

Non-Sterile Concept Freeze Drying Systems for Bulk Material



Smart, efficient single
chamber systems

We create values

Freeze drying systems and beyond with quality and innovation

Single-chamber systems

Suitable for bulk material.

Examples: bacterial suspensions, nanoscale materials, high-quality food products and diagnostics.

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



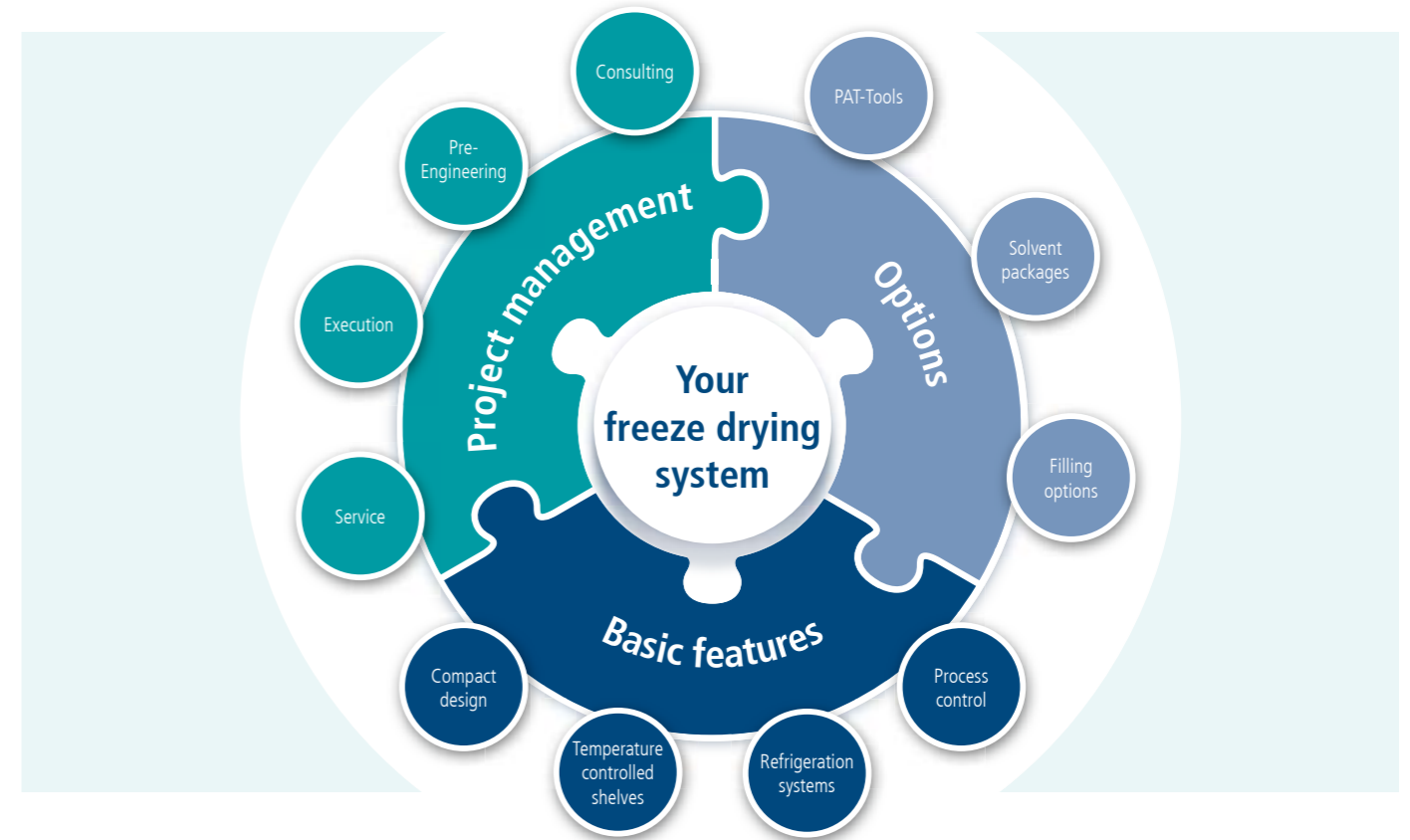
Our expertise and commitment for the optimum, trouble-free operation of your system

Long before your system dries the first batch of your high-quality product, our qualified project planning and service team provides the necessary advice and support. All systems meet the highest requirements in terms of materials to be used and functional reliability.

Adaptation to the spatial conditions in terms of mechanical design or component positioning is just as possible as alternative concepts for vacuum and cooling.

Plug-and-play solutions

A freeze dryer from Martin Christ not only meets all these requirements, but also offers an extremely compact and versatile package that enables simplified installation and plug-and-play operation.



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:

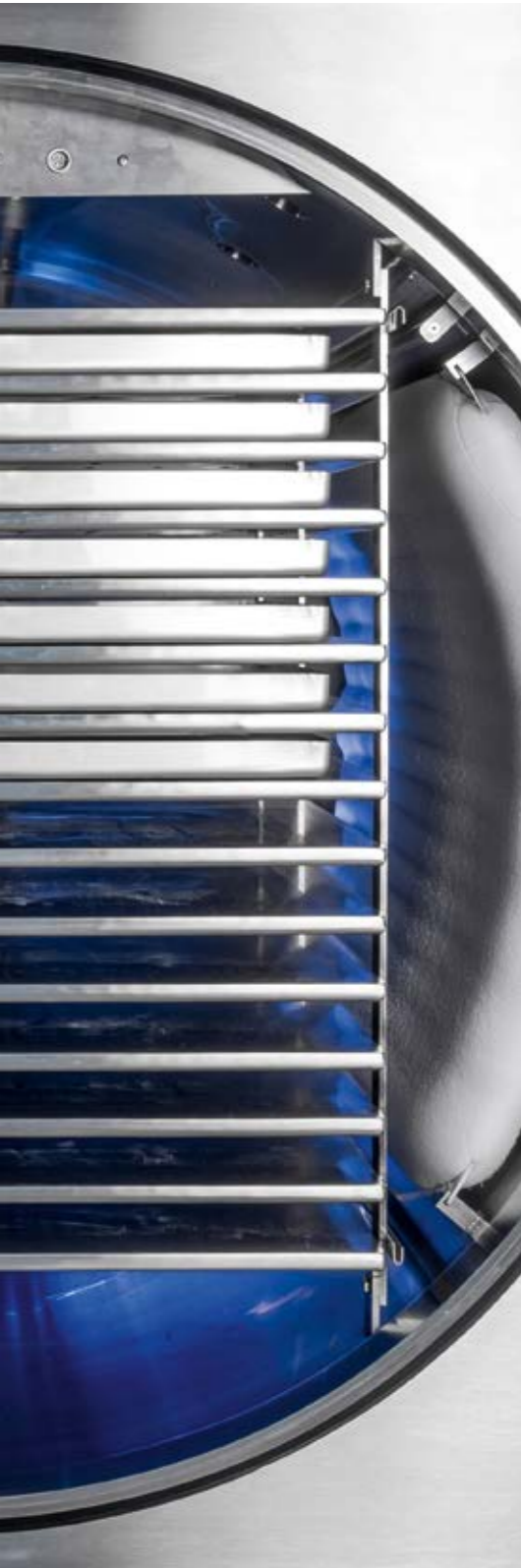
- Conventional refrigeration CFC-free
- CO₂ / air combination
- CO₂ / liquid nitrogen combination
- Liquid nitrogen

Flexible installation concepts – Compact or separate

You can choose between a compact design or a configuration with a separate machine skid, tailored to fit your specific requirements. Whether you need a space-efficient solution or a modular setup, we are dedicated to providing the optimal configuration for your freeze drying needs.

Unbeatable expertise

Our powerful freeze drying system



Single-chamber system

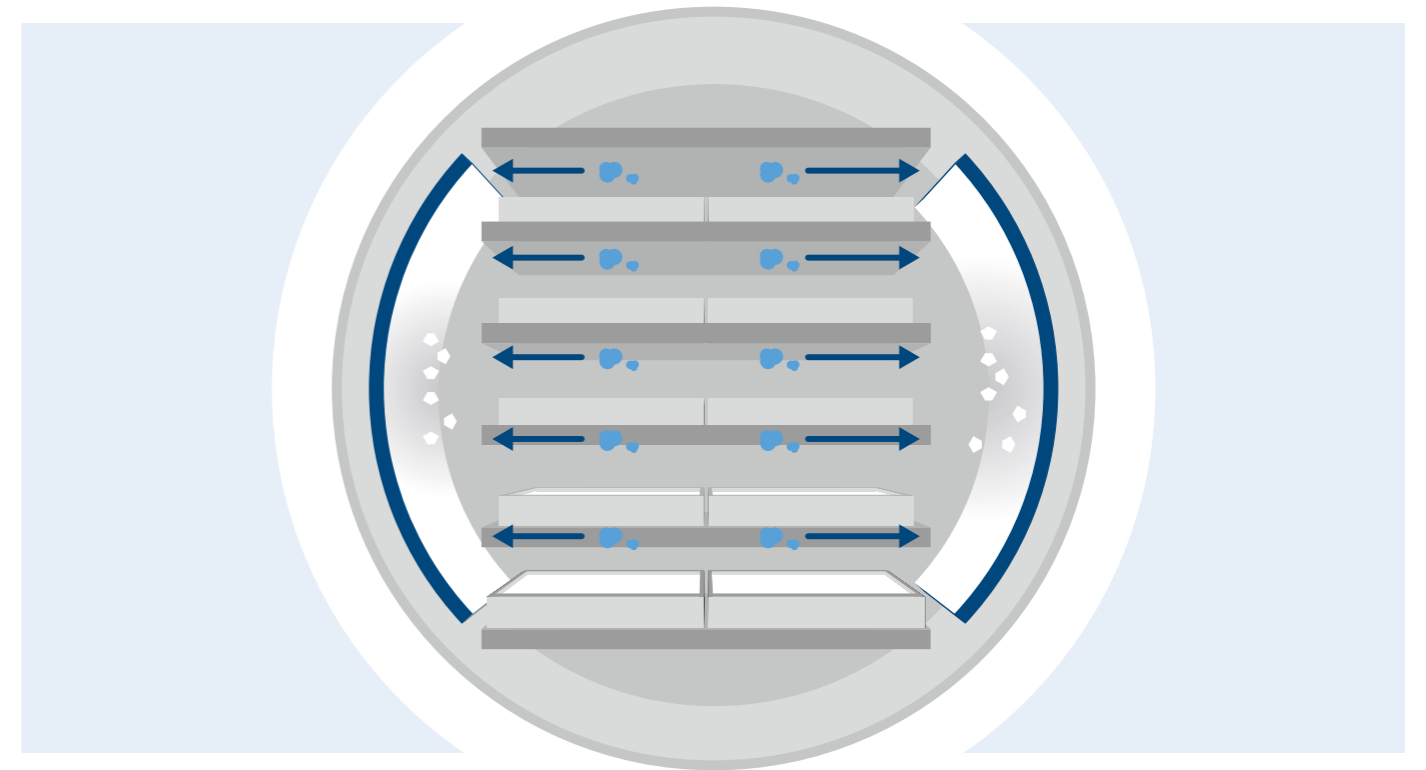
Our production systems are based on the proven single-chamber principle with a cylindrical drying chamber and an integrated ice condenser directly in the product chamber. They offer high drying performance at moderate investment and energy costs and guarantee reliable operation for years.

The liquid-temperature-controlled shelves enable precise freezing and drying. Our freeze dryers are available with oil-free and oil-sealed vacuum pumps to ensure reliable vacuum generation. Choose between a stainless steel housing or a wall-mounted version to make the best use of your space and requirements.

- Short drying times
- Process monitoring during drying and defrosting
- Fast defrosting (20 - 30 minutes)
- Easy manual cleaning
- Low maintenance and operating costs
- Compact design
- Different cooling concepts
- Water-cooled systems

Our system features

Overview



Freeze dryers with individual additional options

Our standardized freeze drying systems are particularly suitable when a quick and cost-effective implementation is required. Our preconfigured freeze dryers can be equipped with a wide range of additional options and can be easily retrofitted.

The single-chamber systems can be supplied either as stand-alone units or prepared for integration into the wall of an existing clean-room. The control cabinet with controls and operation can be installed either next to the drying chamber or at the side.

Our preconfigured freeze dryers are available in various sizes:

Epsilon		2-40	2-60	2-90	2-220
Chamber depth	mm	880	1,180	1,640	2,415
Chamber diameter	mm	970	970	970	1,388
Ice capacity	kg	40	60	90	220
Ice condenser performance	kg/24h	27	40	60	140
Number of shelves		10	10	10	14
Shelf dimension (W x D)	mm	600 x 600	600 x 900	600 x 1,350	900 x 1,200
Shelf area	m ²	3.6	5.4	8.1	15.12
Shelf temperature min. - max.	°C	-50 to +50	-55 to +50	-55 to +50	-55 to +50
Ice condenser temperature ca.	°C	-75	-75	-75	-75

Process optimization with intelligent PAT-Tools

Our high-performance freeze dryers



For process optimization and monitoring, the drying speed should be continuously determined in order to ensure safe and economical operation through targeted changes to the process parameters vacuum and shelf temperature. Conclusions about sublimation and the end of the process can be drawn by using PAT tools.

Product temperature

Product temperature is one of the most important parameters for process control and monitoring. Besides the classic, cable-based method with robust PT-100 sensors, we also offer our wireless WTMplus technology. The use of small, GMP-conforming measurement sensors with no power supply makes it practical to measure product temperature in production batches. The measurement data is fully integrated in our LPCplus process control system as well.

LyoControl

This tool allows the freezing point of a product to be determined. The measured values - product temperature and electrical resistance - are used to determine the safe process parameters and provide an indication of the product's behavior. Incorporating the measurement results into the control system makes it possible to adjust the shelf temperature during the process.

Comparative Pressure Measurement

The simultaneous use of two vacuum sensors with different measuring principles provides information about the drying progress. The predominantly used Pirani sensor shows higher absolute pressure values at the beginning of the main drying process because it is gas dependent and large amounts of water vapor are released at the beginning of the main drying process. The capacitive pressure sensor is independent of the type of gas. The convergence of the two pressure curves over the course of the process indicates the end of the main drying process, as no significant amount of water vapor is present.



Perfect cleaning

Tools for manual cleaning

Manual cleaning

Our proven chamber design provides good accessibility through the full-size door to the drying chamber with the shelves and especially to the ice condenser. This easy accessibility makes manual cleaning easy. As a rule, the user establishes an SOP for the cleaning procedure. With manual spray-down and wiping, both the freeze drying chamber with shelves and the ice condenser are cleaned the same way every time to meet specifications.

WIP - Washing in place

Washing is a major part of various activities performed in different industries. As we know in the various pharmaceutical industries we have to perform cleaning activities all the time whenever we have a change of product or depending on the requirement according to standard cleaning procedures.

Wash in place (WIP) is the process where various closed equipment are washed without dismantling different parts of the equipment. This can be easily performed in our freeze dryers.



Automation concept - transparent and smart

Freeze drying systems commonly require not only comprehensive monitoring of operations, but also seamless quality assurance. High-end customer products in Martin Christ systems are also optimally protected against batch losses by our fully automated process controls with direct parameter correction.

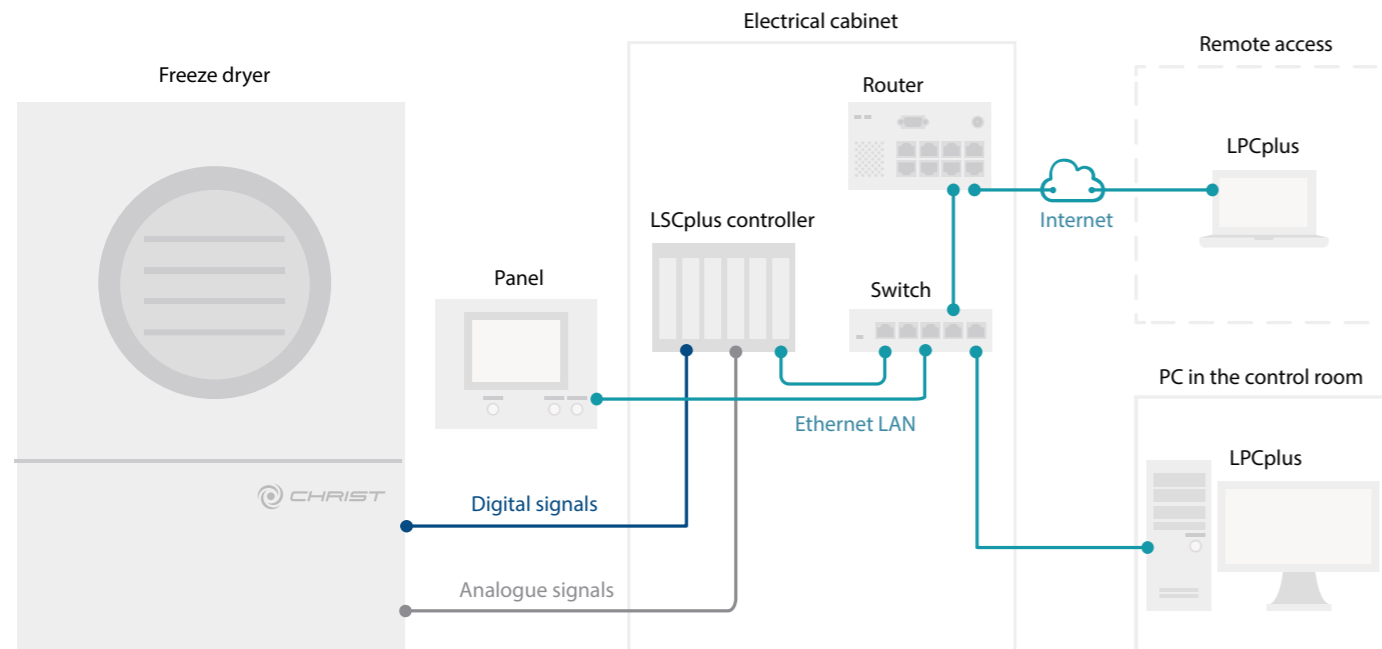
LPCplus process visualization

Our user-friendly process and system control systems bundle all of the freeze drying operations and associated administrative tasks under one uniform user interface. Martin Christ has continued to develop and optimize the LPCplus SCADA software continuously over decades for freeze drying, ensuring it complies with relevant CFR/GMP guidelines and has been refined to meet the highest industry standards. Process automation takes place on the LSCplus MicroController system and has an optimum cost/benefit ratio.

It includes the following functions:

- Process control for manual, fully automated and programcontrolled drying sequences
- Process visualization
- Process recording (measurement data)
- Process documentation and analysis
- Secure data storage
- Administration of freeze drying programs and recipes
- User administration

The LPCplus process control system can be run on Windows-based operating systems. Remote access, such as for maintenance tasks, is also possible.



Process visualization specifically for freeze drying

Some highlights of the LPCplus process control and visualization system, which has been continuously advanced:

- Intuitive system controls
- Context-sensitive help function (integrated detailed operator instructions)
- Optimized for touchscreen and mouse/keyboard controls
- Analysis of several FD sequences with parallel display of process charts and zoom function
- Table of all events and actions in the current process (log book) with filter function
- Graphic-based creation of drying programs (recipes)
- Determines the solidification or freezing point with suggested drying vacuum level
- Prevents unauthorized specification, configuration, and program changes, with plausibility checks via detailed user administration
- Role-based user administration with the ability to connect to a domain
- Optimal data and process integrity, using non-manipulable formats and only one single audit trail
- The system can be operated from several control stations
- Freely configurable messages and alarms, with available forwarding via email and/or text



The experts for loading and unloading

Semi-automatic and manual loading systems for optimized processes



Our customized semi-automatic loading systems with electric height lift for freeze drying systems offer outstanding efficiency. With our systems, you can transport and load a large number of containers effortlessly and safely.

Features:

- **Transfer:** Trays or frames can be transferred into specific drying vessels to optimize the process.
- **Electric vertical lift:** Our loading system is equipped with an electric vertical lift that enables simple and precise adjustment to the height of your freeze dryer.
- **Semi-automatic operation:** The system is designed to optimize the workflow. It is placed and docked in front of the freeze dryer to ensure a seamless transition.
- **Manual operation:** The loading of the transfer frames into the freeze dryer is done manually, allowing for flexible handling and control. The transfer frames can simply be pushed into or pulled out of the dryer.

Our semi-automatic loading system is a reliable and effective solution for your freeze dryer, optimizing workflow and increasing productivity.

- Transport of trays and unstable formats (e.g. ampoules, vials, ...)
- Linkable transfer frames
- Electric height lift
- Optional: Monitored glove intervention



Precise filling & safe powder handling

Mobile filling systems and powder transport systems

Mobile filling system

We develop pioneering solutions for practical applications. Our proven and flexible solution allows a wide range of products to be conveyed precisely and gently. It is particularly suitable for pumping difficult products, such as solid particles. When pumping viscous media, we enable an even and constant flow of liquid without clogging or degradation. We offer a robust and reliable solution for pumping a wide range of fluids, including abrasive, corrosive, viscous and sensitive fluids.

- Peristaltic pump
- Easy maintenance
- Few wearing parts
- Single use hoses
- Flow rate from 6 l/h up to 300 l/h

PTS - Powder Transfer System

After the freeze drying process, the powdered active ingredients can be transported by our developed vacuum conveyors.

Using a vacuum to transport raw materials is easier than you might think. The conveyed material is in a closed system from product infeed to product discharge.

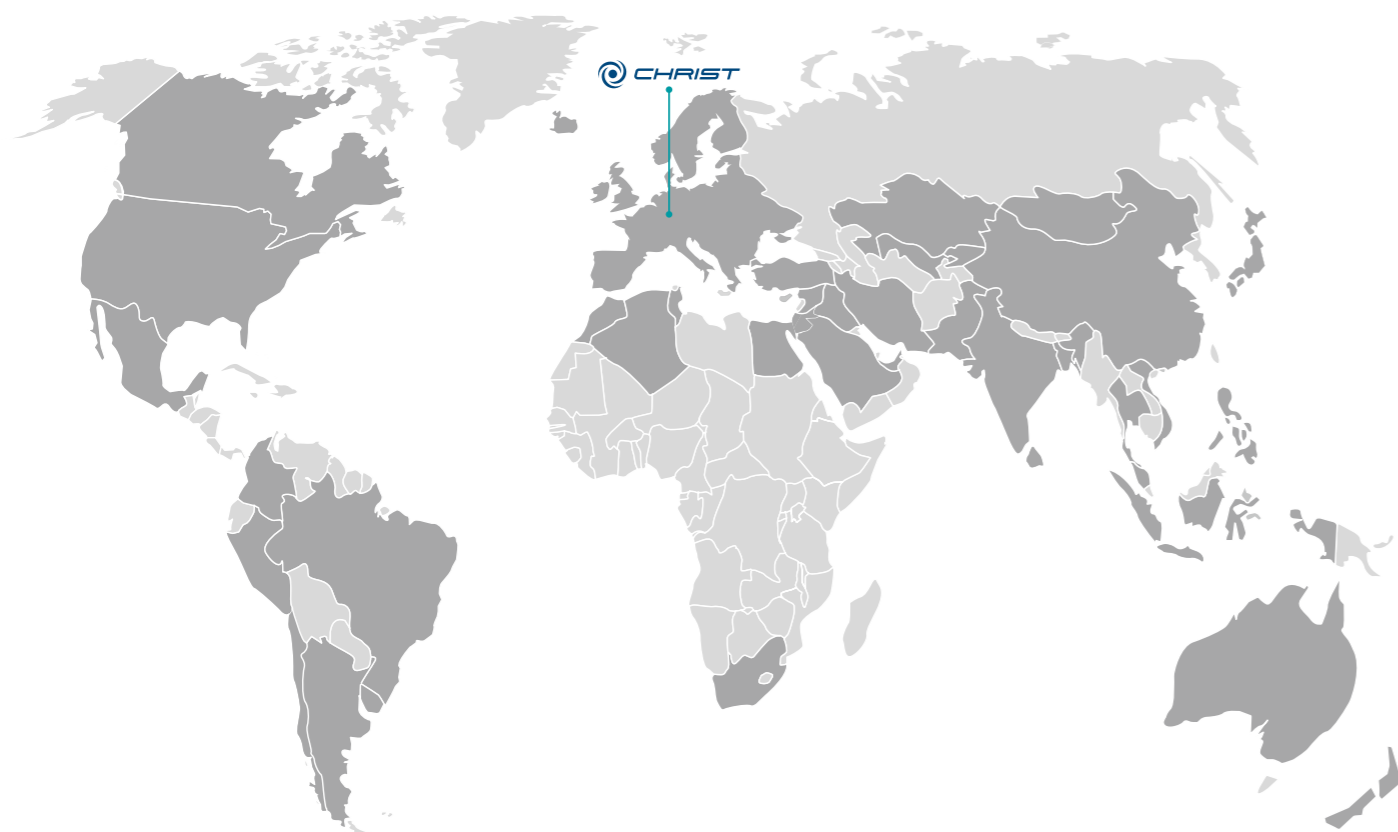
Increase your productivity through more effective material transport.

- Easy installation
- Dust-free conveying
- Long conveying distances possible
- Discharge into processing vessels or grinder



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



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

- 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.



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