Lyovapor™ Solutions

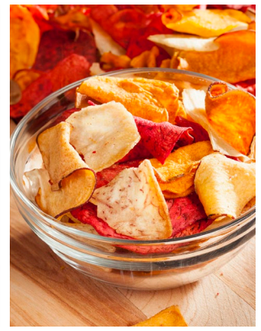
Mastering Freeze Drying Excellence

BÜCHI

Empowering Laboratories
with Versatile Solutions

Numerous industries harness the power of our innovative Lyovapor™ solutions, from pharma to academia. Our instruments have been crafted with care and are designed for durability, prepared to tackle even the most demanding applications.

	Pharmaceutical	**Biotechnology**	**Chemical**
			
Applications	Discovery pharmaceutical ingredients, drug delivery, vaccine, wound dressing.	Peptide, protein cells, bacteria, virus, hormones, enzyme, antibodies, serum.	Organic and inorganic substances, nanotechnology.
Methods	Drying of target compounds, encapsulated materials, formulation in final container.	Gentle drying for maintaining overall structure and functionality.	Loss-free and non-destructive drying.

	Testing	**Food**	**Natural extracts**
			
Applications	Environmental samples, quality control, pathological samples.	Fruits, meat, beverage, dairy products, "smart-food".	Nutraceutical and molecules from plant extracts.
Methods	Sample preparation for analytic investigations and storage.	Drying for safe storage, adding new product characteristics.	Gentle drying.

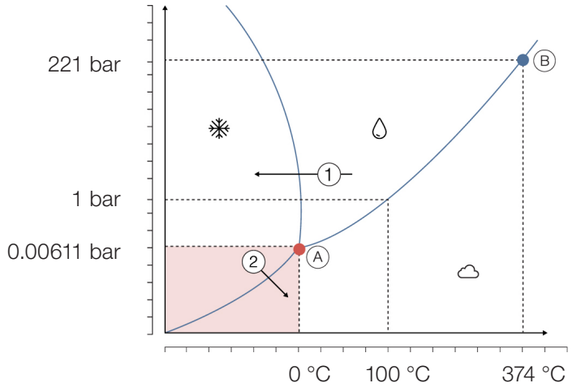
The Lyovapor™ line of high-performance instruments covers applications for all industries, and the choice of instrument depends on a range of factors, such as the drying process, the solvents being removed, and sample quantities.

- The Drying Process: Advanced drying processes may require more precise control of parameters and the ability to dry samples quickly.
- Removed Solvents: The type of solvent being removed, such as aqueous or organic, and solvent mixtures may require specific instruments.
- Sample Quantities: The amount of sample to be dried influences the choice of sample containers and the size of the instrument required.

These parameters influence the configuration of an instrument’s ice condenser, drying chamber, and vacuum pump.

Freeze Drying Foundations
Mastering the magic of molecular transformation

Freeze drying, also known as lyophilization, is a specialized gentle drying process particularly suitable for heat-sensitive, high-value products. The drying process involves freezing a liquid or wet sample, usually a water-based solution, and then directly converting the frozen solvent into gas, bypassing the water phase, using a process called sublimation. Low temperatures are required for sublimation to occur, as well as precise control over temperature and pressure.
The following phase diagram shows how temperature and pressure affect the transitions between different states of matter.



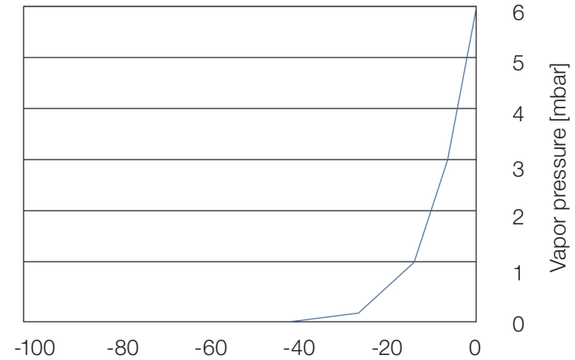
Phase diagram of water.

① Choose freezing temperature depending on solvents and solute.
② Start of sublimation by lowering the pressure.
Ⓐ Triple point.
Ⓑ Critical point.

Freeze drying water-based formulations is possible because water has a significant vapor pressure even when frozen. Specifically, it's 6.11 mbar (= 6.11 hPa) at the triple point. At this pressure, there's a lively exchange of water molecules between the ice and the surrounding atmosphere, i.e., between the solid and gaseous phases. In a freeze dryer, these water molecules are removed by resublimation on cooling surfaces, causing the ice quantity to decrease over time. In order to maintain the process of sublimation, any heat loss needs to be replaced. This is achieved using temperature-regulated shelves where the product is housed.

The optimal condenser temperature for a freeze-drying system should be chosen according to the critical temperature of the sample, such as the collapse temperature of the frozen concentrate solution and the type of solvent being used. The condenser must be 15 – 20 °C colder than the sample for an optimal process. When working with aqueous samples, an instrument with a -55 °C condenser is adequate for most cases, and a colder condenser will not speed up the process. Extra cold condensers such as -85 °C and -105 °C have been designed to process solvents with low freezing points and their mixtures with water.
Temperature alone does not affect the freeze-drying rate. The driving force of the sublimation process is the difference in vapor pressure between the frozen sample's sublimation surface and the condenser's ice layer. In a freeze-drying process, if the sample is not heated, its temperature will be defined by the pressure set in the chamber. The temperature of the coil defines the ice vapor pressure over the condenser wall. This effect can be observed when the pressure and the temperature are plotted together on a graph, exemplary for water. See the figure below.

When reducing the temperature, the vapor pressure decreases quickly to reach a plateau. In order to increase the pressure difference, it is more efficient to increase product temperature than to reduce the condenser temperature. This can be illustrated by calculating the difference of vapor pressure between -40 °C for frozen water and -55 °C for ice condenser (0.109 mbar) compared to -20 °C for frozen water and -55 °C for ice condenser (1.019 mbar).



Relationship between ice temperature and the vapour pressure above it.

Elevating Laboratory Performance
with Unmatched Flexibility

We proudly present our full suite of Lyovapor™ instruments dedicated to the sophisticated demands of laboratory freeze drying, from the L-200 for standard applications to the flagship L-300. Additionally, our latest innovation, the L-250, is expertly crafted to bridge the gap and introduce cutting-edge, energy-efficient cooling technology solutions.

Fit for purpose
Modular configurations for a wide range of applications

The Classic and Pro versions accommodate different sample types in flasks, vials or trays to meet diverse requirements. Upgrade your instrument with drying chambers, Pro control unit whenever you choose.
With the method editor an automated freeze drying run with a programmed protocol and endpoint determination is possible.

Maximize your process efficiency
Digital innovation and automation

BUCHI Infinite-Control™ enables remote monitoring and control of the instrument at anytime, from everywhere. The L-300's automatic defrosting feature reduces downtime by eliminating the need for manual de-icing of the ice condenser, saving your precious time. Furthermore, the instrument and vacuum pump can automatically start up, making the instrument operational within minutes.

Reliable results
Powerful cooling design for a fast and safe drying process

The outstanding cooling performance ensures the complete recovery of solvents by the ice condenser coil, particularly effective for the parallel drying of several samples. This guarantee sample integrity throughout the drying process. Three ice condenser temperatures are tailored to suit application with water and organic solvents with low freezing point.

Lyovapor™ L-200

Modular Accessories
Drying chamber process analytic, sensors.

Intuitive Interface
All process parameters at a glance.

Infinite-Control™

Accessible Connections
Connections to valves, sensor and vacuum pump for an automated start-up.

Convenient Trolley
Space-saving installation next to the bench.

Ice condenser
High quality steel for chemical stability.
Coil design for 6 kg capacity.

Essential Freeze Dryer
with high reproducibility and flexibility

Our Lyovapor™ L-200 instrument was designed with the same robust reliability as our flagship L-300 instrument. The L-200 features our innovative Infinite-Control™ technology that offers unprecedented levels of control. The ice condenser temperature of -55 °C is suitable for standard samples containing water. Furthermore, it offers a wealth of features and flexibility, including a variety of drying chamber options that are as varied as your application needs.

Precise process parameters
- Rapidly achieve a stable ice condenser temperature.
- Regulate vacuum precisely with advanced vacuum control.
- Reproducible results for water-based applications at -55 °C.

Modularity meets flexibility
- A 6 kg ice capacity accommodates a diverse range of samples.
- Several drying chambers accommodate a wide range of applications.
- Easy installation on a bench, trolley, or fume hood.
- Upgrade from a Basic to a Pro instrument as your application needs change.

Technologies to reduce drying time
- The stable ice condenser temperature allows for complete solvent collection, even for large sample quantities.
- Advanced process analytics via endpoint determination of primary and secondary drying.
- Method programming and sample protective state enables an automatic freeze drying run and process interruption if the sample temperature rises above the set collapse temperature.

Lyovapor™ L-250

Modular Accessories
Drying chamber with matching endpoint determination technique.

Touchscreen Interface
Intuitive operation and data logging.

Infinite-Control™

Vacuum regulation
Adaptable to your application from ultimate to precise control for vial application.

Convenient Trolley
Space-saving installation next to the bench.

Ice condenser
High quality steel for chemical stability and coil design for 5 kg capacity.

The Green Freeze Dryer
The standard for Performance and Eco-Friendliness

We are proud to introduce the Lyovapor™ L-250 with EcoStream™ technology: The greenest freeze drying option for your laboratory. The L-250 embodies BUCHI's commitment to enhancing the sustainability of laboratory processes worldwide. Our innovative cooling technology manages to reduce the environmental footprint of the instrument without compromising our commitment to quality and reliability.

EcoStream™ Innovation
- Achieve a condenser temperature of -85 °C with our ground-breaking compressor design.
- Low global warming potential (GWP) of 4 with natural coolants reducing the environmental impact.
- Lower the amount of heat output and noise emissions in your lab.

Save energy, enhance performance
- Profit from reduced electrical energy consumption due to the smart compressor design.
- The stable ice condenser temperature allows for complete solvent collection, for large sample quantities, accompanied by endpoint determination.
- Benefit from reliable freeze drying for water and organic-based solvents.

Embrace efficiency and elevate control
- Featuring Infinite-Control™ technology.
- Live graphic of process parameters on instrument display.
- Easy installation on a bench, trolley, or fume hood.
- Sample protective state is activated if the sample temperature rises above the set collapse temperature, safeguarding precious samples.
- Upgrade from a Basic to a Pro instrument as your application needs change.

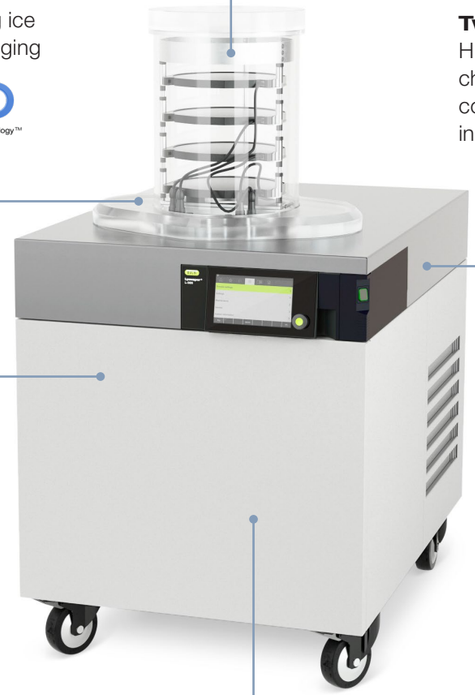
Lyovapor™ L-300

Modular Drying Chambers
Adapt to your flask and shelf application.

Process automation
Automated start-up, automated defrosting ice condensers, data logging on SD card.

Infinite-Technology™

Two ice condensers
High quality steel for chemical stability and condenser capacity of 12 kg in 24 h.



Connection for sensors
Monitor pressure for pressure tests and water level in canisters.

Space saving installation
Two positions of interface; front and side-wise to conveniently place the instrument in your lab.

First Freeze Dryer for Continuous Sublimation
Ultimate Efficiency with Infinite-Technology™

The Lyovapor™ L-300 features our revolutionary Infinite-Technology™ and is the first dual condenser freeze drying system that offers unlimited ice capacity. Perform continuous sublimation thanks to the two condensers that work alternately and are automatically cleaned. The L-300 also features Infinite-Control™ to monitor the entire process from the instrument, laptop, or remotely via mobile devices.

Featuring dual condensers
- Infinite ice capacity for large sample batches.
- Stable process parameters, including cooling temperature and vacuum pressure with Smart-Switch.
- Lyophilization of water and organic-based solvents allows for sample flexibility at -105 °C.
- The stable ice condenser temperature allows for complete solvent collection.

Save time and cost
- Automated, hygienic steam cleaning.
- Minimize downtime with dual condensers, ensuring continual operation.
- Advanced process analytics via endpoint determination using temperature difference tests, pressure difference tests and pressure rise tests reduces run time.

Unparalleled flexibility
- Be prepared for increasing sample volumes on manifold drying chamber for large sample quantities of up to 36 manifold connections.
- Various drying chambers allow for increased sample flexibility.
- Enjoy high process reproducibility by shelf temperature variation ±1 °C.
- Technology with high convenience: You can upgrade from a Basic to a Pro instrument as your application needs change.

Discover more:

Infinite-Technology™

Freeze Drying with Infinite-Control™
Seamless control, everywhere, every time

Infinite-Control™ technology, a digital feature standard across our entire Lyovapor™ range, includes remote process control and monitoring via interface, software and app. Effortlessly create and run methods, log data, and record charts in real time. Monitor the performance of your Lyovapor™ from any location with our specially designed mobile app that provides timely push notifications updating you on the freeze-drying progress. You can also rely on our sample protective state that ensures your valuable products are treated with the utmost care. We have prioritized convenience at every step to provide user-friendly controls that guarantee a flawless experience with your lyophilization instrument.

Instrument control
- Easily view all process parameters.
- Enhance sample integrity with the sample protection state.
- Endpoint determination tracks sublimation progress to reduce the process time automatically.

Software control
- Allows for data recording and customized reports.
- User-friendly operation to create and start methods.
- Provides real-time diagrams and schematics of the process.

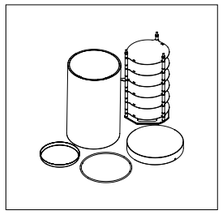
Mobile monitoring
- Remotely monitor your process anywhere, anytime.
- Stay informed with timely push notifications.
- Track several BUCHI products simultaneously.

Discover more:
Infinite-Control™

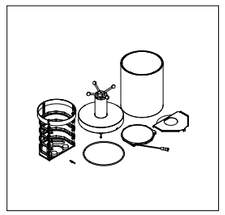
Technical data
Lyovapor™

	Lyovapor™ L-200	Lyovapor™ L-250	Lyovapor™ L-300
Lowest ice condenser temperature at 25 °C	-55 °C	-85 °C	-105 °C
Dimension (WxDxH in mm)	460 × 585 × 510	503 x 645 x 510	710 x 1,000 x 900
Weight kg	75	67	272
Connection voltage	220 – 240 ± 10% VAC	200 – 240 ± 10% VAC	380 – 400 V 3N~
Power consumption	1,200 – 1,800 VAC	1,300 – 1,800 VAC	6,000 5,000 VA
Frequency	50 – 60 Hz	50 – 60 Hz	50 – 60 Hz
Environmental conditions	15 °C – 30 °C, max. relative humidity 80%	5 °C – 30 °C, max. relative humidity 80%	15 °C – 30 °C, max. relative humidity 80%
Minimum clearance on all Sides	30 cm	30 cm	40 cm
Noise level	< 60 dB	< 68 dB	< 68 dB
Minimum system vacuum (with vacuum pump / without samples)	0.03 mbar	0.03 mbar	0.03 mbar
Global Warming Potential (GWP)-Refrigerant	4,000	4	3,559
Leak rate	Max. 10.10 mbar × L / h	Max. 10.10 mbar × L / h	Max. 10.10 mbar × L / h

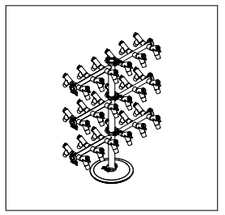
Accessories



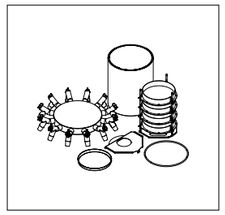
Heating shelves
The temperature-controllable heating shelves, adjustable up to 60 °C (+/-1 °C), expedite your freeze drying process, with options for either 4 or 6 shelves. Additionally, these shelves can be integrated with sample temperature sensors for enhanced monitoring.



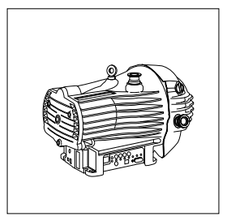
Stoppering top cover
A stoppering cover seals the vial under a vacuum, ensuring that sensitive samples remain dry and contamination-free during storage. Combined with heated and non-heated shelves.



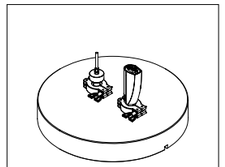
Manifold racks
Connect your samples in flasks of any kind to the manifold rack. BUCHI offers Manifolds with 12, 24, and 36 positions.



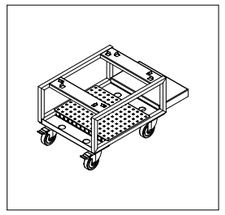
Manifold top cover
To use shelves and manifolds, combine them with the manifold top cover for the acrylic glass chamber.



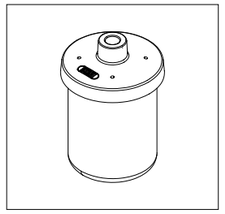
Vacuum pumps
BUCHI offers oil pumps as well as dry pumps for all your applications needs.



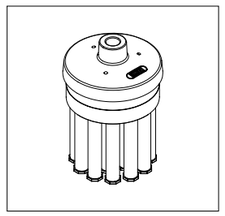
Sensors
The Lyovapor™ sensors accurately track temperature and/or pressure throughout the freeze-drying process, ensuring optimized operations and facilitating accurate endpoint determination using capacitive, Pirani pressure gauges, and sample temperature probes.



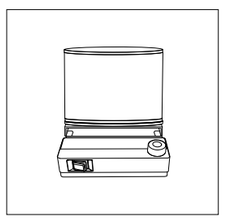
Trolley
With the convenient trolley accessory, you can effortlessly move and position the Lyovapor™ right next to any laboratory bench, ensuring easy setup and mobility.



Beaker Flasks
Enhance accessibility to your dried samples using our range of beaker flasks, available in various sizes to suit your needs.



Ampul Adapter
Use our available ampul adapters to connect ampuls to the manifold adapters.



Dewar accessory
Optimize your manifold applications by achieving a larger surface area and faster drying times thanks to our available Dewar accessory designed for precise sample preparation. Available together with Rotavapor® R-300.

Lyovapor™ Product Overview
The best solution for every need

	Lyovapor™ L-200		Lyovapor™ L-250		Lyovapor™ L-300	
	Classic	Pro	Basic	Pro	Continuous	Pro
Ice condenser						
Temperature	-55 °C		-85 °C		-105 °C	
Application with organic solvents	-	-	•	•	•	•
Maximum sample loading	6 kg / 24 h		4 kg / 24 h		12 kg / 24 h	
Total ice capacity	6 kg		5 kg		Infinite	
EcoStream Technology	-	-	•	•	-	-
Characteristics						
Heated shelves up to 60 °C	-	•	-	•	-	•
Product temperature	-	•	-	•	-	•
Pressure control by Pirani gauge	•	•	•	•	•	•
Pressure control by capacitive gauge	-	•	-	•	-	•
Automatic defrosting of ice condenser	-	-	-	-	•	•
Pressure difference test	-	•	•	•	-	•
Pressure rise test	-	-	-	-	-	•
Temperature difference test	-	•	-	•	-	•

	Lyovapor™ L-200		Lyovapor™ L-250		Lyovapor™ L-300	
	Classic	Pro	Basic	Pro	Continuous	Pro
Drying Chambers						
Heated shelves	-	•	-	•	-	•
Manifold rack / Non-heated shelves / Stoppering	•	•	•	•	•	•
Control unit						
Method editor with graphical display	-	•	-	•	-	•
Touchscreen display	-	•	•	•	-	•
Shelf temperature control	-	•	-	•	-	•
Live graphic of running process	-	-	•	•	-	-
Data logging on SD card	-	•	-	•	-	•
Connection to software	-	•	-	•	-	•

The Lyovapor instrument comes in two versions tailored to your needs:

- Classic / Basic / Continuous: Drying of liquid and solid materials in flasks and trays.
- Pro: Sophisticated drying in vials and trays. It features method programming, end point determination and a sample protective state that is activated if the sample temperature rises above the set collapse temperature.

Service & Training
BUCHI Service packages

BUCHI START – The highest efficiency from the very beginning
From a professional installation to a carefree agreement that will leave you with full cost predictability and the highest possible system efficiency. www.buchi.com/start

«Install»
· Product installation and testing.
· Hands-on training from a certified technician.
· Evaluation of the immediate surroundings of your new product.
· Best integration of your new product into the existing infrastructure.
«IQ / OQ»
· Product or system installation.
· Installation and Operational Qualification.

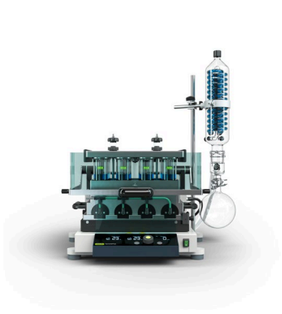
BUCHI EXACT – Certified accuracy for highest level of confidence
Receive comprehensive qualifications with all of your BUCHI products. We perform qualification services on a level that can only be achieved by the manufacturer. www.buchi.com/exact

«OQ»
· Our one-time OQ service will provide you with all the necessary documents and certificates.
· The service team will remind you about the option for a follow-up OQ before the certificates expire.
«OQ Circle»
Buying an OQ package will grant you an additional discount on the documents and offer you priority service with automated visit scheduling.

BUCHI CARE – Unbeatable Reliability
Maintaining a heavily used device requires different parts and inspection frequencies than units that are operated occasionally. Our approach takes factors like these into consideration to provide you with an optimal yet cost-efficient solution. www.buchi.com/care

BUCHI ACADEMY – Increase your know-how, get the edge over your competition
Expert know-how is provided by the application chemists in our competence centers in Flawil, Beijing and Mumbai and the locally available experts at our market organizations. Our scientific support offers pre-sales feasibility studies, tailored solution offers, after sales onsite support, regular basic to advanced courses and on demand customized training. www.buchi.com/academy

Pharma & Chemistry
Freeze Drying for R&D Discovery

	Synthesis, Extraction	Concentration		Separation	Drying	Analysis
	Cold Extraction / Soxhlet	**Evaporation**		**Flash and Prep Chromatography**	**Freeze Drying**	**Melting Point**
						
	Rotavapor®	Rotavapor®	SyncorePlus	Pure & Pure Essential, Sepiatec SFC, Consumables	Lyovapor™	Melting Point
Application	The search for active pharmaceutical ingredients (APIs) and chemical compounds typically begins with a synthesis or an extraction step. Reflux synthesis and Soxhlet extraction can be performed via a rotary evaporator.	Since both synthesis and extraction require large amounts of solvent, a concentration step is required prior to downstream processing. Here, rotary evaporation is used to remove the solvent and concentrate the compound of interest. The use of parallel evaporation can speed up the concentration of multiple samples simultaneously.		Flash and prep HPLC & prep SFC are commonly used to purify target compounds: flash is used as a pre-purification step, whereas prep HPLC and SFC increase the purity of the target compound to the maximum.	Subsequently, molecules of interest are highly diluted and must be concentrated before proceeding with the next steps. Freeze drying can be used to remove solvent from heat sensitive products with minimal damage.	Melting point analysis can be used to perform quality control on the compound of interest and investigate the material's purity. of novel compounds.
Features	· Reflux condenser for reflux synthesis. · Soxhlet accessory for Soxhlet extraction. · One instrument fits several application.	· Evaporating flask size of 50 to 5000 mL for single sample. · Fully communicating system to avoid downtime: solvent library, dynamic distillation, leak test, foam sensor. · Dewar accessory for freeze drying sample preparation.	· Multiple samples in the range of 0.5 – 500 mL. · Flushback module to achieve highest analyte recovery and most reliable results. · Interchangeable racks and volume versatility.	· Flash instruments for basic or advanced applications. · Flash and prep HPLC in one system (optionally). · Integrated UV and ELS detection (optionally). · Compatible with a wide range of flash cartridges, prep HPLC & SFC columns and glass columns.	· L-200: high-quality freeze drying of samples (-55 °C, 6 kg). · L-250: freeze drying of solvent mixtures (-85 °C, 5 kg). · L-300: continuous sublimation with two alternately working and automatically cleansed condensers at -105 °C. · Easy controlling and monitoring of the freeze drying process.	· Automatic determination of melting and boiling points for up to 3 sample in parallel. · Compliant with Pharmacopeia methods (EU, USA, JP). Observation and replay of the phase transition using color display and video recording.

Core messages to our customers
BUCHI creates added value

“Quality in your hands” is the guiding principle that shapes our philosophy and our actions. It challenges us to provide outstanding services that are precisely tailored to your needs. This means that we must stay in close contact with our customers. That is why we keep in touch and continue to work very hard to understand you and your business even better.

We help you by providing high-quality products, systems, solutions, applications and services that offer you added value. This allows you to focus entirely on your processes and your work.

Competent
We have the technological expertise and decades of experience needed to provide competent support and work with you to continually improve our services.

Reliable
We guarantee the quality and functionality of our equipment and will continue to help you quickly and efficiently whenever something does not operate to your satisfaction.

Safe
By collaborating closely with you, we do everything in our power to make our products, systems, solutions, applications and services as safe as possible for people and the environment.

Cost-effective
We strive to create a high level of economic benefit and maximum added value for you.

Global
As an international family-owned business with own subsidiaries and qualified distributors, we have a presence wherever you are located.

Easy
We support you by providing carefully designed solutions as well as instruments and systems that are easy to operate.

Sustainable
We support environmentally friendly processes and manufacture products that have a long service life. We utilize advanced technologies to leave the smallest environmental footprint possible.

We are represented by more than 100 distribution partners worldwide.
Find your local representative at:

www.buchi.com

Quality in your hands