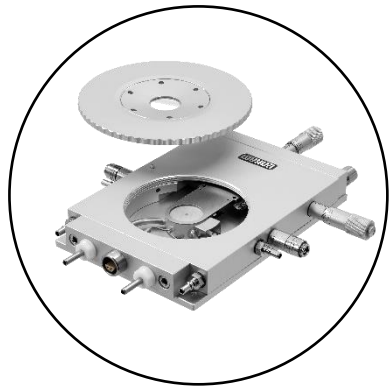


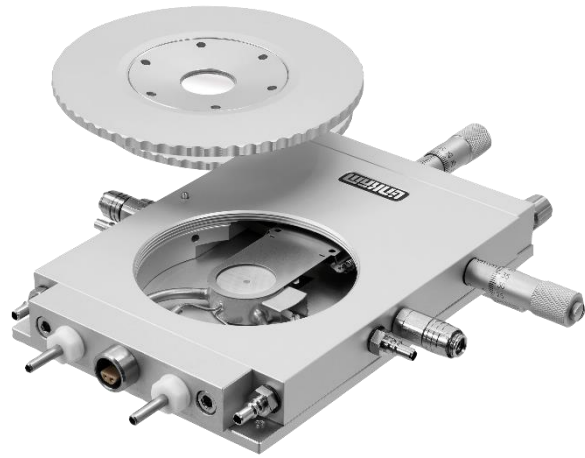


# LINKAM SCIENTIFIC INSTRUMENTS LTD.

Temperature and Environmental Control Systems



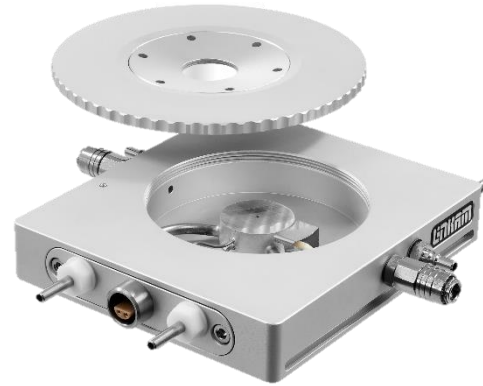
# Standard Body Types



## THMS

### Standard Body Type

- Temperature Range: -195 to 600 °C
- XY Manipulators
- Can be configured for vacuum (max temp: 350 °C)
- 22 mm diameter sample area



## HFS

### Smaller body without XY manipulation

- Temperature Range: -195 to 600 °C
- Can be configured for vacuum (max temp: 350 °C)
- 22 mm diameter sample area

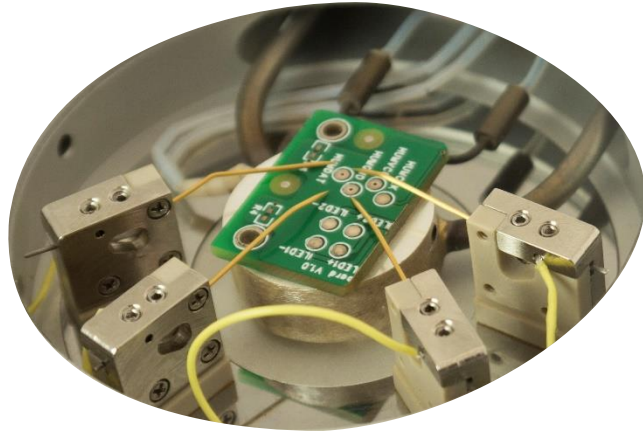


## LTS

### Larger lid and sample mount for larger samples

- Temperature Range: -195 to 420 °C
- XY Manipulators
- Not suitable for vacuum
- 53.5 x 43 mm sample area

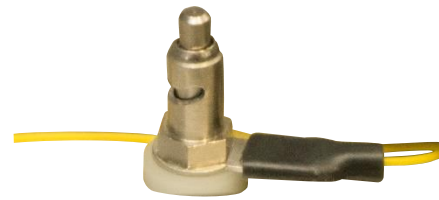
# Standard Stage Options - Electrical



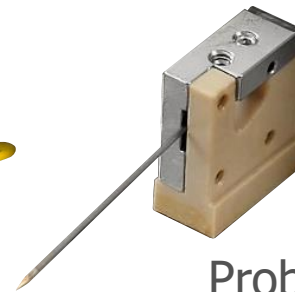
## Electrical (E)

Connections: BNC (B) or Lemo (L)  
Electrical Posts or Probes (P)

- Electrical posts typically come with Lemo connectors



Post Mount



Probe



BNC



Lemo

Example part names:

HFS600E-PB4 = Electrical stage, with 4x probes and BNC Connectors

THMS350EV-4 = Electrical Vacuum Stage with 4 posts and Lemo connector

# Standard Stage Options



## Vacuum Stages (V)

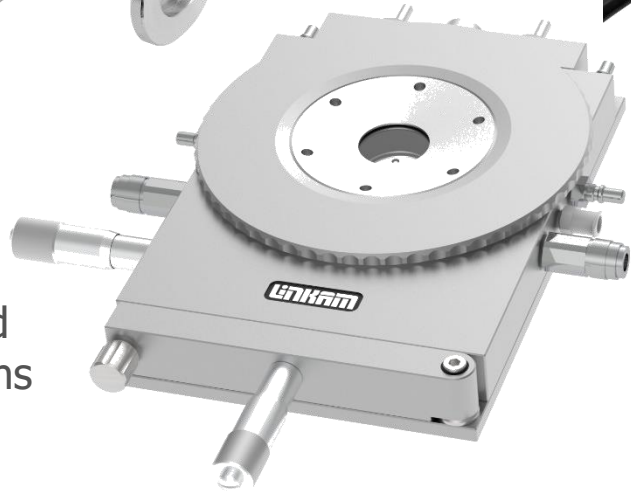
Eliminate condensation issues when cooling to sub-ambient temperatures.

Maximum temperature of 350 °C



## Humidity Stages

Extra ports configured for humidity connections and humidity sensor (requires humidity generator)



## Ellipsometry stages (EL)

Custom stage lids for ellipsometry measurements



## Motorised Stages

Automate XY Manipulation



## FTIR Stage

Enlarged cone angle to maximise optical throughput

*Optional FTIR windows available on request*

## Geological Stages (G)

Smaller light aperture for optimised thermal transfer and specialist accessories  
*Fluid Inclusion standard samples available on request*

# Standard Stage Options – X-Ray Systems



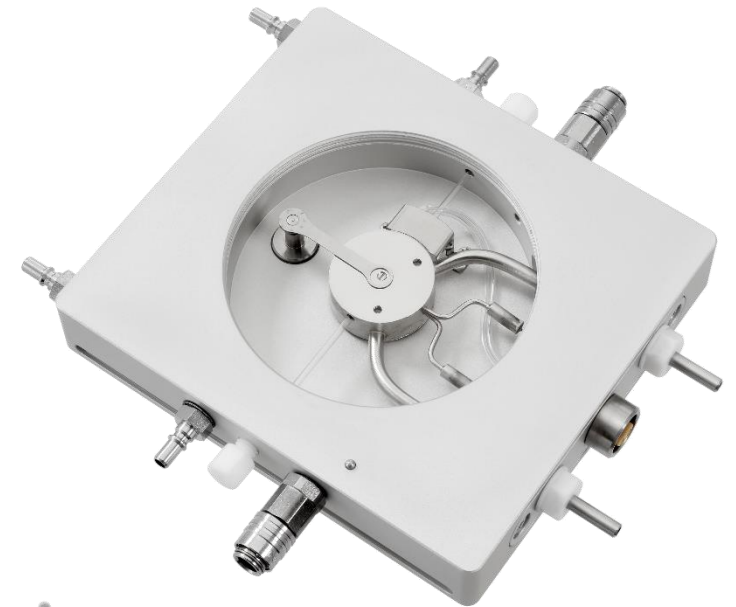
## X-Ray Stages (X)

Stages optimised for use with vacuum chamber, benchtop and beamline X-Ray systems.

Max temperature 350 °C

- HFSX350-CAP
  - Designed for capillary mounted samples
- HFSX350-GI
  - Designed for grazing angle of incidence

Vacuum feedthrough cables available



HFSX350-CAP



HFSX350-GI



- **TS series stages for high temperature applications**

- Heating Rates from 0.1 to 300 °C min<sup>-1</sup>

- **TS1000**

- Ambient to 1000 °C
- Crucible Size: 17 mm diameter, 3 mm deep

- **TS1200**

- Ambient to 1200 °C
- Crucible Size: 10 mm diameter, 5 mm deep

- **TS1500**

- Ambient to 1500 °C
- Crucible Size: 7 mm diameter, 3 or 6 mm deep

- As standard 10x sapphire windows supplied for mounting of samples within the ceramic heater



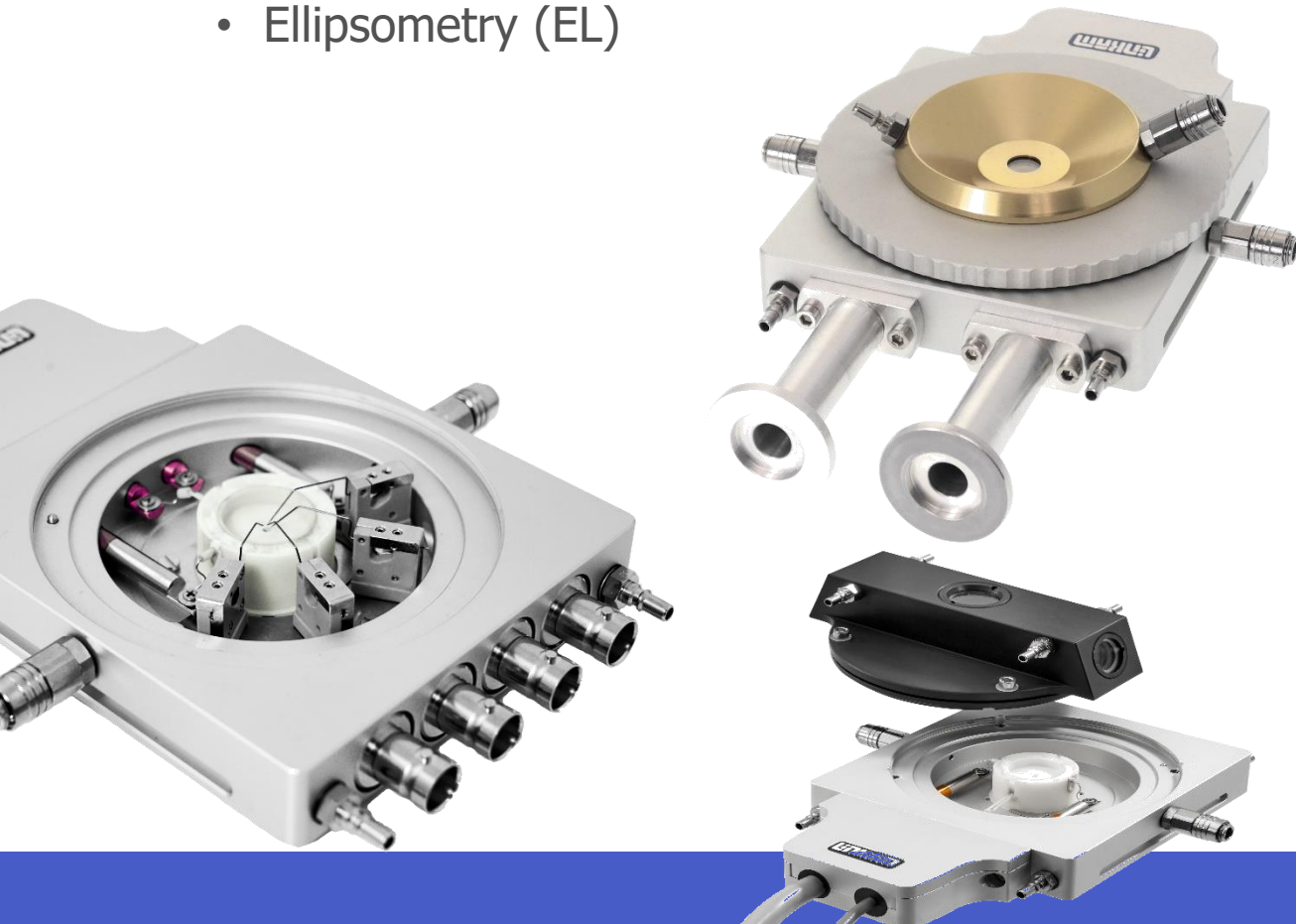
Care should be taken that the sample does not run off the window as this can stick to the ceramic crucible and/or damage the thermocouple

- Optional Pt/Rh sample crucible can also be supplied
  - Dimensions: 7 mm diameter, 3 mm deep

# High Temperature Stage Options



- High Temperature Stage options include:
  - Electrical (E)
  - Vacuum (V) – For gas exchange under ambient conditions. Use at elevated temperatures will significantly reduce the heater lifetime.
  - Ellipsometry (EL)



## TS1400XY

- Ambient to 1400 °C
- Suitable for samples 5.5 mm across, 0.5 mm deep
- XY Manipulators to adjust sample position
  - 4.5 mm in x direction, 14 mm in y direction
- Ambient cold block enables quench cooling with rates of up to 240 °C s<sup>-1</sup> !!



## HS1500

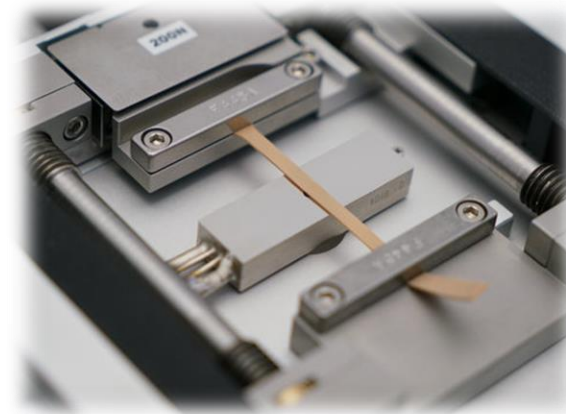
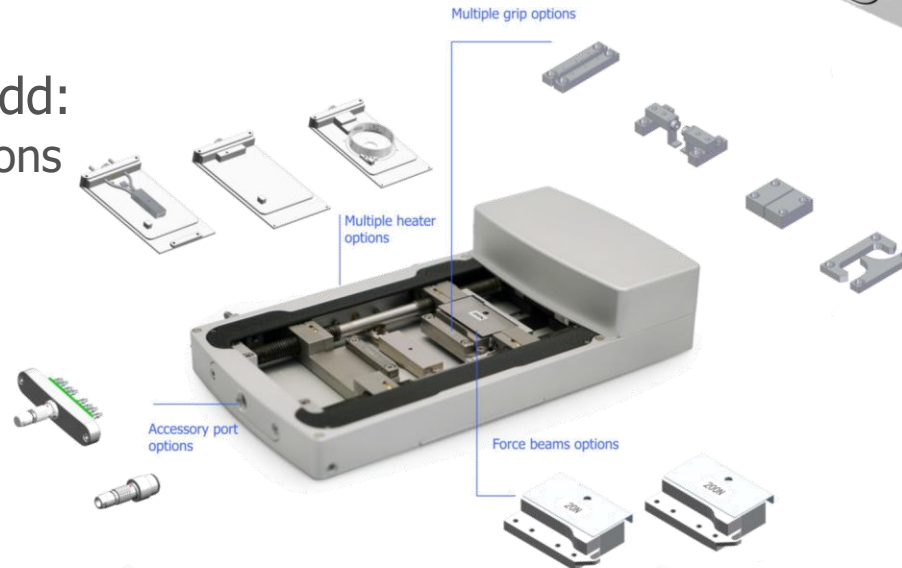
- Rotatable window designed for samples that release volatiles that may fog the window during operation
  - Ambient to 1500 °C
  - 5.5mm diameter cup
  - Compatible with reflected light and Raman microscopes



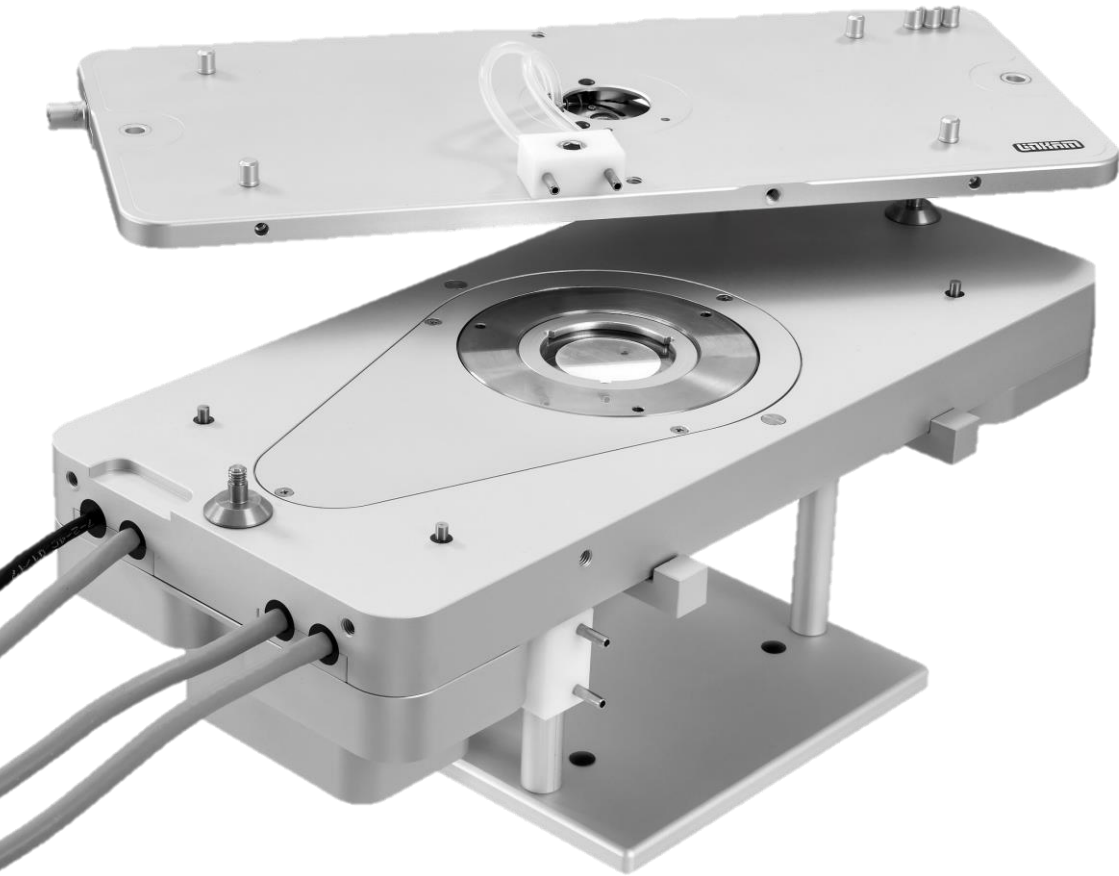
# MFS Stage for force testing



- Test compression and tensile force properties of your sample
- Control parameters include speed, distance and force
- 2 to 600 N modular force beams available
- Modular system allows users to add:
  - Various heating and cooling options
    - -195 to 350 °C
  - Electrical connectors
  - Humidity control,
  - Alternative sample grip options
  - 3 point bending module



# CSS Stage for rheology testing



- Study sample rheology under different shear modes
  - Four modes of operation; oscillatory, step, steady & relax
- Adjust gap between top and bottom windows
  - Gap setting: 5 and 2500  $\mu\text{m}$ , 1  $\mu\text{m}$  increments
- Temperature range: -50 to 450  $^{\circ}\text{C}$
- Sample Size: up to 30 mm diameter
- For liquids (solids can be melted onto the window if required)

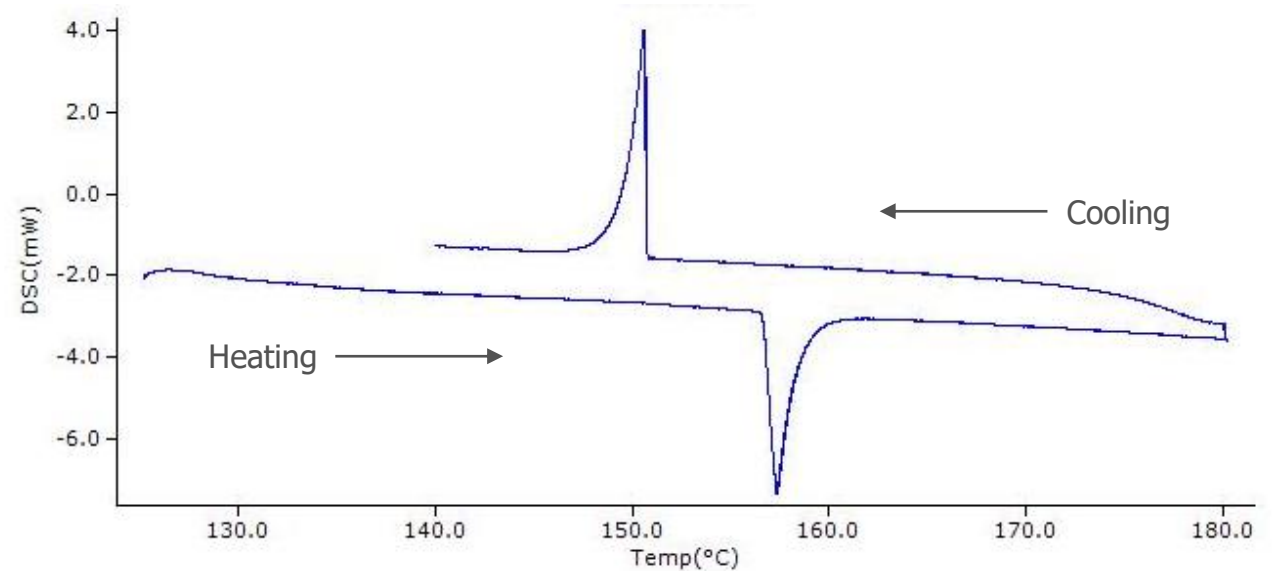
# DSC Stages for thermal properties testing



- Differential Scanning Calorimetry stages
- Used to identify thermal transitions (melting/solidifying/glass transitions)

## DSC450

- Temperature range: -150 to 450 °C
- Heating rates from 0.01 to 30 °C min<sup>-1</sup>
  - Dual Pan system (reference and sample)
  - Reflection mode only
  - Supplied with 10 Aluminium pans with lids



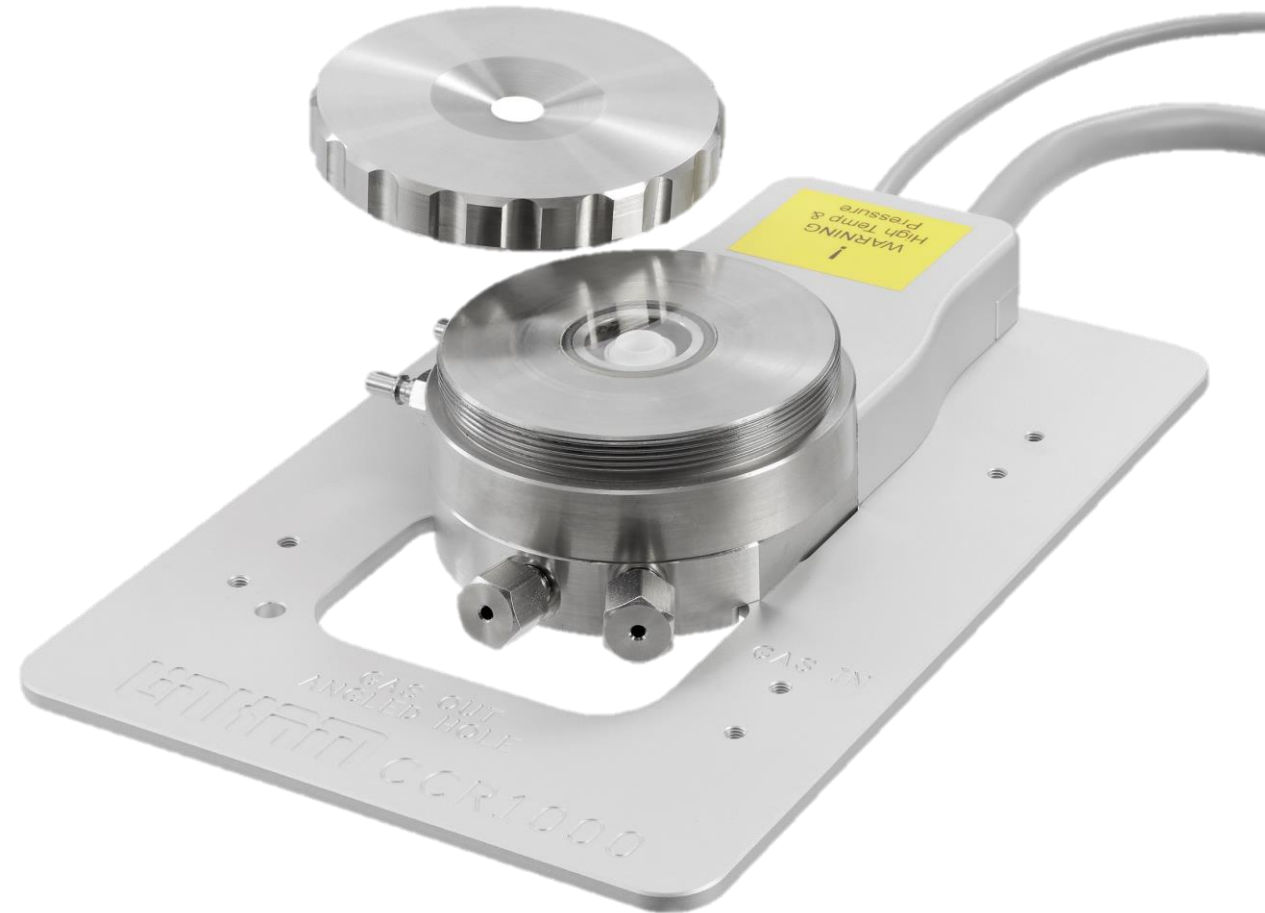
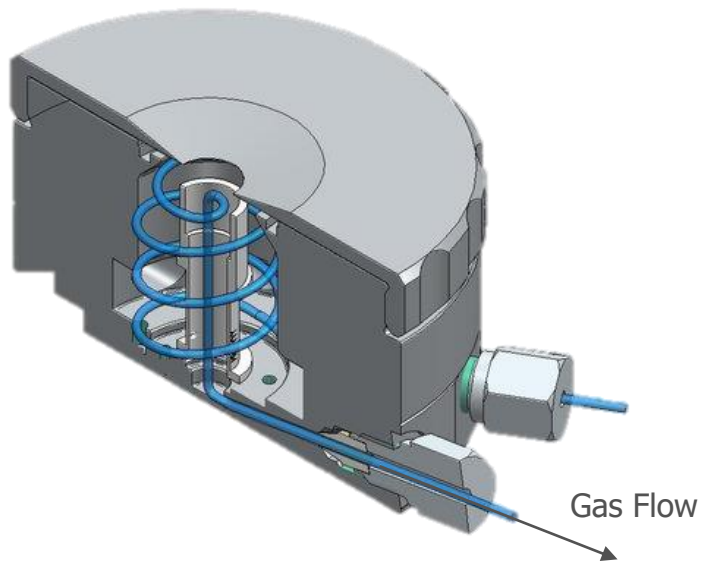
## DSC600

- Temperature range: -195 to 600 °C
- Heating rates from 0.1 to 130 °C min<sup>-1</sup>
- Single Pan system
- Reflection and Transmission
- Supplied with 5 Aluminium pans (+lids) and 1 Sapphire Crucible



# CCR Stage for catalytic testing

- Fluidized Bed system for studying catalytic reactions *in-situ*
- Temperature range: Ambient to 1000 °C
- Pressure rating: Ambient to 5 bar
- For reflected light and Raman microscopy



- Capillary mounted samples with XY sample manipulators
- Temperature range: -196 to 500 °C
- Capillaries can be pressurised by external system
- Suitable for use with Optical, FTIR and Raman systems



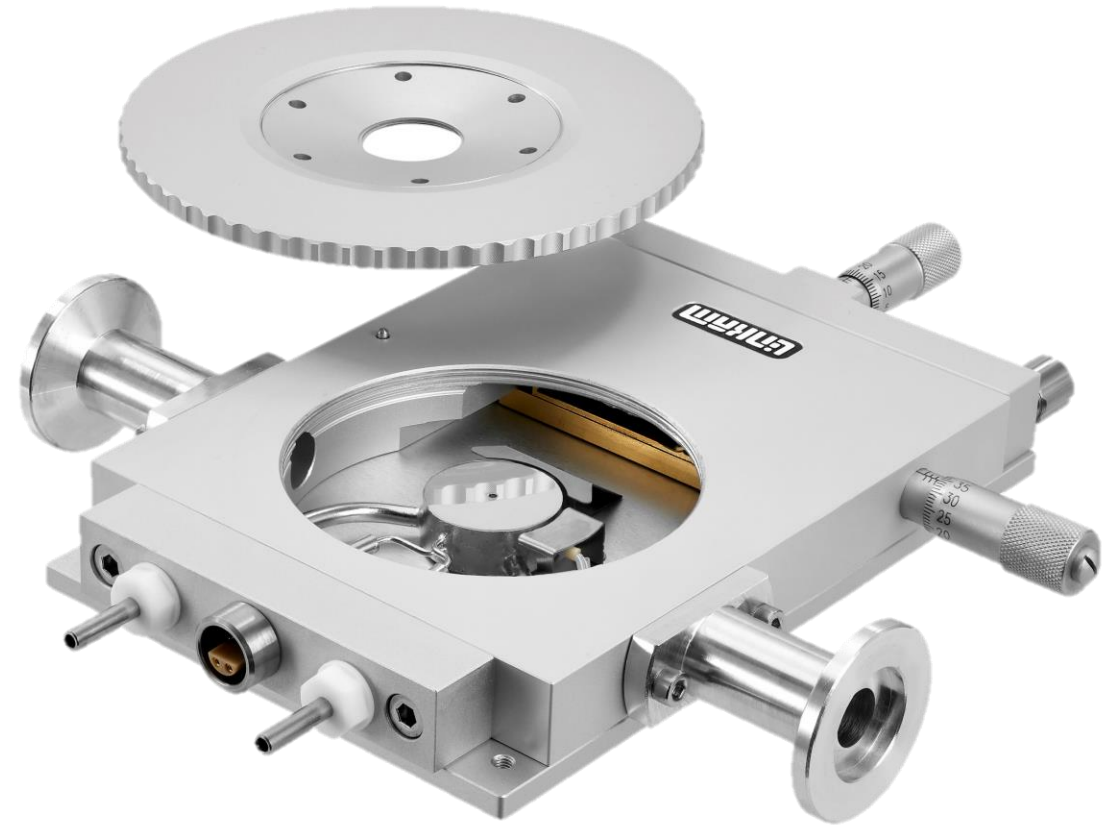


- Vitrified samples mounted on an EM grid held at liquid nitrogen temperatures (-195 °C)
- Designed to enable correlation between Fluorescence measurements (on CMS196 V<sup>3</sup>) with electron microscopy
- Ideal for studying vitrified biological samples
  - Samples where water has been frozen very rapidly forming an amorphous phase, preventing ice crystal expansion that could damage sample structure
- Coordinate conversion tool aids microscopist return to the same position from known landmark coordinates:  
<https://www.linkam.co.uk/cms-coordinate-tool>

# FDCS Stage for Freeze Drying investigations



- For studying systems under different vacuum and temperature conditions
- Simulate industrial protocols on minimal sample quantities
- Temperature range: -195 to 125 °C
- Automated vacuum control (with optional vacuum valve)



- Peltier stages offer a sub-ambient temperature range without the need for liquid nitrogen
- Lower temperature range quoted below requires water supply, and depends on ambient conditions. Use without water cooling result in a higher lowest temperature.

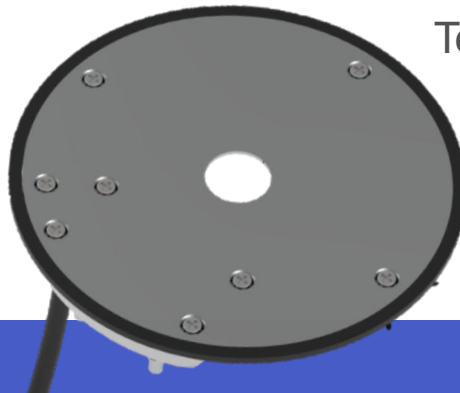
## PE120

Temperature Range:  
-25 to 120 °C



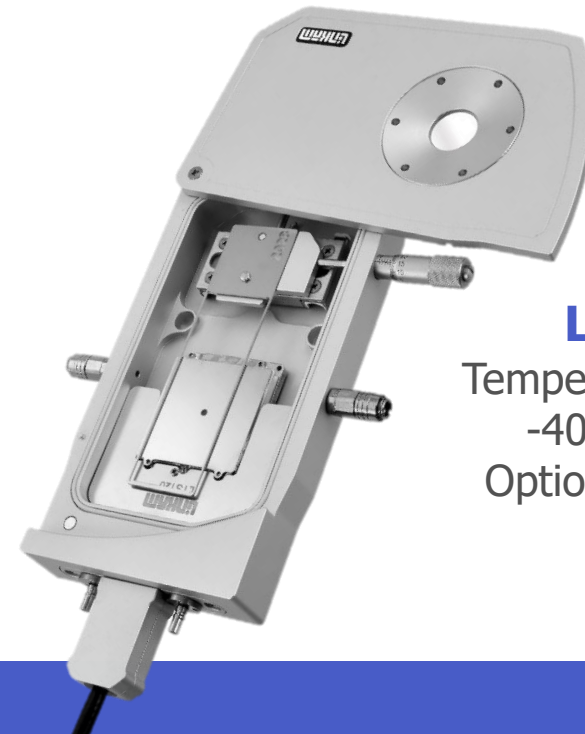
## PE100

Temperature Range:  
-10 to 99 °C



## LTS120

Temperature Range:  
-40 to 120 °C  
Options: Electrical fittings



# **Product Overview**

## **Stage Controllers, Accessories & Imaging Station**

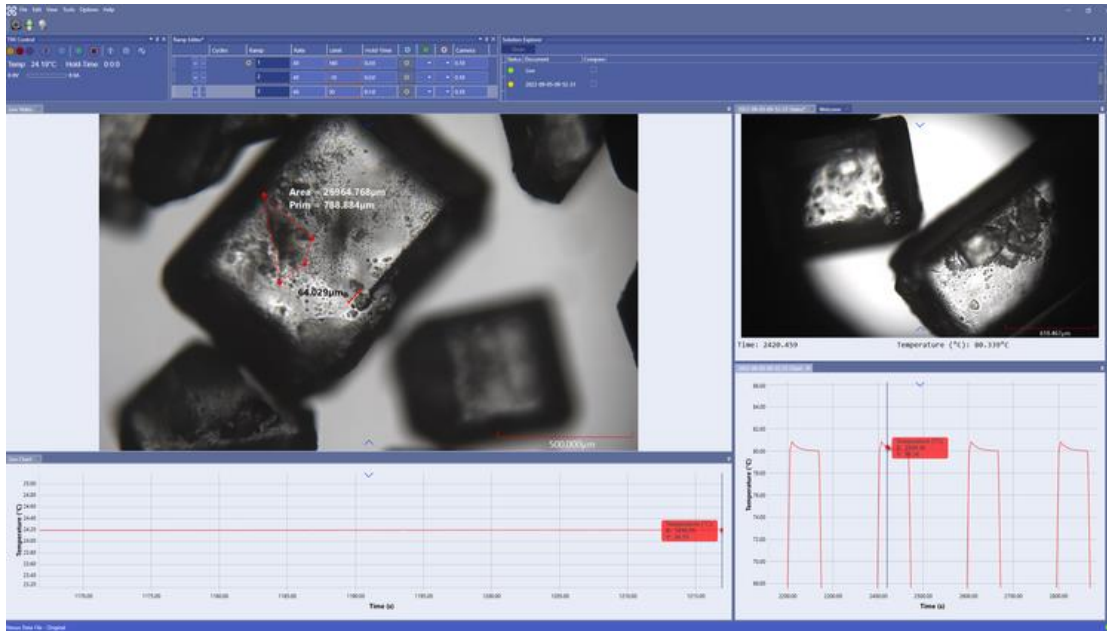
# Temperature Controller



- All stages require a temperature controller to operate (Except CMS196 V<sup>3</sup>)
- Temperature controller can be configured with add-on boards for various specialist connections to connect to 3-4 different stage types

Linkpad controller can be used to control settings (Temperature etc.) without a PC





- Software enables user full control of
  - Heating and cooling rates, limit and hold time
  - Vacuum
  - Humiditywith unlimited ramps
- Compatible with: THMS / HFS / LTS / TS / HS / CCR and PE families

## Optional modules:

**Image Capture** module offers the ability to record optical images with live rewind feature

**Extended Measurements** module adds annotation and measurement capabilities to the image capture module

**Thermal Analysis by Structural Characterisation (TASC)** module offers more sensitive analysis than DSC can typically provide

**Reporting** automates the export of charts and images to MS Word document

**21CFR11 Compliance** module creates a secure audit trail

# Stage Accessories – Humidity Generator



- Humidity control for environmental experimentation
  - 5 to 90% humidity with 0.5% stability
- Connects directly to humidity stages
  - (Sensor supplied with stage)
- Can be used with standalone chamber or with a user chamber up to 2000 cm<sup>3</sup>
  - (Requires Sensor)
- Ambient air is dried automatically and then humidified to the setpoint, saving the user money
- Alternatively can be supplied with an inert gas regulator



## Water Circulating Pump (WCP)

For use with Peltier coolers and to provide water cooling to stage bodies when operating at elevated temperatures

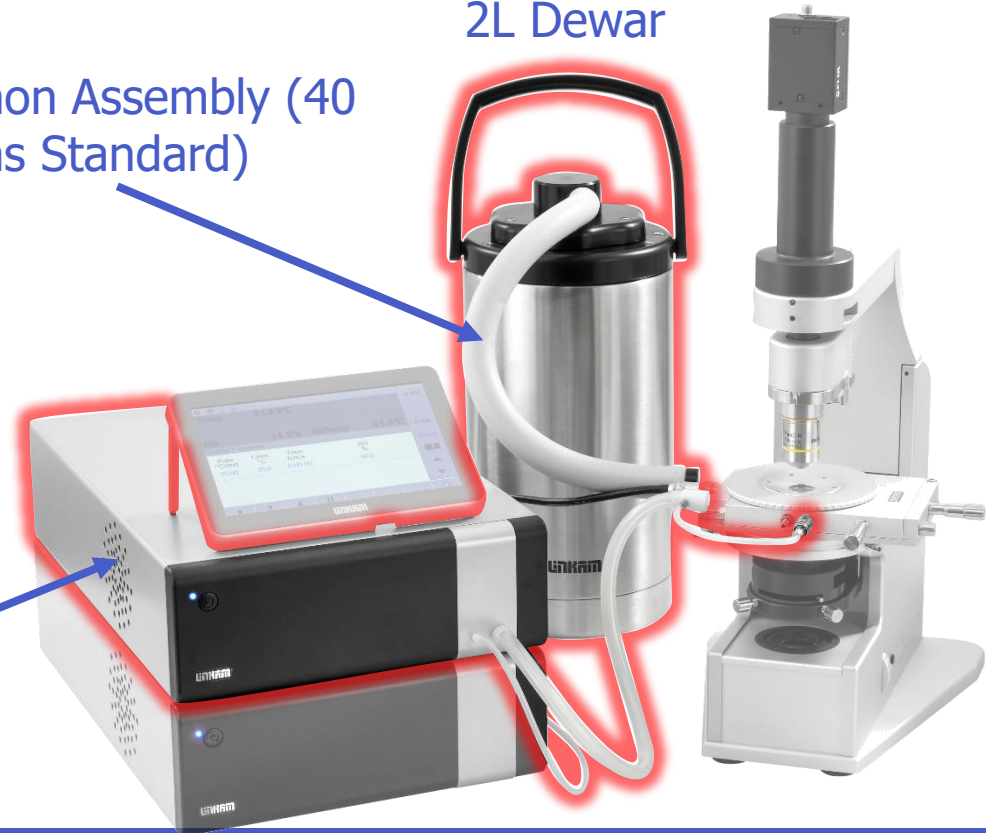
## Liquid Nitrogen Pump (LNP)

For cooling stages below sub-ambient conditions

## Insulated Syphon Assembly (40 cm long as Standard)

## 2L Dewar

LNP96





- Entry level Microscope with research grade imaging for use with Linkam Stages
- Upper optics tilt to allow easy stage access
- LED transmitted light
- Optional reflected light module
- Optimised strain free condenser with 0.5 NA and built in diaphragm – ideal for polarised and phase imaging
- 10X brightfield objective lens with 10.6 mm working distance 0.25 NA
- Polariser and Analyser slot

LINKAM STAGES ARE DESIGNED AND MANUFACTURED IN-HOUSE ENABLING ENDLESS POSSIBILITIES FOR USER CUSTOMISATION. IF YOUR REQUIREMENTS AREN'T MET WITH OUR EXISTING RANGE OF STAGES WE CAN DISCUSS ADAPTING ONE TO MEET YOUR NEEDS.