FDCS196 - Freeze Drying System

Quickly and accurately characterize your freeze drying protocol by precisely controlling sample temperature and stage vacuum pressure. The FDCS196 Freeze Drying system can be built into a complete turnkey solution to meet all your lyophilisation research requirements.

Features and Benefits

Using the FDCS Freeze Drying Cryostage and light microscopy techniques such as phase contrast and polarized light, It is now possible to quickly and accurately determine collapse and eutectic temperature, and intricately investigate freeze dried structure of complex samples.

Both stage pressure and temperature can be accurately controlled and programmed to simulate industrial procedures and determine ideal drying parameters.

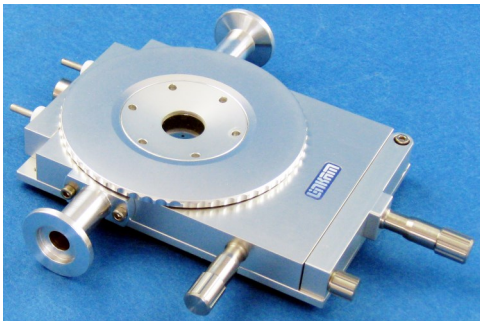
With a temperature range down to -196°C, ultra low temperature eutectics can be investigated with the FDCS196 system. (This is not possible with Peltier controlled systems.)

Chamber pressure is monitored by a Pirani vacuum gauge mounted directly on the stage. A perfectly uniform vacuum is maintained, even when the XY manipulators are used to follow the drying front moving across the sample.

Pressure can be automatically controlled by the new Linkam MV196 motorized valve. A graph of temperature against time also shows the plot of the chamber pressure throughout the experiment.

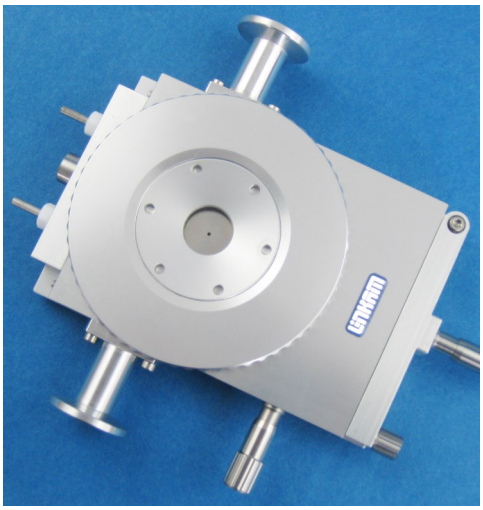
Using the Linksys 32-DV software, time lapse images of the freeze drying run with all the experimental data (temperature, time, date, pressure, magnification) are captured and imprinted onto each image.

These images can be viewed in a gallery or as a movie with captions, containing all the data scrolled underneath the viewing window.



The FDCS196 heating and freezing stage

Temperature Range -196 to 120°C



System Options

There are two Freeze Drying System Options.

Freeze Drying System

This system includes the FDCS196 stage, T95-LinkPad Controller with ergonomic LCD touch screen control, LNP95 cooling pump with 2L Dewar, Pirani vacuum gauge and Linksys 32 system control software (upgradable to digital image capture Linksys 32-DV).

Freeze Drying Pro System

This system includes the same components as the standard system above, but adding the MV196 motorized valve and 2.5 m³/h rotary vacuum pump (including all vacuum connectors).

Freeze Drying System

Optical Specifications

The FDCS196 is designed to be used with an upright microscope, where the objective lens is above the sample.

When working with heating and freezing stages, it is necessary to use long working distance objective lenses. If viewing the sample using transmitted light you also require a long working distance condenser lens.

The objective lens is isolated from the sample by the stage lid window which is a fixed distance from the heating/cooling element. In the FDCS196 this distance is 4.6mm, as seen in the diagram opposite. We recommend that you use an objective lens with at least 4.6mm working distance.

The condenser lens is isolated from the sample by the stage base plate window and the thickness of the heating/cooling element. In the FDCS196 this distance is 12.5mm.

Linkam make condenser extension lenses for many types of condenser, please select the condenser extension lens from the optical accessories section of our website.

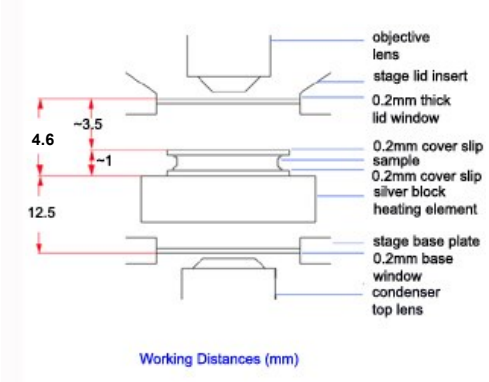
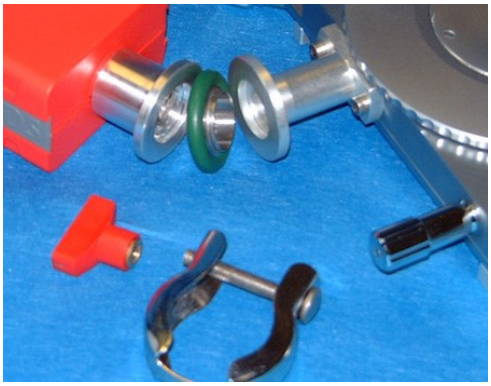


Diagram of objective lens and condenser lens working distances.

Specifications

- Temperature range -196°C to 125°C
- Up to 150°C/min heating
- Temperature stability <0.1°C
- 16mm XY sample manipulation
- Sample area 22mm diameter
- Vacuum tight sample chamber to 10^{-3}mbar even with XY manipulation.
- Clamps directly to the microscope substage for stability
- 100 Ohm platinum resistor sensor
- Light aperture: 1.3mm diameter
- Silver heating block for high thermal conductivity
- Direct injection of the coolant into the silver block
- Single ultra thin lid window: 0.3mm
- Objective lens working distance: 4.5mm
- Condenser lens minimum working distance: 12.5mm
- Range of condenser extension lenses available
- Can be used with all microscope techniques
- Suitable for Confocal, Laser Raman, IR and X-ray
- Stage body size: 137x92x22mm



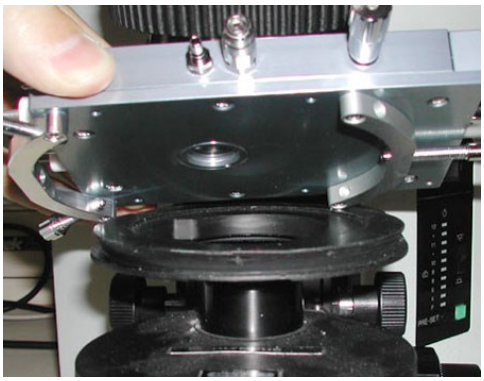
Pirani Vacuum gauge connections with FDCS196 stage

Attaching the FDCS196 to a Microscope

Upright microscopes whether standard optical, or part of a Raman or IR system, usually have an XY table or circular POL table to move the sample relative to the objective lens. These tables are mounted to the microscope substage and need to be removed when using the FDCS196 stage.

Linkam manufactures different stage clamps to attach the FDCS196 stage to many different brands of microscope. The stage clamps are required to adjust the position of the FDCS196 relative to the light path of the objective lens.

Select the stage clamps you require from the 'Selecting Stage Clamps' section on page 5 of this brochure.



Cryo stage FDCS196 with stage clamps being attached to circular dovetail substage.

Options to Increase the Capability

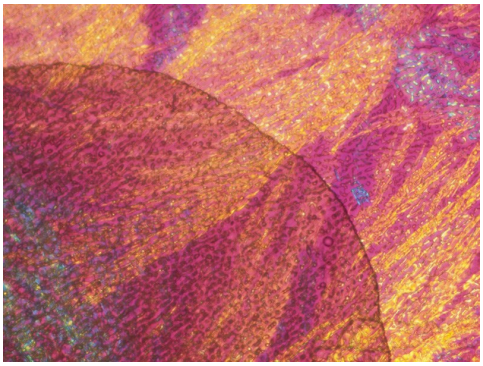
Linksys 32-DV (Digital Image Capture) and Digital Camera

Add digital capture to the Linksys 32 system controller software and one of the range of Q-Imaging digital cameras to enable time lapse image capture including all T95 data saved with the image.

Setup up your temperature profile and pressures for your lyophilisation cycle and leave the software to control the stage and captures images, enabling you to carry on with other tasks.

Quickly find single or groups of images by dragging a box around an area of the time/temperature graph or scrolling through the gallery.

Create movies of experiments and add scale bar, annotations, and measurements. For more information, see 'Software and Image Capture' on our website.



Sublimation front moving through eutectic structure

QImaging Cameras

Linkam supports the entire range of Q-Imaging CCD firewire cameras.

The QICAM Fast 1394 shown here is designed for high resolution brightfield scientific and industrial applications. A progressive scan interline CCD sensor gives a resolution of 1.4million pixels in 12-bit digital output.

This camera is ideally suited to the polarized colourful images seen in many of the birefringent crystalline structures seen in freeze drying.

Diagram of objective lens and condenser lens working distances.

MV196 Motorized Valve

A motorized valve receives pressure data via the T95-LinkPad and controls the vacuum pressure inside the sample chamber. You can dial in a specific vacuum value as part of a temperature profile and the valve will automatically control the pressure. You will need a 2.5 m³/h rotary vacuum pump for this valve to function optimally.

Imaging Station

Free up time on your research microscope by attaching your FDCS196 stage to the Linkam Imaging Station instead. The imaging station has been designed specifically for temperature controlled microscopy. Standard microscope lens can be loaded into the quick lock mounting jaws which can be easily swung back out of the way of the stage to allow greater sample access to the FDCS196 stage.

Linkam Imaging Station. Optics are tilted back to allow easy access to sample

Linkam Complete Temperature Control Solution

1) Select System

Either **10008** Freeze Drying System (includes FDCS196 stage with vacuum gauge and T95-LinkPad standalone system controller, LNP95 cooling pump with 2L Dewar and connections, Linksys 32 system control software).

Or **10098** Freeze Drying Pro System (includes FDCS196 stage with vacuum gauge and T95-LinkPad standalone system controller, LNP95 cooling pump with 2L Dewar and connections, Linksys 32 system control software, 2.5 m^3/h rotary vacuum pump , MV196 Motorized Valve (includes vacuum fittings and tubing).

2) Add Condenser Lens if using transmitted light

See website 'Condenser Extension Lenses'.

3) Add Stage Clamp to mount to microscope substage

See 'Selecting Stage Clamps' on the next page to select clamps specific to your microscope.

4) Add the Digital Video Capture Option

Linksys 32-DV, set up temperature control profiles, display live image, capture time lapse images with data. Requires digital camera.

5) Add Q-Imaging Camera

Camera is required if Linksys 32-DV is added to system. See website 'Q-Imaging Cameras'.

6) Add Linkam Imaging Station

Alternative to be used in place of your existing microscope for temperature controlled microscopy.

See website 'Imaging Station'.

Note:

If Motorized Valve MV196 is not purchased as part of the Freeze Drying Pro System, then the T95-LinkPad will have to be returned to Linkam to be modified to control the valve.

Selecting Stage Clamps

Select a suitable Stage Clamp to mount to your microscope substage. Stage clamps are listed by microscope make and model.

Olympus Upright Microscopes

BX series — 9542 curved clamp

U-SRP Polarising Table — 9654 SRP adapter plate

Nikon Upright Microscopes

Microphot — 9675 Nikon Microphot Adapter

Optiphot 2 Pol — 9669 clamping plate

E800 — 9674 clamping plate

Optiphot 1/2, Labphot 2 — 9542 curved clamp

LV100 with substage MBD65000 — 9775 adapter plate

80i/90i with Rotabable Mechanical stage — 9564 adapter plate

Pol Table — 9654 clamping plate

Zeiss Upright Microscopes

Axiophot, Axioplan, Axioplan 2, Axioskop 2, Axioskop 40 — 9564 clamps

Axiolab, Axioskop & Axiotech — 9565 clamps

AxioImager and Axio Scope — 9734 adaptor plate and clamp

Leica Upright Microscopes

Leitz Ortholux 2 & Orthoplan — 9667 clamping plate

Leitz Metallux 3 — 9671 clamping plate

DMRX, DMRB and DMRB(A) — 9673 clamping plate

Laborlux — 9677 clamping plate

DMLP — 9676 clamping plate

DMLB/M & ATC200 — 9542 curved clamp

DM1000, DM 2000, DM2500, DM4000M, DM5000 and DM6000M — 9670 clamping plate
(Fits onto XY table part 11561090. Also fits DM2500M with Leica XY table part 11888705)

DM2500-P — 9654 clamping plate

DM1000, DM2000, DM2500, DM4000M, DM5000 and DM6000M — 9787 adapter plate and clamps

Other

Meiji microscopes — 9679 adapter

Marzhauser 116x116 Adapter — 9805 adapter
(This is suitable for the Marzhauser Scan 75x50 table, which has a recess of 116x116mm.)

Suggested Spares

These spares are organised into convenient kits. Purchase a spares kit to avoid downtime with your stage and eliminate any future shipping costs.

The FDCS196 cooling element is extremely durable if used carefully. However, it is made from pure silver which is a soft metal. It can be easily scratched, which will compromise the heat flow to the sample and reduce accuracy. The platinum temperature sensor is brittle and can be broken if cleaning is not carefully performed. We recommend a spare heating element to avoid downtime with your stage while element is being repaired.

Please quote **part number** when ordering.

Part No.	Part Name	Part Description
7503	**FDCS Kit**	**Full Replacement Spares Kit**
		33x Glass Cover Slip 9mm
		33x 16x0.17mm Glass
		10x 22x0.3mm Glass
		33x 13x0.1mm Glass
		2x Hose Straight - WGI
		1x THMS G16.3 Sample Slide
		1x Tube Clip
		1x Large Sample Ring
		1x Universal lock tool
		4x 16x0.3mm Quartz
		2x 22x0.5mm Quartz
		1x Quartz Crucible
		40x FDCS Shim SS14mm O/Dx12mm *70
		1x Cruc.Carr. THMSG600 & FDCS196
		1x FDCS196 O Ring Kit consisting of:
		4x Silicone Washer 22x18x0.5mm
		1x 41.0x1.78mm O-Ring Viton
		1x ID31.47 x CS1.78mm Viton
		1x 76.0x3.0mm O-Ring Viton
		2x ID10.0 x CS1.5mm Viton
		1x Amber bottle /silicone oil sample

Suggested Spares Cont'd

Please quote **part number** when ordering.

Part No.	Part Name	Part Description
7504	**FDCS Spare Windows Kit**	**Spare windows for Lid, Base and samples**
		4x Silicone Washer 22x18x0.5mm
		2x Box Glass Windows-FDCS consisting of:
		33x Glass Cover Slip 9mm
		33x 16x0.17mm Glass
		10x 22x0.3mm Glass
		33x 13x0.1mm Glass
		4x 16x0.3mm Quartz
		2x 22x0.5mm Quartz
		1x Quartz Crucible
		40x FDCS Shim SS14mm O/Dx12mm *70
		1x Amber bottle /silicone oil sam
9584	**FDCSB**	**Spare Pure Silver Heating Element incl. Platinum Temperature Sensor**
7505		**Vacuum connection kit**
		10mm bore vacuum O-ring
		16mm bore vacuum O-ring
		3 x Clamping Ring
		500mm stainless steel flexible hose
		10 to 16mm bore vacuum O-ring
		NW10 Elbow 90 degree
		Vacuum grease