
 - c. Click the **Device Manager** button.
3. In the Device Manager window, double-click **Ports (COM & LPT)**.

The available ports are displayed below Ports (COM & LPT) in the Device Manager list.
4. Double-click **Communication Port (COM1)** to display the Communication Port (COM1) Properties dialog box.
5. Click the **Port Setting** tab.
6. Set the configuration parameters as specified in [Table 4](#):

Table 4. Port settings

Parameter	Setting
Bits per Second	19200
Data Bits	8
Parity	none
Stop Bits	1
Flow Control	none

7. Click **OK** to save the changes and close the Communication Port (COM1) Properties dialog box.
8. Close the Device Manager window by clicking the Close button in the title bar.
9. Click **OK** to close the System Properties dialog box.
10. Restart the computer to enable the new settings.

Connecting the Interconnect Cable

The system interconnect cable synchronizes the timing of the modules during an injection sequence. If this cable is not connected properly, the status of an injection remains at *Waiting for Contact Closure*.

Thermo Fisher Scientific provides two versions of the interconnect cable, described in the following sections.

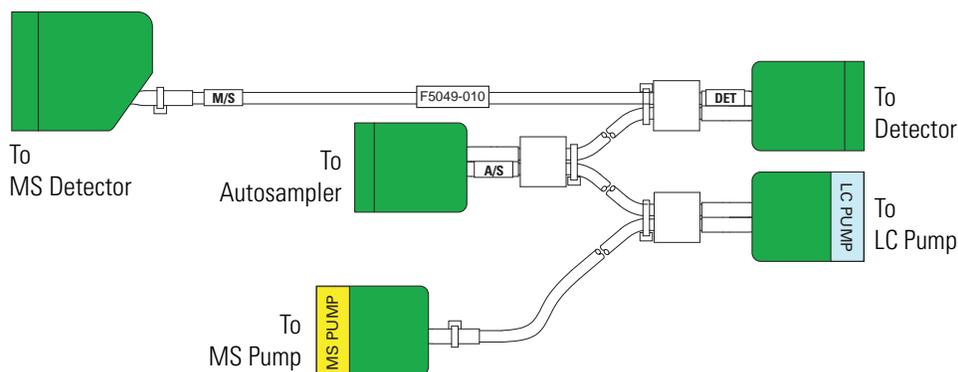
Contents

- [The 5-Connector Interconnect Cable](#)
- [The 7-Connector Interconnect Cable](#)

The 5-Connector Interconnect Cable

As [Figure 12](#) shows, the 5-combicon connectors of the system interconnect cable (P/N F5049-010) are labeled LC PUMP, MS PUMP, A/S, DET, and M/S.

Figure 12. 5-connector interconnect cable, P/N F5049-010



[Table 5](#) lists the part number of the 5-connector version of the system interconnect cable and the part numbers of the adapter cables that you might need to connect a Thermo Fisher Scientific mass spectrometer.

Table 5. 5-connector cable and adapter cable part numbers

Description	Part Number
System interconnect cable	F5049-010
FL detector adapter cable	60153-63002
Adapter interconnect cable for the TSQ Quantum Series MS detector	70111-63136
Adapter interconnect cable for an LTQ Series MS detector (LCQ Fleet, LXQ, LTQ, or LTQ XL)	97055-63070

Attach these connectors to the modules of your LC or LC/MS system as described in the following topics provided in this section:

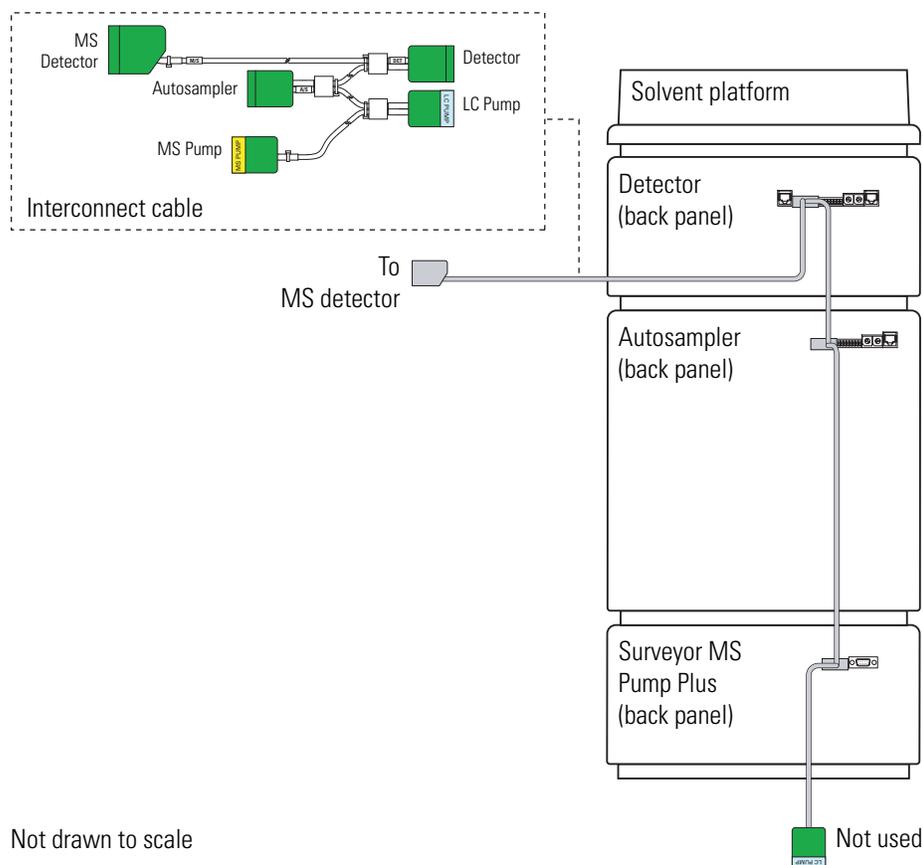
- [Connecting the LC Modules](#)
- [Connecting a Surveyor MSQ MS Detector](#)
- [Connecting an LCQ Series MS Detector](#)
- [Connecting an LTQ Series MS Detector](#)
- [Connecting a TSQ Quantum MS Detector](#)

Connecting the LC Modules

❖ **To connect the LC modules for contact closure with the 5-connector interconnect cable**

1. To connect the autosampler, plug the A/S connector into the left, 8-pin socket on the back panel of the autosampler. See [Figure 13](#).

Figure 13. Back panels of the Surveyor stack, showing the 5-connector interconnect cable



2. To connect the pump, do one of the following:
 - If you are using a Surveyor LC Pump Plus, plug the connector identified by the blue sticker with the text LC PUMP to the 8-pin receptacle on the back panel of the pump. There is a blue label with the text LC PUMP above the receptacle.
 - If you are using a Surveyor MS Pump Plus, plug the connector identified by the yellow sticker with the text MS PUMP to the 8-pin receptacle on the back panel of the pump. There is a yellow label with the text MS PUMP above the receptacle.
3. To connect a Surveyor UV/Vis Plus Detector, Surveyor PDA Plus Detector, or a Surveyor RI Plus Detector, plug the DET connector into the left, 8-pin socket on the back panel of the detector.

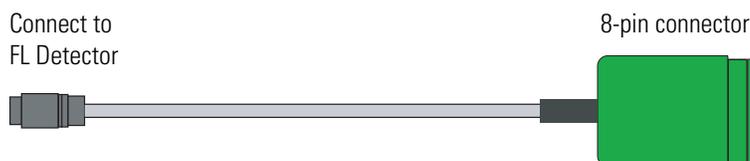
4 Connecting the Interconnect Cable

The 5-Connector Interconnect Cable

4. To connect a Surveyor FL Plus Detector, do the following:

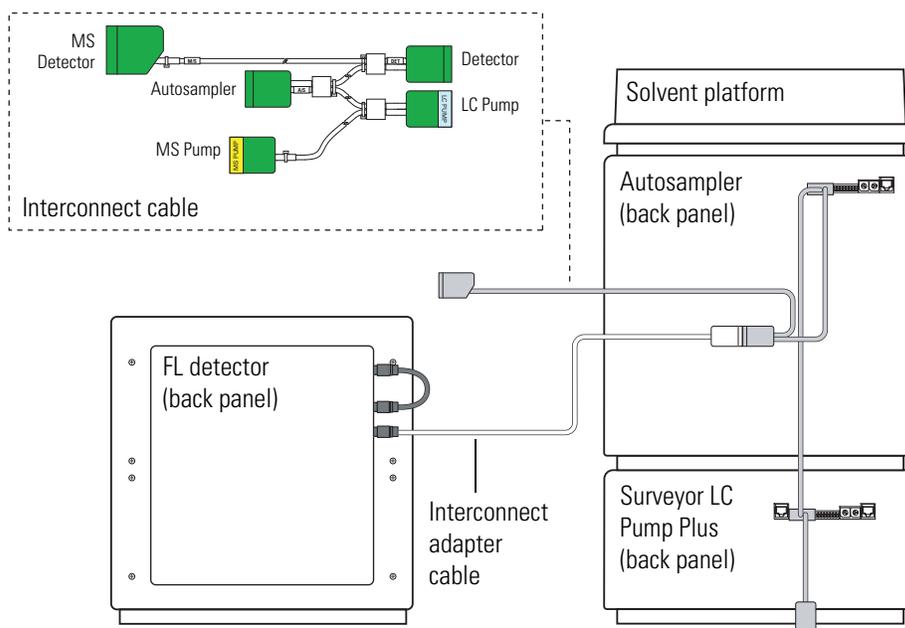
- a. Connect the 8-pin, connector of the adapter cable shown in [Figure 14](#) to the DET connector of the interconnect cable.

Figure 14. Adapter cable (P/N 60153-63002) for the Surveyor FL Plus Detector



- b. Plug the other end of the adapter cable to the port on the back-left side of the FL detector as shown in [Figure 15](#).

Figure 15. Back panels of the modules of a Surveyor Plus LC stack, showing the 5-connector system interconnect cable and the adapter cable for the FL detector



Not drawn to scale

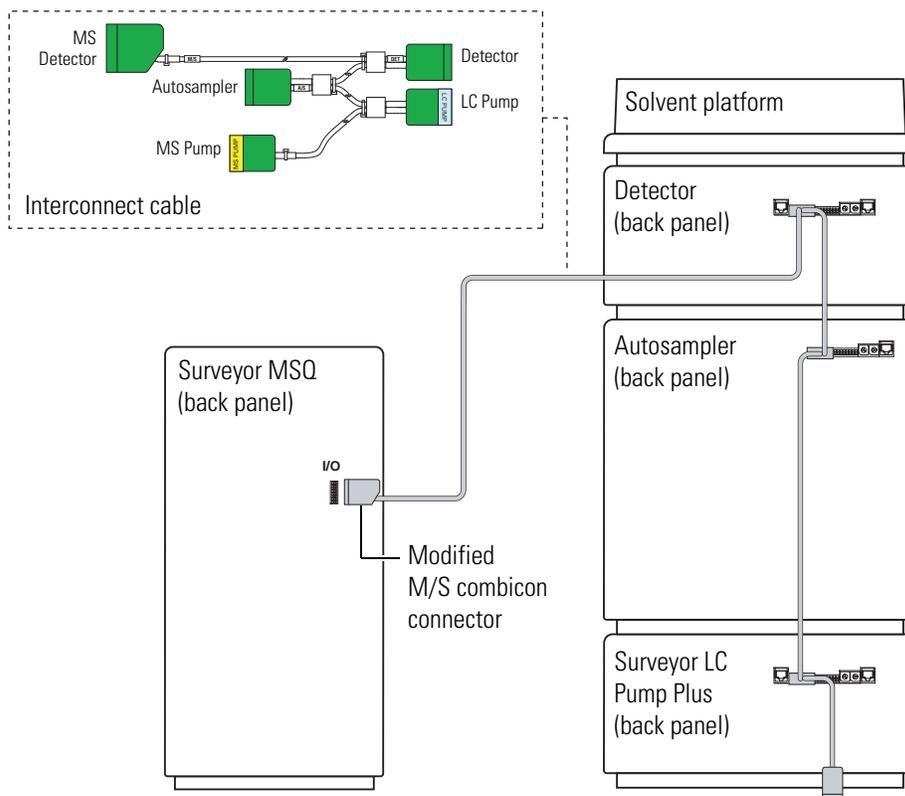
Connecting a Surveyor MSQ MS Detector

To connect a Surveyor MSQ MS detector with the 5-connector interconnect cable, you must modify the M/S combicon connector.

❖ **To connect the Surveyor MSQ MS detector with the 5-connector interconnect cable**

Connect the modified M/S combicon connector to the 8-pin, I/O receptacle on the back panel of the MS detector as shown in [Figure 16](#).

Figure 16. Back panels of the modules of the Surveyor Plus LC/MS system, showing the connections for the 5-connector interconnect cable



Not drawn to scale

4 Connecting the Interconnect Cable

The 5-Connector Interconnect Cable

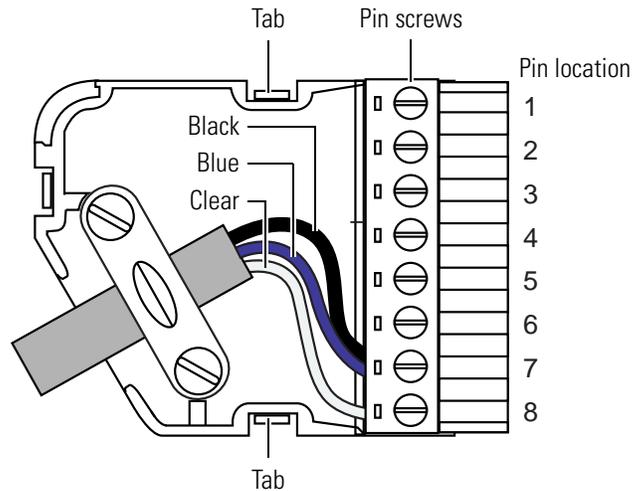
❖ To modify the M/S connector for the Surveyor MSQ Plus MS detector

1. Open the cable housing:
 - a. Place your fingernails under the tabs on either side of the housing.
 - b. Pull outward as you lift the cover of the housing off of its base.

Removing the housing cover exposes the 8-pin connector as shown in [Figure 17](#).

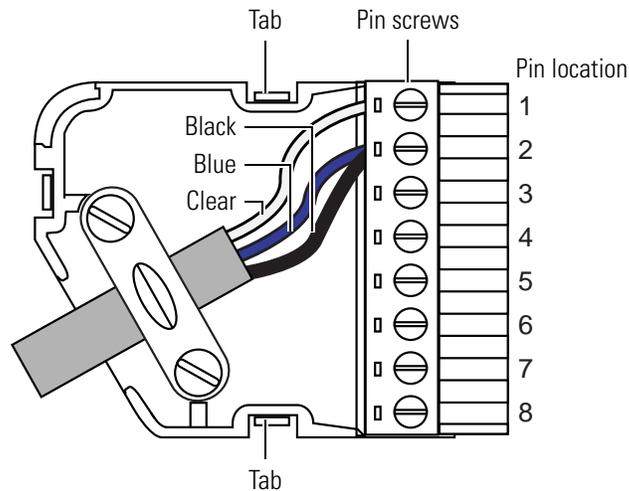
2. Loosen the screws for pins 7 and 8, and then pull the wires out of the pins.

Figure 17. M/S connector, showing the original wire connections



3. Insert the clear wire into pin 1, and then tighten the screw. See [Figure 18](#).

Figure 18. M/S connector, showing the modified wire connections



4. Insert the both the blue and black wires into pin 2, and then tighten the screw.
5. Snap the cover back onto the base of the housing.

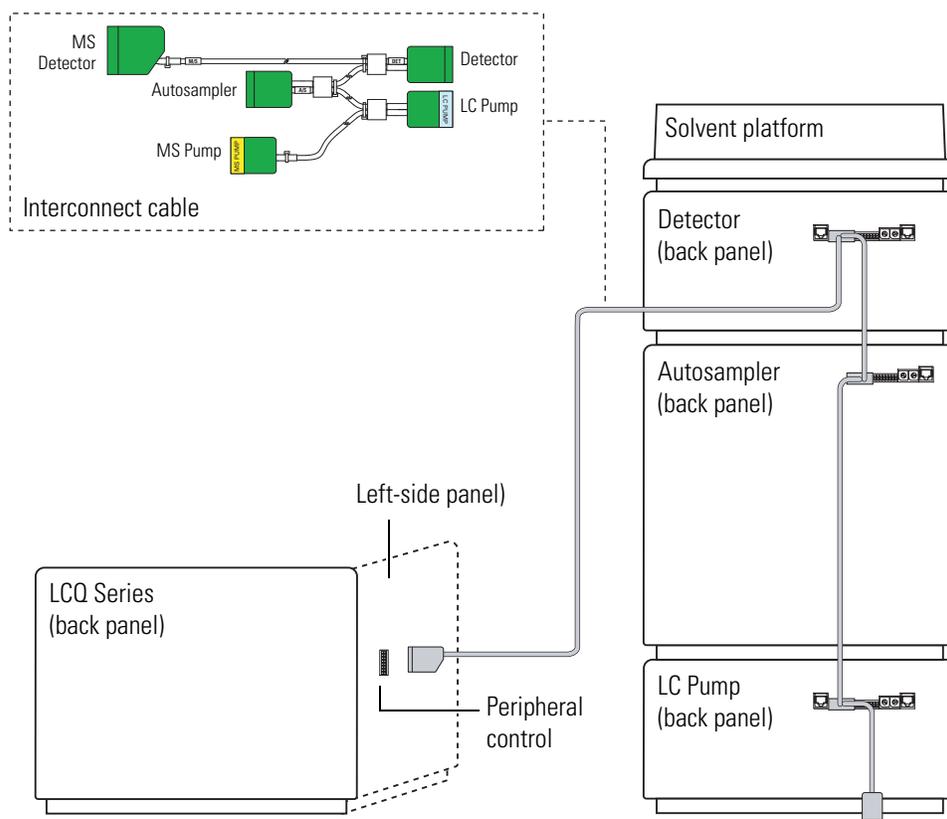
Connecting an LCQ Series MS Detector

The LCQ Series family of MS detectors includes the Advantage, Duo, and the Deca.

❖ To connect an LCQ Series MS Detector with the 5-connector interconnect cable

Plug the M/S combicon connector into the 8-pin, Peripheral Control socket on the left side of the LCQ Series MS detector as shown in [Figure 19](#).

Figure 19. Surveyor Plus LC/LCQ MS system, showing the connections for the 5-connector system interconnect cable



Not drawn to scale

Connecting an LTQ Series MS Detector

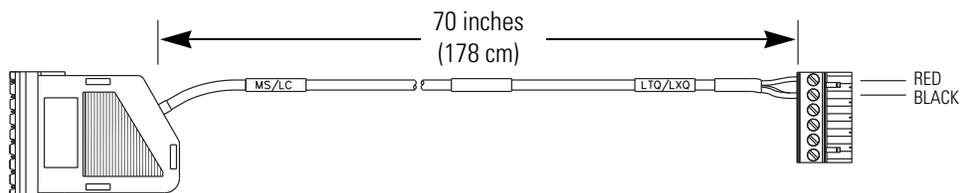
The LTQ Series family of Thermo Scientific MS detectors includes the LCQ Fleet, LXQ, LTQ, and LTQ XL.

To connect an LTQ Series MS detector, you must have the adapter cable (P/N 97055-63070) shown in [Figure 20](#), in addition to the 5-connector system interconnect cable.

4 Connecting the Interconnect Cable

The 5-Connector Interconnect Cable

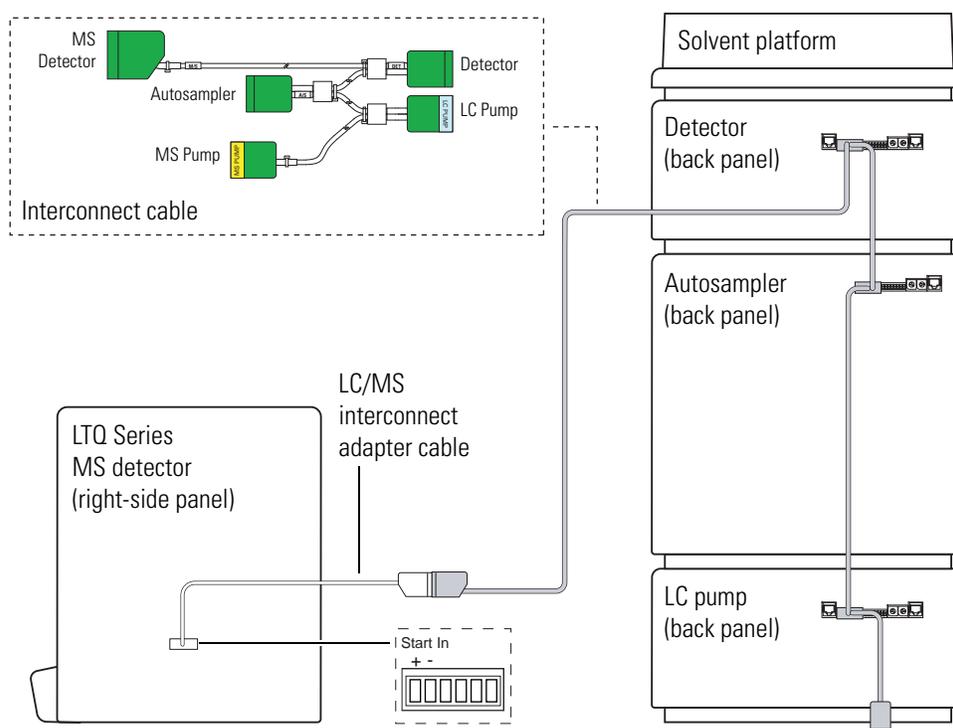
Figure 20. Adapter cable for an LXQ or LTQ MS detector (P/N 97055-63070)



❖ **To connect an LTQ Series MS detector to a Surveyor Plus LC system with the 5-connector system interconnect cable**

1. Connect the 8-pin connector (with hood and labeled MS/LC) end of the LXQ/LTQ interconnect adapter cable (P/N 97055-63070) to the M/S connector of the 5-connector system interconnect cable.
2. Plug the 6-pin end (labeled LTQ/TXQ) of the adapter cable into the START IN connection (green, 2-pin) on the lower-right side of the MS detector as shown in Figure 21.

Figure 21. Modules of a Surveyor Plus LC/LTQ Series MS system, showing the connections for the 5-connector system interconnect cable

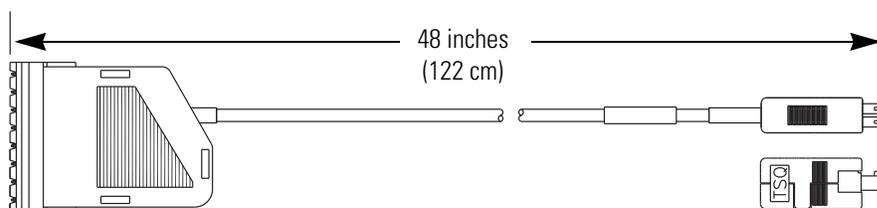


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Connecting a TSQ Quantum MS Detector

To connect a TSQ Quantum Series MS detector, you must have the adapter cable (P/N 70111-63136) shown in [Figure 22](#), in addition to the 5-connector system interconnect cable.

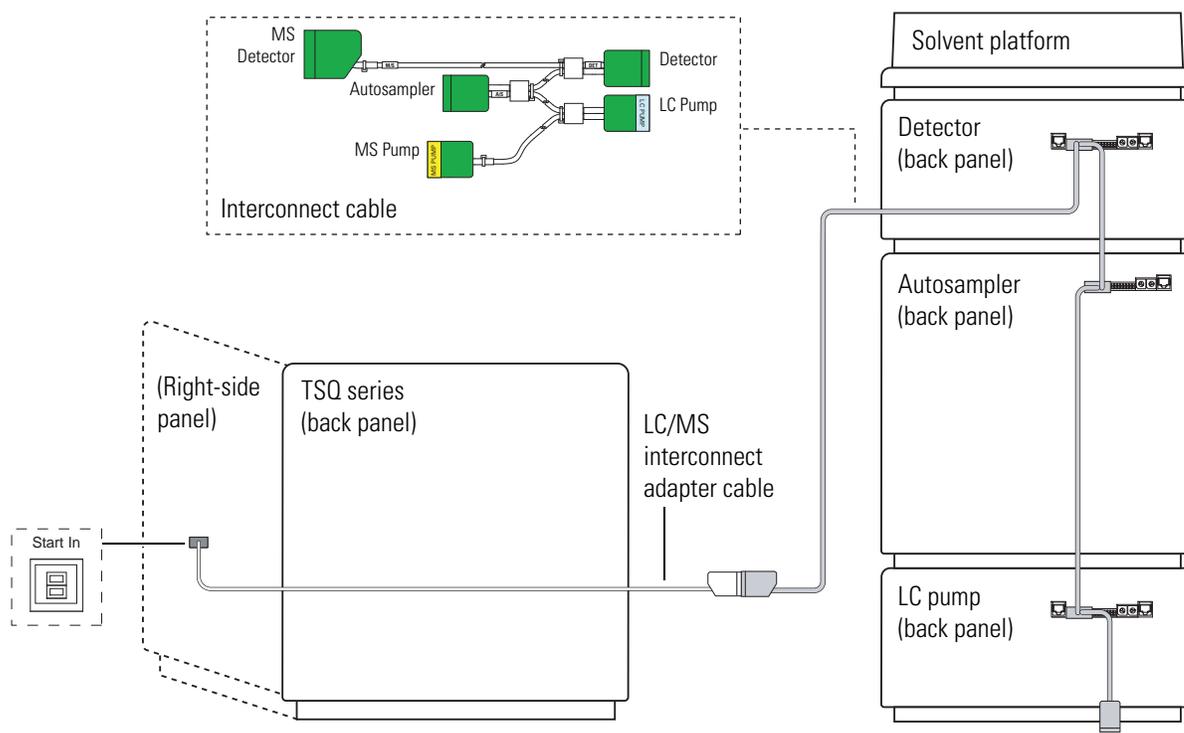
Figure 22. TSQ Quantum Series MS detector adapter cable (P/N 70111-63136) for the 5-connector system interconnect cable



❖ **To connect a TSQ Quantum Series MS detector to a Surveyor Plus LC system with the 5-connector system interconnect cable**

1. Connect the 8-pin connector (with hood) end of the TSQ adapter cable (P/N 70111-63136) to the M/S connector of the 5-connector system interconnect cable.
2. Plug the 2-pin end of the adapter cable into the START IN connection (green, 2-pin) on the lower-right side of the MS detector as shown in [Figure 23](#).

Figure 23. Modules of a Surveyor Plus LC/TSQ Quantum Series MS system, showing the connections for the 5-connector system interconnect cable



Not drawn to scale

The 7-Connector Interconnect Cable

Figure 24 shows the interconnect cable that has seven combicon connectors. The detector connectors have a blue, DETECTOR label. The pump connectors have a yellow, PUMP label. The autosampler connector has a small, A/S tag on its adjacent cable. The MS detector connector has a small, M/S tag on its adjacent cable.

Figure 24. System interconnect cable with 7-combicon connectors (P/N 60053-63034)

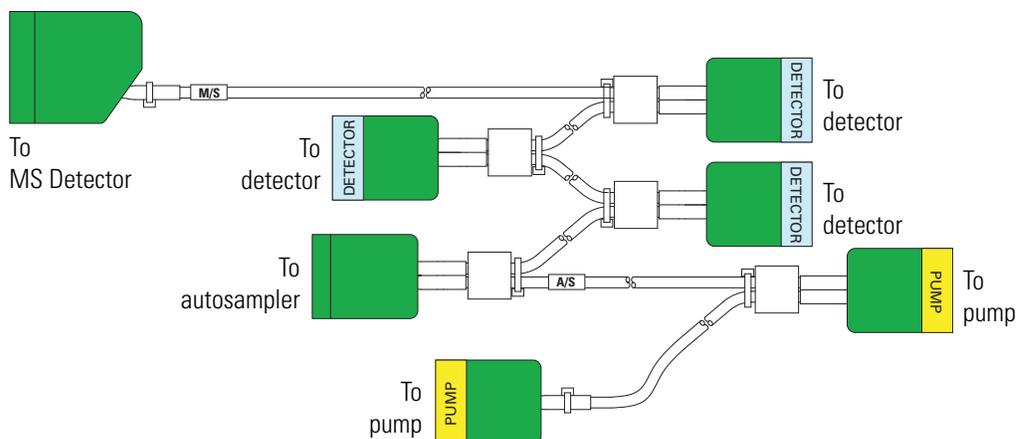


Table 6 lists the part number of the 7-connector version of the system interconnect cable and the adapter cables you might need to connect a Thermo Fisher Scientific mass spectrometer.

Table 6. 7-connector cable and adapter cable part numbers

Description	Part Number
System interconnect cable	60053-63034
Adapter cable for a TSQ Series MS detector	60053-63035
Adapter cable for an LCQ Series MS detector (Advantage, Duo, Deca)	60053-63036
Adapter cable for an LTQ Series MS detector	60053-63037
Adapter cable for a Surveyor MS Pump Plus	60053-63038
FL detector adapter cable	60153-63002

Attach these connectors to the modules of your LC or LC/MS system as described in the following topics provided in this section:

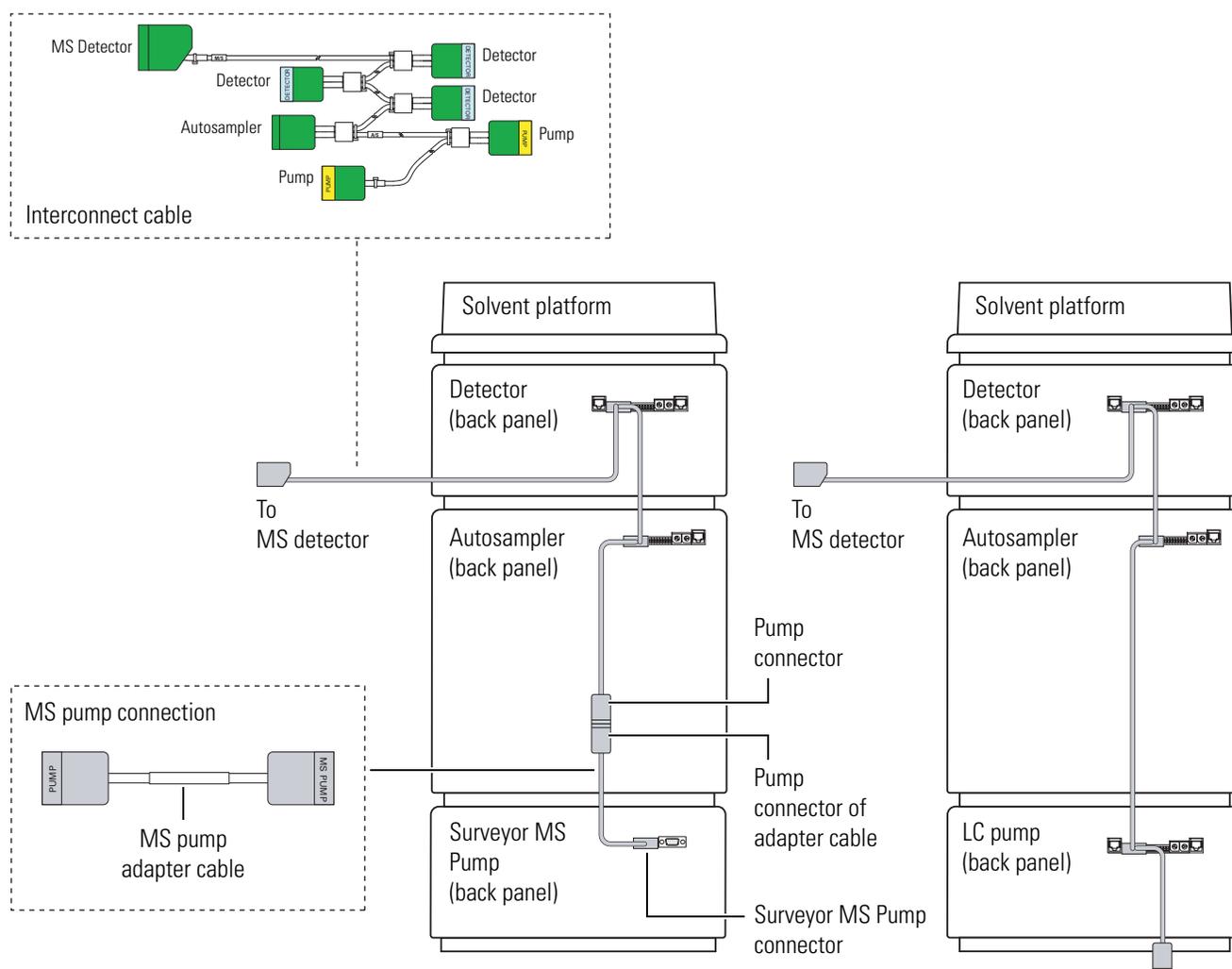
- [Connecting the LC Modules](#)
- [Connecting a Surveyor MSQ MS Detector](#)
- [Connecting an LCQ Series MS Detector](#)
- [Connecting an LTQ Series MS Detector](#)
- [Connecting a TSQ Quantum MS Detector](#)

Connecting the LC Modules

❖ To connect the 7-connector system interconnect cable to the LC modules

1. To connect the Surveyor Autosampler Plus, plug the A/S connector into the left, 8-pin socket on the back panel of the autosampler as shown in [Figure 25](#).
2. To connect a Surveyor LC Pump, plug a connector labeled PUMP into the 8-pin socket on the back panel of the pump.
3. To connect a Surveyor PDA Plus Detector, Surveyor UV/Vis Plus Detector, or a Surveyor RI Plus Detector, plug a detector connector into the left, 8-pin socket on the back panel of the detector.

Figure 25. Back panels of the modules of a Surveyor Plus LC system, showing the 7-connector system interconnect cable



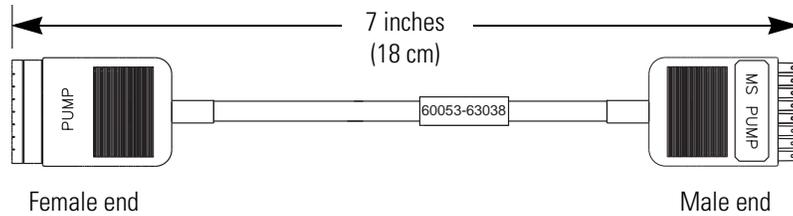
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4 Connecting the Interconnect Cable

The 7-Connector Interconnect Cable

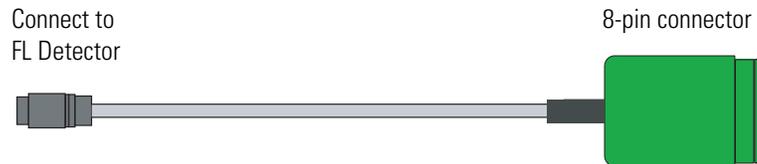
4. To connect a Surveyor MS Pump Plus, do the following:
 - a. Connect the end of the adapter cable labeled PUMP to one of the PUMP connectors of the 7-connector interconnect cable.
 - b. Plug the end of the adapter cable labeled MS PUMP into the 8-pin socket on the back panel of the MS pump. The adapter cable for the MS pump is shown in [Figure 26](#).

Figure 26. Adapter cable for the Surveyor MS Pump Plus



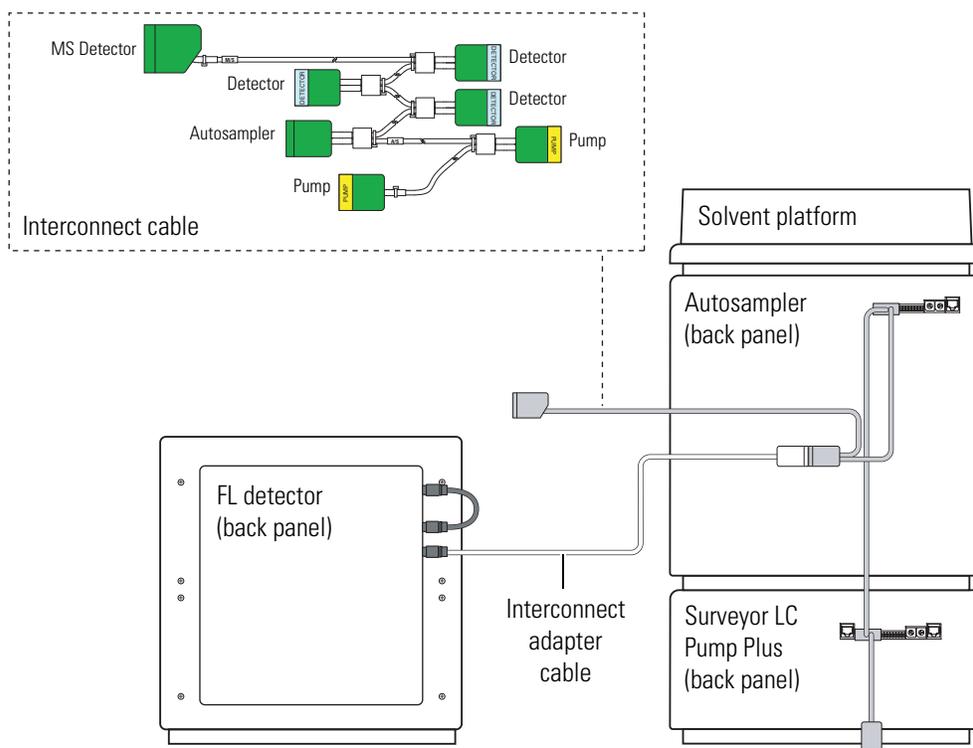
5. To connect a Surveyor FL Plus Detector, do the following:
 - a. Connect one of the DETECTOR connectors of the 7-connector system interconnect cable to the 8-pin end of the adapter cable shown in [Figure 27](#) and provided in the accessory kit for the FL detector.

Figure 27. Surveyor FL Plus Detector adapter cable (P/N 60153-63002)



- b. Connect the other end of the adapter cable to the port on the left side of the FL detector as shown in [Figure 28](#).

Figure 28. Back panels of the modules of a Surveyor Plus LC stack, showing the 7-connector system interconnect cable and the adapter cable for the FL detector



Not drawn to scale

4 Connecting the Interconnect Cable

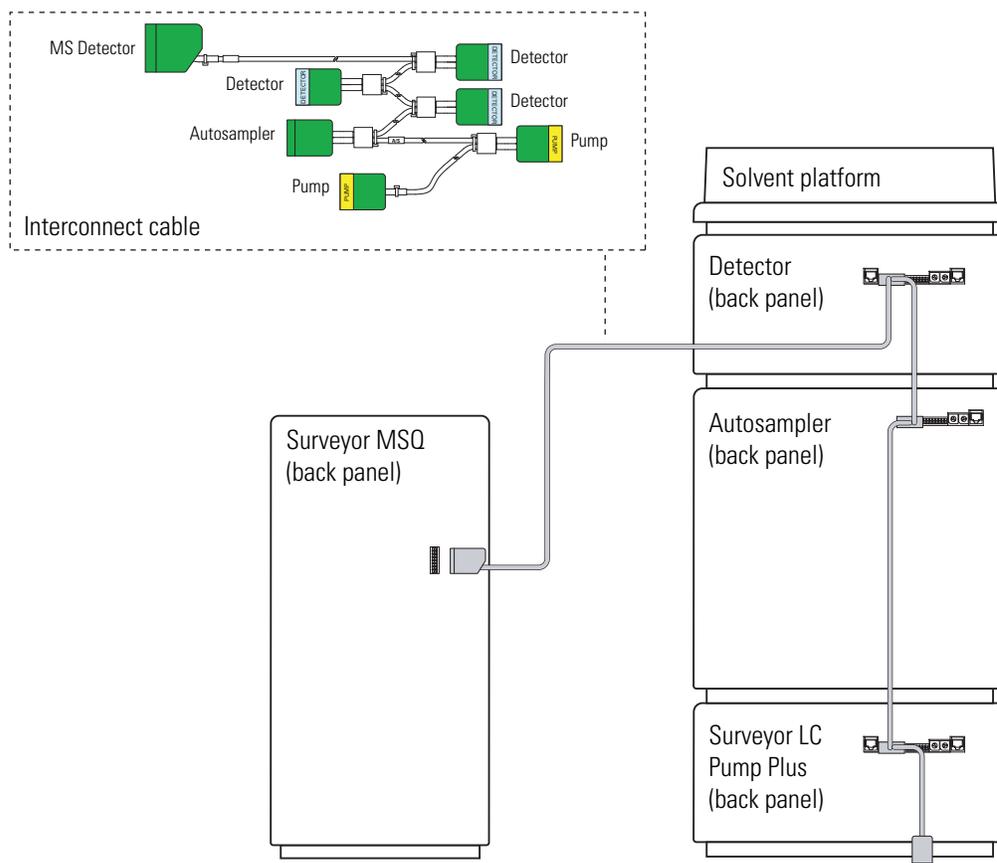
The 7-Connector Interconnect Cable

Connecting a Surveyor MSQ MS Detector

- ❖ To connect a Surveyor MSQ MS detector to a Surveyor LC system with the 7-connector system interconnect cable

As Figure 29 shows, plug the M/S combicon connector of the 7-connector system interconnect cable into the User I/O 8-pin socket on the back panel of the Surveyor Plus MSQ MS detector.

Figure 29. Back panels of the modules of the Surveyor Plus LC/MS system, showing the connections for the 7-connector interconnect cable



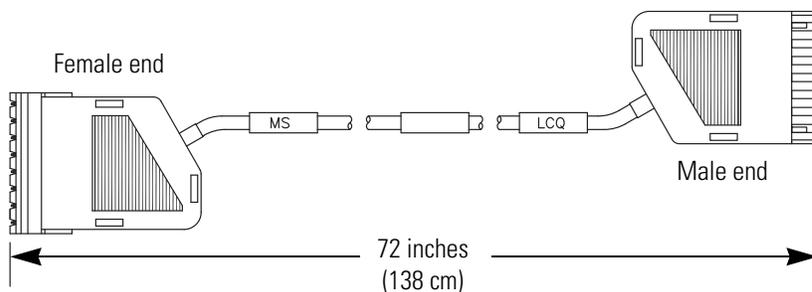
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Connecting an LCQ Series MS Detector

The LCQ Series family of Thermo Scientific MS detectors includes the Advantage, Duo, and Deca.

To connect an LCQ Series MS Detector with the 7-connector interconnect cable, you must have the additional adapter cable (P/N 60053-63036) shown in [Figure 30](#).

Figure 30. LCQ adapter cable (P/N 60053-63036)



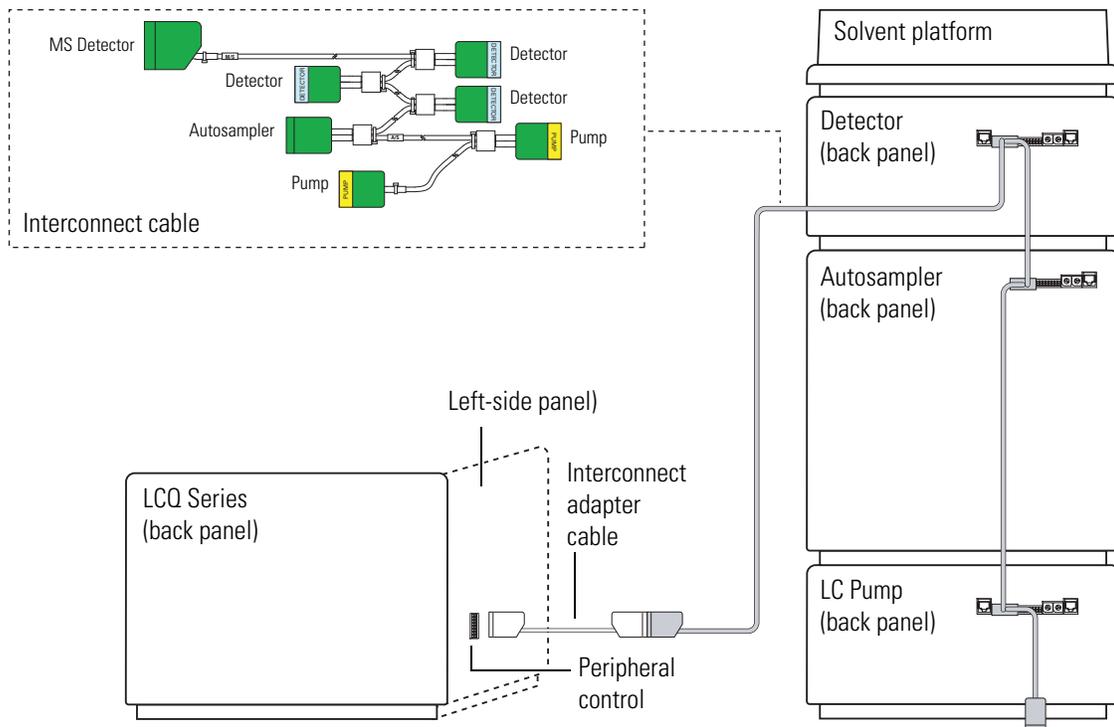
❖ **To connect an LCQ Series MS detector to a Surveyor LC system with the 7-connector interconnect cable**

1. Connect the female end of the adapter cable to the M/S combicon connector of the 7-connector system interconnect cable.
2. Plug the male end of the adapter cable into the 8-pin, Peripheral Control socket on the left side of the LCQ Series MS detector as shown in [Figure 31](#).

4 Connecting the Interconnect Cable

The 7-Connector Interconnect Cable

Figure 31. Modules of a Surveyor Plus LC/LCQ MS system, showing the connections for the 7-connector system interconnect cable



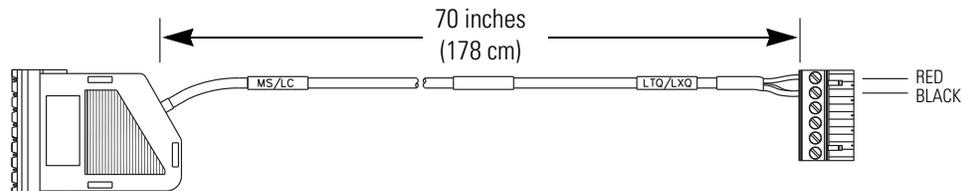
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Connecting an LTQ Series MS Detector

The LTQ Series family of Thermo Scientific MS detectors includes the LCQ Fleet, LXQ, LTQ, and LTQ XL.

To connect an LXQ or LTQ MS detector, you must have the adapter cable (P/N 60053-63037) shown in Figure 32, in addition to the 5-connector system interconnect cable.

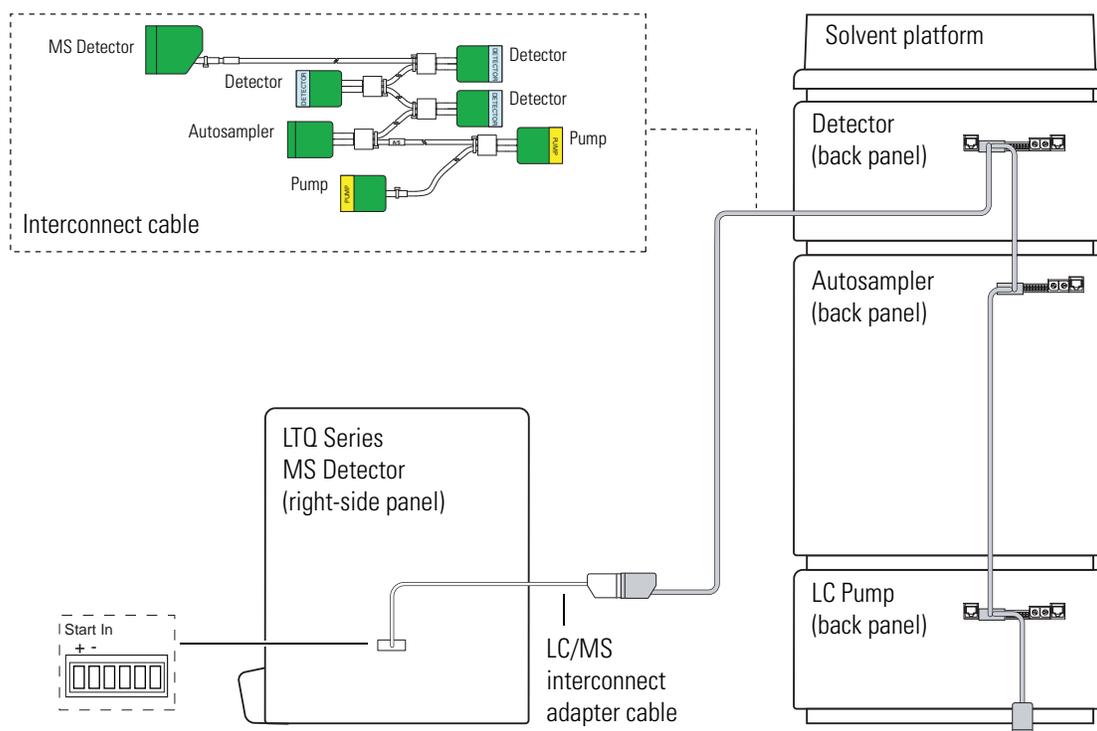
Figure 32. Adapter cable for an LTQ Series MS detector (P/N 60053-63037)



❖ **To connect an LTQ Series MS detector to a Surveyor Plus LC system with the 7-connector system interconnect cable**

1. Connect the 8-pin connector (with hood and labeled MS/LC) end of the LXQ/LTQ interconnect adapter cable (P/N 60053-63037) to the M/S connector of the 7-connector system interconnect cable.
2. Plug the 6-pin end (labeled LTQ/TXQ) of the adapter cable into the START IN connection (green, 2-pin) on the lower-right side of the MS detector as shown in [Figure 33](#).

Figure 33. Modules of a Surveyor Plus LC/LTQ Series MS system, showing the connections for the 7-connector system interconnect cable



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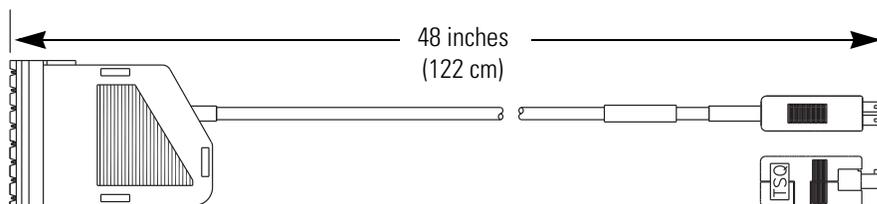
4 Connecting the Interconnect Cable

The 7-Connector Interconnect Cable

Connecting a TSQ Quantum MS Detector

To connect a TSQ Quantum Series MS detector, you must have the adapter cable (P/N 60053-63035) in addition to the 7-connector system interconnect cable. See [Figure 34](#).

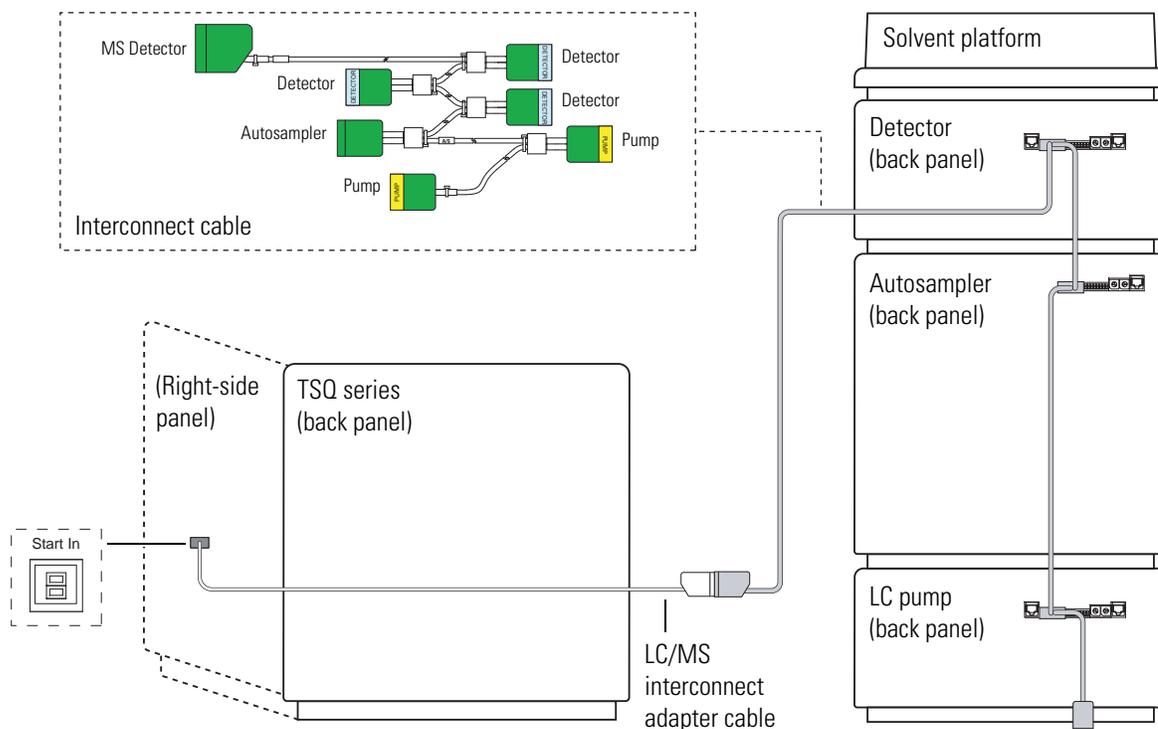
Figure 34. TSQ Quantum Series MS detector adapter cable (P/N 60053-63035) for the 7-connector system interconnect cable



❖ **To connect a TSQ Quantum Series MS detector to a Surveyor Plus LC system with the 7-connector system interconnect cable**

1. Connect the 8-pin connector (with hood) end of the TSQ adapter cable (P/N 60053-63035) to the M/S connector of the 7-connector system interconnect cable.
2. Plug the 2-pin end of the adapter cable into the START IN connection (green, 2-pin) on the lower-right side of the MS detector as shown in [Figure 35](#).

Figure 35. Modules of a Surveyor Plus LC/TSQ Series MS system, showing the connections for the 7-connector system interconnect cable



Not drawn to scale

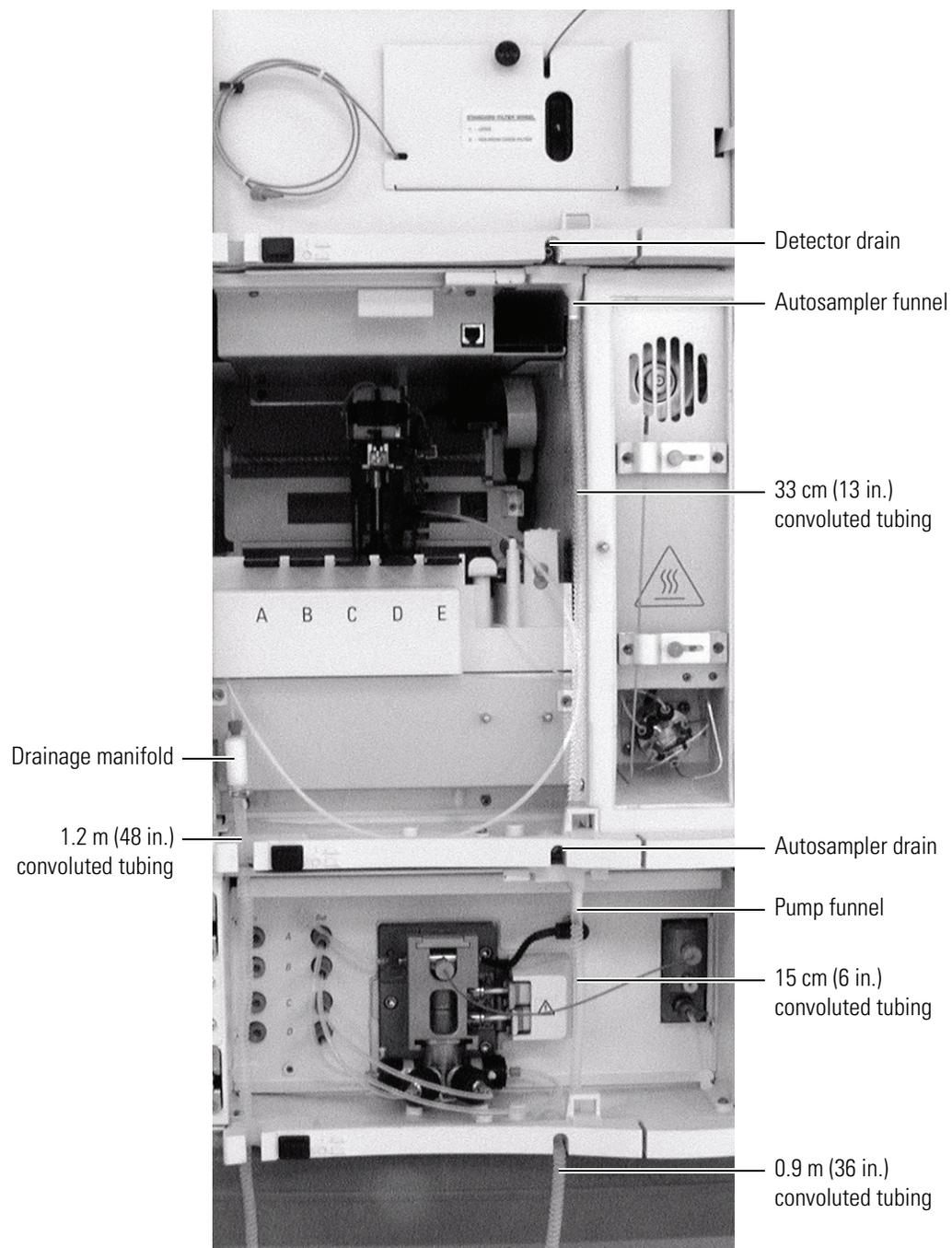
Connecting the Drainage Tubing

To provide drainage and prevent solvent from leaking into the Surveyor Plus system modules, the accessory kits for the autosampler and the pump contain sections of convoluted waste tubing that you use to connect the drainage ports on the front of the Surveyor Plus system modules. See [Table 7](#) for the part numbers and application of the various sections of drainage tubing. A Surveyor Plus system with the drainage tubing connected is shown in [Figure 36](#).

Table 7. Convoluted drain tubing for drainage

Length	Application	Part Number
15 cm (6 in.)	Drains fluid from top to bottom of the pump	F5034-010
33 cm (13 in.)	Drains fluid from top bottom of the autosampler	F5034-020
0.9 m (36 in.)	Drains fluid from the bottom of the pump to the waste bottle (cuff 1 end)	F5034-040
	Drains fluid from the drainage port of the FL detector or an RI detector used in tandem with another detector to waste	
1.2 m (48 in.)	Drains fluid from the drainage manifold of the autosampler to waste bottle (cuff 1 end)	F5034-050

Figure 36. Surveyor Plus Integrated LC/MS system with drainage tubing



❖ **To attach the four pre-cut pieces of drainage tubing**

1. Ensure that the drainage port on the bottom of the detector (PDA or UV/Vis) is aligned directly over the drainage funnel on the top of the autosampler.
2. For the RI detector, do one of the following:
 - If the RI detector is the only detector in the stack, ensure that the drainage port on the bottom of the detector is aligned directly over the drainage funnel on the top of the autosampler.
 - If the RI detector is connected in tandem with another detector, connect drainage tubing to the drainage port on the bottom of the RI detector, insert the outlet port tubing into the drainage tubing, and connect the drainage tubing to a waste container.

Five feet of Teflon®, 0.060 in. ID × 1/16 in. OD tubing with an attached fitting is supplied in the accessory kit that comes with the Surveyor RI Plus Detector.



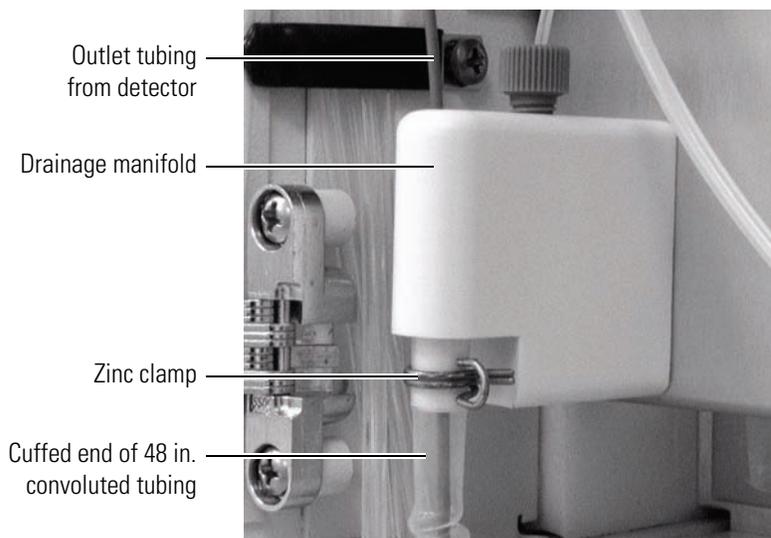
CAUTION The flow cell of the RI detector cannot withstand a backpressure higher than 540 kPa (75 psi). Do not connect a detector or tubing with an inner diameter of less than 0.060 in. to the outlet port of the RI detector. Doing so can damage the flow cell.

3. For the FL detector, do the following:
 - a. Attach one end of a length of convoluted drainage tubing to the drainage port on the bottom of the FL detector.
 - b. Connect the other end of the drainage tubing to a waste container.
 - c. Insert the outlet tubing of the FL detector into the drainage tubing.
4. Connect drainage tubing between the top and bottom of the autosampler:
 - a. Attach one end of the 33 cm (13 in.) piece of convoluted tubing to the drainage funnel on the top of the autosampler.
 - b. Attach the other end to the drainage port on the bottom of the autosampler.
5. Connect drainage tubing between the top and bottom of the pump:
 - a. Attach one end of the 15 cm (6 in.) piece of convoluted tubing to the drainage funnel on the top of the pump.
 - b. Attach the other end to the drainage port on the bottom of the pump.
6. Connect the drain manifold located on the left interior side of the autosampler to a waste container:
 - a. Use pliers to open the zinc spring clamp that is attached to the cuffed end of the 1.2 m (48 in.) length of convoluted tubing.

5 Connecting the Drainage Tubing

- b. Slip the cuffed end of the tubing onto the drain manifold. To secure the tubing to the drain manifold, adjust the clamp over the cuff, ensuring that the straight ends of the clamp face inwards toward the tray compartment. See [Figure 37](#).
 - c. Place the uncuffed end of the tubing into an appropriate waste container.
 7. Connect the pump to a waste container:
 - a. Attach the cuffed end of a 0.9 m (36 in.) length of convoluted tubing to the drain port on the bottom of the pump.
 - b. Place the other end of the tubing into an appropriate waste container.
 8. If the detector is not connected to an MS detector, route the end of the blue, outlet tubing through the drain manifold of the autosampler into the 1.2 m (48 in.) length of convoluted tubing that drains to the waste bottle.

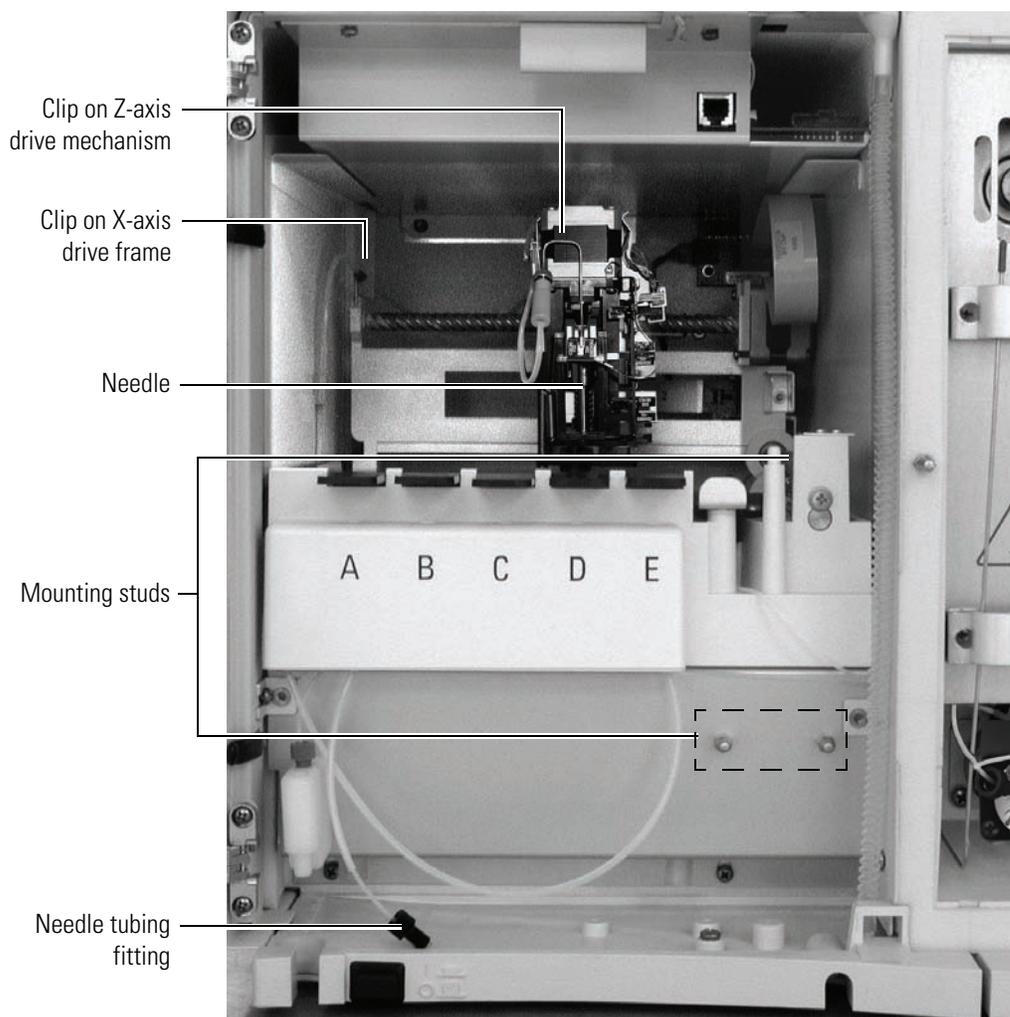
Figure 37. Convoluted tubing with clamp, attached to drain manifold



Mounting the Syringe Drive Assembly

The syringe drive assembly arrives packed in foam inside the tray compartment of the Surveyor Autosampler Plus. The needle tubing assembly and needle assembly arrive with the needle attached to the Z-axis drive mechanism and the tubing routed through clips on the Z-axis drive mechanism and the X-axis drive frame. Before you can operate the autosampler, you must attach the needle tubing to the syringe valve and mount the syringe drive assembly onto the three mounting studs on the front of the autosampler. See [Figure 38](#).

Figure 38. Interior of Surveyor Autosampler Plus



❖ To mount the syringe drive assembly

1. Attach the cable extending from the back of the syringe drive assembly (see [Figure 39](#)) to the 10-pin connection plug of the autosampler (see [Figure 40](#)).

Note The grommets in the mating holes of the syringe drive assembly minimize the effects of vibration. When properly installed, the syringe drive assembly feels loosely attached to the body of the autosampler.

Figure 39. Back of syringe drive assembly

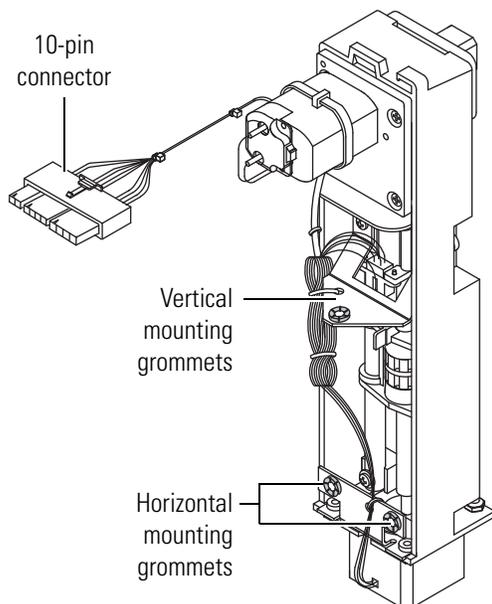
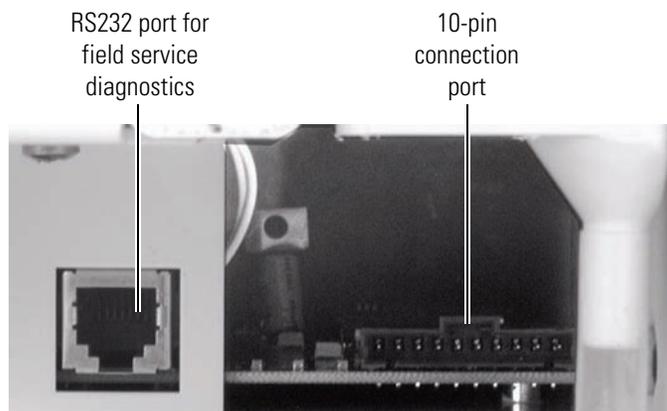


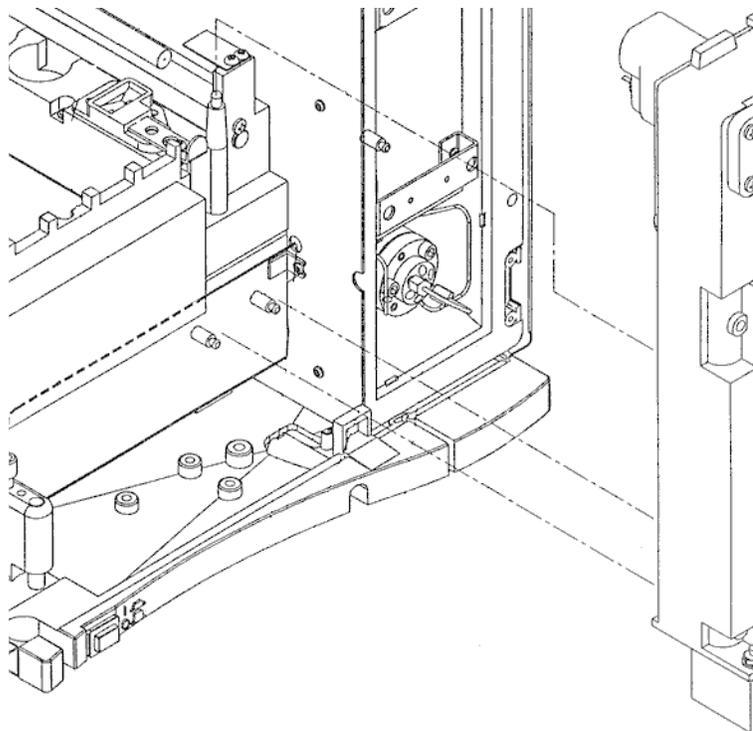
Figure 40. 10-pin connection plug



2. Mount the syringe drive assembly (see [Figure 41](#)) onto the mounting studs of the autosampler:
 - a. Lower the mating hole on the upper part of the assembly onto the top, vertical mounting stud.

- b. Push the two mating holes on the lower part of the assembly onto the two bottom, horizontal mounting studs.

Figure 41. Mounting the syringe drive assembly



3. Connect the needle tubing to the right side of the syringe valve.

Note For more information on connecting the needle tubing, refer to the Surveyor Autosampler Plus Hardware Manual.

Connecting the Solvent Lines

This chapter contains the following sections, which describe how to connect the solvent lines for your LC system:

Contents

- [Tubing Connections Summary](#)
- [Connecting the Wash Bottle Tubing to the Syringe Valve](#)
- [Connecting the Solvent Bottles to the Pump](#)
- [Connecting the Pump to the Autosampler](#)
- [Connecting the LC Column to the Injection Valve](#)
- [Connecting the Outlet of the LC Column to the Detector](#)

Tubing Connections Summary

Before you can operate your Surveyor Plus LC system, you must install the low-pressure and high-pressure connections listed in [Table 8](#).

Table 8. Low pressure and high pressure tubing connections

Tubing

Low-pressure tubing

- Four, 5-ft. lengths of 1/8 in. OD, 1/16 in. ID, FEP tubing connect the solvent reservoir bottles to the inlet ports of the built-in vacuum degasser. The tubing is shipped in lengths of 6 m (20 ft).
- One 5-ft. length of 1/8 in. OD, 1/16 in. ID tubing connects the wash bottle to the left side of the syringe valve.

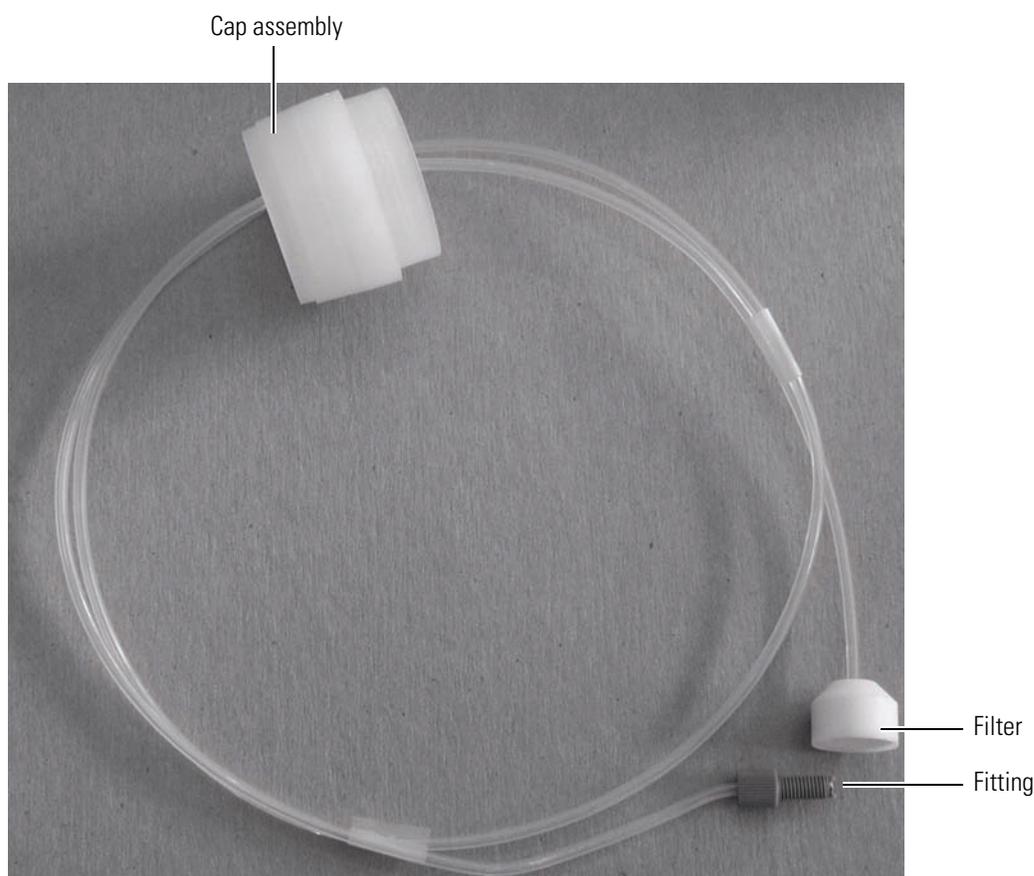
High-pressure tubing

- For the Surveyor Autosampler Plus, the high-pressure connection between the pump and the autosampler consists of a length of 0.020 in. ID stainless steel tubing that extends from the column oven of the autosampler.
 - High-pressure tubing connects port 6 of the injection valve to the inlet of the LC column.
 - Insulated, red, 0.005 in. ID, Teflon tubing connects the LC column outlet to the LightPipe flow cell inlet.
 - For an LC/MS system, red, 0.005 in. ID, Teflon tubing connects the outlet of the LightPipe flow cell or the outlet of the LC column to the MS detector.
-

Connecting the Wash Bottle Tubing to the Syringe Valve

The Wash Bottle kit (P/N 60053-62009) contains a 1-L bottle and the wash bottle tubing assembly (P/N 60053-60041). See [Figure 42](#). A Teflon solvent filter is attached to one end of the tubing and a nut and ferrule fitting is attached to the other end of the tubing.

Figure 42. Wash bottle tubing assembly



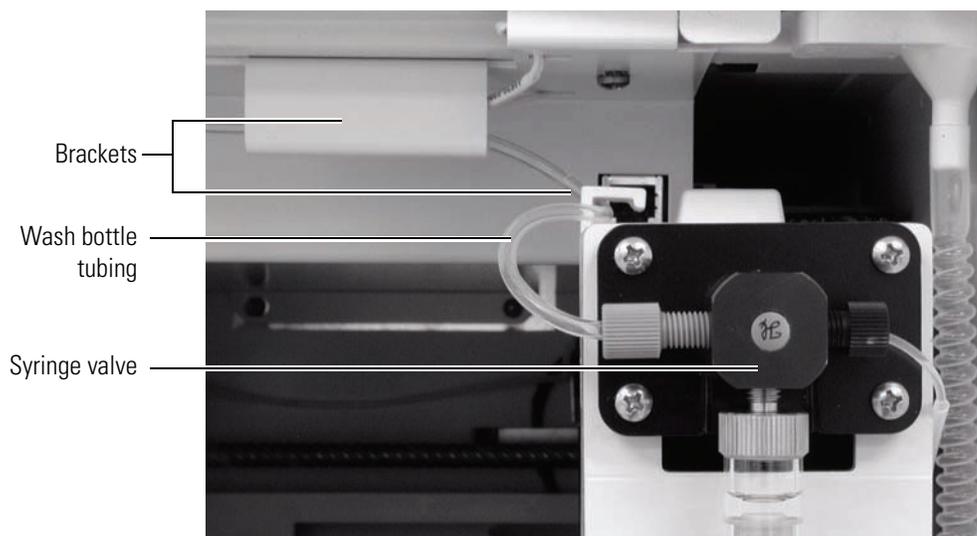
❖ To connect the tubing to the syringe valve

1. Fill the wash bottle with the appropriate solvent.

Note The solvent in the Wash bottle is used as the transfer solvent for injections. This solvent can also be used to flush the inside of the needle tubing assembly and wash the outside of the needle.

2. Place the end of the tubing with the Teflon solvent filter into the bottom of the bottle.
3. Snap the two cap sections together. Then screw the bottle cap onto the wash bottle.
4. Route the tubing through the bracket under the lid of the autosampler and the bracket on the top of the syringe drive assembly. See [Figure 43](#).
5. Screw the fitting into the left side of the syringe valve.

Figure 43. Wash bottle tubing connection to syringe valve, showing brackets



Connecting the Solvent Bottles to the Pump

The Surveyor System Accessory Kit (P/N SRVYR-SYSKT) includes four 1-L solvent bottles, four Teflon solvent filters, four cap adapters, and four solvent caps. This accessory kit also includes a 6 m (20 ft.) length of FEP tubing (1/8 in. OD, 1/16 in. ID), which must be cut into four pieces for use as the solvent lines. These lines are used to deliver the four solvents to the vacuum degassing assembly built into the Surveyor LC Pump. Super Flangeless™ fittings are used to connect the solvent lines to the inlet ports of the vacuum degassing assembly.

Assemble the solvent bottles, and then attach the solvent lines to the inlet ports of the built-in vacuum degasser of the pump as described in the following topics:

- [Assembling the Solvent Bottles](#)
- [Connecting the Solvent Lines to the Built-In Degasser](#)

Assembling the Solvent Bottles

The solvent bottles are used to hold the four solvents that can be used to create your mobile phase.

❖ To assemble the solvent bottles

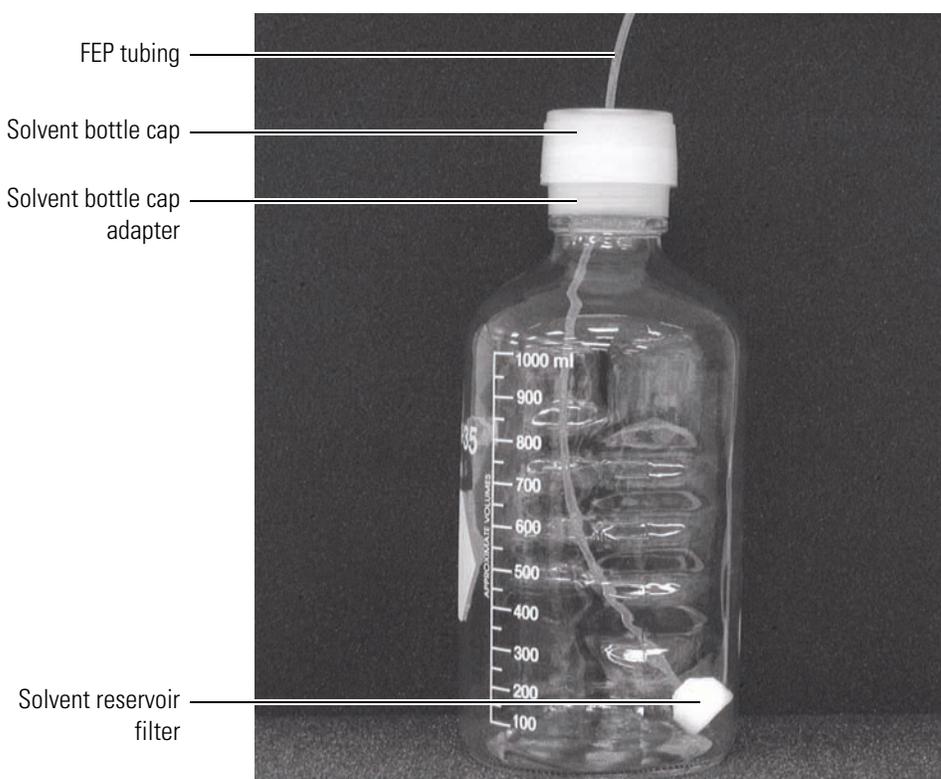
1. Place the stick-on label A on one of the solvent reservoir bottle caps. Thread the inlet line through one of the holes in the top of the reservoir bottle cap.
2. Screw one of the solvent reservoir filters included in the System Accessory Kit onto the end of the line. See [Figure 44](#).

3. Place the solvent reservoir filter and inlet line into one of the solvent reservoir bottles and screw the cap that you have identified with the stick-on label onto the solvent reservoir bottle until it is secure.

Note The cap is a two-piece assembly (Figure 44). The upper section snaps onto a threaded section. The threaded section can be screwed onto the bottle and the upper section snapped on after the tubing has been installed, or, if you are replacing existing tubing, the entire cap can be unscrewed from the bottle.

4. Position the bottle in the Surveyor Solvent Platform, allowing the solvent inlet line to hang down along the left side of the Surveyor system.

Figure 44. Solvent reservoir bottle with solvent line attached



Connecting the Solvent Lines to the Built-In Degasser

Super Flangeless fittings are used to connect the solvent lines to the inlet ports of the pump's built-in vacuum degasser. The Super Flangeless fittings consist of three components: a nut, a ferrule, and a stainless steel compression ring. See [Figure 45](#). The compression ring has two sides. See [Figure 46](#). When you place the three components of the fitting on the end of a solvent line, place the flattened side of the compression ring toward the nut and the narrow end of the ferrule toward the compression ring.

Figure 45. Super Flangeless fitting components

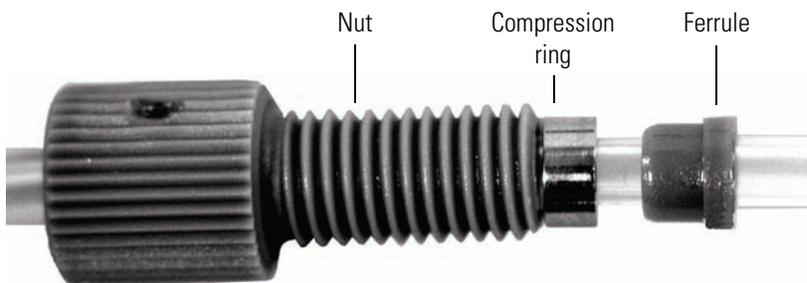
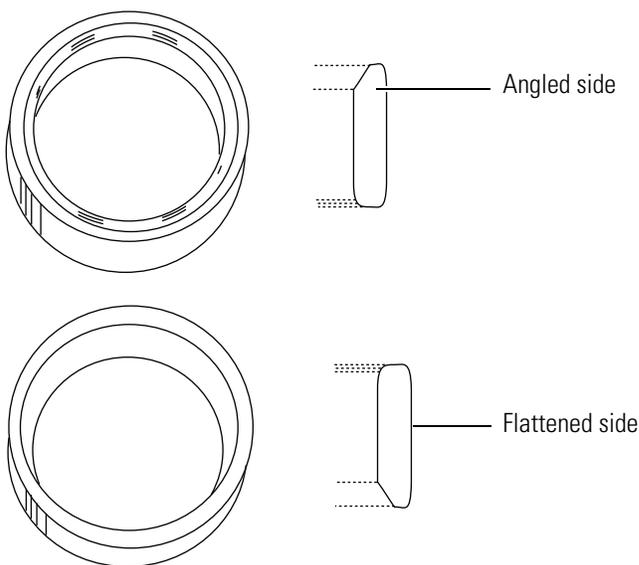


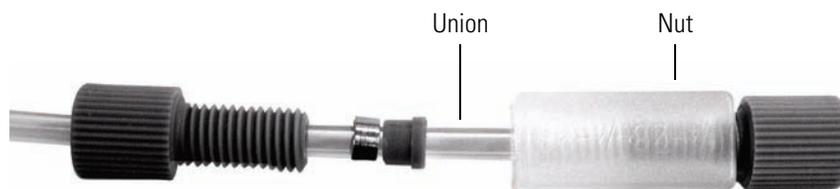
Figure 46. View of steel compression ring, showing the two sides



❖ **To connect the solvent lines to the pump**

1. Slide the three components of the Super Flangeless fitting onto the remaining end of the solvent line (Figure 45):
 - a. Slide the nut (P/N 00101-18225) onto the end of the tubing.
 - b. With its flattened side facing toward the nut, slide the compression ring onto the end of the tubing.
 - c. With its narrow end facing the compression ring, slide the ferrule onto the end of the tubing.
2. Swage the Super Flangeless fitting onto the tubing:
 - a. Create a compression tool by screwing a Super Flangeless nut into one end of a $1/4 \times 28$ thread internal union. See Figure 47.

Figure 47. Inserting Super Flangeless fitting into compression tool



- b. Insert the tubing with the fitting assembly into the other end of the union.
- c. Hold the tubing to the bottom of the tool while tightening the nut.
- d. Unscrew the swaged fitting from the compression tool and verify the following:
 - The end of the square-cut tubing is flush with the end of the ferrule as shown in Figure 48.
 - The steel compression ring is seated over the ferrule as shown in Figure 48.

Figure 48. View of fitting swaged onto tubing



3. Insert the tubing with the properly swaged fitting into inlet port A, and then tighten the nut finger-tight. Be careful not to cross-thread the fitting, which can cause solvent leakage.
4. Pass the solvent line through the openings along the left side of each Surveyor Plus module to complete the installation.

Repeat the above steps for the B, C, and D solvent inlet lines.

Connecting the Pump to the Autosampler

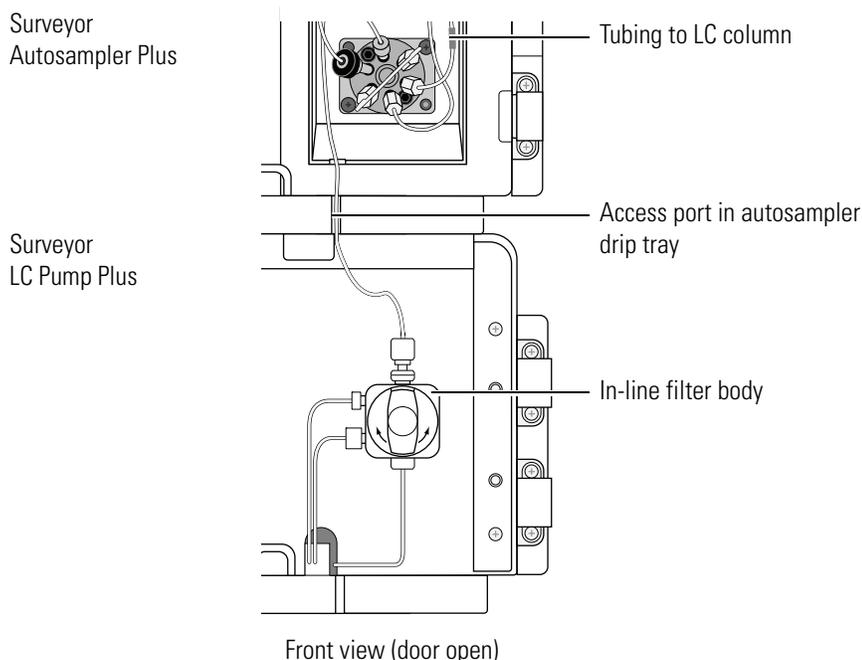
❖ To connect the autosampler to the pump

1. Depending on your autosampler model, do one of the following:
 - For the Surveyor Autosampler Lite, use the bushing (P/N 2522-0066) and the ferrule (P/N 00101-18122) that come in the Surveyor Autosampler Plus accessory kit to attach the 30 cm (12 in.) L, 0.010 in. ID, stainless steel tubing (P/N A0941-010) that also comes in the kit to port 5 of the injection valve.
 - For the Surveyor Autosampler, pull the stainless steel tubing that exits the column oven of the autosampler forward and then downward through the access port in the bottom of the autosampler as shown in [Figure 49](#).

Tip To decrease the gradient delay volume of your system, bypass the tubing behind the column oven. This tubing allows the mobile phase to equilibrate to the requested column oven temperature, but it also adds 250 μL of gradient delay volume to your system.

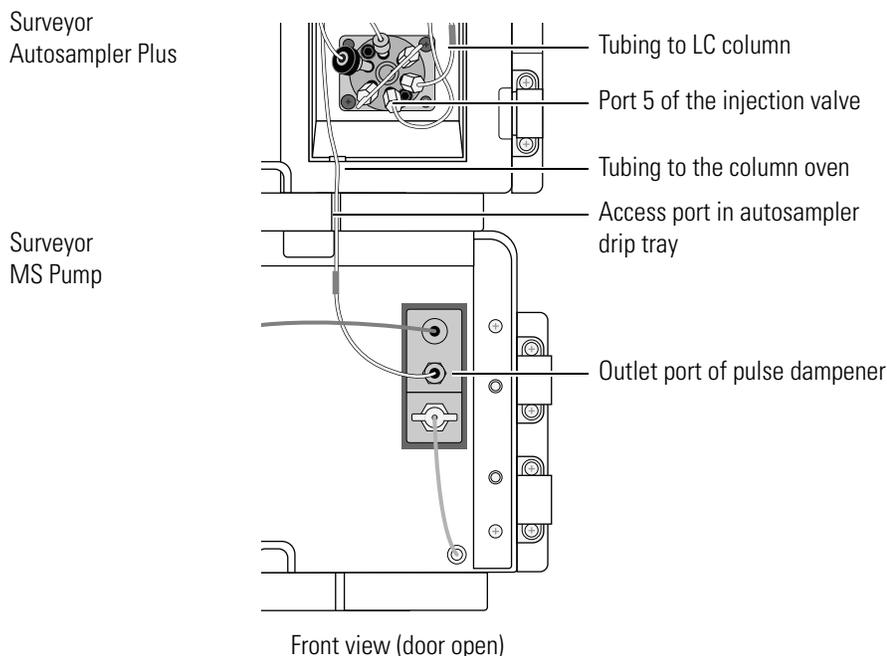
2. Place the fingertight nut and ferrule set (P/N 00101-18088) onto the free end of the stainless steel tubing, and then attach the tubing to the pump:
 - For the Surveyor LC Pump Plus, screw the fitting into the in-line filter body on the top of the purge manifold (see [Figure 49](#)). Do not overtighten the fingertight fitting.

Figure 49. Surveyor LC Pump Plus (original version) connection to autosampler



- For the Surveyor MS Pump Plus, screw the fitting into the outlet port of the pulse dampener (see [Figure 50](#)). Do not overtighten the fingertight fitting.

Figure 50. Surveyor MS Pump Plus connected to the autosampler



❖ **To bypass the tubing behind the column oven**

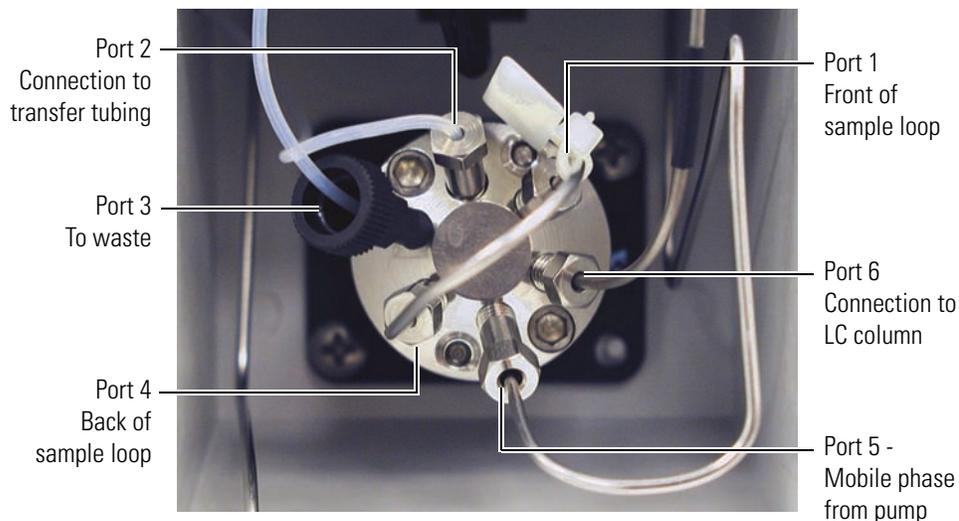
1. Disconnect the column oven return tubing from port 5 of the injection valve.
2. Do one of the following:
 - For the Surveyor LC Pump Plus, use the fingertight ferrule and nut set (P/N 00101-18088) to connect a 30-cm length of high-pressure tubing to the in-line filter body on the top of the purge manifold. Use high-pressure fittings to connect the other end of the tubing to port 5 of the injection valve.
 - For the Surveyor MS Pump, use the fingertight ferrule and nut set (P/N 00101-18088) to connect a 30-cm length of high-pressure tubing to the pulse dampener outlet. Use high-pressure fittings to connect the other end of the tubing to port 5 of the injection valve.

Connecting the LC Column to the Injection Valve

❖ To connect the inlet of the LC Column to the injection valve

1. Use a 1/16 in., 10-32, Valco fitting to connect one end of a length of 1/16 in. OD tubing to port 6 of the injection valve of the autosampler. See [Figure 51](#). Use a 1/16 in. fitting to connect the other end of the tubing to the inlet of the LC Column.
2. Connect the outlet of the LC column:
 - If your system includes an optional PDA detector, use a 1/16 in. fitting to connect the outlet of the LC column to the tubing (red, PEEK, insulated, 0.005 in. ID) that is attached to the inlet of the LightPipe flow cell. Use a 1/16 in. fitting and the tubing that is included in the MS accessory kit to connect the outlet of the LightPipe flow cell to the inlet port of the MS detector.
 - If you are connecting the LC column directly to an MS detector, use a 1/16 in. fitting and the tubing that is included in the MS accessory kit to connect the outlet of the column directly to the inlet port of the MS detector.

Figure 51. Six-Port Valco injection valve



Connecting the Outlet of the LC Column to the Detector

The connections for the Surveyor PDA Plus Detector and the Surveyor UV/Vis Plus Detector are described in [Chapter 8, “Installing the LightPipe Flow Cell into the PDA Detector,”](#) and [Chapter 9, “Installing the LightPipe Flow Cell into the UV/Vis Detector,”](#) respectively.

This section contains the following topics:

- [Connecting the Outlet of the LC Column to the RI Detector](#)
- [Connecting the Outlet of the LC Column to the FL Detector](#)

Connecting the Outlet of the LC Column to the RI Detector

❖ To connect the Surveyor RI Plus Detector

1. Do one of the following to connect the IN port of the RI detector to the solvent path:
 - If the RI detector is the only detector in the LC system, use the 1/16 in. OD stainless steel tubing with fittings (supplied in the RI detector accessory kit) to connect the outlet of the LC column to the In port of the RI detector as shown in [Figure 52](#).
 - If the system contains both a PDA detector or UV/Vis detector and an RI detector, use 0.005-in ID × 1/16 in. OD (red) or 0.010-in ID × 1/16 in. OD (blue) PEEK tubing and fittings to connect the outlet of the LightPipe flowcell to the In port of the RI detector as shown in [Figure 53](#).



CAUTION The flow cell of the RI detector can be easily damaged by reversing the solvent flow. Do not connect tubing with an inner diameter of less than 0.060 in. to the OUT port of the RI detector. Doing so can damage the flowcell.

2. Using the 0.060 in. ID × 1/16 in. OD Teflon® tubing supplied in the accessory kit, connect the OUT port of the RI detector to a waste receptacle. Route the tubing through the access slot of the drip tray. See [Figure 53](#).

7 Connecting the Solvent Lines

Connecting the Outlet of the LC Column to the Detector

Figure 52. Solvent connections for an LC system with an RI detector, shown without doors

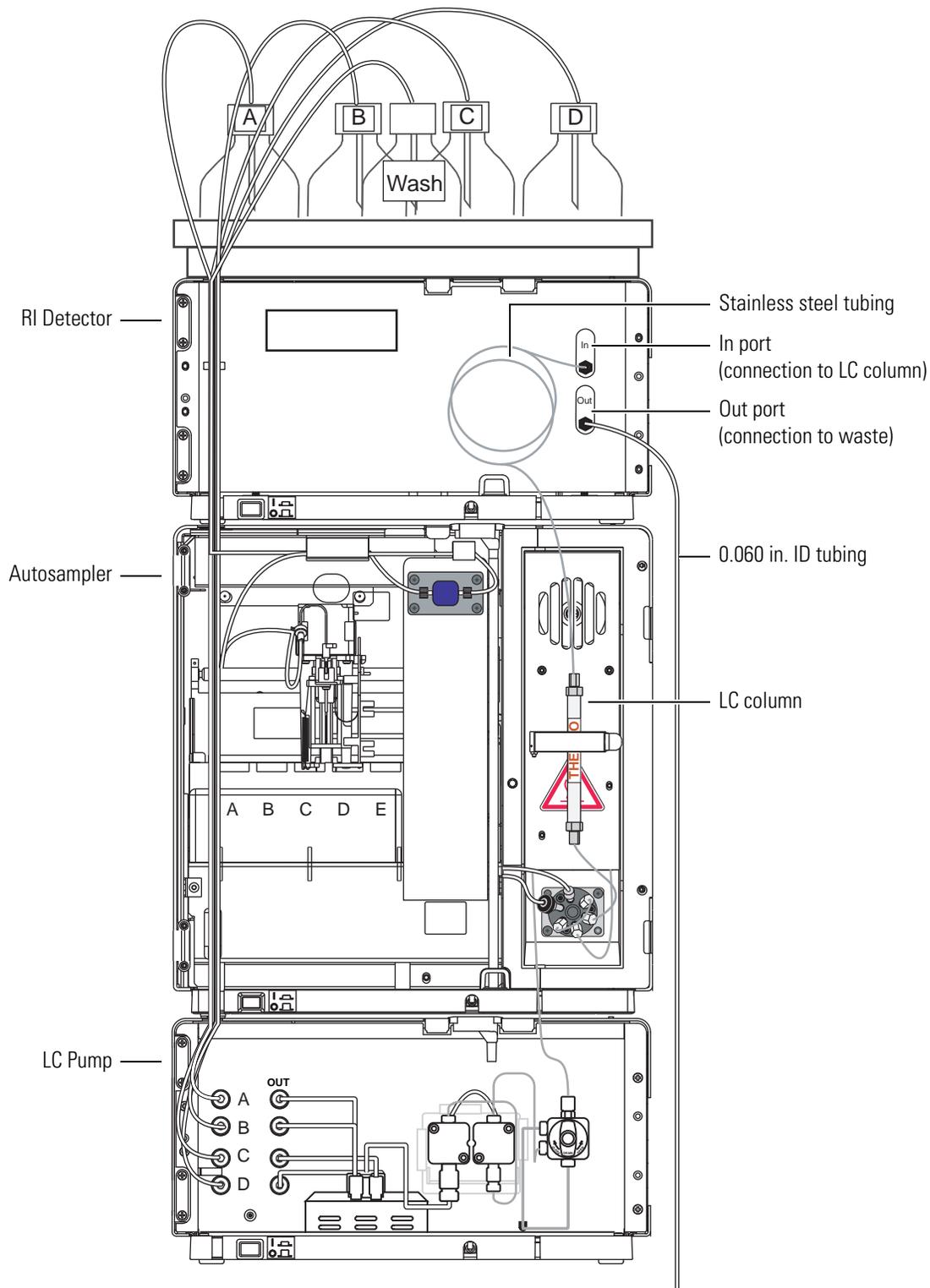
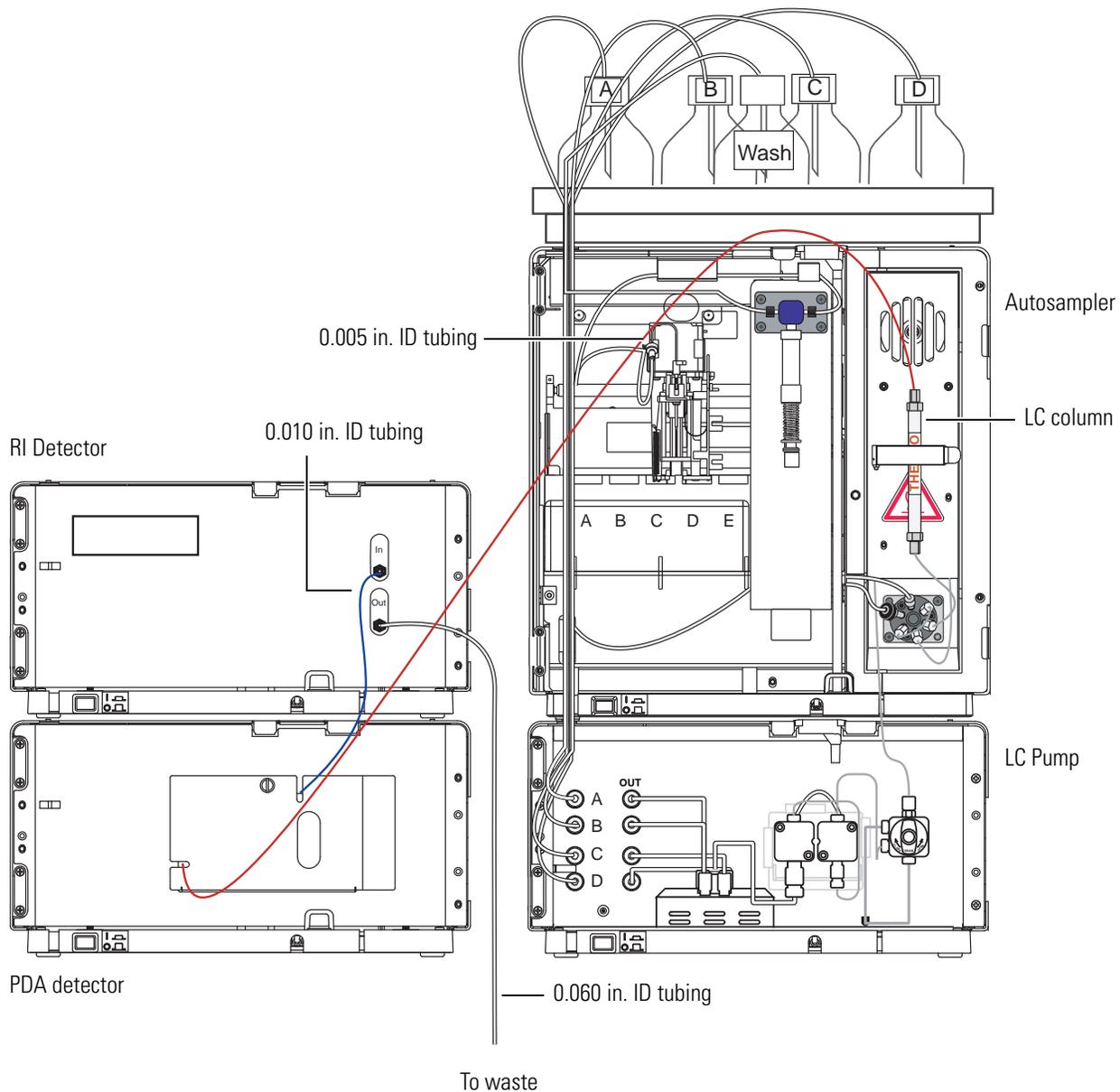


Figure 53. Set up of Surveyor Plus LC system with a PDA detector and an RI detector (shown without doors)



7 Connecting the Solvent Lines

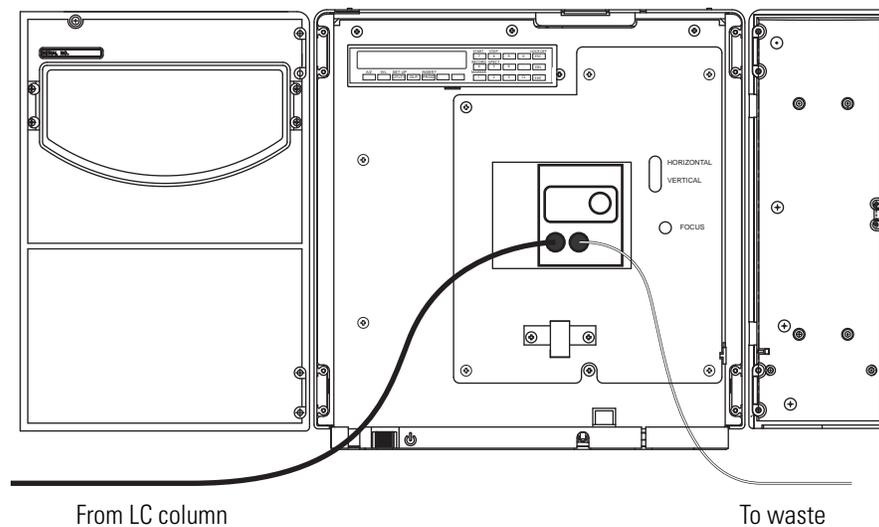
Connecting the Outlet of the LC Column to the Detector

Connecting the Outlet of the LC Column to the FL Detector

❖ To connect the Surveyor FL Plus Detector

1. Using a PEEK fitting (supplied in the FL detector accessory kit), connect the outlet of the LC column to the inlet tubing of the FL detector.
2. Connect the outlet tubing of the FL detector to a waste receptacle.

Figure 54. Front panel of the Surveyor FL Plus Detector, showing the inlet and outlet tubing



Installing the LightPipe Flow Cell into the PDA Detector

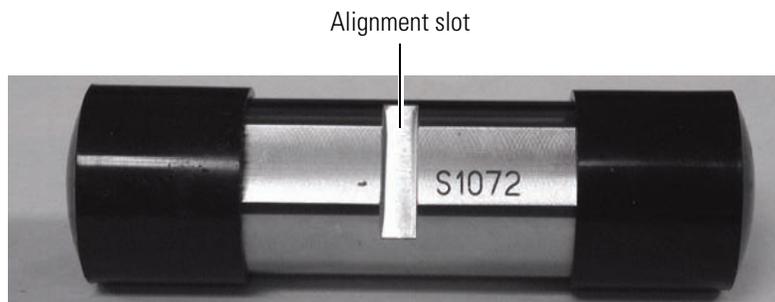
The LightPipe™ flow cell is packed in a small, separate box within the shipping carton for the detector. This small box contains the LightPipe flow cell (with a protective cap on each end) and a plastic bag containing the inlet and outlet tubing and FingerTight fittings. If you are connecting the outlet of the flow cell to an MS detector, you will also need the inlet tubing that is supplied in the MS detector accessory kit. The part numbers for these fittings are listed in [Table 9](#).

Table 9. Part Numbers for LightPipe flow cell assembly

Description	Part Number
Flow cell assembly, with inlet/outlet tubing and fittings (5 cm LightPipe)	803237
FingerTight PEEK™ Ferrule Nuts	2522-0285
Inlet tubing, with insulation, PEEK 1/16 × 0.005 in. ID (Red)	803260
Outlet tubing, PEEK 1/16 × 0.010 in. ID (Blue)	703950
Tubing, PEEK, 0.005 in. ID, 1/16 OD (Red)	00301-22912

The LightPipe flow cell as it is shipped with protective end caps is shown in [Figure 55](#). The slot in the top of the flow cell is used to align the flow cell in the detector.

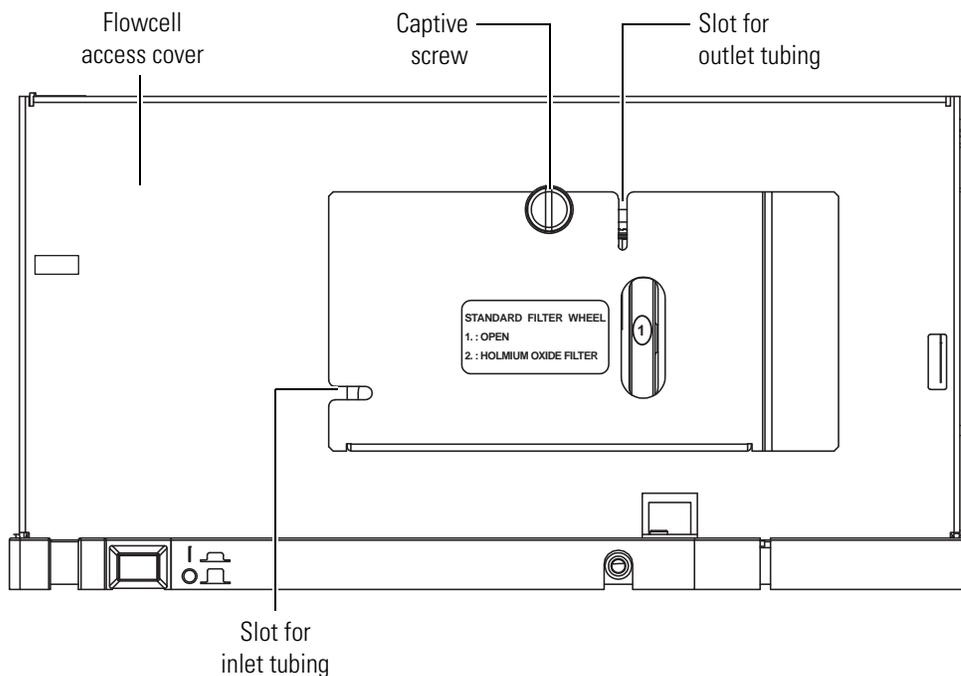
Figure 55. LightPipe flow cell with protective end caps



❖ **To install the LightPipe flow cell**

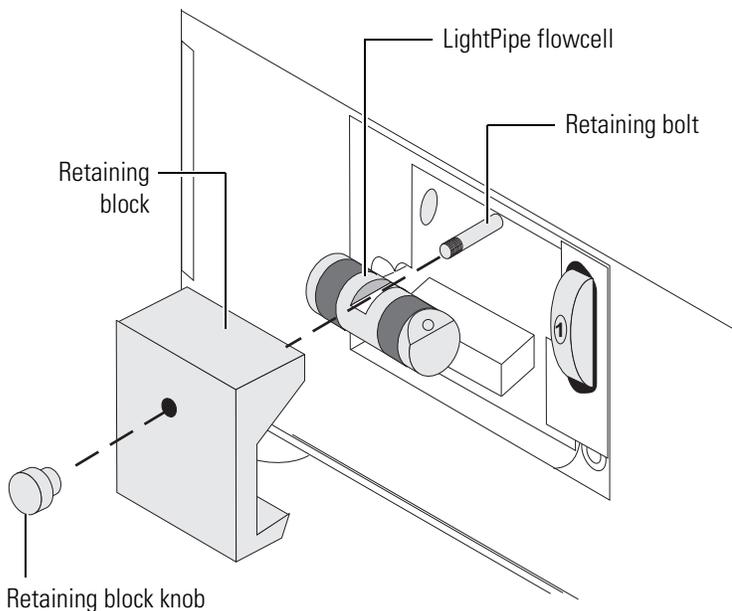
1. Open the front doors of the Surveyor PDA Plus Detector.
2. Remove the flow cell access cover by unscrewing the captive screw. See [Figure 56](#).

Figure 56. Flow cell access cover



3. Unscrew the retaining block nut, and then remove the retaining block. See [Figure 57](#).

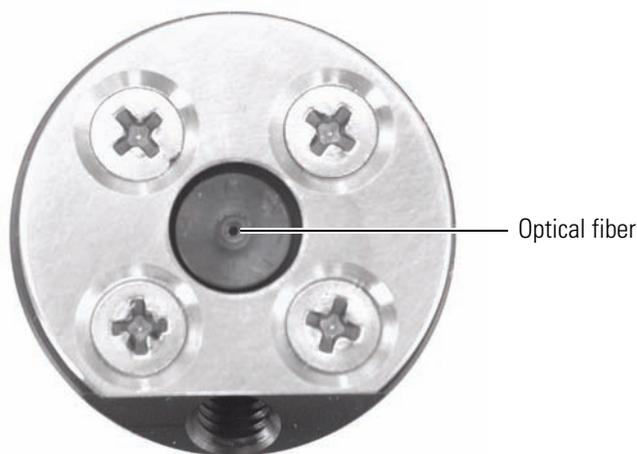
Figure 57. Retaining block for LightPipe flow cell





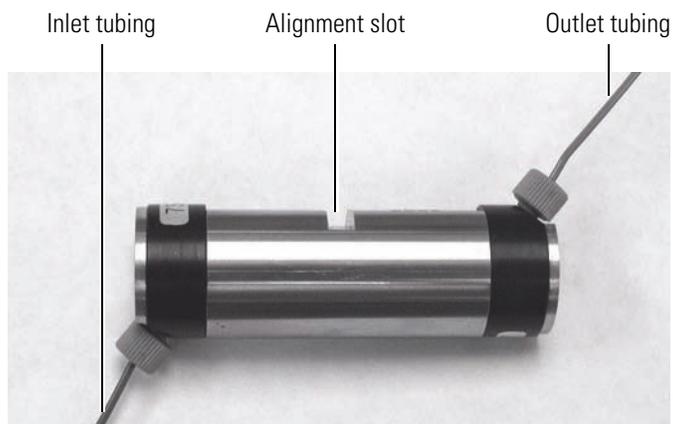
CAUTION Do not touch the ends of the LightPipe as you install it! Each end of the LightPipe flow cell contains a small, exposed, optical fiber. See [Figure 58](#). If you contaminate these optical fibers with oil from your fingertips, your chromatographic baseline will display a strong tendency to drift. The damage caused by contaminating the optical fibers is **irreversible**.

Figure 58. End of LightPipe flow cell, showing the optical fiber



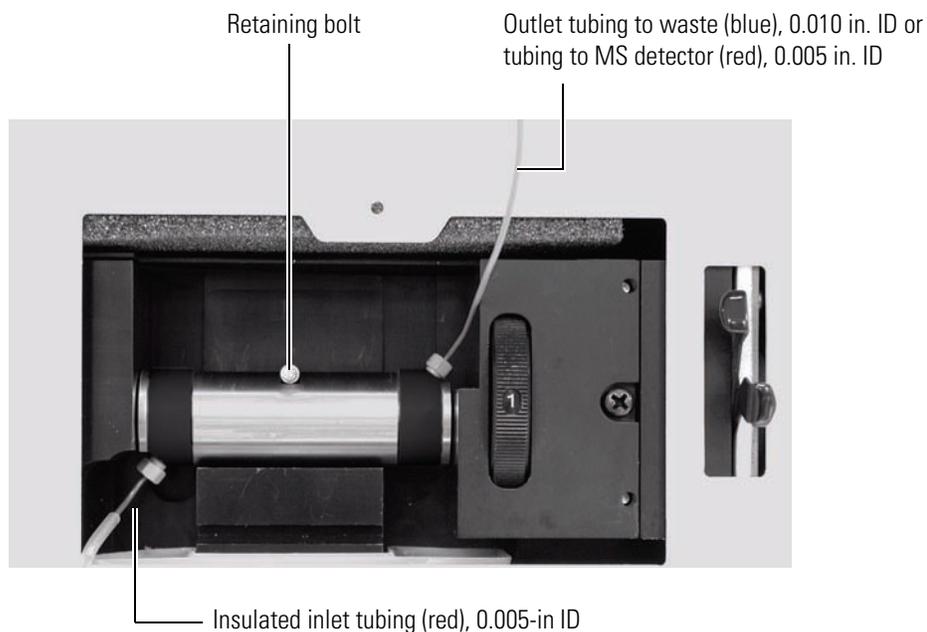
4. Attach the inlet and outlet tubing to the flow cell:
 - a. Connect the 0.005 in. ID, red, insulated inlet tubing that is included with the LightPipe kit to the inlet of the LightPipe flow cell, which is located on the top of the flow cell. Use the PEEK fittings included with the LightPipe kit to make this connection.
 - b. Connect tubing to the outlet of the LightPipe flow cell:
 - If you are not connecting the flow cell to an MS detector, connect the 0.010 in. ID, blue, outlet tubing to the outlet of the flow cell. Place the other end of the tubing into the waste reservoir. When you are using an optional backpressure regulator (P/N 802259), connect the outlet line to the low-pressure union and waste tubing. Use the PEEK fittings included in the LightPipe kit to make this connection.
 - If you are connecting the flow cell to an MS detector, connect one end of the 0.005 in. ID, PEEK, red tubing (P/N 00301-22912) included in the MS detector accessory kit to the outlet of the flow cell. Connect the other end of the tubing to the inlet port of the MS detector. Use the PEEK fittings included in the LightPipe kit to make these connections.

Figure 59. LightPipe flow cell with tubing attached



5. Orient the LightPipe flow cell such that the inlet tubing is on the bottom left and the slot on the top of the LightPipe is facing upwards. Then slide the flow cell into the PDA detector as shown in [Figure 60](#).
6. Align the slot in the top of the flow cell with the retaining bolt. Then, slide the retaining block over the retaining bolt and secure it in place with the retaining block nut (see [Figure 57](#)).
7. Replace the flow cell access cover, ensuring that the inlet and outlet tubings pass through the slots in the left-side and top of the cover, respectively without being pinched (see [Figure 56](#)). Tighten the captive screw to secure the flow cell access cover.
8. Close the front doors of the detector.

Figure 60. LightPipe flow cell



Installing the LightPipe Flow Cell into the UV/Vis Detector

The Surveyor UV/Vis Plus Detector can be shipped in any of three configurations as listed in [Table 10](#).

Table 10. Shippable configurations of the Surveyor UV/Vis Plus Detector

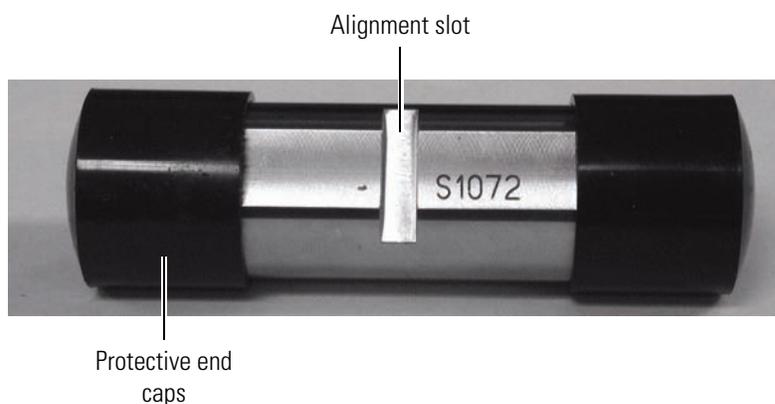
Part Number	Configuration
Surveyor-UV1P	With 10 mm Standard Analytical flow cell
Surveyor-UV5P	With 50 mm LightPipe™ flow cell

The standard analytical flow cell comes already installed in your detector. For more information on the standard analytical flow cell, see the *Surveyor UV/Vis Plus Detector Hardware Manual*.

The LightPipe flow cell comes packed in a small, separate box within the detector shipping carton. This small box contains the LightPipe and a plastic bag containing the inlet and outlet tubing and FingerTight fittings. The LightPipe comes packaged with protective end caps. See [Figure 61](#).

Do not remove the protective end caps until you are ready to install the LightPipe. The slot in the top of the flow cell allows you to properly align the flow cell in the detector housing.

Figure 61. LightPipe flow cell with protective end caps



❖ **To install the LightPipe flow cell**

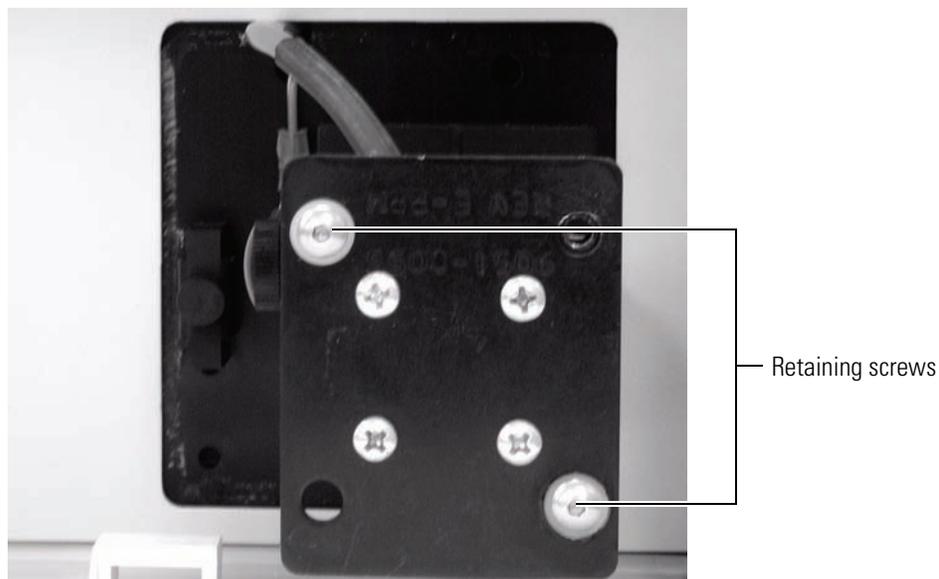
1. Open the front doors of the detector.
2. Remove the flow cell cover. Use an Allen wrench to remove the retaining screw that secures the cover to the detector. See [Figure 62](#).

Figure 62. LightPipe flow cell cover for Surveyor UV/Vis Plus Detector



3. Remove the sample photodiode from the end of the mounting assembly. Use an Allen wrench to remove the two screws that secure the sample photodiode to the end of the mounting assembly. See [Figure 63](#).

Figure 63. Retaining screws for sample photodiode assembly

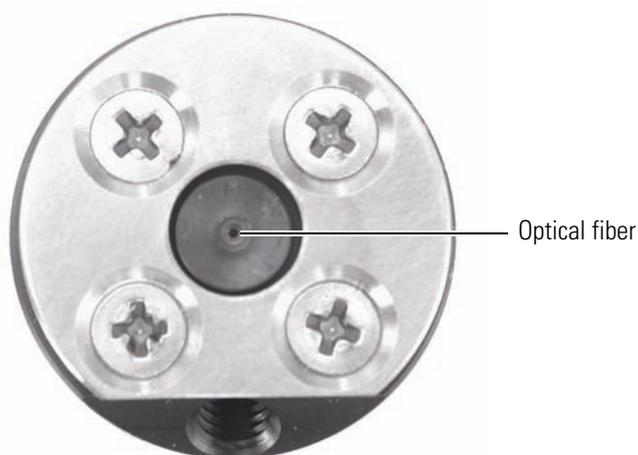


4. Remove the protective caps from the ends of the LightPipe (see [Figure 61](#)). Store the protective caps in a convenient location so that you can replace them if you remove the LightPipe from the detector.



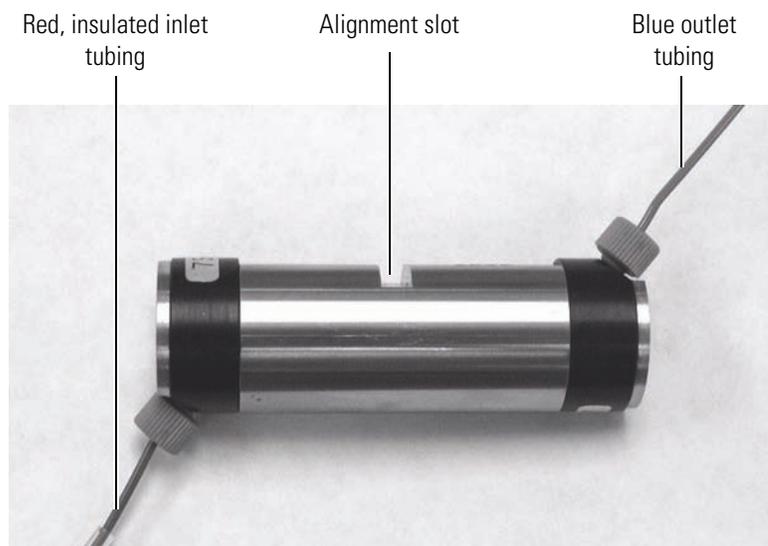
CAUTION Do not touch the ends of the LightPipe. This could damage the sensitive optics. See [Figure 64](#). If you must grasp the ends of the LightPipe to remove it from the assembly, use clean, talc-free gloves.

Figure 64. End of LightPipe flow cell, showing optical fiber



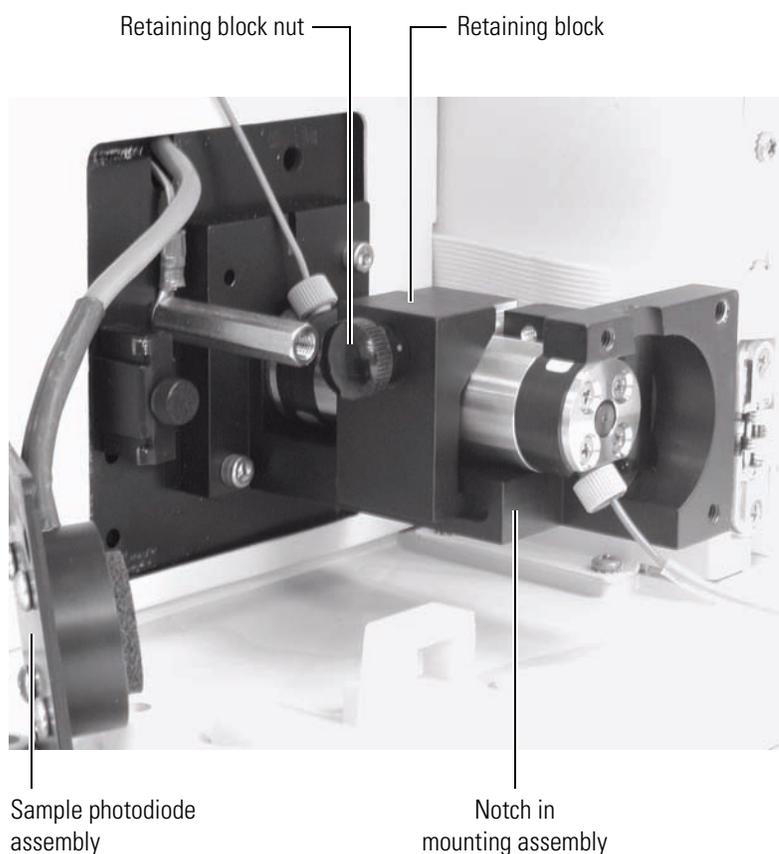
5. Using the supplied fittings, attach the inlet and outlet tubings to the flow cell:
 - a. Connect the insulated, red, PEEK™, inlet tubing to the port in the bottom of the flow cell. See [Figure 65](#).
 - b. Connect the blue, PEEK, outlet tubing to the port in the top of the flow cell (see [Figure 65](#)).

Figure 65. LightPipe flow cell with tubing attached



6. Install the flow cell into the LightPipe mounting assembly as shown in [Figure 66](#):
 - a. With the inlet tubing facing downwards and the slot in the top of the LightPipe flow cell facing upwards, slide the flow cell into the Surveyor UV/Vis Plus Detector.
 - b. Pull the retention bar of the mounting assembly down into the alignment slot in the top of the flow cell.
 - c. While aligning the retention block with the notch in the base of the mounting assembly, slide the hole in the retaining block onto the end of the retention bar.
 - d. Hand-tighten the retaining block securely in place with the retaining block nut.

Figure 66. Retaining block secured on LightPipe flow cell



7. Reinstall the sample photodiode onto the end of the LightPipe mounting assembly. Use an Allen wrench to tighten the two retaining screws. See [Figure 67](#).
8. Reinstall the flow cell cover, making sure that the inlet and outlet tubing pass through the slots without being pinched. Use an Allen wrench to tighten the retaining screw. See [Figure 68](#).

9. After you finish installing the flow cell, close the front doors of the detector.

Figure 67. Sample photodiode installed

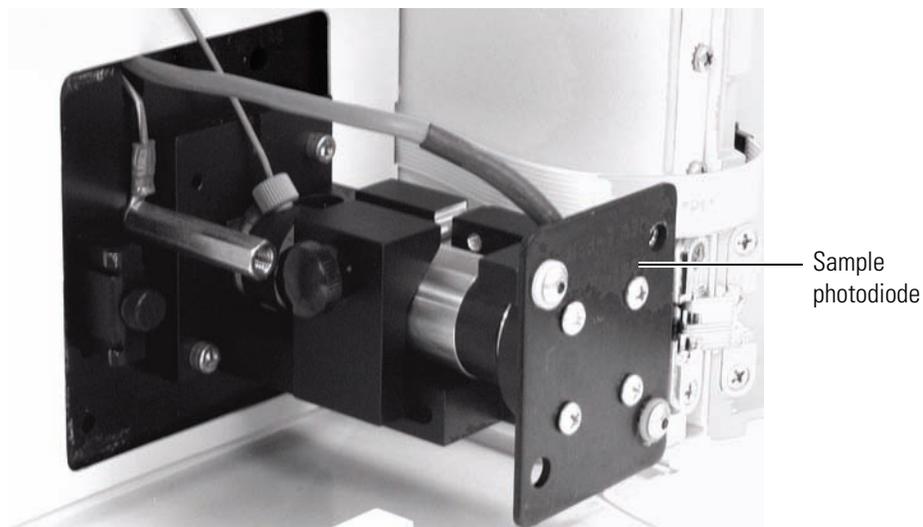
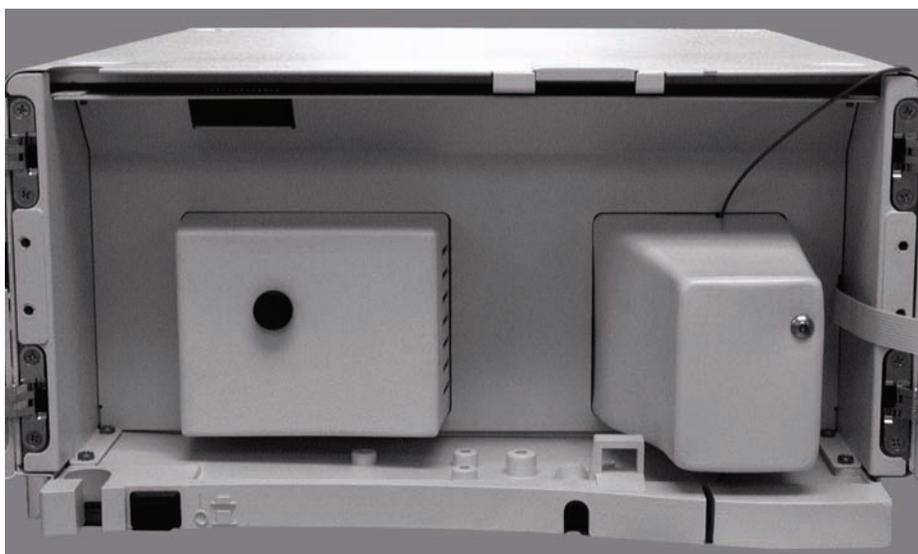


Figure 68. LightPipe flow cell cover installed



Quick Reference Sheets

The following quick reference sheets describe how to connect the two versions of the system interconnect cable:

- [Using the 5-Connector System Interconnect Cable to Interconnect a Surveyor Plus LC or LC/MS System](#)
- [Using the 7-Connector System Interconnect Cable to Interconnect a Surveyor Plus LC or LC/MS System](#)

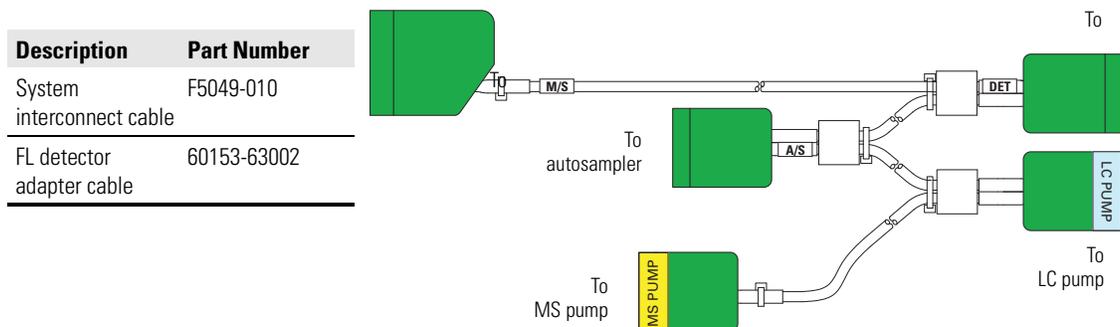
Using the 5-Connector System Interconnect Cable to Interconnect a Surveyor Plus LC or LC/MS System

The 5-Connector System Interconnect Cable

The system interconnect cable, shown in the figure below, synchronizes the timing of the instrument modules during an injection sequence triggered by the Surveyor Plus Autosampler.

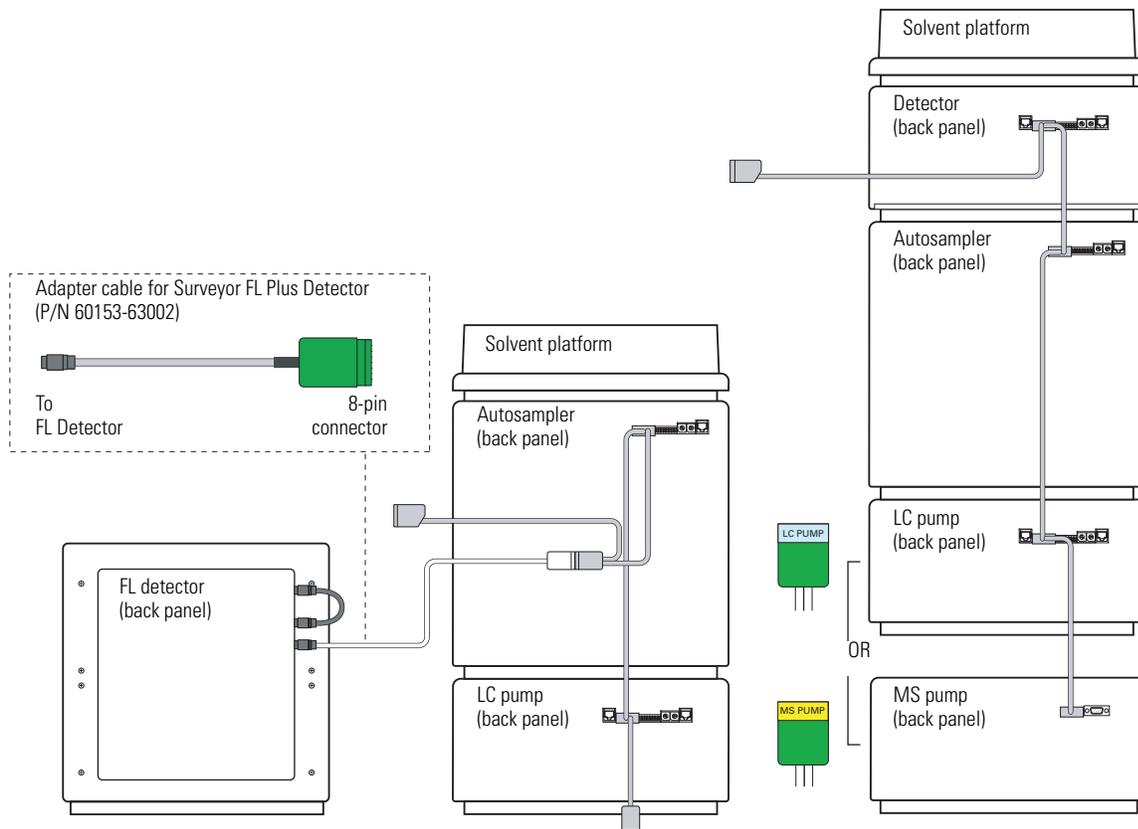
The five combicon connectors of the system interconnect cable are identified as follows:

- The autosampler, detector, and MS detector connectors are identified by small tags on their adjacent cables.
- The Surveyor LC Pump Plus connector is identified by its blue label.
- The Surveyor MS Pump Plus connector is identified by its yellow label.



Connecting the LC Modules

The figure below shows the system interconnect cable connections for the modules of a Surveyor Plus LC system. In addition to the system interconnect cable, the Surveyor FL Plus Detector requires an adapter cable.



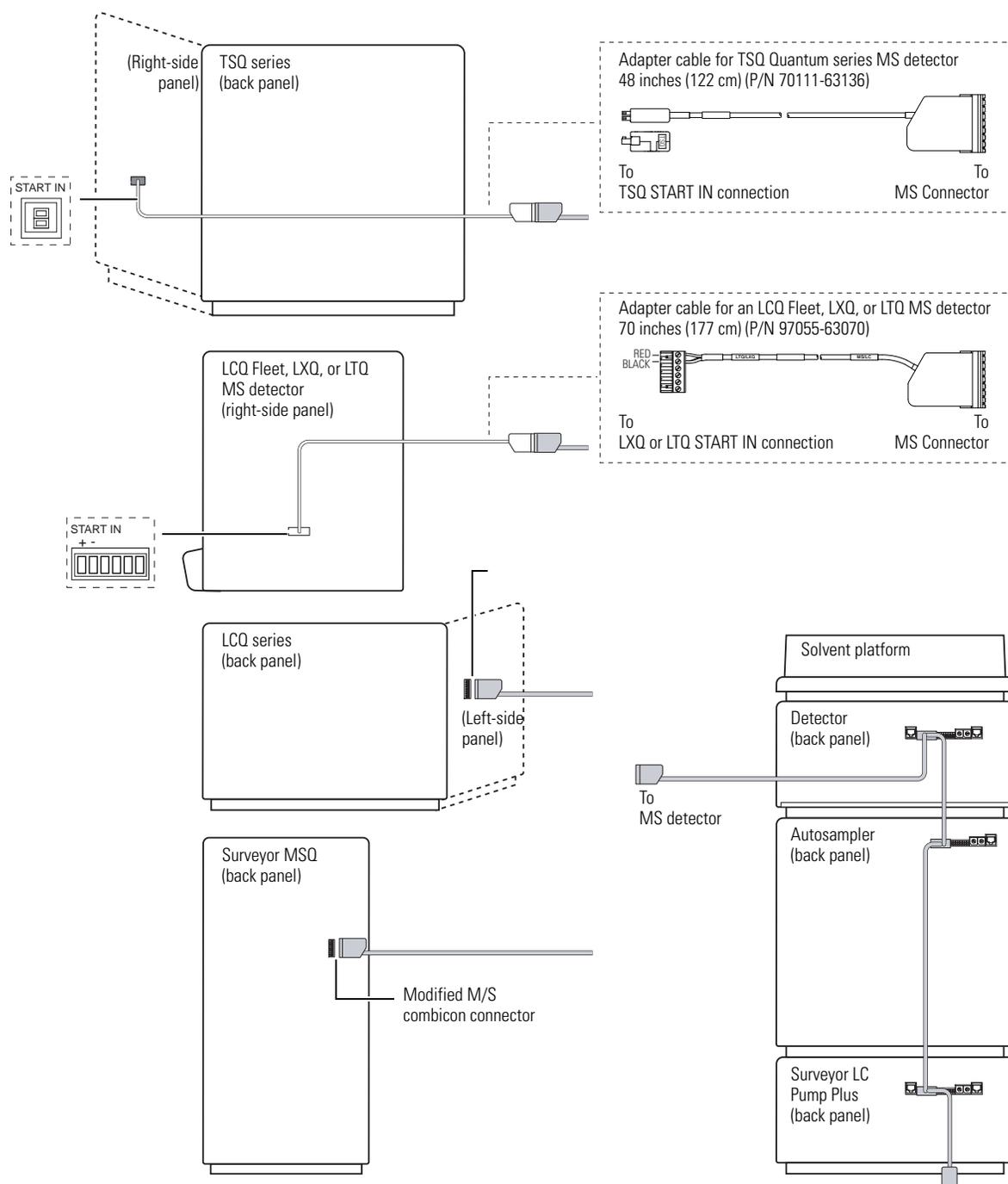
Connecting a Thermo Scientific MS Detector

The MS detector connector of the 5-connector system interconnect cable plugs directly into the 8-pin Peripheral Control receptacle on the left side of an LCQ Series MS detector.

To connect a Surveyor MSQ Plus MS detector, you must modify the MS detector connector as follows: move the white wire from position 8 to position 1, and move the black wire and the blue wire from position 7 to position 2. To connect an LXQ, LTQ, or TSQ Quantum Series MS detector, you must connect an adapter cable to the MS detector connector.

Description	Part number
LXQ/LTQ MS detector interconnect adapter cable	97055-63070
TSQ Quantum MS detector interconnect adapter cable	70111-63136

The figure below shows the connection between a Surveyor Plus LC system and a Thermo Scientific MS detector.



Using the 7-Connector System Interconnect Cable to Interconnect a Surveyor Plus LC or LC/MS System

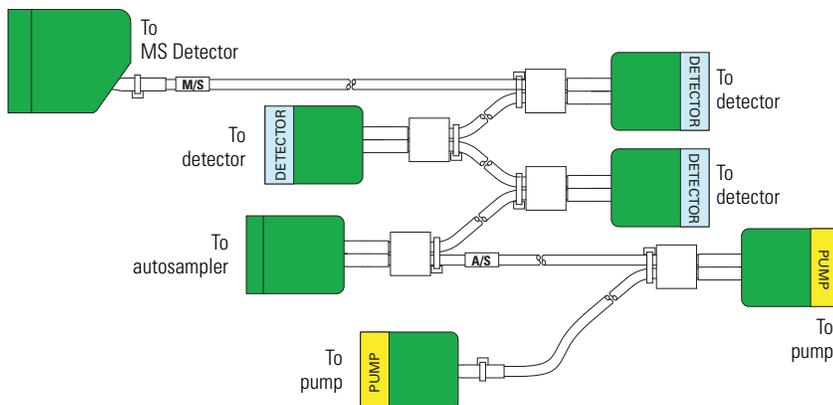
The 7-Connector System Interconnect Cable

The system interconnect cable, shown in the figure below, synchronizes the timing of the instrument modules during an injection sequence triggered by the Surveyor Plus Autosampler.

The seven combicon connectors of the system interconnect cable are identified as follows:

- The autosampler and MS detector connectors are identified by small tags on their adjacent cables.
- The detector connector is identified by its blue label, and the pump connector is identified by its yellow label.

Description	Part Number
System Interconnect Cable	60053-63034
Adapter cable for Surveyor FL Plus Detector	60153-63002
Adapter cable for Surveyor MS Pump Plus	60053-63038

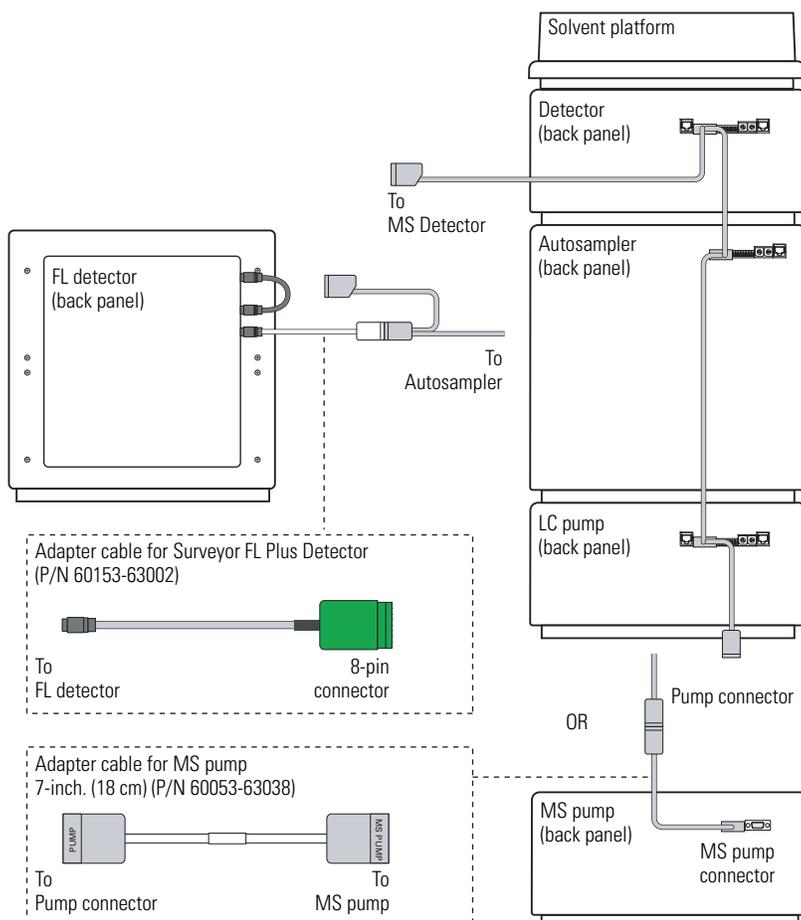


Connecting the LC Modules

The pump connector plugs directly into the left, 8-pin receptacle on the back panel of the Surveyor LC Pump Plus.

The detector connector plugs directly into the left, 8-pin receptacle on the back panel of the Surveyor PDA Plus Detector, Surveyor UV/Vis Plus Detector, or Surveyor RI Plus Detector.

The Surveyor MS Pump Plus and the Surveyor FL Plus Detector require adapter cables. The figure to the right shows the connections for a Surveyor Plus LC system.



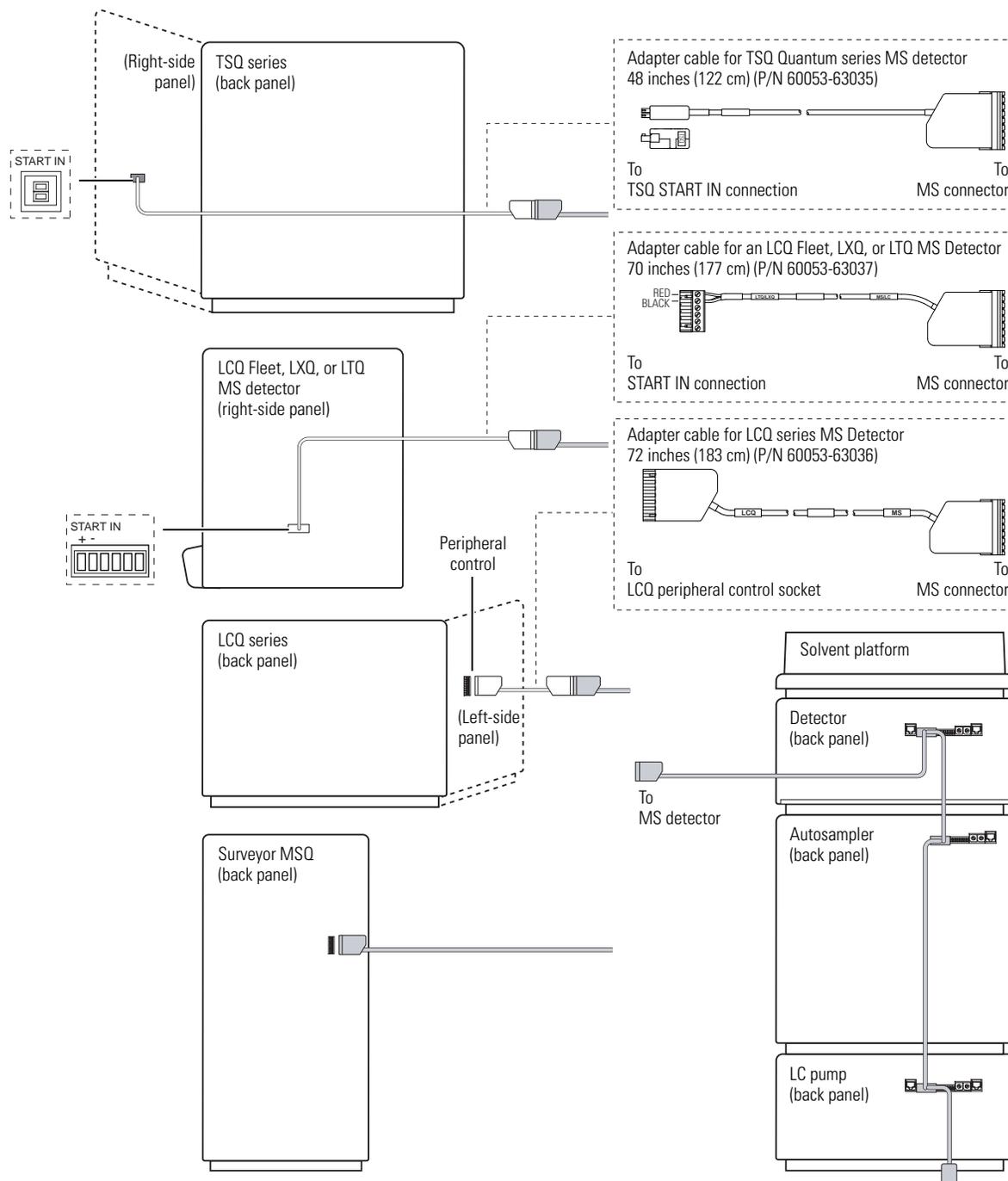
Connecting a Thermo Scientific MS Detector

The MS detector connector of the 7-connector system interconnect cable plugs directly into the 8-pin, I/O receptacle on the back panel of the Surveyor MSQ Plus MS detector.

To connect an LCQ, LXQ, LTQ, or TSQ Quantum Series MS detector, you must connect an adapter cable to the MS detector connector.

Description	Part number
LCQ MS detector interconnect adapter cable	60053-63036
LXQ/LTQ MS detector interconnect adapter cable	60053-63037
TSQ Quantum MS detector interconnect adapter cable	60053-63035

The figure below shows the connection between a Surveyor Plus LC system and a Thermo Scientific MS detector.



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