

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-fit 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 at 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

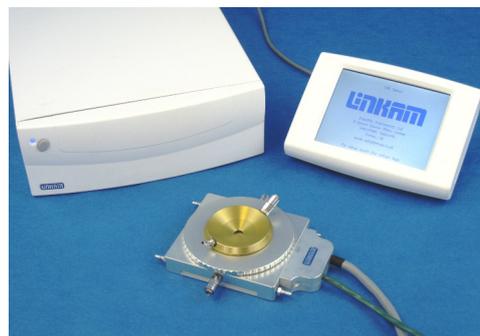
The T95 LinkPad has an LCD touchscreen data input display and can be used as a standalone system controller.

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

Temperature Range ambient to 1500°C



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 6 of this brochure.

Specifications

- Temperature Range ambient to 1000, 1200 or 1500 °C
- Heating rates from 1 to 200 °C/min
- Temperature stability 1 °C
- Type S Pt-10% Rh/Pt thermocouple
- Sample cup sizes: 7x3mm, 7x6mm, 10x5mm or 17x3mm
- Objective lens minimum working distance: 6mm
- Condenser minimum working distance: 14.8mm
- Light aperture: 1.7mm for accurate sample temperature
- Suitable for transmitted and reflected light
- Gas tight chamber 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: 104x95x29mm
- Selection of different window materials and thicknesses available

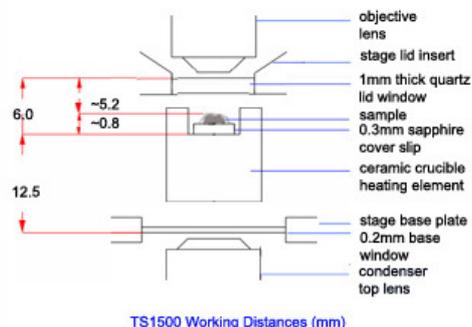
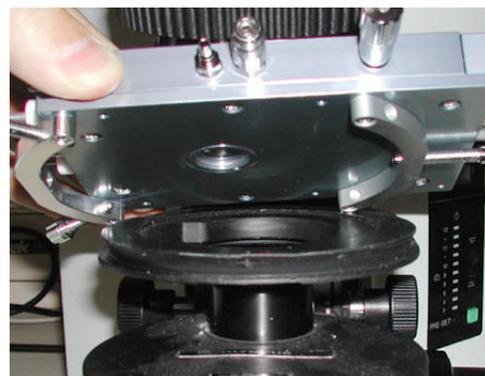
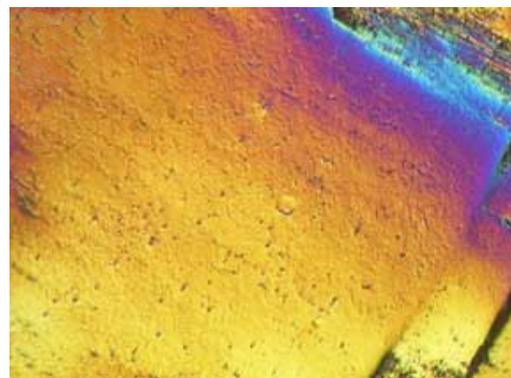


Diagram of objective lens and condenser lens working distances.



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



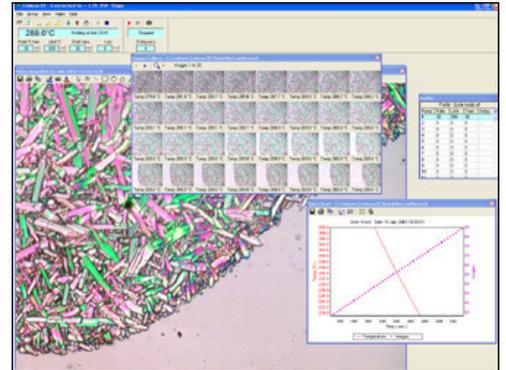
Gold Foil being heated in TS1500 at 700 °C

Increase Capability Options

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

Linksys 32X-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 '[Software and Image Capture](#)' on 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 1.92 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 32X 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 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

Linkam Complete Temperature Control Solution

What do you need for a complete solution

Select Stage

Decide which stage you require by selecting the sample crucible size and whether you want to add vacuum connectors and/or internal electrical connectors.

Each of the systems below come with the ECP water circulator pump for stage body cooling.

| System | Sample size | Max Temperature | Option |
|---------------|-------------|-----------------|-----------------------|
| TS1500-7/3 | 7x3mm | 1500°C | No |
| TS1500E-7/3 | 7x3mm | 1500°C | Electrical |
| TS1500V-7/3 | 7x3mm | 1500°C | Vacuum |
| TS1500EV-7/3 | 7x3mm | 1500°C | Electrical and Vacuum |
| TS1500-7/6 | 7x6mm | 1500°C | No |
| TS1500E-7/6 | 7x6mm | 1500°C | Electrical |
| TS1500V-7/6 | 7x6mm | 1500°C | Vacuum |
| TS1500EV-7/6 | 7x6mm | 1500°C | Electrical and Vacuum |
| TS1200-10/5 | 10x5mm | 1200°C | No |
| TS1200E-10/5 | 10x5mm | 1200°C | Electrical |
| TS1200V-10/5 | 10x5mm | 1200°C | Vacuum |
| TS1200EV-10/5 | 10x5mm | 1200°C | Electrical and Vacuum |
| TS1000-17/3 | 17x3mm | 1000°C | No |
| TS1000E-17/3 | 17x3mm | 1000°C | Electrical |
| TS1000V-17/3 | 17x3mm | 1000°C | Vacuum |
| TS1000EV-17/3 | 17x3mm | 1000°C | Electrical and Vacuum |

Linkam Complete Temperature Control Solution

Once you have selected the stage, add the options below to complete the system.

Add Controller

Either: T95 LinkPad - Stand alone system controller with LCD touchscreen data input

Or: T95 Linksys - Computer interface controller with Linkys 32 software

Add Condenser Lens if using transmitted light

See website 'Condenser Extension Lenses' for more information.

Add Stage Clamp to mount to microscope substage

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

Add Pirani Vacuum Gauge (Only needed if vacuum system selected)

Displays vacuum pressure on T95-LinkPad and or in Linksys 32X software

Add MV196 Motorized Vacuum Control (Only needed if vacuum system selected)

Motorized valve attaches to 1.5L rotary vacuum pump and enables user to dial in desired vacuum

Add Edwards 1.5L Rotary Vacuum Pump

Only required if vacuum or Motorized Vacuum Control is selected

Add System Control Software (Already supplied with T95 Linksys & MV196 motorized vacuum control)

15001 Linksys 32 - see website

Add System Control software including the Digital Video Capture Option

15005 Linksys 32-DV (captures digital images as well as data via PC).

Add Q-Imaging Camera

Required to work with Linksys 32-DV, many camera options in the range. See website 'Q-Imaging Cameras'

Add Linkam Imaging Station

Alternative to be used in place of your existing microscope for temperature controlled microscopy. See website 'Imaging Station'

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 Rotatable 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

Axiomager 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

Perkin Elmer Spectrum One FTIR Spectrometer — 9681 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.

A spare heating element is recommended to enable continuous work flow.

Part No. Part Name Part Description

2347 PT-1500 5.7mm diameter x 2mm high Platinum Sample Crucible

**7508 TS1500-7/3 Kit
TS1500-7/6 Kit Full Replacement Spares Kit for TS1500-7/3 or TS1500-7/6**

| | |
|------------|--|
| WGI | Water/Gas Valve Insert x4 |
| WVC | Water/Gas Valve Connector x4 |
| PVC-1500TK | Tube Kit for ECP water circulator used with TS1500 |
| SRR | Silicon Rings for Lid and Base (Set of 4) |
| RS1500 | Ceramic Radiation Shield for Heating Element |
| W22Q | 22mm diameter Quartz base Window (0.5mm thick) x2 |
| W7S | 7mm diameter Sapphire Sample Window (0.3mm thick) x20 |
| W55Q1 | 55mm diameter Quartz Lid Window (1.0mm thick) x2 |
| ORTS1500 | Set of O-rings for the body and Lid |

Part No. Part Name Part Description

**7509 TS1500-7/3
TS1500-7/6 Replacement Windows for TS1500-7/3, TS1500-7/6 or TS1200-10/5**

| | |
|-------|--|
| SRR | Silicon Rings for Lid and Base (Set of 4) |
| W22Q | 22mm diameter Quartz base Window (0.5mm thick) x2 |
| W7S | 7mm diameter Sapphire Sample Window (0.3mm thick) x20 |
| W55Q1 | 55mm diameter Quartz Lid Window (1.0mm thick) x2 |

Part No. Part Name Part Description

9508 SET1500-7/3 Ceramic Heating Element with Pt/Rh thermocouple (7/3 cup)

9632 SET1500-7/6 Ceramic Heating Element with Pt/Rh thermocouple (7/6 cup)

Suggested Spares

| Part No. | Part Name | Part Description |
|----------|-----------|------------------|
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|--------------|------------------------|------------------------------------|
| 22222 | TS1200-10/5 kit | Full Replacement Spares Kit |
|--------------|------------------------|------------------------------------|

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|------------|--|
| WGI | Water/Gas Valve Insert x4 |
| WVC | Water/Gas Valve Connector x4 |
| PVC-1200TK | Tube Kit for ECP water circulator used with TS1200-10/5 |
| SRR | Silicon Rings for Lid and Base (Set of 4) |
| RS1200 | Ceramic Radiation Shield for Heating Element |
| W22Q | 22mm diameter Quartz base Window (0.5mm thick) x2 |
| W9.5S | 9.5mm diameter Sapphire Sample Window (0.3mm thick) x10 |
| W55Q1 | 55mm diameter Quartz Lid Window (1.0mm thick) x2 |
| ORTS1200 | Set of O-rings for the body and Lid |

| Part No. | Part Name | Part Description |
|----------|-----------|------------------|
|----------|-----------|------------------|

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|--------------|----------------------------|----------------------------|
| 22222 | TS1200-10/3 Windows | Replacement Windows |
|--------------|----------------------------|----------------------------|

| | |
|-------|--|
| SRR | Silicon Rings for Lid and Base (Set of 4) |
| W22Q | 22mm diameter Quartz base Window (0.5mm thick) x2 |
| W9.5S | 9.5mm diameter Sapphire Sample Window (0.3mm thick) x10 |
| W55Q1 | 55mm diameter Quartz Lid Window (1.0mm thick) x2 |

| Part No. | Part Name | Part Description |
|----------|-----------|------------------|
|----------|-----------|------------------|

| | | |
|-------------|---------------------|---|
| 9633 | SET1200-10/5 | Ceramic Heating Element with Pt/Rh thermocouple (10/5 cup) |
|-------------|---------------------|---|

Suggested Spares

| Part No. | Part Name | Part Description |
|-----------------|------------------|-------------------------|
|-----------------|------------------|-------------------------|

| | | |
|--------------|------------------------|------------------------------------|
| 22222 | TS1000-17/3 kit | Full Replacement Spares Kit |
|--------------|------------------------|------------------------------------|

| | |
|------------|---|
| WGI | Water/Gas Valve Insert x4 |
| WVC | Water/Gas Valve Connector x4 |
| PVC-1000TK | Tube Kit for ECP water circulator used with TS1000-17/3 |
| SRR | Silicon Rings for Lid and Base (Set of 4) |
| RS1700 | Ceramic Radiation Shield for Heating Element |
| W22Q | 22mm diameter Quartz base Window (0.5mm thick) x2 |
| W15S | 15mm diameter Sapphire Sample Window (0.3mm thick) x10 |
| W55Q1 | 55mm diameter Quartz Lid Window (1.0mm thick) x2 |
| ORTS1000 | Set of O-rings for the body and Lid |

| Part No. | Part Name | Part Description |
|-----------------|------------------|-------------------------|
|-----------------|------------------|-------------------------|

| | | |
|--------------|----------------------------|----------------------------|
| 22222 | TS1000-17/3 Windows | Replacement Windows |
|--------------|----------------------------|----------------------------|

| | |
|-------|---|
| SRR | Silicon Rings for Lid and Base (Set of 4) |
| W22Q | 22mm diameter Quartz base Window (0.5mm thick) x2 |
| W15S | 15mm diameter Sapphire Sample Window (0.3mm thick) x10 |
| W55Q1 | 55mm diameter Quartz Lid Window (1.0mm thick) x2 |

| Part No. | Part Name | Part Description |
|-----------------|------------------|-------------------------|
|-----------------|------------------|-------------------------|

| | | |
|-------------|---------------------|---|
| 9634 | SET1000-17/3 | Ceramic Heating Element with Pt/Rh thermocouple (17/3 cup) |
|-------------|---------------------|---|

Suggested Spares

| Part No. | Part Name | Part Description |
|-----------------|------------------|-------------------------|
|-----------------|------------------|-------------------------|

| | | |
|--------------|-----------|--|
| 18006 | VP | E2M1.5 Vacuum pump (including - EMF3 Mist Filter) |
|--------------|-----------|--|

| Part No. | Part Name | Part Description |
|-----------------|------------------|-------------------------|
|-----------------|------------------|-------------------------|

| | | |
|--------------|---------------|------------------------------|
| 22222 | VACC-K | Vacuum Connection Kit |
|--------------|---------------|------------------------------|

| | |
|-----------|-------------------------------------|
| NW10-EB | NW10 Elbow 90 degree |
| NW10-O | 10mm bore vacuum O-ring |
| NW10/16-O | 10 to 16mm bore vacuum O-ring |
| NW16-FH | 500mm stainless steel flexible hose |
| NW16-O | Clamping ring x3 |
| NW16-CR | Clamping Ring |
| VG | Vacuum grease |

| | | |
|--------------|---------------|--|
| 22222 | VAC-NV | Vacuum Connection Kit with Manually Operated Needle Valve Control |
|--------------|---------------|--|

| | |
|-----------|-------------------------------------|
| NW15 | T-Piece |
| NW10-O | 10mm bore vacuum O-ring x2 |
| LV10K | Needle valve |
| NW10/16-O | 10 to 16mm bore vacuum O-ring |
| NW16-FH | 500mm stainless steel flexible hose |
| NW16-O | 16mm Bore Vacuum O-ring |
| NW16-CR | Clamping ring |
| VG | Vacuum grease |