

# **T96 System Controller Manual**

**1.1.0**

## **USER GUIDE**

# Table of Contents

<b>Introduction .....</b>	<b>3</b>
<b>Important Notices .....</b>	<b>4</b>
Warranty .....	4
Technical Support.....	4
Feedback .....	4
<b>Safety Information .....</b>	<b>5</b>
Important Notice.....	5
Requirements for Safe Use.....	5
Caution Labels and Indicators.....	5
Handling Liquid Nitrogen.....	5
Filling the Dewar.....	6
Equipment Maintenance.....	6
<b>Informations de sécurité .....</b>	<b>7</b>
Note importante.....	7
Exigences en matière de sécurité d'utilisation.....	7
Étiquettes d'avertissement et indicateurs.....	7
Manipulation de l'azote liquide.....	7
Remplissage du vase Dewar.....	8
Entretien de l'appareil.....	8
<b>System Overview .....</b>	<b>9</b>
Connecting the T96 System Controller.....	10
Stage Connector .....	10
Linkpad Connector .....	10
Instrument Bus .....	10
Expansion Boards .....	11
High Temperature Stages.....	11
Stages with Vacuum Gauge.....	11
Pressure Stage (THMS600-PS).....	11
Stages with Motorised Vacuum Control (MV196).....	11
Stages with Motorised XY Movement (MDS600).....	11
Tensile Stage.....	11
DSC Stages .....	12
Comms Expansion.....	12
External Input and Output Sockets .....	12
USB Connector .....	12
<b>LNP96 Liquid Nitrogen Pump .....</b>	<b>13</b>
System overview.....	13
Handling Liquid Nitrogen.....	13
Filling the Dewar.....	13
Remove Transit Screws.....	14
Back Panel Cable Connection.....	14
<b>Declaration of Conformity .....</b>	<b>15</b>
<b>Technical Specifications .....</b>	<b>16</b>
<b>Equipment Ratings .....</b>	<b>18</b>

## Introduction

Thank you for purchasing your Linkam equipment, please take a moment to read this manual before setting up the equipment.

If you have purchased control software, please install the software first.

## **Important Notices**

### **Warranty**

This equipment has a warranty against defects in material and workmanship for a period of 12 months from the date of shipping. 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 below and on the back of this manual.

Tel: +44(0)1737 363 476

Email: [support@linkam.co.uk](mailto:support@linkam.co.uk)

### **Feedback**

Your feedback will be greatly appreciated, please email us directly [info@linkam.co.uk](mailto:info@linkam.co.uk)

## Safety Information

### Important Notice

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

***do not connect the power cord or switch the unit 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.

### Requirements for Safe Use

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. The mains cord set is the overall disconnect and must remain accessible.
7. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
8. 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.
9. 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.
10. The equipment is not intended to be used outdoors.
11. 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)

12. The power cord must be an appropriately rated and approved cord-set for the country it is being used in.
13. If any problems occur then remove the power cord from the mains outlet and contact Linkam Scientific Technical Support.
14. 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.
15. After servicing the safe state of the equipment must be checked.

### Caution Labels and Indicators

This safety symbol on the back panel warns the user :



Do not make or remove any connections while the unit is powered on.  
Do not 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:



To avoid electric shock the power cord protective grounding conductor must be connected to earth or ground.

### Handling Liquid Nitrogen

To cool samples below room temperature an LNP96 liquid nitrogen pump system is required. Always use liquid nitrogen in a well ventilated room as there is a danger of asphyxiation.

Refer to your health and safety officer regarding instructions on how to handle liquid nitrogen safely and ensure that you have the correct safety equipment including gloves and safety goggles.

### **Filling the Dewar**

Fill the Dewar approximately 2/3 full and replace the lid with the siphon attached, but do not fasten the catches. Wait for the liquid nitrogen to stop bubbling before fastening.

When the lid is removed always ensure you place it with the black capillary tube pointing upwards. It is easily damaged or creased which will impair N<sub>2</sub> flow and the performance of the system.

### **Equipment Maintenance**

The equipment does not require any regular maintenance. Contact Linkam should you require any maintenance.

Before cleaning the case or front panel of the equipment, 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.

## Informations de sécurité

### Note importante

Veuillez vérifier que votre appareil Linkam n'a pas été endommagé pendant le transport. S'il présente une trace quelconque d'endommagement aux éléments électriques:

***ne raccordez pas le cordon d'alimentation et n'allumez pas l'appareil.***

Contactez Linkam Scientific Instruments Ltd ou son distributeur désigné immédiatement. Votre garantie pourrait être réduite si Linkam n'est pas informée de tout dommage causé par le transport dans les 7 jours suivant la livraison.

### Exigences en matière de sécurité d'utilisation

1. Lisez ce guide intégralement avant d'utiliser l'appareil. Conservez ces instructions pour un usage ultérieur.
2. Suivez toutes les mises en garde et instructions marquées sur toute pièce de votre appareil, ou figurant dans les manuels.
3. Si pour une quelconque raison le fusible secteur doit être remplacé, il faut le remplacer par un fusible du même type et avec les mêmes caractéristiques nominales que celles indiquées dans les caractéristiques nominales de l'appareil.
4. Pour prévenir l'électrocution, n'enlevez pas le couvercle de l'appareil.
5. N'utilisez jamais l'appareil si le cordon d'alimentation a été endommagé. Ne laissez pas d'objets lourds appuyés sur le cordon d'alimentation. Ne posez jamais le cordon d'alimentation sur le sol.
6. Le secteur cordon est la déconnexion globale et doit rester accessible.
7. Si l'équipement est utilisé d'une manière non spécifiée par le fabricant, la protection fournie par l'équipement peut être altérée.
8. N'obstruez aucun des orifices de ventilation. N'essayez pas d'insérer quoi que ce soit dans ces ouvertures. Prévoyez un espace de ventilation adéquat d'au moins 75 autour de l'appareil.
9. N'exposez pas l'appareil à l'eau. Si pour une quelconque raison l'appareil est mouillé, retirez le cordon d'alimentation de la prise de courant et contactez le support technique de Linkam.
10. L'appareil n'est pas destiné à un usage à l'extérieur.
11. Chaque produit est équipé d'une fiche d'alimentation mise à la terre ou d'un cordon d'alimentation avec 3 fils à extrémité libre. La fiche ne s'insère que dans une prise de courant mise à la terre. Le cordon d'alimentation à extrémités libres doit être raccordé à une prise de courant à 3 fils correctement mise à la terre. N'empêchez pas le fonctionnement de la fiche mise à la terre. Les cordons d'alimentation à extrémité libre suivent les codes couleur suivants:

Couleur	Fonction
Marron	conducteur de phase
Bleu	conducteur neutre
Vert/jaune	mise à la terre

12. Le cordon d'alimentation doit être constitué d'un ensemble de câbles répondant aux caractéristiques nominales et approuvé dans le pays d'utilisation.
13. Si un problème survient, débranchez le cordon d'alimentation de la prise de courant et contactez le support technique de Linkam.
14. Il convient de NE PAS tenter quoi que ce soit pour réparer ou modifier l'appareil en aucune façon, dans la mesure où il n'y a aucune pièce remplaçable par l'utilisateur. Tout entretien doit être effectué par du personnel qualifié. N'enlevez le couvercle de l'appareil que si le cordon d'alimentation a été débranché de la prise de courant.
15. Après l'entretien de l'état de sécurité de l'équipement doit être vérifiée.

### Étiquettes d'avertissement et indicateurs

Ce symbole de sécurité sur le panneau arrière avertit l'utilisateur:



N'effectuez ou n'enlevez aucun raccordement quand l'appareil est sous tension.  
N'enlevez pas le couvercle.  
L'entretien doit être effectué exclusivement par du personnel qualifié.

Ce symbole de sécurité est visible sur le panneau arrière de l'appareil et avertit l'utilisateur:



Pour éviter l'électrocution, le conducteur de protection du cordon d'alimentation doit être raccordé à la terre.

### Manipulation de l'azote liquide

Pour refroidir les échantillons en dessous de la température ambiante, un système de pompe à azote liquide LNP96 est requis. Manipulez toujours l'azote liquide dans un local bien ventilé, car il présente des risques d'asphyxie. Référez-vous à votre agent de santé et sécurité en ce qui concerne les instructions sur la manière de manipuler l'azote liquide de façon sûre et assurez-vous de porter l'équipement de sécurité adapté incluant des gants et des lunettes de protection.

### **Remplissage du vase Dewar**

Remplissez le Dewar jusqu'à environ 2/3 et remplacez le couvercle par le siphon attaché, mais ne scellez pas les fixations. Attendez la fin du bouillonnement de l'azote liquide avant de sceller le Dewar.

Lorsque le couvercle est enlevé, assurez-vous de le déposer avec le tube capillaire noir pointant vers le haut. Il peut être facilement endommagé ou plié, ce qui affecterait le flux de N<sub>2</sub> et la performance du système.

### **Entretien de l'appareil**

L'appareil ne nécessite pas d'entretien régulier. Contactez Linkam si vous souhaitez procéder à un entretien.

Avant de nettoyer le boîtier ou le panneau avant de l'appareil, débranchez le cordon secteur de la prise de courant. Utilisez une petite quantité d'alcool isopropylique (IPA) sur un chiffon doux et frottez délicatement la surface.



## System Overview



The T96 System Controller is supplied with or without a LinkPad.

- T96-LinkPad: a stand alone system which uses a touch screen colour display to input data to control the stage but can also be used with the optional LINK software. Note: when connected to the PC the LinkPad cannot be used to enter ramp parameters but continues to display all the attached sensor values.
- T96-LINK: a PC interface which requires LINK software to input data to control the stage.

Please check you have received the following items:-

1. T96 System Controller
2. Power cord
3. USB Type A to B cable for PC control (Using the optional LINK software) and firmware upgrades

If you have purchased the LinkPad then please also check you have recieved the following:-

4. LinkPad

There are two types of system controller, the T96-P and T96-S.

### **T96-P**

Used for all Peltier stages

Peltier	
LTS 120	LTSE 120
LTSE 120 LC	LTS 120-Inverted
PE 120	PE 120-XY
PE 120-LI	PE 100-LI3
PE 100-LIL	PE 100-DMI
PE-NK120	PE100-NI
PE100NIF	PE-BX120
PE100-OI	PE-ZE120
PE100-ZI/200	PE100-ZI/100
PE100-ZI/25	PE100-ZAL

## T96-S

Used for all the resistance heater stages. Some of these include:-

Large Area		Large Area	
LTS 420	LTS 420E	LTS 420E	LTS 420E-Probe
LTS 350 (discontinued)	LTS 350E (discontinued)		

High Temperature		High Temperature	
TS 1500	TS 1000	TS 1200	TS 1400-XY
CCR 1000	HS 1500		

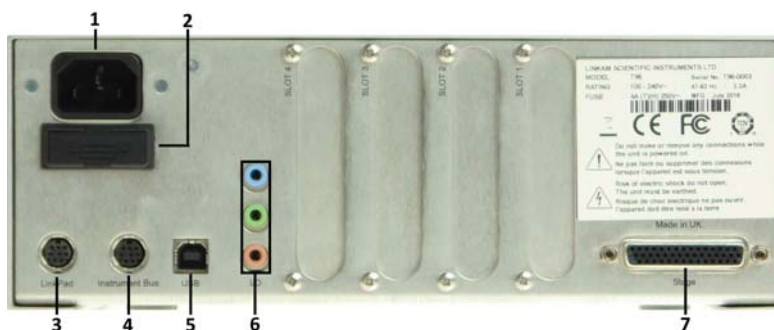
THMS series		HFS Series	
THMS600	THMS350V	HFS600	HFS600E-PB4
THMS600E	THMSEL600	HFSX350-GI	HFSX350-CAP
BCS196	FDCS196	HFS350V-PB4	

## Connecting the T96 System Controller

### Back Panel Cable Connections

**Warning:** To avoid any damage to your T96 it is essential that the unit is switched off before connecting or removing any connections.

- 1: Power socket
- 2: Fuse holder
- 3: LinkPad connector
- 4: Instrument Bus connector, for LNP96 Liquid Nitrogen pump System and/or RH95 Humidity controller.
- 5: USB connector
- 6: External input and output sockets.
- 7: Stage connector.



Refer to your stage manual for additional connection information.

### Stage Connector

Most of the standard silver block, large area stages and the Peltier stages do not require any expansion boards and only the stage needs to be connected to the socket marked Stage (7). This supplies power to the stage and measures the temperature using a platinum resistor sensor.

### Linkpad Connector

If you have purchased a LinkPad then plug it into the LinkPad connector (3).



### Instrument Bus

This connection is used for the LNP96 Liquid Nitrogen Pump and/or RH95 humidity controller. If your stage has been supplied with an LNP96 then a cable will have been provided which is used to connect the T96 to the LNP96 / RH95.



## Expansion Boards

Most of the standard silver block, large area stages and the Peltier stages do not require any expansion boards and only the stage needs to be connected to the socket marked Stage (7).

If you have purchased a LinkPad then plug it into the LinkPad connector (3).

For a PC connection use the supplied USB cable (or RS232 Null modem cable if you have the optional RS232 expansion board). NB: The use of USB communication for control is only supported with the optional LINK software. It may be supported by other 3rd party applications. Please contact the supplier to check.

Any of the stages which use an expansion board will be marked with the same label as the T96 expansion board.

**Warning: To avoid any damage to the T96, switch off before making any connections.**

## High Temperature Stages

Connect the cable from the stage marked TCS to the connector marked TCS on the rear of the T96.



## Stages with Vacuum Gauge

Connect the optional Pirani gauge to the connector marked VAC.



## Pressure Stage (THMS600-PS)

Connect the optional pressure gauge to the connector marked PRESSURE.



## Stages with Motorised Vacuum Control (MV196)

The MV196 motorised valve connects to the MOT VAC connector.



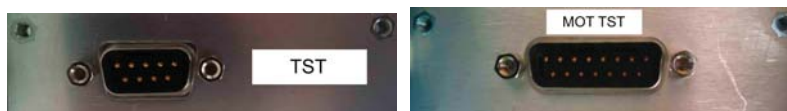
## Stages with Motorised XY Movement (MDS600)

The motorised stages require two motor control boards, one for each axis and are connected to the MOTX and MOTY connectors.



## Tensile Stage

The tensile stage requires two boards, one for the distance and strain gauge connections, the other for the motor control. Connect the MOT TST and TST connectors to the boards as marked.



### DSC Stages

Connect the cable from the stage marked DSC to the connector marked DSC on the rear of the T96.



### Comms Expansion

The optional comms expansion board is used to connect to the LINK application via a serial connection.

**Note:** This does not accept standard RS232 text strings and requires a Linkam driver.



### External Input and Output Sockets

There are three 3.5mm jack sockets (6) on the rear of the T96 for synchronising or controlling external equipment, see the relevant section for the electrical specifications. The LinkPad or optional LINK software can be used to program the outputs on a ramp by ramp basis.

### USB Connector

The USB connector is used for control of the system when used with the optional LINK software. The USB connector is also used for upgrading the firmware of the T96

## LNP96 Liquid Nitrogen Pump

You must read the following sections if the LNP96 Liquid Nitrogen Cooling Pump System is supplied with your system.

The LNP96 System uses liquid nitrogen to cool the stage from ambient to  $-196^{\circ}\text{C}$ . The speed of the LNP96 is automatically controlled from 1 to 100 by the T96.

### System overview

Please check that all of the following parts have been supplied with the LNP96 System.



1. LNP96 Liquid Nitrogen Pump
2. 2L Dewar (7L or 25L Dewars are available)
3. Power cord
4. Instrument Bus Cable for connection to the T96

**Warning:** Liquid Nitrogen can be dangerous. When using Liquid Nitrogen (LN) please ensure you follow the recommended handling and safety procedures. Please be additionally careful when using the equipment at low temperature. Sudden movements of the tubing or the siphon when it is at  $-196^{\circ}\text{C}$  can cause damage.

### Handling Liquid Nitrogen

To cool samples below room temperature an LNP96 liquid nitrogen pump system is required. Always use liquid nitrogen in a well ventilated room as there is a danger of asphyxiation.

Refer to your health and safety officer regarding instructions on how to handle liquid nitrogen safely and ensure that you have the correct safety equipment including gloves and safety goggles.

### Filling the Dewar

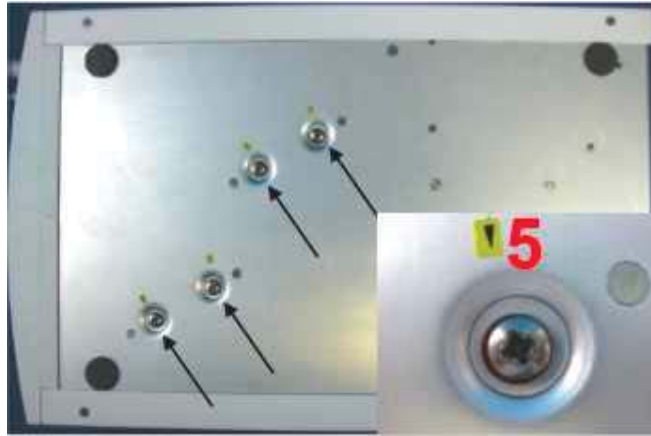
Fill the Dewar approximately 2/3 full and replace the lid with the siphon attached, but **do not fasten the catches**.

Wait for the liquid nitrogen to stop bubbling before fastening.

When the lid is removed always ensure you place it with the black capillary tube pointing upwards. It is easily damaged or creased which will impair N<sub>2</sub> flow and the performance of the system.

## Remove Transit Screws

Before using the LNP96 Liquid Nitrogen Pump System, remove the 4 transit screws marked by small yellow labels (5), from the base of the LNP96. These screws hold the pumps in place to avoid any damage in transit.



Keep the screws safe by storing them in the holes (6) on the back panel as shown by the arrows. Should the LNP96 be returned for service or repair, the screws **must** be removed from the storage holes and used to secure the pumps for transit (5).



## Back Panel Cable Connection

Connect the Instrument Bus cable between the T96 Instrument bus socket (1) and the LNP96 instrument bus socket (2)

**Note:** either of the black Instrument Bus sockets on the LNP96 can be used for this purpose



**THE LNP96 MUST BE SWITCHED ON BEFORE THE T96.**  
*This enables the T96 System Controller to recognise the LNP96.*

## 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, Liquid Nitrogen Cooling System, Linkpad

**Product Numbers:** T96-S, T96-P, LNP96-D, LNP96-S, Linkpad

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

EMC Directive 2014/30/EU using product standard EN 61326-1:2013  
Low Voltage Directive 2014/35/EU using product standard EN 61010-1:2010  
RoHS 2 Directive 2011/65/EU

**and also carries the additional certification:**

**EMC:** FCC CFR47 Part 15B:2015

**Safety:** CSA C22.2 No.61010-1 LB IEC61010-1 : 2010 / EN61010-1-2010

**Date:** 9th November 2016

**R&D Manager:** Peter Grocutt

A handwritten signature in black ink, appearing to read "Peter Grocutt".

## Technical Specifications

### T96 System Controller

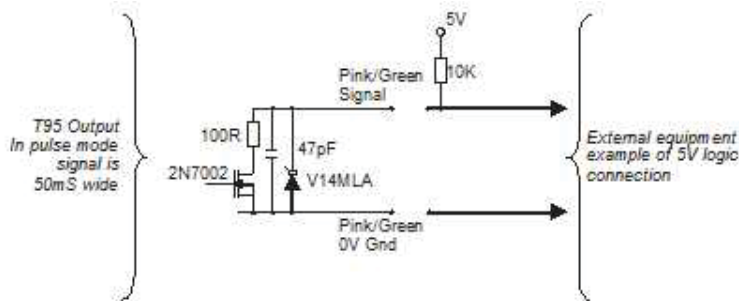
Dimensions:	376L x 243W x 87H (mm)
Weight:	2.6Kg (excluding cables)
Operating Environment:	5~40°C, 80% relative humidity at 31°C decreasing linearly to 50% at 40°C (without condensation)
Temperature Sensor:	Supplied with platinum resistor input as standard
Temperature Range:	-196°C to 750°C (dependent on Stage)
Temperature Resolution:	0.001°C resolution (dependent on Stage)
Temperature Accuracy:	0.05°C
Temperature Stability:	0.05°C
Set Point Resolution:	0.1°C

### USB Interface

USB Type B connector: Used for control using the optional LINK software application and for firmware upgrades

### External input and output sockets

Green 3.5mm stereo jack socket:	Open drain output. Will sink up to 50mA at 12V.
Pink 3.5mm stereo jack socket:	Open drain output. Will sink up to 50mA at 12V.
Blue 3.5mm stereo jack socket:	Logic level input from 3.3V to 5V.



### Optional LinkPad

Dimensions:	180 x 115 x 13 (mm)
Weight:	0.55Kg (excluding cables)
Operating environment:	5~40°C, 80% relative humidity at 31°C decreasing linearly to 50% at 40°C (without condensation)
Display Resolution:	800 X 480 pixels
Display Size:	7 inch
User Interface:	Touch screen

### Optional T96 Dual Thermocouple board

Thermocouple:	Type S
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 T96 Tensile board

20N Beam	Resolution: 0.001N
200N Beam	Resolution: 0.01N

### Optional T96 Vacuum board

Gauge:	Pirani gauge
Vacuum Range:	1x10 <sup>-3</sup> mB to 1268mB

Configured for pressure sensor

Sensor:	PX309 Omega
Output:	0 to 5V dc
Pressure Ranges:	0-20 bar 0-200 bar
Accuracy:	Other ranges may be possible Combined linearity, hysteresis and



repeatability +/-0.25% BSL

**Optional T96 DSC board**

**Optional T96 Stepper Motor board**

Motor Type: Bipolar Stepper Motor  
Motor Resolution: 256  $\mu$ Steps  
Digital Encoder: 24 bit  
End Stops: 2

**Optional T96 Comms Extension board**

Baud Rate: 115.2 KBaud  
Interface: 8 bit, 1 stop, no parity  
Useage: Interfaces to the LINK software

**LNP96 Liquid Nitrogen Pump**

Dimensions: 376L x 243W x 87H (mm)  
Weight: 3.6Kg (excluding cables)  
Operating Environment: 5~40°C, 80% relative humidity at 31°C  
decreasing linearly to 50% at 40°C  
(without condensation)  
Tubing: Silicon Rubber

## Equipment Ratings

### **T96-S**

A.C. Mains Supply:	100-240V at 47-63Hz	
Max current:	3.5A	
Fuse:	Current rating	4A
	Characteristic	T
	Voltage rating	250V~
	Breaking capacity	H

### **T96-P**

A.C. Mains Supply:	100-240V at 47-63Hz	
Max current:	3.5A	
Fuse:	Current rating	4A
	Characteristic	T
	Voltage rating	250V~
	Breaking capacity	H

### **LinkPad**

D.C Voltage:	12V
Max Current:	350mA

### **LNP96**

A.C. Mains Supply:	100-240V at 47-63Hz	
Max current:	3.5A	
Fuse:	Current rating	4A
	Characteristic	T
	Voltage rating	250V~
	Breaking capacity	H

*This page is intentionally blank*

Linkam Scientific Instruments Ltd

Tel: +44(0)1737 363 476

Fax: +44(0)1737 363 480

Email: [support@linkam.co.uk](mailto:support@linkam.co.uk)

Unit 8 Epsom Downs Metro Centre  
Waterfield, Tadworth, Surrey, KT20 5LR, UK  
[www.linkam.co.uk](http://www.linkam.co.uk)