LDetek

LDRPS

USER'S MANUAL

GAS RECOVERY AND PURIFICATION SYSTEM

LDRPS

Gas recovery and purification system

USER'S MANUAL
V1.0

Printed in Canada

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1. Forewarning

All users must read this manual before installing, operating, or servicing the **LDRPS Helium Recovery and Purification System**.

This manual contains important information for the safe installation, operation, shutdown, maintenance, and troubleshooting of the LDRPS. LDetek assumes that all operators and service personnel have reviewed and understood this information before using the system.

The LDRPS is designed to recover helium from gas chromatograph exhaust streams, purify the recovered helium through external purification modules, and return the purified helium to the connected GC system or systems. The LDRPS must be installed and operated according to the configuration supplied with the instrument.

If an error, inconsistency, or unclear instruction is found in this manual, please contact LDetek before proceeding. LDetek reserves the right to make changes to future editions of this document without prior notice.

Thank you for choosing LDetek as your helium recovery and purification system supplier.

2. Warranty, maintenance, and service policies

Goods and part(s) (excluding consumables) manufactured by the seller are warranted to be free from defects in workmanship and material under normal use and service for **twelve (12) months** after installation and start-up and not exceeding **eighteen (18) months** from shipment date. Consumable, chemical traps, O-rings, etc., are warranted to be free from defects in workmanship and material under normal use and service for a period of **ninety (90) days** from the date of shipment by the seller. Goods, part(s) proven by the seller to be defective in workmanship and/or material shall be replaced or repaired, free of charge, F.O.B. Seller's factory provided that the goods, part(s) are returned to Seller's designated factory, transportation charges prepaid, within the twelve (12) months after installation and start-up and not exceeding 18 months from shipment date. In the case of consumables, within the ninety (90) days period of warranty, a defect in goods, part(s) and consumable of the commercial unit shall not operate to condemn such commercial unit when such goods, part(s) and consumable are capable of being renewed, repaired or replaced.

The Seller shall not be liable to the Buyer, or any other person, for the loss or damagedirectly or indirectly, arising from the use of the equipment of goods, from breach of anywarranty, or any other cause.

ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED ARE HEREBY EXCLUDED.

IN CONSIDERATION OF THE HEREIN-STATED PURCHASE PRICE OF THE GOODS, THE SELLER GRANTS ONLY THE ABOVE-STATED EXPRESS WARRANTY. NO OTHER WARRANTIES ARE GRANTED INCLUDING, BUT NOT LIMITED TO, EXPRESS AND IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESSFOR A PARTICULAR PURPOSE.

THIS WARRANTY IS THE ONLY WARRANTY MADE BY LDETEK INC. FOR THE GOODS DELIVERED HEREUNDER, AND NO EMPLOYEE, REPRESENTATIVE OR OTHER PERSON OR ENTITY IS AUTHORIZED TO ASSUME FOR LDETEK INC ANY OBLIGATION OR LIABILITY BEYOND OR AT VARIANCE WITH THIS WARRANTY IN CONNECTION WITH THE SALE OF LDETEK PRODUCTS.

Limitations of Remedy. SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF WARRANTY SHALL BE LIMITED TO REPAIR OR REPLACEMENT UNDER THE STANDARD WARRANTY CLAUSE. IN NO CASE, REGARDLESS OF THE FORM OF THE CAUSE OF ACTION, SHALL THE SELLER'S LIABILITY EXCEEDS THE PRICE TO THE BUYER OF THE SPECIFIC GOODS

MANUFACTURED BY SELLER GIVING RISE TO THE CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY EXTEND TOINCLUDE INCIDENTAL OR CONSEQUENTIAL DAMAGES. CONSEQUENTIAL DAMAGES SHALL INCLUDE BUT ARE NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS, LOSS OF USE, LOSS OF REVENUE, COST OF CAPITALAND DAMAGE OR LOSS OF OTHER PROPERTY OR EQUIPMENT. IN NO EVENTSHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE AND/OR THIRD-PARTY CLAIMS COVERED BY UMBRELLA INSURANCE AND/OR INDEMNITY COVERAGE PROVIDED TO THE BUYER, ITS ASSIGNS, AND EACH SUCCESSORINTEREST TO THE GOODS PROVIDED HEREUNDER.

Major force. The seller is not liable for failure to perform due to labour strikes or actsbeyond the seller's direct control.

SERVICE POLICY

1. If a product should fail during the warranty period, it will be repaired free of charge. Forout-of-warranty repairs, the customer will be invoiced for repair charges at current standard labour and materials rates.

2. Customers who return products for repairs, within the warranty period, and the productis found to be free of defect, may be liable for the minimum current repair charge.

3. For parts replacement, the original part must be returned with the serial and model numbersof the analyzer. **NO PART WILL BE SHIPPED IF THE ORIGINAL IS NOT SENT BACK TO LDETEK INC.**

RETURNING A PRODUCT FOR REPAIR

Upon determining that repair services are required, the customer must:

- Obtain an RMA (Return Material Authorization) number.
- Supply a purchase order number or other acceptable information.
- Include a list of problems encountered along with the name, address, telephone, and RMAnumber.
- Ship the analyzer in its original crating or equivalent. Failure to properly package the analyzer will automatically void the warranty.
- Every gas connection must be capped with appropriate metal caps. Failure to do so will automatically void the warranty.
- Write the RMA number on the outside of the box.
- Use an LDetek-approved carrier. Also, the delivery must be sent to LDetek facilities. LDetek will not accept airport-to-airport delivery.
- LDetek will not cover the transportation fees.

Other conditions and limitations may apply to international shipments.

PROPRIETARY RIGHTS

Buyer agrees that any LDetek's software, firmware and hardware products ordered or included in the goods ordered are proprietary of LDetek. No change, modification, defacement, alteration, reverse engineering, neither software de-compilations nor reproductions of such software or hardware products, or disclosures of programming content to other parties are authorized without the express written consent of LDetek.

To maintain LDetek's trade secret and other proprietary protection of such software and firmware, such items are not sold hereunder but are licensed to the buyer.

LDetek Inc. reserves the right to interrupt all business relationships and warranty or service if there is any tentative from any customers to reverse engineering any of LDetek productsor to tamper with any sealed module.

Trademarks and product identification as LDRPS are the property of
LDetek Inc. and shall be used only in connection with LDetek's products. No third party could remove or deface any model number or marks.

3. Declaration of conformity

EU Declaration of Conformity

1. **Product model:** LDRPS

2. **Name and address of the manufacturer:**

LDetek Inc.
990 Monfette E.
Thetford Mines, QC G6G 7K6
+1 (418) 755-1319
Email: info@ldetek.com

This product is in conformity with the following EU Directives ,Standard(s) or Normative Document(s):

3. **Directives.**

- in compliance with electromagnetic compatibility directive 2014/30/EU as part of the requirements leading to the CE marking
- in compliance with FCC part 15 subpart B
- in compliance with ICES-003

4. **Standards:**

The essential requirements of the directive 2014/30/EU are covered by the following harmonized standards:

- EN IEC 61000-6-4 (2019) – *Generic standards – Emission for industrial environments*
- EN IEC 61000-6-2 (2019) – *Generic standards – Immunity for industrial environments*

5. **On behalf of the above-named company, I declare that under our sole responsibility, on the date that the equipment accompanied by this declaration is placed on the market, it conforms with all technical and regulatory requirements of the above listed EU Directives.**

Dany Gagné / CTO
Thetford Mines, QC
Date: 08/24

4. Specifications

Operating temperature range:	• 5-55 °C
Sample gas temperature:	• 0-100 °C
Recycling gas flow rate capacity:	• 0-2000 sccm (0-2 LPM)
Purification device:	• LDCryo Cryogenic trap system (External to the LDRPS)
Gas collecting pressure range:	• 0-20 psig (sub athmospheric available)
Outlet pressure:	• 20-110 PSIG (other carrier pressure available on request)
Inlet fittings:	• 1/4" Swagelok compression or VCR
Outlet fittings:	• 1/4" Swagelok compression or VCR
Options:	• Modbus, Profibus
Supply:	• 120VAC/240VAC, 50/60 Hz
Enclosure type:	• 6U Rackmount
Ingress protection:	• IP20 in accordance with IEC 60529
Enclosure finish:	• RAL7030 powder coat
Certification:	• In compliance with EMC directives : IEC 61000-4-3: 2020, IEC 61000-4-6: 2013, IEC 61000-4-2: 2008, IEC 61000-4-4: 2012, IEC 61000-4-5: 2014 A1: 2017, IEC 61000-4-8: 2009, IEC 61000-4-11: 2020 for immunity & CISPR 32: 2015 A1: 2019, FCC Part 15, Subpart B: 2021, CISPR 32: 2015 A1: 2019, FCC Part 15, Subpart B: 2021 for emissions.

5. Installation

5.1. System

The LDRPS manages the recovery, compression, pressure control, storage, and routing of recovered helium. The recovered helium is then sent to the external LDCryo and external purifier before being returned to the GC system.

The LDRPS includes the following main internal functions:

1. **Helium recovery**
   The bellows assembly collects helium from the GC exhaust without creating excessive backpressure or pressure fluctuations at the GC outlet.
2. **Gas compression**
   The double-stage pump compresses the recovered helium to the required operating pressure.
3. **Gas storage and pressure stabilization**
   The internal pressure tank stores recovered helium and helps maintain a stable supply pressure to the downstream system.
4. **Moisture protection**
   The LDRPS includes an internal moisture trap to help protect the recovery system and downstream purification equipment.
5. **Pressure control and safety**
   Pressure regulators, electronic pressure sensors, electronic valves, and check valves control the gas flow and protect the system from incorrect pressure conditions.
6. **Backup helium supply management**
   A backup helium source must remain connected to maintain GC carrier gas supply during start-up, shutdown, purging, or when the recovered helium flow is insufficient.

5.2. Start-up

To ensure the proper start-up of the LDRPS, it is important to follow the steps below. All LDetek products are carefully packaged in a sturdy cardboard box, and each instrument is accompanied by a USB drive containing relevant documentation. If you require any assistance, please do not hesitate to contact us at support@ldetek.com.

1. Carefully unpack the LDRPS and inspect the system for visible shipping damage.

2. Confirm that the supplied documentation, USB drive, accessories, fuse kit, and power cable are present.

3. Choose whether to install the unit on a table or mount it on a rack. If mounting on a rack, refer to section 8 for panel cutout drawings and to determine the required space.

4. Refer to the typical installation diagrams in Section 5.4 for the proper gas connections to the unit. The gas connections are customizable depending on the configuration and the application in which the LDRPS is used. Also refer to the operating parameter sheet and installation diagram supplied with the instruments to ensure proper installation.

5. For systems with LDCryo, confirm that its trap is installed outside the liquid nitrogen Dewar during the initial purge. The trap must remain warm and outside the liquid nitrogen until helium purge through the trap has been completed. Please refer to the LDCryo user manual for the proper installation procedure.

6. Confirm that the backup helium source is connected, open, and regulated to the required supply pressure for the connected GC system.

7. Power on the LDRPS.

8. Place the LDRPS in purge mode by clicking on the "Manual Purge" button on the top panel.

9. Set the LDRPS outlet pressure to the desired value, by using the pressure regulator know on the back panel.

10. Purge the LDRPS recovery path using the recovered gas. Allow the system to purge during 10 cycles. The cycle number are displayed beside the pump symbol in the process menu.

11. Switch the LDRPS to automatic mode.

12. After the LDCryo has been properly purged with helium, carefully insert the trap into the liquid nitrogen Dewar according to the LDCryo user instructions.

13. Power on the LDP1000/LDP2000 purifier.

14. Verify that the GC carrier gas supply remains stable and that there are no active LDRPS, LDCryo, purifier, or pressure alarms.

The system is ready for normal operation when the LDRPS is recovering helium, the backup helium source is available as needed, the LDCryo and external purifier are online, and the GC carrier gas supply pressure is stable.

5.3. Shut-off

If the LDRPS must be physically removed from the installation, the connected GC system must first be shut down according to the GC manufacturer's shut-off procedure.

After the GC shut-off procedure has been completed:

1. Confirm that the GC carrier gas flow is safely stopped.
2. Close the backup helium source.
3. Disconnect the backup helium source from the LDRPS.
4. Depressurize the LDRPS and connected lines.
5. Disconnect the LDRPS gas connections.
6. Cap all open gas ports with appropriate caps to prevent contamination.

The LDRPS must not be physically removed while it is required to maintain carrier gas supply to the GC system.

5.4. Typical diagrams

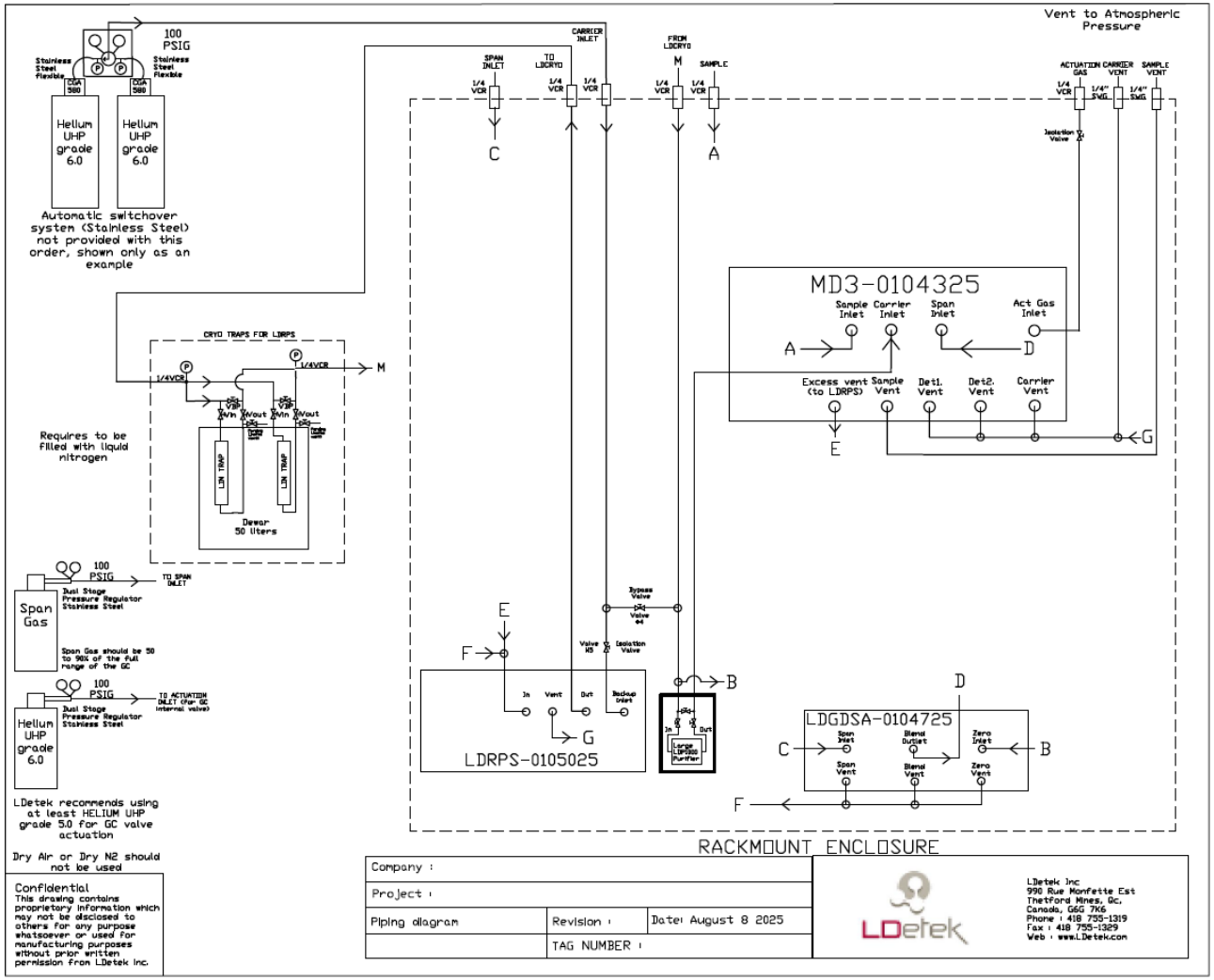


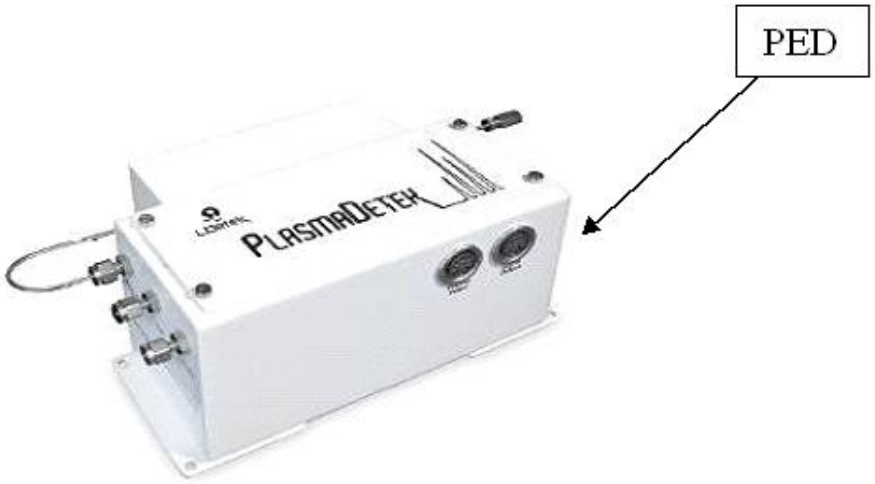
Figure 1: Typical Installation diagram

6. Hardware description

This section explains the function and design of each critical component of the LDRPS.

6.1. Detector

The **PED** detector module is a 155 mm (6.1") x 82 mm (3.22") x 63 mm (2.48") box that contains all components to measure the trace nitrogen and humidity using the micro plasma emission technology. When supplied, the optional PED monitoring module is installed after the recovery and purification system. This detector is mounted after the recovery and purification system to validate the purity of the gas recovered. If the continuous measurement is out of the specifications, then, an alarm is activated to advise that the purification system is in error.



When equipped with the optional PED monitoring module, the LDRPS can monitor the purity of the gas produced by the recovery system. The use of the PED sensor mounted after the purification system ensures the correct measurement of the trace impurities of the purified gas. The detector is compatible with noble gases purification for the analysis of trace N2 and trace H2O in Argon or Helium (Neon/Xenon/Krypton versions are also possible)

The PED operates on the principle of spectroscopic emission. A pure quartz cell is placed in an electromagnetic field generated by a specific high-intensity generator. This electromagnetic field creates plasma, which emits light at different wavelengths. By using appropriate optical filters, the detector can detect the desired impurities. One of the key benefits of the PED is its ability to offer a selective mode based on the spectral line used to measure specific impurities, providing both selectivity and sensitivity.

6.2. Bellow assembly

The bellows assembly is used to collect recovered helium from the GC exhaust or process outlet without creating pressure fluctuations or excessive backpressure at the source.

The bellows are made from an air-impermeable elastomer material to reduce the risk of contamination from ambient air. During operation, each bellow continuously fills and empties as part of the recovery sequence.

A network of solenoid valves and optical sensors controls the bellows sequence. This arrangement isolates the bellows during operation and helps prevent overfilling or contamination from ambient air.

Refer to the maintenance section for replacement frequency and replacement procedure.

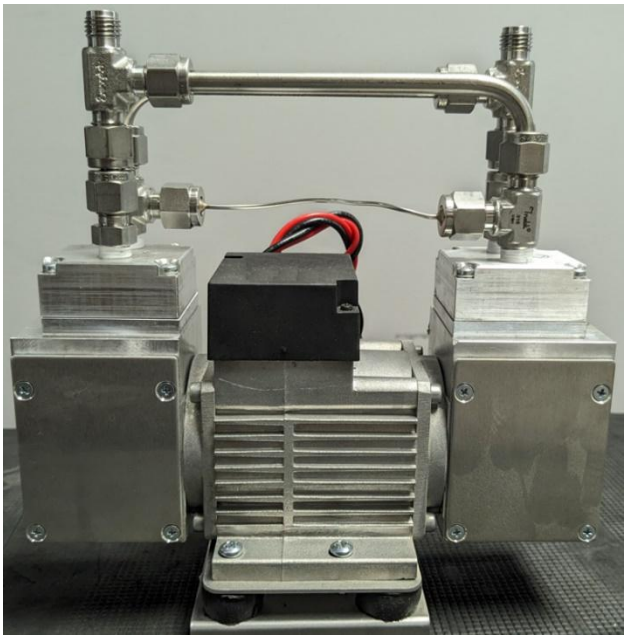
6.3. Double stage pump

The double-stage pump is installed after the bellows assembly. It compresses the recovered helium from near-atmospheric pressure up to the required operating pressure for the application.

The double-head configuration allows the pump to generate a higher outlet pressure while maintaining a compact size and low noise level.

The pump assembly is made from an aluminum block with two elastomer diaphragms. This design helps maintain gas integrity and reduces the risk of contamination from ambient air.

The pump operates on a 24 VDC supply.
Refer to the maintenance section for replacement frequency and replacement procedure.



6.4. Electronic valves

Solenoid valves are installed at key points in the LDRPS assembly to control gas routing, isolation, purging, and recovery sequences.

Each valve is made of stainless steel and is equipped with a 12 VDC solenoid and 1/8 in. NPT female threads.

Two-way shut-off valves are used at the inlet and outlet of each bellow assembly to control the filling and emptying sequence. Additional shut-off valves are used for purge and isolation functions within the LDRPS flow path.

The line purge valve is used during start-up and maintenance to purge the bellows, pump, internal moisture trap, pressure tank, and related tubing before normal operation.

For systems equipped with an optional PED monitoring module, additional valve routing may be used to direct gas to the monitoring device. The PED is used only as an optional purity monitoring device and is not required for all LDRPS configurations.

No specific preventive maintenance is required for the electronic valves.

6.5. Outlet pressure regulator

The outlet pressure regulator is mounted on the back panel of the LDRPS, near the end of the flow path.

It is used to adjust and maintain the required outlet pressure to the connected analytical equipment.

The regulator is made of stainless steel and is configured to preserve ultra-high-purity gas integrity.

6.6. Electronic pressure sensor

Electronic pressure sensors are installed throughout the LDRPS to monitor inlet, pump inlet, tank, and outlet pressure.

Each sensor is made of stainless steel, sealed to reduce the risk of ambient air contamination, and operates on a 5 VDC supply. Each sensor has a 1/8 in. NPT male connection and is mounted on a stainless-steel tee fitting.

The LDRPS uses:

Two 0-15 psig sensors: one at the LDRPS inlet and one before the double-stage pump.

6.7. Pressure tank

The pressure tank is a DOT-compliant, double-ended reservoir made of 304L stainless steel. It has a volume of 500 cm³ and is certified for 1800 psig, or 124 bar.

The pressure tank stores the recovered helium after it has been compressed by the pump. This stored gas is then available to supply the connected external equipment through the downstream flow path.

When the pressure tank does not contain enough recovered helium to maintain the required supply pressure, the system automatically uses the backup helium source connected to the LDRPS. This ensures that the connected GC or external equipment maintains a continuous gas supply.

6.8. LDCryo Trap

The LDCryo cryotrap is installed externally in the LDRPS helium recovery and purification flow path. It is used with an external purifier, such as the LDP1000 or LDP2000, to remove residual argon and other trace impurities from the recovered helium.

The LDCryo is not an internal component of the LDRPS and must be installed according to the system configuration diagram.

Refer to the LDCryo user manual for start-up, shutdown, inspection, and maintenance instructions.

6.9. Check valves

Mechanical check valves are installed at different locations in the LDRPS to control flow direction, protect components, and maintain stable gas supply conditions.

Each check valve is made of 316 stainless steel and cleaned according to the SC10 standard.

A 1 psig check valve is installed at the LDRPS inlet. This valve allows gas to flow through the bypass path when the LDRPS is in standby mode and the inlet valves before the bellows are closed.

For systems equipped with the optional PED monitoring module, a second 1 psig check valve is installed at the PED outlet to prevent pressurization of the PlasmaDetek2.

A 5 psig check valve is installed between the outlet of the double-stage pump and the pressure tank. This valve helps prevent residual pressure above 5 psig from remaining at the pump outlet, which could damage the pump.

A second 5 psig check valve is installed on the backup helium source line. This valve allows the backup helium source to supply the connected equipment when the pressure from the pressure tank drops below the required level. This configuration helps maintain a stable gas supply to the connected GC or external equipment.

A 150 psig check valve is installed on a tee before the pressure tank to protect the system from overpressure. If the pressure exceeds the 150 psig limit, the valve opens and directs the excess pressure to the exhaust vent.

7. LDRPS Interface

The LDRPS is operated through an integrated touchscreen interface. The interface allows the operator to monitor the recovery process, select the operating mode, view system pressures, access settings, and review alarms.

Figure 2: LDRPS display

The interface is designed to provide a clear overview of the system status during start-up, normal operation, purge, troubleshooting, and shutdown.

A USB connector is available on the front panel for connection to a keyboard when required.

7.1. Process menu

When the LDRPS is powered on, the **process menu** is displayed. This page provides access to the main operating information and system menus.

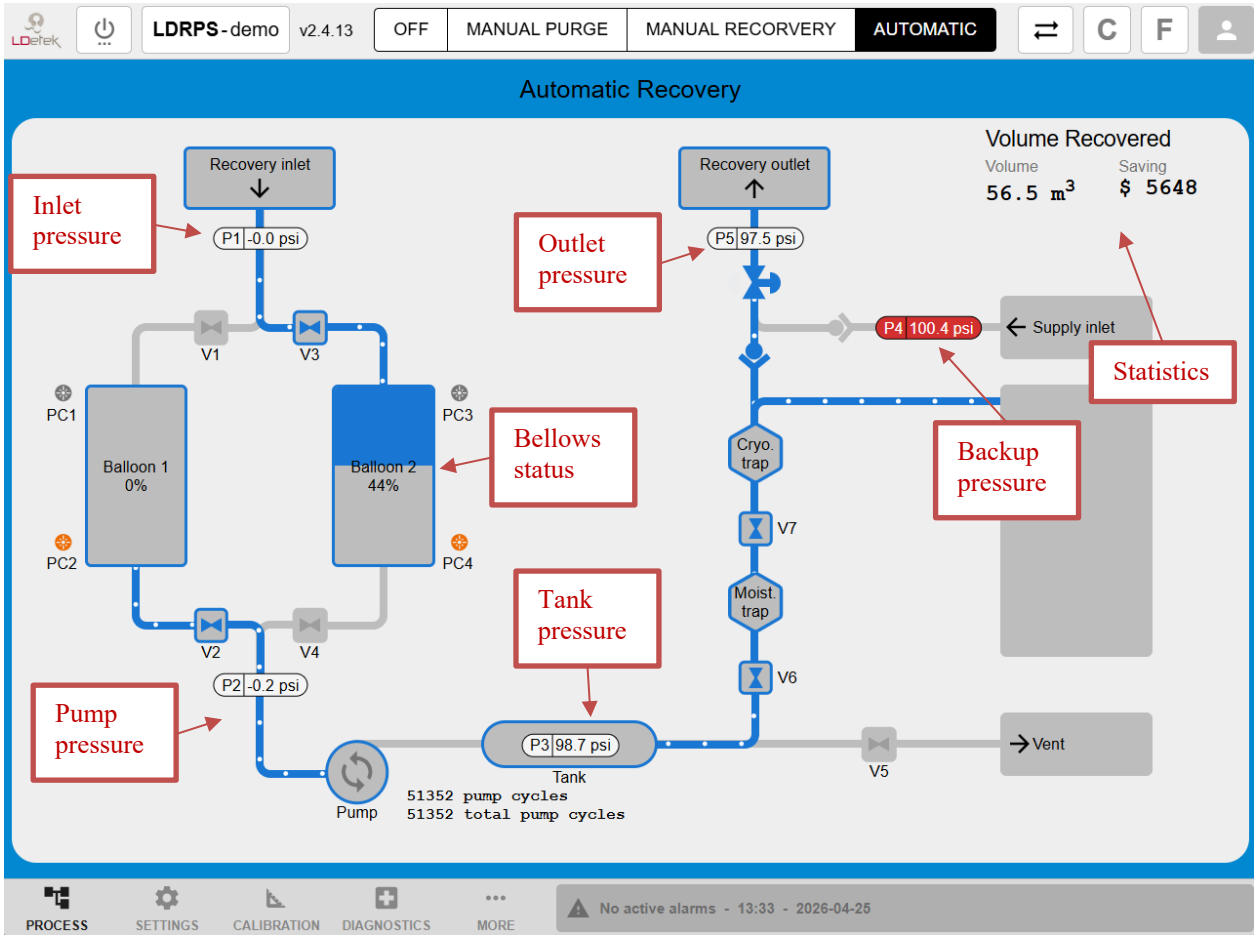
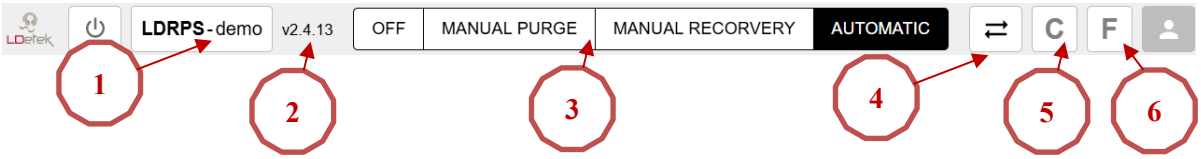


Figure 3: Process menu

7.1.1. Title bar

The title bar is displayed at the top of the interface and remains visible from all main pages. The title bar provides quick access to general system information and operating status.



Depending on the system configuration and software version, the title bar may display the following information:

1. Displays the serial number of the LDRPS. Pressing the serial number may display additional system information, such as the hostname, IP address, and software version.

2. Displays the current software version installed on the LDRPS. Running mode. You can select the current mode of your device.

3. Displays the current operating mode and allows the operator to select the required mode.

   The available running modes are:

   OFF - The LDRPS is not recovering gas. The interface remains active and displays current system values.

   Manual Purge - Incoming recovered gas is vented through the purge path. This mode is used during start-up, maintenance, or troubleshooting to purge the recovery path before normal operation.

   Manual Recovery - The LDRPS recovers incoming gas manually according to the selected operating conditions.

   Automatic - The LDRPS automatically manages the recovery sequence. The system may start in purge mode and then switch to recovery mode when the required operating conditions are met.

4. Indicates that a communication protocol is active.

5. Indicates that a calibration process is active, if applicable to the installed configuration.

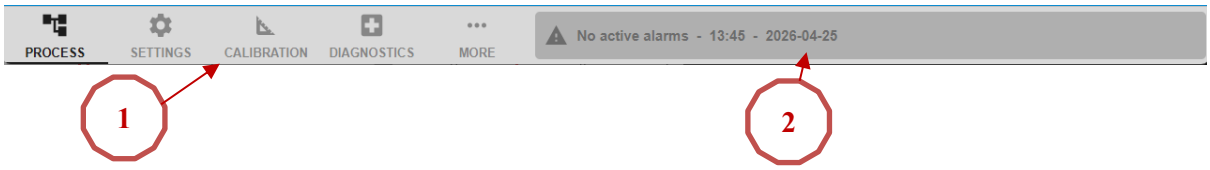
6. Indicates that one or more outputs or values are forced in the system. When available, pressing this icon allows the operator to view or remove active forces.

7.1.2. Taskbar

The taskbar provides access to the main interface menus and displays the alarm bar.

The first section of the taskbar gives access to the main menus of the application, including the Process menu, Settings menu, Calibration menu, Diagnostics menu, and the More menu.

The second section of the taskbar is the alarm bar. When an alarm is active, it is displayed in this area. Pressing the alarm bar opens the Alarms menu, where the operator can review alarm details and identify the condition requiring attention.



Depending on the software version and system configuration, the taskbar may provide access to the following menus. The Process, Settings, Calibration, Diagnostics, and More menus are located on the left side of the taskbar, identified by 1 in the figure above. The Alarm menu is located on the right side of the taskbar, identified by 2.

- **Process menu**

Displays the current operating status of the LDRPS, including pressures, recovery status, bellows status, and pump status.

- **Settings menu**

Provides access to configurable system parameters.

- **Calibration menu**

Used only for configurations that include monitoring devices requiring calibration. Do not perform calibration unless the procedure is supplied with the system or instructed by LDetek service personnel.

- **Diagnostics menu**

Displays system inputs, outputs, sensor readings, and diagnostic information for service and troubleshooting.

- **More menu**

Provides access to secondary menus such as alarms, clock and communication.

- **Alarm menu**

The right side of the taskbar turns red when an alarm is active. Pressing this area opens the Alarm menu.

7.1.3. Settings menu

The Settings menu provides access to the configurable parameters of the LDRPS.

Depending on the software version and system configuration, the Settings menu may contain the following sections:

- **General**

When applicable, this section contains general system settings, such as display and communication options.

- **Method**

Contains settings related to the optional integrated PED monitoring module and the impurities being monitored. This section is used only when the LDRPS is equipped with the optional PED monitoring function.

- **LDRPS**

Contains settings related to the LDRPS recovery system, such as pressure setpoints, operating parameters, purge settings, recovery settings, and other LDRPS-specific configuration values.

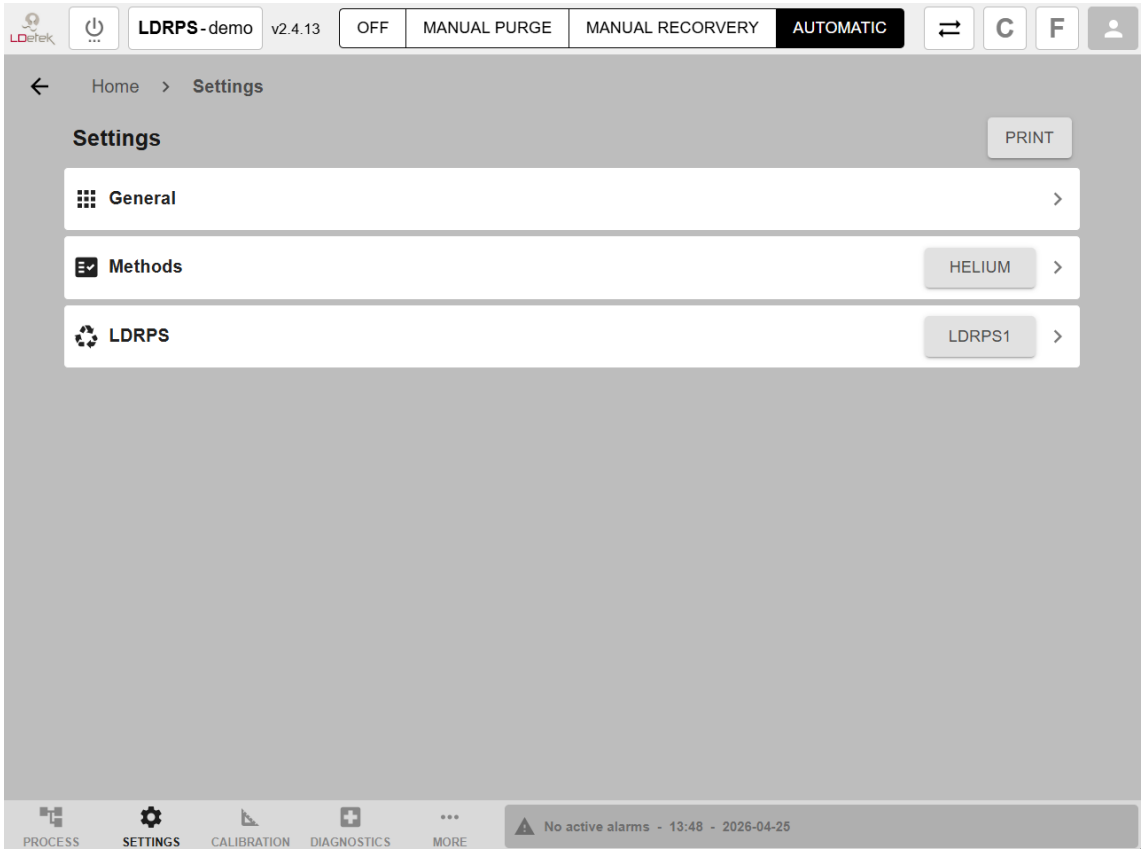


Figure 4: Settings menu

7.1.4. Calibration menu

The Calibration menu is used only for configurations that include a monitoring device requiring calibration, such as the optional integrated PED monitoring module.

When applicable, this menu allows authorized personnel to access calibration functions for the measured impurities.

Do not perform calibration unless instructed by LDetek service personnel.

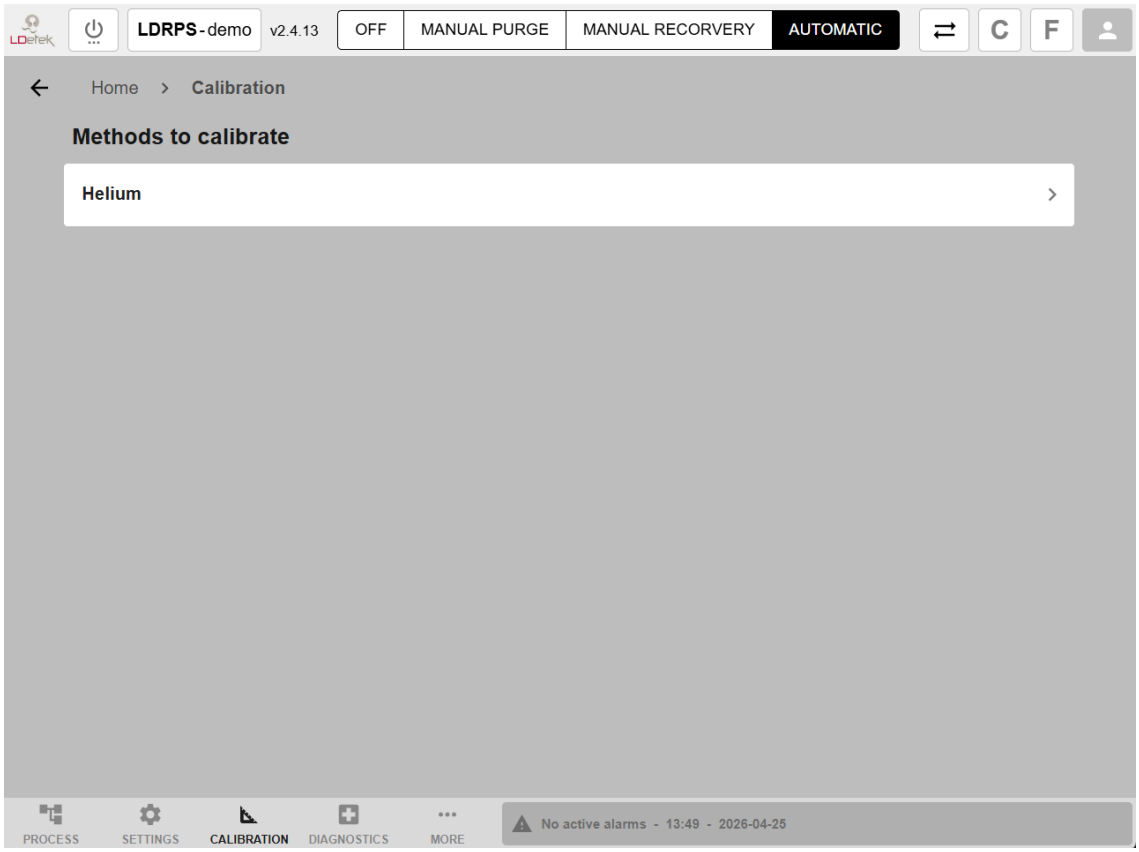


Figure 5: Calibration menu

7.1.5. Diagnostics menu

The Diagnostics menu displays system input and output information used for service, troubleshooting, and verification.

This menu is mainly intended for trained personnel and service support. It can be used to verify that sensors, valves, and other controlled components are responding correctly.

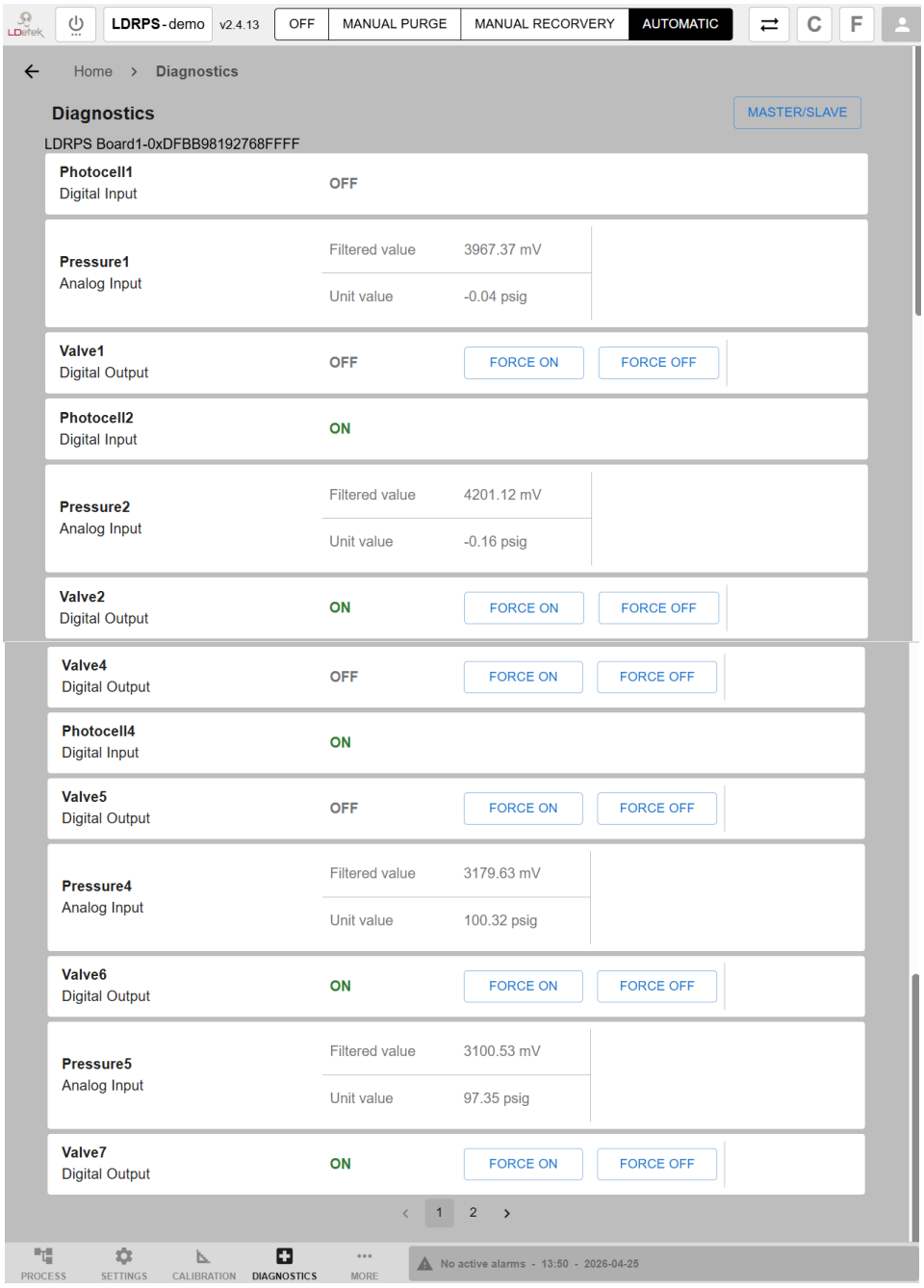


Figure 6: Diagnostics menu

7.1.6. More menu

The **More menu** provides access to secondary menus and additional system functions.

Depending on the software version, user access level, and system configuration, the More menu may include:

- **Language**

Allows the operator to select the display language of the LDRPS interface.

- **Communication**

Provides access to communication settings, when applicable.

- **Clock**

Allows the operator to view or configure the system date and time.

- **Alarms**

Opens the Alarm menu, where the operator can view active and historical alarms.

- **Screen Orientation**

Allows the operator to change the screen orientation, when applicable.

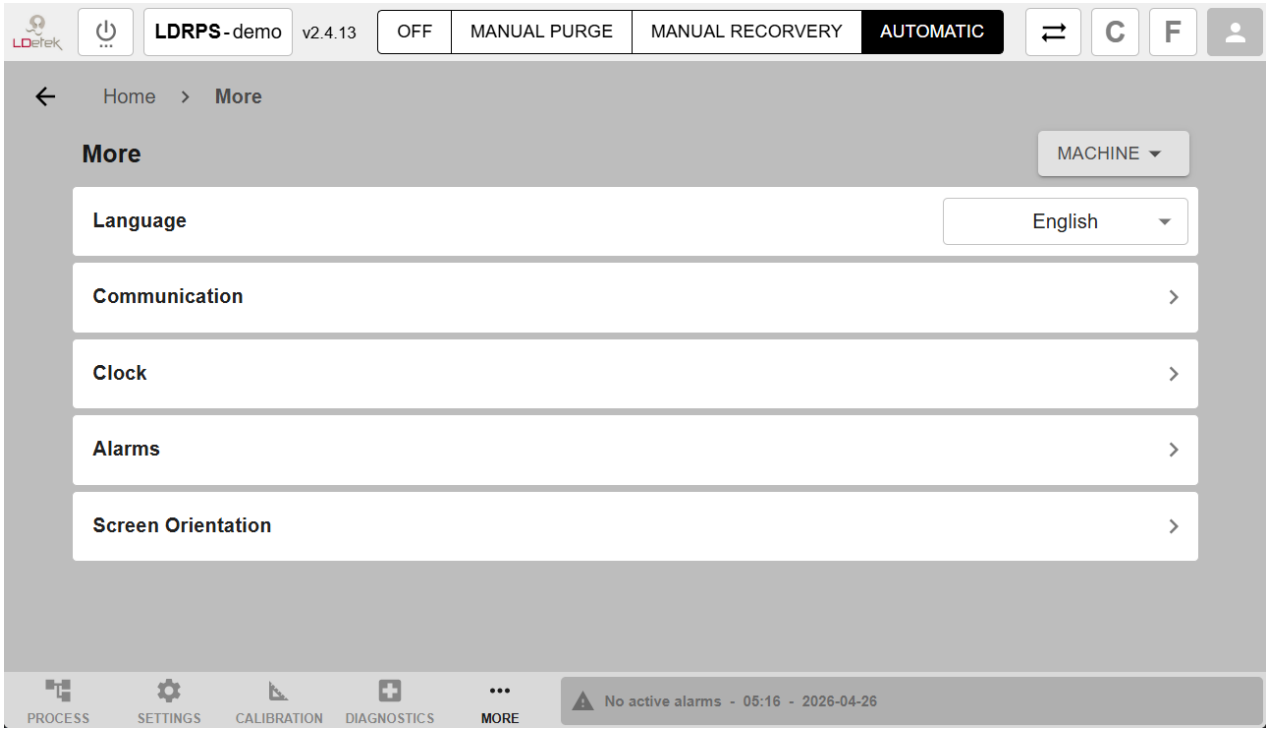


Figure 7: More menu

7.1.7. Alarms menu

The **Alarm menu** allows the operator to view, configure, and review LDRPS alarms.

The Alarm menu includes the following sub-menus:

- **Configuration**

Displays the list of configured alarms and their error codes. Depending on the user access level, authorized personnel may enable or disable alarms and configure how each alarm affects the system status, alarm relays, or start conditions.

- **Templates**

Displays alarm message templates, alarm types, and error codes. This menu is mainly used to manage alarm text and translations.

- **History**

Displays active and historical alarms. The alarm history includes the alarm description, error code, date, and time. The operator can use this menu to review current alarms or past alarm events.

When an alarm is active, the alarm bar on the taskbar changes color. Pressing the alarm bar opens the Alarm menu.

The operator should review the alarm description and follow the troubleshooting instructions provided in Section 9.

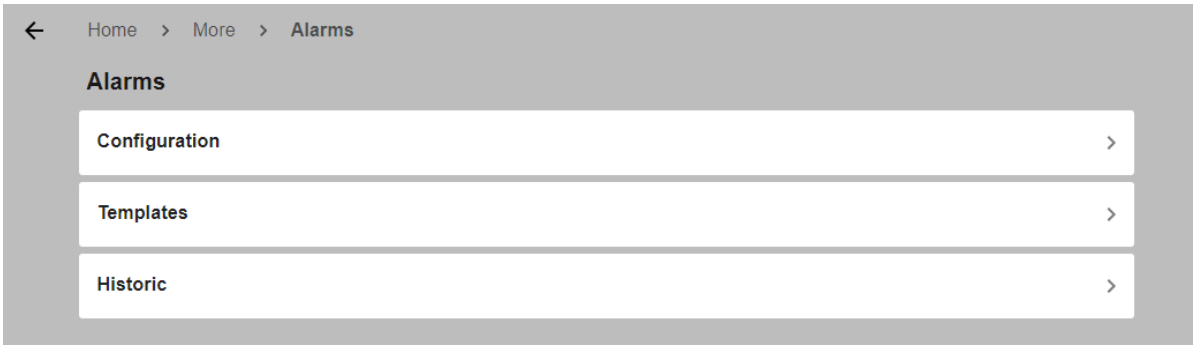
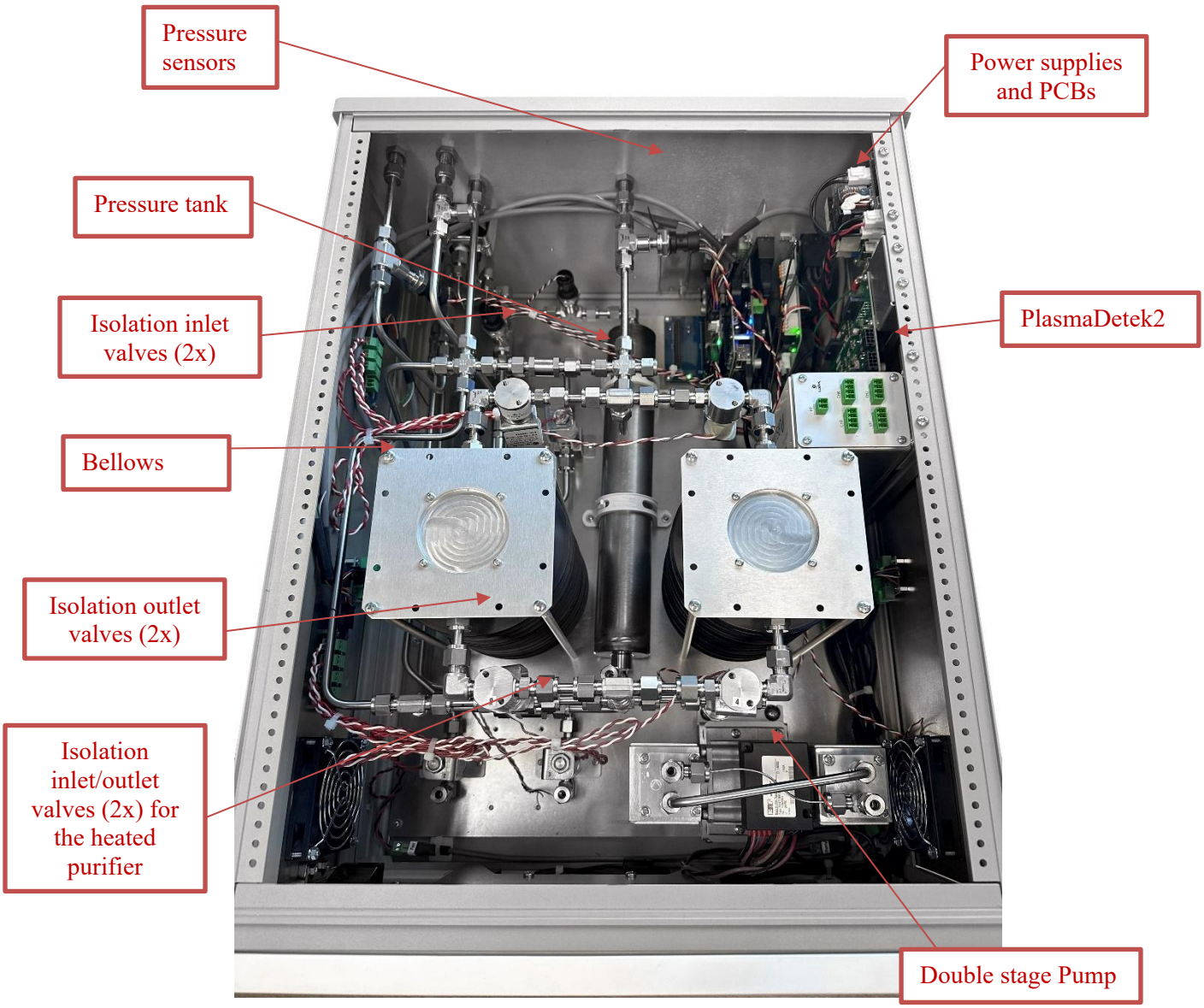


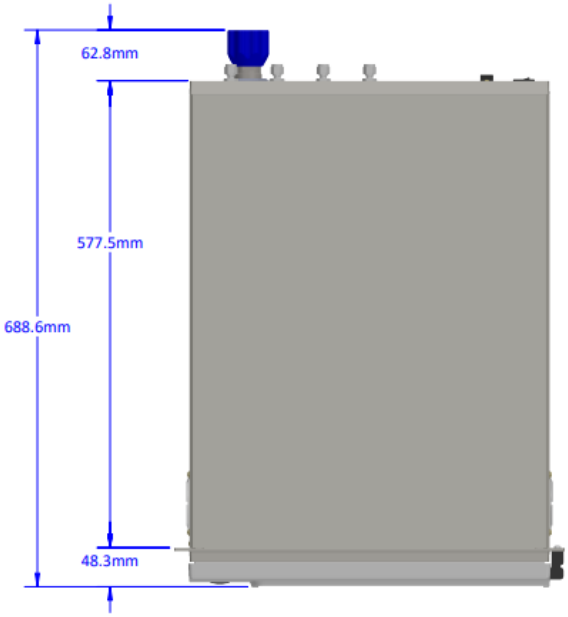
Figure 8: Alarms menu

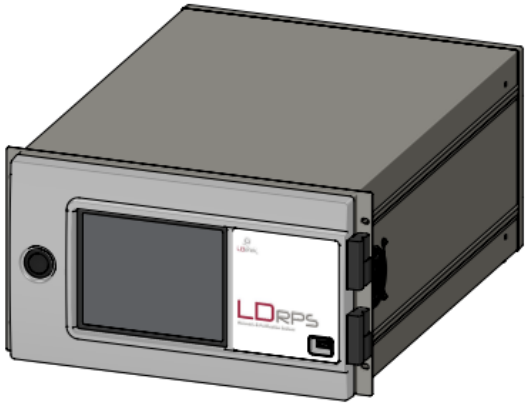
8. Drawings & Schematics

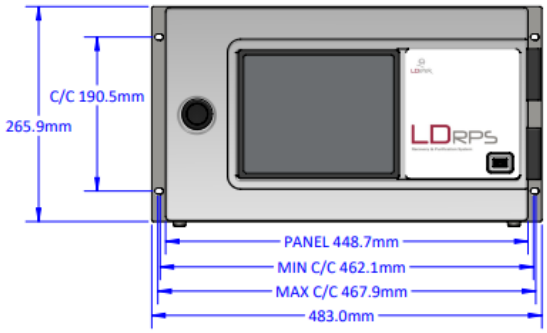
8.1.1. Critical parts identification



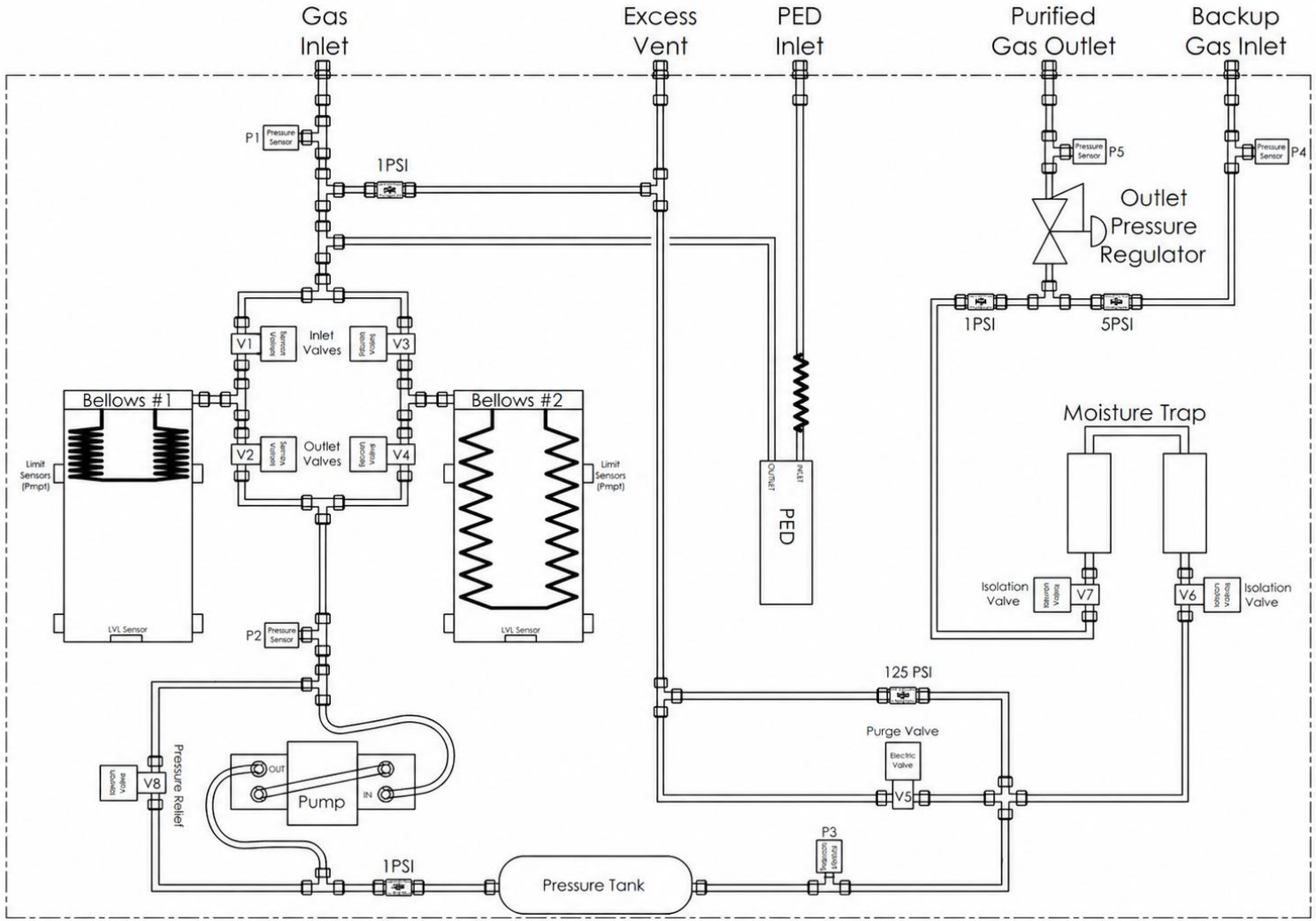
8.1.2. Dimensions and cutout



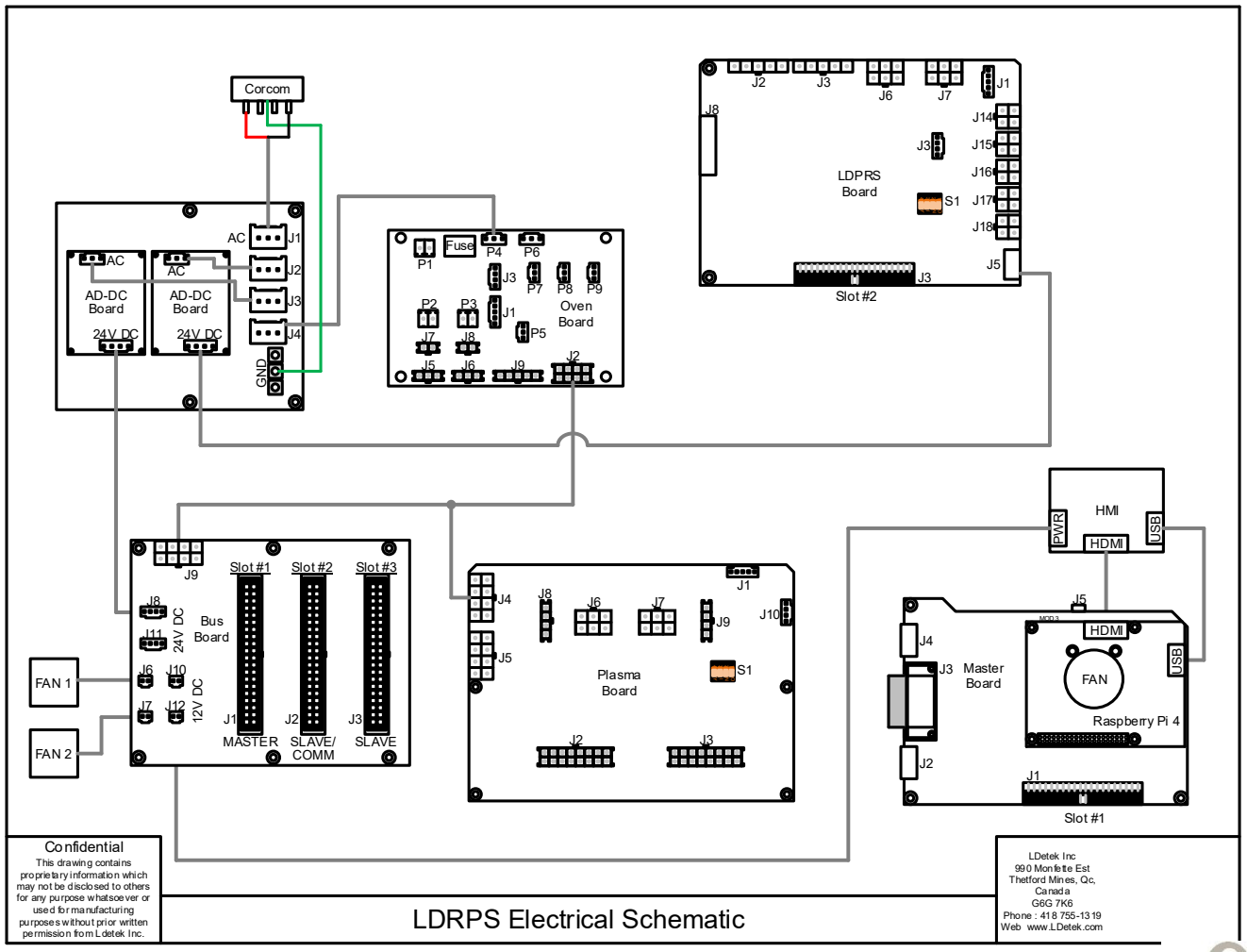


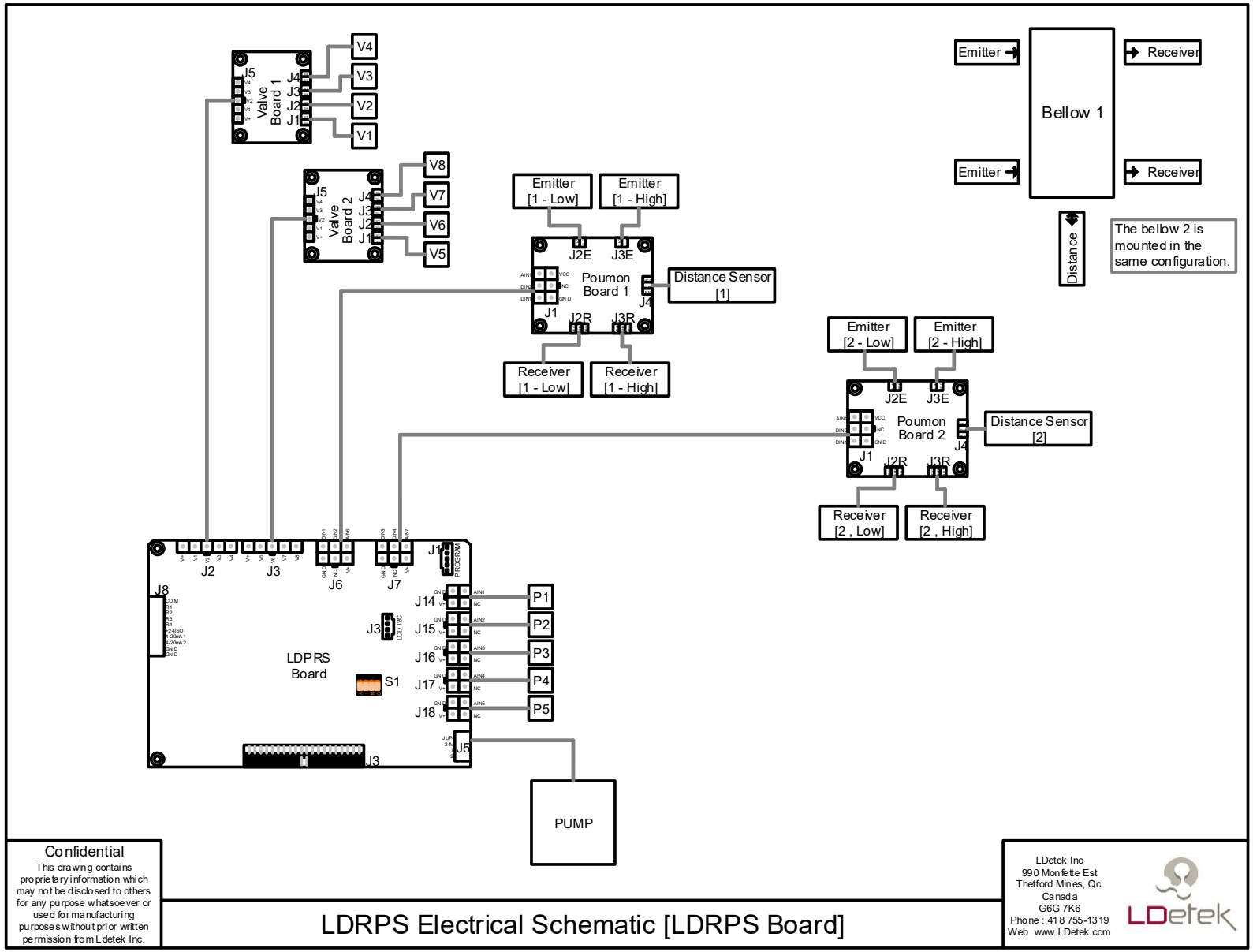


8.1.3. Internal Piping diagram



8.1.4. Electrical diagram




Valve Board 1
J5
J4
J3
J2
J1
V4
V3
V2
V1
Valve Board 2
V8
V7
V6
V5
Emitter
Receiver
Bellow 1
Distance
The bellow 2 is mounted in the same configuration.
Emitter [1 - Low]
Emitter [1 - High]
Poumon Board 1
Distance Sensor [1]
Receiver [1 - Low]
Receiver [1 - High]
Emitter [2 - Low]
Emitter [2 - High]
Poumon Board 2
Distance Sensor [2]
Receiver [2 , Low]
Receiver [2 , High]
LDPRS Board
S1
P1
P2
P3
P4
P5
PUMP
Confidential
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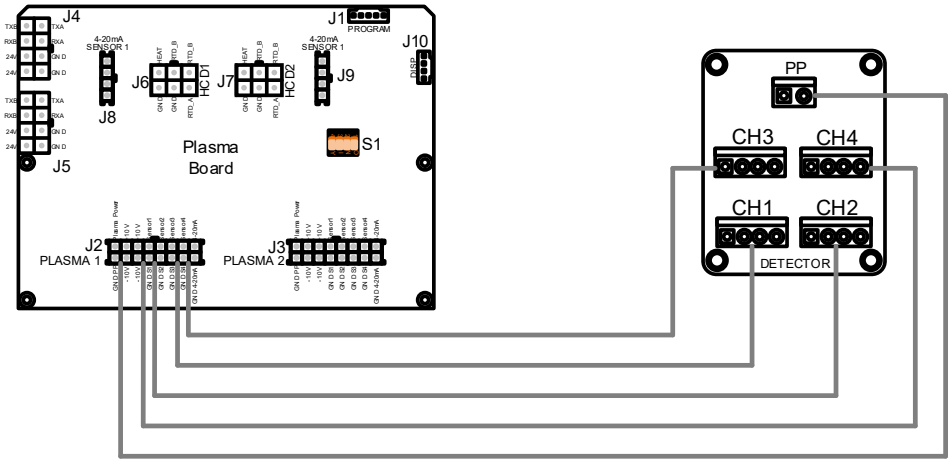
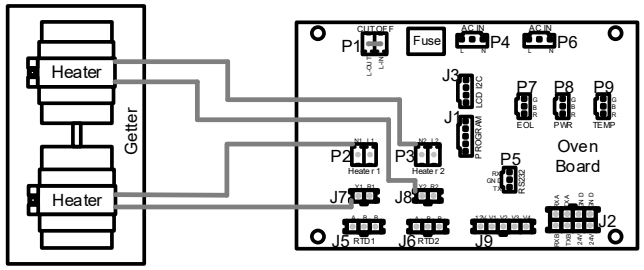
LDRPS Electrical Schematic [LDRPS Board]
LDetek Inc
990 Monfette Est
Thetford Mines, Qc,
Canada
G6G 7K6
Phone : 418 755-1319
Web www.LDetek.com



LDRPS Electrical Schematic [Plasma Board]

LDetek Inc
990 Monfette Est
Thetford Mines, Qc,
Canada
G6G 7K6
Phone : 418 755-1319
Web www.LDetek.com



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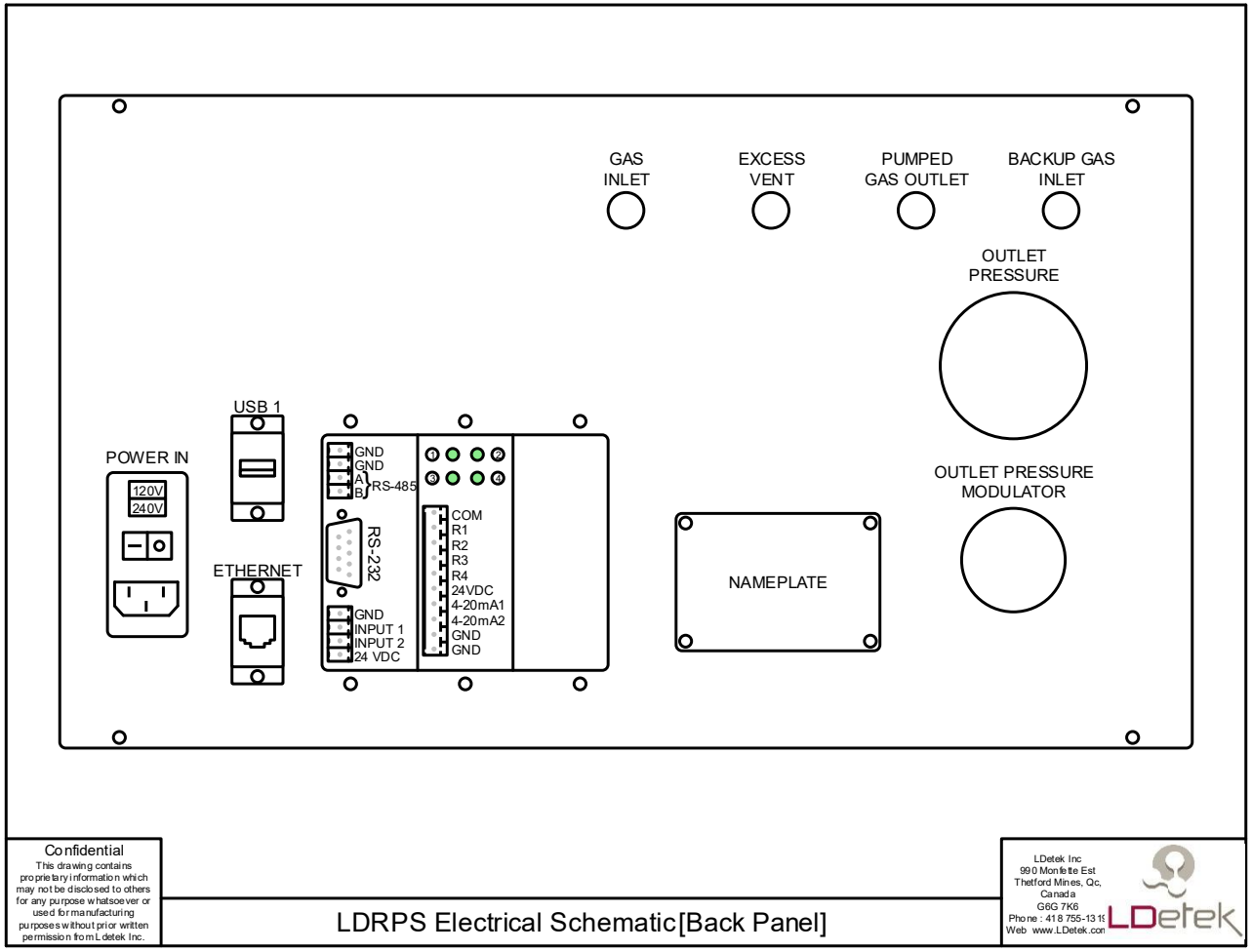
LDRPS Electrical Schematic [Oven Board]

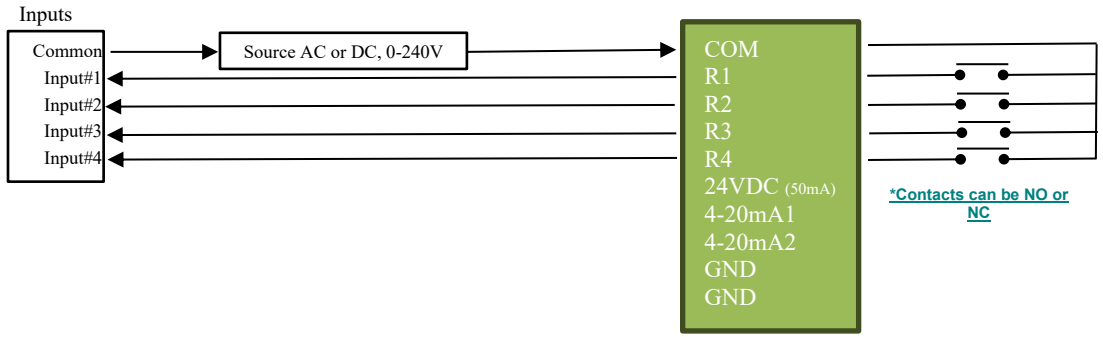
LDetek Inc
990 Monfette Est
Thetford Mines, Qc,
Canada
G6G 7K6
Phone : 418 755-1319
Web www.LDetek.com

8.1.5. Back panel in/out electrical connections

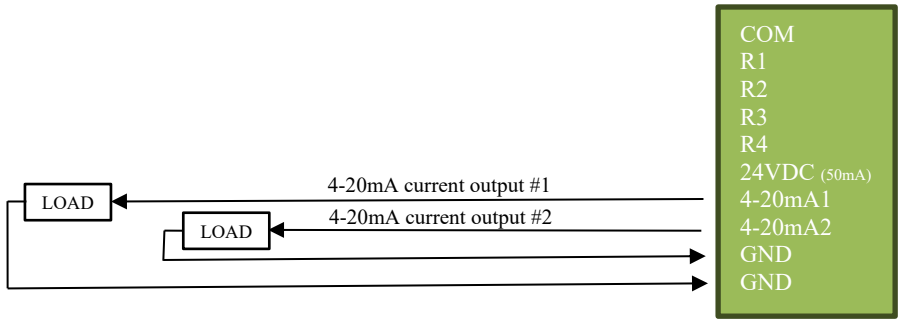
The LDRPS back panel has multiple ports and connectors. It provides a USB port, Ethernet, RS-485, RS-232 and 2 digital inputs. Additionally, it has a 10 positions connector that provides 4 relay outputs, two 4-20mA outputs and a 24V supply.



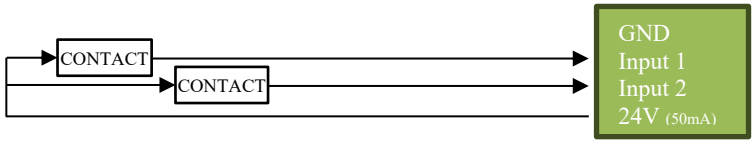
By default, all relays are N.O. but N.C. can be selected by changing the position of the internal jumpers J10 (R1), J11 (R2), J12 (R3) and J13 (R4). The following schematic shows how to connect to the relay outputs.

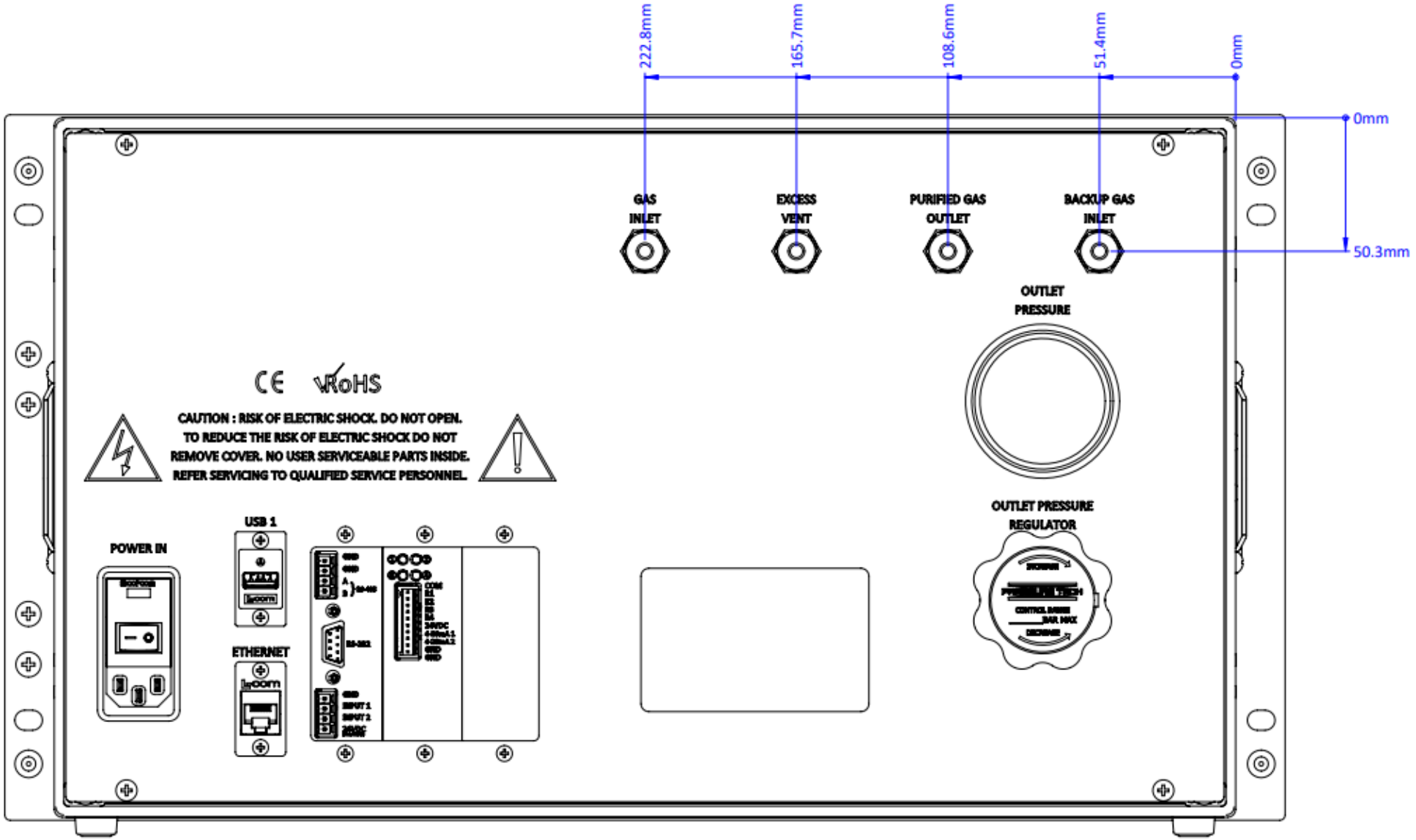


The 4-20mA are designed to be used as shown in the image bellow.



The digital inputs activate when connected to the 24V outputs.




222.8mm
165.7mm
108.6mm
51.4mm
0mm
0mm
50.3mm
GAS INLET
EXCESS VENT
PURIFIED GAS OUTLET
BACKUP GAS INLET
OUTLET PRESSURE
CE
RoHS
CAUTION : RISK OF ELECTRIC SHOCK. DO NOT OPEN.
TO REDUCE THE RISK OF ELECTRIC SHOCK DO NOT
REMOVE COVER. NO USER SERVICEABLE PARTS INSIDE.
REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.
OUTLET PRESSURE REGULATOR
POWER IN
USB 1
ETHERNET

9. Maintenance

The spare parts list of consumable and non-consumable components is listed in this section. The corresponding procedure for part replacement is also described. Feel free to contact LDetek at support@ldetek.com. for more details.

9.1. Spare part list

The below table shows the consumables and capital spare parts that can be required in a LDRPS. Consumables are parts that will deteriorate over time and must be replaced periodically.

Capital parts on the other end are parts that are known to have a long life and/or a small chance of failure. However, failure would cause a shutdown of the equipment because it would take some time to get a replacement part.

The below table shows all the parts that could be required for a LDRPS. However, depending on its configuration, some parts might not be required for your system. Please contact LDetek to get a list of parts specific to your system.

Part #	Description	Type	Replacement frequency
Bellow-LDRPS	1 bellow assembly	Consumable	3-5 years
Pump-LDRPS	Double stage pump assembly	Consumable	3-5 years
FanK-LDRPS	2 replacement fans	Spare	3-5 years
Moisture-Traps-LDRPS	2 moisture traps	Consumable	1 years
Diaphragm kit-LDRPS	Diaphragm kit for one head of the pump	Consumable	3-6 months
Shutoff valve-LDRPS	2 ways, 12VDC electronic shutoff valve assembly	Spare	N/A
3 ways valve-LDRPS	3 ways, 12 VDC electronic 3 ways valve assembly	Spare	N/A

9.2. Tools

Some tools are required when doing a start-up, maintenance or troubleshooting on the LDRPS. The below table shows the list of tools that can become handy. These tools are separated into 2 categories – general and repair.

Tools in the category general are useful to do common tasks like start-ups, shut-offs or maintenance. For advanced users that intend to do repair tasks, tools in the category repair will be useful. Please note that to attend repairs, tools from the category general are required.

Part #	Description	Category
ScrewdriverPH2	Philips screwdriver #2	General

Wrench1/4	Wrench ¼"	General
Wrench3/8	Wrench 3/8"	General
Wrench7/16	Wrench 7/16"	General
Flowmeter500ml	Flow meter 0-500ml/min	General
AngledWrench1/4	Angled wrench 1/4 for 1/16 fittings (10/32 thread)	General

9.3. Alerts/Troubleshooting

Alerts	**Alert description**
Outlet pressure deviation (Relay 1)	Cryogenic trap is plugged due to contamination
Internal reservoir overpressure (Relay 2)	System is plugged and pressure built up in the internal reservoir
N2 reading high (Relay 3)	External purifier or LDCryo cryogenic trap may not be purifying the outlet gas properly.
System ready (Relay 4 = Status)	- No alarm activated - Pressure ok on the backup gas source
System not ready (Relay 4 = Status)	- One or more alarm activated - No pressure from the backup gas source - Pump is running more than the normal period programmed - The external purifier reports an alarm condition.

Leaks
The system is equipped with the Plasma detector technology to compare the N2 reading before and after the purification process.

Pump diaphragm
A pump start/stop cycle counter is set up into the system software. At fifty thousand start/stop cycle of the pump, a pump maintenance alert will appear.

Purifier
If a high amount of N2 is detected by the N2 detector, it could be due to a pressurization of the unit triggered by a clog. The gas purifier could be saturated by air too. That would mean that the gas purifier needs to be changed.

Bellows
If a bellow does not swell with used gas anymore, then it will require some maintenance.

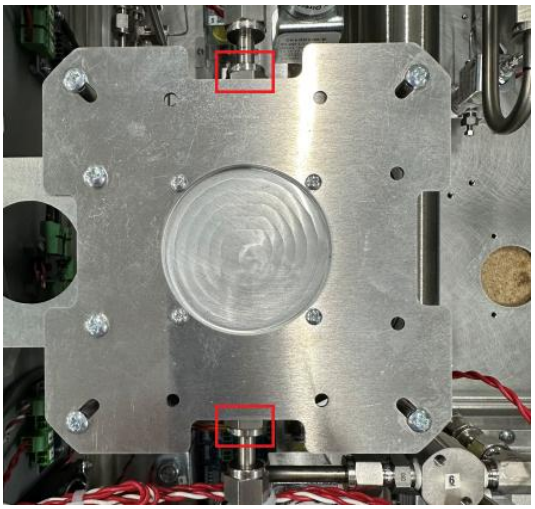
The LDRPS has major components included in its system. This section will describe each component that can be replaced for maintenance.

9.4. Maintenance procedures

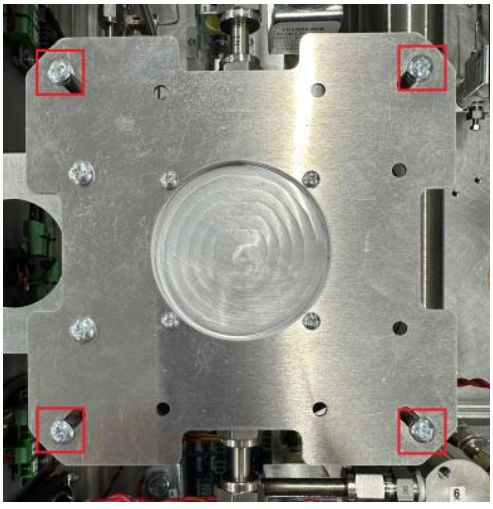
This section explains the most critical maintenance procedures. Some information may be missing for ''custom'' version of the LDRPS unit. Feel free to contact LDetek at support@ldetek.com. if you need clarifications.

9.4.1. How to replace the bellows assembly

1. Make sure the replacement bellows assembly is available.
2. Place the LDRPS in OFF mode.
3. Confirm that the LDRPS is not recovering gas and that the recovery path has been safely depressurized according to the site procedure.
4. Open the front door of the LDRPS.
5. Loosen the two 1/4 in. Swagelok nuts connected to the bellows assembly.



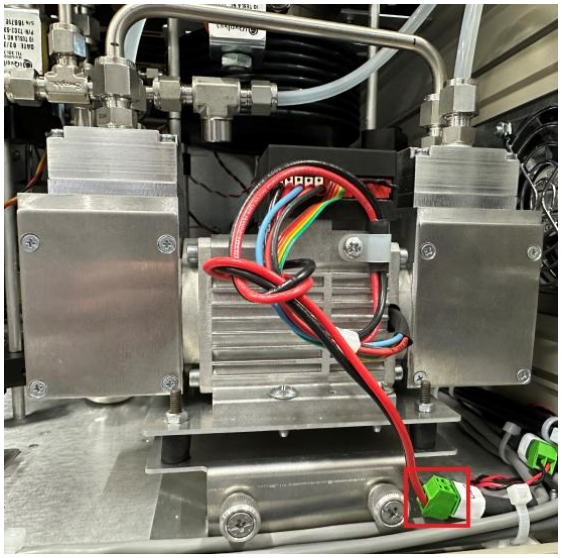
6. Unscrew the four top mounting screws.



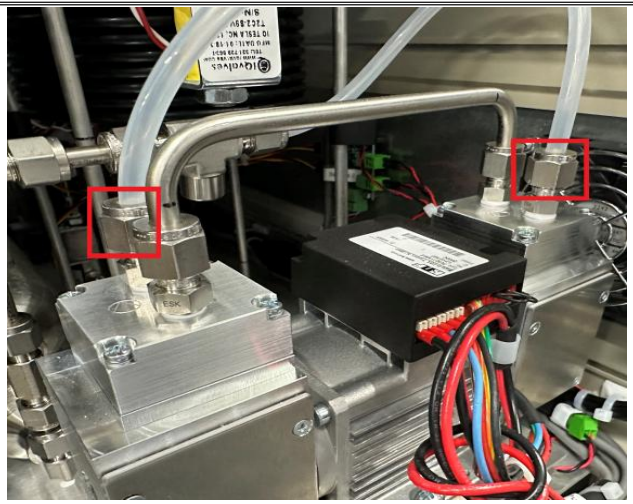
7. Remove the plate and bellows assembly as one piece.
8. Install the new bellows assembly with its attached plate
9. Reinstall and tighten the four mounting screws.
10. Retighten the two 1/4 in. Swagelok nuts.
11. Retighten the two 1/4 in. Swagelok nuts
12. Confirm that all fittings are properly tightened.
13. Close the front door of the LDRPS.

9.4.2. How to replace the double-stage pump

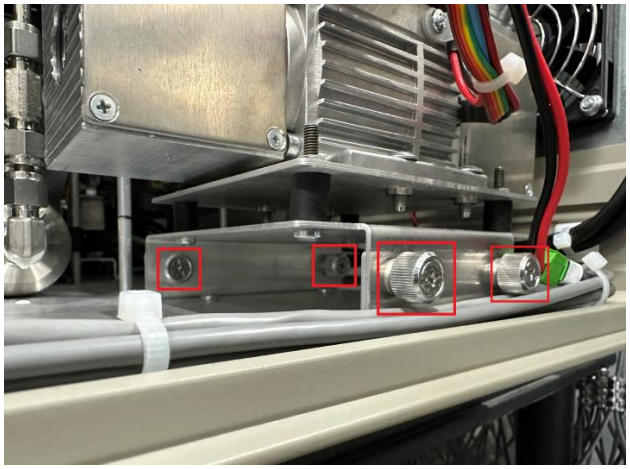
1. Make sure the replacement pump is available.
2. Place the LDRPS in OFF mode.
3. Power off the LDRPS and disconnect the power cord from the unit.
4. Confirm that the LDRPS is not recovering gas and that the recovery path has been safely depressurized according to the site procedure.
5. Open the front door of the LDRPS.
6. Disconnect the pump electrical connector.



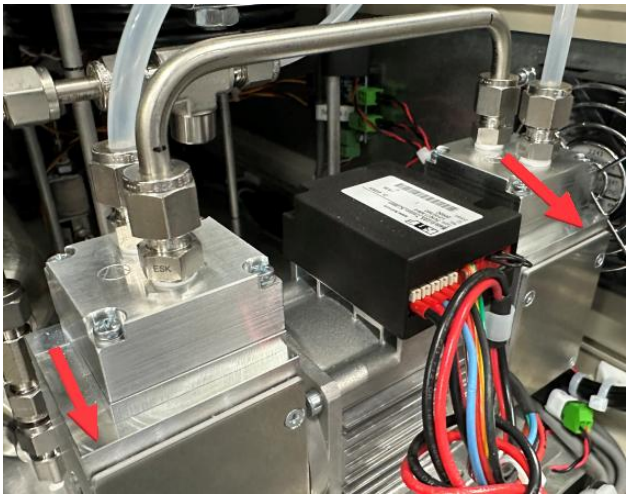
7. Loosen the two fittings connected to the pump tubing. Identify each tube before removal so it can be reinstalled in the same location.



8. Unscrew the four pump mounting screws.



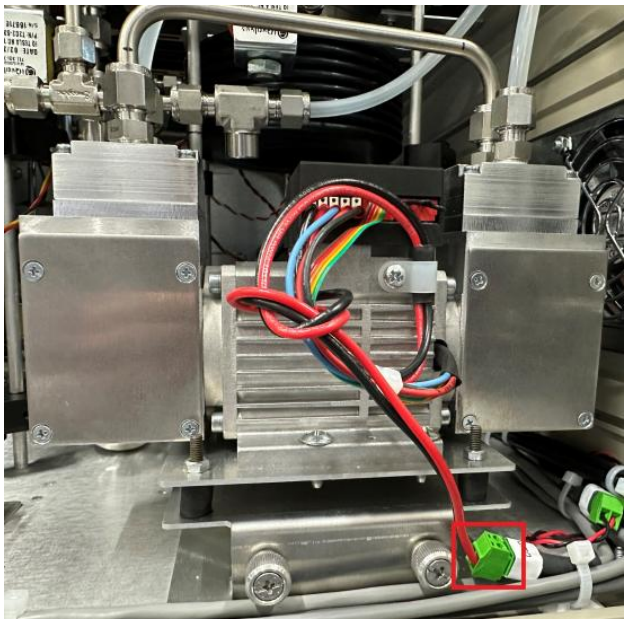
9. Remove the pump by pulling it out carefully.



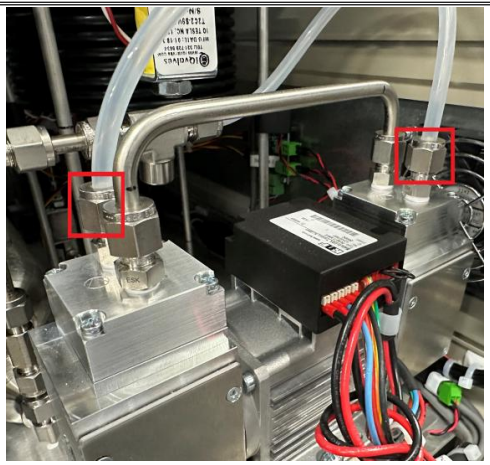
10. Install the new pump in the same position.
11. Reinstall and tighten the four pump mounting screws.
12. Reconnect the two pump tubing fittings in their original locations.
13. Reconnect the pump electrical connector.
14. Confirm that all fittings and connectors are properly installed.
15. Close the front door of the LDRPS.

9.4.3. How to replace the diaphragm kit of the double-stage pump

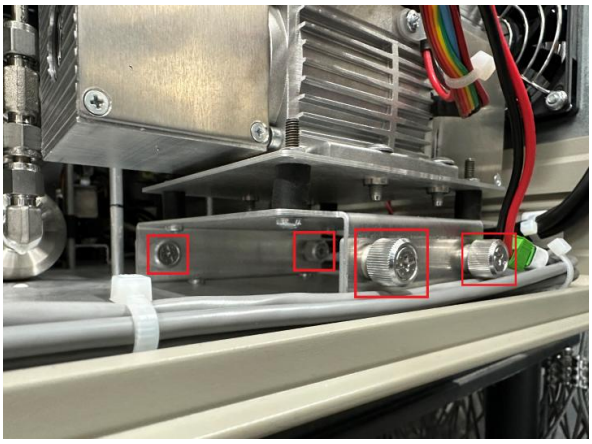
1. Make sure the replacement diaphragm kit is available.
2. Place the LDRPS in OFF mode.
3. Power off the LDRPS and disconnect the power cord from the unit.
4. Confirm that the LDRPS is not recovering gas and that the recovery path has been safely depressurized according to the site procedure.
5. Open the front door of the LDRPS.
6. Disconnect the pump electrical connector



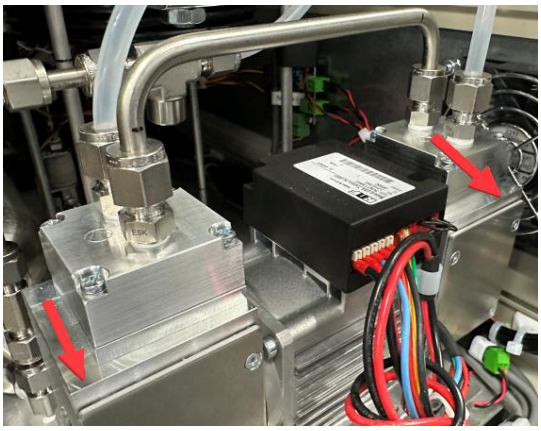
7. Loosen the two fittings connected to the pump tubing. Identify each tube before removal so it can be reinstalled in the same location



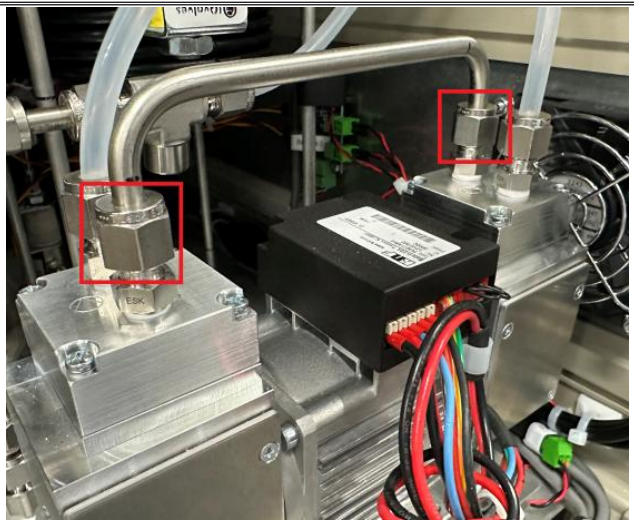
8. Unscrew the four pump mounting screws.



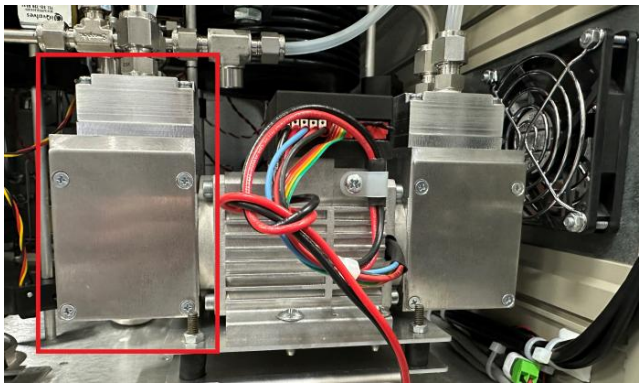
9. Remove the pump by pulling it out carefully.



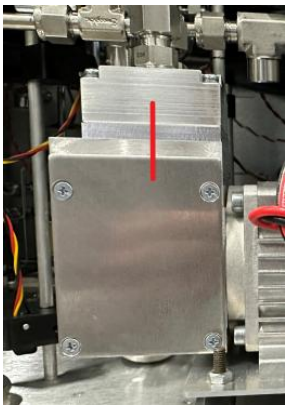
10. Remove the bypass tube from the pump. Identify the orientation of the bypass tube so it can be reinstalled in the same position.



11. Identify the diaphragm head to be replaced (left side).

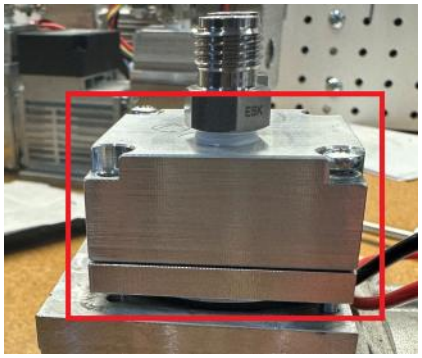


12. Before disassembly, mark the alignment of the pump head components so they can be reinstalled in the same orientation.



13. Unscrew the four screws from the pump head.

14. Remove the upper pump head components.

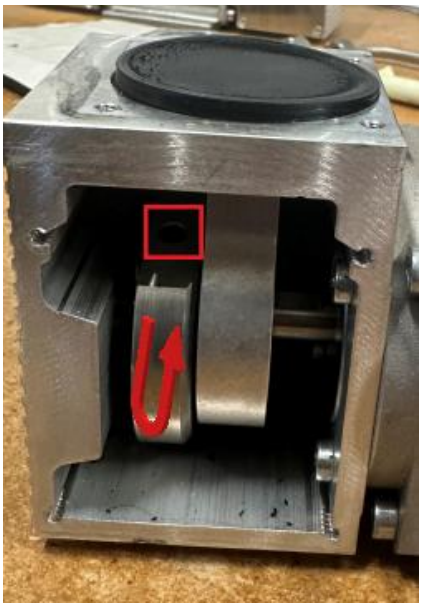


15. Remove the O-rings and gaskets.

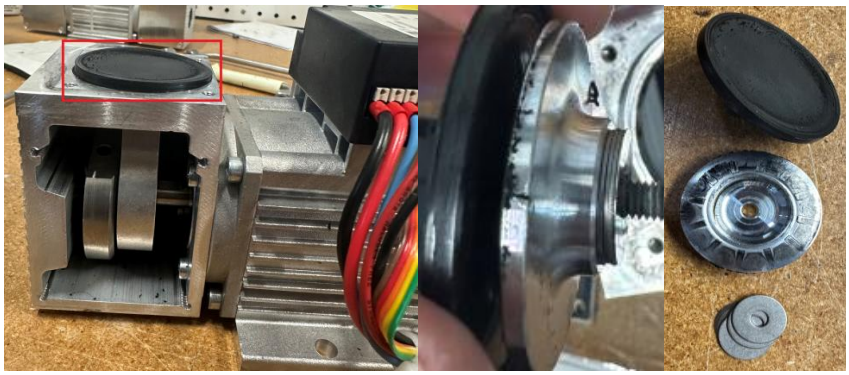
16. Clean the pump head components to remove dust, particles, or rubber residue.
17. Install the new O-rings and gaskets from the diaphragm kit.

18. Unscrew the four screws from the front metal plate and remove the plate.

19. Rotate the internal pump component by hand until the diaphragm mounting hole is facing up.



20. Carefully unscrew and remove the old diaphragm by hand. Do not lose the washers.



21. Clean the diaphragm mounting area to remove dust, particles, or rubber residue.
22. Install the new diaphragm with its metal plate and washers by hand.
23. Keep the diaphragm mounting hole facing up.
24. Reinstall the front metal plate and tighten the four screws. Clean the diaphragm mounting area to remove dust, particles, or rubber residue.
25. Reinstall the upper pump head components in the same orientation marked before disassembly.

Figure 1

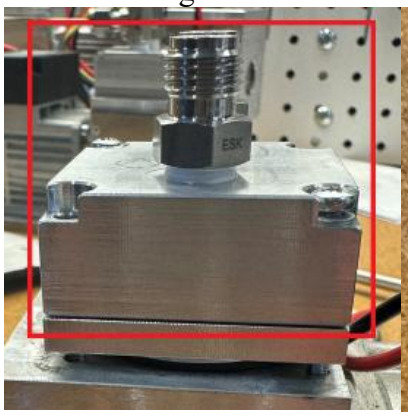


Figure 2

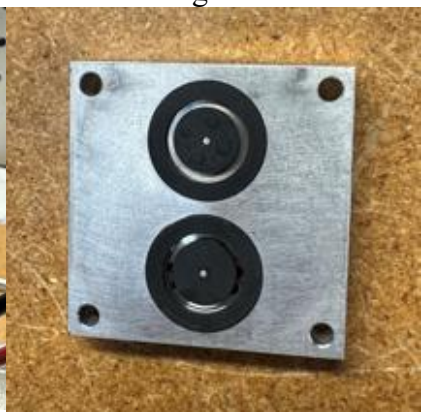
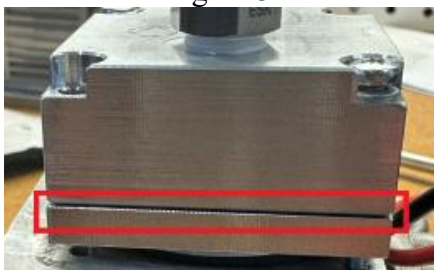
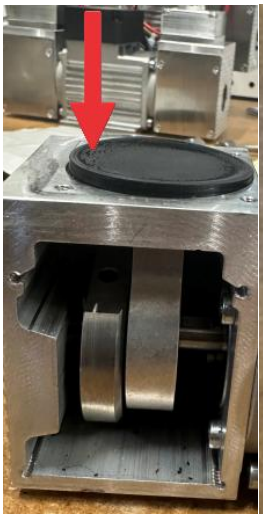
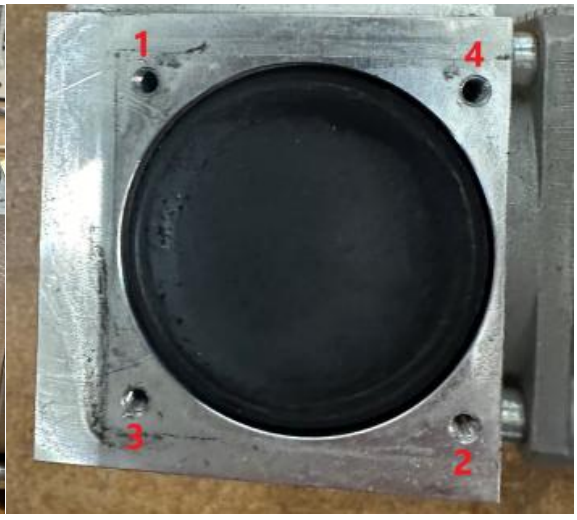


Figure 3



26. Tighten the pump head screws evenly. Pre-tighten the screws gradually in a cross pattern, then perform the final tightening in the same order.





27. Reinstall the bypass tube in its original orientation.
28. Reinstall the pump in the LDRPS.
29. Tighten the four pump mounting screws.
30. Reconnect the pump tubing fittings in their original locations.
31. Reconnect the pump electrical connector.
32. Confirm that all fittings, screws, and connectors are properly installed.
33. Close the front door of the LDRPS.

9.4.4. How to replace the fans in the LDRPS

1. Open the front door of the LDRPS.
2. You will then have access to the 2 fans located on each side. Disconnect the green connector to remove the power from the fans.
3. Remove the fixing screws and replace the fans with new ones.
4. Reconnect the green connector and close back the door.

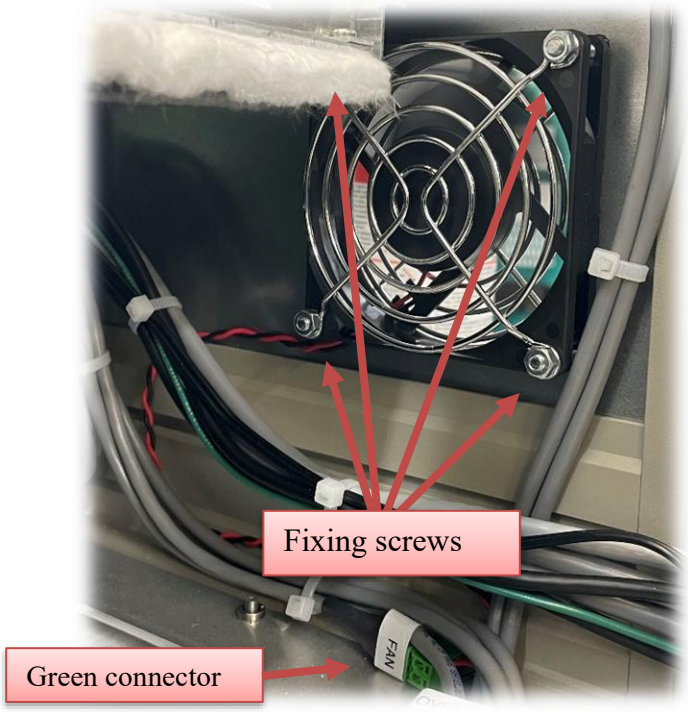


Figure 9: LDRPS fan

Where innovation leads to success