# THMSG600 — Geology System

The THMSG Geology System is the solution for geologists looking for unrivalled temperature accuracy and control. This precision built hotstage can be found in a many Fluid Inclusion laboratories all over the world.

## Features and Benefits

The THMSG600 is based on the design of the highly successful THMS600 stage and then upgraded and modified specifically for geological applications.

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.

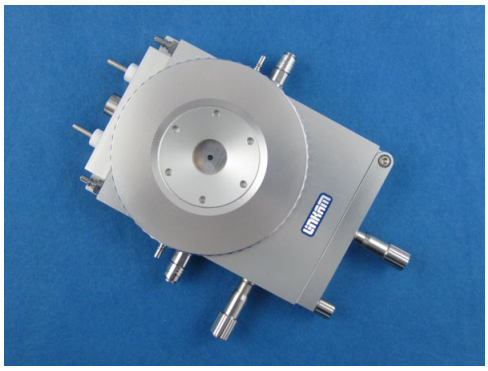
The response time to a 'Hold' or 'Limit' command where the temperature is stable to 0.1C is only 0.1seconds at 30°C/min.

The sample is placed on 7mm 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 LNP95 liquid nitrogen cooling system is used to enable the large 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.

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 32-DV software.

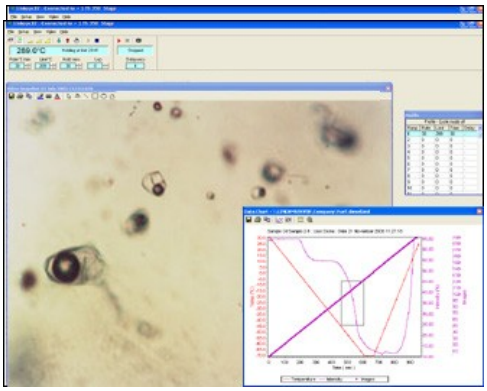
High magnification 100X objectives with less than 4.5mm working distance can be used incorporating a special lid and cooling jacket setup which protects the lens at high temperatures.



*The THMSG600 heating and freezing stage*

*Temperature Range -196°C to 600°C*

*Geology System including LNP95 cooling system*



*Linksys 32-DV System Controller Software*

## Specifications

- Temperature range -196°C to 600°C
- Up to 150°C/min heating
- Temperature stability <0.01°C
- 16mm XY sample manipulation
- Sample area 22mm diameter
- Gas tight chamber for atmospheric control
- 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: 0.17mm
- Objective lens working distance: 0.1mm to 4.5mm
- Condenser lens minimum working distance: 12.5mm
- Water cooled stage body for high temperature work (>300°C)
- Suitable for Confocal, Laser Raman and X-Ray
- Sample side loading without removing the stage lid
- Stage body size: 137x92x22mm

# Optical Specifications

## Objective Lenses

The THMSG600 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 THMSG600 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 either of the 100X lenses listed below, you can use a special lid and cooling jacket which protect the lens from the cooling element when they are passed through the lid.

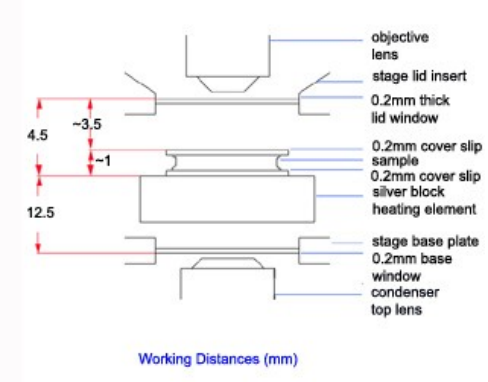



*Diagram of objective lens and condenser lens working distances.*

| 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) |

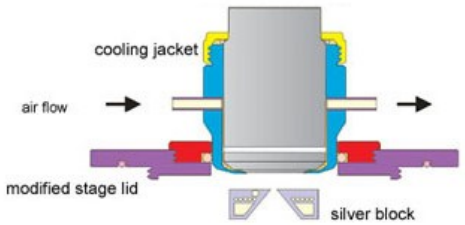



*Diagram shows objective lens with cooling jacket fitted passing through the stage lid. Air is passed around the lens to remove heat and prevent thermal damage.*

## 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 THMSG600 this distance is 12.5mm.

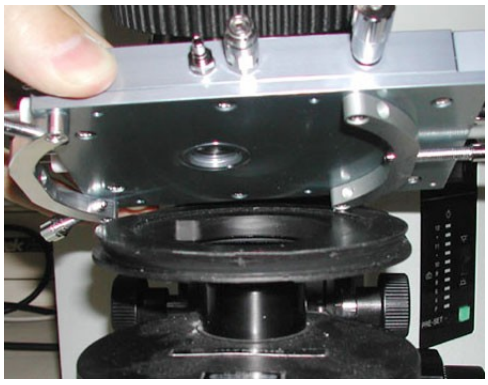
Linkam make condenser extension lenses for many types of condenser, please select the condenser extension lens from the 'Optical accessories' section of our website.

# Attaching THMSG600 to 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 hotstage.

Linkam manufactures different stage clamps to attach the THMSG600 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.

Select the stage clamps you require from the 'Selecting Stage Clamps' section on page 6 of this brochure.



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

# Increase Capability Options

## Linksys 32 System 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.

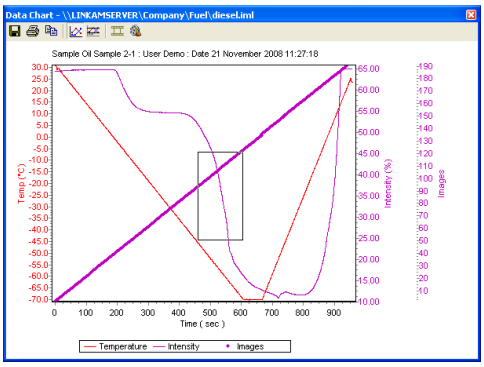



*Diagram of objective lens and condenser lens working distances.*

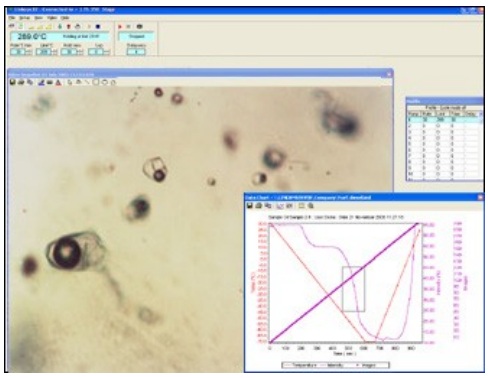
## Linksys 32-DV (Digital Image Capture) and Digital Camera

Add the DV digital video capture module 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.

Light intensity can also be measured which is particularly useful in cloud point testing from crude oil to 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 into the scrollable gallery.

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

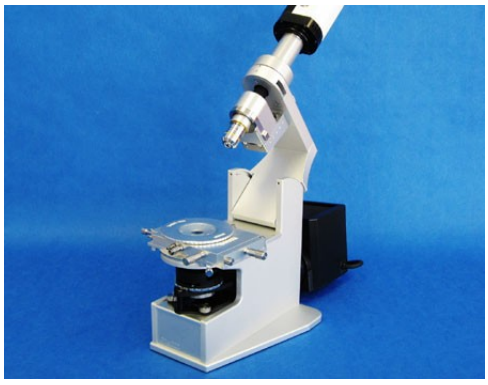


*Fluid Inclusions in live image window. Graph of temperture /time/images captured /light intensity*

## Imaging Station

Free up time on your research microscope by attaching your THMSG600 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 THMSG600 stage.

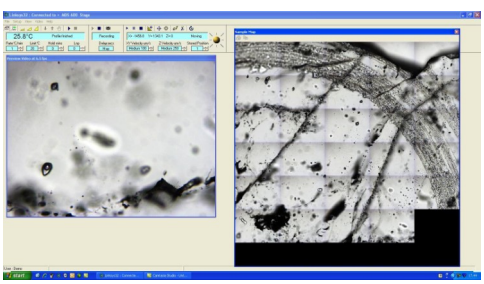
A long working distance condenser is built into the base with polarizer and diaphragm. A 100W halogen light source and C-mount for a camera is also supplied. (See 'Imaging Station' on our website for more information).



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

## XY Motorized Sample Position Control

Sample position can be controlled and stored to micron accuracy by selecting the Geology Pro system instead of the standard Geology System. Precision micro stepper motors control sample position 15mm in X and Y direction. An image map of the entire sample can be built up by multiple image capture serpentine sample sweep. Locations within each image can be stored so that an entire sample can be mapped in detail. See the Geology Pro product brochure for further details.



# Linkam Complete Temperature Control Solution

**What do you need for a complete solution**

**1) Select System**

11004 THMSG600 Geology stage

**2) Add Controller**

**14065** T95-LinkPad standalone system controller

**14066** T95-Linksys PC interface and Linksys 32 system controller software

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

**14050** LNP95 (includes tubing, 2L Dewar and siphon)

**4) Add an ECP if using the stage above 300°C**

**0998 ECP** Water Circulator Pump (stage body and window cooling)(220-240V)

**0997 ECP** Water Circulator Pump (stage body and window cooling)(110-130V)

**0995 ECP** Water Circulator Pump (stage body and window cooling)(220V,60Hz)

**0977 ECP** Water Circulator Pump (stage body and window cooling)(100V,60Hz)

**5) Add Condenser Lens if using transmitted light**

See website 'Condenser Extension Lenses' http://www.linkam.co.uk/condenser-extension-lenses/

**6) Add Stage Clamp to mount to microscope substage**

See 'Selecting Stage Clamps' on page 6 to select clamps specific to your microscope.

**7) Add System Control Software (not necessary if T95 LinkSys controller is selected).**

**15001** Linksys 32 or if you require image capture,

**8) Add System Control software including the Digital Video Capture Option**

*Please note that Linksys32DV software is compatible only with Linkam cameras*

**15005** Linksys 32DV or

**15013** Linksys 32DV add-on (if T95 Linksys selected in step (2))

### 9) Add Q-Imaging Camera

**5719** QIC-F-CLR-12 QICAM Fast 1394 non-cooled CCD Colour - Bayer Mosaic, 12-bit camera

Or see website 'QImaging Cameras' for more options— http://www.linkam.co.uk/cameras/

### 10) Add Linkam Imaging Station

Alternative to be used in place of your existing microscope for temperature controlled microscopy. See website 'Imaging Station' http://www.linkam.co.uk/imaging-station/

**See the following page for clamps for your system**

# 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 substage for Mechanical stage (not rotatable) — 9785 adapter plate and clamps

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

Perkin Elmer Auto Image microscope — 9680 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 future shipping costs.

The THMSG600 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.

Please quote **part number** when ordering.

| Part No. | Part Name | Part Description |
|---|---|---|
| **7510** | **THMSG600 Kit** | **Full replacement spares kit** |
| | 2014 | 2x Box Glass Windows - Geology consisting of: |
| | | 50x 22x0.17mm Glass |
| | | 10x 22x0.3mm Glass |
| | | 50x 13x0.1mm Glass |
| | 2015 | 1x Standard Accessory Bag consisting of: |
| | | 3x6x150mm Clear PVC Tube |
| | | 4x Silicone Washer 22x18x0.5mm |
| | | 2x Hose Straight - WGI |
| | | 2x Hose Valve - WVC |
| | | Universal Lock Tool |
| | 2222 | G7T Sample Slide |
| | 2231 | Tube Clip |
| | 2355 | Silver Cover - SCO |
| | 2624 | THMS O Ring Kit consisting of: |
| | | 4x 2061 Silicone Washer 22x18x0.5mm |
| | | ID31.47 x CS1.78mm Nitrile |
| | | 41.00x1.78mm O-Ring |
| | | 75.94x1.78mm O-Ring |
| | | 76.0x3.0mm O-Ring |
| | 2652 | 4x7x0.3mm Quartz |
| | 2698 | 22x2.0mm Quartz |
| | 3433 | Quartz Crucible |
| | 9569 | Crucible Carrier THMSG600 |

Please see next page for further options

## Suggested Spares

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

| Part No. | Part Name | Part Description |
|---|---|---|
| **7501** | **THMSG Spare Windows Kit** | **Spare Windows for Lid, Base and samples** |
| | 3433 | Quartz Crucible |
| | 2652 | 4 x 2652 Ø7mm Quartz Window (0.3mm thick) |
| | 2061 | (pk of 4) Silicon Rinds for Lid and Base |
| | 3940 | Box of 100 off 13mm diameter Glass Sample Window (0.17mm thick) |
| | 3920 | Box of 100 off 22x0.17 Glass Cover slip for stage top and bottom windows |
| | 3935 | Box of 100 off 22mm Diameter Glass Lid/Base Window (0.3mm thick) |
| **7502** | **W&S Kit** | **Precision Temperature Sample Window (not for use with polarised light work)** |
| **9580** | **THMSGB** | **Spare Silver Heating Element incl. Platinum Temperature Sensor** |
| **7502** | **W7S Spare Window Kit** | **7mm diameter Sapphire Sample Window (0.3mm thick) Pack of 20** |
| **2260** | **CSCO2** | **$CO_2$/$H_2O$ Fluid Inclusions Standard (-56.6°C)** |