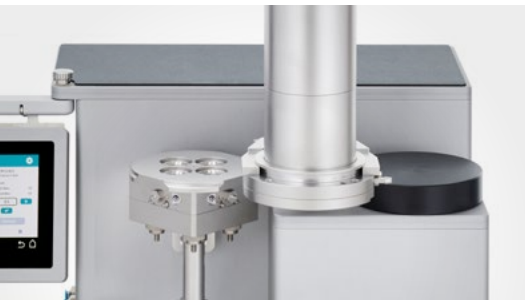
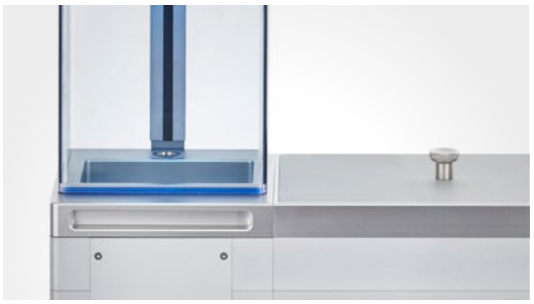
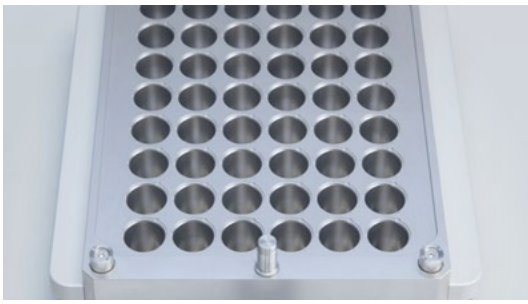
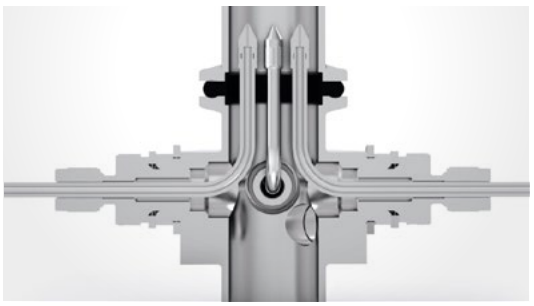
Advanced in vitro exposure systems









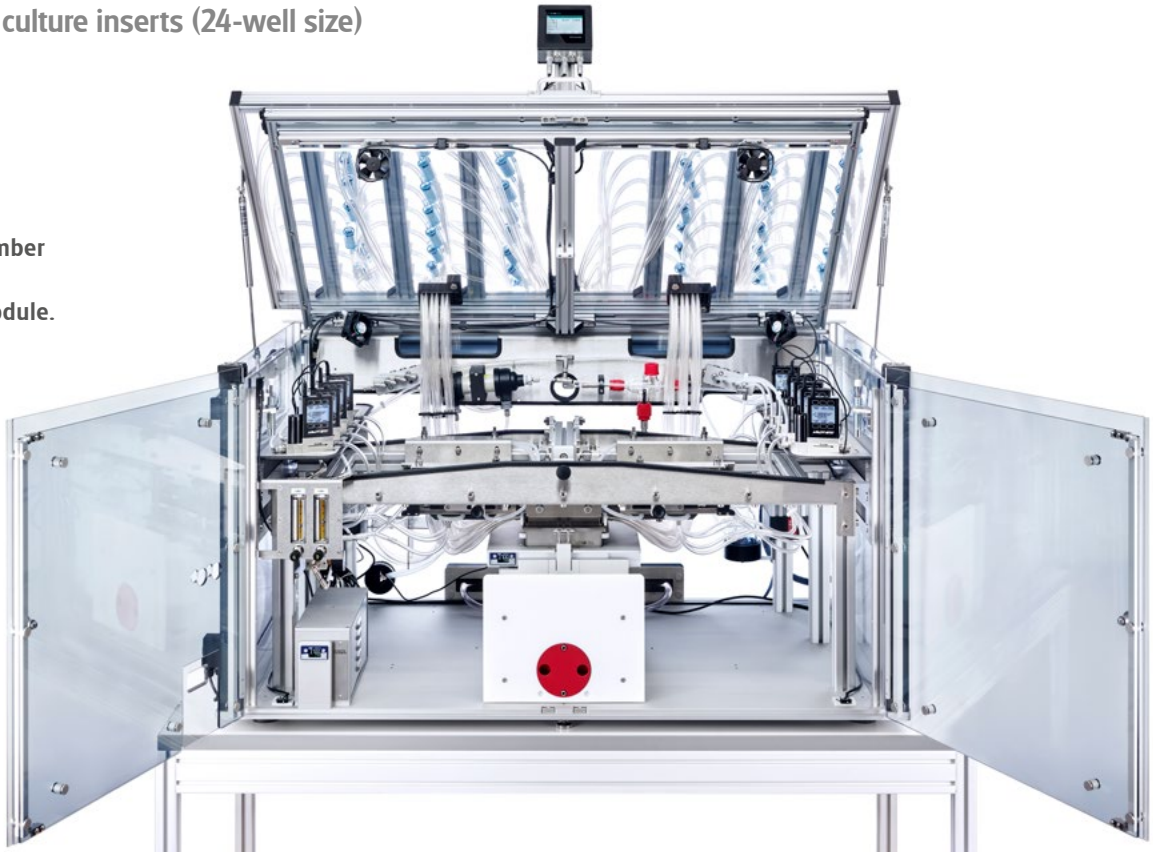
Product News 2023

Edition March 2023

VITROCELL® SYSTEMS

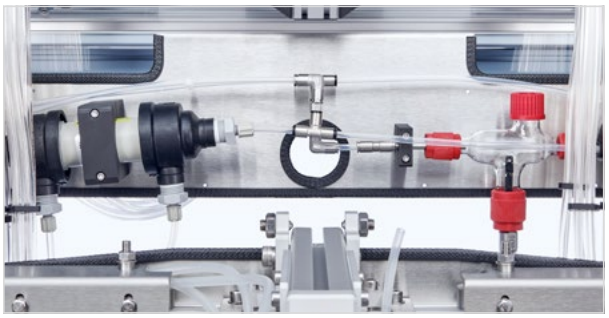
New Features for VITROCELL® 24/48

For 48 cell culture inserts (24-well size)



The updated climatic chamber for 24/48 exposure module.

The VITROCELL® 24/48 module system has been specifically designed and engineered to facilitate the research of human cell cultures in direct exposure to airborne substances such as gases, complex mixtures, nanoparticles and fibers. The system authentically simulates the conditions of human physiological exposure.



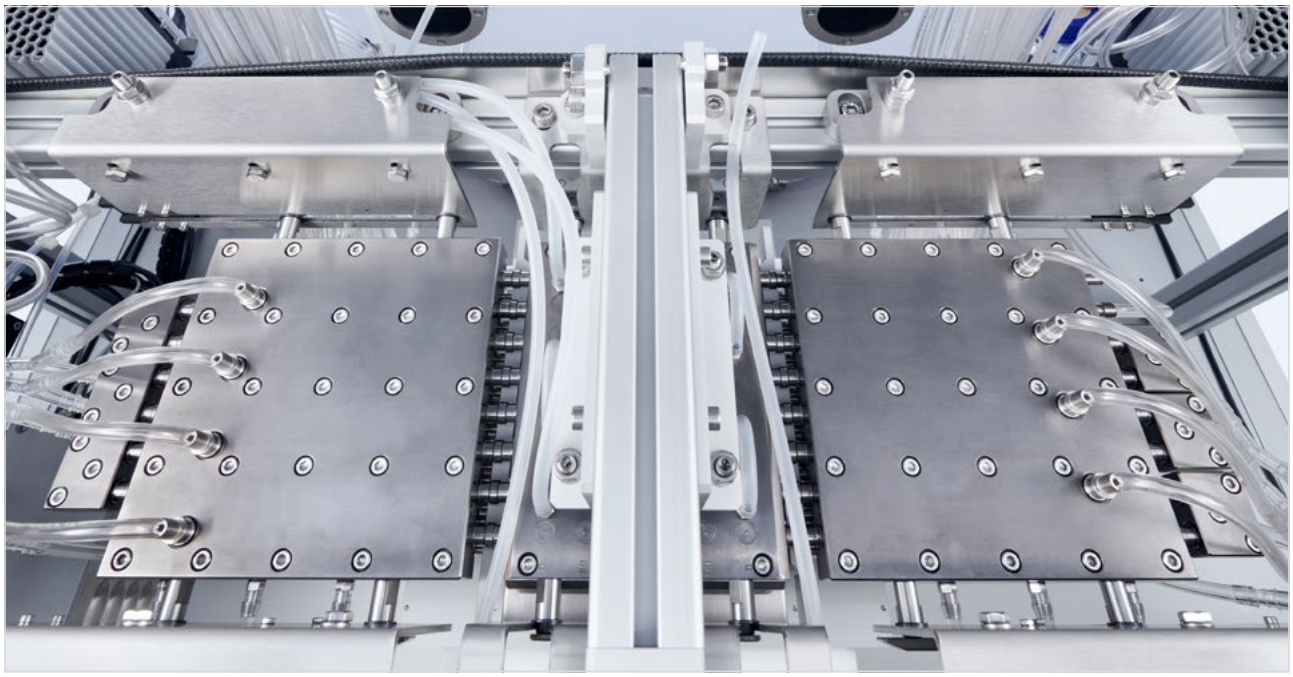
Integrated humidification station

7 dilutions with 6 inserts each are used for for exposure to the substances and 6 inserts in the same system for clean air control. Each dilution represents a different dose concentration, so that a complete dose/response profile can be obtained in one experiment.

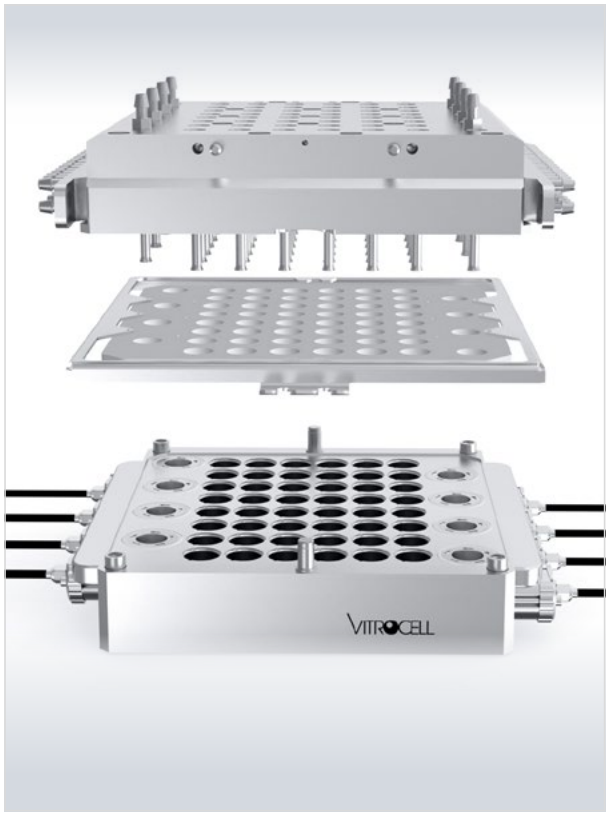
Enlarged Climatic Chamber

The new generation of climatic chambers is enlarged to accomodate all required components for the operation of the VITROCELL® 24/48 System. More space faciltates the handling of dosimetry tools inside the chamber.

The extended version features an integrated humidification system with pre-heating of dilution air. The flow controllers are moved to the inside of the chamber for constant temperature and increased humidity output.



New support and quick-mounting mechanism of dilution systems and exposure top for easier handling.



New 24/48 PLUS version for dosimetry in 8 additional compartments.

Flow controllers integrated in climatic chamber.

Key Features:

- Integrated humidification station
- Flow controllers mounted inside of chamber
- Quick-mount mechanism for dilution systems and exposure top
- Optional dosimetry compartments

VITROCELL® SYSTEMS

VITROCELL® PowderX

For cell culture exposure to smallest quantities of dry powders

Touchscreen operation enables a step-by-step user guidance through the entire process.

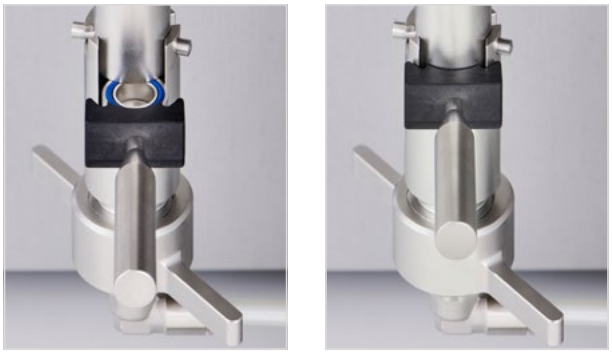
PowderX allows for aerosolisation of small quantities of dry powders and particle deposition on cells cultured on 12- or 24-well sized inserts.

The system features biological barrier integration and continuous sampling from the basolateral compartment.

Base module houses 12- (left) or 24-well sized inserts (right). All commercial brands are supported.

Small powder samples of 1–100 mg are positioned in the quick-lock loading system. Subsequent aerosolisation of the powder takes place under high pressure by a unique jet system. The resulting shear forces facilitate deagglomeration for homogeneous dispersion into the expansion chamber. Final deposition takes place via gravimetric settling.

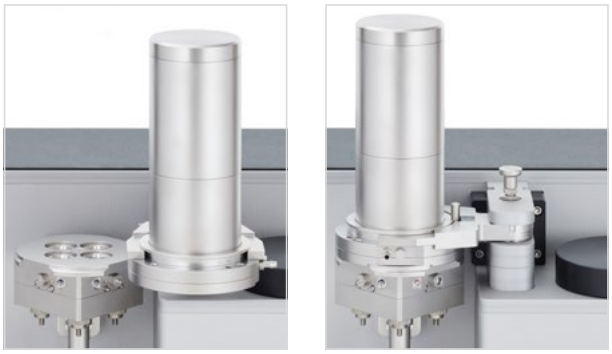
The height of the expansion chamber can be varied in three different steps according to the behaviour and properties of the powder sample. For handling of the inserts the expansion chamber can be seperated effort-free from the exposure module.



Quick-lock loading system open (left) and closed (right).

Working Principle

1. Powder sample is placed in quick-lock loading system.
2. Expansion chamber and base module are tightly sealed by touchscreen operation.
3. Powder sample is aerosolized under high pressure to break up agglomerates for homogeneous dispersion in the expansion chamber.
4. Powder sample settles on cell cultures.



Medium size expansion chamber – standby (left) and sealed (right).

The base module is prepared for continuous or time-based sampling from the media compartment.

Key Features:

- Easy handling
- Only small quantities of powder needed (1–100 mg)
- No external airflow required
- Exposure time < 30 minutes
- Optional continuous media supply or media sampling
- Optional magnetic stirring for media compartment
- Intuitive user experience with touchscreen operation

VITROCELL® SYSTEMS

VITROCELL®
Cloud α MOVE

For fully automated and repeated row-by-row exposure of 12-, 24- and 96-well sized cell culture inserts. Testing of up to 12 dose ranges in one experiment.

The VITROCELL® Cloud Alpha MOVE is our newest innovation and presents another great leap forward in fully automated exposure of cell cultures. It is the ideal device to obtain a dose-response relationship in one experiment.

The development is based on the well-known and frequently published VITROCELL® Cloud formats. It's functionality enables a fully automated process with an all-in-one control unit.

Developed with a focus on automation

The new Cloud Alpha MOVE is capable to expose mammalian cell cultures in Corning® HTS Transwell® 96-Well Permeable Support Systems as well as 12-and 24-well sized inserts.

The Cloud system is suitable for nebulization of solutions and suspensions. Fields of application are screening of inhaled drugs, toxicity testing of inhaled substances such as chemicals or nanoparticles and virus research.

Choice of three types of nebulizers

It comes with a choice of 3 types of vibrating mesh nebulizers having droplet MMAD ranges of 2.5–6.0 µm, 2.5–4.0 µm, 4.0–6.0 µm and in a special version with 9.0–12.0 µm.

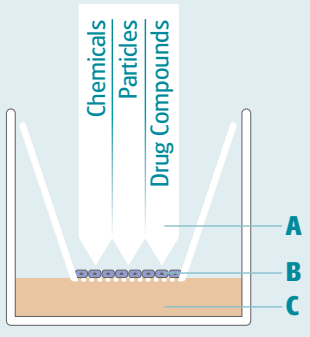
The device is particularly suitable for testing whenever small quantitities of testing materials are available.

Exposure at the Air / Liquid Interface

All VITROCELL® Cloud Alpha exposure devices have been specifically designed to enable direct exposure of mammalian cells or tissue at the Air/Liquid Interface in physiologically relevant conditions. Here the cell cultures are not covered with media as opposed to submerged conditions which cause an undesired interaction of the formerly airborne substances with the culture media.

Air / Liquid Cultivation and Exposure in Exposure Module

- **A** Direct and controlled exposure of test atmosphere to cells
- **B** Cells on membrane
- **C** Media below cells



This approach allows for more credible and authentic results than by submerged exposure due to a closer replication of the human physiology.

96-well: 12 Individual Doses

Sequential Exposure of Corning® HTS Transwell® 96-Well Permeable Support Systems in up to 12 steps @8 replicates.

24-well: 6 Individual Doses

Sequential Exposure of 24-well sized culture inserts in up to 6 steps @4 replicates.

12-well: 4 Individual Doses

Sequential Exposure of 12-well sized culture inserts in up to 4 steps@3 replicates.

For each of the exposures applies: After each nebulization the exposure chamber is automatically evacuated by vacuum pump to enable equal exposure conditions for the following nebulisation.

Dosimetry using Quartz Crystal Microbalance (QCM)

The QCM sensor is integrated in the Cloud Alpha MOVE exposure module. It is capable of measuring the deposited mass in nanogram/cm^2. Results are recorded in the VITROCELL® Monitor software. Data is presented in graphs and stored in MS Excel®

Key Features:

- Fully automated row-by-row exposure of 12-, 24- and 96-well sized cell culture inserts
- Aerosolisation defined by nebulization time or volume
- Integrated controller for aerosol generator
- Optional integrated microbalance controller
- Programmable experiment recipes
- Output rate database for nebulizers
- Heating system
- PowerVent function: evacuation of residual aerosols via vacuum pump
- Designed for screening of inhaled drugs, toxicity testing of inhaled substances such as chemicals or nanoparticles and virus research

VITROCELL® SYSTEMS

Adaptable PM Inlet

For separation of PM_{10} and $PM_{2.5}$ particle sizes.

If an aerosol contains certain particle sizes which are not of interest for a specific experimental set up, size selective inlets can be used at the entrance of an installation to separate these fractions.

Commercially available size selective inlets are normally designed for a specific flow and particle size constellation e.g. $PM_{2.5}$ at a flow of 16.67 lpm (1m^3/h). However, if the sample material is limited or the aerosol generator is not able to deliver enough aerosol, flows need to be adjusted to lower values.

These changes affect the separation properties of the PM inlet and therefor the composition of the test aerosol which is investigated. To address this issue, Vitrocell designed together with research partner KIT an adaptable PM inlet to cover common flow ranges for its installations.

The adaptable PM inlet offers a compact design and a fast and straightforward way to change the nozzle plates for the different flow rates. Each nozzle plate is laser coded with its properties.

The ISO-KF quick connectors offer a quick and secure way to mount all parts together and the connectivity to available standard parts.

PM	Flow rates l/min (m³/h)				
	16.67 (1)	8.33 (0.5)	6 (0.36)	4.167 (0.25)	1 (0.06)
10	✓	✓	✓	✓	✓
2.5	✓	✓	✓	✓	✓

Choice of nozzle plates for different flow rates

Key Features:

- Stainless steel
- Easy cleaning
- Adaptable for a wide range of flow rates

The inlet mounted by small flange quick connector on inlet of exposure station

Automated Exposure Station

Adaptable Isokinetic Sampling

Optimised for different aerosol flow rates.

Isokinetic sampling is the method of choice for a reproducible and representative sampling of an aerosol. To enable an easy adjustment for different flow rates Vitrocell has developed new isokinetic sampling probes. The new standard sampling probe is threaded for mounting individual probe tips for a predefined range of flow settings.

Advantages of isokinetic sampling:

1. Isokinetic (flow velocity of main flow and sample flow is the same)
2. Isoaxial (flow direction of main flow and sampling flow are on the same axis)

The current version allows an isokinetic sampling for a flow constellation of 16.67 l/min for main flow and 100 ml/min sample flow. If the flow rates vary from these standard set up, adjustments in flow settings or the diameter of the sample probe need to be done to match the isokinetic criteria again.

If there is a change in the set-up, the probe tips can easily be replaced by the needed one. Each tip is laser coded to ensure the secure use.

Main flow (l/min)	Sample flow (ml/min)			
	5	25	50	100
16.67	✓	✓	✓	✓
6	✓	–	–	–
3	✓	–	–	–

Standard configurations for probe tips

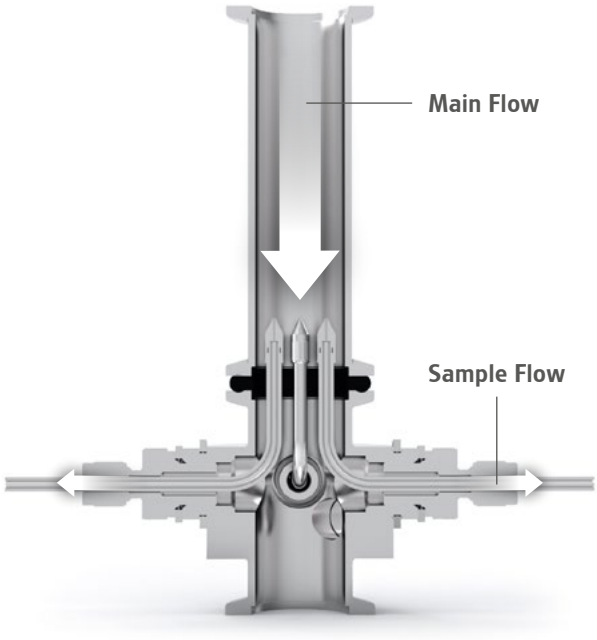


Illustration of main and sample flow.

New probe tip (left) and former probe (no thread).

Key Features:

- Covers wide range of the main flow and sample flow rates
- Easy cleaning
- Easiest exchange of confgurations

VITROCELL® SYSTEMS

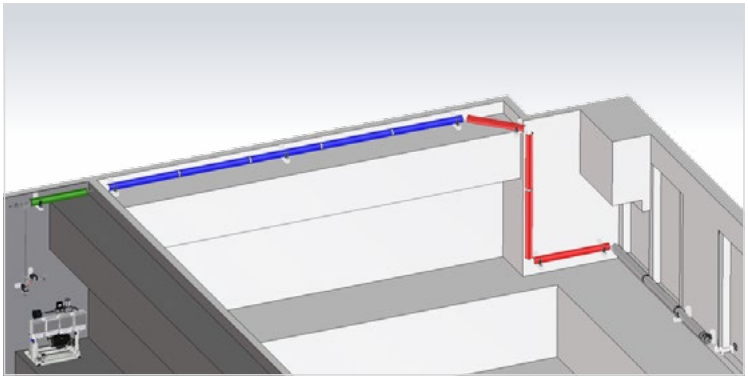
Heated Sampling Line

To prevent condensation in the sample line.

Especially designed for the sampling of complex ambient aerosols with condensing conditions. The heated line prevents condensation inside the sampling tubes and therefore reduces particle losses. Furthermore, it provides stable and reproducible conditions at the aerosol inlet of the set up independent of the environmental conditions. The standard version fits for most of the common installations and systems made by Vitrocell.

A controller with touch screen controls up to three individual heating sleeves. The aerosol is guided through a small flange stainless steel tube inside the heating sleeves for a quick and flush connection to the experimental setup. Temperatures up to 60 °C (140 °F) can be applied via the controller (standard version).

The heated sampling line can be customized to the needs of the customer and given conditions of the laboratory which offers the possibility to operate more than three heating sleeves. A separate PID-Controller with a higher power supply enables a heating of the stainless steel tubes up to 110 °C (230 °F).



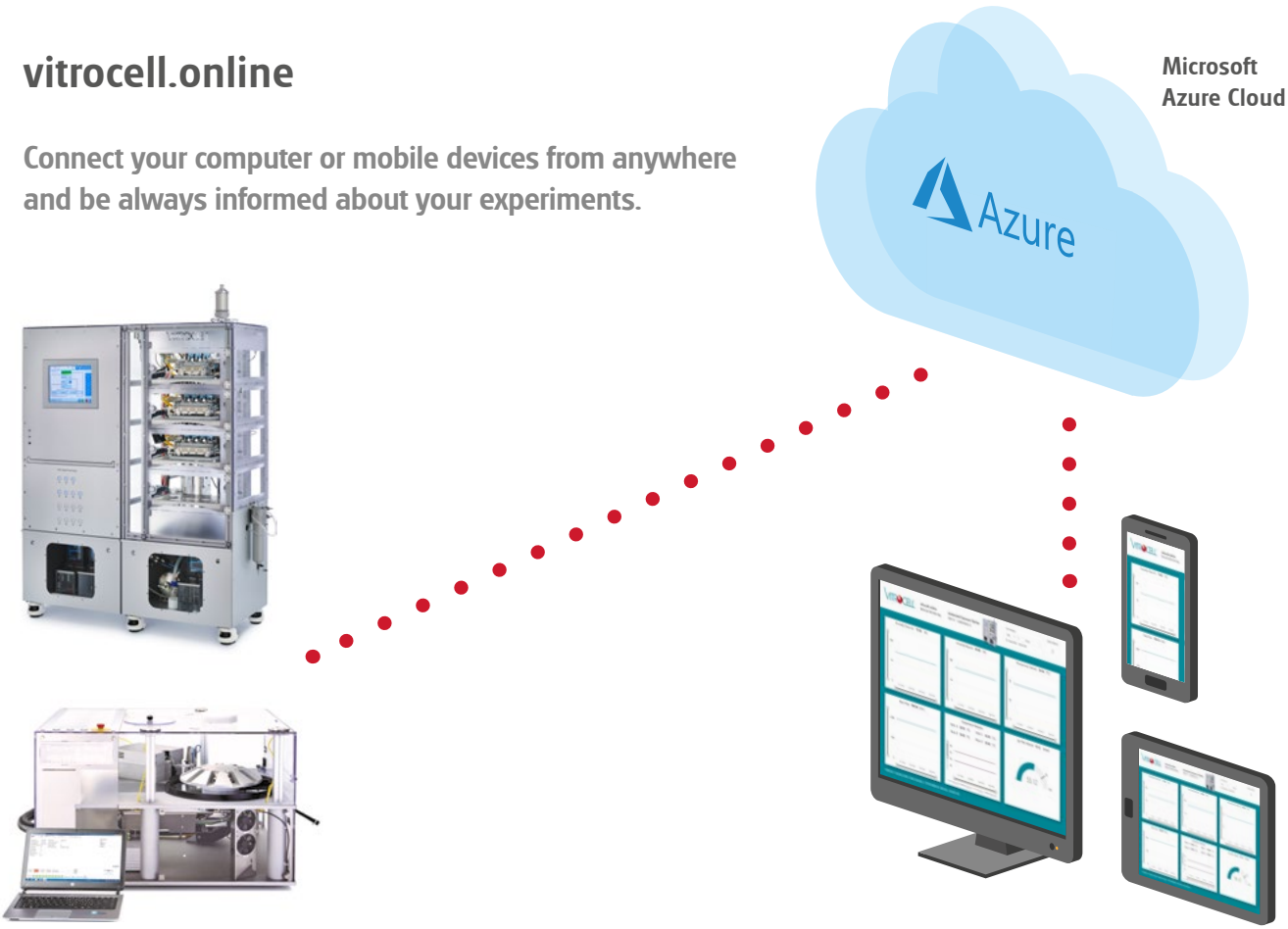
Suitable for longer sampling lines to the exposure system.

Key Features:

- Stainless steel
- Heating (standard version) up to 60 °C
- Heating (special version) up to 110 °C
- For stable and reproducible inlet conditions

vitrocell.online

Connect your computer or mobile devices from anywhere and be always informed about your experiments.



vitrocell.online remote cockpit

If you want to know how your exposure is going, you can connect to your device via vitrocell.online. The cockpit can be configured according to your needs. The example left shows the data from an Automated Exposure Station where long-term experiments are carried out.

Data is securely transmitted and stored in Microsoft Azure. This cloud solution guarantees the highest security standards, scalability and ease of use.

VITROCELL® SYSTEMS

About VITROCELL®

VITROCELL® exclusively concentrates on the developing, producing, installing, training and servicing of advanced *in vitro* exposure systems.

The VITROCELL® Systems' team is driven by their vision for new in-vitro standards through state-of-the-art technology, highly qualified workmanship and absolute client dedication. VITROCELL® has successfully collaborated with clients from leading research institutes, contract research organizations, regulatory authorities or industrial laboratories across the world. Working with our team experts, all modules have been tailored to create durable and complete turnkey-systems for ***in vitro*** inhalation toxicology. Gases, environmental atmospheres, nano particles and complex mixtures are analyzed on lung cells at the air/liquid interface using these systems. VITROCELL® technologies are also applicable to solutions for skin research.

Over a decade of devotion to research in this specific field has given our team of design & precision manufacturing specialists the opportunity to mentor highly diversified and complex projects **from conception to completion**. We strive to become a constructive member of each research team, providing support when it is needed, advice when it is required and modules of the highest quality, which are even polished by hand before leaving here to be integrated into your workspace. Every piece of our German engineered equipment is manufactured to the highest of standards – yours.

For more information please scan the QR-Code:

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