numera³

AUTOSAMPLING FOR ADVANCED
BIOPROCESS LABS

securecell

AUTO SAMPLING EVOLVED

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Numera® 3 is an advanced automated sampling system for real-time bioprocess analytics, automating complex laboratory workflows with consistent and reliable sampling.

Its integrated dilution, filtration, and cold storage streamline sample handling to significantly reduce manual workloads and maximize operational efficiency.

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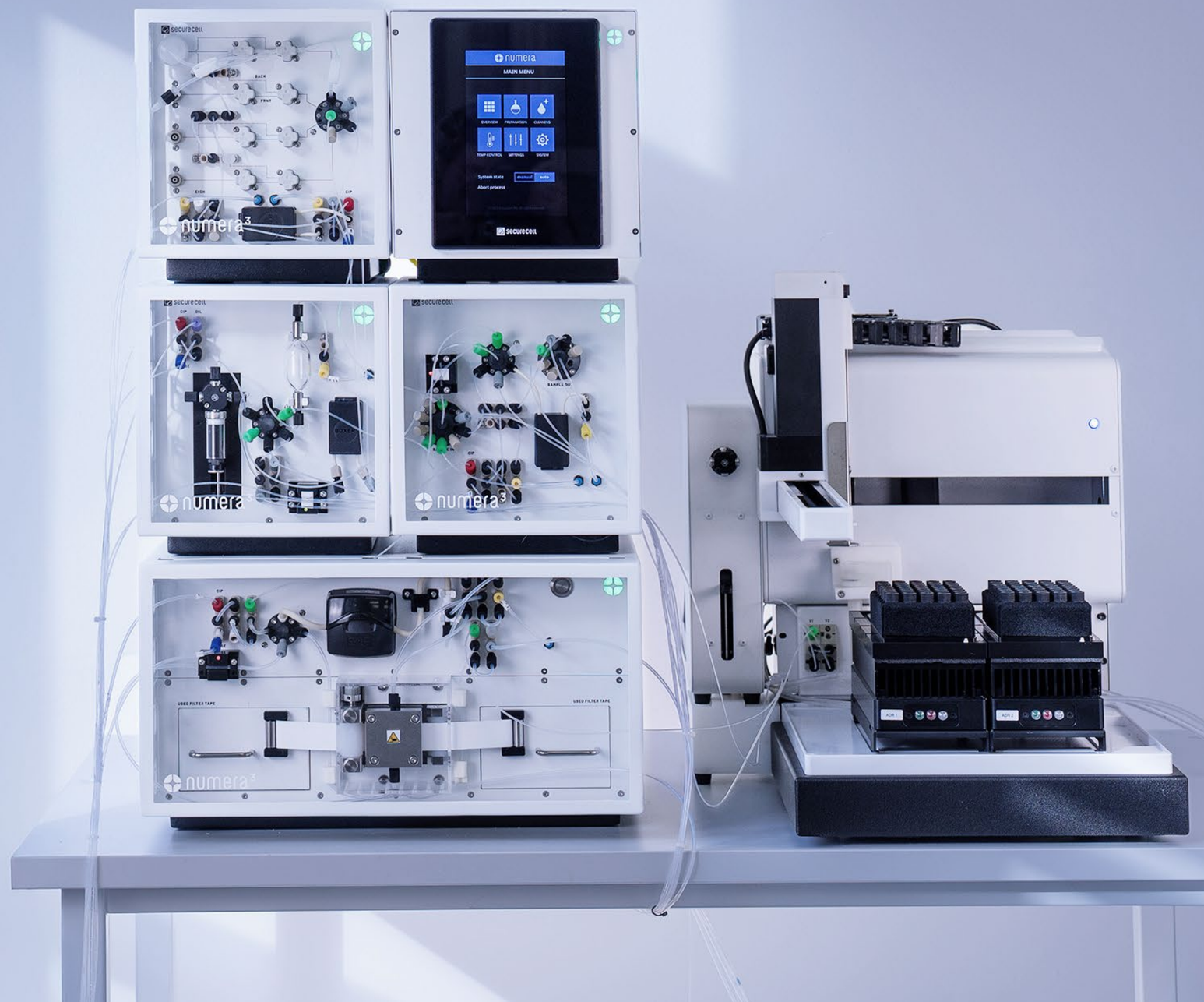
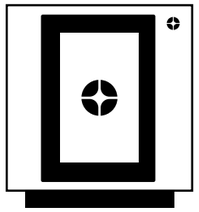
USER FRIENDLY MODULARITY MEETS FULLY INTEGRATED BIOPROCESS AUTOMATION



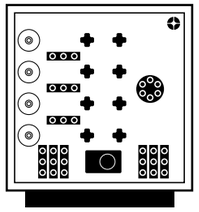
NUMERA 3
MAIN DEVICES

Numera® 3 is a modular PAT system. Each installation includes a Control Module, a Routing Module and at least one Multiplexer Module. The Dilution and Filtration Module for sample preparation are optional modules.

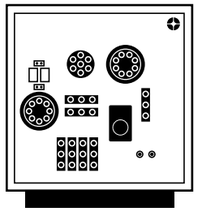
Control Module (CPU)
- 7" User friendly touchscreen
- Configuration settings for system preparation, cleaning, and sampling
- Various communication ports
- Compressed air distribution



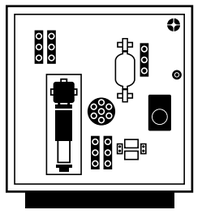
Multiplexer Module (MUX)
- Multiplexing of up to 4 bioreactors per module
- Up to 4 modules per Numera® system
- Pinch valve sterility barrier with ethanol rinsing
- Sterile air blow-back mechanism to prevent cross-contamination and preserve low volume sampling



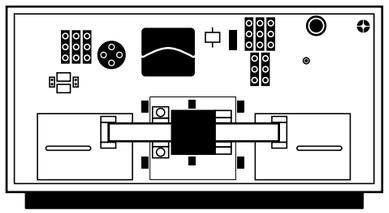
Routing Module (SRU)
- Individual sample distribution within one process
- Direct transfer to maximum six analyzers* (e.g. biochemistry, electrochemistry, cell counters, HPLC, LC-MS)
- Option to split the sample across multiple destinations



Dilution Module (SDU)
- Dilution from 1:2 to 1:100
- Reagent addition and mixing
- Precise and reproducible sample processing



Filtration Module (TFU)
- Unique cross-flow filtration technology
- Low protein binding PES membrane coil
- Up to 375 filtrations per coil
- Membrane pore sizes: 0.22 µm, 0.45 µm, and 1.2 µm
- Fresh membrane section for every filtration cycle avoiding cross-contamination and clogging



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Sterile barrier to Bioreactors via **pinch valves**

Unused sample pushed back into bioreactor with **filtered air**

Bubble free syringe performs precise sample dilution

New and used **filter tape** stored in easy-to-replace coils

7" display with intuitive UI for seamless operation

Variable speed peristaltic pump for optimum sample flow

Filter press enables tangential flow filtration of 2 mL or 4 mL input volumes

CORE BENEFITS

Improved Process Monitoring & Control

Enables frequent, consistent, and real-time sampling.

Supports advanced process analytical technology (PAT) strategies.

Provides better visibility into critical process parameters (CPPs) and critical quality attributes (CQAs).

Increased Accuracy & Consistency

Reduces human error and variability in sampling.

Ensures representative samples drawn at predefined intervals.

Improves data reliability for process modeling and optimization.

Enhanced Sterility & Contamination Control

Minimizes the risk of contamination compared to manual sampling.

Labor & Cost Efficiency

Reduces manual labor, freeing operators for other manual tasks.

Lowers costs associated with failed batches due to contamination or poor monitoring.

Data Integration & Automation

Can be linked with online or at-line analyzers (e.g., HPLC, mass spectrometry, cell counters).

Supports continuous bioprocessing and closed-loop control.

Facilitates digitalization and Industry 4.0 strategies.

Safer Operations

Limits operator exposure to biological materials and hazardous reagents.

Reduces ergonomic strain from frequent manual sampling.

CORE FEATURES

- **Sampling from up to 16 bioreactors**
- **Low sampling volume starting at 2.7 mL**
- **High frequency sampling up to every 6 minutes**
- **Cooled sample storage at 4-8°C**
- **Integration of up to 6 analyzers**
- **Individual sample preparation**
- **Dilution up to 1:100**
- **Smooth cell removal through filtration**
- **Advanced and flexible sample management**
- **Automated data import from analyzers and advanced feedback control loops in combination with Lucullus®**

SAMPLE STORAGE

The Sample Collector is equipped with Peltier cooling racks. The device is available in two sizes with space for up to 320 vials.

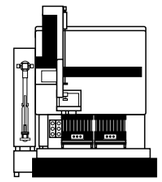
SAMPLE COLLECTION

The Numera® 3 Sample Collector stores retained samples for further processing. The samples can be cooled to 4 °C. The Autosampler is available in two different configurations: the smaller ASX-7200 and the larger ASX-7400. Both models are equipped with a syringe pump and a rinse station.

Different well plates can be chosen depending on customer needs. Securecell offers vial racks for 1.5 ml, 4.0 ml, and 10 ml glass vials. Standard deep-well plates with 2, 5, or 10 ml can also be used.

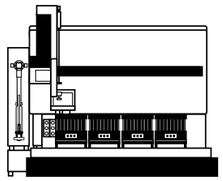
ASX-7200

- 2 Peltier rack modules (storage at 4 to 20 °C)
- 4 well plate positions
- Optional: 1 HPLC injection valve



ASX-7400

- 4 Peltier rack modules (storage at 4 to 20 °C)
- 8 well plate positions
- Optional: 1 or 2 HPLC injection valves



Accessories

Vial racks

- 40 × 1.5 ml vials
- 24 × 4.0 ml vials
- 12 × 10 ml vials

HPLC/UHPLC injection valves

- Variants of 5,000 and 20,000 psi
- Vertical port injector
- Sample loop (ID 0.14 mm) from 5 to 20 µl

DYNAMIC PROCESS FLEXIBILITY

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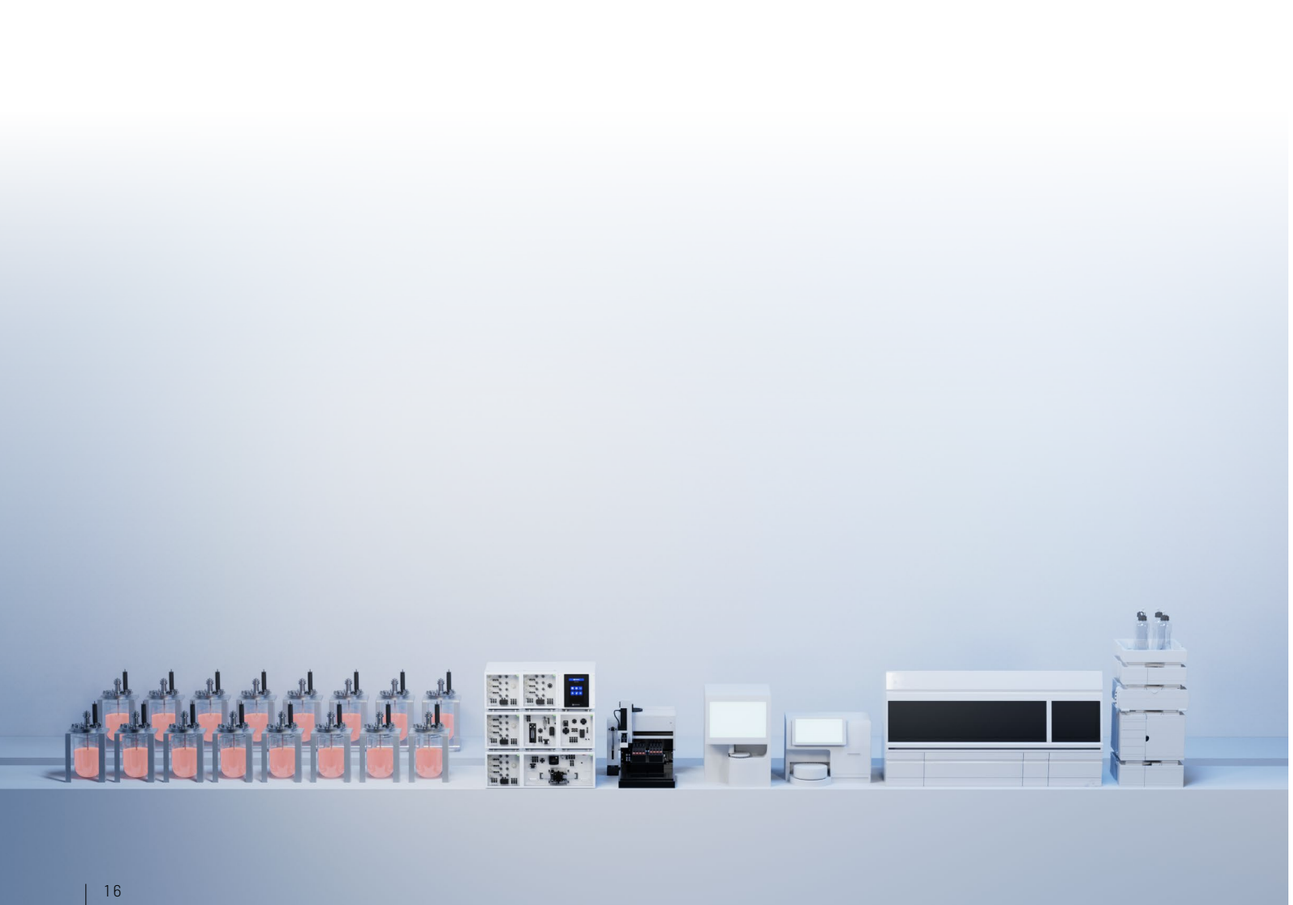
The modular design of Numera® 3 allows for multiple configurations from single reactor sampling and storage to sample processing for up to 16 reactors including dilution, filtration, and integration of the industries leading on-line analyzers.



FLEXIBLE PRODUCT CONFIGURATION

Sample Collection and Storage

Automatically collect samples from connected bioreactors and preserve them at 4–20°C to ensure sample integrity for subsequent analysis.

Automated Sample Processing

Automate sample processing with dilution (up to 1:100) and advanced filtration, enabling reliable collection of cell-free samples.

Integrated On-line Analytics

Achieve real-time insights through automated, parallel analysis of your samples with integrated cell counters, biochemistry analyzers, and LC systems.

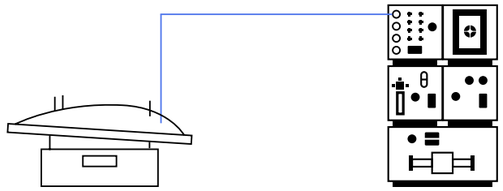
REACTOR CONNECTION

Numera® 3 can be used in many applications from single-use to bench-top to stainless steel reactors. The appropriate connection options are available for all purposes. The modular concept includes:

- Single-use sampling sets
- Sample lines 1 – 10 m

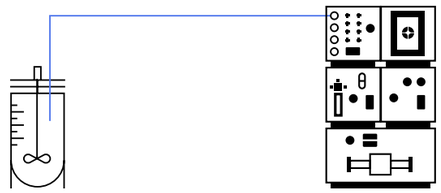
Single Use Bioreactors

+ Sample lines



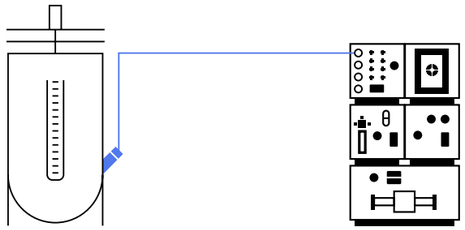
Benchtop Reactors

+ Sample lines
+ Dip tube
+ Adapters



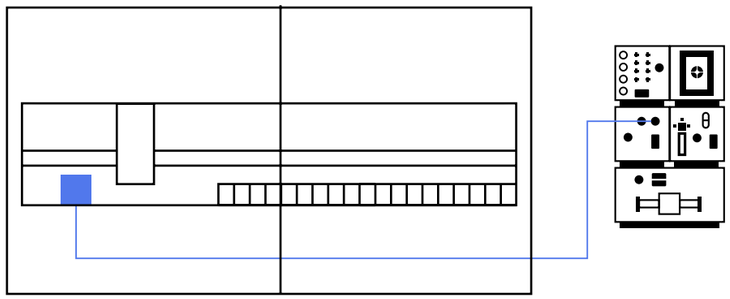
Stainless Steel Reactors

+ Sample lines
+ Sampling port



Ambr®250 High Throughput System*

+ Ambr® Interface
+ Sample lines



* for more details contact our sales team

Ambr® is a registered trademark of
"The Automation Partnership (Cambridge) Limited"

At the Multiplexer Module, autoclavable **sampling sets** including all tubings for sterile sampling, ethanol cleaning, and blow-back with sterile air, are installed for each sample vessel.

Sample lines from 1 to 10 m are used to attach the sampling set at the Multiplexer Module to the corresponding bioreactor interface with Luer-Lock screw connections.

Stainless steel **dip tubes** (30 cm and 50 cm) with a Luer-Lock connector are used in combination with a suitable reactor adapter to sample from benchtop bioreactors.

Adapters from 10 mm, 11 mm, 12 mm, and PG13.5 are available to mount the dip tubes to any common headplate port.

The **aseptic sampling port** enables sampling from stainless steel bioreactors using the 25 mm side port. The connection to the Numera® System is made with a septum piercing needle with side entry. The needle comes with a holder that fits to the aseptic sampling port and with a Luer-Lock connector.

STERILITY BY DESIGN

The Multiplexer offers 4 connections for sampling sets to interface bioreactors or downstream vessels. Sterility is ensured through pinch valves. A Numera® 3 system can include up to 4 Multiplexer Modules and thus, sample from up to 16 reactors.

NUMERA 3 STERILITY GUARANTEE

- Minimal sample loss
- Autoclavable sampling sets
- Push-back of sample residues with sterile air
- Ethanol rinsing procedure followed by drying of the line

Proof of sterility in a technical run

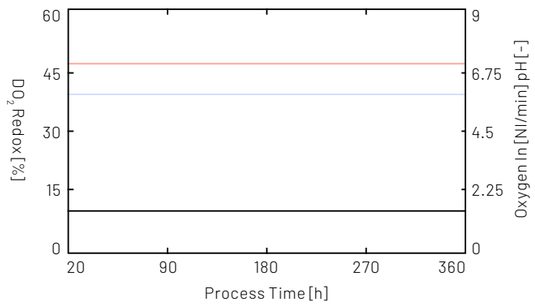


Figure values for pH (red line), pO_2 (blue line) and O_2 inflow (black line) over process time. The steady values indicate a sterile process over 15 days. Samples were drawn every 2 h.

Please visit our website for the full article.

Proven Sterility and Reliable Contamination Control

The Numera® Sampling System has been rigorously validated to ensure uncompromising sterility and protection against cross-contamination — even under challenging conditions.

Validation of Tubing Sterilization

To confirm sterility, sampling tubes were intentionally contaminated with *Bacillus stearothermophilus*, one of the most resistant microorganisms used in sterility testing. After autoclaving, no viable organisms were detected, demonstrating the effectiveness of sterilization.

Long-Term Sterility During Sampling

To assess sterility maintenance during extended use, the system was connected to a 3.6 L bioreactor containing sterile culture medium. Over 15 days, samples were taken every 2 hours — more than 180 individual sampling events. Throughout the trial, no turbidity, pH shifts, or oxygen level changes were observed (see figure). This confirms that the pinch valves ensure a sterile barrier from contamination, even during continuous, high-frequency sampling.

Cross-Contamination Testing

The system was further challenged with alternating samples from sterile and deliberately contaminated media over 10 days, totaling 1,000 samples. Despite repeated switching, no contamination was transferred between sterile and non-sterile vessels. Sterility was verified visually, spectrophotometrically, and in streak plating.

Conclusion:

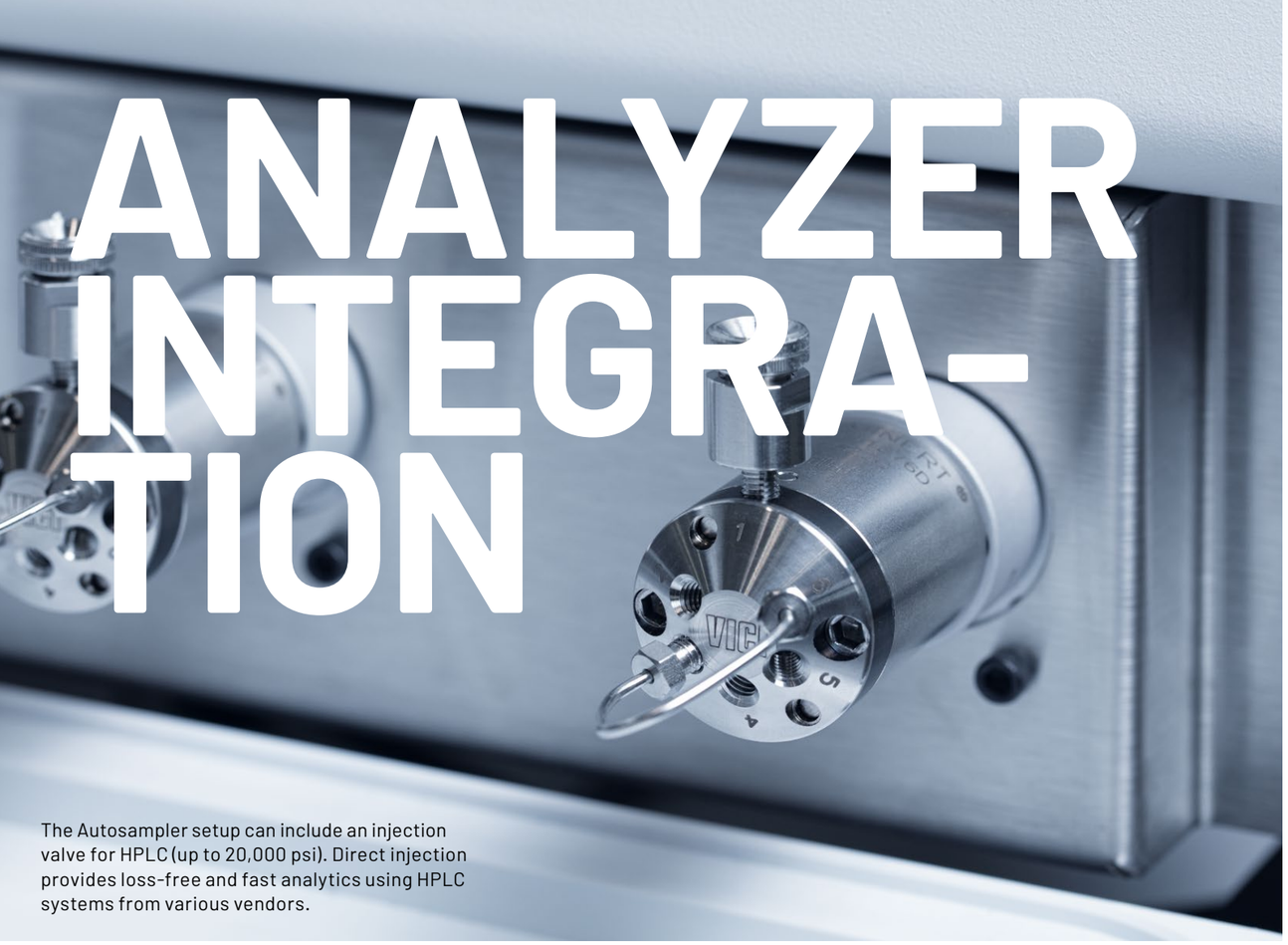
With proven sterility, long-term reliability, and robust protection against cross-contamination, the Numera® Sampling System provides confidence in every sample — ensuring accurate results and safeguarding your processes.

UNIQUE FILTRATION

The patented cross-flow tape filtration design exposes each filtration run to a fresh section of tape, preventing cross-contamination and filter fouling while gently removing cells with low sample volumes.

Various pore sizes from 0.2 to 1.2 µm are available.

ANALYZER INTEGRA-TION



The Autosampler setup can include an injection valve for HPLC (up to 20,000 psi). Direct injection provides loss-free and fast analytics using HPLC systems from various vendors.

Sample Transfer Unit 1
(STU 1) Interface

Sample Transfer Unit 2
(STU 2) Interface

ANALYZER INTEGRATION

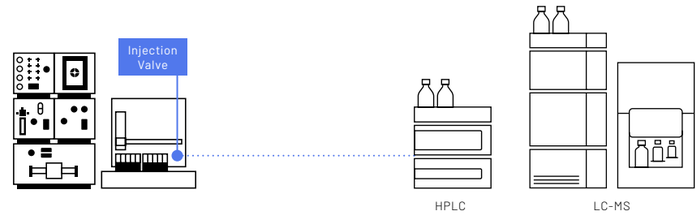
Numera® 3 can be integrated with a variety of analyzers to perform on-line, at-line, and off-line analysis. These analyzers include:

- Cell counters
- Biochemistry analyzers
- HPLC and LC-MS
- Spectral analyzers

Securecell provides the specific accessories and instructions required for the integration of each analyzer.

1.

2.



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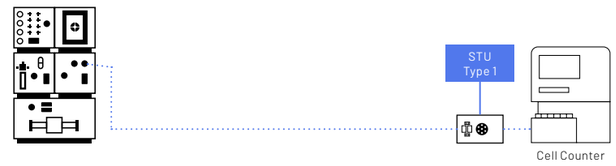

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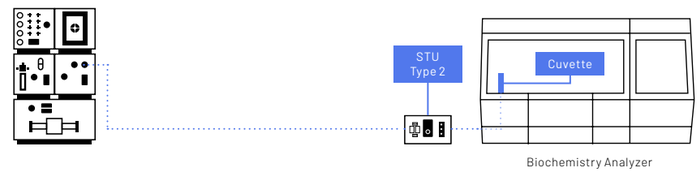
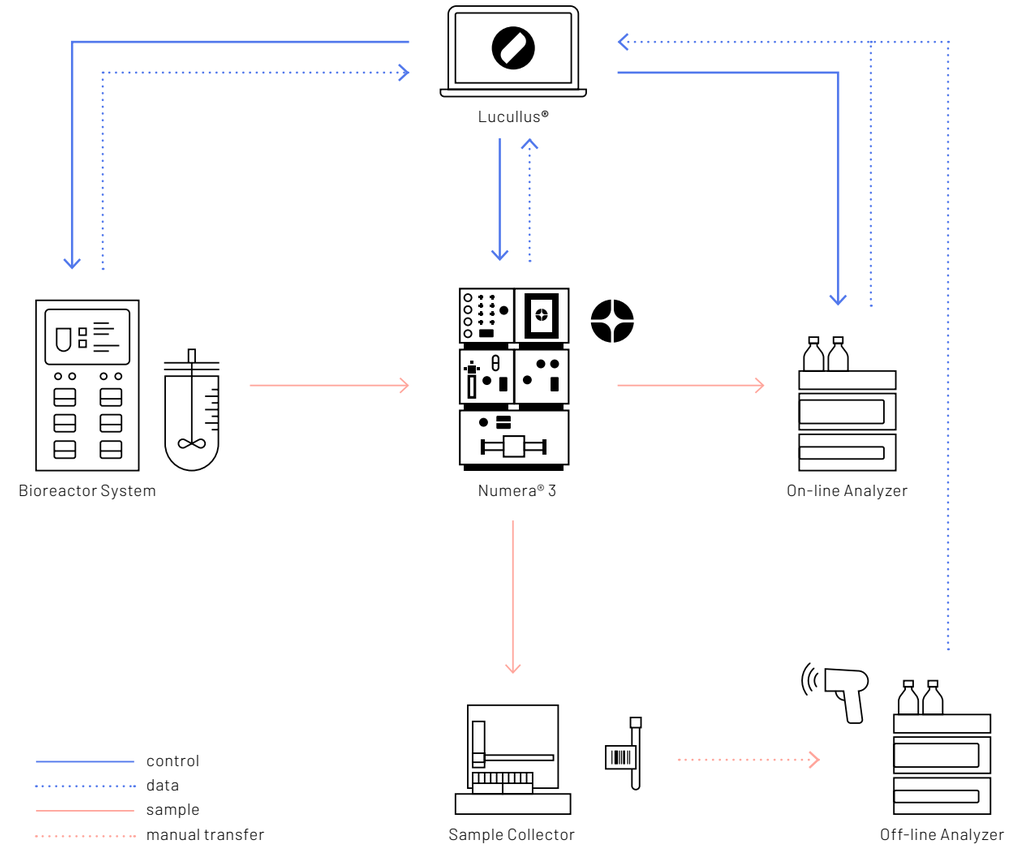


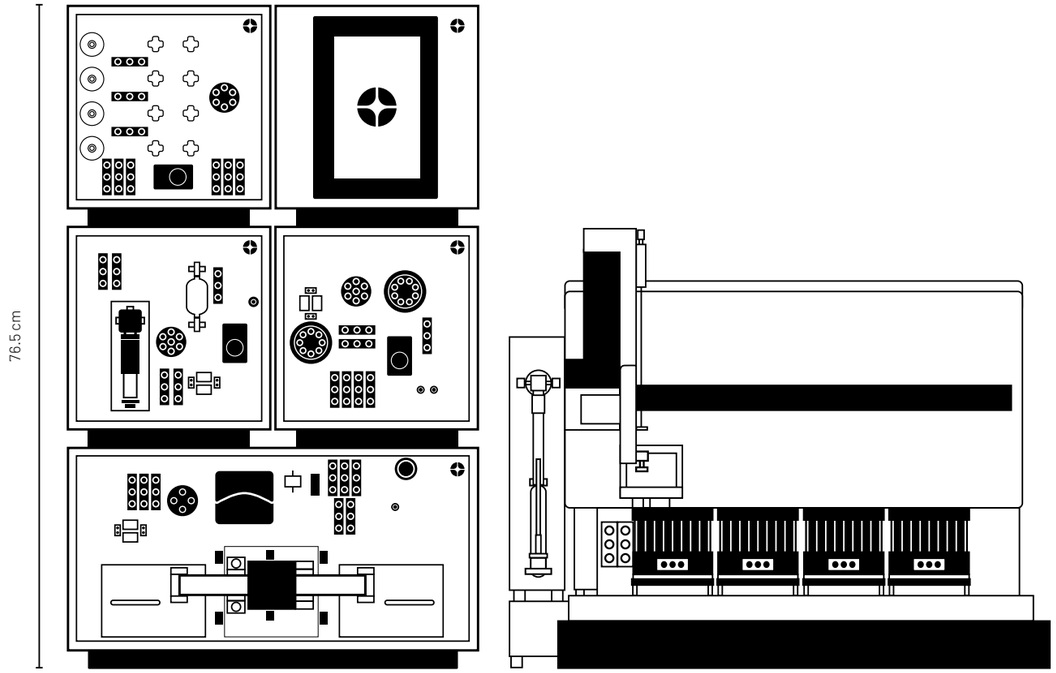
SAMPLE MANAGEMENT

The combination of the automated sampling system, Numera® 3, and Lucullus® Process Information Management System, enables the orchestration of the whole workflow comprising sampling, measurement, process monitoring, and control.

- Sample planning (time- and event-based)
- Analytical methods for all analyzers
- Barcode and label printing
- Automated event-based sample triggering during process execution
- Sample preparation and sample storage
- Automated on-line measurements
- Centralized data management and process monitoring
- Advanced process control and feedback loops



Dimensions and Weight



Numera®3 Modules	Dimension (w × h × d)	Weight
Control Module	23 × 25.5 × 44 cm	6.6 kg
Multiplexer Module	23 × 25.5 × 44 cm	7.0 kg
Dilution Module	23 × 25.5 × 44 cm	7.4 kg
Routing Module	23 × 25.5 × 44 cm	7.5 kg
Filtration Module	46 × 25.5 × 44 cm	16.0 kg

Sample Collector

ASX-7200	37 × 46 × 54 cm	21.0 kg[1]
ASX-7400	57 × 46 × 54 cm	23.0 kg[1]

Sampling Frequencies

The sampling frequencies depend on the applied sample processing and the length of the sampling lines

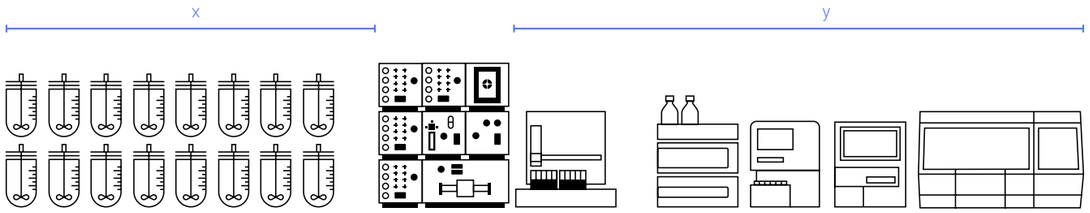
Sample Processing[2]	Duration (mm:ss) Processing[3]	Cleaning	Total	Frequency	
Direct transfer	02:50	06:40	09:30	6.3 h^{-1}	~150 day^{-1}
Sampling + Filtration	01:45	06:45	08:30	7.0 h^{-1}	~170 day^{-1}
Sampling + Dilution	06:00	11:00	17:00	3.5 h^{-1}	~85 day^{-1}
Sampling + Dilution + Filtration	05:20	06:50	12:10	5.0 h^{-1}	~120 day^{-1}

Sampling Volume

Approximate values for sample volume, rinsing solution, and cleaning solution (mL)

Sample Processing[2]	Sample Volume	Sample Used	**Total Volume**	Cleaning Solution	Rinsing Solution
Direct transfer	1.4	1.2	**2.7**	2.0	4.2
Sampling + Filtration	1.4	2.3	**3.7**	11.9	38.7
Sampling + Dilution (1:2)	1.6	1.9	**3.6**	12.0	18.0
Sampling + Dilution (1:20)	1.7	0.6	**2.3**	11.9	18.1
Sampling + Dilution + Filtration (1:2)	1.4	2.3	**3.7**	21.6	38.7
Sampling + Dilution + Filtration (1:20)	1.5	0.9	**2.3**	21.2	38.4

Maximum distance consideration per system



The connected bioreactors and analyzers should be placed within 10 m each Numera 3 system **(x + y ≤ 10 m)**

1. Without syringe module, Peltier racks, and injection valve.
2. All experiments were performed with water at room temperature. Reactor connection tube length: 1.5 m (ID 0.75 mm). No overpressure in the reactor, 155 rpm pump in SRU and SDU. Dilution ratio 1:2 and 1:20.
3. Including sampling and transfer to Autosampler.

The information in this brochure reflects the state of the product at the time of publication.

Securecell AG continuously enhances its products and, therefore, reserves the right to update technical specifications, features, and procedures without prior notice.

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