

TS1500, TS1200 and TS1000 Systems

The TS stages are based on an incredibly efficient ceramic heating assembly allowing the user to observe and characterize samples from ambient to 1500°C (dependent on stage model).

Features and Benefits

The TS stages enable characterization of samples such as ceramics, alloys, high temperature polymers and geological fluid inclusions and can be used with light microscopy, Raman and X-Ray.

The sample is placed inside the ceramic sample cup so that it is heated from underneath as well as from the sides, a ceramic heat shield is placed over the top to prevent heat from escaping this micro oven.

The temperature is accurately controlled by the T95 system controller which enables the stage to heat samples at an incredible **200°C/min**.

The stage body and large diameter quartz lid window are kept at a safe temperature by sealed circulating water.

Precision quick-release gas valves at the sides of the stage body are used to purge the sample chamber with inert gas. Please note that hydrogen gas cannot be used - see the CCR1000 Catalyst Reactor Cell for info on using hydrogen in a hotstage.

A vacuum tight version fitted with standard NW16 vacuum ports enables pressures as low as 10^{-3} mbar.

System Options

Sample size

There are 4 different ceramic cup heating sizes to accommodate different sample diameter and thickness. The larger the diameter the lower the maximum temperature.

TS1500-7/3	7mm diameter, 3mm deep	Max Temp. 1500°C
TS1500-7/6	7mm diameter, 6mm deep	Max Temp. 1500°C
TS1200	10mm diameter, 5mm deep	Max Temp. 1200°C
TS1000	17mm diameter, 3mm deep	Max Temp. 1000°C

Vacuum Connectors

Each of the above stages is available as a vacuum tested system with vacuum connectors and Pirani vacuum gauge that will display pressure value inside the stage on the LinkPad screen or through Linksys 32 system controller software.

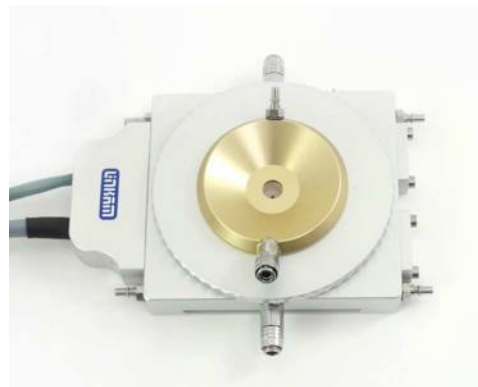
Electrical Connectors

Internal electrical connectors can be added with feed through Lemo connector on the outside of the stage to enable electrical measurements on the sample.

T95-LinkPad or T95-Linksys

The T95 LinkPad has an LCD touchscreen data input display and can be used as a standalone system controller.

The T95-LinkSys is a PC computer interface controller and requires Linksys 32 control software (supplied) to input a temperature profile. It cannot be used standalone.



The TS1500 heating stage



TS1500 stage with T95-LinkPad controller



TS1000EV stage showing electrical connections and vacuum connectors

Optical Specifications

The TS stages are designed to be used with an upright microscope, where the objective lens is above the sample. (Vertical mounting for X-Ray is also possible).

When working with heating 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. This distance is dependent on which size element you have selected. A cross section of the element of the TS1500 shown here demonstrates how this distance is measured.

We recommend that you use an objective lens with at least 6mm working distance and a light filter or polarizer due to the light radiated from heating element at temperatures above 800°C.

The condenser lens is isolated from the sample by the stage base plate window and the thickness of the heating/cooling element. In the TS1500 this distance is 14.8mm.

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 TS1000,1200,1500 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 TS stages 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 7 of this brochure.

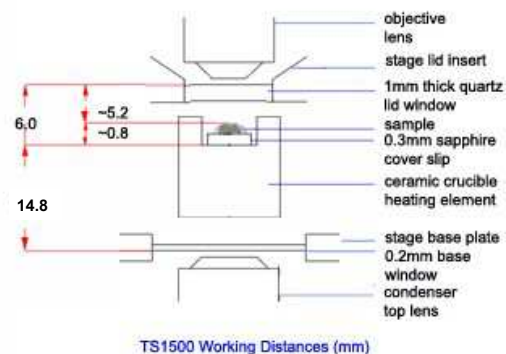
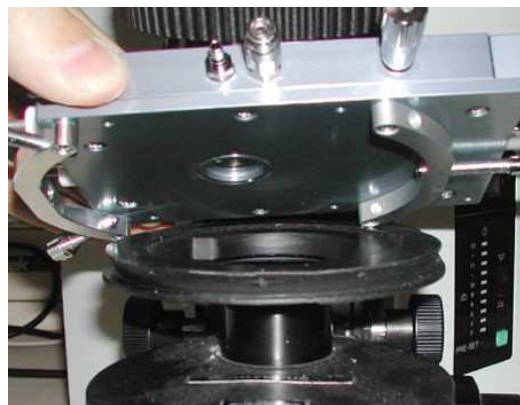
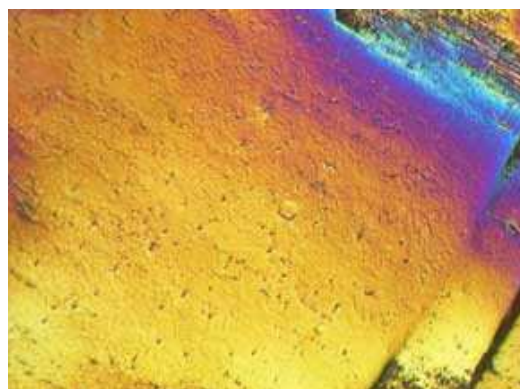


Diagram of objective lens and condenser lens working distances.



TS1500 stage with stage clamps being attached to circular dovetail substage.



Gold Foil being heated in TS1500 at 700°C

Specifications

TS1500 series

- Temperature Range: ambient to 1500°C
- Heating rates from 1 to 200°C/min
- Temperature stability 1°C
- Type S Pt-10% Rh/Pt thermocouple
- Sample cup sizes: 7mm diameter x 3mm deep, 7mm diameter x 6mm deep
- Objective lens minimum working distance: 6.1mm (9mm for the 7x6mm cup)
- Condenser minimum working distance: 14.8mm (12.1mm for the 7x6mm cup)
- Light aperture: 1.7mm for accurate sample temperature
- Suitable for transmitted and reflected light
- Quick-release gas connectors for atmospheric control
- Clamps directly to microscope substage
- Water cooling connections for stage lid and body
- Low mass for fast response in both heating and cooling
- Stage body size: l = 104mm, w = 95mm, height at optical centre: 21mm, max. height at lid water outlet 40.8mm
- Stage weight: 0.5Kg

TS1200 series

- Temperature Range: ambient to 1200°C
- Heating rates from 1 to 200°C/min
- Temperature stability 1°C
- Type S Pt-10% Rh/Pt thermocouple
- Sample cup sizes: 10mm diameter x 5mm deep
- Objective lens minimum working distance: 8.6mm
- Condenser minimum working distance: 12.3mm
- Light aperture: 1.7mm for accurate sample temperature
- Suitable for transmitted and reflected light
- Quick-release gas connectors for atmospheric control
- Clamps directly to microscope substage
- Water cooling connections for stage lid and body
- Low mass for fast response in both heating and cooling
- Stage body size: l = 104mm, w = 95mm, height at optical centre: 21mm, max. height at lid water outlet 40.8mm
- Stage weight: 0.5Kg

TS1000 series

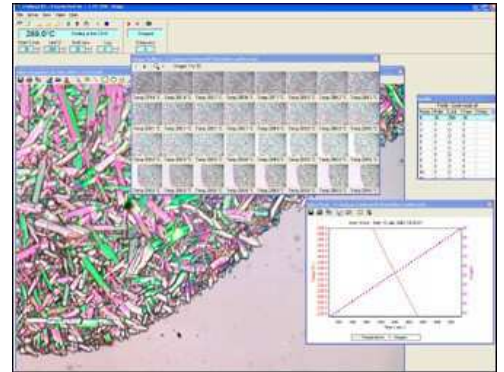
- Temperature Range: ambient to 1000°C
- Heating rates from 1 to 200°C/min
- Temperature stability 1°C
- Type S Pt-10% Rh/Pt thermocouple
- Sample cup sizes: 17mm diameter x 3mm deep
- Objective lens minimum working distance: 7.1mm
- Condenser minimum working distance: 13.8mm
- Light aperture: 1.7mm for accurate sample temperature
- Suitable for transmitted and reflected light
- Quick-release gas connectors for atmospheric control
- Clamps directly to microscope substage
- Water cooling connections for stage lid and body
- Low mass for fast response in both heating and cooling
- Stage body size: l = 104mm, w = 95mm, height at optical centre: 21mm, max. height at lid water outlet 40.8mm
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Increase Capability Options

There are several options to increase the capability of the TS systems.

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

Add system control with digital capture software and one of the range of Q-Imaging digital cameras to enable multiple ramp temperature profiles with time lapse image and data capture. All T95 controller data is saved with the image. 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. (See our website for more information).



Linksys 32X-DV software. A sequence of time lapse captured images is shown in the gallery.

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 1.4 million pixels in 12-bit digital output.



Pirani Vacuum Gauge

If one of the vacuum systems has been selected then you can add a Pirani vacuum gauge which will feed back vacuum pressure data to be displayed on the LCD screen of the T95-LinkPad, or in the Linksys 32 software.

Imaging Station

Free up time on your research microscope by attaching your high temperature 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 stage.

A long working distance condenser is built into the base with polarizer and diaphragm. A specially designed LED 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