

FERROVAC GMBH

ULTRA HIGH VACUUM TECHNOLOGY

LSA2 / LSA2.1 Battery Operated High Voltage Controller for Ion Gettering Pumps

Instruction Manual

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Warranty

Ferrovac GmbH warrants this product to be free of defects in material and workmanship for a period of 12 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

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Terms and Symbols

The information in this document represents the state of the product at the date of print. Technical changes may be made without notice. Ferrovac GmbH 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.



A triangle with exclamation mark indicates a passage in the manual with information that is crucial for the operator. **READ THESE PARAGRAPHS CAREFULLY** or the product might be damaged by misuse.



The high voltage symbol, if found on a product or accessory of a product, indicates voltages that are potentially lethal.

WARNING!

The **WARNING** heading in a manual explains dangers that may result in personal injury or death. Read the associated information always very carefully.

CAUTION!

The **CAUTION** heading in a manual explains hazardous situations that could damage the product. Such damage may invalidate warranty.

Normal Use

The product described in this manual must always be used:

- With original cable sets supplied by Ferrovac which are explicitly specified for the use with the product described in this publication
- With all cabling connected and secured, if applicable
- With all electronic equipment switched on after all cables are connected properly
- In an indoor research laboratory environment
- By personnel qualified for operation of delicate scientific equipment
- In accordance with all related manuals.



Warning: lethal voltages!!

Any adjustment, fault finding procedure, installation and maintenance of the products described in this manual must be carried out by authorized personnel, fully qualified to handle potentially lethal voltages.



CAREFULLY READ THE SAFETY INFORMATION AND ALL RELEVANT MANUALS BEFORE USING THE PRODUCT AND ANY RELATED INSTRUMENTATION!

Safety Precautions

The following safety precautions must be observed at all times before using the product described in this manual and any associated instrumentation.

The product described in this manual is intended for use by qualified personnel who recognize shock hazards and are familiar with the precautions necessary to avoid possible injury.

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 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 the manual and must be observed at all times.

Service Personnel are trained to work on live circuits and 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.

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

CAUTION! Always check for correct mains voltage before connecting any equipment.

WARNING! Lethal Voltages! Adjustments and fault finding measurements may only be carried out by authorised service personnel. Lethal Voltages may be present at parts of the instrument during operation.

1. Introduction

The LSA2 is a battery powered ion pump controller, which under correct conditions allows an operation of the ion pump without mains power supply for about **60h**. A rechargeable NiMh battery pack is used for energy storage.

The LSA2 controller is designed to operate the following types of ion pumps:

- Diode ion pumps (requires positive output polarity)
- Triode ion pumps (requires negative output polarity)

CAUTION:

Please note that the polarity has to be specified upon ordering and cannot be changed by the customer.

2. Unpacking and Inspection

Prepare a sufficiently clean workspace. Carefully unpack the device and perform a visual check for any damage of the package, its contents and accessories. Compare the contents of the package with the delivery note. Any damage or missing items must be reported to Ferrovac within 48 hours after delivery.



Note for devices delivered before June 2014:

Avoid physical shocks. The batteries of the LSA2/LSA2.1 are held in place by leaf spring contacts. Displacement of the batteries can lead to electrical short circuits and irreparable damage of the device. If one senses loose parts in the case, contact us for further procedure.

3. Setup and Installation

3.1 Installation

Installing the battery charger:

- The LSA2 must be charged using the delivered 12V ± 3% power adapter
- Make sure the correct mains connector is installed to the battery charger
- Connect the battery charger to a suitable mains socket
- Connect the cable with the connector to the LSA2 power input socket [FIG1 (6)]

3.2 Controller power management

Before using the Ion Pump controller, the internal battery must be charged for approximately 5h. The fully charged controller will run for **60h** (55h for the LSA2.1) on internal battery supply.

The battery lifetime, with correct charging and discharging, is approximately 1000 cycles.

3.3 Installing the Ion Pump

Connect the pump to the H.V. output connector using a high voltage cable with the correct SHV coaxial connector.

4. Electrical Connections and Startup

The LSA2 controller front and rear panel controls are shown in the following figures:

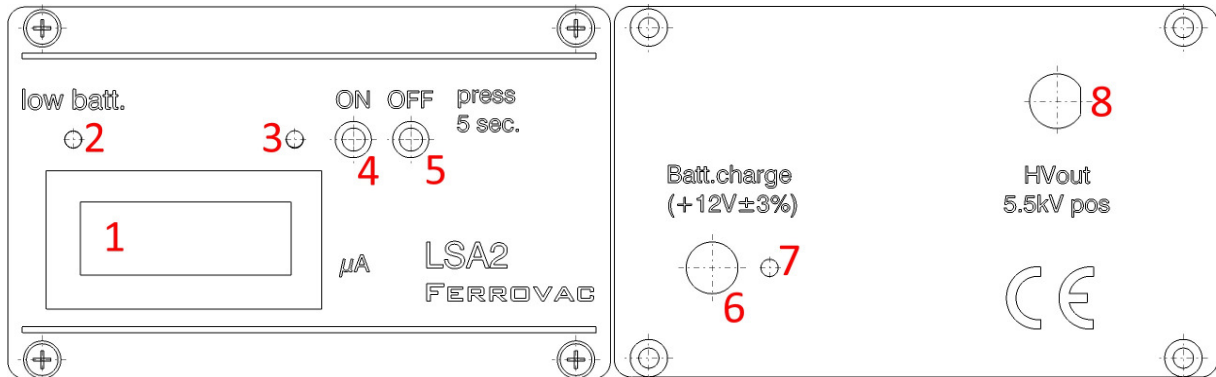


FIG1: LSA2 FRONT

- | | | | |
|---|----------------------------------|---|--|
| 1 | Pumping current in μA | 6 | Controller power entry connector |
| 2 | Batter low LED | 7 | Charging power LED |
| 3 | High voltage LED | 8 | High voltage output connector
(HUBER&SUHNER SHV type) |
| 4 | Controller power on switch | | |
| 5 | Controller power off switch | | |

4.1 Controller start-up

Before starting the controller you must reassure the following:

- The H.V. output polarity selection (factory defined) is correct for the connected pump
- An Ion Pump is connected
- Vacuum conditions are sufficiently good to run the Ion Pump (see Ion Pump specifications)

The LSA2 controller output is short circuit proof. Current overload $>20\mu\text{A}$ will result in an approximately linear decrease of the output voltage.

For starting the controller, press and hold controller power on switch [FIG1 (4)] for 5 seconds.

4.2 Controller shutdown

For shutting down the controller press and hold the controller power off switch for 5 seconds. The high voltage at the output connector will decrease to a harmless level after approximately 1 minute, depending on the load current.

4.3 Low battery

When the controller detects a low battery voltage it will begin to beep incessantly and the red LED [FIG1 (2)] turns on. There will be remaining battery power for about 3h.

4.4 Maintenance

With time of use, the battery storage capacity will decrease. The battery should be replaced after a period of 1000 charge/discharge cycles, as the number of discharge and charge cycles has an effect on the lifetime. Please return the controller for a battery swap to Ferrovac GmbH. If this is not possible please contact Ferrovac GmbH for battery swap instructions.

4.5 Display ion current

Basically the display shows the measured value of the ion current in μA . If the display reads "0.00 μA ", the ion current is out of range (underrange: i.e. vacuum $<1\text{E}-10$ mbar) or the high voltage cable is not connected to the device. "1. μA " on the other hand means overrange (i.e. vacuum $>1\text{E}-7$ mbar). Ion current to pressure data are valid for SAES™ NexTorr pumps of the types D100-5, D200-5, D300-5 and D500-5.

4.6 LSA2 vs. LSA2.1

When ordered a LSA2.1, basically the LSA2 is equipped with an additional printed circuit board (PCB) which allows an ion current measurement down to 1nA. The next digit on the display is enabled and reads "0.000 μA " in case of underrange (i.e. vacuum $<1\text{E}-11$ mbar) or if the high voltage cable is not connected to the device such as "1. μA " in case of overrange (i.e. vacuum $>1\text{E}-7$ mbar).

5. Specifications

Pump capacity:	Diode or triode ion pumps with a load current $< 20\mu\text{A}$ Please refer to the current to pressure diagram of the pump manufacturer
Input:	
Voltage	+12V DC ($\pm 3\%$)
Output:	
Voltage	5500V (refer to FIG5)
Current	max. $20\mu\text{A}$ (refer to FIG6)
Source resistance	$70\text{M}\Omega$
Battery:	
Type	NiMh
Discharge time LSA2.0	~60h @ $5\mu\text{A}$ (refer to FIG3)
Discharge time LSA2.1	~55h @ $5\mu\text{A}$
Charging time	8h
Battery life span	1000 cycles
Operation Temperature	0°C to 40°C
Output connector	Huber & Suhner SHV connector
Charging device	
Input	100V-240V $\sim 50/60\text{Hz}$

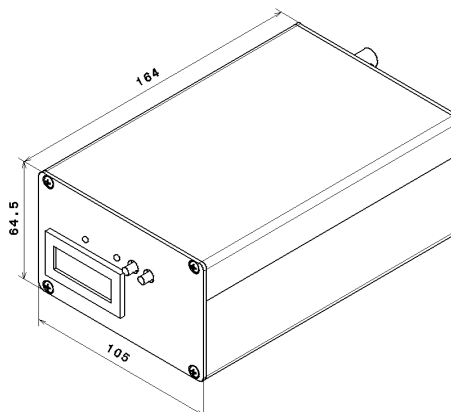


FIG2: LSA2 DIMENSIONS

5.1 Battery discharge

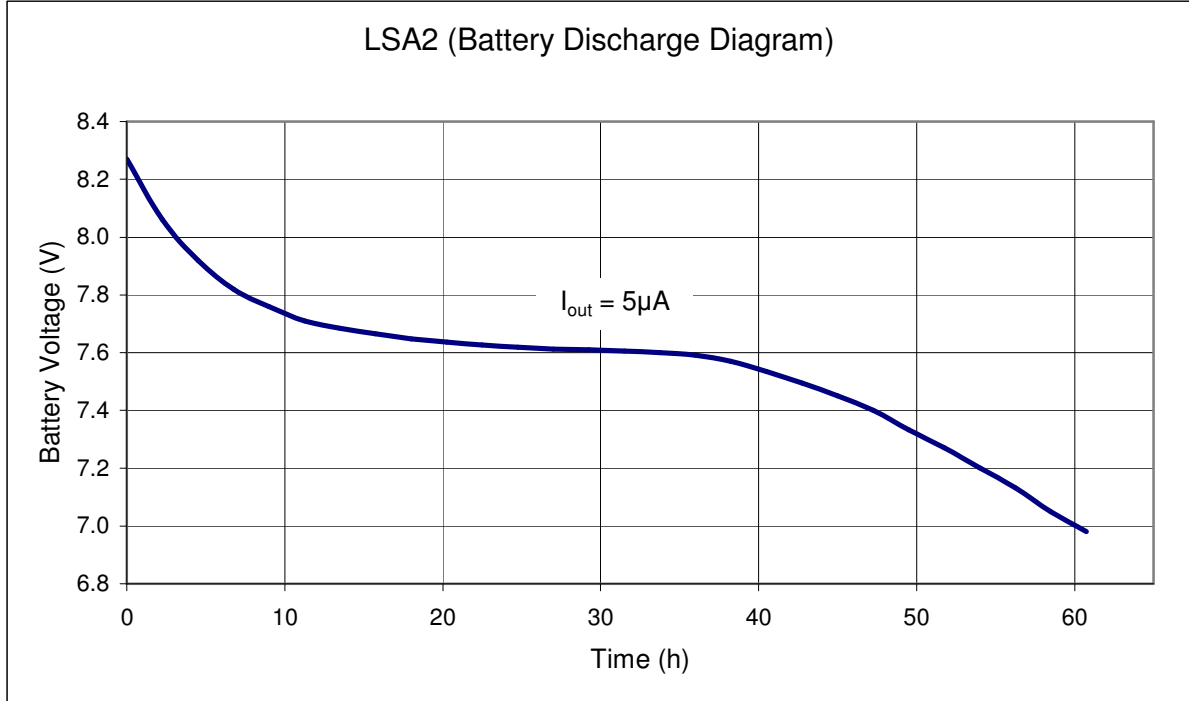


FIG3: BATTERY DISCHARGE

5.2 Battery charge

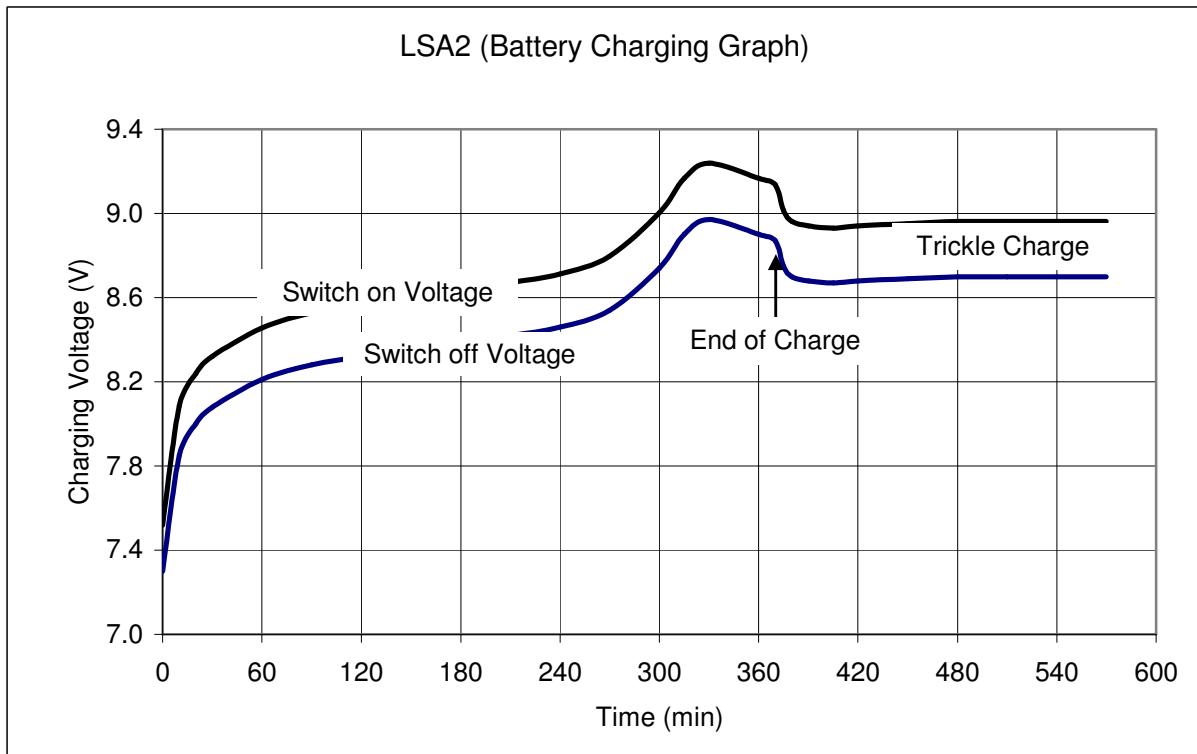


FIG4: BATTERY CHARGE

5.3 Output voltage

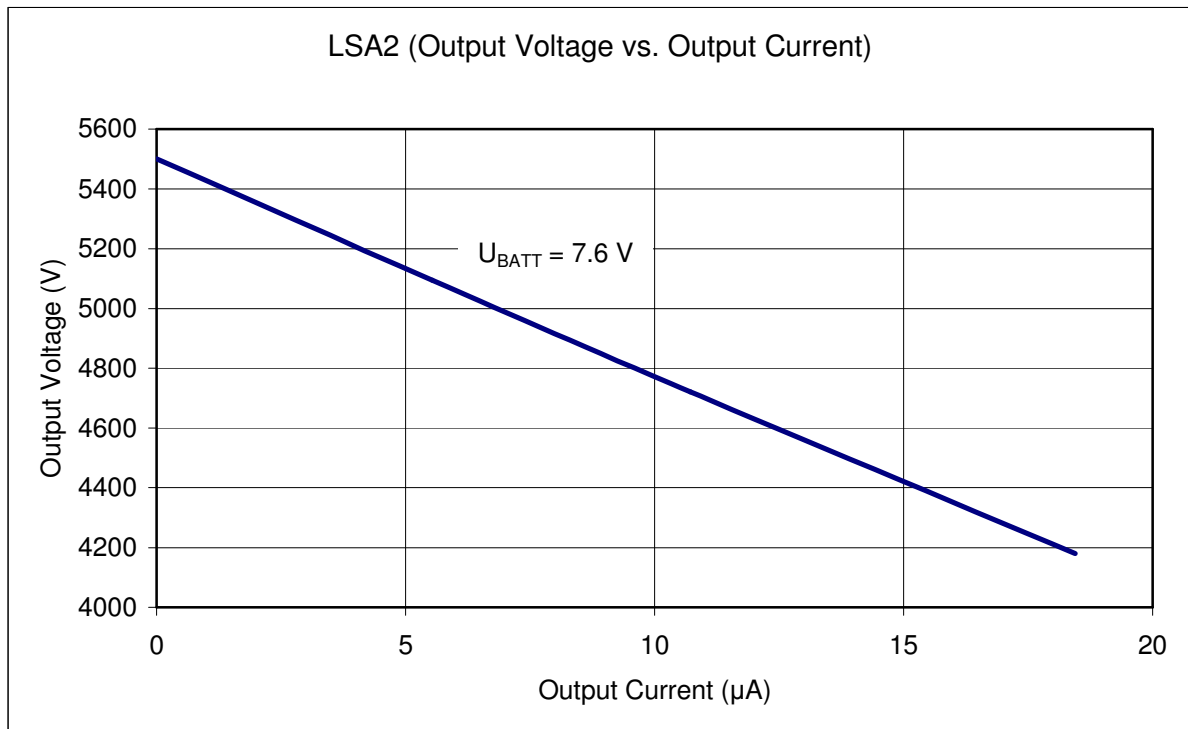


FIG5: OUTPUT VOLTAGE

5.4 Current display

The output current of the LSA2 display in micro amps. When HV is switched on and an ion pump is connected, the ion current is displayed. Pump current is directly proportional to the pressure in the vacuum system. The diagram [FIG7] provides the current to pressure conversion curve of the following pump models:

SAES™ NexTorr pumps:

- D100-5
- D200-5
- D300-5
- D500-5

For other ion pump models, please refer to their manual.

Current value specifications LSA2.0: 20µA - 10nA

Current value specifications LSA2.1: 20µA - 1nA

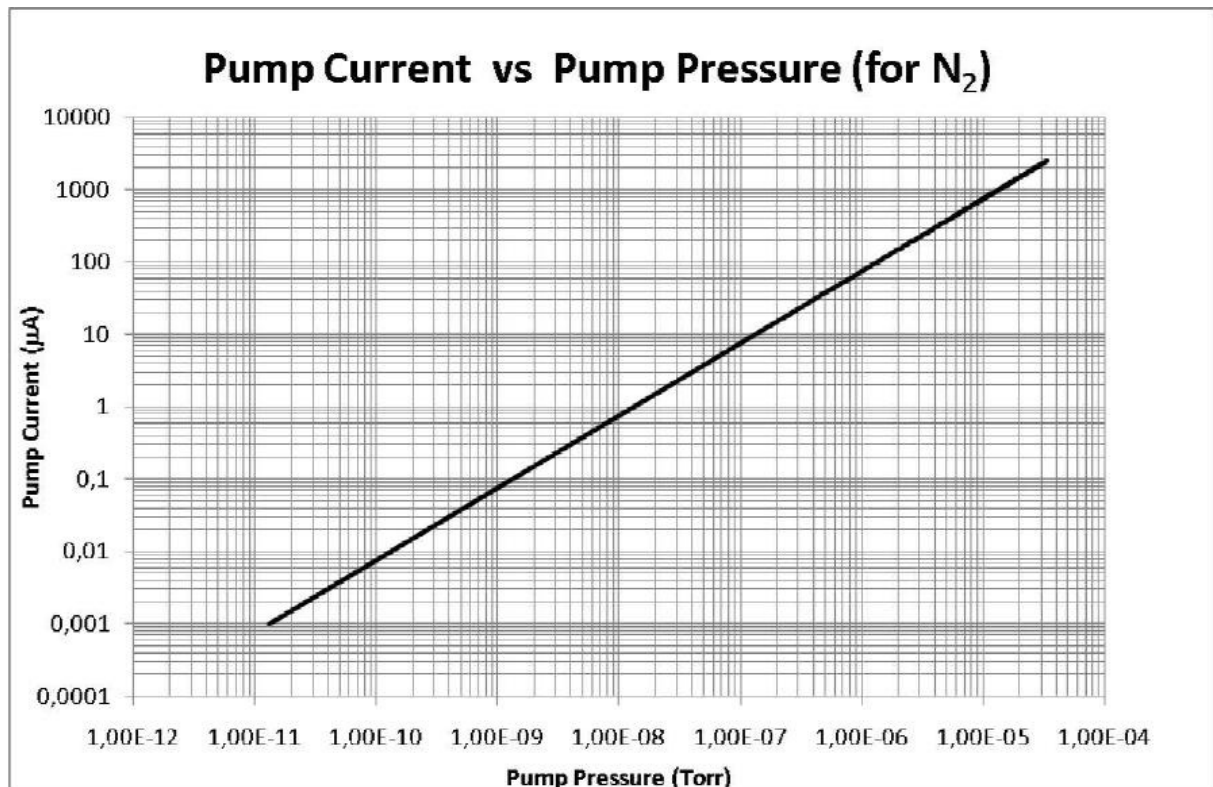


FIG6: PUMPING CURRENT