



Ellipsometer
Low Temperature Controlled Cooling Stage

USER GUIDE

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Before Setting Up Your Equipment

Please register your products by going to www.linkam.co.uk and click on the product/software registration button.

You will need to register your equipment with us to:

- Activate your warranty and technical support
- Access the online setup videos
- Permanently unlock the Linksys32 software (if purchased)

If you have purchased Linksys32 software, please install the software first. This process will guide to register all of your products.

See Linksys32 manual for further installation instructions.

Important Notice

Please check that your Linkam equipment has not been damaged during transport. If there is any evidence of external damage DO NOT SWITCH ON ANY ELECTRICAL ITEMS.

Contact LINKAM SCIENTIFIC or their appointed distributor immediately. Your warranty may be impaired if Linkam is not informed of any transport damage within 7 working days of delivery.

NO attempt should be made to repair or modify the equipment in any way, as there are **NO USER REPLACEMENTS PARTS**.

No attempt should be made to open the case except by qualified personnel as hazardous voltages are present.

In order to use this equipment successfully, please take time to read this manual all the way through before starting to work.

Warranty

This equipment has a warranty against defects in material and workmanship for a period of 12 months. Linkam will either repair or replace products that prove to be defective. For warranty service or repair, this product must be returned to Linkam or a designated service facility.

The warranty shall not apply to defects resulting from interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

Technical Support

Any technical questions or queries should be addressed to the Technical Support Department at the address shown on the back of this manual. Register your instruments at <http://www.linkam.co.uk/> for technical support and access to download manuals and instructional videos.

Equipment Maintenance

The programmer does not require any regular maintenance. If for any reason it is necessary to check the electronic calibration then contact Linkam for procedure.

Before cleaning the case or front panel of the programmer, remove the mains lead from the wall outlet. Use a small quantity of isopropyl alcohol with a soft cloth and gently wipe the surface. To clean the stage, use isopropyl alcohol (IPA) and cotton swabs. Take great care not to touch the platinum temperature sensor protruding from the side of the heating element. The sensor is very fragile.

Using Vacuum With The Ellipsometer

1. WEAR APPROPRIATE SAFETY PROTECTION APPAREL such as gloves and eye protection.
2. DO NOT exceed the vacuum specification of 10^{-3} mBar.

Using the Edwards E2M1.5 Vacuum Pump

1. Read the included vacuum pump manual for more details.
2. Disconnect power before moving or servicing the vacuum pump.
3. Improper use or connections may cause ELECTRICAL SHOCK hazards. Be sure that all associated devices are properly grounded before switching them on.
4. Care must be exercised if touching the pump, as certain component may be hot.
5. The Exhaust Gas from the vacuum pump is composed of oil and gases entering the pump. The exhaust gas therefore should be well ventilated. Never operate the pump with locked or restricted outlet.
6. The vacuum pump supplied is not designed for pumping corrosive, aggressive or explosive gases, or for use in flammable or explosive environment.

Safety Precautions

- 1) Read this guide before using the equipment. Save these instructions for later use.
- 2) Follow all warnings and instructions which may be placed on the programmer or stage.
- 3) If for any reason the mains fuse needs to be replaced then it must be replaced by one of the same type and rating as shown in the equipment ratings.
- 4) To prevent electric shock, do not remove the cover of the controller or associated electronics.
- 5) Never use the equipment if a power cable has been damaged. Do not allow any heavy objects to rest on the power cables. Never lay the power cables on the floor.
- 6) Do not obstruct any ventilation holes. Do not attempt to insert anything into these openings. Provide adequate ventilation of at least 75mm all around the equipment.
- 7) Do not expose the equipment to water. If for any reason it gets wet then unplug it from the mains and contact Linkam Scientific Technical Support.
- 8) The equipment is not intended to be used outdoors.
- 9) Each product is equipped with a 3-wire grounded (earth) mains plug or a free-end 3 wire mains lead. The plug only fits into a grounded-type outlet. The free-end mains lead should be connected to a correctly grounded 3-wire mains outlet. Do not defeat the purpose of the grounded (earth) type plug.

Free - end mains leads are colour coded as follows :

Colour	Function
Brown	Live
Blue	Neutral
Green/Yellow	Earth (Ground)

- 10) If any problems occur then unplug the equipment from the mains outlet and contact Linkam Scientific Technical Support.
- 11) Do not remove the cover from the equipment unless the mains inlet has been removed. Any servicing should be carried out by qualified service personnel.

Symbol Reference

Caution:



This safety symbol is on the back panel of the equipment and warns:-
The user must not make or remove any connections while the unit is powered on.
To avoid electric shock do not remove the cover. Refer servicing to qualified service personnel.

Caution:



This warning symbol indicates that the surface labelled with this symbol may be hot.

Handling Liquid Nitrogen

To cool samples below room temperature a LNP95 liquid nitrogen pump system is required. Danger of asphyxiation, always use liquid nitrogen in a well ventilated room. Refer to your health and safety manual for instructions on how to handle liquid nitrogen safely. The Dewar supplied with the LNP95 system has a safety release valve built into the siphon assembly. See the LNP95 manual for further instructions on how to use the unit.

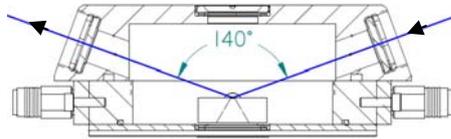
Introduction

Thank you for purchasing the Ellipsometer Low Temperature Cooling Stage. Please take the time to read through the manual as it will help you to get the most out of the equipment.

For work below ambient temperature vacuum must be used to reduce condensation inside the stage and on sample.

Ellipsometer Low Temperature Stage Specifications

Ellipsometer Side Windows light approach angle:	140° overall
Minimum temperature:	-196°C
Maximum temperature:	350°C
Maximum heating rate:	30°C/min



Ellipsometer Low Temperature System

The standard system consists of an Ellipsometer Low Temperature Stage, a T95-LinkPad System Controller and LNP95 Liquid Nitrogen Cooling System.

Linksys32 System control software and digital video capture can be added as an option to control from PC.

Optional Pirani Gauge, MV196 Motorised Vacuum Control System and an Edwards 1.5L Vacuum Pump can be added to upgrade the system.

This manual will describe instruction for setting up the standard System. Page 11,12 and 17 will provide further instruction to set up optional accessories if you have purchased them.

The top and bottom windows have a 22mm glass window fitted and the side windows of the Ellipsometer lid has a choice of quartz or ZnSe windows as ordered with the stage.

Window Options

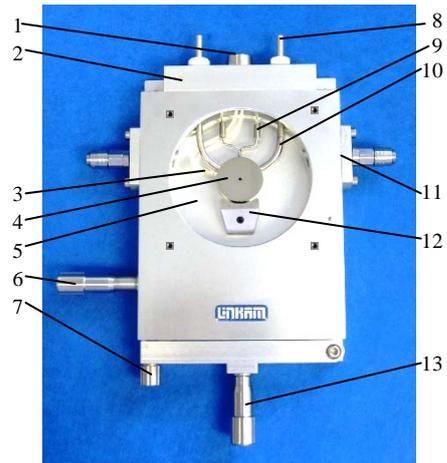
- Quartz 18mm x 5.0mm thick (spectroscopy grade)
- Quartz 18mm x 2.0mm thick
- Quartz 18mm x 0.5mm thick
- ZnSe 18mm x 2.0mm thick



Stage Anatomy

Stage Assembly

1. Lemo connector for Stage Connection Lead
2. Heating element carrier assembly
3. Platinum temperature sensor
4. 22mm copper nickel plated block
5. Sample chamber
6. X-Sample manipulator
7. Door locking thumbscrew
8. Liquid nitrogen cooling connector
9. Heating element wire
10. Stainless steel cooling tube
11. Gas / vacuum port (gas port shown)
12. Sample holder ramp
13. Y-Sample manipulator



Lid Assembly

The Lid is (15) removed from the stage by unscrewing the 4x Clamp screw (14) on top of the lid.

14. Clamp screw
15. Ellipsometer stage lid
16. 22mm Window
17. 18mm Window



Connecting The Instruments

T95 System Controller Cable Connections

For more details on the T95 System Controller please refer to the T95 System Controller manual.

Connect the Stage Cable to the Lemo Connector on the stage and connect the other end to the Stage Connection Socket (1).



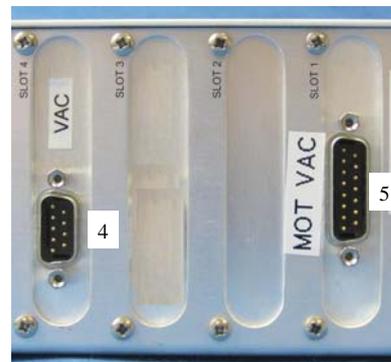
Connect the cable from the LinkPad, to the green socket labelled **LinkPad** (2).

If you have purchased Linksys32 software connect one end the RS232 cable to a PC and the other end to the socket labelled RS232 (3).



If you have purchased a Pirani Vacuum Gauge, connect the cable from the Pirani Gauge to the Slot 4; labelled 'VAC' (4).

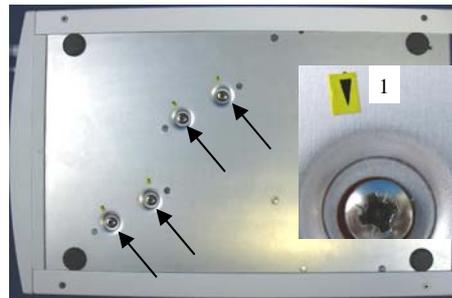
If you have purchased the MV196 Motorised Vacuum Valve System, connect the cable from the MV196 Motorised Valve to Slot 1; labelled 'MOT VAC' (5).



LNP95 Cooling Pump Connection

Remove Transit Screws

Before using the LNP95 remove the 4 transit screws, marked by small yellow labels (1), from the base of the LNP95. Transit screws shown by arrows in the adjacent image. These screws hold the pumps in place for shipping.



Keep the screws safe by screwing them into the holes on the back panel as shown by the arrows.

The screws must be replaced back into the transit holes on the base, when shipping back to Linkam for service or repair.



Back Panel Cable Connection

Connect the Instrument Bus Cable (2) between the LNP95 and T95 as shown.

Note: either of the purple coloured Instrument Bus Sockets on the LNP95 can be used.



THE LNP95 MUST BE SWITCHED ON BEFORE T95 SYSTEM CONTROLLER

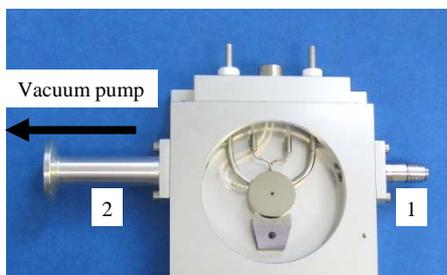
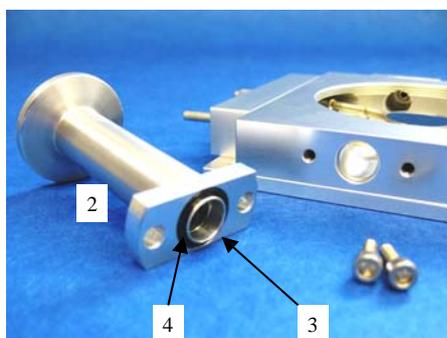
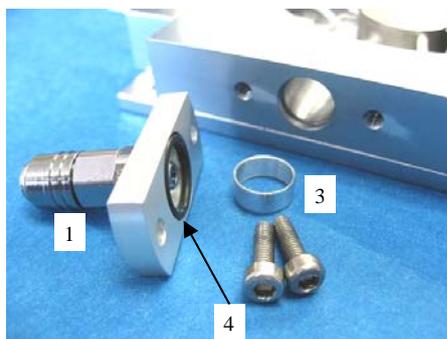
Using The Ellipsometer Stage With Vacuum Port

For ease of transportation the stage is supplied with the Gas Port (1) attached.

When using the Stage at temperatures below ambient to -196°C , **YOU MUST USE** the vacuum ports so that all moisture is removed by connecting to a vacuum pump.

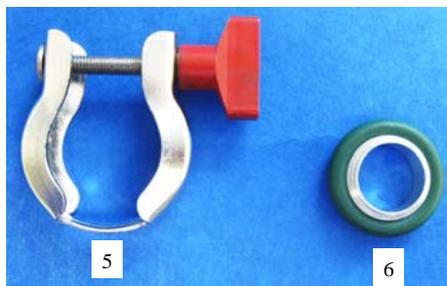
Use the hex key to remove the two screws on either side of the Gas Port (1). Using these screws to fit in the Extended Vacuum Port Connector (2). Make sure that the metal vacuum/gas seal insert (3) is placed between the stage and connector and the rubber O-ring (4) is in place as shown.

Note: the surfaces where the O-ring sits should be completely free of dirt. The O-ring should be smeared with a small amount of vacuum grease before loading in between the vacuum port and the stage vacuum connector.



Use vacuum tubing with a KF16, 16mm flange with the supplied clamping ring NW16 (5) and centring rubber NW16 O-ring (6) to connect the stage to a vacuum pump. Ensure that the O-ring is seated correctly between the vacuum port and the vacuum tubing connector before tightening the clamping screw.

Note: the surfaces where the O-ring sits should be completely free of dirt. The O-ring should be smeared with a small amount of vacuum grease.



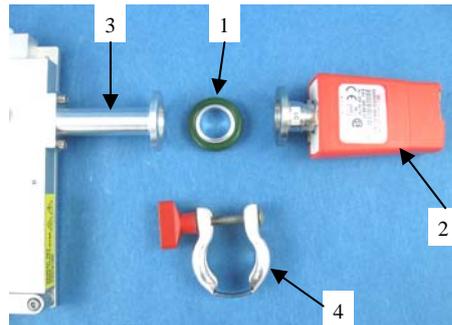
Connecting the Pirani Vacuum Gauge

If you have purchased the system with a Pirani Vacuum Gauge, read the following section to connect the Pirani Gauge to the Stage.

Replace the second Gas Port on the Stage with the Extended Vacuum Port Connector as shown on page 10.

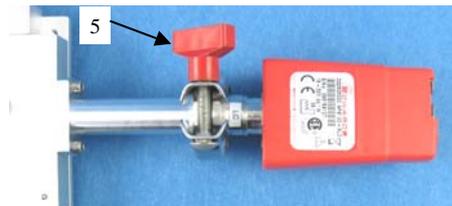
The surfaces where the O-ring (1) sits should be completely free of dirt. The O-rings should be smeared with a small amount of vacuum grease before loading in between the Pirani Gauge (2) and the Stage Vacuum Connector (3).

Note: picture is shown with the standard Vacuum Port.

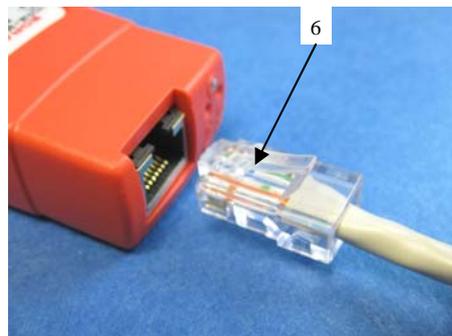


Ensure that the O-ring is correctly seated in the gauge and vacuum connector before tightening the Clamping Bracket screw (5).

Note: picture is shown with the standard vacuum Port



Connect the Pirani Cable with the LAN type connector (6) to the Pirani and the other end of the cable to the back of the T95; Slot 4; labelled 'VAC', see page 8.



Vacuum Pump and MV196 Motorised Valve Setup

Only read the following section if you have purchased the Edwards Vacuum Pump or the MV196 motorised Vacuum Valve System.

Edwards Vacuum Pump Setup

Please read the Edwards Vacuum manual to fill the pump with oil and to install the mist filter (1).

MV196 Motorised Valve System Setup

The MV196 Motorised Vacuum Control System consists of a motorized valve (2) connected to a T-piece (3) on top of the Edward Vacuum Pump (4).

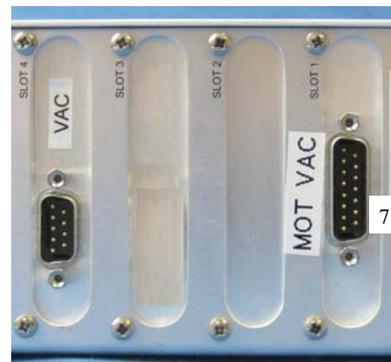
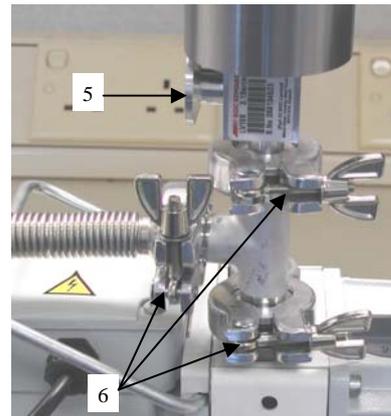
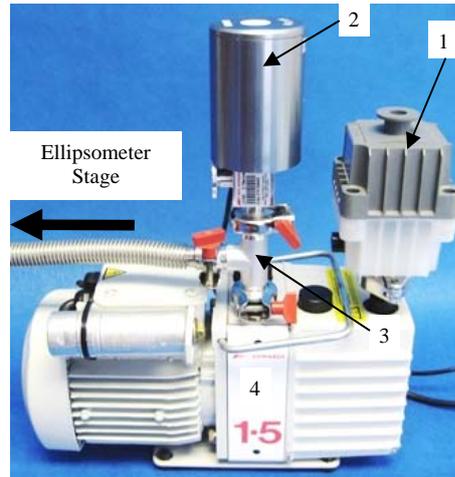
Please note that the motorized valve accurately controls the vacuum within the stage but the maximum vacuum possible is not as great as when using a simple on/off style valve.

Mounting the MV196

The MV196 has a vacuum flange just like the vacuum ports on the sides of the Ellipsometer-Stage. Use a small amount of vacuum grease to coat a thin layer on the surface where the O-ring will sit. Coat the surfaces of the T-piece with vacuum grease as well. The valve has two ports, there is one in line and one protruding perpendicularly out of the side of this valve. The side port (5) is for the controlled vacuum vent and therefore should not have anything attached to it.

Use the Clamping Bracket (6) to secure the T-piece to the port as seen in the opposite picture. Secure the vacuum pipe between the stage and T-piece using the supplied O-rings and clamping rings (6).

Connect the cable from the MV196 Motorised Valve to Slot 1; labelled 'MOT VAC' (7).



Sample Preparation

This sample preparation is for preparing sample when using the temperature from room temperature to -196°C where vacuum must be used.

For accurate results it is most important that the surface of the block is extremely clean, since air gaps between the heating block and the sample will result in temperature errors.

Use a soft cloth and IPA (iso-propyl alcohol) to clean. Do not use excessive force when cleaning the heating element as this will bend the heater assembly. Also be careful not to damage the fragile platinum temperature sensor on the side of the block when cleaning.

Ensure that the sample is as small and as flat as possible, heat flow into or out of the sample is affected by the amount of sample area in contact with the temperature controlled silver block.

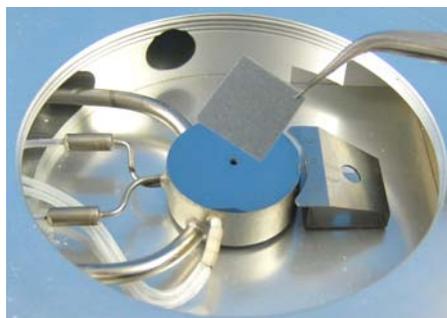
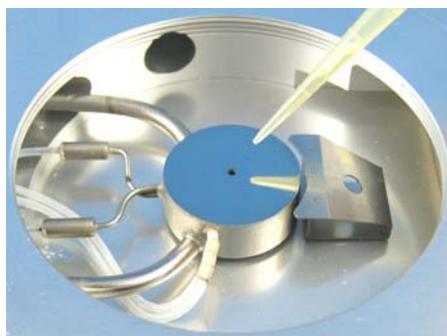
At standard atmospheric pressure the contact between the sample and the silver block is enough to establish good thermal contact as the air molecules in any minute scratches will conduct the heat, but when pulling a vacuum these are drawn out of the stage. Silicon oil is used as thermal seal between the silver block and glass cover slip when vacuum is applied.

Using either the dropper or micropipette to place a tiny drop of oil on the silver block. Be careful not to place the oil over the aperture hole of the heating/cooling block.

Note: vacuum and silicon oil is not needed when the stage is heating from ambient to 350°C . If your sample does not melt or react with the copper/nickel plated heating block when heating, simply place your sample on top of the heating block.

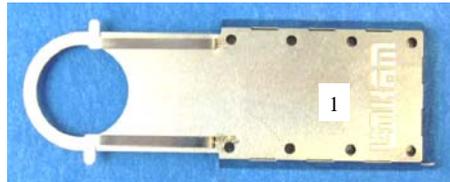
Place a W22G (22 x 0.17mm) glass cover slip on top and move it in both directions by a few millimetres to spread out the oil underneath evenly.

Place your sample on top of the glass cover slip.

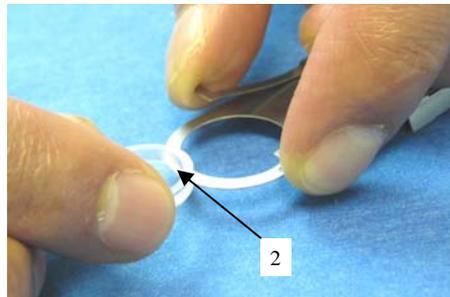


*Sample Loading Using Spring
Crucible Carrier and Quartz Crucible*
This method is used if you are preparing the sample away from the Stage.

The Spring Crucible Carrier (1) has two spring clips to hold the crucible flat against the silver block. This is to ensure good thermal contact.



To load the Quartz Crucible (2) into the carrier, lift the two spring clips about 2mm upward and slide the crucible in to the holder.



Release the two spring clips to hold the Crucible in place.



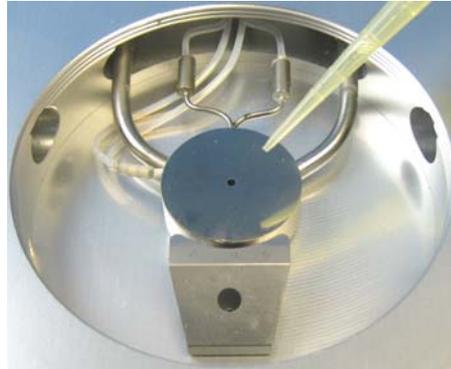
Place your sample on top of the Quartz Crucible.



Before loading the Crucible Carrier the silver block must be prepared with silicon oil to provide a good thermal contact between the crucible and the silver block when the stage is under a vacuum.

Using either the dropper or micropipette place a tiny drop of oil on the silver block. Be careful not to place the oil over the aperture hole of the silver block.

Note: vacuum and silicon oil is not needed when the stage is heating from ambient to 350°C.



Open the door of the stage by unscrewing the door thumbscrew. Now load the Crucible Carrier into the Ellipsometer stage. Unscrew the Y manipulator (the one screwed into the stage door) so that when you close the door, the Crucible Carrier doesn't push the crucible right off the edge of the block and the silicon oil with it.

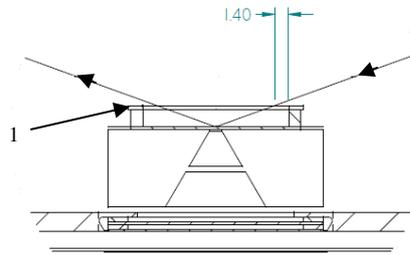


With one hand push the Crucible Carrier and with the other hand lift the edge of the crucible up the ramp and over the drop of oil. When the drop of oil is roughly in the centre of the crucible gently lower the crucible on the block. Now close the door of the stage and screw in the door locking screw. This screw only needs to be finger tight.

Adjust the XY manipulators by a few turns in both directions to spread out the oil underneath the Quartz Crucible and then move the sample holder to the centre of the silver block.



Note: the top rim of the Quartz Crucible (1) will interfere with the incident/reflection beam of the Ellipsometer if the crucible is more than 1.4mm away from the centre of the silver block.



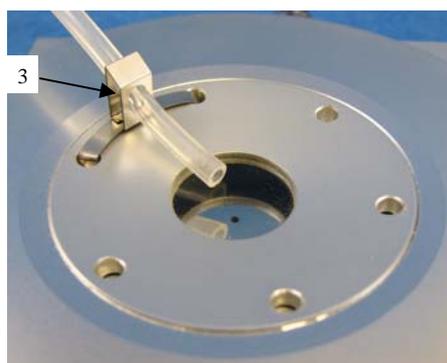
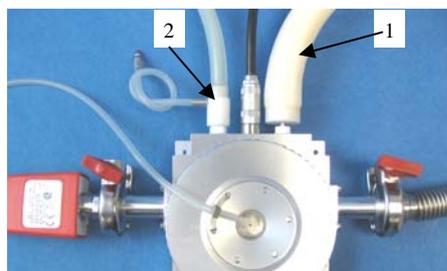
Cooling Connections

The Dewar Siphon (1) is the thick white foam tubing and is attached to the liquid nitrogen Dewar. The thin black capillary tube inside the white foam tube must be inserted into the liquid nitrogen cooling connectors on the stage.

The white tubing slides on to the outside of the connector. Twist the siphon whilst sliding it on and push until it comes to a stop. It does not need to go all the way to the base of the connector.

The thicker silicon tube from the LNP95 cooling pump ends in a white PTFE connector (2), this is pushed over the end of the other stainless steel connector as seen in the image.

The smaller tube from the outlet on the LNP95 should be placed in position on the top of the lid using the Tube Clip Holder (3). This tube blows warm recycled nitrogen gas across the lid window to prevent condensation on the viewing window surface.



Filling the Liquid Nitrogen Dewar

Please follow your health and safety manual for directions on how to handle liquid nitrogen and ensure that you have the correct safety equipment including gloves and safety goggles.

Fill the Dewar approximately 2/3 full and replace the lid with siphon attached.

DO NOT FASTEN THE CATCHES

Wait for the nitrogen to stop bubbling before fastening the catches.

Take care when placing lid on a table to always have the black capillary pointing upwards. It is easily damaged which will impair N₂ flow



Using MV196 and Linksys32 Software To Set Vacuum

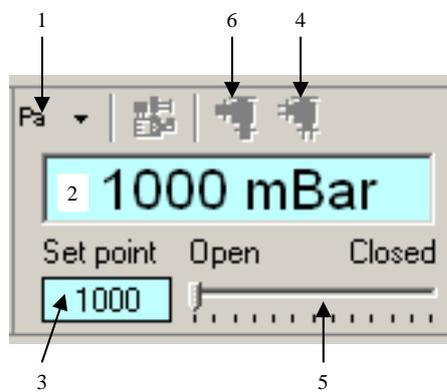
Programming Temperature

Only read the following chapter if you have purchased the Ellipsometer Low Temperature Stage with the MV196 motorised valve system, Pirani gauge and Linksys32 Software. Please refer to Linksys32 Software manual to program the temperature by software using a PC.

Using Linksys32 Software to Control MV196 Motorised Valve

When the Pirani gauge and / or MV196 System are connected correctly to the T95, you will see an additional Vacuum Toolbar in the Linksys32 software main window. See opposite picture.

To set vacuum units click on the Pa icon (1) to select Pascal's, or use the pull down list to select other units.



Set Vacuum

The Pirani gauge will display a live vacuum reading shown in the Main Vacuum Window (2).

To set a vacuum, turn on the Vacuum Pump and type in a vacuum value (value dependent on unit chosen) in the Set point's box (3). Click the Close Valve icon (4) and the motorised valve will automatically adjust itself to achieve the set vacuum value.

Note: a graphical indicator of the valve position between the Close and Open position can be seen in Motorised Vacuum Valve Indicator Bar (5).

Note: to take the Ellipsometer Stage back to atmospheric pressure, turn off the vacuum pump and click on Open Valve icon (6).

Note: if you have only the Pirani Vacuum Gauge with no MV196 system. The Open Valve and Close Valve icons are greyed out and will not function.

Using T95-LinkPad To Control MV196

Only read the following chapter if you have purchased the MV196 Motorised Valve and Pirani Vacuum Gauge.

The T95-LinkPad works as a standalone unit. Please make sure Linksys32 software is not running.

With the Pirani Gauge connected you will see a live vacuum reading (1) on the Link Pad display.

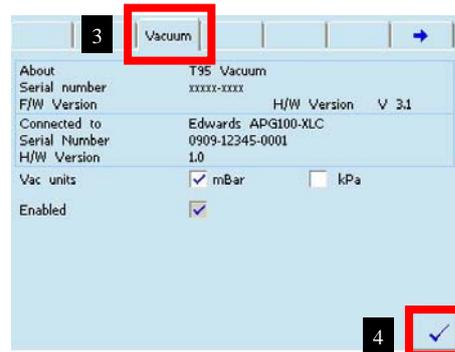
On the display mB represents mBar (millibar) unit or kPa (kilopascals) unit.



To change the vacuum unit, touch the Setup icon (2) to go to the Setup Tab page.

Touch the Vacuum Tab (3) to display the Vacuum Setup menu. Touch either the mBar or kPa check box to select the vacuum unit.

Touch the Confirm icon (4) to go back to the main screen.



If you have the System with the MV196 Motorised Valve connected there is an extra column labelled 'Vac mBar / kPa' displayed in the main screen (5).

This option is available for you to program in a vacuum value for each Ramp in the Programmable Parameters.

Note: please refer to the T95-LinkPad manual for programming the temperature using LinkPad.



Vacuum Parameters

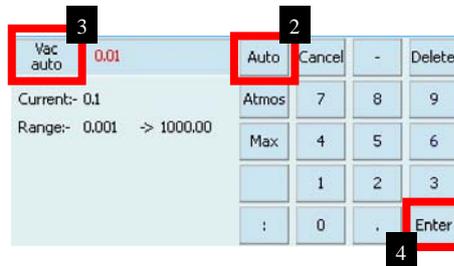
Touch the active area (1) to change the main screen to the Vacuum menu screen.



In the Vacuum main screen there will be 3 options to control the Vacuum value.

1. Auto: in this mode the motorised valve will automatically adjust itself to your programmed vacuum value.

Touch the **Auto** button (2) and make sure the word 'auto' is displayed under the word 'Vac' (3). Use the keypad to type in a vacuum value and touch **Enter** button (4) to go back to the main screen.



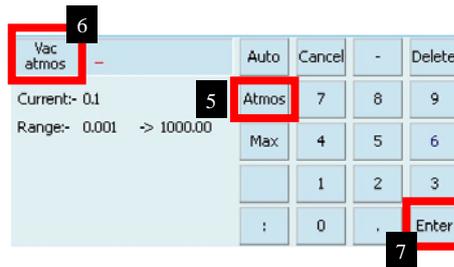
Note: touch the **Cancel** button to go back to the main screen without changing the vacuum value.

Note: Current:- is the current programmed rate.

Note: Range:- is the maximum and minimum vacuum value that can be program for the selected vacuum unit (mBar or kPa).

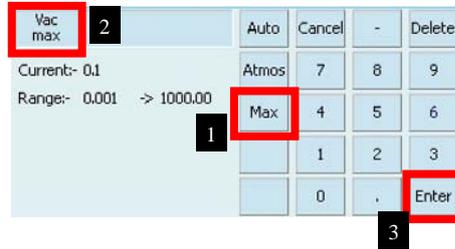
2. Atmos: in this mode the motorised valve will fully open to set the vacuum pump to atmospheric pressure.

Touch the **Atmos** button (5) and make sure the word 'atmos' (6) is displayed under the word 'Vac' to set the Ramp to **Atmos** mode. Touch **Enter** button (7) to go back to the main screen.



3. Max: in this mode the motorised valve will close fully to get the maximum vacuum from the vacuum pump.

Touch the **Max** button (1) and make sure the word 'max' (2) is displayed under the word 'Vac' to set the Ramp to **Max** mode. Touch **Enter** button (3) to go back to the main screen.



Running a Profile with Vacuum

When a Profile is running the following display in the main screen will help you to visualise the programmed vacuum setting in the **Ramp**.

1. The programmed vacuum value will be shown (4) if the Vacuum is set to **Auto**.

Rate °C/min	Limit °C	Time h:m:s	Lnp speed	Vac mBar
20	33.5	0:10:0	0	0.001

2. The word 'Atmos' (5) will be shown if the Vacuum is set to **Atmos** mode.

Rate °C/min	Limit °C	Time h:m:s	Lnp speed	Vac mBar
20	33.5	0:10:0	0	Atmos

3. The word 'Max' (6) will be shown if the Vacuum is set to **Max** mode.

Rate °C/min	Limit °C	Time h:m:s	Lnp speed	Vac mBar
20	33.5	0:10:0	0	Max

Note: when a Profile is running and there is no Vacuum setting in the Ramp, the current Ramp will use the vacuum setting of the previous Ramp.

Using The Stage With Gas Connectors

This is used for temperature work from ambient to 350°C when vacuum is not needed.

Note: when vacuum is not used DO NOT use silicon oil to prepare your sample.

The Ellipsometer is supplied with the gas connectors fitted and can be used to purge the stage and keep it under a controlled atmosphere.

Gas Connections

The Gas Connectors (1) are self-closing, to open them insert the Gas Insert (2).

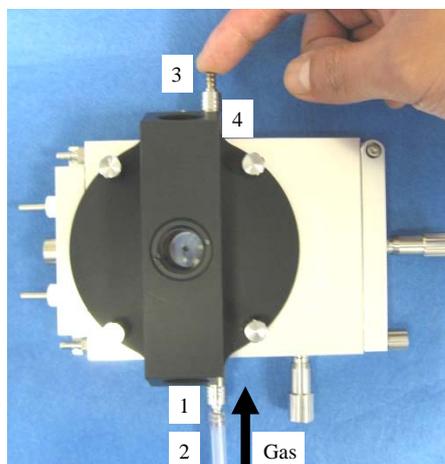
To use the Gas Insert (2); connect one end to a tube (3mm inner diameter, 6mm outer diameter) connected to your gas cylinder and push the other end to the Gas Connector (1). You should hear a “click” when the two parts are connected properly.

To remove the Gas Insert, push back the outer sleeve of Gas Connector toward the base and the Gas Insert should drop out.

Gas Purging

This method uses an inert gas from a gas cylinder to purge the stage at temperatures above ambient when the LNP95 is not required.

1. Make sure the Ellipsometer Lid is screwed in place and the Stage Door is closed.
2. From a gas cylinder connect the Gas Insert (2) with the gas tubing with the Gas Purge Valve (1).
3. Connect a second Gas Insert (3) to the opposite side Gas Purge Valve (4).
4. Use the gas regulator to set a gas flow rate of 1.5L/min.
5. With the gas flowing through the Sample Chamber, block the gas outlet for a few seconds and releasing the gas outlet valve with a finger. Repeat this for a few minutes to purge the stage.



Note: Helium gas is not recommended for continuous purging. This gas has a very high thermal conductivity and will cool the silver heating block too much during an experiment and may cause the temperature to fluctuate.

Appendix

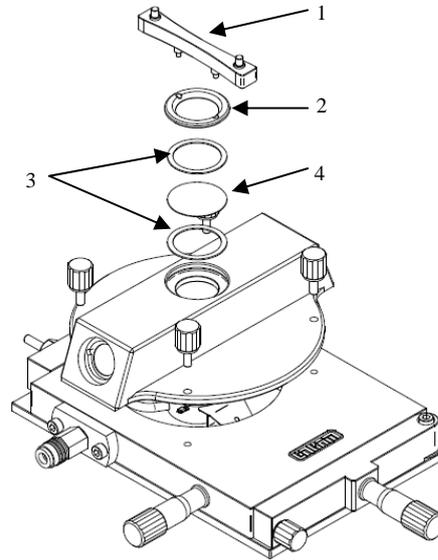
Ellipsometer Windows Assembly

If the windows need to be replaced they should be reassembled as shown in the diagram.

Top Window Assembly

Use the Window Tool (1) to remove the 22mm Locking Ring (2) and reassembled the Top Window as shown in the diagram.

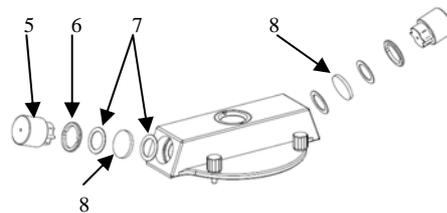
1. Window Tool (1)
2. Locking Ring (22mm)
3. Silicon Rubber Ring (22 x 18mm)
4. Glass Window (22 x 0.3mm)



Side Windows Assembly

Use the Side Window Locking Tool (5) to remove the Side Window Locking Ring (6) and reassemble the Side Window as shown in the diagram

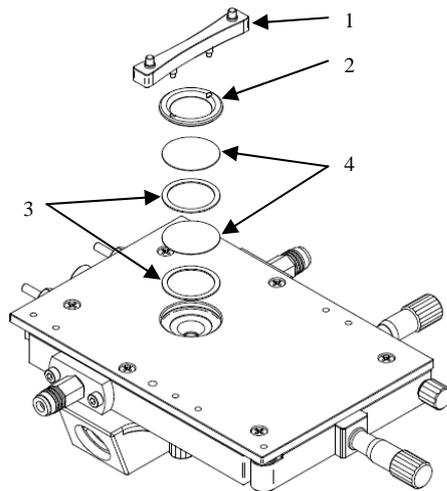
5. Side Window Locking Tool
6. Side Window Locking Ring
7. Silicon Rubber Ring (17 x 12mm)
8. Side Window (up to 5mm thick)



Bottom Window Assembly

Use the Window Tool (1) to remove the 22mm Locking Ring (2) and reassembled the Bottom Window as shown in the diagram.

1. Window Tool (1)
2. Locking Ring (22mm)
3. Silicon Rubber Ring (22 x 18mm)
4. Glass Window (22 x 0.3mm)



Spares and Accessories

The Ellipsometer is supplied with some spares and accessories to enable you to start working immediately. Here is a list of spares you may require in the future. Contact your Linkam representative for other spare parts that are not listed below.

These spares are organised into convenient kits. Purchase a spares kit to avoid downtime with your stage and eliminate future shipping costs.

The Ellipsometer heating element is extremely durable if used carefully. However, it is made from pure silver which is a soft metal. It can be easily scratched, which will compromise the heat flow to the sample and reduce accuracy. The platinum temperature sensor is brittle and can be broken if cleaning is not carefully performed. We recommend a spare heating element to avoid downtime with your stage while element is being repaired.

Part No.	Part Name	Part Description
22222	ELLP LOW TEMP Kit	Full Replacement Spares Kit for Ellipsometer Low Temperature \stage
	WG	Water/Gas Valve Insert x2
	WVC	Water/Gas Valve Connector x2
	SSR	Silicon Rings for Lid and Base (Set of 4)
	THC	Tube Clip Holder (for Nitrogen de-fogging stage lid tube)
	ORTHMS	Set of O-Rings for THMS Stage Body and Lid
	ELLIP/Q	15mm diameter Quartz Crucible for ELLIP/CC
	ELLP/CC	Crucible Carrier with Spring Clips for Ellipsometer Low Temperature Stage
	W22G0.3	22mm diameter Glass Lid/base Window (0.3mm thick) Box of 100
	LT	Lock Tool for 18mm Side Ellipsometer Window
	WT	Window Tool (for unlocking lid insert and base locking ring)
	SO	Bottle of Silicon Oil (1/4 fl.oz)

Part No.	Part Name	Part Description
22222	ELLP LOW TEMP Win Kit	Spare Window Kit for Ellipsometer low temperature stage
	THMS/Q	15mm diameter Quartz Crucible for FDSC/CC
	W22G0.3	22mm diameter Glass Lid/base Window (0.3mm thick) Box of 100
	SO	Bottle of Silicon Oil (1/4 fl.oz)

Part No.	Part Name	Part Description
9811		Ellipsometer Low Temperature spare heating block with sensor

Part No.	Part Name	Part Description
18006	VP	E2M1.5 Edwards Vacuum Pump (including - EMF3 Mist Filter)

Part No.	Part Name	Part Description
7505	VacC-K	Spare Vacuum Connection Kit
	NW10-EB	NW10 Elbow 90 degree for Edwards vacuum pump
	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

Part No.	Part Name	Part Description
3837		Quartz side-window (spectroscopy grade 18mm x 5.0mm thick)
3812		Quartz side-window (18mm x 2.0mm thick)
2695		Quartz side-window (18mm x 0.5mm thick)
3816		ZnSe side-window (18mm x 2.0mm thick)

Trouble shooting

1. *The cooling rate is less than programmed.*

There can be several causes of this problem, the most likely being that one of the connectors has become blocked or damaged. Check that each tube is fitted tightly to the connector and that none of the tubing is twisted or has come loose. The larger diameter tube leading from the LNP95 consists of a tube within a tube, check that the internal tube is connected, it may have come loose. Any constrictions of either the tubing or the connector will have a drastic effect on the cooling ability of the LNP95. If the connectors and tubing are OK, check that the capillary tubing to the Dewar flask is not bent or damaged and that the filter is intact and unblocked. If any damage has occurred to any of these items then it will be necessary to replace them. If no damage is found, check that the silver block is not constricted. This can be checked, simply by blowing through one of the steel cooling tubes using a compressed air line.

2. *Stage will not cool down to -196°C.*

Check that the stage lid is not touching the silver block when screwed down. Check that the silver block has not been pushed down so that it touches the base of the stage. Check the sample holder ramp is not touching the silver block. Any of these faults will cause a substantial loss of cooling ability.

4. *Condensation on the sample and/or the underside of lid window*

This is due to the stage not being sealed properly and therefore allowing moisture in during purging or cooling. Check that the lid and bottom window are seated correctly and that the silicon seals are in position. Check that the rubber O-rings on the Stage Door and the Lid seals are free of dirt. If necessary clean with IPA (isopropanol) and apply a small amount of vacuum grease between these joints. Vacuum must be used for temperature work below ambient to -196°C.

5. *The stage is not holding a vacuum*

Make all the seals and joint are free of dirt and use a small amount of vacuum grease to seal all the joints.

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