Electrical and Probe

Stages for the Analysis of Microelectronics and Semiconductor Materials

HFS600E-PB4

Wide Temperature Range
Stages available covering a temperature range from < -195°C to 1500°C

Environmental Control
Chambers for vacuum control, humidity or gas purging

Probes/Spring Clips
Connectors enabling up to 8 point electrical easurements

LINKAM

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Introducing the Electrical and Probe Stages

Linkam has been creating sample characterisation solutions for the microelectronics and semiconductor fields for many years. Our stages enable accurate temperature control ranging from < -195°C to 1500°C. The environment can additionally be controlled to offer gas purging, controlled vacuum or humidity options.

To allow electrical and probe measurements, these stages are fitted with gold-tipped tungsten needle probes or spring-clip posts which can be coupled to various output connectors. Linkam stages are compatible with light microscopy and spectroscopy including Raman and X-ray. Electrical and probe versions are available for many of our stage types, including:

- **HFS E series** stages offer a temperature range from < -195°C (with the addition of an optional LNP96-S) to 600°C, with options including probes and electrical posts, as well as vacuum, gas purging and humidity control.
- **THMS E series** stages offer sample manipulation using precision ground manipulators, a temperature range from < -195°C (with the addition of an optional LNP96-S) to 600°C, with options including electrical posts, as well as vacuum, gas purging and humidity control.
- **LTS420 E series** stages are ideal for those requiring a larger sample area, a temperature range from < -195°C (with the addition of an optional LNP96-S) to 420°C, with options including humidity, probes and electrical posts.
- **LTS120 E series** stages offer a larger sample area and a temperature range between - 40°C and 120°C without the need for liquid nitrogen, with options including probes and electrical posts.
- **TS E series** stages are ideal for those studying high power electronics which require extreme temperatures. They offer a temperature range from ambient to 1500°C, with options including probes and electrical posts, as well as vacuum.

LTS420E-PB4

TS1000E-PB4

Features

Wide Temperature Range
Stages available covering a temperature range spanning from < -195°C to 1500°C.

Stable and Accurate Temperature Control
The T96-S controller and platinum resistor temperature sensor ensure accurate and repeatable control to better than 0.1°C.

Probes and Electrical Connections
Stages can be supplied with a wide range of electrical connections and probes depending on your individual requirements.

Humidity Control
Variants of the HFS, THMS and LTS series are compatible with our RH95 humidity generator.

Vacuum and Atmospheric Control
Variants of the TS, HFS and THMS series stages are also available with vacuum compatibility and feature quick-release gas ports for environmental control.

Custom Options
Please contact us with details of your requirements.

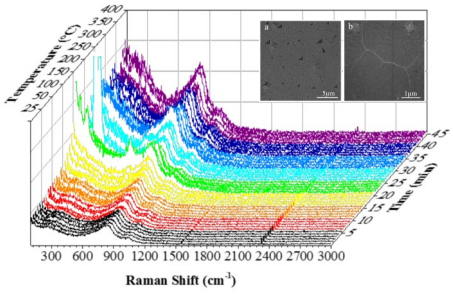
Application Examples and Testimonials

Dr Luca Camilli, Technical University of Denmark - Micro and Nano Technology

Custom built LTS600 probe stage

"In our experiment, a custom Linkam LTS600 stage was used in conjunction with a Raman microscope. The sample is heated to the desired temperature in the Linkam LTS600 stage, and Raman signal from it is collected through a window. This allowed us to study the oxidation process of the sample under study through Raman spectroscopy"

M. Galbiati *et al.* "Real-time oxide evolution of copper protected by graphene and boron nitride barriers" (2017) *Sci. Rep.* 7:39770 DOI: 10.1038/srep39770



Evolution of Raman spectra with temperature from 25– 400°C for graphene/boron/copper semiconducting materials, showing copper oxidation. (From Galbiati *et al.* used under CC BY 4.0)

Professor Sharath Sriram, RMIT - Functional Materials and Microsystems

LTS420E-PB4, HFS600E-PB4 with RH95

"Linkam stages with electrical probes are integral to our research activities. Our reliance on these stages is highlighted by us having bought six of these over the last few years. The integrated electrical probes combined with heating, cooling, and optical ports has allowed us to explore a number of sensor technologies spanning optics, gas, and conductometric devices. These stages enable critical fundamental materials insight for the in situ study of phase transformations"

S. Sriram *et al.* "Influence of Electric Field on SERS: Frequency Effects, Intensity Changes, and Susceptible Bonds" (2012) *J. Am. Chem. Soc.* 134:10, DOI: 10.1021/ja208893q

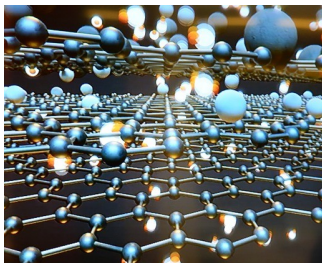
Photograph of the Linkam HFS600E-PB4 probe system in the lab at RMIT, where it is used to apply an oscillating electric field during Surface Enhanced Raman Scattering.

Professor Chunxiao Cong, Fudan Uni - Information Science and Technology

HFS600E-PB4

"The Linkam stage was crucial for temperature-dependent Raman spectroscopy measurements. The HFS600E-PB4 stage was compatible with the confocal low-frequency micro-Raman system, which helped to realize the in situ Raman study for revealing the vibrational symmetry, anharmonicity and electron-phonon coupling of the shear modes as a function of temperature in the ultra-low frequency range of graphene layers"

C. Cong & Y. Ting "Enhanced ultra-low-frequency interlayer shear modes in folded graphene layers" (2014) *Nat Commun.* 5:4709, DOI: 10.1038/ncomms5709



Visualisation of the atomic structure of graphene layers. This research studies the interlayer shear modes of graphene layers using temperature-dependent Raman spectroscopy.

Technical Specification

	HFS E Series	THMS E Series	LTS120 E Series	LTS420 E Series	TS E Series
Temperature Range	HFS350EV < -195°C* to 350°C HFS600E < -195°C* to 600°C	THMS350EV < -195°C* to 350°C THMS600E < -195°C* to 600°C	-40°C† to 120°C	< -195°C* to 420°C	Ambient to 1500°C
Heating/Cooling Rates	0.01°C to 150°C/min	0.01°C to 150°C/min	0.01°C to 30°C/min	0.01°C to 50°C/min	0.1°C to 200°C/min
Temperature Stability	< 0.01°C	< 0.01°C	< 0.1°C	< 0.1°C	< 1°C
Sample Area	22mm ø	22mm ø	40 x 40mm	53.5 x 43mm	TS1500 7 ø x 3mm TS1500 7 ø x 6mm TS1200 10 ø x 5mm TS1000 17 ø x 3mm
Objective Working Distance	4.8mm	5.8mm	5.8mm	6.5mm	Dependent on stage type
Vacuum Compatible	HFS350E Yes (1e-3 mBar) HFS600E No	THMS350E Yes (1e-3 mBar) THMS600E No	No	No	No
Stages with Lemo connectors	HFS600E (1 x 2 Pin)	THMS350EV-4 (1 x 4 Pin) THMS600E (1 X 2 Pin)	LTS120E (1 x 2 Pin) LTS120E-PL8 (2 x 4 Pin)	LTS420E-PL8 (2 x 4 Pin)	TS1500E-7/3 (1 x 4 Pin) TS1500E-7/6 (1 x 4 Pin) TS1200E-10/5 (1 x 4 Pin) TS1000E-17/3 (1 x 4 Pin)
Stages with BNC connectors	HFS350EV-PB4 (4 BNC) HFS600E-PB4 (4 BNC)	Custom options available	Custom options available	LTS420E-PB4 (4 BNC)	TS1000E-PB4 (4 BNC)

* For HFS E, LTS420 E and THMS E series, an LNP96-S liquid nitrogen pump is required for cooling below ambient temperatures.

† For the LTS120 series a water circulator is required, a chilled water circulator is required for temperatures below -20°C.

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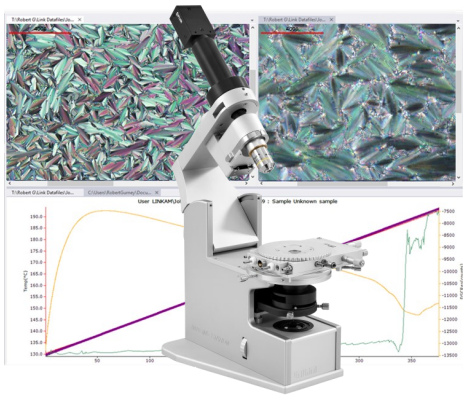
Discover More...

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.



Imaging Station

The Imaging Station provides a digital imaging platform compatible with Linkam temperature and environmental control systems. 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.

RH95 Relative Humidity Controller

The RH95 is designed to provide sample humidity control to a wide range of Linkam's stages.

It allows precise control of water vapour in the environment around a sample. The RH sensor is located close to the sample block, providing a feedback loop ensuring accurate humidity control. The RH95 can be combined with light microscopy, Raman, FT-IR and X-ray to further characterise samples.

The smallest change in RH% can have huge implications on the characteristics of a sample and how it behaves. When combined with a Linkam stage or other sealed chambers, the RH95 can be used to control the RH between 5% - 90% at temperatures from ambient to 85°C (dependent on device).

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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