

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

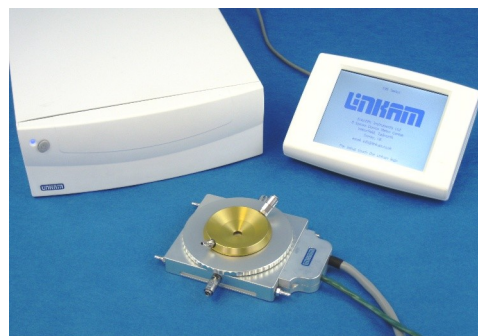
The T95 LinkPad has an LCD touchscreen data input display and can be used as a standalone system controller.

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.

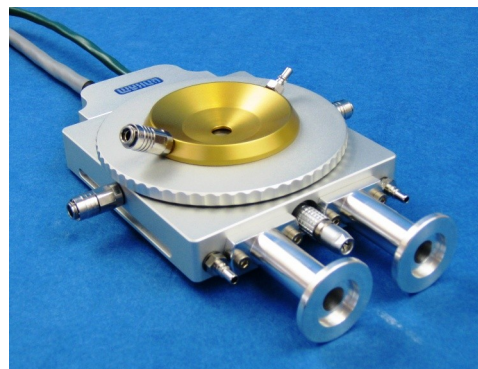


The TS1500 heating stage

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 7 of this brochure.

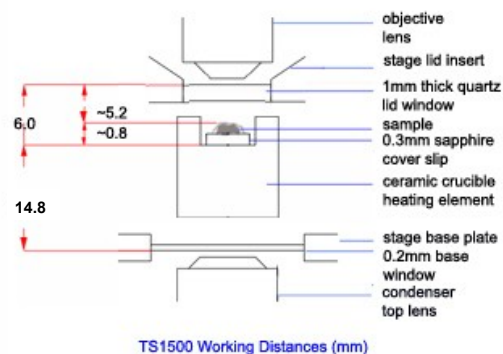
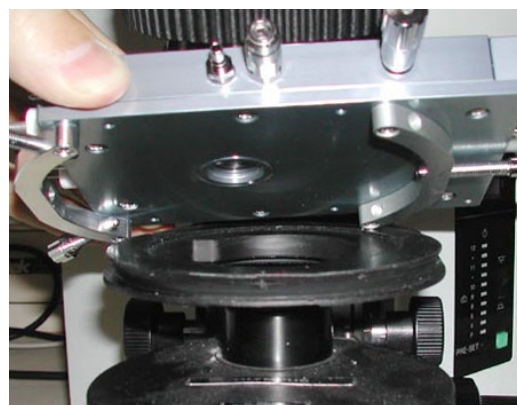
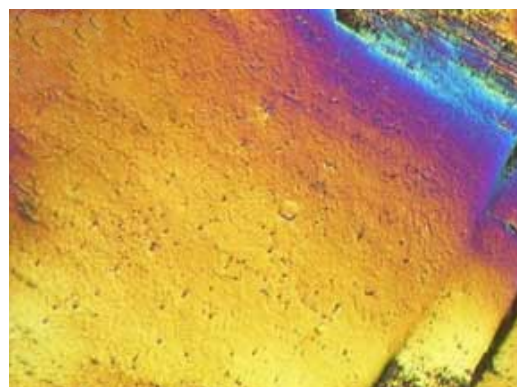


Diagram of objective lens and condenser lens working distances.



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

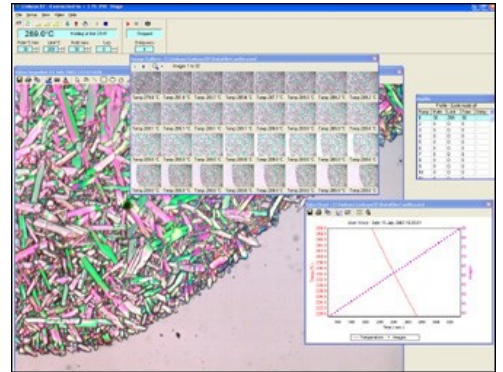
- Temperature Range: ambient to 1000°C
- Heating rates from 1 to 200°C/min
- Temperature stability 1°C
- Type S Pt-10% Rh/Pt thermocouple
- Sample cup sizes: 17mm diameter x 3mm deep
- Objective lens minimum working distance: 7.1mm
- Condenser minimum working distance: 13.8mm
- Light aperture: 1.7mm 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
- Stage weight: 0.5Kg

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 '[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 1.4 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 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

1) 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.

Stage No	Stage Name	Description	Sample size	Max Temperature	Option
11013	TS1500-7/3	Ultra High Temperature (UHT) Stage & ECP Water Circulator	7x3mm	1500°C	No
11014	TS1500V-7/3	UHT Stage with Vacuum Ports & ECP Water Circulator	7x3mm	1500°C	Vacuum
11026	TS1500E-7/3	UHT Stage incl Electrical connections & ECP Water Circulator	7x3mm	1500°C	Electrical
11027	TS1500EV-7/3	UHT Stage incl. Vacuum Ports, Electrical connections & ECP Water Circulator	7x3mm	1500°C	Electrical and Vacuum
11015	TS1500-7/6	UHT Stage with 7 x 6mm Crucible Cup & ECP Water Circulator	7x6mm	1500°C	No
11025	TS1500V-7/6	UHT Stage Stage with 7 x 6mm Crucible cup incl. Vacuum Ports & ECP Water Circulator	7x6mm	1500°C	Vacuum
11028	TS1500E-7/6	UHT Stage Stage with 7 x 6mm Crucible cup incl. Electrical connections & ECP Water Circulator	7x6mm	1500°C	Electrical
11029	TS1500EV-7/6	UHT Stage with 7 x 6mm Cup incl. Vacuum Ports, Electrical connections, incl. ECP Water Circulator	7x6mm	1500°C	Electrical and Vacuum
11023	TS1000-17/3	UHT Stage with 17 x 3mm Crucible Cup & ECP Water Circulator	17x3mm	1000°C	No
11024	TS1000V-17/3	UHT Stage with 17 x 3mm Crucible Cup incl. Vacuum Ports & ECP Water Circulator	17x3mm	1000°C	Vacuum
11030	TS1000E-17/3	UHT Stage with 17 x 3mm Crucible Cup incl. Electrical connections & ECP Water Circulator	17x3mm	1000°C	Electrical
11031	TS1000EV-17/3	UHT Stage with 17 x 3mm Cup incl. Vacuum Ports, Electrical connections & ECP Water Circulator	17x3mm	1000°C	Electrical and Vacuum
11032	TS1200-10/5	UHT Stage with 10 x 5mm Crucible Cup & incl. ECP Water Circulator	10x5mm	1200°C	No
11034	TS1200V-10/5	UHT Stage with 10 x 5mm Crucible Cup incl. Vacuum Ports & ECP Water Circulator	10x5mm	1200°C	Vacuum
11033	TS1200E-10/5	UHT Stage with 10 x 5mm Crucible Cup incl. Electrical connections & ECP Water Circulator	10x5mm	1200°C	Electrical
11035	TS1200EV-10/5	UHT Stage with 10 x 5mm Cup incl. Vacuum Ports, Electrical connections & ECP Water Circulator	10x5mm	1200°C	Electrical and Vacuum

Linkam Complete Temperature Control Solution

2) Add Controller

14069 T95-HT LinkPad Controller TS1500(E), TS1200(E), TS1000(E), TS1400 and CCR1000

14070 T95-HT Linksys Controller TS1500(E), TS1200(E), TS1000(E), TS1400 and CCR1000

Includes Linksys32 software

14075 T95-HT LinkPad Controller TS1500(V)(EV), TS1200(V)(EV), TS1000(V)(EV)

14076 T95-HT Linksys Controller TS1500(V)(EV), TS1200(V)(EV), TS1000(V)(EV)

Includes Linksys32 software

3) Add Condenser Lens if using transmitted light

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

4) Add Stage Clamp to mount to microscope substage

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

5) Add System Control Software (not necessary if T95 Linksys controller is selected).

15001 Linksys 32

or if you require image capture then see (6)

6) 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))

7) 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/>

8) 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 next 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 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.

Please quote **part number** when ordering.

Part No.	Part Name	Part Description
7508	SPARES KIT	TS1500 7/3, 7/6 Full Replacement Spares Kit
		TS Accessory Bag (Eheim)
		1x PVC Tube 150 cm fitted with WGI
		1x PVC Tube 150 cm
		1x PVC Tube 20 cm fitted with WVC
		1x PVC Tube 20 cm
		1x ECP - Set Up Instructions
		4x Hose Straight - WGI
		4x Hose Valve - WVC
		1x Radiation Shield
		2x 22x0.5mm Quartz
		20x 7x0.3mm Sapphire
		2x 55x1.0mm Quartz
		1x TS O Ring Kit consisting of:
		2x Silicone Washer 22x18x0.5mm
		1x 69.60x2.4mm O-ring Viton
		1x 47.37x1.78mm O-ring Viton
		2x 36.27x1.78mm O-ring Viton
7509	SPARES KIT	Replacement Windows for TS1500-7/3, TS1500-7/6 or TS1200-10/5
		4 x Silicon Rings for Lid and Base
		2 x 22mm Diameter Quartz base Window (0.5mm thick)
		20 x 7mm diameter Sapphire sample window (0.3mm thick)
		2 x 55mm diameter Quartz lid window (1.0mm thick)
9719	Sil	Silver Sample

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.

Please quote **part number** when ordering.

Part No.	Part Name	Part Description
7511	SPARES KIT	TS1000 17/3 Full Replacement Spares Kit
		1x TS Accessory Bag (Eheim)
		1x PVC Tube 150 cm fitted with WGI
		1x PVC Tube 150 cm
		1x PVC Tube 20 cm fitted with WVC
		1x PVC Tube 20 cm
		1x ECP - Set Up Instructions
		4x Hose Straight - WGI
		4x Hose Valve - WVC
		5x 15x0.3mm Sapphire
		2x 22x0.5mm Quartz
		2x 55x1.0mm Quartz
		1x Large Radiation Shield
		1x TS O Ring Kit consisting of:
		2x Silicone Washer 22x18x0.5mm
		1x 69.60x2.4mm O-ring Viton
		1x 47.37x1.78mm O-ring Viton
		2x 36.27x1.78mm O-ring Viton
2694		22mm diameter Quartz Lid/base Window (0.5mm thick)
3434		55mm diameter Quartz Lid Window (1.0mm thick)
3435		55mm diameter Quartz Lid Window (1.8mm thick) (For Leica corrected lenses)
3823		55mm diameter Sapphire Lid Window (1mm thick)
3430		7mm diameter Sapphire Sample Window (0.3mm thick)
7502		7mm diameter Sapphire Sample Window (0.3mm thick) Pack of 20
2690		15mm x 0.3mm diameter Sapphire sample window

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.

Please quote **part number** when ordering.

Part No.	Part Name	Part Description
7517	SPARES KIT	TS1200 - 10/5 Full Replacement Spares Kit
		1x TS Accessory Bag (Eheim)
		1x PVC Tube 150 cm fitted with WGI
		1x PVC Tube 150 cm
		1x PVC Tube 20 cm fitted with WVC
		1x PVC Tube 20 cm
		1x ECP - Set Up Instructions
		4x Hose Straight - WGI
		4x Hose Valve - WVC
		1x Radiation Shield
		2x 22x0.5mm Quartz
		2x 55x1.0mm Quartz
		10x 9.5x0.3mm Sapphire
		1x TS O Ring Kit consisting of:
		2x Silicone Washer 22x18x0.5mm
		1x 69.60x2.4mm O-ring Viton
		1x 47.37x1.78mm O-ring Viton
		2x 36.27x1.78mm O-ring Viton
2347	PT-1500	5.7mm diameter x 2mm high Platinum Sample Crucible
9508	SET1500	Ceramic Heating Element including S-type Thermocouple (for 7/3 cup)
7507		Ceramic Heating Element including S-type Thermocouple (for 7/3 cup) Pack of three
9632	SET1500 7/6	Ceramic Heating Element including S-type Thermocouple (for 7/6 cup)
9634	SET1000 17/3	Ceramic Heating Element including S-type Thermocouple (for 17/3 cup)
9633	SET1200 10/5	Ceramic Heating Element including S-type Thermocouple (for 10/5 cup)
9508	SET1500ex	Exchange Heating Element including S-type Thermocouple (for 7/3 cup)
9632	SET1500ex 7/6	Exchange Heating Element including S-type Thermocouple (for 7/6 cup)
9634	SET 1000ex 17/3	Exchange Heating Element including S-type Thermocouple (for 17/3 cup)
9633	SET1200ex 10/5	Exchange Heating Element including S-type Thermocouple (for 10/5 cup)