LD8001

USER'S MANUAL

TRACE NITROGEN IN ARGON, HELIUM AND CRUDE ARGON GAS ANALYZER

LD8001 series

Trace impurity analyzer

USER'S MANUAL
V1.0

Printed in Canada

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1. Forewarning

This manual is required to be read by any user wanting to use the LD8001 Trace Impurity analyzer. It contains important information to successfully operate the instrument. LDetek assumes that all operators have taken the time to read this information before they install, operate and troubleshoot the analyzer.

If any error is suspected by the reader, please contact LDetek. LDetek reserves the right to make changes to subsequent editions of this document without prior notice to holders of this edition.

In no event shall LDetek be liable for any damages arising out of or related to this document or the information contained in it.

We would like to thank you for choosing **LDetek** *as your gas analyzer supplier.*

2. Warranty 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. Consumables, chemical traps, O-rings, etc., are warranted to be free from defects in workmanship and material under normal use and service for 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 consumable, 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 damage directly or indirectly, arising from the use of the equipment of goods, from breach of any warranty, or any other cause.

ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED ARE HEREBY EXCLUDED.

IN CONSIDERATION OF THE HEREIN STATED PURCHASE PRICE OF THE GOODS, 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 FITNESS FOR A PARTICULAR PURPOSE.

THIS WARRANTY IS THE ONLY WARRANTY MADE BY LDETEK INC. WITH RESPECT TO 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 SELLER'S LIABILITY EXCEEDS THE PRICE TO 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 TO INCLUDE 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 CAPITAL AND DAMAGE OR LOSS OF OTHER PROPERTY OR EQUIPMENT. IN NO EVENT SHALL SELLER BE LIABLE FOR PROPERTY DAMAGE AND/OR THIRD-PARTY CLAIMS COVERED BY UMBRELLA INSURANCE AND/OR INDEMNITY COVERAGE PROVIDED TO BUYER,

ITS ASSIGNS, AND EACH SUCCESSOR INTEREST TO THE GOODS PROVIDED HERE UNDER.

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

SERVICE POLICY

1. If a product should fail during the warranty period, it will be repaired free of charge. For out-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 product is 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 numbers of 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:

1. Obtain an RMA (Return Material Authorization) number.

2. Supply a purchase order number or other acceptable information.

3. Include a list of problems encountered along with the name, address telephone, and RMA number.

4. **Ship the analyzer in its original crating or equivalent. Failure to properly package the analyzer will automatically void the warranty.**

5. **Every gas connection must be capped with appropriate metal caps. Failure to do so will automatically void the warranty.**

6. Write the RMA number on the outside of the box.

7. Use an LDetek approved carrier. Also, the delivery must be sent to LDetek facilities. LDetek will not accept airport to airport delivery.

8. 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 decompilations nor reproduction of such software or hardware products, or disclosures of programming content to other parties is 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 services if there is any tentative from any customers to reverse engineering any of LDetek products or to tamper with any sealed module.

Trademarks and product identification as LD8001 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. Cautions & Warnings

Improper installation, operation or service of this analyzer may cause damage to the analyzer and void the manufacturer's warranty.

3.1 Electrical shock hazard

Do not operate unless the cabinet is securely closed. Servicing this instrument implies possible exposure to shock hazard level voltages which can cause death or serious injury.

For both safety and proper performance, this instrument **must** be connected to a properly grounded three-wire source of electrical power.

Both alarm switching relay contacts and digital output contacts wired to a separate power source must be disconnected before servicing.

Tampering or unauthorized substitution of components may adversely affect the safety of this product. Use only factory-approved components for repair.

3.2 Possible explosion hazard

Never introduce other gases than argon or helium in this analyzer. If explosive, flammable or corrosive gases or mixtures are allowed to flow in the analyzer, fire or explosion may result. This analyzer is not designed to be used in hazardous areas.

This analyzer must be installed in laboratory environments: moisture- and vibration-free, with stable temperatures.

4. Declaration of conformity

EU Declaration of Conformity

1. **Product model:** LD8001 online analyser series

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. **Standards:**

Test name Standard	Limit Test level	EUT	Results
Measurement of conducted emissions on the supply line CISPR 32: 2015 A1: 2019	Class A	E41428	Pass
Measurement of conducted emissions on the supply line FCC Part 15, Subpart B: 2021	Class A	E41428	Pass
Measurement of radiated emissions (30 MHz – 6 GHz) CISPR 32: 2015 A1: 2019	Class A	E41428	Pass
Measurement of radiated emissions (30 MHz – 7.5 GHz) FCC Part 15, Subpart B: 2021	Class A	E41428	Pass
Radiated electromagnetic field immunity – radio frequencies IEC 61000-4-3: 2020	Scan: 10 V/m (80 MHz – 1 GHz) 3 V/m (1.4 GHz – 6 GHz)	E41428	Pass
Conducted immunity IEC 61000-4-6: 2013	10 V power line	E41428	See Sec. 4
Electrostatic discharge immunity IEC 61000-4-2: 2008	±4 kV contact ±8 kV air	E41428	Pass

Test name Standard	Limit Test level	EUT	Results
Electrical fast transient immunity IEC 61000-4-4: 2012	±2 kV power line	E41428	Pass
Surge immunity IEC 61000-4-5: 2014 A1: 2017	±1 kV L - L ±2 kV L - Ground	E41428	Pass
Magnetic field immunity IEC 61000-4-8: 2009	30 A/m, 50 Hz	E41428	Pass
Voltage dips, short interruptions and voltage variations immunity IEC 61000-4-11: 2020	0 % - 1 cycle 40 % - 10 cycle 70 % - 25 cycles 0 % - 250 cycles	E41428	Pass

4. **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: 03/23

990, rue Monfette Est, Thetford Mines G6G 7K6
Tél. 418 755-1319, Tél. 418 755 1329

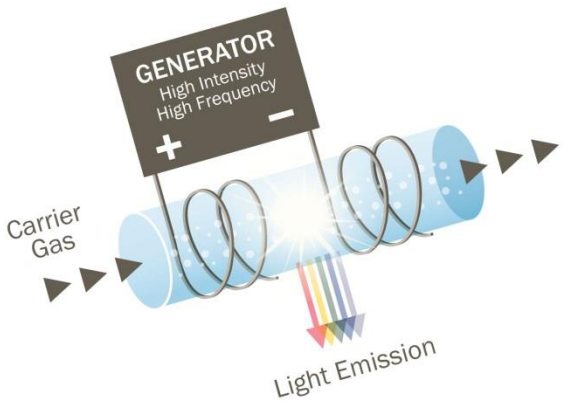
5. Specifications

Detector type:	Plasma Emission Detector design based on a Duty Cycle Controlled System
Range:	Application dependent (0-1, 0-10 and 0-100 ppm as standard)
Accuracy:	Better than ± 1% full scale
Standard features:	• Manual or auto-ranging (user selectable) • Microprocessor controlled • 7" 800x480 Display with Touch Screen • Self-diagnosis system with auto-resolve alarm • 4-20 mA isolated output • Alarm Historic • Safe calibration procedure to avoid any bad calibration • 4 Digital outputs for remote monitoring: (all dry relay contacts) ○ System status, alarms, range, stream • Serial port: RS-232 / 485 • 2 Digital inputs
Options:	• Internal sampling system for zero, span and two samples • Main industrial protocols (Modbus, Profibus, Profinet, Ethernet/IP, EtherCAT…)
Gas connections:	Sample: 1/8'' Stainless Steel double compression compatible tube fitting Vent: 1/8'' Stainless Steel double compression compatible tube fitting
Calibration gas:	Zero: LDP1000 purified gas (Getter) Span: 75% to 90% of the working range of N_2 in Argon or Helium
Sample flow requirements:	75 to 200 sccm
Operating sample pressure range:	3 (20 kPag) to 30 psig (138 kPag) (Low-pressure option available)
Operating temperature:	10 °C to 45 °C (but stable environment)
Supply:	115 VAC, 50 – 60 Hz or 220 VAC, 50 – 60 Hz
Power consumption:	Maximum 40 watts
Response time:	T90 <10 seconds
Drift:	± 1% over 24 hours
Dimensions:	176mm (6-7/8") high X 446mm (17-1/2") wide X 624mm (24-5/8") deep
Weight:	29 lbs (13 kg)

6. Cautions & Installation

6.1 Detector cautions

The LD8001 uses a detection technique known in the industry for many years. The principle is not new, but the design of the detector and the electronics make it unique for its performance and reliability.



The analysis is based on spectroscopic emission. The detector is a pure quartz cell put in an electromagnetic field created by a specific high-intensity generator. This electromagnetic field creates plasma that emits light to different wavelengths. A filter for nitrogen is used to avoid any interference and get the best performance.

The detector also uses a "Duty Cycle Controlled System" to increase the lifetime of the cell. It increases lifetime, stability and sensitivity compared to any other system on the market.

Since the cell is made of thin quartz, this analyzer must be used at **atmospheric pressure to avoid any cracking.**

Any backpressure to the detector vent connection will cause damage and will require replacement of the plasma detector module.

6.2 Analyzer application

The LD8001 is designed to be used **for the impurity and sample detailed on the specification sheet of the instrument only**. Using this instrument with any other type of gases can cause damage to the analyzer.

This is not an instrument to be used in hazardous areas.

For dual-background analyzers, please allow a minimal time of 5 hours after changing background to get maximal performances of the analyzer. This time is required to evacuate any background not desired in the system that causes interference and drift.

6.3 Installation

Some simple steps are required to make a successful installation.

Unpack the instrument from the box carefully without damaging the gas connections. Inspect the instrument to be sure it is in good condition and hasn't been damaged during shipping.

Remove all plugs from the gas connections on the rear panel. **Don't forget to remove the plug on the detector vent connection and make sure to never pressurize the instrument**. It will damage the detector. This instrument is made to work at atmospheric pressure.

Any backpressure to the detector vent connection will cause damage and replacement of the plasma detector module.

Make sure to purge the gas line with pure argon or helium depending on the application (using UHP grade 5.0 or better) before connecting gas to the sample inlet connection.

Connect the sample gas to the sample inlet of the instrument.

WARNING: BEFORE CONNECTING A SAMPLE INLET GAS, BE SURE THE DETECTOR VENT CONNECTION IS AT ATMOSPHERIC PRESSURE.

For the integrated stream selector version, connect all gas lines to each identified channel inlet. Please refer to the integrated stream selector section in this manual for the connections.

LDH2O moisture trap must always be mounted before the sample inlet of the instrument. Refer to the installation drawing on the next page. This trap is consumable and must be replaced every year. (See ordering section of this manual)

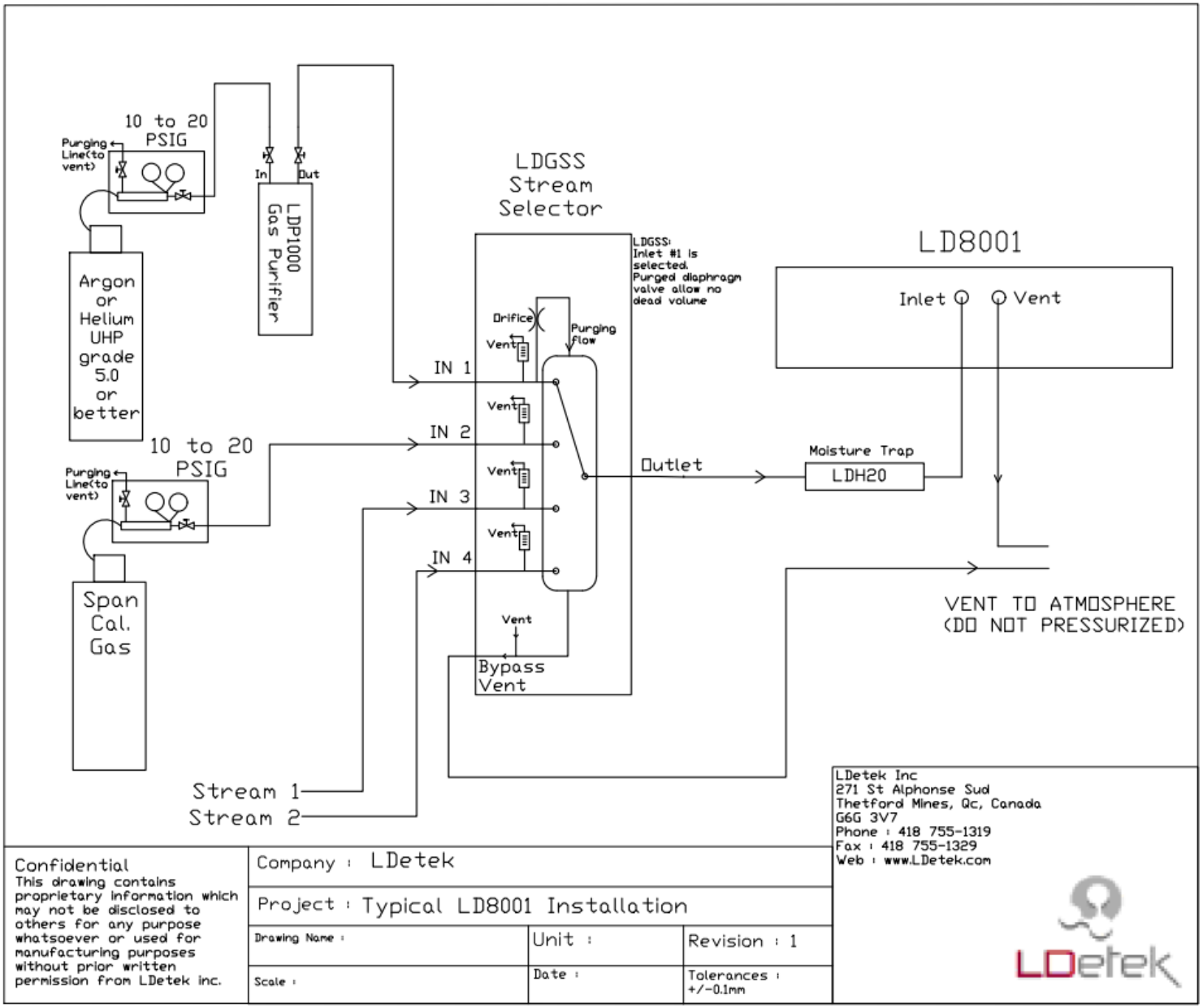
Be sure to connect the right source voltage to the instrument. Please refer to the model number of the instrument that shows the voltage of it (110VAC or 240VAC). The red indicator in the power inlet module on the back panel must have the same voltage indication as the indication shows in the model number. Having the wrong power source connected to the instrument can cause severe damage to the instrument.

Be sure the operating parameters are configured the same way it appears on the Operating Parameter sheet included with the instrument.

Turn on the unit. The detector should turn on by itself after few minutes and start showing ppm reading.

NOTE: FOR A GOOD INSTALLATION, PLEASE REFER TO TYPICAL INSTALLATION SCHEMATIC.
Allow at least 24 hours of purging before using the instrument. A calibration must be run after the purging process. Always refer to the calibration sheet included with the instrument to compare the zero and span counts with the calibration counts obtained by LDetek before shipping.

6.4 Typical installation schematic



7. Hardware Description & Maintenance

The LD8001 has major components included in the chassis. This section will describe each component that can be replaced for maintenance or upgrade.

7.1 Detector module

The detector module is a 142 mm (5.6”) x 107 mm (4.2”) x 77 mm (3”) box that contains all components needed to detect the impurity and provide the signal to the electronics. The mini-din connectors are used to interface the motherboard with the module. No other electrical connection is required.

Two Compression 1/16" Stainless Steel Bulkhead types are used for connecting gas inlet and gas outlet to the Detector Module.

This module can be defective if the detector has been pressurized or contaminated with inappropriate liquid or gases. In some cases, it can be cleaned with a proper solvent to clean the surface of the cell inside the module. However, this alternative can be done only at the first stage of contamination. If any suspected contamination is detected, please advise the factory if the cleaning solution process is possible. If the instrument looks un-stable, please get in contact with LDetek factory, they will guide you through different testing steps to evaluate the status of the Detector. In the eventuality that the Detector needs to be replaced, there are only the 2 mini-din cables and the two fittings to connect. After having installed the new detector module, just reboot the instrument, purge the unit for a minimum of 12 hours and proceed to a recalibration of the unit.

The defective unit must be returned to LDetek Factory for evaluation.

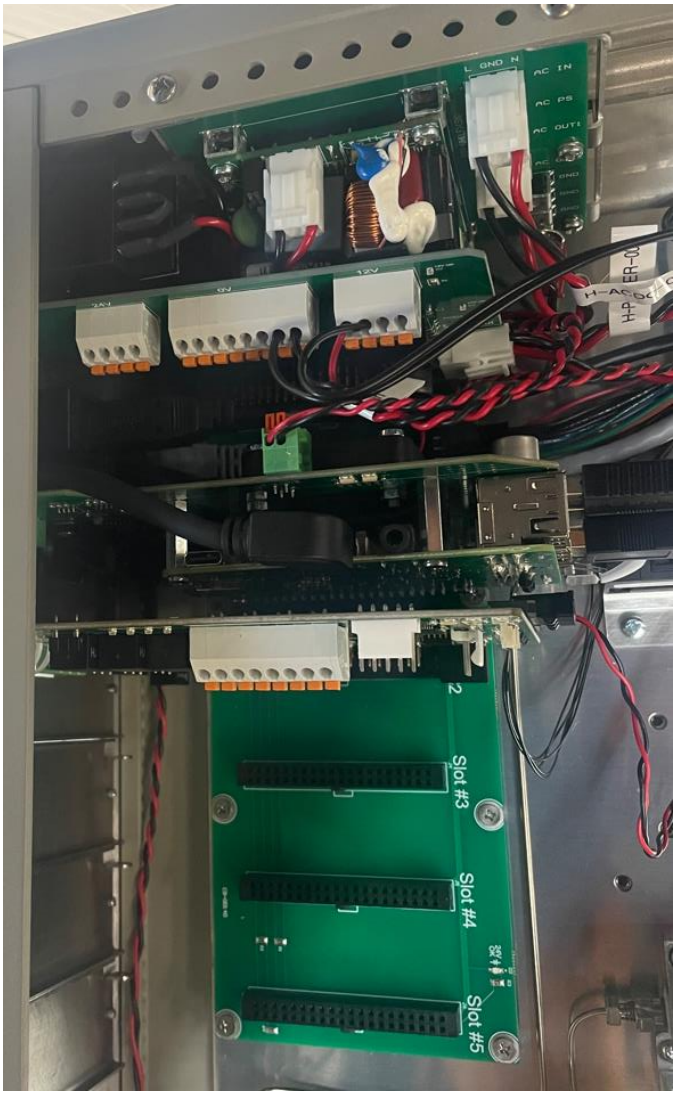
Please refer to the ordering section of this manual to get the part number for a replacement part.

Note: Always provide S/N of the instrument where the part will be installed when ordering replacement parts. This is to ensure to have the appropriate version for your instrument.

7.2 Motherboard and MCU

This electronic board controls all components inside the analyzer: Flow reading, Flow control, Detector acquisition, Detector control, LCD Display, Temperature reading, Alarms, 4-20mA Analog Output and all other options available. This board must be replaced only if you had the confirmation from LDetek.

When replacing this motherboard be sure to avoid any electrostatic contact. This Motherboard is built in a way that most parts can be easily replaced by just snapping a new part on it. This avoids the whole replacement of the circuit if only one component is damaged. It is a cost-effective solution for satisfying our clients.



Here are the submodules on this board that can be replaced just by unsnapping the damaged part and replacing it with a new part:

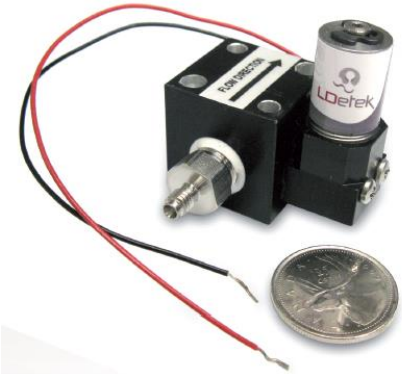
- 4-20mA Analog Output
- Flow sensor
- Temperature sensor
- 4-20mA fuse
- Relay fuse
- Microcontroller Unit

For localization of the components on the Motherboard, please refer to the Parts Identification drawing in this manual. It appears in the Drawing section.

Please refer to the Ordering section of this manual to get the part number for a replacement part.

Note: Always provide S/N of the instrument where the part will be installed when ordering replacement part. This is to ensure to have the appropriate version for your instrument.

7.3 Solenoid Proportional Valve



This valve is used to control the flow inside the detector module. This is a very low dead volume valve that allows minimal purging at startup and is very fast for flow stabilization. This microvalve has been designed by LDetek to meet good performances of the instrument. These advantages are demonstrated in the LD8001 Design Report.

The standard configuration of the LD8001 allows a pressure range going from 3 psig up to 30psig. Having higher pressure may cause damage to the valve. In the eventuality that the valve has been exposed to high pressure, the valve may start to have difficulties staying stable or also have difficulties closing totally. In this case, the valve would have to be re-built. So, a replacement valve can be easily installed. There are only two wires and two fittings to connect to do the replacement.

Please refer to the Ordering section of this manual to get the part number for a replacement part.

Note: Always provide S/N of the instrument where the part will be installed when ordering replacement parts. This is to ensure to have the appropriate version for your instrument.

7.4 Display with Touch Screen (7" 800x480)

This 7" display allows having a user's friendly interface. Moreover, its touch screen allows easy navigation through the different menus. Carefully handling the touch screen is essential to ensure not damaging it.

If the display is damaged, it can be easily replaced by removing the back plate of the door and the four fixing screws. A new display can be ordered from LDetek.

Please refer to the Ordering section of this manual to get the part number for a replacement part.

Note: Always provide S/N of the instrument where the part will be installed when ordering replacement part. This is to ensure to have the appropriate version for your instrument.

8. Operation

The LD8001 has a screen and the web interface is available through the Ethernet port.
Refer to the tag on the back of the device to get the proper web link associated to your instrument.

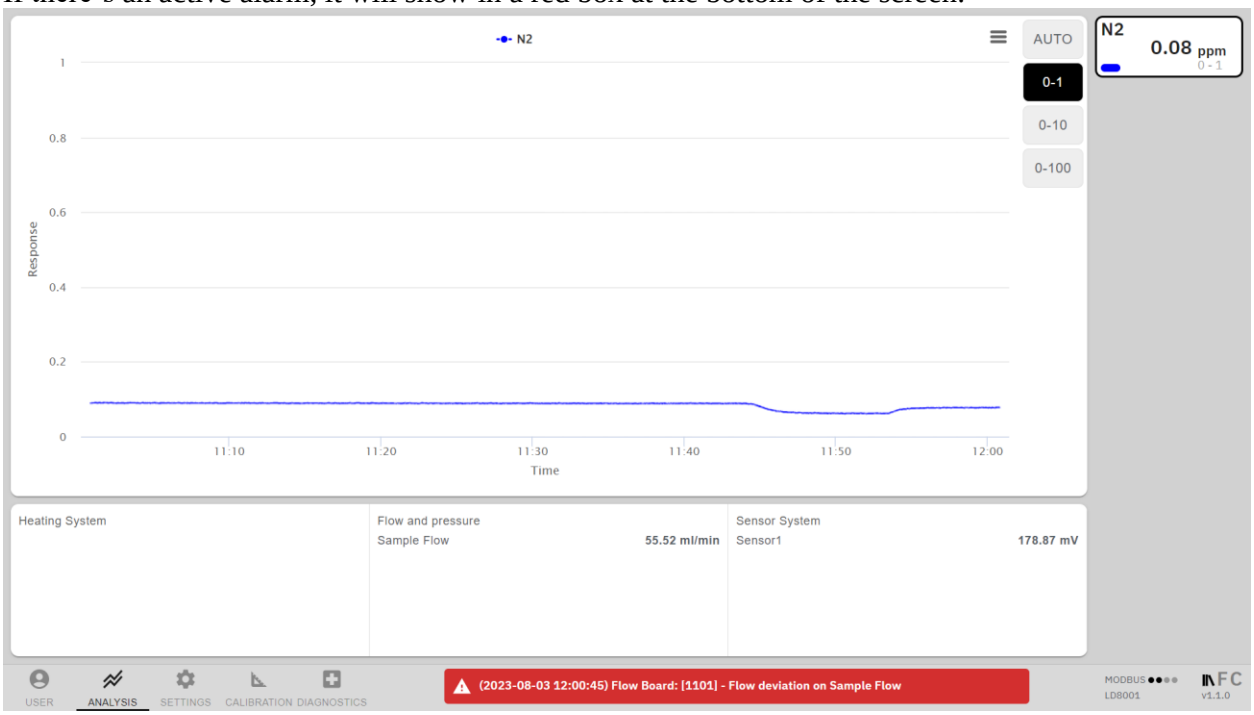
8.1 Analysis menu

This is the main menu of the instrument and the menu where the analyzer must stay for normal operations. The real time concentration is shown on the right section of the screen.

- • Value in ppb, ppm or %
- • Selected range
- • Digital signal from the detector in mV
- • Flow in milliliter/minute
- • Software Version (at the right bottom)

The middle section of the screen gives a real-time trending. The real-time results are on the right side of the screen and under the graphic, the flow and sensor mV are shown at all times.
The bottom section gives the choice of the different menus to navigate through: the user interface, the analysis menu, more settings parameters, the calibration menu and diagnostic tools menu used for troubleshooting.

If there's an active alarm, it will show in a red box at the bottom of the screen.



8.2 Calibration menu

This menu is used to calibrate the instrument.

REZERO: Pressing COPY REAL TIME UNIT will calibrate the zero with the zero-value entered previously. You can do it manually by clicking on the box with value and enter the one you need.

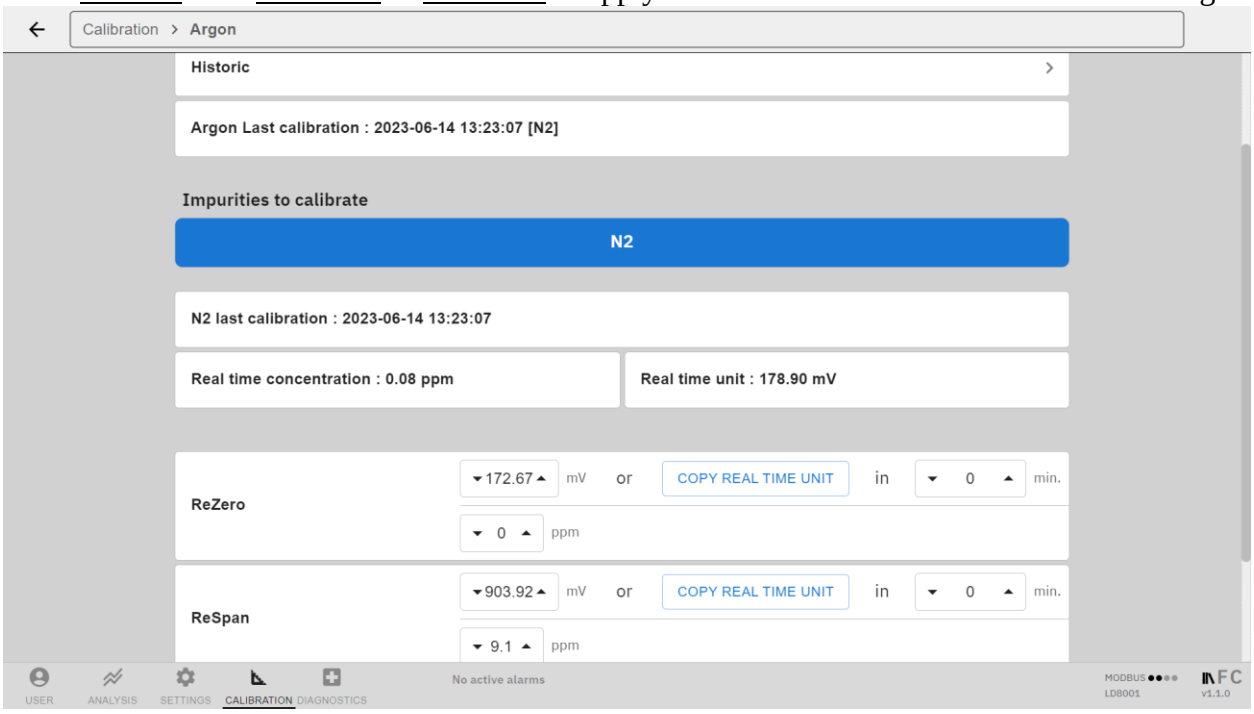
RESPAN: Pressing COPY REAL TIME UNIT will calibrate the span with the span value entered previously. You can do it manually by clicking on the box with value and enter the one you need.

CALIBRATION NOTE: Add a calibration note to keep track of the different calibration done with time on the instrument.

HISTORIC: Used to switch back to old calibration.

REAL TIME: The real time concentration and real time unit shows what's going through the instrument at the moment.

Click APPLY after REZERO or RESPAN to apply the new calibration to the real time reading.



8.3 Settings menu

This menu configures many parameters of the analyzer that should be **changed only by qualified personnel**. Those parameters can change the functionalities of the analyzer.

General: This is where the language, time and date can be changed. The different units that are used in the analyzer are set up there. (voltage, current, flow, concentration, temperature, outpout, state, pressure, time and frequence)

Methods: This is where the method is set up, if there is more than one method, the other ones will be shown there. The current method can be changed there to another one if applicable. Clicking on the method will let you change the impurities and the method name.

Plasma: The plasma is set up here, the hardware that's connected to it and disabling the hardware is done here.

Output Value (%): Power sent to the detector. Changing this value can result to severe damage to the Detector Module. **This value is set in Factory and must never be changed without advising LDetek.**

HCD: If there's a HCD in the analyzer, the setup is made here. Enabling or disabling the hardware is done here, the set point and PID are set here.

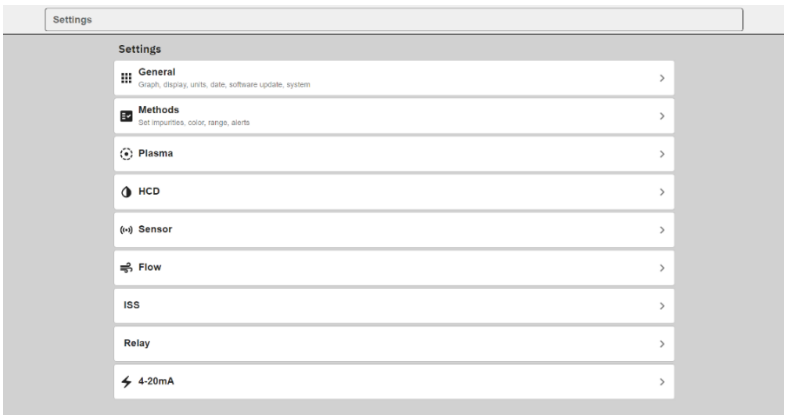
Sensor: The sensor menu is where the sensor can be disabled if necessary and the shown on analysis can be enabled.

Flow: This is where the sample flow settings are set up. The type, (regulated or read only) the PID, shown on analysis, the hardware, the flow deviation tolerated, the setpoint can be set from here and from the analysis page.

ISS: The ISS system can be managed from here, the different valves are shown in this menu. If there is an integrated sampling system installed, the feature must be ON. **This value is set in Factory and must never be changed without advising LDetek.**

Relay: The relays are managed from this menu.

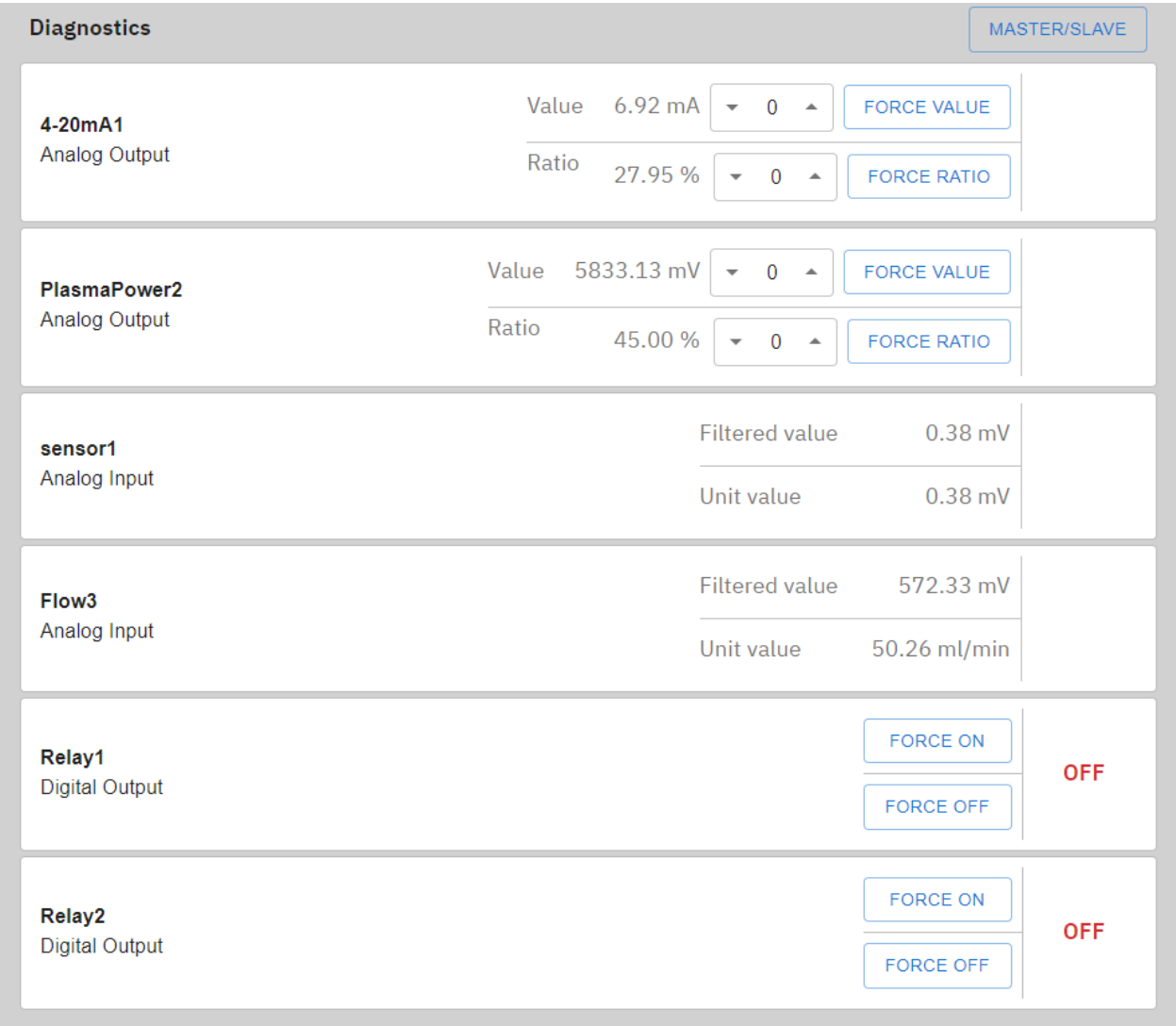
4-20mA: This is where the 4-20mA is calibrated.



8.4 Diagnostic menu

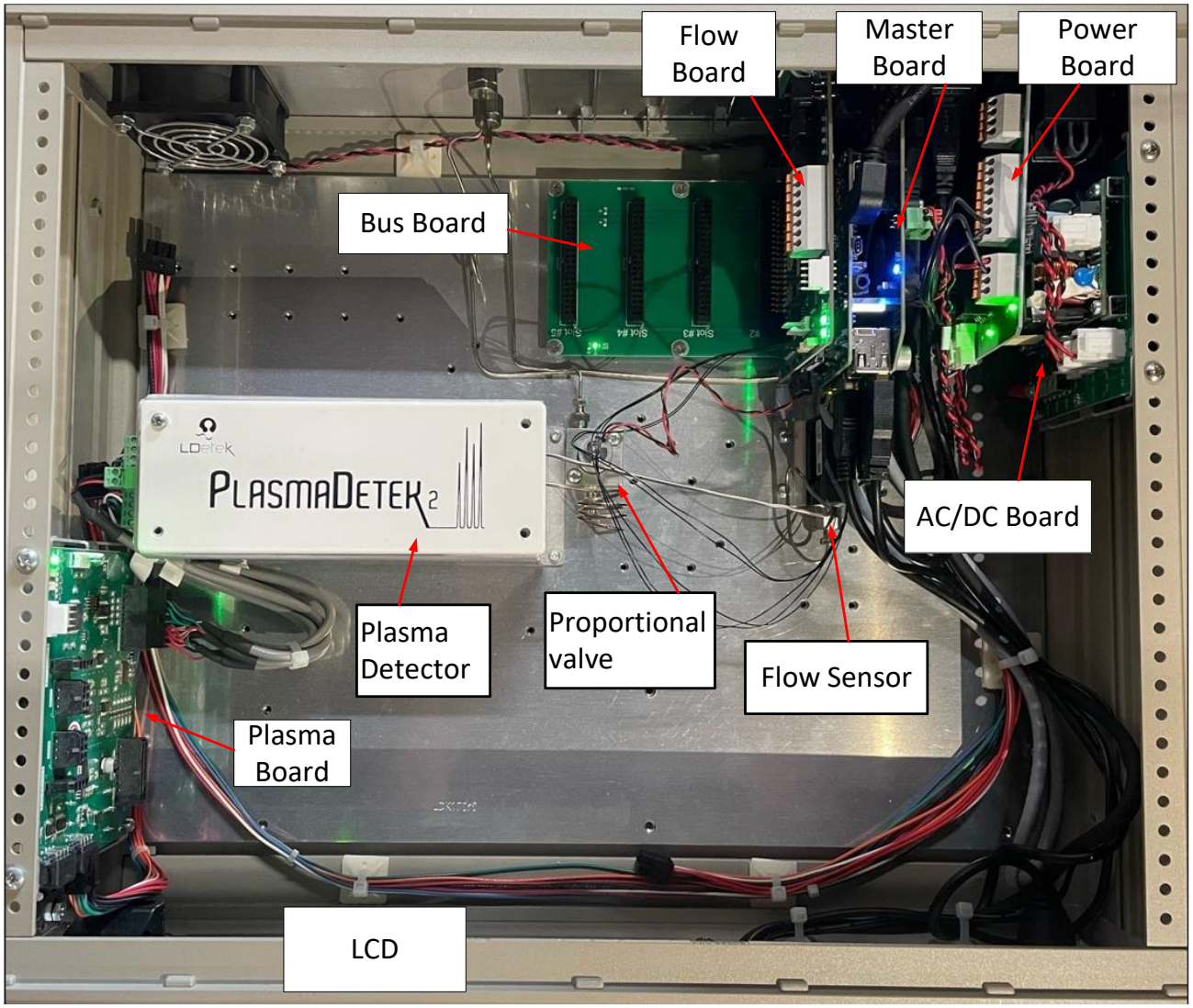
This menu is only used for troubleshooting and diagnostic. It is not required for standard operations.

The analog input (flows, sensors, RTD) gives the real time values and help diagnose.
The analog output (valves, relays) can be forced to test.
The digital output (4-20mA, plasma power) can be forced to test too.

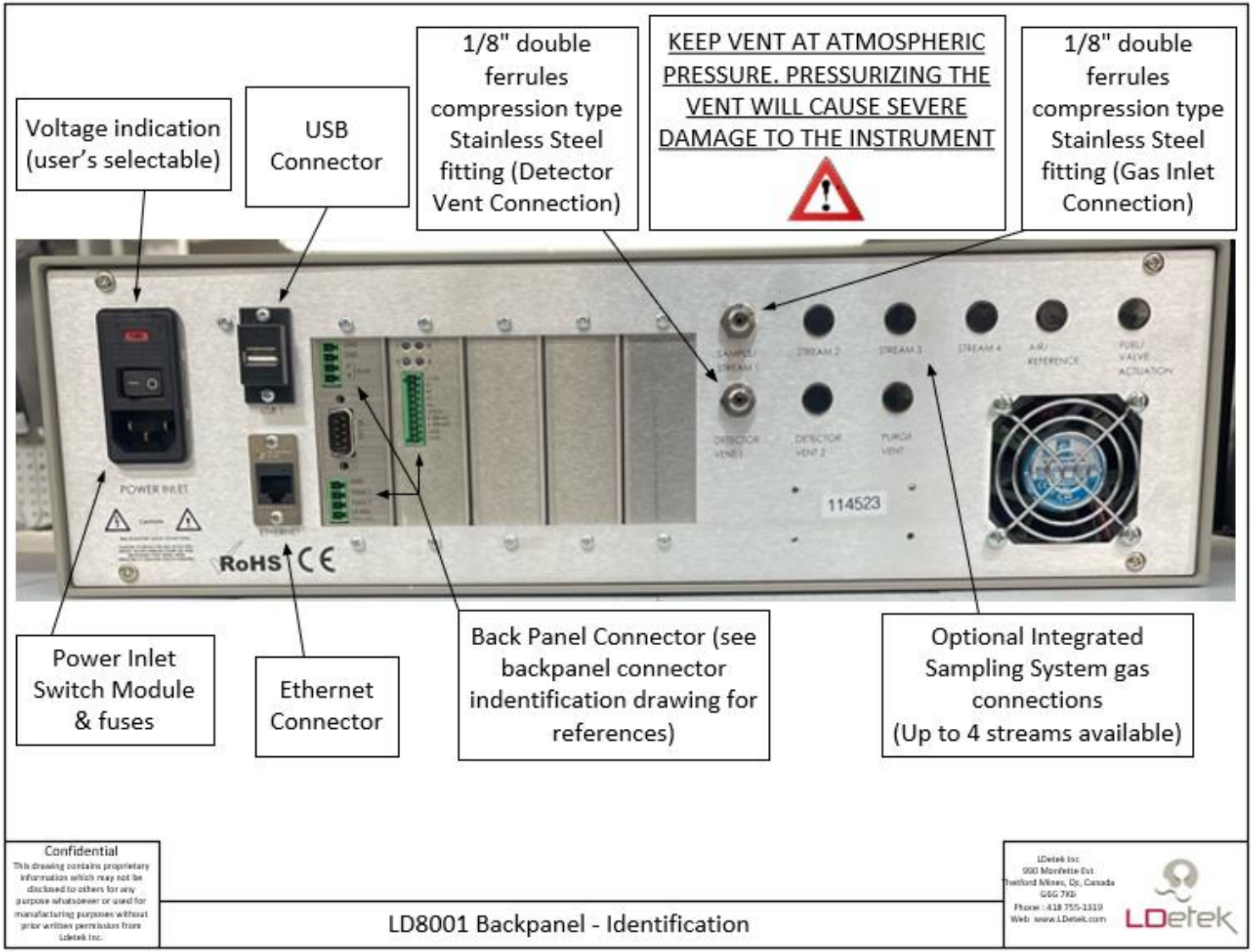


9. Drawings & Schematics

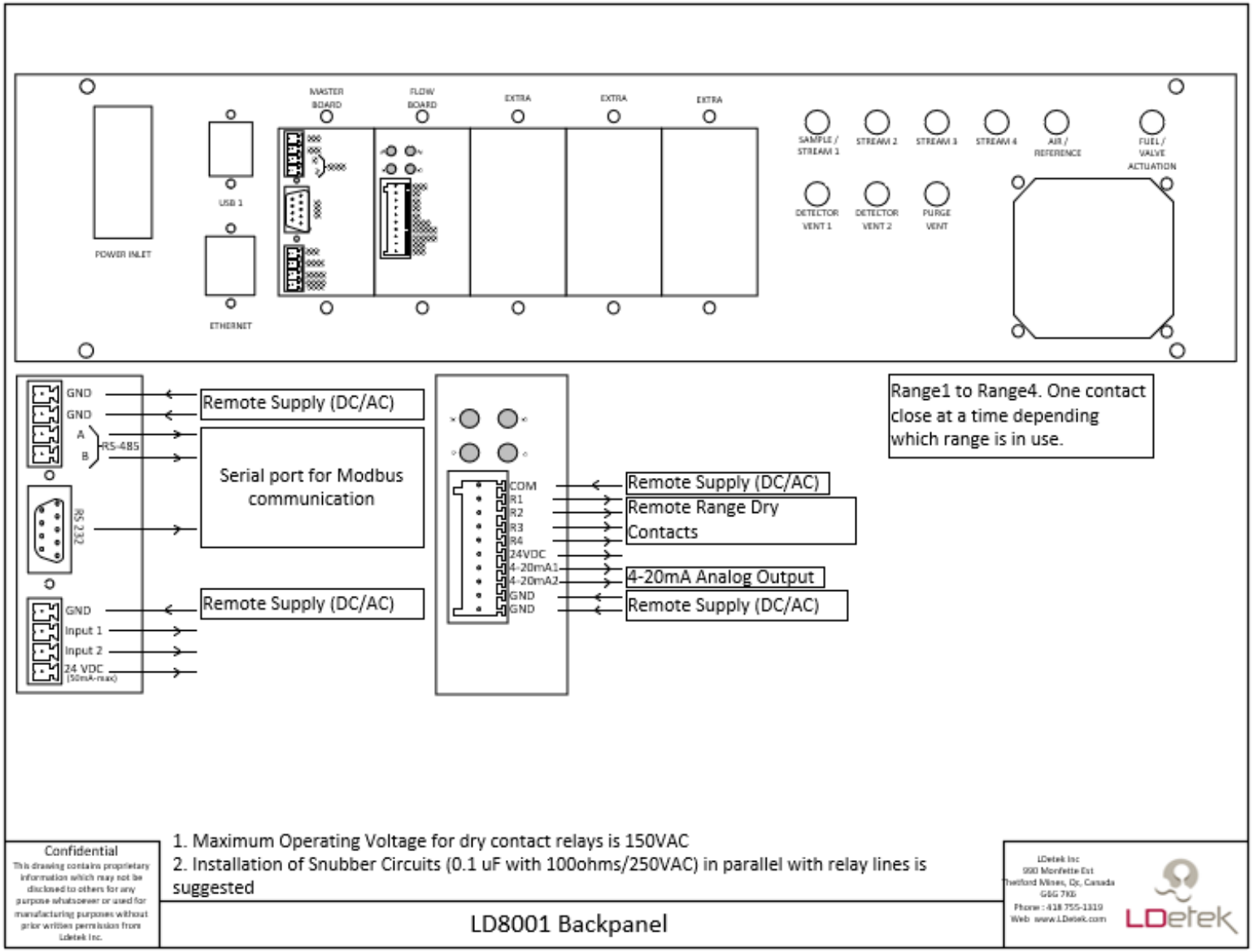
9.1 Parts Identification



9.2 Back Panel Identification

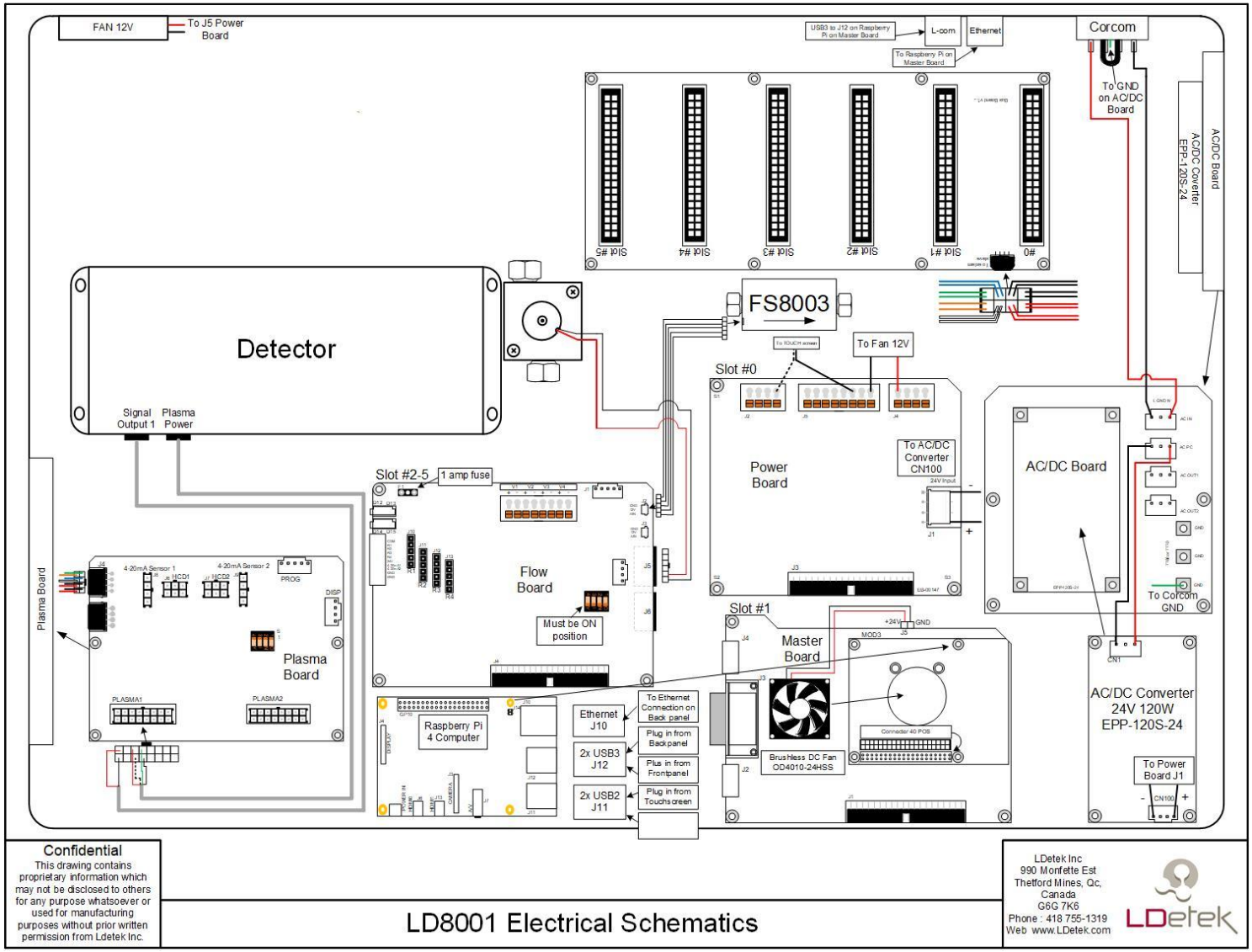


9.3 Back Panel Connector Identification

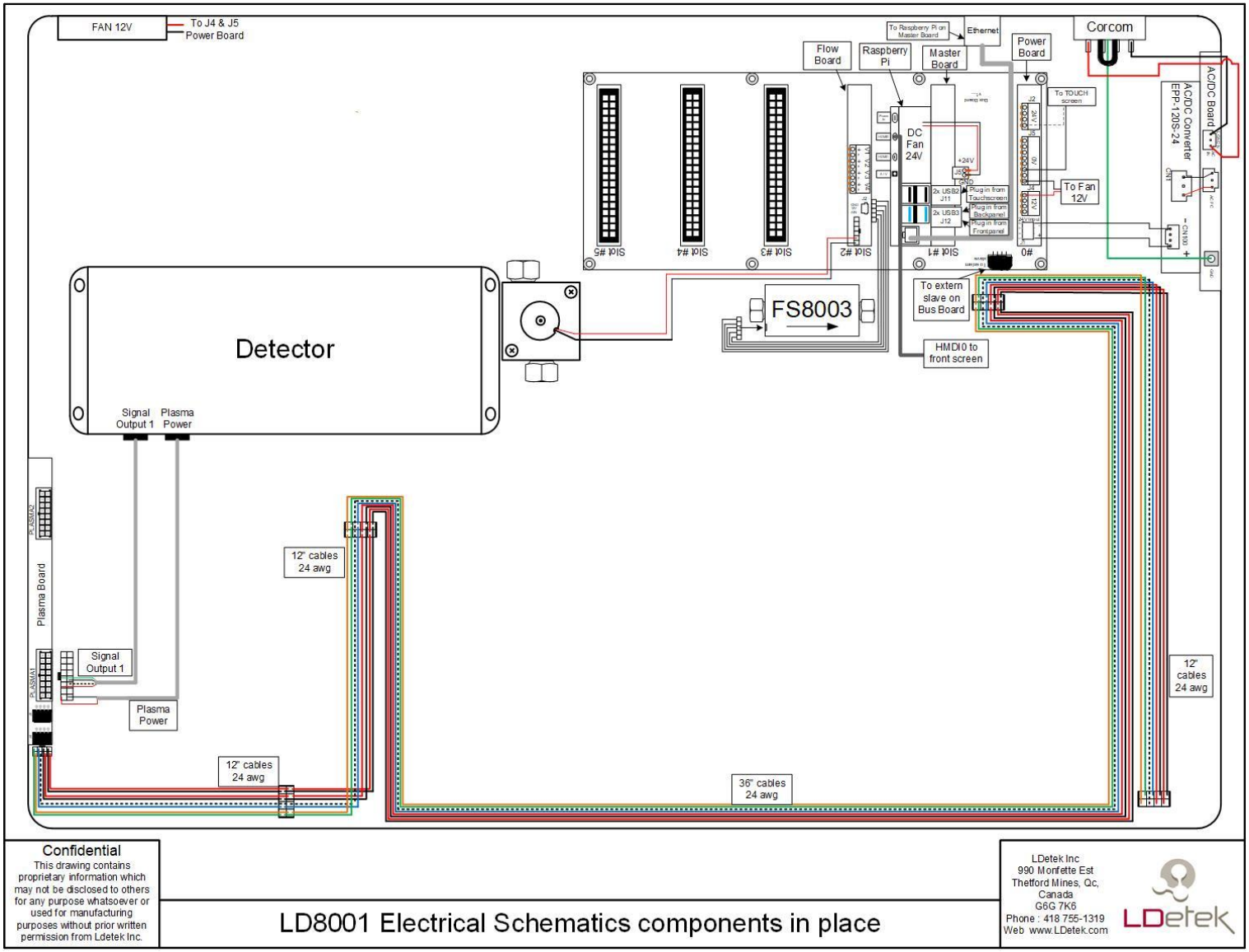


9.4 Electrical Schematic LD8001

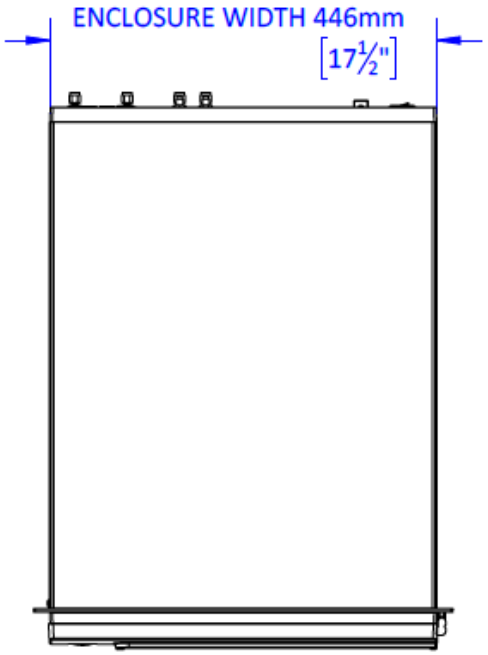
Bloc diagram view

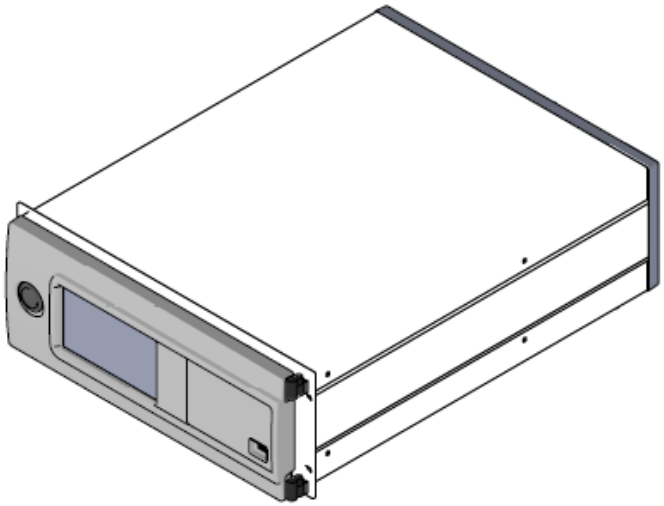


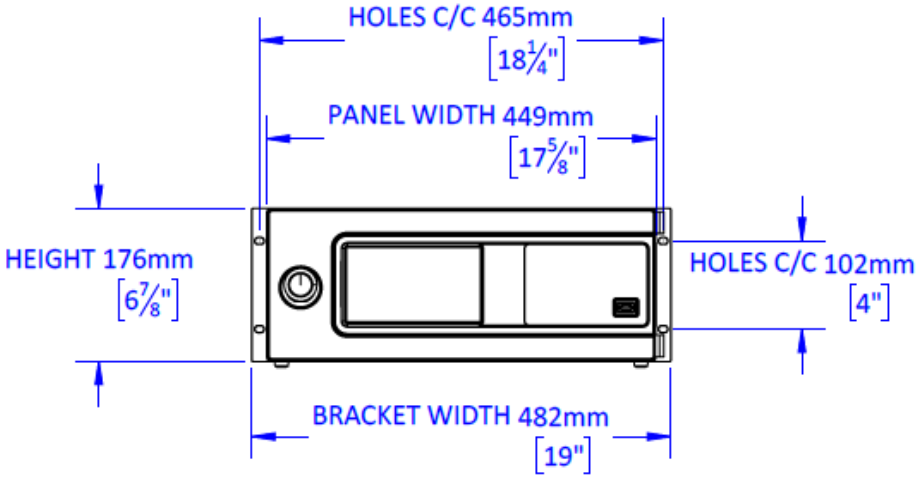
Real internal view

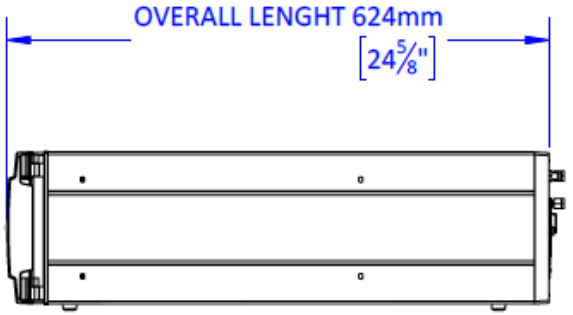


9.6 Enclosure Dimensions & Panel Cutout









10. Procedures

This section will give the procedures to follow regarding some manipulation to do with the instrument and/or its different functions. It is strongly suggested to read it before the installation of the instrument.

10.1 Leak Finding Procedure

Experience has shown that bad analysis results often come from inboard contamination following by leaks in the tubing bringing the sample to the analyzer's detector.

Using the right procedure, the trace Nitrogen analyzer LD8001 can self-diagnose the presence or absence of contaminating leaks.

We first have to understand that the gas circuit is divided into two major zones. The proportional valve located inside the analyzer is the boundary separating these two zones. So, the first zone is constituted of all the tubing, valves, sampling system, pressure regulators etc. located between the gas source (gas cylinder, gas tank, truck tank, etc) and the inlet of the proportional valve located inside the analyzer. The second zone is constituted of everything located between the proportional valve outlet and the detector (the cell module) inlet. There is a specific procedure for checking leaks of each zone. The main difference between our two zones is that the gas pressure in the first zone (upstream the proportional valve) is high (usually 5 to 15 PSIG) while the gas pressure in the second zone is just a little bit higher than atmospheric pressure (0.1 or 0.2 PSIG).

The main difference between the two leaks finding procedures will be the following one:

- In zone 1, we will play with the gas pressure (generally with a gas regulator) and check changes in the analyzer reading.
- In zone 2, we will play with the analyzer flow and watch for changes in the analyzer reading.

We recommend doing both tests before trying to fix leaks.

To run both tests, we will watch the changes in ppm value. Of course, the results will be reliable providing that the analyzer already has a reliable calibration. New analyzers are shipped pre-calibrated so we can use this pre-calibration to run the tests. If the calibration has been fouled up by calibrating with contaminated calibration gas, we will need to watch the raw signal from the detector in the analysis menu.

TEST FOR ZONE 1

This test will mainly consist in changing the line pressure from normal operating pressure (usually somewhere between 5 to 15 PSIG) to a pretty low pressure i.e., < 1 PSIG. To achieve this, you drop the pressure low enough in such a way that the analyzer flow will slightly drop from its normal 100 ml/min flow to, let's say 90-95 ml/min. The analyzer flow should stay that much low, ≈ 90-95 ml/min, since the inlet pressure is not high enough to supply the whole normal flow. We know at that moment that the line pressure is well below 1 psi, usually around 0.6 psi. If there is no leak, there will be no noticeable change in analyzer reading (ppm and mV). If the signal (ppm or mV) goes high and after a while resumes to a value close to the one, we had before dropping the pressure, this is symptomatic of a dead leg or dead volume. If the signal goes high (could be a 5 or 10 ppm step or many mV) and stays high, there is a leak for sure.

Before trying to fix leaks, this test can be done using different gas sources i.e., zero calibration gas, span gas, normal sample etc. Of course, if the same leak is observed for any of the gas sources, we will look for the source of this leak in a part of the gas circuit which is common to all the streams and so on. We have to notice that during this test, the conditions have not changed in zone 2 i.e., downstream the proportional valve; except if we have caused an important flow change by dropping the pressure too low. A good system will not show a noticeable change in signal (<0.5 ppm) while running it at low or high pressure. Of course, we easily understand that the presence of leaks will bring unreliable calibrations, erratic sample analysis results and all the nightmares that come with all that. The only solution is a good tubing and sampling system.

TEST FOR ZONE 2

Before running this test, make sure that the analyzer is running under gas for at least 2 or 3 days. Doing this test on a newly installed analyzer could give false results since the analyzer's dry down is not done yet. Therefore, this test will be simply done by changing the flow (±50ml/min) and checking for a signal change. If there is a leak, we will observe mainly a leak dilution phenomenon. Usually, a leak brings in a certain amount of impurity, no matter how high or low is the flow in the tubing. Since we will run this test with the zero gas, the presence of a leak will be confirmed by an increase in reading when dropping the flow (less diluted contaminant) or a decrease in reading when increasing the flow.

N.B.: The inlet pressure should be normal (between 5 and 15 PSIG) when running this test otherwise with a low inlet pressure we would observe the dilution of a leak that could be in zone 1.

N.B.: to change the flow, you have to go to the configuration menu and change the sample set point. When changing the flow from 100 ml/min to 75 ml/min an increase in the reading of no more than 0.30 ppm should be observed. If the presence of a leak is detected, try to retighten each fitting one by one and wait 10 seconds between each tightening to see if there is a change in the reading.

One could ask how come he should check these fittings since the analyzer's manufacturer should have installed them correctly. It is a fact that when an LD8001 leaves the factory it has been thoroughly checked and there was no leak inside since we are aware of leak problems, and we know very well how to track them. But here is what experience shows about compression fittings:

- When fittings are newly installed according to the manufacturer's specification (Swagelok, Parker, Valco, etc) they most of the time show no leak, except if some irregularities are present (scratched tubing, dirt or dust on the ferrule, etc.). Anyway, these possible problems have been checked and solved at LDetek factory (regarding the analyzer itself).

So, a properly installed fitting, when tightened, is preloaded i.e. there is a permanent pressure applied on the front ferrule against its seat providing, therefore, a good sealing. Over time, in the real-life, what happens? During shipping, transport, installation, operation, if too much vibration occurs, the ferrule preload can release, and the leak appears. Other factors also affect this phenomenon like using tubing having a too-thin wall, which accelerates the apparition of leaks. However, let's not be pessimist. Experience has shown us that easily 95% of the fittings will work great for a very long time. We just have to be aware that the presence of a leak is always possible. The only important point is to know how to check if leaks are present and how to solve the problem.

10.2 The importance of purging a regulator

Here are some quick calculations to help you understand why it is so important to have some techniques to evacuate the air from pressure regulators when replacing calibration cylinders.

For example, let's take a pure argon cylinder of size 44 (i.e., $6m^3$ of gas). On this cylinder, there is a double-stage pressure regulator with two pressure gauges, CGA connector, and an outlet isolation valve. Let's assume that the internal volume of this pressure regulator is 100 ml (±10%). When installing this pressure regulator on the cylinder, the internal volume is occupied by the atmospheric air i.e., 78.2% N_2, 20.9% O_2, 0.9% Ar, moisture, CO_2, etc.

When the regulator is screwed in place on the pressure regulator, the air still is trapped inside the regulator. If you open the valve on the cylinder to pressurize the regulator, and there is no or little flow through the regulator, the air trap inside the regulator will diffuse inside the argon cylinder. The shock caused by the quick pressure build-up inside the regulator helps to speed up the diffusion process. So, assume no flow (worst case), we have the following situation:

100ml of air and atmospheric impurities added to $6m^3$ of pure argon (assuming perfect argon i.e., no impurities at all). This leads to the following calculation:

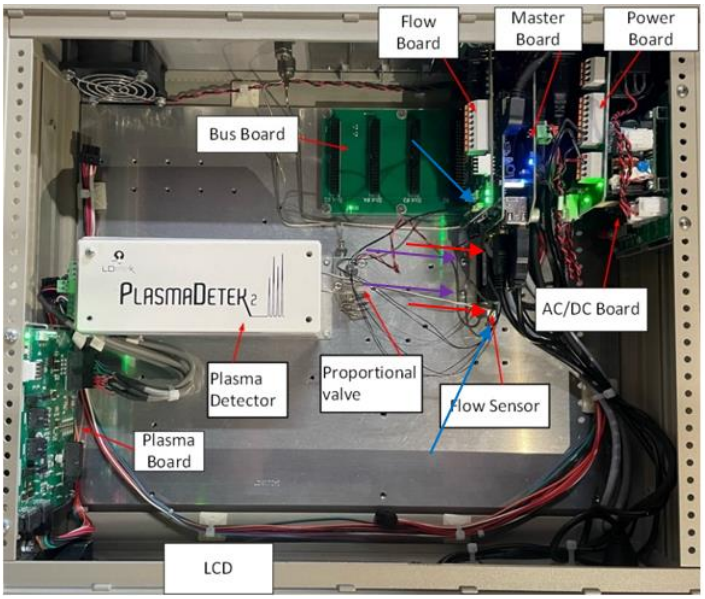
$$\frac{100 \times 10^{-6}\ m^3 \text{ (i.e., 100 CC) of Air}}{6\ m^3 \text{ argon}} = 16.66 \times 10^{-6}$$

So, the dilution ratio is 16.66×10^{-6} and $16.66 \times 10^{-6} \times 78.2\%\ N_2 = 13$ ppm of N_2
and $16.66 \times 10^{-6} \times 20.8\%\ O_2 = 3.5$ ppm of O_2

Therefore, starting from a pure argon cylinder and just by a bad pressure regulator purging procedure, we've got an argon cylinder with 13 ppm of N_2 and 3.5 ppm of O_2. These impurities will be added to any other impurity in the cylinder. This situation makes it difficult or even impossible to get accurate calibration. In some cases, we received phone calls from people claiming that the zero-cylinder had higher readings than the span cylinder.

10.3 How to replace the MotherBoard and/or its components

1. Switch off the unit and remove the lid of the instrument to access inside the unit.
. Remove the following components from the installed Bus Board:



- **Flow transducer:**

Simply pull on the wires carefully but firmly to remove connector from J2 on the Flow Board to change the board, or from the flow transducer to change the flow transducer.

If the flow transducer needs to be changed, simply remove the two tube screws as well as the two pan head screws located behind the flow transducer and re-install them on the new flow transducer.

- **4-20mA module:**

Unplug the Flow transducer cable on J2 as well as the Proportional Valve cable at J5 on the Flow board. Remove the two screws on the back panel that hold the Flow board and pull the board out of the Bus board. You will have to re-install a new Flow board in its place and plug back in the Flow Transducer and Proportional Valve.

- **Cables:**

All cables must be removed from the different connectors. Please refer to the Electrical schematic diagram in this manual for the connections.

Note 1: Be aware that glue may be used to fix the cables to its connectors. Then be careful not to damage the connectors in manipulation.

LDetek isn't responsible if damage to any parts occurs during replacement. The warranty isn't covering damage due to manipulation in the unit.

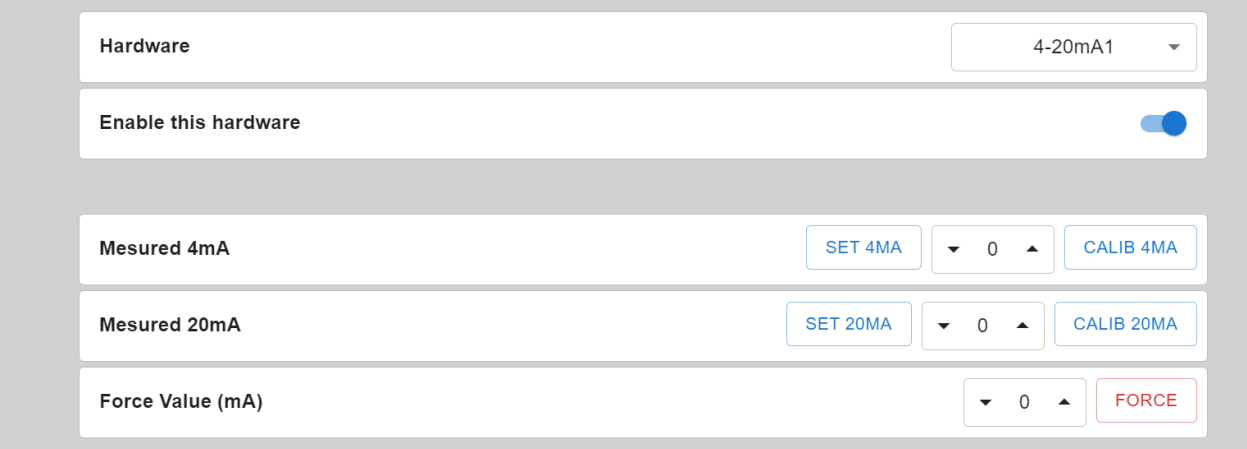
10.4 Analog Output Calibration Procedure (4-20mA)

The Analog Output has already been calibrated by LDetek specialist before shipping. In normal conditions, the analog output doesn't have to be recalibrated on site. In the eventuality that the Analog Output must be recalibrated, the procedure below explains how to proceed with the 4-20mA calibration

1) Connect an Ampere meter set at DC mA to monitor the analog signal in current (black on ground and red on 4-20mA1 (or 4-20mA2 depending which one needs calibration)

2) In the Settings menu, go to 4-20mA and select the right output.

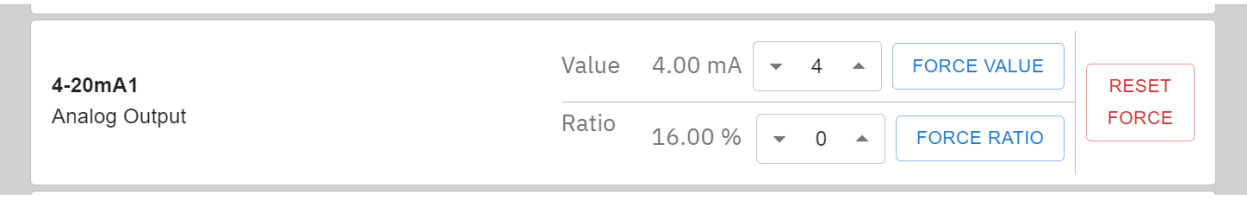
3) Start by pressing the Set 4mA button. Enter the value in mA that appears on the Ampere Meter in the box next to the calibration button then press Calib 4mA to save the parameters. Then press Set 20mA, enter the value in the box next to the button and press Calib 20mA to save the settings. Once the calibration is done, press Apply at the top of the page to get the settings properly saved.



4) The calibration is now completed. To test it, there is a box at the bottom of the 4-20mA settings page to force the values. Now change as you want the mA value from 4mA up to 20mA to verify the accuracy of the 4-20mA Output by comparing the forced value on the screen with the shown value on the Ampere Meter.

5) At any moment, you can go into the Diagnostic menu to force a value to check if the calibration is good.

6) At the end of it, be sure to reset force in the Diagnostic menu to make sure that the measured values in real-time are tracked.



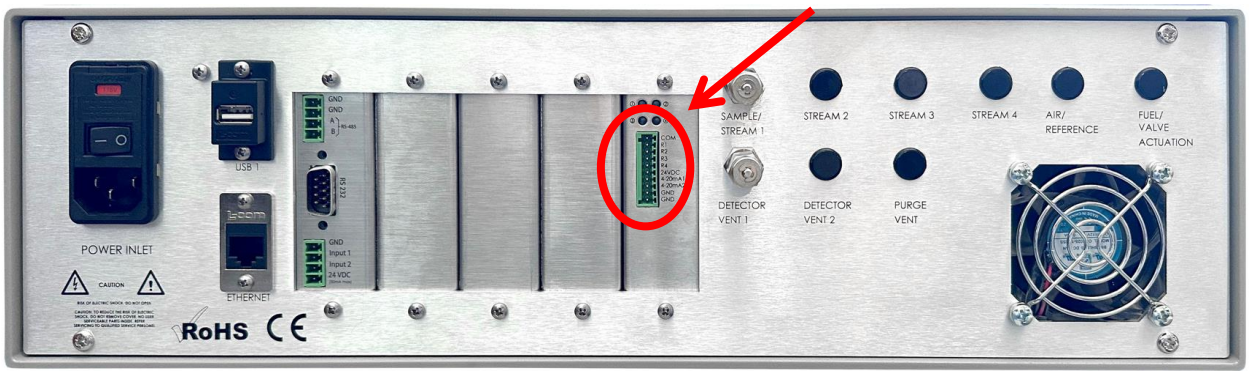
11. Options

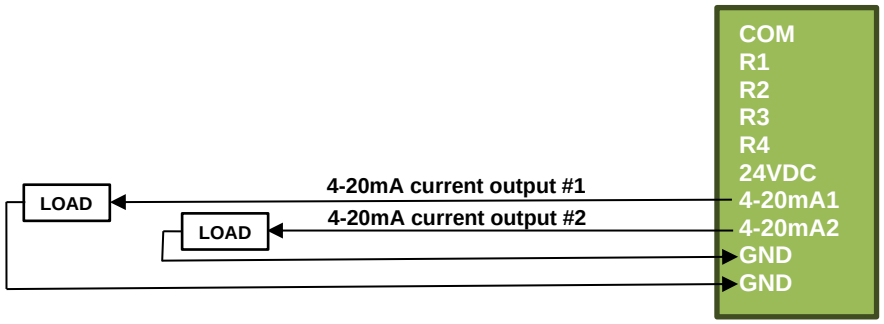
11.1 RS232/RS485 communication port

The LD8001 has a RS232/RS485 port.

This port can be used to receive and send data to the LD8001.

11.2 4-20mA





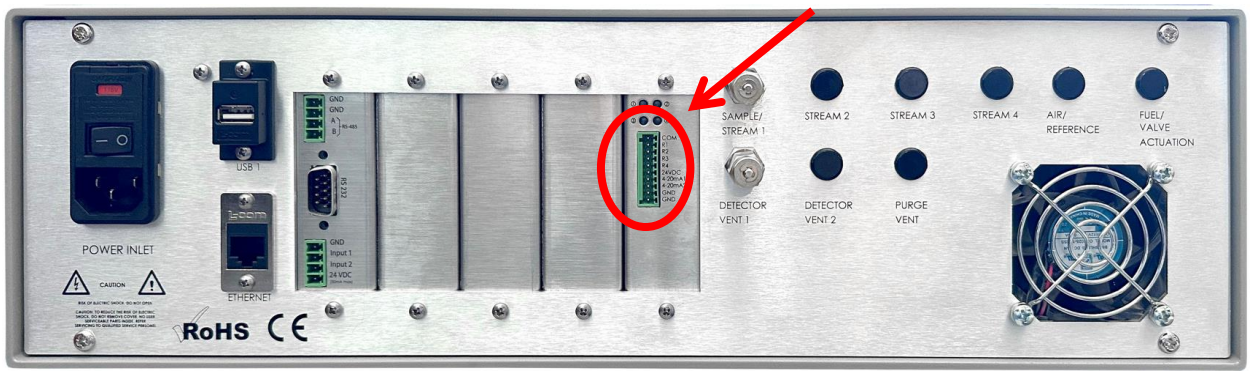
11.3 Main industrial protocols

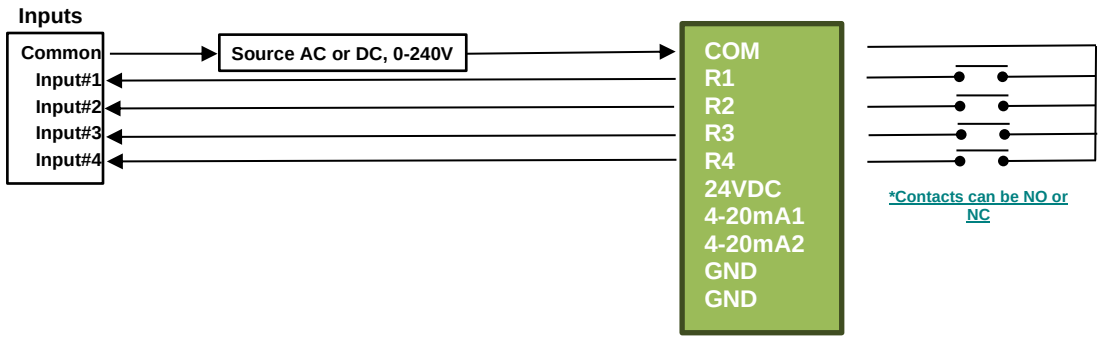
With your LD8001 you can add anyone of the major industrial protocols:

- Modbus (RTU or TCP/IP)
- Profibus
- Profinet
- Ethernet/IP
- EtherCAT
- …

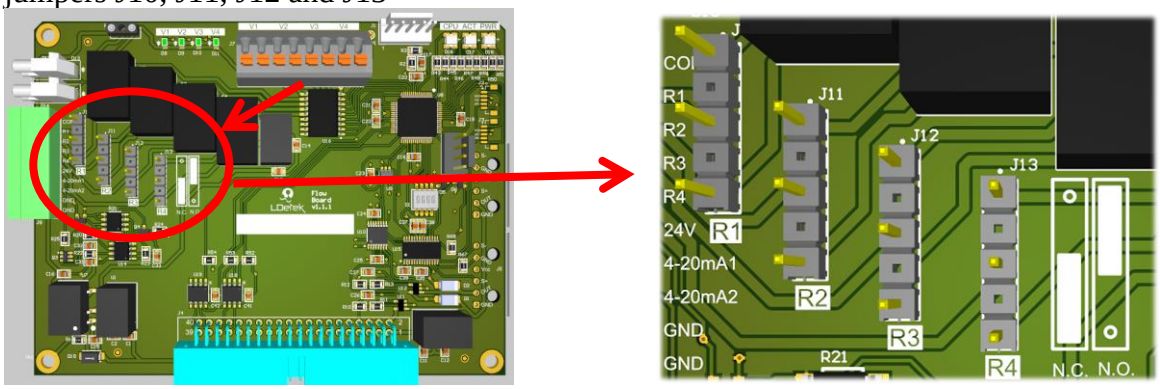
See the specific document for each of those protocols to have more details.

11.4 Relays

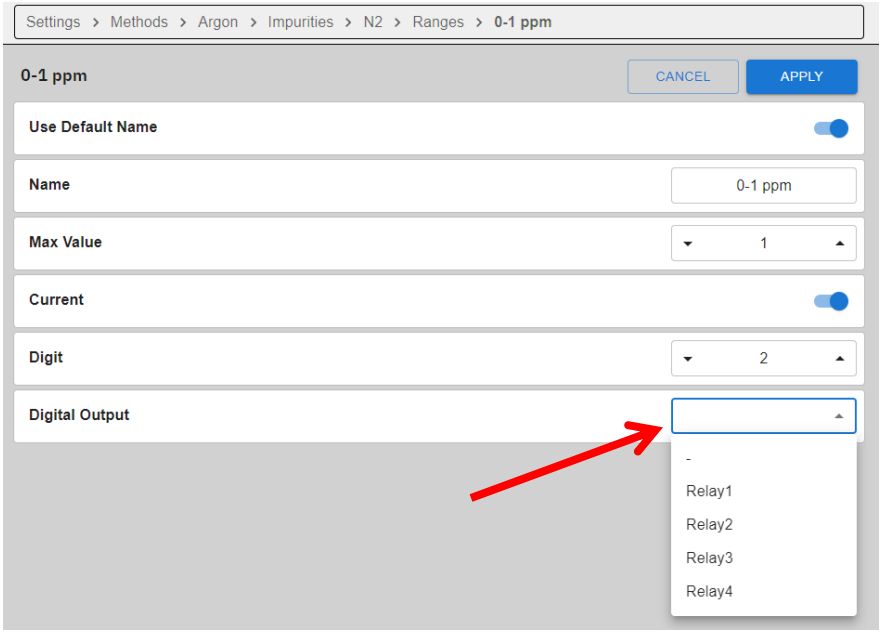




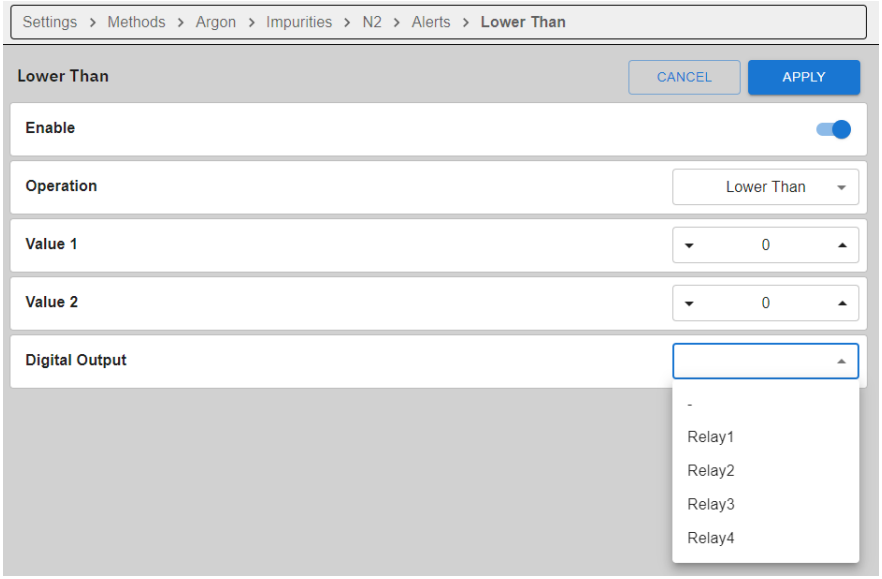
By default, all relays are N.O. but we can change for N.C. by changing the position of the jumpers J10, J11, J12 and J13



A relay can be assigned to a range



A relay can be assigned to imputity alarm



A alarm can be:

- Lower than
- Higher than
- In range
- Out range

The default function for relay#1 is “Device status”.

When this relay is activated, it means the LD8001 is running normally, and any major alarm are actives.

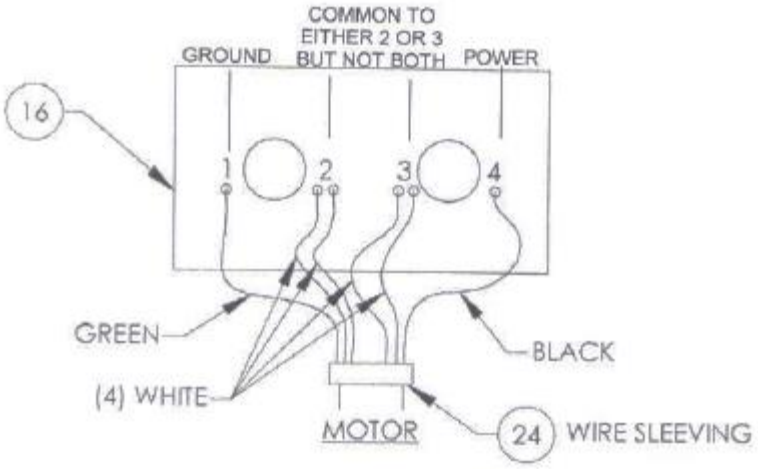
The default function for relay#2 and relay#3 are for the current range.

11.5 Low-pressure pump

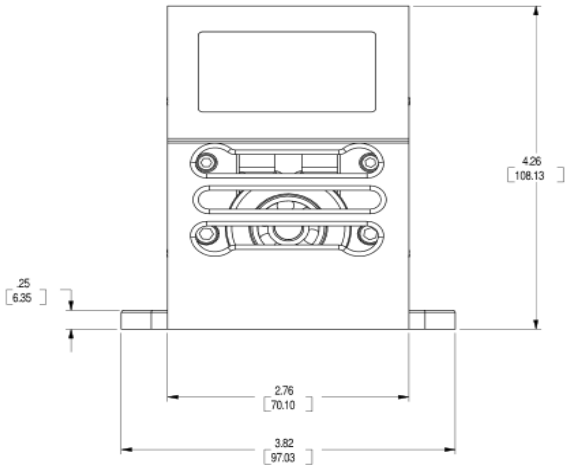
If the sample point pressure is lower than 3 psig, it is required to install our metal bellow compressor to increase the sample pressure in the nominal range of the LD8001 which is between 5 PSIG to 10 PSIG. The pump type is high purity and allows measurement of low ppb nitrogen. It is fully tested at LDetek facility.

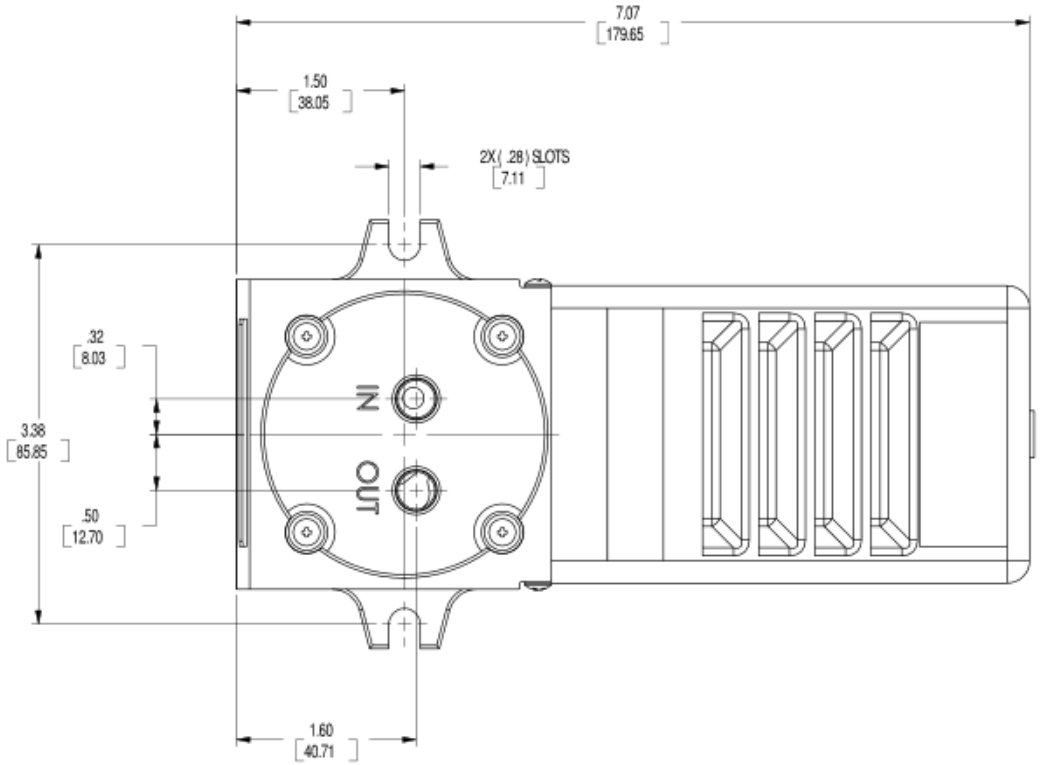
- The pump must be mounted external to the LD8001 and mounted on a rubber standoff to reduce vibration of it.
- The pump must be connected to an external power source on 110VAC 50/60HZ or 220VAC50/60HZ depending on the requested pump model
- The connections on the inlet and outlet of the pump are 1/8inch Stainless Steel Swagelok compression type.
- The electrical connections to respect are indicated on the pump itself. Please refer to it. For the 220VAC version, refer to the image below for electrical connections.
- It is very important to install the included 1/8'' inches OD, 10micron particle filters in the inlet fitting. This filter will block the particles coming upfront the pump. Not installing the particle filter may result in damaging the pump.
- Outlet port relief valve setting should be 10 psig. Having higher outlet pressure will result in damaging the thin metal below. Increasing the flow rate in the LD8001 is an alternative to the use of a relief valve to maintain the outlet pressure below 10 psig.

Electrical connections for 220VAC version



WIRING DIAGRAM
FIGURE 3


4.26
[108.13]
.25
[6.35]
2.76
[70.10]
3.82
[97.03]


7.07
[179.65]
1.50
[38.05]
2X(.28) SLOTS
[7.11]
.32
[8.03]
3.38
[85.85]
.50
[12.70]
IN
OUT
1.60
[40.71]

12. Ordering Information

ORDERING INFORMATION:

Product Parent Code : LD8001
LD8001 (ppm) Impurity N_2 , Detector PED

PRODUCT ORDERING CODE (Feature A) + (Feature B) + (Feature C) + (Feature D) + ... + (Feature H)		
Feature	**Item**	**Description**
FEATURE (A)	**BASE MODEL**	
	LD8001	Trace N2 analyser with plasma emission detector, 0-1, 0-10, 0-100 ppm (as default), electronic flow control
FEATURE (B)	**SAMPLE GAS**	
	B1	Argon
	B2	Helium
	B3	Crude Argon
	B4	Dual (Argon + Helium)
FEATURE (C)	**OPERATING VOLTAGE**	
	C1	120V
	C2	220V
FEATURE (D)	**OUTPUT**	
	D0	No output
	D1	4-20 mA Outputs
	D2	A (Alarm option)
FEATURE (E)	**SERIAL COMMUNICATION**	
	E0	No Serial Interface
	E1	Serial Interface - Modbus RS232
	E2	Serial Interface - Modbus RS-485
	E3	Serial Interface - Modbus Ethernet
	E4	Serial Interface - Profibus
FEATURE (F)	**INTEGRATED SAMPLING SYSTEM**	
	F0	No integrated sampling system
	F1	1 sample + zero + span
	F2	2 samples + zero + span
FEATURE (G)	**ZERO GAS FREE**	
	G0	No Zero gas free system
	G1	C (Zero gas free system)
FEATURE (H)	**PURGE OPTION**	
	H0	No purged valve and flowmeter
	H1	P (Purged valve and flowmeter)

12.1 Spare part list

Description	**Part Number**
Moisture trap	LD-H2O-T
LD8001 fuse kit	FK-LD8001
Integrated zero generator for LD8001	Zero-gas-purifier-LD8001
Sample Flow Micro Valve	Svalve-LD8001
7" Touchscreen Display	LCD-LD8001
Complete Mother Board PCB assembly	MB-LD8001
Analog Output Module	AO-LD8001
Sample Flow Sensor	FT-LD8001
Micro Controller Unit	MCU-LD8001
Rear Panel assembly	BP-LD8001
Entire LD-8001 frame with top and bottom cover	Frame-LD8001
Front Panel assembly	FP-LD8001

Notes:

Notes:

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990 Monfette Est, Thetford Mines, (Qc), Canada, G6G 7K6
Phone: 418 755-1319 • Fax: 418 755-1329 • **info@ldetek.com**

www.ldetek.com