FERROVAC

ULTRA HIGH VACUUM TECHNOLOGY

LSN1 – Controller for NEG Activation of NexTorr D100-5 and D200-5 pumps

Operating Instructions

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Important!

It is the sole responsibility of all users to carefully read the operating instructions and keep them safe. Read and follow all safety instructions carefully before using the product described in this document. Ferrovac declines any and all responsibility and liability for any damage/injuries resulting from incorrect use/adjusting/controlling or programming of the product.

Warranty

Ferrovac warrants this product to be free of defects in material and workmanship for a period of 24 months from the date of shipment. In case of proof of any defective parts in the product, we will at our option, either repair the product or replace it.

Warranty limitations

The warranty for this product does not apply to defects resulting from the following:

- Non-observance of operational- and safety instructions
- Natural wear of components
- Consumables
- Modifications to our products without our written consent
- Misuse of any product or part of the product

This warranty stands in place of all other warranties, implied or expressed, including any implied warranty of implied merchantability or fitness for a particular use. The remedies provided herein are buyer's sole and exclusive remedies.

Neither the company Ferrovac nor any of its employees shall be liable for any direct, indirect, incidental, consequential or special damages arising out of the use of its products, even if the company Ferrovac has been advised in advance of the possibility of such damages. Such excluded damages shall include but are not limited to: Costs of removal and installation, losses sustained as the result of injury to any person, or damage to property.

Copyright

1 General Information

This manual covers all important information about installation, commissioning and operation of your LSN Controller for non-evaporable getter (NEG) activation. It also provides important safety information, maintenance- and fault-finding procedures.

The product described was manufactured in accordance with the applicable national standards and guidelines. The information in this document represents the state of the product at the date of print. Technical changes may be made without further notice. Ferrovac makes no warranties or representations with respect to accuracy or completeness of the contents of this publication. Figures and photos are not binding. The product names used are for identification purposes and may be trademarks of their respective companies.

1.1 Designated Use

The product described in this document may only be used for its designated application. Designated use of the product is exclusively given if the following rules are obeyed:

- Product is used with original parts supplied by Ferrovac which are explicitly specified for the use with the product described in this publication
- In an indoor research laboratory environment or an industrial production or processing facility
- With all cabling connected and secured, if applicable
- By personnel qualified for operation of delicate scientific equipment
- In accordance with all related manuals.

Important!

Carefully read all safety instructions and all relevant manuals before using the product and any related equipment!

Non-designated use is given if the following is true:

- Product is used with other equipment not explicitly acknowledged by Ferrovac in writing
- Product is used outdoors or at ambient conditions exceeding the values given in the product specification
- Product is used by non-qualified persons
- Operation of the product in disregard of the safety instructions
- Operation of the product with disabled, modified, removed or damaged safety equipment and devices.

2 Terms and Symbols

Symbol	Term	Meaning
	**Danger!**	Risk of mortal danger when not observed
	**Warning!**	Risk of severe injury or danger to life when not observed
	**Caution!**	Slight risk of injury or damage to product when not observed
	**High voltage!**	Potentially lethal voltages are present
	**Cryogenic Substances!**	Potential cold burn hazard if safety precautions are not followed
	**Important!**	Important information for proper operation of the product
	**Info, hint!**	Useful hints, tips and clues

3 General Safety Information

Read the safety instructions very carefully. All safety precautions must be strictly observed at all times before using the product described in this manual and any associated instrumentation.

Study this document to learn how to operate your product properly. Keep this instruction manual in a save place close to the described product and inform all other users of the product. Always include this manual when handing the product over to third party persons.

Responsible body is the individual or group of persons that are responsible for the proper use and maintenance of the product, ensuring that the product is operated within its specifications and operating limits. The responsible body must ensure that users of the product are adequately trained.

Operators are using the product for its intended purpose. Users must be trained in electrical safety, handling of cryogenic liquids and adequate use of the instrument. They must be protected from electric shock and contact with potentially dangerous situations.

Maintenance Personnel perform routine tasks on the product to keep it in proper operating conditions i.e. setting up the line voltage or replacing consumables. Maintenance procedures are described in this manual and must be followed at all times.

Service Personnel are trained to work on live circuits and to work cryogenic liquids as well as perform fault-finding measurements and repair work to the product. Only fully trained service personnel qualified to handle potentially lethal voltages may perform servicing and repair.

Shock hazard: The American National Standards Institute states that a shock hazard exists when voltage levels are greater than 30 V RMS, 42.2 V peak or 60 VDC. A good safety practice is to assume that hazardous voltages are present in any unknown circuitry.

Warning!

- Always observe and strictly follow the safety notes and regulations given in this document
- Always use the originally delivered cables with the product for all electrical connections.
- Always switch off the device before disconnecting cables.
- Never operate the device outside its dedicated environment.
- DO NOT OPEN the device unless you fulfill the requirements of a fully trained service personnel and you are familiar with live circuits and potentially lethal voltages.

Warning: Potentially Lethal Voltages!

This Product operates at potentially lethal voltages of up to 230VRMS.
Any adjustment, fault finding procedure, installation and maintenance of the product described in this manual must be carried out only by authorized service personnel.

- In case of malfunction, immediately disconnect the unit from the mains power supply
- Do not touch any electrical terminals, connectors or wires
- Report damaged cabling immediately to service personnel
- Always wear electrically isolating safety shoes when performing maintenance

Important! Ambient conditions and environment:

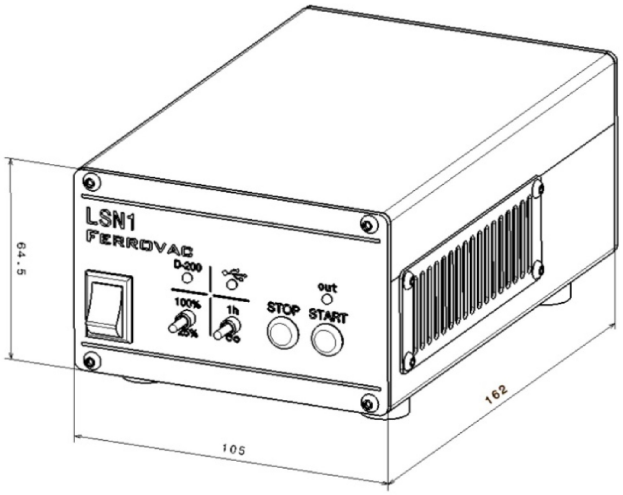
This product is only to be used indoors, in locations meeting the following requirements:

- Room temperature lies between 5°C/41°F and 40°C/104°F
- Humidity up to maximum of 80%
- Altitudes up to 2000m
- Pollution Degree 2 environments

4 About

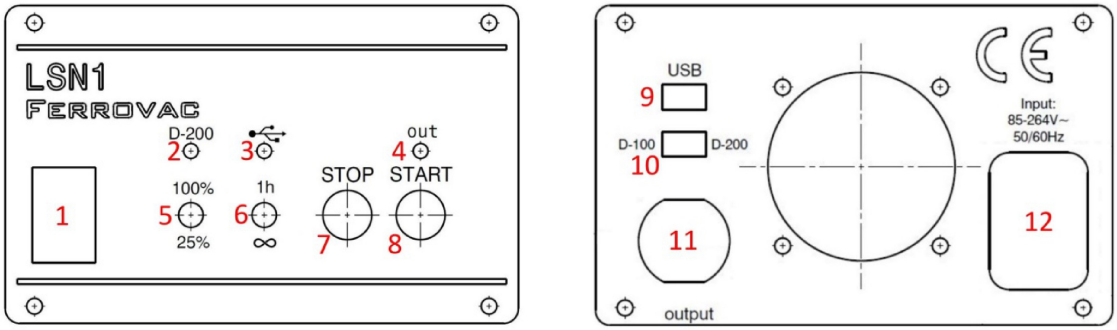
The LSN1 power controller provides predefined, timed activation and reactivation cycles for Non-Evaporable Getter (NEG) pumps. The LSN is designated and optimized to activate NEG elements used in the SAES NEXTorr® D100-5 and D200-5 series. SAES Capacitorr™ NEG-cartridges fulfilling the specifications can be activated with this unit as well.

4.1 Dimensions



(All dimensions in mm)

4.2 Panel Description and Connections



1. Mains Switch
2. Status LED (red) indicating D-200 Pump Selection
3. Status LED (red) indicating USB availability
4. Status LED (blue) indicating Power Output
5. Conditioning Mode Switch (25% or 100%)
6. Timed Activation Mode Switch (1h or ∞)
7. Power Output STOP Switch
8. Power Output START Switch
9. USB Connection
10. D-100/D-200 Pump selection Switch
11. Output Connector for Connection of NEG Element
12. Mains Power Input

4.3 Specifications

- **Input:**
  - Voltage: 90-260 VAC, 50-60 Hz

- **Ambient Conditions:**
  - Mains voltage fluctuations: ±10 %
  - Temperature: 5 °C to 40 °C
  - Relative humidity: maximum 80% for temperatures up to 31 °C, decreasing linearly to 5% relative humidity at 40 °C
  - Altitude: up to 2000 m

• **Power Output:**	**For D-100:**	**For D-200:**
○ Voltage:	+9 VDC (±5 %)	+12.5 VDC (±5 %)
○ Current:	5 A max	4.8 A max
○ Power:	45 W max	60 W max

- **NEG Reactivation Temperature:**
  - Conditioning Mode 100%: ~450 °C
  - Conditioning Mode 25%: ~350 °C

5 Unpacking and Inspection

Before unpacking, optically inspect the parcel. If damage is found, take pictures of the parcel and send them to Ferrovac immediately. Compare content with the delivery note. The package should contain the following products, but may vary upon specific customer requests:

1. LSN1 Power Controller for NEG Activation
2. This manual and any manuals of additional subunits, if applicable.

Any damage or missing item must be reported to Ferrovac **within 48 hours after arrival of the goods**.

5.1 Installation

Put the LSN on a solid table, such that it cannot fall down. When connecting any cables, ensure that they cannot become a tripping hazard for people working nearby or that anybody could tear down the LSN controller.

Controller Setup:

- Use the correct mains cable for your country and plug it into the C14 IEC Connector.
- Connect the power plug to a mains socket.

5.2 Connecting the NEG pump

Caution!

Only connect or disconnect cables when the device is switched off. Only use original cables supplied with the unit.

Make sure that the LSN is switched off. Connect the pump to the “Output” connector using the originally supplied cable. The cable must be fully intact.

6 Operation

6.1 Output Settings

On the backside of the controller, choose the presently connected pump model: D-100 or D-200 NEG pump. Depending on the setting, the controller will output a different voltage according to the specifications of the pump. In D-100 mode, the output will be +9 VDC (5 A max, 45 W). For the D-200 mode, the output will be +12.5 VDC (4.8 A max, 60 W). Once the mains switch is turned on, the D-200 LED on the front panel will light up when D-200 mode is selected.

6.2 Start-up

For starting the controller, switch on the mains switch on the front panel. The switch will light up red indicating that the controller is powered.

6.3 Conditioning Mode – 25% or 100%

Reactivation of the getter material is necessary when the pump was either exposed to air or when the pumping speed falls below acceptable limits. If the pump was exposed to air (or to any other large gas load), conditioning must be carried out at full power.

- D-100 Mode: In 100% Conditioning Mode, the supply delivers 9V/5A, full power 45 W
- D-200 Mode: In 100% Conditioning Mode, the supply delivers 12.5V/4.8A, full power 60W

If the reactivation needs to be carried out upon normal operation without previous exposure to air, the reactivation of the element can be carried out at lower temperatures (approximately 350-400 °C). In this case, it is recommended to choose a conditioning setting of 25%:

- D-100 Mode: In 25% Conditioning Mode, the supply delivers 4.5V/2.5A, 25% of full power
- D-200 Mode: In 25% Conditioning Mode, the supply delivers 6V/2.5A, 25% of full power

6.4 Timed Activation Mode – 1h or ∞

During the activation process, a heating cycle of at least one hour must be carried out. You can decide if the activation process should stop automatically after 1 hour (set to 1h), or if the activation process should be stopped manually (set to ∞).

6.5 Turning the Output ON and OFF

Caution!

Check vacuum & temperature conditions:
• Operate the device and its components only in the specified and described pressure and temperature range
• Too high temperature and/or reactive gas environment can lead to severe damage and injuries

Before turning the output on and starting the activation process of the NEG pump, you must always verify that the following settings are correct and that the NEG pump is under vacuum conditions better than $1x10^{-4}$ mbar:

- Pump mode selection (see 6.1 Output Settings)
- Output power selection (see 6.3 Conditioning Mode – 25% or 100%)
- Timer settings (see 6.4 Timed Activation Mode – 1h or ∞)

After verifying the correct settings, start the activation process by pressing the red START button for at least 5 seconds. Once the process starts, the green “out” LED will light up. If you have chosen the “1h timed activation” setting, the controller will automatically stop the activation process after 1 hour. In both cases where 1h or ∞ was chosen, the user can still manually interrupt or stop the activation process by pressing the “stop” button for at least 5 seconds.

7 Transport and Packing

During transport outside a laboratory environment for long distances, the device must remain switched off. The LSN can be carried by hand or in an appropriate package. The device must be protected from mechanical shocks and humidity.

8 Storage and Disposal

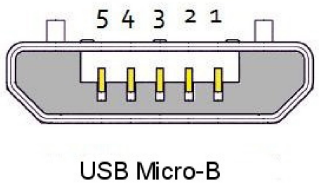
Before removing the cables, the LSN must be switched off. The device must be stored in a safe place where it cannot fall and the cables need to be gently coiled without making any kinks. At the end of lifetime of the unit, it must be disposed properly into electronic waste or be recycled at safely managed sites according to the local laws.

9 Connectivity

The LSN has a USB port that can be used for digital communication. Programmable aspects of this interface include:

- Baud Rate (9600)
- Data Bits (8)
- Parity (None)
- Stop Bit (1)

This means complete application programs can be realized on the drivers that can be executed independently without a higher-order controller.



USB Micro-B

1. Vcc (+5V)
2. D -
3. D +
4. NC
5. GND

Arduino Micro Driver: Plug in your board and wait for Windows to begin its driver installation process. If the installer does not launch automatically, navigate to the Windows Device Manager (Start>Control Panel>Hardware) and find the Arduino Micro listing. Right click and choose Update driver.

To control and readout the data of the LSN, any serial terminal emulator software (such as Tera Term or Putty) can be used.

9.1.1 Read Data

The controller is programmed in such a way that it sends a string of all information at all times. No command needs to be sent, only a readline command has to be performed. The data are separated with ",".

Response Format: "Current value in A, Voltage value in V, Power value in Watts."
Example: "4.8 A, 12.5 V, 60W"

10 Maintenance

There are no user serviceable parts inside the unit. For repair or maintenance, return the unit to Ferrovac. If immediate factory return is not possible, please contact Ferrovac for instructions.

11 Additional Information

11.1 Return of Defective Items

Ferrovac requires a completed declaration of contamination form and will issue an RMA (Return of Materials Authorization) form, before any items are factory returned. Please contact us beforehand. You will be given an RMA number and information on how to proceed with the return of defective items.

11.2 Downloads

The latest version of this manual can be downloaded from our website www.ferrovac.com. For any suggestions or questions concerning this manual, please don't hesitate to contact us.

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