Thermo Scientific Dionex UltiMate 3000 Pumps

The Benchmark in LC Solvent Delivery

Thermo Scientific™ Dionex™ UltiMate™ 3000 products are UHPLC compatible by design, establishing the new standard in conventional LC. Integrating hardware, software, and separation chemistry, we offer UHPLC to everyone, for all needs.

- Industry-leading LC solvent delivery portfolio of UHPLC, HPLC, and biocompatible pumps.
- Future-proof flow-pressure footprint provides highest application flexibility.
- Outstanding reliability and durability combined with unrivaled flow and gradient performance.

Versatile and Flexible

The Thermo Scientific™ Dionex™ UltiMate 3000 pump family offers the most complete choice in the industry. From nano LC to standard and UHPLC applications to semi-preparative flow rates, the UltiMate 3000 pumps provide industry-leading performance.

In addition, a range of UHPLC pumps are available that are compatible with buffers used in biochromatography, even under harsh salt and pH conditions. Since the UltiMate 3000 RSLC pump family is biocompatible by design, it is therefore the first choice for advanced biochromatographic separations.

UHPLC+ focused

Precise and Reliable

High quality pump components, intelligent mechanical and electronic design, and rigorous quality assurance testing guarantee durable and reliable operation. Automated equipment qualification tests and predictive indicators simplify installation, qualification, and performance verification. Easy front-panel access and a clean and intuitive fluidic design ensure optimum ease of use and effortless maintenance.

Unique and Elaborate

SmartFlow™ pumping technology with automatic compensation for changing eluent compressibility ensures highly accurate flows, as well as gradients independent of eluent composition and backpressure.

With unique dual-gradient pumps, productivity solutions and advanced chromatographic techniques such as parallel LC, tandem LC, online SPE-LC, or multidimensional LC, are easy.

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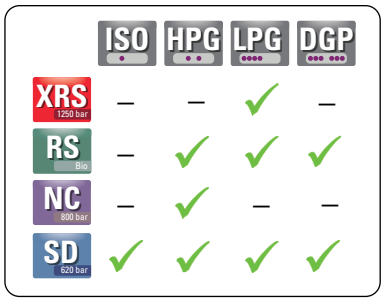


Figure 1. UHPLC pump variants

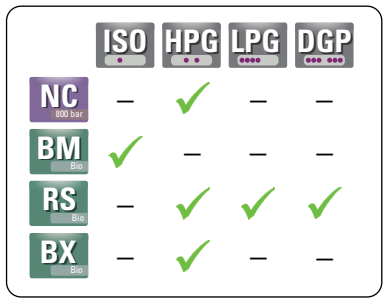


Figure 2. Biocompatible pump variants

Most Complete Choice in Industry

With various UHPLC and biocompatible versions, we provide the most complete choice of HPLC pumps in the industry. Whatever your LC challenge, the family of UltiMate 3000 pumps always offers the right solution.

XRS 1250 bar Quaternary UHPLC pump optimized as front-end for MS and MS/MS with lowest gradient delay volume.

RS Binary, quaternary, and dual-gradient biocompatible RSLC pumps with unrivaled flowpressure footprint for maximum flexibility in UHPLC and conventional HPLC.

SD The benchmark in standard HPLC solvent delivery. With pressures up to 620 bar, the pumps offer future-proof performance to fully support conventional HPLC while offering compatibility with UHPLC applications.

NC Biocompatible RSLCnano pumps for UHPLC nano/cap flow-rates between 20 nL/min and 50 µL/min and pressures up to 800 bar.

BM Biocompatible isocratic micro pump optimized for electrochemical detection for flow rates up to 2.5 mL/min.

BX Biocompatible semi-preparative pump for flow-rates up to 50 mL/min.

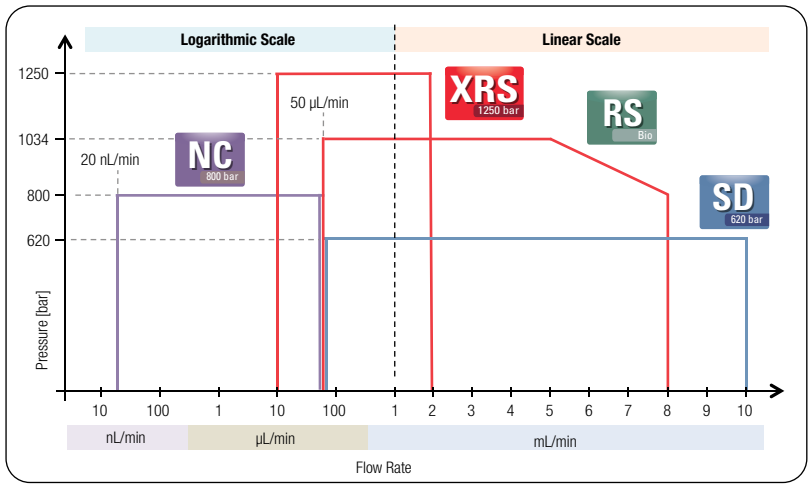


Figure 3. Future-proof UHPLC flow-pressure footprint for the XRS, RS, NC and SD pumps

Future-Proof Flow-Pressure Footprint

With flow rates from 20 nL/min to 10 mL/min and pressures of up to 1250 bar, UltiMate 3000 pumps provide an outstanding flow-pressure footprint across the XRS, RS, NC and SD pump families.

- Able to provide the right choice for any UHPLC application task.
- Compatible with legacy, standard LC columns and methods.

Figure 4. The Thermo Scientific™ Dionex™ DGP-3600RS combines two biocompatible UHPLC pumps in a single housing

Dual-Gradient Pumps Offer Greater Flexibility

With the unique UltiMate 3000 dual-gradient pumps, advanced chromatographic techniques become easier than ever before.

- Automated on-line SPE-LC for UHPLC sample preparation and automation.
- Inverse gradient for uniform response with charged aerosol detection.
- Tandem and parallel analyses for UHPLC high throughput.
- Automated application switching for improved UHPLC system utilization.

Setting Benchmarks through Innovation

The UltiMate 3000 pump family is particularly developed to meet two major goals in LC flow delivery:

- Surpassing flow and gradient performance for unrivaled retention time precision and highest data confidence.
- Outstanding durability for highest-possible system up-time and low total cost of ownership.

UltiMate 3000 pumps achieve this through an industry-leading symbiosis of advanced technology, high-performance materials, and innovative features.

The UltiMate 3000 pump family clearly sets new benchmarks in conventional LC and UHPLC.

- SmartFlow technology ensures highest possible flow and gradient precision, independent of eluent composition and backpressure.
- Patented off-axis pump design for ultra-precise piston drive with 2 nL resolution ensures unrivaled retention time precision.
- Auto-aligning floating piston design ensures highest possible seal life time for robust and reliable operation.

Redefining Reliable and User-Friendly Operation

The maintenance-minimized, service friendly design of the UltiMate 3000 pumps provide extra long lifetime, minimum downtime and lowest qualification effort. Qualification and service periods are monitored within the Thermo Scientific™ Dionex™ Chromeleon™ software.

- Flow-optimized pump heads for reliable solvent changeover and bubble free operation.
- All pumps feature an active rear seal wash as standard for increased seal lifetime.
- No manual solvent settings are needed due to SmartFlow automatic compressibility compensation.
- Optimized flow path and clearly arranged components for maximum ease of use.
- Easy and safe maintenance with automatic piston decoupling and single screw mounting.
- Reliable operation through predictive performance indicators and automated pump drive lubrication.

The Art of Mixing

In gradient elution, complete mixing is necessary to achieve a smooth baseline for high signal-to-noise ratios, and accurate peak identification. The mixer requirements are challenging because the mixer must reliably provide highest possible performance over a wide application range with varying solvent ratios, solvent miscibilities, and flow rates.

To meet these requirements, the unique SpinFlow™ mixing design was developed, using a two-step process of radial mixing followed by longitudinal mixing. The mixer can be easily adapted to fit specific method requirements, from high-speed LC/MS to high-sensitivity TFA applications.

Figure 5. RSLCnano modules with industry-leading performance for UHPLC nano/cap applications. The Thermo Scientific™ Dionex™ NCS-3500RS integrates the nano/cap pump, a ternary LPG micro pump, and a heated column compartment in a single housing.

Figure 6. Clearly arranged components and optimized flow path for maximum ease of use

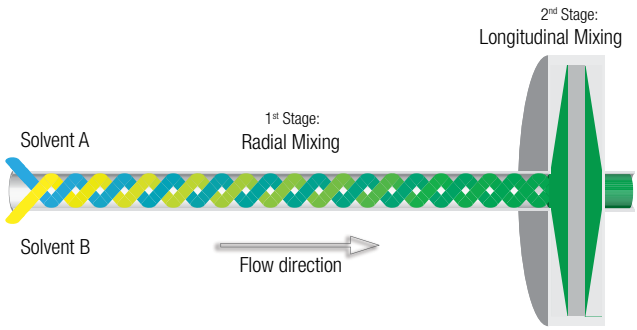


Figure 7. Proprietary SpinFlow mixing design uses a two-step process of radial mixing, followed by longitudinal mixing

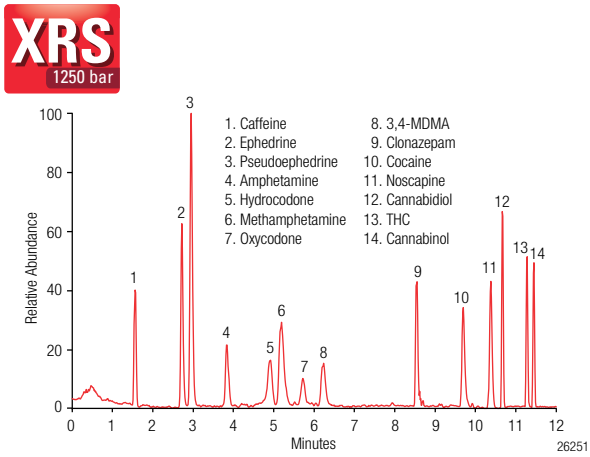
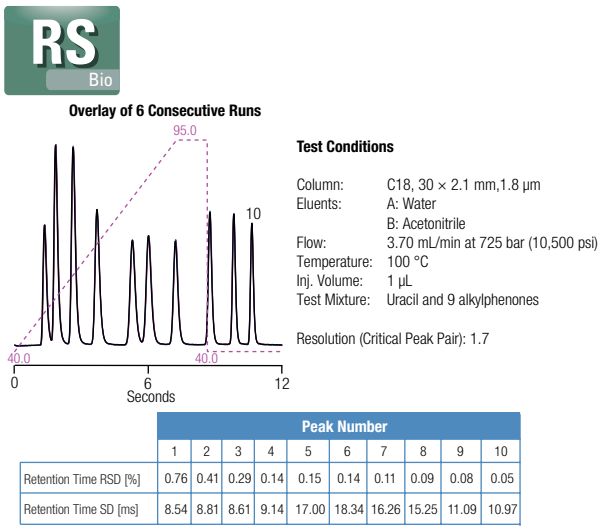


Figure 8. Optimized UHPLC/MS separation of 14 illicit drugs with ternary gradient using a Thermo Scientific™ Dionex™ LPG-3400XRS Quaternary Rapid Separation Pump.

XRS Pump

The Thermo Scientific™ Dionex™ UltiMate 3000 XRS is a unique, LC/MS-optimized quaternary UHPLC pump. With pressures up to 125 MPa (18,130 psi), the pump offers state-of-the-art performance for high-speed and ultra-high resolution applications. Thanks to the ultra-compact pump head design, the pump excels with a gradient delay volume of only 200 µL while providing the highest degree of flexibility in solvent proportioning. This makes the pump the first choice as the LC front-end for MS and MS/MS.

- Support of very long sub-2 µm particle columns applied for natural products screening, life sciences, and complex environmental, food and beverage sample analysis.
- Support of fast gradients for high throughput applications on short UHPLC columns.



	Peak Number									
	1	2	3	4	5	6	7	8	9	10
Retention Time RSD [%]	0.76	0.41	0.29	0.14	0.15	0.14	0.11	0.09	0.08	0.05
Retention Time SD [ms]	8.54	8.81	8.61	9.14	17.00	18.34	16.26	15.25	11.09	10.97

Figure 9. Highest precision even at the most challenging conditions using a Thermo Scientific™ Dionex™ HPG-3400RS Biocompatible Binary RS Pump. The retention time reproducibility is as low as 8.54 ms SD.

Biocompatible RS Pumps

The biocompatible UltiMate 3000 RS pumps are the standard and offer an industry-leading flow-pressure footprint of 103 MPa (15,000 psi) at up to 5 mL/min and 80 MPa (11,600 psi) at 8 mL/min. With their superior performance, they are the perfect choice for ultra high-speed and ultra high-resolution applications but at the same time fully compatible with conventional analytical applications.

The UltiMate 3000 RS pumps ensure highest flow precision and reliability even at elevated backpressures. The outstanding flow-pressure footprint covers the full range of HPLC, including conventional LC and UHPLC.

- Support of short sub-2 µm particle columns for ultra-fast separations.
- Support of longer columns for high resolution UHPLC applications.
- Fully compatible with legacy, standard LC columns and methods.
- Available in binary, quaternary, and dual-gradient variants.

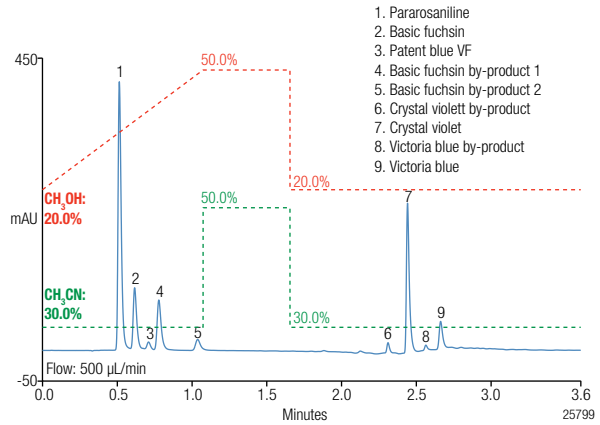


Figure 10. Ternary gradient separation of ink under rapid separation conditions using a Thermo Scientific™ Dionex™ LPG-3400RS Biocompatible Quaternary RS Pump. This separation is 6× faster than the conventional forensic LC method.

True Ballistic Gradients

The UltiMate 3000 Biocompatible Binary RS pumps are capable of providing true ballistic gradients at unrivaled retention time precision. This is achieved through ultra-precise flow acceleration and deceleration with an internal resolution of 125 Hz, and a piston-drive precision of 2 nL. Together with gradient delay volumes down to 35 µL, the binary pump is the first choice for any ultra high-speed application in LC and LC/MS.

Beyond UHPLC

The Thermo Scientific™ Dionex™ DGP-3600RS Biocompatible Dual-Gradient RS Pump extends UHPLC capabilities. Double the throughput with tandem UHPLC, boost chromatographic resolution with 2D-UHPLC, or automate sample preparation with online SPE-UHPLC.

SD Pumps

With the future-proof support for pressures up to 62 MPa (9,000 psi) at flow rates of up to 10 mL/min, the UltiMate 3000 SD pumps excel in standard LC applications while offering full compatibility with fast UHPLC separations.

Simple Method Transfer

The SD and RS pumps and system configurations provide similar gradient delay and extra column volumes. This simplifies the method transfer between method development, which commonly use UHPLC pumps, and QC and production labs with their standard LC pump setups.

All models combine unrivaled flow and gradient performance with outstanding reliability and durability.

- Support of short sub-2 µm particle columns for faster analysis at lower solvent consumption.
- Ideal for working with solid-core particle columns, such as Thermo Scientific Accucore columns.
- Available in isocratic, binary, quaternary, and dual-gradient designs.

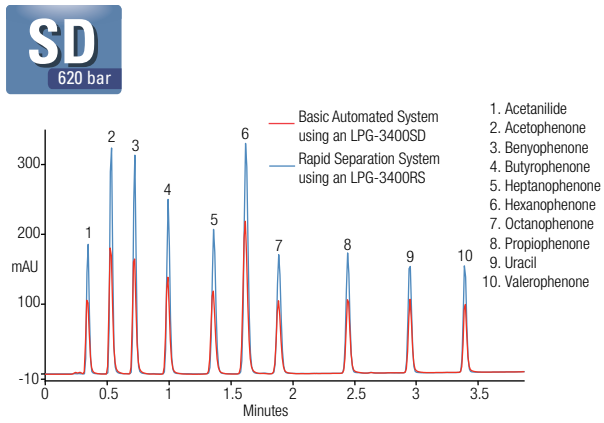


Figure 11. Fast alkylphenone separation shows easy method transferability between basic automated systems using an Thermo Scientific™ Dionex™ LPG-3400SD pump and RSLC systems using an LPG-3400RS pump.

Nano/Cap Pumps (RSLCnano)

The continuous direct flow binary HPG nano pump is designed to deliver gradients at the lowest imaginable flow rates with the exceptionally high precision required for high-confidence compound identification. It is also available as a RSLCnano system*, which integrates the HPG nano-pump, a ternary LPG micro-pump, and a heated column compartment, with up to two UHPLC-compatible switching valves in a single housing.

- No interrupted runs due to continuous direct flow
- Flow delivery from 20 nL/min up to 50 µL/min at a maximum pressure of 800 bar
- Small gradient delay volume of only 25 nL
- Unparalleled gradient precision
- Biocompatible by design

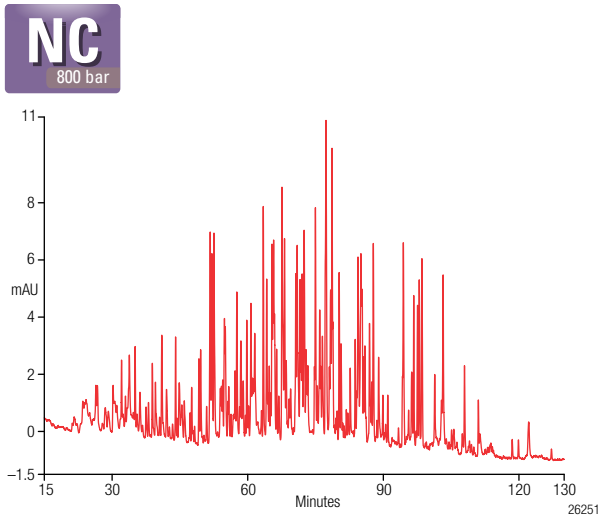


Figure 12. High-resolution separation of a complex tryptic digest sample on a 50 cm long 75 µm Thermo Scientific™ Acclaim™ PepMap column using a Thermo Scientific Dionex NCS-3500RS system

Biocompatible Pumps

We offer a complete range of biocompatible pumps to meet the requirements needed in biochromatography analysis .

Together with the biocompatible Thermo Scientific™ Dionex™ UltiMate 3000 RSLC and RSLCnano Series*, an industry-leading flow rate range, from as low as 20 nL/min (nano LC) up to 50 mL/min (semi-prep LC), is covered.

- Compatible with corrosive mobile phases (i.e. extreme pH and high salt concentrations), especially appreciated when assaying peptides, proteins and more complex large molecules.
- Special biocompatible isocratic micro pump ISO-3100BM with ultra-low pulsation for high-sensitivity applications using electrochemical detection.

* For more details see the UltiMate 3000 RSLCnano System Data sheet

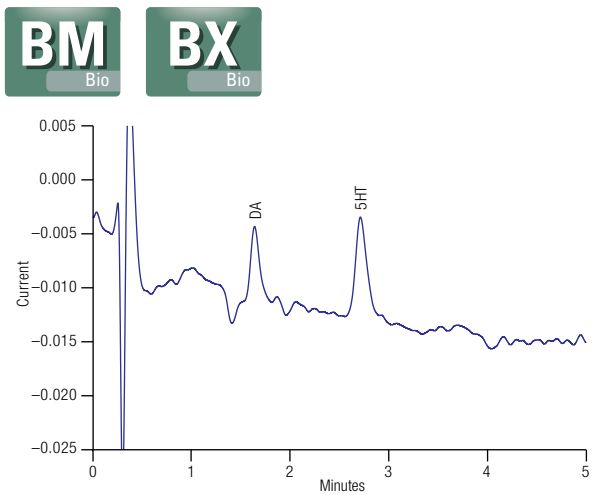


Figure 13. Routinely achieved low-femtogram levels of neurotransmitter (<50 fg) using a Thermo Scientific™ Dionex™ Electrochemical Detector system with an ISO-3100BM pump and an ECD-3000RS detector.

Solvent Racks

Thermo Scientific™ Dionex™ UltiMate 3000 HPLC solvent racks are the ideal complement to every UltiMate 3000 pump. Whether you need high efficiency degassing or simply want to safely organize your solvent bottles, the UltiMate 3000 solvent rack series delivers the perfect solution. From the 2-channel degasser rack for a binary pump, to the most flexible 6-channel degasser rack for the powerful ×2 dual-ternary pump, there is a solvent rack to fit your system needs.

The solvent rack degasser can be field upgraded with additional channels, for example a dedicated wash fluid channel used by the WPS-3000 series autosamplers.

ULTIMATE 3000 SOLVENT RACK SPECIFICATIONS	
Eluent Bottle Capacity (all versions)	Eight 1-L reservoirs or four 2.5-L reservoirs or two 5-L reservoirs or five 1-L reservoirs and one 5-L reservoir or three 2.5-L reservoirs and two 1-L reservoirs or three 1-L reservoirs and two 2.5-L reservoirs or sixteen 0.5-L reservoirs
Degassing Channels	SRD-3600: 6 vacuum channels (analytical) SRD-3400: 4 vacuum channels (analytical) SRD-3200: 2 vacuum channels (analytical) SR-3000: None
Channel Volume	670 µL
Max. Flow Rate per Channel	12 mL/min
Wetted Materials	Amorphous fluoropolymer (AF), PEEK®, FEP, and ETFE/ECTFE
Emission Sound Pressure Level	< 60 B(A) in 1-m distance
Dimensions (h × w × d)	10 × 42 × 51 cm (3.9 × 16.5 × 20 in)
Weight	SR-3000: 3.0 kg (6.6 lbs) SRD-3x00: 4.8 kg (10.6 lbs)

Integrated Vacuum Degassing

All UltiMate 3000 quaternary pumps have an integrated four-channel degasser. The online, chemically inert degassers feature unsurpassed performance and ensure stable baselines.

ULTIMATE 3000 PU

Pump Class	XRS 1250 bar	RS Bio			
Thermo Scientific™ Dionex™ pump	LPG-3400XRS	HPG-3200RS	LPG-3400RS	DGP-3600RS	ISO-3100SD
Flow range (recommended range)	0.001–2.0 mL/min (0.01–2.0 mL/min)	0.001–8.0 mL/min (0.05–8.0 mL/min)	0.001–8.0 mL/min (0.1–8.0 mL/min)	0.001–8.0 mL/min (0.1–8.0 mL/min)	0.001–10.0 mL/min (0.05–10.0 mL/min)
Max. Pressure	2–125 MPa	2–103.4 MPa up to 5 mL/min, 2–80 MPa up to 8 mL/min			
Gradient Formation	Low-pressure proportioning	High-pressure proportioning	Low-pressure proportioning	Dual low-pressure proportioning	
Proportioning Accuracy	± 0.5% (full scale)	± 0.2% (full scale)	± 0.5% (full scale)	± 0.5% (full scale)	
Proportioning Precision	< 0.15% SD				
No. of Eluent Lines	4	2	4	6 (2 × 3)	1
Gradient Delay Volume	200 µL	35–1550 µL* Default: 200 µL	325–1840 µL* Default: 690 µL	325–1840 µL* Default: 690 µL	
Version with SSV		HPG-3400RS			
Solvent Degassing	Built-in, 4 Channels	External (optional)	Built-in, 4 Channels	External (optional)	External (optional)
Weight	15.8 kg (34.8 lbs)	16.2 kg (35.2 lbs)	13.5 kg (29.8 lbs)	16.5 kg (36.4 lbs)	12.4 kg (27.3 lbs)

* Depending on the SpinFlow mixer configuration

‡ For details on the NCS-3500RS see the UltiMate 3000 RSLCnano System data sheet

ULTIMATE 3000 COMMON PUMP SPECIFICATIONS

Operating Principle	Serial dual-piston
Flow Accuracy	± 0.1% (For BM pumps: ± 0.5%; For NCP-3200RS: < 0.1% RSD at 300 nL/min and 40 MPa)
Flow Precision	< 0.05% RSD or < 0.01 min SD whichever is greater
Pulsation	Typically: < 0.2 MPa or < 1% whichever is greater (For ISO-3100BM pump: Typically: < 0.02 MPa or < 0.1%, whichever is greater)
GLP Features	Full support of Thermo Scientific™ Dionex™ AutoQ instrument qualification, qualification status and system wellness monitoring. All system parameters are logged in the Chromeleon™ Audit Trail.
Communications	USB for PC connection, USB hub with 3 sockets integrated, 15-pin D-sub connector for solvent rack/degasser connection.
I/O Interface	2 digital inputs, 2 relay outputs.
Emission Sound Pressure Level	< 70 dB(A) in 1-m-distance
Dimensions (h × w × d)	16 × 42 × 51 cm (6.3 × 16.5 × 20 in)
Power requirements	100–120 V, 60 Hz; 200–240 V, 50 Hz

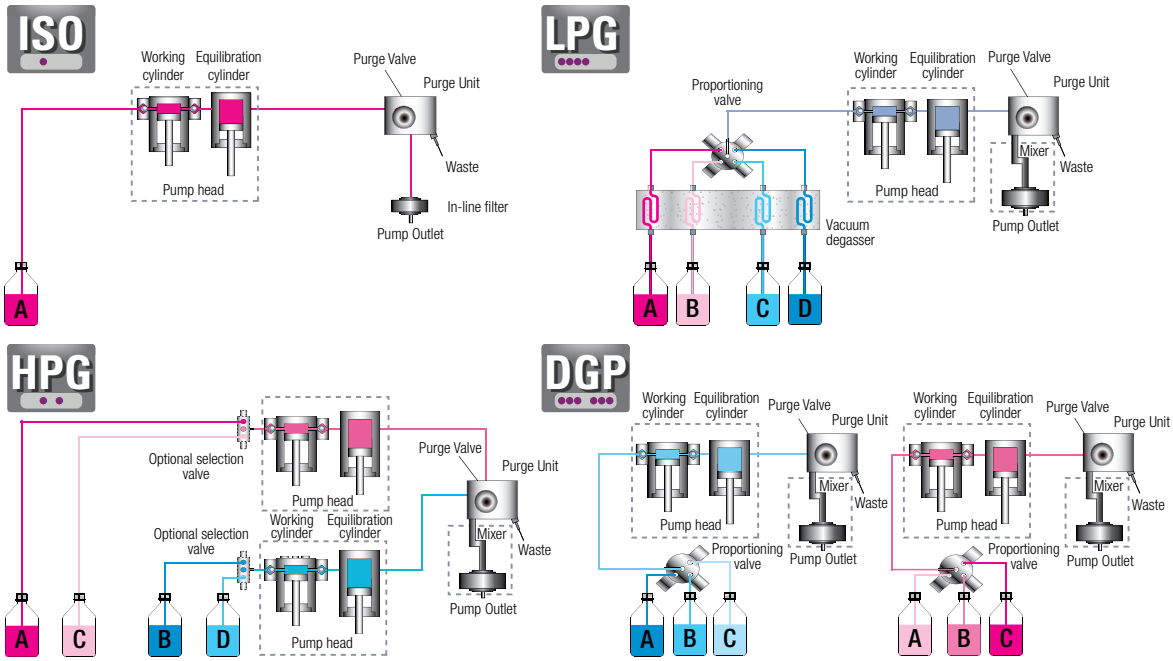


Figure 14. Functional principle and flow diagram of the different pump types

MP SPECIFICATIONS

SD 620 bar			NC 800 bar	BM Bio	BX Bio
HPG-3200SD	LPG-3400SD	DGP-3600SD	NCP-3200RS‡	ISO-3100BM	HPG-3200BX
0.001–10.0 mL/min (0.1–10.0 mL/min)	0.001–10.0 mL/min (0.2–10.0 mL/min)	0.001–10.0 mL/min (0.2–10.0 mL/min)	1 nL/min–50 µL/min (20 nL/min–50 µL/min)	0.001–2.5 mL/min (0.05–2.5 mL/min)	0.001–50.0 mL/min (0.5–50.0 mL/min)
62 MPa			80 MPa	62 MPa	2–16.5 MPa up to 30 mL/min, 2–13.5 MPa up to 50 mL/min
High-pressure proportioning	Low-pressure proportioning	Dual low-pressure proportioning	High-pressure proportioning		High-pressure proportioning
± 0.2% (full scale)	± 0.5% (full scale)	± 0.5% (full scale)	Typically: < 1.0% SD		± 0.2% (full scale)
< 0.15% SD			Typically: < 0.2% RSD		< 0.2% SD
2	4	6 (2 × 3)	2	1	2
35–1550 µL* Default: 400 µL	325–1840 µL* Default: 690 µL	325–1840 µL* Default: 690 µL	< 25 nL		800–1550 µL* Default: 800 µL
HPG-3400SD					
External (optional)	Built-in, 4 Channels	External (optional)		External (optional)	
16.2 kg (35.2 lbs)	13.5 kg (29.8 lbs)	16.5 kg (36.4 lbs)	17.5 kg (38.6 lbs)	12.8 kg (28.3 lbs)	16.2 kg (35.2 lbs)

Fully Controlled by Various Software Packages

All pumps are controlled by a variety of software programs.

Chromeleon Software

No other data system comes close to providing the capabilities and the usability of Chromeleon Chromatography Data System (CDS) software–it's Simply Intelligent™. The software is designed to take users from samples to results in the shortest possible time. Sequence set-up, processing, and result calculations can all be performed quickly, easily, and without training. It controls IC, LC and GC instruments from a wide range of manufacturers.

Other Software Integration

Chromeleon software has the capability to integrate full instrument control for the complete range of UltiMate 3000 LC modules with other software. Thermo Scientific™ Dione™x DCMS^{Link} provides the integration with Xcalibur, Analyst®, and HyStar™ mass spectrometry software. Additionally, UltiMate 3000 instrument interfaces are available for Thermo Scientific Atlas and Empower™ 3 chromatography data acquisition software. These solutions provide Chromeleon's advanced instrument control capabilities in the user's familiar software environment.

Enjoy Industry-Leading Support

Thermo Fisher Scientific Customer Support Centers are located in the United States, Europe, and Asia. These state-of-the-art laboratories are equipped with the full line of Thermo Scientific instrumentation and software capabilities. Support Centers provide accessible locations for advanced training and enhanced application development capabilities. Users can visit these laboratories or sign up to learn new skills in addressing challenging applications, receive training and support, and discover new, innovative HPLC, GC, and IC solutions.

Ordering Information

Part No.	Rapid Separation Pumps
5040.0026	HPG-3200RS Biocompatible Binary Rapid Separation Pump
5040.0046	HPG-3400RS Biocompatible Binary Rapid Separation Pump with Solvent Selector Valves
5040.0036	LPG-3400RS Biocompatible Quaternary Rapid Separation Pump
5043.0036	LPG-3400XRS Quaternary Rapid Separation Pump with Extended Pressure Range
5040.0066	DGP-3600RS Biocompatible Dual-Gradient Rapid Separation Pump
5041.0030	NCP-3200RS Biocompatible Nano/Capillary Pump
5041.0010	NCS-3500RS Biocompatible Nano LC Pump with Column Compartment
5041.0020	NCS-3500RS Biocompatible Capillary LC Pump with Column Compartment
	Standard Pumps
5040.0011	ISO-3100SD Isocratic Analytical Pump
5040.0021	HPG-3200SD Binary Analytical Pump
5040.0041	HPG-3400SD Binary Analytical Pump with Solvent Selector Valves
5040.0031	LPG-3400SD Quaternary Analytical Pump
5040.0061	DGP-3600SD Dual-Gradient Analytical Pump
	Biocompatible Pumps with Extended Flow Range
5042.0011	ISO-3100BM Biocompatible Isocratic Micro Pump
5042.0025	HPG-3200BX Biocompatible Binary Semipreparative Pump
	Solvent Racks
5035.9200	Thermo Scientific Dionex SR-3000 Solvent Rack (without degasser)
5035.9250	Thermo Scientific Dionex SRD-3200 Solvent Rack with 2 degasser channels
5035.9245	Thermo Scientific Dionex SRD-3400 Solvent Rack with 4 degasser channels
5035.9230	Thermo Scientific Dionex SRD-3600 Solvent Rack with 6 degasser channels
6035.0089	Degasser Channel Upgrade Kit for SRD
6510.0004	External Power Supply for stand-alone use
	Pump Accessories
6040.0610	Manual Injection Valve Kit, analytical, 50 MPa
6042.0600	Manual Injection Valve Kit, biocompatible, 34 MPa
6040.0110	Motorized Manual Injection Valve Kit, 103 MPa
6040.5000	Mixer Kit for 35 µL Mixing Volume, for RS/SD pumps, 103 MPa
6042.5000	Mixer Kit for 35 µL Mixing Volume, for biocompatible RS pumps, 103 MPa
6040.5100	Mixer Kit for 100 µL Mixing Volume, for RS/SD pumps, 103 MPa
6042.5100	Mixer Kit for 100 µL Mixing Volume, for biocompatible RS pumps, 103 MPa
6040.5110	Mixer Kit for 200 µL Mixing Volume, for RS/SD pumps, 103 MPa
6040.5310	Mixer Kit for 400 µL Mixing Volume, for RS/SD pumps, 103 MPa
6040.5750	Mixer Kit for 800 µL Mixing Volume, for RS/SD pumps, 103 MPa
6040.5450	Mixer Kit for 1550 µL Mixing Volume, for RS/SD pumps, 103 MPa
6041.0002	Flow Selector for Nano LC (50–1000 nL/min) for NCP-3200RS/NCS-3500RS
6041.0003	Flow Selector for Capillary LC (0.5–10 µL/min) for NCP-3200RS/NCS-3500RS
6041.0014	Flow Selector for Micro LC (2.5–50 µL/min) for NCP-3200RS/NCS-3500RS

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