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# Integral Process An

## Optimize Your Process Operations by Improving Process Monitoring

All industrial processes have a common need—reliable, accurate, and timely methods for analyzing process chemistry. Continuous monitoring with on-line liquid chromatography enables detection of process variations earlier than laboratory-based measurements before yield is impacted or costly process shutdowns become necessary. Improving process monitoring capabilities helps fine-tune the process chemistry to maximize efficiency and reduce operating costs. The result—increased returns on investment and improved profitability.

On-line liquid chromatography-based techniques such as on-line Reagent-Free™ IC (RFIC™) or HPLC systems have several advantages over other process analytical technologies:

- Multi-component analysis provides more information than single component or bulk property analyses
- Chromatographic separations enable measurement of specific analytes in highly complex matrices
- Unique detection capabilities provide unparalleled detection limits, enabling trace component measurement
- Chromatographic quantification is typically more robust than spectroscopic-based techniques



Since 1984, Dionex has been providing liquid chromatography-based process analytical technology (PAT) to enable customers to optimize process operations by improving process monitoring. On-line LC process analyzers have allowed critical analytes to be measured in multiple process operations in the following fields:

- **Pharmaceutical production**—reaction intermediates and final products
- **Semiconductor manufacturing**—contaminant ions in ultrapure water
- **Power plants**—corrosive ions and additives in coolant and boiler water
- **Environmental**—contaminants in ground water
- **Bioreactors**—metabolites and nutrients
- **Chemical manufacturing**—organic acids and amines
- **Industrial waste**—metals and organics in plant waste streams
- **Food and beverage production**—additives and final products
- **Plating processes**—components, additives, and contaminants in plating baths

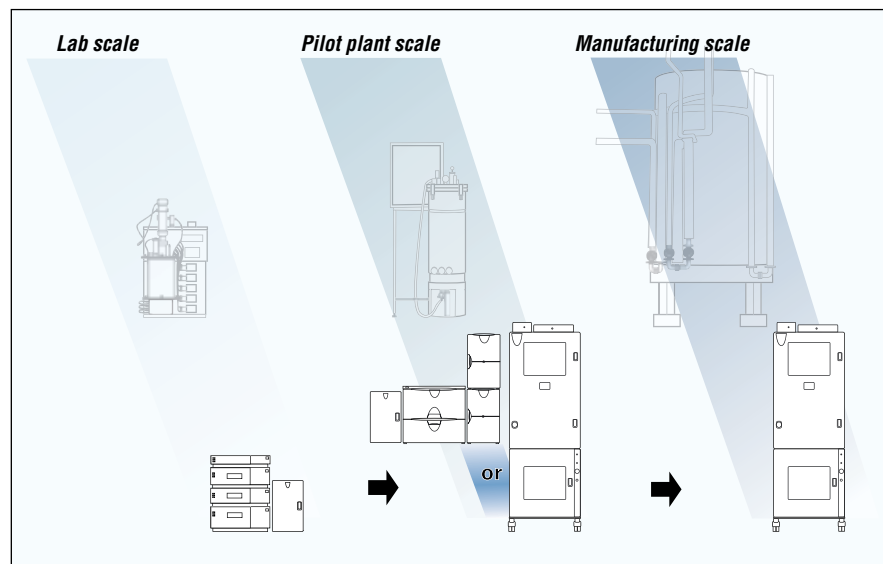
# alytical Systems

## A Modular System to Fit Your Needs

With the introduction of the Integral™ system, Dionex brings the power of industry-leading liquid chromatography instrumentation to process analysis applications, including PAT. Integral provides cost effective, flexible solutions to apply on-line IC/HPLC to applications in a controlled environment, such as a laboratory, or in the challenging environment of an industrial site. No matter what the application, Integral has a configuration for on-line IC/HPLC wherever and whenever it is needed.

## Integral Migration Path™

The Integral Migration Path approach enables you to use on-line IC/HPLC to generate timely, high-resolution information when monitoring a small-scale reactor in a process R&D lab, testing the production of tomorrow's new product in a pilot plant, or improving current processes in a manufacturing plant.



This flexibility provides several advantages:

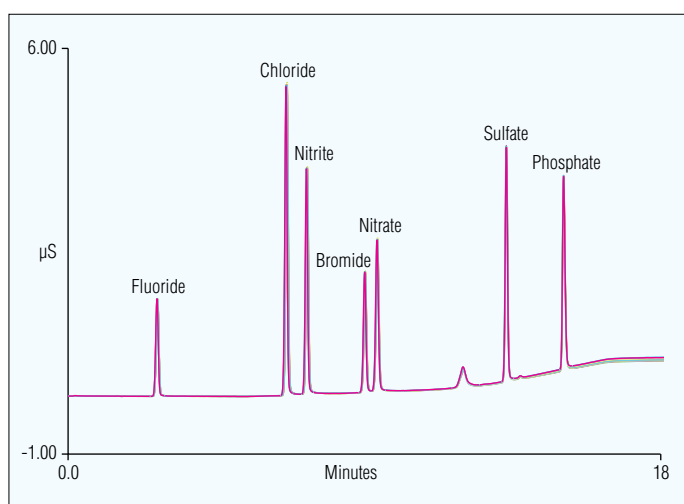
- More time to determine the benefits: Develop analytical methods and process parameters before committing to installing the technology in manufacturing
- Lower regulatory risk: Explore this technology in the pharma process R&D phase when GMPs are less restrictive
- Cost effective: Add modules and the industrial enclosure only when needed
- Increased versatility: Convert your lab-based, on-line IC/HPLC to a conventional lab IC/HPLC system for grab sample analysis

# Integrate Development and From Bench Top to Production Floor

## Sample Modules Travel with Your Process

Integral achieves flexibility by separating sample stream selection and sample preparation functions into stand-alone modules controlled by Chromeleon® PA software. These modules serve as automated interfaces between your process and your Dionex analytical systems. The SS Stream Selector allows you to lower your financial investment by using one Integral on-line IC/HPLC system to monitor up to 21 sample streams. The SP Sample Preparer provides the functionality to automatically:

- Deliver samples or standards to the on-line analyzer
- Add reagents and diluents to process samples or standards
- Capture and concentrate analytes on selective resins
- Generate multi-point calibration curves



Overlay of 30 injections of a 200-2000 ppm anion stock standard diluted 1:1000 using the SP. Peak Area RSDs <0.5%



# d Production

## Award-Winning Systems for the Lab and Plant

Sample analysis is performed using Dionex IC (ICS-3000, ICS-2000) or HPLC (UltiMate® 3000) instrumentation. These instruments are designed to meet your on-line analysis needs:

- RFIC systems for consistency and ease-of-use
- Modular HPLC and IC systems for flexibility and adaptability
- High flow-rate, high-pressure UHPLC separations for faster results and higher throughput
- Single channel or dual channel systems for higher throughput or increased information per sample
- Isocratic and binary or quaternary gradient systems for high method flexibility
- Multiple detector options including conductivity, electrochemical, UV-Vis (variable wavelength, multi-wavelength, and diode array), fluorescence, ELSD, and RI to cover all analyte classes

When you are ready to apply on-line IC/HPLC technology in the plant, add the optional AE Analyzer Enclosure and/or LE Liquids Enclosure:

- Stainless steel construction to protect the instrumentation from the plant environment
- Onboard PC, LCD display, and touchpad mouse controller
- Designed to accommodate single- or dual-channel systems
- Optional air conditioning unit for ambient temperatures above 35 °C
- Easy access to instrumentation for maintenance
- Purge controller options for installation in NEC Class 1, Division 1 (EU Zone 1) and Class 1 Division 2 (Zone 2) explosion hazard areas



SS Stream Selector

# Chromeleon PA

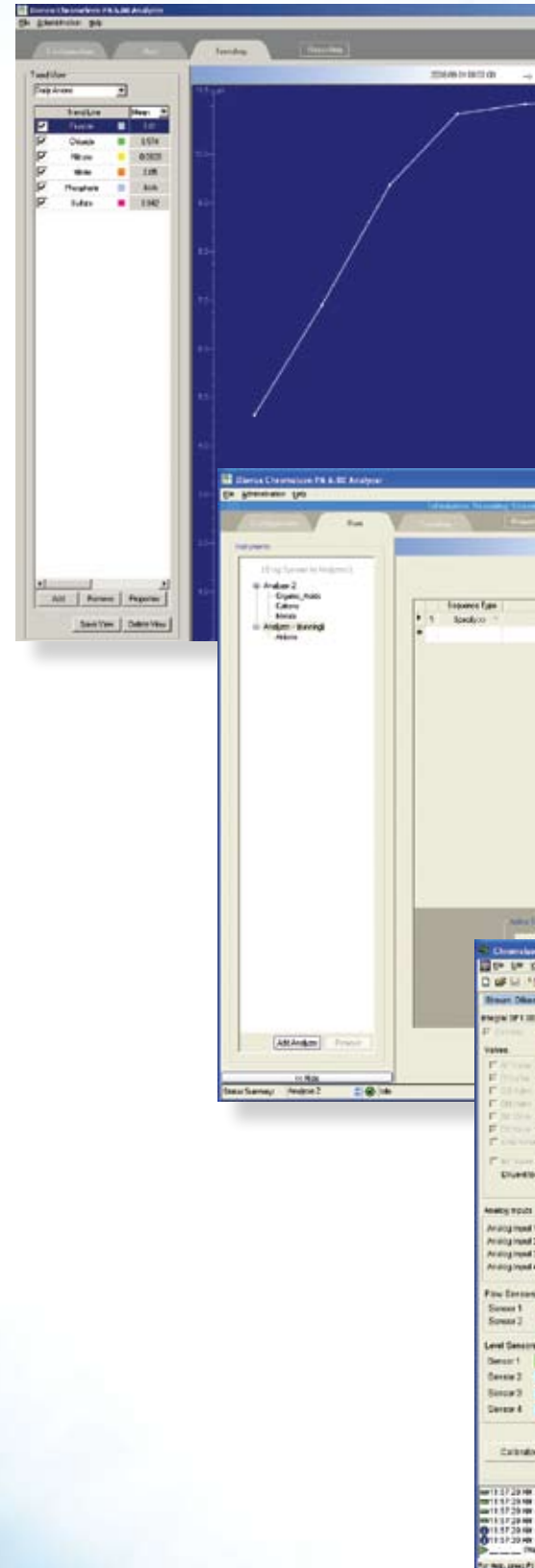
## Integrated Process Control Software

Chromeleon PA software provides analyzer configuration and control as well as data acquisition, processing, and reporting for the Integral system. It is a versatile software interface for viewing analyzer status, handling alarms, reporting results, and interfacing with plant data acquisition, automation, and control systems using industry standard OPC communications. Chromeleon PA is CFR 21/Part 11 compliant, an important requirement for US FDA regulated industries.

The Integral platform easily fits into existing process environments. Chromeleon PA facilitates this through reliable, precise, and integrated control of the entire sampling and analysis process to enable unattended, 24/7 analyzer operation.

### **Analyzer control**

- Controlled analyzer access based on user ID and access level
- Programmable sample stream sequencing and analysis frequency
- Complete control and status of all analyzer components
- Automatic alarm handling using preprogrammed conditional responses including changing stream sequences, analysis frequency, and methods
- Automatic scheduling of system suitability checks, check standards, and calibrations
- Synchronized operation of multi-channel analyzer systems



## Results trending



## **Comprehensive information retrieval and industrial connectivity**

- Real-time display of analyzer status and critical component parameters
- Notification of result-based events, hardware alarms, and options for response actions
- Audit trail log showing date, time, and actions being taken by the analyzer
- Historical trending of analysis results, calculated variables, and analyzer parameters
- Hard copy reports with user-defined content and reporting frequency

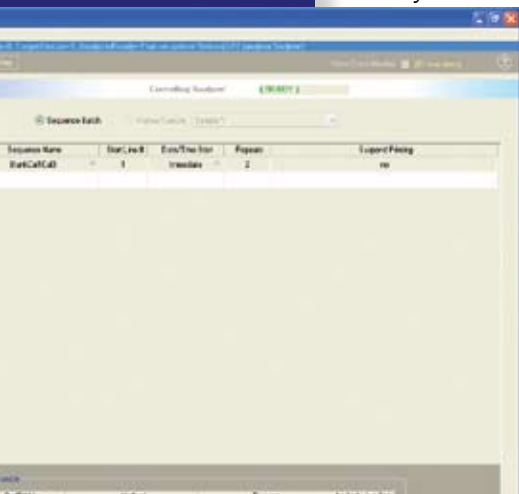
## **Share analyzer information with external data acquisition, automation, and control systems**

Export data using simple text files or use the optional OPC Server software.

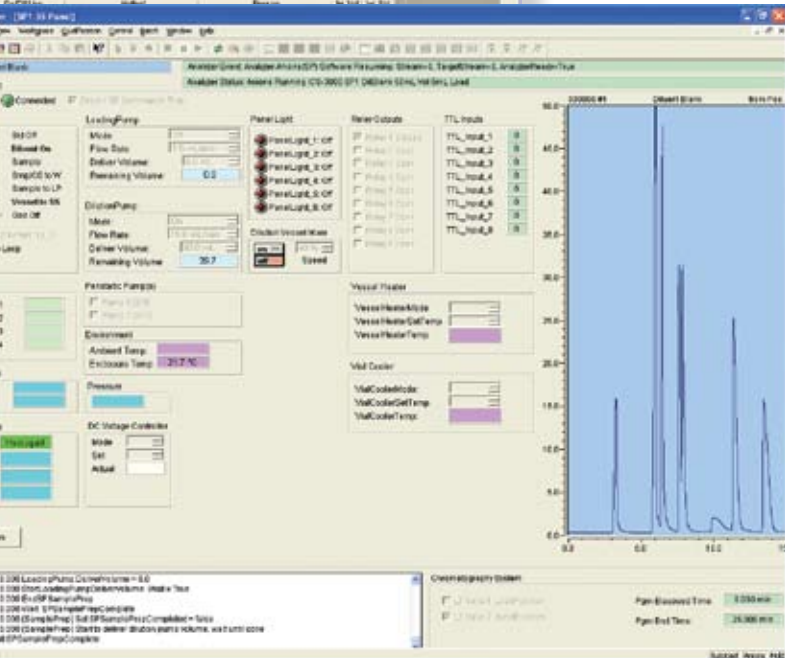
The OPC Server provides bidirectional communications for:

- Sharing results with external OPC compliant systems to enable decisions using the on-line IC/HPLC results
- External control of the analyzer, e.g., start/stop, system suitability checks, and calibrations
- Communication of analyzer status with external control systems

## Analyzer control



## System status



## Complete Solutions for Your Process Analytical Needs

Timely and accurate analytical information, versatile sampling modules and enclosure systems, and powerful automation capabilities from Dionex all combine to provide what you need for your process analytics, *wherever and whenever you need it.*

When it's time to implement your choice of solutions from the Integral Migration Path, Dionex is committed to providing total satisfaction through after-sales service, on-site training, system qualification services, and a broad range of products for your process analytical applications. With nearly 25 years of experience in process analytical liquid chromatography, we understand how to install and maintain process systems for optimal performance and maximum uptime. We do more than install your system; we ensure it will provide solutions for your analytical challenges.



Dionex 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 Dionex LC instrumentation and software capabilities. Support Centers provide accessible locations for advanced training and enhanced application development capabilities. Users can attend these laboratories to learn new skills in addressing challenging applications, receive training and support, and discover new, innovative HPLC and IC solutions.

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