

Thermo

# EASY-nLC 1200

## Troubleshooting and Maintenance Guide

Touch-screen application version 4.2

60053-97274 Revision C 2019

**thermo**  
scientific

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Release history: Revision C, 2019

Hardware versions: EASY-nLC 1200 instrument.

Software version: Touch-screen software version 4.2

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

## 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 instrument is delivered to you, it meets all pertinent electromagnetic compatibility (EMC) and safety standards.

Changes that you make to the instrument might void compliance with one or more of these EMC and safety standards. Changes to the instrument 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.

## 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: This instrument must be used in the manner specified by Thermo Fisher Scientific to ensure protections provided by the instrument are not impaired. Deviations from specified instructions on the proper use of the instrument include changes to the system and part replacement. Accordingly, order replacement parts from Thermo Fisher Scientific or one of its authorized representatives.

For manufacturing location, see the label on the instrument.

## WEEE Compliance

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



Thermo Fisher Scientific is registered with B2B Compliance ([B2Bcompliance.org.uk](https://www.b2bcompliance.org.uk)) in the UK and with the European Recycling Platform ([ERP-recycling.org](https://www.erp-recycling.org)) in all other countries of the European Union and in Norway.

If this product is located in Europe and you want to participate in the Thermo Fisher Scientific Business-to-Business (B2B) Recycling Program, send an email request to [weee.recycle@thermofisher.com](mailto:weee.recycle@thermofisher.com) with the following information:

- WEEE product class
- Name of the manufacturer or distributor (where you purchased the product)
- Number of product pieces, and the estimated total weight and volume
- Pick-up address and contact person (include contact information)
- Appropriate pick-up time
- Declaration of decontamination, stating that all hazardous fluids or material have been removed from the product

For additional information about the Restriction on Hazardous Substances (RoHS) Directive for the European Union, search for RoHS on the Thermo Fisher Scientific European language websites.

**IMPORTANT** This recycling program is **not** for biological hazard products or for products that have been medically contaminated. You must treat these types of products as biohazard waste and dispose of them in accordance with your local regulations.

## Conformité DEEE

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



Thermo Fisher Scientific s'est associé avec une ou plusieurs sociétés de recyclage dans chaque état membre de l'Union Européenne et ce produit devrait être collecté ou recyclé par celle(s)-ci. Pour davantage d'informations, rendez-vous sur la page <http://www.thermofisher.com/se/en/home/technical-resources/rohs-certificates.html>.







## WEEE Konformität

Dieses Produkt entspricht der EU Waste Electrical & Electronic Equipment (WEEE) Richtlinie 2002/96/EC. Es ist mit dem folgenden Symbol gekennzeichnet:



Thermo Fisher Scientific hat Vereinbarungen mit Verwertungs-/Entsorgungsfirmen in allen EU-Mitgliedsstaaten getroffen, damit dieses Produkt durch diese Firmen wiederverwertet oder entsorgt werden kann. Weitere Informationen finden Sie unter <http://www.thermofisher.com/se/en/home/technical-resources/rohs-certificates.html>.

CAUTION Symbol	CAUTION	VORSICHT	PRECAUCIÓN	MISE EN GARDE
	<b>Risk electric shock:</b> This instrument uses voltages that can cause electric shock and/or personal injury. Before servicing, shut down the instrument and disconnect it from line power. While operating the instrument, keep covers on. Do not remove the protective covers from the printed circuit board assemblies (PCBAs).	<b>Stromschlaggefahr:</b> Dieses Gerät arbeitet mit Spannungen, die Stromschläge und/oder Personenverletzungen verursachen können. Vor Wartungsarbeiten muss das Gerät abgeschaltet und vom Netz getrennt werden. Betreiben Sie das Gerät nicht mit abgenommenen Abdeckungen. Nehmen Sie die Schutzabdeckungen von Leiterplatten nicht ab.	<b>Riesgo de descargas eléctricas:</b> Este instrumento utiliza voltajes que pueden causar descargas eléctricas y/o lesiones personales. Antes de revisar o reparar el instrumento, apáguelo y desconéctelo de la red eléctrica. Mantenga colocadas las cubiertas mientras se utiliza el instrumento. No retire las cubiertas protectoras del circuito impreso completo (PCBA).	<b>Risque de choc électrique :</b> l'instrument utilise des tensions susceptibles de provoquer une électrocution et/ou des blessures corporelles. Il doit être arrêté et débranché de la source de courant avant toute intervention. Ne pas utiliser l'instrument sans ses couvercles. Ne pas enlever les capots de protection des cartes à circuit imprimé (PCBA).
	<b>Chemical hazard:</b> Wear gloves and other protective equipment, as appropriate, when handling toxic, carcinogenic, mutagenic, corrosive, or irritant chemicals. Use approved containers and proper procedures to dispose of waste oil and when handling wetted parts of the instrument.	<b>Gefahr durch Chemikalien:</b> Tragen Sie beim Umgang mit toxischen, karzinogenen, mutagenen, ätzenden oder reizenden Chemikalien Schutzhandschuhe und weitere geeignete Schutzausrüstung. Verwenden Sie bei der Entsorgung von verbrauchtem Öl und beim Umgang mit medienberührenden Komponenten die vorgeschriebenen Behälter, und wenden Sie ordnungsgemäße Verfahren an.	<b>Peligro por sustancias químicas:</b> Cuando manipule sustancias químicas, tóxicas, carcinogénicas, mutágenas, corrosivas o irritantes, utilice guantes y otro equipo de protección. Utilice siempre recipientes homologados y siga los procedimientos adecuados cuando deseche aceite residual o manipule partes mojadas del instrumento.	<b>Danger lié aux produits chimiques :</b> porter des gants et d'autres équipements de protection appropriés pour manipuler les produits chimiques toxiques, cancérigènes, mutagènes, corrosifs ou irritants. Utiliser des récipients homologués et des procédures adéquates pour la mise au rebut des huiles usagées et lors de la manipulation des pièces de l'instrument en contact avec l'eau.
	<b>Hot surface:</b> Before touching, allow any heated components to cool.	<b>Heiße Oberflächen:</b> Lassen Sie heiße Komponenten vor der Berührung abkühlen.	<b>Superficies calientes:</b> Antes de tocar los componentes calientes, espere a que se enfríen.	<b>Surface chaude :</b> laisser refroidir les composants chauffés avant toute manipulation.
	<b>Flammable substances hazard:</b> Use care when operating the system in the presence of flammable substances.	<b>Gefahr durch entzündbare Substanzen:</b> Beachten Sie die einschlägigen Vorsichtsmaßnahmen, wenn Sie das System in Gegenwart von entzündbaren Substanzen betreiben.	<b>Peligro por sustancias inflamables:</b> Tenga mucho cuidado cuando utilice el sistema cerca de sustancias inflamables.	<b>Danger lié aux substances inflammables :</b> agir avec précaution lors de l'utilisation du système en présence de substances inflammables.
	<b>Risk of eye injury:</b> Eye injury could occur from splattered chemicals, airborne particles, or sharp objects. (Sharp objects that customers might install in the instrument include fused-silica tubing, the autosampler needle, and so on.) Wear safety glasses when handling chemicals or servicing the instrument.	<b>Augenverletzungsrisiko:</b> Verspritzte Chemikalien, Schwebstoffpartikel oder scharfe Objekte können Augenverletzungen verursachen. (Scharfe Objekte, die Kunden möglicherweise im Gerät installieren, sind z. B. Quarzglas-Kapillaren, die Nadel des Autosamplers, usw.) Tragen Sie beim Umgang mit Chemikalien oder bei der Wartung des Gerätes eine Schutzbrille.	<b>Riesgo de lesiones oculares:</b> Las salpicaduras de sustancias químicas, las partículas flotantes en el aire y los objetos afilados pueden causar lesiones oculares. (Entre los objetos afilados que los clientes pueden instalar en el instrumento se encuentran tubos de sílice fundida, agujas del muestreador automático, etc.). Para manipular sustancias químicas o realizar tareas de mantenimiento, utilice gafas de seguridad.	<b>Risque de lésion oculaire :</b> Les projections chimiques, les particules en suspension dans l'air et les objets tranchants peuvent entraîner des lésions oculaires. (Les objets tranchants pouvant être installés par les clients dans l'instrument comprennent les tubes en silice fondue, les aiguilles du passeur automatique, etc.). Porter des lunettes de protection lors de toute manipulation de produit chimique ou intervention sur l'instrument.
	<b>General hazard:</b> A hazard is present that is not included in the other categories. This symbol also appears on the instrument. For details about the hazard, refer to the instrument manual. When the safety of a procedure is questionable, contact Technical Support for Thermo Scientific San Jose products.	<b>Allgemeine Gefahr:</b> Es besteht eine weitere Gefahr, die nicht in den vorstehenden Kategorien beschrieben ist. Dieses Symbol wird auch auf dem Gerät angebracht. Einzelheiten zu dieser Gefahr finden Sie in den Gerätehandbüchern. Wenn Sie sich über die Sicherheit eines Verfahrens im Unklaren sind, setzen Sie sich, bevor Sie fortfahren, mit dem technischen Support für Thermo Scientific San Jose Produkte in Verbindung.	<b>Peligro general:</b> Existen peligros que no se incluyen en las otras categorías. Este símbolo también aparece en el instrumento. Si desea obtener más información sobre estos peligros, consulte el manual del instrumento. En caso de duda sobre la seguridad de un procedimiento, póngase en contacto con el personal de servicio técnico de los productos Thermo Scientific San Jose.	<b>Danger d'ordre général :</b> indique la présence d'un risque n'appartenant pas aux catégories citées plus haut. Ce symbole figure également sur l'instrument. Pour plus de détails sur ce danger potentiel, se reporter au manuel de l'instrument. Si la sûreté d'une procédure est incertaine, contacter l'assistance technique pour les produits Thermo Scientific San Jose.

CAUTION Symbol	CAUTION	VORSICHT	PRECAUCIÓN	MISE EN GARDE
	<b>Laser hazard:</b> This instrument uses a laser that is capable of causing personal injury. This symbol also appears on the instrument. For details about the hazard, refer to the instrument manual.	<b>Gefahr durch Laserstrahlen:</b> Der in diesem Gerät verwendete Laser kann zu Verletzungen führen. Dieses Symbol wird auch auf dem Gerät angebracht. Einzelheiten zu dieser Gefahr finden Sie in den Gerätehandbüchern.	<b>Peligro por láser:</b> Este instrumento utiliza un láser que puede producir lesiones personales. Este símbolo también aparece en el instrumento. Si desea obtener más información sobre el peligro, consulte el manual del instrumento.	<b>Danger lié au laser :</b> L'instrument utilise un laser susceptible de provoquer des blessures corporelles. Ce symbole figure également sur l'instrument. Pour plus de détails sur ce danger potentiel, se reporter au manuel de l'instrument.
	<b>Ultra violet light hazard:</b> Do not look directly at the ultra-violet (UV) light or into the UV source. Exposure can cause eye damage. Wear UV eye protection.	<b>Gefahr durch UV-Licht:</b> Richten Sie Ihren Blick nicht direkt auf ultraviolettes Licht (UV-Licht) oder in die UV-Quelle. Dies kann zu Augenschäden führen. Tragen Sie eine UV-Schutzbrille.	<b>Peligro por luz ultravioleta:</b> No mire directamente a una luz ultravioleta (UV) ni a una fuente UV. La exposición puede causar daños oculares. Lleve protección ocular para UV.	<b>Danger lié aux rayons ultraviolets :</b> ne jamais regarder directement la lumière ultraviolette (UV) ou la source d'UV. Une exposition peut entraîner des lésions oculaires. Porter des protections oculaires anti-UV.
	<b>Sharp object:</b> Avoid physical contact with the object.	<b>Scharfes Objekt:</b> Vermeiden Sie den physischen Kontakt mit dem Objekt.	<b>Objeto puntiagudo:</b> Evite el contacto físico con el objeto.	<b>Objet tranchant :</b> éviter tout contact physique avec l'objet.
	<b>Pinch point:</b> Keep hands away from this area.	<b>Quetschgefahr:</b> Halten Sie Ihre Hände von diesem Bereich fern.	<b>Puntos de pinzamiento:</b> Mantenga las manos apartadas de esta área.	<b>Risque de pincement :</b> éloigner les mains de cette zone.
	<b>Heavy objects:</b> Never lift or move the instrument by yourself; you can suffer personal injury or damage the equipment. For specific lifting instructions, refer to the instrument manual.	<b>Schweres Objekt:</b> Bewegen und heben Sie das Gerät niemals allein an; dies kann zu Verletzungen oder zur Beschädigung des Geräts führen. Spezifische Anweisungen zum Anheben finden Sie im Gerätehandbuch.	<b>Objeto pesado:</b> Nunca levante ni mueva el instrumento por su cuenta, podría sufrir lesiones personales o dañar el equipo. Para obtener instrucciones específicas sobre levantamiento, consulte el manual del instrumento.	<b>Objet lourd :</b> ne jamais soulever ou déplacer l'instrument seul sous peine de blessure corporelle ou d'endommagement de l'instrument. Pour obtenir des instructions de levage spécifiques, se reporter au manuel de l'instrument.
	<b>Trip obstacle:</b> Be aware of cords, hoses, or other objects located on the floor.	<b>Stolpergefahr:</b> Achten Sie auf Kabel, Schläuche und andere Objekte auf dem Fußboden.	<b>Tropiezo con obstáculos:</b> Tenga en cuenta los cables, mangueras u otros objetos colocados en el suelo.	<b>Risque de trébuchement :</b> faire attention aux câbles, tuyaux et autres objets situés sur le sol.
	When the safety of a procedure is questionable, contact Technical Support for Thermo Scientific San Jose products.	Wenn Sie sich über die Sicherheit eines Verfahrens im unklaren sind, setzen Sie sich, bevor Sie fortfahren, mit Ihrer lokalen technischen Unterstützungsorganisation für Thermo Scientific San Jose Produkte in Verbindung.	En caso de duda sobre la seguridad de un procedimiento, póngase en contacto con el personal de servicio técnico de los productos Thermo Scientific San Jose.	Si la sûreté d'une procédure est incertaine, contacter l'assistance technique pour les produits Thermo Scientific San Jose.



## CAUTION Symbol

## CAUTION

## 警告

## 危険警告



**Risk electric shock:** This instrument uses voltages that can cause electric shock and/or personal injury. Before servicing, shut down the instrument and disconnect it from line power. While operating the instrument, keep covers on. Do not remove the protective covers from the printed circuit board assemblies (PCBAs).

**感電の危険性:** この機器では、感電および/または身体傷害を引き起こすおそれのある電圧を使用しています。整備点検の前には、機器の電源を切り、電源コードを抜いてください。機器の作動中は、カバーを付けたままにしてください。プリント基板アセンブリ (PCBA) から保護カバーを取り外さないでください。

**触电危险:** 本仪器所用电压可能导致电击或人身伤害。进行维修服务前, 务必关闭仪器电源并断开其电源连接。操作此仪器时, 不要卸下顶盖。勿卸下印刷电路板组件 (PCBA) 的保护盖。



**Chemical hazard:** Wear gloves and other protective equipment, as appropriate, when handling toxic, carcinogenic, mutagenic, corrosive, or irritant chemicals. Use approved containers and proper procedures to dispose of waste oil and when handling wetted parts of the instrument.

**化学的危険性:** 毒性、発癌性、変異原性、腐食性、または刺激性のある化学薬品を取り扱うときは、必要に応じて手袋などの保護具を着用します。廃油を処分したり、機器の接液部品を取り扱うときは、認可された容器を使用し、適切な手順に従います。

**化学品危险:** 当处理毒性、致癌性、致突变性、腐蚀性或者刺激性化学品时, 佩戴手套和其他保护性设备。当处理浸湿的仪器部件以及废油时, 使用认可的容器和合适的步骤。



**Hot surface:** Before touching, allow any heated components to cool.

**高温面:** 触れる前に、加熱した部品を冷ましてください。

**热表面:** 待高温部件冷却之后再行维修。



**Flammable substances hazard:** Use care when operating the system in the presence of flammable substances.

**可燃性物質の危険性:** 可燃性物質があるところでシステムを作動させる場合は十分注意してください。

**易燃物危险:** 在有易燃物质的场地操作该系统时, 务必小心谨慎。



**Risk of eye injury:** Eye injury could occur from splattered chemicals, airborne particles, or sharp objects. (Sharp objects that customers might install in the instrument include fused-silica tubing, the autosampler needle, and so on.) Wear safety glasses when handling chemicals or servicing the instrument.

**眼外傷の危険性:** 飛散した化学薬品、浮遊粒子、または鋭利な物体によって眼外傷を負うおそれがあります (機器に取り付けられる可能性がある鋭利な物体は、ヒューズドシリカ、オートサンプラーニードルなどです)。化学薬品を取り扱ったり、機器を整備点検するときは、保護メガネを着用します。







**眼睛伤害风险:** 眼睛受伤可能源自飞溅的化学品、空气中的颗粒, 或者锋利的物体。(安装在仪器内的锋利物体包括熔融石英管、自动进样器的进样针等。) 处理化学品或对仪器进行维修服务时, 务必戴上防护眼镜。



**General hazard:** A hazard is present that is not included in the other categories. This symbol also appears on the instrument. For details about the hazard, refer to the instrument manual. When the safety of a procedure is questionable, contact Technical Support for Thermo Scientific San Jose products.

**一般的な危険性:** それぞれのカテゴリーに当てはまらない危険があります。この標識記号は機器にも表示されています。この危険の詳細については、機器のマニュアルを参照してください。手順の安全性にご不明な点がある場合は、Thermo Scientific San Jose 製品のテクニカルサポートまでお問い合わせください。

**普通危険:** 未归入其他类别的危险。此符号也会在仪器上出现。有关此危险的详细信息, 参阅适当的仪器手册。若对任何步骤的安全事项有疑问, 联系 Thermo Scientific San Jose 产品的技术支持中心。

CAUTION Symbol	CAUTION	警告	危険警告
	<b>Laser hazard:</b> This instrument uses a laser that is capable of causing personal injury. This symbol also appears on the instrument. For details about the hazard, refer to the instrument manual.	<b>レーザー光線の危険性:</b> この機器では、身体傷害を引き起こすおそれのあるレーザーを使用しています。この標識記号は機器にも表示されています。この危険の詳細については、機器のマニュアルを参照してください。	<b>激光危険:</b> 本仪器所用激光会导致人身伤害。此符号也会在仪器上出现。有关此危险的详细信息，参阅适当的仪器手册。
	<b>Ultra violet light hazard:</b> Do not look directly at the ultra-violet (UV) light or into the UV source. Exposure can cause eye damage. Wear UV eye protection.	<b>紫外光の危険性:</b> 紫外 (UV) 光または UV 光源を直接見ないでください。照射によって眼損傷を引き起こすおそれがあります。UV 保護メガネを着用します。	<b>紫外光危険:</b> 不要直视紫外 (UV) 光或者紫外光源。直视可能导致眼睛伤害。佩戴紫外线防护眼镜。
	<b>Sharp object:</b> Avoid physical contact with the object.	<b>鋭利な物体:</b> 物体との身体的接触を避けてください。	<b>鋒利物体:</b> 避免直接接触锋利的物体。
	<b>Pinch point:</b> Keep hands away from this area.	<b>ピンチポイント:</b> この部分には手を挟まれないようにしてください。	<b>夹点:</b> 勿将手放在此部位。
	<b>Heavy objects:</b> Never lift or move the instrument by yourself; you can suffer personal injury or damage the equipment. For specific lifting instructions, refer to the instrument manual.	<b>重量物:</b> 1人で機器を持ち上げたり移動しないでください。身体傷害を負ったり、機器を損傷するおそれがあります。具体的な持ち上げ方法については、機器のマニュアルを参照してください。	<b>重物:</b> 切勿独自提起或移动本仪器；可能遭受人身伤害或损坏仪器。有关具体的提起说明，参阅仪器手册。
	<b>Trip obstacle:</b> Be aware of cords, hoses, or other objects located on the floor.	<b>作業の障害物:</b> 床にあるコード、ホース、その他の物体に注意してください。	<b>绊倒危険:</b> 注意地面上的线、管或其他物品。
	When the safety of a procedure is questionable, contact Technical Support for Thermo Scientific San Jose products.	手順の安全性にご不明な点がある場合は、Thermo Scientific San Jose 製品のテクニカルサポートまでお問い合わせください。	如对安全程序有疑问，联系 Thermo Scientific San Jose 产品的技术支持中心。

# Contents

	<b>Preface</b> .....	<b>xvii</b>
	Related Documentation .....	xvii
	Safety and Special Notices .....	xviii
	Contacting Us .....	xx
<b>Chapter 1</b>	<b>Introduction</b> .....	<b>1</b>
	Hardware Components .....	2
	Autosampler .....	2
	Solvent System Components Behind the Right Side Panel .....	4
	Computer and Autosampler Behind the Left Side Panel .....	15
	Back Panel .....	16
	Touch-Screen Application .....	18
	Description of the Touch-Screen Monitor .....	18
	Logging In to the EASY-nLC Instrument for Maintenance Tasks .....	21
	Closing Down the EASY-nLC Instrument .....	22
	Specifications .....	23
	Performance Specifications .....	23
	Technical Specifications .....	24
<b>Chapter 2</b>	<b>Maintenance Schedule</b> .....	<b>27</b>
	Daily Maintenance .....	27
	Weekly Maintenance .....	28
	Quarterly Maintenance .....	28
	Half-yearly Maintenance .....	29
	Yearly Maintenance .....	30
	Field Service Repairs .....	30

<b>Chapter 3</b>	<b>Maintenance Scripts and Service Records</b> . . . . .	<b>31</b>
	Maintenance Scripts . . . . .	31
	Purge Solvent . . . . .	32
	Flush Air . . . . .	33
	Precolumn Equilibration . . . . .	34
	Analytical Column Equilibration . . . . .	36
	Isocratic Flow . . . . .	38
	Column Conditioning . . . . .	39
	MS Connection . . . . .	39
	Sample Pickup . . . . .	42
	Leaks . . . . .	44
	Pump Torque . . . . .	47
	Back Pressure . . . . .	47
	Autosampler Torque . . . . .	48
	Recording . . . . .	49
	Constant Pressure . . . . .	50
	Constant Flow . . . . .	51
	Flow Sensors . . . . .	52
	Reset Pressure Sensor . . . . .	54
	Direct Infusion . . . . .	55
	Keeping Service Records . . . . .	57
	Checking and Resetting the Device Usage Counters . . . . .	59
<b>Chapter 4</b>	<b>System Modifications</b> . . . . .	<b>61</b>
	Ordering the UHPLC Liquid Junction Kit . . . . .	61
	Installing the Modified Column Out and Waste In Lines . . . . .	62
<b>Chapter 5</b>	<b>Routine Maintenance</b> . . . . .	<b>65</b>
	Maintaining a Clean Working Environment . . . . .	66
	Using Only UHPLC/MS-Grade Solvents . . . . .	66
	Refreshing solvents . . . . .	66
	Re-calibrating Flow Sensors . . . . .	67
	Replacing the Main Power Fuse . . . . .	68
	Maintaining the Syringe Pumps . . . . .	70
	Retracting the Piston . . . . .	72
	Replacing the Piston Seal . . . . .	73
	Priming the Pump . . . . .	78
	Resetting the Pump Usage Counter . . . . .	80
	Removing Air After Replacing a Piston Seal or a Pump . . . . .	81
	Running the Leaks Script after Replacing a Piston Seal or a Pump . . . . .	81
	Replacing the Check Valves . . . . .	82
	Replacing Viper/nanoViper solvent lines . . . . .	83
	Replacing the Autosampler Needle . . . . .	85
	Replacing the Sample Loop . . . . .	88
	Replacing a Pressure Sensor . . . . .	89

	Replacing a Flow Sensor . . . . .	92
	Replacing the Hard Drive . . . . .	95
	Managing the Devices List. . . . .	99
<b>Chapter 6</b>	<b>Field Service Maintenance . . . . .</b>	<b>101</b>
	Replacing the Built-In Computer . . . . .	101
	Replacing the Monitor . . . . .	105
	Replacing the Autosampler . . . . .	109
	Replacing the Autosampler Cooler . . . . .	115
	Replacing the ASC cooler . . . . .	115
	Replacing a Rotary Valve. . . . .	118
	Replacing a Pump . . . . .	121
	Replacing a Pump . . . . .	121
	Replacing a Pump PCB. . . . .	124
<b>Chapter 7</b>	<b>Troubleshooting. . . . .</b>	<b>129</b>
	Troubleshooting Tips . . . . .	130
	Autosampler Problems. . . . .	131
	Contact Closure Problems. . . . .	132
	Instrument Startup Problems. . . . .	132
	Trapped Air. . . . .	133
	Delayed Elution. . . . .	133
	Excessive Duration or Higher Pressure for the Column Equilibration and Sample Loading Steps . . . . .	139
	System Reaches Its Maximum Pressure During the Gradient. . . . .	141
	Sample Signal Weak or Absent . . . . .	144
	Slow or No Pressure Increase in Subsystem A or B . . . . .	148
	Errors Reported by the Xcalibur Data System . . . . .	151
	Carryover . . . . .	155
	Spray Issues . . . . .	157
	Chromatographic Performance . . . . .	158
	Device Failures . . . . .	159
	Miscellaneous . . . . .	163
	Using the Direct Controls for Troubleshooting and Maintenance. . . . .	165
	Using the Valve Controls. . . . .	165
	Using the Pump Controls . . . . .	166
	Using the Autosampler Controls . . . . .	172
	Troubleshooting a Pump That Fails the Flush Air Script. . . . .	174
	Troubleshooting a Pump That Fails the Leaks Script. . . . .	177
	Running a System Leak Test . . . . .	178

Troubleshooting the Results of the System Leak Test . . . . .	183
Checking Valve S for Leaks . . . . .	184
Checking the Sample Loop Connections for Leaks . . . . .	184
Locating Leaks in the Solvent Path from Valve B to Flow Sensor B. . . . .	184
Locating Leaks in the Solvent Path from Pump A to Flow Sensor A. . . . .	186
Locating Leaks In or Between Valve S and Valve W . . . . .	188
Locating Leaks Between the Flow Sensors and Valve S . . . . .	196
Identifying a Leaking Check Valve . . . . .	207
Troubleshooting a System Blockage . . . . .	208
Running the Back Pressure Test for the A and B Solvent Paths . . . . .	209
Troubleshooting a System Blockage when Test Solvent A Fails . . . . .	210
Troubleshooting a System Blockage when Test Solvent B Fails . . . . .	216
Troubleshooting the Autosampler Aspiration . . . . .	220
Checking Sample Pickup. . . . .	222
Troubleshooting Communication Problems . . . . .	223
Network Access . . . . .	223
Network Connection Failures . . . . .	223
Testing the Network Connection to the EASY-nLC Computer. . . . .	225
Verifying that the LC/MS System Is Properly Grounded. . . . .	227
<b>Chapter 8 Calibrating the Autosampler’s XYZ Robot . . . . .</b>	<b>229</b>
Replacing the Autosampler Adapter Plate . . . . .	229
Replacing the Adapter Plate in the ASC Model Autosampler. . . . .	230
Managing Plate Formats . . . . .	231
Selecting a Plate Format . . . . .	231
Creating a New Plate Format . . . . .	232
Deleting a Plate Format. . . . .	234
Preparing the Autosampler for the Calibration Routines . . . . .	235
Calibrating Plates . . . . .	236
Calibrating the Wash Bottle and Extra Vial Positions . . . . .	241
<b>Chapter 9 Remote Support . . . . .</b>	<b>243</b>
Connecting the EASY-nLC Instrument to the Support Server. . . . .	244
Saving System Files on a USB Removable Storage Device . . . . .	250
Downloading the Latest Firmware File . . . . .	252
<b>Chapter 10 Returning the EASY-nLC Instrument . . . . .</b>	<b>255</b>
Transport Instructions. . . . .	255
<b>Appendix A Error Codes . . . . .</b>	<b>257</b>
<b>Appendix B Mobile Phase Viscosity . . . . .</b>	<b>265</b>
<b>Appendix C Consumables and Replacement Parts . . . . .</b>	<b>267</b>
Ordering Information . . . . .	267

Solvent System Schematic for the EASY-nLC 1200 Instrument . . . . . 268

Common Replacement Parts . . . . . 270

    Common Replacement Parts for the EASY-nLC 1200 Instrument . . . . . 270

**Appendix D Quick Reference Guides for Routine Maintenance . . . . .271**

    Using nanoViper Fittings Quick Reference Guide . . . . . 273

        Connecting nanoViper Fittings . . . . . 273

        nanoViper Tubing Connections . . . . . 274

        Returning the System to Atmospheric Pressure . . . . . 276

    Maintaining the Pump Quick Reference Guide . . . . . 279

    Replacing a Damaged Autosampler Needle . . . . . 283

**Index . . . . .285**

## Contents



## Preface

This guide describes the maintenance and troubleshooting procedures required to maintain the EASY-nLC™ instrument in optimal working condition.

The hardware maintenance procedures are divided into two chapters: Routine Maintenance and Advanced Maintenance. The Routine Maintenance chapter contains common maintenance procedures that you can perform to keep the EASY-nLC instrument in optimal working condition. The Advanced Maintenance chapter contains hardware repair procedures that can only be performed by a Thermo Fisher Scientific field service engineer or a skilled technician with equivalent training.

For information about setting up the EASY-nLC instrument and running chromatographic separations, refer to the *EASY-nLC 1200 Getting Started Guide*.

### Contents

- [Related Documentation](#)
- [Safety and Special Notices](#)
- [Contacting Us](#)

### ❖ To suggest changes to the documentation or to the Help

Fill out a reader survey online at [www.surveymonkey.com/s/PQM6P62](http://www.surveymonkey.com/s/PQM6P62).  
Thank you in advance for your help.

## Related Documentation

In addition to this guide, Thermo Fisher Scientific provides the following documents for the EASY-nLC instrument as PDF files:

- *EASY-nLC 1200 User Guide for the Xcalibur Data System*
- *EASY-nLC 1200 Preinstallation Requirements Guide*
- *EASY-nLC 1200 Getting Started Guide*
- *Safety and Regulatory Guide*

The EASY-nLC instrument also ships with a printed copy of the *Safety and Regulatory Guide*. This guide contains important safety information about Thermo Scientific™ liquid chromatography (LC) and mass spectrometry (MS) systems. Make sure that all lab personnel have read and have access to this document.

You can find the EASY-nLC Series manuals in the following locations:

- The USB flash drive provided in the EASY-nLC accessory kit
- The data system computer

❖ **To view the product manuals on the data system computer**

Choose **Start > All Programs > Thermo Instruments > Manuals > LC Devices > Thermo**.

❖ **To view the EASY-nLC Help**

- From the EASY-nLC view of the Instrument Setup window, choose **Help > Thermo EASY-nLC Help** to open the Help to the Welcome topic.
- To view the Help topic for the current view, page, or dialog box, press the F1 key for information about setting parameters. Or, from the EASY-nLC view of the Instrument Setup window, choose **Help > Help On Current Item**.

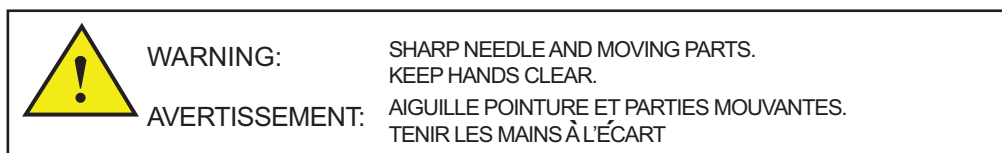
## Safety and Special Notices

Make sure to follow the safety practices presented in this guide, and observe the safety and special notices that appear in boxes.

Observe all written safety precautions during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument and might result in injury or loss of life.

The following two stickers appear on the EASY-nLC instrument:

This sticker warns you that the instrument includes a sharp needle and moving parts that are accessible to the operator. To prevent personal injury or damage to parts of the EASY-nLC instrument, take care when loading samples into the instrument's tray compartment.



This sticker alerts you to consult this manual for instructions on how to operate the instrument.



This guide includes the following cautions and special notices.



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



**CAUTION** Highlights electrical hazards to humans or property.



**CAUTION** Highlights a sharp object hazard to humans.



**CAUTION** Highlights an eye hazard to humans.



**CAUTION** Highlights a chemical hazard to humans, property, or the environment.



**CAUTION** Highlights lifting hazards.

**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** Highlights helpful information that can make a task easier.

**IMPORTANT** General Residual Hazards






**WARNING—Biohazard** Human-sourced material, for example microorganisms, cell cultures, tissues, body fluids, and other biological agents can transmit infectious diseases. To avoid infections with these agents:

- Assume that all biological substances are at least potentially infectious.
- Wear personal protective equipment as required by the hazard and follow good laboratory practice.
- Dispose of bio-hazardous waste in an environmentally safe manner that is consistent with local regulations. Follow a regulated, approved waste disposal program.

**IMPORTANT** Operate the instrument with closed side panels only.

## Contacting Us

There are several ways to contact Thermo Fisher Scientific for the information you need. You can use your smartphone to scan a QR code, which opens your email application or browser.

Contact us	Customer Service and Sales	Technical Support
	(U.S.) 1 (800) 532-4752	(U.S.) 1 (800) 532-4752
	(U.S.) 1 (561) 688-8731	(U.S.) 1 (561) 688-8736
	<a href="mailto:us.customer-support.analyze@thermofisher.com">us.customer-support.analyze@thermofisher.com</a> 	<a href="mailto:us.techsupport.analyze@thermofisher.com">us.techsupport.analyze@thermofisher.com</a> 

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2. Click **Contact Us**, select the **Using/Serviceing a Product** option, and then type the product name.
3. Use the phone number, email address, or online form.

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- Complete a survey at [www.surveymonkey.com/s/PQM6P62](http://www.surveymonkey.com/s/PQM6P62).

❖ **To order consumable and spare parts for the EASY-nLC instrument**

For the EASY-nLC 1200 instrument, go to

<https://www.thermofisher.com/order/catalog/product/LC140>



# Introduction

The EASY-nLC instrument (see [Figure 1](#)) consists of a high-pressure dual pump chromatography system that provides split-free flows down to the low nanoLiter/min range, an automated sampling system, and a built-in computer with a touch-screen interface for instrument control and troubleshooting. The automated sampling system includes a tray compartment that can hold standard sample vials and microtiter plates, an XYZ robot that moves to the sample location, and a syringe pump that draws only the user-specified sample volume.

The EASY-nLC 1200 instrument operates in the ultra-high-performance pressure range of 0 to 1200 bar.

**Figure 1.** EASY-nLC 1200



To familiarize yourself with the EASY-nLC instrument and its touch-screen application, review these sections:

## Contents

- [Hardware Components](#)
- [Touch-Screen Application](#)
- [Specifications](#)

## Hardware Components

These sections describe the hardware components of the EASY-nLC instrument:

- [Autosampler](#)
- [Solvent System Components Behind the Right Side Panel](#)
- [Computer and Autosampler Behind the Left Side Panel](#)
- [Back Panel](#)

### Autosampler

The autosampler module of the EASY-nLC instrument is located behind the tray compartment door. You can open the tray compartment door by using the touch-screen controls.

The standard installed adapter plate works with HPLC vials and MTP, either 96 or 384 well. The additional adapter plate in the Accessory Box also supports MTP and in addition holds PCR tubes.

The robotic unit moves the  $z$ -axis needle holder along the  $x$  and  $y$  axes to the user-specified sample location during a run. When the autosampler needle reaches the sample location, it descends into the sample vial or microplate well.

The autosampler needle draws solvent from wash bottle W3 to perform a standard wash and ejects the solvent into wash bottle W4, which contains the needle wash insert. The autosampler can also perform a custom wash using the solvents from wash bottles W1–W3.

The waste beaker to the right of the tray compartment collects solvent that is delivered by pumps A and B when these pumps empty solvent to waste. This waste beaker also collects solvent delivered by pump A during the precolumn equilibration and sample loading steps (for a two-column setup).



Figure 2 shows the ASC autosampler model that is installed in the EASY-nLC 1200 instrument.

**Figure 2.** ASC autosampler model

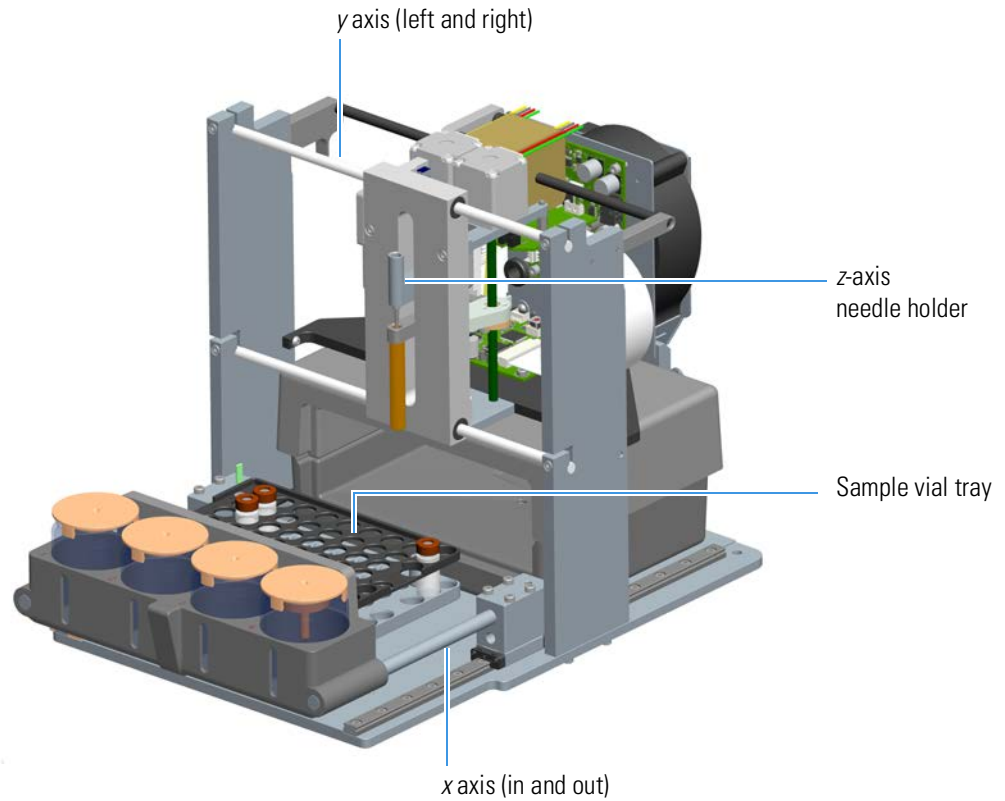
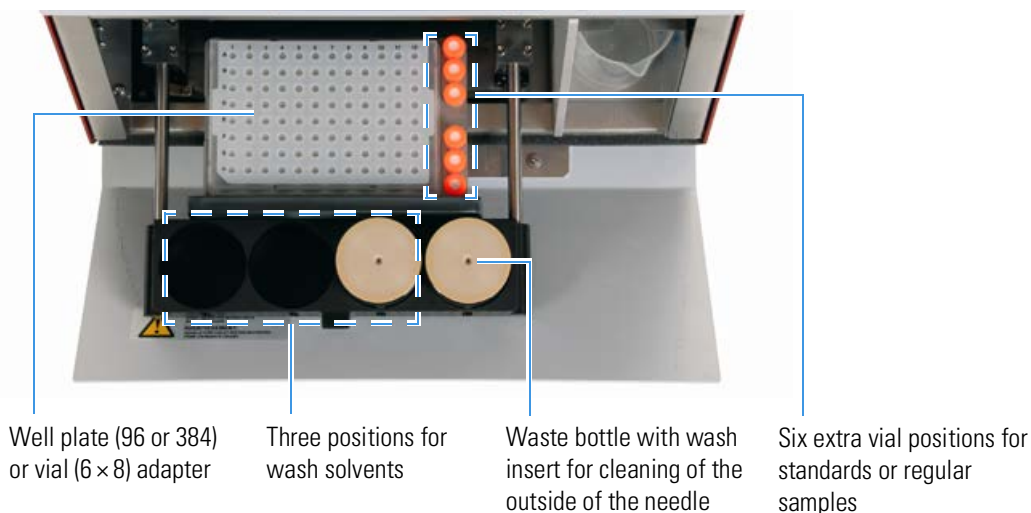


Figure 3 shows the tray compartment for the ASC autosampler as viewed from above when the tray compartment door is open. The tray compartment of the ASC autosampler model holds a vial adapter or a well plate adapter, six additional vials, three wash solvent bottles, and a wash bottle with a wash insert for cleaning the autosampler needle. The installed adapter supports both 96 and 384 well MTB, or 48 standard HPLC vials, plus 6 additional HPLC vials for blanks, standards or QC samples.

**Figure 3.** Tray compartment for the ASC autosampler model (viewed from above)



## Solvent System Components Behind the Right Side Panel

The EASY-nLC solvent delivery system is located behind the right side panel and consists of three syringe pumps, three pressure sensors, two flow sensors, four rotary valves, four check valves (two for each assembly), and a mixing Tee.

**Note** Two of the syringe pumps (pumps A and B) produce the binary mobile phase and the third syringe pump (pump S) draws the sample into the sample loop that is attached to one of the rotary valves (valve S).

**Note** Acetonitrile concentrations greater than 95% reduce the lifetime of system components. A concentration of 80% acetonitrile in water is recommended for solvent B

These sections describe the hardware components behind the right side panel:

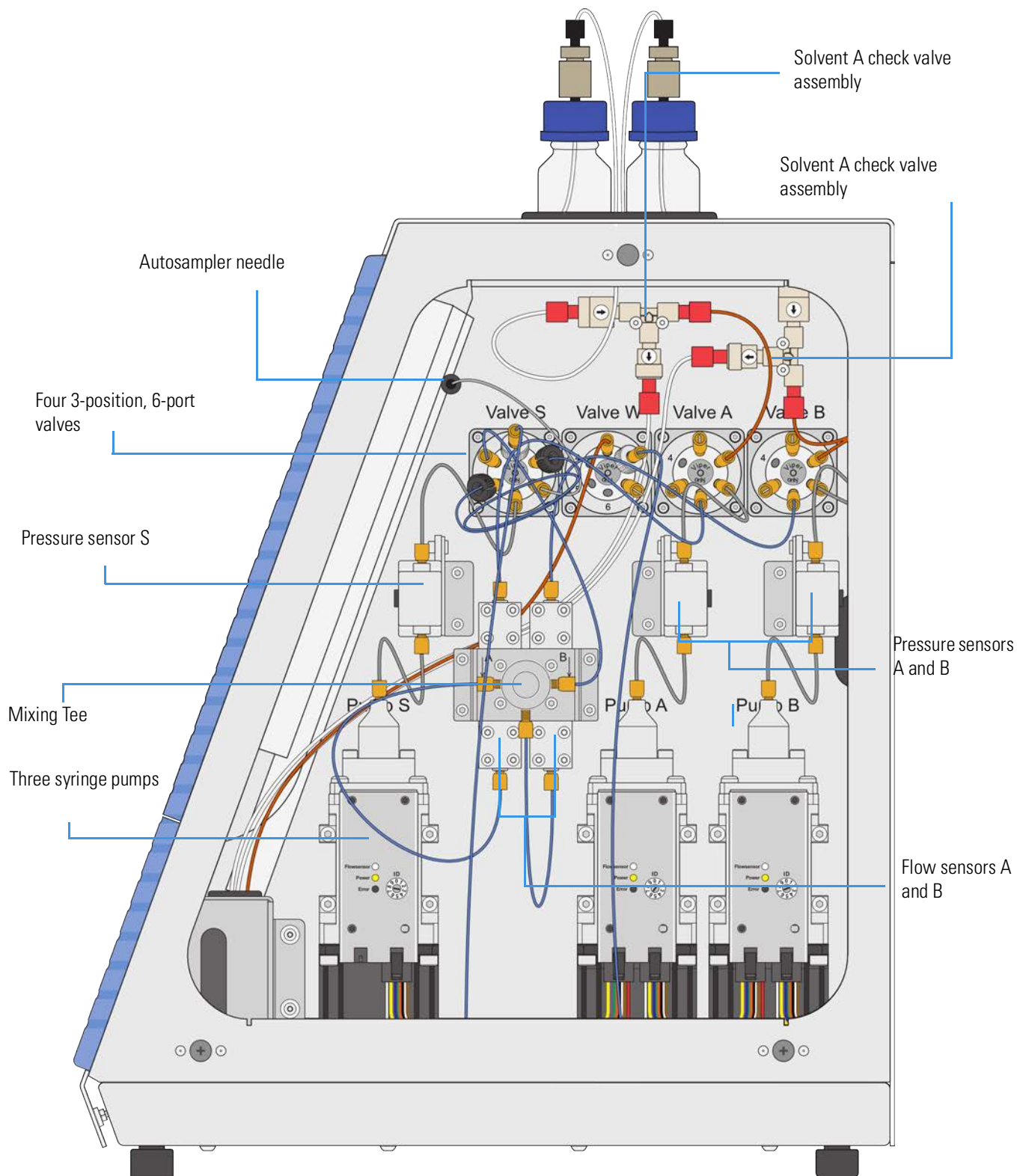
- [View Behind the Right Side Panel](#)
- [Syringe Pumps](#)
- [Pressure Sensors](#)
- [Flow Sensors](#)
- [Check Valve Assemblies](#)
- [Six-Port Rotary Valve Pods](#)
- [Autosampler Needle](#)

### **View Behind the Right Side Panel**

You can access the solvent system components by removing the instrument's right side panel, which is secured to the housing with three captive quarter-turn screws.

[Figure 4](#) shows the solvent system components for the EASY-nLC 1200 instrument.

Figure 4. Solvent system components behind the right panel of the EASY-nLC 1200 instrument



## Syringe Pumps

The EASY-nLC instrument contains three syringe pumps. The binary liquid chromatography system consists of two high-pressure pumps: pumps A and B. The automated sampling system uses syringe pump S to aspirate samples from a sample vial or well and transfer it into the sample loop attached to valve S.

Figure 5 shows the EASY-nLC syringe pump components.

Each syringe pump consists of these primary components: a stepper motor, a pump body, a pump head, a piston, a piston seal, and a backup ring. The PLU model also has an LED panel and a pump printed circuit board (PCB) cover. The piston seal is the only user-replaceable component.

The pump head holds up to 140  $\mu\text{L}$  of solvent. The backward movement of the piston draws solvent into the pump head and the forward movement of the piston pushes solvent into the attached high-pressure solvent line. The stepper motor controls the forward and backward movement of the piston within the pump head. The pump body provides piston alignment.

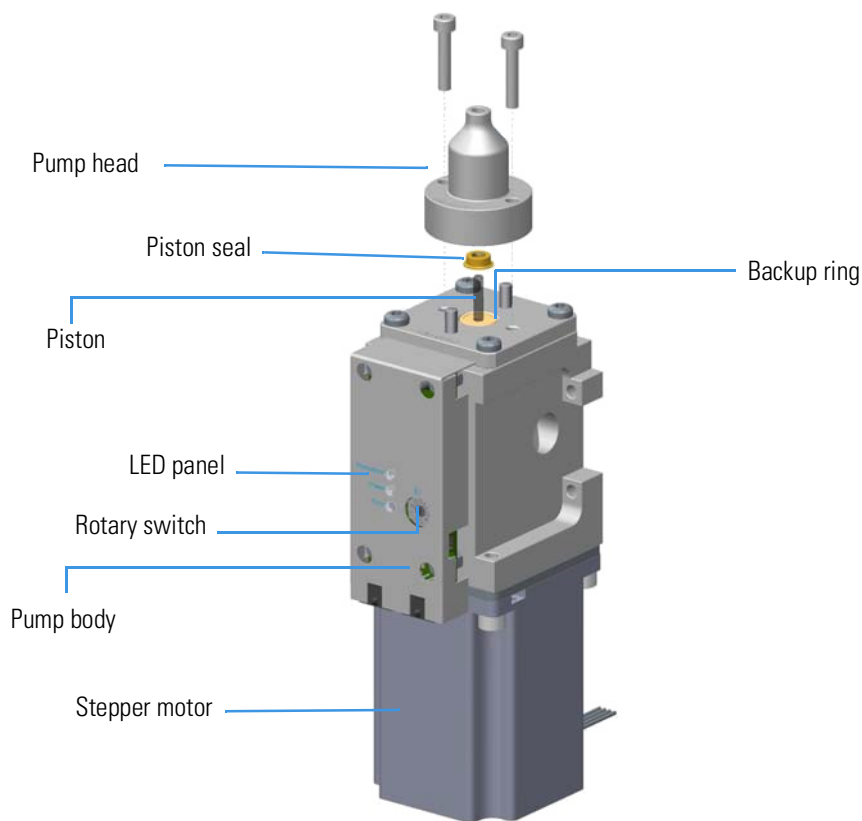
The piston seal allows the piston to move freely within the pump head. The piston seal is made of an extremely strong thermoplastic. The seal for the EASY-nLC 1200 pumps contains a wire spring that forces the inside flange of the seal against the piston to prevent leaks. The seals are not leak proof. In fact, wetting the surface of the pistons requires a small quantity of liquid, which acts as a lubricant to reduce wear on the piston seal. Through continued use and over time, the seal degrades and must be replaced. Allowing the pump to run dry and neglecting to rinse the pump head assemblies after pumping buffered eluents shorten the lifespan of the seals.

The backup ring holds the piston seal in place. It also provides better alignment of the piston.

**IMPORTANT** The EASY-nLC 1200 (LC140) is not compatible with pumps of earlier EASY-nLC systems (EASY-nLC II and EASY-nLC 1000) and vice versa.

**Figure 5.** Syringe pump components (showing the pump head removed from the pump body)

**EASY-nLC 1200 syringe pump (PLU model)**



The syringe pumps perform these functions:

Component	Function
Pumps A and B	Draw solvent from the solvent bottles on top of the instrument, empty solvent to the waste beaker, and deliver solvent to the mixing Tee.
Pump S	Draws solvent from the W3 bottle, draws sample from the specified sample location into the autosampler needle, and empties solvent to the W4 bottle in the autosampler tray compartment.

For maintenance purposes, the system tracks the volume pumped by each pump (see “[Checking and Resetting the Device Usage Counters](#)” on [page 59](#)).

The LED panels for the pump module installed in the EASY-nLC 1200 instrument provide the following status informations.

LED	States
Flow sensor for Pumps A and B	Illuminates blue—the instrument is turned on and the flow sensor is connected to the pump. Not illuminated—the instrument is not turned on or the flow sensor is not connected to the pump.
Power	Illuminates yellow—The instrument power is turned on. Not illuminated—The instrument power is turned off.
Error	Illuminates red—A pump error has occurred. Not illuminated—The pump is operating properly.

## Pressure Sensors

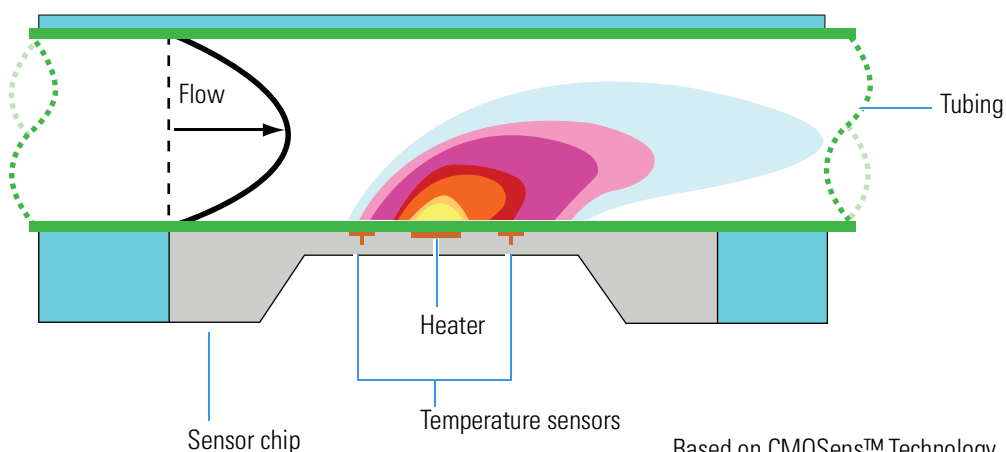
Pumps A, B and S each have a individual pressure sensor connected to them. The pressure sensors are located between the pump and its associated rotary valve

Using the strain gauge principle to measure pressure accurately, the pressure sensors are flow-through, zero dead volume devices with a wetted path that contains 1  $\mu\text{L}$  of swept volume. The pressure sensors for the EASY-nLC 1200 instrument have an operating range of 0 to 20 000 psi (1379 bar).

## Flow Sensors

The two flow sensors provide feedback control for pumps A and B. The flow sensors are liquid mass flow meters with a CMOSens™ patented technology. Each flow meter consists of a length of fused silica capillary, a sensor chip, a heating resistor, and two temperature sensors (see Figure 6).

**Figure 6.** Flow sensor schematic



Based on CMOSens™ Technology  
Principle patented: US Pat. 6 813 944

**IMPORTANT** EASY-nLC 1200 flow sensors are compatible with EASY-nLC 1000. EASY-nLC 1000 flow sensors are not compatible with EASY-nLC 1200.

Only flow sensors whose serial number is larger than 1528-XXXXXX can be used on EASY-nLC 1200 systems (software plausibility check).

The flow sensors determine the flow rate of solvents passing through the system by measuring the heat transfer through the fused silica capillary. Outside the capillary, a heating resistor on a thermally optimized membrane is maintained above ambient temperature. When liquid flows through the capillary, the temperature distribution upstream and downstream of the heating resistor is disturbed. The two temperature sensors measure this temperature asymmetry.

Because the temperature distribution depends on both the solvent flow rate and the solvent mixture, you must recalibrate the flow sensors whenever the composition of solvents A or B is changed. For example, if you use methanol instead of acetonitrile or change the acetonitrile concentration for the solvent B mixture, run the script “Flow Sensors” on page 52.

**CAUTION** Solvent B acetonitrile concentration >95% can damage the instrument!

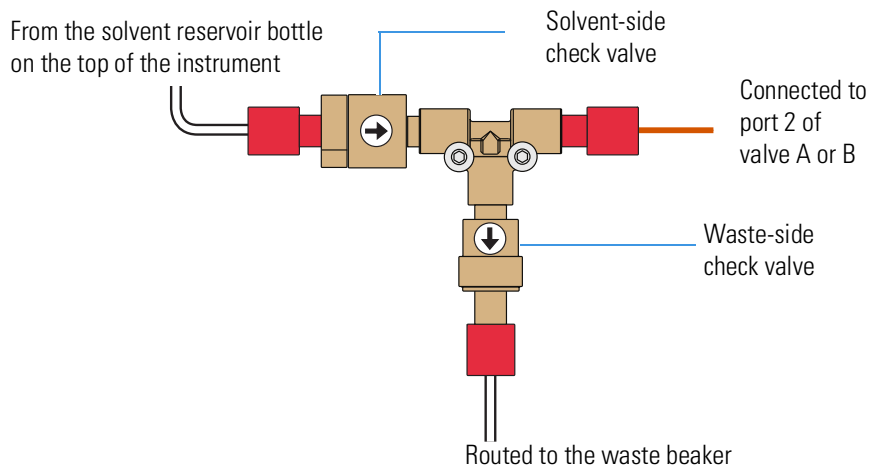
The EASY-nLC 1200 instrument uses two flow sensors with a maximum measuring range of 4.5  $\mu\text{L}/\text{min}$ .

## Check Valve Assemblies

When the corresponding high-pressure (6-port rotary) valves for pumps A or B are in position 1–2, the check valves perform these functions:

- The solvent-side check valve prevents backflow into the associated solvent inlet line when the associated pump is emptying solvent to the waste beaker.
- The waste-side check valve prevents backflow from the waste beaker when the associated pump is filling and drawing solvent from the associated solvent bottle.

**Figure 7.** Check valve connections



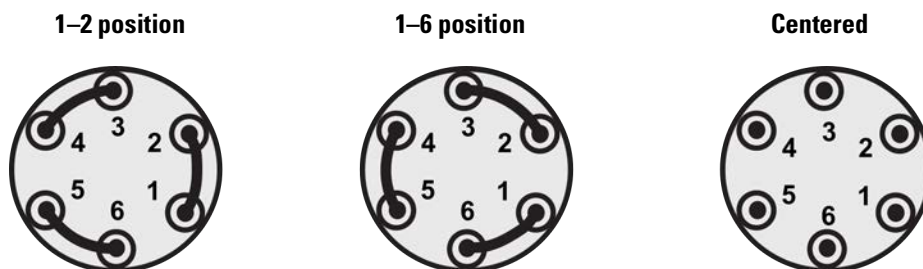


The check valves are replaceable. For more information about determining if the check valves are leaking, see “Identifying a Leaking Check Valve” on page 207.

## Six-Port Rotary Valve Pods

The six-port valves can be in three different positions: 1–2 position, 1–6 position, and centered (see Figure 8).

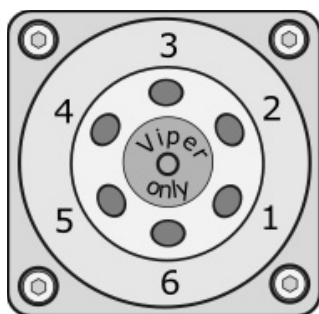
**Figure 8.** Valve positions



For maintenance purposes, the system tracks the number of valve shifts for each valve (see “Checking and Resetting the Device Usage Counters” on page 59)

**Note** Please note the numbering of the valve ports as depicted in Figure 9 (clockwise numbering with valve port 1 in 4 o'clock position). Due to operational reasons, the graphical representation in this guide or in the instrument’s built-in software may show the valves in a different orientation. Please use only the port numbers for identification of port positions.

**Figure 9.** Valve orientation



Depending on the valve position, the valves perform the functions listed in Table 1.

**Note** The EASY-nLC solvent system contains three subsystems, one for each pump. A subsystem includes the pump, the pressure sensor, the solvent lines to and from the pressure sensor, and the rotary valve.

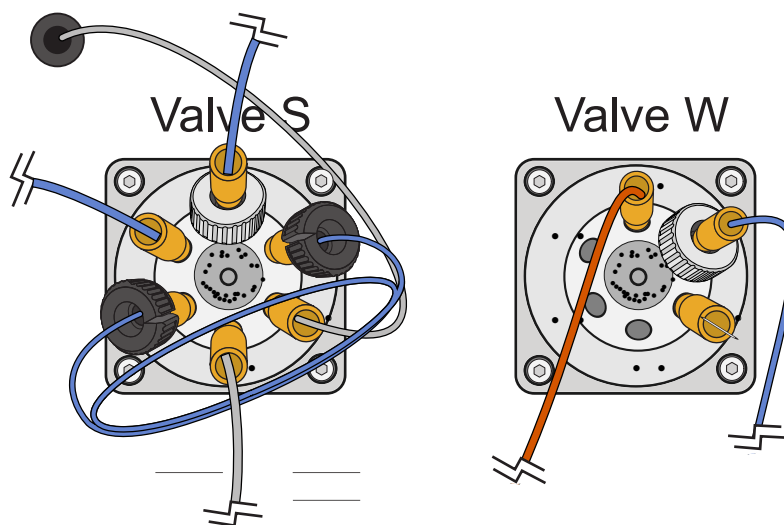
**Table 1.** Valve functions

Valve	Function
Valves A and B	Direct the solvent flow from syringe pump A and B, respectively.
	1–2 position Directs the solvent flow toward the check valve. When the valve is in the 1–2 position, the pump draws solvent from the solvent bottle on top of the instrument or empties solvent to the waste beaker.
	1–6 position Directs the solvent flow toward the mixing Tee.
	Centered <ul style="list-style-type: none"> <li>Prevents backflow into the solvent line upstream of the mixing Tee.</li> <li>Allows the backpressure for the solvent A and B lines to equalize before the gradient step of a sample run.</li> <li>Enables pump B to pre-pressurise in the Prepare gradient step.</li> <li>Provides backpressure for several maintenance scripts.</li> </ul>
Valve S	Directs the solvent flow from syringe pump S and the solvent flow from the mixing Tee.
	1–2 position The solvent flow bypasses the sample loop.
	1–6 position The solvent flow passes through the sample loop.
	Centered <ul style="list-style-type: none"> <li>Provides backpressure for the Flush Air script for pump S.</li> <li>Provides backpressure for the system leak test.</li> <li>Shuts off the flow to the Column Out line and provides backpressure during the Flow Sensor Calibration script.</li> </ul>
Valve W	Directs the solvent flow through the venting Tee to the waste beaker or provides pressure venting to the system.
	1–2 position Provides backpressure to direct flow towards the analytical column (blind nut in port 2).
	1–6 position Directs the solvent flow from the venting Tee to the waste beaker.
	Centered Blocks the solvent flow through the valve to the waste beaker.

The EASY-nLC is designed as a front end system for mass spectrometers. In this configuration, electrical currents leakages, originating from the MS high voltage, can flow towards the EASY-nLC

To protect valves W and S from these electrical currents, grounding adapters are mounted on ports 3 of valve S and port 2 of valve W. The adapters have NO influence on the chromatography or the MS performance.

**Figure 10.**



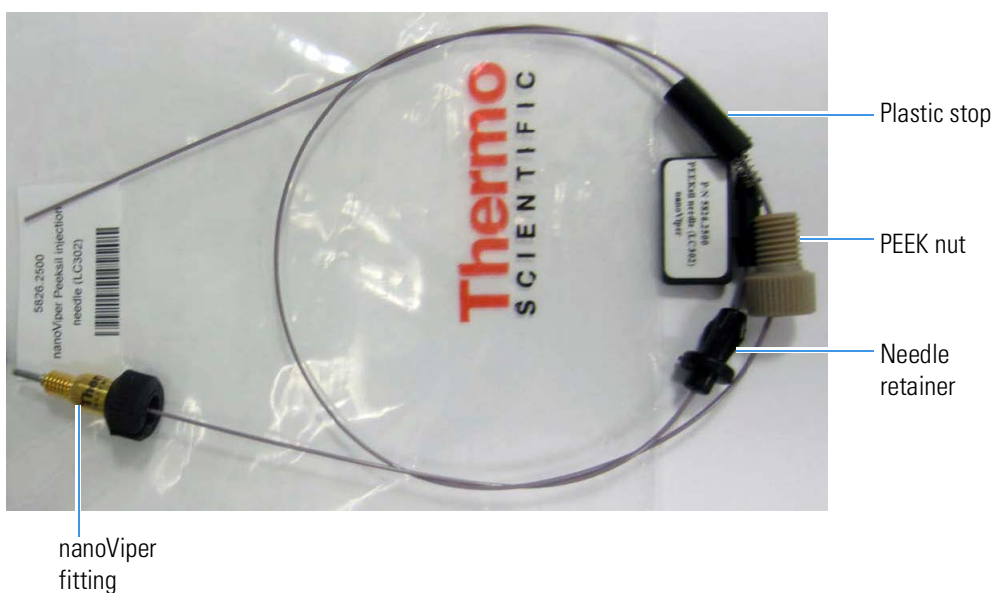
**IMPORTANT** Removal of the grounding adapter from valve S (port 3) and Valve W (port 2) will lead to irreparable damage to the valves!

## Autosampler Needle

During a sample run, the autosampler needle descends into the selected sample vial or well, and then pump S aspirates the sample into the needle tubing. The autosampler needle is a user-replaceable part. For information about replacing the autosampler needle, see [“Replacing the Autosampler Needle”](#) on page 85.

The autosampler needle is a length of tubing with a nanoViper fitting at one end and a PEEK™ nut and plastic stop at the other end (Figure 11). The needle retainer fits into a slot in the panel between the solvent system compartment and the tray compartment and properly positions the needle tubing. The nanoViper fitting connects to port 1 of valve S.

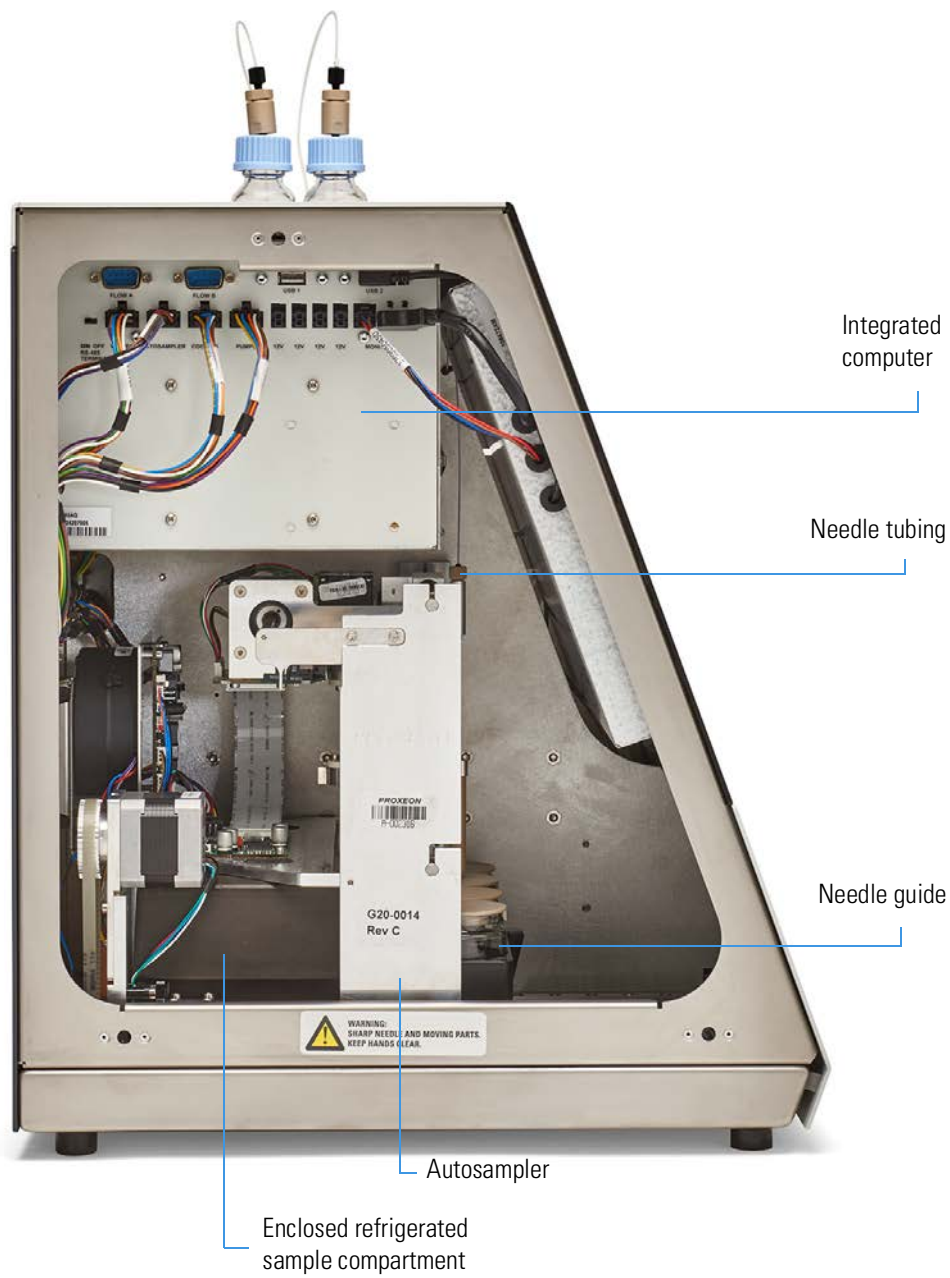
**Figure 11.** Autosampler needle for the ASC autosampler



## Computer and Autosampler Behind the Left Side Panel

You can access the integrated computer and the autosampler needle fitting that connects to the needle guide by removing the left side panel of the instrument (see [Figure 12](#)). Three captive quarter-turn screws secure the left side panel to the instrument housing.

**Figure 12.** Internal features (behind the left side panel)



## Back Panel

The system communication, contact closure, and power line connections are on the back panel of the instrument.

**Figure 13.** Back panel of the EASY-nLC instrument (with the current computer box)

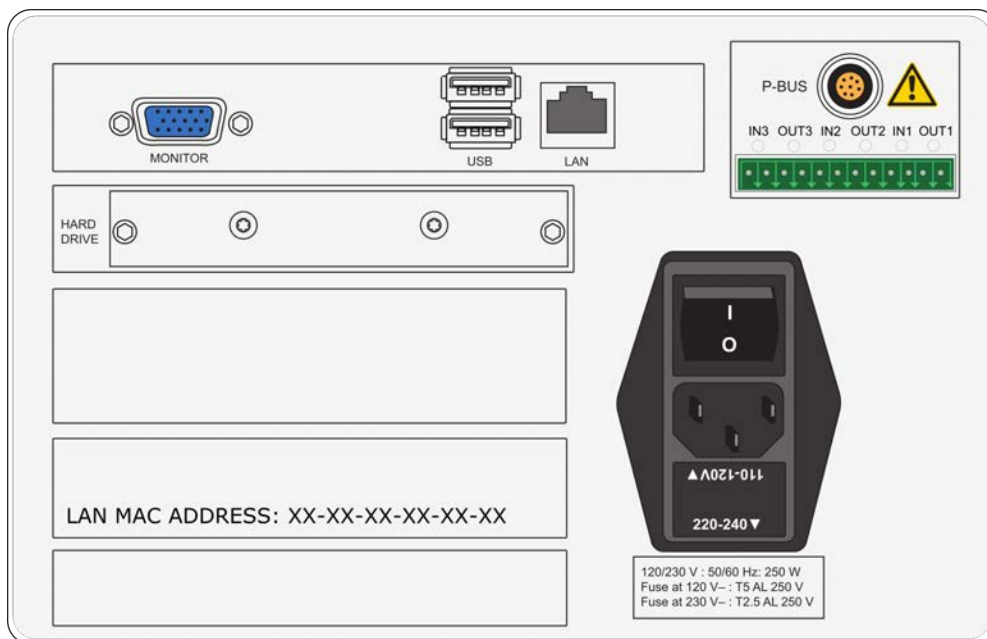


Table 2 lists the function of each back panel element.

**Table 2.** Back panel elements (Sheet 1 of 2)

Element	Description
Monitor	Output for connection of external display
USB	Two ports for keyboard or mouse or removable USB storage device
LAN	For 10/100 MB/sec Ethernet connection
P-BUS	For communication with add-on devices
IN/OUT pins	Contact closure (primarily for communication with the mass spectrometer)

**Table 2.** Back panel elements (Sheet 2 of 2)

<b>Element</b>	<b>Description</b>
I O	Power switch
Fuse holder below I O switch	Replaceable fuse ratings: <ul style="list-style-type: none"> <li>• For 120 V, T 5 AL, 250 V</li> <li>• For 230 V, T 2.5 AL, 250 V</li> </ul>
P/N	Product order code
S/N	Instrument serial number
LAN MAC ADDRESS	MAC address of the embedded computer (Gives the EASY-nLC computer a unique network identifier on your local network.)

## Touch-Screen Application

The EASY-nLC instrument includes an integrated computer with a touchscreen instrument control application that you access from the instrument monitor.

These sections provide an overview of the touch-screen application and describe how to log in to the EASY-nLC instrument as an administrator and how to close down the instrument:

- [Description of the Touch-Screen Monitor](#)
- [Logging In to the EASY-nLC Instrument for Maintenance Tasks](#)
- [Closing Down the EASY-nLC Instrument](#)

### Description of the Touch-Screen Monitor

The instrument monitor is a transparent layer of glass that detects finger pressure (even when the operator is wearing gloves) and sends the corresponding commands to the computer (Figure 14).

**Figure 14.** Touch-screen controls



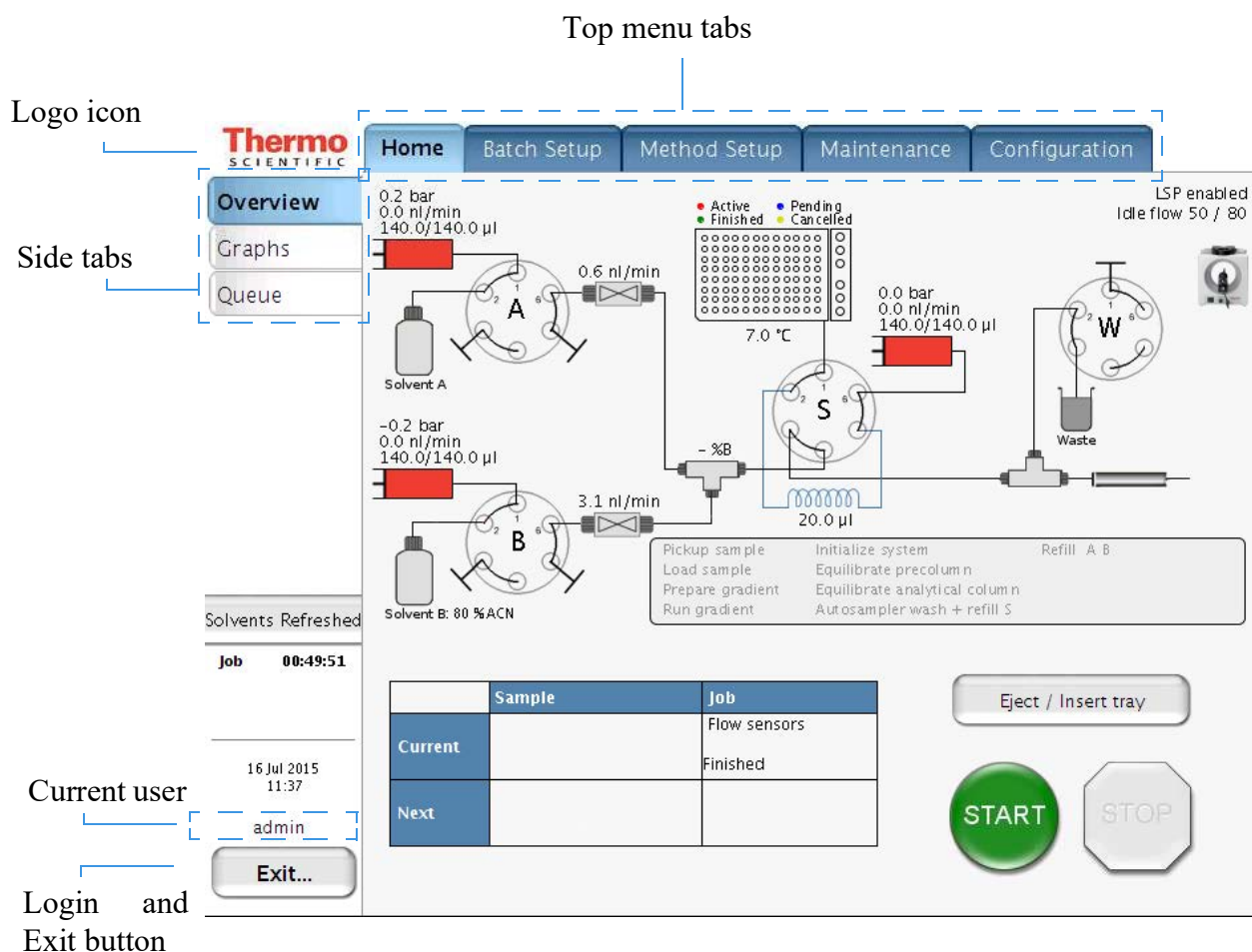


Instrument control from this touch-screen application includes a method wizard that helps you create chromatographic methods, a batch editor that helps you create and run sample batches (injection sequences); maintenance scripts and record keeping features; and direct control of the valves, pumps, XYZ robot, and tray temperature.

**Note** For information about the maintenance scripts and record keeping features, see Chapter 3, “Maintenance Scripts and Service Records.” For information about creating methods and sample batches and running sample batches, refer to the *EASY-nLC 1200 Getting Started Guide* (for the touch-screen application).

The EASY-nLC touch-screen application contains five menu tabs at the top of the touch screen. When you press a tab at the top of the touch screen, a set of side tabs appears on the left side of the touch screen. Figure 15 shows the menu layout for the Home > Overview page.

Figure 15. EASY-nLC touch screen version 4.2 with the menu layout on the Home > Overview page



During a session, the application tracks which page (side tab) you chose inside each menu (top tab) and shows that page when you next choose that menu.

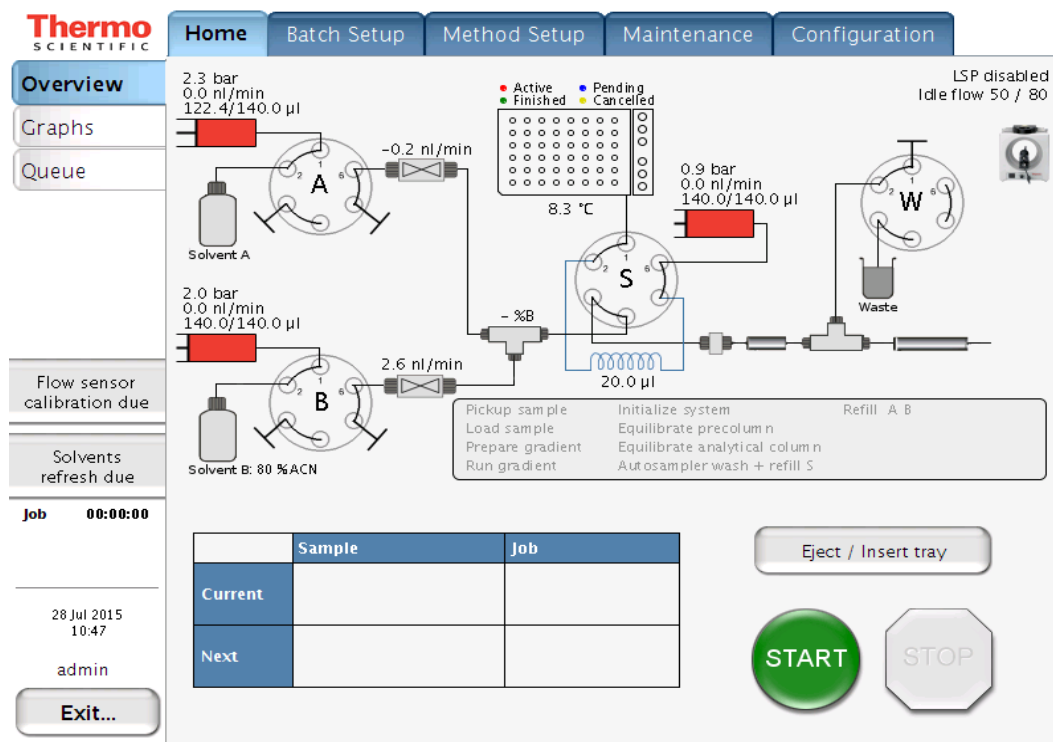
The Thermo Scientific logo icon in the upper left corner, the reminders in the left center and the Logo button in the lower left corner are always available.

To view the version information for the application, press the **Logo** icon.

If a solvent refresh due or a flow sensor calibration due has been raised, the respective reminder is shown on the middle left of the screen.

A click on a reminder links to the required action (Solvent refreshed confirmation or Flow sensor calibration script) to remove the reminder by satisfying the due (Figure 16)

Figure 16.



If no solvent refresh due is raised, a solvent refreshed field is shown instead. There a early solvent refresh can be acknowledged. More on dues in the maintenance schedule chapter.

Certain areas of the Home > Overview page are dynamically linked to sections of the software where you can enter values and perform actions:

- Solvent bottles, ACN concentration and flow sensors are linked to the flow sensor calibration script.
- The top right corner is linked to the Properties page for the EASY-nLC HPLC device.
- The pre-column is linked to the pre-column equilibration script.
- The analytical column is linked to the analytical column equilibration script.

## Logging In to the EASY-nLC Instrument for Maintenance Tasks

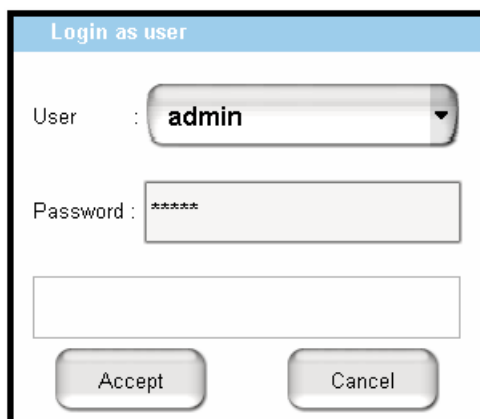
To run the maintenance scripts, use the direct controls, set up the system configuration, and so on, you must log in to the EASY-nLC instrument as an administrator.

### ❖ To log in as a user with administrative privileges

1. Press **Login** in the lower left corner of the touch screen (see [Figure 15](#) on [page 19](#)).

The Login As User dialog box opens (see [Figure 17](#)).

**Figure 17.** Login As User dialog box

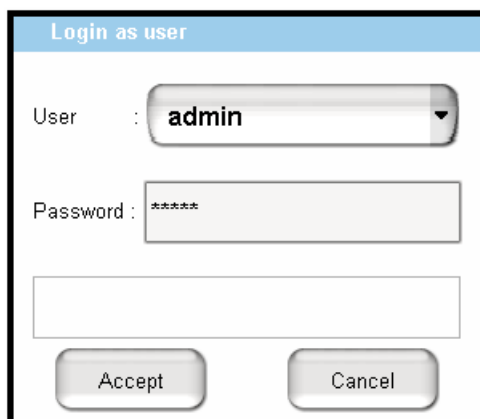


2. In the User list, select a user with administrative rights.
3. In the Password box, enter the password for this user.

**Tip** For changing and resetting the password, refer to the *EASY-nLC 1200 Getting Started Guide*.

4. Press **Accept**.

**Figure 18.** EASY-nLC login dialog box



## Closing Down the EASY-nLC Instrument

Closing down the instrument in a controlled manner is important to allow all of the components to shut down in an orderly sequence. Using this controlled method saves important data so that the instrument starts with the correct information the next time you use it.

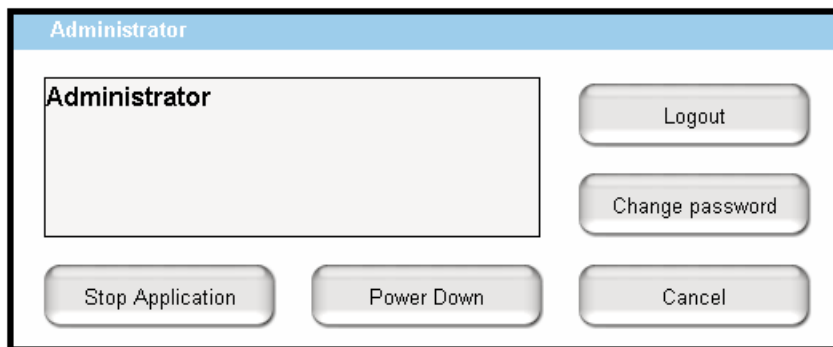
**IMPORTANT** With the exception of an emergency shutdown, closing down the instrument in a controlled manner is important to allow all the components to shut down in an orderly sequence. If you turn off the power switch during normal operation, you risk damaging essential system components. Follow the procedure outlined here whenever possible.

### ❖ To close down the EASY-nLC instrument and turn off the power

1. Press **Exit** (lower-left corner of the screen).

A confirmation dialog box opens (see [Figure 19](#)).

**Figure 19.** Confirmation dialog box that opens after pressing Exit



2. Press **Power Down**.

The EASY-nLC application displays a white screen with a small progress bar. When the progress bar is filled out and the message appears indicating you can safely turn off the instrument, go to the next step.



3. After receiving the message that you can safely turn off the instrument, turn off the power switch on the back panel of the instrument.

## Specifications

These sections describe the performance and technical specifications for the EASY-nLC syringe pumps and autosampler:

- [Performance Specifications](#)
- [Technical Specifications](#)

## Performance Specifications

[Table 3](#) lists the performance specifications for the EASY-nLC 1200 instrument.

**Table 3.** Performance specification (Sheet 1 of 2)

Item	Specification
Flow range (gradient)	20 to 2000 nL/min Recommended: 100 to 1000 nL/min
Flow while loading and equilibrating	Up to 25 $\mu$ L/min
Pressure range	0 to 1200 bar
Retention time reproducibility (RT RSD)	Within the recommended flow range: 0.1 to 0.4% Outside the recommended flow range: typically better than 1%
Peak widths	Typically 3 to 5 seconds full width at half maximum (fwhm), using PepMap™ nano-bore columns as supplied at delivery
Carryover	Typically < 0,05% with Caffeine; < 0,5% with 100 fmol tryptic digest of BSA Conditions: Injection of 100 fmol tryptic digests of BSA on Pepmap columns as supplied at delivery and by using the standard wash procedure for the autosampler
Autosampler sample pickup volume range	0.1 to 18 $\mu$ L with the standard 20 $\mu$ L loop 0.1 to 48 $\mu$ L with a 50 $\mu$ L loop
Injection reproducibility (injection RSD)	0.2% at 5 $\mu$ L pickup 3.0% at 0.1 $\mu$ L pickup
Injection linearity	0.9985 at 0.5 to 10 $\mu$ L injection volume

**Table 3.** Performance specification (Sheet 2 of 2)

Item	Specification
Autosampler	6 × 8 Vials + 6 Vials 1 × 96 well MTP + 6 Vials 1 × 384 well MTP + 6 Vials 2 × 48 PCR strips + 6 Vials 4 × 24 PCR strips + 6 Vials
Autosampler cooling	20 °C below ambient, typical setting: 7 °C (45 °F)
Gradient delay volume (mixing tee to venting tee)	~730nL

## Technical Specifications

These tables list the technical specifications for the EASY-nLC instrument:

- General specifications, [Table 4](#)
- Physical specifications, [Table 5](#)
- Electrical specifications, [Table 6](#)
- Communication specifications, [Table 7](#)
- Hardware components, [Table 8](#)

**Table 4.** General specifications

Item	Specification
Sound pressure level	< 70 dBA
Operating temperature	5 to 30 °C
Storage temperature	–25 to +60 °C
Humidity	20 to 80% RH, non-condensing
Sample viscosity	0.1 to 5 cP
Solvent A	UHPLC/MS-grade water with 0.1% formic acid
Solvent B	Max 95% UHPLC/MS-grade acetonitrile with 0.1% formic acid
<b>IMPORTANT</b> Use only LC/MS-grade solvents.	
Safety	According to IEC 61010
Solvent compatibility	≤ 95% acetonitrile in water. Wetted parts: Fused silica, PEEK™, 316 stainless steel, zirconium dioxide

**Table 5.** Physical specifications

Item	EASY-nLC 1200
Width	36 cm (14.2 in.)
Depth	38 cm (15.1 in.)
Height	45 cm (17.7 in.)
Weight	35 kg (77 lb)
Weight in the shipping container	45 kg (99 lb)

**Table 6.** Electrical specifications

Item	Specification
Power requirements	120 Vac, 50/60 Hz, 250 W 230 Vac, 50/60 Hz, 250 W  For universal power supply (UPS) dimensioning, assume 250 W.
Fuses	For 120 Vac: one T 5 AL 250 V fuse (5 × 20 mm, IEC 60127) For 230 Vac: one T 2.5 AL 250 V fuse  All fuses are UL Listed and CSA certified.

**Table 7.** Communication specifications

Item	Specification
Contact closure	3 outputs, 3 inputs, and 6 ground pins
IN circuit	TTL Level
OUT circuit	PhotoMOS™ relay protected against high voltages. Continuous switch current from 0.8 to 5 V is 35 mA.
LAN	10/100/1000 Mb/s BaseT Ethernet
USB	Two ports for keyboard or mouse or removable USB storage device
P-Bus	Reserved for instrument add-ons, using the internal EASY-nLC instrument protocol bus: 8-wire control and limited power at 9/24 V
Monitor	Output for connection of external display

**Table 8.** Hardware components

Item	Specification
Pumps	<ul style="list-style-type: none"><li>• 140 <math>\mu</math>L volume (enough for a &gt;10 h, 0–100% B, 300 nL/min gradient)</li><li>• 1 nL/min to 300 <math>\mu</math>L/min flow range</li><li>• External pressure sensor</li></ul>
Rotary valves	<ul style="list-style-type: none"><li>• 6 ports</li><li>• 3 positions (1–6, 1–2, or CENTERED)</li></ul>
Autosampler	<ul style="list-style-type: none"><li>• Peltier-cooled. Capacity is maximum 20 °C (68 °F) below ambient temperature, measured at 60% RH. Expect less if you remove the side panels, use an adapter plate in the autosampler other than the standard plate, or both.</li><li>• Plate holder ejects through spring-mounted autosampler door.</li><li>• 4 glass bottles with plastic lids for waste or wash liquids</li></ul>



# Maintenance Schedule

To familiarize yourself with the maintenance schedule for the EASY-nLC instrument, review this chapter.

## Contents

- [Daily Maintenance](#)
- [Weekly Maintenance](#)
- [Quarterly Maintenance](#)
- [Yearly Maintenance](#)
- [Field Service Repairs](#)

## Daily Maintenance

Check the solvent levels, draw fresh solvent through the solvent system, and flush air out of the solvent system on a daily basis.



**CAUTION** When working with solvents, wear safety glasses and safety gloves. Make sure that the gloves are compatible with the solvents you are using.

When working with volatile hazardous chemicals, use an appropriate fume hood.



**CAUTION** Use only LC/MS-grade solvents with the EASY-nLC instrument. Using HPLC-grade solvents and water from laboratory purification systems causes system blockages and poor spray stability.

❖ **To check the solvent levels**

**Note** The instrument reminds the user if the solvents have not been refreshed within the last 14 days. It is particularly recommended to refresh solvent B regularly for stable concentrations.

1. Visually inspect solvent bottles A and B, and the autosampler bottles W3, as well as W1 and 2, if used. Refill if necessary but do not top-up.

**Tip** You can also inspect the purity of the solvent to ensure no visible precipitates have formed that might lead to blockages in the pump line.

2. Visually inspect the autosampler wash bottle in position W4 and the plastic waste beaker in front of the solvent system compartment, and empty if necessary.

❖ **To draw fresh solvent into the system and to flush air out of the system**

Run the **Purge Solvent** scripts with two purge iterations, and run the **Flush Air** script until flush volumes fall below 12  $\mu$ L.

## Weekly Maintenance

Because the vapor pressures of formic acid, water, and acetonitrile differ, the solvent composition changes over time. Refill the solvent bottles to maintain a consistent solvent composition. Discard the old solvents and fill the bottles with new, do not top up.

Exchange solvent B mixture (max. 95% ACN) instead of filling up to maintain a defined composition.

A solvent refresh due reminder is shown 14 days after the last solvent refresh acknowledge.

## Quarterly Maintenance

Perform the following procedures quarterly (every 3 months).

❖ **To check the backpressure**

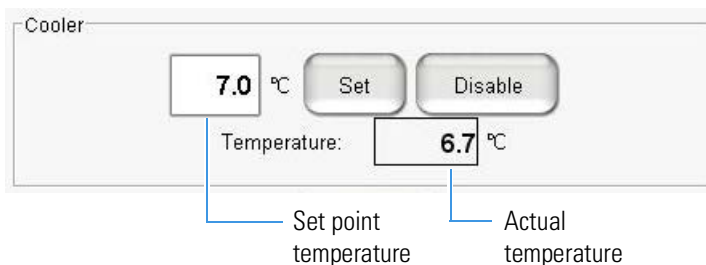
To test for system blockages, run the **Back Pressure** script for both solvents (see “[Back Pressure](#)” on [page 47](#)).

**IMPORTANT** The script evaluates the backpressure based on using 99.9% water for solvent A and 80% acetonitrile for solvent B.

❖ **To check the cooler temperature**

Check that the actual plate temperature matches its set point (readout on the Home > Overview page). Allowed maximum deviation from set point temperature is +/- 0,5°C.

**Figure 20.** Cooler area of Autosampler dialog box



❖ **To check the autosampler pickup function**

Run the **Sample Pickup** script to check the sample pickup function (see “[Sample Pickup](#)” on [page 42](#)).

❖ **To check the EASY-nLC solvent system for leaks**

Run the **Leaks** script for “A+B” and for “System,” to check for and diagnose instrument leaks. For more information, see “[Leaks](#)” on [page 44](#) and “[Running a System Leak Test](#)” on [page 178](#)).

❖ **To check the check valves**

Run the **Purge Solvent** script (see “[Purge Solvent](#)” on [page 32](#)) and do the following:

- When the pumps are ejecting solvent, make sure that solvent is exiting the A and B waste tubing into the waste beaker.
- When the pumps are refilling, make sure that no solvents are going into the pump through the waste tubing.

If you detect a leaking check valve, replace it.

## Half-yearly Maintenance

Check the flow sensor calibration.

❖ **To check the flow sensor calibration**

Run the **Flow Sensor** calibration script with the **Inspection Only** parameter enabled (see “[Flow Sensors](#)” on [page 52](#)).

This checks that the flow sensor calibration is working within specifications.

**Note** If the last flow sensor calibration dates back more than 6 months, a reminder will be shown on the home screen.

## Yearly Maintenance

Replace the solvent filters.

### ❖ To exchange low-pressure solvent filters

Thoroughly clean new solvent filters with 2x10 minutes sonication in UHPLC/MS methanol before use as these can be a contamination source.



**CAUTION** Methanol (CAS number: 67-56-1) is highly flammable and toxic by inhalation, ingestion, or skin absorption. Take appropriate measures to protect yourself and your equipment. Make sure that the mobile phases are miscible with methanol or flush the A and B solvent lines with an intermediate solvent.

## Field Service Repairs

If any of these instrument components is irreparably damaged, contact your local Thermo Fisher Scientific field service engineer for repairs:

- Autosampler or autosampler cooler
- Rotary valve
- Pump (for both instruments)
- Integrated computer
- Touch-screen monitor



**CAUTION** Chapter 6, “Field Service Maintenance,” describes how to replace these instrument components. However, only a Thermo Fisher Scientific field service engineer can perform these procedures. Attempted repairs by untrained personnel might cause personal injury or irreparably damage the instrument.

# Maintenance Scripts and Service Records

For information about the maintenance scripts and record keeping features provided by the EASY-nLC touch-screen application, see these sections:

## Contents

- [Maintenance Scripts](#)
- [Keeping Service Records](#)
- [Checking and Resetting the Device Usage Counters](#)

## Maintenance Scripts

The EASY-nLC touch-screen application includes a variety of built-in maintenance scripts that help you prepare the instrument for use and troubleshoot instrument problems. These maintenance scripts are divided into four categories: Prepare, Test, Service and Calibrate. Each of the following sections combines the category with the actual script name.

Prepare category	Test category	Calibrate category	Service category
<ul style="list-style-type: none"> <li>• Purge Solvent</li> <li>• Flush Air</li> <li>• Precolumn Equilibration</li> <li>• Analytical Column Equilibration</li> <li>• Isocratic Flow</li> <li>• Column Conditioning</li> </ul>	<ul style="list-style-type: none"> <li>• MS Connection</li> <li>• Sample Pickup</li> <li>• LeaksBack Pressure</li> <li>• Autosampler Torque</li> <li>• Recording</li> </ul>	<ul style="list-style-type: none"> <li>• Constant Pressure</li> <li>• Reset Pressure Sensor</li> <li>• Direct Infusion</li> </ul>	<ul style="list-style-type: none"> <li>• Recording</li> <li>• Constant Pressure</li> <li>• Constant Flow</li> </ul>

### ❖ To select a maintenance script

1. On the touch screen, press **Maintenance > Scripts**.
2. Select a category and then the script for the specific operation you want.

You can also schedule some of the scripts for execution using the job queue.

## Purge Solvent

The Purge Solvent script fills the selected pump or pumps with solvent and then ejects it into the waste beaker. Use the Purge Solvent script when exchanging solvents, removing air from the solvent lines, or filling the pumps.

Figure 21 shows the parameters for the Purge Solvent script.

Figure 21. Purge Solvent script parameters

The screenshot shows the Thermo Scientific software interface for the Purge Solvent script. The top navigation bar includes 'Home', 'Batch Setup', 'Method Setup', 'Maintenance', and 'Configuration'. The 'Maintenance' tab is selected, and the 'Scripts' section is active. The 'Parameters' tab is selected, showing a table with the following data:

Parameter	Value
Purge iterations	10
Purge pump A	<input checked="" type="checkbox"/>
Purge pump B	<input checked="" type="checkbox"/>
Purge pump S	<input checked="" type="checkbox"/>
Full purge	<input type="checkbox"/>

Below the table are buttons for 'Schedule', 'START', and 'STOP'. The 'START' button is highlighted in green. On the right side of the interface, there are two 'No graph' dropdown menus.

### ❖ To run the Purge Solvent script

1. Open the Purge Solvent script as follows:
  - a. On the touch screen, press **Maintenance > Scripts**.
  - b. In the Category list, select **Prepare**.
  - c. In the Name list, select **Purge Solvent**.
2. Set up the parameters for this script as follows:
  - a. Press the **Parameters** tab.
  - b. Select the check boxes for the appropriate pump or pumps. If you select the Full Purge check box, the Purge Iterations parameter becomes unavailable.
  - c. In the Purge Iterations box, enter the number of empty/fill cycles to be performed:
    - To refresh solvents on a daily basis, enter **2** iterations.
    - To exchange solvents, use the “Full purge” option. Full purge does 10 purge iterations for pump A and B and 5 for pump S.

**Note** Entering a value of zero (0) for purge iterations refills the pump.

3. Press **Start**.

## Flush Air

The Flush Air script removes air from inside the pump head by pressurizing the pump and then releasing that pressure into the flow path toward the waste beaker.

The pump refills, pressurizes, releases pressure, and empties for each iteration of the script. While the script runs, it calculates the pressurization time dynamically based on measurements from previous iterations and measures the pumped volume required to reach 200 bar.

**Note** Because the solvents are slightly compressible and the pump itself expands, even an air-free pump allows some pumping before reaching 200 bar.

Depending on the solvents, a pumped volume less than 12 µL for the pump module is acceptable.

Figure 22 shows the parameters for the Flush Air script.

**Figure 22.** Flush Air script parameters

The screenshot shows the Thermo Scientific software interface for the 'Flush Air' script. The 'Maintenance' tab is selected. The 'Scripts' section shows 'Prepare' as the category and 'Flush air' as the script name. The 'Parameters' tab is active, displaying a table with the following data:

Parameter	Value
Flush pump A	<input checked="" type="checkbox"/>
Flush pump B	<input checked="" type="checkbox"/>
Flush pump S	<input checked="" type="checkbox"/>
Flush threshold [µl]	12.00

At the bottom of the interface, there are three buttons: 'Schedule', a large green 'START' button, and a grey 'STOP' button. The left sidebar shows 'Scripts', 'Log Book', 'Support', and 'Devices' options. The bottom left corner displays the date '16 Jul 2015 11:58' and the user 'admin'.

❖ **To run the Flush Air script**

1. Open the Flush Air script as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Prepare**.
  - c. In the Name list, select **Flush Air**.
2. Set up the parameters for this script as follows:
  - a. Press the **Parameters** tab.
  - b. In the Flush Threshold [ $\mu\text{L}$ ] box, enter **12**.
3. Press **Start**.

The script ends after the first iteration that gives a flush volume below the set threshold.

## Precolumn Equilibration

The Precolumn Equilibration script equilibrates the precolumn with solvent from pump A.

Use this script to equilibrate or flush the precolumn and to determine a suitable flow rate for the sample loading step in your method.

Figure 23 shows the parameters for the Precolumn Equilibration script.

**Figure 23.** Precolumn Equilibration script parameters

The screenshot displays the Thermo Scientific software interface for the Precolumn Equilibration script. The interface is organized into several sections:

- Navigation:** Home, Batch Setup, Method Setup, Maintenance (selected), Configuration.
- Scripts:** A sidebar menu with options: Log Book, Support, Devices.
- Script Selection:** Category: Prepare (dropdown), Name: Precolumn equil... (dropdown).
- Parameters Table:** A table with columns 'Parameter' and 'Value'.

Parameter	Value
Volume [ $\mu\text{L}$ ]	10.00
Flow [ $\mu\text{L}/\text{min}$ ]	5.00
Max pressure [bar]	
- Graphs:** Two 'No graph' dropdown menus.
- Job Information:** Solvents Refreshed, Job 00:00:00.
- System Info:** 10 Nov 2016 14:46, admin.
- Control Buttons:** Exit..., Schedule, START (green), STOP (grey).



**❖ To run the Precolumn Equilibration script**

1. Open the Precolumn Equilibration script as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Prepare**.
  - c. In the Name list, select **Precolumn Equilibration**.
2. Set up the parameters for this script as follows:
  - a. Press the **Parameters** tab.
  - b. Enter the appropriate values:
    - In the Volume [ $\mu\text{L}$ ] box, enter the volume of solvent A to use to equilibrate the precolumn.  
  
For best results, use at least 10 column volumes to equilibrate the precolumn.
    - In the Flow [ $\mu\text{L}/\text{min}$ ] box, enter the flow rate for the precolumn equilibration step.  
  
If the flow field is left empty, the pump operates at the set pressure.
    - In the Max Pressure [bar] box, enter the maximum allowed pressure.  
  
If the pressure field is left empty, the pump operates at the set flow (as long as it is below the instrument maximum pressure of 1180 bar). If both a flow and a max pressure are specified, the pump flow is limited by whichever parameter is reached first.



**CAUTION** Check the maximum pressure rating for the precolumn. Running the instrument at pressures higher than the column's maximum pressure rating reduces the column lifespan.

3. Press **Start**.

## Analytical Column Equilibration

The Analytical Column Equilibration script equilibrates the analytical column with solvent from pump A.

Use this script to equilibrate or flush the analytical column, determine a suitable equilibration flow rate for the method, or initialize a new analytical column.

Figure 24 shows the parameters for the Analytical Column Equilibration script.

**Figure 24.** Analytical Column Equilibration script parameters

The screenshot shows the Thermo Scientific software interface for the Analytical Column Equilibration script. The main panel has three tabs: Description, Parameters, and Output. The Parameters tab is selected, showing a table with the following data:

Parameter	Value
Volume [µl]	10.00
Flow [µl/min]	5.00
Max pressure [bar]	

Below the table are three buttons: Schedule, START (a large green button), and STOP (a grey button). The right-hand panel has two dropdown menus, both labeled 'No graph'. The top navigation bar includes Home, Batch Setup, Method Setup, Maintenance (selected), and Configuration. The left-hand menu includes Scripts, Log Book, Support, and Devices. At the bottom left, there is a status bar showing 'Job 00:00:00', the date '16 Jul 2015 15:00', and the user 'admin'.

**Note** The Analytical Column Equilibration script sets the valves to these positions:

- Valve A: 1–6
- Valve B: Center
- Valve S: 1–2
- Valve W: 1–2

### ❖ To run the Analytical Column Equilibration script

1. Open the Analytical Col Equilibration script as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Prepare**.
  - c. In the Name list, select **Analytical Col Equilibration** (abbreviated to fit in the space allotted).

2. Set up the parameters for this script as follows:

- a. Press the **Parameters** tab.
- b. In the Volume [ $\mu\text{L}$ ] box, enter the volume of solvent A to use to equilibrate the analytical column.

For best results, use at least 10 column volumes to equilibrate the analytical column.

- c. In the Flow box [ $\mu\text{L}/\text{min}$ ], enter the flow rate for the analytical column equilibration step.

If the flow field is left empty, the pump operates at the set pressure.

- d. In the Max Pressure [bar] box, enter the maximum allowed pressure.

If the pressure field is left empty, the pump operates at the set flow (as long as it is below the instruments maximum pressure of 1200 bar).

If both a flow and a maximum pressure are specified, the pump flow is limited by whichever parameter is reached first.



**CAUTION** Check the maximum pressure rating for the analytical column. Running the instrument at pressures higher than the maximum pressure rating for the column reduces the column lifespan.

3. Press **Start**.

## Isocratic Flow

The Isocratic Flow script runs solvents A and B at a user-defined mixture ratio. The script uses the AFC system to accurately control the flow. For details on the AFC system control, refer to the *EASY-nLC 1200 Getting Started Guide*. Use this script to tune the mass spectrometer at a given B percentage or when cleaning the instrument, the columns, or both. [Figure 25](#) shows the parameters for the Isocratic Flow script.

**Figure 25.** Isocratic Flow script parameters

The screenshot shows the Thermo Scientific software interface for the Isocratic Flow script. The 'Maintenance' tab is selected, and the 'Scripts' section is active. The 'Parameters' tab is selected, showing the following parameters:

Parameter	Value
Volume [µl]	100.00
Flow [µl/min]	0.30
AB Mix: [%B]	30
Run indefinitely	<input checked="" type="checkbox"/>

Below the table are buttons for 'Schedule', 'START', and 'STOP'. The top navigation bar includes 'Home', 'Batch Setup', 'Method Setup', 'Maintenance', and 'Configuration'. The left sidebar includes 'Scripts', 'Log Book', 'Support', and 'Devices'. The bottom left shows the user 'admin' and a date '16 Jul 2015 15:01'.

### ❖ To run the Isocratic Flow script

- Select the Isocratic Flow script as follows:
  - Press **Maintenance > Scripts**.
  - In the Category list, select **Prepare**.
  - In the Name list, select **Isocratic Flow**.
- Set up the parameters (see [Figure 25](#)) for this script as follows:
  - Press the **Parameters** tab.
  - Enter the appropriate values:
    - In the Volume box [µL], enter the total volume to be delivered by the pumps.

**Note** If you select the Run Indefinitely check box, the script ignores this volume setting.

- In the Flow box [µL/min], enter the flow rate to be used.

- In the AB Mix box [%B], enter the solvent composition as a percentage of solvent B.
- If you want the solvent flow to continue until you press Stop, select the **Run Indefinitely** check box.

3. Press **Start**.

**Note** The system will need a few minutes for initiation.

When either pump runs out of solvent, both pumps refill. The refilling process takes approximately 2 minutes.

## Column Conditioning

This script applies a stepwise pressure ramp with solvent A to a new column.

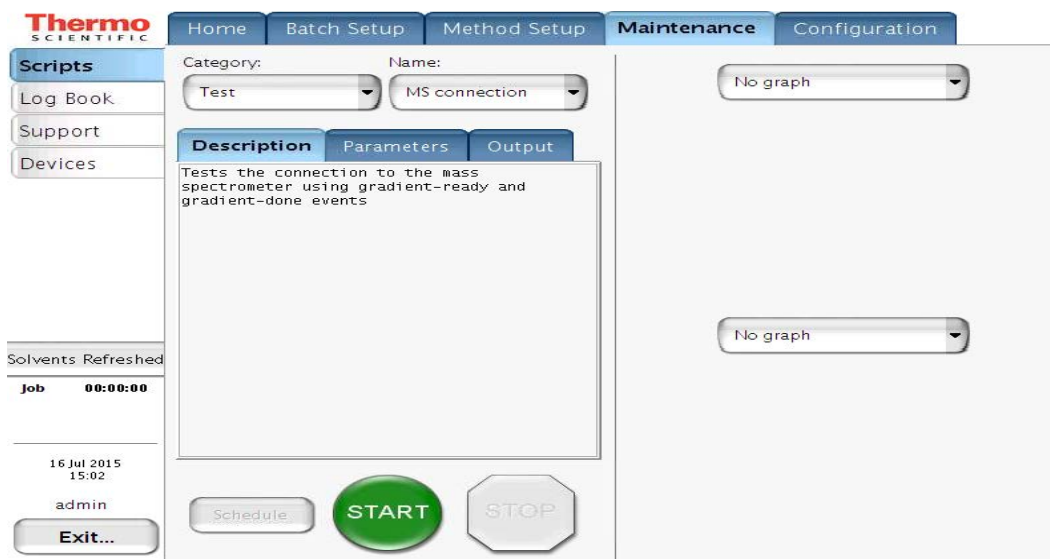
The parameters are: Total duration, max. pressure, no. of steps.

## MS Connection

The MS Connection script tests the contact closure function between the EASY-nLC instrument and the mass spectrometer.

Figure 26 shows the MS connection script.

**Figure 26.** MS Connection script

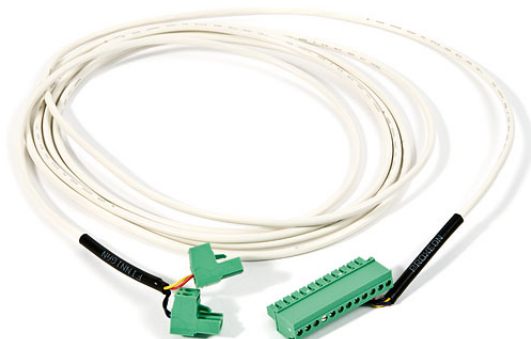


### ❖ To run the MS Connection script and test the contact closure connection

1. Connect the contact closure cable to the EASY-nLC instrument and the mass spectrometer.

Figure 27 shows the contact closure cable for an EASY-nLC instrument that connects to a Thermo Scientific mass spectrometer.

**Figure 27.** Thermo Fisher contact closure cable, part number LC160 (part name)

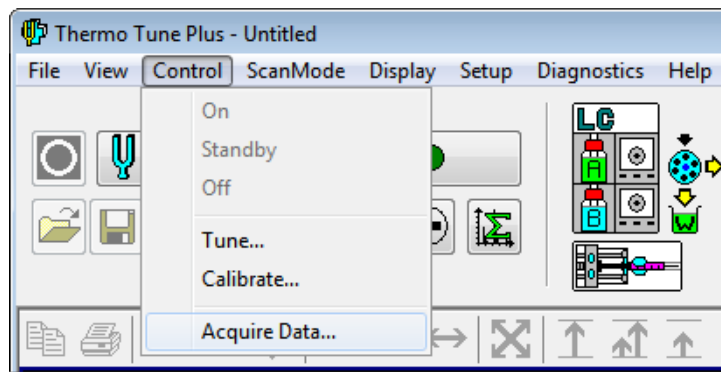


**Tip** Use the Thermo Fisher contact closure cable (LC160) to make contact closure between the EASY-nLC instrument and a Thermo Scientific mass spectrometer. Connect the 12-pin connector to the back panel of the EASY-nLC instrument. For an LTQ™ or TSQ™ mass spectrometer, connect the two-pin connector to the mass spectrometer's Start In pins. For a TSQ Quantiva™, a TSQ Endura™, or an Orbitrap Fusion™ mass spectrometer, modify the contact closure cable as described in the *EASY-nLC 1200 Getting Started Guide*.

2. Check the contact closure settings for the LC/MS system as follows:
  - a. On the EASY-nLC touch screen, press **Configuration > Connections**.
  - b. For a Thermo Scientific mass spectrometer, make the following selections:
    - In the Instrument (cable no.) list, select either **Thermo Scientific (LC160)** or **Thermo Scientific Orbitrap Fusion (LC160)**.
    - In the Protocol list under Contact Closure Settings, select **One-way**.
    - In the State at Start list under Contact Closure Settings, select **Open**.
3. Turn on the mass spectrometer and set it up to wait for a contact closure signal.
  - For a third-party mass spectrometer, follow the instructions in the documentation provided with the mass spectrometer. Then, go to [step 5](#).
  - For an LTQ Series mass spectrometer, go to [step 4](#).
4. For an LTQ Series mass spectrometer, set up the mass spectrometer to wait for a contact closure signal as follows:
  - a. Open the Tune Plus window.
  - b. On the menu bar, choose **Control > Acquire Data**.

Figure 28 shows the Control menu of the Tune Plus window for an LTQ Series mass spectrometer.

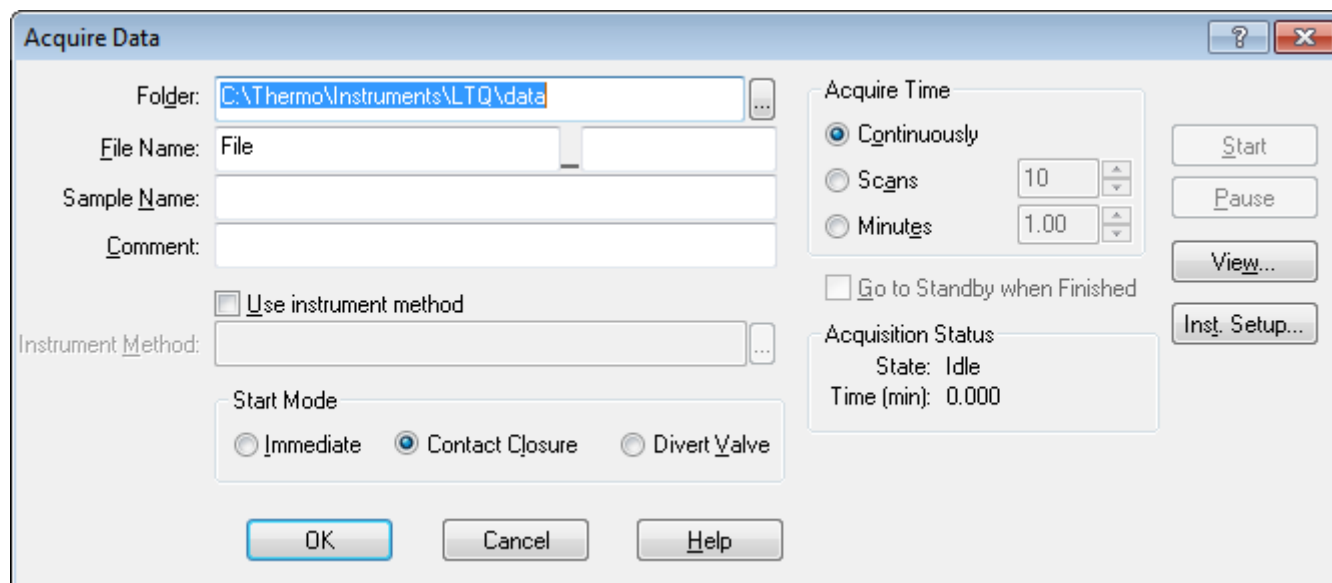
**Figure 28.** Control menu



The Acquire Data dialog box opens (see Figure 29).

- c. In the Start Mode area, select the **Contact Closure** option.

**Figure 29.** Acquire Data dialog box with the Contact Closure option selected



- d. Click **Start**.

The mass spectrometer remains in the Waiting for Contact Closure state until it receives a contact closure signal.

5. Send the contact closure signal from the EASY-nLC instrument to the MS detector as follows:
  - a. On the EASY-nLC touch screen, press **Maintenance > Scripts**.  
The Maintenance Scripts page opens.
  - b. In the Category list, select **Test**.
  - c. In the Name list, select **MS Connection**.
  - d. Press **Start**.

The EASY-nLC instrument sends a contact closure signal to the mass spectrometer. The contact closure signal triggers the mass spectrometer to start scanning. The Scan LED on the front panel of a Thermo Scientific mass spectrometer flashes blue when the contact closure signal is set up correctly.

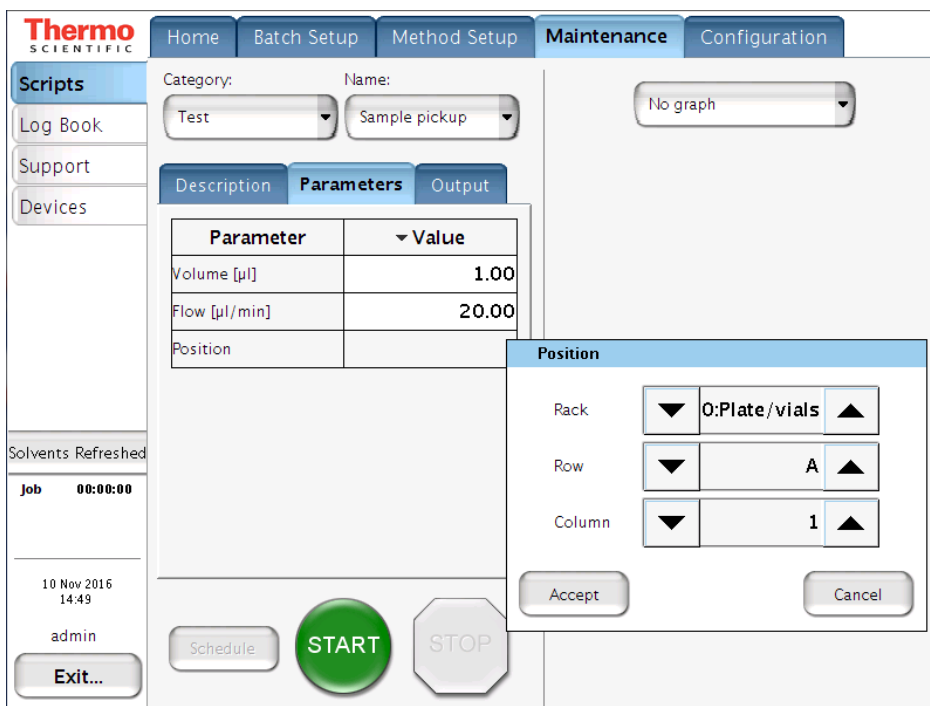
## Sample Pickup

The Sample Pickup script tests the accuracy of the autosampler pickup function. During the script, the XYZ robotic arm moves to the specified sample location. Then pump S aspirates the specified volume from the vial or microplate well and ejects this volume to waste. To determine if the autosampler is aspirating the specified sample volume, weigh the sample both before and after you run the test script as described in “Checking Sample Pickup” on page 222.

Use this script to verify the calibration of the XYZ robotic arm and to determine the appropriate flow rate (aspiration rate by pump S) setting in the method (or Xcalibur instrument method) that you plan to use for your samples. The appropriate flow rate depends on the sample viscosity.

Figure 30 shows the parameters for the Sample Pickup script and the Position dialog box that opens when you press the value box for the Position parameter.

**Figure 30.** Sample Pickup script parameters





**❖ To run the Sample Pickup script**

1. Load the autosampler with the appropriate samples.

**Tip** For more information about running this script and testing the accuracy of the sample pickup function, see “[Checking Sample Pickup](#)” on page 222.

2. Open the Sample Pickup script as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Test**.
  - c. In the Name list, select **Sample Pickup**.
3. Set up the parameters for this script as follows:
  - a. Press the **Parameters** tab.
  - b. In the Volume box [ $\mu\text{L}$ ], enter the volume to be picked up.
  - c. In the Flow box [ $\mu\text{L}/\text{min}$ ], enter the flow rate that pump S uses to aspirate the sample. For aqueous samples enter 20  $\mu\text{L}/\text{min}$ .
  - d. In the Position box, specify the position of the sample in the autosampler. See the Position dialog box in [Figure 30](#).
4. Press **Start**.

## Leaks

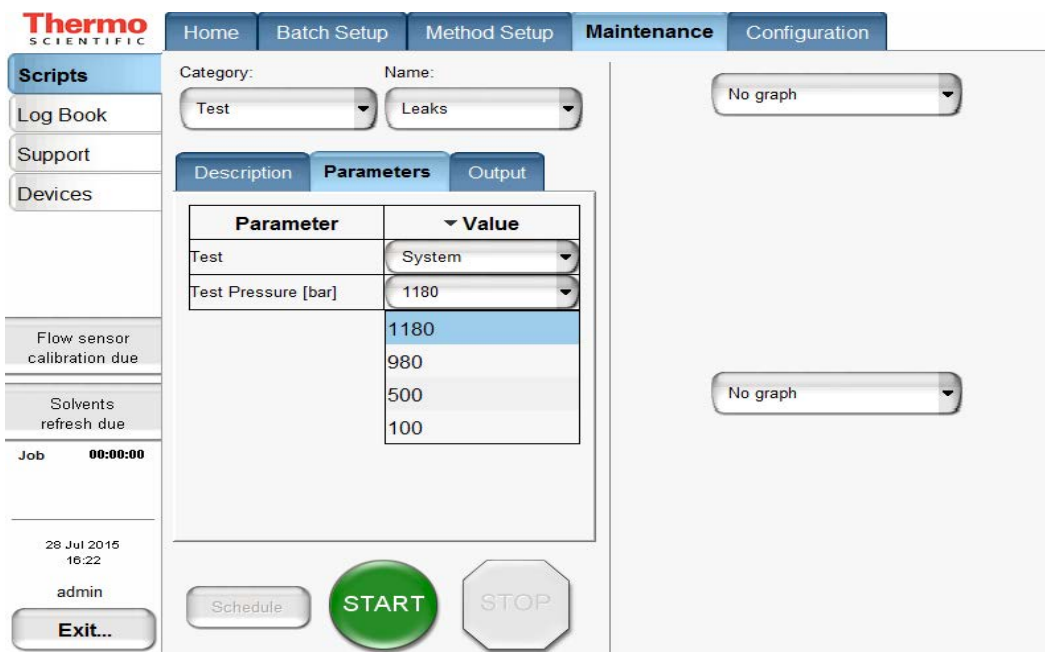
The Leaks script tests for possible leaks at the pump seal and in the valve, plus it's associated flow path (high-pressure subsystems A or B). The Leaks script can also test for system leaks in the flow path downstream of valves A and B.

Use this script when you suspect leak problems in the pumps (pump piston seals), in the flow path between the pump outlet and the associated valve, or downstream of valves A and B. For information about running the system leak test, see [“Running a System Leak Test”](#) on page 178.

**Note** There is no leak test for pump S as it does not operate under high pressure during normal use.

Figure 31 shows the parameters for the Leaks script

**Figure 31.** Leaks script parameters

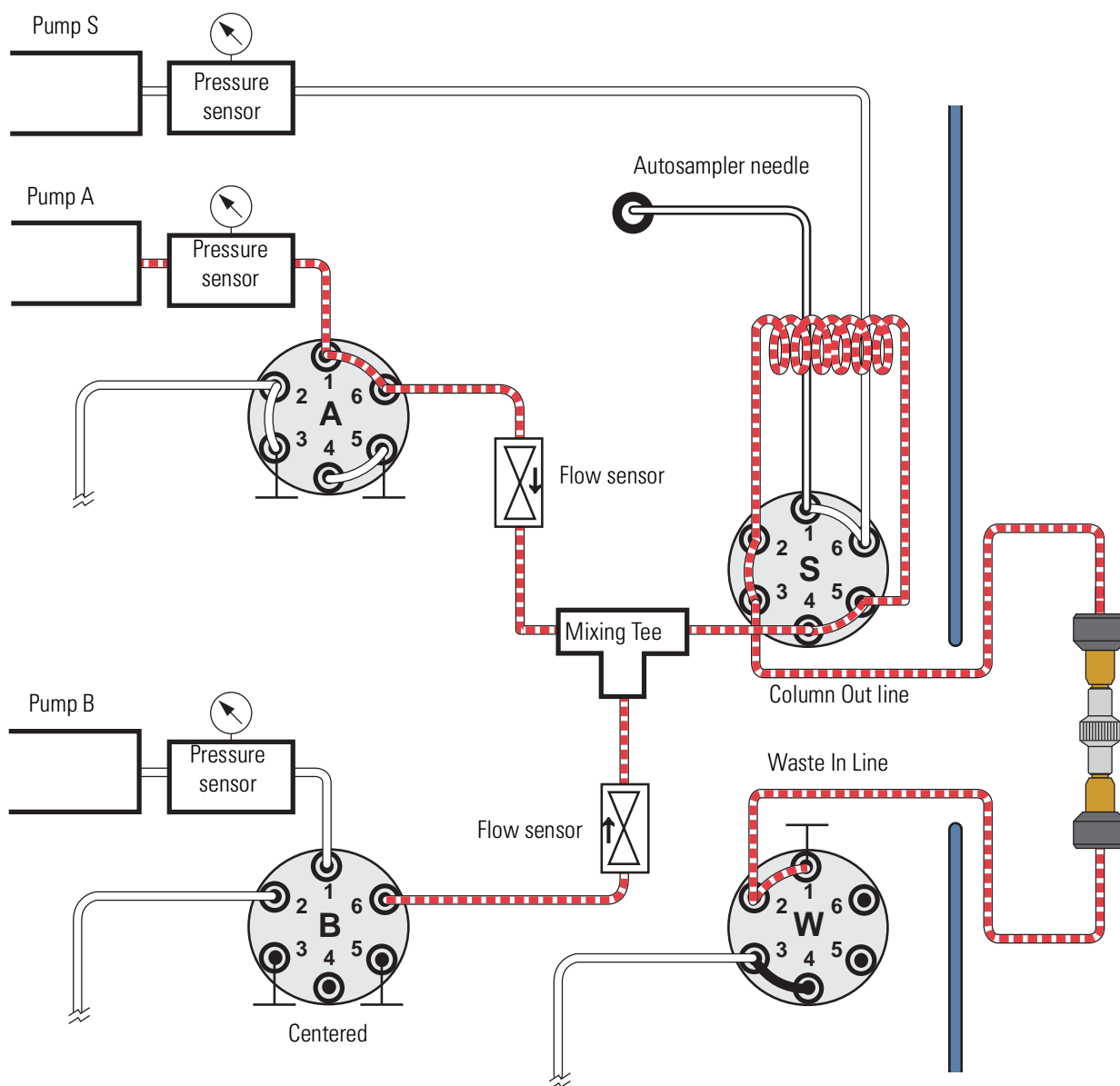


During the leak test of pump A or B, the following events occur.

Step	Event
1	The pump refills.
2	The associated valve centers, blocking the solvent flow through the valve.
3	The pump builds pressure to the selected value.
4	When the pressure stabilizes at the specified value, the pump calculates the flow loss based on the pump piston movement required to maintain this pressure. If the flow loss is less than 400 nL/min, the pump passes the leak test.

During a system leak test (Leaks script with System selected), the script pressurizes the flow paths shown with red dashed lines in [Figure 32](#), monitors the flow sensors and pump piston movement, and identifies the location of a leak. Before you run a system leak test, you must connect the Column Out line to the Waste In line with the appropriate union (see [Table 9](#) on [page 46](#)). The leak test for pump A and B should also be passed first, to make logical sense of any potential failure reports from the System Leak Test.

**Figure 32.** Pressurized lines for a system leak test





**Note** Please note the numbering of the valve ports as depicted in [Figure 9](#) (clockwise numbering with valve port 1 in 4 o'clock position). Due to operational reasons, the graphical representation in this guide or in the instrument's built-in software may show the valves in a different orientation. Please use only the port numbers for identification of port positions.

❖ **To run the Leaks script**

1. Open the Leaks script as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Test**.
  - c. In the Name list, select **Leaks**.
2. Set up the parameters for this script as follows:
  - a. Press the **Parameters** tab.
  - b. To select pump A or B, both pumps, or the entire system flow path for the leak test, press the cell in the Value column and make your selection from the list:
    - To test the solvent path from pump A to valve A (upstream of valve A), select **A**.
    - To test the solvent path from pump B to valve B (upstream of valve B), select **B**.
    - To test the solvent path from pump A to valve A and from pump B to valve B (upstream of pumps A and B), select **A + B**.
    - To test the solvent path downstream of valves A and B, select **System**. [Figure 32](#) on [page 45](#) shows the pressurized solvent path for the system leak test.
3. For a system leak test, connect the Column Out line to the Waste In line using the appropriate union for your instrument setup ([Table 9](#)).
4. Select the pressure at which the leak test shall be performed. The default setting is 1180 bar.

**Note** A leak test should be performed at pressures that are used during the business logic. For example 1180 bar for equilibrate steps and near the pressure during the gradient.

**Table 9.** Leak test unions

Instrument	Part number	Description
EASY-nLC 1200	SC900	Viper union stainless steel zero-dead-volume union for 1/16 in. OD tubing
		
EASY-nLC 1200 with the modified Column Out and Waste In lines provided in the UHPLC Liquid Junction Kit	ES272	UHPLC fused-silica union
		

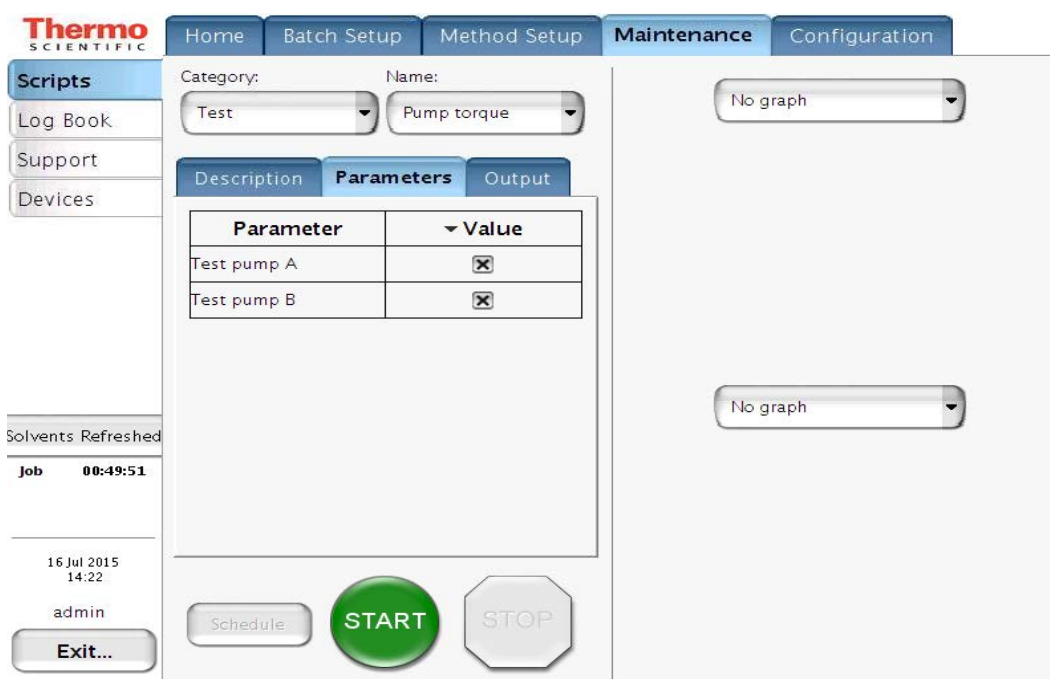
For information about troubleshooting system leaks, see “Troubleshooting the Results of the System Leak Test” on page 183 and “Troubleshooting a Pump That Fails the Leaks Script” on page 177.

## Pump Torque

For the pump module in the EASY-nLC 1200 instrument, the Pump Torque script measures the actuator’s ability to generate pressure at predefined torque levels.

Figure 33 shows the parameters for the Pump Torque script.

**Figure 33.** Pump Torque script parameters



## Back Pressure

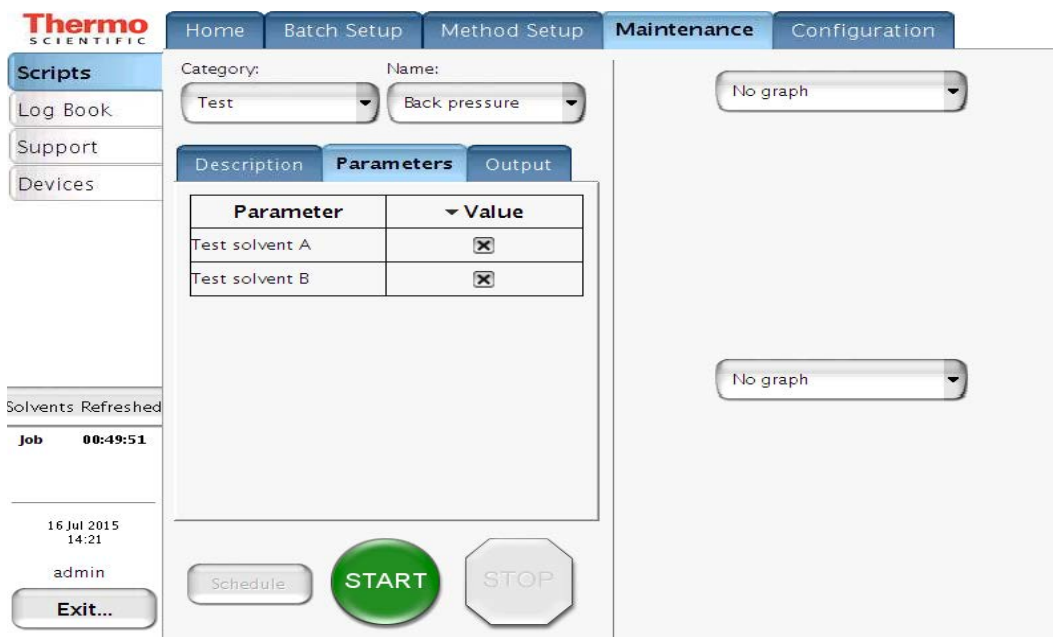
The Back Pressure script determines instrument backpressure for solvent A and B. The script runs at a preset flow and measures the backpressure on the system.

**IMPORTANT** Before you perform the Back Pressure script, ensure that the solvent A bottle contains UHPLC/MS-grade water and the solvent B bottle contains UHPLC/MS-grade acetonitrile/water (max. 95% acetonitrile). This test is not valid for other solvents.

Use this script to test for a blockage in the solvent system. Before running the script, connect the Column Out line to the Waste In line as shown in [Figure 32](#) on [page 45](#).

[Figure 34](#) shows the parameters for the Back Pressure script.

**Figure 34.** Back Pressure script parameters



#### ❖ To run the Back Pressure script

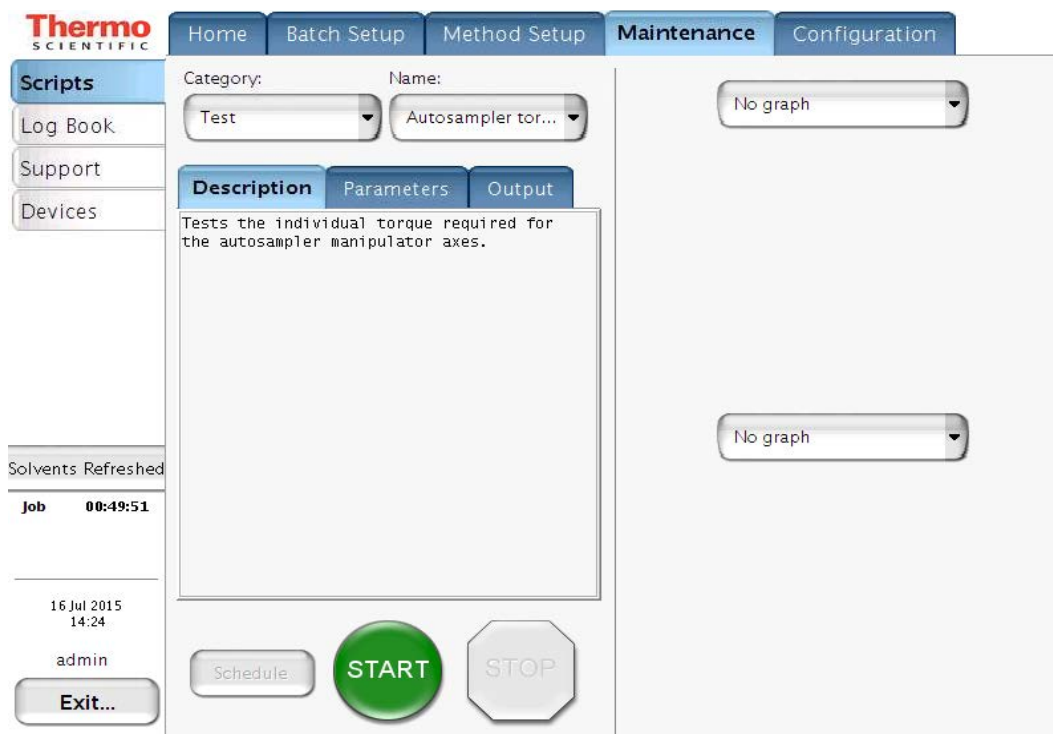
1. Open the Back Pressure script as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Test**.
  - c. In the Name list, select **Back Pressure**.
2. Set up the parameters for this script as follows:
  - a. Press the **Parameters** tab.
  - b. Test solvent A, solvent B, or both A and B by selecting the corresponding check box or check boxes.
3. Press **Start**.

## Autosampler Torque

The Autosampler Torque script measures the torque required to move the XYZ robot on each of its axes for the ASC autosampler.

[Figure 35](#) shows the Description page of the Autosampler Torque script.

Figure 35. Autosampler Torque script description



## Recording

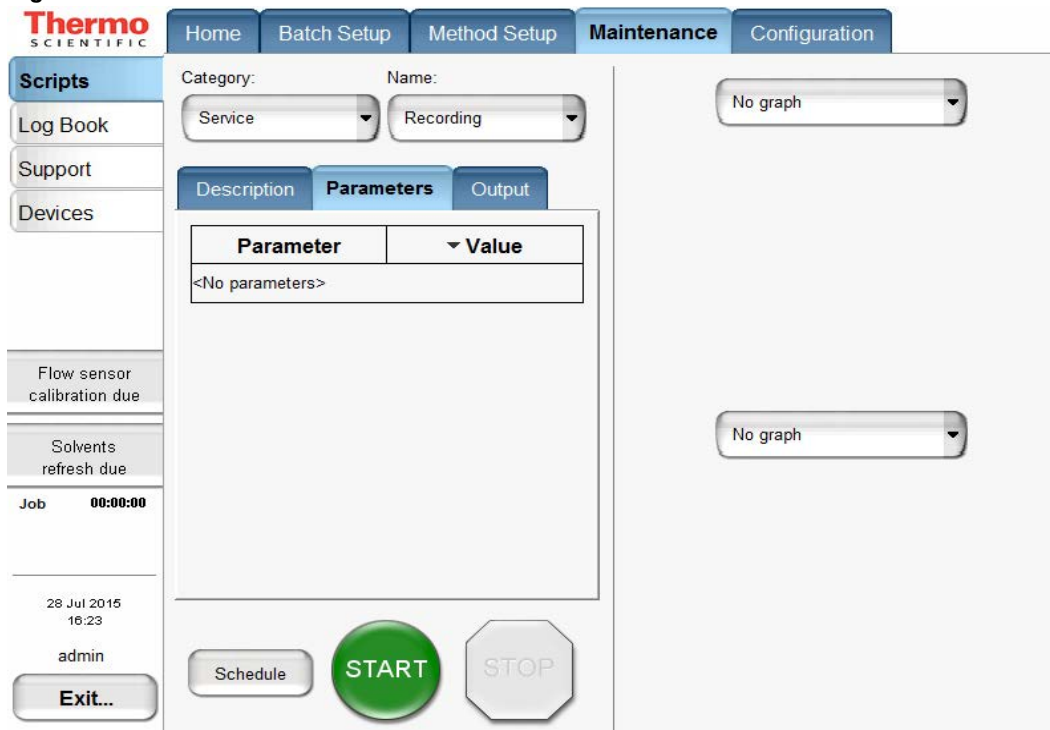
**Note** For service and troubleshooting purposes.

The script enables graphs and logging while it is active.

Use manual control to manipulate devices.

The script can be useful for advanced debugging.

Figure 36.



## Constant Pressure

**Note** For service and troubleshooting purposes.

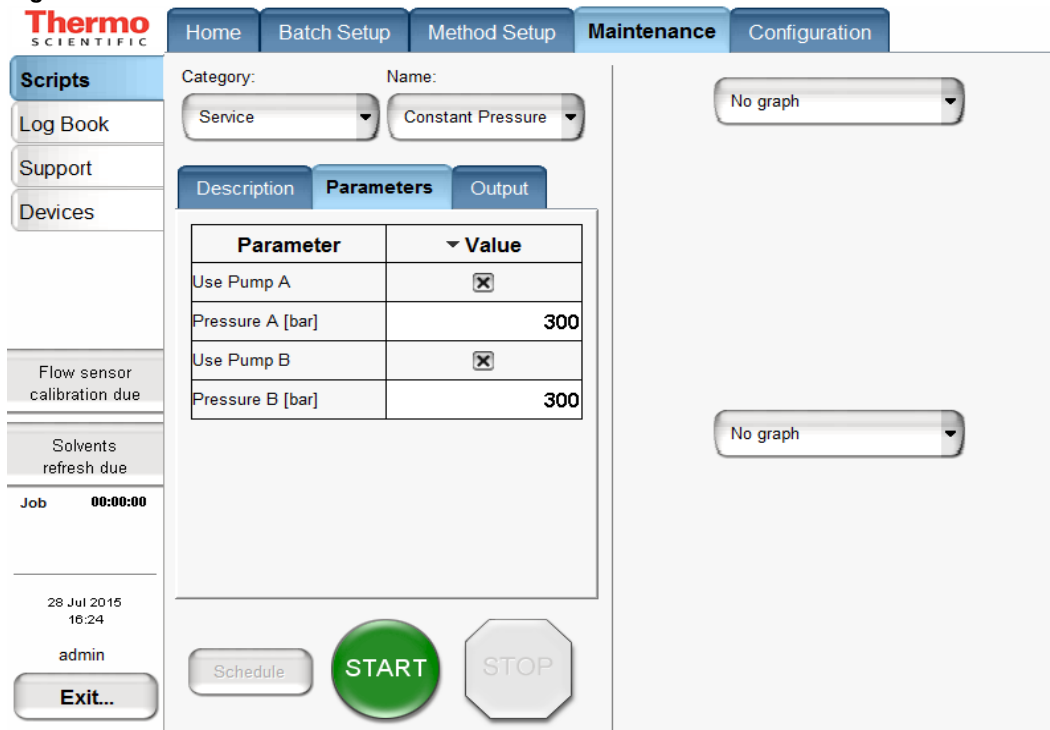
This script applies a constant pressure on selected pumps for advanced troubleshooting.

Use manual control for manipulating devices.

The script can be useful for advanced debugging.



Figure 37.



## Constant Flow

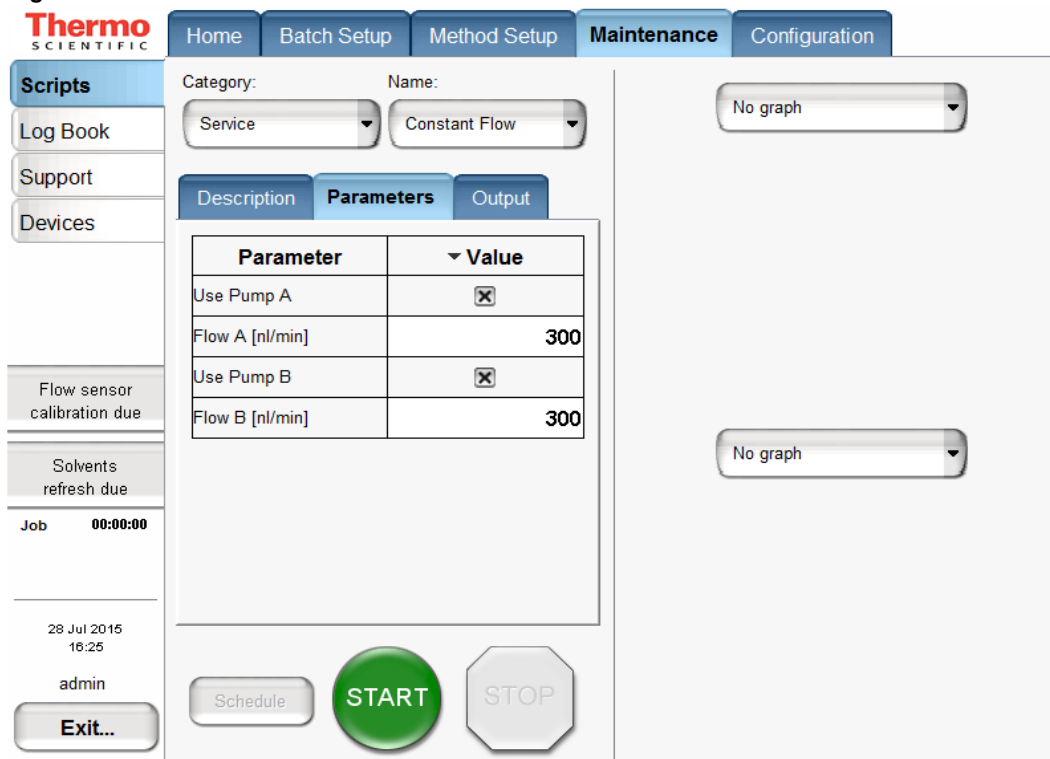
**Note** For service and troubleshooting purposes.

This script applies a constant flow on selected pumps for advanced troubleshooting.

Use manual control for manipulating devices.

The script can be useful for advanced debugging.

Figure 38.



## Flow Sensors

The Flow Sensors script calibrates the flow sensors for pumps A and B.

Use this script to do the following:

- Periodically check the accuracy of the flow sensor calibration for your maintenance records (select the Inspection Only check box).

**Note** If the last flow sensor calibration dates back more than 6 months, a reminder will be shown on the home screen.

- Calibrate the flow sensors when you change the solvent composition of either solvent A or B (clear the Inspection Only check box).

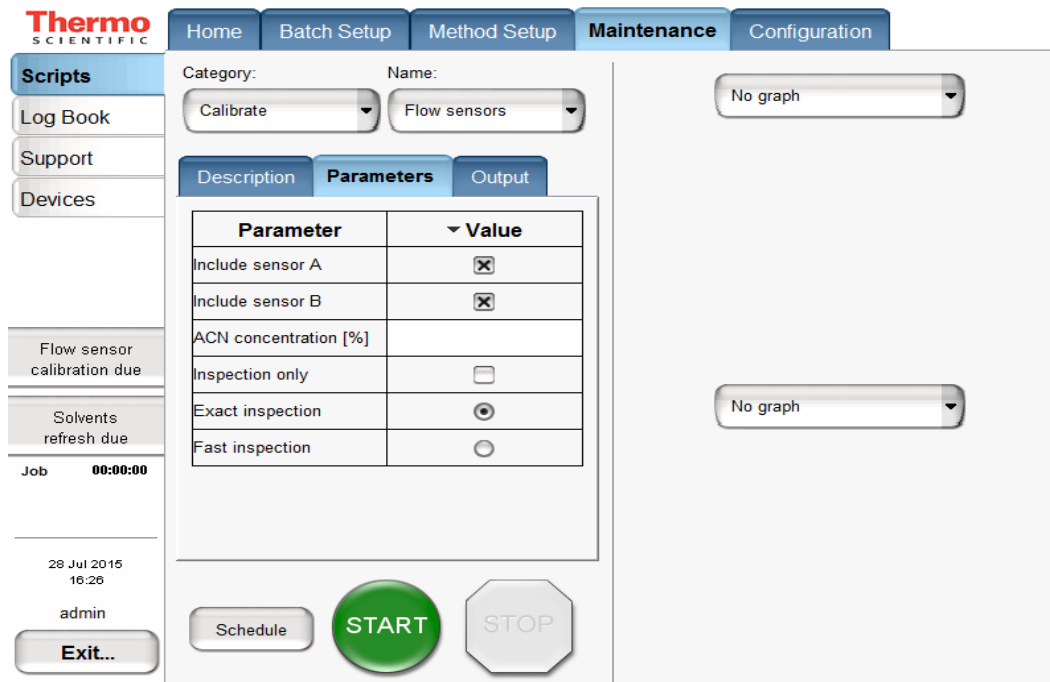
This calibration does not require any additional plumbing.

**IMPORTANT** Because the flow sensor calibration requires a stable operating temperature, ensure that the instrument's side panels are installed and that the instrument has been on for a minimum of 30 minutes.

**Note** Acetonitrile concentrations greater than 95% reduce the lifetime of system components. An acetonitrile concentration of 80% in water is recommended for solvent B.

Figure 39 shows the parameters for the Flow Sensors script.

**Figure 39.** Flow Sensors script parameters



❖ **To run the Flow Sensors script**

1. Open the Flow Sensors script as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Calibrate**.
  - c. In the Name list, select **Flow Sensors**.
2. Set up the parameters for this script as follows:
  - a. Press the **Parameters** tab.
  - b. Select the check boxes for flow sensors A, B, or both that you want to either inspect or calibrate and inspect.

**Note**

To calibrate and inspect the flow sensors, this script performs a two-point calibration as follows:

1. Calibrates the 0  $\mu\text{L}/\text{min}$  point. Then inspects and evaluates this first calibration point.
2. Calibrates the 500  $\mu\text{L}/\text{min}$  point. Then inspects and evaluates this second calibration point.

When you select the Inspection Only check box, the script does not apply the new calibration. Selecting the Fast Inspection option instead of the Exact Inspection option reduces the duration of the inspection and evaluation steps from 16 minutes to 5 minutes, without reducing the accuracy of the calibration.

c. Do one of the following:

- Type in the acetonitrile concentration for solvent B. Type in the acetonitrile concentration for solvent B.

**Note** Acetonitrile concentrations higher than 95% shorten the lifetime of system components. An acetonitrile concentration of 80% in water is recommended for solvent B.

- To check the accuracy of the current calibration (only inspect the current calibration), select the **Inspection Only** check box.

**Note** When you select the Inspection Only check box, the program does not recalibrate the flow sensors.

- To calibrate and inspect the flow sensors (and apply the new calibration), clear the **Inspection Only** check box.

d. Select the inspection duration as follows:

- When you want an estimate of the flow sensor accuracy, select the **Inspection Only** check box and the **Fast Inspection** option.
- When you are recalibrating the flow sensors, clear the **Inspection Only** check box and select the **Exact Inspection** option.

3. Press **Start**.

## Reset Pressure Sensor

This script auto-zeroes the pressure sensor.

**IMPORTANT** Performing this script incorrectly will compromise the performance of the instrument. Contact your local Thermo Fisher Scientific representative before running this script.

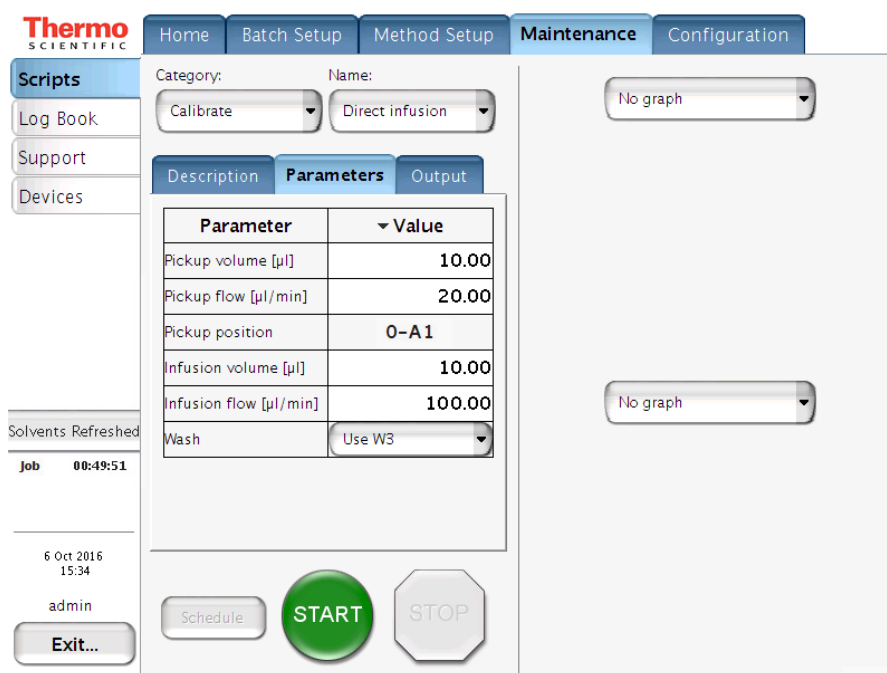
## Direct Infusion

Use the Direct Infusion script to analyze samples by direct infusion or to optimize the spray stability by infusing a known peptide.

In a direct infusion experiment, sample is introduced into the mass spectrometer without chromatographic separation by an analytical column. The EASY-nLC instrument picks up the sample volume from the specified location, and then pumps it directly into the ion source using the solvent flow from pump A.

Figure 40 shows the parameters for the Direct Infusion script.

**Figure 40.** Direct Infusion script

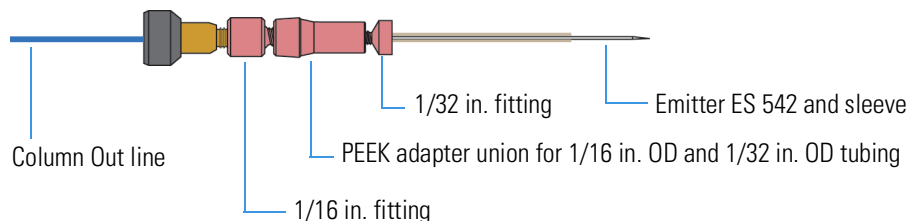


### ❖ To set up the system for a direct infusion experiment

1. Connect an emitter to the Column Out tubing.

Figure 41 shows an example of a direct infusion setup for an EASY-nLC 1200 instrument.

**Figure 41.** Setup for a direct infusion experiment



2. Mount the assembly onto your nanoflow ion source.

#### ❖ To run the Direct Infusion script

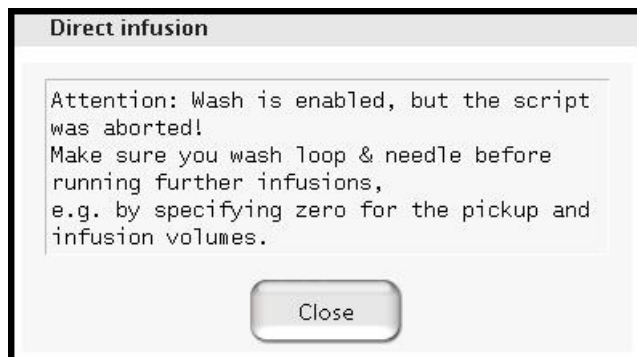
1. Select the Direct Infusion script as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Calibrate**.
  - c. In the Name list, select **Direct Infusion**.
2. Set up the parameters for this script as follows:
  - a. Press the **Parameters** tab.
  - b. In the Pickup Volume [ $\mu\text{L}$ ] box, enter the volume that you want the autosampler needle to pick up. The autosampler transfers this volume into the sample loop.
  - c. In the Pickup Flow [ $\mu\text{L}/\text{min}$ ] box, enter the flow rate at which pump S aspirates the sample from the vial or well.
  - d. In the Pickup Position box, enter the vial or well position.
  - e. In Infusion Volume box [ $\mu\text{L}$ ], enter the volume that pump A dispenses to deliver the sample from the sample loop to the Column out line, to the emitter.
  - f. In the Infusion Flow [ $\mu\text{L}/\text{min}$ ] box, enter the flow rate at which pump A delivers the sample to the emitter.
  - g. In the Wash option box select which Wash bottle (W1, W2 or W3) is used in a Wash step after pump A has dispensed the specified volume of solvent A. Select **Off** to skip the Wash step.

During the Wash step, pump S delivers 100  $\mu\text{L}$  of solvent W3 through the loop and needle to the waste bottle. Afterwards, the loop and the needle are washed with the solvent from the selected Wash bottle (W1, W2, or W3). Then, the entire fluid path is purged with solvent W3.
3. Press **Start**.

**IMPORTANT** The Direct Infusion script flushes the solvent lines before it ends. Stopping the script before it ends can leave sample solution in the flow path.

4. If you press Stop before the script ends, follow the instructions in message box that appears to make sure that the current sample is flushed from the system (see [Figure 42](#)).

**Figure 42.** Wash instructions that appear when you stop the Direct Infusion script



## Keeping Service Records

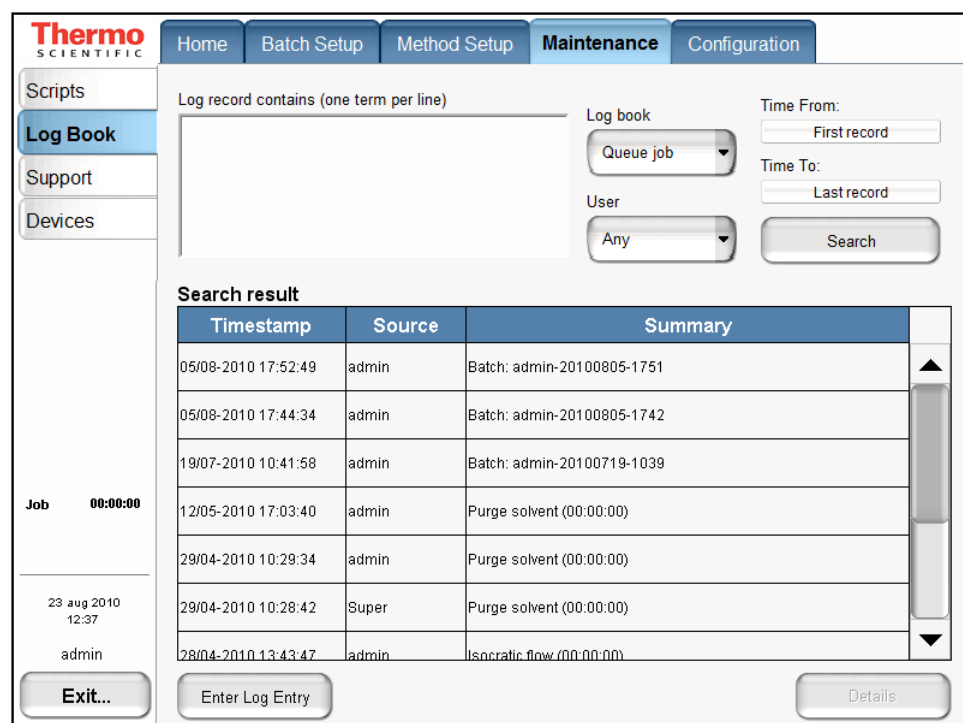
Use the Maintenance > Log Book page to electronically enter all the service actions that you perform on the instrument.

❖ **To record a service action**

1. Press **Maintenance > Log Book**.

The Maintenance > Log Book page opens (see [Figure 43](#)).

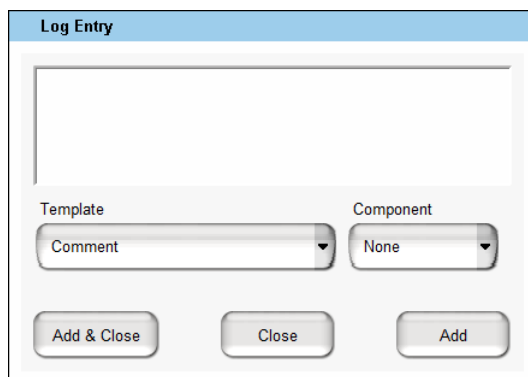
**Figure 43.** Log Book page of the Maintenance menu tab



2. Press **Enter Log Entry**.

The Log Entry dialog box opens.

**Figure 44.** Log Entry dialog box



3. In the box at the top of the dialog box, enter a description of the service action.
4. In the Template list, select a template.

The Template list contains the following selections: Comment, New Part, Maintenance, Property Change, and Precolumn Changed by <User> on <Date>.

5. In the Components list, select a hardware component.

The Components list contains the following selections: None, Gradient, Valve B, Valve A, Valve S, Valve W, Analytical Column, Precolumn, Autosampler, Pump A, Pump B, Pump S, and other added devices such as the EASY-Spray™ column heater.

6. Do one of the following:
  - Press **Add** to add this entry and keep the Log Entry dialog box open.
  - Press **Add and Close** to add this entry and close the Log Entry dialog box.
  - Press **Close** to close the Log Entry dialog box without saving any entries.

❖ **To search the log**

1. In the Log Book list, select **Queue Job** or **User**.
2. In the User List, select **Any**, **Admin**, or **Guest**.
3. In the Time From list, select a time.
4. In the Time To list, select a time.
5. Press **Search**.

The search results appear in the Search Result table.



## Checking and Resetting the Device Usage Counters

The EASY-nLC system tracks the volume pumped by pumps A, B, and S and the number of valve shifts for valves A, B, W, and S.

### ❖ To view the device usage values

1. Press **Maintenance > Devices**.
2. Do one the following:
  - To view the volume pumped by a pump, select the pump from the list of devices.
  - To view the number of valve shifts for a valve, select the valve from the list of devices.
3. Press the **Summary** tab.

The Summary view opens.

### ❖ To reset the volume pumped to zero

1. Open the appropriate Summary page.
2. Press **Reset**.

For a pump, the value in the Intermediate Volume box resets to 0.

### **3 Maintenance Scripts and Service Records**

Checking and Resetting the Device Usage Counters

## System Modifications

The EASY-nLC 1200 instrument is designed to work with specific analytical columns. If you want to use analytical columns with bare fused-silica ends, you must modify the instrument as described in this chapter.

For information about installing columns with bare fused-silica ends, refer to the *EASY-nLC 1200 Getting Started Guide*.

### Contents

- [Ordering the UHPLC Liquid Junction Kit](#)
- [Installing the Modified Column Out and Waste In Lines](#)

## Ordering the UHPLC Liquid Junction Kit

Use the following part number to order the UHPLC Liquid Junction Kit from Thermo Fisher Scientific: ES269. [Table 10](#) lists the items in the UHPLC Liquid Junction Kit.

**Table 10.** UHPLC Liquid Junction Kit contents (Sheet 1 of 2)

Description	Part number
Column Out line with a nanoViper fitting at one end and bare fused-silica tubing at the other end	6041.5290
Waste In line with a nanoViper fitting on one end and bare fused-silica tubing at the other end	6041.5289
UHPLC fused-silica union, which consists of the following: <ul style="list-style-type: none"> <li>• PEEK holder</li> <li>• Two internally-threaded knurled nuts</li> <li>• Two microferrules</li> <li>• Stainless steel cartridge with coned ports and a 280 µm thru-hole</li> </ul>	ES272



**Note** The UHPLC fused-silica union has two functions:

- For a two-column setup, it connects the Column Out line to the precolumn inlet.
- For system leak testing and backpressure testing, it connects the Column Out line to the Waste In line. For information about leak testing, see [“Leaks”](#) on [page 44](#).

## 4 System Modifications

Installing the Modified Column Out and Waste In Lines

**Table 10.** UHPLC Liquid Junction Kit contents (Sheet 2 of 2)

Description		Part number
UHPLC liquid junction cross with a platinum electrode and two-piece protective cover		N/A
Tightening tool used to torque internally-threaded knurled nut fittings (quantity: 2)		(IDEX™) P-278
Microferrules (quantity: 3)		(IDEX™) PK-152
Blind plug microferrule		(IDEX™) P-116

## Installing the Modified Column Out and Waste In Lines

This section describes how to install the modified Column Out and Waste In lines that are supplied in the UHPLC Liquid Junction Kit. For information about setting up the liquid junction, refer to the *EASY-nLC 1200 Getting Started Guide*.

Installing the modified Column Out and Waste In lines requires the following tools and materials.

Tools	Parts and materials
<ul style="list-style-type: none"><li>• #2 Phillips head screwdriver</li><li>• Flat-blade screwdriver</li></ul>	<ul style="list-style-type: none"><li>• Liquid Junction Kit (P/N ES269)</li><li>• Powder-free safety gloves</li></ul>

### ❖ To install the modified Column Out and Waste In lines

1. Close down the EASY-nLC instrument, and turn off the power to the instrument (see “Closing Down the EASY-nLC Instrument” on page 22).
2. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.

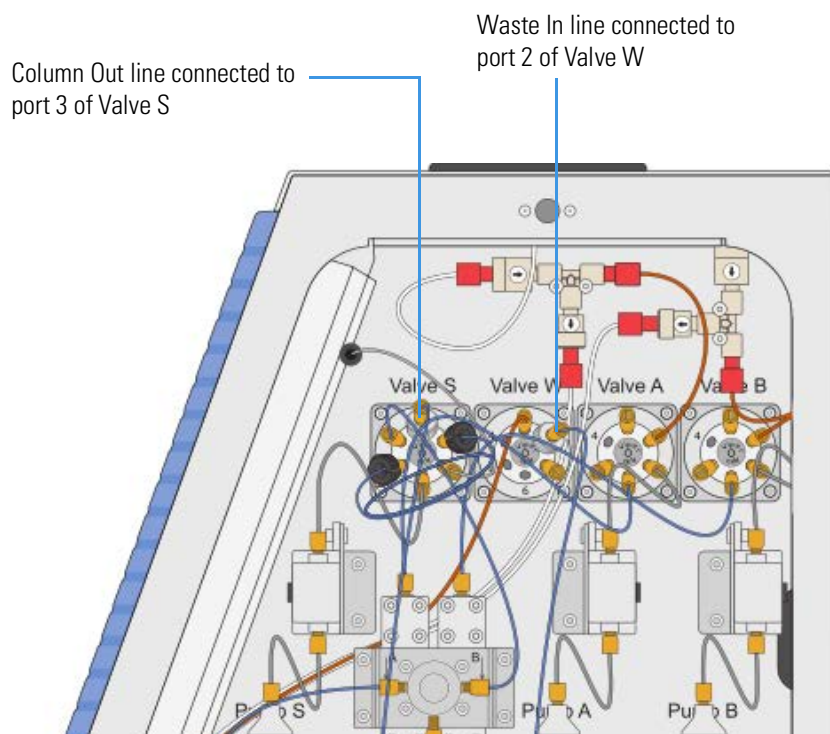
- Using the black knurled tightening tool, remove the Column Out line from port 3 of valve S and the Waste In line from port 2 of valve W.



**CAUTION** Ensure that the grounding adapters are still kept tight.

Figure 45 shows the Column Out line connection to valve S and the Waste In line connection to valve W.

**Figure 45.** Right panel removed from the EASY-nLC 1200 instrument



The Column Out and Waste In lines provided in the UHPLC Liquid Junction Kit have a nanoViper fitting at one end and bare fused-silica tubing at the other end.

- Connect the Column Out line's nanoViper fitting to port 3 of valve S and the Waste In line's nanoViper fitting to port 2 of valve W. To avoid damage to the nanoViper fittings, take care to install these lines as described in [“Replacing Viper/nanoViper solvent lines”](#) on page 83.
- Leak test the system as described in [“Running a System Leak Test”](#) on page 178.

**Note** When running a system leak test, use the UHPLC fused-silica union to connect the Column Out line to the Waste In line.

- Reconnect the right panel.

#### **4 System Modifications**

Installing the Modified Column Out and Waste In Lines

For information about installing analytical columns with bare fused-silica ends, refer to the *EASY-nLC 1200 Getting Started Guide*.

## Routine Maintenance

To maintain the EASY-nLC instrument, follow the procedures in this chapter.

**Tip** You can access most of the instrument components by removing either the left or right side panel of the instrument. Three captive quarter-turn screws secure each panel to the instrument housing. To remove a side panel from the housing, loosen (unlock) the screws from the housing by rotating them 90° counterclockwise. When loosened, the screws rotate freely without constraint, but remain connected to the side panel.

For information about the suggested maintenance schedule and the built-in maintenance scripts and record keeping features provided by the EASY-nLC touch-screen application, see [Chapter 3, “Maintenance Scripts and Service Records.”](#)

### Contents

- [Maintaining a Clean Working Environment](#)
- [Using Only UHPLC/MS-Grade Solvents](#)
- [Refreshing solvents](#)
- [Re-calibrating Flow Sensors](#)
- [If a solvent refresh was acknowledged less than two weeks ago, this button reads “Solvents Refreshed” \(Figure 46\).](#)
- [Maintaining the Syringe Pumps](#)
- [Replacing the Check Valves](#)
- [Replacing Viper/nanoViper solvent lines](#)
- [Replacing the Autosampler Needle](#)
- [Replacing the Sample Loop](#)
- [Replacing a Pressure Sensor](#)
- [Replacing a Flow Sensor](#)
- [Replacing the Hard Drive](#)
- [Managing the Devices List](#)

## Maintaining a Clean Working Environment

Maintain a clean working environment for the EASY-nLC instrument.

When cleaning the outside of the EASY-nLC instrument, use a mild detergent and a clean cloth.

## Using Only UHPLC/MS-Grade Solvents

Use only UHPLC/MS-grade solvents with your EASY-nLC instrument.

**CAUTION** Using HPLC-grade solvents or water produced by a laboratory purification system can cause system blockages and poor spray stability.

To eliminate system blockages caused by contaminated solvents, Thermo Fisher Scientific recommends that you use only solvent blends ordered from Thermo Fisher Scientific in the solvent A and B bottles and the wash solvent bottle.

For information about solvents and solvent blends from Thermo Fisher Scientific, refer to the *EASY-nLC 1200 Getting Started Guide*.

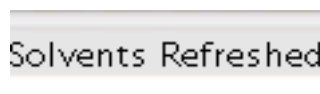
The Optima LC/MS mobile phases can be ordered through [www.fishersci.com](http://www.fishersci.com) (search for Optima LC/MS)

## Refreshing solvents

To maintain a constant solvent quality, it is recommended to exchange the solvents at least every two weeks. Discard the old solvents and fill the bottles with new, do not top up.

Solvent refresh reminder:

**Figure 46.**



**Figure 47.**



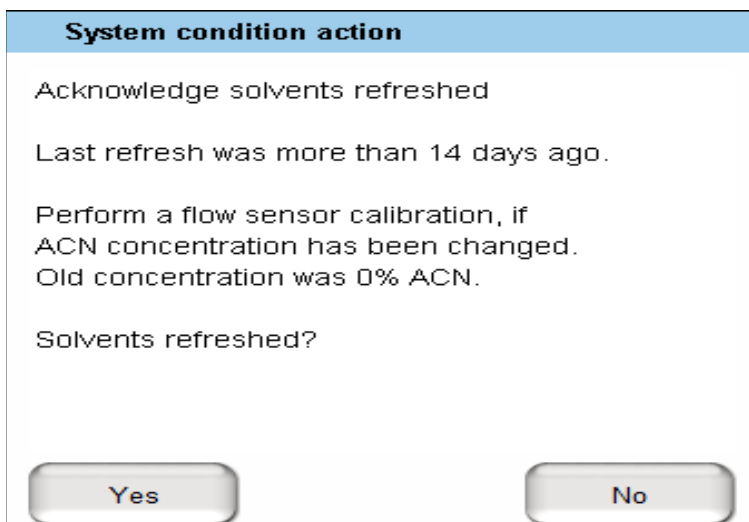
If a solvent refresh was acknowledged less than two weeks ago, this button reads “Solvents Refreshed” (Figure 46).



Two weeks after the last acknowledged solvent refresh, a solvents refresh due reminder button is shown on the left menu panel (Figure 47).

**CAUTION** You have to acknowledge a solvent refresh by clicking on the “Solvents refresh due” or the “Solvents Refreshed” button. Otherwise the solvents refresh reminder doesn't work properly.

**Figure 48.**



**CAUTION**

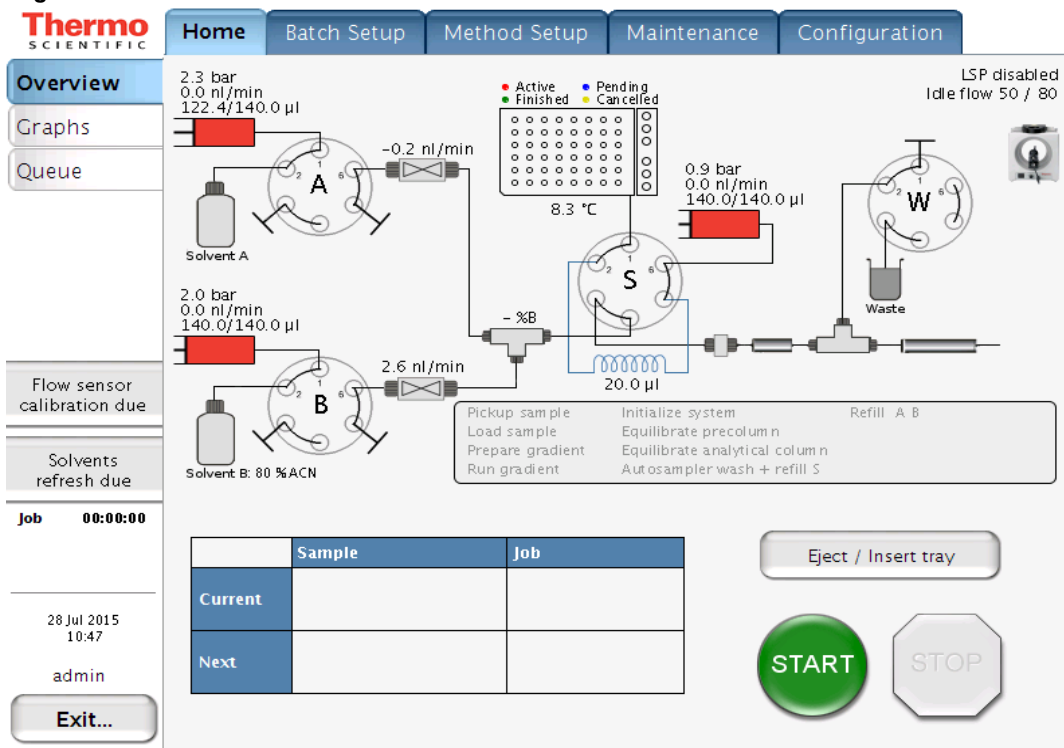
- Always refresh solvents A and B at the same time. Otherwise the solvent refresh reminder doesn't work properly.
- If the solvent B composition has been changed during the solvent refresh, please perform a flow sensor calibration.

## Re-calibrating Flow Sensors

**Note** A re-calibration of the flow sensors is recommended every 6 months and if either solvent A or B composition has changed.

6 months after the last flow sensor calibration for flow sensors A and B, a “Flow sensor calibration due” button appears on the left menu panel.

Figure 49.



By clicking on the button, you jump to the flow sensor calibration script.

After the flow sensor calibration script has been successfully finished, the “Flow sensor calibration due” reminder disappears.

For more details see [Flow Sensors](#) on page 52.

## Replacing the Main Power Fuse

The EASY-nLC uses these fuses:

- For 120 Vac, the instrument uses one T 5 AL 250 V fuse (5 × 20 mm, IEC 60127).
- For 230 Vac, the instrument uses one T 2.5 AL 250 V fuse.

Use only UL Listed and CSA-certified fuses, All fuses supplied with the instrument are UL Listed and CSA certified.



**CAUTION** Before removing the fuses, turn off the instrument and remove the power cable.

❖ **To replace the main power fuses**

1. Move the EASY-nLC instrument to a benchtop where you can access the back panel.

Figure 51 shows the steps required to remove the fuse holder.

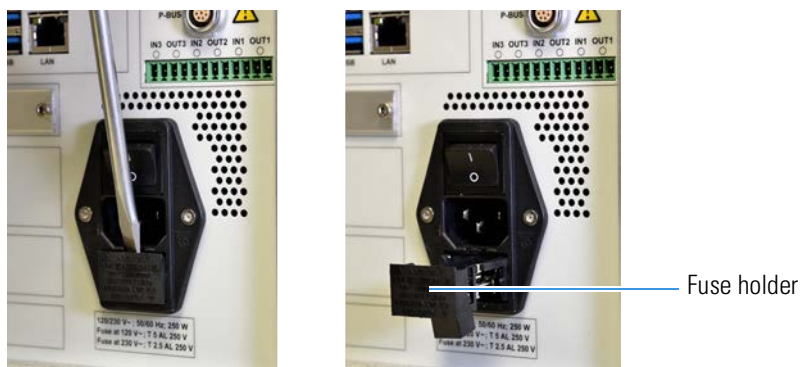
2. Turn off the instrument power and pull the power plug out of the power receptacle (Figure 50).

**Figure 50.** Power cable removed from the instrument's power receptacle



3. Remove the power fuse as follows (Figure 51):
  - a. Place a flat-blade screwdriver into the slot in the top of the fuse holder, and turn the screwdriver to loosen the fuse holder.
  - b. Pull the fuse holder out of the power entry module.

**Figure 51.** Removing the fuse holder



4. To install the appropriate fuse, do one of the following:
  - Insert the 5 A fuse into the slot that aligns with the white triangle at the end of the 110–120 V line power text.
  - Insert the 2.5 A fuse into the slot that aligns with the white triangle at the end of the 220–240 V text.

5. Make sure that the fuse ends align with the mounting brackets.

**Note** The fuse holder holds two fuses. One fuse is for a 220–240 V line power and the other is for a 110–120 V line power.

6. Insert the fuse holder into the power entry module in the orientation that corresponds to the operating power.

The triangle to the right of the voltage rating points toward the white mark at the bottom of the power entry module (Figure 52).

**Figure 52.** Power entry module



Appropriate orientation for 220–240 line voltage

## Maintaining the Syringe Pumps

Each pump contains a piston seal and a piston. Over time, the buffered solutions leave deposits on the pistons, and through constant contact with the moving pistons, the piston seals slowly deteriorate.



**CAUTION** Overtightening stainless steel viper solvent lines damages their fittings.

To replace a pump piston seal and clean the piston, follow these procedures:

1. “Retracting the Piston” on page 72
2. “Replacing the Piston Seal” on page 73

3. [“Priming the Pump” on page 78](#)
4. [“Resetting the Pump Usage Counter” on page 80](#)
5. [“Removing Air After Replacing a Piston Seal or a Pump” on page 81](#)
6. Depending on whether you are performing maintenance on one of the chromatography pumps (pump A or B) or on the sample pump (pump S), follow one of these procedures:
  - For pumps A and B, run a pump leak test as described in [“Running the Leaks Script after Replacing a Piston Seal or a Pump” on page 81](#).
  - For pump S, run a sample pickup test as described in [“Sample Pickup” on page 42](#).

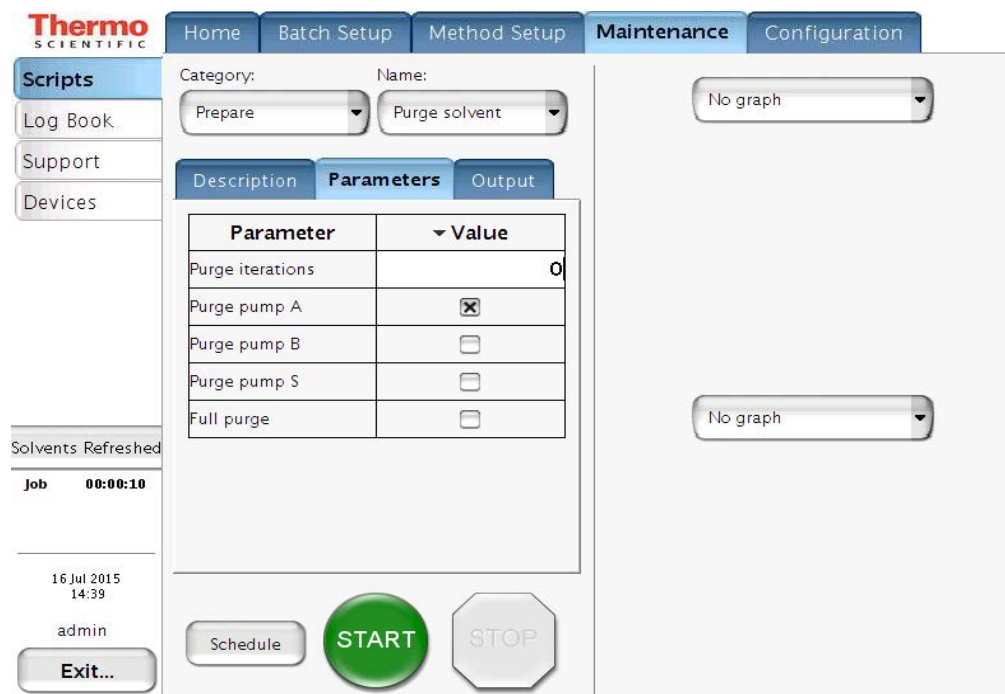
## Retracting the Piston

Set the pump piston to the fully retracted position by running the Purge Solvent script with 0 iterations.

❖ **To retract the pump piston**

1. On the touch screen, press **Maintenance > Scripts**.
2. In the Category list, select **Prepare**.
3. In the Name list, select **Purge Solvent**.
4. Press the **Parameters** tab.
5. In the Purge Iterations box, enter **0** (Figure 53).

**Figure 53.** Purge Solvent script with 0 iterations



6. Select the check box for the appropriate pump.
7. Press **Start**.

The piston moves backward until it reaches the 140 µL position.

8. To replace the piston seal, go to the piston seal replacement procedure [“Replacing the Piston Seal”](#) on [page 73](#)

## Replacing the Piston Seal

Replacing the piston seal requires these tools and materials:

Tools	Parts and materials
<ul style="list-style-type: none"> <li>• #2 Phillips head screwdriver</li> <li>• 3 mm L-hex wrench</li> <li>• Pipette</li> </ul>	<ul style="list-style-type: none"> <li>• Powder-free safety gloves</li> <li>• UHPLC/MS-grade methanol</li> <li>• UHPLC/MS-grade acetonitrile</li> <li>• Piston seal and piston seal tool, P/N LC510</li> <li>• Stainless steel viper solvent line</li> </ul>

### ❖ To replace the piston seal



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

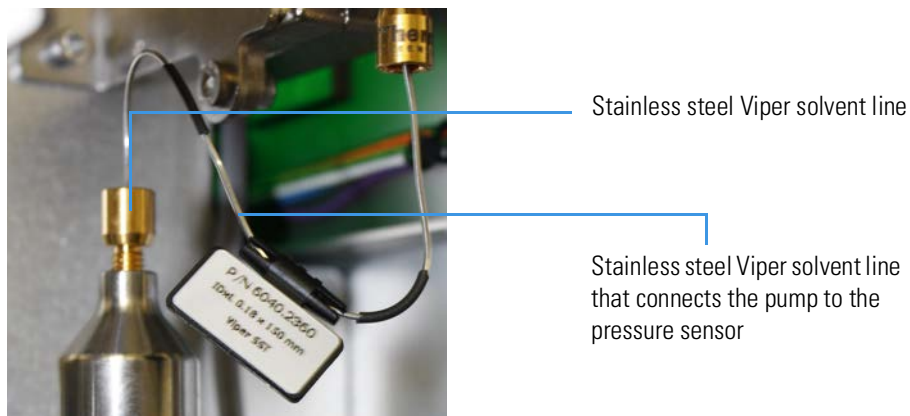
1. If you have not already done so, set the piston to its fully retracted position as described in “Retracting the Piston” on page 72.
2. Set the corresponding valve to the **Center** position as described in “Using the Valve Controls” on page 165.

**Note** Setting the corresponding valve to the **Center** position prevents the solvent from leaking down from the solvent bottle.

3. Close down the EASY-nLC instrument and turn off the power (see “Closing Down the EASY-nLC Instrument” on page 22).
4. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.

5. Remove the used piston seal as follows:
  - a. Remove the stainless steel Viper solvent line connected to the pump head (Figure 54). It is also recommended to disconnect the tubing from the pressure sensor. This prevents damage, because it does not have to be bent out of the way.

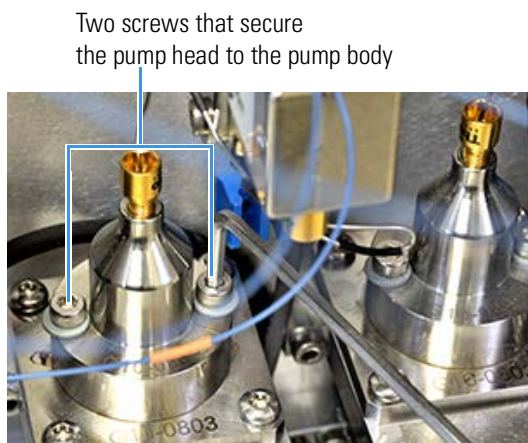
**Figure 54.** Stainless steel fitting connected to the pump head (PLU model pump)



- b. Using a 3 mm L-hex wrench, remove the two screws that secure the pump head to the pump body (Figure 55).

**IMPORTANT** Do not move the piston if the pump head has been removed. Doing so can affect the piston alignment, which might cause the piston calibration to be lost and result in irreversible piston damage.

**Figure 55.** Using a 3 mm L-hex wrench to remove the pump head



- c. Clean the exposed portion of the piston with a lint-free tissue soaked in UHPLC/MS-grade methanol and visually inspect the piston for scratches. Ensure that no solvent runs into the pump.



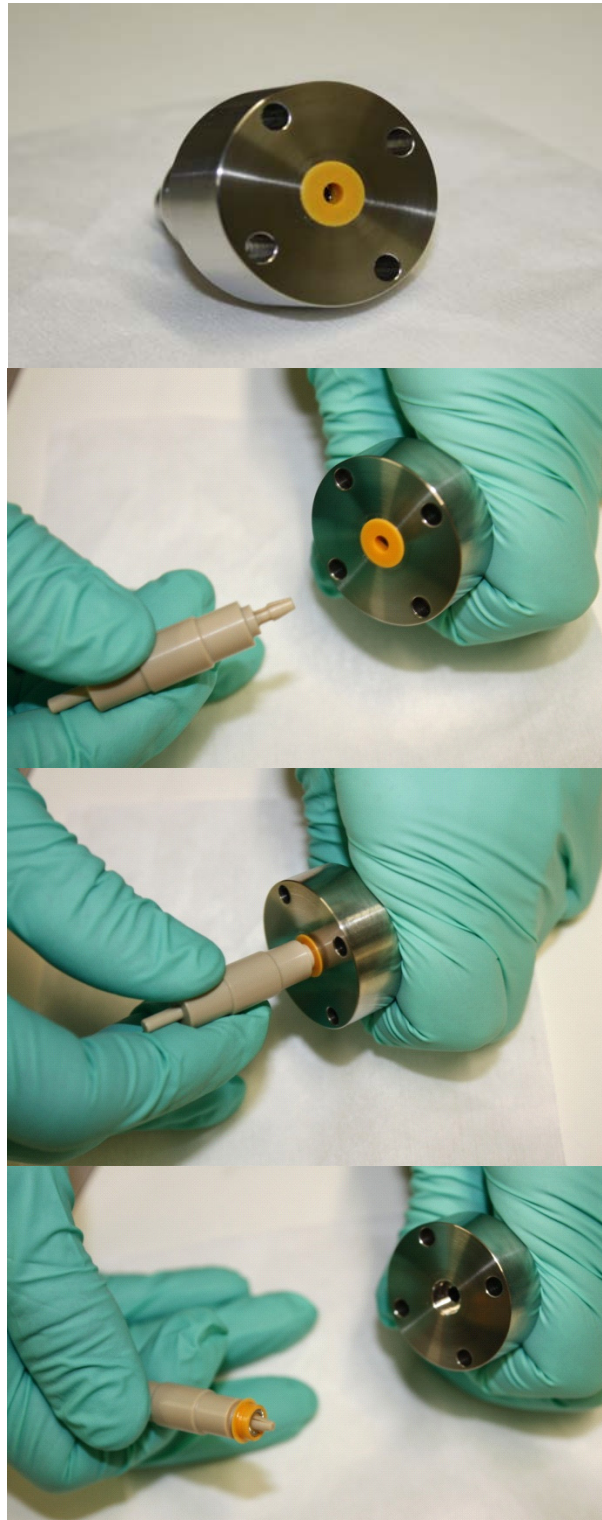
- d. Remove the old seal from the pump head using the piston seal removal tool (Figure 57). The piston seal removal tool is part of the accessory kit of the EASY-nLC 1200 (Figure 56).

**Figure 56.** Piston seal removal tool



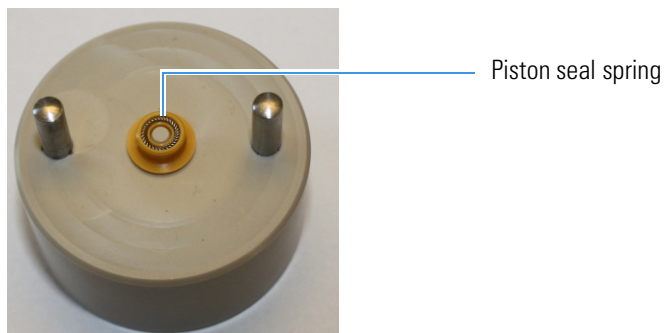
**CAUTION** Use only the dedicated piston seal tool for removing the piston seal from the pump head. Other tools can scratch the inside of the pump head and generate leaks.

**Figure 57.** Removal of old piston seal



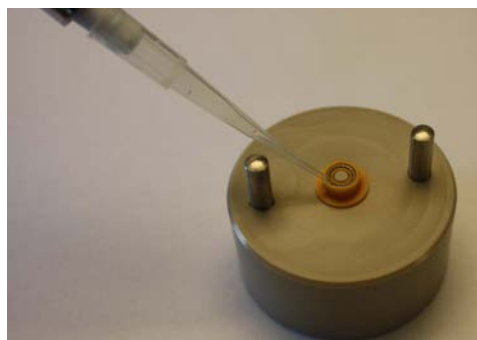
6. Install the new piston seal as follows:
  - a. With the spring side of the piston seal facing upward, mount the new piston seal onto the piston seal tool (Figure 58).

**Figure 58.** Piston seal mounted on the piston seal tool



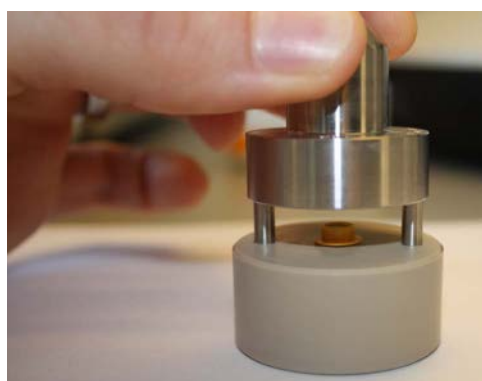
- b. Using a pipette, fill the rim of the piston seal with 100% UHPLC/MS-grade methanol to remove the air from the piston seal spring (Figure 59).

**Figure 59.** Filling the piston seal with methanol



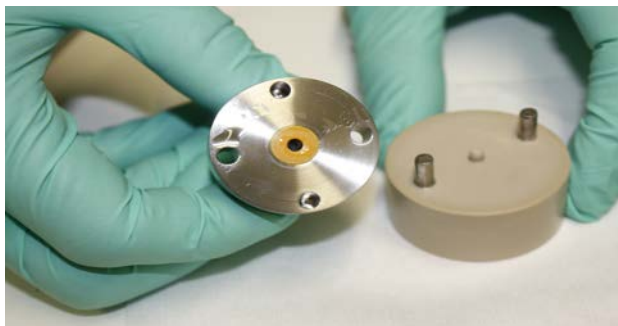
- c. Place the pump head on the guide rods and evenly press it all the way down against the piston seal tool to insert the seal into the pump head (Figure 60).

**Figure 60.** Inserting the piston seal into the pump head



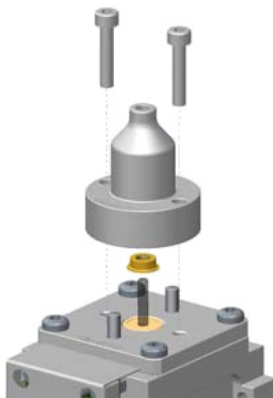
- d. Gently pull the pump head off of the guide rods (Figure 61).

**Figure 61.** Removing the pump head from the piston seal tool



7. Mount the pump head back on the pump body using the two screws and a 3 mm L-hex wrench. Do not mount the stainless steel tubing to the pump head.

**Figure 62.**



8. Go to the next procedure, “Priming the Pump.”

## Priming the Pump

After you replace a piston seal, prime the pump with the appropriate solvent before you reconnect the solvent line to the pump head.

### ❖ To prime the pump

1. Turn on the EASY-nLC instrument and log in as an administrator.
2. Set the piston to its fully extended position as follows:
  - a. On the touch screen, press **Home > Overview**.
  - b. Press the pump icon for the pump that you want to control.  
The Pump *X* dialog box opens, where *X* identifies the pump (A, B, or S).
  - c. Set the flow rate to **300**  $\mu\text{L}/\text{min}$  and the volume to **140**  $\mu\text{L}$ .
  - d. Press **Start**.

- e. Once completed, go to step 3.
3. Fill the pump head with solvent as follows:
  - a. Pipette an aliquot of the appropriate solvent into the pump head (Figure 63).

**Figure 63.** Adding solvent to the pump head



**CAUTION** Be careful not to spill solvent on the PCBs.

- b. In the Pump dialog box, set the flow rate to **-300**  $\mu\text{L}/\text{min}$  and the volume to **140**  $\mu\text{L}$ . Then press **Start**.  
The piston moves down, drawing the solvent into the pump.
  - c. Make sure the pump head is filled with solvent during the entire retraction of the piston.
4. Mount the stainless steel Viper back on the pump head and the pressure sensor.
  5. Mount the right side panel to the instrument housing. Then, with a #2 Phillips head screwdriver, secure the panel by rotating the three captive screws a quarter-turn clockwise.

After you mount the pump head back on the pump body and the high-pressure line from the pressure sensor on the pump head, reset the pump usage counter, and then remove air from the system.

**Note** Reset the usage counters before removing air from the system because the air removal procedure requires the pump to go through 10 purge cycles.

## Resetting the Pump Usage Counter

Reset the pump usage counter after you prime the pump.

### ❖ To reset the pump usage counter

1. On the touch screen, press **Maintenance > Devices**.
2. Select the pump from the list of devices.
3. Press the **Summary** tab.
4. Press **Reset**.

The value in the Intermediate Volume box resets to 0.

For more information, see [“Checking and Resetting the Device Usage Counters”](#) on [page 59](#).

## Removing Air After Replacing a Piston Seal or a Pump

To draw fresh solvent through the solvent system and to remove air from the solvent system components, including the pump heads, follow these procedures after you prime the pump and reset the usage counters:

### ❖ To draw fresh solvent into the system and remove air from the system

1. To draw fresh solvent into the system and remove air from the solvent lines, do the following:
  - a. On the touch screen, press **Maintenance > Scripts**.
  - b. In the Category list, select **Prepare**.
  - c. In the Name list, select **Purge Solvent** (see “[Purge Solvent](#)” on [page 32](#)).
  - d. Press the **Parameters** tab.
  - e. In the Purge Iterations box, enter **10**.
  - f. Select the check box for the appropriate pump.
  - g. Press **Start**, and wait for the system to perform 10 purge cycles.
2. To remove air from the pump head, do the following:
  - a. In the Name list, select **Flush Air** (see “[Flush Air](#)” on [page 33](#)).
  - b. Press the **Parameters** tab.
  - c. Set the flush volume threshold to **12 µL**.
  - d. Press **Start** and wait for the script to finish.

## Running the Leaks Script after Replacing a Piston Seal or a Pump

After you prime pump A or pump B, reset the usage counters, remove air from the system, and run a pump leak test.

**Note** For pump S, run a sample pickup test as described in “[Sample Pickup](#)” on [page 42](#).

For information about replacing a pump, see “[Replacing a Pump](#)” on [page 121](#). Only a Thermo Fisher Scientific field service engineer can replace a damaged pump, as replacing the pump is an advanced maintenance procedure.

### ❖ To run a pump leak test on a replacement pump or a pump with a new piston seal

Follow the instructions in “[Leaks](#)” on [page 44](#). When the instrument is leak tight, the instrument is ready for use.

You can easily damage the stainless steel viper tubing that connects the pump to the pressure sensor by overtightening the fittings. If the script detects a leak, replace this flow line.

## Replacing the Check Valves

If a check valve is not functioning, replace it.

Replacing a check valve requires the following tools, materials, and replacement parts.

Tools	Parts and materials
<ul style="list-style-type: none"><li>• 9/16 in. open-ended wrench</li><li>• #2 Phillips head screwdriver</li></ul>	<ul style="list-style-type: none"><li>• Powder-free safety gloves</li><li>• Solvent-side check valve, P/N LC233</li><li>• Waste-side check valve, P/N LC234</li></ul>



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

### ❖ To replace a check valve

1. Close down the EASY-nLC system, and turn off the power to the instrument (see “Closing Down the EASY-nLC Instrument” on page 22).
2. Using a #2 Phillips head screwdriver, make a quarter turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.
3. Do the following:
  - For a solvent-side check valve, remove the solvent inlet line from the check valve, and then terminate the solvent line with a plug.
  - For a waste-side check valve, remove the waste line from the check valve.



**CAUTION** To prevent solvent from siphoning out of the solvent bottle on top of the instrument and onto system components, use a plug to terminate a solvent inlet line when you disconnect it from the solvent-side check valve.

The pump PCB is easily damaged by contact with solvents.

4. Do one of the following:
  - For a solvent-side check valve, use a 9/16 in. open-ended wrench to loosen the valve from the check valve assembly.
  - For the waste-side check valve, remove the check valve by turning it counterclockwise with your fingers.
5. Screw the new check valve onto the check valve assembly. Slightly tighten the solvent-side check valve to the assembly using a 9/16 in. open-ended wrench.

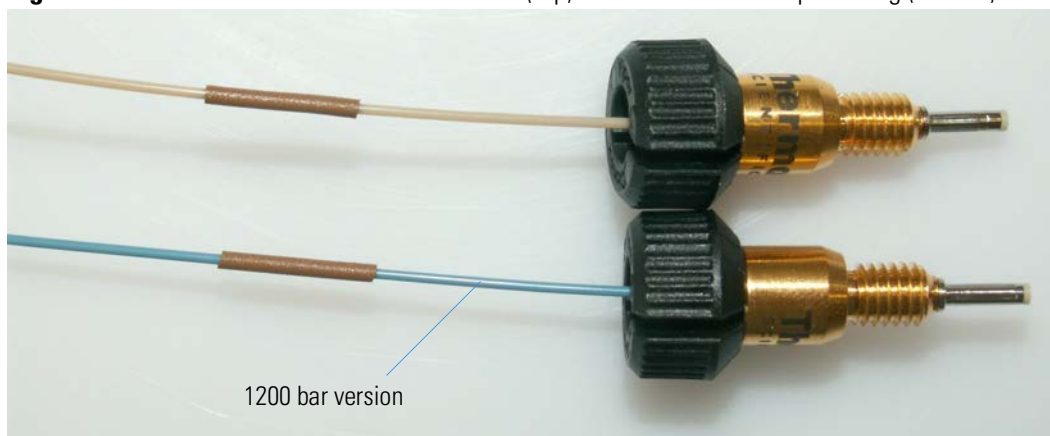


6. Do one of the following:
  - For a solvent-side check valve, reconnect the solvent inlet line.
  - For a waste-side check valve, reconnect the waste line.
7. Mount the right side panel to the instrument housing. Then, with a #2 Phillips head screwdriver, secure the panel by rotating the three captive screws a quarter-turn clockwise.
8. Run the Purge Solvent script for the pump associated with the replaced check valve, and monitor the flow from the solvent bottle when the pump is filling and the flow to the waste beaker when the pump is emptying (see “Purge Solvent” on page 32).

## Replacing Viper/nanoViper solvent lines

**IMPORTANT** The EASY-nLC 1200 requires nanoViper fitting systems with a specified pressure range up to 1200 bar. Older versions are only specified up to 1000 bar. The new 1200 bar nanoViper fitting system consists of blue PEEK tubing, which distinguishes it from the beige 1000 bar version, see [Figure 64](#).

**Figure 64.** Visual difference between 1000 bar (top) and 1200 bar nanoViper fitting (bottom)



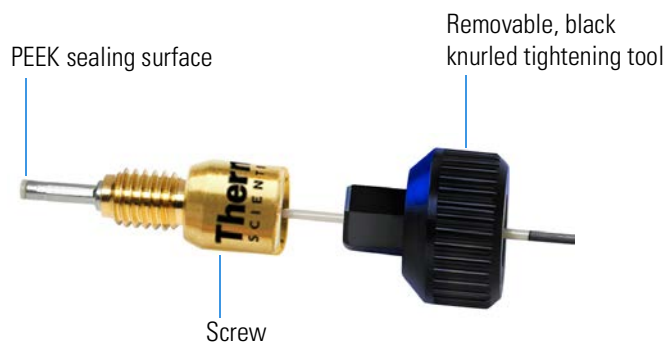
For the EASY-nLC instrument, most of the plumbing connections are made with nanoViper fittings ([Figure 65](#)).

**Note** For more information about working with nanoViper fittings, see “[Using nanoViper Fittings Quick Reference Guide](#)” on page 273.

## 5 Routine Maintenance

Replacing Viper/nanoViper solvent lines

**Figure 65.** nanoViper fitting



Even though nanoViper fittings can withstand UHPLC backpressures of up to 1200 bar (17404 psi), they are fingertight fittings, which require only very small torques to seal. Therefore, you must follow the guidelines below to avoid damage by overtightening.

### ❖ To use a nanoViper fitting

1. Insert the nanoViper fitting into the target port and slowly rotate the screw clockwise until you feel resistance.
2. Turn the screw clockwise to an angle between 0 and 45 degrees (1/8-turn) using the black knurled tightening tool.
3. Run the Leaks script for the system as described in [“Running a System Leak Test”](#) on [page 178](#).

When the leak test ends, the system is at atmospheric pressure.

**IMPORTANT** To extend the lifetime of the nanoViper fittings, open and close connections at atmospheric system pressures only. Opening and closing connections at high system pressures can reduce the lifetime of the fitting system.

4. If the Leaks script fails because the new connection is not leak tight, use the black knurled tightening tool to turn the screw by as much as an additional 45 degrees. Do not turn the screw beyond an angle of 90 degrees from where you felt the initial resistance.

**IMPORTANT** To prevent damage to the sealing surface of the nanoViper fitting, take care not to overtighten the nanoViper fitting.

## Replacing the Autosampler Needle

Replacing the autosampler needle requires these tools and materials:

Tools	Parts and materials
<ul style="list-style-type: none"> <li>#2 Phillips head screwdriver</li> </ul>	<ul style="list-style-type: none"> <li>Powder-free safety gloves</li> <li>ASC autosampler needle, P/N LC302<sup>1</sup></li> </ul>

<sup>1</sup>For the current revision of the autosampler needle (LC302 revision B), a nanoViper fitting replaces the stainless steel nut.

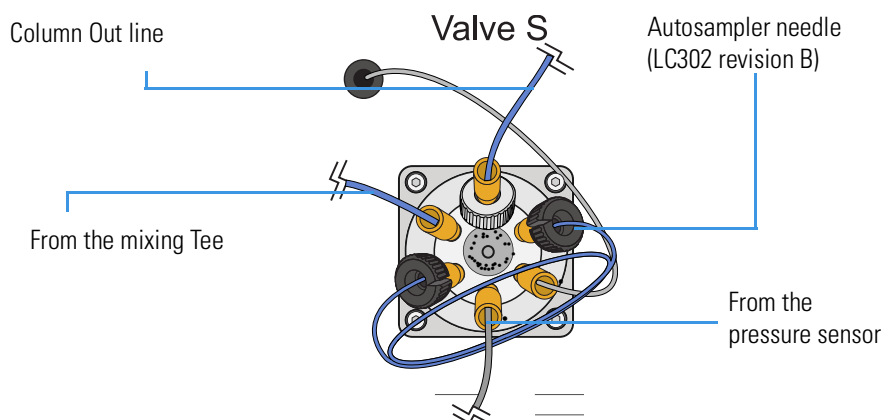
### ❖ To remove the autosampler needle from an ASC model autosampler

- Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.
- Disconnect the autosampler needle from port 1 of valve S by using the black knurled nut to unscrew the fitting that secures the autosampler needle to port 1 of valve S.

**Note** Ensure that the grounding adapters are still kept tight.

Figure 66 shows the solvent line connections to valve S.

**Figure 66.** Valve S solvent line connections



- Move the holder to position A1 as follows:
  - Press **Home > Overview**.
  - Press the **Autosampler** icon.  
The Autosampler dialog box opens.
  - In the XYZ Robot area, select position **A1** in the Well box

4. Move the *z*-axis needle holder to position W1 as follows:

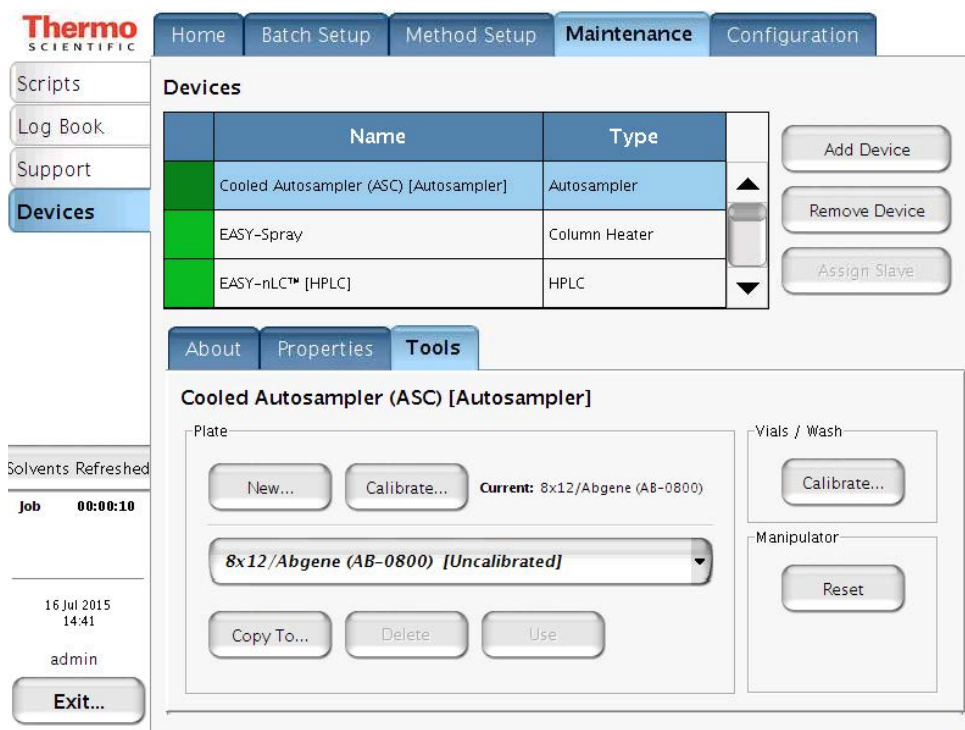
- a. Press **Home > Overview**.
- b. Press the **Autosampler** icon.

The Autosampler dialog box opens.

- c. In the XYZ Robot area, press **Go to Calibration**.

The Tools page of the Autosampler view on the Maintenance > Devices page opens (Figure 67).

**Figure 67.** Tools page of the Autosampler view on the Maintenance > Devices page

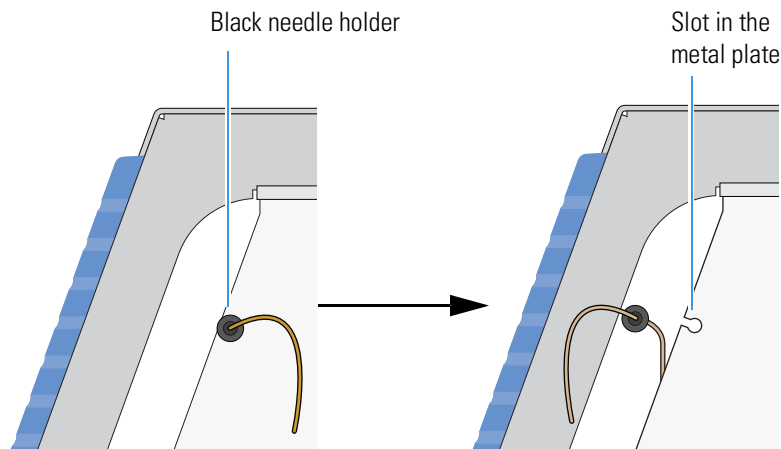


- d. In the Manipulator area, press **Reset**.

The *z*-axis needle holder moves to the W1 position.

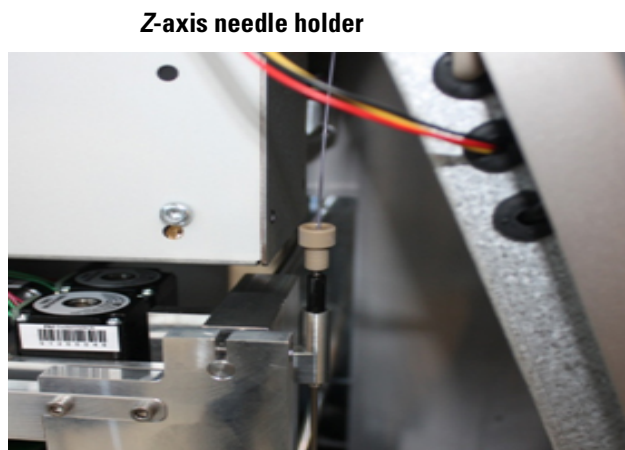
5. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.
6. Remove the black needle holder from the slot in the metal plate that separates the solvent system hardware from the autosampler compartment. Removing the fitting requires some gentle movement from both sides of the plate (Figure 68).

**Figure 68.** Removing the black needle holder from the slot in the metal plate



7. Loosen the nut that is connected to the z-axis needle holder by turning it counterclockwise (Figure 69). Then carefully pull the autosampler needle upward and away from the holder.

**Figure 69.** Autosampler needle connected to the z-axis needle holder



❖ **To install a new autosampler needle**

1. Mount the new autosampler needle in the z-axis holder. Check that the small spring is situated between the PEEK nut and the plastic stop.
2. Guide the end of the needle that connects to valve S through the large hole in the metal plate that separates the tray compartment from the solvent system compartment.
3. Install the black needle holder in the side plate.
4. Connect the needle to port 1 of valve S as follows:

- a. Insert the nanoViper fitting into the receiving port. Then turn the screw clockwise until you feel resistance.
  - b. Turn the screw clockwise to an angle between 0 and 45 degrees (1/8-turn) using the black knurled nut.
5. Recalibrate the needle position as described in [Chapter 8, “Calibrating the Autosampler’s XYZ Robot.”](#)
6. Run five iterations of the Purge Solvent script for Pump S.  
For information about running the Purge Solvent script, see [“Purge Solvent”](#) on [page 32](#).
7. Run the Flush Air script for Pump S with a flush volume threshold of 12  $\mu\text{L}$ .  
For information about running the Flush Air script, see [“Flush Air”](#) on [page 33](#).

## Replacing the Sample Loop

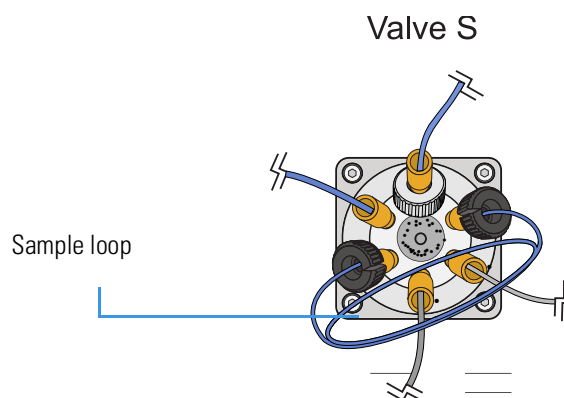
Thermo Fisher Scientific provides sample loops in several sizes for the EASY-nLC instruments.

### ❖ To replace the sample loop

1. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.
2. To remove the sample loop from the valve, do one of the following:
  - a. Return the system to atmospheric pressure (see [“Returning the System to Atmospheric Pressure”](#) on [page 276](#)).
  - b. Disconnect the nanoViper fittings connected to ports 2 and 5 of valve S.

[Figure 70](#) shows the sample loop connections for the EASY-nLC 1200 instrument.

**Figure 70.** Sample loop connections for the EASY-nLC 1200 instrument



3. Connect the replacement sample loop to valve S as follows:
  - a. Insert the fittings at the end of the sample loop into ports 2 and 5 of valve S.
  - b. Secure the fittings to their receiving ports as described in “[Replacing Viper/nanoViper solvent lines](#)” on page 83. Take care not to overtighten these fingertight fittings.
4. Check for leaks by running the system leak test as described in “[Checking the Sample Loop Connections for Leaks](#)” on page 184.

## Replacing a Pressure Sensor

This section describes how to replace a pressure sensor.

Replacing the pressure sensor requires these tools and materials:

Tools	Parts and materials
<ul style="list-style-type: none"> <li>• #2 Phillips head screw driver</li> </ul>	<ul style="list-style-type: none"> <li>• Powder-free safety gloves</li> </ul>
<ul style="list-style-type: none"> <li>• 2.5 mm L-hex wrench or ball driver</li> </ul>	<ul style="list-style-type: none"> <li>• Pressure sensor, P/N LC592</li> </ul>



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

**IMPORTANT** The EASY-nLC 1200 is not compatible with the pressure sensors from the EASY-nLC II and EASY-nLC 1000 and vice versa. The EASY-nLC 1200 pressure sensors are identified by the white connector to the pump PCB and the product number LV2-TI105-01-20K.

**Figure 71.** Pressure sensor product number



To replace a pressure sensor, follow these procedures:

1. [“To remove a pressure sensor from the instrument” on page 90](#)
2. [“To install the new pressure sensor” on page 91](#)

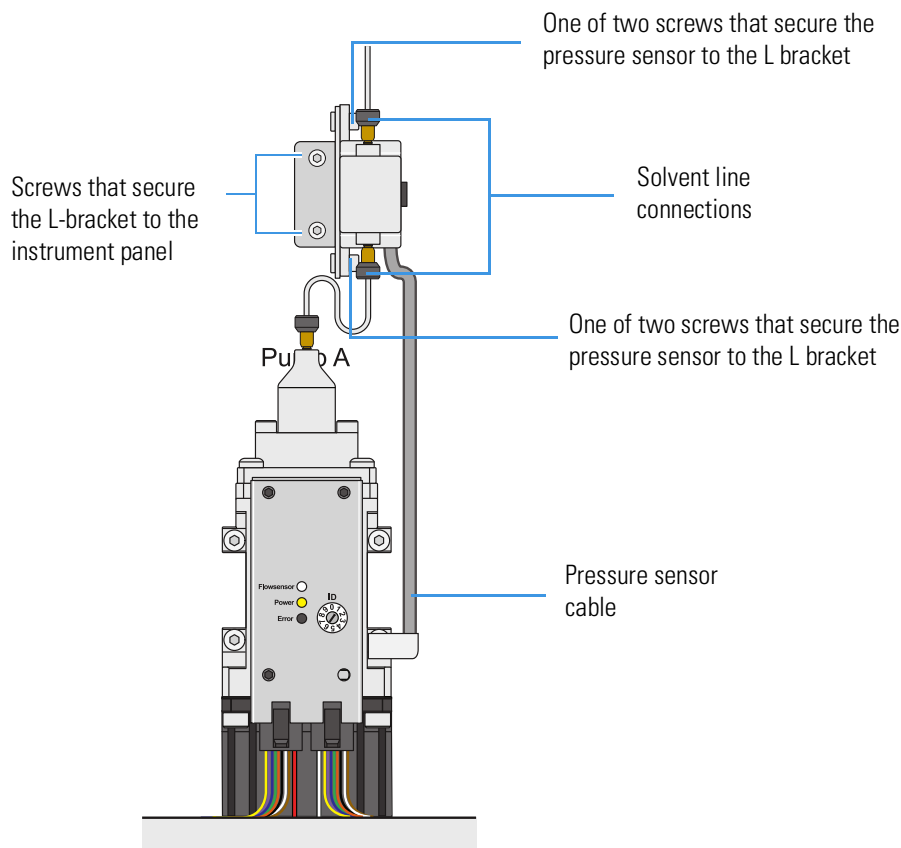
❖ **To remove a pressure sensor from the instrument**

1. Set the corresponding valve to the **Center** position as described in [“Using the Valve Controls” on page 165](#).
2. Close down the EASY-nLC system, and turn off the power to the instrument (see [“Closing Down the EASY-nLC Instrument” on page 22](#)).
3. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.
4. Disconnect the stainless steel Viper capillary attached to the inlet and outlet ports of the pressure sensor.
5. Using a 2.5 mm L-hex wrench or ball driver, remove the two screws that secure the pressure sensor L bracket to the instrument panel.
6. While holding the pressure sensor, use a 2 mm L-hex wrench to remove the two screws that secure the pressure sensor to the bracket.
7. Disconnect the pressure sensor cable from the pump.

[Figure 72](#) shows the pressure sensor connections.



**Figure 72.** Pressure sensor connections



❖ **To install the new pressure sensor**

1. Using a 2 mm L-hex wrench and the screws that you removed in [step 6](#) on [page 90](#), secure the new pressure sensor to the bracket.
2. Using a 2.5 mm L-hex wrench or ball driver and the screws that you removed in [step 5](#) on [page 90](#), reconnect the pressure sensor bracket to the interior right panel of the instrument.
3. Reconnect the stainless steel solvent lines to the inlet and outlet ports of the pressure sensor.
4. Mount the right side panel to the instrument housing. Then, with a #2 Phillips head screwdriver, secure the panel by rotating the three captive screws a quarter-turn clockwise.
5. Reconnect the pressure sensor cable.
6. Run three iterations of the Purge Solvent script as described in “[To run the Purge Solvent script](#)” on [page 32](#).
7. Run the Flush Air script as described in “[Flush Air](#)” on [page 33](#).

## Replacing a Flow Sensor

Replacing a flow sensor requires these tools and materials:

Tools	Parts and materials
<ul style="list-style-type: none"><li>• #2 Phillips head screw driver</li></ul>	<ul style="list-style-type: none"><li>• Powder-free safety gloves</li></ul>
<ul style="list-style-type: none"><li>• 2.5 mm hex wrench or ball driver</li></ul>	<ul style="list-style-type: none"><li>• Flow sensor A/B, P/N LC540</li></ul>

**IMPORTANT** EASY-nLC 1200 flow sensors are compatible with EASY-nLC 1000. EASY-nLC 1000 flow sensors are not compatible with EASY-nLC 1200.

Only flow sensors whose serial number is larger than 1528-XXXXXX can be used on EASY-nLC 1200 systems (software plausibility check).



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

To replace a flow sensor follow these procedures:

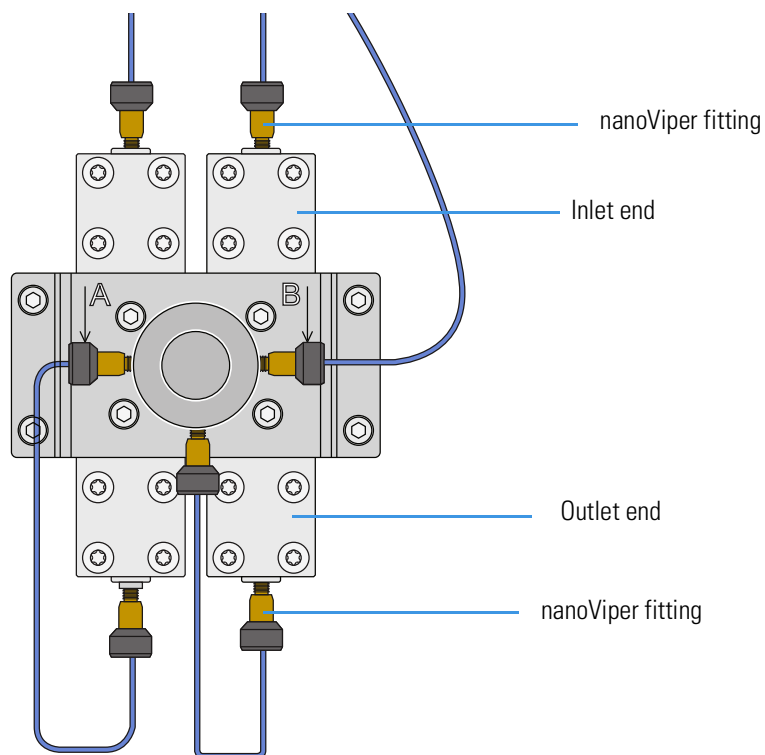
1. “[To remove an flow sensor,](#)” next procedure
2. “[To install an flow sensor](#)” on [page 95](#)

❖ **To remove an flow sensor**

1. Close down the EASY-nLC system, and turn off the power to the instrument (see “[Closing Down the EASY-nLC Instrument](#)” on [page 22](#)).
2. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.
3. Remove the nanoViper tubing from the inlet and outlet of the flow sensor.

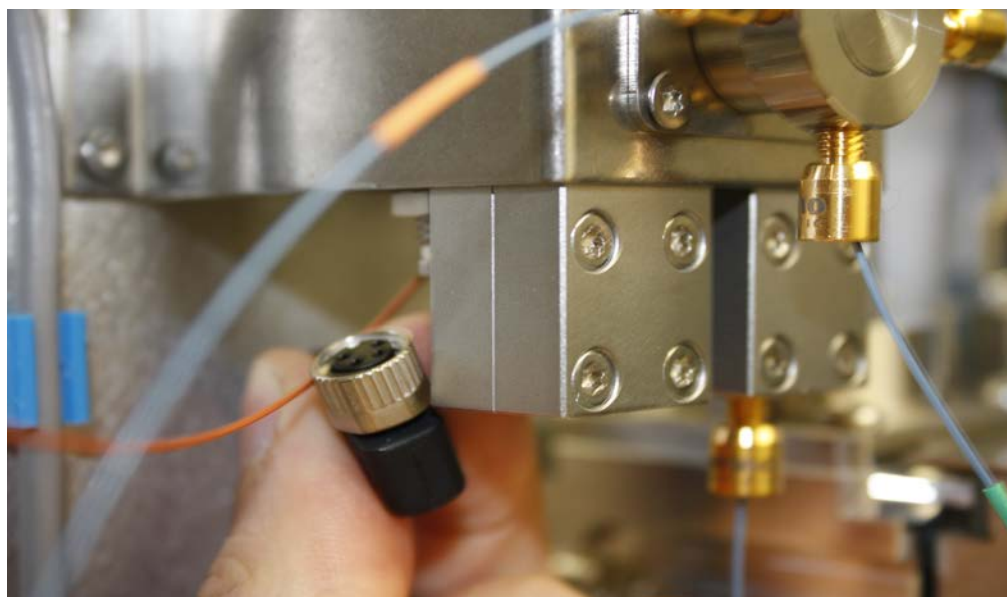
[Figure 73](#) shows the flow sensors mounted behind the bracket. The flow direction is labeled on the bracket.

**Figure 73.** Flow sensors



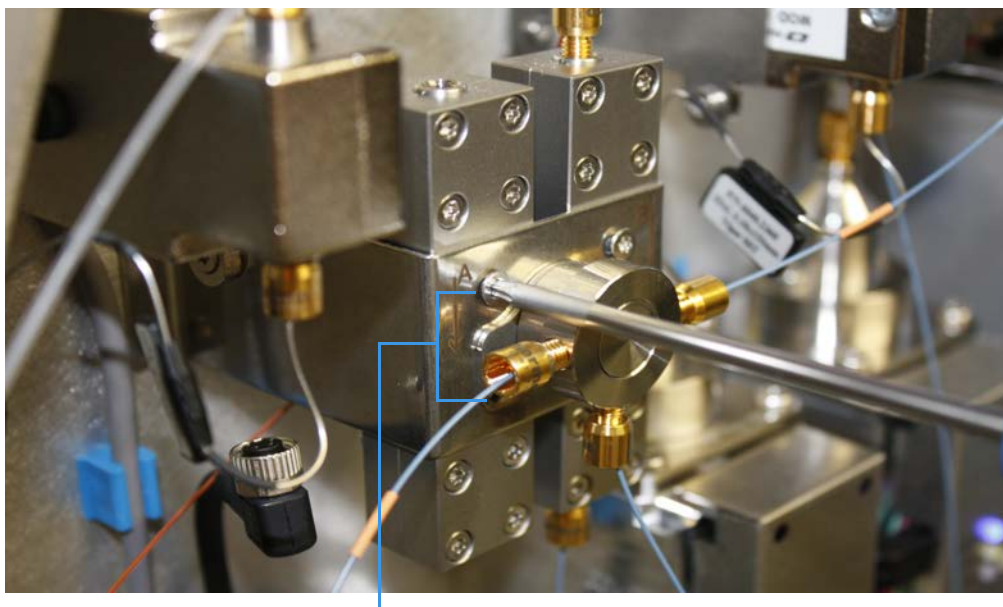
4. Remove the black cable from the flow sensor ([Figure 74](#)).

**Figure 74.** Removing the cable from the flow sensor



5. Using an 2.5 mm hex wrench, remove the two screws that secure the flow sensor to the bracket ([Figure 75](#)).

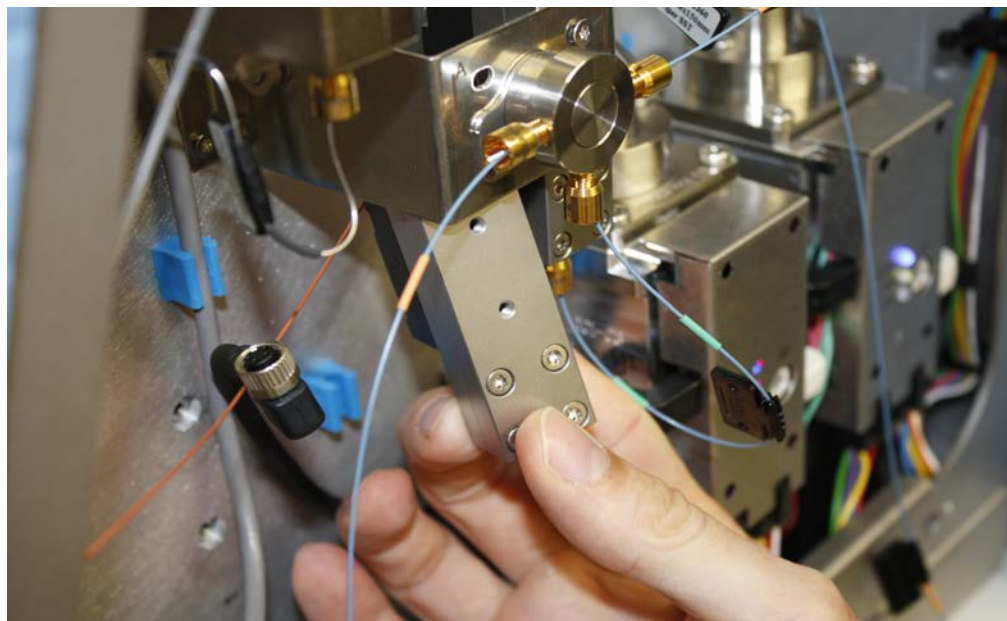
**Figure 75.** Removing the screws attaching the flow sensor to the bracket



Location of screws that secure flow sensor A

6. Remove the flow sensor ([Figure 76](#)).

**Figure 76.** Removing the flow sensor



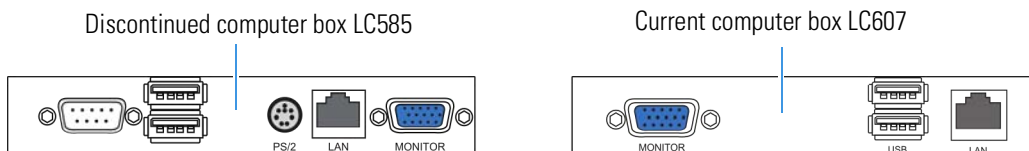
❖ **To install an flow sensor**

1. Insert the new flow sensor behind the bracket.
2. Insert the two screws (Figure 75 on page 94) that secure the flow sensor to the bracket, and tighten the screws with a 2.5 mm hex wrench.
3. Connect the black cable to the flow sensor (see Figure 74 on page 93).
4. Reconnect the nanoViper tubing to both ends of the flow sensor (see Figure 73 on page 93).
5. Replace the right side panel.
6. Turn on the EASY-nLC 1200 system, and wait one hour for the flow sensor to reach the correct operating temperature.
7. Calibrate the new flow sensor by using the Flow Sensors script (see “Constant Pressure” on page 50).

## Replacing the Hard Drive

Thermo Fisher Scientific supplies several versions of the hard drive. Order the appropriate hard drive based on the computer box where you are replacing the hard drive. The discontinued computer box has an RS 232 port (Figure 77).

**Figure 77.** Comparison of computer ports



Replacing the hard drive requires these tools and materials:

Tools	Replacement part
2.5 mm hex wrench	• LC586: compatible with obsolete computer box (P/N LC585)
Torx T-10 wrench	• LC608: compatible with current computer box (P/N LC607)

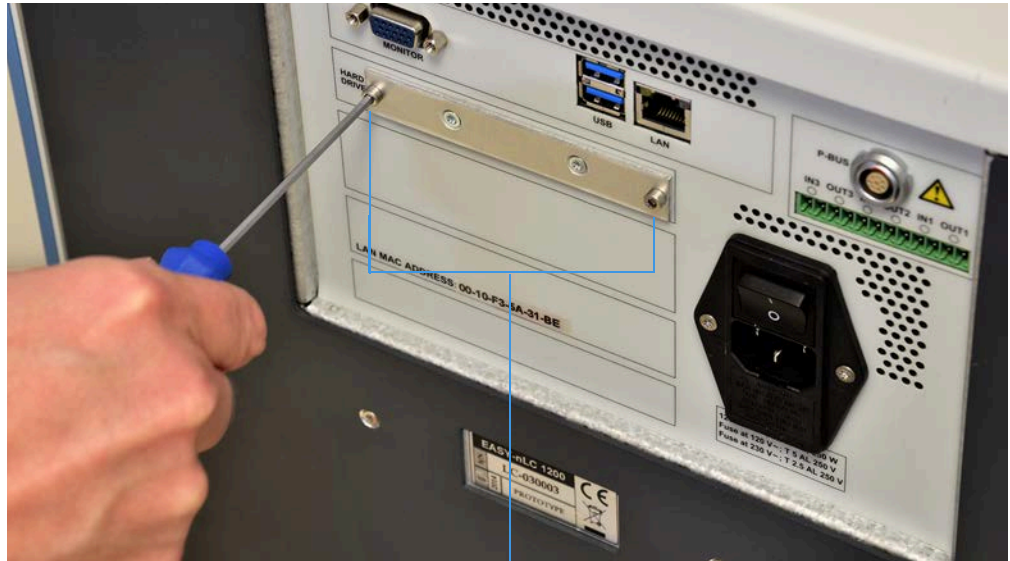
To replace the hard drive, follow these procedures:

1. “To remove the hard drive,” next procedure
2. “To install the hard drive” on page 98

❖ **To remove the hard drive**

1. Close down the EASY-nLC instrument, and turn off the power to the instrument (see “Closing Down the EASY-nLC Instrument” on page 22).
2. Loosen the two screws in the hard-drive drawer using a 2.5 mm hex wrench (Figure 78).

**Figure 78.** Screws that secure the hard-drive drawer



Two screws that secure the hard-drive drawer

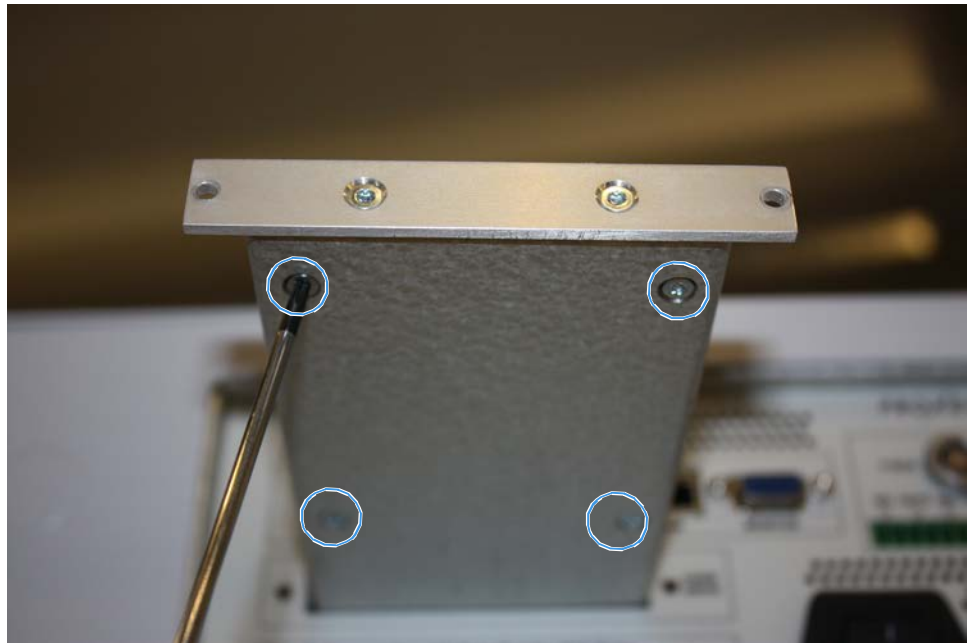
3. Pull out the hard-drive drawer, as shown in Figure 79.

**Figure 79.** Pulling out the hard-drive drawer



4. Using a Torx T-10 wrench, remove the four screws underneath the hard-drive drawer that secure the hard drive to the drawer (Figure 80).

**Figure 80.** Removing the screws underneath the hard-drive drawer



5. Unplug the hard drive from the SATA cable (Figure 81).

**Figure 81.** Hard drive unplugged from the SATA cable



The SATA cable is connected to the hard disk. The pins on the hard drive fit in the same place on the cable connector.

**Tip** If the SATA cable plug is difficult to access, remove the brass rod that holds the cable down (Figure 82). Use a Torx T-8 wrench to remove the screws. Place the rod back in the drawer afterward.

**Figure 82.** Removing the brass rod that holds the cable down



❖ **To install the hard drive**

1. Insert the new hard drive.
2. Connect the hard drive to the SATA cable.
3. Insert the four screws into the holes underneath the hard-drive drawer and then, using a Torx T-10 wrench, tighten the four screws to secure the hard drive to the drawer (see [Figure 80](#) on [page 97](#)).
4. Close the hard-drive drawer.
5. Using a 2.5 mm L-hex wrench, insert and tighten the two screws that secure the drawer to the back panel (see [Figure 78](#) on [page 96](#)).
6. Turn on the EASY-nLC instrument.
7. When prompted, enter the serial numbers for the instrument and the PC box.

**Note** After replacing the hard drive, the system automatically detects the pumps and valves during the startup procedure. For the autosampler function, you must calibrate the plate formats and wash bottle positions, as these calibrations were stored on the old hard drive.

8. Set the new administrator password and record the master key as described in the *EASY-nLC 1200 Getting Started Guide*.
9. Purge the computer hard drive. For further information, refer to “[Purging the Computer Hard Drive.](#)” in [Chapter 4, “Configuring the EASY-nLC System.”](#) in the *EASY-nLC 1200 Getting Started Guide*.
10. Calibrate the autosampler as described in [Chapter 8, “Calibrating the Autosampler’s XYZ Robot.”](#)



## Managing the Devices List

The Device list on the Maintenance > Devices page lists the current devices installed in the EASY-nLC instrument.

When you add or remove a device that is not automatically detected during the startup procedure, you must add the device to or remove the device from the Devices list on the Maintenance > Devices page.

### ❖ To add a device to the Device list

1. Press **Maintenance > Devices**.
2. Press **Add Device**.

The Select a Device to Add dialog box opens.

Name	Type
Advion RePlay	Fluid Storage
Autosampler (ASC)	Autosampler
EASY-Spray	Column Heater
EASY-nLC	HPLC
Pump A	Piston Pump w/ flow feedback
Pump B	Piston Pump w/ flow feedback

3. Locate the device in the list and select it.
4. Press **Accept** to add the autosampler device to the Devices list and close the Select a Device to Add dialog box.
5. Verify that the device was added to the system by locating it in the Devices list. Select the device in the Devices list, and review the information on the About page.

### ❖ To remove a device from the Devices list

1. Press **Maintenance > Devices**.
2. Select the device in the Devices list.
3. Press **Remove Device**.

The Remove Device dialog box appears.

4. Press **Accept** to remove the device and return to the Maintenance > Devices page.

### ❖ To view information about a device

1. Press **Maintenance > Devices**.
2. Select the device in the Devices list.
3. Press the **About** tab.

The About view contains information about the serial numbers and firmware versions for the rotary valves, piston (syringe) pumps, autosampler, and HPLC.

# Field Service Maintenance

This chapter provides procedures for use by Thermo Fisher Scientific field service engineers on replacing the subassemblies in the EASY-nLC instrument. Only Thermo Fisher Scientific field service engineers can perform these procedures.



**CAUTION** Only Thermo Fisher Scientific field service engineers can perform the procedures in this chapter.

## Contents

- [Replacing the Built-In Computer](#)
- [Replacing the Monitor](#)
- [Replacing the Autosampler](#)
- [Replacing the Autosampler Cooler](#)
- [Replacing a Rotary Valve](#)
- [Replacing a Pump](#)
- [Replacing a Pump PCB](#)

## Replacing the Built-In Computer

Replacing the computer box requires the following part and tools.

Tools	Parts
<ul style="list-style-type: none"> <li>• #2 Phillips screwdriver</li> <li>• Torx T-10 wrench</li> <li>• Small flathead screwdriver</li> </ul>	Computer box: <ul style="list-style-type: none"> <li>• P/N LC607 (shipped with Hard drive HDD)</li> </ul>

To replace the built-in computer, follow these procedures:

1. [“To remove the computer box,”](#) next procedure
2. [“To install the new computer box”](#) on [page 104](#)

### ❖ To remove the computer box

1. Close down the EASY-nLC instrument (see [“Closing Down the EASY-nLC Instrument”](#) on [page 22](#)) and then unplug the power cable.

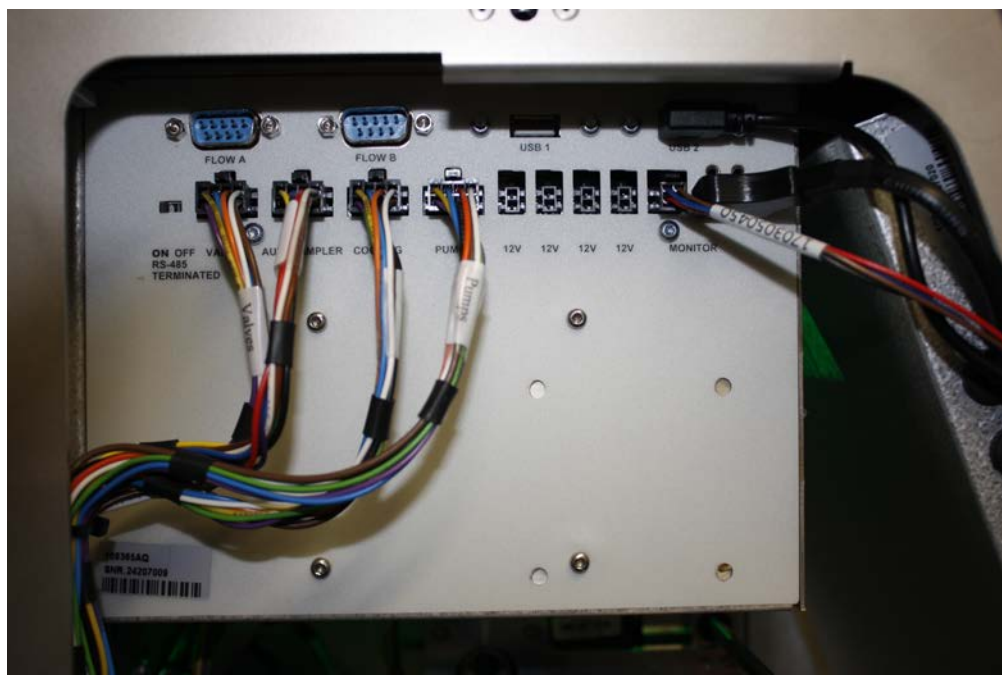
2. Disconnect all of the cables from the instrument's back panel.
3. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the left side panel to the instrument housing. Then remove the panel.
4. Remove the internal cables connected to the computer box.

**Note** The cable connectors can be hard to loosen. You might need to wiggle the connectors carefully from side to side to loosen them.

**Note** Take care when you disconnect the monitor's LVDS cable (low voltage differential signaling) because it is easily damaged.

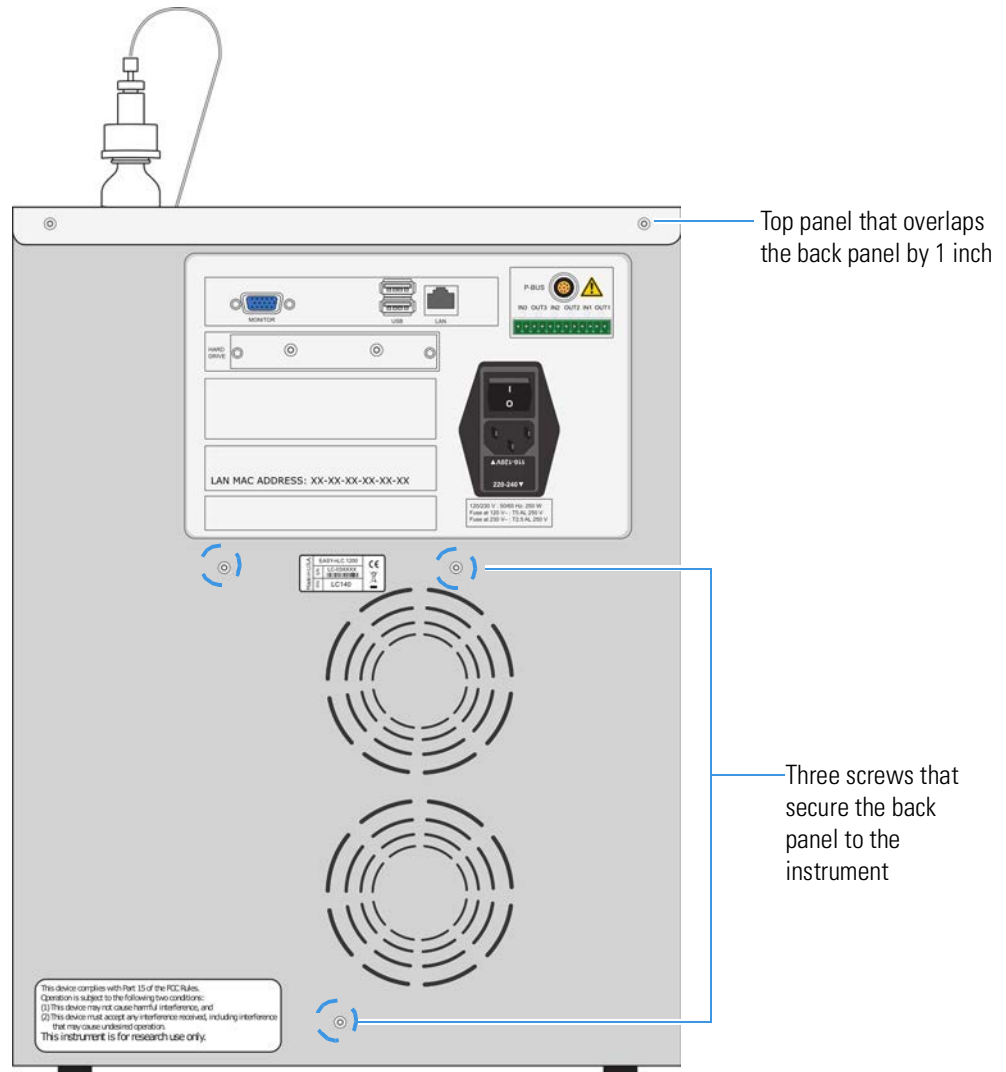
Figure 83 shows these cables in the EASY-nLC 1200 instrument.

**Figure 83.** Cables connected to the computer box in the EASY-nLC 1200 instrument



5. Using a Torx T-10 wrench, remove the three screws that secure the back panel to the instrument (see Figure 84).

**Figure 84.** Screws that secure the back panel to the instrument housing



6. Using a Torx T-10 wrench, remove the two screws that secure the top panel to the instrument (see [Figure 84](#)).
7. Remove the computer box from the instrument as follows:
  - a. Using a Torx T-10 wrench, remove the bottom two screws that secure the computer box to the instrument (see [Figure 85](#)).
  - b. Raise the top panel by at least one inch.
  - c. Using a Torx T-10 wrench, remove the top two screws that secure the computer box to the instrument (see [Figure 85](#)).

**Figure 85.** Screws to remove from the computer box



- d. Pull the computer box out of the EASY-nLC housing. [Figure 86](#) shows an earlier version of the housing. In the current version, the top panel overlaps the computer box flange, so you must lift the top panel by about one inch before you can pull the computer box out of the housing.

**Figure 86.** Pulling out the computer box



- e. Lower the top panel.

❖ **To install the new computer box**

1. Lift the top panel by about one inch.
2. Insert the new computer box into the EASY-nLC housing.

3. Reconnect all of the internal cables to the computer box.
  - [Figure 83](#) on [page 102](#) shows the connections to the computer box inside the EASY-nLC 1200 instrument.
4. Using a Torx T-10 wrench and the four screws that you removed in [step 7](#) on [page 103](#), secure the computer box to the instrument (see [Figure 85](#) on [page 104](#)).
5. Using a Torx T-10 wrench and the screws that you removed in [step 5](#) on [page 102](#), secure the back panel to the instrument.

**Tip** Do not reconnect the left side panel to the instrument housing until after you recalibrate the autosampler.

6. Using a Torx T-10 wrench and the screws that you removed in [step 6](#) on [page 103](#), secure the top panel to the instrument.
7. Reconnect the cables to the back panel as follows:
  - Reconnect the power cable to the back panel and to a laboratory power outlet.
  - If the instrument was connected to a laboratory LAN port, reconnect the Ethernet cable.
  - If the instrument is part of a Thermo Scientific LC/MS system, reconnect the Ethernet cable to the back panel of the instrument, and make sure that the other end of the cable connects to the Ethernet switch for the data system hardware.
8. Turn on the EASY-nLC instrument and select **admin** in the User list.
9. Set the new administrator password and record the master key as described in the *EASY-nLC 1200 Getting Started Guide*.
10. Recalibrate the autosampler (see [Chapter 8](#)).

## Replacing the Monitor

Replacing the monitor requires the following part and tools.

Tools	Part
<ul style="list-style-type: none"> <li>• Torx T-10 wrench</li> <li>• 2 mm L-hex wrench or straight wrench</li> </ul>	Monitor P/N LC282

To replace the monitor, follow these procedures:

1. [“To remove the monitor,”](#) next procedure
2. [“To install the new monitor”](#) on [page 107](#)

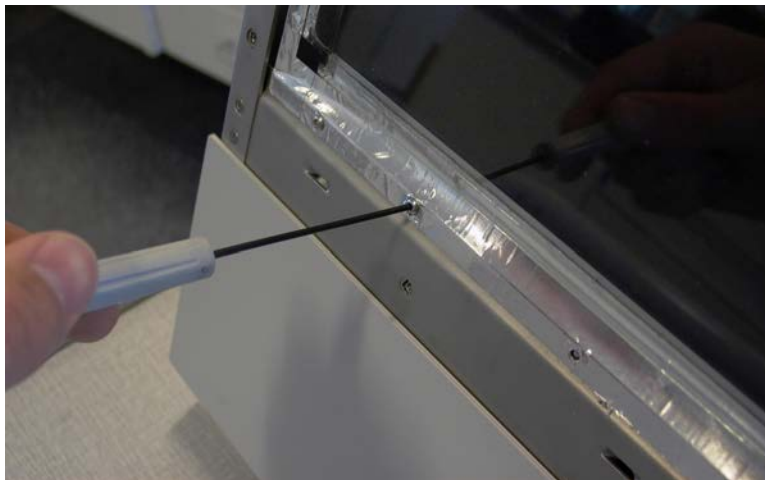
#### ❖ To remove the monitor

1. Close down the EASY-nLC instrument (see “Closing Down the EASY-nLC Instrument” on [page 22](#)) and unplug the power cable.
2. To remove the top-front panel from the EASY-nLC 1200 instrument, do the following:
  - a. Using a Torx T-10 wrench, remove the two screws that secure the top-front panel to the top back of the instrument.
  - b. Open the tray compartment door, and then use a Torx T-10 wrench to remove the screw that secures the top-front panel to the front of the instrument.
3. Using a 2 mm hex wrench, remove the four screws that secure the monitor to the instrument (see [Figure 87](#)).



**CAUTION** Use only hand tools with a hex tip to avoid damaging the screw heads.

**Figure 87.** Removing the screws from the front of the monitor

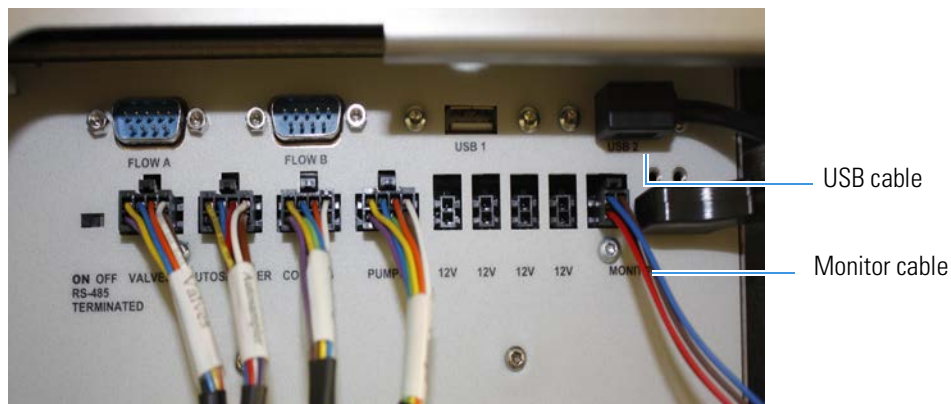


4. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the left side panel to the instrument housing. Then remove the panel.



5. Remove the USB, LVDS, and monitor cables connected to the computer box, being careful not to damage the LVDS plug (see [Figure 88](#)).

**Figure 88.** USB, LVDS, and monitor cables



6. Carefully remove the monitor by pulling it straight forward (see [Figure 89](#)).

**Figure 89.** Removing the monitor



❖ **To install the new monitor**

1. Carefully insert the new monitor into the instrument housing.
2. If you removed the white plastic needle guide on the back of the monitor, reinstall it.
3. If the computer box has a PS/2 keyboard connector on its back panel as shown in [Figure](#) on [page 16](#), connect the adapter cable that is supplied with the new monitor to the monitor cable.
4. Connect the USB, LVDS, and monitor cables to the computer box, being careful not to damage the LVDS plug (see [Figure 88](#) on [page 107](#)).

## 6 Field Service Maintenance

### Replacing the Monitor

5. Using a 2 mm ball driver and the screws that you removed in [step 3 on page 106](#), secure the monitor to the instrument.
  - Use a Torx T-10 wrench and the three screws that you removed in [step 2 on page 106](#) to secure the top-front panel to the housing.
6. Mount the left side panel to the instrument housing. Then, with a #2 screwdriver, secure the panel by rotating the three captive screws a quarter-turn clockwise.
7. Plug in the power cable, and turn on the EASY-nLC instrument.

## Replacing the Autosampler



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

Replacing the autosampler requires these items:

Tools	Parts and materials
<ul style="list-style-type: none"> <li>• #2 Phillips screwdriver</li> <li>• 3 mm L-hex wrench or ball driver</li> <li>• Torx T-10 wrench</li> <li>• Cutting pliers</li> </ul>	<ul style="list-style-type: none"> <li>• Powder-free gloves</li> <li>• 4 in. or 10 cm length tie wrap</li> <li>• Autosampler (ASC), P/N LC301 (shipped with cooling module)</li> </ul>

To replace the autosampler, follow these procedures:

1. [“To remove the autosampler,”](#) next procedure
2. [“To install the autosampler”](#) on [page 114](#)

### ❖ To remove the autosampler

1. Close down the EASY-nLC instrument (see [“Closing Down the EASY-nLC Instrument”](#) on [page 22](#)). Then unplug the power cable.
2. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive quarter-turn screws that secure each side panel to the instrument housing. Then remove both panels.
3. Remove the computer box from the instrument as described in [“To remove the computer box”](#) on [page 101](#).
4. Unscrew the autosampler needle fitting, and remove or pull up the autosampler needle from the needle holder.

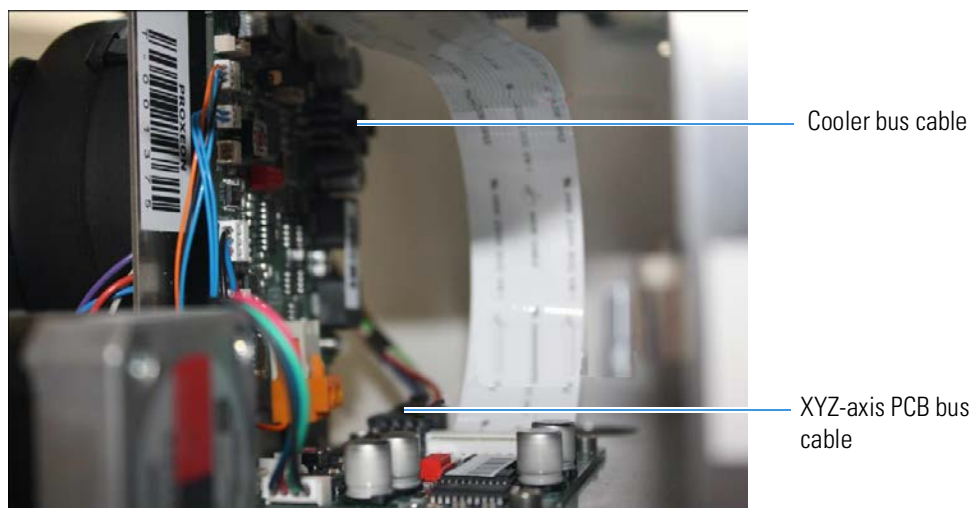
[Figure 90](#) shows the autosampler needle connected to the needle holder.

**Figure 90.** Needle connected to the needle holder



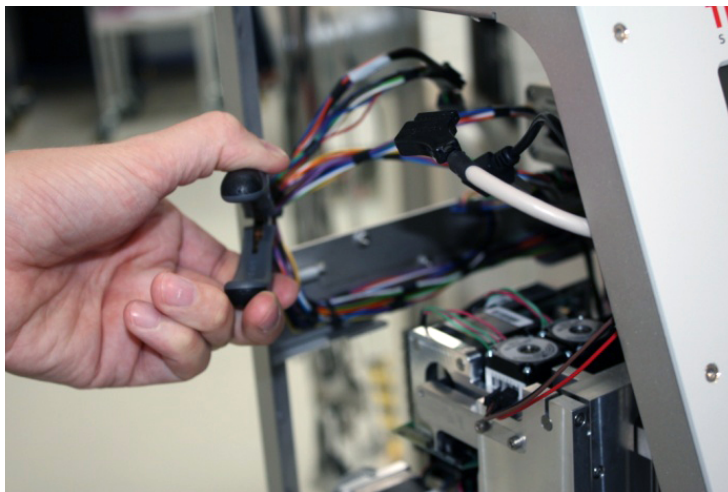
5. Unplug the bus cables on the left side of the instrument from the autosampler cooler and horizontal XYZ-axis PCB (see [Figure 91](#)).

**Figure 91.** Bus cables



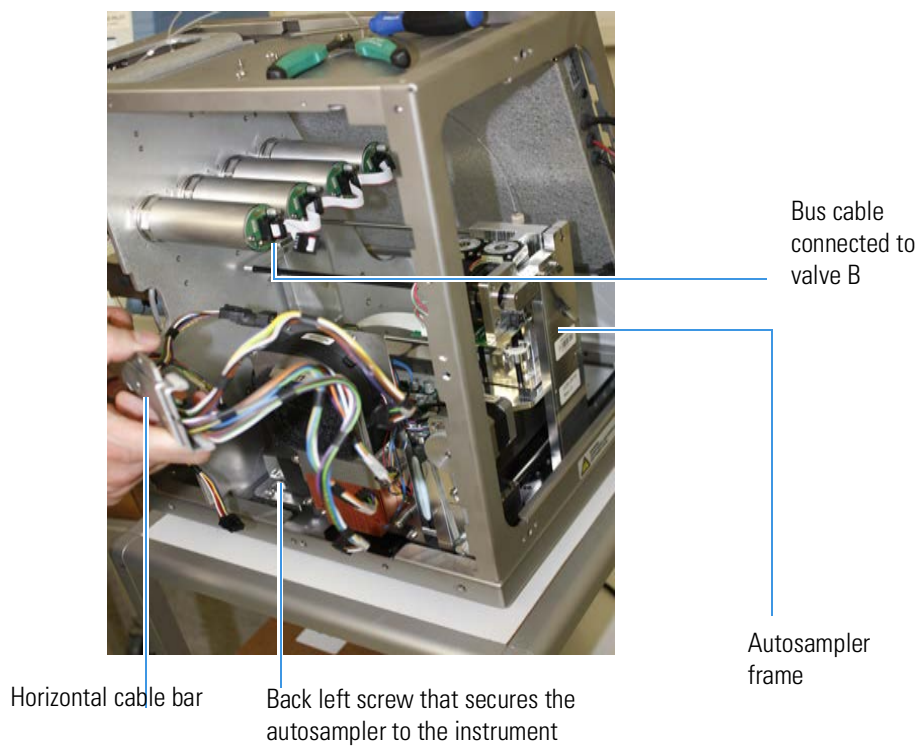
6. Cut the tie wrap attaching the cables to the vertical part of the autosampler frame, as shown in [Figure 92](#).

**Figure 92.** Cutting the strip attaching the cables to the autosampler frame



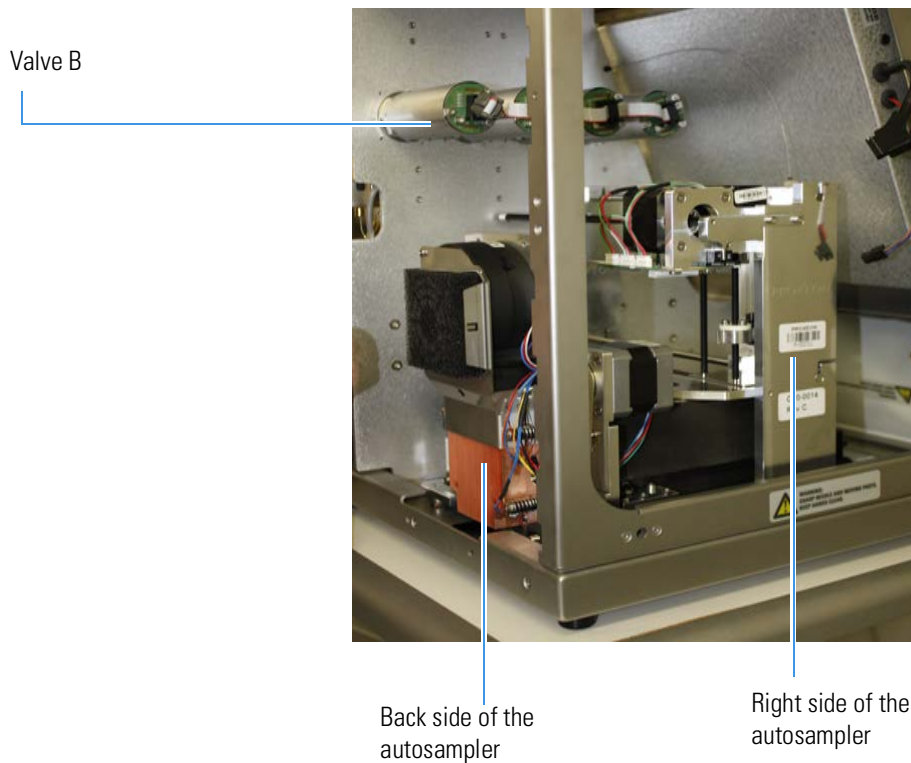
7. Using a Torx T-10 screwdriver, remove the screws that secure the back horizontal cable bar to the autosampler frame (see [Figure 93](#)).

**Figure 93.** Horizontal cable bar after removal of screws



8. Move the cable bar to the side (this is easier to do if you also remove the bus cable to valve B). See [Figure 94](#).

**Figure 94.** Horizontal cable bar moved aside



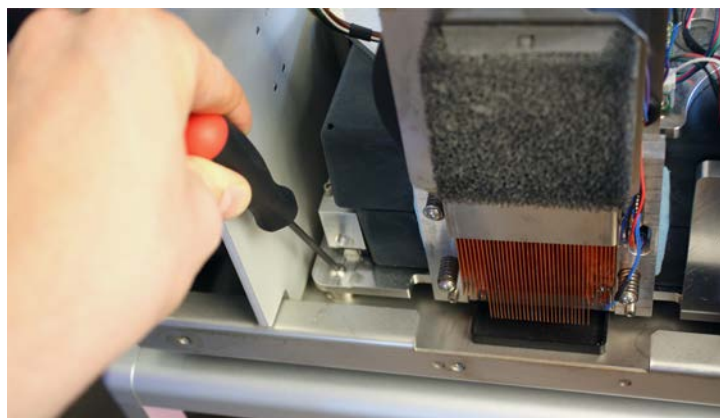
9. Using a 3 mm L-hex wrench, remove the three screws that secure the autosampler to the bottom plate of the housing (see [Figure 95](#), [Figure 96](#), and [Figure 97](#)):
  - Remove the screw from the right side of the autosampler (see [Figure 95](#)).

**Figure 95.** Removing the screw from the right side of the autosampler



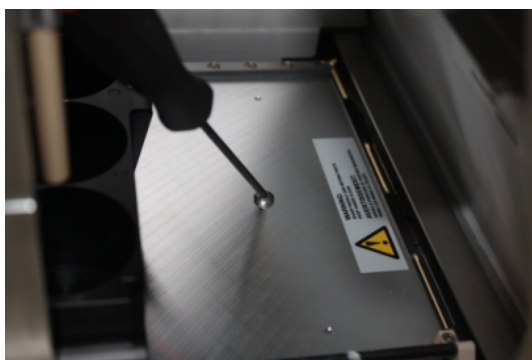
- Remove the screw from the back left side of the autosampler (see [Figure 96](#)).

**Figure 96.** Removing the screw from the back left of the autosampler



- Remove the screw the screw on the front of the autosampler (see [Figure 97](#)).

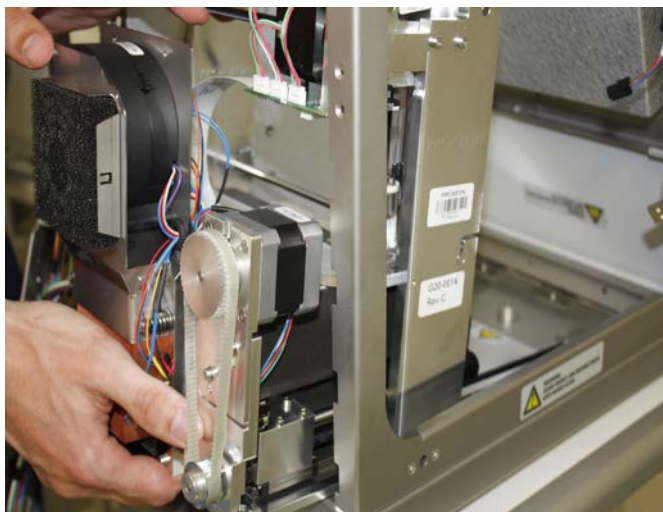
**Figure 97.** Removing the front screw from the autosampler



10. Remove the autosampler from the housing through the back of the instrument.

[Figure 98](#) shows the housing with the autosampler partially removed.

**Figure 98.** Housing with autosampler partially removed



#### ❖ To install the autosampler

1. Insert the new autosampler into the housing.
2. Using a 3 mm L-hex wrench and, if necessary, a needle-nosed pliers or tweezers, insert and tighten the screws that secure the autosampler to the bottom of the housing as follows:
  - Insert and tighten the screw on the back left side of the autosampler (see [Figure 96](#) on [page 113](#)).
  - Insert and tighten the screw on the right side of the autosampler (see [Figure 95](#) on [page 112](#)).
  - Insert and tighten the screw on the front of the autosampler (see [Figure 97](#) on [page 113](#)).
3. Insert and tighten the screws that secure the back horizontal cable bar to the autosampler frame (see [Figure 93](#) on [page 111](#)).
4. Install a new tie wrap to secure the cables to the vertical part of the autosampler frame.
5. Plug the bus cables into the autosampler cooler and horizontal XYZ-axis PCBs.
6. Reinstall the computer box as described in “[To install the new computer box](#)” on [page 104](#).
7. Reinsert the autosampler needle into the holder and tighten the fitting.
8. Mount the right side panel to the instrument housing. Then, with a #2 screwdriver, secure the panel by rotating the three captive screws a quarter-turn clockwise.

**Tip** Reconnect the left side panel to the housing after you recalibrate the autosampler.

9. Reconnect the power cable.
10. Turn on the EASY-nLC instrument.
11. Calibrate the autosampler as described in [Chapter 8](#).



# Replacing the Autosampler Cooler

## Replacing the ASC cooler

Replacing the ASC cooler requires these items:

Tools	Parts
<ul style="list-style-type: none"><li>• Torx T-10 wrench</li><li>• 2.5 mm L-hex wrench</li></ul>	ASC autosampler cooling module, P/N LC310

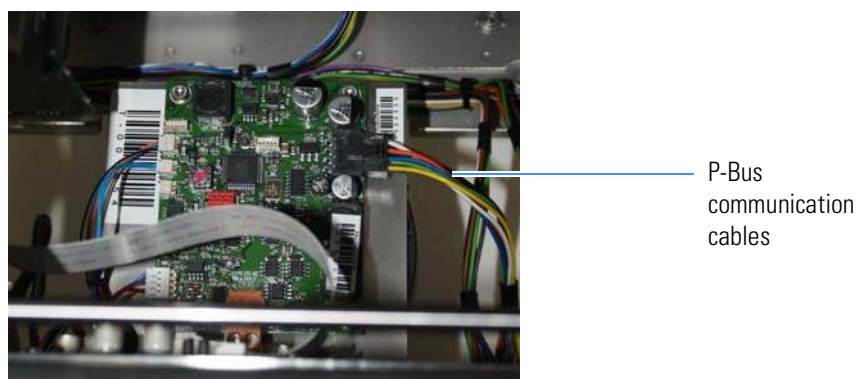
To replace the ASC cooler, follow these procedures:

1. “To remove the cooling module,” next procedure
2. “To install the new ASC cooler” on page 117

### ❖ To remove the cooling module

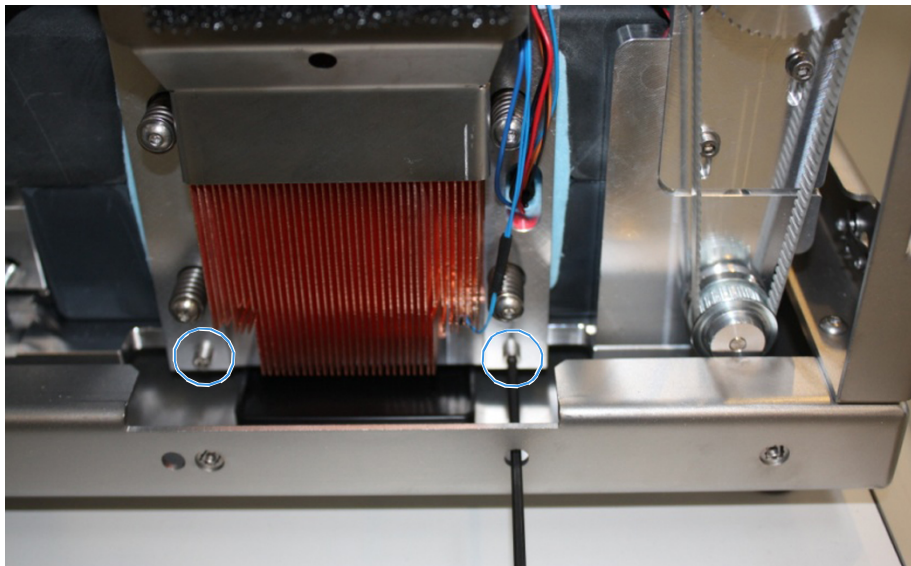
1. Close down and turn off the EASY-nLC instrument (see “Closing Down the EASY-nLC Instrument” on page 22). Then disconnect the power cable.
2. Remove the screws on the back cover panel using a Torx T-10 wrench and remove the panel.
3. Access the PCB on the back of the cooler through the back of the instrument, and unplug the P-Bus communication cables, shown in Figure 99.

**Figure 99.** P-Bus communication cables



4. Using a 2.5 mm ball driver, remove the two 2.5 mm hex screws at the bottom of the cooler, shown in Figure 100.

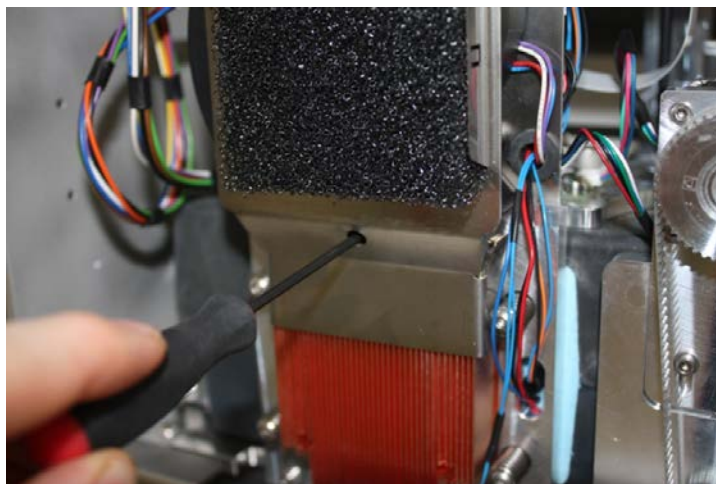
**Figure 100.** Screws at the bottom of the cooler



5. Remove the 2.5 mm hex screw in the top center position of the cooler using a 2.5 mm ball driver, as shown in [Figure 101](#).

The screws do not fall out when loosened, because they are held in place by O-rings.

**Figure 101.** Removing the top center screw



6. Pull out the cooler, as shown in [Figure 102](#).

**Figure 102.** Pulling out the cooler

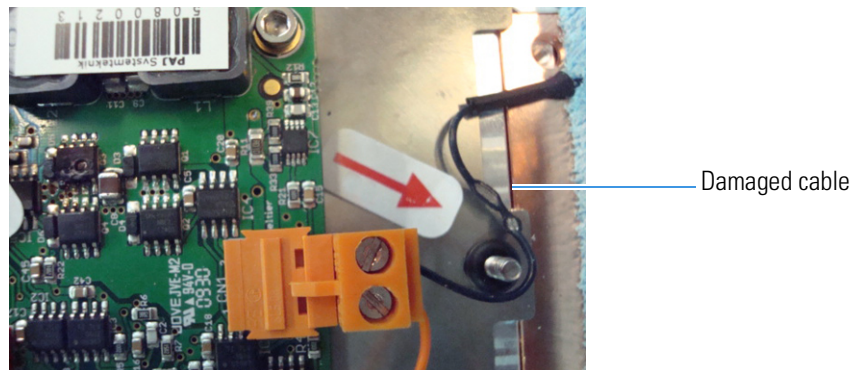


❖ **To install the new ASC cooler**

1. Insert the new cooler.

Be careful not to damage any of the cables during reassembly. [Figure 103](#) shows a damaged cable.

**Figure 103.** Damaged cable



2. Insert and tighten the 2.5 mm hex screw in the top center position using a 2.5 mm ball driver (see [Figure 101](#) on [page 116](#)).
3. Insert and tighten the two 2.5 mm hex screws at the bottom of the cooler using a 2.5 mm ball driver (see [Figure 100](#) on [page 116](#)).
4. Plug the P-Bus communication cables into the PCB on the back of the cooler, accessing the PCB through the back of the instrument.
5. Align the back panel to the back of the instrument.
6. Using a Torx T-10 wrench, tighten the eleven screws that secure the back panel to the instrument.
7. Reconnect the power cable.
8. Turn on the EASY-nLC instrument.

## Replacing a Rotary Valve



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

Replacing a high-pressure valve requires these items:

Tools	Parts and materials
<ul style="list-style-type: none"> <li>• #2 Phillips screwdriver</li> <li>• 1/4 in. open-ended wrench</li> <li>• Torx T-10 wrench</li> <li>• 2.5 mm L-hex wrench</li> <li>• Flathead screwdriver</li> </ul>	<ul style="list-style-type: none"> <li>• Powder-free gloves</li> <li>• Valve 6790.0001</li> </ul>

To replace a rotary valve, follow these procedures:

1. [“To remove a rotary valve,”](#) next procedure
2. [“To install a new rotary valve”](#) on [page 119](#)

### ❖ To remove a rotary valve

1. Close down the EASY-nLC instrument (see [“Closing Down the EASY-nLC Instrument”](#) on [page 22](#)) and then unplug the power cable.

**IMPORTANT** Ensure that the EASY-nLC 1200 is unplugged for the next steps. „Hot-plugging“ of the valves will damage the valve electronics.

2. Remove the computer box as described in [“To remove the computer box”](#) on [page 101](#).
3. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.
4. From the right side of the instrument (solvent system compartment), remove the tubing from the stator on the valve that you are replacing. Be careful to avoid pulling any fused silica lines, as there is limited space around the valves.

**Tip** When replumbing the system, follow the solvent system schematics in [Appendix C, “Consumables and Replacement Parts.”](#)

5. From the back of the instrument, disconnect the cables shown in [Figure 104](#) from the valve to be exchanged.

**Figure 104.** Cables connected to valves



6. Using a 2.5 mm L-hex wrench, remove the four 2.5 mm hex screws that keep the valve in place inside this compartment.
7. Pull out the valve, as shown in [Figure 105](#).

**Figure 105.** Pulling out a valve



❖ **To install a new rotary valve**

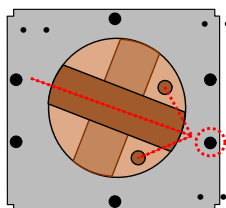
1. Using a small flathead screwdriver, set the rotary switch on the PCB of the new valve, shown in [Figure 106](#), to the same address as the valve being replaced:
  - Valve A=1

- Valve B=2
- Valve S=3
- Valve W=4

**Figure 106.** Valve rotary switch



**Figure 107.** Schematic illustration of the valve address switch: Address shown is 3.



2. Insert the new valve.
3. In the back of the instrument, connect the cables shown in [Figure 104](#) on [page 119](#) to the new valve.
4. Using a 2.5 mm L-hex wrench, insert and tighten the four hex screws that keep the valve in place inside the autosampler compartment.
5. In the solvent system compartment, restore the tubing and connections to the stator on the replacement valve.
6. Reinstall the computer box as described in [step 2](#) through [step 7](#) of “[To install the new computer box](#)” on [page 104](#).
7. Mount the left and right side panels to the instrument housing. Then, with a #2 screwdriver, secure each panel by rotating the three captive screws a quarter-turn clockwise.
8. Run three iterations of the Purge Solvent script as described in “[To run the Purge Solvent script](#)” on [page 32](#).
9. Run the Flush Air script as described in “[To run the Flush Air script](#)” on [page 34](#):
  - Enter **12**  $\mu$ L
10. Run the Leaks script for the subsystem that you have worked on as described in “[To run the Leaks script](#)” on [page 46](#).
  - For valve A, select **A**.
  - For valve B, select **B**.
  - For valves W or S, select **System**.

## Replacing a Pump

**IMPORTANT** The EASY-nLC 1200 is not compatible with the pumps from the EASY-nLC II and EASY-nLC 1000. Equally these earlier pumps are not compatible with the EASY-nLC 1200.



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

## Replacing a Pump

Replacing a pump requires these tools and materials:

Tools	Parts and materials
<ul style="list-style-type: none"> <li>• #2 Phillips screwdriver</li> <li>• 2.5 mm hex wrench</li> <li>• 3 mm hex wrench</li> <li>• Small flathead screwdriver</li> <li>• Pipette for priming the pump</li> </ul>	<ul style="list-style-type: none"> <li>• Powder-free gloves</li> <li>• Pump, P/N LC591</li> </ul>

To replace a pump in the EASY-nLC instrument, follow these procedures:

1. “[To remove a pump from an EASY-nLC instrument,](#)” next procedure
2. “[To install a pump in an EASY-nLC instrument](#)” on page 123

### ❖ To remove a pump from an EASY-nLC instrument

1. Empty the pump of solvent by setting the valve to position 1-2 and using manual control.
2. Set the valve for the pump to the **Center** position as follows:

Switch the valve for the pump concerned to Center:

- a. Press **Home > Overview**.
- b. Press the appropriate valve icon.
- c. In the Valve dialog box, press **Center**.

Placing the valve in the Center position shuts off the solvent flow to the subsystem.

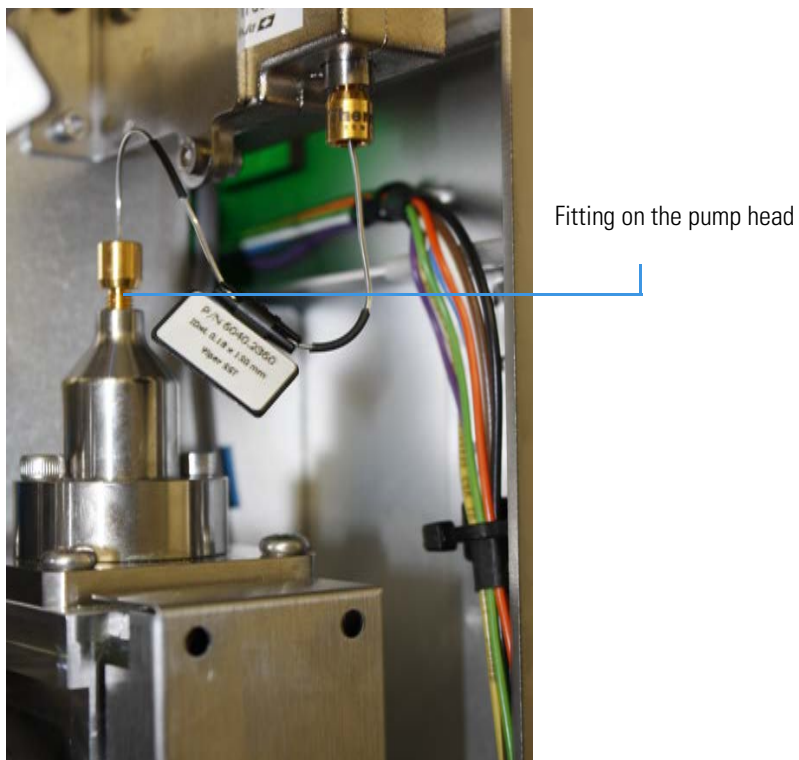
3. Close down and then turn off the EASY-nLC instrument.
4. Disconnect the power cable from the instrument’s back panel.

## 6 Field Service Maintenance

### Replacing a Pump

5. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.
6. Disconnect the stainless steel Viper tubing from the pump and the pressure sensor. This prevents damage to the fitting of the pressure sensor, because it does not have to be bent out of the way. [Figure 108](#).

**Figure 108.** Fitting on the pump head

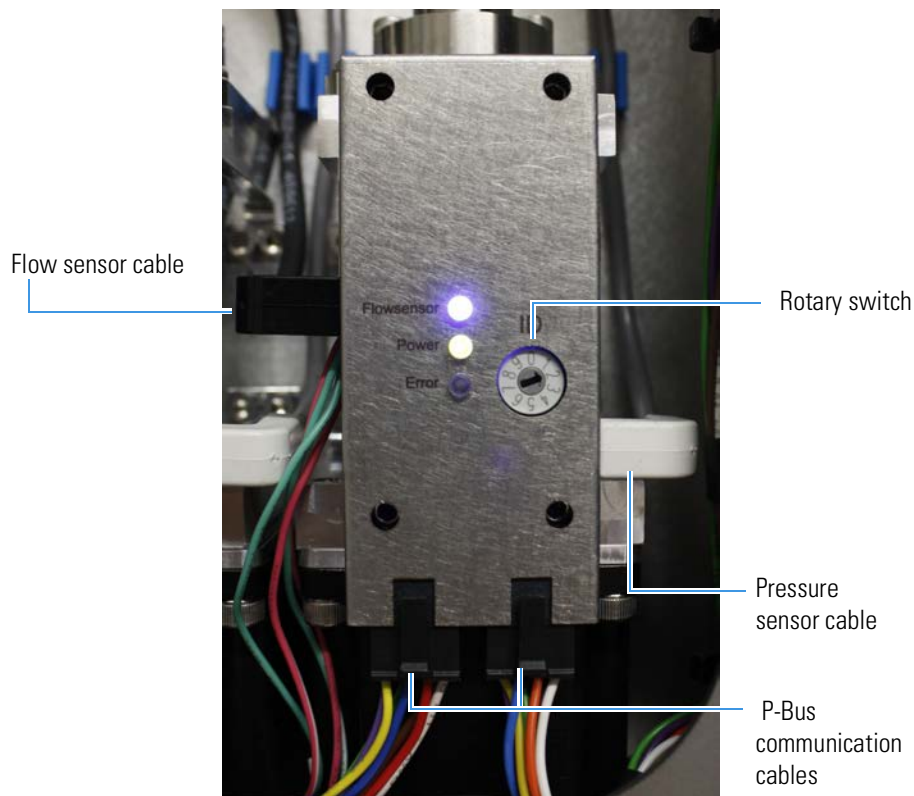




7. Depending on the instrument model, do one of the following:

- Unplug the flow sensor cable (from pump A or B), the pressure sensor cable, and the P-Bus communication cables, shown in [Figure 109](#).

**Figure 109.** Flow sensor cable, pressure sensor cable, and P-Bus communication cables for an EASY-nLC 1200 instrument



8. Using a 3 mm ball driver or L-hex wrench, remove the four 3 mm hex screws that secure the pump to the instrument panel, and then remove the pump. Set the screws aside.

❖ **To install a pump in an EASY-nLC instrument**

1. Connect the new pump as follows:
  - a. Using a 3 mm ball driver or L-hex wrench and the four 3 mm hex screws that you removed in [step 8](#) on [page 123](#), secure the new pump to the instrument panel.
    - Reconnect the flow sensor cable, the pressure sensor cable, and the P-bus communication cables.
2. Make sure that the address setting on the pump PCB is the same as the setting for the old PCB. Use a small flathead screwdriver to change the rotary switch address on the new pump PCB.
3. Reconnect the power cable to the instrument's back panel.
4. Turn on the EASY-nLC instrument, and log in as an administrator.

5. Prime the pump as described in [“Priming the Pump”](#) on [page 78](#).
6. Mount the tubing back on the pump head. Tighten the fitting using a 1/4 in. open-ended wrench.
7. Draw fresh solvent into the solvent lines and remove air from the pump head as described in [“Removing Air After Replacing a Piston Seal or a Pump”](#) on [page 81](#).
8. Depending on the pump you are replacing, do the following:
  - When replacing pump A or B, run the pump leak test, and then run the flow sensor calibration (see [“Leaks”](#) on [page 44](#) and [“Constant Pressure”](#) on [page 50](#)).
  - When replacing pump S, run the sample pickup test (see [“Sample Pickup”](#) on [page 42](#)).

## Replacing a Pump PCB

Replacing the pump PCB requires these items:

Tools	Parts
<ul style="list-style-type: none"> <li>• #2 Phillips screwdriver</li> <li>• 2.5 mm hex wrench</li> <li>• Small flathead screwdriver</li> </ul>	Pump PCB, P/N LC590

To replace the pump PCB on the PLU pump, follow these procedures:

1. [“To remove a pump PCB,”](#) next procedure
2. [“To replace a pump PCB”](#) on [page 127](#)

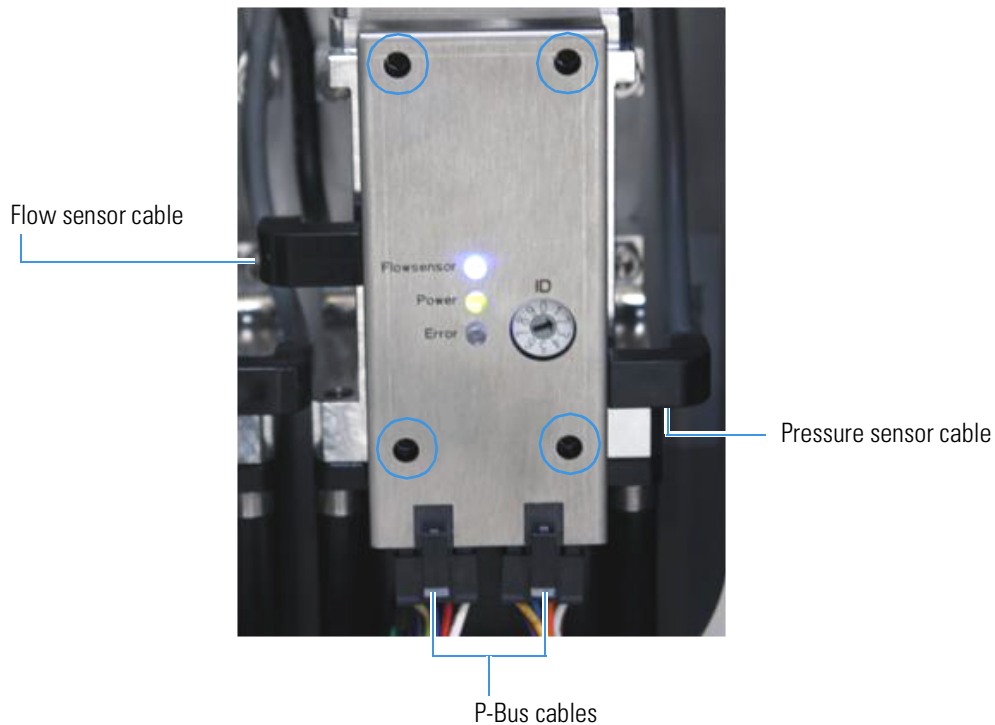
### ❖ To remove a pump PCB

1. Close down the EASY-nLC 1200 instrument as described in [“Closing Down the EASY-nLC Instrument”](#) on [page 22](#).
2. Disconnect the power cable from the instrument’s back panel.
3. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument housing. Then remove the panel.
4. Disconnect the P-Bus communication cables, the flow sensor cable, and the pressure sensor cable from the pump.

[Figure 110](#) on [page 125](#) shows these cables connected to the pump.

5. Loosen the four captive screws on the PCB shield using a 2.5 mm hex wrench or ball driver (see [Figure 110](#)). Then remove the PCB shield (see [Figure 111](#)).

**Figure 110.** Four PCB shield screws



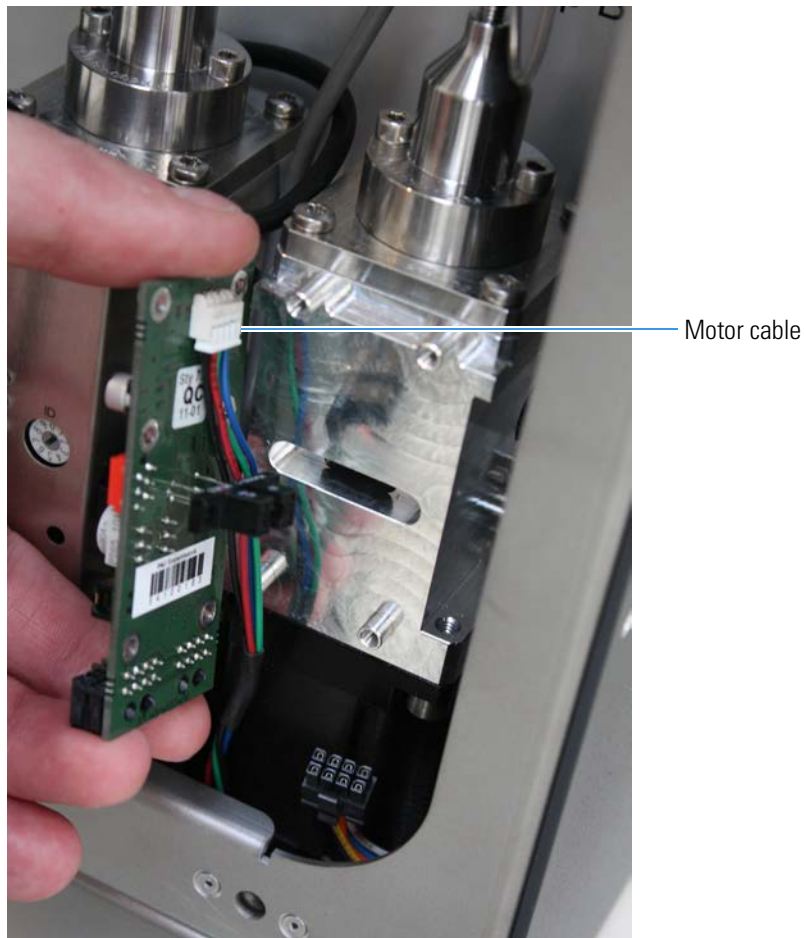
The four captive screws remain in place (see [Figure 111](#)).

**Figure 111.** Removing the PCB shield



6. Slide the PCB forward and away from the four mounting studs.
7. Disconnect the motor cable on the back of the pump PCB (see [Figure 112](#)).

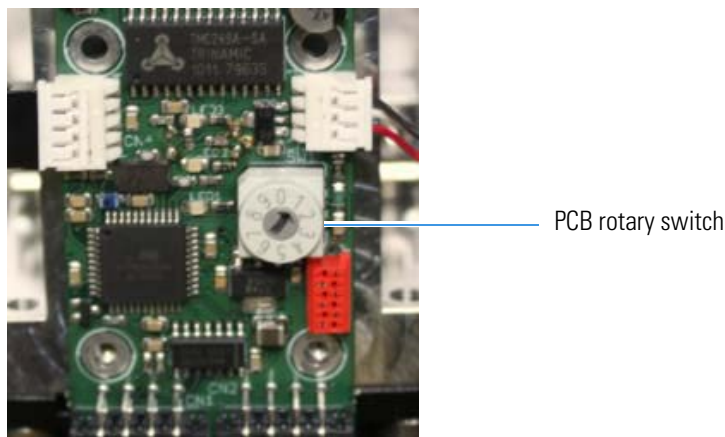
**Figure 112.** Motor cable connected to the pump PCB



❖ **To replace a pump PCB**

1. Using a small flathead screwdriver, reset the address on the rotary switch on the pump PCB (see [Figure 113](#)) as follows:
  - Pump A = 1
  - Pump B = 2
  - Pump S = 3

**Figure 113.** PCB rotary switch



2. Plug the motor cable into the back of the PCB (see [Figure 112](#) on [page 126](#)).
3. Insert the new pump PCB onto the pump.
4. Install the PCB shield.
5. Tighten the four 2.5 mm hex screws in the PCB shield using a 2.5 mm hex wrench or ball driver.
6. Reconnect the P-Bus communication cables, the flow sensor cable, and the pressure sensor cable (see [Figure 110](#) on [page 125](#)) to the pump.
7. Mount the right side panel to the instrument housing. Then, with a #2 screwdriver, secure the panel by rotating the three captive screws a quarter-turn clockwise.
8. Reconnect the power cable to the back panel of the instrument.
9. Turn on the instrument.
10. Wait for 30 minutes to allow the temperature in the housing to stabilize.
11. Calibrate the flow sensor by following the automated script described in “[Constant Pressure](#)” on [page 50](#).

## **6 Field Service Maintenance**

Replacing a Pump PCB

# Troubleshooting

To troubleshoot problems with the EASY-nLC instrument, follow the troubleshooting tips and procedures in this chapter.

## Contents

- [Troubleshooting Tips](#)
- [Using the Direct Controls for Troubleshooting and Maintenance](#)
- [Troubleshooting a Pump That Fails the Flush Air Script](#)
- [Troubleshooting a Pump That Fails the Leaks Script](#)
- [Running a System Leak Test](#)
- [Troubleshooting the Results of the System Leak Test](#)
- [Identifying a Leaking Check Valve](#)
- [Troubleshooting a System Blockage](#)
- [Troubleshooting the Autosampler Aspiration](#)
- [Checking Sample Pickup](#)
- [Troubleshooting Communication Problems](#)
- [Verifying that the LC/MS System Is Properly Grounded](#)

## Troubleshooting Tips

To troubleshoot problems with the EASY-nLC instrument, see these pages:

- “Autosampler Problems” on page 131
- “Contact Closure Problems” on page 132
- “Instrument Startup Problems” on page 132
- “Trapped Air” on page 133
- “Excessive Duration or Higher Pressure for the Column Equilibration and Sample Loading Steps” on page 139
- “System Reaches Its Maximum Pressure During the Gradient” on page 141
- “Sample Signal Weak or Absent” on page 144
- “Slow or No Pressure Increase in Subsystem A or B” on page 148
- “Errors Reported by the Xcalibur Data System” on page 151
- “Carryover” on page 155
- “Spray Issues” on page 157
- “Chromatographic Performance” on page 158
- “Device Failures” on page 159
- “Miscellaneous” on page 163



## Autosampler Problems

Table 11 lists troubleshooting tips for the autosampler.

**Note** For information about troubleshooting sample pickup, see “Troubleshooting the Autosampler Aspiration” on page 220.

**Table 11.** Autosampler troubleshooting tips

Symptom	Possible causes	Action
The needle cannot penetrate the plastic film on the microtiter plate.	The needle tip is damaged or bent.	<p>Do the following:</p> <ol style="list-style-type: none"> <li>1. Check the configuration settings for the adapter tray on the Tools page for the autosampler device, which you can access from the Maintenance &gt; Devices page.</li> <li>2. Eject the tray.</li> <li>3. Remove the left side panel and visually inspect the needle tip.</li> <li>4. Do one of the following: <ul style="list-style-type: none"> <li>• If the needle tip is bent or damaged, replace it (see “Replacing the Autosampler Needle” on page 85).</li> <li>• If there is any residue on the needle tip, wipe the needle tip with a lint-free tissue soaked in LC/MS-grade ethanol.</li> </ul> </li> </ol>
XYZ robot error	Something is blocking the movement of the autosampler’s XYZ arm and causing a step loss on one of the motors.	<p>Remove the obstacle and try again. You might need to calibrate the autosampler for more precise penetration of the microtiter plate or the wash bottles.</p> <p>For information about calibrating the autosampler, see Chapter 8, “Calibrating the Autosampler’s XYZ Robot.”</p>
	The error repeats without any visible reason.	<p>Contact Thermo Fisher Scientific:</p> <ul style="list-style-type: none"> <li>• <a href="mailto:us.customer-support.analyze@thermofisher.com">us.customer-support.analyze@thermofisher.com</a></li> <li>• <a href="mailto:eu.techsupport.cms@thermofisher.com">eu.techsupport.cms@thermofisher.com</a></li> </ul>
A server warning message about the plate format for the autosampler configuration pops up when you submit a batch.	The plate format has been deleted from the system configuration. For information about deleting a plate format, refer to the <i>EASY-nLC 1200 Getting Started Guide</i> .	<p>If you want to run the batch, you must create the plate format again.</p> <p>For information about selecting, creating, and deleting plate formats, see “Managing Plate Formats” on page 231.</p>

## Contact Closure Problems

Table 12 contains troubleshooting tips for contact closure problems.

**Table 12.** Contact closure troubleshooting tips

Symptom	Possible causes	Action
The mass spectrometer is waiting for a contact closure signal.	Incorrect contact closure setup	<p>If you are running two-way contact closure (with feedback from the mass spectrometer), set the contact closure Protocol setting to <b>Two-way</b> on the Configuration &gt; Connections page.</p> <p>If the mass spectrometer is waiting for a signal, set the contact closure State setting to <b>Open</b>.</p>
The EASY-nLC instrument is waiting for a ready signal from the mass spectrometer.		<p>If you are running one-way contact closure (that is, the EASY-nLC instrument sends a start signal to the mass spectrometer, but feedback from the mass spectrometer is ignored), set the contact closure Protocol setting to <b>One-way</b> on the Configuration &gt; Connections page.</p>

## Instrument Startup Problems

Table 13 contains troubleshooting tips for instrument startup problems.

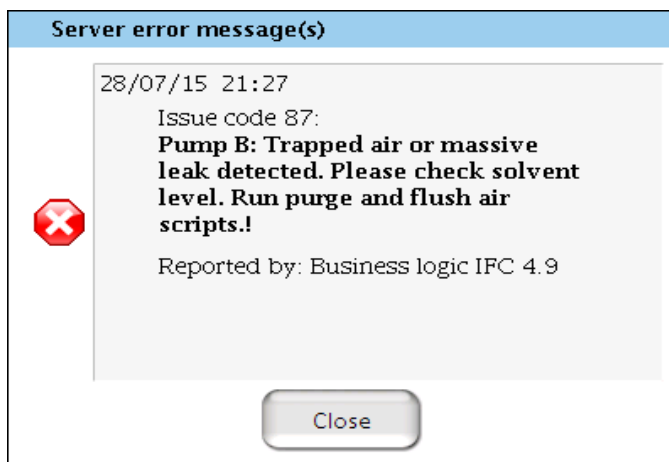
**Table 13.** Startup troubleshooting tips

Symptom	Possible causes	Action
Dark monitor  (Check if the power cable is connected to the instruments as well as to a working power plug.)	<p>Broken or open main power fuse</p> <p>Defective monitor</p>	<ol style="list-style-type: none"> <li>1. Turn on the power to the instrument.</li> <li>2. Remove the right side panel of the EASY-nLC instrument.</li> <li>3. If there is no light on the pumps, turn off the EASY-nLC instrument, replace the right side panel, and check the fuse.</li> </ol> <p>Attach an external monitor to the VGA connector (labeled MONITOR) on the back panel of the instrument (see Figure on page 16).</p>
Startup bar is no longer proceeding.	Damaged instrument	<p>Turn off the EASY-nLC instrument, wait 5 seconds before turning it on again, and then wait approximately 10 minutes for the restart process to finish. In some cases this recovers the system. Contact Thermo Fisher Scientific if the problem recurs:</p> <ul style="list-style-type: none"> <li>• <a href="mailto:us.customer-support.analyze@thermofisher.com">us.customer-support.analyze@thermofisher.com</a></li> <li>• <a href="mailto:eu.techsupport.cms@thermofisher.com">eu.techsupport.cms@thermofisher.com</a></li> </ul>

## Trapped Air

Before sample pick-up starts the system checks to see if there is air in the pumps.

If this automatic test fails, an error “Trapped air...” pops-up and the sample run is paused.



**Note** The sample pick-up is only being performed if all pumps passed the air check. This helps to save your valuable samples.

In case of a “Trapped air...” error message, confirm that solvent is in bottle A, B, and W3. Perform three purge iterations and flush air for the error reporting pump.

## Delayed Elution

Table 14 lists the common causes of delayed elution. The most common cause of delayed elution is a leak in valve B.

These sections show the effect of leaks and swept volume on the pressure and flow traces:

- [“Leaks that Cause Delayed Elution,”](#) next section
- [“Introduced Swept Volume”](#) on [page 137](#)

**Table 14.** Common causes of delayed elution

Symptom	Possible cause	Action
Delayed elution	Leak in the solvent system	<ol style="list-style-type: none"> <li>1. Run the Leaks script for the system (see <a href="#">“Leaks”</a> on <a href="#">page 44</a>).</li> <li>2. Locate the leak by following <a href="#">“Troubleshooting the Results of the System Leak Test”</a> on <a href="#">page 183</a>.</li> </ol>
	Incorrect tubing installed	<ol style="list-style-type: none"> <li>1. Remove the right side panel of the instrument.</li> <li>2. Verify that the tubing matches the solvent system schematic.               <ul style="list-style-type: none"> <li>• For the EASY-nLC 1200 instrument, see <a href="#">page 268</a>.</li> </ul> </li> <li>3. Replace the incorrect tubing with the specified tubing.</li> </ol>
	Swept volume introduced by incorrect tubing connections	<p>Check the tubing connections.</p> <p>In the EASY-nLC II instrument, you can inadvertently introduce swept volume (extra volume in the solvent path) by not seating the tubing against the bottom of the receiving port.</p>

## Leaks that Cause Delayed Elution

If there is a leak upstream of flow sensor B, solvent A will preferentially leave the mixing Tee towards flow sensor B rather than the analytical column, as there is less resistance in this direction. The solvent line between the mixing Tee and flow sensor B starts to fill with solvent A during column equilibration and sample loading. When the gradient starts, instead of delivering solvent B into the mixing Tee, pump B therefore has to first push this volume of solvent A out, delaying the actual start of the gradient (see [Figure 114](#)).

When the gradient step begins, instead of pushing solvent B into the mixing Tee, pump B initially pushes this small volume of solvent A, delaying the start of the actual gradient.

**Note** Please note the numbering of the valve ports as depicted in [Figure 9](#) (clockwise numbering with valve port 1 in 4 o'clock position). Due to operational reasons, the graphical representation in this guide or in the instrument's built-in software may show the valves in a different orientation. Please use only the port numbers for identification of port positions.

**Figure 114.** Negative flow of solvent B toward valve B during the column equilibration and sample loading steps

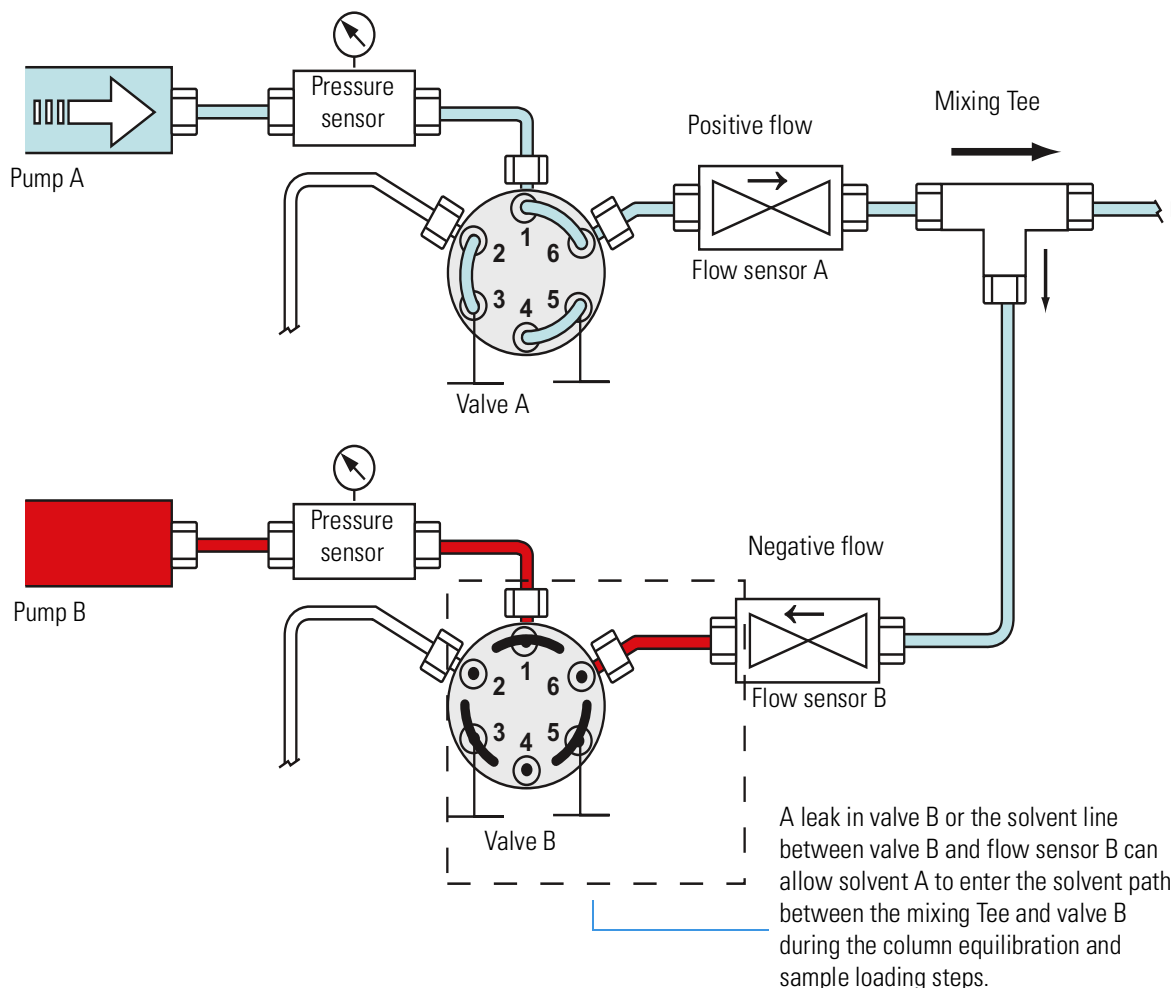
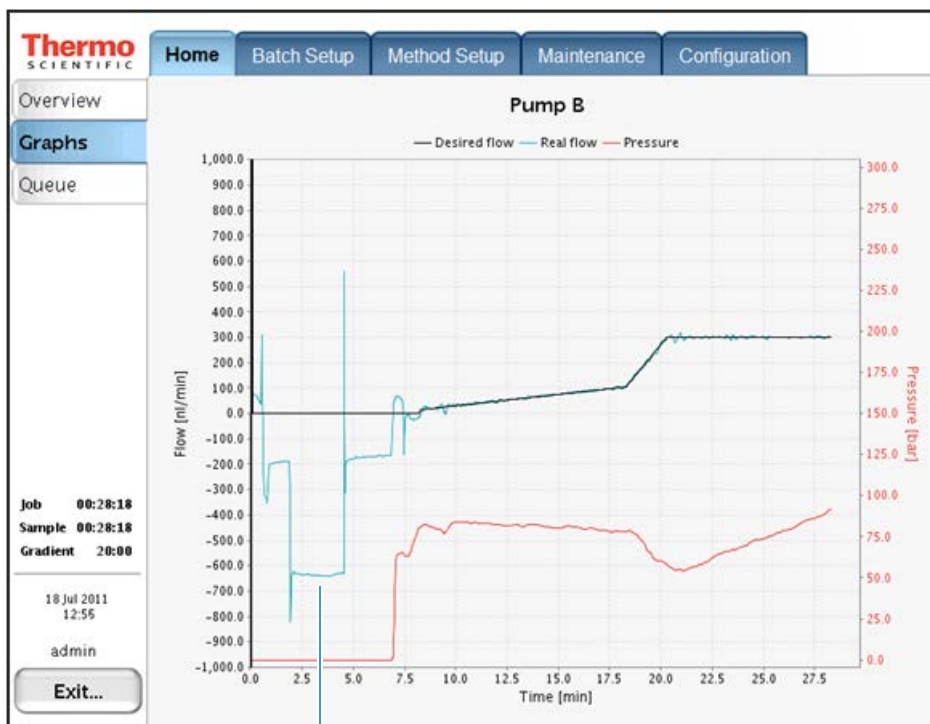


Figure 115 shows the flow and pressure traces for pump B for a system with a leak upstream of flow sensor B. The measured flow rate is negative rather than 0 nL/min during the column equilibration and sample loading steps.

**Figure 115.** Flow trace for pump B when there is a leak upstream of flow sensor B



Negative flow rate during the column equilibration and sample loading steps

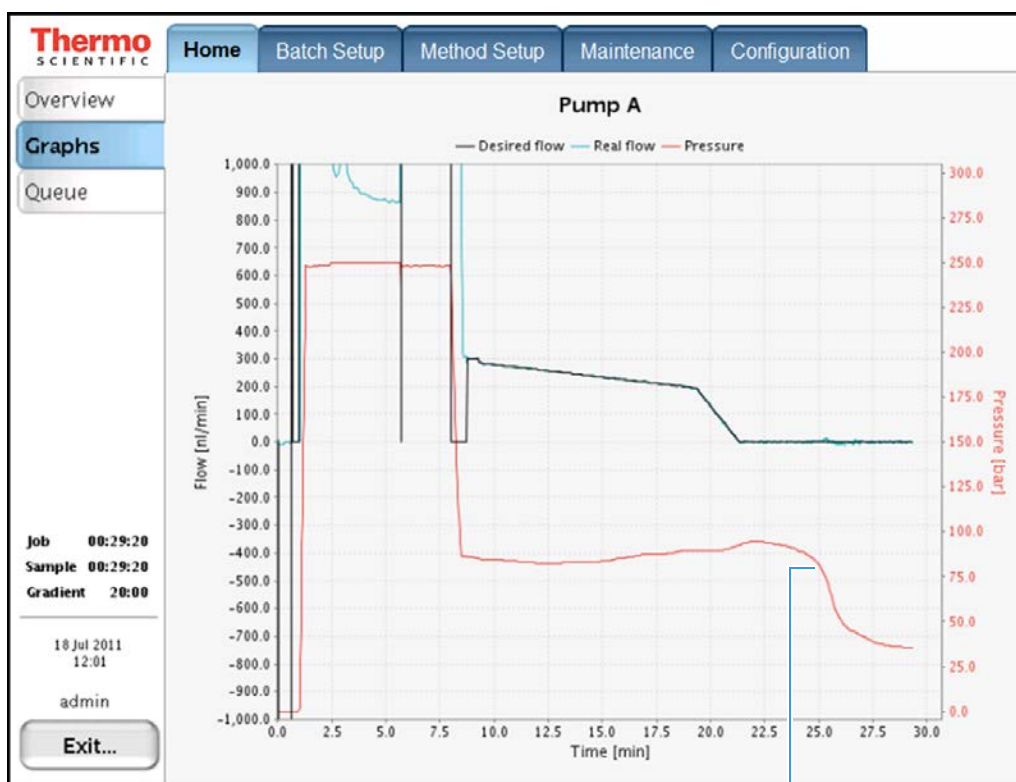
## Introduced Swept Volume

Normally when solvent B (95% acetonitrile with 0.1% formic acid) reaches the column, the backpressure measured by pressure sensor A drops to less than one-half the amount measured for solvent A (water with 0.1% formic acid) alone. If the backpressure does not drop by more than 50 percent when solvent B reaches the column, the solvent system might contain an additional swept volume introduced by poor tubing connections.

The additional swept volume increases the gradient delay volume so that the gradient reaches the column later.

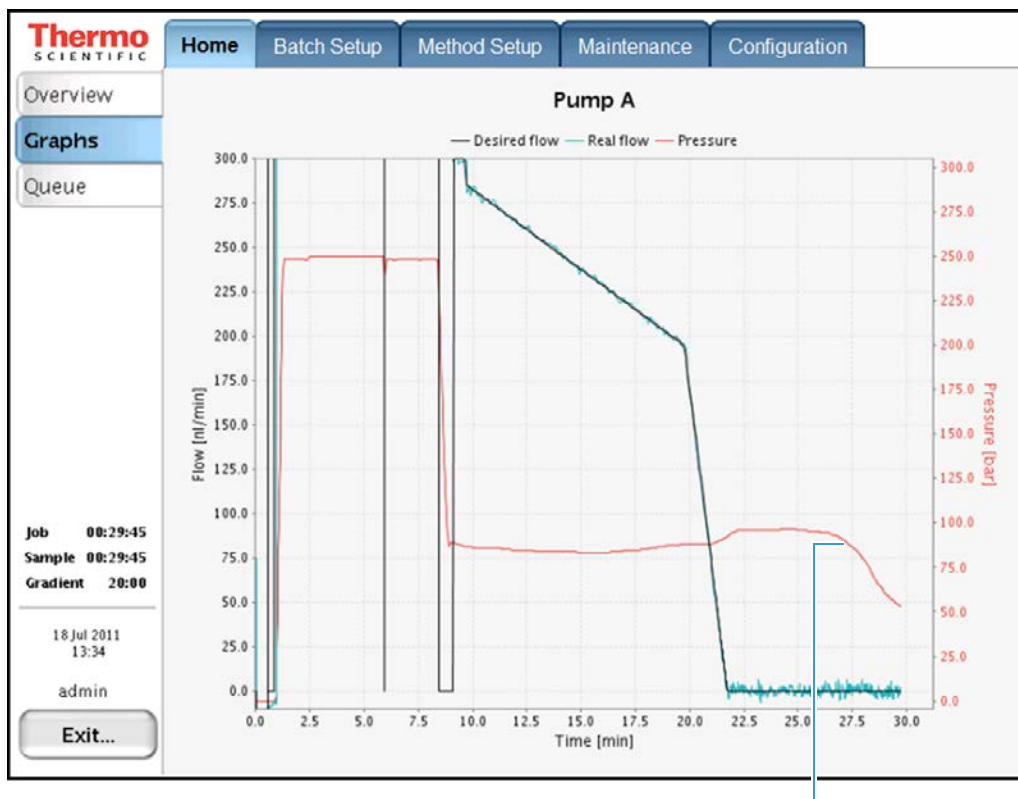
Figure 116 shows the pressure dip that occurs when the gradient starts to reach the column. Figure 117 shows the pressure dip for the sample chromatographic method, but occurring two minutes later due to the added gradient delay volume.

**Figure 116.** Normal pressure dip for pressure sensor A as the gradient reaches the column



The pressure starts to drop at approximately 25 minutes as 100% solvent B reaches the column.

**Figure 117.** Pressure dip begins later when the system has introduced swept volume



The pressure starts to drop at approximately 27 minutes as 100% solvent B reaches the column.

Backpressure is proportional to the viscosity of the solvent mixture. If you are not running a water/acetonitrile gradient, the pressure profile of your gradient run will differ. [Table 31](#) on [page 265](#) lists the viscosities for two-solvent mobile phases consisting of a water/methanol mixture or a water/acetonitrile mixture.



## Excessive Duration or Higher Pressure for the Column Equilibration and Sample Loading Steps

Table 15 lists possible causes for the following:

- When the column equilibration and sample loading steps are controlled by a specified pressure, the duration of these steps is longer than expected.
- When these steps are controlled by a specified flow, the pressure is higher than expected during the column equilibration step, the sample loading step, or both steps.

During the sample loading and column equilibration steps, pump A delivers the user-specified volume of solvent A to the system at the user-specified flow rate or maximum pressure or the maximum system pressure. When the columns or the Column Out line is clogged, the system must lower the flow rate to maintain the pressure at the maximum pressure specified in the method. The lower flow rate increases the column equilibration time, the sample loading time, or both.

**Table 15.** Common causes of a longer than expected column equilibration time or sample loading time

Symptom	Possible cause	Action
When the method specifies a set flow rate for the column equilibration, sample loading, or both of these steps, the pressure is higher than usual.	Clogged column	Run the Back Pressure script for pump A (see “Back Pressure” on page 47).  If the test passes, one of the columns is probably clogged and must be replaced.
	Clogged system	Run the Back Pressure script for pump A.  If the test fails, go to “Troubleshooting a System Blockage” on page 208.
When the method specifies a maximum pressure for one or both of these steps, the duration of these steps is longer.		

Figure 118 and Figure 119 show the flow rate and pressure traces for pump A for a normal run and a run with a partially clogged column, respectively. The flow rate for a run with a clogged column is lower than the flow rate for a normal run. The lower flow rate increases the duration of the column equilibration and sample loading steps.

**Note** The specifications for the precolumns used to acquire the data in Figure 118 and Figure 119 are as follows:

- 2 cm length
- 100 µm ID
- 5 µm particle size
- C18

Figure 118. Normal run

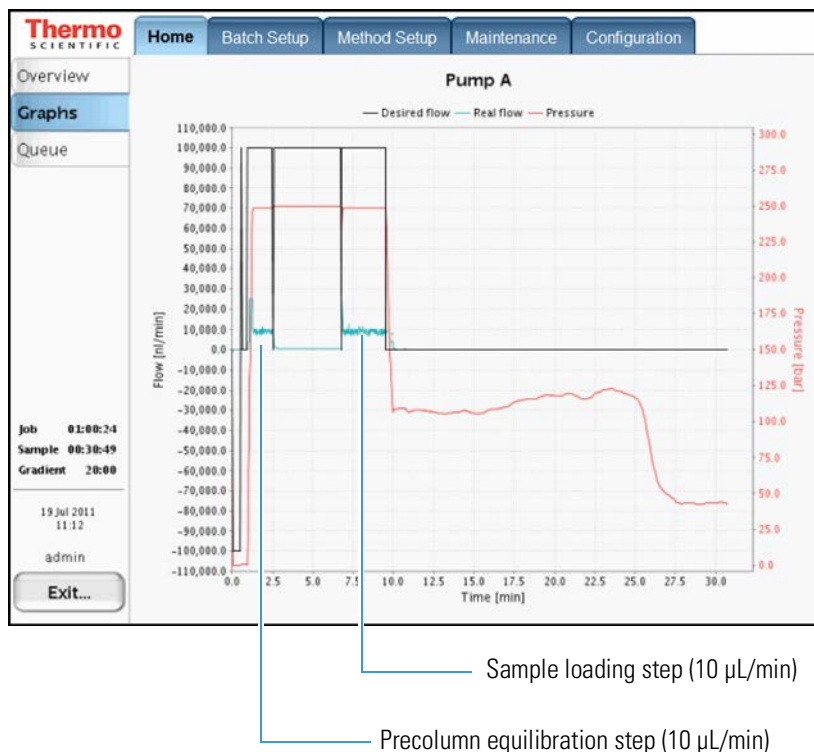
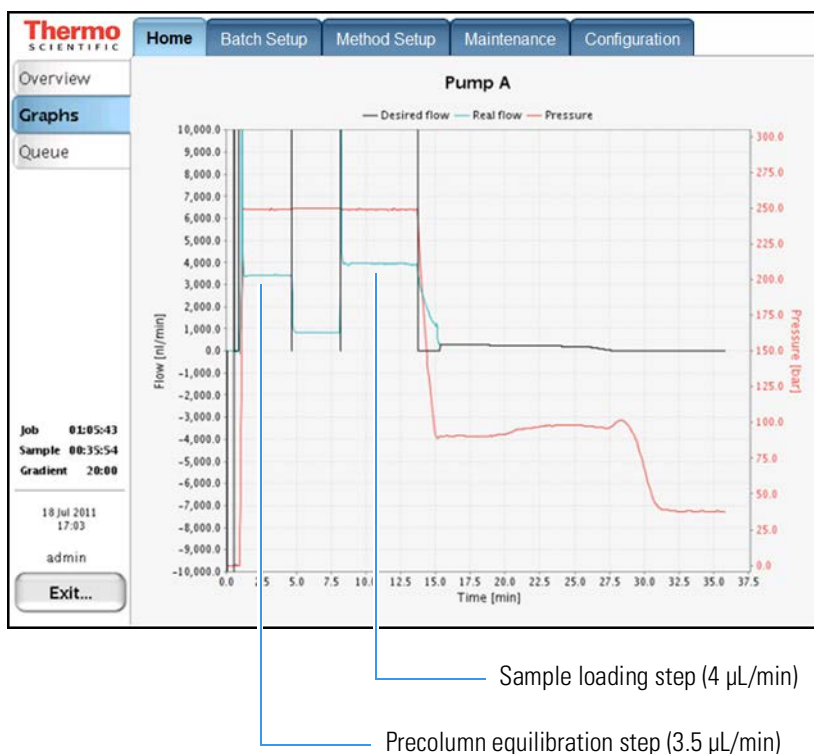


Figure 119. Run with a partially blocked column



## System Reaches Its Maximum Pressure During the Gradient

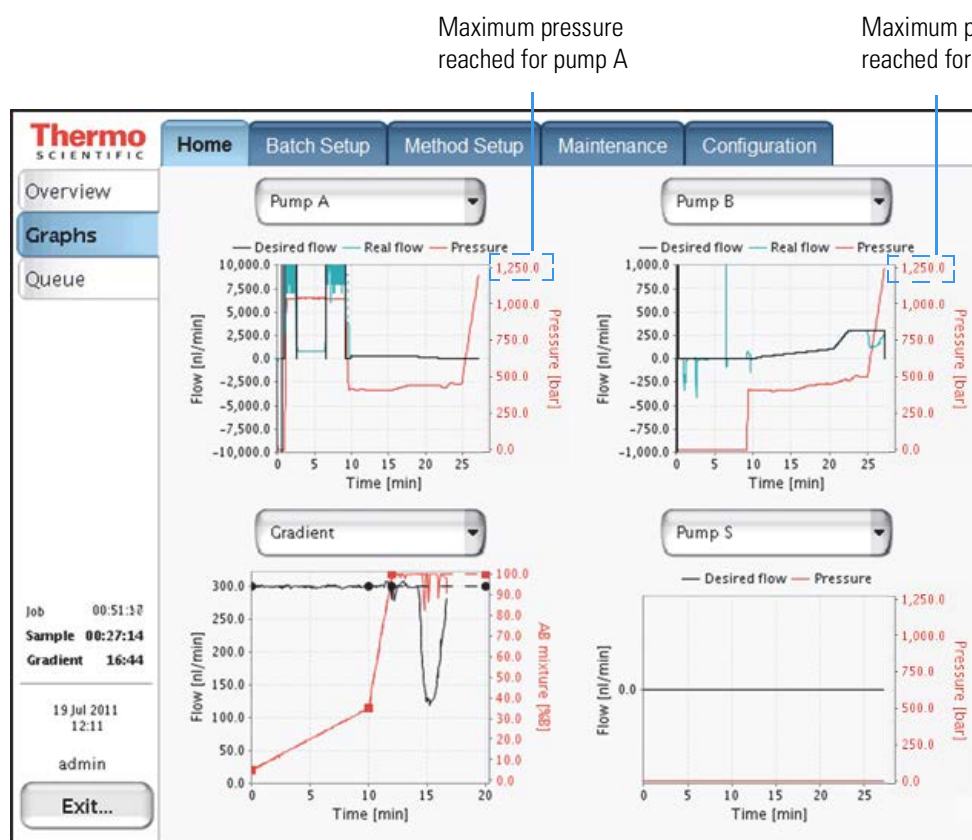
If the pressure trace shows maximum pressure during the gradient, review the possible causes in [Table 16](#).

**Table 16.** Possible causes of maximum pressure spikes during a run

Symptom	Possible cause	Action
The system reaches its maximum pressure during a run.	Clogged column	Run the Back Pressure script for pumps A and B.  If the test passes, one of the columns is probably clogged and needs to be replaced.
	Clogged system	Run the Back Pressure script for pumps A and B.  If the test fails, go to “ <a href="#">Troubleshooting a System Blockage</a> ” on <a href="#">page 208</a> .
	Excessively high flow rate	Reduce the flow rate in the method.

When a column or the Column Out line is clogged, the backpressure can increase to the maximum system pressure for pump A, pump B, or pumps A and B during the gradient (see [Figure 120](#)).

**Figure 120.** Backpressure shown reaching the maximum system pressure for pumps A and B



When only the flow path between pump B and the mixing Tee has a blockage, the backpressure on pump B increases and differs from the backpressure on pump A.

Figure 121 shows the typical profile for a blockage in the solvent system between pump B and the mixing Tee.

Figure 121. Backpressure shown reaching the maximum pressure for pump B only

Maximum pressure reached for pump B

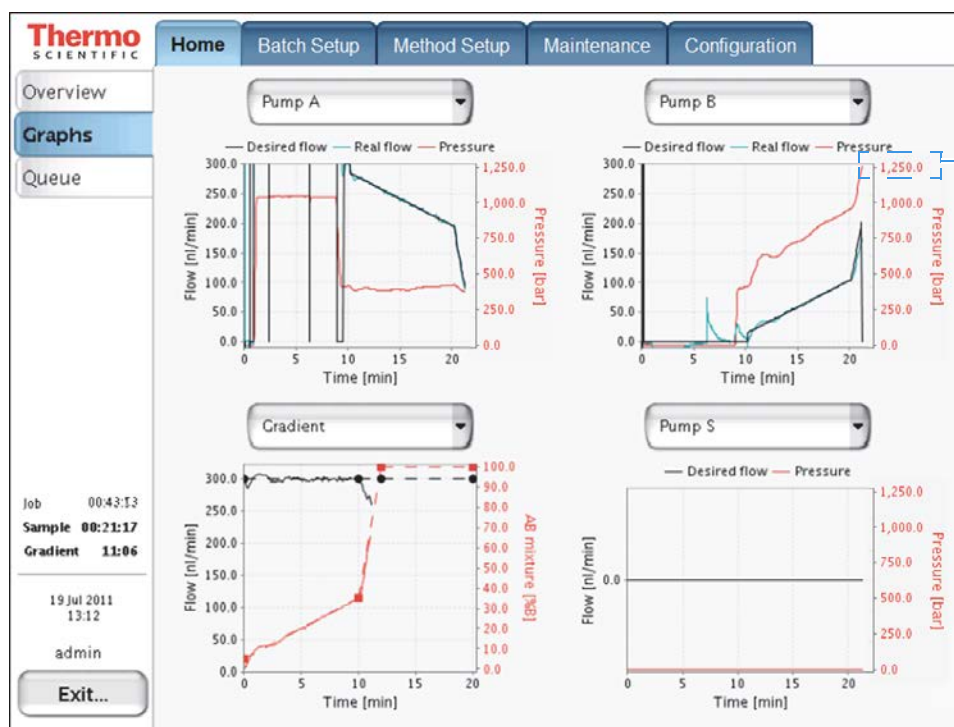
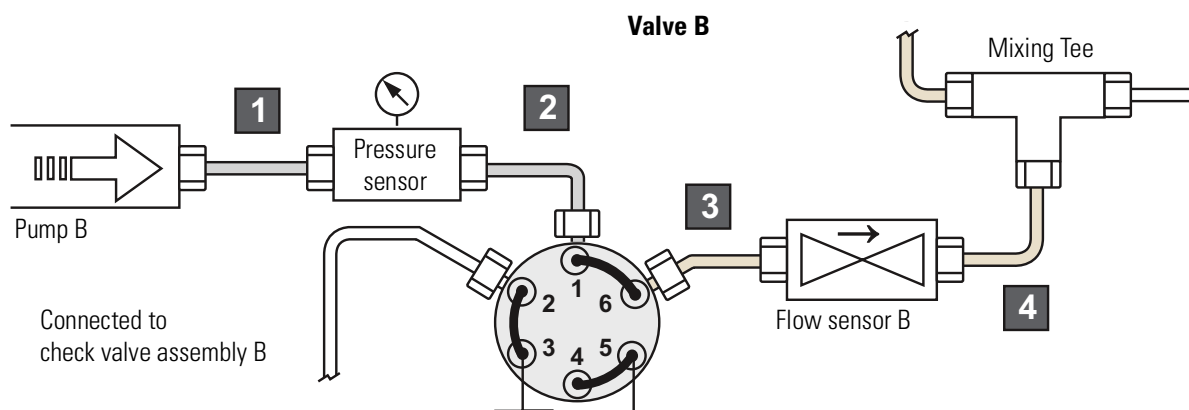


Figure 122 shows the flow path between pump B and the mixing Tee.

**Figure 122.** Solvent lines between pump B and the mixing Tee

**Note** Please note the numbering of the valve ports as depicted in Figure 9 (clockwise numbering with valve port 1 in 4 o'clock position). Due to operational reasons, the graphical representation in this guide or in the instrument's built-in software may show the valves in a different orientation. Please use only the port numbers for identification of port positions.



No.	EASY-nLC 1200 instrument
1	Stainless steel tubing and fittings
2	Stainless steel tubing and fittings
3	nanoViper
4	nanoViper

## Sample Signal Weak or Absent

If the sample signal is missing or weak, review the troubleshooting tips in [Table 17](#).

**Table 17.** Possible causes of a weak or absent signal

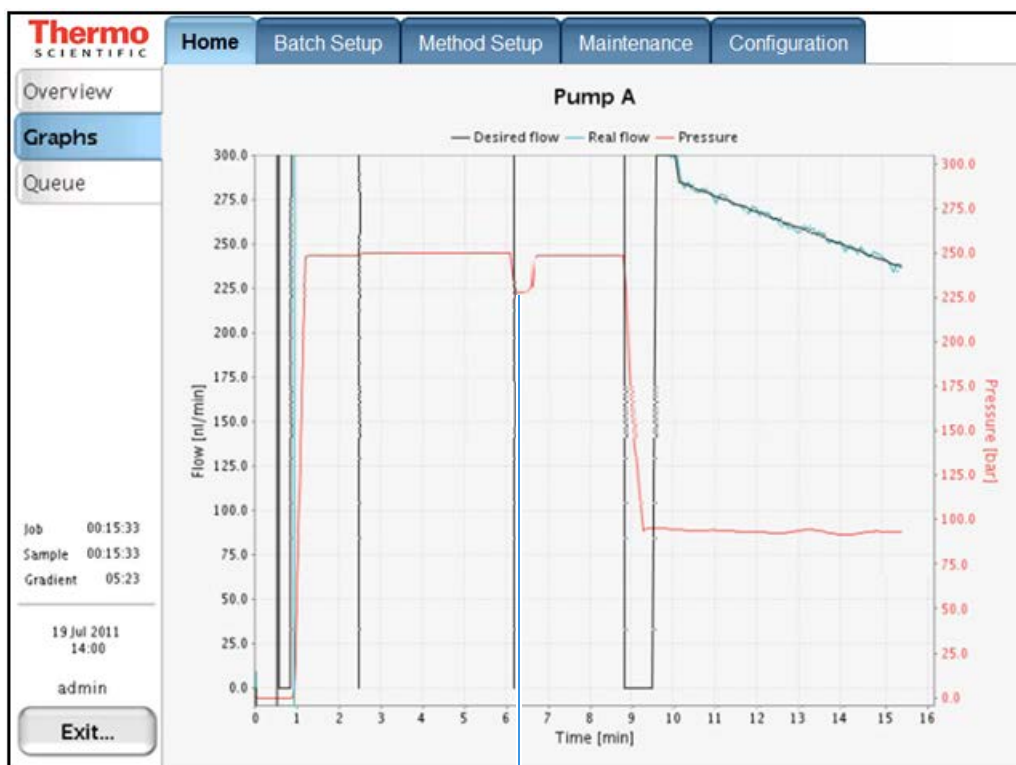
Symptom	Possible cause	Action
The sample signal is missing or weak.	Sample not aspirated (See <a href="#">Figure 123</a> on <a href="#">page 145</a> .)	Run the Sample Pickup script. If the Sample Pickup script fails, see “ <a href="#">Troubleshooting the Autosampler Aspiration</a> ” on <a href="#">page 220</a> .
	Damaged or incorrect column (See <a href="#">Figure 124</a> on <a href="#">page 146</a> .)	Make sure that you have installed the correct column or columns.  Check the backpressure on the columns by running the column equilibration scripts.
Leak in the system (See <a href="#">Figure 125</a> on <a href="#">page 147</a> .)		Run the Leaks test on the system.  If the test fails, see “ <a href="#">Troubleshooting the Results of the System Leak Test</a> ” on <a href="#">page 183</a> .
		Incorrect column configuration
Incorrect solvent in W3 bottle		Make sure that the W3 bottle contains solvent A.
Incorrect sample loop configuration		Check the loop configuration on the Properties page for the EASY-nLC HPLC device on the Maintenance > Devices page.  Make sure that the configured loop volume matches the installed sample loop.

## Weak or Absent Signal—Sample Not Aspirated

A pressure drop at the start of the sample loading step indicates that pump S has introduced air into the sample loop (see [Figure 123](#)).

When the method uses pressure to control the flow rate, the pressure should return to the specified level within approximately 4 seconds after the sample is loaded onto the column. If the pressure does not return to the specified level within approximately 4 seconds, pump S has probably introduced air into the system.

**Figure 123.** Typical pump A profile for a system with air in the sample loop



Pressure drop at the start of the Sample Loading step

## Weak or Absent Signal—Defective Precolumn

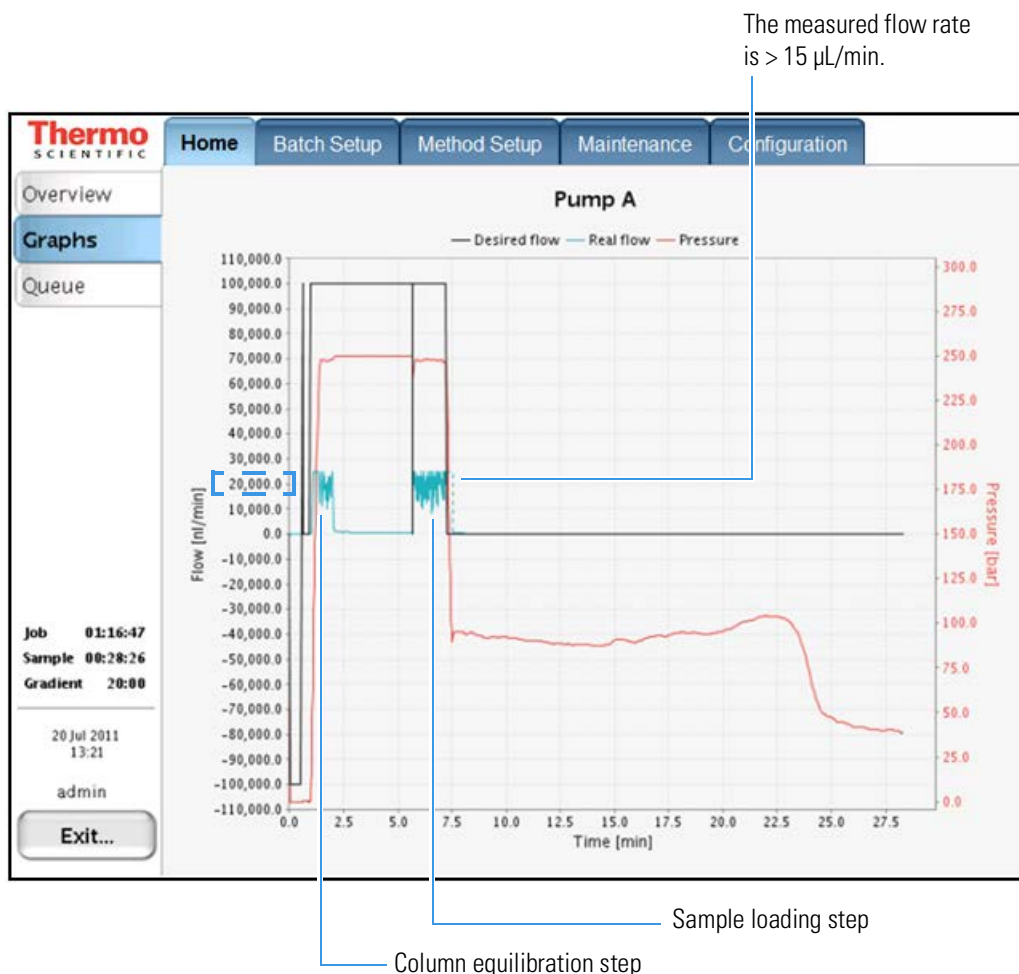
When compared to the Pump A graph for a normal run shown in [Figure 118](#) on [page 140](#), [Figure 124](#) shows the reduced time for the precolumn equilibration and sample loading steps when the precolumn is damaged and has lost a significant portion of its packing material.

The flow rate for the column equilibration and sample loading steps is higher (>15  $\mu\text{L}/\text{min}$ ) and the duration is shorter because the precolumn is exerting less backpressure.

**Note** The specifications for the precolumns used to acquire the data in [Figure 118](#) and [Figure 119](#) are as follows:

- 2 cm length
- 100  $\mu\text{m}$  ID
- 5  $\mu\text{m}$  particle size
- C18

**Figure 124.** Typical pump A profile for a damaged precolumn



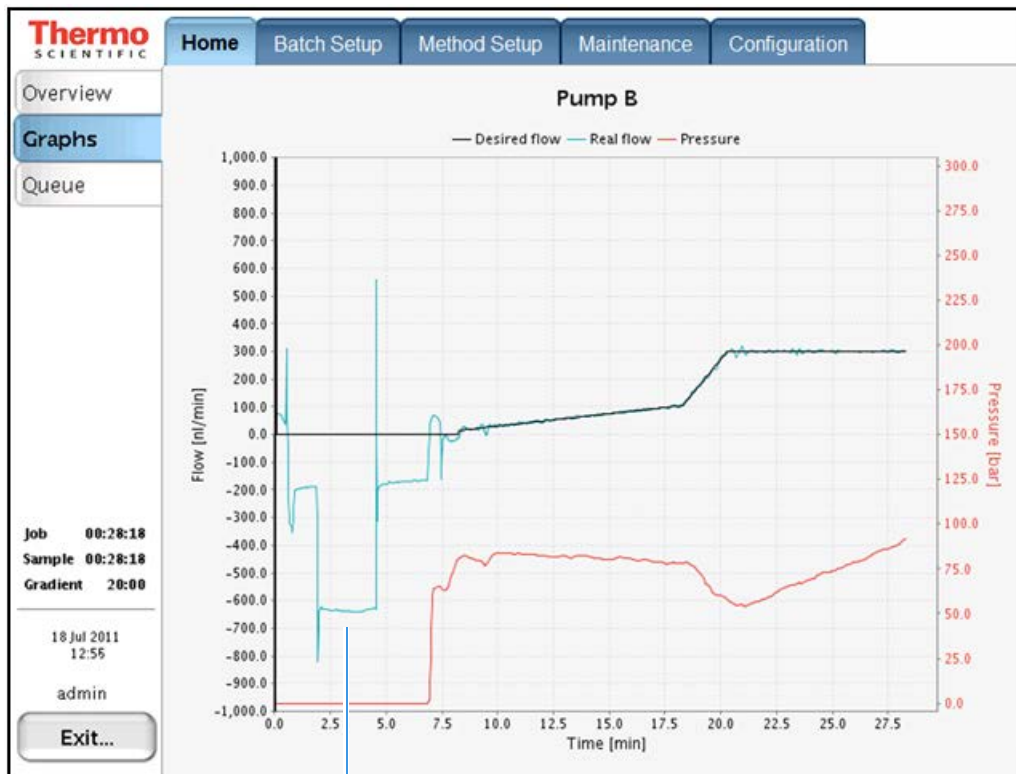


## Weak or Absent Signal—Leak Upstream of Flow Sensor B

Figure 125 shows a typical pump B profile for a system with a leak upstream of flow sensor B. Flow sensor B displays a negative flow during the column equilibration and sample loading steps.

If the gradient is short, a leak upstream of flow sensor B will cause a complete lack of signal because solvent B is not reaching the columns within the duration of the gradient.

**Figure 125.** Typical pump B profile for a leak upstream of flow sensor B



Negative flow during the column equilibration and sample loading steps

## Slow or No Pressure Increase in Subsystem A or B

A lack of pressure or a slow increase in pressure in subsystem A or B is often caused by a worn piston seal, a leak in the valve(s), or a leaking tubing connection.

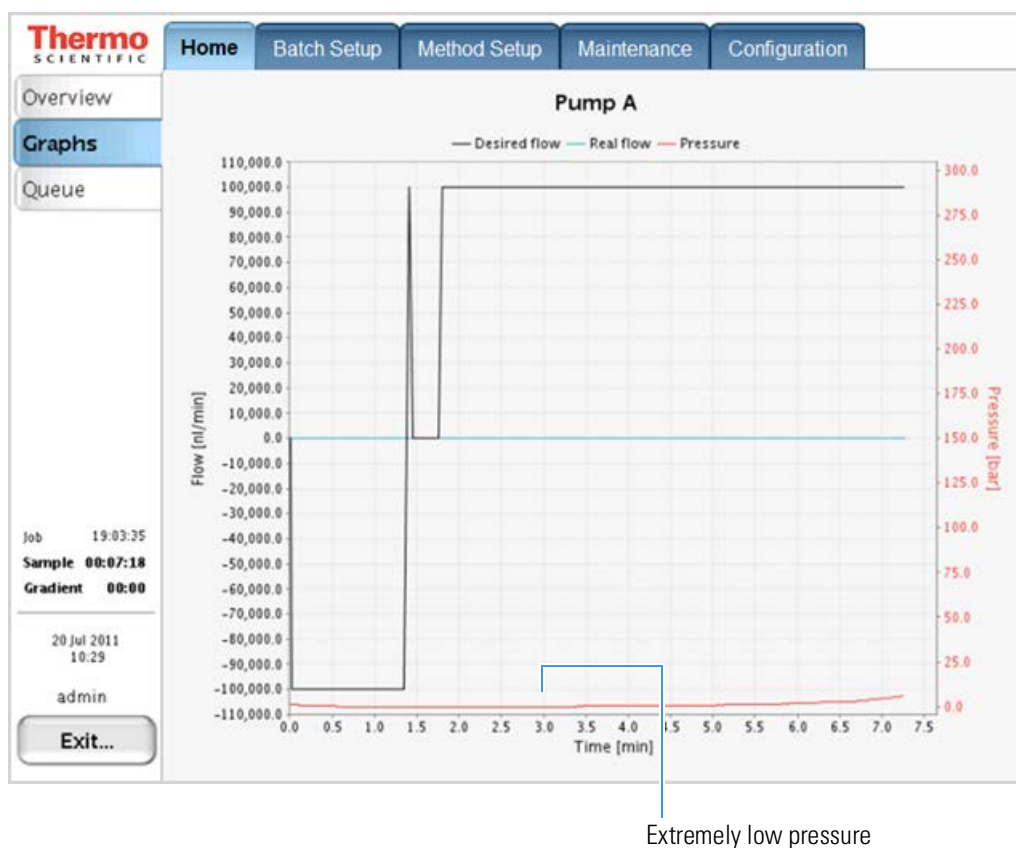
**Note** A subsystem includes the pump, the solvent line that connects the pump to the pressure transducer, the solvent line that connects the pressure transducer to the valve, and the valve.

**Table 18.** Troubleshooting low backpressure in subsystems A or B

Symptom	Possible cause	Action
Backpressure is low in subsystem A or B.	Air in the pump	Run the Purge Solvent script for the affected pump with 2 iterations. Then, run the Flush Air script. If the Flush Air script fails, see “Troubleshooting a Pump That Fails the Flush Air Script” on page 174.
	Leak in the pump	Run the Leaks script for the affected pump. If the Leaks script fails, see “Troubleshooting a Pump That Fails the Leaks Script” on page 177.

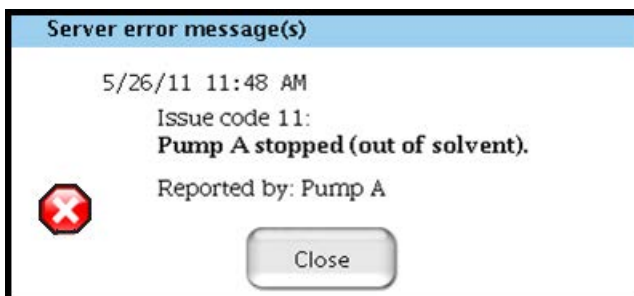
Figure 126 shows the leak test profile for pump A. Even when the flow rate is set to the maximum allowable value, the pressure for pump A does not increase.

**Figure 126.** Leak test profile for pump A



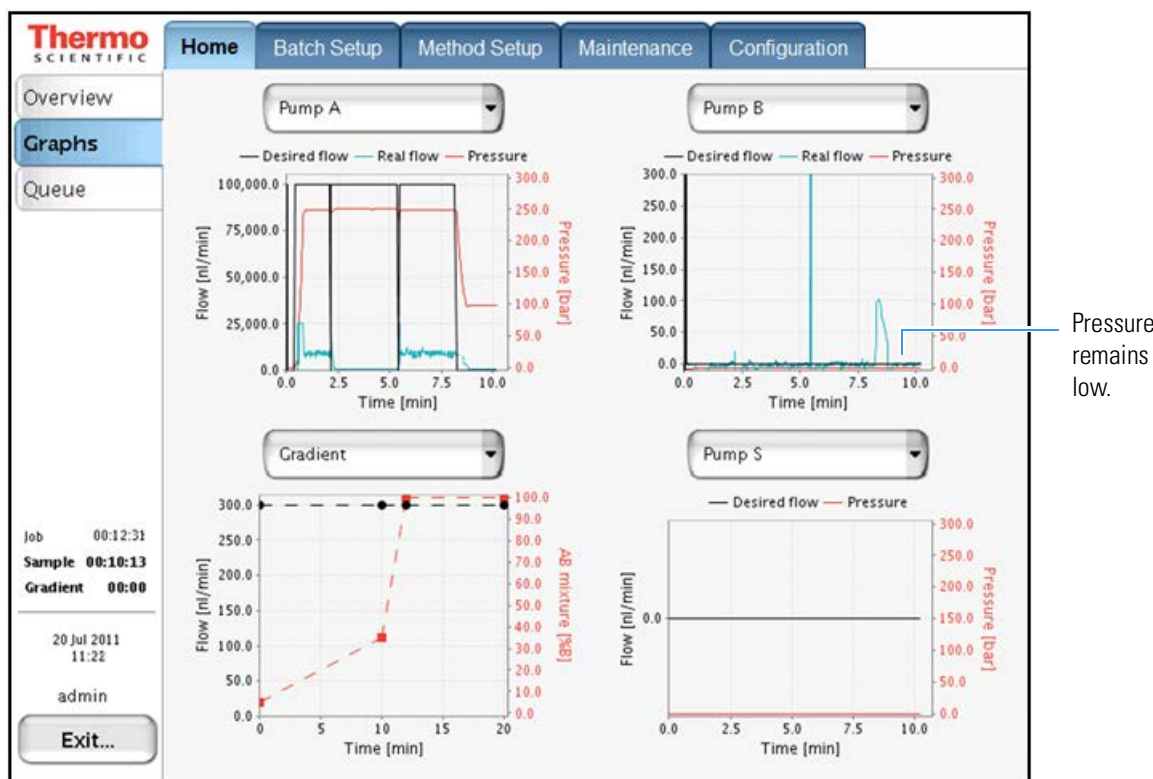
When subsystem A has a large leak, pump A can run out of solvent during a sample run, resulting in the server error message shown in Figure 127. An automatic refill will happen during the gradient step.

**Figure 127.** Server error message displayed when pump A runs out of solvent



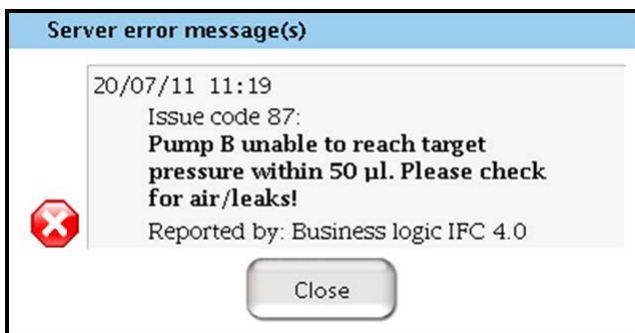
When subsystem B has a large leak or is filled with air, the gradient fails to start because the pressure cannot be increased to reach the starting conditions (see Figure 128).

**Figure 128.** Subsystem B leak



When pump B cannot generate sufficient pressure to start the gradient, the server error message shown in [Figure 129](#) appears.

**Figure 129.** Server error message displayed when pump B cannot generate sufficient pressure to start the gradient



## Errors Reported by the Xcalibur Data System

Table 19 lists the possible causes of the common errors reported by the Xcalibur data system.

**Table 19.** Possible causes of errors reported by the Xcalibur data system

Symptom	Possible cause	Action
An Acquisition Server failure prevents the sequence from running (see Figure 130 on page 152).	Lost connection between the EASY-nLC instrument and the external data system computer	<p>Check the Ethernet connections between the EASY-nLC instrument and the data system computer.</p> <p>Exit the Xcalibur data system. Then, open the Thermo EASY-nLC Configuration dialog box and click <b>Test Connection</b>.</p> <p>If necessary, restart the EASY-nLC instrument.</p>
The Acquisition Server displays the message that the EASY-nLC device has reported a failure during the Prepare For Run step.	Injection volume is greater than the loop size minus 2 $\mu\text{L}$ .	<p>Check the loop configuration on the Properties page for the EASY-nLC HPLC device on the Maintenance &gt; Devices page.</p> <p>Make sure that the configured loop volume matches the installed sample loop.</p>
Unable to submit samples. The following error message appears: Invalid Autosampler Vial Position	Incorrect plate configuration (See Figure 131 on page 153.)	Select the correct autosampler plate in the Thermo EASY-nLC Configuration dialog box.
The mass spectrometer remains in the Waiting for Contact Closure state and data acquisition does not start (see Figure 132 on page 154).	Contact closure configured incorrectly	<p>Press <b>Configuration &gt; Connections</b>.</p> <p>Select the correct MS configuration and settings.</p>
	Failing contact closure relay due to incorrect grounding	Check whether the LC/MS system is properly grounded as described in “ <a href="#">Verifying that the LC/MS System Is Properly Grounded</a> ” on page 227.

Figure 130 shows the Acquisition Server message that appears when the EASY-nLC instrument loses communication with the data system computer during a sequence run. The sequence pauses until you intervene.

**Figure 130.** Lost connection between the EASY-nLC instrument and the Acquisition Server

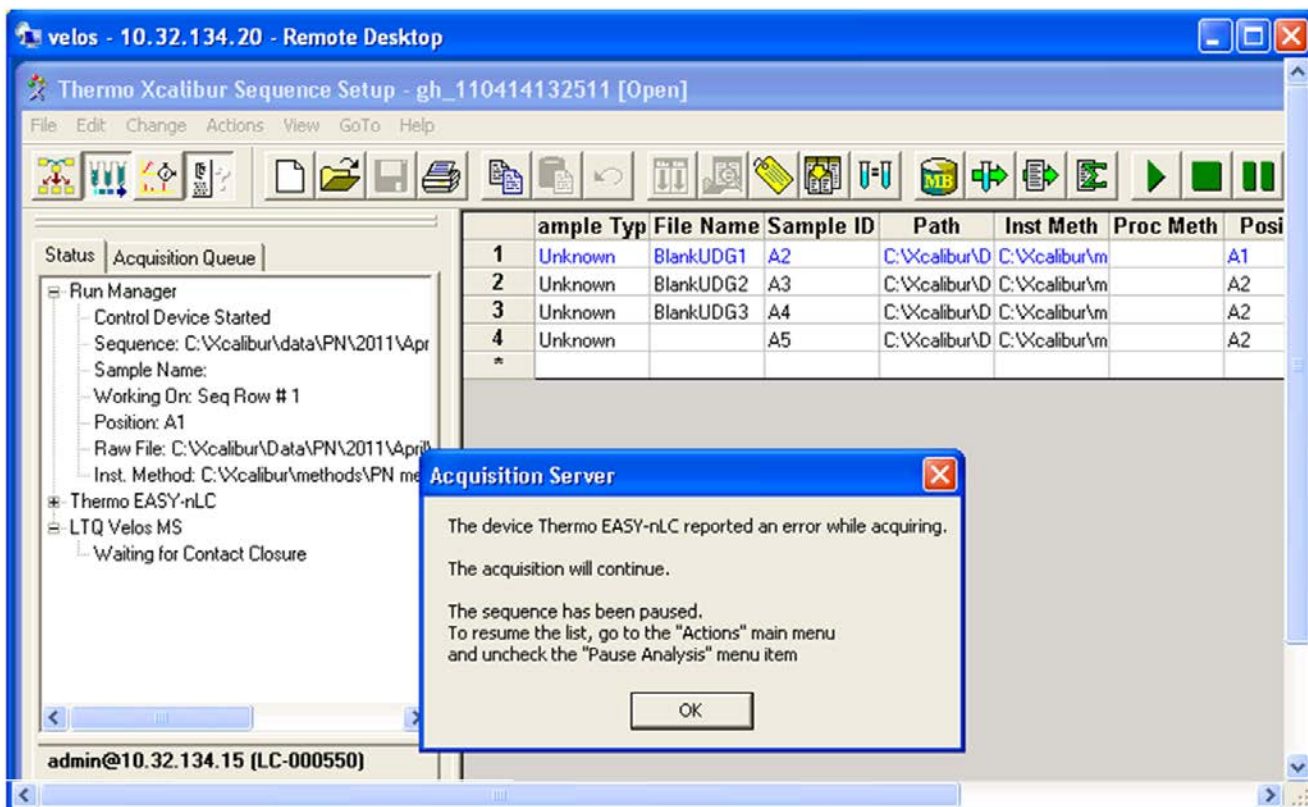


Figure 131 shows the Home Page error message that appears when the sequence list contains a well plate position and the autosampler configuration is set up for the vial adapter plate format.

**Figure 131.** Incorrect vial position for the vial adapter plate format

Invalid vial position

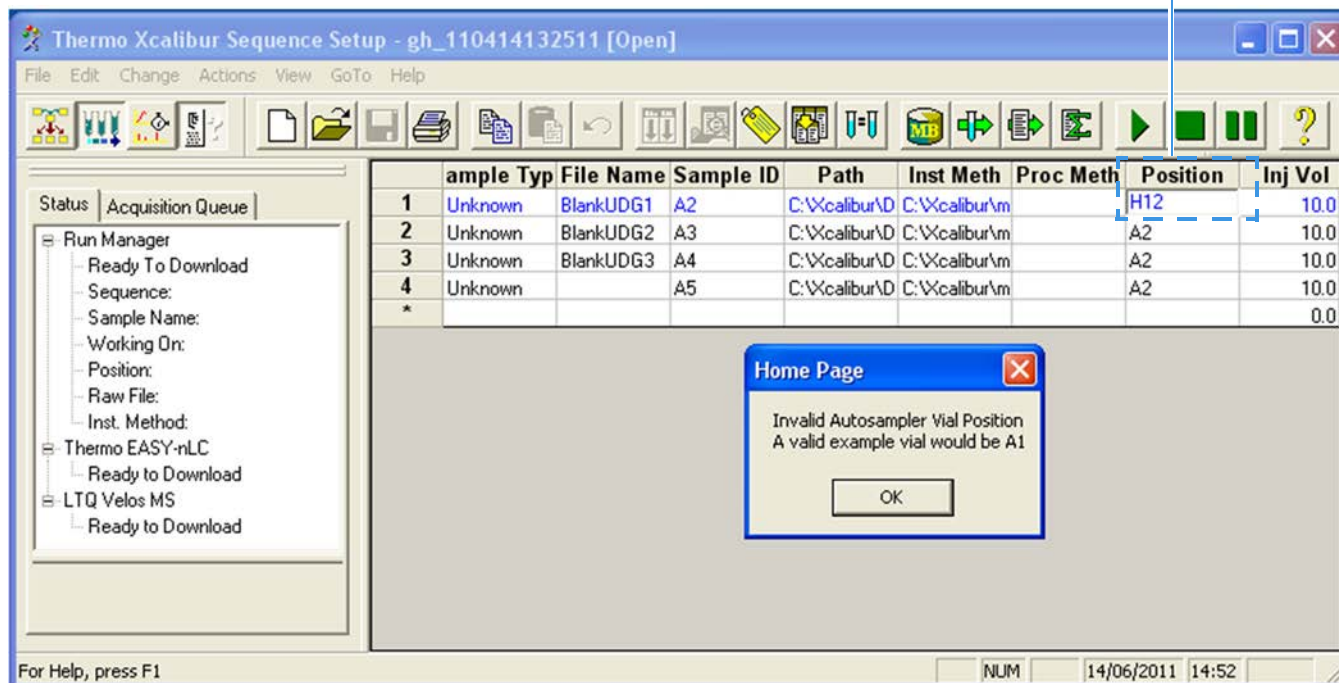
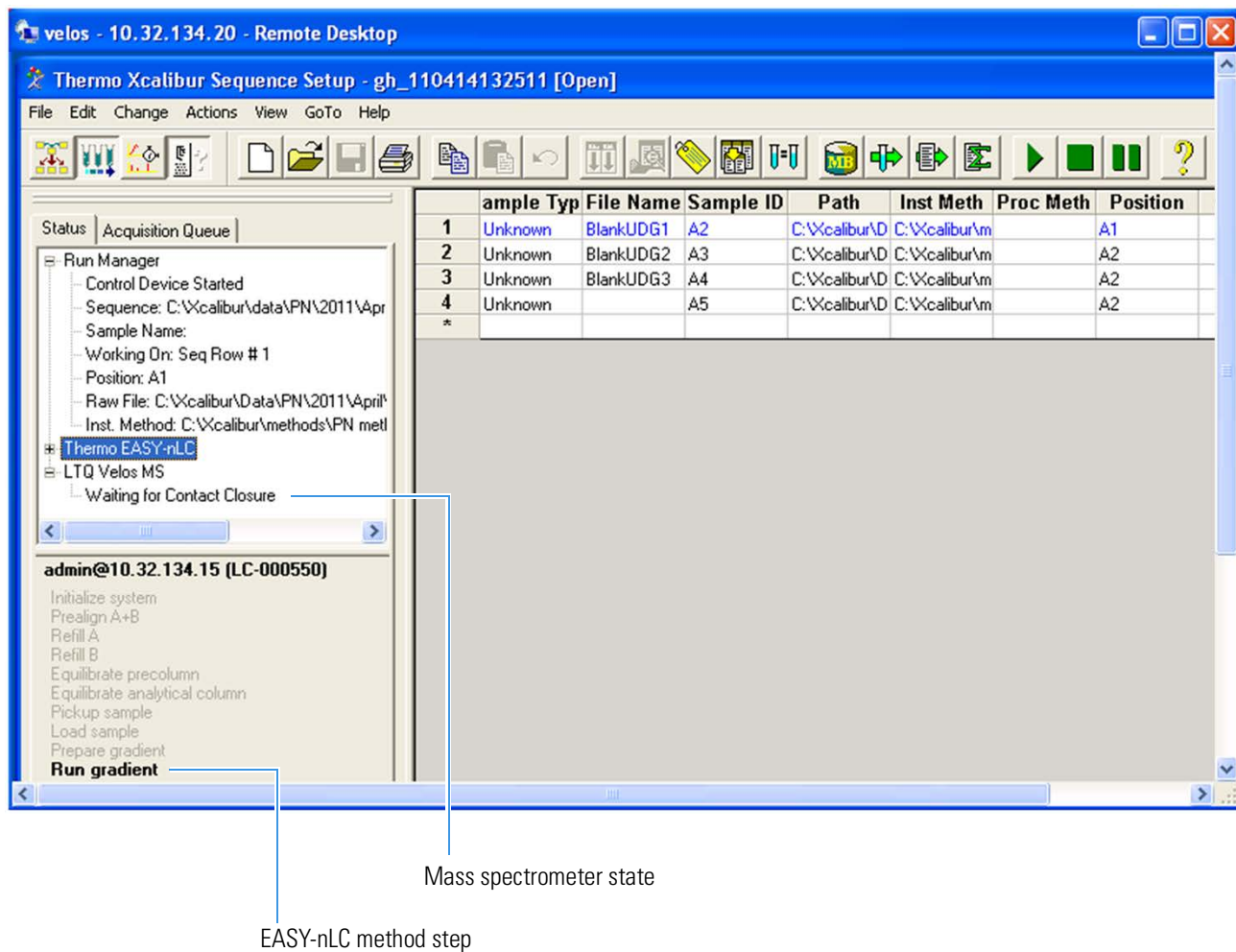


Figure 132 shows that the mass spectrometer is waiting for a start signal from the EASY-nLC device before it starts data acquisition. The mass spectrometer remains in the Waiting for Contact Closure state until it receives the start signal. The EASY-nLC instrument sends the start signal when the run gradient step begins.

Figure 132. Waiting for Contact Closure error





## Carryover

Table 20 lists the possible causes of carryover.

**Table 20.** Possible causes of carryover

Symptom	Possible cause	Action
Carryover from one run to the next	Incomplete elution of peptides from column	Add extra time to the end of the gradient or add a high-organic hold to the end of the gradient.  To determine if the high-organic hold is long enough, make sure that you see a pressure drop during the hold period and the pressure reaches a minimum and maintains it (see Figure 133 and Figure 134).
	Insufficient washing of needle and loop	Add extra wash steps to the method. Consider using an organic solvent for one of the custom wash solvents.
	Dead volumes in the column setup	Remake the connections in the column setup.

Figure 133 shows a gradient run with a high-organic hold at the end of the run that is too short for the column to see the high-organic solvent, as displayed by the lack of a pressure drop at the end of the run.

**Figure 133.** Gradient run without an adequate high-organic hold at the end of the run

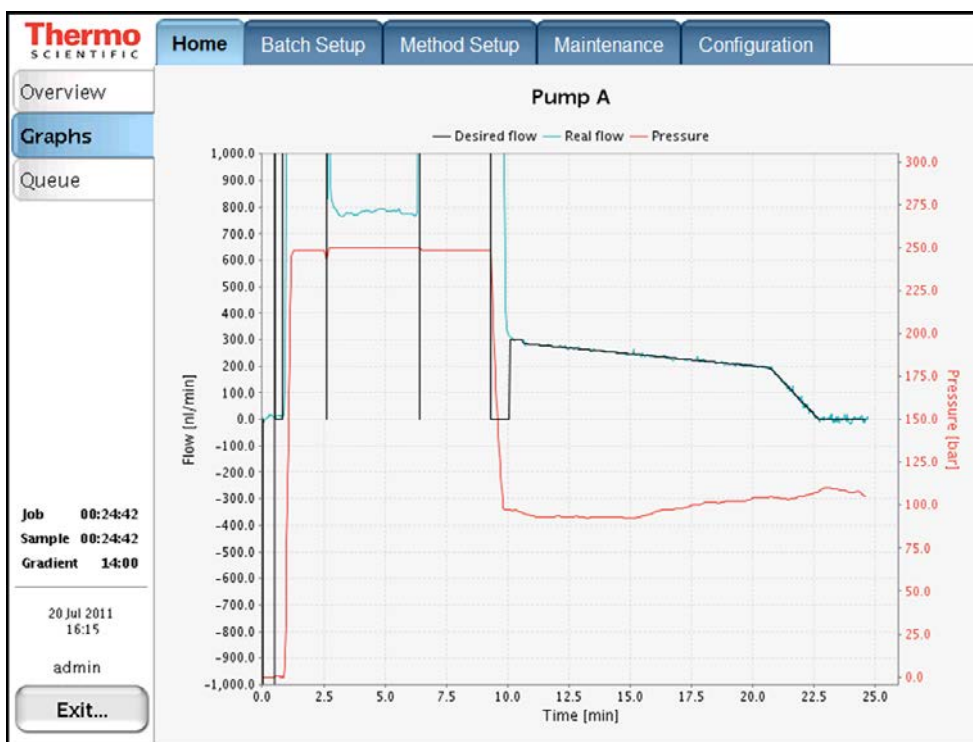
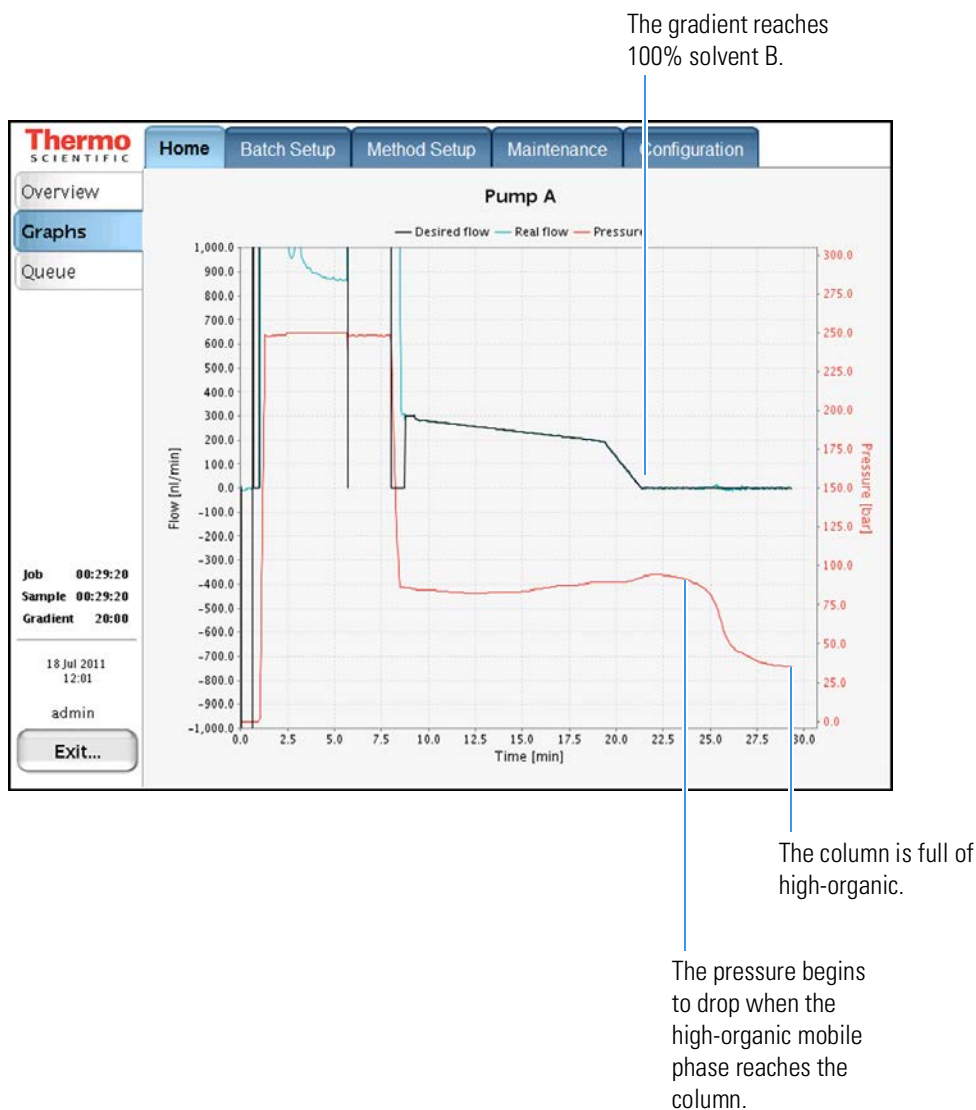


Figure 134 shows the effect of a high-organic hold at the end of the gradient run on pressure. The pressure continues to drop until the column equilibrates to the high-organic content.

**Figure 134.** Gradient run with an adequate high-organic hold at the end of the run



## Spray Issues

Table 21 lists possible causes of an unstable spray.

**Table 21.** Possible causes of an unstable spray

Symptom	Possible cause	Action
Unstable spray	Post-column outgassing	Degas the solvents.
	Poor connection in either the liquid junction or the DirectJunction	Check all of the connections.
	Incorrect MS settings or emitter position	Optimize the MS tune file for the desired flow rate and the emitter position.
	Dirty emitter	Clean the emitter with an organic solvent such as methanol, acetonitrile, or ethanol.  Use only LC/MS-grade solvents.
	Poor high-voltage connection	Check all of the high-voltage connections. Reconnect as necessary.
	Air movement from an air conditioning vent	Deflect the air from the vent, or use a shield to protect the ion source.
	Incorrect sleeve	Refer to the complete Nano LC Connections Guide, available here: <a href="https://tools.thermofisher.com/content/sfs/manuals/PP-64583-LC-MS-NanoLC-Complete-Easy-Guide-PP64583-EN.pdf">https://tools.thermofisher.com/content/sfs/manuals/PP-64583-LC-MS-NanoLC-Complete-Easy-Guide-PP64583-EN.pdf</a>

## Chromatographic Performance

Table 22 lists troubleshooting tips for common chromatography problems.


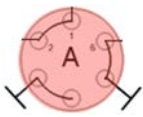
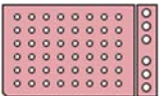
**Table 22.** Troubleshooting tips for chromatographic performance

Symptom	Possible cause	Action
Broad peaks	Dead volume between the column and emitter	Check the connections. Replace the fittings if needed.
	Damaged column	Inspect the column, especially the outlet. Replace the column if it is damaged.
Poor retention time reproducibility	Temperature fluctuations in the laboratory	Monitor the laboratory temperature.  Stabilize the temperature by keeping the laboratory doors closed and by ensuring that the air conditioning system is kept constant at all times.  Do not run the EASY-nLC instrument with the panels removed.
		Back flow on flow sensor B
	Spikes seen in flow sensor B during valve shifts	Use the scripts to check for a leak in the B subsystem (Leak test Pumps A + B, and System).  Replace defective seals, rotors, and solvent lines as needed.
Sub-optimal analytical or pre-column equilibration volumes	Target pressure calculation is affected.	Use the correct equilibration volume.

## Device Failures

Table 23 lists troubleshooting tips for devices failures.

**Table 23.** Troubleshooting tips for device failures

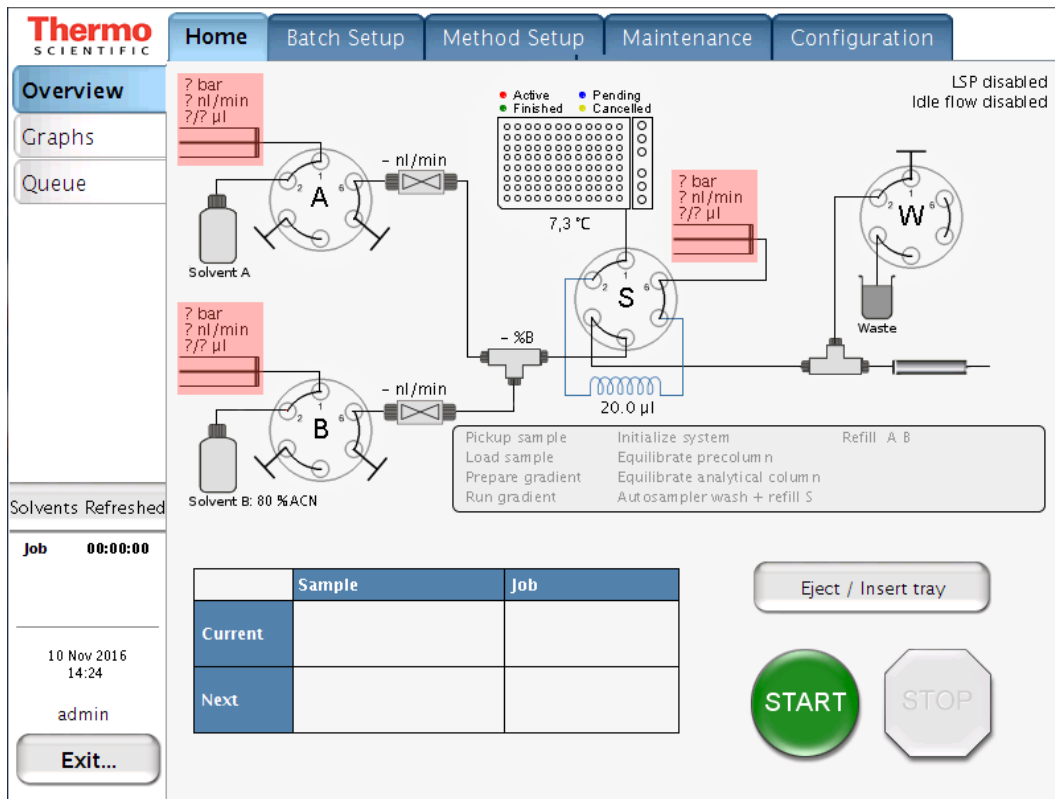
Symptom		Possible cause	Action
The pump icon for a pump that is not functioning turns a pink color on the Home > Overview page.		Communication failure to the pump.  Could be the pump or the PC BUS cable.	Check that the cables are connected correctly.
See <a href="#">Figure 135</a> on <a href="#">page 160</a> .			
The valve icon for a valve that is not functioning turns a pink color on the Home > Overview page.		Communication failure to the valve.  Could be the valve or the PC BUS cable	Check that all of the cables are connected correctly.
See <a href="#">Figure 136</a> on <a href="#">page 161</a> .			
The autosampler icon turns a pink color on the Home > Overview page.		Communication failure on the cooling unit.  Could be the PC box, a damaged cable, or a loose connection.	Check that all of the cables are connected correctly.
See <a href="#">Figure 137</a> on <a href="#">page 162</a> .			

A pump icon turns pink when the pump loses communication with the EASY-nLC computer. The pumps are serially connected, so if pump B loses communication, all of the pumps lose communication. Pump B is the first pump in the series.

Communication between the pumps and the embedded computer can be lost when the cables are loose, when the embedded computer fails, or when the pump PCB fails.

Figure 135 shows the pink pump icons on the Home > Overview page.

**Figure 135.** Pink pump icons on the Home > Overview page

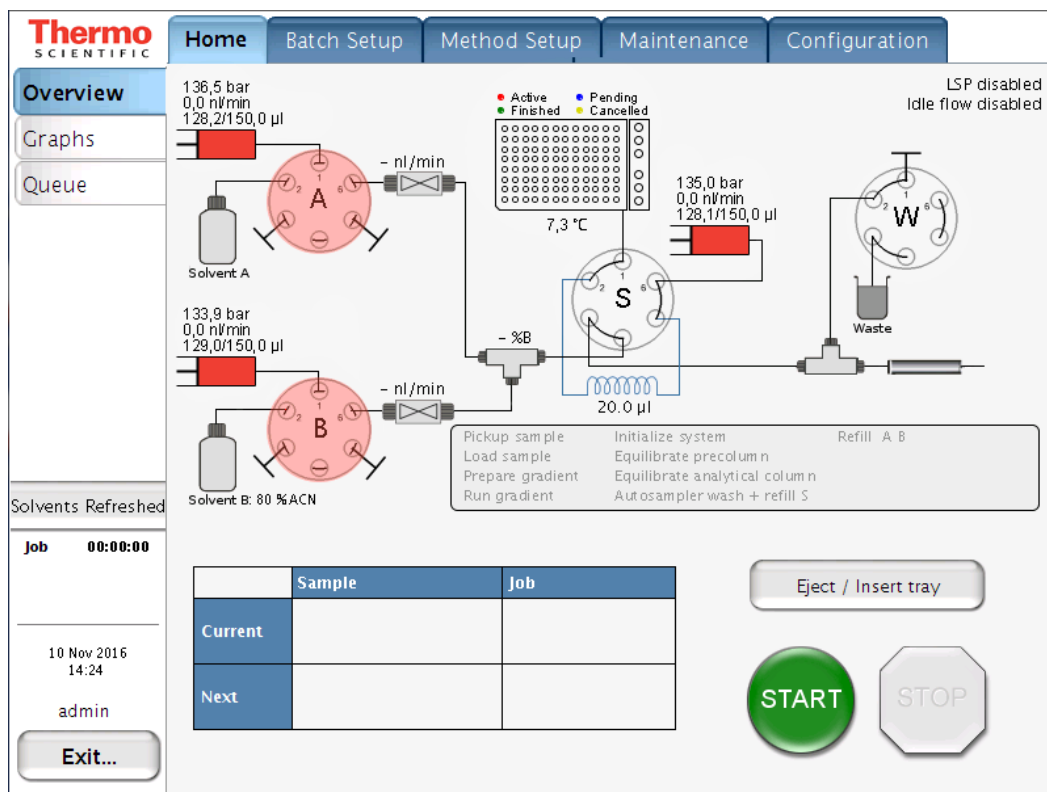


A pink valve icon means that the communication to the unit has been lost. Be aware that the valves are serially connected, so a failing valve might cause other valve icons to turn pink as well.

Communication between the valves and the embedded computer can be lost when the cables are loose, when the embedded computer fails, or when the valve PCB fails.

Figure 136 shows the pink valve icons on the Home > Overview page.

Figure 136. Pink valve icons on the Home > Overview page



An autosampler icon turning pink means that the communication to the unit has been lost.

Figure 137 shows the pink autosampler icon on the Home > Overview page.

**Figure 137.** Pink autosampler icon on the Home > Overview page

The screenshot shows the Thermo Scientific software interface. The top navigation bar includes 'Home', 'Batch Setup', 'Method Setup', 'Maintenance', and 'Configuration'. The 'Overview' section displays system parameters for Solvent A (136,5 bar, 0,0 nl/min, 128,2/150,0 µl) and Solvent B (133,9 bar, 0,0 nl/min, 129,0/150,0 µl). A central diagram shows the autosampler (A), solvent B (B), and waste (W) components. A status window shows a pink icon for the autosampler, indicating a communication loss. A table below the diagram lists various actions and their status.

Sample	Job
Current	
Next	

Additional interface elements include 'Eject / Insert tray', 'START', and 'STOP' buttons. The bottom left shows the date '10 Nov 2016 14:24' and the user 'admin'.



## Miscellaneous

For additional issues that might arise while using the EASY-nLC instrument, consult these miscellaneous troubleshooting tips (Table 24):

**Table 24.** Miscellaneous troubleshooting tips (Sheet 1 of 2)

Symptom	Possible causes	Action
Copying log files to a USB memory stick failed.	Memory stick in wrong format	Format the memory stick in FAT/FAT16 format.
	Memory stick not recognized by the instrument	Use one of the memory sticks supplied by Thermo Fisher Scientific, or try plugging the stick into the other USB port.  Contact Thermo Fisher Scientific if neither action works: <ul style="list-style-type: none"> <li>• <a href="mailto:us.customer-support.analyze@thermofisher.com">us.customer-support.analyze@thermofisher.com</a></li> <li>• <a href="mailto:eu.techsupport.cms@thermofisher.com">eu.techsupport.cms@thermofisher.com</a></li> </ul>
Copying to the USB memory stick does not stop.	Too much data to be copied	Remove the memory stick from the EASY-nLC instrument and press <b>Ignore</b> when the error message appears.  Contact Thermo Fisher Scientific for an instrument check-up: <ul style="list-style-type: none"> <li>• <a href="mailto:us.customer-support.analyze@thermofisher.com">us.customer-support.analyze@thermofisher.com</a></li> <li>• <a href="mailto:eu.techsupport.cms@thermofisher.com">eu.techsupport.cms@thermofisher.com</a></li> </ul>
Forgot the admin password.		If you are already logged in to the EASY-nLC instrument, Thermo Fisher Scientific can extract the password from the system in two ways: <ul style="list-style-type: none"> <li>• Use the master key to create a new password as described in the <i>EASY-nLC 1200 Getting Started Guide</i>.</li> </ul> <p>–or–</p> <ul style="list-style-type: none"> <li>• Run a factory reset.</li> </ul>
System is running slower and slower.	Memory filled with graph data from long gradient run	Press <b>Home &gt; Graph</b> and disable the graphs by pressing <b>No Graph</b> in each graph window.
	System overload caused by other reasons	Restart the application or power down/power up from <b>Exit... &gt; Power Down</b> .

**Table 24.** Miscellaneous troubleshooting tips (Sheet 2 of 2)

Symptom	Possible causes	Action
Valve – unknown position	The valve’s duty cycle requires calibration.	<p>Run the Valve Check script (see “For information about troubleshooting system leaks, see “Troubleshooting the Results of the System Leak Test” on page 183 and “Troubleshooting a Pump That Fails the Leaks Script” on page 177.” on page 47).</p> <p>This script is only valid for EASY-nLC II instrument valves with a serial number below V-009999.</p> <p>Contact your local Thermo Fisher Scientific field service engineer if the reported overshoot is greater than 6.</p>
Unhandled error or SVG (scalable vector graphics) error	Program error in the software release	<p>In most situations you can continue your work by pressing Ignore or OK. More serious error situations might require restarting the HPLC.</p> <p>To improve on the software quality, email details to the following:</p> <ul style="list-style-type: none"> <li>• <a href="mailto:us.customer-support.analyze@thermofisher.com">us.customer-support.analyze@thermofisher.com</a></li> <li>• <a href="mailto:eu.techsupport.cms@thermofisher.com">eu.techsupport.cms@thermofisher.com</a></li> </ul> <p>Or, connect to the remote support server. See “Connecting the EASY-nLC Instrument to the Support Server” on page 244.</p>

## Using the Direct Controls for Troubleshooting and Maintenance

You can access the direct controls for the instrument's hardware components by pressing the component icons on the Home > Overview page.

To use the direct controls, follow these procedures:

- [Using the Valve Controls](#)
- [Using the Pump Controls](#)
- [Using the Autosampler Controls](#)

### Using the Valve Controls

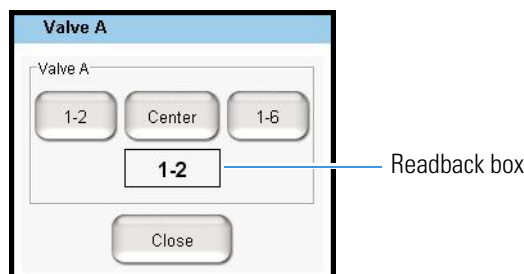
You can change the positions of the instrument's three-position valves from the Home > Overview page. For information about the valve positions, see [“Six-Port Rotary Valve Pods”](#) on [page 11](#).

#### ❖ To change the position of a valve

1. On the Home > Overview page, press the valve icon for the valve that you want to control.

The Valve dialog box opens (see [Figure 138](#)). The readback box lists the current valve position.

**Figure 138.** Valve dialog box



2. Press the button for the position that you want the valve to switch to: **1–2**, **Center**, or **1–6**.

The readback box displays the new position.

### Using the Pump Controls

You can refill and empty the pumps from the Home > Overview page.

**IMPORTANT** Use the pump's direct controls for troubleshooting. To avoid contaminating the pumps, take care when you use these controls:

- For pump A or B, make sure that its corresponding valve is in position 1–2 before you refill the pump.
- For pump S, before you empty or fill the pump, use the autosampler's direct controls to insert the autosampler needle into the W4 or W3 bottle, respectively.

**Tip** To prepare the EASY-nLC instrument for operation, use the Prepare – Purge Solvent script to flush the solvent lines (see “Purge Solvent” on page 32). The Purge Solvent script places the valves in the appropriate positions for filling and emptying pumps A and B and places the autosampler needle in the appropriate wash and waste bottles for filling and emptying pump S.

To work with the pump's direct controls, follow these procedures:

- [Opening the Direct Controls for the Pumps](#)
- [Using the Direct Controls To Fill or Empty Pump A or B](#)
- [Using the Direct Controls To Fill or Empty Pump S](#)

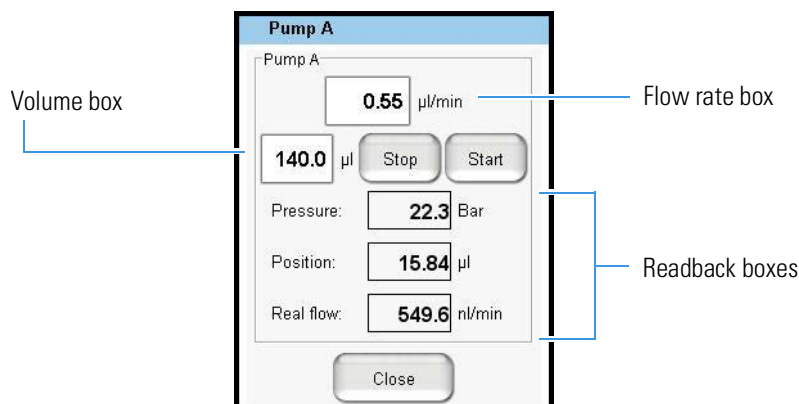
### Opening the Direct Controls for the Pumps

Each pump is represented by a pump icon on the Home > Overview page.

#### ❖ To open the pump dialog box

On the Home > Overview page, press the pump icon for the pump that you want to control.

Its dialog box opens (see [Figure 139](#)). The Position readback box displays the current pump position from 0  $\mu\text{L}$  (empty) to 140  $\mu\text{L}$  (full).

**Figure 139.** Pump dialog box

**Note** Because pump S does not have an associated flow sensor, the Pump S dialog box does not include a Real Flow readback box.

## Using the Direct Controls To Fill or Empty Pump A or B

Before using the direct controls to fill or empty pump A or B, make sure that the valves are in the appropriate position. For information about controlling the position of the valves, see “Using the Valve Controls” on page 165.

**IMPORTANT** Before you fill pump A or B, make sure that the pump’s associated valve is in position 1–2. You can contaminate the pump by attempting to fill the pump when its associated valve is in position 1–6.

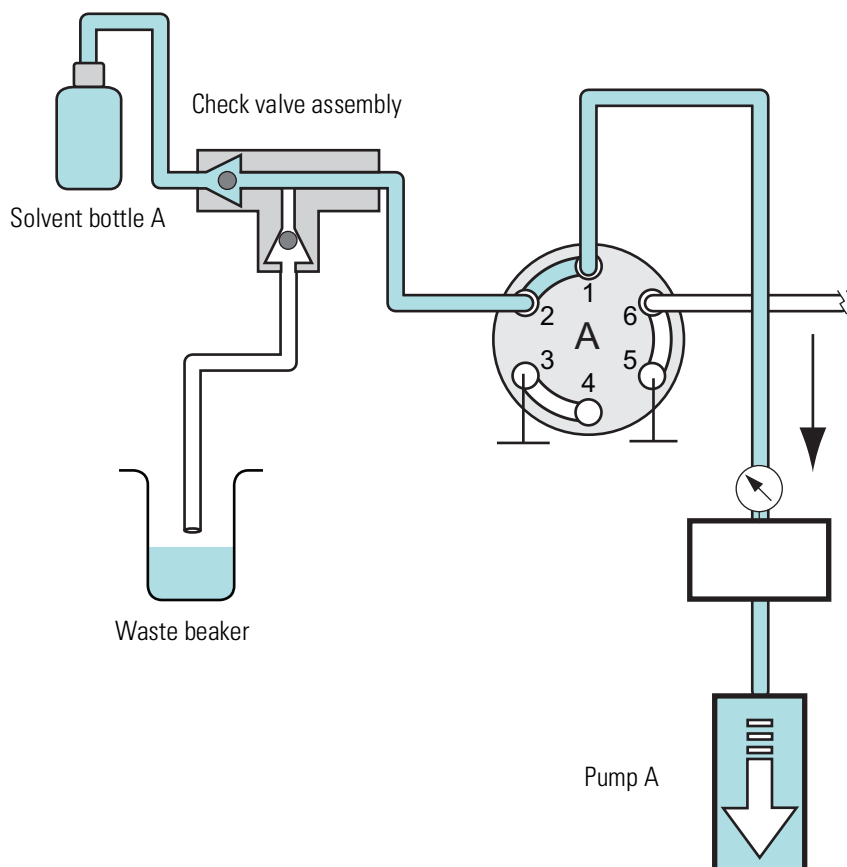
### ❖ To fill pump A or B with solvent

1. On the Home > Overview page, check the position of the valve that controls the solvent flow direction for the pump of interest.
2. Make sure that the valve is set to position 1–2.

When valve A or B is in the 1–2 position, the corresponding pump draws solvent from the solvent bottle on top of the instrument (see Figure 140).

**Figure 140.** Position of the rotary valve when filling a pump

**Note** Please note the numbering of the valve ports as depicted in [Figure 9](#) (clockwise numbering with valve port 1 in 4 o'clock position). Due to operational reasons, the graphical representation in this guide or in the instrument's built-in software may show the valves in a different orientation. Please use only the port numbers for identification of port positions.



3. Press the pump icon for the pump you want to control.

The Pump dialog box opens (see [Figure 139](#)).

4. In the flow rate box, enter the filling flow rate: **-0.01** to **-300**  $\mu\text{L}/\text{min}$ .

For best results, enter a flow rate of  $-100$   $\mu\text{L}/\text{min}$  to fill the pump.

5. In the volume box, enter the volume that you want pump A or B to draw.

6. Press **Start**.

The pump draws solvent until it draws the requested volume or reaches the full position, whichever occurs first.

❖ **To empty pump A or B to waste**

1. Check the position of the pump valve on the Home > Overview page.
2. Do one of the following:
  - To empty pump A or B directly to waste, make sure that its valve is in position 1–2.
  - To empty pump A or B to waste by way of valve W, place the pump valve in position 1–6 and valve W in position 1–6.

Valve	Position	Solvent flow
A or B	1–2	Empties to the waste beaker.
	1–6	Passes through valve S and into the Column Out line.
S	1–2	Bypasses the sample loop.
	1–6	Passes through the sample loop.
W	1–2	Passes through the installed columns.
	1–6	Exits the Column Out line to waste for a one column setup or passes through the precolumn and then exits the system to waste for a two-column setup.

3. Press the pump icon for the pump you want to control.

The Pump dialog box opens (see [Figure 139](#) on [page 167](#)).

4. In the flow rate box, enter the flow rate: **0.01** to **300**  $\mu\text{L}/\text{min}$ .

When valve A or B is in position 1–6, the maximum system pressure limit constrains the maximum flow rate.

5. In the volume box, enter the volume that you want the pump to empty to waste.
6. Press **Start**.

The pump empties until it pumps the requested volume or reaches the empty position, whichever occurs first.

### Using the Direct Controls To Fill or Empty Pump S

Before using the direct controls to fill or empty pump S, make sure that the autosampler needle is inserted into the appropriate wash or waste bottle.

**IMPORTANT** To avoid contaminating pump S, take care to place the autosampler needle in the appropriate wash bottle before filling the pump.

#### ❖ To fill pump S

1. Make sure that a wash bottle with the appropriate solvent is installed in position W3.
2. Send the autosampler needle to the appropriate position as follows:
  - a. On the Home > Overview page, press the autosampler icon.  
The Autosampler dialog box opens (see [Figure 141](#) on [page 172](#)).
  - b. Press **W3**.  
The autosampler needle moves to the W3 position.
  - c. Press **Needle Down**.  
The autosampler needle descends into the W3 bottle.
  - d. Press **Close** to close the Autosampler dialog box.
3. Draw solvent into pump S as follows:
  - a. Press the pump S icon.  
The Pump S dialog box opens.
  - b. In the flow rate box, enter the filling flow rate: **-0.01** to **-300**  $\mu\text{L}/\text{min}$ .  
For best results, enter a flow rate of **-40**  $\mu\text{L}/\text{min}$  to fill pump S.
  - c. In the volume box, enter the volume that you want pump S to draw.
  - d. Press **Start**.  
The pump draws solvent until it draws the requested volume or reaches the full position, whichever occurs first.

**CAUTION** To equalize the pressure, leave the needle for at least 30 seconds after the completed refill in the W3 bottle. Otherwise air can be pulled into the needle.

#### ❖ To empty pump S to waste

1. Make sure that a wash bottle with a needle wash insert is installed in position W4.
2. Send the autosampler needle to the appropriate position as follows:
  - a. On the Home > Overview page, press the autosampler icon.  
The Autosampler dialog box opens (see [Figure 141](#) on [page 172](#)).



- b. Press **W4**.  
The autosampler needle moves to the W4 position.
  - c. Press **Needle Down**.  
The autosampler needle descends into the W4 bottle.
  - d. Press **Close** to close the Autosampler dialog box.
3. Dispense solvent from pump S as follows:
- a. Press the pump S icon.  
The Pump S dialog box opens.
  - b. In the flow rate box, enter the flow rate: **0.01** to **300**  $\mu\text{L}/\text{min}$ .
  - c. In the volume box, enter the volume that you want the pump to empty to waste.
  - d. Press **Start**.  
The pump empties until it pumps the requested volume or reaches the empty position, whichever occurs first.

## Using the Autosampler Controls

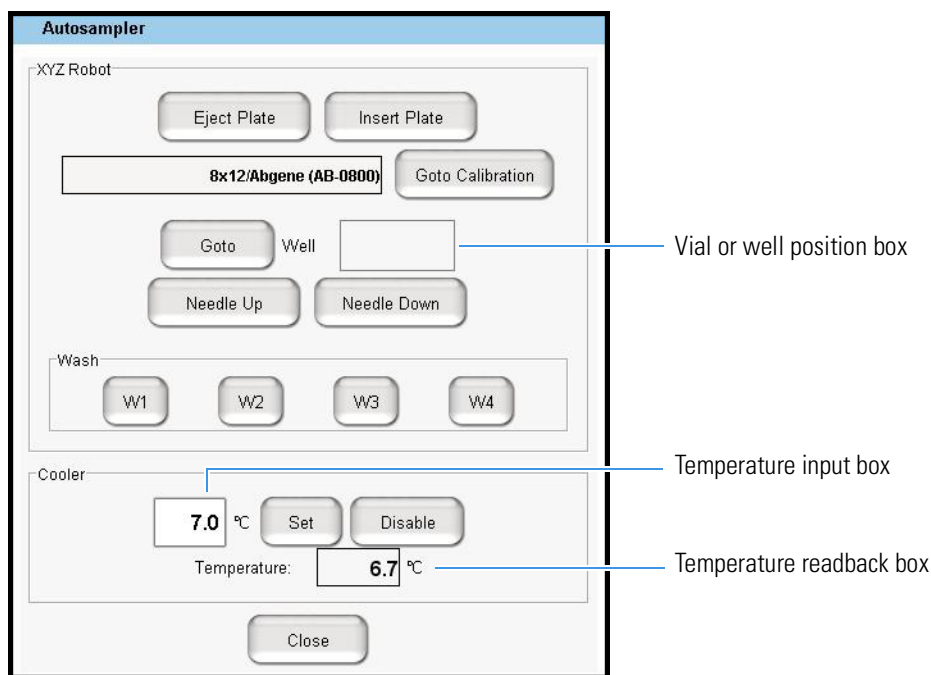
You can control the XYZ robot and the cooler temperature from the Home > Overview page.

### ❖ To open the Autosampler dialog box

Press the autosampler icon on the Home > Overview page.

The Autosampler dialog box opens (see [Figure 141](#)).

**Figure 141.** Autosampler dialog box



### ❖ To start the calibration procedure for the current plate format

1. Press **Goto Calibration**.

The Tools view for the autosampler on the Maintenance > Devices page opens.

2. To calibrate the XYZ robot for the plate format, follow the instructions in [“Calibrating Plates”](#) on [page 236](#).

### ❖ To move the needle to a vial or well position

1. In the Vial or Well box, enter a vial or well position.
2. Press **Goto**.

### ❖ To move the needle to a wash bottle position

Press **W1**, **W2**, **W3**, or **W4**.

**❖ To change the cooler temperature**

1. Enter a temperature in the temperature input box.
2. Press **Set**.
3. Monitor the temperature change in the temperature readback box.

## Troubleshooting a Pump That Fails the Flush Air Script

If pump A, B, or S fails the Flush Air script and the Output page displays one of the following messages, a leak or blockage could be preventing solvent from entering the pump.

- Aborting unable to build pressure
- Aborting check solvent level

**Note** For information about the Flush Air script, see “Flush Air” on page 33.

The following procedure systematically checks for a blockage in the check valve assembly, in the solvent line that connects the pressure sensor to the valve, and in the pump head.



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

### ❖ To determine why the pump has failed the Flush Air script

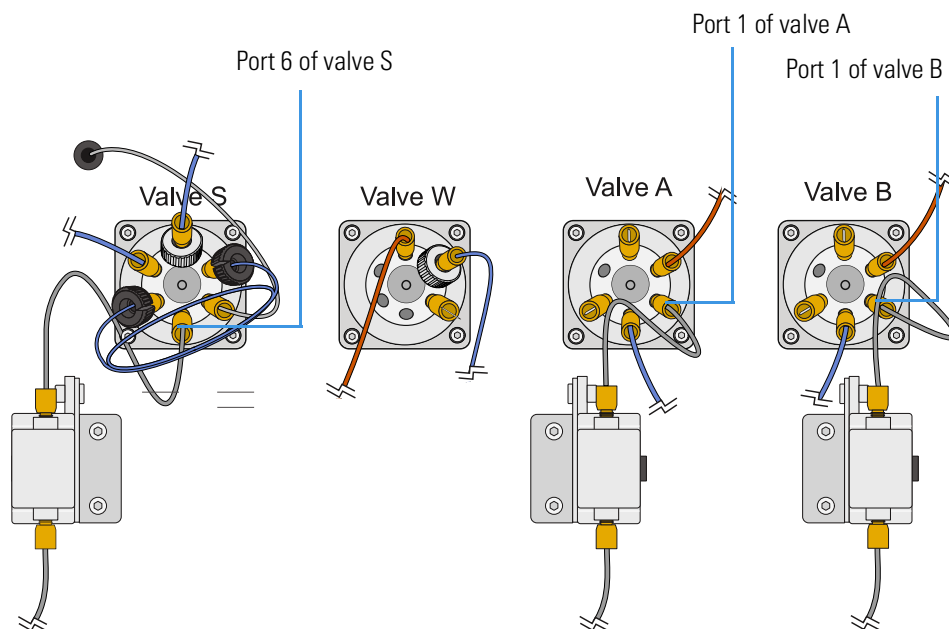
1. If you have not already done so, remove the right side panel of the instrument.
2. Depending on the pump, do one of the following:
  - For pumps A and B, go to [step 3](#).
  - For pump S, go to [step 4](#) on [page 175](#).
3. For pumps A and B, determine whether the check valve assembly is functioning as follows:
  - a. Run the Purge script for the pump that has failed (see “Purge Solvent” on [page 32](#)).
  - b. Check that solvent is being aspirated and dispensed correctly through the Teflon™ lines.
    - If the pump is drawing solvent during the fill portion of the purge cycle, the solvent-side check valve is working properly.
    - If the pump is dispensing solvent into the waste beaker during the empty portion of the purge cycle, the waste-side check valve is working properly.

**Note** If a check valve is not working properly, replace it as described in “Replacing the Check Valves” on [page 82](#).

- c. If the check valve assembly is functioning properly, go to [step 4](#).

4. Check whether the pump can draw solvent through the tubing that connects the pressure sensor to the rotary valve as follows:
  - a. Disconnect the solvent line from the rotary valve (see [Figure 142](#)).
    - For pumps A or B, disconnect the solvent line from port 1 of the valve.
    - For pump S, disconnect the solvent line from port 6 of the valve.

**Figure 142.** Rotary valve layout for the EASY-nLC 1200 instrument



- b. Place the free end of the solvent line into a small vial that contains the appropriate solvent. Use solvent A for pump A and solvent B for pump B.
- c. Run the Purge Solvent script and check that solvent is being aspirated from the vial into the pump.

For information about the Purge Solvent script, see “[Purge Solvent](#)” on [page 32](#).

- d. Depending on whether the pump aspirated the solvent, do one of the following:
  - If the pump does not aspirate solvent from the vial, go to [step 5](#).
  - If the pump aspirates solvent from the vial, the problem is probably resolved. To verify that the system is working, go to [step 4e](#).
- e. Reconnect all of the solvent lines, and run the Flush Air script again.
- f. Depending on the results of the Flush Air script, do one of the following:
  - If the Flush Air script fails, go to [step 6](#) on [page 176](#).
  - If the Flush Air script passes, you have completed this troubleshooting procedure.

5. Check whether the tubing that connects the pressure sensor to the valve is blocked as follows:
  - a. Reconnect the solvent line to port 1 of the valve.
  - b. Disconnect the fitting connected to the top of the pressure sensor.
  - c. Pipette solvent into the port on the top of the pressure sensor.



**CAUTION** Be careful not to spill solvent on the PCBs.

- The LED panel cover for each pump protects the PCB from accidental contact when the instrument's right side panel is removed. However, the cover does not form a waterproof seal with the pump body so that the PCBs are exposed to solvent leaks from above.
- d. Run the Purge Solvent script and check that the pump is aspirating solvent through the pressure sensor.
  - e. Depending on whether solvent is aspirated, do one of the following:
    - If the pump does not aspirate solvent, go to [step 6](#).
    - If the pump aspirates solvent, the tubing that connected the pressure sensor to the valve is damaged. Do the following:
      - i. Disconnect this tubing from the valve, and install a new solvent line.
      - ii. To confirm that installing new tubing fixes the problem, run two iterations of the Purge Solvent script. Then, run the Flush Air script with a threshold of 12  $\mu\text{l}$ .
6. To determine if the problem is in the pump, do the following:
    - a. Reconnect the solvent line to the top of the pressure sensor and tighten the fitting.
    - b. Disconnect the solvent line from the pump head.
    - c. Pipette the appropriate solvent into the port in the pump head (see [Figure 63](#) on [page 79](#)).
    - d. Run the Purge script and check that the pump is aspirating solvent from the pump head into the pump.
      - If the pump does not aspirate solvent from the pump head, the problem is in the pump.
      - If the pump does aspirate solvent from the pump head, replace the tubing that connects the pump to its pressure sensor.
  7. If the problem is in the pump, verify that the piston is not dirty, broken, or scratched and replace the piston seal as described in [“Maintaining the Syringe Pumps”](#) on [page 70](#).

## Troubleshooting a Pump That Fails the Leaks Script

Follow this procedure to determine why the pump failed the Leaks script.

**Note** For information about running the Leaks script see “Leaks” on [page 44](#). In the Value column on the Parameters page of the Leaks script, select A to test pump A or B to test pump B.

This procedure systematically checks whether the following problems caused the Leaks script failure:

- Excess air in the system
- Tubing connections between the pump and the pressure sensor
- Tubing connections between pressure sensor and the valve
- A worn piston seal (in the pump head)



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

### ❖ To troubleshoot a pump that has failed the Leaks script

1. Run the Flush Air script for the failed pump (see “Flush Air” on [page 33](#)). Enter 12  $\mu$ L for the Flush Volume parameter.
2. Do one of the following:
  - If the Output page reports one of these messages, go to “Troubleshooting a Pump That Fails the Flush Air Script” on [page 174](#).
    - Aborting unable to build pressure
    - Aborting check solvent level
  - If the script passes, go to [step 3](#).
3. Run the Leaks script for the failed pump or both pumps (see “Leaks” on [page 44](#)).
  - If the Leaks script fails, the leak is either in the pump, the valve, or the connecting lines or fittings. Go to [step 4](#).
  - If the Leaks script passes, excess air in the system was the source of the problem.

4. To determine whether the leak is between the pressure sensor and the valve or the pressure sensor and the pump, do the following:
  - a. Remove the fitting from the top of the relevant pressure sensor, and replace it with a viper blind plug 6040.2303. Tighten the fitting as described in [“To use a nanoViper fitting”](#) on page 84.
  - b. Repeat the Test – Leaks script.
  - c. Depending on the result of the Test – Leaks script, do one of the following:
    - If the Test – Leaks script passes, go to [step 5](#), as the piston seal is leak tight and the leak is between the pressure sensor and the valve.
    - If the Test – Leaks script fails, go to [step 6](#), as the leak is between the pressure sensor and the pump.
5. To locate a leak between the pressure sensor and the valve, do the following:
  - a. Remove the blanking nut and replace the original fitting.
  - b. Manually check the fittings between the pressure sensor and the valve, and confirm that they are leak tight.

If the fittings are leak tight, the valve might be the source of the leak.
  - c. If the valve is leaking, please contact product support.
  - d. Run the Test – Leaks script for the relevant pump and confirm that you have fixed the leak.
6. To locate a leak between the pressure sensor and the pump, do the following:
  - a. Remove the viper blind plug and replace the original fitting.
  - b. Confirm that the fittings between pump and the pressure sensor are leak tight.
  - c. Repeat the Test – Leaks script.
  - d. If the script fails again, the cause might be a worn piston seal.
  - e. If you suspect that the leak is caused by a worn piston seal, go to [“Maintaining the Syringe Pumps”](#) on page 70.

## Running a System Leak Test

To identify and locate a leak downstream from valves A and B, run the system leak test (Test – Leaks script with System selected), and then take appropriate action as described in [Table 26](#) on page 183.





[Table 25](#) lists the materials required to identify and locate leaks. Because this troubleshooting procedure requires you to handle the solvent lines, you must wear gloves and safety glasses.





**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

**Table 25.** Materials required for running the system leak test and troubleshooting leaks

Instrument	Union	Plug or blind fitting
EASY-nLC 1200	P/N SC900 Viper union    Zero-dead-volume union for 1/16 in. OD tubing	Thermo Scientific Dionex™ P/N 6040.2303  
EASY-nLC 1200 with fused-silica Column Out and Waste In lines	P/N ES272 UHPLC fused-silica union    Non-conductive microunion with stainless steel cartridge and microferrules for 360 µm OD fused-silica tubing	IDEX P/N P-116 Blind microferrule  

To run a system leak test, follow these procedures:

1. [To prepare the instrument for a system leak test](#)
2. [To run a system leak test](#)

❖ **To prepare the instrument for a system leak test**

1. Run the Flush Air script for pump A as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Prepare**. In the Name list, select **Flush Air**.
  - c. Press the **Parameters** tab.
  - d. In the Flush Threshold [µL] box, enter the value 12.

[Figure 22](#) on [page 33](#) shows the parameters for the Flush Air script.

- e. Press **Start**.

The script starts and the Output page opens.

2. Depending on the results of the Flush Air script displayed on the Output page, do the following:
  - If the script passes, run a system leak test as described in the next procedure, “[To run a system leak test.](#)”
  - If one of these messages appears, go to “[Troubleshooting a Pump That Fails the Flush Air Script](#)” on page 174.
    - Aborting unable to build pressure
    - Aborting check solvent level



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

❖ **To run a system leak test**

1. If you have not already done so, run the Flush Air script to prepare the instrument for a system leak test (see the previous procedure [To prepare the instrument for a system leak test](#)).
2. Connect the Column Out and Waste In lines with the appropriate union (see [Table 25](#) on page 179).

**Note** The EASY-nLC 1200 instrument ships with Column Out and Waste In lines that have nanoViper fittings at both ends. However, if you have modified the instrument to use columns that have bare fused-silica ends, these solvent lines do not have fittings on their free ends.

For an EASY-nLC 1200 instrument with the standard nanoViper Column Out and Waste In lines, do the following:

- a. Insert the nanoViper fittings on the ends of the Column Out and Waste In lines into the Viper union.
- b. Alternate tightening each fitting in small increments until you feel resistance. Then Tighten both fittings by an additional 45 degrees (1/8-turn). Do not tighten the fittings by more than a 1/4-turn (see “[Replacing Viper/nanoViper solvent lines](#)” on page 83).



**CAUTION** Because the fittings seal against each other inside the union, do not tighten them by more than 90 degrees (1/4-turn). Overtightening the fittings can irreparably damage their sealing surfaces.

[Figure 143](#) shows the connection between the standard Column Out and Waste In lines. The Viper union makes a zero-dead-volume connection between the two nanoViper fittings.

**Figure 143.** Column Out line connected to the Waste In line

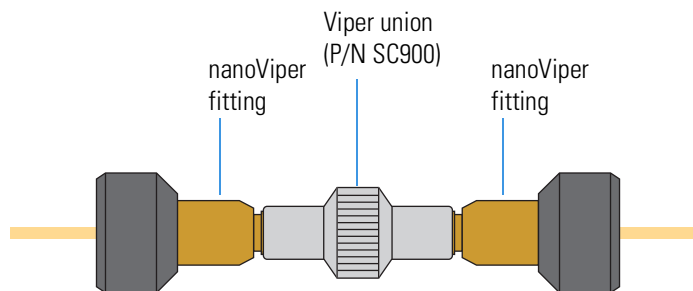
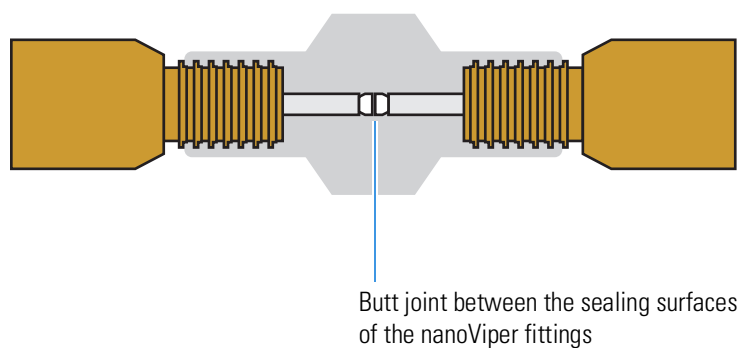


Figure 144 shows an internal view of the Viper union with nanoViper fittings connected to both ports. The two nanoViper fittings seal against each other in the center of the union. A portion of the last thread on each nanoViper fitting is visible.

**Figure 144.** Viper union with nanoViper fittings connected to both ports (internal view)



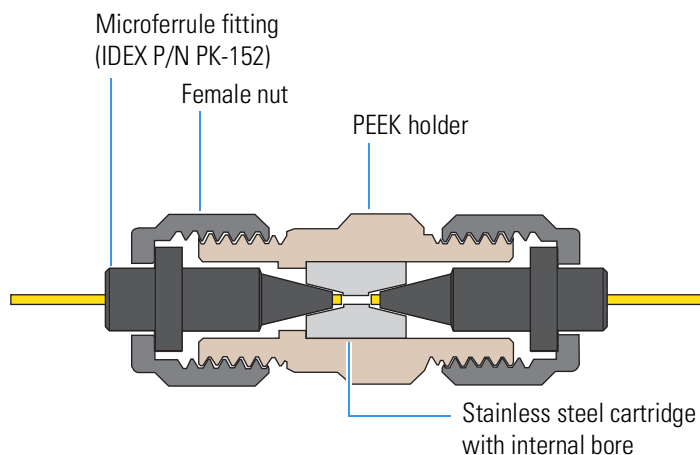
**IMPORTANT** Follow the instructions in “[Replacing Viper/nanoViper solvent lines](#)” on [page 83](#) to ensure that the nanoViper fittings are securely connected to the union.

For an EASY-nLC 1200 instrument with modified solvent lines, connect the fused-silica Column Out and Waste In lines with the UHPLC fused-silica union (P/N ES272) that is supplied in the UHPLC Liquid Junction Kit as follows:

- a. Insert the stainless steel cartridge into the PEEK holder.

Figure 145 shows an enlarged cross section of the UHPLC fused-silica union connected to the solvent lines.

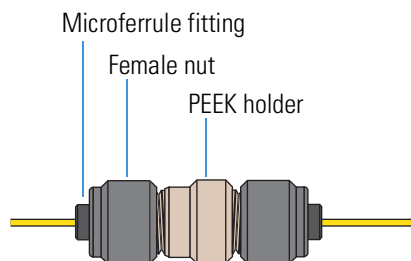
**Figure 145.** UHPLC fused-silica union (enlarged cross section)



- b. Slide a female nut and a microferrule onto the free ends of both the Column Out tubing and the Waste In tubing.
- c. Insert the ferrules into the ends of the PEEK holder and hand tighten the nuts.

Figure 146 shows the solvent lines connected to the UHPLC fused-silica union.

**Figure 146.** UHPLC fused-silica union connected to the Column Out and Waste In lines



3. Open the Test – Leaks script as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Test**.
  - c. In the Name list, select **Leaks**.
4. Set the parameters for the system leak test as follows:
  - a. Press the **Parameters** tab.
  - b. In the Value list, select **System**.
5. Press **Start**.

The script starts and the Output page opens. During the duration of this script, the EASY–nLC instrument pressurizes the flow paths highlighted with a dotted red line in Figure 32 on page 45 and monitors the flow sensors and pump piston movements to identify and localize leaks. When the script ends, the Output page displays a message.

6. Depending on the message displayed on the Output page of the Test – Leaks script, take the appropriate action as listed in [Table 26](#).

## Troubleshooting the Results of the System Leak Test

[Table 26](#) lists the actions required to troubleshoot the results of a system leak test.

**Tip** The “[Using nanoViper Fittings Quick Reference Guide](#)” on [page 273](#) describes how to return the solvent lines in the flow path of the EASY-nLC 1200 instrument to atmospheric pressure. Print this reference guide to refer to while troubleshooting leaks coming from the nanoViper tubing connections.

**Table 26.** Output messages for a system leak test and actions to take when this test fails

Message	Action
System tight. (Sensor A <100nl/min)	No action is required; however, the system leak test does not test for a a leak in valve B or pump B.
Flow sensor A should be calibrated. The 0 nL/min point is off by more than $\pm 30$ nL/min, so the script cannot determine leaks.	Rerun the system leak test. If the same message appears, run the Flow Sensor script to calibrate flow sensor A (see “ <a href="#">Flow Sensors</a> ” on <a href="#">page 52</a> ).
Flow sensor B should be calibrated. The 0 nL/min point is off by more than $\pm 30$ nL/min, so the script cannot determine leaks.	Rerun the system leak test. If the same message appears, run the Flow Sensor script to calibrate flow sensor B (see “ <a href="#">Flow Sensors</a> ” on <a href="#">page 52</a> ).
Check valve S for leaks. (Flow sensor A >100 nL/min)	Go to “ <a href="#">Checking Valve S for Leaks</a> ” on <a href="#">page 184</a> .
Check the sample loop for leaks.	Go to “ <a href="#">Checking the Sample Loop Connections for Leaks</a> ” on <a href="#">page 184</a> .
Check the B solvent line (valve to flow sensor) and valve B for leaks. (Flow sensor B $\pm 30$ nL/min)	Go to “ <a href="#">Locating Leaks in the Solvent Path from Valve B to Flow Sensor B</a> ” on <a href="#">page 184</a> .
Check from pump A to flow sensor A for leaks. (Pump A flow loss >1000 nL/min)	Go to “ <a href="#">Locating Leaks in the Solvent Path from Pump A to Flow Sensor A</a> ” on <a href="#">page 186</a> .
Check from valve S to valve W, including valve W, for leaks.	Go to “ <a href="#">Locating Leaks In or Between Valve S and Valve W</a> ” on <a href="#">page 188</a> .
Check solvent lines between flow sensor A and valve S, including the mixing Tee and flow sensor B, for leaks.	Go to “ <a href="#">Locating Leaks Between the Flow Sensors and Valve S</a> ” on <a href="#">page 196</a> .

### Checking Valve S for Leaks

The system leak test returned the following message (see [Table 26](#) on [page 183](#)):

Check valve S for leaks. (Flow sensor A >100 nL/min)

The most likely cause of this test result is a leak in the flow path between ports 3 and 4 of valve S.

Please contact product support for a valve replacement.

### Checking the Sample Loop Connections for Leaks

The system leak test returned the following message (see [Table 26](#)):

Check the sample loop for leaks.

The connections in the sample loop are leaking, or there is a leak in valve S itself.

#### ❖ To fix the leaking sample loop connections or the leaking valve

1. Return the instrument to atmospheric pressure as described in the “[Using nanoViper Fittings Quick Reference Guide](#)” on [page 273](#). Then individually disconnect and reconnect the nanoViper fittings connected to ports 2 and 5 on valve S. Take care not to overtighten these fingertight fittings.
2. Rerun the system leak test (see “[Running a System Leak Test](#)” on [page 178](#)).
3. If the script still fails, replace the sample loop (see “[Replacing the Sample Loop](#)” on [page 88](#)).
4. If the problem persists, the leakage is more than likely in valve S itself. Please contact product support.

### Locating Leaks in the Solvent Path from Valve B to Flow Sensor B

The system leak test returned the following message (see [Table 26](#) on [page 183](#)):

Check the B solvent line (valve B to flow sensor B) and valve B for leaks.

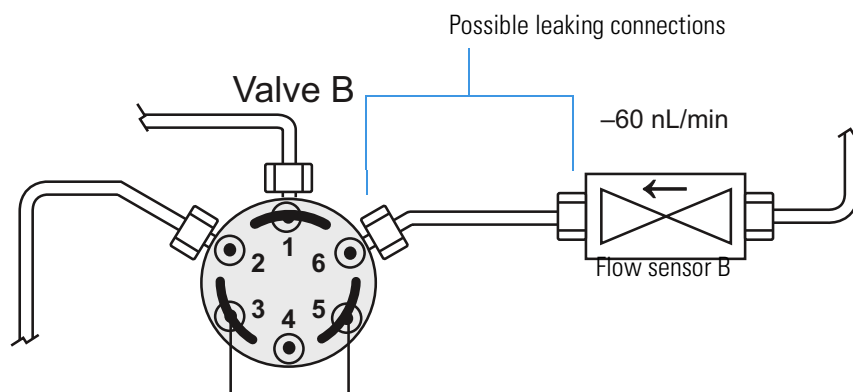
Flow sensor B has detected solvent flow toward valve B. This negative flow rate is caused by a leak in valve B, or in the connections to port 6 of valve B and the flow sensor inlet.

**Note** When the system is leak tight and valve B is in the Center position, the solvent flow through flow sensor B from pump A should be negligible. A negative flow rate of up to  $-30$  nL/min is within the normal range. A higher negative flow rate indicates a leak that could affect the retention time of analytes.

[Figure 147](#) shows a reading for flow sensor B of  $-60$  nL/min. This means there is a leak in the solvent path from valve B to flow sensor B.

**Figure 147.** Solvent line between valve B and flow sensor B

**Note** Please note the numbering of the valve ports as depicted in [Figure 9](#) (clockwise numbering with valve port 1 in 4 o'clock position). Due to operational reasons, the graphical representation in this guide or in the instrument's built-in software may show the valves in a different orientation. Please use only the port numbers for identification of port positions.



❖ **To troubleshoot a leak in the solvent line connections between valve B and flow sensor B**

1. Return the solvent system upstream of valve S to atmospheric pressure as described in the [“Using nanoViper Fittings Quick Reference Guide”](#) on [page 273](#). Then individually disconnect and reconnect the nanoViper fittings connected to port 6 on valve B and the flow sensor B inlet. Take care not to overtighten these fingertight fittings.
2. Rerun the system leak test.
  - If the system leak test fails again, this might be due to a leak in valve B.
  - If the system leak test passes, return the system to normal operation.

## Locating Leaks in the Solvent Path from Pump A to Flow Sensor A

The system leak test returned the following message (see [Table 26](#) on [page 183](#)):

Check from pump A to flow sensor A for leaks. (Pump A flow loss >1000 nL/min)

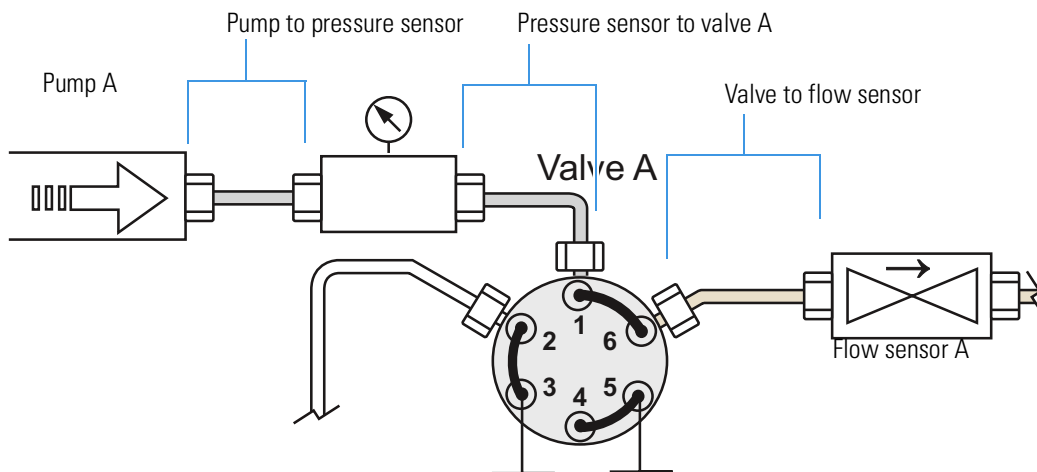
The cause of this test result is a leak between flow sensor A and the inside of pump A. The system leak test script has detected that the piston movement is 1000 nL/min more than the flow measured at flow sensor A.

This procedure checks whether the leak is in the solvent path between the valve and the flow sensor. If the leak is not between the valve and the flow sensor, this procedure directs you to the “[Troubleshooting a Pump That Fails the Leaks Script](#)” on [page 177](#) where you determine if the leak is coming from the solvent path between the pump and the valve or from the pump itself.

[Figure 148](#) shows the solvent path from pump A to flow sensor A.

**Figure 148.** Solvent path from pump A to flow sensor A

**Note** Please note the numbering of the valve ports as depicted in [Figure 9](#) (clockwise numbering with valve port 1 in 4 o'clock position). Due to operational reasons, the graphical representation in this guide or in the instrument's built-in software may show the valves in a different orientation. Please use only the port numbers for identification of port positions.





**❖ To identify a leak in pump A or the solvent path between pump A and flow sensor A**

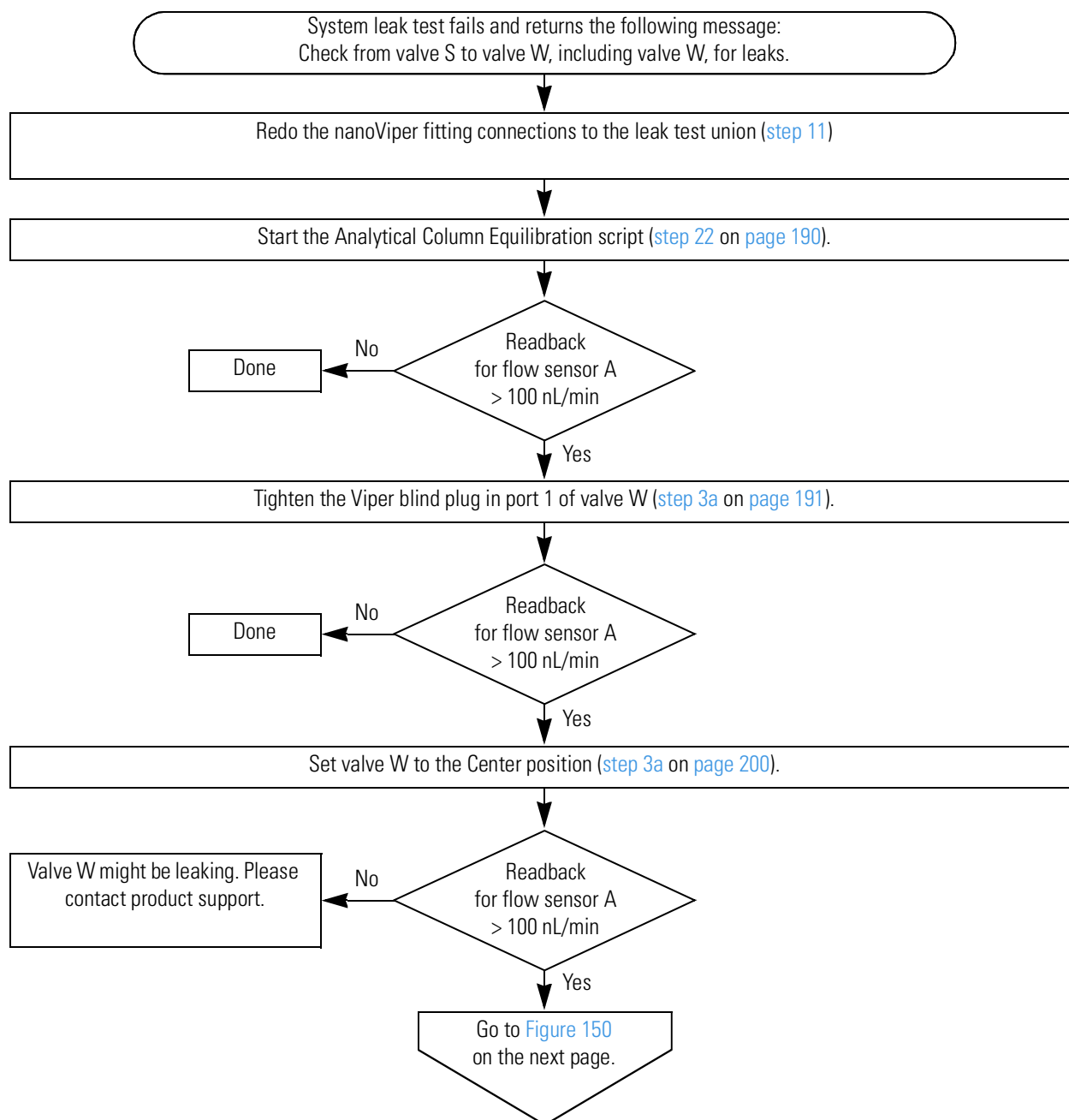
1. Run the Leaks script for pump A only as follows:
  - a. Set the parameters for the Leaks script as follows:
    - i. If you exited the Leaks script on the Maintenance > Scripts page, reopen it.
    - ii. Press the **Parameters** tab.
    - iii. In the Value list, select **A** (pump A).
  - b. Press **Start**.
2. Depending on whether the leak test for pump A passes or fails, do the following:
  - If the script passes, the leak is in the solvent path from valve A to flow sensor A. Go to [step 3](#).
  - If the script fails, the leak is in pump A. Go to [“Troubleshooting a Pump That Fails the Leaks Script”](#) on [page 177](#).
3. Check the connections to port 6 of valve A and the inlet to flow sensor A as follows:
  - Return the flow path upstream of valve S to atmospheric pressure as described in the [“Using nanoViper Fittings Quick Reference Guide”](#) on [page 273](#). Then individually disconnect and reconnect the nanoViper fittings connected to port 6 on valve A and the flow sensor A inlet. Take care not to overtighten these fingertight fittings.
4. Rerun the system leak test. Depending on whether the test fails or passes, do the following:
  - If the system leak test fails again, this might be due to a leak in valve A.
  - If the test passes, the system is leak tight. You have completed this troubleshooting procedure. Return the EASY-nLC instrument to normal operation.

## Locating Leaks In or Between Valve S and Valve W

If the system leak test returns the following message, follow the workflow in [Figure 149](#) and [Figure 150](#) or the procedure on pages 179–196 to locate and remedy the leak.

Check from valve S to valve W, including valve W, for leaks.

**Figure 149.** Workflow for locating leaks in the solvent path between valves S and W or in these valves (Part 1)



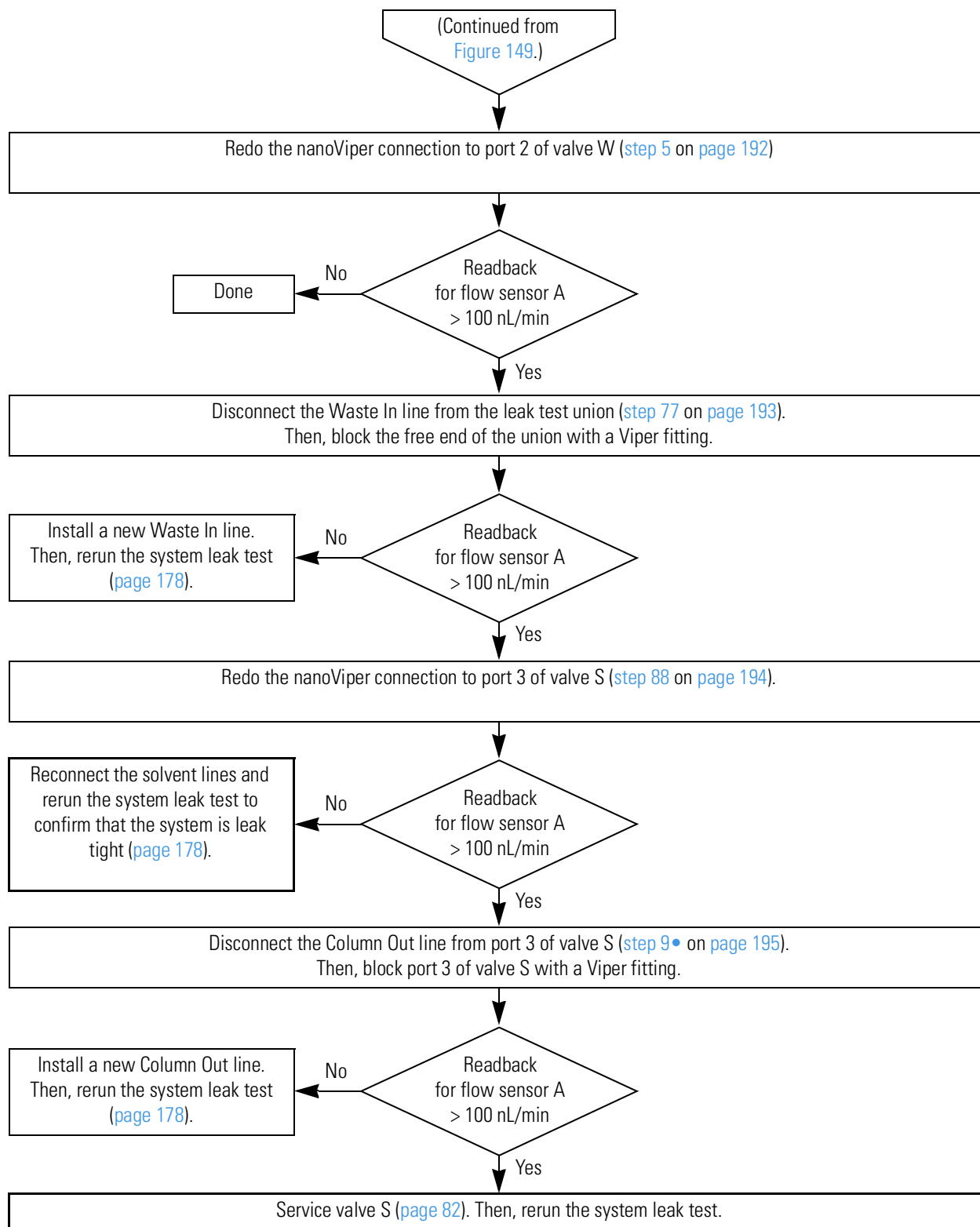
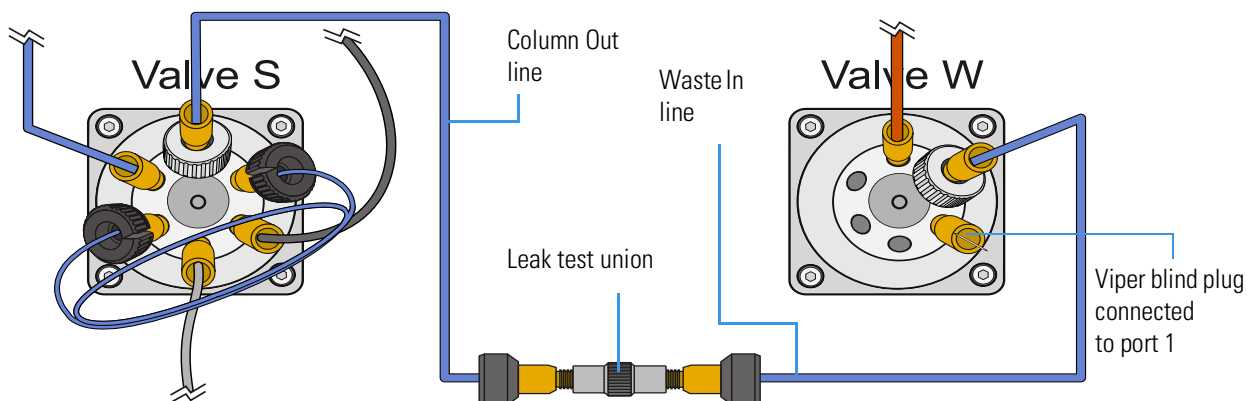
**Figure 150.** Workflow for locating leaks in the solvent path between valves S and W or in these valves (Part 2)

Figure 151 shows the path between valves S and W

**Figure 151.** Solvent path between valve S and valve W



❖ **To locate and remedy a leak in valve S or valve W or in the solvent path between these valves**

1. Tighten the test union connections as follows:
  - i. Remove the nanoViper fittings from the leak test union.
  - ii. Reinsert the nanoViper fittings into the stainless steel union. Then, slowly tighten the fittings until you feel resistance (Figure 151).
  - iii. Tighten both fittings by an additional 45 degrees (1/8-turn). Do not tighten the fittings by more than 90 degrees (1/4-turn).

For more information, see “Replacing Viper/nanoViper solvent lines” on page 83.

**Note** Incorrectly tightened fittings in the leak test union is one of the most common causes for initial failure of the system leak test.

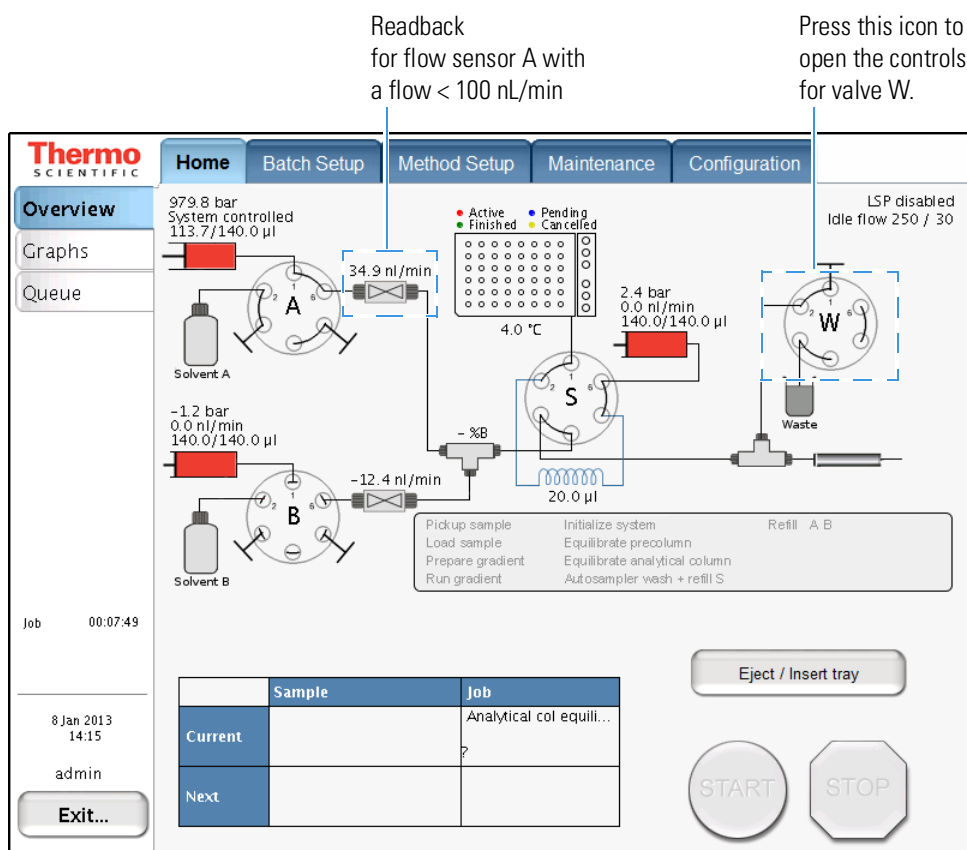
2. To leak test the connections to the test union, do the following:
  - a. Set up and start the Analytical Column Equilibration script as follows:
    - i. On the Maintenance > Scripts page, select **Prepare** in the Category list and then **Analytical Col Equilibration** in the Name list.
    - ii. Press the **Parameters** tab.
    - iii. In the Volume [μL] box, enter **140**. This volume should be sufficient to keep the solvent flow on during this troubleshooting procedure.
    - iv. Leave the Flow box [μL/min] box empty so that pump A operates at the set pressure.
    - v. In the Max Pressure [bar] box, enter **1180** bar
    - vi. Press **Start**.

The instrument places the valves in the following positions, and pump A begins pumping solvent through flow sensor A.

- Valve A: 1–6
- Valve S: 1–2
- Valve B: Center
- Valve W: 1–2

Figure 152 shows the solvent system schematic on the Home > Overview page. Use this page to monitor the readback for flow sensor A and to access the valve controls. For information about changing the valve positions, see “Using the Valve Controls” on page 165.

**Figure 152.** Home > Overview page showing the readback for flow sensor A



- On the Home > Overview page, check the readback for flow sensor A. Then, depending on the flow rate, do one of the following:
  - If the flow rate is <100 nL/min, you have remedied the leak and completed this troubleshooting procedure. Return the instrument to normal operation.
  - If the flow rate is >100 nL/min, go to the next step.
- Make sure that the connection between the Viper blind plug and port 1 of valve W is leak tight as follows:
  - Finger-tighten the Viper blind plug connected to port 1 of valve W.

- b. With the Analytical Column Equilibration script running, monitor flow sensor A. Then, depending on the flow rate, do one of the following:
  - If the flow is <100 nL/min, you have remedied the leak and completed this troubleshooting procedure. Return the instrument to normal operation.
  - If the flow is >100 nL/min, go to the next step.
4. Check if valve W is leaking as follows:
  - a. On the Home > Overview page, press the **valve W** icon and set the valve to the **Center** position.

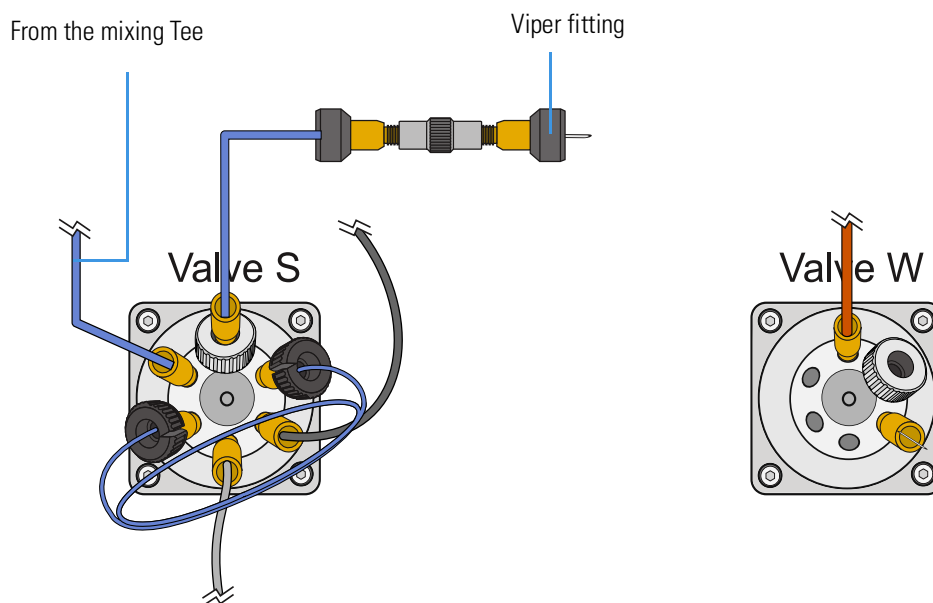
Placing valve W in the Center position blocks the solvent flow into valve W and eliminates valve W as the possible source of the leak.
  - b. With the Analytical Column Equilibration script running, monitor flow sensor A. Depending on the flow rate, do one of the following:
    - If the flow is <100 nL/min with valve W removed from the solvent path, valve W is the source of the system leak. Please contact product support.
    - If the flow is >100 nL/min, go to the next step.
5. Check for a leak-tight connection to port 2 of valve W as follows:
  - i. On the Home > Overview page, change the position of the following valves to return the system to atmospheric pressure:
    - Valve S: Center
    - Valve W: 1-6
  - ii. Disconnect and reconnect the nanoViper fitting of the Waste-In capillary and the grounding adapter from port 2 of valve W. Take care to avoid overtightening of the fingertight fitting.
  - iii. On the Home > Overview page, reset valves A and S as follows:
    - Valve S: 1-2
    - Valve W: 1-2
  - iv. With the Analytical Column Equilibration script running, monitor flow sensor A. Then, depending on the flow rate, do one of the following:
    - If the flow is <100 nL/min, you have remedied the leak and completed this troubleshooting procedure. Return the instrument to normal operation.
    - If the flow is >100 nL/min, go to the next step.
6. Check the grounding adapter at port 2 of valve W as follows:
  - i. On the Home > Overview page, change the position of the following valves to return the system to atmospheric pressure:

- Valve S: Center
- Valve W: 1-6
- ii. Remove the grounding adapter from valve W by following these steps:
  - Disconnect the nanoViper fitting in the Waste-In capillary and the grounding adapter from port 2 of valve W.
  - Reinstall the nanoViper fitting of the Waste-In capillary in port 2 of valve W.

**IMPORTANT** The grounding adapter is removed for troubleshooting purposes only. Operation without the grounding adapter can lead to irreparable damage of the valves!

- iii. On the Home > Overview page, reset valves A and S as follows:
    - Valve S: 1-2
    - Valve W: 1-2
  - iv. With the Analytical Equilibration script running, monitor flow sensor A. Then depending on the flow rate, do one of the following:
    - If the flow is 100 nL/min, install a new grounding adapter. Then, reconnect the Waste-In solvent line and rerun the system leak test as described in [“Running a System Leak Test”](#) on page 178.  
  
For ordering information, see [Appendix C, “Consumables and Replacement Parts.”](#)
    - If the flow is >100 nL/min, go to the next step.
7. Check the Waste In line as follows:
- i. On the Home > Overview page, change the position of the following valves to return the system to atmospheric pressure:
    - Valve S: Center
    - Valve W: 1-6
  - ii. Using the black knurled nut to loosen the nanoViper fitting, disconnect the Waste-In line from the leak test union. Then, block the free end of the union with a Viper blind plug.
  - iii. On the Home > Overview page, reset valves S and W as follows:
    - Valve S: 1-2
    - Valve W: 1-2

[Figure 153](#) shows the Waste In line disconnected from the leak test union and the free end of the union plugged with a Viper fitting.

**Figure 153.** Setup for eliminating the Waste In line as the source of the system leak

- a. With the Analytical Column Equilibration script running, monitor flow sensor A. Then, depending on the flow rate, do one of the following:
  - If the flow is  $<100$  nL/min, install a new Waste In line. Then, reconnect the solvent lines and rerun the system leak test as described in “[Running a System Leak Test](#)” on [page 178](#).
  - For ordering information, see [Appendix C](#), “[Consumables and Replacement Parts](#).”
  - If the flow is  $>100$  nL/min, go to the next step.
8. Check for a leak-tight connection to port 3 of valve S as follows:
  - i. On the Home > Overview page, set valve S to the Center position to return the system to atmospheric pressure.
  - ii. Disconnect and reconnect the nanoViper fitting of Column-Out capillary and the grounding adapter from port 3 of valve S. Take care to avoid overtightening of the fingertight fitting.
  - iii. On the Home > Overview page, reset valves S to position 1-2.
  - iv. With the Analytical Column Equilibration script running, monitor flow sensor A. Then, depending on the flow rate, do one of the following:
    - If the flow is  $<100$  nL/min, reconnect the solvent lines and rerun the system leak test as described in “[Running a System Leak Test](#)” on [page 178](#) to confirm that the system is leak tight.



- If the flow is  $>100$  nL/min, go to the next step.
9. Check the grounding adapter at port 3 of valve S as follows:
- i. On the Home > Overview page, set valve S to the Center position to return the system to atmospheric pressure.
  - ii. Remove the grounding adapter from valve S by following these steps:
    - Disconnect the nanoViper fitting of the Waste-In capillary and the grounding adapter from port 3 to valve S.
    - Reinstall the nanoViper fitting of the Waste-In capillary in port 3 of valve S.

**IMPORTANT** The grounding adapter is removed for troubleshooting purposes only. Operation without the grounding adapter can lead to irreparable damage of the valves!

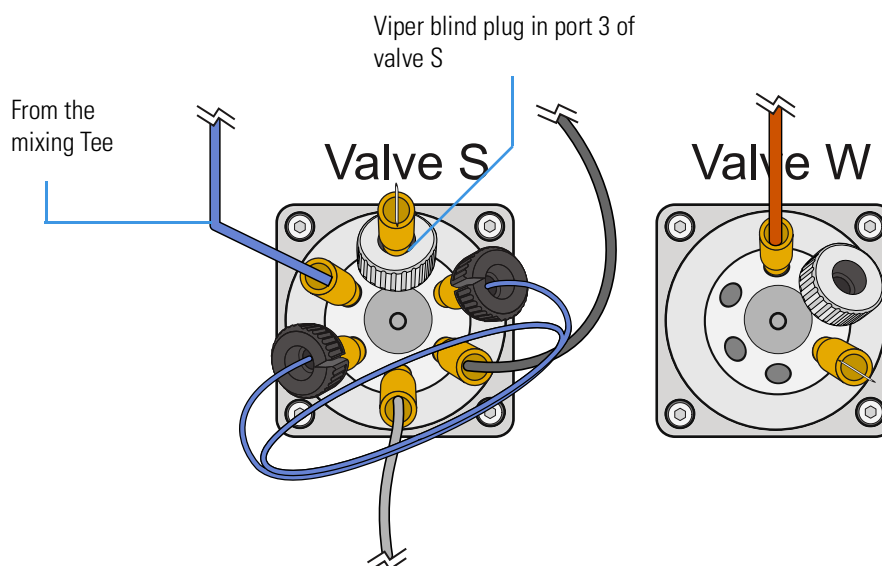
- iii. On the Home > Overview page, reset valve S to position 1-2.
- iv. With the Analytical Column Equilibration script running, monitor flow sensor A. Then, depending on the flow rate, do one of the following:
  - If the flow is  $<100$ nL/min, install a new grounding adapter. Then, reconnect the Column-Out solvent line and rerun the system leak test as described in “Running a System Leak Test” on page 178 “

For ordering information, see [Appendix C, “Consumables and Replacement Parts.”](#)

  - If the flow is  $> 100$  nL/min, valve S might be leaking. Please contact product support.

Figure 154 shows port 3 of valve S plugged with a Viper blind plug.

**Figure 154.** Port 3 of valve S plugged with a Viper blind plug



### Locating Leaks Between the Flow Sensors and Valve S

When one or more of the connections are leaking in the solvent path between the flow sensor outlets and the mixing Tee inlets, the system leak test returns this message (see [Table 26](#) on [page 183](#)):

Check solvent lines between flow sensor A and valve S, including the mixing Tee and flow sensor B, for leaks.

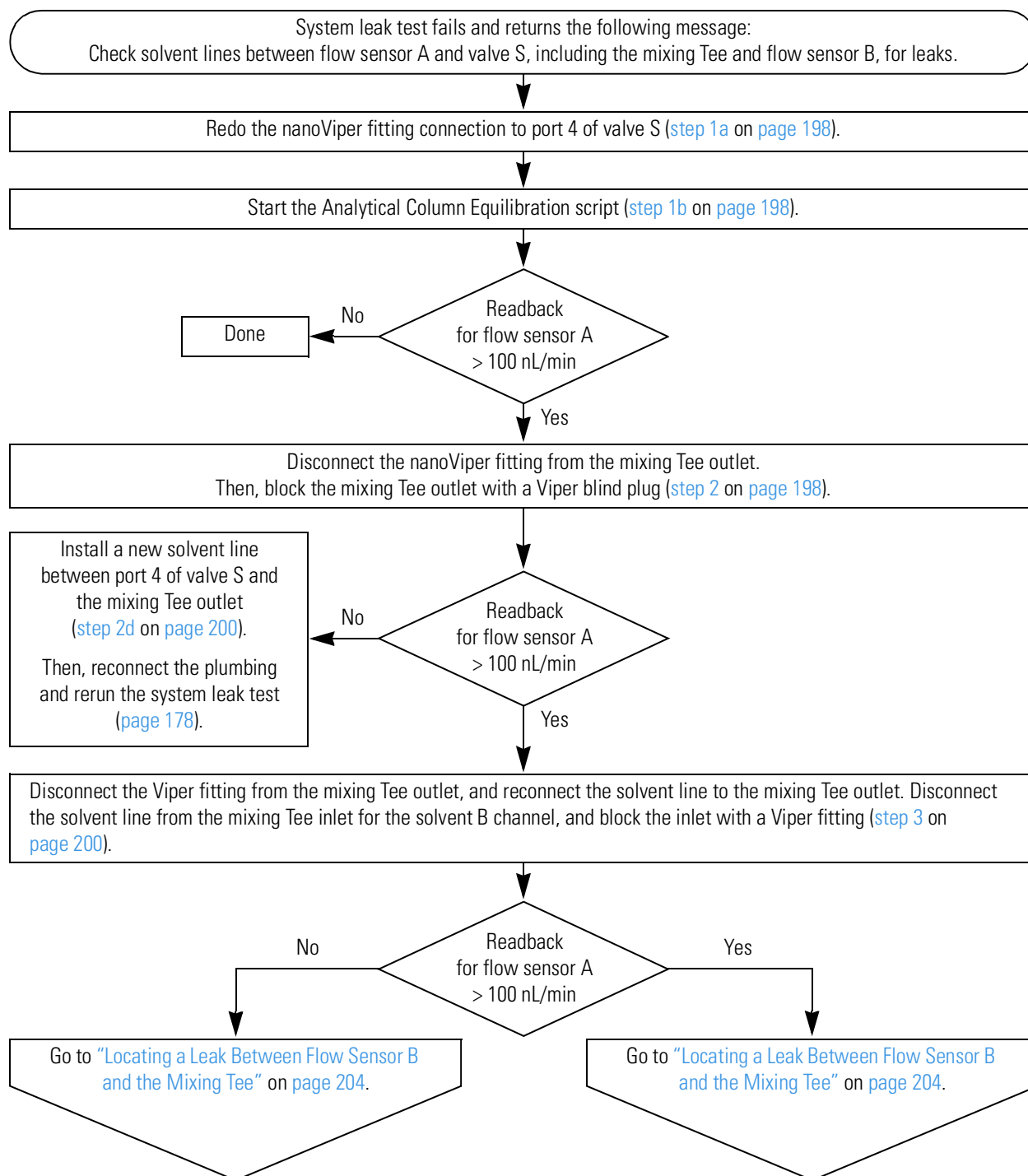
Follow this section to locate and remedy the leak:

- [“Locating a Leak Between the Flow Sensors and Valve S”](#) on [page 197](#)

## Locating a Leak Between the Flow Sensors and Valve S

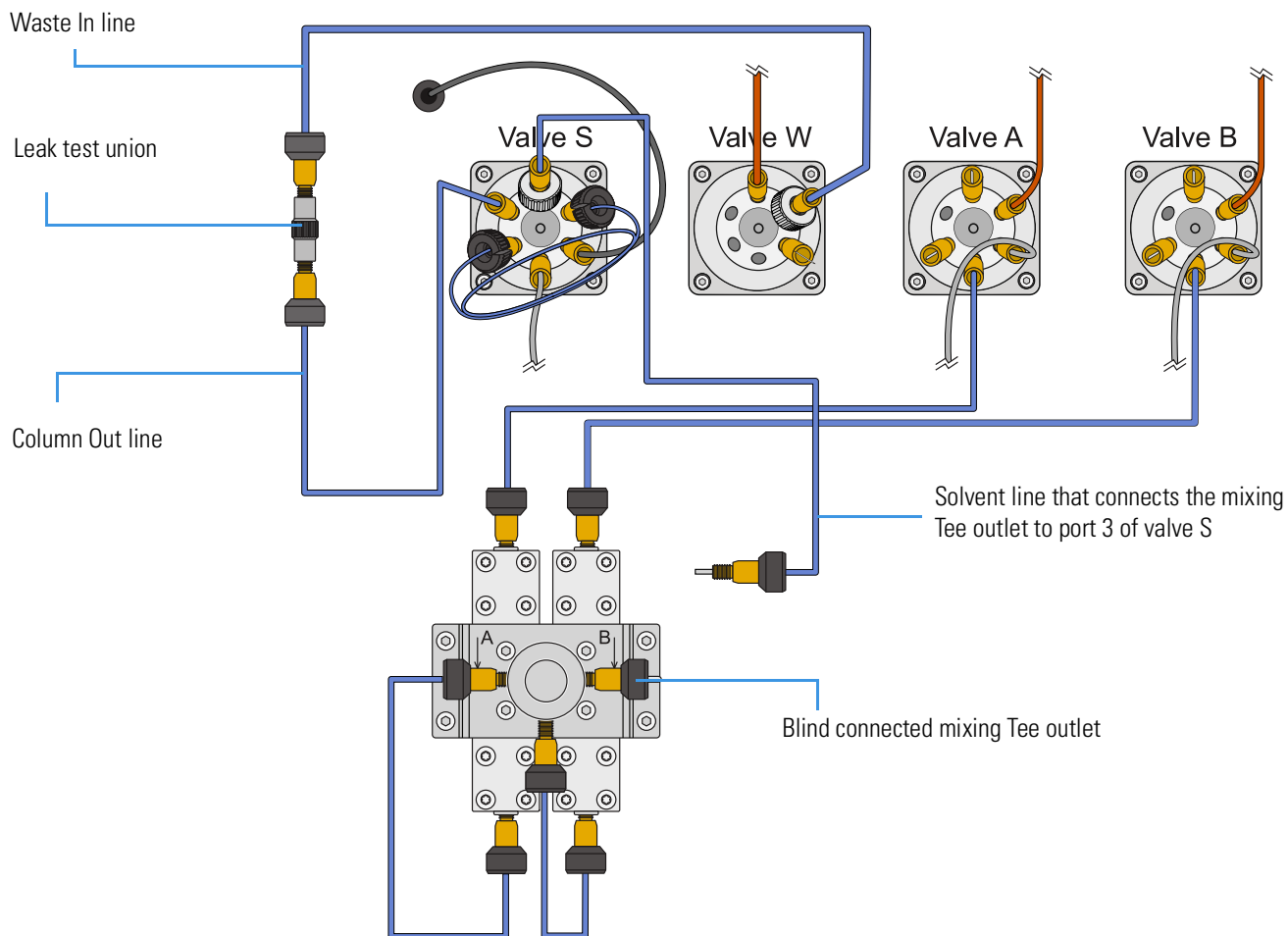
To determine whether the leak is coming from the connection to port 4 of valve S, the connection to the mixing Tee outlet, or the connections between the flow sensor outlets and the mixing Tee inlets, follow the workflow in [Figure 155](#) or the procedure on pages 198–201.

**Figure 155.** EASY-nLC 1200 workflow for locating leaks between the flow sensors and valve S



#### ❖ To locate leaks between the flow sensors and valve S

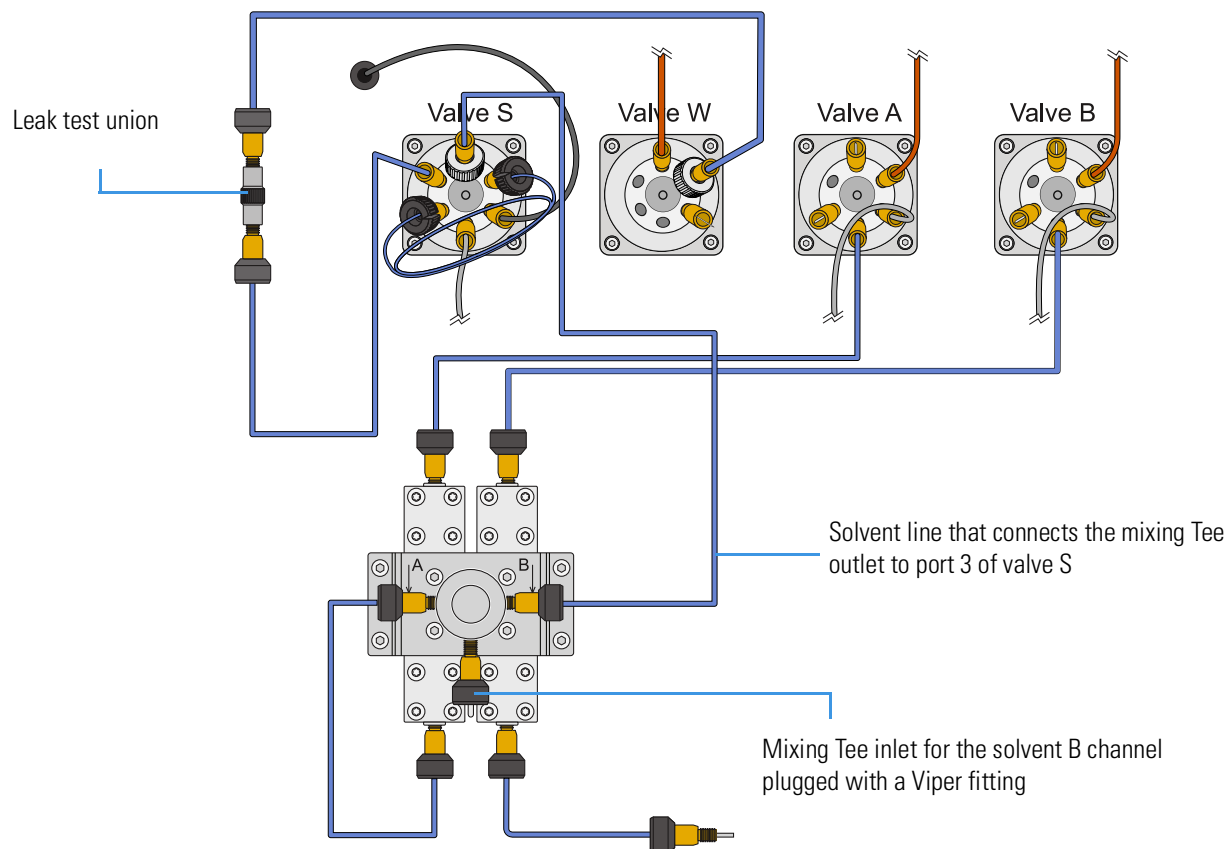
1. To ensure a leak-tight connection to port 4 of valve S, do the following:
  - a. Disconnect and then reconnect the nanoViper fitting to port 4 of valve S.
  - b. From the Maintenance > Scripts page, start the Analytical Column Equilibration script with the maximum pressure set to **1180** bar and the volume set to **140**  $\mu$ L.  
For information about setting up the Analytical Column Equilibration script, see [step 22](#) on [page 190](#).  
When you start the Analytical Column Equilibration script, the instrument sets the rotary valves to these positions and begins pumping solvent through flow sensor A:
    - Valve A: 1–6
    - Valve B: Center
    - Valve S: 1–2
    - Valve W: 1–2
  - c. On the Home > Overview page, check the readback for flow sensor A. Then, depending on the flow rate, do one of the following:
    - If the flow rate is <100 nL/min, you have remedied the leak and completed this troubleshooting procedure. Return the instrument to normal operation.
    - If the flow rate is >100 nL/min, go to the next step.
2. To check the solvent line that connects the mixing Tee outlet to port 4 of valve S, do the following:
  - a. On the Home > Overview page, set valves A and W to the following positions to return the system to atmospheric pressure:
    - Valve A: Center
    - Valve W: 1–6For information about changing the valve positions, see [“Using the Valve Controls”](#) on [page 165](#).
  - b. Disconnect the nanoViper fitting from the mixing Tee outlet. Then, block the mixing Tee outlet with a Viper blind plug (see [Figure 156](#)).

**Figure 156.** Mixing Tee outlet plugged with a Viper fitting

- c. On the Home > Overview page, reset these valve positions:
- Valve A: 1–6
  - Valve W: 1–2

- d. On the Home > Overview page, check the readback for flow sensor A. Then, depending on the flow rate, do one of the following:
  - If the flow rate is <100 nL/min, do the following:
    - i. Stop the Analytical Column Equilibration script and return the system to atmospheric pressure.
    - ii. Disconnect the damaged solvent line from port 4 of valve S.
    - iii. Install a new solvent line to connect the mixing Tee outlet to port 4 of valve S.  
  
For ordering information, see [Table 32](#) on [page 268](#).
    - iv. Rerun the system leak test (see “[Running a System Leak Test](#)” on [page 178](#)).
  - If the flow rate is >100 nL/min, go to the next step.
3. To eliminate the solvent B channel as the leak source, do the following:
  - a. Set **valve A** to the **Center** position to return the system to atmospheric pressure while maintaining pressure on the front end of the system.
  - b. Disconnect the Viper blind plug from the mixing Tee outlet, and reconnect the solvent line to the mixing Tee outlet.
  - c. Disconnect the solvent line from the mixing Tee inlet for the solvent B channel, and block the inlet with a Viper blind plug.  
  
[Figure 157](#) shows the solvent line disconnected from the mixing Tee and a Viper blind plug in the inlet port of the mixing Tee for the solvent B channel.
  - d. Reset **valve A** to position **1–6**.

**Figure 157.** Mixing Tee inlet for the solvent B channel plugged with a Viper blind plug



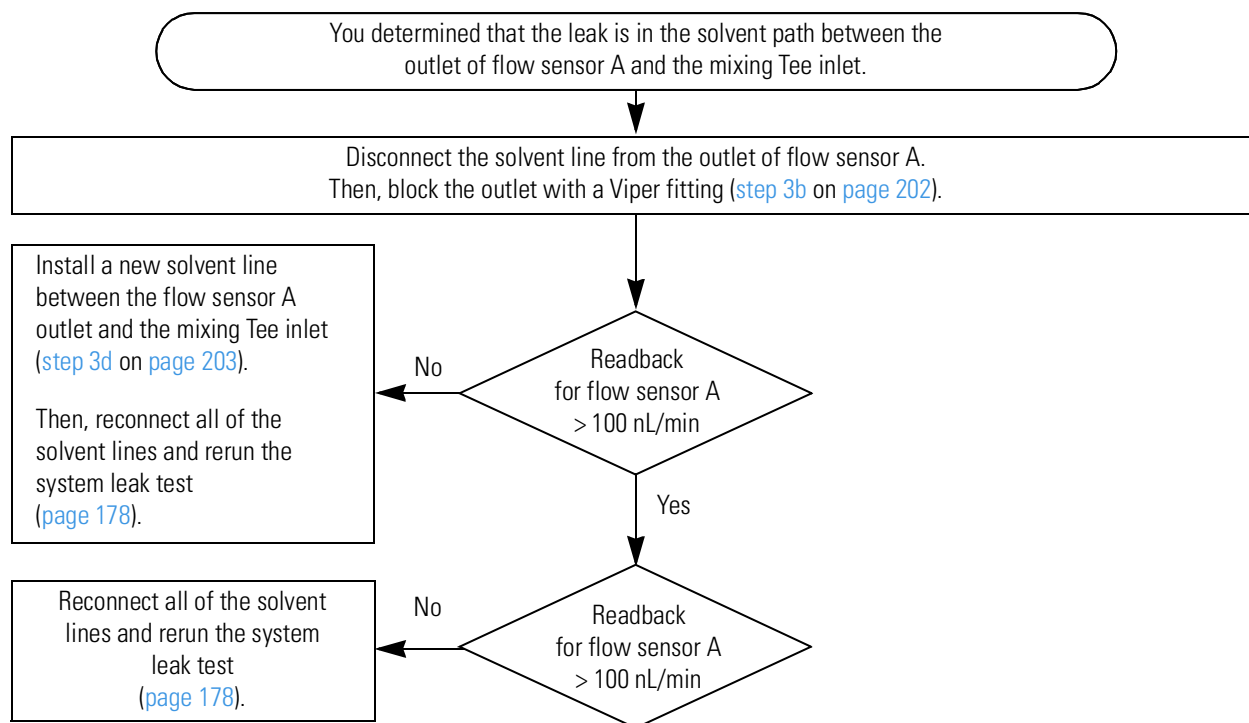
- e. On the Home > Overview page, check the readback for flow sensor A. Then, depending on the flow rate, do one of the following:
- If the flow rate is <math><100\text{ nL/min}</math>, go to [“Locating a Leak Between Flow Sensor B and the Mixing Tee”](#) on [page 204](#), as removing the solvent B channel from the flow path remedied the leak.
  - If the flow rate is >math>100\text{ nL/min}</math>, the leak is in the solvent A channel, as removing the solvent B channel from the solvent path did not remedy the leak. Go to the next procedure, [“Locating a Leak Between Flow Sensor A and the Mixing Tee.”](#)

### Locating a Leak Between Flow Sensor A and the Mixing Tee

By following the workflow in [Figure 155](#) on [page 197](#) or the procedure on [pages 198–201](#), you determined that the leaking connection is between flow sensor A and the mixing Tee. The system plumbing is set up as shown in [Figure 157](#) on [page 201](#), with the solvent channel B disconnected from the mixing Tee.

Follow the workflow in [Figure 158](#) or the procedure on [pages 202–203](#) to locate and remedy the leak.

**Figure 158.** EASY-nLC 1200 workflow for locating a leak between flow sensor A and the mixing Tee (Part 1)



#### ❖ To locate and remedy a leak between flow sensor A and the mixing Tee

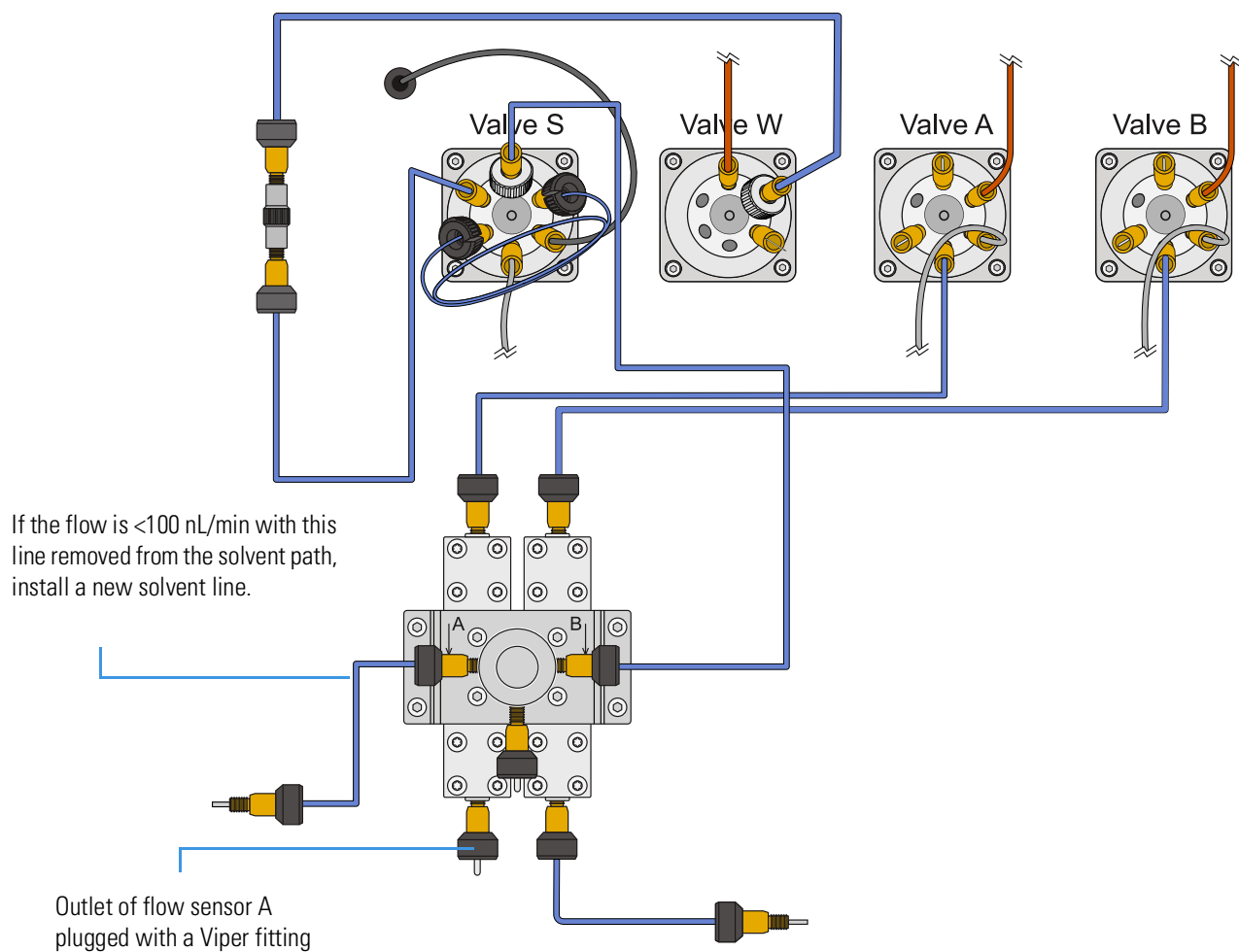
To check if you must replace the solvent line that connects the outlet of flow sensor A to the mixing Tee, do the following:

- Set **valve A** to the **Center** position.
- Disconnect the solvent line from the outlet of flow sensor A. Then, block the outlet of flow sensor A with a Viper fitting.

[Figure 159](#) shows the solvent path blocked at the outlet of flow sensor A.

- Reset **valve A** to position **1–6**.



**Figure 159.** Solvent A channel blocked at the outlet of flow sensor A

- d. Check the readback for flow sensor A. Then, depending on the flow rate, do one of the following:

- If the flow rate is  $< 100\text{ nL/min}$ , do the following:
  - i. Stop the Analytical Column Equilibration script.
  - ii. Disconnect the damaged solvent line from the mixing Tee's inlet for the solvent A channel.
  - iii. Install a new solvent line between the mixing Tee's inlet for the solvent A channel and the flow sensor's outlet.

For ordering information, see [Table 32](#) on [page 268](#).

- iv. Reconnect the solvent lines, and rerun the system leak test (see [“Running a System Leak Test”](#) on [page 178](#)).
- If the flow rate is  $> 100\text{ nL/min}$ , go to the next step.

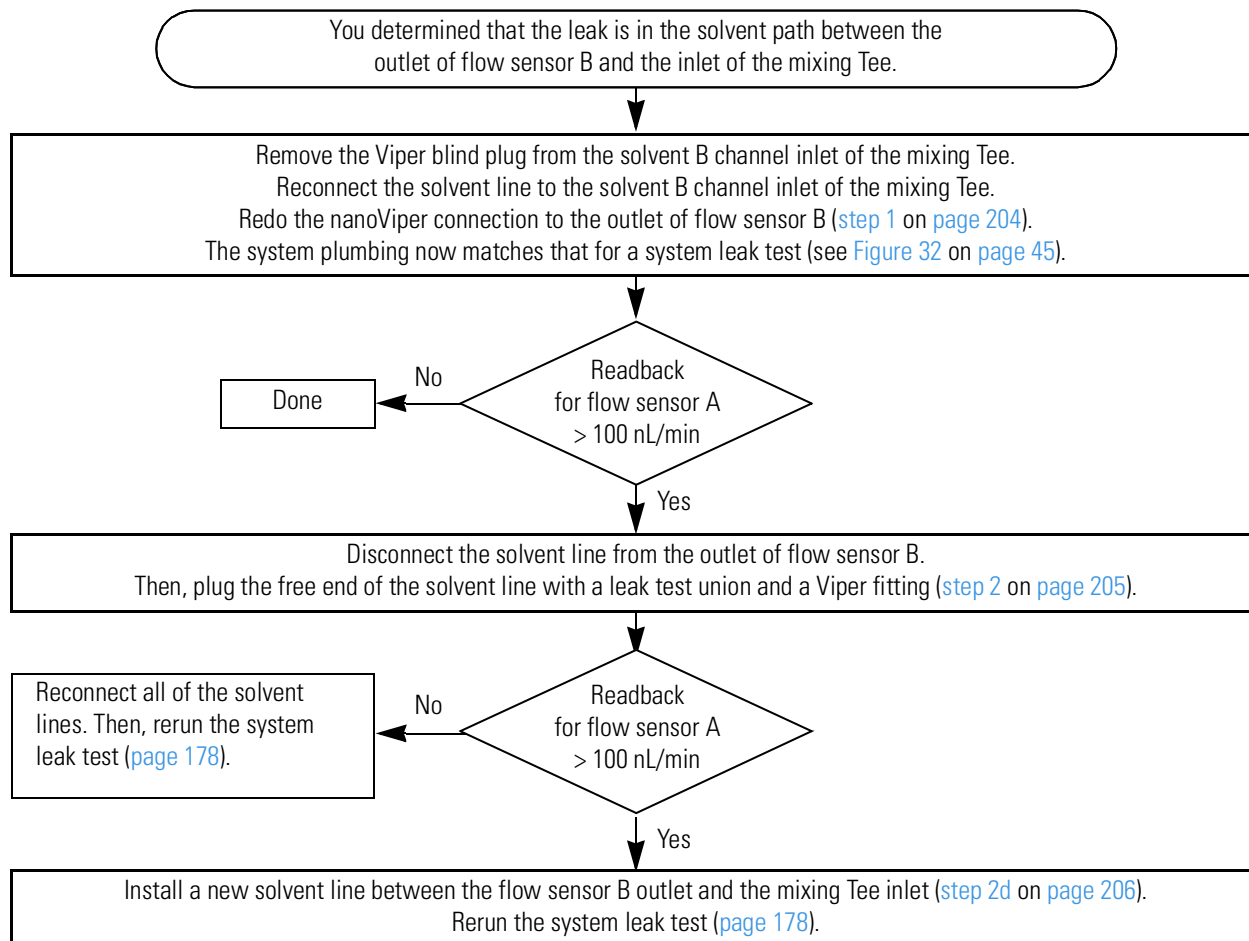
## Locating a Leak Between Flow Sensor B and the Mixing Tee

- v. Stop the Analytical Column Equilibration script.
- vi. Reconnect all of the solvent lines.
- vii. Rerun the system leak test (see “Running a System Leak Test” on page 178).

By following the workflow in Figure 155 on page 197 or the procedure on pages 198–201, you determined that the leaking connection is between the flow sensor B outlet and the mixing Tee inlet. The system plumbing is set up as shown in Figure 157 on page 201, with the solvent channel B disconnected from the mixing Tee inlet.

Follow the workflow in Figure 160 or the procedure on pages 204–206 to locate and remedy the leak.

**Figure 160.** Workflow for locating a leak between flow sensor B and the mixing Tee



### ❖ To locate a leak between flow sensor B and the mixing Tee

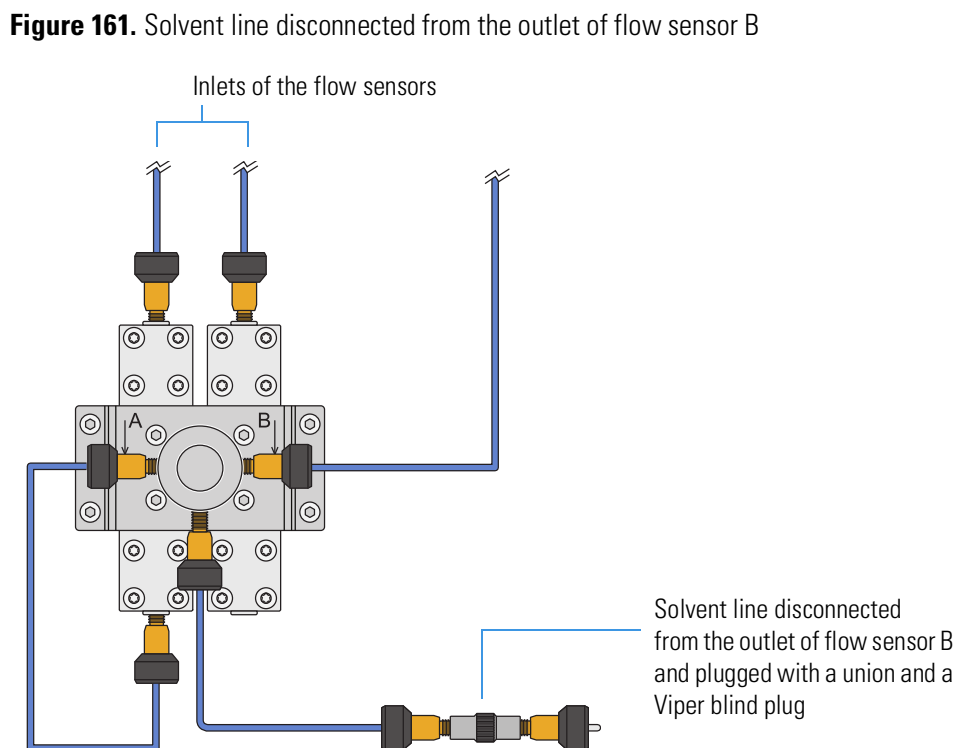
1. To ensure leak-tight connections for the solvent line that connects the outlet of flow

sensor B to the mixing Tee inlet, do the following:

- a. Set **valve A** to the **Center** position.
- b. Set up the system plumbing as follows:
  - i. Remove the Viper blind plug from the mixing Tee's inlet for the solvent B channel.
  - ii. Reconnect the solvent line to the solvent B channel inlet of the mixing Tee.
  - iii. Redo the nanoViper connection to the mixing Tee's inlet for the solvent B channel.

The system plumbing now matches that for a system leak test.

- c. Reset **valve A** to position **1-6**.
  - d. Check the readback for flow sensor A. Then, depending on the flow rate, do one of the following:
    - If the flow rate is  $<100$  nL/min, you have completed this troubleshooting procedure. Return the instrument to normal operation.
    - If the flow rate is  $>100$  nL/min, go to the next step.
2. To determine whether the solvent line is the leak source, do the following:
    - a. Set **valve A** to the **Center** position.
    - b. Disconnect the solvent line from the outlet of flow sensor B. Then, plug the free end of the solvent line with a leak test union and a Viper fitting (see [Figure 161](#)).



## 7 Troubleshooting

### Troubleshooting the Results of the System Leak Test

- c. Reset **valve A** to position **1–6**.
- d. Check the readback for flow sensor A. Then, depending on the flow rate, do one of the following:
  - If the flow rate is <100 nL/min, do the following:
    - i. Stop the Analytical Column Equilibration script.
    - ii. Reconnect the system plumbing and rerun the system leak test (see [“Running a System Leak Test”](#) on page 178).
  - If the flow rate is >100 nL/min, do the following:
    - i. Stop the Analytical Column Equilibration script.
    - ii. Install a new solvent line between the flow sensor B outlet and the mixing Tee inlet.  
  
For ordering information, see [Table 32](#) on page 268.
    - iii. Rerun the system leak test (see [“Running a System Leak Test”](#) on page 178).

## Identifying a Leaking Check Valve

The EASY-nLC instrument has four check valves. Each solvent inlet line connects to a check valve assembly with a solvent-side check valve and a waste-side check valve.



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

### ❖ To determine if the waste-side check valve is leaking

1. Run the Purge Solvent script as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Prepare**.
  - c. In the Name list, select **Purge Solvent**.
  - d. Press the **Parameters** tab.
  - e. Select the check box for the appropriate pump.
  - f. Press **Start**.
2. As the pump is filling, observe the waste line.

If you observe solvent moving toward the check valve assembly, the waste-side check valve is leaking.
3. If the waste-side check valve is leaking, replace it and repeat the Purge Solvent script.

### ❖ To determine if the solvent-side check valve is leaking

1. Start the Purge Solvent script.
2. As the pump is emptying, observe the solvent line.

If you observe solvent moving toward the solvent bottle from the check valve assembly, the solvent-side check valve is leaking.
3. If the solvent-side check valve is leaking, replace it and repeat the Purge Solvent script.

## Troubleshooting a System Blockage

Use this troubleshooting procedure when the backpressure for a chromatographic method rises above the expected level or when the flow decreases below the set rate for the column equilibration or sample loading steps.

In most cases, an increase in backpressure is caused by a blocked column or a blocked Column Out line. The Column Out line has an ID of 20  $\mu\text{m}$  for the EASY-nLC 1200 instrument and is the smallest ID line that the sample passes through, from sample pickup to the columns.

Troubleshooting a system blockage requires these tools and materials:

Tools	Parts and materials
	<ul style="list-style-type: none"><li>• Powder-free gloves</li><li>• EASY-nLC 1200 instrument: Viper union, P/N SC900</li></ul>



**CAUTION** Wear powder-free gloves and safety glasses when handling parts of the LC system that come into contact with solvents.

When running the Back Pressure script, the system also checks for an unusually low backpressure. If the backpressure is unusually low, the system probably has a leak.

To troubleshoot a system blockage, follow these procedures:

1. “[Running the Back Pressure Test for the A and B Solvent Paths](#),” next procedure
2. Depending on the test results, replace the blocked components in the column assembly or follow one or both of these procedures:
  - “[Troubleshooting a System Blockage when Test Solvent A Fails](#)” on [page 210](#)
  - “[Troubleshooting a System Blockage when Test Solvent B Fails](#)” on [page 216](#)

## Running the Back Pressure Test for the A and B Solvent Paths

The Back Pressure script determines instrument backpressure for solvent lines A and B. The script runs at a preset flow and measures the backpressure on the system.

**IMPORTANT** Before you perform the Back Pressure script, ensure that the solvent A bottle contains water and the solvent B bottle contains a maximum concentration of 95% acetonitrile. This test is not valid for other solvents.

### ❖ To run the Back Pressure script for both the A and B solvent paths

1. Remove the columns and connect the Column Out line to the Waste In line using the appropriate HPLC union.

Instrument	Union
EASY-nLC 1200	SC900 (Viper union)

2. Run the Back Pressure scripts for both Solvent A and Solvent B as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Test**.
  - c. In the Name list, select **Back Pressure**.
  - d. Press the **Parameters** tab.
  - e. Select the **Test Solvent A** and **Test Solvent B** check boxes.
  - f. Press **Start**.
3. Depending on the test results, do one of the following:
  - If the Test Solvent A test fails and the following message appears, go to [“Troubleshooting a System Blockage when Test Solvent A Fails” on page 210](#).
    - EASY-nLC 1200 instrument—Pressure is xxx bar (exceeds 175 bar limit), test failed!
  - If the Test Solvent B test fails and the following message appears, go to [“Troubleshooting a System Blockage when Test Solvent B Fails” on page 216](#).
    - Pressure is xxx bar (exceeds 250 bar limit), test failed!
  - If both Test Solvent A and Test Solvent B tests pass and the following message appears, inspect and if necessary replace the columns, the packed emitter, or both. Ensure that the column tee is not blocked. Run the Analytical Column Equilibration script to check the column or emitter, and see if the resulting flow rate is too low.
    - Pressure is xxx bar, test passed.

## Troubleshooting a System Blockage when Test Solvent A Fails

Follow this procedure when the Back Pressure test for Test Solvent A fails (see [“Running the Back Pressure Test for the A and B Solvent Paths”](#) on page 209).

### ❖ To verify the system blockage

1. Run the Precolumn Equilibration script and check the backpressure as follows:
  - a. On the Maintenance > Scripts page, select **Prepare** in the Category list and then **Precolumn Equil** in the Name list.
  - b. Press the **Parameters** tab.
  - c. In the Volume [μL] box, enter **140** μL.
  - d. In the Flow [μL/min] box, enter **2** μL/min.
  - e. Leave the Max Pressure [bar] box blank.
  - f. Press **Start**.
  - g. Monitor the pump A pressure trace.
2. Depending on the backpressure, do the following:
  - If the backpressure is below the pressure threshold, the system blockage has been removed. To confirm that the backpressure is below the pressure threshold, rerun the Back Pressure script with the **Test Solvent A** check box selected.
  - If the backpressure is above the pressure threshold, keep the Precolumn Equil script running and go to [“To locate the source of the blockage when the Test Solvent A test fails”](#) on page 213.

Instrument	Pressure threshold
EASY-nLC 1200	Solvent A: 175 bar / Solvent B: 250 bar



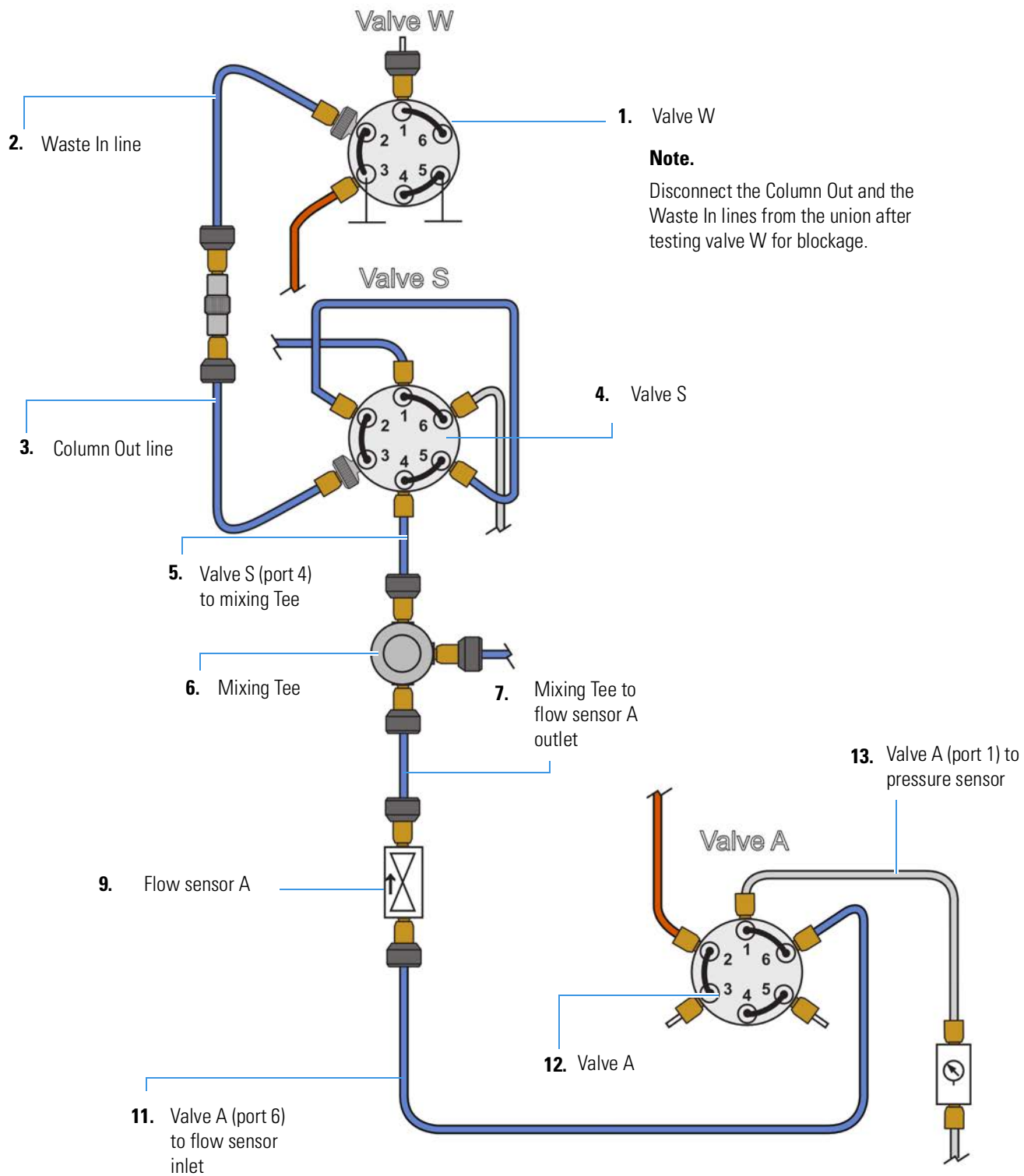
Figure 162 shows the areas that the following procedure systematically checks for blockage.

**Figure 162.** Solvent path from pressure sensor A to the Waste In line

**Note** Please note the numbering of the valve ports as depicted in Figure 9 (clockwise numbering with valve port 1 in 4 o'clock position). Due to operational reasons, the graphical representation in this guide or in the instrument's built-in software may show the valves in a different orientation. Please use only the port numbers for identification of port positions.

## 7 Troubleshooting

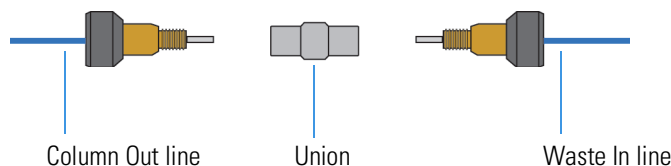
### Troubleshooting a System Blockage



❖ **To locate the source of the blockage when the Test Solvent A test fails**

1. To determine if valve W is blocked, do the following:
  - a. Make sure that the Precolumn Equilibration script is set up and running as described in [step 1](#) on [page 210](#) and that the Column Out and Waste In lines are connected with a union.
  - b. Disconnect the Waste In line from port 2 of valve W (see [Figure 162](#) on [page 211](#)).
  - c. Depending on the backpressure, do one of the following:
    - If the pressure is below the threshold, valve W is blocked. Please contact the product support.
    - If the pressure is above the threshold reconnect the Waste In line, go to [step 2](#).

2. To determine if the Waste In line is blocked, do the following:
  - a. Disconnect the Column Out line and the Waste In line from the union.



- b. Depending on the backpressure, do one of the following:
    - If the pressure is below the threshold of 125 bar, the Waste In line is blocked. Discontinue this troubleshooting procedure and replace the Waste In line with a new line.
    - If the pressure is above the threshold of 125 bar, go to [step 3](#).
3. To determine if the Column Out line is blocked, do the following:
  - a. Disconnect the Column Out line from port 3 of valve S.
  - b. Depending on the backpressure, do one of the following:
    - If pressure is below the threshold of 90 bar, the Column Out line is blocked. Discontinue this troubleshooting procedure and replace the Column Out line with a new line.
    - If the pressure is above the threshold of 90 bar, reconnect the Column Out line, and go to [step 4](#).

4. To determine if valve S is partially or totally blocked, do the following:
  - a. Disconnect the mixing Tee line from port 4 of valve S.
  - b. Depending on the backpressure, do one of the following:
    - If the pressure is below the threshold of 90 bar, valve S is partially or totally blocked. Discontinue this troubleshooting procedure and contact product support.
    - If the pressure is above the threshold, reconnect the mixing Tee line to port 4 of valve S, and go to [step 5](#).
5. To determine if the line that connects valve S to the mixing Tee is blocked, do the following:
  - a. Disconnect the line from the mixing Tee.
  - b. Depending on the backpressure, do one of the following:
    - If the pressure is below the threshold of 65 bar, the line that connects the mixing Tee to valve S is blocked. Replace it.
    - If the pressure is above the threshold of 65 bar, reconnect the line to the mixing Tee, and go to [step 6](#).
6. To determine if the mixing Tee is blocked, do the following:
  - a. Disconnect the line that exits flow sensor A from the mixing Tee.
  - b. Depending on the backpressure, do one of the following:
    - If the pressure is below the threshold of 65 bar, the mixing Tee is blocked. Clean the mixing Tee, or if necessary replace it.
    - If the pressure is above the threshold of 65 bar, reconnect the line to the mixing Tee, and go to [step 7](#).
7. To determine if the line that connects the mixing Tee to flow sensor A is blocked, do the following:
  - a. Disconnect the line from the outlet of flow sensor A.
  - b. Depending on the backpressure, do one of the following:
    - If the pressure is <20 bar, the line that connects the mixing Tee to flow sensor A is blocked. Replace it with a new solvent line.
    - If the pressure is >20 bar, reconnect the line to flow sensor A, and go to [step 8](#).

8. To determine if flow sensor A is blocked, do the following:
  - a. Disconnect the solvent line from the flow sensor A inlet.
  - b. Depending on the backpressure for flow sensor A, do one of the following:
    - If the pressure is <20 bar, flow sensor A is blocked. Replace it with a new flow sensor as described in [“Replacing a Flow Sensor”](#) on [page 92](#).
    - If the pressure is >20 bar, reconnect the line to flow sensor A, and go to [step 9](#).
9. To determine if the line that connects valve A to flow sensor A is blocked, do the following:
  - a. Disconnect the solvent line from port 6 of valve A.
  - b. Depending on the backpressure, do one of the following:
    - If the pressure is <20 bar, the line from valve A to flow sensor A is blocked. Replace it with a new solvent line.
    - If the pressure is >20 bar, reconnect the line to valve A, and go to [step 10](#).
10. To determine if valve A is blocked, do the following:
  - a. Disconnect the solvent line from port 1 of valve A.
  - b. Depending on the backpressure, do one of the following:
    - If the pressure is <20 bar, valve A is blocked. Please contact product support.
    - If the pressure is >20 bar, reconnect the line to valve A, and go to [step 11](#).
11. To determine if the line from pressure sensor A to valve A is blocked or if pressure sensor A is blocked, do the following:
  - a. Disconnect the solvent line from the outlet of pressure sensor A.
  - b. Depending on the backpressure, do one of the following:
    - If the pressure is <20 bar, the line that connects pressure sensor A to valve A is blocked. Replace it with a new solvent line.
    - If the pressure is >20 bar, pressure sensor A is blocked. Replace it with a new pressure sensor as described in [“Replacing a Pressure Sensor”](#) on [page 89](#).

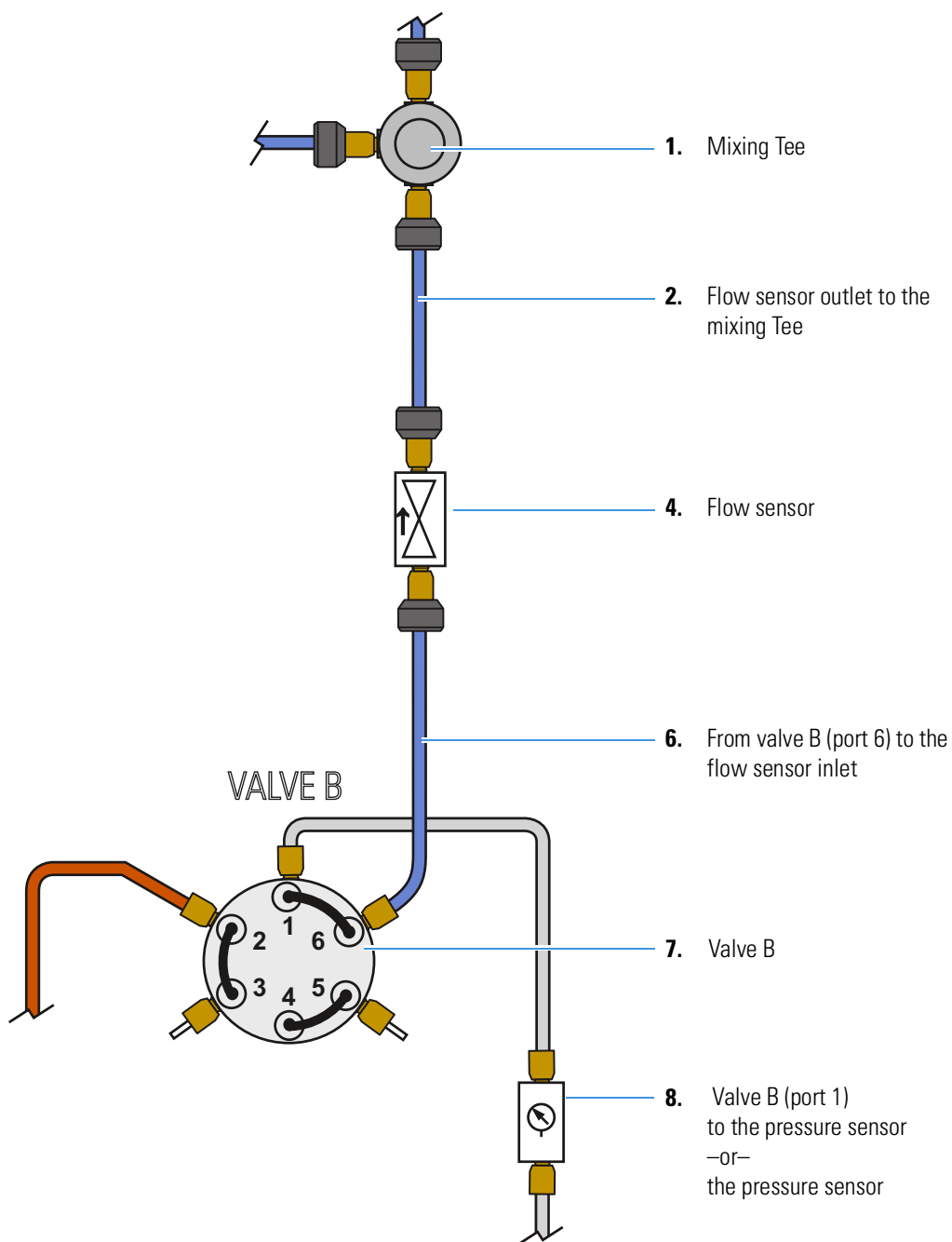
## Troubleshooting a System Blockage when Test Solvent B Fails

Follow this procedure when the Back Pressure test for Test Solvent B fails (see [“To run the Back Pressure script for both the A and B solvent paths”](#) on page 209).

[Figure 163](#) shows the areas that this procedure systematically checks for blockage.

**Figure 163.** Solvent system from pressure sensor B to the mixing Tee

**Note** Please note the numbering of the valve ports as depicted in [Figure 9](#) (clockwise numbering with valve port 1 in 4 o'clock position). Due to operational reasons, the graphical representation in this guide or in the instrument's built-in software may show the valves in a different orientation. Please use only the port numbers for identification of port positions.



❖ **To troubleshoot a system blockage when only the Test Solvent B test fails**

1. To determine if the blockage is in the mixing Tee, do the following:
  - a. Make sure that the Column Out line is connected to the Waste In line with a union.
  - b. Remove the solvent line from the mixing Tee that connects it to flow sensor B.
  - c. Repeat the Back Pressure script with the Test Solvent B check box selected.

- d. Depending on the test results, do one of the following:
  - If Test solvent B passes, clean the mixing Tee and if necessary replace it.
  - If Test solvent B fails, go to [step 2](#).
2. To determine if the blockage is in the solvent line that connects the B flow path to the mixing Tee, do the following:
  - a. Disconnect the solvent line from the outlet of flow sensor B.
  - b. Place valve B in position 1–6 as follows:
    - i. Press **Home > Overview**.
    - ii. Press the valve B icon.
    - iii. In the Valve B dialog box, press **1–6**.
  - c. Set pump B to deliver 2 µL/min as follows:
    - i. Press the pump B icon.
    - ii. In the flow rate box, type **2 µL/min**.
    - iii. Press **Start**.
    - iv. Leave the dialog box open.

For more information about the direct controls for the pump, see [“Using the Pump Controls”](#) on [page 166](#).
  - d. Monitor the Pressure readback box for pump B. Then, depending on the backpressure, do one of the following:
    - If the pressure is <20 bar, the solvent line is blocked.
      - Place valve B in position **1–2** to release the pressure. Remove the blocked nanoViper line and replace it with a new nanoViper line. Then, to confirm that the blockage was in the discarded solvent line, repeat the Back Pressure script with the **Test Solvent B** check box selected.
    - If the pressure is >20 bar, keep pump B running and go to [step 3](#).
3. To determine if flow sensor B is blocked, do the following:
  - a. Disconnect the solvent line from the inlet of flow sensor B, and monitor the pressure.
  - b. Depending on the pressure, do one of the following:
    - If the pressure is <20 bar, flow sensor B is blocked. Replace it as described in [“Replacing a Flow Sensor”](#) on [page 92](#).
    - If the pressure is >20 bar, keep pump B running and go to [step 4](#).
4. To determine if the line that connects valve B to flow sensor B is blocked, do the following:
  - a. Disconnect the line from port 6 of valve B, and monitor the pressure.



- b. Depending on the pressure, do one of the following:
  - If the pressure is below the threshold of 10 bar, the solvent line is blocked. Discontinue this troubleshooting procedure, and replace the solvent line that connects port 6 of valve B to the flow sensor inlet.
  - If the pressure is above the threshold of 10 bar, keep the pump running and go to [step 5](#).
5. To determine if valve B is blocked, do the following:
  - a. Remove the solvent line from port 1 of valve B, and monitor the pressure.
  - b. Depending on the pressure, do one of the following:
    - If the pressure is < 10bar, valve B is blocked. Please contact product support.
    - If the pressure is > 10bar, keep the pump running and go to [step 6](#).
6. To determine if either the line that connects valve B to pressure sensor B is blocked or pressure sensor B is blocked, do the following:
  - a. Remove the solvent line that connects valve B to pressure sensor B from pressure sensor B, and monitor the pressure.
  - b. Depending on the pressure, do one of the following:
    - If the pressure is < 10bar, the solvent line is blocked. Replace it.
    - If the pressure is >20 bar, pressure sensor B is blocked. Replace it as described in [“Replacing a Pressure Sensor”](#) on [page 89](#).

## Troubleshooting the Autosampler Aspiration

Troubleshooting the autosampler aspiration requires these tools and materials:

Tools	Parts and materials
	<ul style="list-style-type: none"> <li>• Powder-free gloves</li> <li>• Sample vial filled with solvent A</li> <li>• Microtiter plate (if you are using a microtiter plate format)</li> </ul>

### ❖ To troubleshoot the autosampler aspiration of sample into the needle

1. Make sure that the W3 wash bottle contains sufficient solvent.
2. Use the Flush Air script to remove air from pump S as follows:
  - a. Press **Maintenance > Scripts**.
  - b. In the Category list, select **Prepare**.
  - c. In the Name list, select **Flush Air**.
  - d. Press the **Parameters** tab.
  - e. Select the **Flush Pump S** check box.
  - f. For Flush Threshold [ $\mu$ L], **12** (see [Figure 164](#)).

**Figure 164.** Flush Air script

The screenshot shows the Thermo Scientific software interface for the Flush Air script. The 'Maintenance' tab is selected, and the 'Scripts' section is active. The 'Prepare' category and 'Flush air' script are chosen. The 'Parameters' tab is selected, showing a table with the following data:

Parameter	Value
Flush pump A	<input type="checkbox"/>
Flush pump B	<input type="checkbox"/>
Flush pump S	<input checked="" type="checkbox"/>
Flush threshold [ $\mu$ L]	12.00

The interface also includes a sidebar with 'Scripts' selected, a 'Log Book' button, 'Support' and 'Devices' links, a 'Solvents refresh due' notification, a 'Job 00:00:00' timer, a date and time display (9 Sep 2015 13:42), an 'admin' user indicator, and an 'Exit...' button. At the bottom, there are 'Schedule', 'START', and 'STOP' buttons.

- g. Press **Start**.

The script runs until the flush threshold reaches the specified value or one of these error messages appears on the Output page:

- Aborting unable to build pressure
- Aborting check solvent level

3. Depending on whether the Flush Air script passed or failed, do one of the following:
- If the Flush Air script failed, leave the Maintenance > Scripts page open and go to [step 4](#) to determine if the autosampler needle is blocked.
  - If the Flush Air script passed, leave the Maintenance > Scripts page open and go to [step 5](#) to determine if the autosampler requires calibration.
4. To determine if the autosampler needle is blocked, do the following:
- a. Disconnect the PEEKsil autosampler needle from port 1 of valve S.
  - b. Disconnect the waste line from port 3 of valve W and connect it to port 1 of valve S.
  - c. Place the free end of the waste line in an HPLC vial filled with solvent A.
  - d. To open the Purge script, select **Purge** in the Name list.
  - e. Select the **Purge Pump S** check box.
  - f. Press **Start**.
  - g. Verify that pump S aspirates solvent from the HPLC vial.
  - h. Do one of the following:
    - If pump S can aspirate solvent through the waste tubing, the needle is blocked. Reconnect the PEEK waste tubing to port 3 of valve W and replace the autosampler needle (see [“Replacing the Autosampler Needle”](#) on page 85).
    - If pump S cannot aspirate solvent through the waste tubing, go to [“Troubleshooting a Pump That Fails the Flush Air Script”](#) on page 174.
5. To determine if the autosampler needle is going to the correct position and depth, go to the next procedure, [“Checking Sample Pickup.”](#)

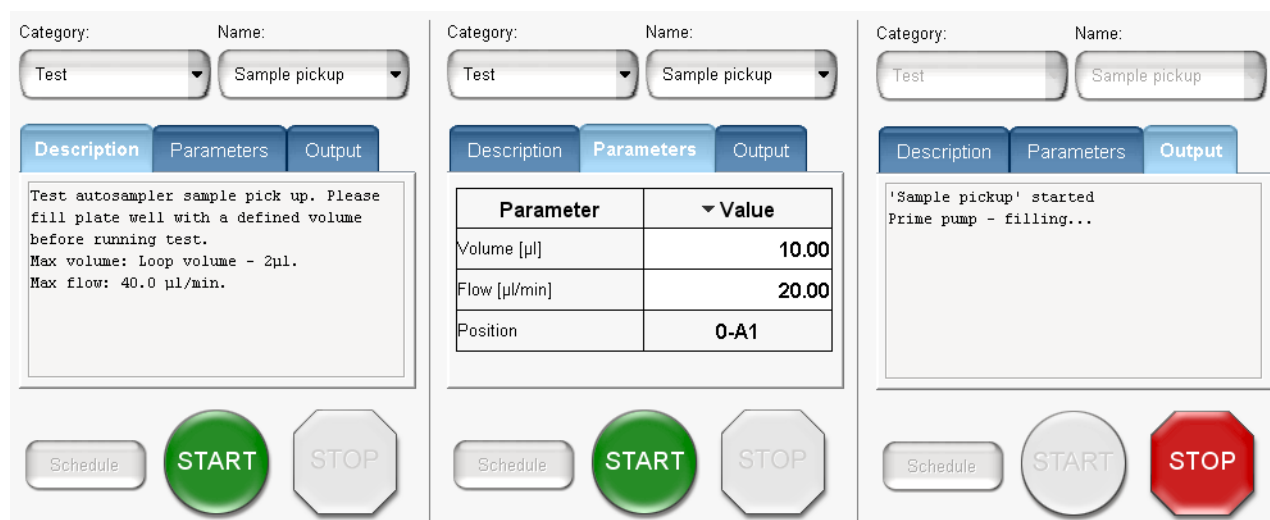
## Checking Sample Pickup

When you run the Sample Pickup script, the autosampler withdraws a specified volume from a specified position. To verify the volume withdrawn by the autosampler, place a known volume into the specified position, and measure the remaining volume after you run the script. You can use a pipette or an analytical balance with microgram accuracy to determine the initial and final volumes.

### ❖ To check sample pickup from a microtiter plate or vial

1. Fill the well or vial with 12  $\mu\text{L}$  of solvent A.
2. Weigh the microwell plate or vial.
3. Insert the tray into the tray compartment.
4. Press **Maintenance > Scripts**.
5. Run the Sample Pickup script with a pickup volume of 10  $\mu\text{L}$  and your default flow (see [Figure 165](#)).

**Figure 165.** Sample Pickup script under the Maintenance menu tab



6. After the EASY-nLC application finishes the script, do the following:
  - a. Eject the tray.
  - b. Check that 2  $\mu\text{L}$  is left in the well or vial by reweighing the microplate or vial or by checking the volume with a pipette.
  - c. If the result is different from 2  $\mu\text{L}$ , check the needle for any damages, recalibrate the autosampler, run the Flush Air script, and then rerun the sample pickup check.  
For information about calibrating the autosampler, see [Chapter 8](#). For information about the Flush Air script, see [“Flush Air” on page 33](#).
7. Repeat the above steps using lower volumes:

- a. Fill the well or vial with 3  $\mu\text{L}$  of solvent A. Repeat [step 2](#) through [step 4](#).
- b. Run the Sample Pickup script with a pickup volume of 1  $\mu\text{L}$  and your default flow (see [Figure 165](#)). Repeat [step 6](#).

## Troubleshooting Communication Problems

To troubleshoot communication problems, see these sections:

- [Network Access](#)
- [Network Connection Failures](#)
- [Testing the Network Connection to the EASY-nLC Computer](#)

### Network Access

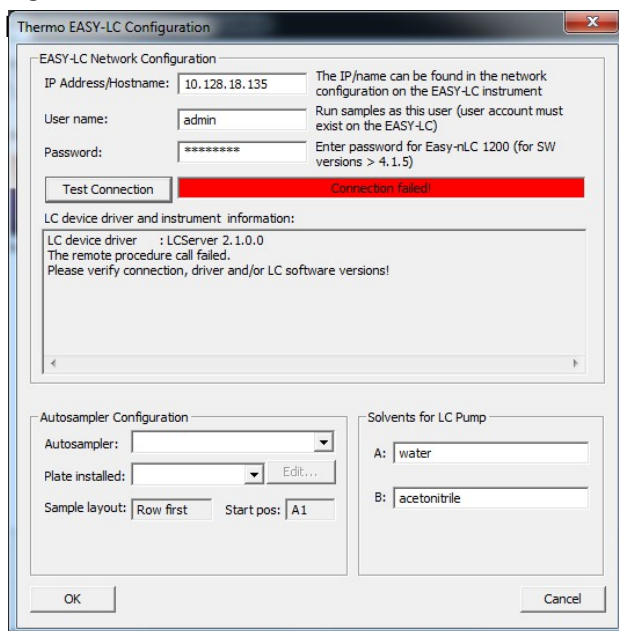
[Table 27](#) contains troubleshooting tips for network access problems.

**Table 27.** Network access problems

Symptom	Possible causes	Action
System is not responding after pressing Save Configuration on the Network page under Configuration.	Length of completion time to update the network settings	As indicated, wait while the system changes the network settings.
Cannot access the EASY-nLC system through the network.	Changed network address	Check the network address of the EASY-nLC system on the Configuration > Network page.
	The stand-alone EASY-nLC instrument is not connected to a laboratory LAN port with intranet access.	Connect the stand-alone EASY-nLC instrument to a laboratory LAN port with intranet access.
	The LC/MS system is not connected to a laboratory LAN port with intranet access.	Connect the data system computer for the LC/MS system to a laboratory LAN port with intranet access.

### Network Connection Failures

[Table 28](#) lists the possible causes of a network connection failure. [Figure 166](#) shows the Thermo EASY-nLC Configuration dialog box that you access from the Thermo Foundation Instrument Configuration application. When the EASY-nLC instrument cannot establish communication with the data system computer, the Connection Failed message appears when you click Test Connection.

**Figure 166.** Network connection failure**Table 28.** Possible causes of a network connection failure (Sheet 1 of 2)

Error message	Possible cause	Action
No such interface supported.	LCServer.exe not running / not running anymore.	Test the network connection as described in “” on <a href="#">page 224</a> .
The remote procedure call failed.	LCServer.exe not running / not running anymore.	Close down the EASY-nLC instrument as described in “ <a href="#">Closing Down the EASY-nLC Instrument</a> ” on <a href="#">page 22</a> and turn off the power. Restart the Xcalibur data system computer. Turn on the EASY-nLC instrument and log in as an administrator. Retest the connection.
Server execution failed.	LCServer.exe could be running, but you cannot access “Thermo Scientific LCServer” services (e.g. it hangs in “Stopping” state).	Restart the Xcalibur data system computer. Turn on the EASY-nLC instrument and log in as an administrator. Retest the connection.
Transport Error: Failed connecting to ‘10.128.18.135’: An attempt was made to access a socket in a way forbidden by its access permissions.	TCP port 6666 is blocked.	Verify that the antivirus program is not blocking the port. Change firewall settings.

**Table 28.** Possible causes of a network connection failure (Sheet 2 of 2)

Error message	Possible cause	Action
Transport Error: Failed connecting to '10.128.18.64': A connection attempt failed because the connected party did not properly respond after a period of time, or established connection failed because connected host has failed to respond.	TCP port 6666 is open, but the device cannot be reached.	Check that the device is online and that you used the correct IP address.
An event was unable to invoke any of the subscribers: Incorrect login/password.	No or incorrect login used.	Use correct login data. For information about resetting your password, refer to the <i>EASY-nLC 1200 Getting Started Guide</i> .

**Note** It is recommended to include your local IT to resolve these failures.

## Testing the Network Connection to the EASY-nLC Computer

If the connection between the EASY-nLC instrument and the data system computer fails when you click Test Connection in the Thermo EASY-nLC Configuration dialog box of the Foundation Instrument Configuration window, follow this procedure.

❖ **To test the network connection between the data system computer and the EASY-nLC instrument**

1. From the Windows Start menu, choose **Run**.

The Run dialog box opens.

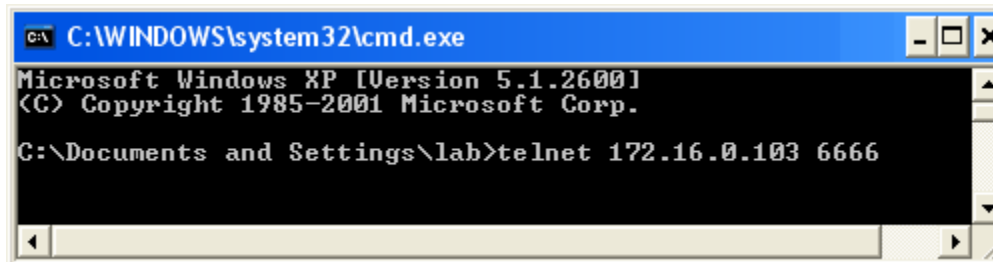
2. In the Open box, type **cmd**.

3. Press **OK**.

The Command Prompt window opens.

4. Type telnet *IP address for the EASY-nLC system* 6666 (see [Figure 167](#)).

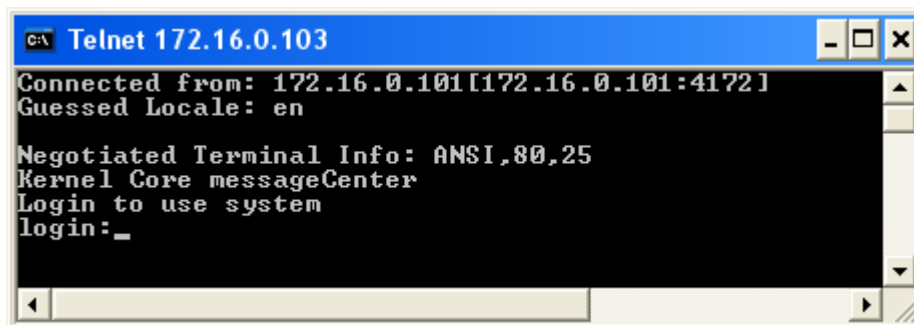
**Figure 167.** Command Prompt window with the default IP address for the EASY-nLC instrument



5. Press the ENTER key.
  - If the connection is set up correctly, a login prompt appears in the Telnet window (see [Figure 168](#)).
  - If the connection is not set up correctly, the following message appears:

Could not open connection to host.

**Figure 168.** Telnet window with login prompt





## Verifying that the LC/MS System Is Properly Grounded

When you use the EASY-nLC instrument as an inlet to an MS detector, the LC/MS system might require two or more fourplex outlets. The interconnected electrical outlets must have a common point to one ground connector. Connecting the hardware to external grounds at different potentials can create a ground loop that causes noise and interference and can damage the contact closure relays on the instrument's back panel.

**IMPORTANT** The EASY-nLC instrument, the MS or LC detector, and the (optional) data system hardware must have a common ground for several reasons:

- Improper grounding or no grounding can result in shock and fire hazards in case of instrument malfunction.
- Connecting the hardware to external grounds at different potentials can create a ground loop that causes noise and interference.
- Improper grounding or no grounding can damage the contact closure relays on the instrument's back panel. Fixing damaged relays requires the replacement of the instrument's built-in computer.

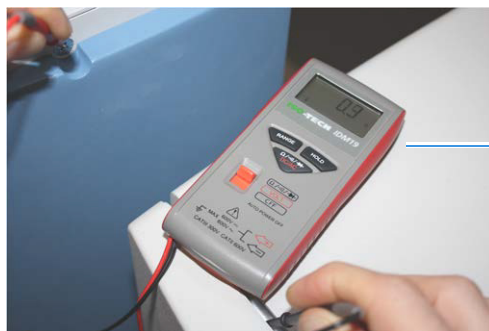


**CAUTION** Electrical safety regulations require that the EASY-nLC instrument be grounded to prevent electrical shock and a fire hazard in case of malfunction.

### ❖ To verify a common ground between the EASY-nLC instrument and external hardware

1. Connect the EASY-nLC instrument to line power, but do not turn on the instrument.
2. Using a multimeter, measure the resistance between the EASY-nLC chassis and the external hardware chassis (for example, the mass spectrometer chassis or the data system computer) as follows:
  - a. Connect one probe to an unpainted surface on the EASY-nLC chassis and connect the other probe to an unpainted surface on the external hardware chassis (see Figure 169).

**Figure 169.** Resistance measurement



Multimeter set up to take a resistance measurement

- b. Ensure that the resistance measurement is from 0 to 10 ohms.

## **7 Troubleshooting**

Verifying that the LC/MS System Is Properly Grounded

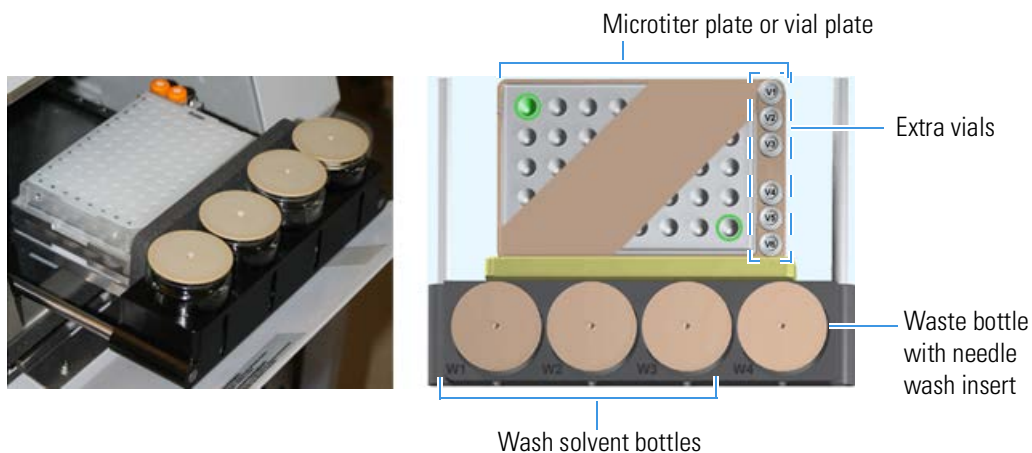
## Calibrating the Autosampler's XYZ Robot

To calibrate the autosampler's XYZ robot, follow the instructions in this chapter.

### Contents

- [Replacing the Autosampler Adapter Plate](#)
- [Managing Plate Formats](#)
- [Preparing the Autosampler for the Calibration Routines](#)
- [Calibrating Plates](#)
- [Calibrating the Wash Bottle and Extra Vial Positions](#)

For the ASC autosampler, the calibration covers the following areas of the autosampler.



## Replacing the Autosampler Adapter Plate

The installed plate adapter will hold the 48 standard HPLC or a SBS standard microtiter plate (96 or 384), plus the 6 additional vials for blanks/standards/QC.

The additional plate adapter is for PCR stripes or SBS standard microtiter plates (96 or 384), plus the 6 additional vials for blanks/standards/QC.

## 8 Calibrating the Autosampler's XYZ Robot

### Replacing the Autosampler Adapter Plate

Follow the procedure for the autosampler model in your EASY-nLC system to switch between the two adapter plates as necessary.

- “[Replacing the Adapter Plate in the ASC Model Autosampler](#),” next procedure

## Replacing the Adapter Plate in the ASC Model Autosampler

### ❖ To replace the adapter plate in the ASC model autosampler

1. Press **Home > Overview**.

The Overview page of the Home menu opens.

2. Make sure that the area in front of the tray compartment is clear, and press **Eject/Insert Tray**.

The tray compartment opens. [Figure 170](#) shows the vial adapter plate mounted to the tray holder. The four studs on the bottom side of the plate fit snugly into the mounting holes on the tray holder.

**Figure 170.** Open tray compartment



3. Remove the current adapter plate by pulling it up and away from the tray holder (see [Figure 171](#)).

**Figure 171.** Removing the vial adapter plate before installing the MTP adapter plate.



4. Install the other adapter plate in the autosampler.

## Managing Plate Formats

When the EASY-nLC instrument is initially installed, the touch-screen application includes plate formats for vials and microtiter plates.

Follow the appropriate procedure to use an existing plate format, create your own plate format, or delete a plate format that you no longer need.

- “[Selecting a Plate Format](#),” next procedure
- “[Creating a New Plate Format](#)” on [page 232](#)
- “[Deleting a Plate Format](#)” on [page 234](#)

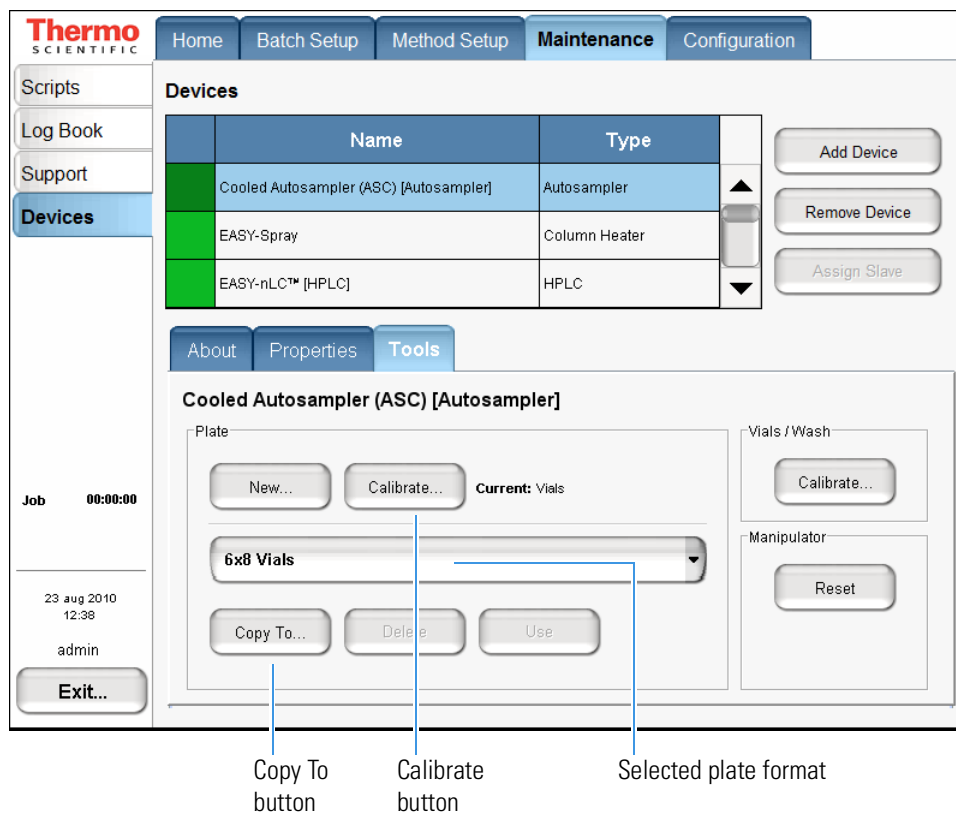
## Selecting a Plate Format

### ❖ To select the plate format that you want to use

1. Open the Tools view for the autosampler as follows:
  - a. Press **Maintenance > Devices**.
  - b. In the Devices list, select the autosampler device.
  - c. Press the **Tools** tab.

[Figure 172](#) shows the Tools view for the autosampler.

Figure 172. Tools view for the autosampler



2. Select a plate format from the Plate list.
3. Press **Use**.

**Tip** If you are using a Thermo Scientific application or data system to control your liquid chromatograph/mass spectrometer (LC/MS) system, the plate selection for the EASY-nLC instrument in the EASY-nLC Configuration dialog box (Foundation Instrument Configuration) must match the touch-screen application selection.

## Creating a New Plate Format

### ❖ To create a new plate format

1. Open the Tools view for the autosampler as follows:
  - a. Press **Maintenance > Devices**.
  - b. In the Devices list, select the autosampler device.
  - c. Press the **Tools** tab.

Figure 172 shows the Tools view for the autosampler.

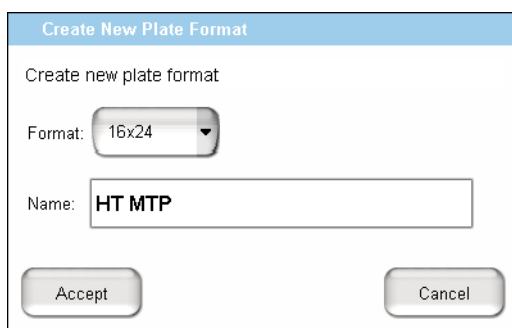
2. Do one of the following:
  - To create a new plate format, go to [step 3](#).
  - To copy an existing plate format (copies the format selection), go to [step 4](#).

3. Create a new plate format as follows:

- a. Press **New**.

The Create New Plate Format dialog box opens ([Figure 173](#)).

**Figure 173.** Create New Plate Format dialog box



- b. In the Format list, select a plate format: **6 × 8** (vials), **8 × 12** (96-well plates), or **16 × 24** (384-well plates).
- c. In the Name box, enter a name for the new plate format.
- d. Press **Accept**.

The new plate name appears in the plate list with the text [uncalibrated] appended on the right.

- e. Go to [“Calibrating Plates”](#) on [page 236](#) to calibrate the vial or well positions.
4. Copy an existing plate format as follows:
- a. Select an existing plate format from the Plate list.
  - b. Press **Copy To**.

The Copy Plate Format dialog box opens.

- c. In the Name box, type a name for the new plate format.
- d. Press **Accept**.

- e. Go to [“Calibrating Plates”](#) on [page 236](#) to calibrate the vial or well positions.

## Deleting a Plate Format

### ❖ To delete a plate format

1. Open the Tools view for the autosampler on the Devices page of the Maintenance menu (see [step 1](#) on [page 232](#)).
2. Select a plate format from the Plate list.

**Note** You cannot delete the plate in use. When you select the plate in use (highlighted in bold text), the Delete button becomes unavailable.

3. Press **Delete**.

The Delete Plate Data dialog box opens.

4. Press **Accept**.



## Preparing the Autosampler for the Calibration Routines

To prepare the autosampler for the calibration routines, you must remove the left side panel from the instrument and load the appropriate adapter plate, vials or microtiter plate, wash bottle (W4) with insert, and (optional) extra vial into the tray compartment.



**CAUTION** Calibrating the autosampler requires removal of the side plate and visual inspection of the autosampler needle holder. Because the autosampler compartment contains moving parts and sharp needles, make sure to keep hands clear when operating the autosampler during calibration.

### ❖ To prepare the autosampler for the plate calibration routine

1. Install the appropriate adapter plate.
2. To calibrate the vial or well positions on a plate, do one of the following:
  - To calibrate the 6 × 8 vial positions, remove the vial caps from two vials and load them into the adapter plate in positions A1 and F8.
  - To calibrate a microwell plate, remove the mat or cover from the microwell plate and load the microwell plate onto the adapter plate.
3. Open the Tools view for the autosampler as follows:
  - a. Press **Maintenance > Devices**.
  - b. In the Devices list, select the autosampler.
  - c. Press the **Tools** tab.
4. In the Plate area, do the following:
  - a. Select the appropriate plate format from the list, or create a new plate format (To create and select plate formats, see “[Managing Plate Formats](#)” on [page 231](#)).
  - b. Press **Use**.
5. Remove the left side panel so that you can watch the movement of the needle.

To calibrate the plate, see “[Calibrating Plates](#).”

### ❖ To prepare the autosampler for the V1 and W4 calibration routine

1. Place an empty, uncapped vial in position V1.
2. Ensure a wash bottle is placed in position W4 (used for ejecting waste and cleaning the outside of the injection needle).
3. For information about preparing the W4 wash bottle, refer to the *EASY-nLC Series Getting Started Guide*.

4. Install the wash bottle in position W4.

**IMPORTANT** For the autosampler to determine the appropriate depth for the needle, the wash bottle in position W4 must contain the needle wash insert.

5. Remove the left side panel so that you can watch the movement of the needle.

To calibrate the wash bottle and extra vial positions, go to “[Calibrating the Wash Bottle and Extra Vial Positions](#)” on page 241.

## Calibrating Plates

For information about selecting or creating a plate format, see “[Managing Plate Formats](#)” on page 231.

**IMPORTANT** When calibrating the XYZ robot for vial or microwell plates, make sure to remove the vial caps or plate covers. Keeping the caps or covers on, makes the needle susceptible to bending and breaking.

During a sample run, the *z*-axis needle holder moves to the specified sample position along the *xy*-plane. When the *z*-axis needle holder reaches the specified location, the needle descends along the *z*-axis into the sample vial or well.

Calibrating plates requires determining the *xyz* positions for the top left and bottom right vial or well. [Table 29](#) lists the top left and bottom right positions for the three plate formats.

**Table 29.** Top left and bottom right positions on the plate formats

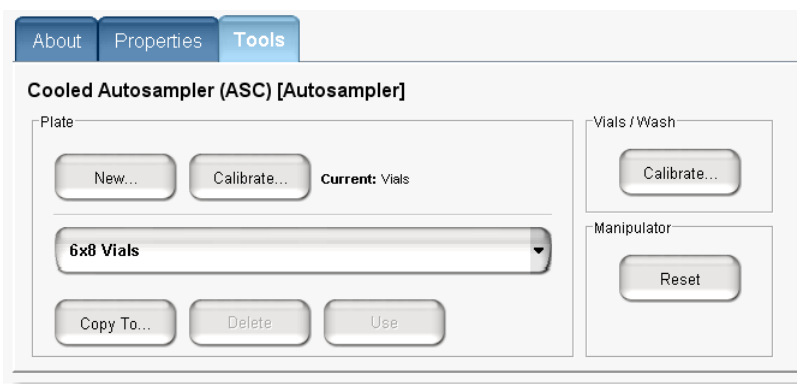
Plate format	Top left position	Bottom right position
6 × 8	A1	F8
8 × 12	A1	H12
16 × 24	A1	P24

❖ **To calibrate plates**

1. If you have not already done so, prepare the autosampler for the plate calibration routine (see “[To prepare the autosampler for the plate calibration routine](#)” on page 235).
2. Open the Autosampler Plate Calibration dialog box as follows:
  - a. Press **Maintenance > Devices**.
  - b. In the Devices list, select the autosampler.
  - c. Press the **Tools** tab.

The Tools view opens (see [Figure 174](#)).

**Figure 174.** Tools view for the autosampler

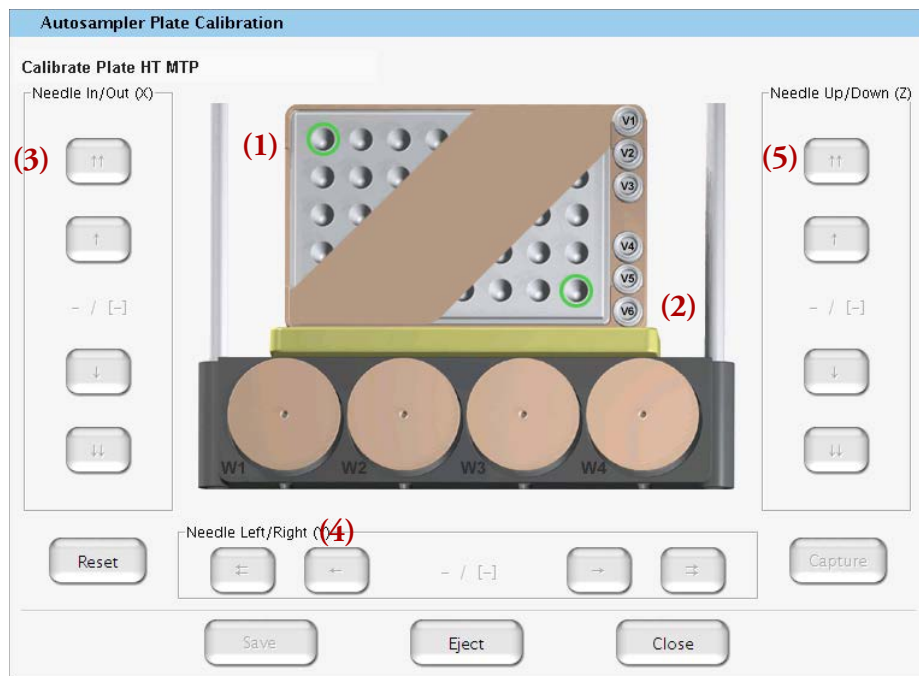


- d. In the Plate area of the Tools view for the autosampler, press **Calibrate** (see Figure 174 on page 237).

The Autosampler Plate Calibration dialog box opens.

Figure 175 shows the dialog box at the beginning of the plate calibration routine. The top left and bottom right positions are highlighted in green. The position readouts for the *xyz* axes are unpopulated, - / [-].

**Figure 175.** Plate view in the Autosampler Plate Calibration dialog box



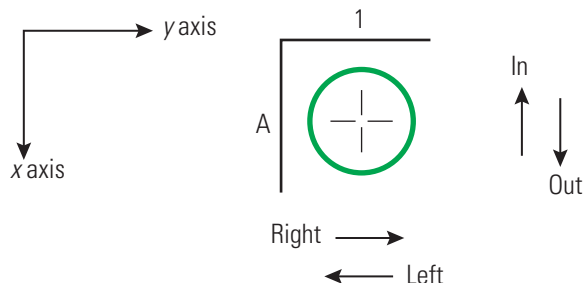
3. Press the green vial or well in the upper left corner of the plate view (1).

The needle moves to the current saved coordinate. The saved coordinates for the *x* and *y* axis appear on the left side of the slash, the needle does not descend into the vial or well, and the *z*-axis value on the left side of the slash remains at 0.

The values on the left side of the slash change as you adjust the needle position.

4. Center the needle above the vial or well as follows:

- Press the **Needle In/Out** (3) buttons to adjust the  $x$ -axis position.
- Press the **Needle Left/Right** (4) buttons to adjust the  $y$ -axis position.



5. Using the step buttons in the Needle Up/Down area (5), adjust the needle height as follows:

- Use the double step button until the needle reaches the bottom - indicated as the O-ring on the needle moves away from the PEEK nut.
- Use 2 double steps to lift the needle up.

**Tip** For the ASC autosampler, the O-ring at the top of the needle holder rises a little when the needle reaches the bottom of the vial or well (see [Figure 176](#)).

**Figure 176.** O-ring pushed slightly above the ASC needle holder



Observe when the O-ring moves up a bit, or gently hold needle tubing as you press the step button.

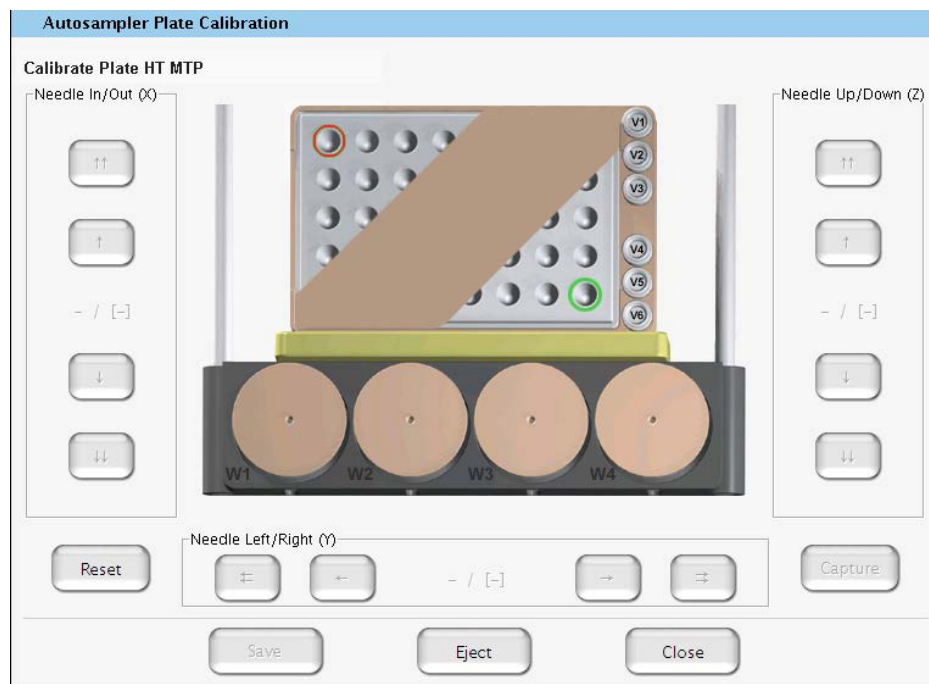
- Use single steps to move needle down and accurately reach the bottom.
- Use 2 single steps to move needle just off the bottom.

The appropriate needle height is two small step higher than the bottom of the vial or well. If a very small sample volume is used and everything needs to be aspirated, the appropriate needle height is one small step higher than the bottom of the vial or well.

6. When you are satisfied with the current  $xyz$ -coordinate for the vial or well, press **Capture**.

The color of the vial or well on the plate graphic changes from green to red and the position readouts for the  $xyz$  axes are unpopulated, - / [-] (see Figure 177).

**Figure 177.** Plate calibration captured for the A1 position



7. Press the green vial or well in the lower right corner of the plate view.  
The needle moves to the current saved coordinate. The saved coordinates for the  $x$  and  $y$  axis appear on the left side of the slash, the needle does not descend into the vial or well, and the  $z$ -axis value on the left side of the slash remains at 0.
8. Repeat step 4 through step 6 on that vial or well.
9. Press **Save** and then press **Close** to close the calibration dialog box.
10. Replace vial caps and plate covers as necessary.
11. Go to the next procedure to calibrate the W4 bottle position or reinstall the EASY-nLC instrument's left side panel.

**IMPORTANT** To maintain a stable temperature inside the tray compartment, the left side panel must be installed.

## Calibrating the Wash Bottle and Extra Vial Positions

In addition to holding the sample trays, the EASY-nLC tray compartment holds four wash bottles (W1–W4) and six extra vials (V1–V6).

❖ **To calibrate the W4 wash bottle position, the extra vial positions, or both**

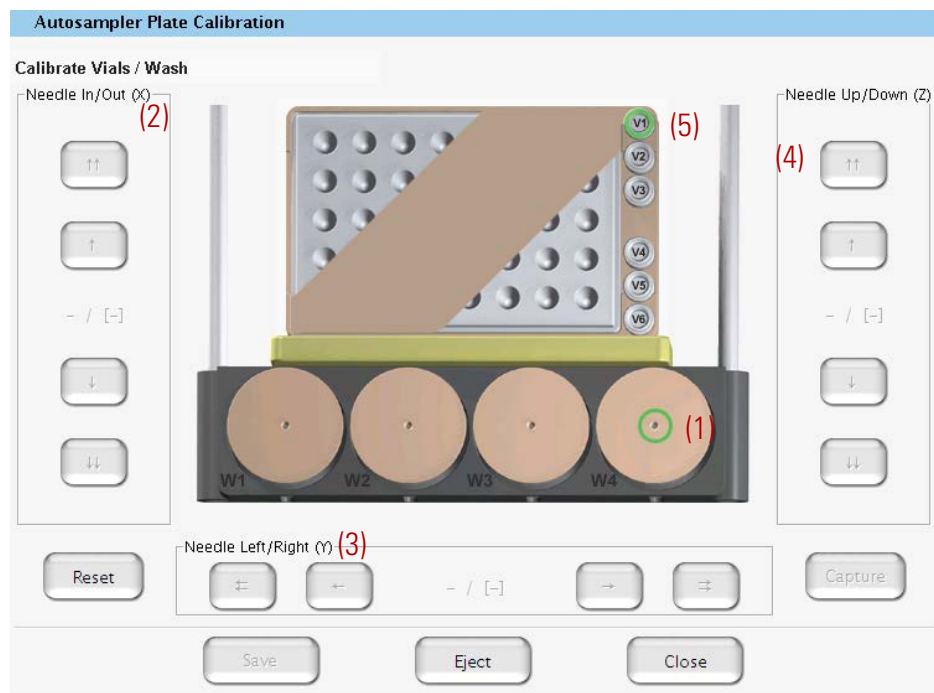
1. If you have not already done so, prepare the autosampler for the extra vial and wash bottle calibration as described in “[To prepare the autosampler for the V1 and W4 calibration routine](#)” on page 235.
2. Open the Autosampler Vials/Wash Calibration dialog box as follows:
  - a. Press **Maintenance > Devices**.
  - b. In the Devices list, select the autosampler.
  - c. Press the **Tools** tab below the Devices list.
  - d. In the Vials/Wash area, press **Calibrate**.

The Autosampler Vials/Wash Calibration dialog box opens (see [Figure 178](#)).

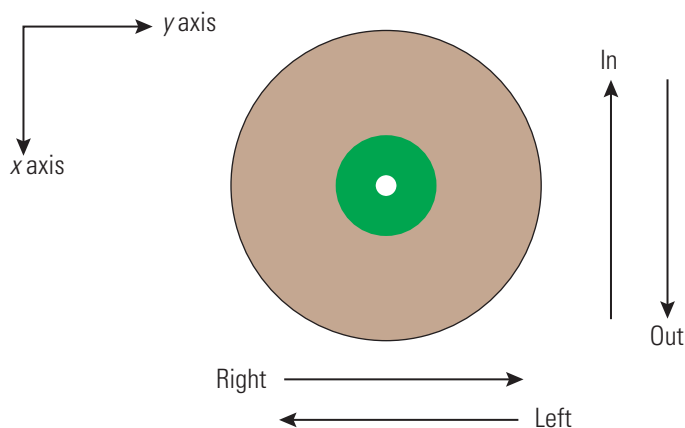
3. Press the bottle container in W4 (1) (see [Figure 178](#)).

The needle moves to the current saved coordinate. The saved coordinates for the  $x$  and  $y$  axis appear on the left side of the slash, the needle does not descend into the bottle, and the  $z$ -axis value on the left side of the slash remains at 0.

**Figure 178.** Vials/Wash view in the Autosampler Vials/Wash Calibration dialog box



4. Center the needle above the bottle as follows:
  - Press the **Needle In/Out** (2) buttons to adjust the  $x$ -axis position.
  - Press the **Needle Left/Right** (3) buttons to adjust the  $y$ -axis position.



5. Using the step buttons in the Needle Up/Down area (5), adjust the needle height as follows:
  - a. Use the double step button until the needle reaches the bottom - identified as the O ring moves.
  - b. Use 2 double steps to lift the needle up.

**Note** The O-ring at the top of the needle holder rises a little when the needle reaches the bottom of the well.

- c. Use single steps to move needle down and accurately reach the bottom.
    - d. Use 2 double steps and then 2 steps to move the needle up.
- Two large steps higher than the bottom of the wash bottle insert is the appropriate needle height.
6. Press **Capture** when you are satisfied with the current  $xyz$ -coordinate for position W4. The color of the bottle container number changes from green to red.
  7. (Optional) To calibrate the extra vial positions for the  $6 \times 8$  plate format, do the following:
    - a. Press **V1** vial (5) to select it.
    - b. Repeat [step 4](#) through [step 6](#) for vial V1.
  8. Press **Save** and then press **Close** to close the calibration dialog box.



# Remote Support

The EASY-nLC instrument includes a remote support feature that enables Thermo Fisher Scientific Technical Support to diagnose and troubleshoot your EASY-nLC system remotely while the instrument is connected to the support server. When you connect the instrument to the remote server, you can also install the latest firmware file for the touch-screen application.

Technical Support cannot initiate the communication link between your EASY-nLC instrument and the support server. You must initiate this communication link from your EASY-nLC instrument.

To connect the EASY-nLC instrument to the support server or download system files to a removable storage device, follow these procedures.

## Contents

- [Connecting the EASY-nLC Instrument to the Support Server](#)
- [Saving System Files on a USB Removable Storage Device](#)
- [Downloading the Latest Firmware File](#)

# Connecting the EASY-nLC Instrument to the Support Server

Use this procedure to establish a communication link between the EASY-nLC instrument's computer and the support server.

**IMPORTANT** To establish communication with the support server, you must first connect the EASY-nLC instrument directly to your local network, and then open the communication link for remote support through the touch-screen application. Thermo Fisher Scientific Technical Support cannot initiate this communication link.

The EASY-nLC instrument uses Secure Shell (SSH™), a network protocol for secure data communication, to connect to the support server, which uses the Linux™ operating system.

To use the remote support feature, the firewalls for your local network must allow outgoing TCP/IP traffic from the EASY-nLC system to the support server at IP address 46.226.219.10, port 22.

When you establish the communication link with the support server, the support server triggers the file compression utility on the EASY-nLC instrument to build a zip file with the appropriate log files, and then retrieves the zip file from the EASY-nLC instrument. Meanwhile, the EASY-nLC instrument sends an email with your supplied message and contact information to Thermo Fisher Scientific Technical Support.

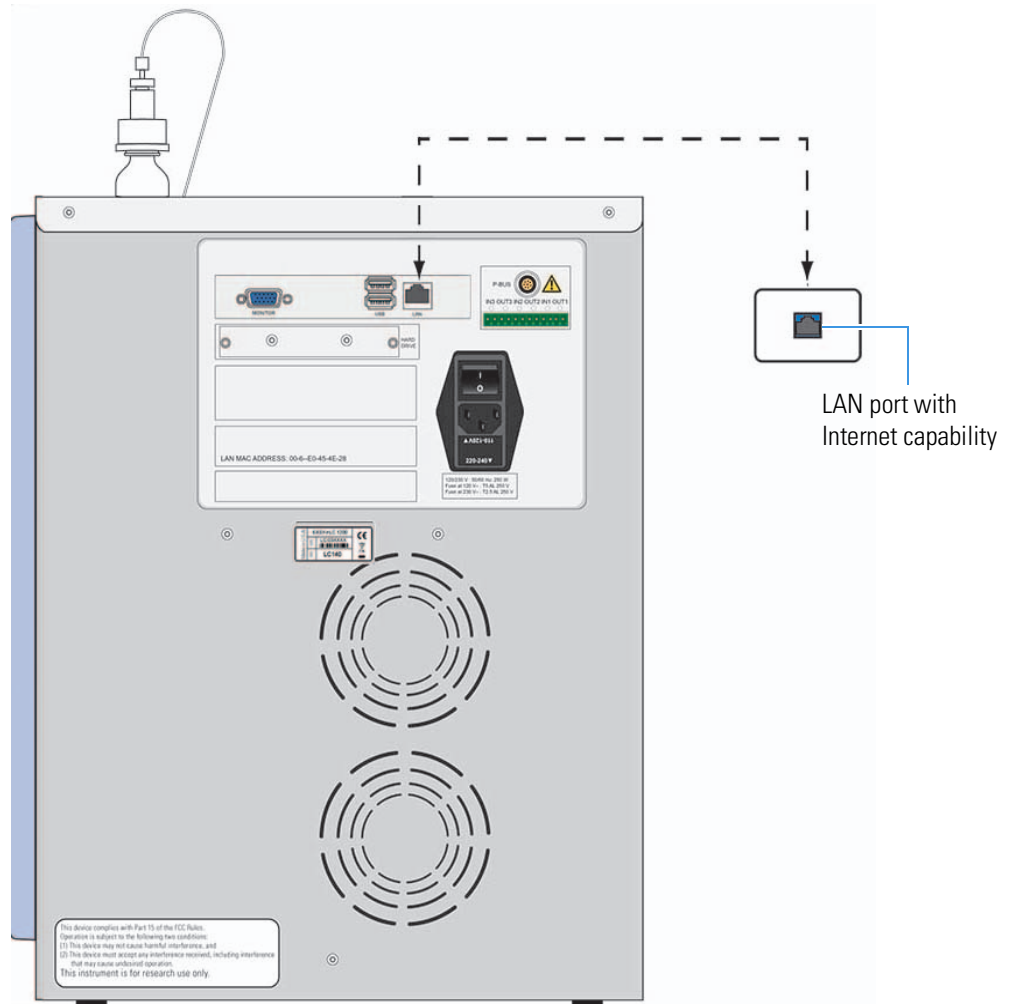
After you send a message through the remote support feature, a member of the Thermo Fisher Scientific Technical Support team will contact you.

### ❖ To open a communication link between the EASY-nLC system and the support server

1. Using a shielded Ethernet cable, connect the LAN port on the back panel of the EASY-nLC system (see [Figure 179](#)) directly to a laboratory LAN port that provides access to the Internet.

To use the remote support feature, the firewalls for your local network must allow outgoing TCP/IP traffic from the EASY-nLC system to the support server at IP address 46.226.219.10, port 22.

Figure 179. Ethernet connection between the EASY-nLC system and the laboratory LAN port



## 9 Remote Support

Connecting the EASY-nLC Instrument to the Support Server

2. If you have not already set up the support server configuration, set it up as follows:

a. Press **Configuration > Network**.

The Network page of the Configuration menu opens (Figure 180).

**Figure 180.** Network page of the Configuration menu with a fixed IP address for the MS LAN

The screenshot displays the Thermo Scientific Configuration menu. The 'Configuration' tab is selected, and the 'Network' sub-tab is active. The LAN configuration is set to 'MS LAN' with a 'Fixed' configuration. The IP address is 172.16.0.103, and the subnet is 255.255.0.0. The gateway is 0.0.0.0, and the DNS is 0.0.0.0. The name is LC140, and the domain is empty. The Support server IP is 46.226.219.10, with a 'Default IP' button. The page includes a sidebar menu with options like Users, Connections, Network, Time, and Data. There is also a section for 'Flow sensor calibration due' and 'Solvents Refreshed' with a job timer set to 00:00:00. The date and time are 29 Jul 2015 10:38, and the user is admin. An 'Exit...' button is at the bottom left.

b. In the LAN area, do the following:

- Select **Internet** in the Profile list. Contact your local IT administrator for assistance.
- Press **Apply**.

c. In the Support Server area, do the following:

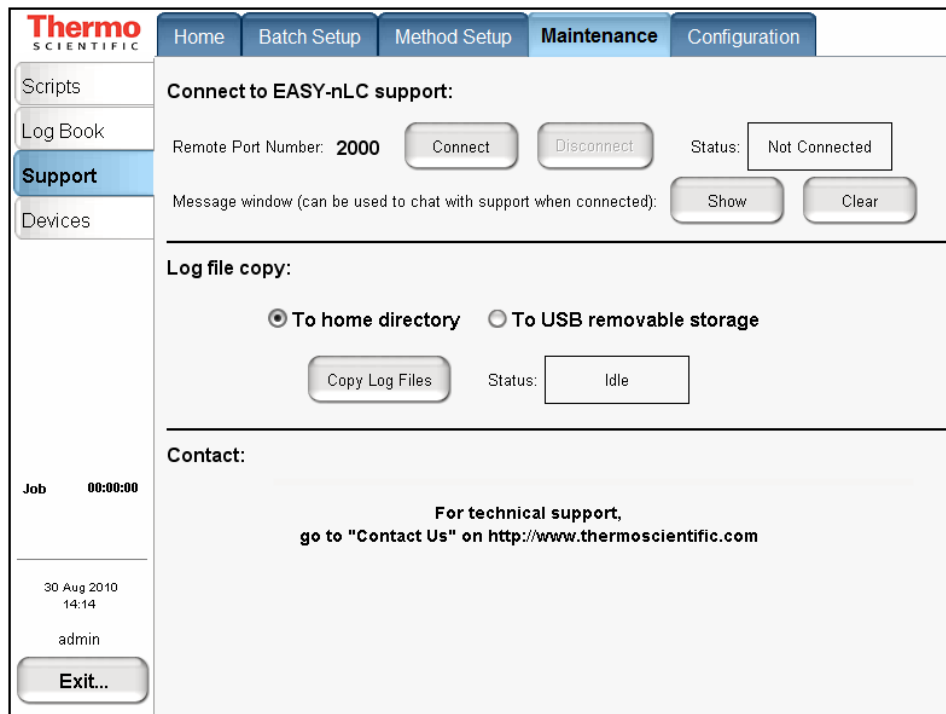
- Confirm the following IP address: 46.226.219.10.
- Press **Apply**.

3. Send a support request message and a zip file containing the appropriate log files to Technical Support as follows:

a. Press **Maintenance > Support**.

The Support page of the Maintenance menu appears (see [Figure 181](#)).

**Figure 181.** Support page of the Maintenance menu



b. In the Connect to EASY-nLC Support area, press **Connect**.

Depending on whether the instrument has the latest firmware file installed, one of these dialog boxes appears:

- If the instrument has the latest firmware file installed, the Message to Support Team dialog box appears (see [Figure 182](#)).
- If the instrument does not have the latest firmware file installed, the Upgrade is Available dialog box appears (see [Figure 185](#) on [page 252](#)).

c. If the Upgrade is Available dialog box appears, do one of the following:

- Upgrade the firmware as described in “[Downloading the Latest Firmware File](#)” on [page 252](#).

–or–

- Click **Skip**.

The Message to Support Team dialog box appears.

## 9 Remote Support

Connecting the EASY-nLC Instrument to the Support Server

- d. Select a support region, provide valid contact information, and describe the problem that you are experiencing.

**Figure 182.** Message to Support Team dialog box



The dialog box is titled "Message to support team". It features a dropdown menu for "Support region:", text input fields for "Name:", "Email address:", and "Phone number:", and a larger text area for "Enter message:". At the bottom, there are two buttons: "Accept" and "Cancel".

**Note** When you place the cursor in the Phone Number box, the program prompts you for a country code and phone number.

**Tip** When you place the cursor in the Email Address box, the program prompts you to enter an address in this format: *name@company.com*.

To enter the @ symbol, press **Shift**. The numbers row changes to the symbols row. Then press @.

- e. Press **Accept**.

After you enter the requested information, the Status box on the right side of the Support page should change from Not Connected to Connected.



The status box displays "Status: Connected!".

- f. Depending on the connection status, do one of the following:
- If the status changes from Not Connected to Connected, go to [step 3g](#).
  - If the connection fails, see the next procedure, “[To troubleshoot a failed connection to the support server.](#)”

When the connection fails, the SSH Connection Error dialog box might appear with this message, “Not able to determine connection status. See message.log for details.”

The message.log file is in the <user-account>\systemLog folder on the EASY-nLC system. For information about accessing the admin folder from another computer on your local network, refer to the *EASY-nLC Series Getting Started Guide*.

While the message.log file might provide useful information to a member of Thermo Scientific Technical Support, users should follow the suggested troubleshooting procedure, “[To troubleshoot a failed connection to the support server.](#)”

- g. After the status changes to Connected, allow enough time for the EASY-nLC system to create the zip file in the admin folder and for the support server to retrieve the zip file. Then go to [step 4](#).

After you send a message with the appropriate contact information through the remote support feature, a member of the Thermo Fisher Scientific Technical Support team will contact you.

4. To close the communication link, press **Disconnect**.
5. To return the system to normal operation, do the following:
- a. Reconnect the Ethernet cables as appropriate.  
For information about connecting the EASY-nLC system to a data system computer, refer to the *EASY-nLC Series Getting Started Guide*.
  - b. In the LAN area of the Configuration > Network page, do the following:
    - i. Select **MS LAN** in the Profile list.
    - ii. Press **Apply**.

❖ **To troubleshoot a failed connection to the support server**

1. Check the support server configuration (see [step 2](#) on [page 246](#)).
2. Verify that the Ethernet cable is securely connected to both the LAN port on the back panel of the EASY-nLC system and the laboratory LAN port.
3. Verify that the Ethernet cable is working.
4. Ask your IT administrator if the network firewalls allow outgoing traffic to port 22 through an SSH connection.

## Saving System Files on a USB Removable Storage Device

The EASY-nLC system includes network capability. Through the network you can back up your system, export and import batches and methods, analyze your system by examining the log files, and perform many other tasks. However, when you are not connected to the network or the network is broken, or you do not have a computer with network access that is near the EASY-nLC system, you can use the copy function to copy all the system files on the system to a USB removable storage device, such as a USB flash drive or memory stick.

The EASY-nLC system ships with a USB flash drive for your convenience. But you can use any USB storage device formatted with the file system FAT/FAT16 and at least 128 MB of free space.

### ❖ To copy system files to a USB storage device

1. Press **Maintenance > Support**.

The Support page of the Maintenance menu opens (see [Figure 181](#) on [page 247](#)).

2. Insert the USB storage device into the connector panel on the back of the EASY-nLC instrument. Choose between one of two USB ports on the upper left side of the panel (see [Figure 183](#)).

**Figure 183.** USB port location on the back panel of the EASY-nLC instrument



3. In the Log File Copy area, select the **To USB Removable Storage** option.

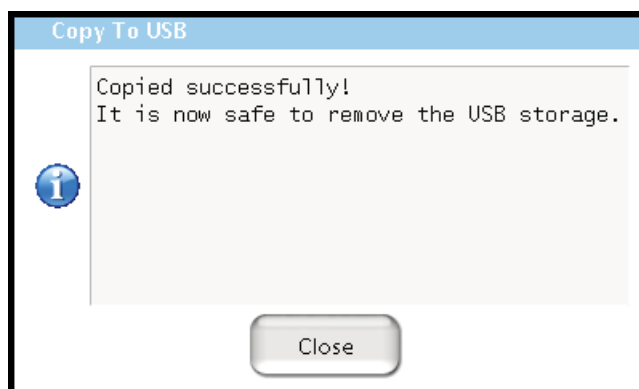
**Note** When you select the To Home Directory option, the EASY-nLC system creates zip files in the admin folder.

For information about accessing the admin folder from another computer on your local network, refer to the *EASY-nLC 1200 Getting Started Guide*.



4. Press **Copy Log Files**.

When the copying is finished, the following confirmation appears.

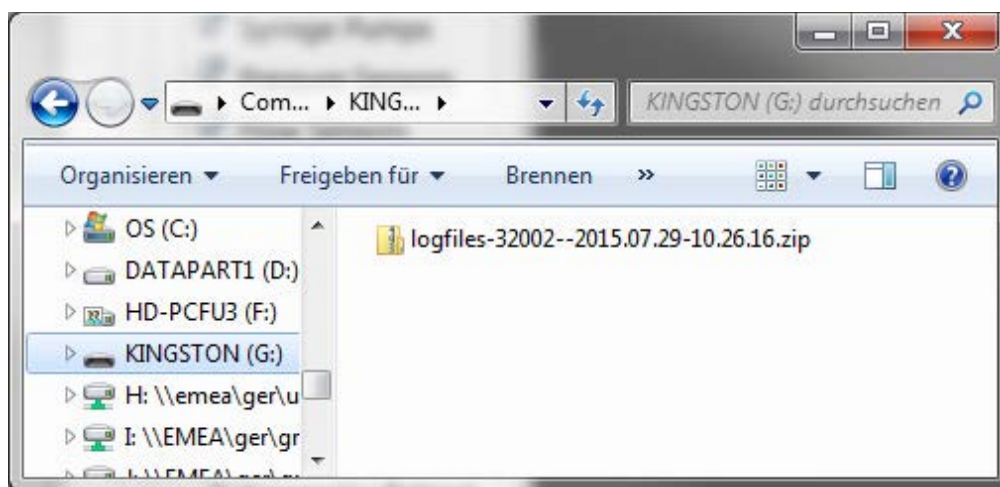


5. Press **Close** and remove the USB storage device from the connector panel.

6. Insert the USB storage device into your computer.

A zipped file will appear on the USB storage device (see [Figure 184](#)).

**Figure 184.** Files on the USB memory stick



The zipped file contains the following information:

- A batch log and one folder for each batch that admin users have run with information on samples, methods, and EASY-nLC device performance.
- A batch log and one folder for each batch that guest users have run with information on samples, methods, and EASY-nLC device performance.

- System configuration files.
- System log files with information on overall system performance.
- One folder for each maintenance script you have run with information on EASY-nLC device performance.

If you have problems with your system, forward the files to Thermo Fisher Scientific Technical Support for assistance.

**Note** Log files do not contain analytic data, only EASY-nLC instrument data.

## Downloading the Latest Firmware File

If the EASY-nLC instrument does not have the latest version of the touch-screen application, connect the instrument to the remote server and install the appropriate firmware files as described in the following procedure.

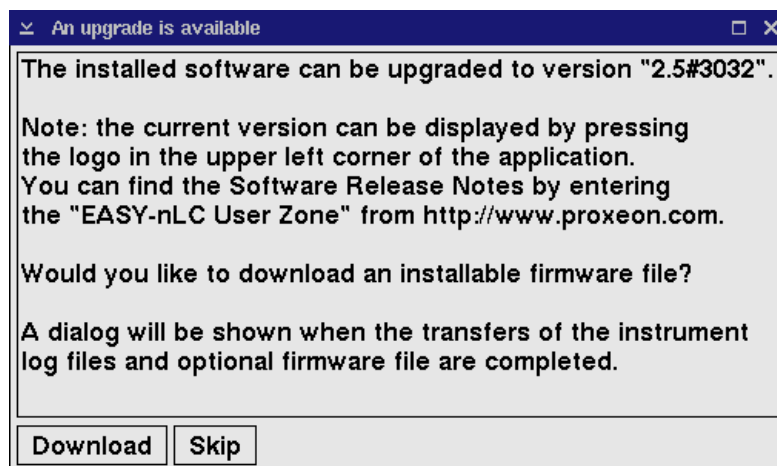
### ❖ To install the latest firmware file

1. If the instrument is not already connected to the remote server, connect the instrument as follows:
  - a. From the touch screen, press **Maintenance > Support**.  
The Support page of the Maintenance menu appears.
  - b. In the Connect to EASY-nLC Support area, press **Connect**.

If the EASY-nLC instrument does not have the latest version of the touch-screen application, the Upgrade is Available dialog box appears.

Figure 185 shows the message for an instrument with firmware version 2.4.

**Figure 185.** Firmware upgrade message

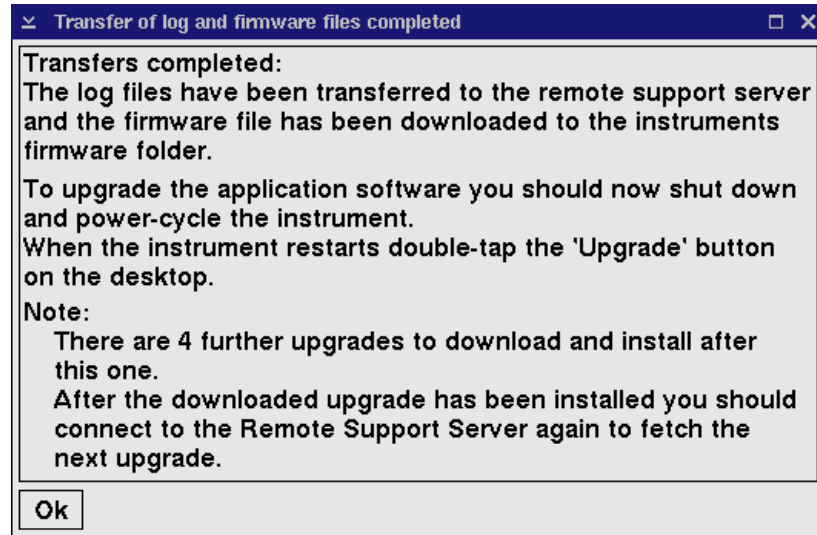


2. Click **Download**.

When the file transfer is complete, the Transfer of Log and Firmware Files Completed dialog box appears.

Figure 186 shows the transfer information for an instrument with firmware version 2.4.

**Figure 186.** Information for upgrading from a previous version



3. Click **OK**.
4. To begin the firmware upgrade, do the following:
  - a. Press **Exit** in the lower left corner of the touch screen.

A confirmation dialog box opens (see [Figure 19](#) on [page 22](#)).
  - b. Press **Power Down**.

The EASY-nLC application displays a white screen with a small progress bar. When the progress bar is completely filled, a message appears indicating you can safely turn off the instrument.
  - c. Turn off the instrument, and then turn it back on.
  - d. When the Upgrade button appears, double-tap it.
5. If the complete upgrade requires more firmware files, reconnect to the server and install the upgrade files as described in [step 1](#) through [step 4](#) of this procedure.

## 9 Remote Support

Downloading the Latest Firmware File

## Returning the EASY-nLC Instrument

If it is necessary to return the EASY-nLC instrument to the factory, follow the instructions in this chapter.

### Contents

- [Transport Instructions](#)

## Transport Instructions

Before packaging the instrument for transport, purge pump A, B and S with UHPLC/MS-grade methanol. Take care to remove all solvents from the instrument by running the last purge iteration on air.

### ❖ To prepare the instrument for transport

1. Press **Home > Overview**.
2. Press **Eject/Insert Tray**.
3. Remove the plates/tubes.
4. Remove the waste beaker and the wash/waste bottles.
5. Press **Eject/Insert Tray**.
6. Close down the system (see [“Closing Down the EASY-nLC Instrument”](#) on page 22).
7. Remove the cables on the back side.
8. Fill out the Declaration of Contamination.
9. Place the EASY-nLC instrument in the original shipping container.

## **10** Returning the EASY-nLC Instrument

Transport Instructions

## Error Codes

Table 30 lists the possible error codes that might appear.

**Table 30.** Error codes (Sheet 1 of 8)

No.	Issue code name	Description	Cause	Solution
1	ERROR_IO_CLOSING_FILE	Failed closing log file	File system error	Internal filesystem error - Replace the hard drive.
2	ERROR_IO_WRITING_TO_FILE	IOException	I/O error	Internal filesystem error - Replace the hard drive.
3	ERROR_IO_NO_FILE_OPEN	Log was closed trying to log the following message:	Filesystem error	Internal filesystem error - Replace the hard drive.
4	ERROR_IO_CREATE_FILE	Failed creating log file 'LOG_FILE_NAME'	I/O error	Internal filesystem error - Replace the hard drive.
5	ERROR_IO_CREATE_FOLDER	Failed creating log folder 'LOG_FOLDER_NAME'	I/O error	Internal filesystem error - Replace the hard drive.
6	ERROR_IO_FILE_EXISTS	Failed creating log 'LOG_FILE_NAME AND_PATH' (file already exists)	Filesystem error	Internal filesystem error - Replace the hard drive.
7	ERROR_IO_FILE_CANNOT_WRITE	Failed creating log 'LOG_FILE_NAME AND_PATH' (file not writable)	Filesystem error	Internal filesystem error - Replace the hard drive.
8	ERROR_BATCH_BEING_EDITED	It appears the current batch is being edited, please close or reschedule it.	[See issue description.]	Close or reschedule the batch.
9	ERROR_DEVICE_ACCESS_FAILED	Failed accessing device DEVICE_ID	Missing the hardware component driver	Add the device to the list on the Maintenance > Devices page.

**Table 30.** Error codes (Sheet 2 of 8)

No.	Issue code name	Description	Cause	Solution
10	ERROR_PREP_ GRADIENT_ PRESSURE_BUILD_ FAILED	Pump B unable to reach 90% A pressure within 30 $\mu$ L. Please check for air/leaks!	Pump unable to reach set pressure during prep gradient	Check that solvent bottle is not empty and check for air and leaks in the system.
11	ERROR_PUMP_ STOPPED_EMPTY	Stopped (out of solvent).	Out of solvent	Refill the solvent reservoir bottle. Check for air and leaks in the system.
12	ERROR_PUMP_ STOPPED_ UNEXPECTEDLY	Stopped unexpectedly (unknown cause).	Pump hardware issue	Check the pump functionality.
26	ERROR_QUEUE_ ELEMENT_BEING_ EDITED	Current queue element is being edited; stopping.	Trying to execute a job currently being edited	Close or reschedule the batch.
27	ERROR_PBUS_IN_ SERVICE_MODE	P-BUS interface in service mode	Trying to initialize the RS485 interface while serial port is in the service mode	Check that the RS485 switch on PC is in the ON position.
28	ERROR_PBUS_ INTERFACE_INIT	Initialization of P-BUS interface failed	[See issue description.]	Troubleshoot P-BUS communication - Check that the cables are properly connected.
29	ERROR_PBUS_ SEND_BYTES	Error writing to interface COMM_PORT	[See issue description.]	Troubleshoot P-BUS communication - Check that the cables are properly connected.
30	ERROR_PBUS_ READ_BYTES	Error reading from interface COMM_PORT	[See issue description.]	Troubleshoot P-BUS communication - Check that the cables are properly connected.
31	ERROR_SENSIRION_ FACTOR_PARSING	Failed parsing flow sensor factor from INFO_COMMAND	Could not parse some string to a double.	Turn off the EASY-nLC instrument, and turn it back on.
32	ERROR_SENSIRION_ FACTOR_NOT_ FOUND	Flow sensor factor not found in info output. Factor unknown.	Error getting flow sensor scaling factor	Turn off the EASY-nLC instrument, and turn it back on.



**Table 30.** Error codes (Sheet 3 of 8)

No.	Issue code name	Description	Cause	Solution
33	ERROR_SENSIRION_INIT	Port COM_PORT does not support reading/Error getting input stream from flow sensor port COM_PORT.	Error getting input from flow sensor	Turn off the EASY-nLC instrument, and turn it back on.
34	ERROR_SENSIRION_NO_DATA	No data received from flow sensor for <i>X</i> seconds	[See issue description.]	Turn off the EASY-nLC instrument, and turn it back on. Check the flow sensor functionality.
35	ERROR_SENSIRION_IN_MEASURE_MODE	Flow sensor in measurement mode. Stop measurements before sending further commands.	Trying to start a flow sensor that is already started	Turn off the EASY-nLC instrument, and turn it back on.
36	ERROR_SENSIRION_IO	IO Error while communicating with flow sensor	[See issue description.]	Check the flow sensor communication/cable.
37	ERROR_SENSIRION_TIMEOUT	No response from flow sensor (timeout)	[See issue description.]	Turn off the EASY-nLC instrument, and turn it back on. If the problem persists, replace the flow sensor.  See <a href="#">“Replacing a Flow Sensor”</a> on page 92.
38	ERROR_SENSIRION_ECHO_MISMATCH	Flow sensor echo "ECHO" does not match command "COMMAND".	Flow sensor fails to "talk back."	Rare error - Connect the EASY-nLC system to remote support.  See <a href="#">“Connecting the EASY-nLC Instrument to the Support Server”</a> on page 244.
39	ERROR_SENSIRION_BAD_RESPONSE	Flow sensor error: ERROR_MESSAGE/Flow sensor did not respond with OK, but did not report an error either	Flow sensor failing, but does not report it	Rare error - Connect the EASY-nLC system to remote support.

**Table 30.** Error codes (Sheet 4 of 8)

No.	Issue code name	Description	Cause	Solution
40	ERROR_SENSIRION_IN_IDLE_MODE	Cannot calibrate sensor in idle mode.	Flow sensor in idle mode during calibration	Turn off the EASY-nLC instrument, and turn it back on. Check the flow sensor functionality.
41	ERROR_SENSIRION_CALIBRATION	Cannot store flows larger than 9999 nL/min.	Abnormal value trying to be written to the flow sensor	Turn off the EASY-nLC instrument, and turn it back on. Check flow sensor functionality.
42	ERROR_RS232_INIT	Initialization of interface "PORT_NAME" failed	Access to interface failed	Turn off the EASY-nLC instrument, and turn it back on.
54	ERROR_RS485_COMMAND_VERIFY	COMPONENT_ID COMMAND failed: ERROR_MESSAGE	Error occurred when sending COMMAND.	Troubleshoot P-BUS communication/hardware.
55	ERROR_MANIPULATOR_UNKNOWN_RACK_SHELF	Unknown rack shelf RACK_SHELF_VALUE	Unknown rack shelf position supplied to driver	Verify that the sample position is correct.
56	ERROR_MANIPULATOR_UNKNOWN_RACK_POS_ID	Unknown rack position id RACK_POSITION_ID_VALUE	Could not move to bad rack position.	Verify that the sample position is correct.
57	ERROR_MANIPULATOR_SET_GRID_CONFIG L	Grid configuration change failed (AUTOSAMPLER_RETURN_CODE)	Error uploading autosampler plate calibration (0 = asrOK, 1 = asrBusy, 2 = asrBadLocation, 3 = asrBadCoordinate, 4 = asrEjected, 5 = asrAxisError, 6 = asrChecksumError)	Calibrated position not recognized by the touch-screen application. See <a href="#">Chapter 8, "Calibrating the Autosampler's XYZ Robot."</a>
58	ERROR_MANIPULATOR_SET_WASH_CONFIG	Wash configuration change failed (AUTOSAMPLER_RETURN_CODE)	Error while saving autosampler wash calibration (see code 57 for asr codes)	Calibrated position not recognized by the touch-screen application. See <a href="#">Chapter 8, "Calibrating the Autosampler's XYZ Robot."</a>

**Table 30.** Error codes (Sheet 5 of 8)

No.	Issue code name	Description	Cause	Solution
59	ERROR_ MANIPULATOR_SET_ VIAL_CONFIG	Vial configuration change failed (AUTOSAMPLER_RETURN_CODE)	Error while saving autosampler vial calibration (see code 57 for asr codes)	Calibrated position not recognized by the touch-screen application. See <a href="#">Chapter 8, “Calibrating the Autosampler’s XYZ Robot.”</a>
60	ERROR_ MANIPULATOR_TRAY_ _EJECT	tray eject failed (AUTOSAMPLER_RETURN_CODE)	See code 57 for asr codes.	Verify that the correct plate is configured in the EASY-nLC touch-screen application and the EASY-nLC Configuration dialog box (Foundation Instrument Configuration). Check that no objects in the tray compartment are obstructing the XYZ robot movement. Reset manipulator and run the Torque script for the ASC model autosampler.
61	ERROR_ MANIPULATOR_TRAY_ _LOAD	tray load failed (AUTOSAMPLER_RETURN_CODE)	See code 57 for asr codes.	(See above.)
62	ERROR_ MANIPULATOR_GRID_ _ADDRESS	grid address failed (AUTOSAMPLER_RETURN_CODE)	Could not move to sample position (see code 57 for asr codes).	(See above.)
63	ERROR_ MANIPULATOR_ WASH_ADDRESS	wash address failed (AUTOSAMPLER_RETURN_CODE)	Could not move to wash position (see code 57 for asr codes).	(See above.)
64	ERROR_ MANIPULATOR_VIAL_ ADDRESS	vial address failed (AUTOSAMPLER_RETURN_CODE)	Could not move to vial position (see code 57 for asr codes).	(See above.)
65	ERROR_ MANIPULATOR_ NEEDLE_DOWN	needle down failed (AUTOSAMPLER_RETURN_CODE)	Could not move needle down (see code 57 for asr codes).	(See above.)
66	ERROR_ MANIPULATOR_ NEEDLE_UP	needle up failed (AUTOSAMPLER_RETURN_CODE)	Could not move needle up (see code 57 for asr codes).	(See above.)

**Table 30.** Error codes (Sheet 6 of 8)

No.	Issue code name	Description	Cause	Solution
69	ERROR_VALVE_SET_POSITION	COMPONENT_ID setPosition failed: Unrecognized position POSITION/	Valve unable to switch position	Clean the rotor seal and the stator. Replace the rotor seal if necessary.  If the problem persists, please contact product support.
70	ERROR_PARALLEL_PORT_WRITE		Contact closure port IO error	Contact Thermo Fisher Scientific.
71	ERROR_PARALLEL_PORT_NOT_INITIALIZED		Contact closure port IO error	Contact Thermo Fisher Scientific.
72	ERROR_PARALLEL_PORT_MASS_SPEC_BUSY		Contact closure port IO error	Contact Thermo Fisher Scientific.
73	ERROR_PARALLEL_PORT_MASS_SPEC_TIMEOUT		Contact closure port IO error	Contact Thermo Fisher Scientific.
74	ERROR_PARALLEL_PORT_INIT		Contact closure port IO error	Contact Thermo Fisher Scientific.
75	ERROR_PARALLEL_PORT_WRONG_PORT		Contact closure port IO error	Contact Thermo Fisher Scientific.
77	ERROR_DEVICE_LOW_24_VOLT_SUPPLY	DEVICE: Low voltage (VALUE V)	[See issue description.]	Faulty 24V supply. Connect to remote support.
78	ERROR_MANIPULATOR_INIT	DEVICE: Init failed (not ready within 1 minute)	[See issue description.]	Autosampler hardware issue. Turn off the EASY-nLC instrument, and turn it back on. If the problem persists, check the P-bus cables to the autosampler.
79	ERROR_DEVICE_SELF_TEST	DEVICE: Status bit(s) set after self test: 0xBITS_IN_HEX	Error returned from hardware component firmware	Connect the system to the remote support server (see <a href="#">Chapter 9</a> ).
80	ERROR_DEVICE_IN_BOOT_MODE	DEVICE: Device in boot mode after device reset	Error returned from hardware component firmware because a PCB is damaged	Contact Thermo Fisher Scientific.

Table 30. Error codes (Sheet 7 of 8)

No.	Issue code name	Description	Cause	Solution
81	ERROR_PELTIER_SPURIOUS_TEMPERATURE	DEVICE: Spurious temperature (TEMPERATURE_IN_DEGREES_CELSIUS)	Cooler sensor defective	Replace the cooler.  See <a href="#">“Replacing the Autosampler Cooler”</a> on page 115.
82	ERROR_DEVICE_LOW_CURRENT	DEVICE: Low current consumption (CURRENT_VALUE A)	Peltier element defective	Replace the cooler.
84	ERROR_APPLICATION_STATE	HISTORY_TRACE	Application state empty or illegal	Turn off the EASY-nLC instrument, and turn it back on.
85	IC_STATUS_FLAG_WARNING		Monitor reported flag(s) raised (log file only).	Follow the error message instructions.
86	IC_STATUS_FLAG_SEVERE		Monitor reported flag(s) raised (in user interface, current run stopped).	Follow the error message instructions.
87	IC_LC_CONDITION_UNSATISFIED	Waiting for some condition during run unsuccessful	Failed reaching a specific flow, pressure, etc. within a specified volume/period of time	Troubleshoot the LC system for leaks and air.  See <a href="#">“Troubleshooting the Results of the System Leak Test”</a> on page 183.
88	IC_STATUS_FLAG_ERROR		Monitor reported flag(s) raised (in user interface).	Follow the error message instructions.
90	IC_DEVICE_UNSUPPORTED_OPERATION		A device type operation was attempted on a device instance that does not support it.	Contact Thermo Fisher Scientific.
92	IC_BUSINESSLOGIC_REFILL_DURING_GRADIENT	Gradient interrupted by pump refill warning	Pump solvent volume too small for next gradient step	No action is necessary. This is just a warning that the pumps were refilled during gradient processing.
93	IC_SCRIPT_AUTO_ABORT	Maintenance script self-abort	Probably because a pump ran out of solvent while building/maintaining pressure	Check for air and leaks in the subsystem. See <a href="#">“Troubleshooting the Results of the System Leak Test”</a> on page 183.

**Table 30.** Error codes (Sheet 8 of 8)

<b>No.</b>	<b>Issue code name</b>	<b>Description</b>	<b>Cause</b>	<b>Solution</b>
110	IC_MISSING_EXECUTION_PREREQUISITE	Script or sample run couldn't be started.	See explanation of error message.	See explanation of error message.
112	IC_DEVICEUSAGECATEGORYCONTROL_ABORTED_JOB	Sample run was aborted due to an external device error (e.g. EasySpray)	See explanation of error message.	See explanation of error message.

## Mobile Phase Viscosity

Table 31 lists the viscosities for two-solvent mobile phases consisting of a water/methanol mixture or a water/acetonitrile mixture.

**Table 31.** Mobile-phase viscosity at 25 °C for reversed-phase gradients

Mobile phase (%v organic/water)	$\eta_{25}$ (cP)	
	Methanol	Acetonitrile
0	0.89	0.89
10	1.18	1.01
20	1.40	0.98
30	1.56	0.98
40	1.62	0.89
50	1.62	0.82
60	1.54	0.72
70	1.36	0.59
80	1.12	0.52
90	0.84	0.46
100	0.56	0.35

Reference: Herman, D. P.; Billiet, A. H.; de Galan, L. *J. of Chromatogr.*, **1989**, 1, 463.





## Consumables and Replacement Parts

To order consumables and replacement parts for the EASY-nLC system, see the ordering information and solvent system schematics in this appendix.

### Contents

- [Ordering Information](#)
- [Solvent System Schematic for the EASY-nLC 1200 Instrument](#)
- [Common Replacement Parts](#)

## Ordering Information

To obtain ordering information for the EASY-nLC instrument's spare parts and accessories, go to the following website:

<https://www.thermofisher.com/order/catalog/product/LC140>

These EASY-nLC parts are consumable parts and not covered by the normal first year Limited Warranty offered by Thermo Fisher Scientific, or any other service contract agreement containing extended warranty coverage.

- All bottles and lids
- All flow lines including Tee-pieces and fittings (nuts, ferrules, sleeves, and valve stops)
- All sample vials, microtiter plates, and associated lids and mats
- Solvent filters and all associated filter holders
- Pump piston seals
- Autosampler needle
- Check valves
- Columns
- Fuses

## Solvent System Schematic for the EASY-nLC 1200 Instrument

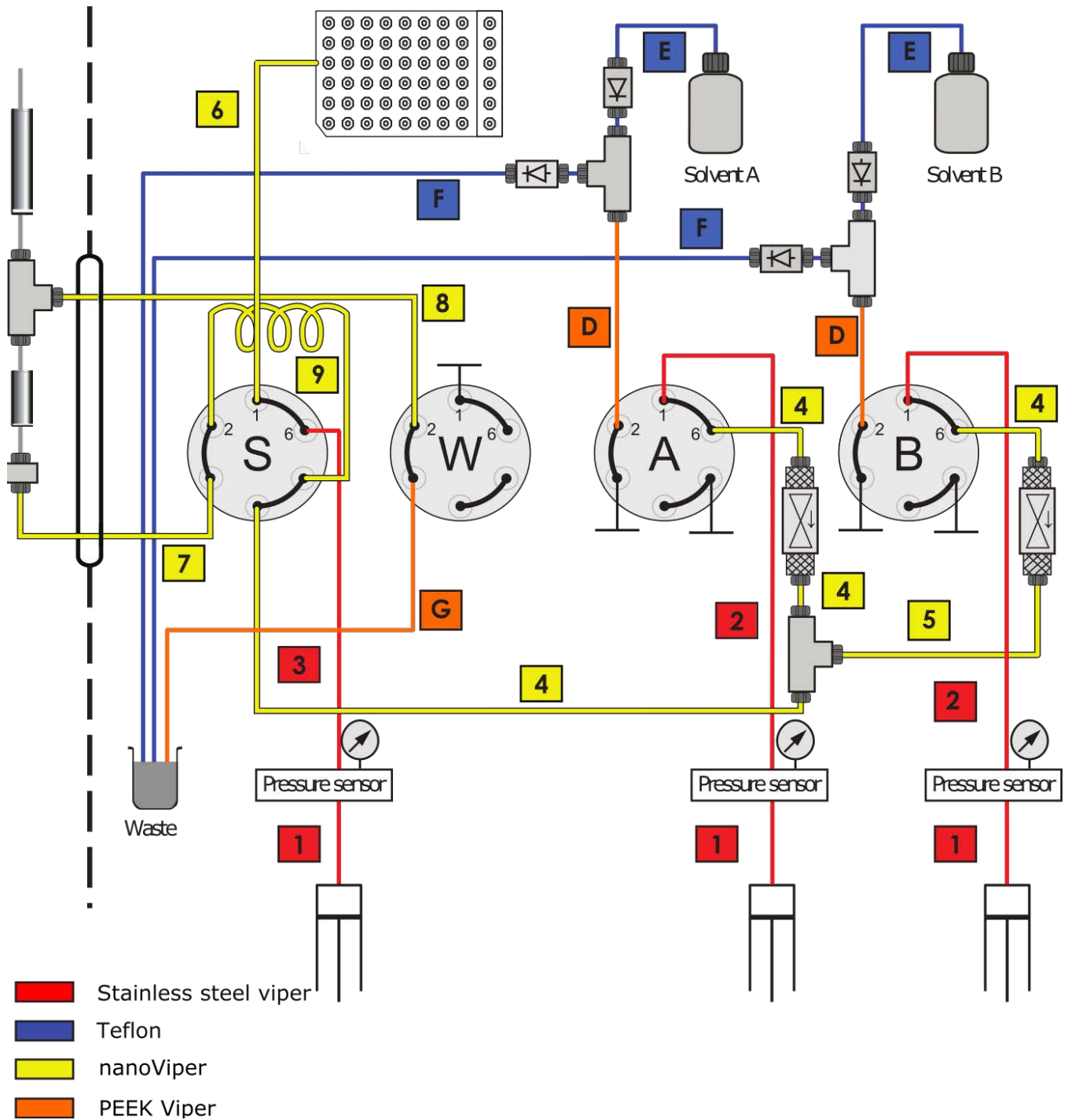
The pump and valve compartment behind the right panel of the EASY-nLC instrument contains all the flow lines between the components. In addition to pumps and valves, the solvent delivery and waste system includes several filters and four check valves. The two check valves on each solvent line ensure that solvent is drawn from the solvent bottles and ejected to waste without switching valve positions.

Table 32 lists the tubing requirements and identifies the tubing components shown in Figure 187. The Low-Pressure Solvent Line Kit (P/N LC593) contains the Tees, check valves, and low-pressure solvent lines to connect one pump (A or B) to the waste system and to its corresponding solvent bottle and six-port rotary valve.

**Table 32.** Tubing requirements for the EASY-nLC 1200 system

No.	Connections	Tubing	Part number
1	Pump outlet to pressure sensor inlet	Stainless steel Viper, 180 µm ID, 150 mm length	6040.2360
2	Pressure sensor outlet to valve A or B	Stainless steel Viper, 180 µm ID, 150 mm length	6040.2360
3	Pressure sensor outlet to valve S	Stainless steel Viper, 180 µm ID, 150 mm length	6040.2360
4	Mixing Tee to valve S Valve A to flow sensor A Valve B to flow sensor B Flow sensor A to mixing Tee	nanoViper, 20 µm ID, 350 mm length	LC522
5	Flow sensor B to mixing Tee	nanoViper, 10 µm ID, 180 mm length	LC543
6	Autosampler needle connected to port 1 of valve S	nanoViper, 150 µm ID, 550 mm length	LC302
7	Column Out tubing connected to port 3 of valve S	nanoViper, 20 µm ID, 550 mm length	LC560
8	Waste In line, venting Tee to port 2 of valve W	nanoViper, 75 µm ID, 550 mm length	LC562
9	Sample loop, 20 µL	nanoViper, 250 µm ID, 410 mm length	LC472
D	Port 2 of valve A to check valve A Port 2 of valve B to check valve B	PEEK, 500 µm ID, 150 mm length	LC594
E	Tubing (2) from check valves to solvent bottles	Teflon, 500 µm ID, 390 mm length	LC593
F	Tubing (2) from check valves to waste beaker	Teflon, 500 µm ID, 390 mm length	LC593
G	Tubing from valve W to waste beaker	PEEK, 500 µm ID, 500 mm length	LC595

**Figure 187.** Solvent system schematic for the EASY-nLC 1200 system



## Common Replacement Parts

For proper maintenance of your EASY-nLC instrument, Thermo Fisher Scientific recommends that you maintain an inventory of replacement parts:

- [Common Replacement Parts for the EASY-nLC 1200 Instrument](#)

### Common Replacement Parts for the EASY-nLC 1200 Instrument

[Table 33](#) lists the annual consumption of common replacements parts for the EASY-nLC 1200 instrument.

**Table 33.** Common replacement parts for the EASY-nLC 1200 instrument

Description	Part number	Quantity
Pump Piston Seal Replacement Kit (contains four spring-energized piston seals and the piston seal tool)	LC510	4 piston seals (1 per pump) + 1 extra
Column Out solvent line	LC560	2
Waste In solvent line	LC562	1
Autosampler needle, ASC model	LC302	2

## Quick Reference Guides for Routine Maintenance

This appendix contains a set of quick reference guides for the routine maintenance procedures that you can perform to keep the EASY-nLC system in optimal working condition. These guides are the condensed versions of the procedures in [Chapter 5, “Routine Maintenance.”](#)

### Contents

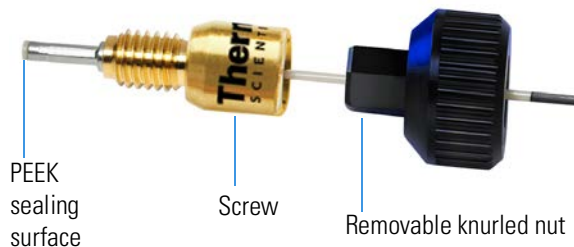
- [Using nanoViper Fittings Quick Reference Guide](#)
- [Maintaining the Pump Quick Reference Guide](#)
- [Replacing a Damaged Autosampler Needle](#)



# Using nanoViper Fittings Quick Reference Guide

Most of the plumbing connections use nanoViper fittings (see [Figure 1](#)).

**Figure 1.** nanoViper fitting



Even though nanoViper fittings can withstand UHPLC backpressures of up to ~1200 bar (~17 404 psi), they are fingertight fittings, which require only very small torques to seal. To avoid damage by overtightening, follow the instructions in this guide.

## Contents

- [Connecting nanoViper Fittings](#)
- [nanoViper Tubing Connections](#)
- [Returning the System to Atmospheric Pressure](#)

## Connecting nanoViper Fittings

### ❖ To connect a nanoViper fitting to a receiving port

1. Insert the nanoViper fitting into the receiving port. Then turn the screw clockwise until you feel resistance.
2. Turn the screw clockwise to an angle between 0 and 45 degrees (1/8-turn) using the black knurled nut.
3. Run the system leak test (see [“Running a System Leak Test”](#) on [page 178](#)).

When the leak test ends, the system is at atmospheric pressure.

**IMPORTANT** To extend the lifetime of the nanoViper fittings, open and close connections at atmospheric system pressures only. Opening and closing connections at high system pressures can reduce the lifetime of the fitting system.

4. If the Leaks script fails because the new connection is not leak tight, use the black knurled nut to turn the screw up to an additional 45 degrees. Do not turn the screw beyond an angle of 90 degrees from where you felt the initial resistance.

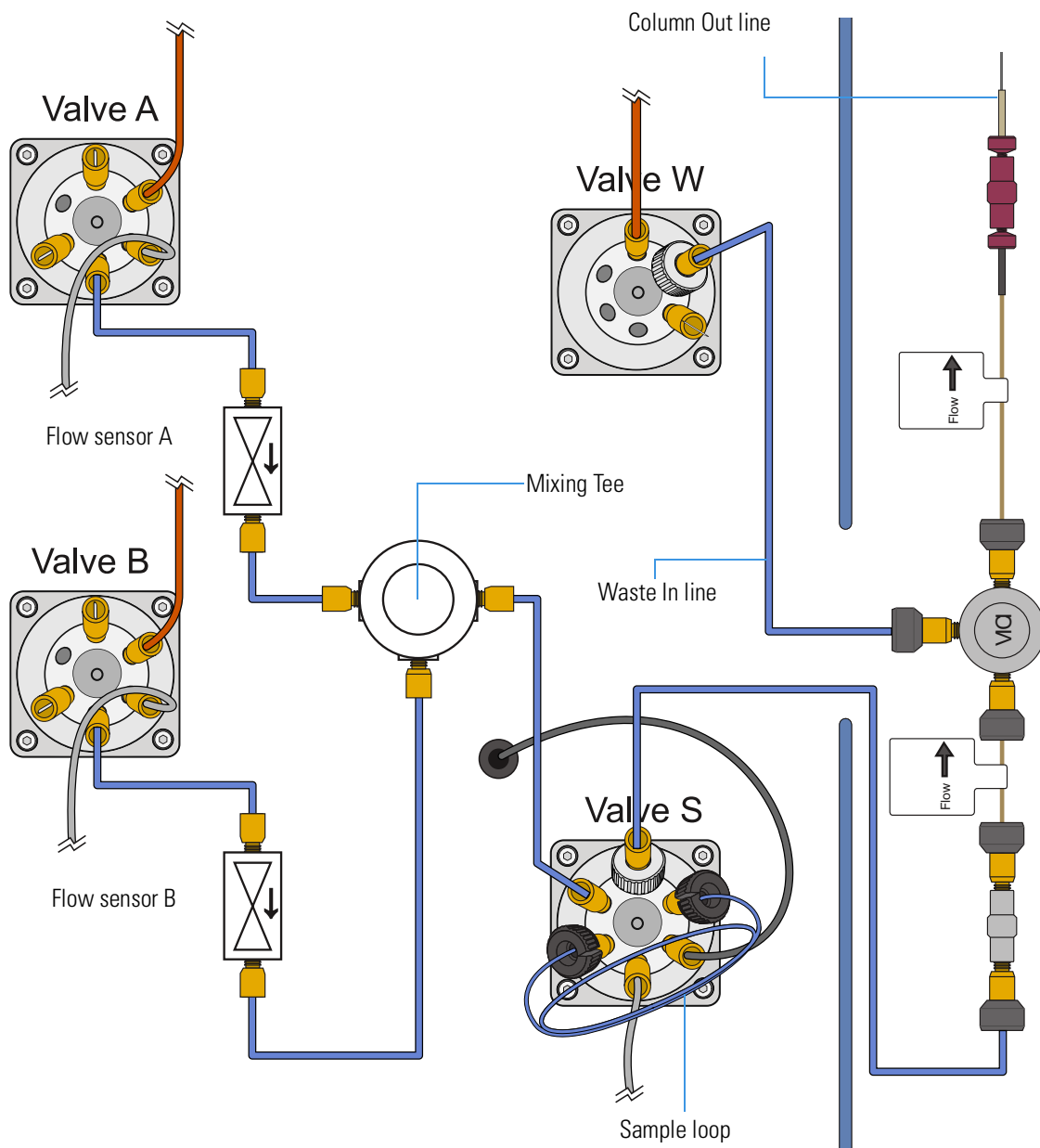
**IMPORTANT** To prevent damage to the sealing surface of the nanoViper fitting, take care not to overtighten the fingertight nanoViper fitting.

Figure 2 shows the nanoViper tubing connections in the EASY-nLC 1200 instrument.

- Port 6 of valve A to flow sensor A inlet
- Port 6 of valve B to flow sensor B inlet
- Flow sensor A outlet to mixing Tee inlet
- Flow sensor B outlet to mixing Tee inlet
- Mixing Tee outlet to port 4 of valve S
- Sample loop connected to ports 2 and 5 of valve S
- Column Out line connected to port 3 of valve S and the HPLC union
- Waste In line connected to port 2 of valve W and the HPLC union or the venting Tee
- Autosampler needle connected to port 1 of Valve S



**Figure 2.** nanoViper tubing connections in the EASY-nLC 1200 instrument



## Returning the System to Atmospheric Pressure

Before you disconnect a nanoViper fitting from its receiving port, always return the solvent line to atmospheric pressure. The high-pressure solvent lines in the EASY-nLC solvent system can be divided into two categories based on their position relative to valve S.

- [Upstream of Valve S Solvent Lines](#)
- [Downstream of Valve S Solvent Lines](#)

### Upstream of Valve S Solvent Lines

The following solvent lines (numbered from left to right in [Figure 3](#)) are in the flow path upstream of valve S.

#	Solvent line	#	Solvent line
1	Port 6 of valve A to flow sensor A inlet	4	Flow sensor B outlet to mixing Tee inlet
2	Port 6 of valve B to flow sensor B inlet	5	Mixing Tee outlet to port 4 of valve S
3	Flow sensor A outlet to mixing Tee inlet	6	Sample loop connected to ports 2 and 5 of valve S

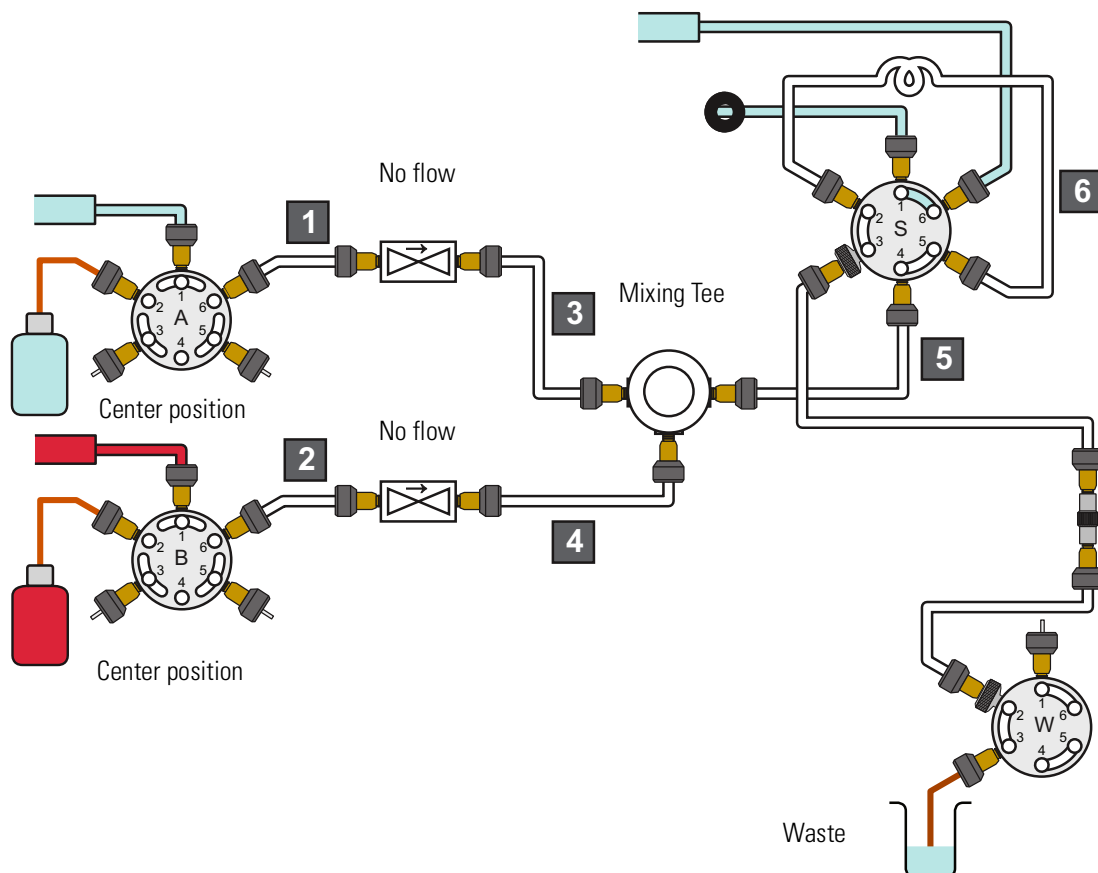
#### ❖ To return the solvent lines that are upstream of valve S to atmospheric pressure

1. On the touch screen, press **Home > Overview**.
2. Using the valve controls, set the valves to the following positions:

Valve	Position	Effect
A and B	Center	Maintains the pressure between the pump A and valve A during the Analytical Column Equilibration script.
S and W	1–6	Vents the system pressure downstream of valve A.

[Figure 3](#) shows the flow path when valves A and B are Centered and valves S and W are in position 1–6.

**Figure 3.** Solvent lines that are downstream of valves A and B and upstream of valve S, numbered 1–6



### Downstream of Valve S Solvent Lines

The following solvent line connections are in the flow path downstream of valve S:

- Column Out tubing connected to port 3 of valve S and the Viper union (P/N SC900)
- Waste In tubing connected to port 2 of valve W and the Viper union or the venting Tee

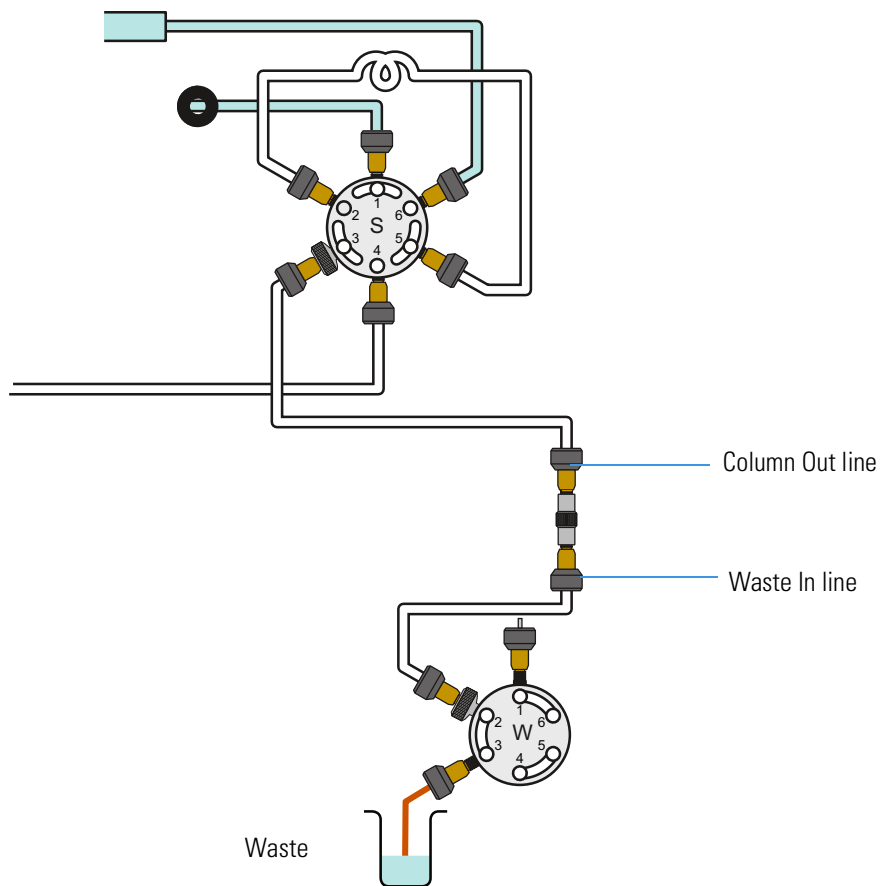
❖ **To return the solvent lines that are downstream of valve S to atmospheric pressure**

1. On the touch screen, press **Home > Overview**.
2. Using the valve controls, set the valves to the following positions:

Valve	Position	Effect
S	Center	Maintains the system pressure upstream of valve S.
W	1–6	Vents the system pressure downstream of valve S.

Figure 4 shows the Column Out and Waste In solvent lines that are downstream of valve S.

**Figure 4.** Solvent lines that are downstream of valve S



# Maintaining the Pump Quick Reference Guide

Replace the piston seal when you detect a leak in the pump.

## Contents

- [Removing a Used Piston Seal](#)
- [Installing a New Piston Seal](#)

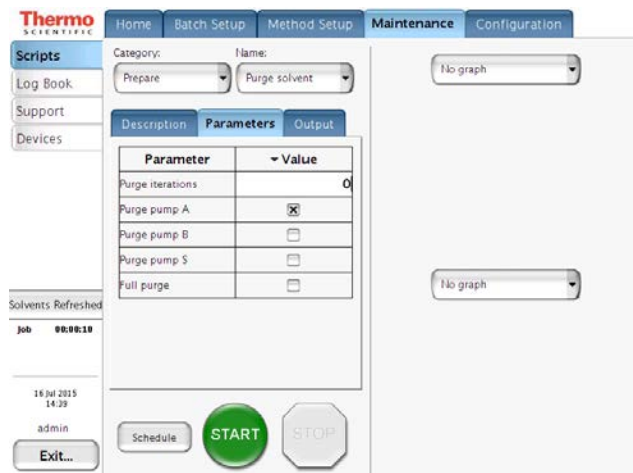
Replacing a piston seal requires these tools and materials:

Tools	Parts and materials
3 mm hex wrench	Pipette
Piston seal tool	Powder-free safety gloves
#2 Phillips head screwdriver	UHPLC/MS-grade methanol
	UHPLC/MS-grade acetonitrile
	Piston seal, P/N LC510
	Pump-to-pressure sensor flow line for an EASY-nLC 1200 instrument, 6040.2360

## Removing a Used Piston Seal

1. Set the pump piston to the fully retracted position as follows:
  - a. On the touch screen, press **Maintenance > Scripts**.
  - b. In the Category list, select **Prepare**.
  - c. In the Name list, select **Purge Solvent**.
  - d. Press the **Parameters** tab.
  - e. Press **Purge Iterations** and enter **0**.

**Figure 1.** Purge Solvent script set to 0 iterations



- f. Select the check box for the appropriate pump.

- g. Press **Start**.

The piston moves downward to the 140  $\mu$ L position.

2. Exit the EASY-nLC 1200 system and turn off the power.
3. Using a #2 Phillips head screwdriver, make a quarter-turn to loosen the three captive screws that secure the right side panel to the instrument. Then remove the panel.



**CAUTION** Wear powder-free gloves when handling the wetted components of the LC system.

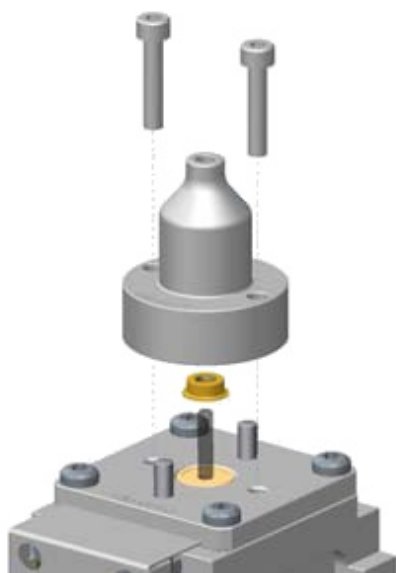
4. Remove the used piston seal as follows:
  - a. Remove the stainless steel Viper solvent lines connected to the pump head. It is also recommended to disconnect the tubing from the pressure sensor. This prevents damage, because it does not have to be bent out of the way.

**Figure 2.** Stainless steel fitting removed from the pump head



- b. Using a 3 mm hex wrench, remove the two screws that secure the pump head to the pump body.

**Figure 3.** Pump head removed from the pump body

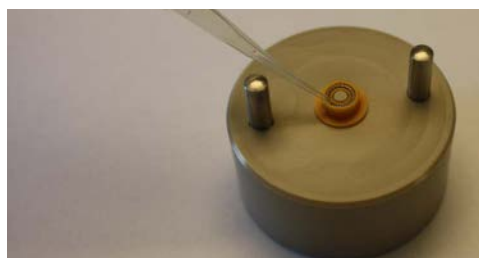


- c. Clean the visible portion of the piston with a lint-free tissue soaked in UHPLC/MS-grade methanol and visually inspect the piston for scratches. Ensure that no solvent runs into the pump.
- d. Remove the old seal from the pump head with great care (Figure 57 on page 76). Do not use any metal tools, as they can scratch the inside of the pump head and generate leaks.

### Installing a New Piston Seal

1. With the spring side of the piston seal spring facing away from the piston seal tool, mount the new piston seal onto the piston seal tool.
2. Using a pipette, remove the air from the piston seal spring by carefully filling the rim of the piston seal with methanol.

**Figure 4.** Filling the piston seal with methanol



3. Place the pump head on the guide rods and evenly press it all the way down to insert the seal and then gently remove the pump head when the seal is in position.

**Figure 5.** Inserting the piston seal into the pump head

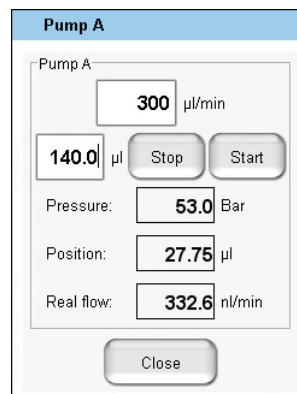


4. Mount the pump head back on the pump using the two screws and a 3 mm L-hex wrench. Do not mount the stainless steel tubing to the pump head.
5. Turn on the EASY-nLC system and log in as an administrator.
6. Fill the pump head with the appropriate solvent as follows:
  - a. Press **Home** > **Overview**.
  - b. Press the pump icon for the pump that you want to control.

The Position readback displays the current pump position from 0  $\mu\text{L}$  (empty) to 140  $\mu\text{L}$  (full).
  - c. Set the flow rate to **300**  $\mu\text{L}/\text{min}$  and the volume to **140**  $\mu\text{L}$ . Then press **Start**.

The piston moves up to the top of the pump head.

**Figure 6.** Pump dialog box



- d. Pipette the appropriate solvent into the pump head.

**Figure 7.** Adding solvent to the pump head



- e. Set flow rate to  $-300 \mu\text{L}/\text{min}$  and the volume to  $140 \mu\text{L}$ . Then press **Start**.

The piston moves down, drawing solvent into the pump head. Make sure the pump head is filled with solvent during the entire retraction of the piston.



**CAUTION** Be careful not to spill solvent onto the printed circuit board behind the LED panel.

7. Mount the stainless steel Viper back on the pump head and the pressure sensor. (see [Figure 2](#) on [page 279](#)).
8. Reinstall the right side panel.
9. Reset the usage counter for the pump as follows:
  - a. Press **Maintenance > Devices**.
  - b. Select the pump from the list of devices.
  - c. Press the **Summary** tab.

- d. Press **Reset**.

The value in the Intermediate Volume box resets to 0.

10. To draw fresh solvent through the solvent lines and to remove air, do the following:
  - a. Open the Parameters page for the Purge Solvent script as described in [step 1](#) on [page 279](#).
  - b. In the Purge Iterations box, enter **10**.
  - c. Select the check box for the appropriate pump.
  - d. Press **Start** and wait for the system to perform 10 purge cycles.
11. To remove air from the pump head, do the following:
  - a. In the Name category on the Maintenance > Scripts page, select **Flush Air**.
  - b. Press the **Parameters** tab.
  - c. In the Flush Threshold [ $\mu\text{L}$ ] box, enter **12**.
  - d. Press **Start**.
  - e. Wait for the script to finish.
12. Run the Leaks script for the pump with the new piston seal
  - a. On the Maintenance > Scripts page, select **Test** in the Category list and then **Leaks** in the Name list.
  - b. Press the **Parameters** tab.
  - c. Select the check box for the pump with the new seal.
  - d. Press **Start**.
13. If the script detects a leak, replace the stainless steel tubing that connects the pump to the pressure sensor.
14. When the instrument is leak tight, it is ready for use.





# Replacing a Damaged Autosampler Needle

Replace the autosampler needle when it is bent or clogged.

## Contents

- [Removing the Damaged Autosampler Needle](#)
- [Installing a New Autosampler Needle](#)



**CAUTION** Wear powder-free safety gloves when working with solvents and handling the wetted components of the instrument.

Replacing a damaged needle requires these tools and materials:

## Tools

- #2 Phillips head screwdriver
- 

## Parts and materials

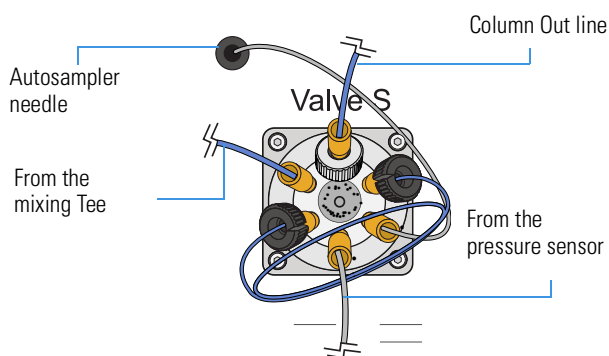
- Powder-free safety gloves
- ASC autosampler needle, P/N LC302

## Removing the Damaged Autosampler Needle

### ❖ To remove the autosampler needle

1. Using a #2 Phillips screwdriver, make a quarter-turn to loosen the three captive screws that secure the panel to the right side of the EASY-nLC instrument, and then remove the panel.
2. Disconnect the autosampler needle from port 1 of valve S as follows:
  - Use the black knurled nut of the Viper fitting to unscrew it.

**Figure 1.** Valve S solvent line connections for the EASY-nLC 1200 system



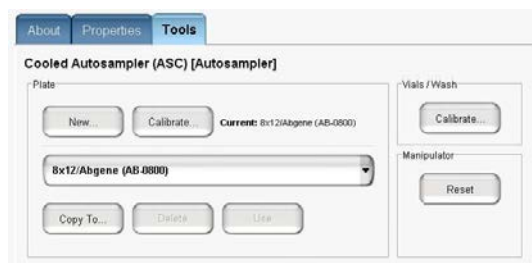
3. Move the z-axis needle holder to an accessible location within the tray compartment.
4. Move the z-axis needle holder to position W1 as follows:
  - a. Press **Home > Overview**.
  - b. Press the autosampler icon.

The Autosampler dialog box opens.

- c. In the XYZ Robot area, press **Go to Calibration**.

The Tools page of the Autosampler view on the Maintenance > Devices page opens.

**Figure 2.** Tools page of the Autosampler view on the Maintenance > Devices page

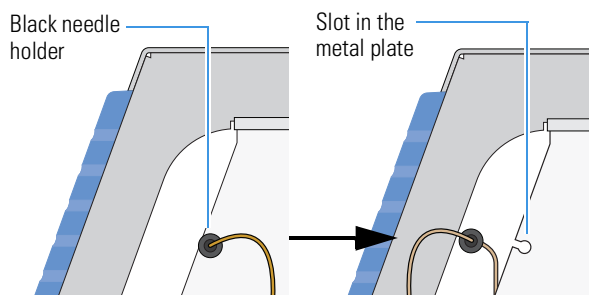


- d. In the Manipulator area, press **Reset**.

The z-axis needle holder moves to the W1 position.

5. Using a #2 Phillips screwdriver, loosen the three quarter-turn screws that secure the panel to the left side of the EASY-nLC instrument, and then remove the panel.
6. Remove the black needle holder from the slot in the panel that separates the solvent system hardware from the autosampler compartment. Removing the fitting requires some gentle movement from both sides of the plate.

**Figure 3.** Removing the black needle holder from the slot in the panel



7. Loosen the nut that is connected to the z-axis needle holder by turning it counterclockwise. Then carefully pull the autosampler needle upward and away from the holder.

**Figure 4.** Autosampler needle connected to the z-axis needle holder

ASC z-axis needle holder



## Installing a New Autosampler Needle

### ❖ To install a new autosampler needle

1. Mount the new autosampler needle in the z-axis holder. Check that the small spring is situated between the PEEK nut and the plastic stop.
2.
  - a. Guide the end of the needle that connects to Valve S through the large hole in the metal plate that separates the tray compartment from the solvent system compartment.
  - b. Install the black needle holder in the side plate.
3. Connect the needle to port 1 of valve S as follows:
  - a. Insert the nanoViper fitting into the receiving port. Then turn the screw clockwise until you feel resistance.
  - b. Turn the screw clockwise to an angle between 0 and 45 degrees (1/8-turn) using the black knurled nut.
4. Recalibrate the needle position.
5. Press **Maintenance > Scripts**.
6. In the Category list, select **Prepare**.
7. In the Name list, select **Purge Solvent**. Then run two iterations of the Purge Solvent script for Pump S.
8. In the Name list, select **Flush Air**. Then run the Flush Air script for Pump S with a flush volume threshold of 12  $\mu\text{L}$ .



# Index

## A

- adapter plate, replacing
  - ASC autosampler 230
- air, removing from pump heads 33
- Analytical Column Equilibration script 36
- application version 20
- ASC autosampler
  - adapter plate, replacing 230
  - description 3
  - needle, description of 14
  - See also*
    - autosampler
- ASC cooler, replacing (service repair) 115
- autosampler
  - calibrating XYZ robot 229–242
  - checking sample pickup, schedule 29
  - description 2
  - direct control 172
  - needle
    - blocked 221
    - description 14
    - replacing 85
  - Sample Pickup script 222
  - Torque script 48
  - tray compartment, accessing 2
  - troubleshooting tips 131

## B

- back panel, instrument 16
- Back Pressure script 47
- backpressure
  - testing 47
  - troubleshooting
    - maximum pressure spikes during gradient 141
    - system blockage 208
    - too high during sample loading and column equilibration 139
- backup ring 7
- beaker, waste 2

- blank injections, troubleshooting 144, 145, 222
- blind fittings or plugs 179
- blockages
  - caused by contaminated solvents 66
  - troubleshooting 208

## C

- cables, internal
  - computer box cable connections 102
  - connected to EASY-nLC 1200 pump 123
  - cooler bus cable 110
  - LVDS cable 102, 107
  - monitor cable 107
  - USB cable 107
- calibrating
  - autosampler XYZ robot 229–242
  - flow sensors 52
  - plates 237
  - pressure sensors 54
- carryover
  - specification 23
  - troubleshooting tips 155
- check valves
  - description 10
  - replacing 82
- checking
  - check valves for leaks 29, 207
  - sample pickup 222
  - solvent levels 28
  - system for leaks 44
- clogged column or system, troubleshooting 139
- closing down the EASY-nLC instrument 22
- Column Out line
  - checking for blockage 213
  - clogged 139, 141
  - modified with bare fused-silica tubing at one end 61
  - tubing ID 208
- column, clogged 139
- compliance
  - FCC iii

## Index:

- regulatory [iii](#)
- WEEE [v](#)
- computer box
  - cables connected to [102](#)
- computer, integrated
  - location [15](#)
  - out of memory [163](#)
- consumables [270](#)
- contact closure
  - MS Connection script [39](#)
  - troubleshooting [132](#)
- contacting us [xx](#)
- contamination
  - preventing [166](#)
- cooler temperature
  - checking [28](#)
  - direct control [173](#)

## D

- daily maintenance [28](#)
- devices
  - managing the Devices list [99](#)
  - usage counters [59](#)
- Direct Infusion script [55](#)
- documentation, accessing [xviii](#)

## E

- EASY-nLC 1200 instrument (service repairs)
  - ASC autosampler, replacing [114](#)
  - ASC cooler, replacing [115–117](#)
  - computer box, replacing [105](#)
  - monitor, replacing [108](#)
  - PLU pump, replacing [124](#)
  - pump PCB, replacing [124–127](#)
  - valves, replacing [120](#)
- electromagnetic compatibility [iii](#)
- Exit button [22](#)

## F

- failure messages [177](#)
- Fast Inspection option [54](#)
- FCC compliance [iii](#)
- field service repairs
  - See*
    - EASY-nLC 1200 instrument (service repairs)
- filling a pump with solvent [167](#)
- flow rate
  - determining appropriate
    - analytical column [36](#)
    - precolumn [34](#)
  - direct control [166](#)
  - measuring [9](#)

- flow sensor cable [123, 124, 127](#)
- flow sensors
  - calibration script [52](#)
  - checking for blockage [215, 218](#)
  - description [9](#)
  - replacing
    - EASY-nLC 1200 instrument [92](#)
- Flush Air script [33](#)
- fuse, replacing [69](#)
- fused-silica union [179](#)

## G

- grounding requirements [227](#)

## H

- Help, Xcalibur instrument control software [xviii](#)

## I

- Inspection Only check box [54](#)
- instrument startup, troubleshooting [132](#)
- interface layout [19](#)
- IP address, support server [246](#)
- Isocratic Flow script [38](#)

## K

- kit, UHPLC Liquid Junction [61](#)

## L

- L brackets, pressure sensor [90](#)
- LC/MS-grade solvents [27](#)
- Leaks script [44, 44–47](#)
- leaks, checking for [29, 44–47, 84, 178](#)
- liquid junction cross, UHPLC [62](#)
- log book [57](#)
- Logo icon, Thermo Scientific [20](#)
- loop, sample, replacing [88](#)
- LVDS cable, internal [107](#)

## M

- maintenance
  - daily [28](#)
  - quarterly [28](#)
  - scripts [31](#)
  - weekly [28](#)
- manuals, accessing [xviii](#)
- mass spectrometer, contact closure
  - MS Connection script [39](#)
  - troubleshooting [132, 225](#)
- memory stick, correct format [163](#)
- message.log file [249](#)

messages, failure 177

mixing Tee

checking for blockage 214

monitor cable, internal 107

motor cable 126, 127

MS Connection script 39

## N

nanoViper fittings

connecting to Viper union 180

EASY-nLC 1200 solvent lines 268

using 83, 273

needle guide, white plastic 107

needle position, calibrating 235–242

needle, autosampler 14

network access, troubleshooting 223

## P

parts, common replacement 270

password, initial 21

P-Bus communication cables

connecting to cooler PCB 117

connecting to pump 127

disconnecting from cooler PCB 115

disconnecting from pump 123, 124

PCB shield 125, 127

performance specifications 23

pink

autosampler icon 162

pump icons 160

valve icon 161

piston seals

function 7

replacing

in the PLU model pump 73

plate formats

creating 232

deleting 234

selecting 231

plates, calibrating 237

plugs or blind fittings 179

port 22, firewall setup for 244

Power Down button 22

power, turning off 22

preparing

autosampler for the calibration routines 235

solvents 66

system for daily use 27

pressure sensor cable 123, 124, 127

pressure sensors

replacing

EASY-nLC 1200 instrument

(routine maintenance) 89

pump

direct control 166

manual control 78, 166

PLU, EASY-nLC 1200 instrument

maintaining 73

volume pumped usage counter 59

Pump dialog box 167

pump PCB, replacing (service repair)

EASY-nLC 1200 instrument 121, 124–127

Purge Solvent script 32

purification system, water 27, 66

## Q

quick reference guides

autosampler needle, replacing 283

EASY-nLC 1200 pump, maintaining 279

nanoViper fittings, using 273

## R

regulatory compliance iii

remote support 243

replacement parts, common 270

Reset Pressure Sensor script 54

## S

safety

calibrating the autosampler 235

precautions for the EASY-nLC instrument xviii

sample

pickup check 222

Pickup script 42

sample loop, replacing 88

schedule, maintenance 27

scripts

Analytical Col Equilibration 36

Autosampler Torque 48

Back Pressure 47

Flow Sensors 52

Flush Air 33

Isocratic Flow 38

Leaks 44

Maintenance 31

MS Connection 39

Purge Solvent 32

Reset Pressure Sensor 54

Sample Pickup 42, 222, 223

sealing surface, nanoViper fitting 83, 181

seals

piston

description 7

replacing

## Index:

- in the PLU model pump 73
- Secure Shell (SSH) network protocol 244
- serial numbers, device 100
- service log 57
- service repairs
  - See
    - EASY-nLC 1200 instrument (service repairs)
- sharp objects, autosampler needle 235
- sluggish system operation 163
- software, upgrading the touch-screen application 252
- solvent system
  - components behind the right side panel 5
  - schematic
    - EASY-nLC 1200 system 269
- solvents
  - checking levels 28
  - ordering 66
  - viscosity table 265
- specifications
  - performance 23
  - technical 24
- spray, unstable 157
- SSH Connection Error message box 249
- support server, IP address 246
- swept volume, extra 137
- system overload 163

## T

- technical specifications 24
- Telnet window 225
- temperature
  - direct control 173
  - maintaining stable 240
- Testing 225
- testing 61
- Testing the Network Connection to the EASY-nLC Computer 223, 225
- tightening tool, internally-threaded knurled nut 62
- tools, required
  - autosampler needle, replacing 85
  - check valve, replacing 82
  - hard drive, replacing 95
  - PLU pump piston seal, replacing 73
- touch-screen application
  - description 18
  - upgrading 252
- transport instructions 255
- tray compartment, accessing 2
- troubleshooting
  - autosampler 131
  - contact closure 132
  - identifying and locating leaks 178
  - instrument startup 132

- network access 223
- system blockage 208
- turning off the EASY-nLC instrument 22

## U

- UHPLC/MS-grade solvents, using 66
- unions
  - leak test 46, 179
  - UHPLC fused-silica union 61
  - Viper union 179
- upgrading the touch-screen application 252
- URLs, consumable parts xxi
- usage counters, device 59
- USB cable, internal 107
- USB flash drive with manuals xviii
- USB ports, EASY-nLC instrument 16, 250
- USB storage device, copying system files 250
- user guides, accessing xviii
- user interface layout 19

## V

- valve position
  - description 11
  - manual control 165
- valves
  - check valves
    - description 10
    - replacing 82
  - checking for blockage
    - valve B 216
    - valves A, S, and W 210
  - checking for leaks 184
- versions, application 20
- vials
  - extra vial positions, calibrating 241
  - plate format, calibrating 236
- Viper union
  - internal view 181
  - part number 179
- viscosities, solvent 265

## W

- wash bottles
  - calibrating W4 bottle with insert 241
  - description 2
- waste beaker, description 2
- Waste In line
  - checking for blockage 213
  - modified with bare fused-silica at one end 61
- weak signal from detector 144
- WEEE compliance v
- weight, EASY-nLC instrument 25

well plates  
  calibrating [237](#)  
  plate formats, managing [231](#)

## X

$x$ -axis position of the needle, adjusting [239](#)  
Xcalibur data system, errors reported by [151](#)  
XYZ robot  
  calibrating [235–242](#)  
  direct control [172](#)  
XYZ-axis PCB [110](#), [114](#)  
XYZ-axis PCB bus cable [110](#)

## Y

$y$ -axis position of the needle, adjusting [239](#)

## Z

$z$ -axis needle holder [236](#)  
 $z$ -axis value [238](#)