PRODUCT SPECIFICATIONS 73418

Dionex Integral process analytical liquid chromatography systems

Dionex Integral Migration Path: system solutions where you need them

Thermo Scientific™ Dionex™ Integral™ systems provide a versatile and adaptable approach to process analytical liquid chromatography (LC) systems. An unsurpassed range of ion chromatography (IC) and high performance liquid chromatography (HPLC) capabilities are combined with configurable sampling systems and adaptable industrial enclosure options. Configure solutions for research and development labs, pilot plants, or production environments.

- Thermo Scientific™ Dionex™ Integral™ sampling modules and enclosures can be configured with a Thermo Scientific™ Dionex™ ICS-6000 system or Thermo Scientific™ Dionex™ Integrion Reagent-Free™ ion chromatography (RFIC™) system, or with Thermo Scientific™ UltiMate™ 3000 HPLC systems
- Versatile sampling capabilities provide support for system multiplexing and core functions such as dilution, concentration, matrix elimination, and reagent addition
- Multicomponent LC provides valuable high-resolution analytical results from challenging and complex samples
- The Thermo Scientific™ Dionex™ Integral Migration Path™ approach to process analytics implementation means systems can be configured for bench-top research and development lab studies, pilot plant or wet-lab monitoring, or dedicated plant floor installations

- Enclosures provide environmental protection and industrial compliance
- Thermo Scientific™ Chromeleon™ 7 Process Analyzer (PA) software provides system control, status, reporting, intelligent alarms, and connectivity with industrial control systems via industry standard OPC communications
- Support for process analytics systems is based on over 35 years of Thermo Scientific Dionex experience in a wide range of industries worldwide

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Sampling modules and features

Sample Preparer (SP) module

The Thermo Scientific™ Sample Preparer (SP) module provides versatile capabilities for sample preparation before chromatographic analysis. The SP module is designed for continuous monitoring applications. Standard functions include sample and standard selection, preparation, and loading. Sample mixing, heating, and monitoring of pressure, flow, and pH are available options. Standard solution cooling is also available.

The SP module can be configured with Thermo Scientific bench-top IC and HPLC systems or with systems using the Thermo Scientific™ Analytical Enclosure (AE) module and/or Thermo Scientific™ Liquids Enclosure (LE) module. Multiple plumbing and accessory orientations are available as either preconfigured or customized options. Two versions of SP modules are also available: one for use on a bench-top or mounting to an AE module, and a second for mounting inside the AE module.

SP module features

- Available in preconfigured and customizable plumbing configurations
- SP1 module configuration provides automated standard preparation and sample preconcentration; sample is loaded onto a preconcentration column using a stepper metering pump
- SP2 module configuration provides automated standard preparation and sample dilution; sample is loaded into the injection valve using a micro-peristaltic pump
- Preconfigured modules are equipped with stepper motor-driven dilution pump; 200 mL dilution vessel with variable-speed magnetic stirrer; 10-port, two-position metering valve; 100 psi, 3-way solenoid valves; liquid leak detection and management; ambient temperature measurement; four 16-bit analog signal inputs, variable DC control output (0–20 V)
- Dilution pump flow rate settable from 0.1 to 15.0 mL/min, loading pump from 0.1 to 3 mL/min; precision metering pumps are equipped with manual backup seal wash
- SP electronics support control for up to three 2-position or multi-position valves
- Metering (dilution) valve available as 10-port PEEK (std), 10-port SST, 6-port PEEK, or 6-port SST

Figure 1. SP module, external configuration with door open

- Dilution vessels available in two configurations: 200 mL HDPE for routine dilutions and 50 mL PEEK with 40 °C (max) heater; both can be configured with a magnetic stirrer in the base
- Control for up to 10 solenoid valves; two solenoid controls are configurable as 0–20 V, 0.5 A power circuits for devices such as peristaltic pumps
- All devices are designed for autosensing at installation; sense circuits also help detect device failure modes
- SP module electronics configured with internal USB hub and serial port for future expansion devices
- Devices are calibrated from Chromeleon 7 PA software using user-accessible wellness screens
- Optional SP module features
  - TTL in/relay out kit available for I/O to and from discrete logic devices
  - Peltier effect standard vial cooler available for 20 mL scintillation vial
  - Pressure transducer available to monitor liquid or gas pressure
  - Capacitance-type liquid sensors (up to four) available to provide notification of empty standard, solvent, and buffer containers, or full waste containers (plastic containers only)
  - PEEK thermal-type flow sensors (up to two), able to monitor flows from 0.1 to 5.0 mL/min

Table 1

SP module	
Configurations	SP1 module for direct injection or preconcentration; SP2 module for direct injection or dilution SPx base configuration for custom applications
Enclosure options	External, vertical, stand-alone External, vertical, AE module mounted Internal, horizontal
Dilution pump	**Variable speed, single-piston, stepper motor drive**
Materials	Chemically inert, metal-free PEEK pump heads and flow paths compatible with aqueous solutions, pH 0–14, and reversed-phase solvents
Pressure range	0–14 MPa (0–2000 psi)
Flow rate range	0.1–15.0 mL/min in 0.1 mL/min increments
Volume precision	< 0.2% RSD
Volume accuracy	< 0.2% RSD
Piston seal wash	Standard, manual
Loading pump (stepper)	**Variable speed, single-piston, stepper motor drive**
Materials	Chemically inert, metal-free PEEK pump heads and flow paths compatible with aqueous solutions, pH 0–14, and reversed-phase solvents
Pressure range	0–14 MPa (0–2000 psi)
Flow rate range	0.1–3.0 mL/min in 0.1 mL/min increments
Volume precision	< 0.2% RSD
Volume accuracy	< 0.2% RSD
Piston seal wash	Standard, manual
Wetted parts	PEEK, sapphire, ruby, ceramics, UHMW polyethylene, PCTFE, PTFE
Loading pump (peristaltic)	
Pressure range	0–0.1 MPa (0–15 psi)
Flow-rate range	0–5 mL/min, depending on tubing and manually set drive voltage
Wetted parts	Dependent on tubing material
Metering (dilution) valve	
Options	10-port PEEK (standard) 10-port SST 6-port PEEK 6-port SST
Valve port dimensions	0.020 in. bore
Pressure rating	0–14 MPa (0–2000 psi)
Solenoid valves	
Type	3-way, PEEK body, 0.7 MPa (100 psi)
Actuation	24 V, 1 A PWM drive with reduced hold voltage; total of 10 connections available; two drive connections configurable as user-settable DC drive circuits (peristaltic pump control)
Standard vial cooler option	
Type	Peltier cooled block, equipped with condensate drain
Set point range	4–15 °C
Vial volume	20 mL, designed for scintillation vial dimensions

Table 1 *(continued)*

Additional components and specifications	
Dilution vessels	200 mL HDPE (standard with SP1 and SP2 modules) 50 mL PEEK with external DC heater, 40 °C max settable temperature Both designs bottom-draining, with dual top inlets (liquid and gas)
Dilution vessel mixer	Variable-speed magnetic stirrer with 1.5" stir bar (user replaceable) Firmware-controlled auto-recovery algorithm for when drive circuit detects disengaged stirrer
Analog inputs	4 inputs available, 20-bit, 0–10 V
TTL in/relay out option	8 TTL in; input modes are software configurable 9 Relay out: factory set for normally-open in deactivated state; user configurable for NC
Pressure transducer option	0–10 V input, 7 MPa (1000 psi) standard, panel-mount, flow-through design
Liquid level sensors option	Connections for up to 4 capacitance-type liquid sensors for use with polymeric bottles; software indicates “liquid” or “no liquid” present
Flow sensor option	Thermal pulse type, PEEK, 0.1–5.0 mL/min, support for up to two sensors
Temperature monitor	RTD sensor, accuracy ±1 °C (user calibrated), one sensor provided with SP module, two connections available, second sensor provided with AE module
Leak detection	Optical sensor (no calibration required), one sensor provided with SP module, two connections available, second sensor provided with AE module
Control modes	Chromeleon 7 PA software through USB
Computer connection	USB device connector; with USB hub (three) connectors
Power requirements	90–240 V; 50-60 Hz; 2 A max at 120 V
Operating temperature range	4–40 °C (40–104 °F)
Operating humidity range	5–95% relative, non-condensing; 100% relative with air conditioning or air purge
Dimensions (h × w × d)	43 × 29 × 36 cm (17 × 11.5 × 14 in.)
Weight	21 kg (46 lb)

Stream Selector (SS) module

The Thermo Scientific™ Stream Selector (SS) module provides a full-featured module that automatically selects from up to 21 process streams for analysis. The SS module can be configured to deliver samples to up to four LC systems running in parallel. Sample streams can be configured to run to waste or sample recovery, deadhead at the SS valve, or recirculate back to the process. The sample streams can be configured in the Chromeleon 7 PA software to be sampled in sequence, randomly, or based on a stream result.

SS module features

- SS module available with one, two, or three multiposition valves for 7-, 14-, or 21-sample stream capacity
- Multiposition valves available in PEEK or SST
- Module equipped with liquid leak detection and management, and ambient temperature sensing
- The SS module can be configured with additional electronics and accessory devices as with the SP module

Figure 2. SS module setup with one multiposition valve, door open; up to three valves can be installed

Table 2

SS module	
Configurations	1, 2, or 3 multiposition valves for up to 7, 14, or 21 sample streams
Enclosure options	External, stand-alone for bench-top or wall-mount; internal for AE module, vertical or horizontal orientation
Selection valve(s)	
Options	17-port PEEK, 17-port SST
Valve port dimensions	0.040 in. bore
Pressure rating	3.4 MPa (500 psi) maximum pressure
Additional components and specifications	
Solenoid control	10 connections are available with base SS module for add-on solenoid valves
Temperature monitor	RTD sensor, accuracy ±1 °C (user calibrated); one sensor provided with SS module, two connections available; second sensor provided with AE module
Leak detection	Optical sensor (no calibration required); one sensor provided with SS module, two connections available; second sensor provided with AE module
Control modes	Chromeleon 7 PA software through USB
Computer connection	USB device connector; with USB hub (three) connectors
Power requirements	90–240 V; 50–60 Hz; 2 A max at 120 V
Operating temperature range	4–40 °C (40–104 °F)
Operating humidity range	5–95% relative, non-condensing; 100% relative with air conditioning or air purge
Dimensions (h × w × d)	43 × 29 × 36 cm (17 × 11.5 × 14 in.)
Weight	16 kg (35 lb)

Industrial enclosures

Analyzer Enclosure (AE) module

The Thermo Scientific™ Analyzer Enclosure (AE) module provides an adaptable housing for a variety of IC or HPLC system configurations. Stainless steel (SST) construction provides compatibility with harsh operating environments and the value of a long-lasting, low-maintenance investment. The AE module is designed for NEMA 12/IP52 areas in its basic configuration. The enclosure can also be configured for NEC C1D2/EU Zone 2 or C1D1/Zone 1 rated hazardous environments. Optional air conditioning allows operation in a wider range of environmental temperatures.

The AE module can be wall mounted or installed on a LE module for a free standing unit. The AE module houses the PC-based controller, flat-panel display, and panel mounted touch mouse device. Power input and automation connections are directed through the top of the AE module. Liquid and gas connections are directed through the bottom and sides of the AE and LE modules.

AE module features

- Accessible and open design allows installation of a wide variety of LC components
- Stainless steel construction provides compatibility with harsh environments, easy maintenance, and long-term reliability
- Slide-out shelves and tool-free access panels provide convenient access for module installation and configuration
- Basic configuration supports NEMA 12/IEC IP52 environments (indoor use); available options, including air conditioning and purge, support NEMA 4X/IP56 conditions
- Reliability and safety are enhanced by routing electrical I/O through top of AE; liquids and gases are routed through bottom and sides
- Standard features include filtered power input circuit equipped with emergency off switch (for SEMI-S2 compliance), internal cable chases for wire management, USB and Ethernet hubs, leak management, leak detection (with SP or SS modules configured), and individually labeled fluid lines

Figure 3. AE module

- Inlet ventilation panels (NEMA 12/IEC IP52) incorporate washable wire mesh filters
- Blank side panels can be reconfigured with liquids I/O panels
- Controller mounting and display kit provides a supplemental hinged enclosure for top-mounted PC-based controller; controller cover allows installation of small form factor PCs for Chromeleon 7 PA software operation; kit also includes a panel-mounted 17" flat-panel display and panel mounted touch mouse for configuration, operation, and status display
- AE module can be wall mounted with optional bracket kit or installed on an LE module

Table 3

AE module	
Enclosure options	Wall mounted (with kit)
LE module mounted for stand-alone or wheeled analyzer configuration	External, stand-alone for bench-top or wall-mount, internal, for AE module, vertical or horizontal orientation
Power I/O	Configured at enclosure top
Fluidics I/O	Configured at enclosure bottom panel and side panels
Blower	Standard option for NEMA 12/IP52 environments
Air conditioner option	NEMA 4X/IP56 rated unit provides cooling for ambient conditions between 25 and 45 °C; requirements vary with power load
Purge options	X-Purge w/Power Isolation and Keyed Bypass for NEC C1D1/EU Zone 1 rated hazardous environments Z-Purge for NEC C1D2/EU Zone 2 rated environments
Door	Two positive draw latches with option for keyed latches
Access panels	User-accessible panels on left side and rear of enclosure
Temperature monitor	RTD sensor, accuracy ±1 °C (user calibrated) One sensor provided with AE module (electrical connection in SP or SS modules)
Leak detection	Optical sensor, (no calibration required) One sensor provided with AE module (electrical connection in SP or SS modules)
Leak management	Liquid and gas lines provided for analytical module; I/O secondary drain located on bottom I/O panel
EMO circuit	Door-mounted emergency off switch, configurable by user
Computer connection	Internal USB hub and Ethernet hub with 4X/IP56-type connections to exterior
Power requirements	90–240 V, 50–60 Hz; Integral circuit breaker rated for 20 A at 120 V
Operating temperature range	4–40 °C (40–104 °F)
Operating humidity range	5–95% relative, non-condensing; 100% relative with air conditioning or air purge
Dimensions (h × w × d)	189 × 76 × 68 cm (75 × 30 × 27 in.) with blower; height from floor when mounted on LE module 113 × 76 × 69 cm (45 × 30 × 28 in.) with blower, wall mounted
Weight	70 kg (155 lb) empty

Liquids Enclosure (LE) module

The Thermo Scientific™ Liquids Enclosure (LE) module provides an optional base for the AE module and a means of isolating and protecting eluent, reagent, and standards containers. It can also be used as an expansion enclosure for additional LC modules. The LE module is designed to be NEMA 12/IEC IC52 compliant, and can be configured for NEMA 4X/IEC IP56 operation.

LE module features

- The LE module provides an optional base for the AE module for a stand-alone or wheeled analyzer configuration; casters allow practical means of transport within a facility
- Basic configuration supports NEMA 12/IEC IP52 environments (indoor use); options support NEMA 4X/IP56 operation
- The LE module provides isolation and protection of eluent, reagent, and standards containers without opening main AE module
- Tempered glass window in door allows operator viewing of contents without opening
- Slotted shelving in base provides easy movement of containers or instrumentation in and out of enclosure, while providing protection from leaks or spills

Figure 4. LE module

- Leak detection provided via SP or SS module electronics
- Leak management provided via threaded drain fitting in the bottom of the LE module
- The LE module can be used as an expansion enclosure for additional LC modules
- Liquids and gas I/O panel between AE module base and LE module top can be configured to isolate two enclosures or to allow airflow between both

Table 4

LE module	
Enclosure options	Mounted beneath AE module for stand-alone or wheeled analyzer configuration
Power I/O	Not applicable
Fluidics I/O	Configured at I/O panel between AE and LE modules, and side panels
Door	Positive draw latch with tempered glass window option for keyed latch
Gas controller	Panel-mounted regulator with two equalizing shut-off valves; provides nominal pressurization of reagent bottles to maintain inert head pressure
Leak detection	Optical sensor (no calibration required) One sensor provided with LE module (electrical connection in SP or SS modules)
Leak management	Liquid and gas lines provided for analytical module I/O; secondary drain located on bottom I/O panel
Casters	Double-wheel design for low profile and system stability
Caster extension kit	Available for configurations where SP module or AC unit are mounted on side of AE module
Dimensions (h × w × d)	75 × 64 × 68 cm (30 × 25 × 27 in.)
Weight	75 kg (166 lb) empty

Chromeleon 7 Process Analyzer (PA) software

Chromeleon 7 PA software is part of a total solution for continuous process monitoring using IC or HPLC. This software incorporates a unique analyzer interface to expand the user's ability to configure, control, monitor, and report data from multiple IC or HPLC systems configured for continuous monitoring.

Chromeleon 7 PA capabilities

- Consistent user interface for on-line systems and laboratory systems
- Real-time display of instrument status with user-definable parameters
- Complete analyzer control for synchronized operation of multiple systems for sequential sample analysis
- Single-pass batch sequences or continuous sequencing; a feature unique to Chromeleon 7 PA software (Figure 6)
- Notification of alarm conditions and conditional responses; a broad range of preconfigured and user-defined conditional responses to keep the systems running and generating meaningful results, even when your process produces results outside the expected range
- User-defined sequences for samples, calibration standards, validation samples, and sequences invoked as a result of conditional responses
- Support of remote monitoring and control of the analyzer
- Direct, manual control from software when desired (Figure 7)
- Support for 21 CFR Part 11 compliance, including secure, administrator-controlled user access and permissions, and audit trails (Figure 8)
- Analysis methods are easily transferred from existing laboratory methods
- Seamless data transfer to industrial information systems using either an optional OPC (OLE for Process Control) Server (for reporting and analyzer control) or text file exporting of user-defined reports

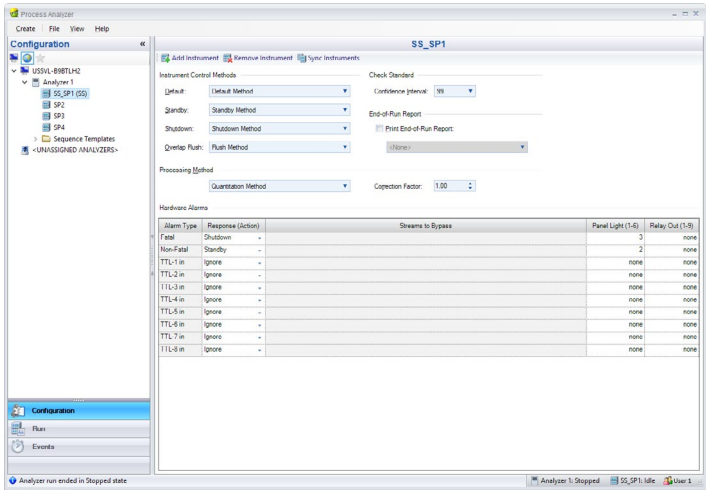

Figure 5. Chromeleon 7 PA software: Analyzer configuration

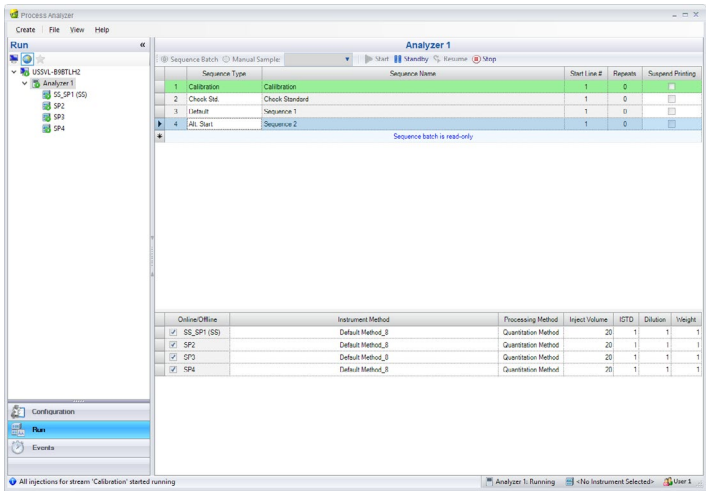

Figure 6. Chromeleon 7 PA software: Analyzer sequence run

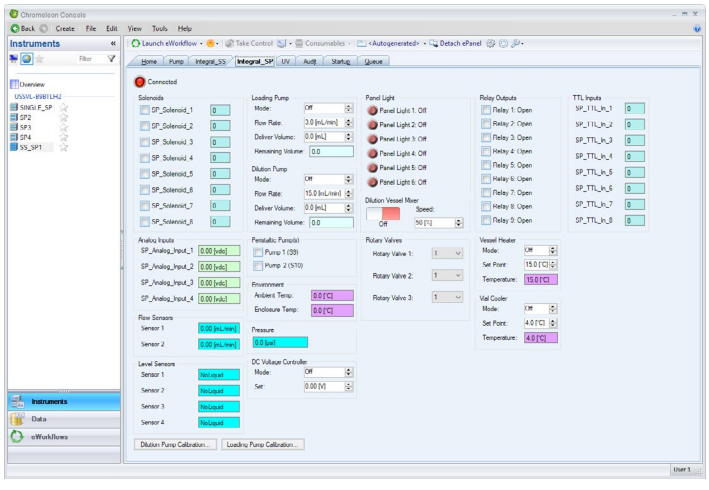

Figure 7. Chromeleon 7 PA software: Sample preparation control

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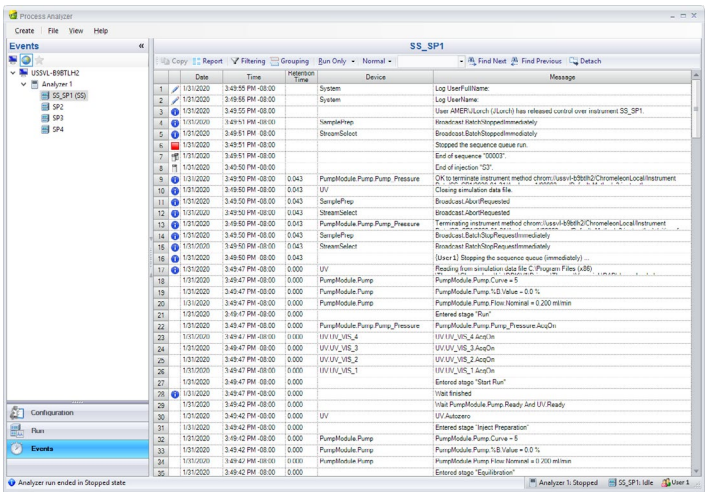

Figure 8. Chromeleon 7 PA software: Audit trail

Table 5

Chromeleon 7 Process Analyzer Software specifications	
System description	Chromatography data system and software enables instrument monitoring, data acquisition, processing, and reporting for process applications
Number of systems supported	An unlimited number of analyzers, with up to four instruments each, can be configured
Instrument control	Real-time bidirectional control through USB interface
Minimum hardware requirements *(subject to change—check software for the latest Chromeleon requirements)*	
RAM	16 GB
Hard disk space	120 GB
Ports	License device: 1 USB port; Thermo Scientific modules: 1 or more additional ports
Peripherals	Keyboard, mouse, and printer
Operating platform	Microsoft® Windows® 10 Enterprise/Pro

Find out more at **thermofisher.com/processanalytical**

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