



LD8000

Trace impurity analyzer

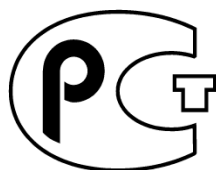
USER'S MANUAL



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V1.6



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1. Forwarning

This manual is required to be read by any user wanted to use the LD8000 Trace Impurity analyzer. It contains important information to successfully operate the instrument. LDetek makes assumption that all operators have taken the time to read this information prior to 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 want to thank you to choose LDetek as your gas analyzer supplier.

2. Warranty and Service Policies

Goods and part(s) (excluding consumable) manufactured by Seller are warranted to be free from defects in workmanship and material under normal use and service for a period of **twelve (12)** months after installation and start up and not exceeding **18 months** from shipment date. Consumable, chemical trap, 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 date of shipment by Seller. Goods, part(s) proven by 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 to 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 from 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 EXCEED 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. Seller is not liable for failure to perform due to labor strikes or acts beyond 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 labor 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 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 name, address and 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 RMA number on the outside of the box.
7. Use a 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 transport 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, software recompilations or 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 trade secret and other proprietary protection of such software and firmware, such items are not sold hereunder but are licensed to buyer.

LDetek Inc. reserves the right to interrupt all business relationship and warranty or service 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 LD8000 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.

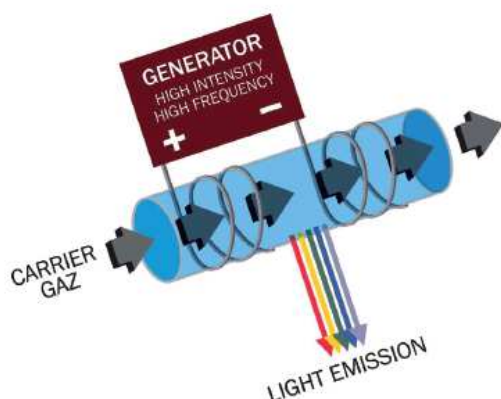
4. Specifications

Detector type:	Plasma Emission Detector design based on a Duty Cycle Controlled System
Range:	Application dependant (0-1, 0-10 and 0-100 ppm as standard)
Accuracy:	Better than $\pm 1\%$ full scale
Standard features:	<ul style="list-style-type: none">• Manual or autoranging (user selectable)• Microprocessor controlled• 5.6" LED intelligent LCD module with Touch Screen• Self diagnosis system with auto-resolve alarm• LAN/Web control• 4-20 mA isolated output• Alarm Historic• Safe calibration procedure to avoid any bad calibration• Digital outputs for remote monitoring: (all dry relay contacts)<ul style="list-style-type: none">○ System status (1 output)○ Range in use (3 output)○ Calibration in use (1 output)
Options:	<ul style="list-style-type: none">• Internal sampling system for zero, span and two samples• Serial port: RS-232 / 422 / 485 / Profibus• 2 alarm outputs (user programmable set point)
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 in Helium
Sample flow requirements:	15 to 200 sccm
Recommended Sample flow	75sccm
Recommended operating pressure:	10 PSIG (69 kPAG)
Maximum operating pressure:	20 PSIG (138 kPAG)
Minimum operating pressure:	4 PSIG (28 kPAG) optional 1 PSIG (7 kPAG)
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:	15 seconds for 90% of a step change at 75 sccm
Drift:	$\pm 1\%$ over 24 hours
Dimensions:	5.1" (129 mm) high, 14.75" (375 mm) deep, 19" (482 mm) wide
Weight:	29 lbs (13 kg)

5. Cautions & Installation

5.1. Detector cautions

The LD8000 uses a detection technique known from 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 the nitrogen is used to avoid any interference and get the best performance.

The detector also uses a “Duty Cycle Controlled System” to increase 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 in **atmospheric pressure to avoid any cell cracking.**

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

5.2. Analyzer application

The LD8000 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 area.

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

5.3 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 pressurized the instrument.** It will damage the detector. This instrument is made to work at atmospheric pressure.

Any back pressure 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 of the application (using UHP grade 5.0 or better) before to connect gas to the sample inlet connection.

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

WARNING : BEFORE TO CONNECT 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 at 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 than the indication shows in the model number. Having the wrong power source connected to the instrument can cause severe damage to the instrument.

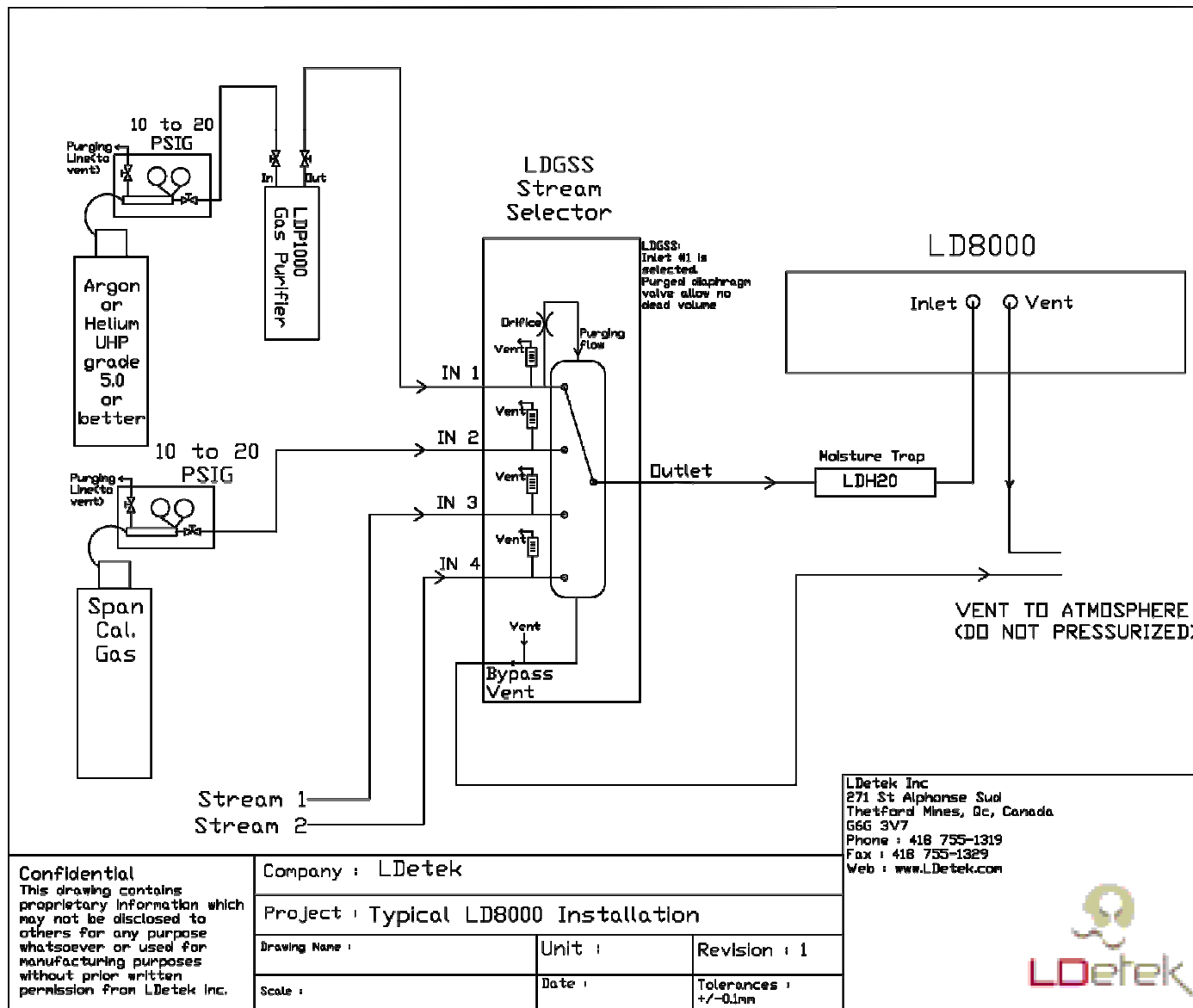
Turn on the unit.

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

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

NOTE: FOR A GOOD INSTALLATION, PLEASE REFER TO LD8000 TYPICAL INSTALLATION SCHEMATIC THAT APPEARS AT THE NEXT PAGE.

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 prior to shipping.



6. Hardware Description & Maintenance

The LD8000 has major components included in the chassis. This section will describe each component that can be replaced for maintenance or upgrade.

6.1. 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 type 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 factory if the cleaning solution process is possible.

If the instrument looks unstable, please get in contact with LDetek factory that will guide 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 of it.

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.

6.2. 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 sub modules on this board that can be replaced just by unsnapping the damaged part and replacing it by a new part:

- 4-20mA Analog Output
- Flow sensor
- Temperature sensor
- 4-20mA fuse
- Relay fuse
- Micro Controller 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.

6.3. 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 very quick for flow stabilization. This micro valve has been designed by LDetek to meet good performances of the instrument. These advantages are demonstrated in the LD8000 Design Report.



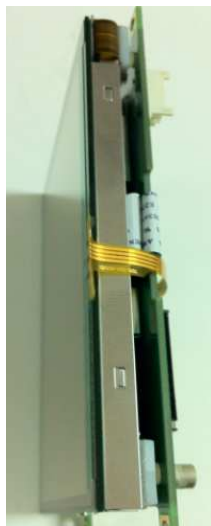
The standard configuration of the LD8000 allows a pressure range going from 4 PSIG up to 20 PSIG. Having higher pressure may cause damage to the valve. In the eventuality that valve has been exposed to high pressure, the valve may start to have difficulties to stay stable or also have

difficulties to close totally. In this case, the valve would have to be re-build. 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 part. This is to ensure to have the appropriate version for your instrument.

6.4. LCD Touch screen Display



This 5.6'' low power consumption LED Intelligent LCD Touch Screen Display Module allows having a user's friendly interface. Moreover, its touch screen allows an easy navigation through the different menus.

Handling carefully the touch screen is essential to ensure not damaging it.

If the LCD is damaged, it can be easily replaced by removing the four fixing screws and the two connectors on it. A new LCD can be ordered from LDetek. The LCD comes already configured for the instrument.

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. Operation

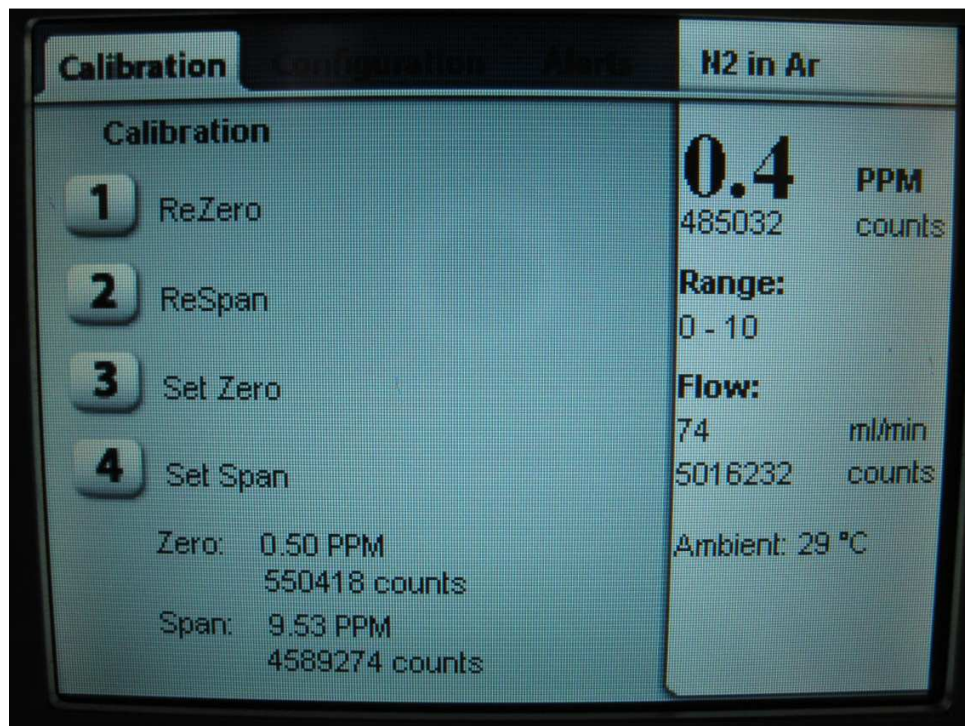
The LD8000 has a microcontroller interface with 5.6 LED touch screen. A keypad is also available to enter specific values used in the software. The touch screen must be handled carefully to avoid any problem with the sensitivity.

The following figures show the different menus to operate the instrument.

7.1 Real Time menu

On the right of the screen, the real time data is always shown. Whatever the menu you are in.

value in ppb, ppm or %
digital signal from the detector in counts (24 bits)
Actual range (can be changed by using the Select button on the keypad, if the analyzer is not in Lock Range mode)
Flow in milliliter / minute
Digital flow signal from transducer (24 bits)
Ambient temperature inside the analyzer
Software Version



7.2 Calibration menu

This menu is used to calibrate the instrument in relation with the specific range of the instrument.

REZERO : Will calibrate the zero with the zero value entered previously

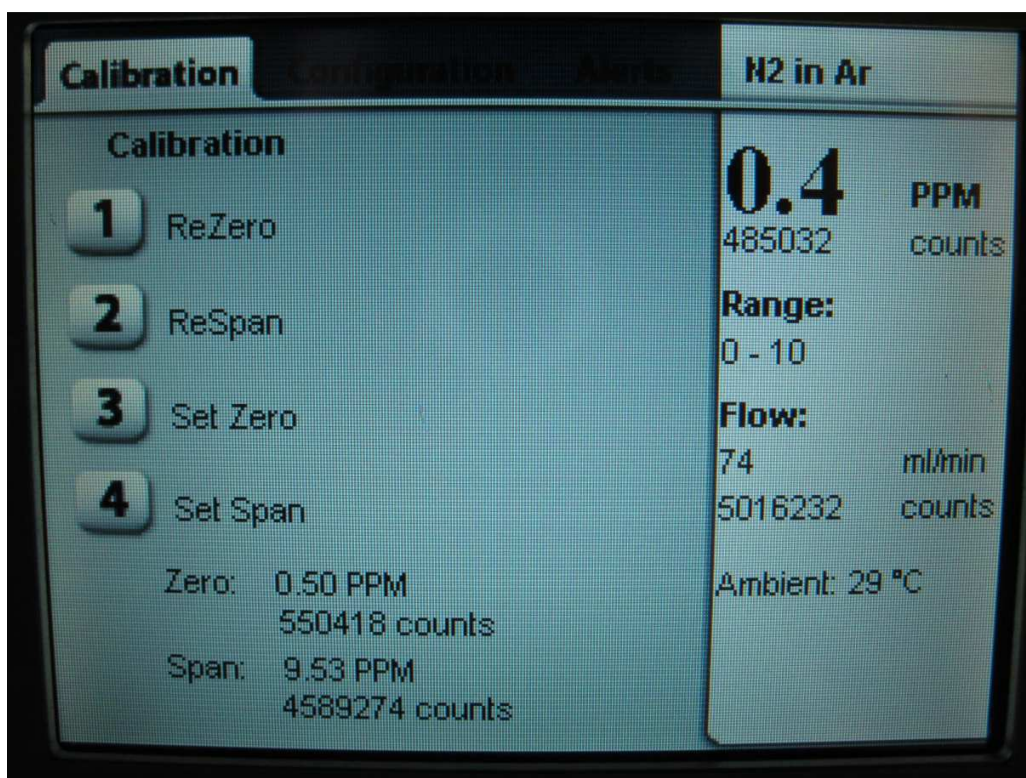
RESPAN : Will calibrate the span with the span value entered previously.

SET ZERO : Used to change the value of the zero gas.

SET SPAN : Used to change the value of the span

As calibration reference and history, the latest Zero ppm value and Zero counts are shown at the bottom of the page. This tells you what was the latest Zero calibration value.

The same thing is also shown for the Span values.



7.3 Configuration menu

This menu is used to configure many parameters of the analyzer. This menu is accessible to any users.

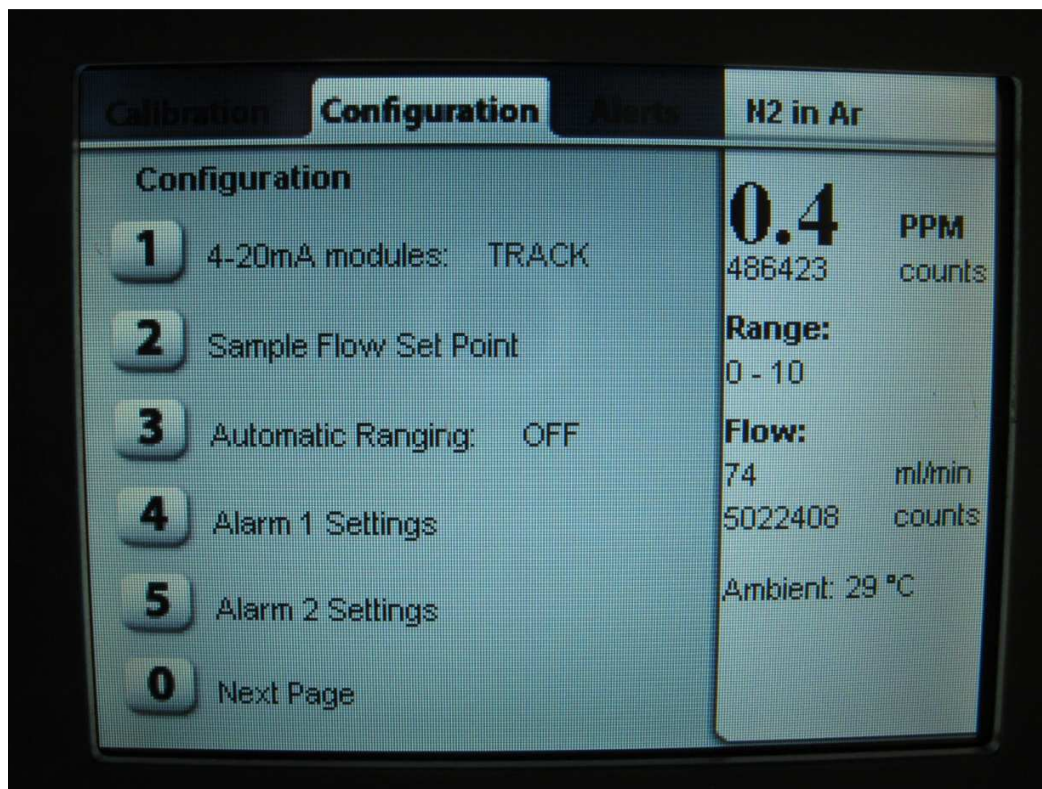
Page 1:

4-20mA MODULES : (TRACK or HOLD): when in track mode the 4-20 always outputs the reading value of the analyzer. If in hold mode, the 4-20 mA outputs hold the last value until change to track mode.

SAMPLE FLOW SETPOINT : (0 to 200 cc/min): Change sample flow set point controlled by the internal valve. The default setpoint value is 75cc/min.

AUTOMATIC RANGING : (ON or OFF): when in ON mode, the range of the analyzer will switch automatically when reaching overscale value or lower range scale.

ALARM SETTINGS : used to set the alarm value that will activate the relay options of the analyzer. When the value read is higher than the set point of the alarm, the relay will be activated. There is two alarms level.



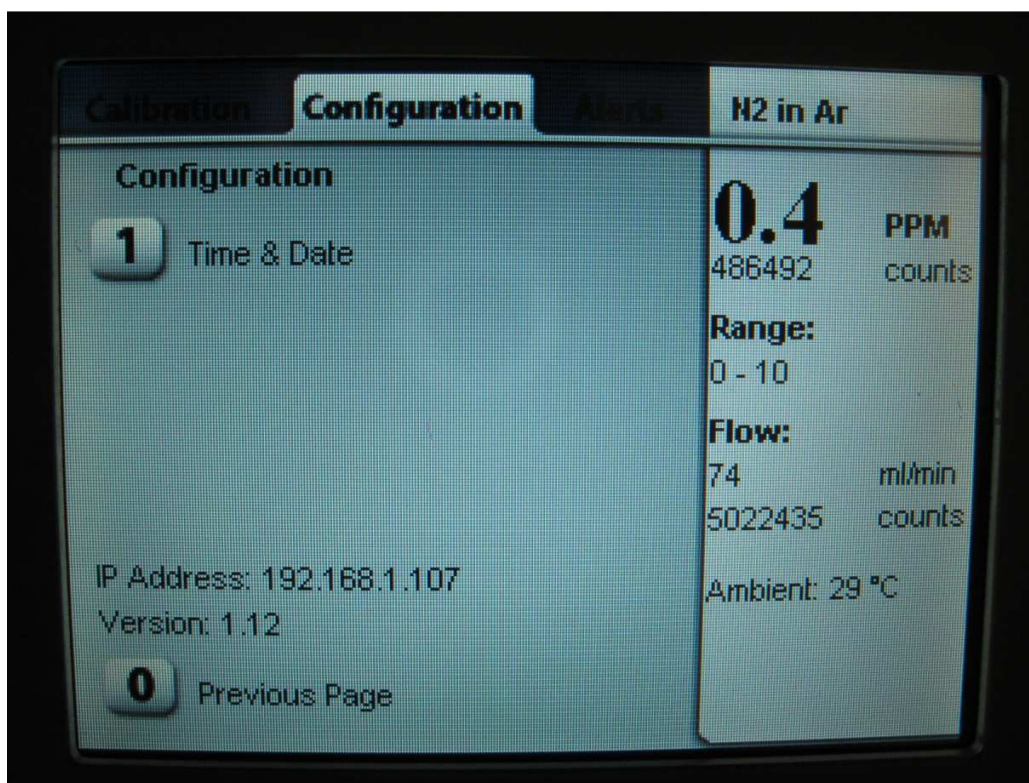
Page 2:

TIME & DATE : Used to set date and time in the analyzer

When an analyzer has been setup for dual background, choice #2 will be available to toggle between backgrounds.

IP ADDRESS: Shows the IP address of the instrument when it is connected on a network.(used to make software update). When the Instrument isn't linked to a Network, it shows Error getting IP address.

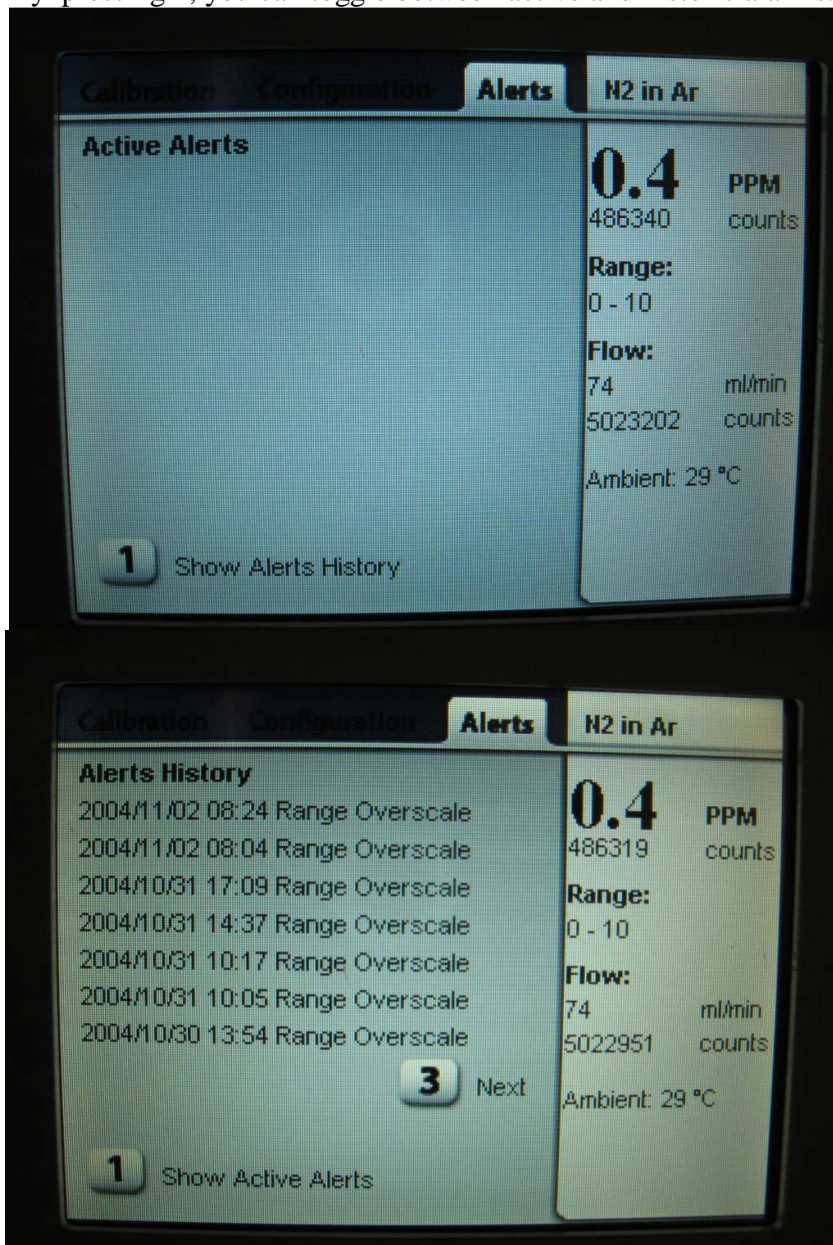
SOFTWARE VERSION : Gives the Software version installed in the instrument



7.4 Alerts menu

This menu is used to monitor each alerts happening in the analyzer. When an alert is active, it will be shown and will disappear when it is resolved. The history alerts is used to review the last 50 alerts.

By pressing 1, you can toggle between active and historic alarms.



The system status dry contact will be activated with those alerts only:

- Detector off
- Low Flow (when sample flow go below 10 ml/min)
- Alarms setpoints (option)

7.5 Administration 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. To get in this menu, press 967 from the alerts menu.

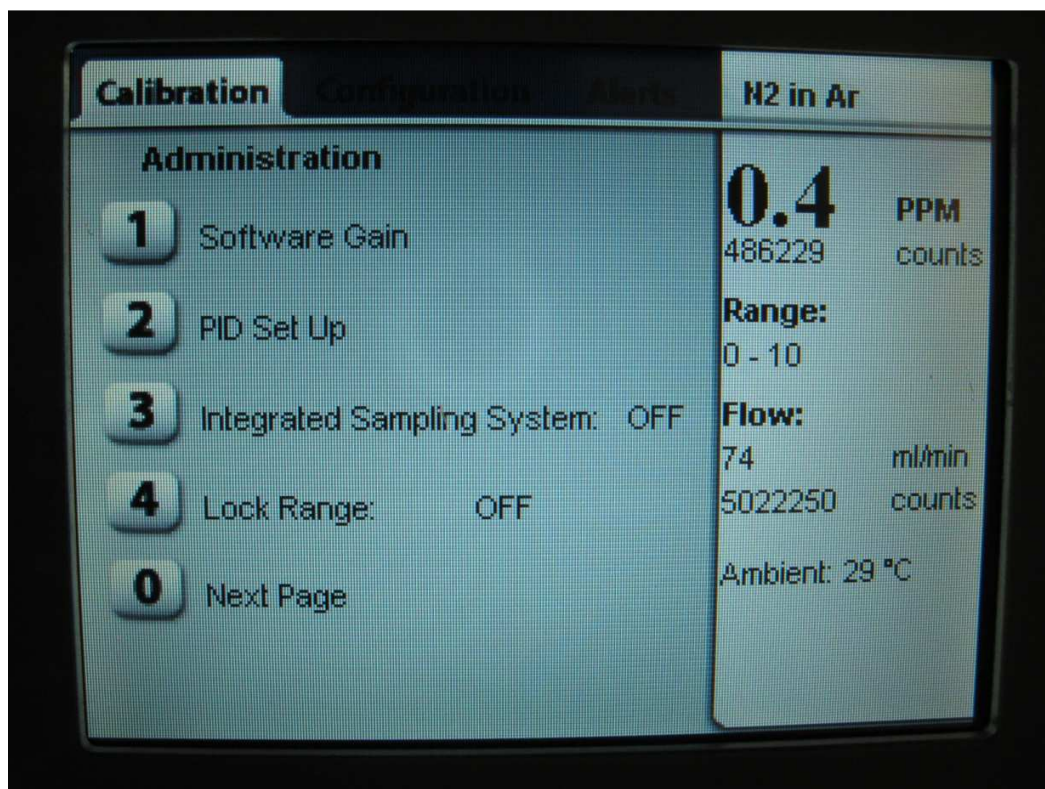
Page 1:

SOFTWARE GAIN : Adjust the gain set by the software. This value is set in Factory and must never be changed without advising LDetek.

PID Set Up : Use to adjust the PID parameters for the sample flow valve control.

INTEGRATED SAMPLING SYSTEM : 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.**

LOCK RANGE : The range can be locked by the administrator. When ON, the user cannot change range manually. It will be fixed to the actual range in use.



BACKGROUND SETTINGS: It is used to set the background that the unit can work (Argon, Helium or Argon /Helium). The analyzer cannot work on a background that has not been tuned in factory. **This value is set in Factory and must never be changed without advising LDetek.**

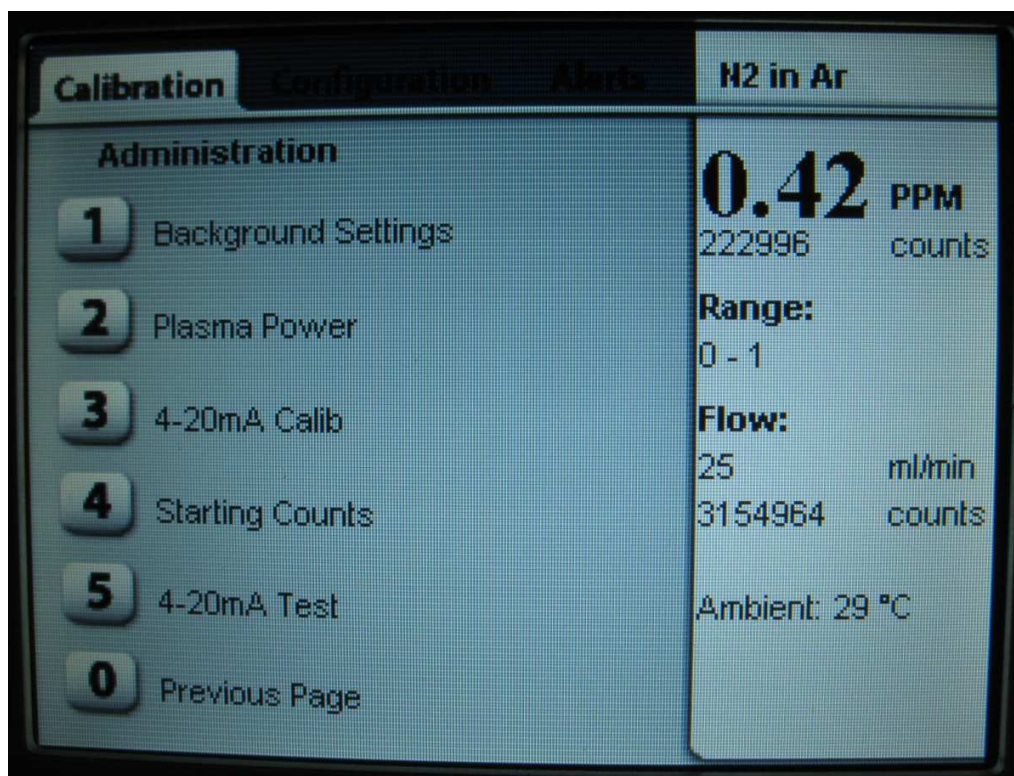


PLASMA POWER: Power sent to the detector. Changing this value can result to severe damage to the Detector Module. **This value is set in Factory and must never be changed without advising LDetek.**

4-20mA CALIB : This is used to calibrate the 4-20 mA or any system connected to the analyzer. Please refer to the detailed 4-20mA Calibration Procedure shown in this manual to proceed to a 4-20mA Calibration.

STARTING COUNTS: Used to determine the level where the detector is considered to be ON or OFF. This value is set in factory. **This value is set in Factory and must never be changed without advising LDetek.**

4-20 mA TEST: This is used to test the 4-20mA output. It is also use to test if the 4-20mA output is well calibrated. Please refer to the detailed 4-20mA Calibration Procedure shown in this manual to proceed to a 4-20mA Calibration.



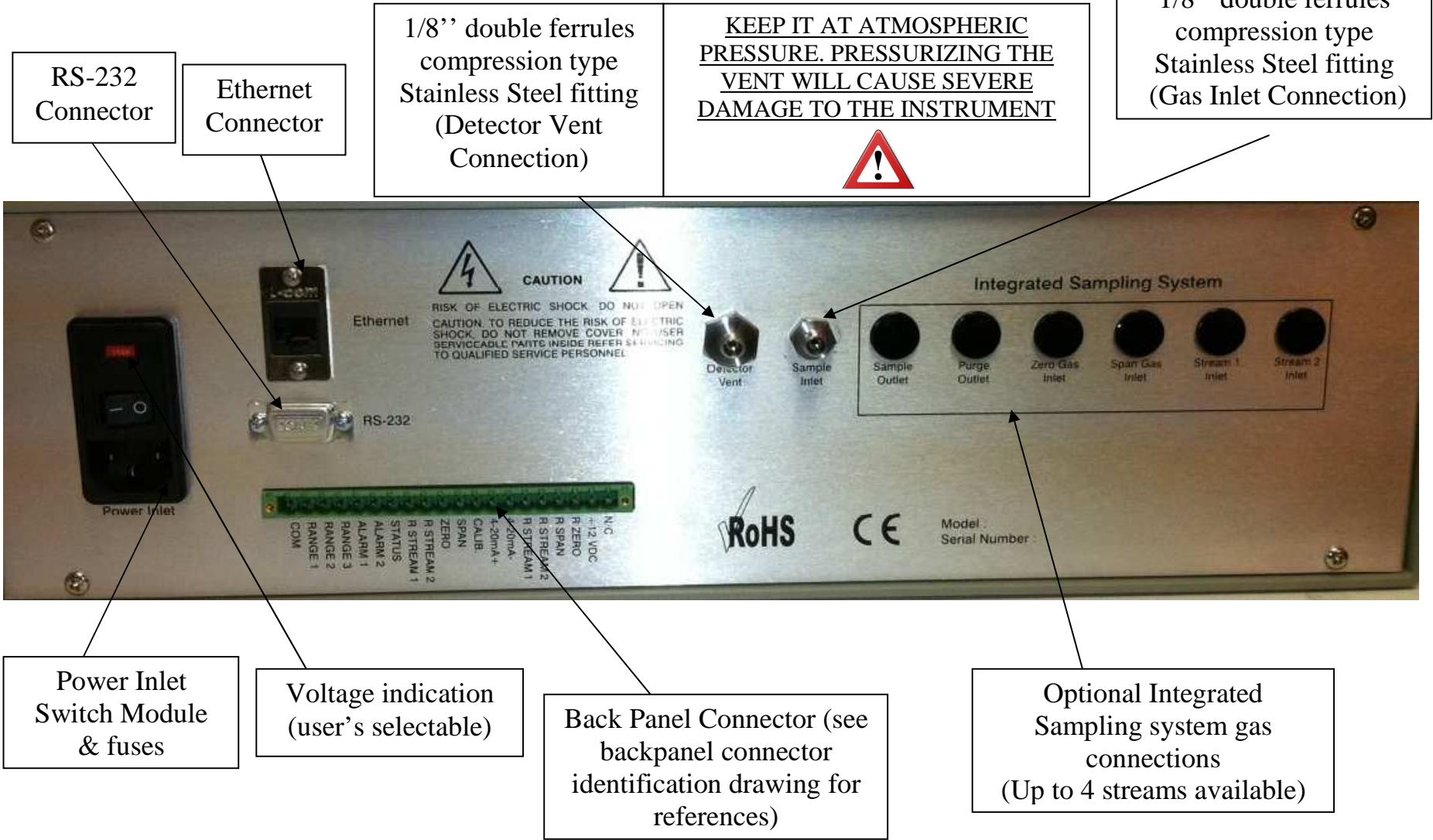
8.0 Drawings & Schematics

Drawings & Schematics

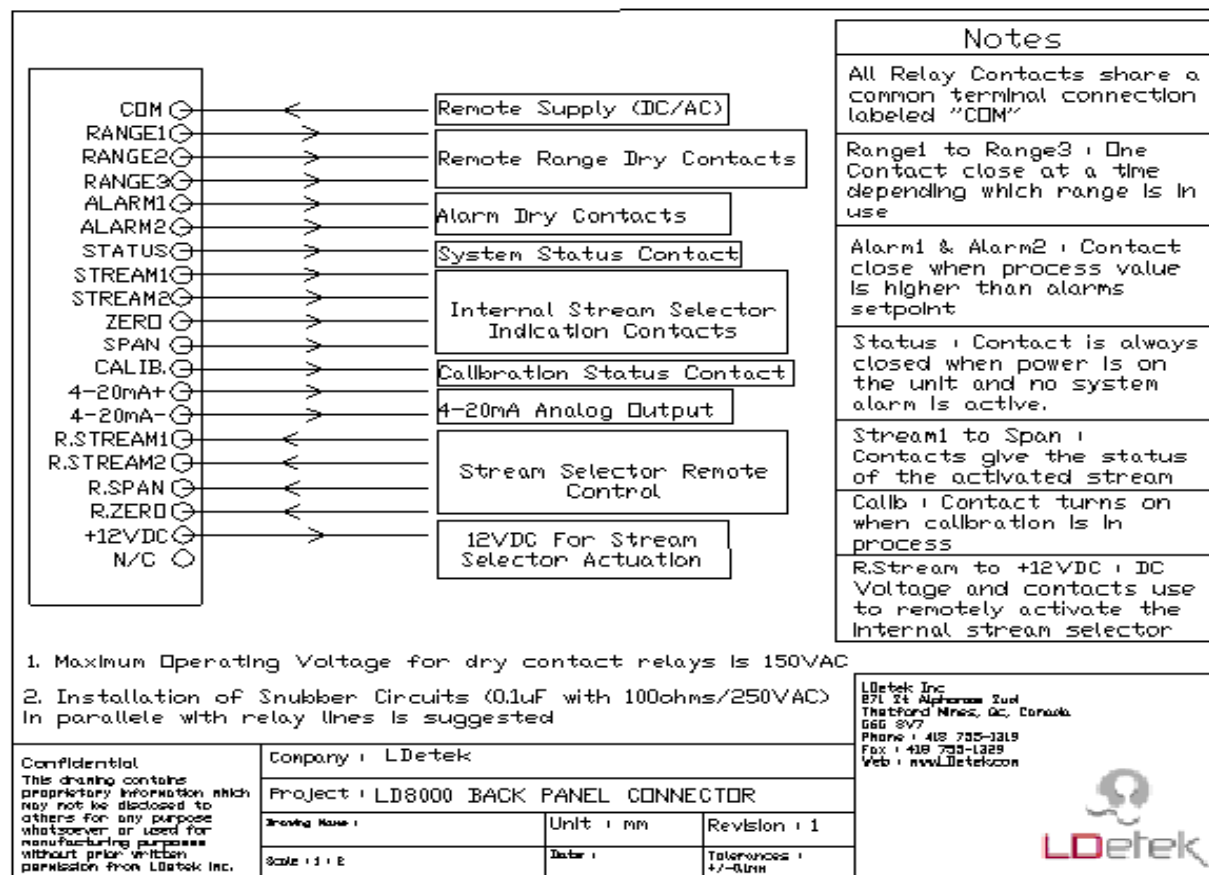
8.1 Parts Identification



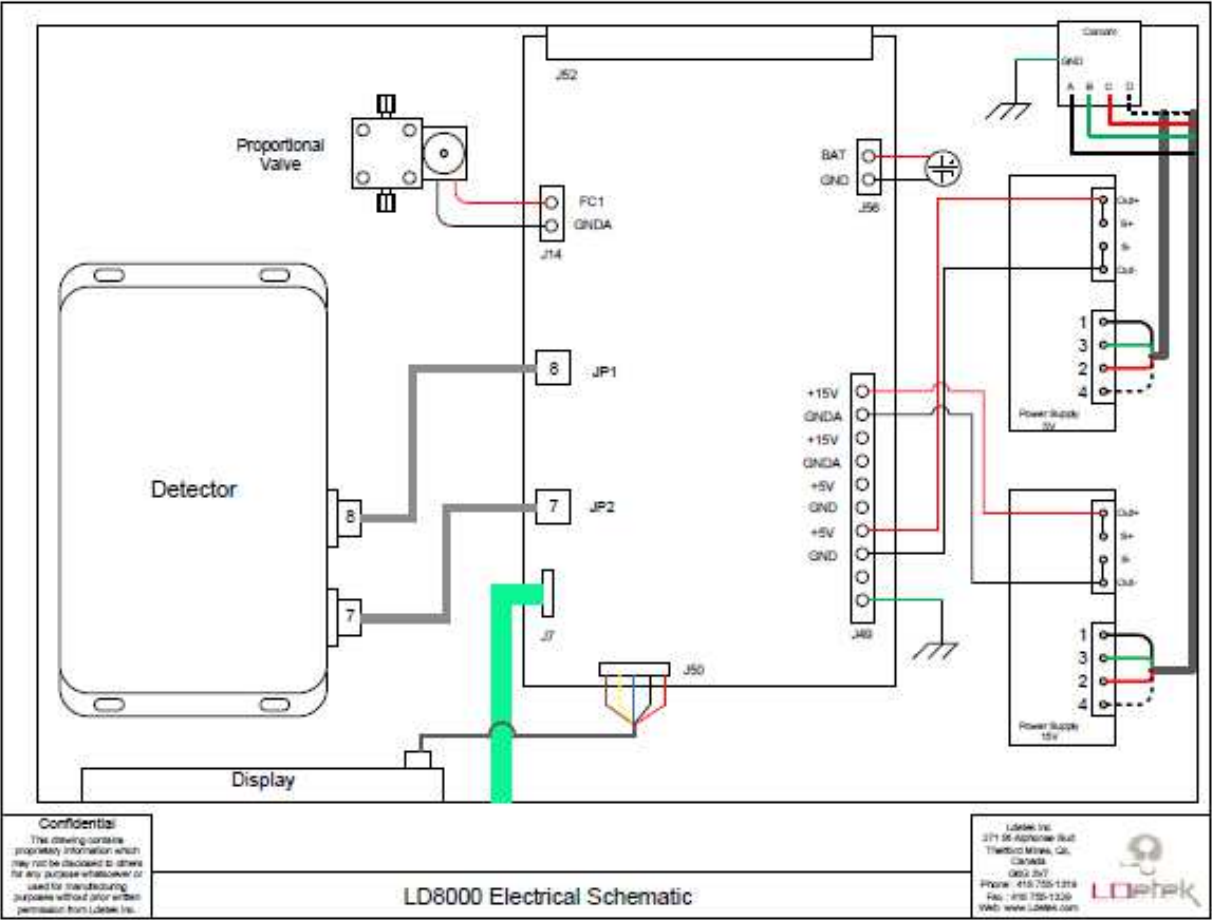
8.2 Back Panel Identification



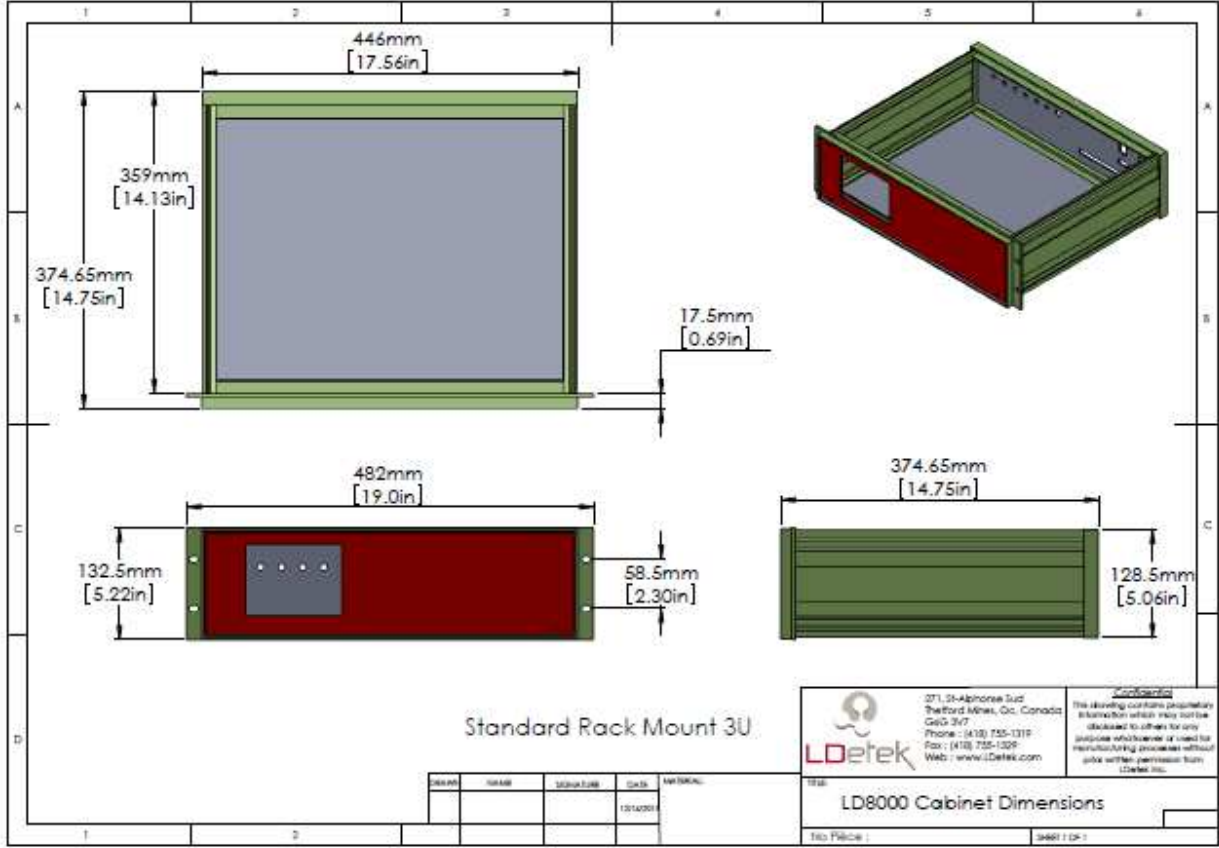
8.3 Back Panel Connector Identification



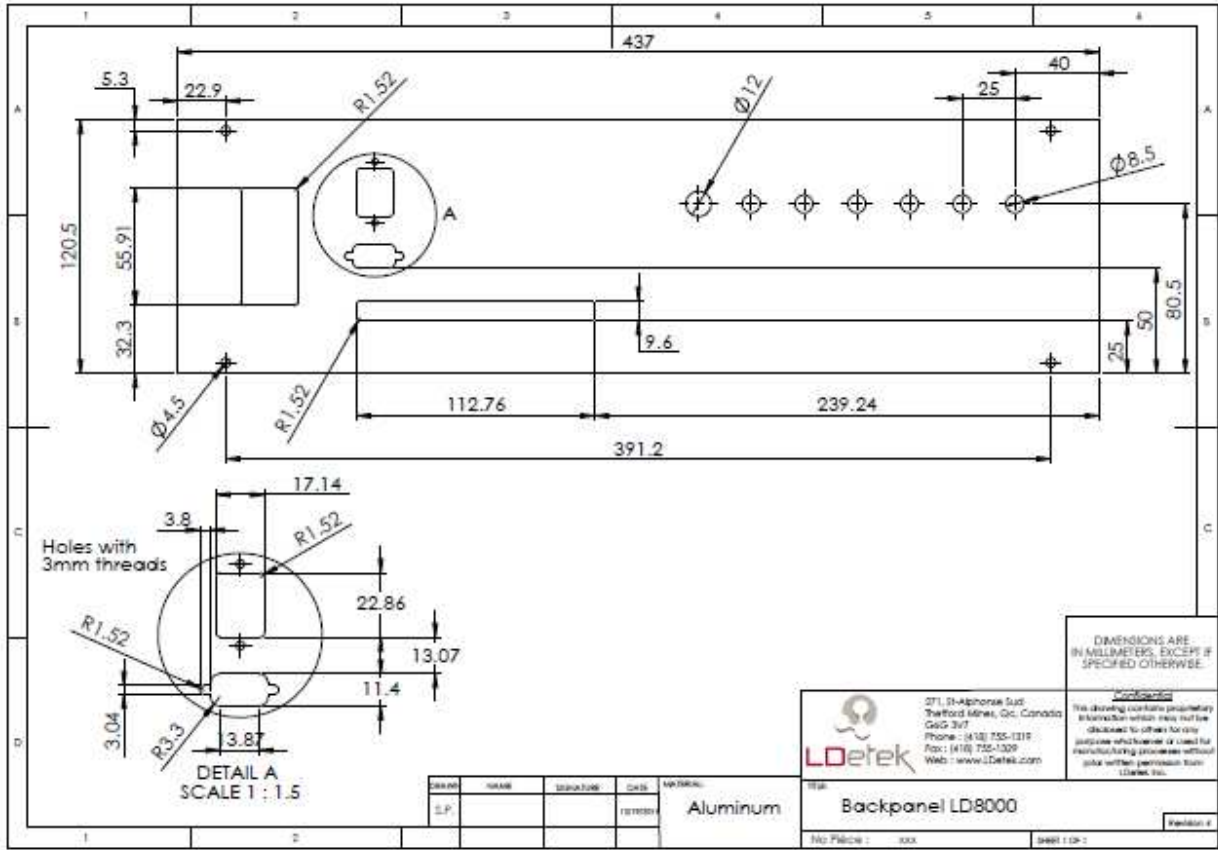
8.4 Electrical Schematic



8.5 Enclosure Dimensions & Panel Cutout



8.6 Back Panel Dimensions



9.0 Procedures

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

9.1 Leak Finding Procedure

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

Using the right procedure, the trace Nitrogen analyzer LD8000 can self diagnose the presence or absence of contaminating leaks.

We first have to understand that the gas circuit is divided in 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 off 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 pretty 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 procedure will be the following one:

- In zone 1, we will play with the gas pressure (generally with a gas regulator) and check changes in 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 i.e. the cell count

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 75 cc flow to, let's say 70 cc. The analyzer flow should stay that much low, ≈ 70 cc, due to the fact that 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 or cell counts. If the signal (ppm or cell counts) 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 thousand cell counts) 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 the 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 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

Prior to run this test, make sure that the analyzer is running under gas since 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 and checking for 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, presence of a leak will be confirmed by an increase in reading when dropping the flow (less diluted contaminant) or 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 located in zone 1.

N.B.: to change the flow, you have to go to configuration menu and change the sample set point. When changing the flow from 75 cc/min to 25 cc/min an increase in the reading of no more than 0.25 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 a LD8000 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 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. Overtime, 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 too much thin wall, which accelerates apparition of leaks. However, let's not be too 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 presence of leak is always possible. The only important point is to know how to check if leaks are present and how to solve the problem.

9.2 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. 6m³ 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 CC (±10%). When installing this pressure regulator on the cylinder, the internal volume is occupied by the atmospheric air i.e. 78.2% N₂, 20.9% O₂, 0.9% Ar, moisture, CO₂, 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:

100 CC of air and atmospheric impurities added to 6 m³ of pure argon (assuming perfect argon i.e. no impurities at all). This leads to the following calculation:

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

So the dilution ratio is 16.66×10^{-6} and $16.66 \times 10^{-6} \times 78.2\% \text{ N}_2 = 13 \text{ ppm}$ of N₂

and
 $16.66 \times 10^{-6} \times 20.8\% \text{ O}_2 = 3.5 \text{ ppm}$ of O₂

So 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 N₂ and 3.5 ppm of O₂. 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....

So Be Aware !!!

9.3 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.
2. Remove the following components from the installed MotherBoard :

- **Flow transducer :**

Simply remove the 2 screws that hold it and pull on the transducer. You will have to re-install it on the new motherboard.

If the flow transducer need to be changed, simply take off the 2 plastic tubes on it and re-install them on the new flow transducer .

- **4-20mA module :**

Simply remove the top screw that hold it and pull on the module. You will have to re-install it on the new motherboard.

- **MCU :**

Remove the screw in the top right corner that hold it. Then split the two side clips that maintain the MCU and then hold up the MCU to take it out of its connector. Replace with the new MCU or keep it to re install on the new motherboard.

- **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 : Inverting the 2 DIN gray cables (#7 & #8) will cause severe damage to the detector.

Note 2 : Be aware that glue is used to fix the cables to its connectors. Then be careful for not damaging 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.



- **Fuse for relays :**

The relays fuse (F2) can be replaced by removing the fixing glue and pulling on it. Be sure to use the 1A fuse ordered from LDetek.

- **4-20mA Fuse (F4) :**

The 4-20mA fuse (F4) can be replaced by removing the fixing glue and pulling on it. Be sure to use the 100mA fuse ordered from LDetek.

Lithium battery :

Remove the Lithium battery by removing its 2 wires that goes to the motherboard connector.

Keypad cable :

Can be removed by carefully removing glue and pulling on the connector.

LCD cable :

Can be removed by carefully removing glue and pulling on the connector.



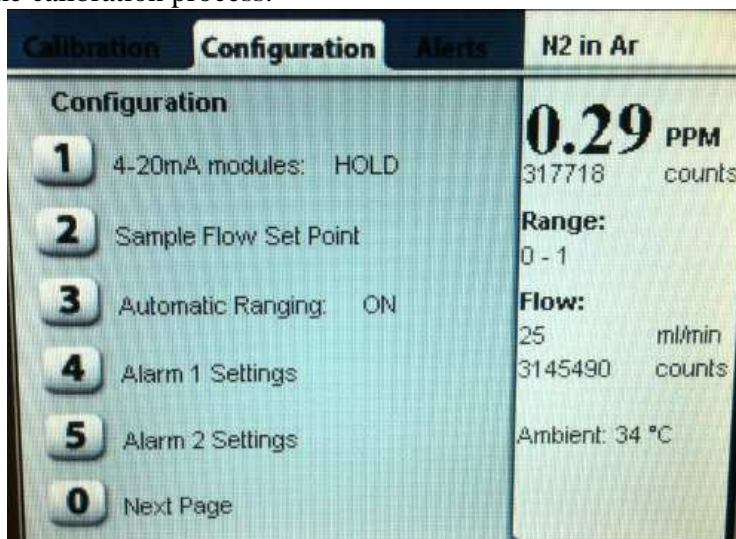
9.4 Analog Output Calibration Procedure (4-20mA)

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

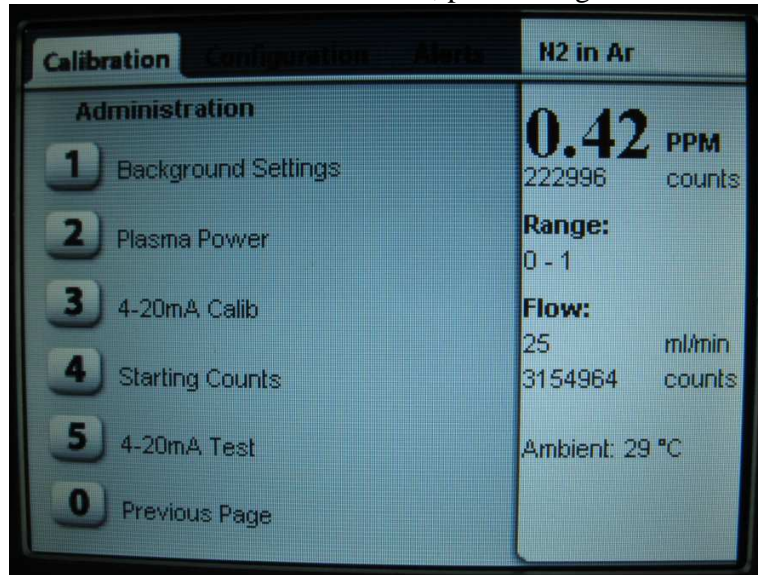
Step 1: Disconnect all cables connected to the 4-20mA+ & 4-20mA- terminals on the rear panel. Connect an Ampere meter set at DC mA to monitor the analog signal in current.



Step 2: In the menu Configuration, set the 4-20mA module in HOLD mode to allow the calibration process.



Step 3: Go in the Administration menu by pressing button 9-6-7 from the Alerts Menu. Once you are in the Administration menu, press 3 to get access to 4-20mA Calib.



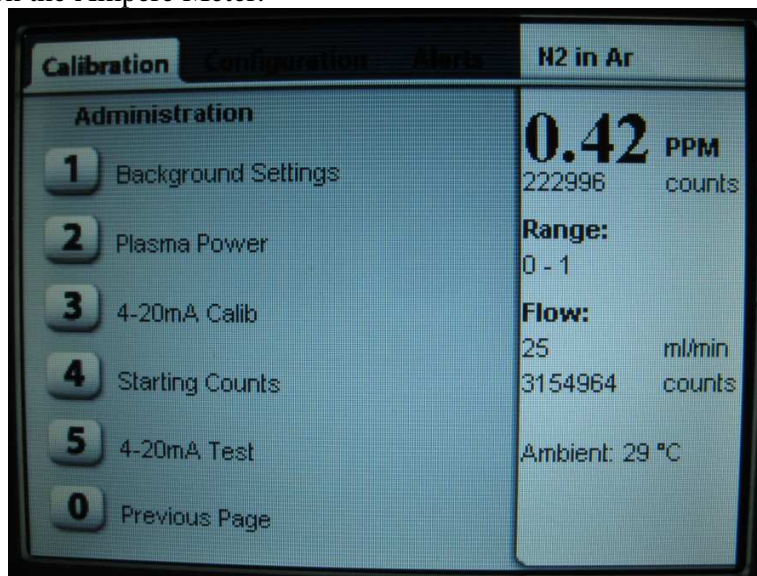
Step 4: It will now pop up a window that tells you to enter the measured value. You have to enter the value in mA that appears on the Ampere Meter and press Accept button.



Step 5: It will now pop up a new window that tells you to enter the measured value. You have to enter the value in mA that appears on the Ampere Meter and press Accept button.



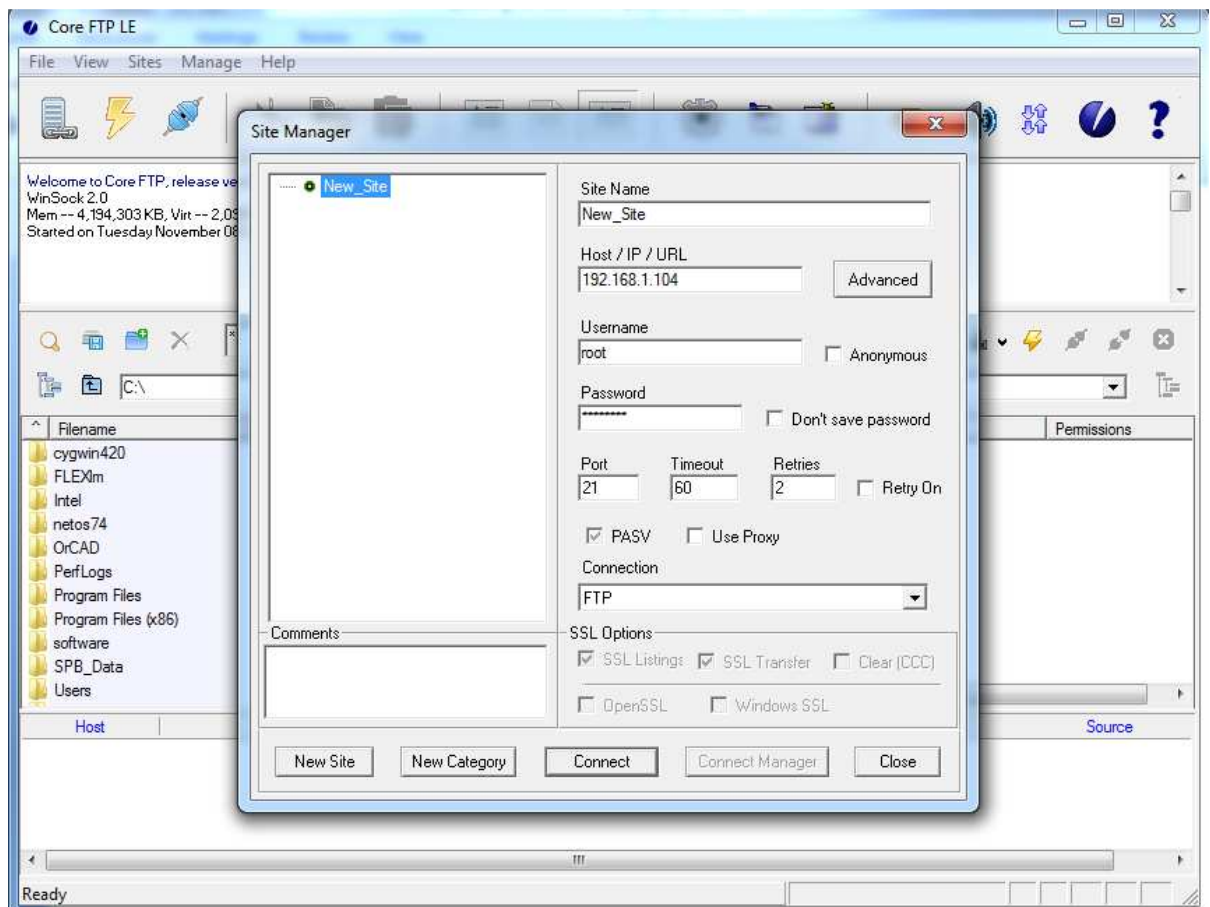
Step 6: The calibration is now completed. To test it, you can now press the 5 button from the administration menu to get access to the 4-20mA test. By going in this menu, you can change as you want to mA value from 4mA up to 20mA to verify the accuracy of the 4-20mA Output by comparing the shown value on the screen with the shown value on the Ampere Meter.



At the end of it, be sure to set back the 4-20mA Module in the Configuration menu to Track. This is to make sure the measured values in real time are tracked.

9.5 Software Update Procedure

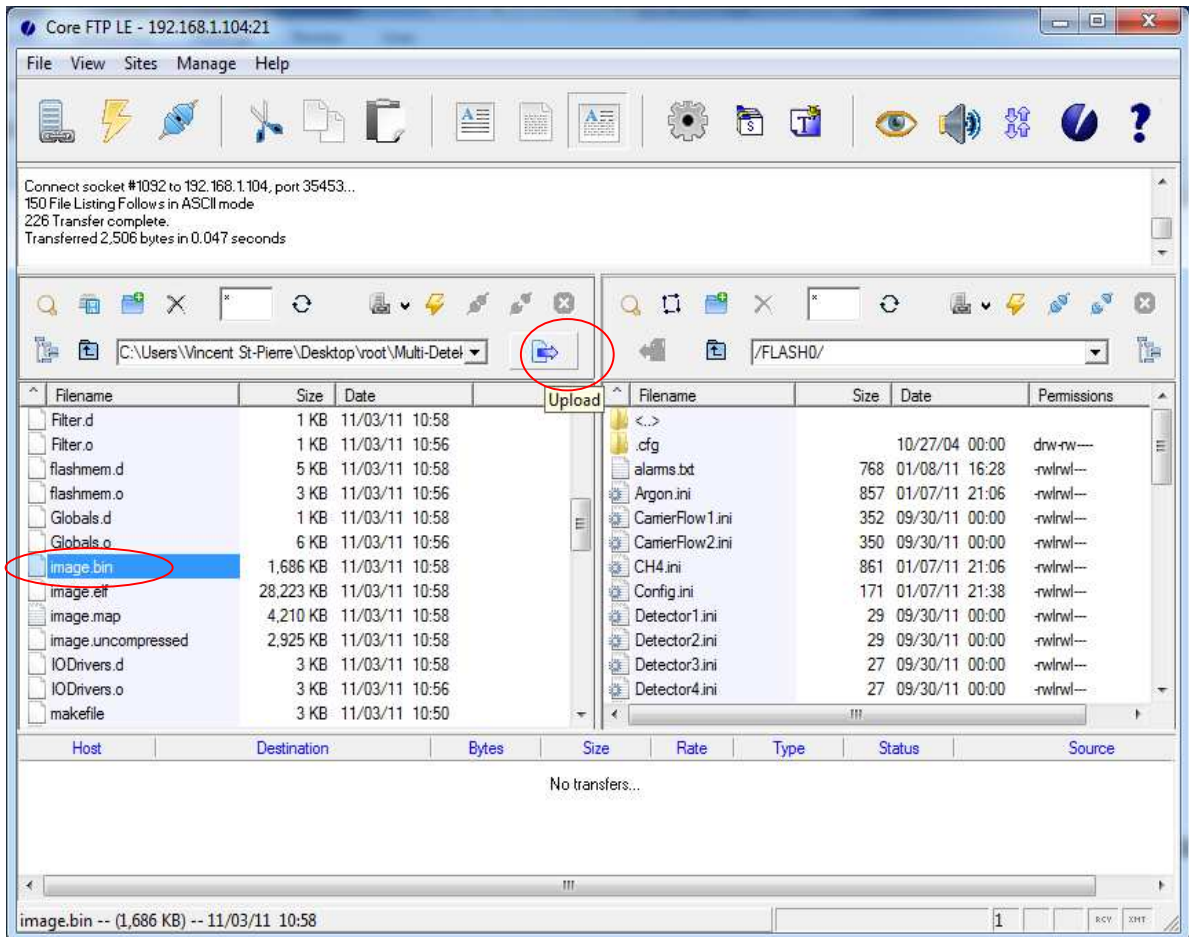
- 1) You need to connect a computer to the analyzer with a FTP client. To do that uses a FTP client like Core FTP. (download on www.coreftp.com)
- 2) Connect an Ethernet cable to your analyzer on your server. You can retrieve the analyzer IP in the configuration menu.
- 3) Open your FTP client (the screen below will then appears)
 - Enter the IP address of the analyzer in the field "Host/IP/URL" to connect to the analyzer
 - You will need to enter the username and the password to be able to connect to the analyzer. The username is **root** and the password is **password**. Then click on connect.



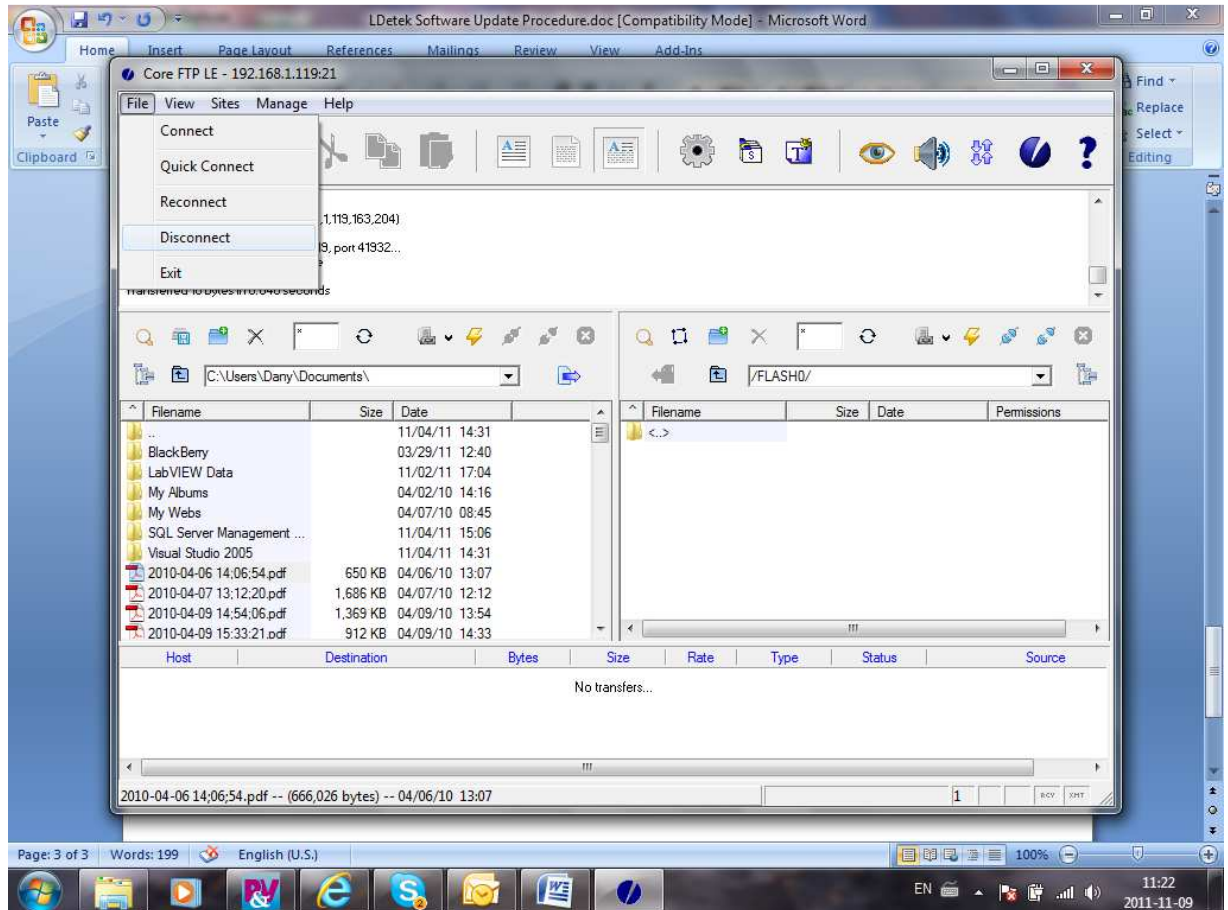
- 4) When you are connected to the analyzer (the screen below will then appears),
- 5) You now have to upload the image.bin to the analyzer:
 - First select the new file "image.bin" then click on upload button.



It is important to not modify the other files .ini in the analyzer. These are the configuration files.



- 6) After the file is uploaded, just disconnect your FTP connection to the analyzer by clicking File/disconnect. Then the analyzer will restart automatically after 1 minute. And the software update is finish.



10. Options

10.1 RS232/RS485/Profibus communication

The RS-232 option is used to monitor the values and the status of the analyzer. A female DB-9 connector is available on the back of the LD8000 when the option is installed.

Baud rate: 9600 bauds

The string coming out of the serial port is ASCII. Here is the structure:

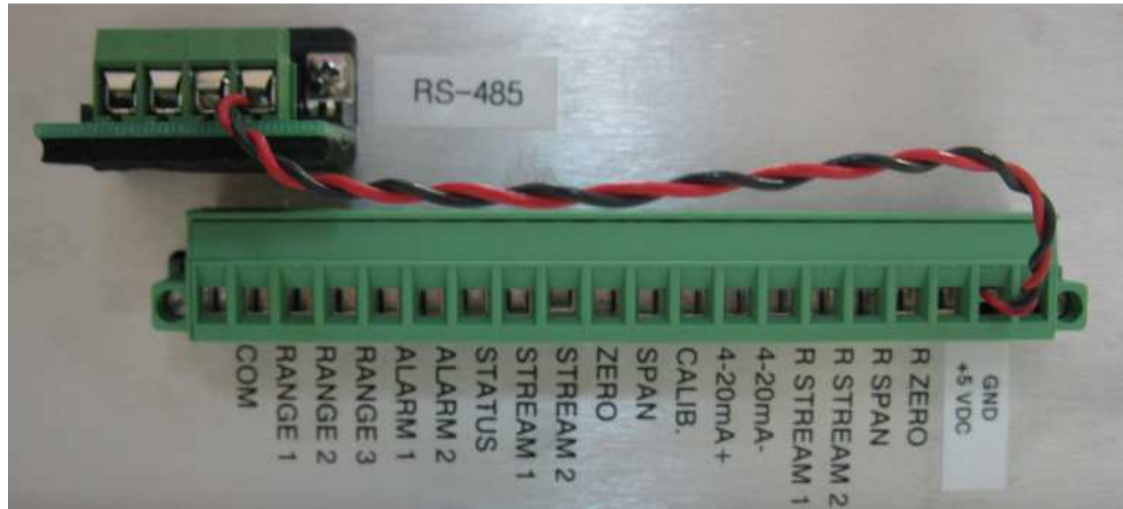
ppm value
TAB
Range used (1-2 or 3)
TAB
Sample flow
TAB
Ambient temperature
TAB
Status Byte
Carriage Return

Here is the structure for the status byte:

- Bit 1 : status
- Bit 2 : low sample flow
- Bit 3 : detector off
- Bit 4 : overscale
- Bit 5 : alarm 1
- Bit 6 : alarm 2
- Bit 7: Not used

The string is sent at every second.

A RS-485 communication can also be available by installing a RS-232 to RS-485 converter module. The RS-485 can then be accessible by connecting the TX and RX wires in the terminal block of the converter module mounted on the back panel of the analyzer. The module is powered by the analyzer itself. No need to bring external power source. See on the image below a typical installation.



RS-485

A compact RS-232 to Profibus serial gateway can also be mounted on the back panel of the LD8000. The unit is housed in a 2 1/2" x 3 1/4" plastic housing. A standard DB9-Female connector provides the Profibus interface and a DB9-Male connector provides the RS232 interface.

The Profibus channel is fully isolated from the supplied power. The power is conditioned by a loss-of-ground protection circuit. The power source is feed by the LD8000. No need of external power source is required. The RS232 serial stream is internally buffered allowing a Master node to send and receive data using standard Profibus messaging.

The module provides a fully buffered serial interface between Profibus and peripheral devices. Internal FIFO's, buffer up to 255 bytes for both receive and transmit data, easing the interface for slower RS232 based devices. Hardware or software flow control is supported. See on the image below our RS-232 to Profibus converter module.

Features & Benefits:

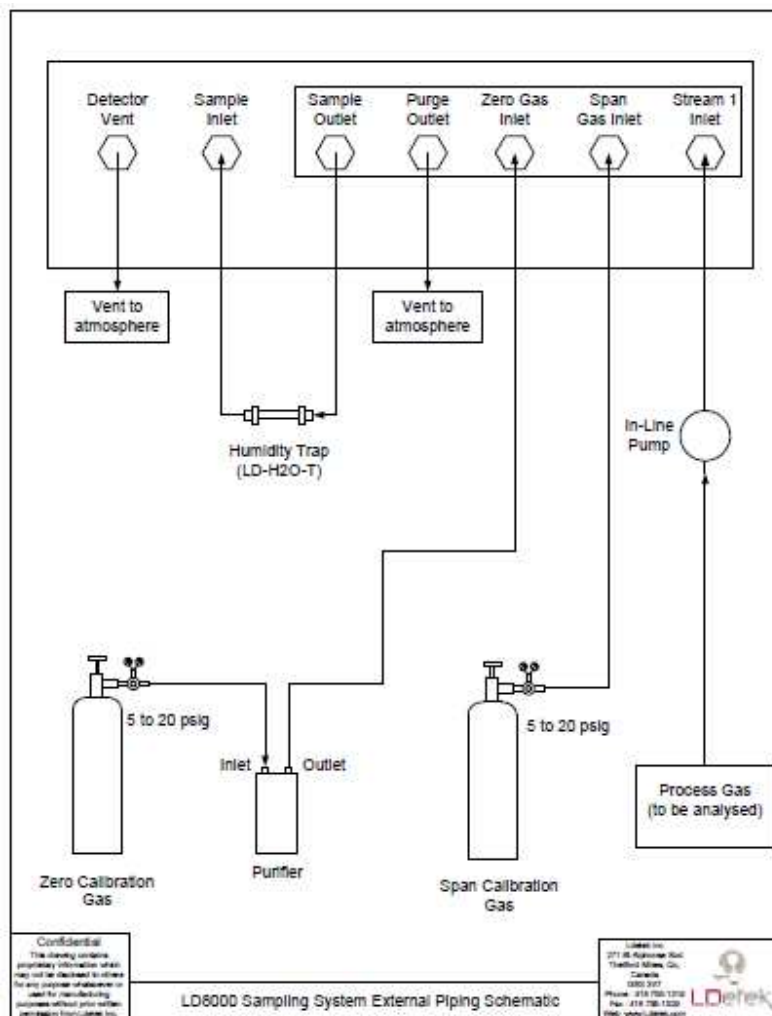
- Fully isolated Profibus channels
- Powered from 11-28 VDC supply
- Rotary hex switches for unit node address
- 2 Bi-Color LEDs for module status
- 2 Bi-Color LEDs for serial channel status
- Control & Information

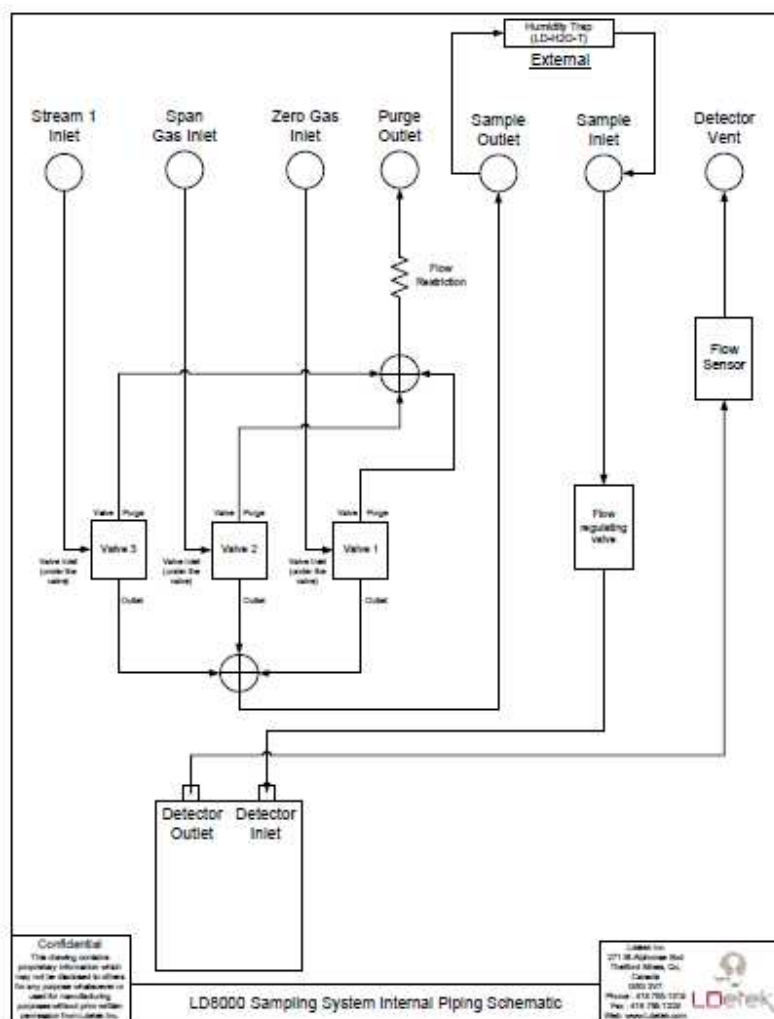


Profibus module

10.2 Integrated stream selector & auto calibration

The integrated stream selector is used for selecting the desired stream from the LD8000 interface. The compact stream selector system is mounted inside the LD8000 and is certified and tested for high purity. It can have up to 4 different streams. Mostly, one stream is used for zero gas, a second stream for span gas and the two extra streams are user's selectable depending of the number of analysis streams. Please refer to the images below for piping diagram.

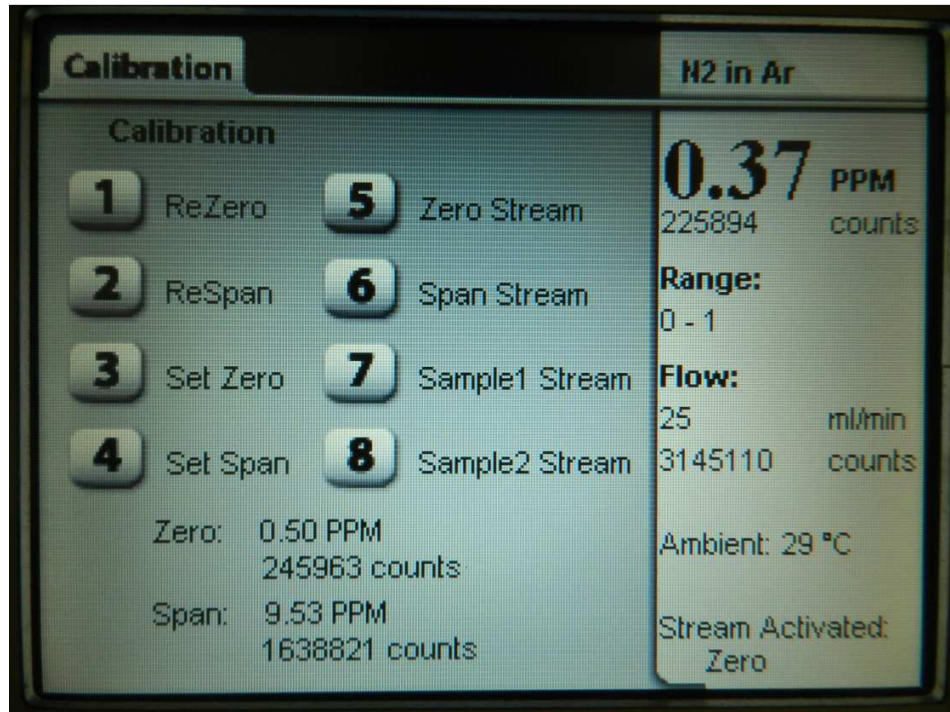




The auto calibration option can also be added to the integrated stream selector system. It consists of having the software interface that gives the benefit to configure an automatic routine for the analyzer calibration. Please refer to the calibration menu snapshot below for further details.

Calibration menu:

When the client chose the option of integrating sampling system the calibration menu appears as below.



ReZero : Will calibrate the zero with the zero value entered previously.

ReSpan : Will calibrate the span with the span value entered previously.

SetZero: Used to change the value of the zero gas.

SetSpan : Used to change the value of the span.

Zero Stream : Will activated the zero stream.

Span Stream : Will activated the span stream.

Sample1 Stream : Will activated the sample 1 stream.

Sample2 Stream : Will activated the sample 2 stream. (only appear if they have 2 samples)

When the user selects one stream, a message will indicate which stream is activated in the lower right corner. The user connect is valve on the back panel connector. When the zero relay is activated, the I/O pin (R Zero) on the back panel connector of the LD8000 will be connect to the COM.

10.3 Zero gas free system

The zero gas free system is used for generating a zero reference gas which is necessary for the zero calibration of the LD8000. The integrated zero gas generator module combined with the high purity selection valves make this system ideal to generate a good zero calibration.

In many cases, the zero calibration is not considered seriously and it results in giving negative reading on the process gas since the process gas can be better quality than the zero gas that was used for calibration. Using LD8000 zero gas free system, the process gas (sample gas) is purified to get high purity argon or helium for generating a good zero calibration. Furthermore, no need of external gas purifier or traps system is required for purifying the zero gas source.

The whole system is integrated in the LD8000 and is fully monitored and controlled by the interface. Most of the operations are compatible with a standard LD8000. You can refer to the sections of the present document. The differences that are unique to the zero gas free system are listed in this 10.3 Zero gas free system section.

Specifications:

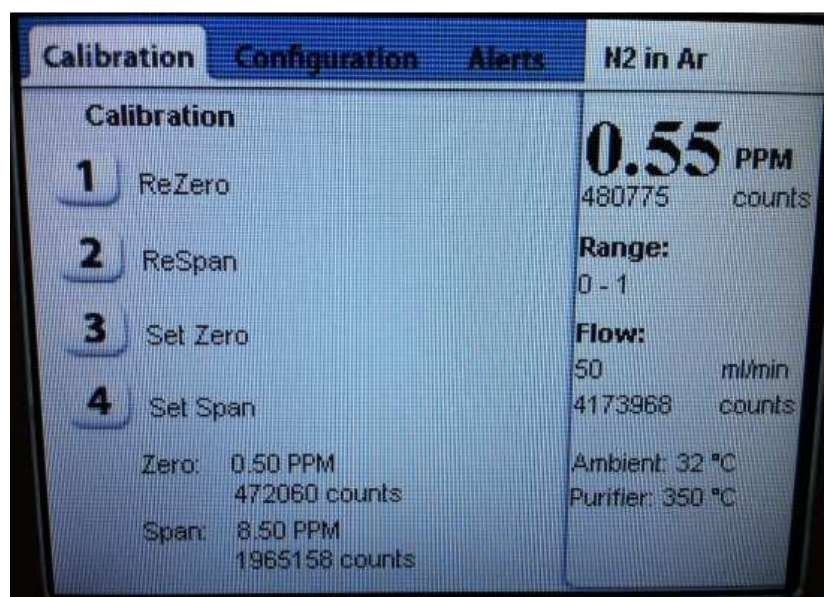
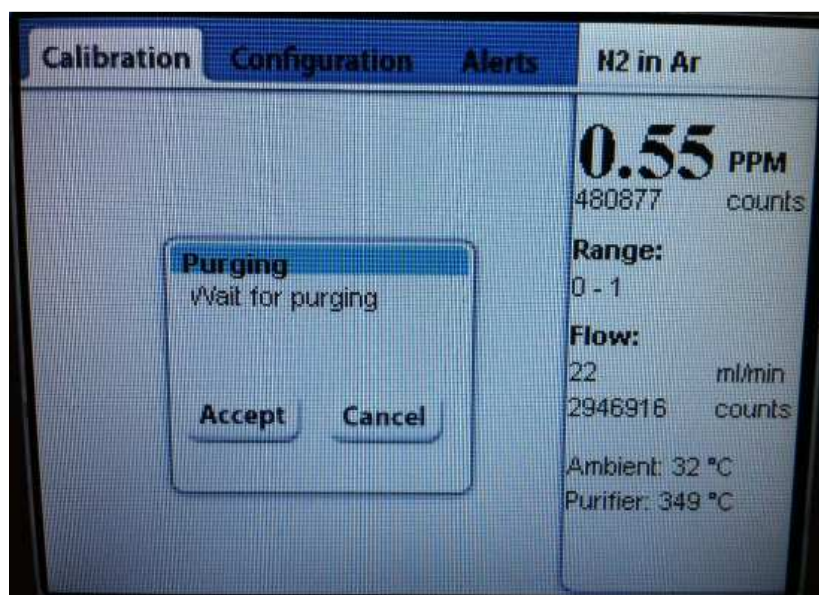
The operating sample inlet pressure of the LD8000 with the integrated zero gas free system must operate at a minimum pressure of 10 PSIG. The maximum acceptable inlet pressure is 50 PSIG. LDetek can't guarantee the performances of the unit if the sample inlet pressure isn't in the requested range of operation. The unit can be damaged if the inlet pressure goes over 50 PSIG.

Calibration menu:

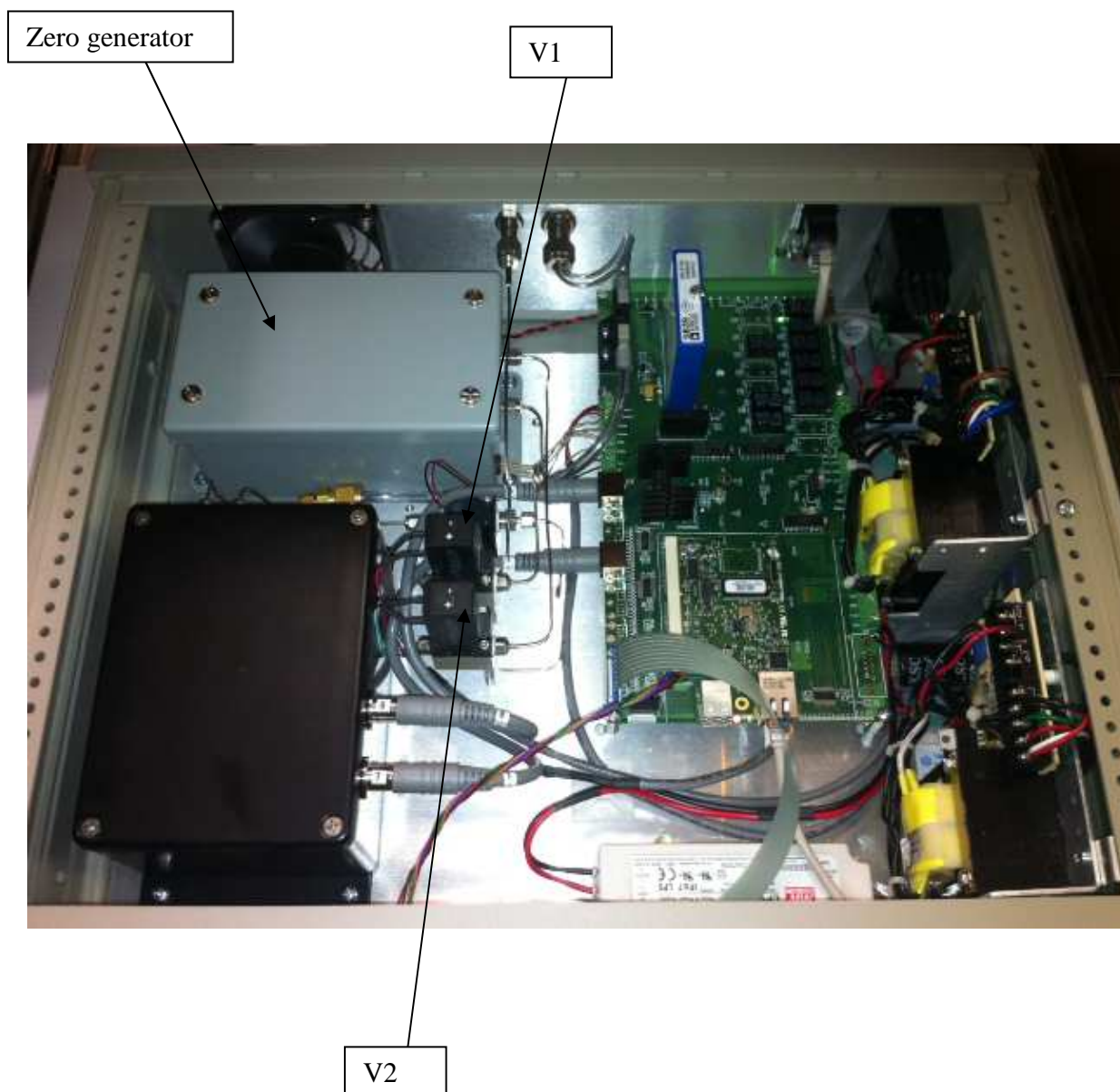
For running a zero calibration. Go in calibration menu and press 1 to ReZero the unit. The valves are then set automatically in the position to allow the sample gas going through the integrated zero gas generator module to purify the sample gas. After pressing 1 (Re-Zero) button, a screen will then appear showing that the system is purging (see image below). You have to wait until the reading in ppm is stable before to push the "E" button to "Accept" the zero calibration. Waiting for system stabilization before to accept the zero calibration is required. LDetek usually suggest waiting in between 3 to 5 minutes to allow system stabilization prior to zero calibration. To ensure the good performances of the system, it is important to keep the operating sample flow rate and the zero calibration sample flow rate with the factory settings.

Real time menu:

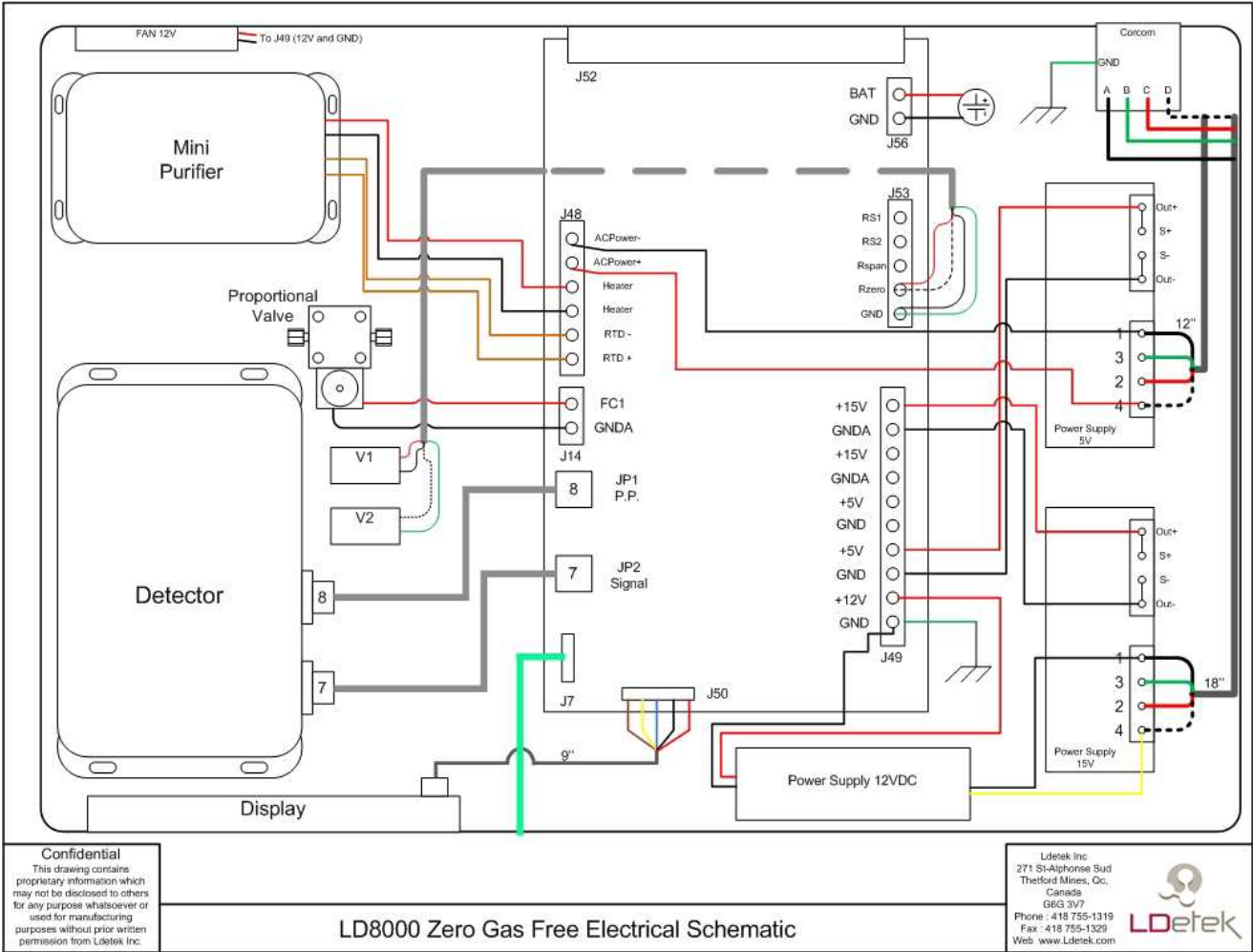
The internal zero generator operating temperature is displayed in the RealTime area. The normal running temperature is 350° Celcius. An alert will show up if a deviation of +/- 15 ° Celcius appears. The status dry relay will then be activated until the temperature comes back to +/- 10 ° Celcius. It is important to have this temperature at 350 Celcius prior to run a zero calibration to ensure that the integrated gas purifier operates correctly.



Zero gas free system components:



Zero gas free electrical diagram:



Confidential
This drawing contains
proprietary information which
may not be disclosed to others
for any purpose whatsoever or
used for manufacturing
purposes without prior written
permission from Ldetek Inc.

LD8000 Zero Gas Free Electrical Schematic

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Fax : 418 755-1329
Web : www.Ldetek.com

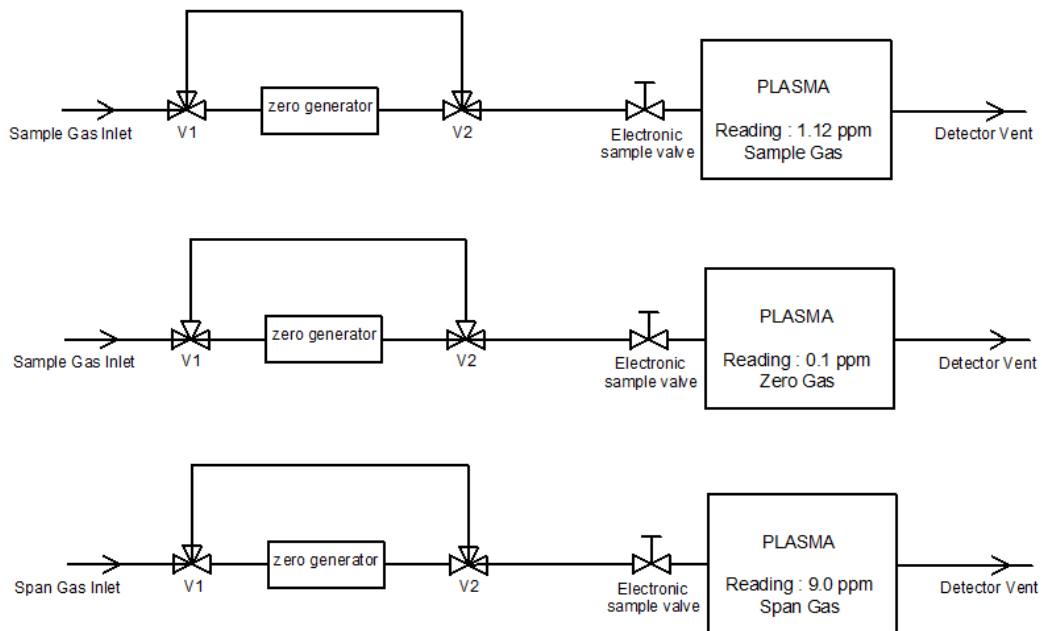


Zero gas free flow path diagram:

Sample gas position : The valve 1 & valve 2 are set at off position to allow sample gas going directly to the plasma. This is the normal operation mode for sample gas analysis.

Zero gas position : The valve 1 & valve 2 are set at on position to allow sample gas going in the zero generator and then go to the plasma. This is the zero calibration operation mode.

Span gas position : The valve 1 & valve 2 are set at off position to allow span gas going directly to the plasma. This is the span calibration operation mode.



Important note

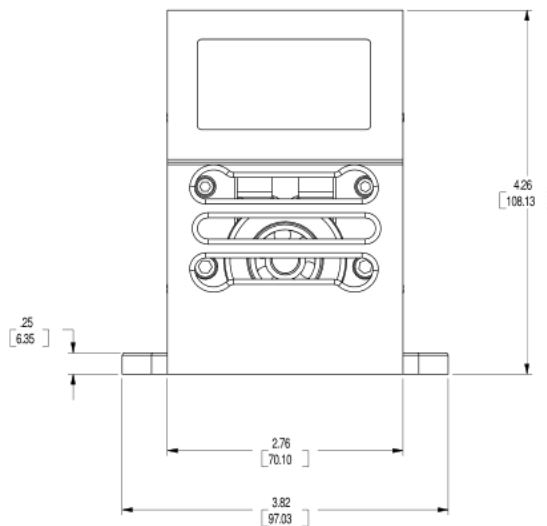
The integrated zero gas generator can be damaged if bad purging of the sample line prior to the sample inlet occurs. It is mandatory to keep gas flow rate as configured by LDetek factory through the LD8000 in all time. LDetek isn't responsible of damaged or bad functions of the zero gas free option if factory settings have been changed without advice to LDetek or if bad purging of the instrument has occurred. If the zero reference cell counts can't be reaching, it could be caused by contamination of the zero gas generator. In this case, contact LDetek factory.

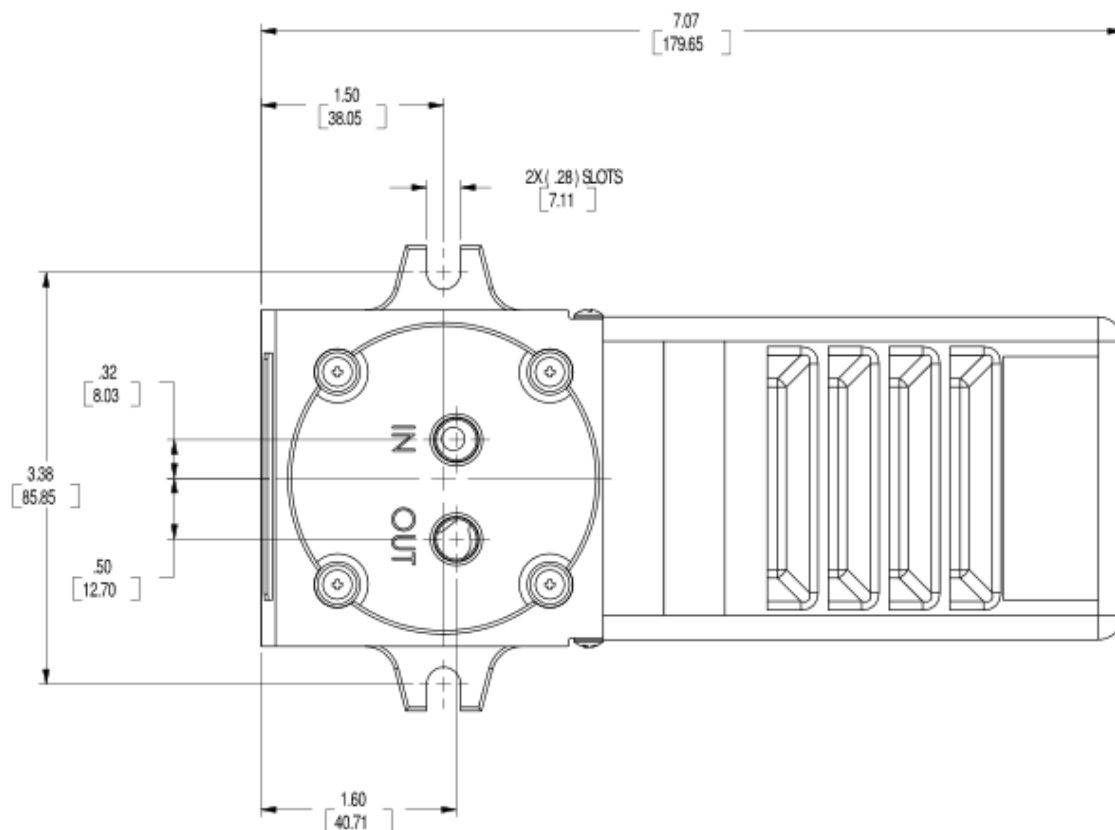
The zero gas generator is a consumable. It is then suggested to keep some parts in inventory for replacement.

10.4 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 working range of the LD8000 which is between 10 PSIG to 50 PSIG. The pump type is high purity and allows measurement of low ppb nitrogen. It is fully tested at LDetek facility.

1. The pump must be mounted external of the LD8000 and mounted on rubber standoff to reduce vibration of it.
2. The pump must be connected to an external power source on 110VAC 50/60HZ or 220VAC50/60HZ depending of the requested pump model.
3. The connections on the inlet and outlet of the pump are 1/8'' inches Stainless Steel Swagelok compression type.
4. The electrical connections to respect are indicated on the pump itself. Please refer to it.
5. 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 up front the pump. Not installing the particle filter may result in damaging the pump.





10.5 Crude Argon system

The crude argon online gas analyzer allows the measurement of nitrogen level in a gas mixture containing Argon gas from 96% to 100% and Oxygen gas up to a limit of 4%. It is continuous measurement using a plasma detector working in vacuum mode. The principle is based on a differential measurement with an Oxygen selective detector and a nitrogen selective detector. An algorithm is used to get a linear and stable nitrogen measurement for the requested nitrogen range of measurement (application dependant).

The whole system is integrated in the LD8000 and is fully monitored and controlled by the interface. Most of the operations are compatible with a standard LD8000. You can refer to the sections of the present document. The differences that are unique to the crude argon system are listed in this 10.5 Crude Argon system section.

Specifications:

The operating sample inlet pressure of the LD8000 Crude Argon must operate at a minimum pressure of 10 PSIG. The maximum acceptable inlet pressure is 25 PSIG. LDetek can't guarantee the performances of the unit if the sample inlet pressure isn't in the requested range of operation. The unit can be damaged if the inlet pressure goes over 50 PSIG.

Real Time menu:

On the right of the screen, the real time data is always shown:

value in ppm

digital signal from the N2 detector in counts (24 bits)

digital signal from the O2 detector in counts (24 bits)

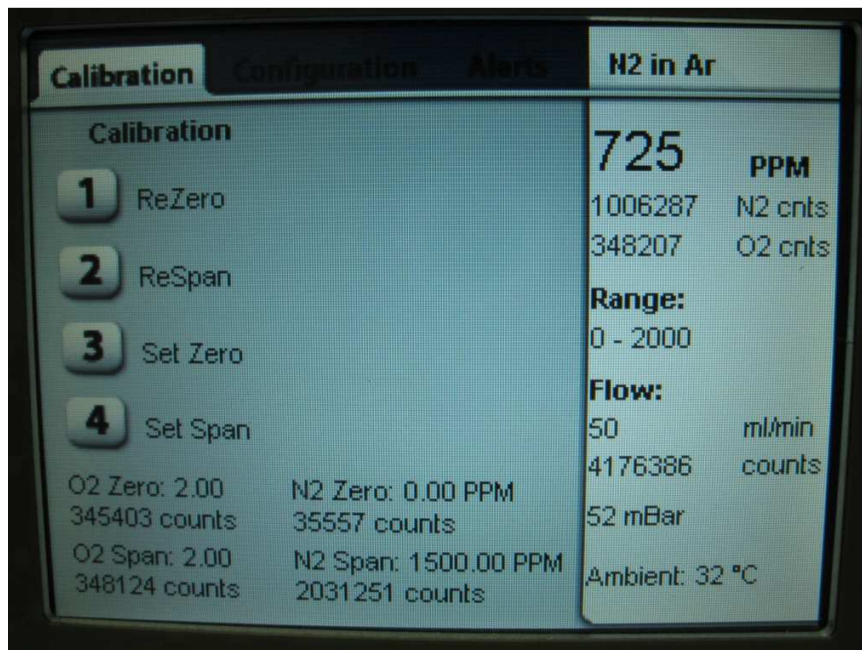
Actual range (0-2000ppm fix range for this instrument) (application dependant)

Sample Flow in milliliter / minute (must stay at the factory set value. Please refer to the operating data sheet included with the instrument)

digital signal from the sample flow in counts (24 bits)

Vacuum pressure in mBar

Ambient temperature inside the analyzer

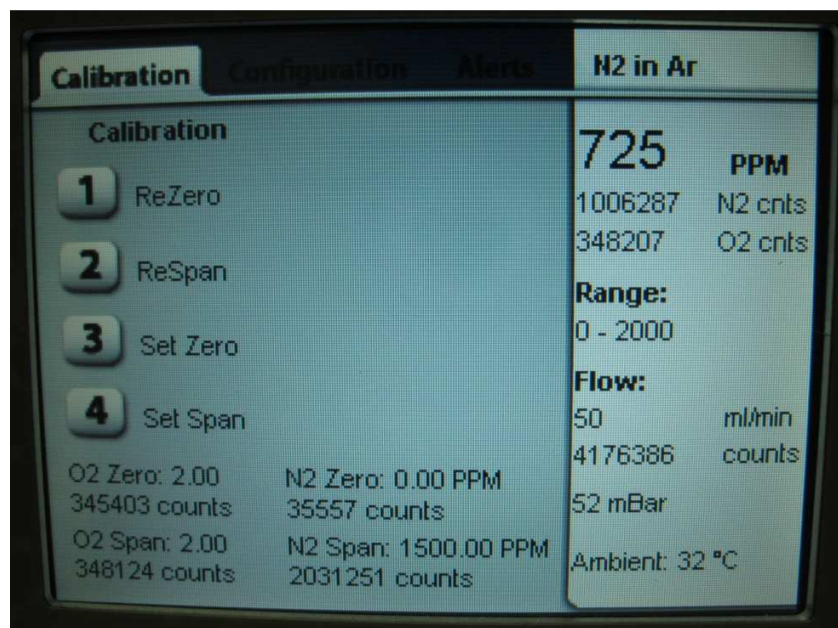


Calibration menu:

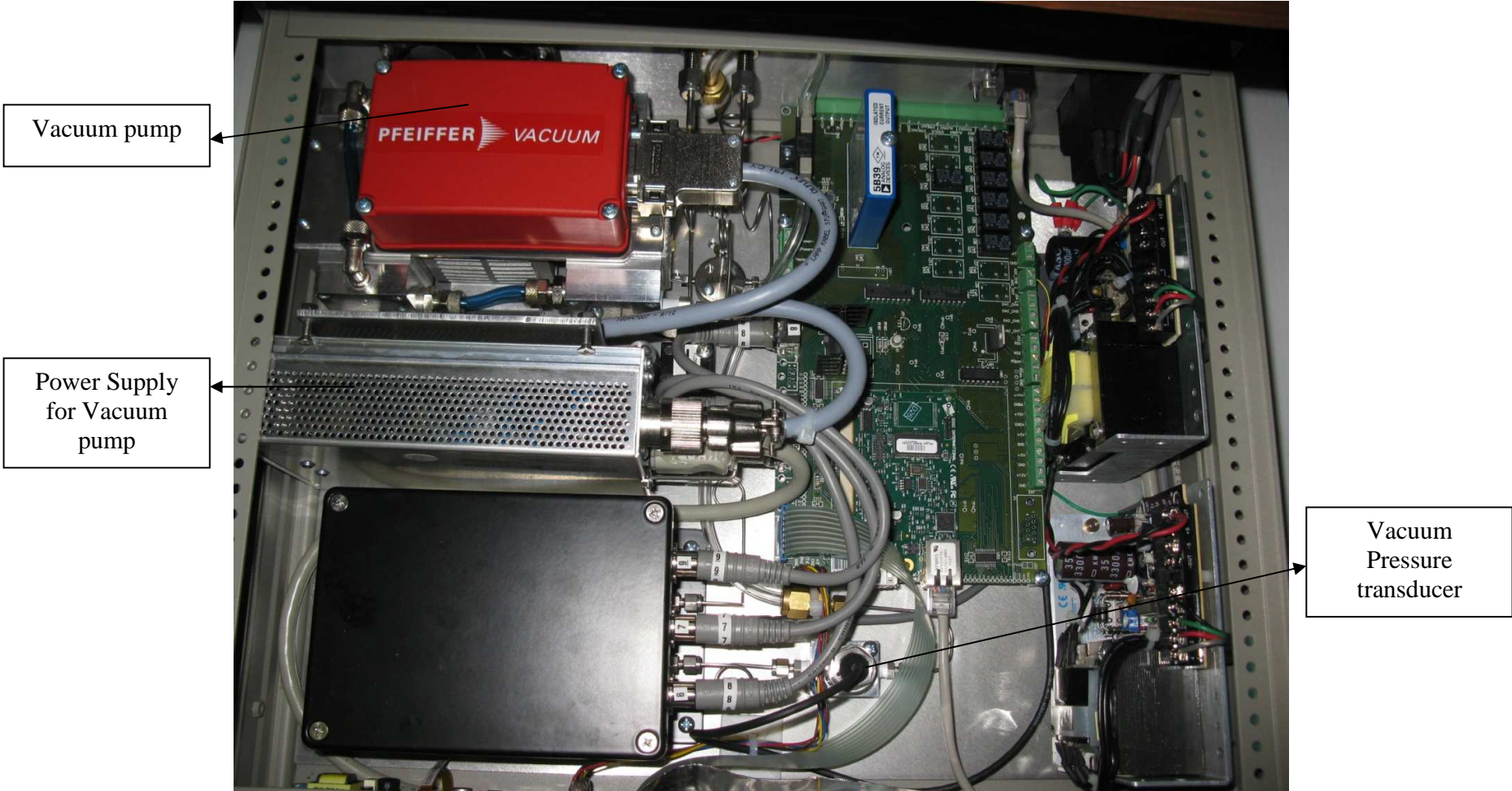
The calibration of the instrument must always be done with the same gas mixture that has been requested by LDetek. Always refer to the operating data sheet included with every instrument. Using different gas mixtures will result in giving bad reading due to incorrect calibration and may also results in damaging the instrument.

In the software interface, set the zero gas value and the span gas value of the calibration bottles. Use button “3” for zero and button “4” for span.

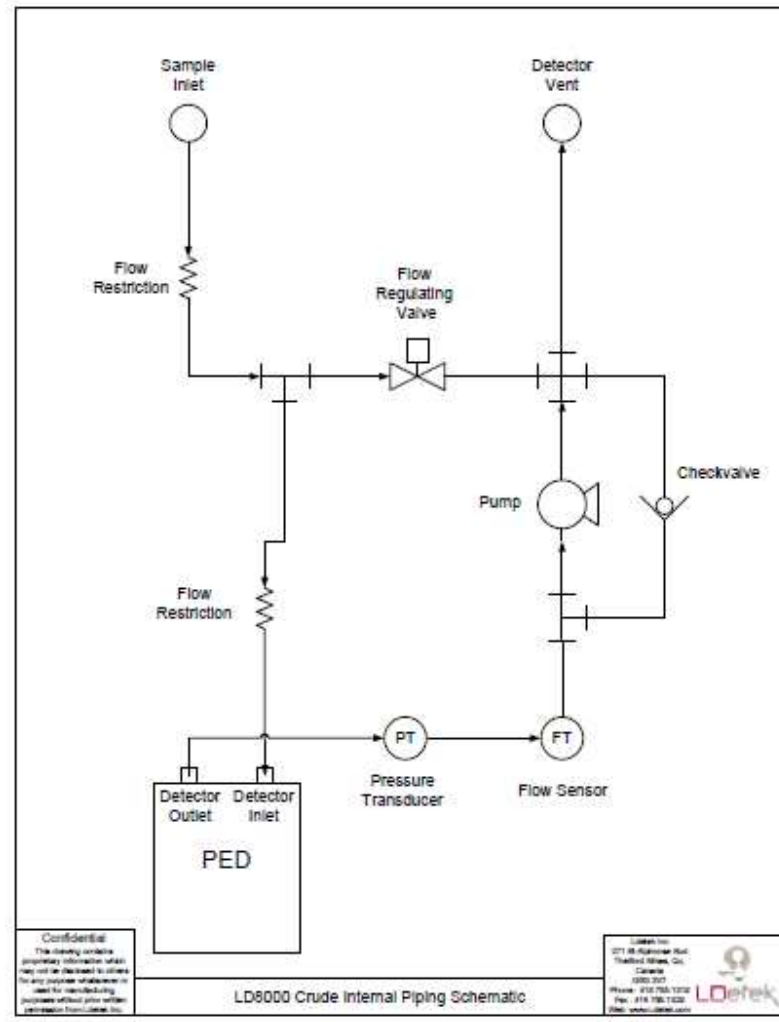
For calibrating the zero, use button”1” and for calibrating the span, use button “2”. The last calibration counts and value always appears at the bottom of the menu.



Crude argon system components:



Crude argon system internal piping diagram:



With its plasma working in vacuum mode, the flow control has been designed in bypass mode to avoid any source of contamination coming from the flow controller. It is the reason why it is so important to keep the sample inlet pressure in a range of 10 psig to 25 psig. Having a sample inlet pressure higher than the specified value may damaged the unit by pressurizing the detector (which is made of quartz) and will results in high flow consumption in the bypass line.

At the opposite, having a sample inlet pressure to low will result in having no sample flow in the bypass line and will create source of contamination that will make the unit being unstable and not accurate.

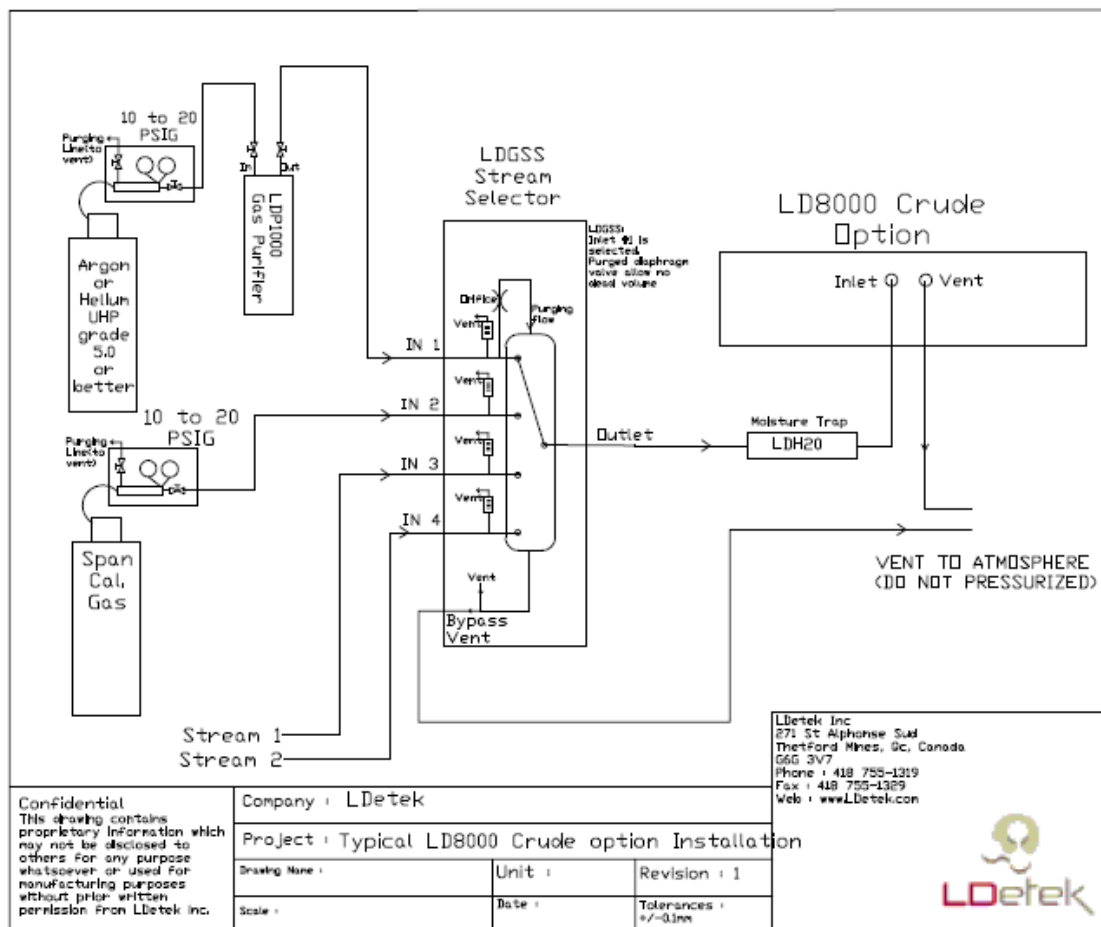
At the outlet of the detector, a low pressure check valve has been mounted in parallele to the vacuum pump to protect the detector (which is made of quartz) from pressurization in case the pump stop to work or blocked.

A pressure transducer and a flow transducer are mounted on the detector outlet as well to avoid any source of contamination. The pressure transducer pressure monitored in the real time menu gives the vacuum pressure in the detector chamber. It is very important to keep the pressure at a value of $\pm 10\%$ of the value written in the operating data sheet. The vacuum pressure also gives the status of the vacuum pump.



It is very important to never pressurized the detector vent. Pressurizing the detector vent will results in severe damage to the detector.

Crude argon system typical installation diagram:



The vent connection must be connected to a non pressurized vent header to ensure correct venting of the gas without pressurizing the detector.



Since that some trace ozone are present at the detector vent caused by the Argon/Oxygen mixture in the plasma, it is the responsibility of the user to correctly and safely evacuate the ozone level generated by the instrument.

11. Ordering Information

LD8000	-X	-XXX	-X	-XX	-X	-XXX
	A : Argon H : Helium C : Crude	Operating Voltage	A : Alarm Option	Integrated sampling system	C : Zero gas free system	Serial communication
		120 : 120 Volts 220 : 220 Volts		S1 : 1 Stream + zero + span S2 : 2 Streams + zero + span		RS2 : RS-232 RS4 : RS-485 PFB : Profibus

11.1 Spare parts

Description	Part Number
LDH2O	Moisture trap
LD8000FK	LD8000 fuses kit
miniLDP1000	Integrated zero generator for LD8000 zero gas free system
Sample Flow Micro Valve	LD8000-microvalve
5.6" LED Touchscreen Display	LD8000-LCD
Complete Mother Board PCB assembly	LD8000-motherboard
Analog Output Module	LD8000-4.20mA Module
Sample Flow Sensor	LD8000-FlowSensor
Micro Controller Unit	LD8000-MCU
Rear Panel assembly	LD8000-RearPanel
5VDC Power Supply	LD8000-5VDCPowerSupply
15VDC Power Supply	LD8000-15VDCPowerSupply
Top Cover assembly	LD8000-TopCover
Bottom Cover assembly	LD8000-BottomCover
Front Panel assembly	LD8000-FrontPanel
Lithium Battery	LD8000-Battery



Where **innovation** leads to **success**

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