

Multi Concept Freeze Drying Systems for Bulks and Vials



Compact,
flexible all-rounder
double chamber systems





Double-chamber systems

Ideally suited for tray and vial drying.

Examples: MTPs, diagnostics, collagen or pharmaceuticals

We create values

Freeze drying systems and beyond with quality and innovation

Martin Christ - Innovative solutions are our tradition

Martin Christ Gefriertrocknungsanlagen GmbH is a leading global company with more than 75 years of experience in the development and manufacture of freeze drying systems.

One of our main focus on custom-engineered systems for applications such as diagnostics, biotechnology, inorganic materials and non-sterile pharmaceuticals. We offer innovative solutions such as wireless product temperature measurement, controlled freezing and visual process recording. Our lyophilization systems are ideal for temperature-sensitive and high-value products often found in diagnostics and other non-sterile applications.

Intralogistics with premium loading systems

Our subsidiary Motus Engineering GmbH & Co. KG is one of the leading manufacturers of advanced loading systems for freeze dryers - we can offer optimal complete solutions consisting of freeze dryers with suitable loading systems for almost any tasks.

We also deliver customized solutions for special containers and accessories, as well as manual, semi-automated or fully automated loading and unloading systems for various applications production.

Our wide range of products and services is designed to optimize your operations and ensure maximum efficiency.



Customized solutions for your project

From expert advice to professional implementation

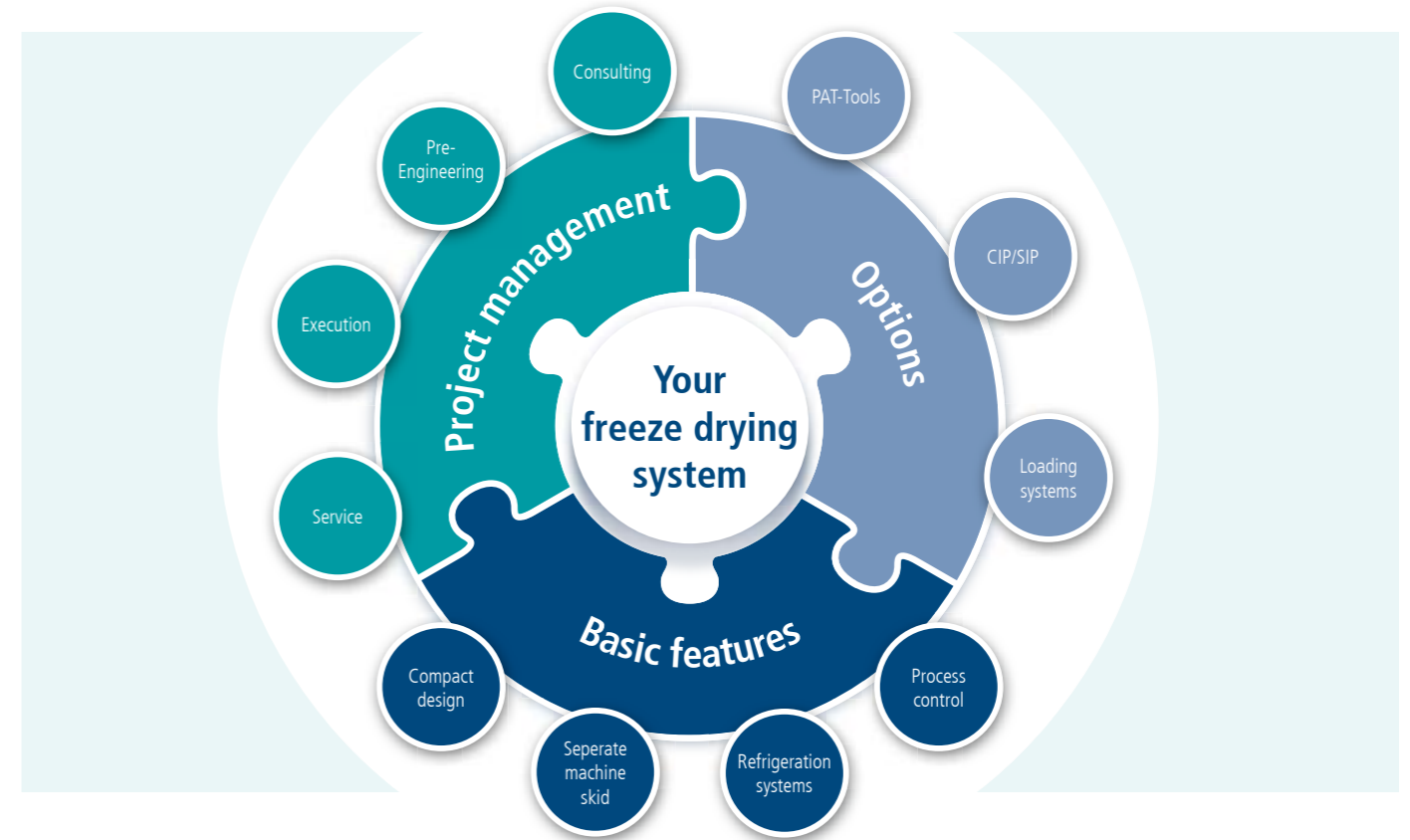


Our expertise for your needs

All these needs can be met with a single solution. A Martin Christ freeze dryer not only fulfills all these requirements, but also offers an extremely compact and versatile package, allowing for simplified installation and plug-and-play operation.

Focus on your application

Your defined requirements are the basis for planning your freeze-drying system. We support you from the initial idea through to realisation and beyond with our sustainable service offerings. As a leading manufacturer, Christ offers the experience, flexibility and expertise to realise both standard market options and customised special solutions of any size.



Alternative refrigeration systems – Always up to date

To make sure your freeze dryer is ready for the future, we stay at the forefront of refrigeration technology. These are the current, future-proof technical solutions:

- Conventional refrigeration CFC-free
- CO₂ / air combination
- CO₂ / liquid nitrogen combination
- Liquid nitrogen

Intralogistics, filling and more – Perfect integration

Through our subsidiary Motus Engineering we can solve the challenges of transporting between filling machines, clean rooms, capping machines and freeze dryers. Our extended product portfolio:

- Monitoring equipment
- Containments and sterile containers
- Magazine robots
- Belt connections, buffer
- Tray filling and powder handling

In principle unbeatable

Our high-performance freeze drying systems



Double-chamber systems

In the two-chamber principle developed by Martin Christ, the ice condenser is located directly under the drying chamber. The large, closable openings create ideal flow cross-sections for the water vapour.

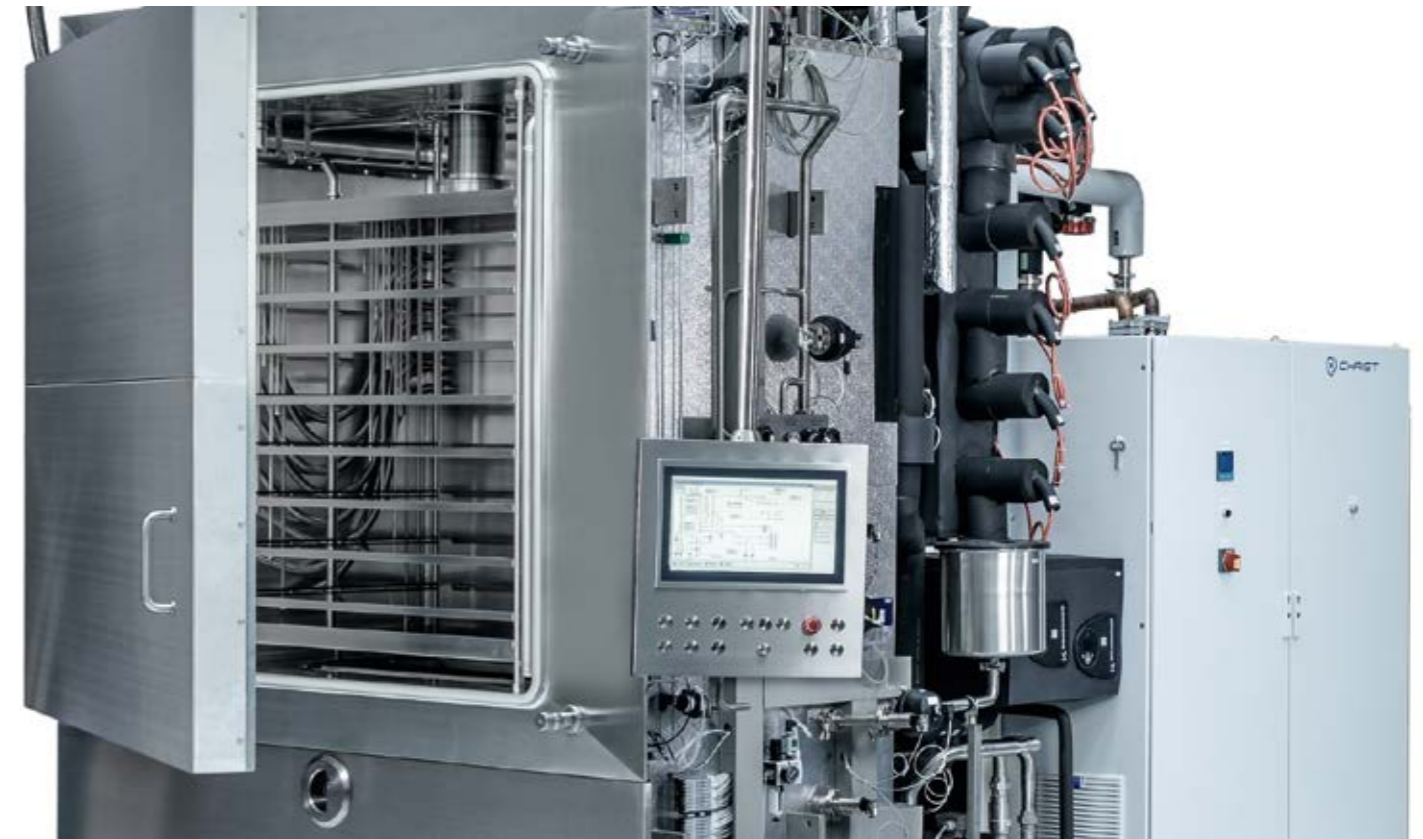
Only if sufficient cross-sections are available to cope with the enormous quantities of vapour during the drying process will there not be an undesirably high pressure difference between the drying and ice condenser chambers. The performance and efficiency of a system is significantly increased (operation close to the collapse temperature). Particularly temperature-sensitive material can be dried safely with this system concept.

The two-chamber systems offer shelf areas between 1.2 and 14 m² with ice condenser capacities of 16 to 220 kg.

- Compact system design
- Easily accessible ice condenser
- Easy to clean
- Large cross-section between drying and ice condenser chamber
- Easy to validate

Our system features

Overview



Standardised freeze dryer with individual additional options

In addition to standardised freeze drying systems, we also offer special systems according to customer specifications. As a leading manufacturer, Christ offers the experience, flexibility and expertise to realise both standard market options and customised special solutions. Our preconfigured freeze dryer can be equipped with a wide range of additional options and can be easily retrofitted.

Our preconfigured freeze dryers are available in various sizes:

Epsilon		2-25D	2-45D	2-65D	2-100D	2-160D	2-220D
Shelf area	m ²	1.35	2.88	4.32	6.48	9.72	14.4
Number of shelves		5	8	8	6	9	10
Shelf dimension (W x D)	mm	450 x 600	600 x 600	600 x 900	900 x 1,200	900 x 1,200	1,200 x 1,200
Ice capacity	kg	25	45	65	100	160	220
Ice condenser temperature min.	°C	-75	-78	-75	-75	-75	-75
Ice condenser performance	kg/24h	15	30	45	70	110	150
Shelf temperature min. - max.	°C	-60 to +50	-60 to +50	-60 to +50	-60 to +50	-60 to +50	-60 to +50
Cooling rate (+20°C to -40°C)	K/min	1.5	1.50	1.50	1.50	1.50	1.50
Heating rate (-40°C to +20°C)	K/min	0.8	0.8	0.8	0.8	0.8	0.8

Process optimisation through intelligent PAT-Tools

Superior tools for quality assurance and process optimisation

Our freeze-drying systems are already equipped in the basic version for many process monitoring requirements or can easily be supplemented accordingly as an option.

All tools are fully integrated into our LPCplus process control and visualisation system and can therefore be used to control and optimise the process sequence. Of course, all data are stored in the process recording

Product temperature

Product temperature is one of the most important variables for process control and monitoring. In addition to the classic, wired method with robust PT-100 sensors, we also offer wireless WTMplus technology. The use of small GMP-compliant measuring sensors without a power supply makes it possible to measure the product temperature even in production batches. The measurement data is also fully integrated into our LPCplus process control system.

LyoControl

Our LyoRx sensor monitors the electrical resistance and the product temperature. You can automatically determine the freezing point of your product from the progression of both data. This is made possible by our LyoControl software module integrated in LPCplus. The LyoRx sensor allows automatic control of the energy supply for the control surfaces during the main drying phase. Possible thawing effects of the product are thus limited.

Comparative pressure measurement

By using two different vacuum sensors (pirani and capacitive measuring principle), the end of the main drying process can be determined. If the difference between the pressure measurements falls below a preselected limit value, post-drying is started automatically.

Pressure rise test

The transition between main drying and secondary-drying can be determined using the pressure rise test. If the pressure rise in the product chamber remains below a limit value when the intermediate valve is closed, there is no more sublimating ice in the product and secondary drying can be started.

◀ wireless product temperature sensor WTMplus



LyoCam – more transparency in freeze drying

Due to the process times extending over many hours, it is virtually impossible to monitor the drying process. On the other hand, process anomalies that last only seconds or minutes are decisive for poor product quality.

This is where the LyoCam from Christ comes in: a high-quality full HD industrial camera continuously photos the product at variable intervals depending on the process stage. The behaviour of the ice condenser (occupancy) can also be documented. The decisive feature here, however, is the linking of the images with our LPCplus SCADA system for the freeze dryer. A perfect tool for process optimisation and quality control.

To the video
LyoCam:
martinchrist.de/LyoCam



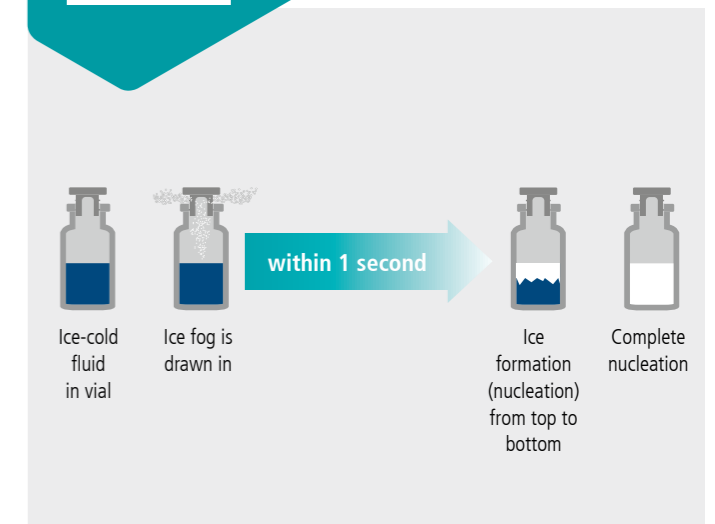
LyoCam integrated in the front door

LyoCoN – Optimisation of the freezing process

The freezing process of numerous samples in a freeze dryer is normally a stochastic process. The individual vials crystallise in an uncontrolled manner within a certain time window, e.g. one hour.

The crystallisation temperature and therefore also the ice structure varies. This has an effect on the subsequent drying phases. Christ has developed LyoCoN to achieve the precise freezing of all vials.

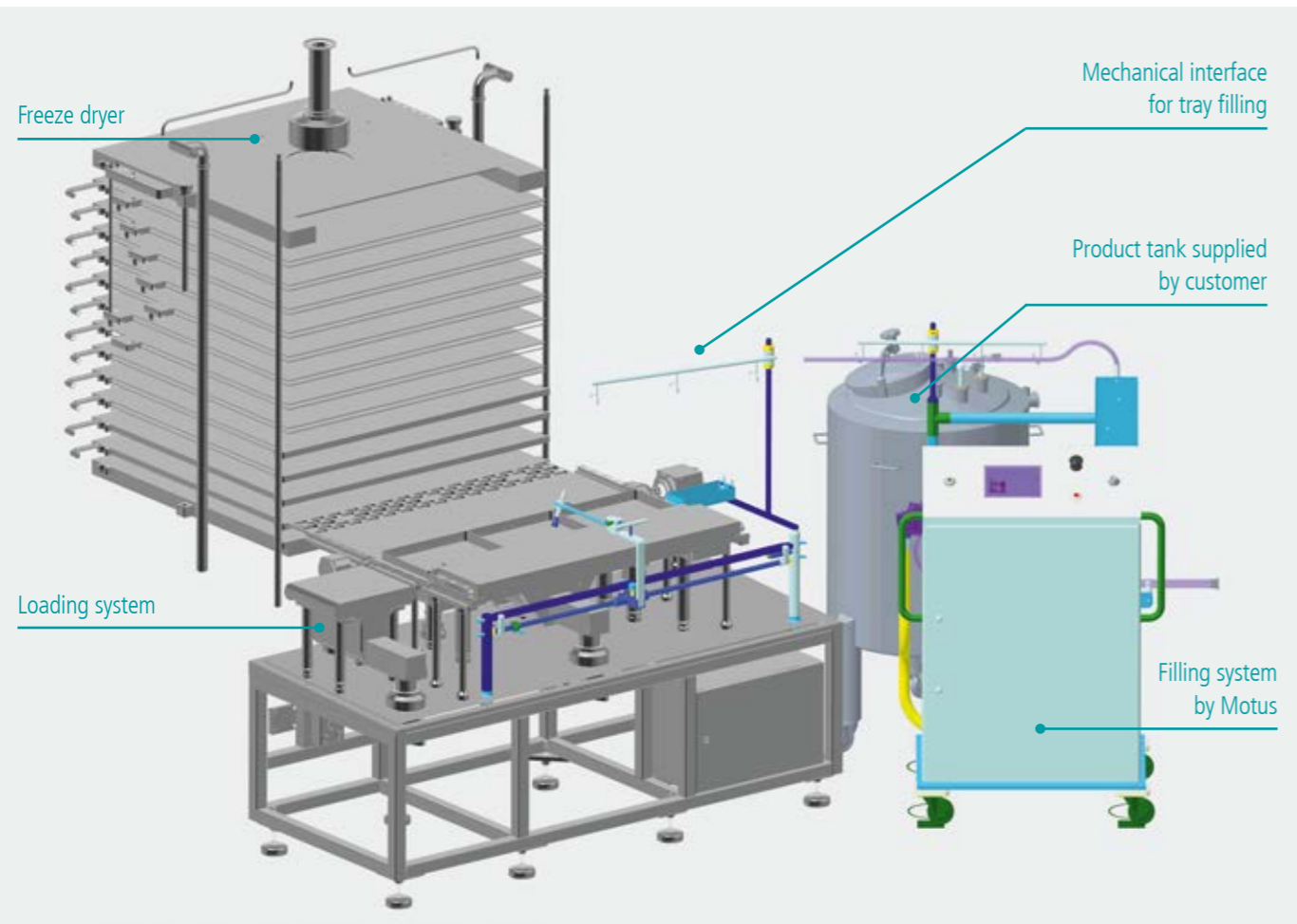
To the video
LyoCoN:
martinchrist.de/LyoCoN



LyoCoN – precise, homogeneous freezing in record time

More than just freeze drying

Increase your efficiency: filling, loading, unloading and detraying



Everything from a single source

We rely on pre-engineering to develop customised solutions that are precisely tailored to your requirements. From conception to realisation, we work closely with you to find the optimal solution to advance your project and your production processes. Together with our subsidiary and loading system manufacturer Motus Engineering, we work hand in hand to customise your freeze-drying process to your needs. In addition to our expertise in freeze drying, as a group of companies we offer customised loading systems, mobile filling systems and safe powder handling, including the transfer of lyophilisate into bottles. Discover the diversity of our services with us. Let us convince you of our experience and commitment - we are more than just a specialist in freeze-drying!

- **Integrated solutions**
- **Efficient communication**
- **Better control and coordination**
- **Cost savings by bundling resources and processes**
- **Innovation advantage through synergies**

Precise filling

Mobile filling system



Mobile filling system positioned at isolator



Insertion of single use filling hose



Tray insertion



Positioning filling needle

Mobile filling systems

Motus can offer a state-of-the-art mobile filling system that is specially designed for precise filling requirements. This flexible system can be integrated into a sterile filling line with isolator.

Our Mobile Filling System is directly connected to the substance tank and can be easily moved into position to accurately fill containers such as trays for the freeze-drying process or in conjunction with a loading system. Filling is automated and can be fully controlled via the system.

Thanks to this innovative solution, precise dosing is guaranteed, which significantly improves the efficiency and quality of your filling processes. Rely on our Mobile Filling System for reliable and high-precision filling of your products.

- **Flexibility and mobility**
- **Precise dosing**
- **Easy system integration**
- **Simple control**
- **Suitable for sterile use**

Maximize productivity

Loading and unloading systems for optimal process performance



Our loading and unloading systems complement our product range perfectly. They are individually adapted to the needs of our customers, taking into account the capacity of the freeze dryers as well as all relevant requirements, including GMP regulations. Our offer ranges from manual solutions to semi- and fully automatic frame loading systems to fully automatic loading and unloading systems based on the push-pull principle.

Together with Motus, we have the expertise to offer you the optimum loading and unloading system for your requirements. Our wide range of systems includes pilot to production sizes and allows for customized adaptation to any layout and project-related requirements. High performance and reliability are fundamental features of our solutions that ensure maximum process reliability.

Our frame loading systems boast excellent efficiency and flexibility. We offer different solutions from semi-automatic to fully automated systems that meet a diverse range of requirements. These solutions are ideal for medium-sized batches and retrofit projects as they can be seamlessly integrated into existing infrastructures.

Fully automatic container handling is possible thanks to our push-pull systems, especially at high filling speeds and without the need for operator intervention. We can adapt the various system configurations, from the classic push-pull system to our innovative LyoShuttle system, to best suit your individual requirements.

In addition, we use containment technologies to ensure the highest safety standards when handling hazardous products and sterility in demanding environments. These technologies play a crucial role in ensuring the safety of operators and products, especially in sensitive production environments.

Choose from a variety of solutions of loading and unloading. You can have them set up to work systematically with your upstream and downstream equipment.

MOTUS
Life Science Technology



Together we can do more
Motus is part of Christ group

www.martinchrist.de/motus

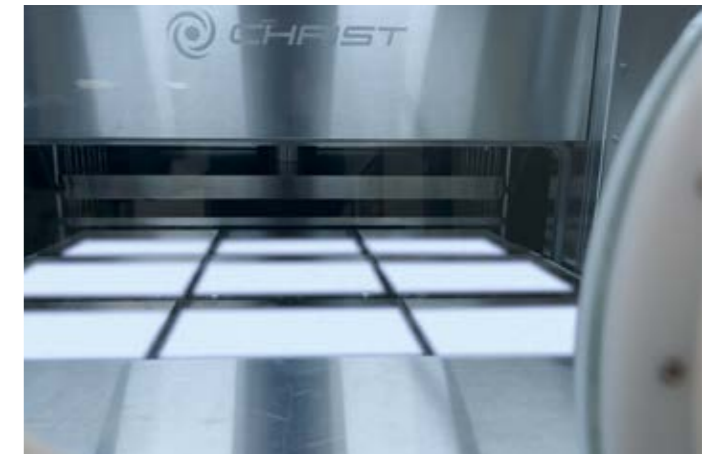
LyoShuttle for trays and vials

Fully automatic loading system for more options

Loading



Unloading

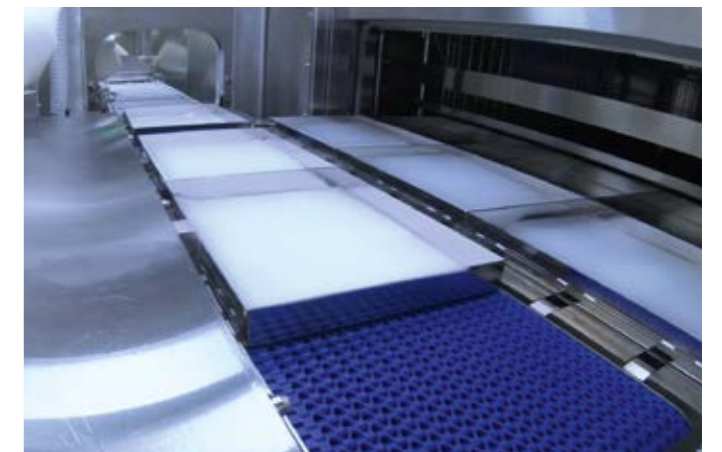


Our fully automatic loading and unloading system LyoShuttle is specially designed for handling of trays or vials. Using the latest technology, a battery-operated robot is moved along a chute to place the products safely and precisely on the shelves and transport them out again once the drying cycle is complete.

This innovative technology ensures an efficient process with no moving parts inside the machine, minimising the risk of breakdowns and ensuring continuous operation.

Thanks to its compact design, the LyoShuttle not only offers easy access to all components, but also outstanding cleaning properties. This is particularly important in order to comply with strict hygiene and quality standards, especially in sensitive environments such as isolators.

- No moving parts above the vials and trays
- Robust operation with no chains or bars
- Close shelf spacing
- Compact and easy to clean
- Design for use in isolators



Safe powder handling

Customised emptying of trays



Detraying units

We offer customised detraying units for the safe and efficient transfer of powdered active ingredients after the freeze-drying process into individual vessels such as bottles or containers.

For example, the trays with the dried product can be transported on a conveyor belt in a special frame table that is automatically lifted. The operator can then tilt the table manually, whereby the powder is fed directly into the desired container through a funnel.

Our detraying units offer a unique combination of automation and manual loading, allowing a high degree of flexibility and control. The processes are intuitively designed to ensure smooth and efficient handling of powdered substances.



- Safe handling thanks to safe and controlled decanting
- Reduced product loss
- Combination of automation and manual operation (cost efficiency)

Perfect cleaning

The optimum solution for every system

Rely on our cleaning options for the highest hygiene standards in freeze drying.

1. CIP (Cleaning in Place)

Our automated cleaning process ensures the effective cleaning of production freeze dryers. Special design features and flexible configuration allow us to customise the process to your requirements.

2. VHP (Vapourized Hydrogen Peroxide)

Ideal for systems in which steam sterilisation is not practicable. VHP offers reproducible decontamination without thermal stress on the system.

3. SIP (Sterilization in Place)

For complete sterilisation of the drying and ice condenser chamber. The process is controlled and documented on a customer-specific basis.



Customized containment options

When safety is a high priority

The integration of containment technologies protects employees, ensures product quality and fulfils regulatory requirements.

Our systems enable the seamless integration of loading systems into isolators or RABS systems, minimising risks to operators and products.

RABS systems with LF units provide controlled environments for sampling. Our integrated monitoring solutions enable real-time monitoring and fast correction of deviations.

With coordinated interfaces to upstream and downstream systems, we optimise production processes and minimise errors.



Automation concept – transparent and smart

It is often required that freeze-drying systems not only have comprehensive monitoring of the processes taking place, e.g. for quality assurance, for example.

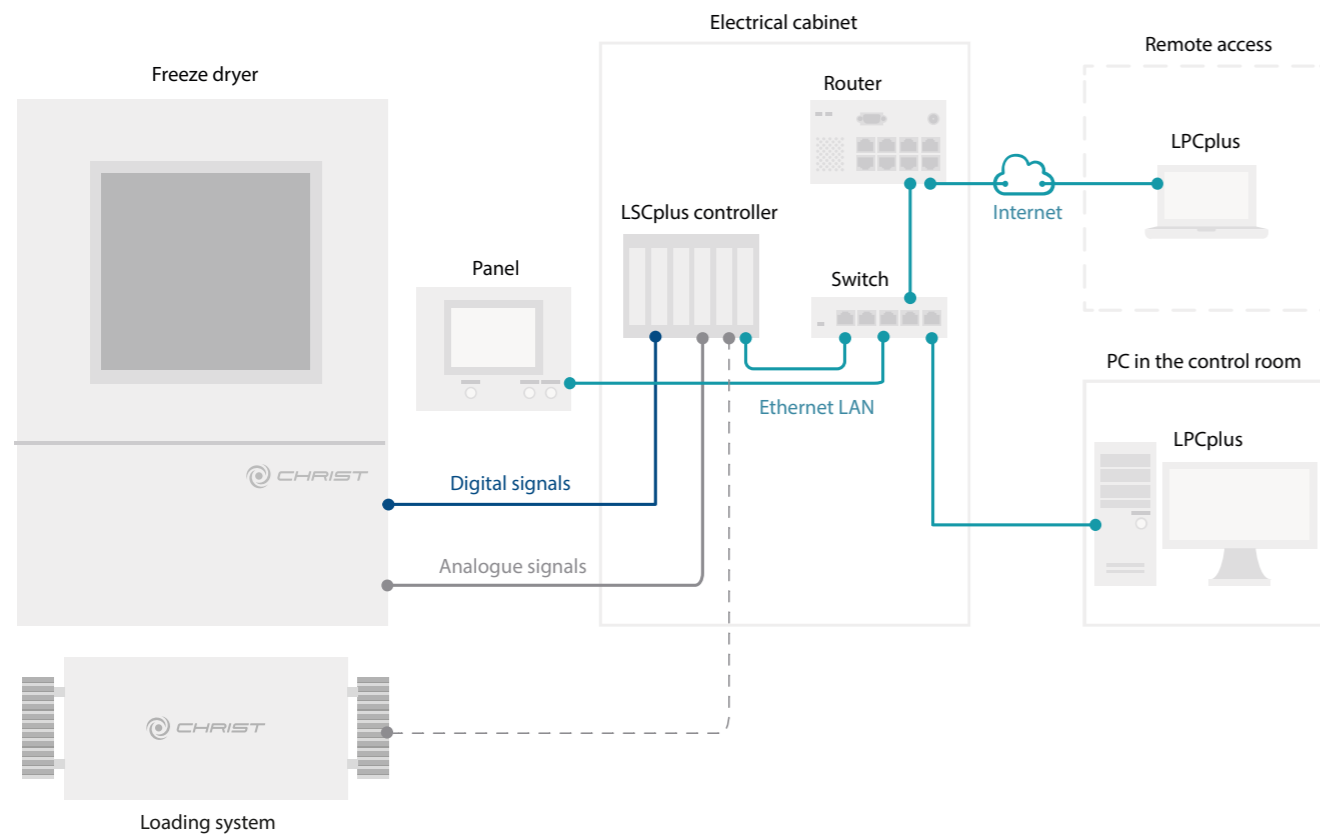
In fact, the high-quality customer products in Christ systems are optimally protected against batch loss thanks to the fully automatic process control with direct parameter correction.

Process visualisation LPCplus

Our user-friendly process and system control bundles the operation of all freeze drying functions and the associated administrative tasks under a standardised user interface. The LPCplus SCADA software has been continuously developed at Christ over decades and optimised for freeze drying. The following functional areas are covered:

- Process control of the manual, fully automatic and programmecontrolled drying process
- Process visualisation
- Process recording (measurement data)
- Process documentation and analysis
- Data backup
- Management of freeze drying programmes/recipes
- User administration

The LPCplus process control system can be operated on Windows-based PC operating systems. Remote access, e.g. for maintenance tasks, is also possible. All process steps can be configured and carried out fully automatically by LPCplus.



Process visualisation especially for freeze drying

Some highlights of the LPCplus process control and visualisation system, which has been continuously developed over decades

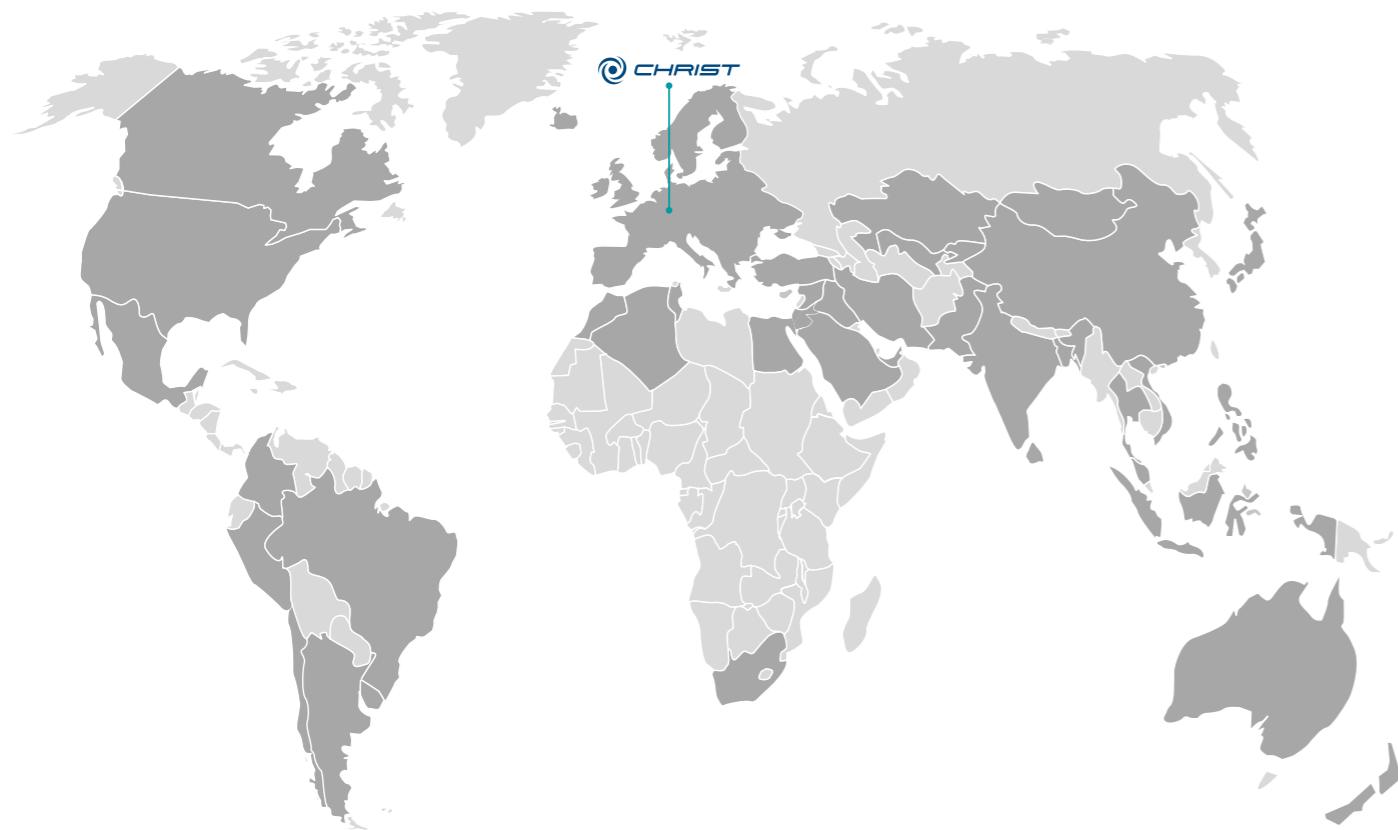
- Intuitive system operation
- Context-sensitive help function (integrated detailed operation instructions)
- Optimised for touchscreen and mouse/keyboard operation
- Analysis of several GT runs with parallel display of the process graphics, zoom function
- Table of all events and actions of the current process (logbook) with filter function
- Graphics-oriented creation of drying programmes (recipes)
- Determination of the solidification point/freezing point with proposal of the drying vacuum
- Avoidance of unauthorised setpoint, configuration and program changes, plausibility checks through detailed user administration
- Role-based user administration with the option of linking to a domain
- Optimum data and process integrity through the use of non-manipulable formats and a single audit trail
- The system can be operated via several operation stations
- free configuration of messages and alarms, forwarding via e-mail and/or SMS possible

To the video
LPCplus:
martinchrist.de/LPCplus



Global service

Service network in over 70 countries worldwide



Lifetime support by Martin Christ

At Martin Christ, we attach importance to high service quality, and offer comprehensive services for all aspects of our products. Our goal is to ensure optimal functionality and long service life of your system by consulting, supporting, or implementing. Decades of experience enable us to act quickly and competently. Check it out for yourself...

- Specialised and certified service technicians on site
- Online support for problems
- 24/7 hotline for technical solutions to problems
- Short response times in case of malfunction or fault
- Calibration of all sensors, incorporating local standards
- Wear parts and critical spare parts available for at least 10 years
- Planning and coordination of maintenance activities
- Comprehensive retrofits and upgrades to ensure system reliability

Our product spectrum

Comprehensive program of freeze dryer systems



- 1 Pilot freeze drying systems for process development and optimization, with ice condenser capacities from 4 to 16 kg.
- 2 Freeze drying systems for industrial production, with ice condenser capacities from 20 to 500 kg, individualized systems planning including loading and unloading.
- 3 Manual, semi-automatic and fully automatic loading systems to fully automatic push-pull loading and unloading systems from pilot to production size.

We also manufacture laboratory-scale freeze dryers and RVCs (Rotational vacuum concentrators) for routine applications and R&D.



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