

**T95
System Controller
for
Heating and Freezing Stages**

USER GUIDE

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Declaration of Conformity

Manufacturers Name: Linkam Scientific Instruments Ltd.

Manufacturers Address: 8 Epsom Downs Metro Centre
Waterfield
Tadworth
Surrey
KT20 5LR
UK

Declares that the products as originally delivered:

Product Name: Temperature Programmer
Product Numbers: T95-HS T95-PE T95-HT

has been independently tested and found to comply with the following applicable European Directives, and carries the CE marking accordingly:

EMC Directive 2004/108/EC using product standard EN 61326-1:2006
Low Voltage Directive 2006/95/EC using product standard EN 61010-1:2001

and also carries the additional certification:

EMC: FCC CFR47 Part 15

Safety: CB IEC 61010-1/ EN 61010-1
MET UL 61010-1/ CSA C22.2 No.61010-1 under listing E112928

Date
28th August 2009

Peter Grocutt R&D Manager
Peter Grocutt

Important Notice

Please check that your Linkam equipment has not been damaged during transport. If there is any evidence of external damage to electrical items:

DO NOT CONNECT THE POWER CORD OR SWITCH THE ITEM ON

Contact Linkam Scientific Instruments Ltd 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.

Safety Precautions

1. Read all of this guide before using the equipment. Save these instructions for later use.
2. Follow all warnings and instructions marked on any of your Linkam equipment, or contained within the manuals.
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 equipment.
5. Never use the equipment if the power cord has been damaged. Do not allow any heavy objects to rest on the power cord. Never lay the power cord 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 remove the power cord from the mains outlet and contact Linkam Scientific Technical Support. The equipment is not intended to be used outdoors.
8. Each product is equipped with a 3-wire grounded (earth) power plug or a free-end 3 wire power cord. The plug only fits into a grounded-type outlet. The free-end power cord should be connected to a correctly grounded 3-wire power outlet. Do not defeat the purpose of the grounded (earth) type plug.

Free - end power cords are colour coded as follows:

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

9. The power cord must be an appropriately rated and approved cord-set for the country it is being used in.
10. If any problems occur then remove the power cord from the mains outlet and contact Linkam Scientific Technical Support.
11. NO attempt should be made to repair or modify the equipment in any way, as there are **no user replaceable parts**. Any servicing should be carried out by qualified service personnel. Do not remove the cover from the equipment unless the power cord has been removed from the mains outlet.

Symbol Reference



This safety symbol is seen on the back panel of the equipment and warns the user: Not to make or remove any connections while the unit is powered on. Not to remove the cover. Servicing should only be done by qualified service personnel.



This safety symbol is seen on the back panel of the equipment and warns the user: That to avoid electric shock the power cord protective grounding conductor must be connected to ground.

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.

Equipment Ratings

T95-HS		
A.C. Mains Supply:	100-240V	
A.C. Frequency:	47-63Hz	
Max current:	3.2A	
Fuse:	Current rating	4A
	Characteristic	T
	Voltage rating	250V~
	Breaking capacity	H
T95-PE		
A.C. Mains Supply:	100-240V	
A.C. Frequency:	47-63Hz	
Max current:	3.2A	
Fuse:	Current rating	4A
	Characteristic	T
	Voltage rating	250V~
	Breaking capacity	H
T95-HT		
A.C. Mains Supply:	100-240V	
A.C. Frequency:	47-63Hz	
Max current:	3.7A	
Fuse:	Current rating	4A
	Characteristic	T
	Voltage rating	250V~
	Breaking capacity	H

LinkPad

D.C Voltage:	12V
Max Current:	550mA

Technical Specifications

T95 System Controller

Dimensions: 376L x 243W x 87H (mm)
Weight: 2.6Kg (excluding cables)
Operating environment: 5~40°C, 80% relative humidity at 31°C decreasing linearly to 50% at 40°C (without condensation)

Platinum resistor sensor input:

Temperature Range: -196°C to 750°C (dependent on Stage)
Temperature Resolution: 0.01°C resolution (dependent on Stage)
Temperature Accuracy: 0.05°C
Temperature Stability: 0.05°C
Set Point Resolution: 0.1°C

Optional LinkPad

Dimensions: 125L x 172W x 80H (mm)
Weight: 0.75Kg (excluding cables)
Operating environment: 5~40°C, 80% relative humidity at 31°C decreasing linearly to 50% at 40°C (without condensation)

Display Resolution: 320 X 240 pixels
Display Size: 5.7 inch
User Interface: Touch screen

Optional T95 Dual Thermocouple board

Type S thermocouple:

Temperature Range: 0°C to 1750°C
Temperature Resolution: 1°C resolution (dependent on Stage)
Temperature Accuracy: 1°C
Temperature Stability: 1°C
Set Point Resolution: 1°C

Optional T95 Vacuum board

Gauge: Edwards APG100-XLC
Vacuum Range: 1×10^{-4} mB to 1268 mB

Optional T95 Tensile board

20N Beam

Resolution: 0.001N

200N Beam

Resolution: 0.01N

Optional T95 DSC board

Counts: +/- 65536
Noise: +/- 3 counts

Optional T95 Motor board

Motor Type: Bipolar Stepper Motor
Motor Current: Programmable up to 1.2A
Motor Resolution: 64 uSteps
Digital Encoder: 24 bit
End Stops: 2

Optional T95 Video Text Overlay board

Video System: PAL/NTSC
Clock Format: DD-MM-YY HH:MM:SS
Character Grid: 16 Rows X 30 Characters (PAL)
13 Rows X 30 Characters (NTSC)

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.

Equipment Maintenance

The T95 does not require any regular maintenance. Contact Linkam should you require any maintenance. Before cleaning the case or front panel of the T95, remove the mains cord from the mains outlet. Use a small quantity of isopropyl alcohol (IPA) on a soft cloth and gently wipe the surface.

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.

Product Registration

Register your Linkam instrument and software; please go to www.linkam.co.uk to fill in the Product / software Registration form. After registration, you can login to our website to download manuals and access 'How To Videos'.

Feedback

Your feedback will be greatly appreciated, please go to www.linkam.co.uk to fill in the Feedback form.

Introduction

Thank you for purchasing a Linkam system. Please take the time to read through all manuals, as it will help you to make the most out of the equipment.

There are three possible system configurations supplied with the T95 System Controller.

1. T95-Linkad: this system is supplied with a LinkPad touch screen to program the T95.
2. T95-Linksys32: this system is supplied with Linksys32 software and used with a PC to program the T95. Please refer to the Linksys32 manual for more detail.
3. T95-LinkPad and Linksys32 Software. This system uses the supplied TouchPad **OR** Linksys32 software to control the T95.

Note: it is not possible to use the TouchPad to control the T95 when Linksys32 software is running, the TouchPad's screen becomes an active display for data, e.g. temperature and rate.

The logo for Linkam, featuring the word "Linkam" in a bold, stylized, black font with a white outline.

Scientific Instruments Ltd.
8 Epsom Downs Metro Centre, Waterfield, Tadworth
Surrey, KT20 5LR, United Kingdom
email: info@linkam.co.uk

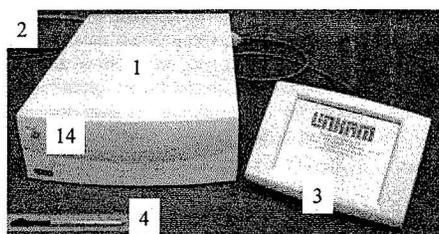
Set Up the Instrument

Warning: no cables should be connected or removed while the T95 unit is powered on.

T95-LinkPad

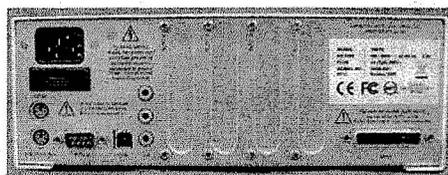
If the T95 is supplied with a Linkpad, please check that all of the following parts below have been supplied with this System.

1. T95
2. Power cord
3. LinkPad
4. Stylus



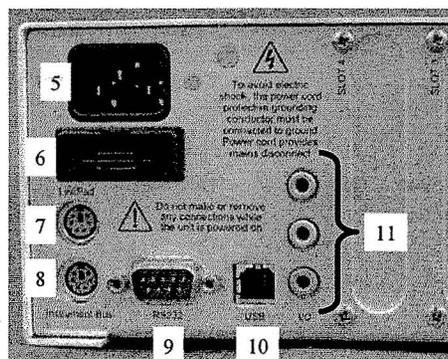
T95-Linksys32

If the T95 is supplied with the Linksys32, please check that the T95 (1), Linksys32 software installation CD and RS232 cable have been supplied with this System.



Back Panel Connections

5. Power Socket
6. Fuse box
7. LinkPad Socket
8. Instrument Bus Socket, for LNP95 Liquid Nitrogen Pump System, see page 16.
9. RS232 Socket for PC Comm port connection
10. USB Socket. **Do not use**
11. Input and Output Sockets. **Do not use**
12. Additional module expansion slot(s)
13. Stage Connection Socket



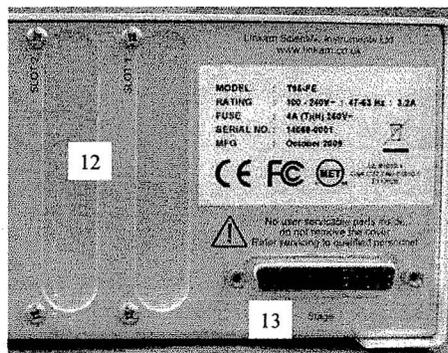
Instrument Cable Connections

LinkPad Connection

For T95-LinkPad System: connect the LinkPad cable to the green LinkPad Socket (7).

Linksys32 RS232 Connection

For T95-Linksys32 System: connect the supplied crossed-over RS232 cable from the PC to the RS232 Socket (9) and refer to the Linksys32 Software Manual for programming the T95.



Stage Connection

Connect the Stage Cable Lemo plug to the Lemo socket of the stage and connect the other end of the cable to the Stage Connection Socket (13). Plug the power cord into the power socket (5) and use the Power Switch (14) on the front of the T95 to turn it on.

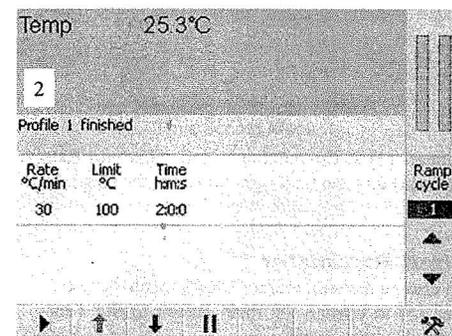
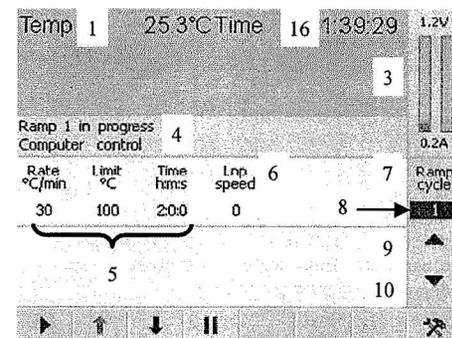
Note: If the LNP95 is supplied (see page 16), IT MUST BE SWITCHED ON BEFORE THE T95.

Using LinkPad

The LinkPad display screen is touch sensitive, use the stylus to touch the screen to program the T95.

Main screen display:

1. Temperature reading of stage (°C)
2. Profile selected (1-3)
3. Power consumption of stage bar graph
4. Status display
5. Programmable parameters (Rate, temperature Limit and hold Time)
6. Liquid Nitrogen Pump Speed (1 to 100). If LNP95 is connected see Page 16.
7. Ramp status
8. Current Ramp number (1-100)
9. Ramp Up button
10. Ramp Down button
11. Start / Stop button
12. Manual Heat button
13. Manual Cool button
14. Pause button
15. Setup button
16. Hold Time, countdown timer



Program T95

Profile and Ramp Parameters

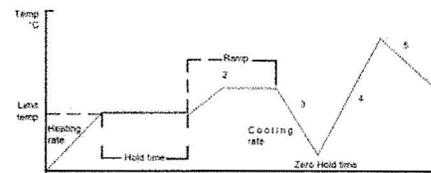
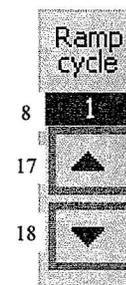
The T95 can store and save 3 Profiles. See page 14 for changing the Profile number.

Each Profile has 100 Ramps.

Touch the Ramp Up (17) or Ramp Down (18) buttons to move to the Ramp number (8) up or down by one number.

Each Ramp has 3 programmable parameters: heating/cooling rate Rate, temperature Limit and hold Time.

A graphical representation of a typical Profile is shown in the opposite diagram.



Example of a 5 Ramp T95 Profile

Rate Parameter

To change the heating / cooling **Rate** in the selected Ramp number. Touch the active area (1) to change the main screen to the Rate menu screen.

Use the keypad to type in a Rate and touch **Enter**.

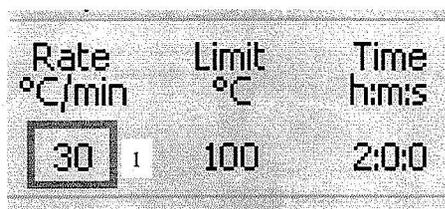
Touch either the °C/min or °C/hr to change the rate parameter from degrees centigrade per hour to degrees centigrade per minute.

Touch **Cancel** to go back to the main screen without changing the Rate value.

Touch **Delete** to delete the previous keyed number.

Note:
Current:- (2) is the current programmed rate.

Range:- (3) is the maximum and minimum Rate (°C/min) that can be programmed for the stage.



Rate °C/min	30	°C/hr	Cancel	-	Delete	
Current:-	20	2	°C/min	7	8	9
Range:-	0.0	> 150.0	3	4	5	6
			1	2	3	
			0	.	Enter	

Rate Screen Menu

Limit Parameter

To change the temperature **Limit**, touch the active area (4) to change the main screen to the Temperature screen menu.

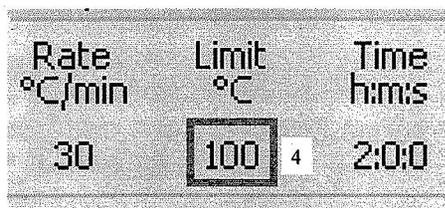
Use the keypad to type in a new temperature and touch **Enter**.

Touch **Cancel** to go back to the main screen without changing the **Limit** value.

Touch **Delete** to delete the previous keyed number.

Note:
Current:- (5) is the current programmed temperature.

Range:- (6) is the maximum and minimum temperature that can be programmed for the stage.



Limit °C	345.3	Cancel	-	Delete		
Current:-	100	5	7	8	9	
Range:-	-1960.0	> 600.0	6	4	5	6
			1	2	3	
			0	.	Enter	

Temperature Screen Menu

Time Parameter

To change the hold **Time**, touch active area (1) to change the main screen to the hold Time screen menu.

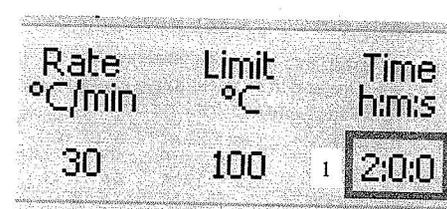
Use the keypad to type in a new hold **Time** and touch **Enter**. Use the colon symbol (:) to separate hour, minutes and second. If no hold time is needed type in '0' and touch **Enter**.

Touch **Cancel** to go back to the main screen without changing the Hold Time value.

Touch **Delete** to delete the previous keyed number.

Note:
Current:- (4) is the current programmed hold Time.

Range:- (5) is the minimum and minimum hold Time that can be programmed for the stage.

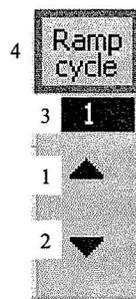


Time h:m:s	1:45	Cancel	-	Delete		
Current:-	2:50	4	7	8	9	
Range:-	0:0:0	> 9999:59:59	5	4	5	6
			1	2	3	
			:	0	.	Enter

Time Screen Menu

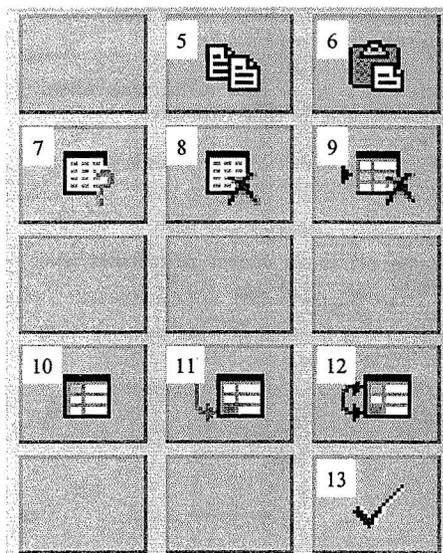
Ramp Table Edit

Use the Ramp Up (1) or Ramp Down (2) buttons to move the Ramp number (3) by one step. Use this to programme or edit different Ramp numbers with different Rate, Limit and Time parameters



Touch active area Ramp button (4) to activate the Ramp Table Edit menu. Touch the appropriate icons to:

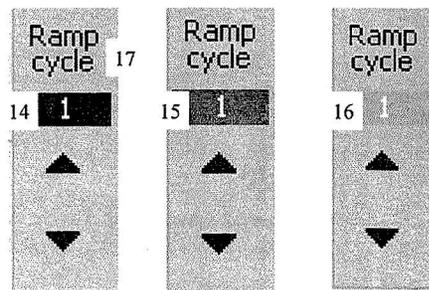
5. Copy the currently selected Ramp parameters
6. Paste Ramp parameters
7. Select Profile (1-3)
8. Delete Profile
9. Clear the current row
10. Select the Start Ramp
11. Select the End Ramp
12. Cycle continuously between the Start Ramp and End Ramp
13. Touch the 'confirm' (13) button to go back to the main screen



Note: A profile can have up to 100 Ramps. The Start Ramp and End Ramp will tell the T95 where to begin and stop within a profile.

Note: a profile will also stop on a row where the Rate = 0.

In the main menu screen, the selected Start Ramp number has a dark blue background (14), the selected End Ramp number has a red background (15) and the active row has a light blue background (16).



When the Cycle function is selected the word 'cycle' (17) appears in the main screen as shown.

Running a Profile

Touch the Start button (1) to start the profile and touch it again to stop the profile.

When the stage has reached a programmed temperature Limit (2) a countdown timer (3) with the programmed hold Time value will appear on the main screen and it will begin a countdown to zero. Touch the Pause button (4) to pause the countdown and touch it again to continue the countdown.

After counting down to zero, the Profile will move on to the next Ramp number with its set of parameters.

Touch the Heat Up button (5) or Cool Down button (6) to override the profile settings.

Use these two buttons to control the temperature of the stage manually. The heating and cooling Rate used will be the one currently displayed on the screen.

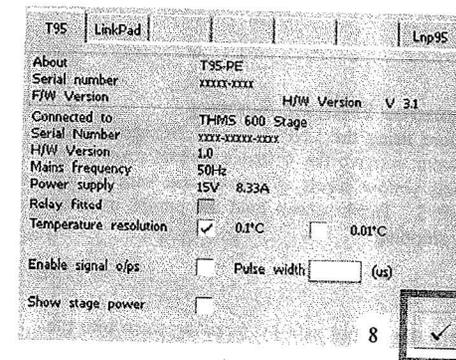
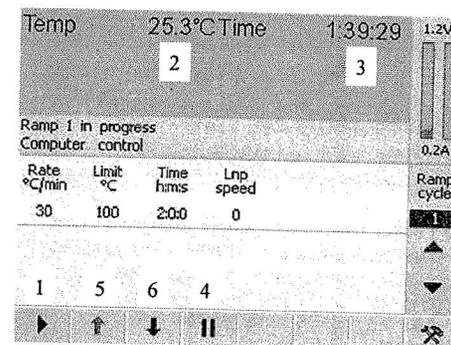
Setup Tab

Touch the Setup button (7) to go to the Setup Tab page.

The Setup Tab page shows information about various options available with the T95.

DO NOT make any changes in the Tab menu screen, unless asked to do so by Linkam Scientific Instruments Ltd.

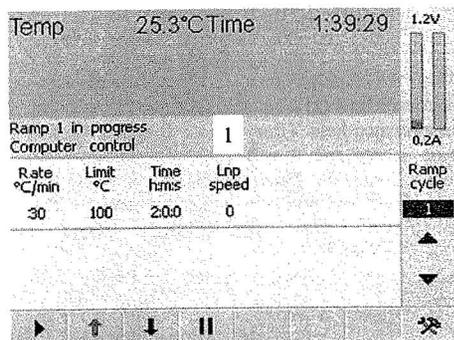
Touch the 'Confirm' button (8) to go back to the main menu.



T95 with LNP95 Option

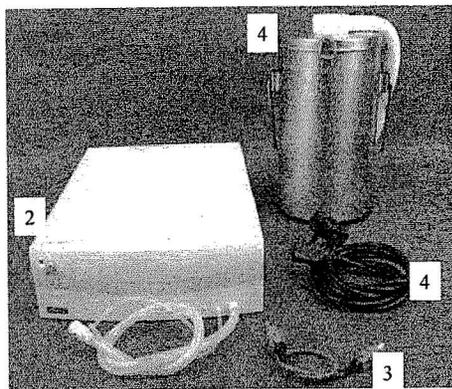
Only read the following if the LNP95 Liquid Nitrogen Cooling Pump System is supplied with the T95 System Controller.

The LNP95 System uses liquid nitrogen to cool the stage from ambient to -196°C . The speed of the LNP95 (1) is automatically controlled from 1 to 100 by the T95.



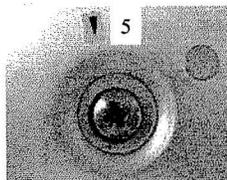
Please check that all of the following parts have been supplied with the LNP95.

2. LNP95 Liquid Nitrogen Pump
3. Instrument Bus Cable
4. Power cord
5. 2L Dewar (7L or 25L Dewar is available)



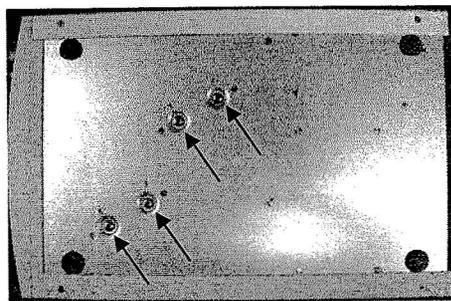
Remove Transit Screws

Before using the LNP95 Liquid Nitrogen Pump System, remove the 4 transit screws marked by small yellow labels (5), from the base of the LNP95. These screws hold the pumps in place for shipping.



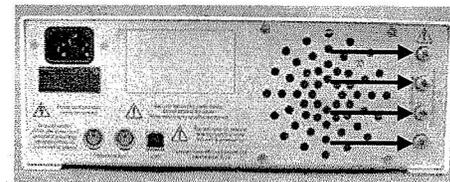
Keep the screws safe by screwing them into the holes on the back panel as shown by the arrows.

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



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

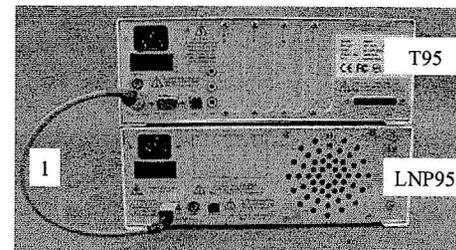


Back Panel Cable Connection

Connect the Instrument Bus Cable (1) between the LNP95 and T95 as shown.

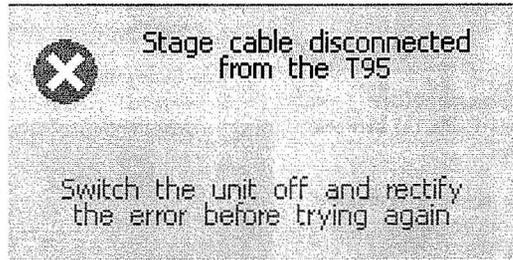
Note: either of the purple coloured Instrument Bus Sockets on the LNP95 can be used.

Note: **THE LNP95 MUST BE SWITCHED ON BEFORE THE T95.** This will enable the T95 System Controller to recognise the LNP95.



Troubleshooting

Error Messages



When an Error message window appears such as the one above, follow the suggestion to see if it solves the problem. If it does not, please contact Linkam Support Department.

Below is a list of possible Error Messages:

"Stage cable disconnected from the T95"

"Stage cable identifier error"

"Stage temperature sensor open circuit or overrange"

"Load power supply is incorrect for the stage type"

"Load power supply output voltage incorrect"

"The stage requires a relay fitted in the T95"

"The T95 has the wrong combination of option boards"

"Cable disconnected from one of the option boards"

"Incorrect cable connected to one of the option boards"

"Sensor open circuit or overrange on one of the option boards"

"The T95 unit fan is not working correctly"

"The LNP95 is reporting an error"

"There has been a communications error"

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