

QB AutoSampler

Software-Defined Automated
Bioprocess Sampling

Software-defined hardware systems for liquid handling
March 2026v2

FLEXIBLE
INNOVATIVE
LIMITLESS



The Sampling Challenges

Manual Errors

Human sampling introduces variability, contamination risk, and inconsistent volumes across batches

Cross-Contamination

Shared fluid paths without proper cleaning protocols compromise sample integrity and data quality

Limited Scalability

Fixed-port systems cannot grow with your process — adding vessels means buying entirely new hardware

Compliance Gaps

Manual documentation creates audit trails that are incomplete, error-prone, and not 21 CFR Part 11 ready

The Solution: QB AutoSampler



Aseptic Sampling

Sterility assurance with multi-stage path cleaning



Modular & Scalable

Add sources, destinations, and modules without system redesign



Software-Defined

Every parameter configurable via QB Control web interface



Fully Automated

Schedule-based, event-triggered, and adaptive sampling modes



21 CFR Part 11 Ready

Complete audit trail with electronic signatures and batch reports

01

SYSTEM ARCHITECTURE

**Modular hardware
defined & controlled
by software**

Modular Architecture

Build your sampling system from independent **QB Modules**
— each controlled via **QB Edge** and **QB Control**



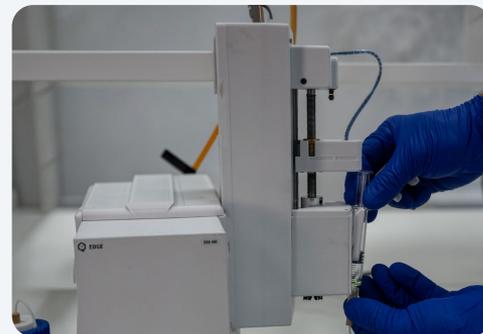
QB Edge

- Central controller hub
- Connects all modules
- OPC-UA / MQTT
- Real-time orchestration



QB SelectorValve

- 24-port selector valve
- Fluid path routing
- Source/Dest. switching
- Near-zero dead volume



QB SyringePump

- Precision syringe pump
- 1-5 mL volume range
- High-accuracy dosing
- Modular syringe swap

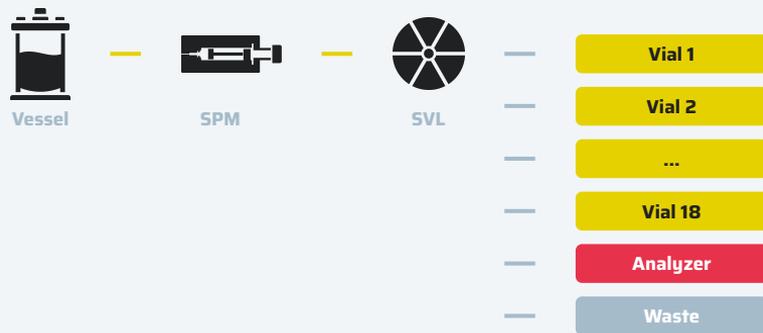
Scaling Scenarios

Single Vessel

Scenario A

1 Vessel → 1 SelectorValve

Up to 18 destination samples per valve



- 1x SyringePump + 1x SelectorValve
- Up to 18 destination ports + source + wash ports
- Ideal for single-vessel, multi-destination routing

All modules connect to a **single QB Edge**. Scale by adding hardware, not redesigning the system

Scenario B

1 Vessel → Multiple SelectorValves

When more destinations exceed a single valve capacity



- 1x SyringePump + Nx SelectorValve
- Stack valves to expand destination capacity
- All connected to a single QB Edge

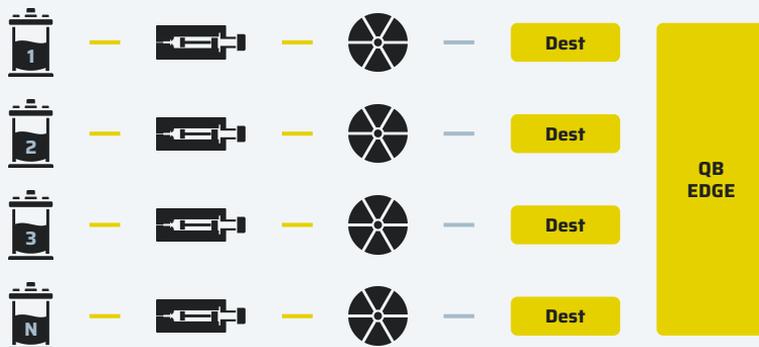
Scaling Scenarios

Multiple Vessels

Scenario C

N Vessels → N × 1 SelectorValve

Each vessel has its own SPM + SVL pair



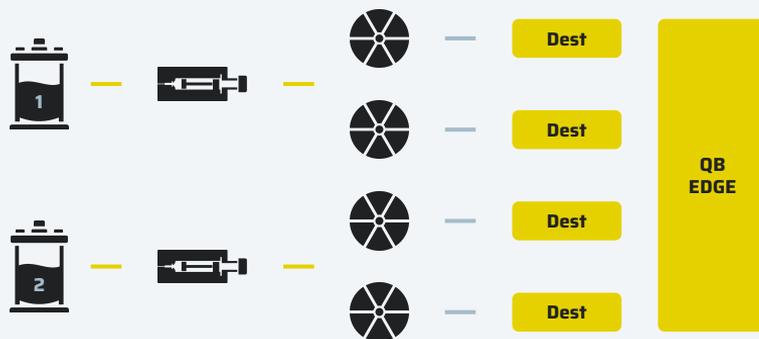
- N× SyringePump + N× SelectorValve
- Dedicated device pair per vessel
- Single QB Edge controls all devices

Regardless of the number of devices, all connect to the same QB Edge and are controlled as one unit

Scenario D

N Vessels → N × M SelectorValves

Maximum scale: multiple valves per vessel



- N× SyringePump + (N×M) SelectorValves
- Expand both vessels and destinations simultaneously
- Single QB Edge — plug & play scaling

Concurrent vs In-Sequence Sampling

Regardless of the number of devices, all connect to the same **QB Edge** and are controlled as one unit

Concurrent Sampling

All vessels sampled at the same time

12 vessels sampled simultaneously



Requires: 12× SyringePump + 12× SelectorValve

Each vessel needs a dedicated device pair

In-Sequence Sampling

Recipe-based rounds — cost-optimized alternative

Round 1

Vessels 1-6 sampled



Round 2

Vessels 7-12 sampled (same 6 devices reused)



Requires: 6× SyringePump + 6× SelectorValve

50% hardware reduction via 2 sequential rounds
Samples from Round 2 are time-delayed vs Round 1

Key Insight

If time-shifted sampling is acceptable, in-sequence recipe-based automation provides significant cost savings for scaled multi-vessel deployments. Both strategies are orchestrated through QB Control recipes.

Six Competitive Advantages



Aseptic Integrity

Multi-stage cleaning: air purge, wash, rinse, dry, disinfection hold. Sterility assurance in place.



Dedicated Fluid Paths

Eliminate cross-contamination with per-source dedicated or configurable hybrid sampling paths.



True Modularity

Scale from 1 to 24+ sources. Add QB Modules without system redesign or process downtime.



Adaptive Scheduling

Time-based, event-triggered, and OPC-UA / MQTT driven adaptive sampling — change strategy mid-batch (Q2 2026)



Modular Cooling

QB Chamber modules: 4-40°C
12-24 vial capacity per chamber
(Q2-Q3 2026)



Compliance

21 CFR Part 11 audit trails and auto-generated batch sampling reports.

Technical Specifications

Parameter	Specification
Sample Volume Range	1 - 5 mL per sample (configurable per sampling run)
Volume Accuracy	±1% (precision syringe pump with position feedback)
Sampling Sources	Up to 24 per SelectorValve module (stackable for 48+)
Destinations	Vials, analytical devices, waste
Temperature Control	2 - 40°C (QB Chamber modules, Q2-Q3 2026)
Cleaning Stages	Configurable: Air Purge (optional) → Wash → Rinse → Dry → Disinfection Hold
Sterility Assurance	Aseptic sampling capability
Communication	OPC-UA / MQTT
Compliance	21 CFR Part 11 ready — audit trail, reports
Footprint	Benchtop modular — scales horizontally with your process
Control Software	QB Control (web-based, multi-user, multi-process, real-time dashboard)

02

SAMPLING & CLEANING

**Automated services
with configurable strategies**

Sampling Strategies

Configure multiple sampling modes through the **Automated Sampling Service** in **QB Control**

Scheduled Sampling

Time-based intervals with configurable start time, frequency, and sample count. Ideal for routine process monitoring across long batch runs.

Event-Triggered

Sampling activated by process events via OPC-UA — pH shifts, temperature excursions, feed additions, or custom conditions.

Adaptive Sampling

Real-time process data drives sampling decisions. Automatically increase frequency during critical growth phases (Q2 2026)

Concurrent Split-Routing

Split a single sample to both a vial for cold storage AND an at-line analyzer — simultaneously, in one cycle (Q2-Q3 2026)

Automated Sampling Workflow

Each sample execution follows a precise, fully automated sequence controlled by **QB Control**

01**Aspirate**

Draw sample from source vessel via syringe pump at configured speed

02**Route**

SelectorValve directs fluid to the configured destination port

03**Dispense**

Deliver precise volume to vial, analyzer, or both concurrently

04**Clean**

Execute the assigned cleaning strategy for path decontamination

05**Log**

Record all parameters, IDs, and timestamps in the audit trail

Configurable Parameters per Sample

- ✓ Source vessel and port assignment
- ✓ Aspiration volume (1-5 mL)
- ✓ Aspiration / dispense speed
- ✓ Destination routing (vial / analyzer / etc.)
- ✓ Cleaning strategy selection
- ✓ Sample ID linkage and metadata tags

Cleaning Strategies

Configurable multi-stage path decontamination
via the **Sampler Cleaning Service**



Fully Configurable

Each stage can be independently enabled/disabled with configurable volumes, flow rates, and hold times. Choose Quick Rinse, Standard Clean, Deep Clean, or build custom profiles.

Strategy Combinations

Combine sampling modes with cleaning profiles to match your **specific application requirements**

Application	Sampling Mode	Fluid Path	Cleaning Profile	Stages Used
Cell Culture QC	Scheduled (2h interval)	Dedicated	Standard Clean	Air → Wash → Rinse → Dry
Fed-Batch Critical	Adaptive (OPC-UA)	Dedicated	Deep Clean + Disinfect	All 5 stages
Multi-Vessel Screen	Time-shifted (offset)	Shared + Clean	Full 5-Stage	All 5 stages + hold
Upstream R&D	On-demand manual	Dedicated	Standard Clean	Air → Wash → Rinse → Dry
GMP Production	Scheduled + Event	Dedicated	Deep Clean + Disinfect	All 5 + extended hold

Key Benefit

All combinations are software-configurable per sample in QB Control.
Change strategy mid-batch without any hardware modification.

Cleaning Configuration

Per-Stage Parameters

- **Washing Source Port** Port connected to wash agent (1-24)
- **Flow Rate** Speed for aspiration and dispense (mL/min)
- **Port Selection** 24 individual on/off switches per port
- **Full Syringe Volume** Max volume dispensed per port per cycle
- **Waste Routing** Syringe empties to waste before each cycle
- **Device Lock Check** Verifies pump and valve are available
- **Enable/Disable Stages** Toggle any stage per cleaning profile

Preset Cleaning Profiles

Quick Rinse

Air + Rinse + Dry — Low-risk, same-media sequential samples

Standard Clean

Air + Wash + Rinse + Dry — Routine sampling across different media

Deep Clean + Disinfect

All 5 stages with extended hold — Cross-species or high-risk contamination

Custom Profile

User-defined per stage — Application-specific requirements

Automated Sampling Service

A software service in **QB Control** that orchestrates the complete sample acquisition cycle

Service Capabilities

- ✓ Aspirate configured volume from any source port
- ✓ Route sample to vial, analyzer, or concurrent split
- ✓ Configurable aspiration and dispense speeds
- ✓ Automatic valve switching between ports
- ✓ Device lock check before execution
- ✓ Sample ID assignment and metadata tagging
- ✓ Audit trail logging of every parameter
- ✓ Automatic cleaning trigger after dispense

Configurable Parameters

- **Source Port** SelectorValve port (1-24) connected to vessel
- **Destination Port** Target port for vial rack or analyzer
- **Sample Volume** 1-5 mL configurable per run
- **Aspiration Speed** Flow rate for drawing sample (mL/min)
- **Dispense Speed** Flow rate for delivering sample (mL/min)
- **Split Routing** Concurrent delivery to 2 destinations (Q2-Q3 2026)
- **Cleaning Profile** Assign cleaning strategy post-sample
- **Sample Metadata** ID, timestamp, source linkage

Automated Cleaning Service

A dedicated software service that decontaminates all fluid paths between samples

Service Capabilities

Port-Level Control

24 individual on/off switches — clean only the ports that were used

Wash Source Selection

Dedicated valve port for wash agent supply

Volume Per Port

Full syringe volume dispensed through each active port

Waste First

Syringe empties to waste before each clean cycle begins

Device Lock

Verifies syringe pump and valve availability before start

Multi-Stage

Up to 5 sequential stages: air, wash, rinse, dry, disinfect

Configurable Parameters

- 1 Check device availability (syringe pump + valve)
- 2 Empty syringe contents to waste port
- 3 Aspirate wash agent from configured source port
- 4 Dispense full syringe volume through each active port
- 5 Log cleaning event — ports, volumes, timestamps

03

AUTOMATION & CONTROL

**From manual control to fully
unattended batch execution**

Three Levels of Control

QB Control provides progressive automation — from manual device control to fully unattended batch execution



Mode A Manual Control

Direct Device Interaction

- ✓ Operate devices directly from P&ID view
- ✓ Click on a syringe pump or valve to control it
- ✓ Set parameters and execute individual actions
- ✓ Full visibility of device states in real time
- ✓ Ideal for setup, testing, and troubleshooting



Mode B Service Execution

On-Demand Automation

- ✓ Run Sampling or Cleaning service from P&ID
- ✓ Service automates the full multi-step sequence
- ✓ User triggers execution manually — on demand
- ✓ Repeat execution for each sample needed
- ✓ Semi-automated: user initiates, service runs



Mode C Recipe Automation

Fully Unattended Execution

- ✓ Recipe Management module orchestrates the batch
- ✓ Chain multiple services into automated sequences
- ✓ Scheduling, loops, pauses, and conditional logic
- ✓ No user intervention needed after recipe start
- ✓ Full batch runs — from first to last sample

Recipe Management

Recipe Building Blocks



Service Execution

Run Sampling or Cleaning service with preset parameters



Sleep / Wait

Timed delay between service executions (sampling intervals)



Loops & Repeats

Repeat sampling sequences for defined number of cycles



Mode Switch

Switch between different service configurations mid-recipe



Event / Conditional

Branch recipe logic based on process conditions



Validation Gate

Recipe must be Verified or Validated before execution

Design, validate, and execute fully automated sampling sequences — no user intervention required

Recipe Lifecycle

Both Verified and Validated recipes can be executed. Validated recipes require a new version for any changes, ensuring traceability.

DRAFT

Design recipe in visual editor — drag and drop service blocks



VERIFIED

Reviewed — can be executed. Changes allowed without new version



VALIDATED

Approved & locked — can be executed. Changes require new version

Example

12-Hour Batch Sampling Recipe

- ✓ Start → Sampling Service (Reactor 1, Port 3, 2mL to Vial)
- ✓ → Cleaning Service (Standard Clean, 4 stages)
- ✓ → Sleep 2 hours
- ✓ → Loop x6 (repeat sampling + cleaning cycle)
- ✓ → End — 12 samples collected, fully automated, report generated

Aseptic Sampling Setup

Dedicated consumables, validated procedures, and testing reports for sterile sampling environments

Recipe Building Blocks



Dedicated Consumables

All tubing and fluid-path components are consumables provided as pre-assembled aseptic consumable sets



Standard Operating Procedure

A4BEE-provided SOP must be followed for proper assembly and operation of the aseptic sampling setup



Aseptic Testing Report

Testing report documenting sterility verification is available and shared on demand



Consumable Sets

Pre-packaged aseptic consumable sets include all tubing and connectors required for sterile sampling paths

Aseptic vs Non-Aseptic

	Standard	Aseptic
Tubing	Reusable	Consumable sets
Assembly	Standard	SOP-guided
Validation	Optional	Required report

Key Takeaway

The same QB AutoSampler hardware supports both standard and aseptic sampling. The difference is in consumables and procedure — not in the system itself. This makes it easy to transition between modes based on project requirements.

Use Cases



Cell Culture Monitoring

Automated periodic sampling from bioreactors for cell count, viability, and metabolite analysis with full traceability and cooled storage.



Fed-Batch Production

Adaptive sampling during feed additions. Increase frequency during critical growth phases. Dedicated fluid paths per reactor.



Multi-Reactor Screening

Sample from 12+ parallel vessels with time-shifted scheduling. Deep cleaning between different cell lines prevents cross-contamination.



PAT Integration

Concurrent split-routing to both vials and at-line analyzers. Real-time analytical data combined with stored reference samples (Q2-Q3 2026)

Pricing & Licensing Model

Transparent pricing driven by hardware configuration and consumables - software scales with your setup

What Impacts Price

Sampling Mode

In-sequence or concurrent — concurrent requires more HW device pairs

Consumables

Standard or aseptic consumable sets depending on process requirements

Port Configuration

Source & destination port combinations determine selector valve setup

Fluid Paths

Individual (dedicated) or shared paths for sampling lines

Aseptic Requirement

Aseptic sampling requires dedicated consumable sets and SOP

Software License

- ✓ License linked to HW modules & services (Sampling + Cleaning) and Recipe Management
- ✓ Perpetual license — fixed one-time cost
- ✓ Scaling with new hardware requires license upgrade (applied in real-time)
- ✓ Modifications are plug & play — no HW rework needed

Support Plans

Standard (included)

12 months remote support — software updates, new versions, bug fixes

Extended (optional)

Prioritized reaction times, spare parts shipment, dedicated support

Product Gallery



Complete AutoSampler Setup



QB Edge + Module Stack



Edge Controller Detail



24-Port SelectorValve



Vial Rack & Tubing



Syringe Pump Module



Thank you!

QB AutoSampler

Software-Defined Automated
Bioprocess Sampling



Request a Demo

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