MATHESON TRI•GAS

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USER MANUAL

LCMS M-4

NITROGEN GENERATOR FOR LC/MS

MATHESON TRI-GAS
166 Keystone Drive
Montgomeryville, PA 18936
Phone: 215-641-2700
Fax: 215-641-2714
Email: mtgmmville@matheson-trigas.com

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1 Introduction

1.1 General

This manual forms an integral part of the product. The manual describes the installation, daily operation, maintenance and troubleshooting.

Content

Read the manual carefully before you start with the *LCMS M-4*. Familiarize yourself with the content.

Condition of change

Only execute changes to the *LCMS M-4* after explicit prior written permission by the manufacturer. Non-conformance to this rule, as well as any consequential damage, loss and costs are the responsibility of the owner and the user.

Information

All information in this manual, including additional drawings and technical descriptions, remains the property of the producer and may not be used (otherwise than for the use of this product), copied, multiplied or published to or for a third party without explicit prior written permission by the manufacturer.

1.2 Pictograms

In this manual and on the generator, the following pictograms are used:

Warning
A warning shows a hazard that can cause death or serious injury. Follow the instructions.

Caution
A caution shows a danger that can cause damage to the equipment. Follow the instructions.

Electricity
High voltage: danger of electric shock.

Warning
Risk for death due to suffocation.

Risk of fire
Oxygen-enriched air leads to an increased risk of fire in the event of contact with inflammable products.

High-pressure risk
Follow the instructions with respect to compressed gasses.

Environment
Instructions with respect to the environment.

Read instructions in the manual.

1.3 Identification and service

The identification plate is located on the right hand side of the *LCMS M-4*. The identification plate shows the characteristics of the *LCMS M-4*.

For service and technical assistance, please contact your distributor and/or the manufacturer.

WARNING: in case of a warranty failure of the compressors, the manufacturer requires the SD card (MEMORY CARD) to be send together with the compressor. The user will of course get his SD card send together with the new replacement compressor.

1.4 Certificates

The *LCMS M-4* meets the following requirements:

Subject	**Applicable standard**
Directive for electromagnetic compatibility (EMC)	EN-50081-1, EN50082-2
Low Voltage Directive	NEN EN 60204-1
Pressure equipment directive (PED)	Sound engineering practice
Quality assurance	ISO 9001:2000
Environmental care	ISO 14001:1996

1.5 Use in accordance with purpose

The *LCMS M-4* is intended to make nitrogen out of normal ambient air. The system is based on gas separation membranes. Each different or further use will not be in conformity with the purpose. The manufacturer will not accept any liability for improper use.

The *LCMS M-4* is in compliance with the prevailing directives and standards. Only use this *LCMS M-4* in a technically perfect condition, in conformity with the purpose as described above.

1.6 User instructions

Only well-trained personnel are allowed to work on the *LCMS M-4*. The user must be aware of hazards related to operating the *LCMS M-4* and

processes connected to the *LCMS M-4*. The user is responsible for the safety of the personnel. All personnel working on the *LCMS M-4* must have free access to the applicable manuals.

1.7 Liability

The producer will not accept any liability if:

- The instructions in this manual are ignored.
- Replacement parts are used which are not approved by the manufacturer.
- The *LCMS M-4* is operated incorrectly.
- The system is fed with other gasses than air.
- The *LCMS M-4* is modified without notification and authorization of the manufacturer.
- Maintenance and repair are not carried out according to the instructions.

2 Health, safety and environmental aspects

2.1 General

Correct use of the *LCMS M-4* nitrogen generator is important for your personal safety and for trouble-free functioning of the *LCMS M-4*. Incorrect use can cause damage to the *LCMS M-4* or can lead to incorrect gas supply.

Warning

- **Read this manual before you start the installation and putting into operation of the *LCMS M-4*. Prevent accidents and damage to the *LCMS M-4*.**
- **Contact your supplier if you detect a problem that you cannot solve with this manual.**
- **Use the *LCMS M-4* in accordance with its purpose. Refer to §1.5.**
- **Only service-engineers, that are qualified to work on electric and pneumatic equipment, are allowed to do the installation, maintenance and repairs. Unqualified people are not allowed to repair the equipment. Refer to §1.6. Lift the *LCMS M-4* with a forklift. Follow the legislation and instructions for operating the forklift.**
- **Do not tamper or experiment with the equipment. Do not exceed the technical specifications for the *LCMS M-4*. Refer to chapter 4.**

2.2 Nitrogen and oxygen

The *LCMS M-4* generates nitrogen as a product. Oxygen enriched air is released as waste.

Warning

- **Nitrogen can cause suffocation!**
- **Oxygen-enriched air leads to increased risk of fire in the event of contact with flammable products. Make sure that there is adequate ventilation at all times!**

- **The *LCMS M-4* is not designed for installation in an Exx-classified area.**
- **Do not install the *LCMS M-4* in an area where explosive mixtures may occur.**

2.3 Electricity

Warning

- **Only service-engineers, that are qualified to work on electrical equipment, are allowed to do the installation, maintenance and repairs.**
- **Disconnect the main power supply before you do the maintenance or repair.**
- **If a service-engineer has to work on the *LCMS M-4* while the electric power it is connected, the service-engineer must be very careful with respect to the electric hazards.**

2.4 Safety precautions

Warning

- **Make sure that the ventilation rate is sufficient in the room where the enriched oxygen is ventilated, or lead the enriched air outside. Keep the ambient temperature between 10 and 35 °C.**
- **Install the peripheral equipment, piping and nitrogen storage vessels according to standard procedures. The manufacturer cannot take responsibility for this.**
- **Do regular maintenance to the *LCMS M-4,* to ensure proper and safe operation. Refer to chapter 8.**
- **Make sure that instructions concerning health and safety are compliant with the local legislation and regulations.**

2.5 Environmental aspects

The use and maintenance of the *LCMS M-4* does not include environmental dangers. Most parts are made of metal and can be disposed in the regular way. The packaging of the *LCMS M-4* is 100% recyclable. Optimal sizing of buffer tanks and setting of the pressure switch will result in minimal energy consumption. The lower the delivery pressure, the longer the lifetime of the system.

According to EC-regulations electrical systems have to be disassembled and recycled at the end of their life.

Make sure that instructions concerning health, safety and environment are compliant with the local legislation and regulations.

3 Description of the appliance

3.1 General

The *LCMS M-4* separates compressed air produced by an on-board compressor into nitrogen and an oxygen enriched air stream. The separation system is based on membranes.

There are two versions of the *LCMS M-4*:

- The Low Pressure (LP) version, suitable for delivery of nitrogen at low pressure (2.0 bar(g) max.) and
- The High Pressure (HP) version, suitable for delivery of nitrogen at elevated pressures (8.0 bar(g) max.)

3.2 Separation principle

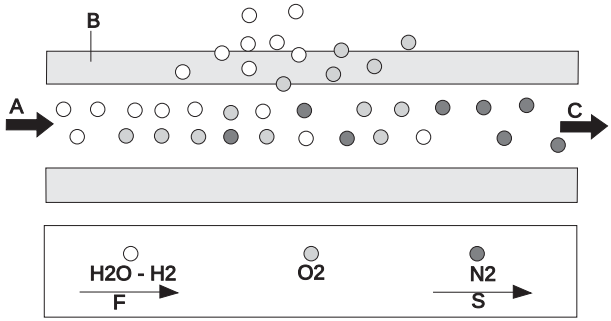


Fig. 3-1: Separation principle

A Pressurized air inlet
B Hollow fibre membrane
C Nitrogen outlet
F Fast permeation
S Slow permeation

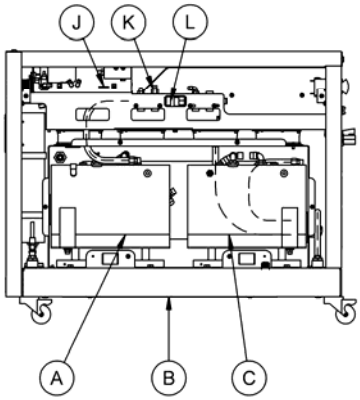
Ambient air contains nitrogen (78.1%), oxygen (20.9%), argon (1%), carbon dioxide, water vapor and traces of other inert gasses. Pressurized air (A) is led through hollow fibre membranes(B). The various air components diffuse through the porous wall of the membranes.

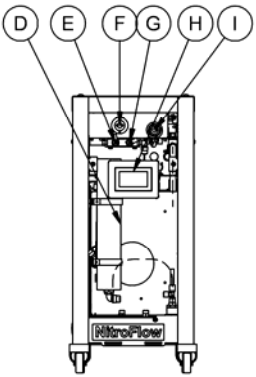
The diffusion rate differs for the various gasses:

- Oxygen and water vapor have a high diffusion rate and diffuse rapidly through the membrane wall.
- Nitrogen has a low diffusion rate and diffuses slowly through the membrane wall.

Pressurized nitrogen enriched air is released at the outlet of the membranes (E) which can be stored in a nitrogen storage vessel.

3.3 Parts

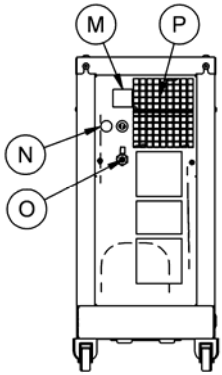




A Nitrogen compressor
B Hollow fiber membrane and heat exchanger (M)
C Air compressor

J SD-card
K Pressure relief valve
L Non-return valve

D Inlet carbon adsorber
E purity control valve
F Oxygen sensor
G O2 sensor adjustment valve (do not adjust)
H Touch screen display
I Pressure control valve



M Main switch/automatic fuse
N Electrical feed cable
O Product outlet
P Ventilation outlet (keep clear)

3.4 Process diagram

The *LCMS M-4* can be connected directly to the nitrogen consumer (Fig. 3-3) or to a buffer vessel (Fig. 3-4).

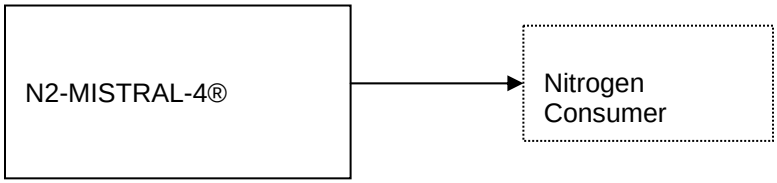


Fig. 3-3

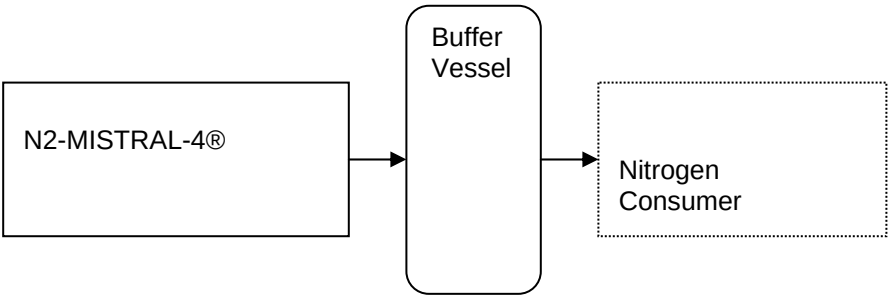
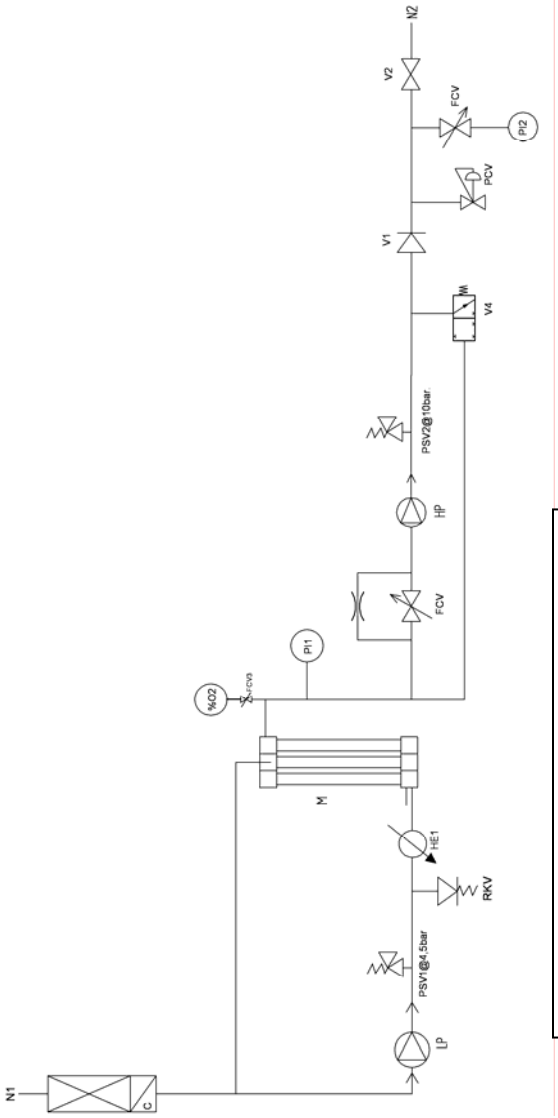


Fig: 3-4

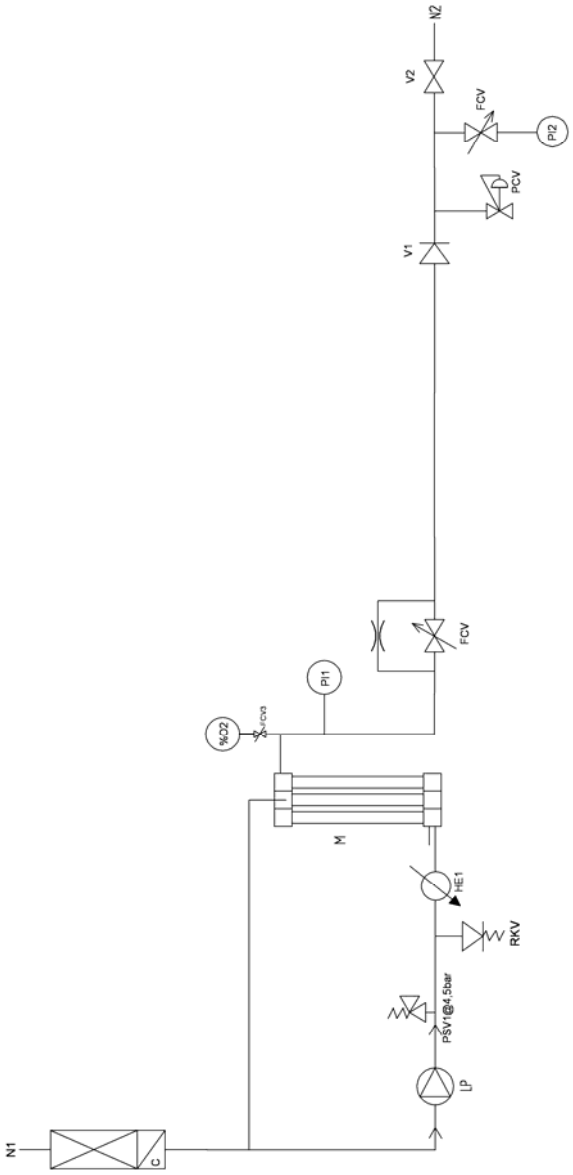
3.5 Process scheme

3.5.1 Process scheme *LCMS M-4* HP



N1	Air inlet
N2	Nitrogen outlet
C	Inlet carbon adsorber
LP	Air compressor
RKV	Start up valve
M	Gas separation membrane
PI1	Membrane pressure indicator
FCV	Flow control valve
HP	Nitrogen compressor
PCV	Nitrogen pressure relief valve
PSH	Pressure switch
PI2	Nitrogen pressure indictor
V1	Non return valve
N2	Nitrogen outlet
V2	Ball valve
V4	Depressurisation valve

3.5.2 Process scheme *LCMS M-4* LP



N1	Air inlet
N2	Nitrogen outlet
C	Inlet carbon adsorber
LP	Air compressor
RKV	Start up valve
M	Gas separation membrane
PI1	Membrane pressure indicator
FCV	Flow control valve
PCV	Nitrogen pressure relief valve
PSH	Pressure switch
PI2	Nitrogen pressure indictor
V1	Non return valve
N2	Nitrogen outlet
V2	Ball valve

4 Technical specifications

4.1 General

Delivery pressure	
Maximum delivery pressure	Low Pressure: 2 bar(g)/29 psig High Pressure: 8 bar(g)/116 psig

Ambient conditions	
Temperature	10 to 35 °C / 50 to 95 °F
Air quality	Normal clean ambient air, relative humidity < 90%
Max. ambient relative humidity	<80 %
Noise level	< 58 dB(A) @ 1 meter

Dimensions and connections	
Dimensions (H x W x D) [mm]	700 x 900 x 310
Dimensions (H x W x D) [inch]	27.6 x 35.4 x 12.2
Net weight	92.5 kg / 204 lbs
Connections	outlet: G ¼ " / ¼" NPT

Electrical data	
Voltage/frequency[1]	100Vac/50Hz, 100Vac/60Hz, 120Vac/60Hz, 230Vac/50Hz
Power consumption	1400 W

[1] Main supply voltage fluctuations not to exceed +/- 10% of nominal voltage.

Default software settings		
Menu	**What**	**Default setting**
Logs	Delay-time	180 sec
Local settings	Language	English
Local settings	Pressure	Bar
Local settings	Flow	LPM
Local settings	Purity	%O2
Alarm settings	O2 high	Active: No Stop: 0 Level: 5 Delay: 30
Alarm settings	O2 low	Active: No Stop: 0 Level: 0.0 Delay: 30
Alarm settings	Pin high	Active: No Stop: 0 Level: 13 Delay: 30
Alarm settings	Pin low	Active: No Stop: 0 Level: 2 Delay: 30

Alarm settings	Pout high	Active: No Stop: 0 Level: 10 Delay: 30
Alarm settings	Pout low	Active: No Stop: 0 Level: 2 Delay: 30
Pressure switch	P-switch	No
Pressure switch	Unit on	2.0
Pressure switch	Unit off	7.0
Options	Auto restart	No
Options	Remote	No
Options	Pincode	No
Options	Show Flow	No

Table 4-1: General data

4.2 Capacity data

Type	**Nominal production capacity Nlpm***								
Purity%	**99.9**	**99.7**	**99.5**	**99**	**98**	**97**	**96**	**95**	**93**
LP**	10	15	18	24	31	35	40	43	50
HP**	7.6	12	13	18	23	26	30	32	38

**Table 4-3: Capacity at nominal conditions:*

- Ambient temperature: 20 °C /68 °F
- Ambient pressure: 1013 mbar(a).

**LP = Low Pressure, max. 2 bar(g) / 29 psig nitrogen pressure
**HP = High Pressure, max. 8 bar(g)/ 116 psig nitrogen pressure

4.3 Maintenance kit

Part	**Part number**
Maintenance kit • 1x Carbon adsorber	N2-4-005
Oxygen sensor	N2-4-004

5 Installation

Follow the paragraphs in this chapter to install the *LCMS M-4*.

5.1 Transport

Warning

- **Transport the *LCMS M-4* upright.**
- **Put the *LCMS M-4* in the original box to transport the *LCMS M-4* over longer distances.**
- **Lift the *LCMS M-4* with a forklift.**
- **For qualifications of personnel, refer to §2.1.**

5.2 Define location

IMPORTANT

- **The *LCMS M-4* contains compressors that generate heat; for optimal performance and lifetime it is necessary that cooling air can be vented without resistance. A minimum clearance distance from walls or other objects of at least 50 cm/ 20 inches on all sides (back, left, right and top) is a necessity; also efficient local ventilation at the ventilation outlet is highly recommended especially when the device is installed under a bench**

Install the *LCMS M-4* on a fixed location. The location must meet the following requirements:

- Minimum clearance of 50 cm on all sides (back, left, right and top) as to facilitate heat removal
- Indoors
- Dry
- No continuous direct irradiation by sunlight
- Away from heat sources
- Properly ventilated room.
- Easy accessibly for operating and service

5.3 Unpack and check equipment

- Open the packaging.
- Make sure that all components are delivered. Refer to Table 4-1.

5.4 Connect nitrogen consumer

Warning

- **Do not connect the power at this time.**
- **Make sure that the inlet and outlet tubes are free of dust, particles, metal parts and curls, liquids and grease before you connect the *LCMS M-4*.**

- Connect the product outlet to the application or to a buffer vessel.

5.5 Connecting power

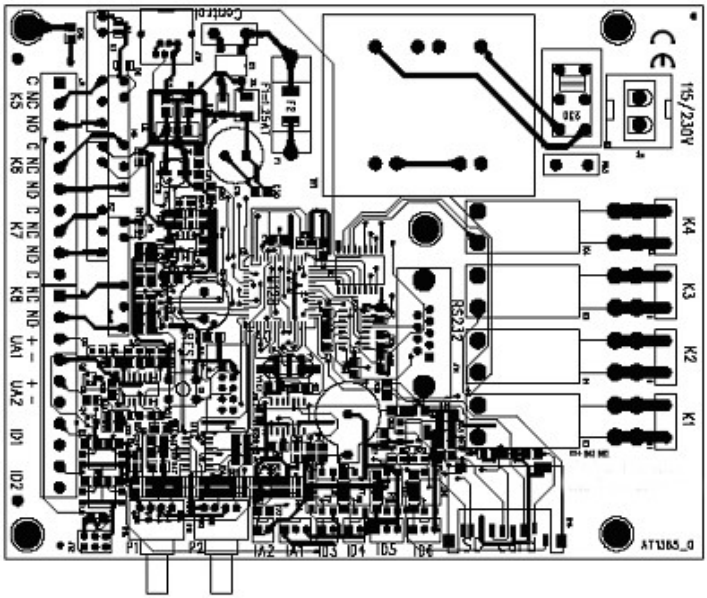
1. Connect the mains plug to a suitable wall socket with earth connection
2. The control system has in- and output contacts for remote control and alarm signaling (refer to §5.6).

Warning

The main supply line voltage must be within 10% of nominal rated voltage for the generator. In case of larger variations the *LCMS M-4* will stop and not restart; continued use under these circumstances will inevitably lead to motor damage.

5.6 Connect input and output signals

In- and put signals can be connected to the terminal strip on the printed circuit board.

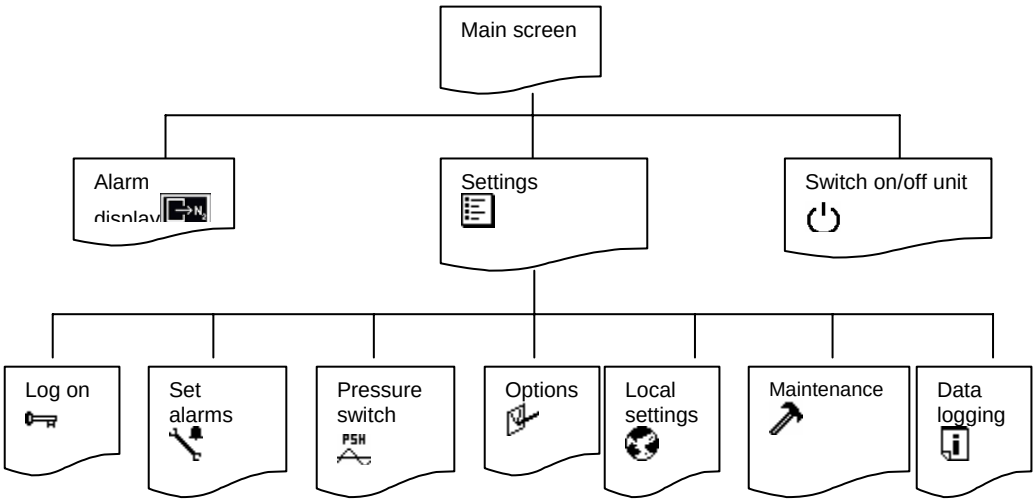


Clamp	Function
ID1	Remote control input
UA1	Oxygen concentration
UA2	Outlet pressure
UD5	Start stop signal to external booster
UD6	Alarm oxygen level low
UD7	Alarm oxygen level high
ID1	Remote start-stop

6 Operation of the control system

6.1 Menu structure

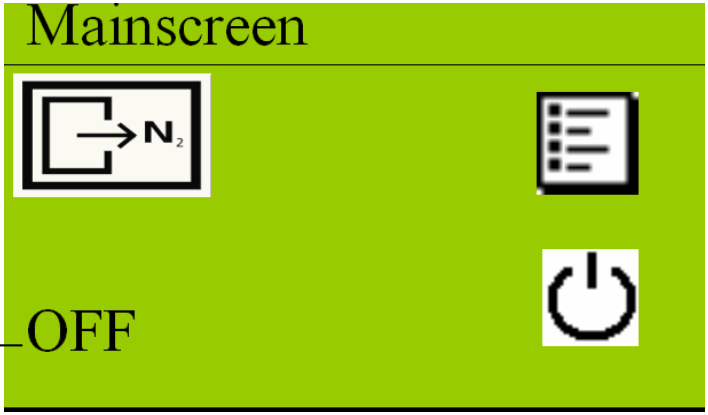
The menu structure of the control system is built up as shown below. One can always go back to a higher level in the menu by pushing the -button.



6.2 Main screen

Access: This is the start-up screen that automatically appears when the generator is switched on.

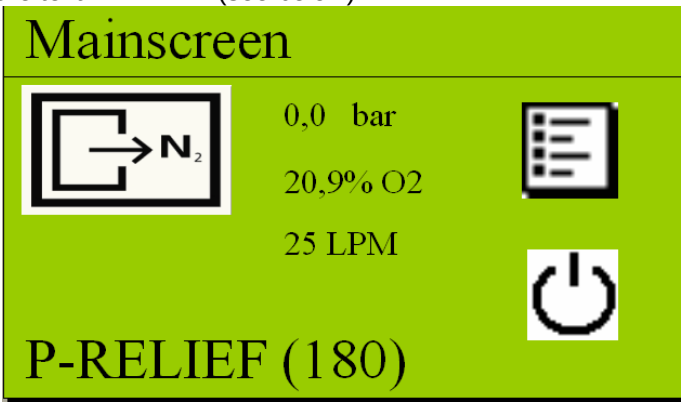
Function: Gives access to the different menus.



A

Symbol/data	Information/result
	When flashing there is an alarm; touch the symbol and the current alarm will be shown.
Status of unit (A)	Can be OFF/RUN/STAND-BY/ALARM/P-RELIEF
	Menu button, touch to go to settings menu
	Switch ON/OFF button, generator will turn ON or OFF

To turn the unit on, touch the switch ⏻-button. The status will switch to P-RELIEF. The compressors will start three minutes (180 seconds) after the unit has been switched on. The delay time countdown time is shown next to the text P-RELIEF (see below).



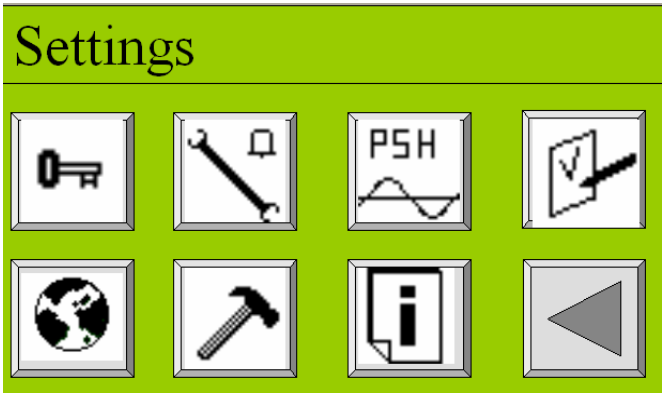
When the unit is switched on the controller will show:

- Actual outlet pressure
- Actual oxygen or nitrogen level
- Flow indication (when selected, refer to §6.3.4)

6.3 Settings menu

Access: Touch settings menu button in the main screen (refer to §6.2)

Function: Access to different menus



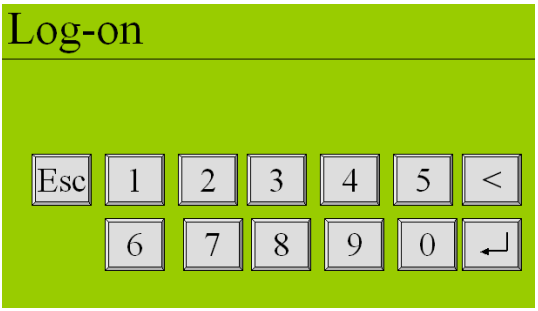
Symbol	Menu
	Access to **log on menu** (refer to §6.3.1)
	Access to **alarm settings menu** (refer to §6.3.2)
	Access to **pressure switch menu** (refer to § 6.3.3)
	Access to **options menu** (refer to § 6.3.4)
	Access to **local settings menu** (refer to § 6.3.5)
	Access to **maintenance menu** (refer to § 6.3.6)
	Access to **data logging menu** (refer to § 6.3.7)
	Returning to previous menu

6.3.1 Log on menu

Access: Touch log on menu button in settings screen (refer to §6.3)

ATTENTION: When you start-up the system for a first time you do not need to enter a PIN CODE

Function: Protect the settings in the system with a (personal) pin code.



In the log on menu:

- Enter the default pin code (**1234**) after selecting PINCODE YES under the options menu (refer to §6.3.4).
- Change the default pin code to a personal pin code of 4 digits (refer to §6.3.4)
- Return to default factory settings by entering pin code **7833** (refer to §4.1)
- In case you lost your pin code, please contact your supplier

Caution:
When returning to factory settings, the alarms, p-switch, options and settings must be reset. Also the log on pincode is back to default value 1234

6.3.2 Alarm settings menu

Access: Touch alarm settings menu button in settings screen (see § 6.3.2)

Function: Set different alarms

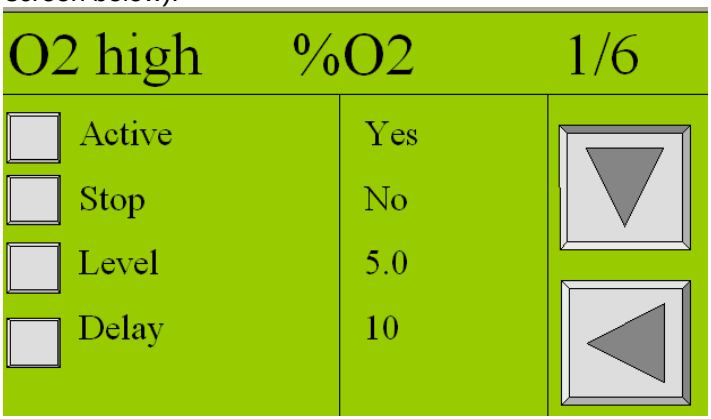
In the alarm settings menu it is possible to set 6 different alarms.

Screen	Alarm	Explanation
1/6	O2 high	oxygen level too high
2/6	O2 low	oxygen level too low
3/6	Pres. Inlet high	inlet pressure too high
4/6	Pres. Inlet high	inlet pressure too high
5/6	Pres. Outlet high	outlet pressure too high
6/6	Pres. Outlet low	outlet pressure too low

1. To activate an alarm touch button A. When the button is touched you can select the options YES, AUTO RESET or NO by pressing the arrow keys.

Default all alarms are set to NO, which means they are not activated; activating the alarms or not is the choice of the user; alarms do not influence the output and purity.

2. When you select YES or AUTO RESET, the rest of the alarm parameters that need to be set will pop-up automatically (see screen below).



Button	Selection	Result
Active	No	Alarm function for this parameter is not active
Active	Yes	Alarm function for this parameter is active; alarm messages must be reset manually
Active	Auto reset	Alarm function for this parameter is active; When alarm level is not exceeded any longer before manual reset, the alarm will reset itself
Stop	Yes	Generator will switch off in case alarm level is exceeded
Stop	No	An alarm signal will be given but generator will continue to run in case alarm level is exceeded
Level	0-16% O_2 100 – 84% N_2	For screen 1/6 and 2/6: this is the oxygen- or nitrogen level* at which the alarm is set.
Level	0-13 BAR* 0-188.5 PSI*	For screen 3/6 and 4/6. This is the pressure level at which the alarm is set
Level	0-10 BAR* 0-145 PSI*	For screen 5/6 and 6/6. This is the pressure level at which the alarm will appear.
Delay	0-300 sec	Delay time in seconds between the moment that the alarm level has been exceeded and signaling; this feature prevents false alarms in case of short spikes

*see also -menu (local settings)

ATTENTION:
It is impossible to set O_2 low at a higher level than O_2 high. The setting of O_2-low is limited once O_2-high has been set. Therefore first set O_2 high level before setting the O_2 low level.

6.3.3 Pressure switch menu

Access: Touch pressure switch menu button in settings screen (refer to § 6.3)

Function: Set the pressure switch

In the pressure switch menu the levels at which outlet pressure the generator will switch on and off, can be set. To change the settings, touch the button in front of the text.

Button	Selection	Result
P-switch	Yes	Pressure switch is active
P-switch	No	Pressure switch is not active
Unit on	0-10 Bar*/ 0-145 PSI*	Pressure level at which the unit will switch on
Unit off	0-10 Bar*/ 0-145 PSI*	Pressure level at which the unit will switch off

*refer to local settings menu

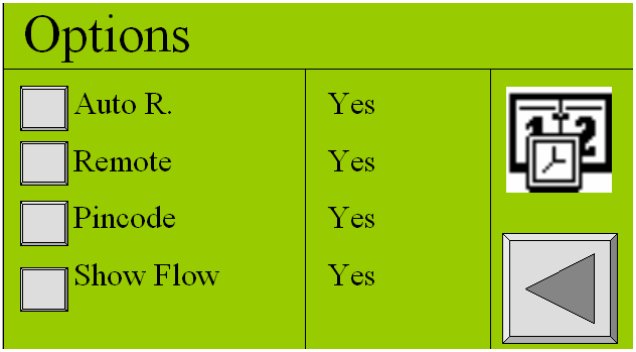
To determine the correct switch on and off pressure, please check § 7.4.

6.3.4 Options menu

Access: Press option menu button in settings screen (refer to §6.3)

Function: Set different options

ATTENTION:
All options are default set to NO. Options do not affect the output and purity.



Button	Selection	Result
Auto R.	Yes	After a power failure the unit will automatically restart itself and return to the same situation/status.
Auto R.	No	After a power failure the unit will not start automatically. Unit needs to be restarted manually.
Remote	Yes	Unit can be switch on and off from a remote location. Only select **Yes** after connecting the printed circuit board to an external device.
Remote	No	Unit cannot be controlled from a remote location.
Pincode	Yes	Settings are instantly protected with a pin code. Return to **log on menu** and enter the **default pin code 1234**.

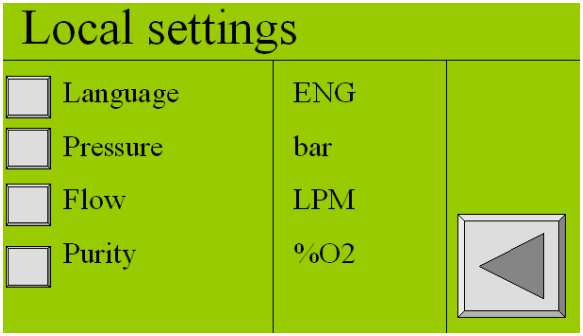
Pin code	No	Settings can be changed without a pin code
Pin code	Change	Pin code can be changed to a personal 4 digits code. **(In case you forget your personal code, consult your supplier)**
Show Flow	Yes	Flow rate will be displayed in main screen
Show Flow (D)	No	Flow rate will not be displayed.
		Operate to adjust date and time

6.3.5 Local settings menu

Access: Touch local settings menu button in settings screen (refer to § 6.3)

Function: Set data to local requirements

Depending on the local situation it is possible to change the setting accordingly.



Button	Selection	Result
Language	English, Francais, Deutsch, Nederlands, Español	Text in the screen will appear in the chosen language.
Pressure	BAR/PSI*	Pressure indications will appear in the chosen setting
Flow	LPM/CFM	Flow will appear in the chosen setting
Purity	%N2/%O2	Purity will appear in nitrogen (%N2) or oxygen (%O2) percentage

* Select BAR, to display temperature in °C. Select PSI to display temperature in °F.

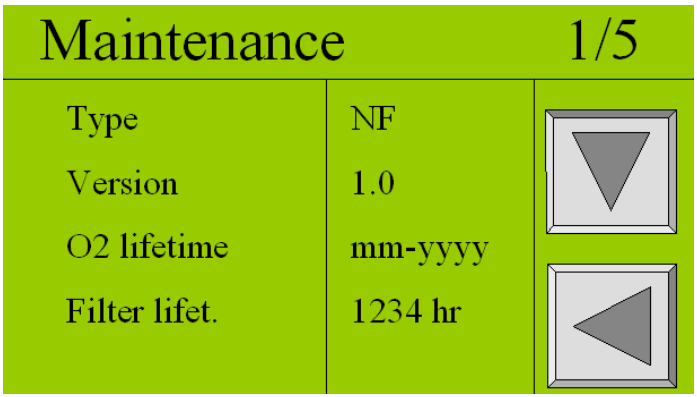
6.3.6 Maintenance menu

Access: Touch maintenance menu button in settings screen (refer to § 6.3)

Function: Shows maintenance status and offers calibration possibility.

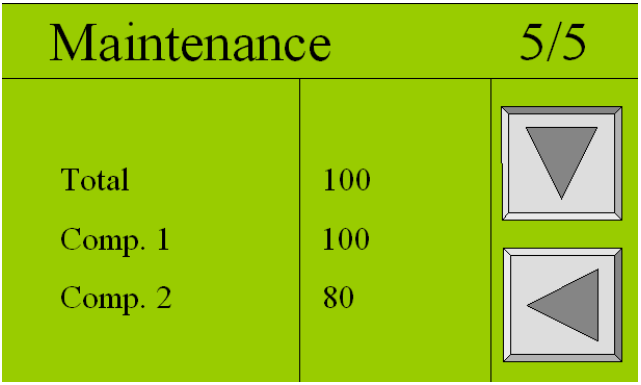
The maintenance menu consists of 5 different screens. Each screen displays maintenance status or calibration buttons.

SCREEN 1/5



Data	Explanation
Type	Shows type of generator this unit is
Version	Software revision number
O2 lifetime	Month-year when O_2-sensor needs to be changed (3 years from data of order)
Filter life	Hours countdown from 1 year to 0 hrs

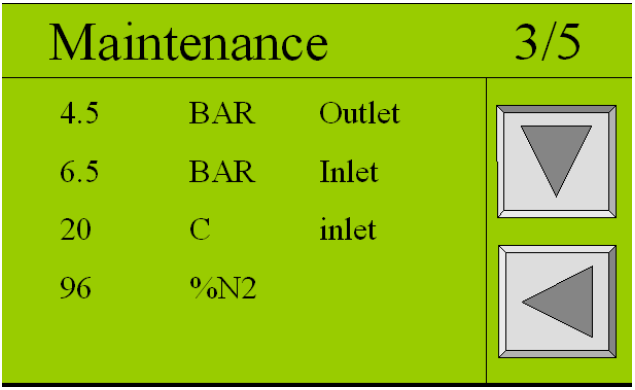
SCREEN 2/5



Data	Explanation
Total	Total running hours of the generator
Comp. 1	Total running hours of compressor box 1*
Comp. 2	Total running hours of compressor box 2*

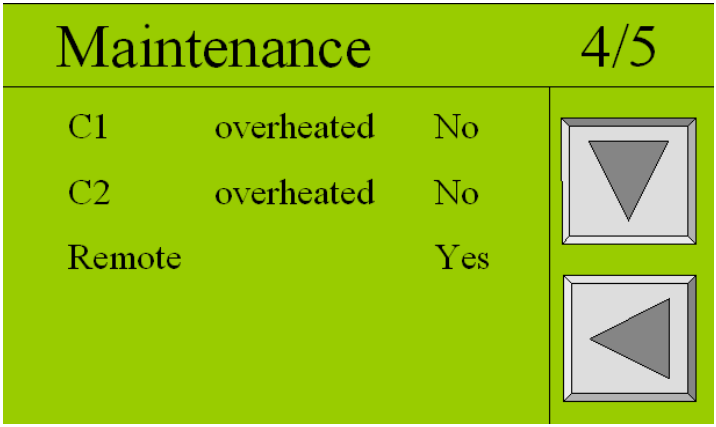
* Does not show up in *LCMS M-4* HP

SCREEN 3/5



Data	Explanation
Outlet	Outlet pressure in either BAR or PSI
Inlet	Inlet/compressor pressure in either BAR or PSI
C Inlet	Compressed air inlet temperature in °C or °F

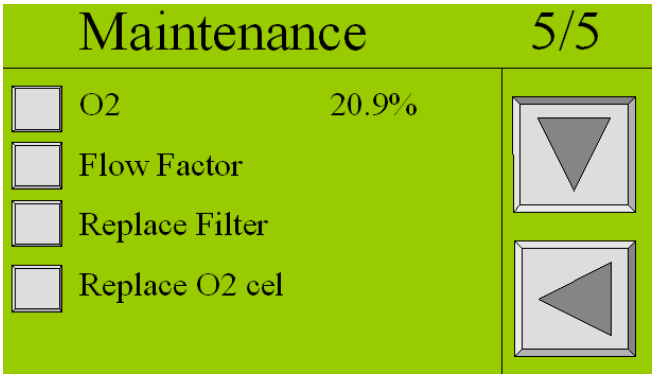
SCREEN 4/5



Data	Explanation
C1 overheated*	YES or NO Shows if compressor box 1 is overheated or not
C2 overheated*	YES or NO shows if compressor box 2 is overheated or not
Remote	YES or NO Shows whether remote control option is on or off

* In the *LCMS M-4* HP versions, these first 2 lines will not appear

SCREEN 5/5



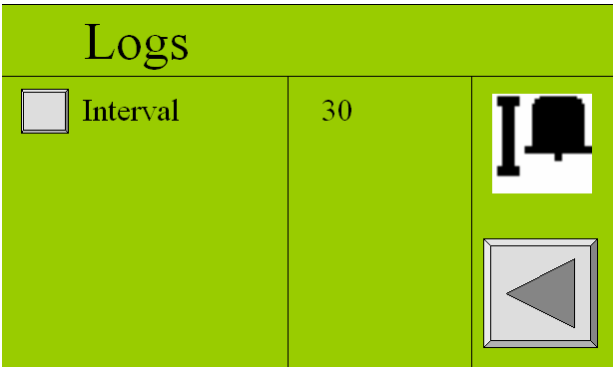
Button	Explanation
O2 – 20.9%	Calibrate O_2 sensor to 20.9% (refer to §9.4for detailed explanation)
Flow Factor	Only visible when selected Show Flow in the options menu (refer to §6.3.4) and when the unit is running. Calibrate the flow by entering the flow measured with an external flow meter.
Replace Filter	When a filter has been replaced during maintenance, this button can be touched and the countdown for the new filter is set. System asks for confirmation. In maintenance screen 1/5 the filter lifetime should read 5500 hr.
Replace O2 cell	When an O2 cell has been replaced during maintenance, this button can be touched and a new date to replace the O2 cell is set. System asks for confirmation. In maintenance screen 1/5 the O2 lifetime should read 3 year ahead from date of changing.

6.3.7 Data logging menu

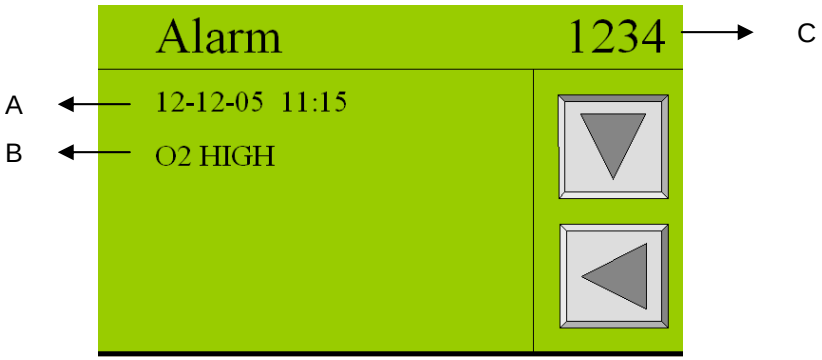
Access: Press data logging menu button in settings screen (refer to § 6.3)

Function: Read the logged (saved) data

Alarms as well as status of the sensors are saved on the SD-card. The time between the logging (saving) of this data to the memory card can be chosen in the data-logging menu.



Button	Selection	Result
Interval	30-3600	Time in seconds between the logging (saving) of alarm data
		Shows all the alarms that have been saved on the memory drive (see below)



Button	Explanation
A	Date and time of alarm incident
B	Alarm description
C	The number of logged alarms

It is also possible to read the logged data from the SD-card on a computer.
To read the files:

1. Switch off the unit.
2. Remove the SD-card
3. A new folder is saved on the SD-card every month. Each folder contains a almxxxx.csv and a logxxx.csv file.
4. Select the files needed.
5. Open the data-files with an Excel spread sheet
6. Place the SD-card back in the unit.
7. Switch the unit back on.

CAUTION:
Please check the alarm, p-switch, options and settings before you restart the unit.
The unit cannot run without the SD-card. This will generate an alarm (SD-card failed).

7 Operation

7.1 Commisioning *LCMS M-4*

1. Make sure that the connections are correct and fixed properly.
2. Switch on the *LCMS M-4* with the button at the back of the generator (refer to §3.3).
3. Then touch the ON/OFF button ⏻ on the touch screen display in the front of the generator.

CAUTION
Don't use sharp objects to operate the screen.

4. It will take about 3 minutes before the *LCMS M-4* will start to run. The countdown in seconds is shown on the display.

Important
The *LCMS M-4* must be run with sheet metal covers mounted on the unit; not doing so will affect the heat management of the system; prolonged running without sheet metal covers will shorten the life of the appliance and can lead to irreparable damage.

5. Check the inlet pressure level in the maintenance 🔨-menu (screen 3/5); in case this exceeds a level of 4.5 bar(g), the unit must be switched off and checked for blockades on the outlet. When a cause cannot be found, stop running the system and contact your supplier.
6. Check whether the connections of the tubing between the *LCMS M-4* and the application are free of leaks.
7. When the outlet is blocked the delivery pressure must not be higher than 8 bar(g) (HP-version) or 2 bar(g) (LP-version); the excess nitrogen is vented via an internal pressure relief valve or the unit is switched off in case of no nitrogen demand.
8. The purity of the *LCMS M-4* is factory set as required. To adjust the oxygen content, adjust the purity control valve FCV. Refer to §7.3 for instructions.

9. The pressure control of the *LCMS M-4* is factory set as required. Two modes of pressure control are possible.
   - Switching on and off depending on the outlet pressure (e.g. when a nitrogen storage vessel is installed)(max. switch-off pressure = 8.0 bar(g) (HP-version)) or 2 bar(g) (LP-version))
   - Continuous operation; excess produced nitrogen is vented. Maximum nitrogen pressure 8.0 bar(g) (HP-version) or 2 bar(g) (LP-version).

   Refer to §7.4 for instructions.

7.2 Start *LCMS M-4*

1. Switch the button on the back of the *LCMS M-4* to the ON-position.
2. Switch on the *LCMS M-4* with the switch on the touch screen panel (refer to §6.2).
3. There is a 3 minutes delay between stop and restarting the generator.
4. The *LCMS M-4* will deliver nitrogen instantaneously.

7.3 Adjusting the purity

The purity of the output can be read on the display.

1. The purity is determined by measuring the residual oxygen content in the nitrogen outlet.
2. To change the purity, change the setting of the purity control valve (refer to § 3.3)
3. First unlock the needle valve by loosening the hexagonal lock nut on its spindle. (Fig. 7-1)
4. Turning the valve clockwise will result in a decrease of the oxygen level and vice versa. The oxygen level can be read on the main screen of the display.

Fig. 7-1 Needle valve

ATTENTION
The response time of the measurement is slow. Change the flow in small steps of a quarter turn per step and wait until the display reading changes.

Do not close the purity control valve fully.

Adjusting the purity must preferably be done when the system is at normal operating temperature after it has run for some time (1-2 hrs).

Adjusting the purity must be done while all sheet metal is mounted on the appliance.

5. Once the desired purity has been reached, fasten the lock not on the spindle of the purity control valve securely.

ATTENTION
Fastening the lock nut too tightly can have an influence on the purity of the output

7.4 Control of the outlet pressure

The outlet pressure of *LCMS M-4* can be controlled in two ways depending on whether the nitrogen is stored in a vessel or not.

No nitrogen vessel installed: excess nitrogen will be vented; *LCMS M-4* will run continuously. The PSH-function must be **off**

- Close the ball valve V2 (refer to §3.3) at the outlet while the system is running.
- Adjust the back pressure valve PCV such that the outlet pressure on the touch screen reads 8.0 bar(g) at maximum. The lower the pressure is set the better for energy consumption reasons and compressor life.
- Open the ball valve V2 at the outlet.

Nitrogen vessel installed: excess nitrogen will be stored; *LCMS M-4* will start and stop automatically. To set the pressure (PSH) switch function in the software for this situation, proceed as follows:

- Close PCV completely (turn right) (refer to §3.3).

- Set the switch on pressure at maximum 7.0 bar(g). Switch-off pressure 8.0 bar(g). The lower the pressure is set the better for the energy consumption reasons and compressor life.
- Set the difference between the switch on and off pressure preferably not less than 1 bar. Smaller differences will result in frequent switching which will shorten the life of the compressors.

NOTE
After the unit switches off due to reaching switch off pressure in the storage tank, the unit cannot switch on within 5 minutes after the switch-off. The switch-on delay is there to prevent too frequent start-up of the compressors that shorten the compressor life.

7.5 Stop *LCMS M-4*

1. Switch off the power switch before you perform maintenance.
2. Make sure the system is depressurized; check the internal pressure level in the maintenance menu (screen 3/5)
3. When you restart afterwards there is a 3 minutes delay before it starts again

8 Troubleshooting

8.1 Error list

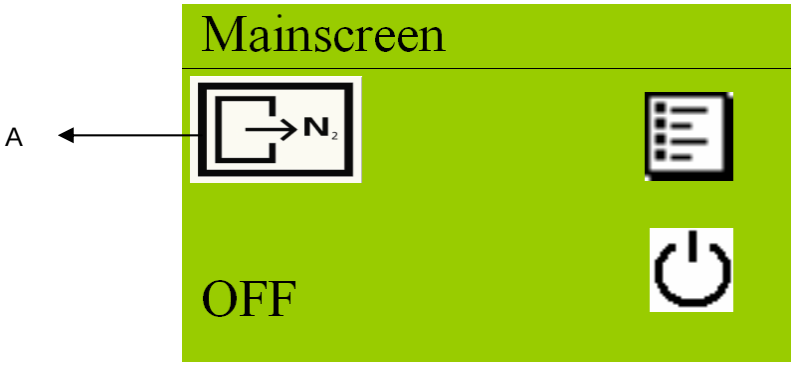
Error	Possible cause	Possible solution
No start and no display	Main switch is off	Switch main ON and push power switch ON.
	No power to supply outlet	Check electrical panel circuit breaker.
Delivery of nitrogen too low or absent	Ambient temperature is too high	Lower the temperature, if possible Check whether the minimum clearance between the *LCMS M-4* and the walls is large enough.
	Inlet carbon adsorber filter is polluted	Replace the inlet filter
	LCMS M-4 is switched off	Switch on the *LCMS M-4*
	Leak in piping	Check for leaks in the piping.
	Nitrogen outlet line is blocked.	Check/open the outlet line
	Temperature is too high	• Ambient temperature is too high (over 35°C/ 95°F). • In-/outlet gratings are clogged. • Cooling fans are not or insufficiently functioning. • Compressors are overloaded.
Residual oxygen content too high	Pressure in nitrogen storage vessel over 8 bar(g) because of erroneous setting of pressure switch	Reset pressure switch levels
	Ambient temperature lower than normal	Increase temperature or readjust purity (refer to §7.3)

Error	Possible cause	Possible solution
	Purity setting has changed over time	Readjust purity (refer to §7.3)
	Leak in piping	Check for leaks in the piping.

Table 8-1: Error list

8.2 Alarm messages

When the Nitrogen Out symbol (A) in the main screen is flashing, it means that an alarm is occurring. To see which alarm is occurring, touch the symbol for more information.



Default all alarms that can be set, are set to NO. This means they are not activated

.

What happens	Alarm description	Default
Oxygen level too high	O2 high	Off
Oxygen level too low	O2 low	Off
Inlet pressure too high	P-inlet high	Off
Inlet pressure too low	P-inlet low	Off
Outlet pressure too high	P-outlet high	Off
Outlet pressure too low	P-outlet low	Off
Inlet temperature too high	T-inlet high	On
Inlet temperature too low	T-inlet low	On
Membrane pressure sensor fails	P-mem sensor fail	On

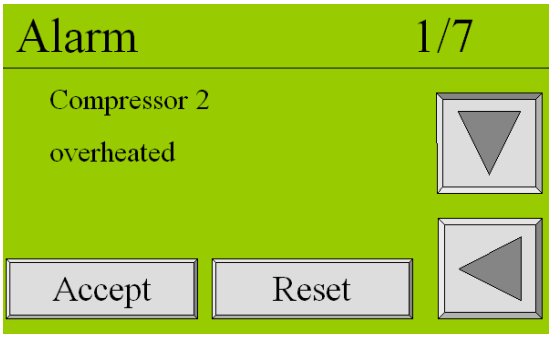
Outlet pressure sensor fails	P-Outlet sensor fail	On
Inlet temperature sensor fails	T-Inlet sensor fail	On
Status of temperature of compressor box 1	Temp comp1	On
Status of temperature of compressor box 2	Temp comp2	On
Oxygen sensor needs to be calibrated	Calibrate O2 cel	On

When an alarm is displayed there are two options:

1. Accept
2. Reset

When **ACCEPT** is touched, the alarm sound will disappear while the alarm level is still exceeded. If the alarm is not resolved the alarm message will appear again in 24 hours. This function gives you some time to work on the solution.

When **RESET** is touched the alarm status is cleared. However, if the alarm still exist it will appear again after the delay time that has been entered in the alarm settings menu (refer to § 6.3.2) has passed.



9 Maintenance

9.1 Maintenance scheme

Part	Action	Frequency
Filters	Replace outlet carbon adsorber	• 1x per year
Oxygen sensor	Replace oxygen sensor	• 1x per 3 years
Oxygen sensor	Calibrate oxygen sensor	• 1x per year

Table 9-1: Maintenance scheme

9.2 Replace inlet filter element

1. Switch off the *LCMS M-4*.
2. Let the system depressurize.
3. Take off the upper part of the front panel of the *LCMS M-4* (refer to Fig. 9-1).No tools are required.
4. Unscrew the two screws on top of the front panel (refer to Fig. 9-2).

Fig. 9-1

Fig. 9-2

5. Open the front panel (refer to Fig. 9-3).
6. Disconnect the plug from the printed circuit board (refer to Fig. 9-4).

Fig. 9-3

Fig. 9-4

7. Disconnect the tubing from the inlet filter (refer to Fig. 9-5).
8. Loosen the screws of the brackets (refer to Fig. 9-6).

Fig. 9-5

Fig. 9-6

9. Slide out the inlet filter and replace it with the new one. Follow the steps in reverse order.
10. Switch the *LCMS M-4* back on.

9.3 Replace oxygen sensor

1. Switch off the *LCMS M-4*.
2. Remove the front cover above the touch screen from the *LCMS M-4* (no tools required) (refer to Fig. 9-1).
3. Carefully remove the sensor cap (E). Do not pull the tube.
4. Unscrew the screw ring (D).
5. Disconnect connector (A).
6. Install the new sensor (C).
7. Switch on the *LCMS M-4*.
8. Calibrate the oxygen sensor. Refer to §9.4

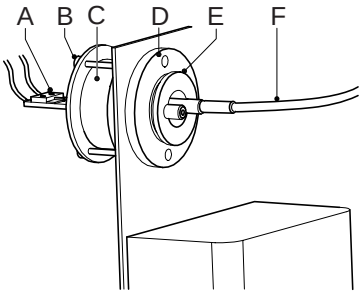


Fig. 9-1: Replace oxygen sensor

9.4 Calibrate oxygen sensor

1. Check the sample flow of the sensor (0.3 l/min.) coming out of the tube (F) that is connected to the sensor cap (E). The flow can be adjusted with the needle valve (FCV3).
2. Switch the unit off by touching the front **switch off** button ⏻ (refer to §6.2).
3. Let the system depressurize
4. Remove the sensor cap (E) and expose the sensor to ambient air.
5. Wait for 60 seconds.
6. Then enter again the maintenance menu 🔨, screen 3/5 wait until the oxygen level reads 20.9%.
7. Then go to screen 5/5 and touch O2 20.9% button. The system will ask for confirmation. Select YES.

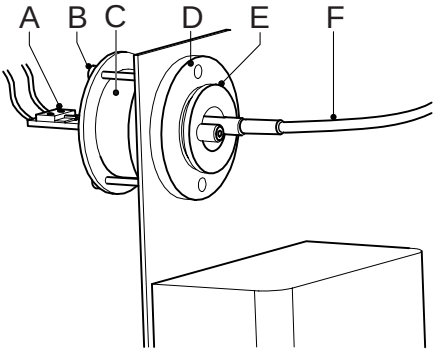
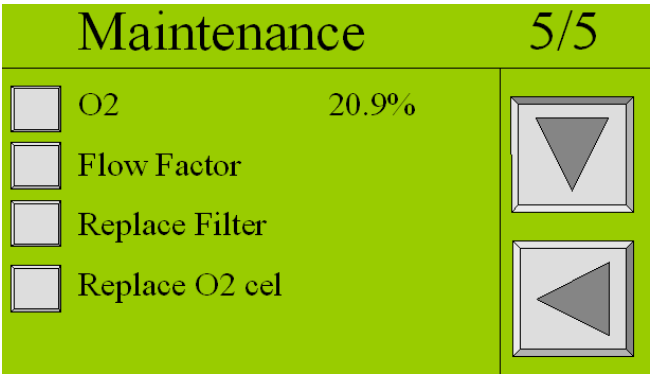


Fig. 9-2: Calibrate oxygen sensor



8. Reconnect the tube (F) and the sensor cap (E) with the sensor (C).

9.5 Replace compressor

1. Switch off the *LCMS M-4*.
2. Let the system depressurize.
3. Remove both left and right-side cover from the *LCMS M-4* by taking the 2 screws from each side. (Fig.8-3).
4. Then remove the second cover from each side(Fig. 8-3).
5. Use a 19mm spanner to undo all bull nose connections to the compressor. (Fig. 8-5).

Fig. 8-3 – unscrew side panels

Fig. 8-4 – remove second cover

Fig. 8-5 undo bull nose connections

6. Use a 13mm spanner to unscrew the bolts holding the compressors to the unit on both sides.(Fig. 8-6).
7. Use a 10mm spanner to push the ring in with the pipe. Hold the spanner while pulling away the pipe. (Fig. 8-7).
8. Use an 8mm spanner to push ring in with the pipe. Hold the spanner while pulling away the pipe (Fig. 8-8).

Fig. 8-6 – unscrew bolts from compressors

Fig. 8-7 – pull away pipe

Fig. 8-8 – pull away pipe

9. Disconnect the multi-pin plug from the socket by squeezing the clips on each side. (Fig. 8-9).
10. Lift and withdraw the compressor assembly from the unit (Fig. 8-10)
11. Remove the new compressor from it s packaging. Remove the transit support blocks. (plaatje).

Fig. 8-9 – disconnect multi-pin plug

Fig. 8-10 – remove compressor

Fig. 8-11 – remove transit support blocks

12. Remove the pipe fitting, which can be disposed of. (It's only included for manufacturer's use). (Fig. 8-12).
13. Install the new compressor in reverse order of removal.

Fig. 8-12 – remove pipe fitting

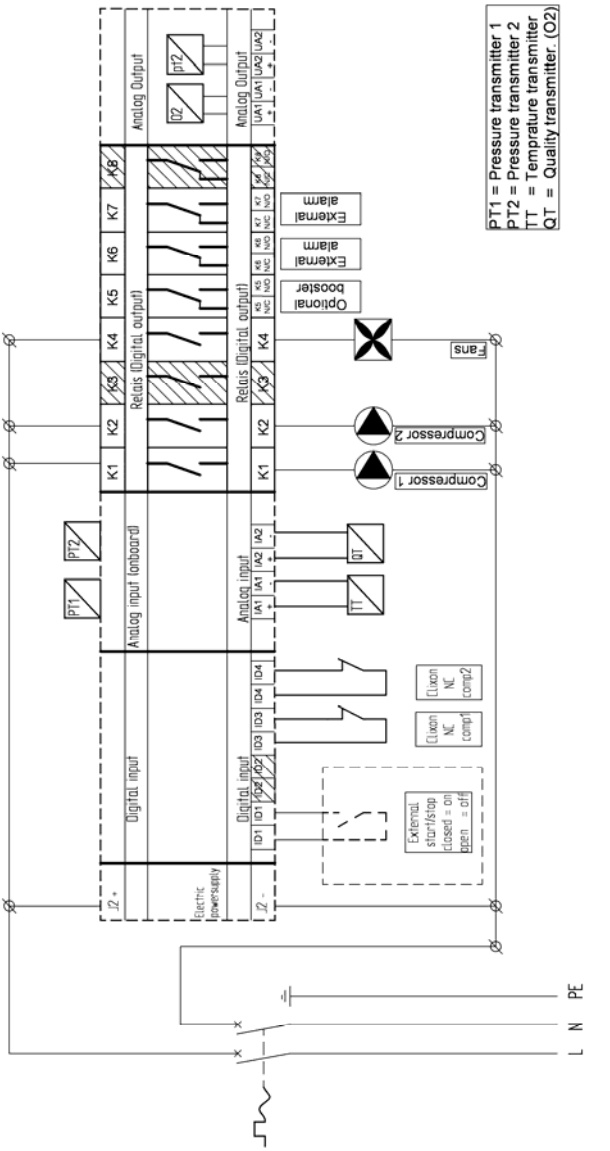
14. Retain compressor packaging to ship old compressor (if necessary).
15. Check for leaks before re-assembly.

9.6 Software updates

The issue number of the software version for the controller of the N2-MISTRAL-4® can be found in the maintenance -menu (refer to §6.3.6). When the producer would update the software in the future you can have full advantage of that. A new version can be put on the control system by following the instructions below.

1. Switch the unit off.
2. Allow the system to depressurize.
3. Remove the SD-card
4. Place the SD-card in a card reader connected to a computer
5. On the SD-card are 2 bin files: *io.bin* & *lcd.bin*. Just for safety you could save the old contents of the SD-card on your computer.
6. Replace the old files with new versions, which you receive from the producer.
7. Replace the SD-card in the control unit.
8. Switch the power back on.
9. Now the controller is updating, while beeping.
10. Turn the power off and on when the display shows “turn power off/on”.
11. Now the display is updating, while beeping.
12. Once the beeping stops the system

10 Electrical scheme



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