MDSG600 - Geology System

The MDSG600 Geology System is the top of the range solution for geologists working at the cutting edge of research demanding unrivalled temperature accuracy and motorized sample control. This precision built hotstage system is used by many of the best Fluid Inclusion scientists in the world.

Features and Benefits

The MDSG600 is a motorized version of the THMSG600, arguably the most popular geology heating/freezing stage in the world.

The sample is motorized in X and Y directions by precision mico stepped motors that enable micron repeatable position resolution and position recall so that a sample can be mapped in order to quickly relocate positions of interest and carry out temperature controlled experiments significant to that point.

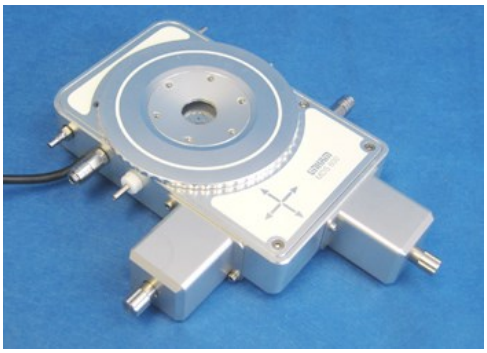
Unrivalled accuracy and control of temperature enable the user to characterize fluid inclusions to better than 0.1°C and hold a stability of 0.001°C.

The response time to a 'Hold' or 'Limit' command where the temperature is stable to 0.1C is only 0.1seconds at 30°C/min.

The sample is placed on 7mm diameter quartz cover slip and encased within a pure silver lid so that it is heated from all sides to ensure a perfectly uniform temperature.

The heating element is held by transverse stainless steel tubes to ensure perfect stability in Z-plane critical to confocal applications.

High magnification 100X objectives with less than 4.5mm working distance can be used incorporating a special lid and cooling jacket setup which protects the lens at high temperatures.



The MDSG600 heating and freezing stage

Temperature Range -196°C to 600°C

High Speed Controlled Cooling

The new LNP95 liquid nitrogen cooling system enables a vast range in cooling rates from 0.01 to 150°C/min. This highly efficient liquid nitrogen pump, using proprietary pumps and tubing, automatically controls pumping rate to ensure minimal liquid nitrogen is required and a consistent smooth cooling curve no matter which rate is selected.

Geology Pro System including LNP95 cooling system

Touch Screen User Interface

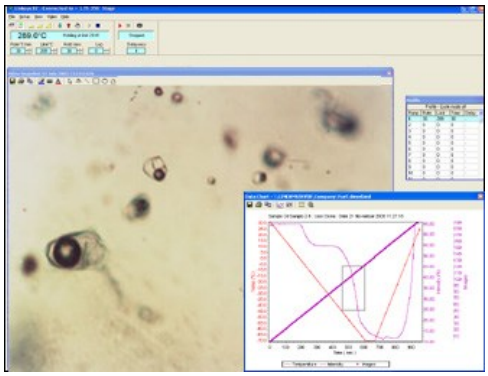
The new T95-LinkPad temperature controller with LCD touch screen control is used to quickly program a temperature profile by simply tapping the onscreen controls. Heating rates have also been increased up to 150°C/min to enable even faster characterization. To control the system from the PC and capture both data and digital images, upgrade the system by adding the intuitive Linksys 32X-DV software.

Intuitive Temperature Control Software

The Linksys system control software enables the user to quickly setup complex temperature control profiles.

Up to 100 ramps per profile, where each ramp sets temperature limit, heating/cooling rate and hold time. The profile can be saved for future use along with a temperature/time plot of the experiment.

Events within a temperature profile can be quickly examined by overriding the temperature profile using the on screen controls that mimic the touch screen of the LCD LinkPad.



Linksys 32X-DV System Controller Software

Optical Specifications

Objective Lenses

The MDSG600 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 MDSG600 this distance is 4.5mm, as seen in the diagram opposite. We recommend that you use an objective lens with at least 4.5mm working distance.

However, if you have any of the 100X lenses listed below, you can use a special lid and cooling jacket to protect the lens from the heating element when they are passed through the lid.

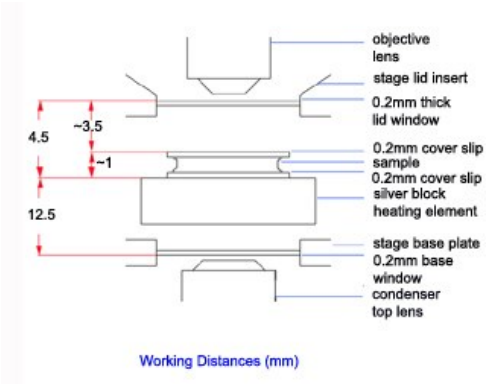


Diagram of objective lens and condenser lens working distances.

Part Name	Compatible Objective Lenses
SLO80	80x Olympus ULWD objective (032667)
SLO100	100x Olympus LMPLAN FL objective (037664)
SLN100	100x Nikon SLWD objective (MTJ67900)
SLN101	100X Nikon CF Plan objective (MUL04900)
SLN102	100X Nikon CFILPI Epi SLWD (MUE30900)
SLL100	100X Leica PL Fluotar L 100x/0.75 (767000)

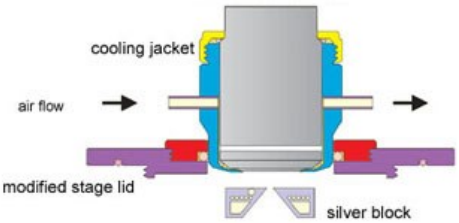


Diagram shows objective lens with cooling jacket fitted passing through the stage lid. Air is passed around the lens to remove heat and prevent thermal damage.

Condenser Lenses

The condenser lens is isolated from the sample by the stage base plate window and the thickness of the heating/cooling element. In the MDSG600 this distance is 12.5mm.

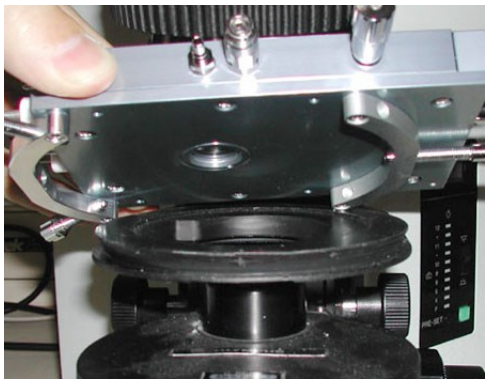
Linkam make condenser extension lenses for many types of condenser, please select the 'Condenser Extension Lenses' from the 'Optical accessories' section of our website.

Attaching MDSG600 to Microscope

Upright microscopes whether standard optical, or part of a Raman or IR system, usually have an XY table or circular rotating polarizing 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 hotstage.

Linkam manufactures different stage clamps to attach the MDSG600 stage to many different brands of microscope. The stage clamps are required to adjust the position of the hotstage relative to the light path of the objective lens and clamp it into place to prevent further movement during the experiment.

Select the stage clamps you require from the 'Selecting Stage Clamps' section on page 4 of this brochure.



THMSG600 stage with stage clamps being attached to circular dovetail substage.

Increase Capability Options

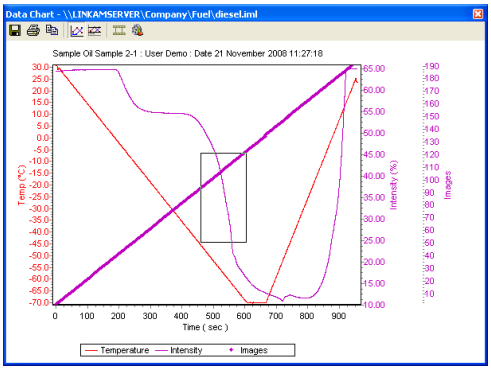
Linksys 32X-DV (Digital Image Capture) and Digital Camera

Add the DV digital video capture module to the Linksys 32X system controller software and one of the range of Q-Imaging digital cameras to enable both time lapse image and T95 data capture

Light intensity can also be measured which is particularly useful in cloud point testing in various fuels such as crude oil and jet fuel. Onset of crystallization can be quantitatively measured as a function of light intensity.

Quickly find individual or groups of images by dragging a box around an area of the time/temperature graph and loading the images and data into the scrollable gallery.

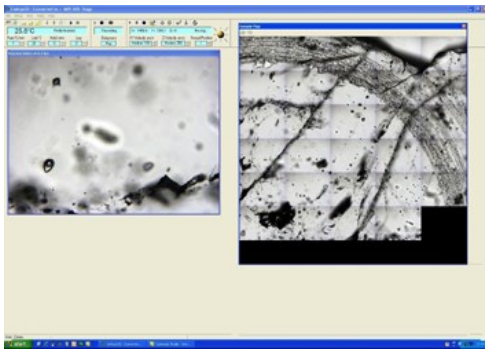
Create movies of experiments and add scale bar, annotations, and measurements to images. (See 'Software and Image Capture' on our website for more information).



Graph of temperature /time/images captured/light intensity.

XY Motorized Sample Position Control

By adding the Linksys 32X-DV option, the MDSG600 can automatically scan the entire sample capturing high resolution images and constructing an image map. Points of interest can be instantly be relocated for further temperature control analysis by clicking on the specific area in the image map. This feature can save the researcher hours of manual sample mapping.



Motor driven image map of fluid inclusions in quartz.

Imaging Station

Free up time on your research microscope by attaching your MDSG600 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 MDSG600 stage. Optical performance is similar to a high grade research microscope.

A long working distance condenser is built into the base with polarizer and diaphragm. A 100W halogen light source and C-mount for a camera is also supplied. (See 'Imaging Station' on our website for more information).

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

Specifications

- Temperature Range -196°C to 600 °C
- Heating and cooling rates of 0.01 to 150°C/min
- Positional resolution of motors 0.05µm
- Position repeatability <3um
- 150 X,Y coordinates can be stored
- Max. 15mm motorized X,Y travel
- Manual & PC operation
- Definable sample scan area
- 7, 10 or 16mm (G7, G10 or G16) sample holders available
- Sample vibration eliminated over entire range of speeds
- Ventilated bottom window to eliminate condensation
- Novel low profile lid design for rapid lens change
- Extremely efficient use of liquid nitrogen
- Mounts directly on microscope substage using stage-clamps
- Objective lens working distance - 0.1mm to 4.9mm
- Condenser lens minimum working distance 12.7
- Light aperture - 1.3mm Ø for accurate sample temperatures
- Optional lid and cooling jacket for high magnification lenses

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 — 9541 curved clamp

Nikon Upright Microscopes

E50i/55i, E400/E600 — 9541 curved clamp

LV100 with substage MBD65000 — 9773 adapter plate and clamps

Zeiss Upright Microscopes

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

Axiolab, Axioskop & Axiotech — 9565 clamps

AxioImager — 9783 clamp ring

Leica Upright Microscopes

Leitz Ortholux 2 & Orthoplan — 9668 adapter plate

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

DMLB/M & ATC200 — 9541 curved clamp

Linkam Complete Temperature Control Solution

What do you need for a complete solution

Select Stage

MDSG600

Select Controller Option

Either T95-LinkPad standalone system controller

Or T95-Linksys PC interface and Linksys 32X system controller software

Add Cooling Option to extend range from Ambient to –196°C

LNP95 (includes tubing, 2L Dewar and siphon)

Add Condenser Lens if using transmitted light

See website ‘Condenser Extension Lenses’

Add Stage Clamp to mount to microscope substage

See ‘Selecting Stage Clamps’ on the previous page to select clamps specific to your microscope.

Add System Control Software (Not necessary if T95-Linksys is selected.)

Linksys 32X, set up temperature control profiles, save and export data.

Add System Control software including the Digital Video Capture Option

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

Add Q-Imaging Camera

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

Add Linkam Imaging Station

See website ‘Imaging Station’

Suggested Spares

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

The MDSG600 heating 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.

Part No.	Part Name	Part Description
7500	**MDSGSG Kit**	**Full Replacement Spares Kit**
	WGI	Water/Gas Valve Insert **x2**
	WVC	Water/Gas Valve Connector **x2**
	SRR	Silicon Rings for Lid and Base (Set of 4)
	SCO	22mm diameter Silver Cover Lid to fit on block for accurate temp.
	TCH	Tube Clip Holder (for Nitrogen de-fogging stage lid tube)
	G7MT	7mm Sample Carrier (tapered)
	G10MT	10mm Sample Carrier (tapered)
	W10Q	10mm diameter Quartz Sample Window (0.3mm thick) **x4**
	W7Q	7mm diameter Quartz Window (0.3mm thick) **x4**
	ACCE	Box of Glass Sample: 22x0.17mm (x50); 16x0.17mm (x50); 22x0.3mm (x10) **x2**
	W13G	13mm diameter glass cover slip for SCO assembly (box of 30)
	WT	Window Tool (for unlocking lid insert and base locking ring)
	LT	22mm Lock Tool
	HEXK	2.5mm Ball Driver Hex Key

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Part No.	Part Name	Part Description
22222	**MDSGSG Spare Windows Kit**	**Spare Windows for Lid, Base and samples**
	W10Q	10mm diameter Quartz Sample Window (0.3mm thick) **x5**
	W7Q	7mm diameter Quartz Window (0.3mm thick) **x4**
	ACCE	Box of Glass Sample: 22x0.17mm (x50); 16x0.17mm (x50); 22x0.3mm (x10) **x2**
	W13G	13mm diameter glass cover slip for SCO assembly (box of 30)
	SRR	Silicon Rings for Lid and Base (Set of 4)

Part No.	Part Name	Part Description
7502	**WS Kit**	**Precision Temperature Sample Window (nor for polarised light work)**
	W7S	7mm diameter Sapphire Sample Window (0.3mm thick) **x20**

Part No.	Part Name	Part Description
9507	**MDSB**	**Spare Heating Element Assembly including Temperature Sensor**

Part No.	Part Name	Part Description
2260	**CSCO2**	**CO_2/H_2O Fluid Inclusions Standard (-56.6°C)**