



Process security technologies

for the Freedom EVO® liquid handling platform

Integrated process security technologies enhance reliability, manageability and efficiency of liquid transfers

Sample preparation is perhaps the most crucial step in any successful experiment. It is the key to obtaining accurate and reliable results. Process security matters especially when:

- You care about what happens to your samples during preparation
- You wish to be free from the bench with true walkaway automation
- You need traceability for your assay results

The process security technologies built into the Freedom EVO platforms expose any anomaly interfering with the liquid handling and data reporting functions.

Identifying and correcting issues early is not only critical for a uniform output, it can also reduce the risk of sample contamination, support regulatory compliance requirements and save time, money and resources.

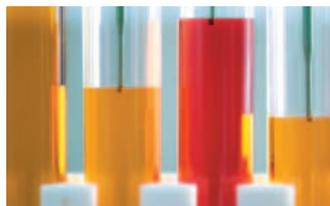
Tecan offers a comprehensive range of process security technologies for control and monitoring, exception handling and process traceability of your sample preparation tasks.

- Is any sample tube barcode missing or unreadable?
- Was a sample tray loaded in the wrong place?
- Is there insufficient sample in the source vessel?
- Is there insufficient reagent for the number of samples?
- Has a clot in the sample occluded the tip?

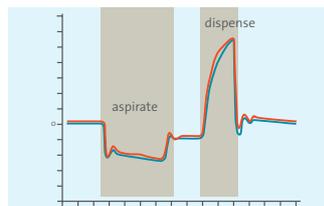
Online process security technologies make it possible to detect these potential issues and to handle them in real time throughout the liquid handling process.



Positive identification of samples



Liquid level detection



Pressure Monitored Pipetting



Control of robotic operations



Work area access protection



Pressure-based liquid level detection



Capacitive liquid level detection



Control of incubation

Sample loading

Pre-aspiration check

Aspiration Dispense

Downstream automation

Superior exception handling and process recovery

Identifying and correcting for liquid handling issues early in the process saves time, money and resources. The Freedom EVOware software provides scientists with remarkable flexibility and yet simplicity in the development of step-by-step exception handling procedures.

Configurable exception handling

Choice of selectable predefined settings to meet every application need in regard to sample preservation, throughput and data integrity.

Process recovery

Should a run be interrupted, the recovery wizard helps you to resume your run safely from where it stopped. It is possible to continue pipetting even if the process was stopped in the middle of a loop command.

Remote instrument monitoring

The Common Notification System (CNS) allows the user to monitor an instrument's status through any networked computer or mobile device with a web browser. Remote monitoring can be particularly useful if the instrument is in a clean room, bio-safety cabinet or cold room.



Common Notification System for remote status monitoring

Robust traceability and audit trail

Process security functionality not only enables the continuous secure execution of the process, it also automatically generates comprehensive status information for every sample throughout the process. This is particularly useful for regulatory compliance, guaranteeing electronic traceability and an audit trail.

Freedom EVOware Sample Tracking

- Tracking of barcodes or automatically assigned identifiers
- Recording of transfer quality evaluation by PMP
- Safe data exchange with LIS/LIMS
- Tracking of sample volume, dilution and concentration
- Merging of pipetting and plate reader data

Freedom EVOware Sample Tracking supports:

- **Chain of custody** documentation requirements for environmental contamination investigation and for legal standing in forensic testing
- **Process control** documentation requirements, with itemized log of process related problems for compliance with GLP and ISO regulatory standards
- **FDA 21 CFR part 11** rule on electronic records and signatures



Customizable Freedom EVOware Sample Tracking reports

Tecan supports your quality management plan

Two common methods are available for checking the precision and accuracy of our liquid handling robots:

Gravimetric method

The dispensed volume is calculated from the weight, measured by a calibrated balance, and the liquid density. Tecan offers automated gravimetric verification methods as part of the instrument operation qualification procedure.

Colorimetric method

Aliquots of a colored solution are dispensed into a known volume of diluent and the absorbance is measured by a calibrated spectrophotometric reader. An Orange-G solution is commonly used for this purpose. Tecan also offers a ready-to-use colorimetric kit.



QC check using a colored solution

Pipetting controls and process monitoring

Sample identification and human error prevention

Positive identification of samples and reagents

The Positive Identification System (PosID™) automatically scans barcodes on standard labware and logs the position of each sample.

Features:

- Confirmation of correct placement of labware
- Detection of missing or unreadable barcodes
- Detection of mismatch between sample requisition barcodes and scanned barcodes

Benefit: Ensures a reliable link between sample identification and final assay results for flawless data reduction and reporting.



Work area access protection

Safety covers with interlocks

- Automatically lock when instrument is in operation

Optional Active Worktable

- Sensors located under the worktable detect the location of labware carriers and monitor the work area for the addition or removal of carriers
- LEDs highlight carriers requiring operator interaction:
 - Flashing green: load carrier
 - Green: ready to load
 - Red: error

Benefits

- Safety covers protect reagents and samples from unintentional human interaction during operation.
- Optional Active Worktable ensures correct carrier positioning on the work area at all times and guides the operator when loading and unloading carriers during a run.



Barcode scanning

Work area access protection



Sample loading

SECURITY BENEFITS ALONG THE ENTIRE LIQUID HANDLING PROCESS

System readiness check before aspiration

Confirmation of disposable tip mounting

A feedback sensor on each liquid handling channel continuously monitors the presence or absence of a disposable tip mounted on the cone.

Features:

- Confirmation of successful disposable tip mounting operation before aspiration
- User prompt if disposable tip rack is missing or empty

Benefit: Reliability of disposable tip channel configuration.



Liquid level detection

Two liquid level detection technologies can be used, either independently or in combination, to locate the liquid surface. Conductive liquid level detection (cLLD) is suited to polar liquids, while pressure-based liquid detection (pLLD) is suitable for both polar and non-polar liquids.

Features:

- Optional pre-run verification of sufficient reagent quantities to satisfy the process for the selected number of samples
- Recognition of empty or insufficiently filled wells
- Volume determination for system decision making or record keeping purposes
- Tip tracking during aspiration for minimized tip submergence
- Detection of tips occluded by fibrin clots
- Enhanced safety with the cLLD double detection, for example in case of bursting bubbles on the liquid surface

Benefit: Liquid level detection is at the heart of the liquid handling process. It guarantees not only the reliability, but also the optimum precision of the liquid handling process.



◀ Confirmation of tip mounting

Liquid level detection ▶



Pre-aspiration check

SECURITY BENEFITS ALONG THE ENTIRE LIQUID HANDLING PROCESS

Control of liquid transfer quality

Unique Pressure Monitored Pipetting technology (PMP™)

PMP identifies pipetting anomalies by monitoring the pressure in the disposable tip. An aspiration or dispense cycle is unsuccessful when the pressure/time profile during aspiration does not match the expected profile.

Features:

- Detection of clots
- Detection of air aspiration
- Detection of wrong disposable tips being used
- Detection of system leakage
- Preservation of sample by optional automatic dispense back to source vessel in case of flawed aspiration
- Optional automatic retry in case of clot or air aspiration
- Real-time evaluation, viewing and reporting of liquid transfer quality

Benefit: For critical pipetting steps requiring online performance verification and for liquids prone to clotting, PMP provides continuous monitoring of the liquid transfer quality. PMP also offers the ability to check for possible drift of performance.



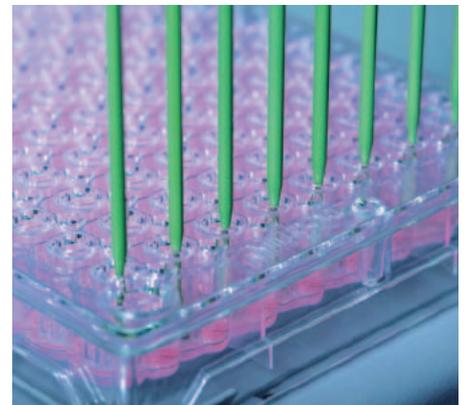
Post-dispense liquid level detection

By determining the height of the liquid in a vessel of a known geometry, the volume can be calculated.

Features:

- Fast and efficient when performed just after the dispense while the tip is still in the vessel
- Results can be transferred to the Laboratory Information Management System for automated selective exclusion of samples of insufficient dispensed volume

Benefit: Confirms that the automated pipetting process delivered the expected volume into the destination labware.



SECURITY BENEFITS ALONG THE ENTIRE LIQUID HANDLING PROCESS

Control of critical automation steps

Besides the pipetting operation itself, several other automation steps in the workflow are controlled inconspicuously by the system, including: Robotic Manipulator Arm labware transport, disposable tip release and incubation.

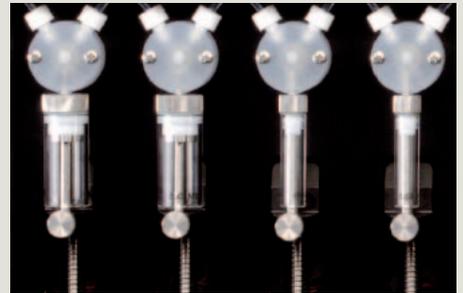
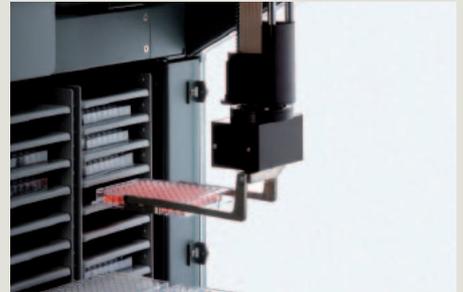
Control of robotic operations

The liquid handling channels and the robotic manipulator head are equipped with feedback sensors, while the diluters detect any step loss during plunger movement.

Features:

- Confirmation of successful release of the tip into the waste container on completion of the dispense cycle
- Confirmation of object gripping and releasing
- Diluter emergency stop if a channel is blocked

Benefit: Verifies that the automated process runs as expected and allows for immediate corrective action, either automated or prompted, in the event of a problem.

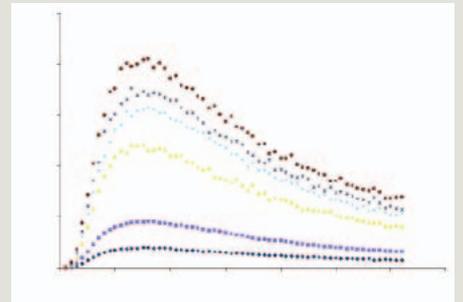


Control of incubation steps

The Monitored Incubator Option, a heated plate incubator, provides active temperature monitoring for each heated slot. Furthermore, the maximum permitted waiting time for an incubation step can be defined in the Freedom EVOware® Plus software.

Features:

- Confirmation that the temperature in each heated slot remains as set at all times during incubation
- Timeout user notification generated when waiting time exceeds the permitted limit
- Ability to resume the process from the appropriate step using the recovery wizard

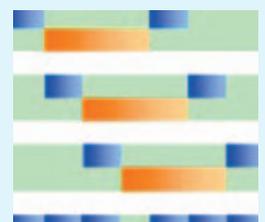


Benefit: Prevents loss of samples and inaccurate assay results potentially caused by incorrect incubation temperature or excessive incubation time.



◀ Control of robotic operations

Control of incubation ▶



Downstream automation

SECURITY BENEFITS ALONG THE ENTIRE LIQUID HANDLING PROCESS

Tecan are pioneers in automated liquid handling and innovative life science solutions. For over 30 years we continue to enable and support our customers to make the world a healthier and safer place.

Tecan

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