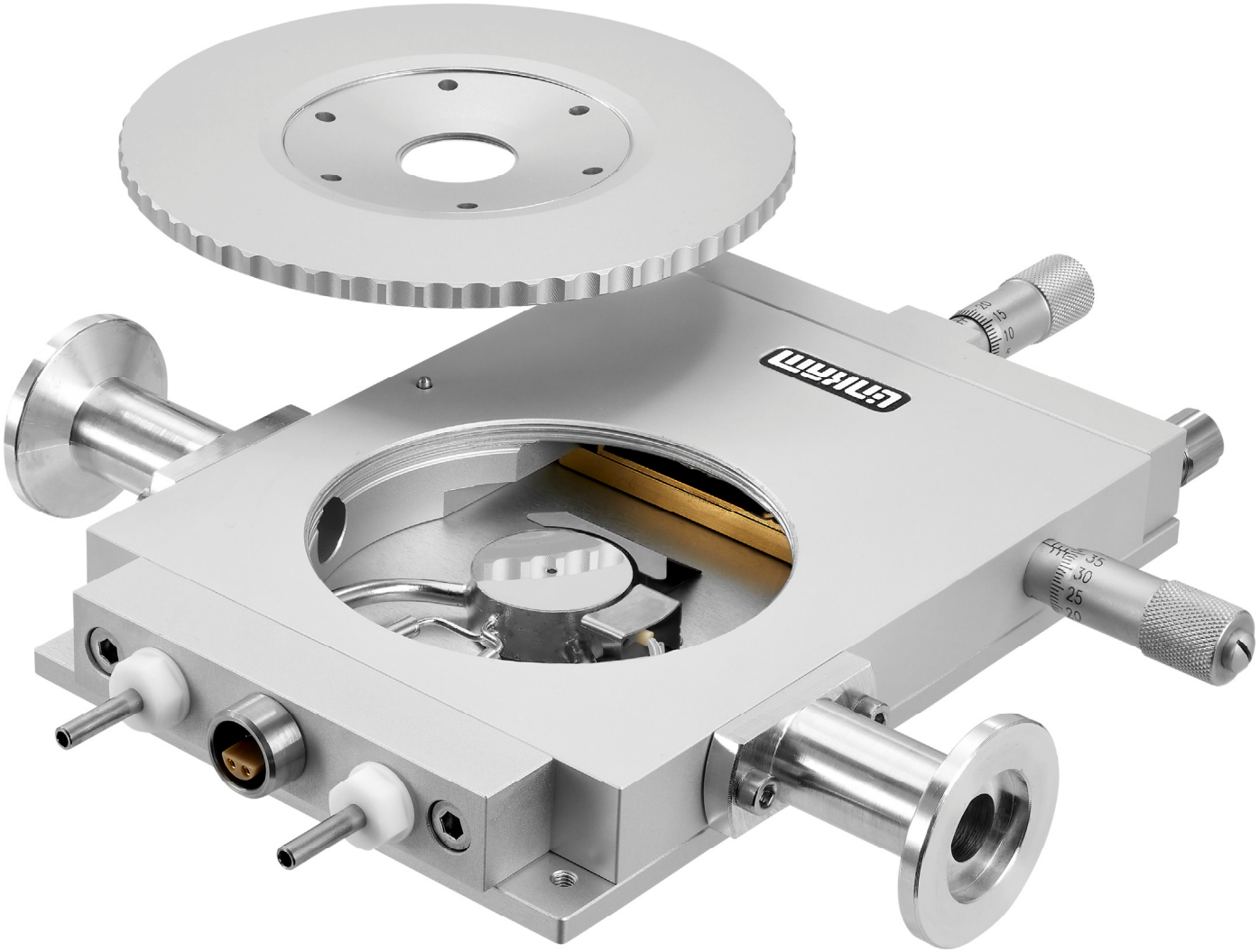
FDCS196

Lyophilisation Stage



Uniform Vacuum Control
Precise temperature control to < -195°C, and cryo-stable vacuum to 10^{-3} mbar

Small Sample Volume
Only requires ~5µl of sample, preventing loss of APIs and saving on costs

Lyophilisation Imaging
High quality sample imaging throughout the freeze-drying process

LINKAM

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Introducing the FDCS196

Developing freeze-drying protocols is a time-consuming and expensive process which can be wasteful. Linkam's FDCS196 allows fast and accurate characterisation of freeze-drying protocols by precise control of sample temperature and vacuum pressure.

Using light microscopy techniques such as phase contrast and polarised light, it is now possible to quickly and precisely determine collapse and eutectic temperature, and investigate the freeze-dried structure of complex samples. Both stage pressure and temperature can be controlled and programmed to simulate industrial procedures and determine ideal drying parameters. The small sample volume of 5µL ensures minimal loss of APIs and helps save on research costs.

Chamber pressure is monitored by a Pirani vacuum gauge mounted directly on the stage. The X and Y manipulators can be used to follow the drying front moving across the sample, and pressure can be automatically controlled by the optional Linkam MV196 motorised valve. For cooling below ambient temperatures an optional LNP96-S liquid nitrogen pump is available.

Using LINK software, the experimental data can be charted, and time-lapse images of the freeze-drying run can be recorded with experimental data (temperature, time, date, pressure, magnification) imprinted onto each image. Images can be viewed in a gallery or as a captioned movie with data displayed underneath the video.

The FDCS196 is also available as part of two pre-configured systems:

- **Freeze-drying System** which comprises a FDCS196 stage, T96-S LinkPad Controller, LNP96-S, Dewar flask, Pirani vacuum gauge and LINK software.
- **Freeze-drying Pro System** which additionally includes a 2.5L vacuum pump and MV196 motorised vacuum valve for vacuum control.

Features

Uniform Vacuum
Chamber pressure is monitored by a Pirani vacuum gauge mounted directly on the stage which allows a perfectly uniform vacuum to be maintained.

Simulate Industrial Procedures
Vacuum and temperature can be accurately controlled and programmed to simulate industrial procedures and determine ideal drying parameters.

Small Sample Volume
With the FDCS196 you can observe the lyophilisation process using only ~5µL of sample which ensures minimal loss of APIs. This also helps save on research costs by reducing waste.

Lyophilisation Imaging
Using the imaging system module of LINK, create time-lapse images and videos with experimental data imprinted on each shot. Use the XY manipulators to track and image the drying front.

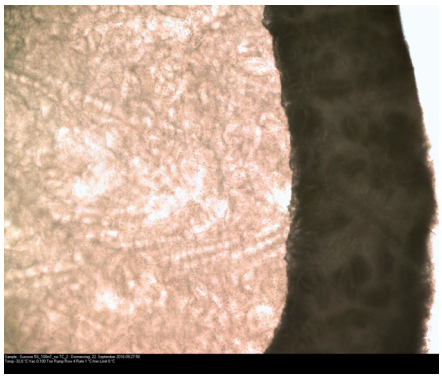
Automatic Pressure Control
Add ultimate control to your freeze-drying system with Linkam's MV196 motorised valve.

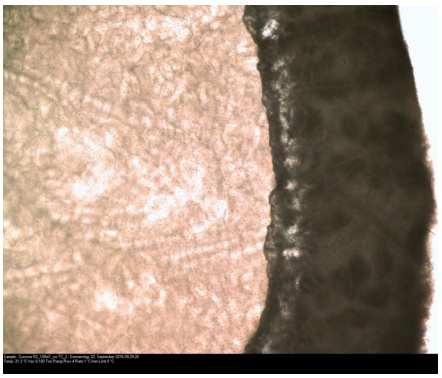
Custom Options
Please contact us with details of your requirements.

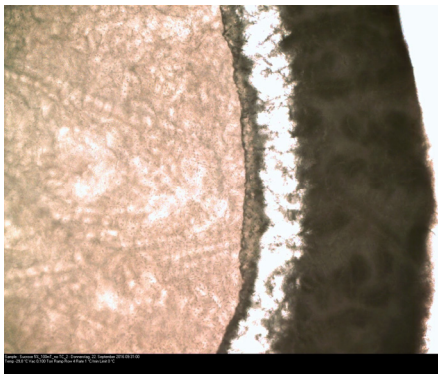
Application Examples

The versatile FDCS196 is used across cryo-biology and materials fields in academic institutes, hospitals and industrial research. It aids a wide variety of applications, including protein lyophilisation and ultra-low temperature eutectics.

The sample pictures below, courtesy of Dr Zixin Huang, show the freeze-drying process of 5% sucrose solution. The collapse of the product can be visualised and the temperature recorded, a parameter critical for the freeze-drying process.







Testimonial

Dr Zixin Huang, University of Erlangen
Research Group of Dr H. Giesler

"The FDCS196 provides a measurement condition, which is similar to real freeze-drying. Thanks to this system, people can determine the critical formulation parameters and investigate formulation behaviour under various thermal conditions prior to the freeze-drying process. Information obtained is essential for understanding the physicochemical characteristics of the formulations and designing an efficient freeze-drying cycle."

References

Hussain M.T., Matejtschuk P. *et al.*
"Freeze-drying cycle optimization for the rapid preservation of protein-loaded liposomal formulations" (2020). *Int. J. Pharmaceutics* 573 DOI: 10.1016/j.ijpharm.2019.118722

Yi J., Liang X.M., Zhao G., He X.
"An Improved Model for Nucleation-Limited Ice Formation in Living Cells During Freezing" (2014). *PloS one* 9:5
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"Freeze-Dry Microscopy: Impact of Nucleation Temp. and Excipient Concentration on Collapse Temp. Data." (2009). *AAPS PharmSciTech*, 10:2
DOI: 10.1208/s12249-009-9245-y

Technical Specification

Temperature Range	< -195°C (with the addition of an optional LNP96-S) to 125°C
Heating/Cooling Rates	0.01°C to 150°C/min
Temperature Stability	< 0.1°C
Condenser Lens Working Distance	12.5mm
Objective Lens Working Distance	4.8mm
Typical Sample Volume	~5µl
Vacuum	Up to 10^{-3} mbar
Compatibility	Confocal, Laser Raman, IR, X-ray, Imaging Station and third-party microscopes. Clamping options are additionally available for most microscopes.

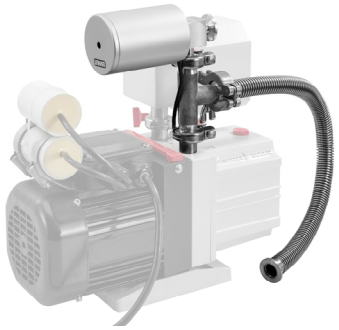
Discover More...

Control Options

Take control of your experiment with LINK software, or the stand-alone LinkPad touch screen, alongside the T96 temperature controller.

Both LINK software and LinkPad share a unified user interface that can control and monitor temperature and many other parameters including vacuum, humidity, tensile and shear force (dependent on system). The LinkPad provides an easy-to-use interface to the T96, for total control without a PC. Profiles with up to 100 ramps can be programmed, allowing simulation of complex processes.

LINK software enhances this with data-logging functions and real time graphical feedback. Optional modules to enhance your system include the LINK Imaging Module for synchronised image capture, the LINK Extended Measurements module to measure key image features, the LINK 21CFR11 Module for data regulatory compliance, and LINK TASC providing image-based thermal analysis.

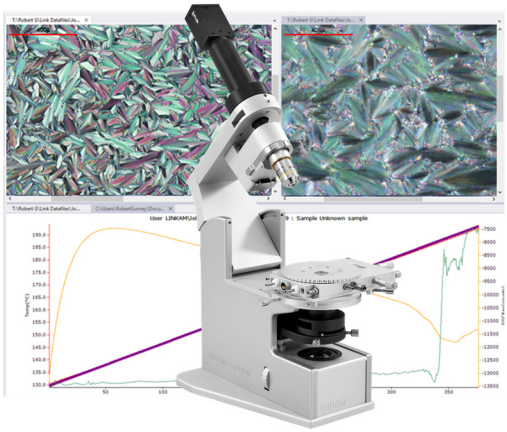


MV196 Motorised Valve

The MV196 is a motorised valve system enabling precise control of the vacuum level between 0.1 to 100mBar.

It can be used in conjunction with all of Linkam's vacuum-compatible instruments alongside the T96-S controller and a vacuum pump. Other Linkam vacuum stages include the THMS350V and TS1500V.

The vacuum set point can be controlled from either the LinkPad or LINK software. The MV196 is shown here with an optional vacuum pump.



Imaging Station

The Imaging Station provides a digital imaging platform compatible with all Linkam heating and cooling stages. Use our high-resolution camera to capture images and videos of your samples while controlling the temperature and environmental conditions.

The Imaging Station has been specially designed with a pivoted mechanism to allow greater access to your Linkam stage, making it quick and easy to access the chamber and change samples. It has a built-in LED light source for transmitted light with further options available for reflected light, polarisation and phase contrast imaging.

The Imaging Station is also compatible with a range of long working distance objective lenses which can be easily switched with the quick-release mechanism.

Contact Details

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We make scientific instruments that help characterise materials from polymers to biological tissue and metals to composites. Our instruments are used for research by the world's most advanced scientific organisations and companies. Each of our instruments are designed and manufactured in-house by our team of highly experienced electronics, software and mechanical design engineers. We design and develop solutions for sample characterisation by collaborating with the best scientists in the world. Will you be next?

Linkam products are constantly being improved, hence specifications are subject to change without notice.
TASC products are a family of techniques developed by Prof. Mike Reading (Cyversa) and Linkam.

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