



Translation of the original operating instructions

# LDS3000 AQ

Mass spectrometer module

Catalog No.  
560-600

From software version  
MS-Modul 3.16

jind54en1-15-(2608)



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# 1 About this Manual

This document applies to the software version specified on the title page.

Product names may occur in the document, which are added for identification purposes only and belong to the respective owner of the rights.

## 1.1 Other associated documents

|                                           |         |
|-------------------------------------------|---------|
| Operating Manual Control Unit CU1000      | jina54  |
| Operating instructions bus module         | jiqb10  |
| Operating instructions I/O module         | jiqc10  |
| Operating instructions XL sniffer adapter | jinxa54 |
| Interface protocols                       | jira54  |

## 1.2 Explanation of the Warning Notices



### DANGER

Immediate danger with death or serious injuries as a consequence



### WARNING

Dangerous situation with possible death or serious injuries as a result



### CAUTION

Dangerous situation resulting in minor injuries

### NOTICE

Dangerous situation resulting in property or environmental damage

## 1.3 Target groups

This operating manual is intended for operators and technically qualified personnel with experience in leak testing technology and the integration of leak testing devices into leak testing systems. The installation and use of the device also require knowledge of handling electronic interfaces.

## 1.4 Definition of terms



### Mention of helium in the manual

The device is a helium leak detector. If you want to use a forming gas instead of helium to detect the hydrogen contained therein, the information for helium also applies to hydrogen.

## Accumulation

In connection with leak testing, it is about the enrichment of tracer gas over a definable period of time. This allows the detection of small leak rates without the use of a vacuum chamber. Helium or forming gas can be used.

When you talk about "AQ" in this manual, it's about accumulation mode. It is only available for devices in the AQ version.

## Automatic tuning / mass setting

This function adjusts the mass spectrometer so that a maximum leak rate indicator is achieved. In order to detect a maximum ion current with the ion detector, the control computer adjusts the voltage for accelerating the ions within the selected mass range accordingly.

During each calibration, there is an automatic adjustment.

## Operation mode

The leak detector distinguishes between the "Vacuum" and "Sniffing" operation modes. For the "Vacuum" operation mode, generally the tracer gas flows into the test object. The pressure in the test object is less than the ambient pressure.

In the "Sniffing" operation mode, the tracer gas flows out from the test object and is extracted with a sniffer probe. The pressure in the test object is greater than the ambient pressure.

## FINE

FINE denotes the connection to the turbo molecular pump for inlet pressures up to 0.4 mbar. This is also used for the "Sniffing" operation mode.

## Forming gas

Forming gas is a collective term for gas mixtures of nitrogen and hydrogen.

## GROSS

GROSS denotes the connection to the turbo molecular pump with the lowest sensitivity. This allows high inlet pressures (up to 15 mbar).

## Internal helium background

The measurement system of the leak detector also contains a residual amount of helium. This creates an internal measurement signal component (background signal), which overlaps the display of the leak right from the beginning and thus disturbs the search for leaks.

So that this background signal can be suppressed, an internal "background suppression" can be activated with the factory settings.

## Minimum detectable leak rate

The minimum detectable leak rate which can be detected by the leak detector under ideal conditions ( $< 5 \times 10^{-12}$  mbar l/s).

## ULTRA

ULTRA denotes the connection to the turbo molecular pump for the measurement range with the highest sensitivity at inlet pressures below 0.4 mbar (adjustable).

## Background signal

Helium or hydrogen (as part of water) are natural components of air.

Operation mode "Vacuum": Before any leak detection, a certain amount of the adjusted tracer gas is already in the volume on the surfaces of the test chamber, supply lines, and even in the leak detector itself. This certain amount of tracer gas generates a measurement signal which is called the "Background signal". The ongoing evacuation of the test chamber continuously reduces this background signal.

Operation mode "Sniffing": Ambient air is continuously fed into the leak detector via the sniffer line. The amount of helium or hydrogen occurring naturally in air creates a constant background signal.

## Foreline pressure

Pressure of the backing pressure between the turbo molecular pump and the backing pump.

## ZERO

There is helium that is weakly bound to the surfaces of a specimen as a natural part of the ambient air and is pumped bit by bit into the measurement system of the leak detector. It produces a slowly decreasing measurement signal.

If you want to hide this background signal or the display of existing leaks, then use the ZERO function.

## 2 Safety

### 2.1 Intended use

The device is a modular leak detector for installation in industrial leak testing unit systems. The tracer gases that can be measured with the device are helium and hydrogen (forming gas).

The LDS3000 AQ is intended for the measurement of tracer gases when enriched in an external measuring chamber, but can also be converted into an LDS3000 for other purposes.

The LDS3000 is suitable for overpressure and negative pressure testing, whereby in addition to testing in vacuum, a local test with a sniffer line is also possible. See also the separate operating instructions for the LDS3000.

- You may only install, operate and maintain the device indoors in accordance with these operating instructions.
- Comply with application limits, see "Technical Data".

#### Incorrect usage

Avoid the following unintended uses:

- Use in radioactive areas. Leak detectors could become contaminated.
- Pumping off aggressive, flammable, explosive, corrosive, microbiological, reactive or toxic substances, creating a hazard
- Pumping down of condensible fluids and vapors
- Suctioning of liquids into the device
- Operating with impermissible high gas loads
- Operating with impermissibly high pre-pressure
- Operating at excessive ambient temperature
- Flushing with excessive flushing rate
- Usage of the pumps in plants where sudden loads and vibrations or periodic forces act upon the pump

### 2.2 Duties of the Operator

- Read, observe, and follow the information in this manual and in the work instructions provided by the owner. This concerns in particular the safety and warning instructions.
- Always observe the complete operating instructions for all work.
- If you have any questions about operation or maintenance that are not answered in this operating instructions, contact INFICON service.

### 2.3 Owner Requirements

The following notes are for companies or any person who is responsible for the safety and effective use of the product by the user, employees or third parties.

#### Safety-conscious operation

- Operate the device only if it is in perfect technical condition and has no damage.

- Only operate the device properly in accordance with this instruction manual, in a safety and risk conscious manner.
- Adhere to the following regulations and observe their compliance:
  - Intended use
  - Universally valid safety and accident prevention regulations
  - International, national and local standards and guidelines
  - Additional device-related provisions and regulations
- Only use original parts or parts approved by the manufacturer.
- Keep this instruction manual available on site.

### Personnel qualifications

- Only instructed personnel should be permitted to work with and on the device. The instructed personnel must have received training on the device.
- Make sure that authorized personnel have read and understood the instruction manual and all other applicable documents.

## 2.4 Dangers

The measuring instrument was built according to the state-of-the-art and the recognized safety regulations. Nevertheless, improper use may result in risk to life and limb on the part of the user or third parties, or damage to the unit or other property may occur.

### Hazards due to liquids and chemicals

Liquids and chemicals can injure people or damage the device.

- Comply with application limits, see "Technical Data".
- Do not suck up liquids with the instrument.
- Avoid sniffing gases, such as hydrogen, above the lower explosion limit. The allowable composition of venal gas mixtures can be read in the safety data sheets of the respective manufacturers.
- Avoid unprotected contact with operating materials or operating fluid reservoirs that contain hazardous or harmful substances. For information on permissible handling, please refer to the safety data sheets provided by the respective manufacturers.
- Only use the device away from areas with a risk of explosions.

### Danger for wearers of implants such as pacemakers

There are magnets in the mass spectrometer module. The magnetic fields can interfere with the function of the implant.

- Always keep at least 10 cm distance from the mass spectrometer module.
- In order not to fall below the minimum distance, avoid unpacking or mounting the mass spectrometer module.
- Furthermore, take into account distances specified by the manufacturer of the implant.

### Dangers from electric power

The device is operated with electrical voltages of up to 24V. Inside the device there are voltages that are considerably higher. There is a danger to life from the contact of conductive parts inside the device.

- Disconnect the device from the power supply prior to any installation and maintenance work. Make sure that the electric power supply cannot be reconnected without authorization.

- Before starting the leak test, disconnect electrically operated test objects from the power supply.

The device contains electric components that can be damaged from high electric voltage.

- Make sure before connecting to the power supply that the supply voltage is 24 V +/- 5%.

**Kinetic energy**

If the rotating parts in the turbo molecular pump are blocked because of some damage, high centrifugal forces must be absorbed. If this is not successful, the mass spectrometer module will breakaway and possibly cause damage to property or personal injury.

- Make sure the mount of the mass spectrometer module is able to absorb a braking torque of 820Nm.

**Injury from bursting objects**

There is risk of injury from bursting objects caused by a test object notwithstanding the vacuum pressure when a test object is connected.

- Take appropriate precautions.

**Danger due to imploding measuring chamber**

An external measuring chamber connected to an LDS3000 AQ is pumped off at approximately 60 sccm. Within normal measurement times (2 - 30 seconds) no dangerous negative pressure is generated.

If the measuring chamber is leak-proof, but not vacuum resistant, and continues to pump, it may implode. This can occur, for example, in a 1-liter measuring chamber after about 10 minutes.

- Do not continue pumping a measuring chamber after the measuring time has expired.
- Consider suitable protective measures!

### 3 Scope of delivery, transport, storage

#### Scope of delivery

| Item                                                                                                         | Quantity |
|--------------------------------------------------------------------------------------------------------------|----------|
| Mass spectrometer module (560-600 LDS3000 AQ)                                                                | 1        |
| Plug for 24V connection                                                                                      | 1        |
| Pressure sensor PSG500                                                                                       | 1        |
| Self-locking nuts                                                                                            | 4        |
| Plug for Output                                                                                              | 1        |
| Plug for Gauges Exit                                                                                         | 1        |
| Inlet module                                                                                                 | 1        |
| Adapter DN16 with throttle <sup>1)</sup>                                                                     | 1        |
| Digital operating instructions, to download as PDF from <a href="http://www.inficon.com">www.inficon.com</a> | 1        |

1.) See "Select components and connect [► 27]".

- Please check the delivery for completeness after receiving the device.

#### Transport

##### NOTICE

##### Damage due to unsuitable packaging material

Transport in unsuitable packaging material can damage the device.

- Transport the unit only in the original packaging material.
- Keep original packaging material.

##### NOTICE

##### Damage to property due to missing attachment of the vibration damper

- Secure the vibration damper with the transport screws to prevent damage due to vibration.

#### Storage

- Always store the device in compliance with the technical data, see "Technical Data [► 20]".



## 4 Description

### 4.1 Function

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Objective</b>                  | The mass spectrometer module is a detection device for the test gases helium and hydrogen. Integrated in test systems, the device is used to detect gas being emitted from a test object in order to indicate leaks.                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Mode AQ<br/>(Accumulation)</b> | <p>In order to be able to detect small leak rates without the use of a vacuum chamber, devices for the AQ mode are connected to an external measuring chamber. In the external measuring chamber, the tracer gas is enriched (accumulation).</p> <p>The test object filled with helium or forming gas under pressure is brought into the measuring chamber or pressurized in the measuring chamber. If there is a leak in the test object, the concentration of helium or forming gas in the measuring chamber will increase. This increase is measured and output as a leak rate.</p> |
| <b>Device Interfaces</b>          | <p>The mass spectrometer module is part of the leak detection system LDS3000 AQ. Es can be operated in a test system together with a bus module or I/O module and a data cable without additional INFICON accessories.</p> <p>The MSB box outputs data on digital interfaces to the control unit CU1000, I/O module IO1000 or bus module BM1000.</p>                                                                                                                                                                                                                                   |
| <b>Conversion possibility</b>     | <p>The LDS3000 AQ is intended for the measurement of tracer gases when enriched in an external measuring chamber, but can also be converted into an LDS3000 for other purposes.</p> <p>The LDS3000 is suitable for overpressure and negative pressure testing, whereby in addition to testing in vacuum, a local test with a sniffer line is also possible. See also the separate operating instructions for the LDS3000.</p>                                                                                                                                                          |

## 4.2 Design of device

### 4.2.1 Overall device)

In the accumulation version, the mass spectrometer module is integrated into a special measurement setup by hardware and software.

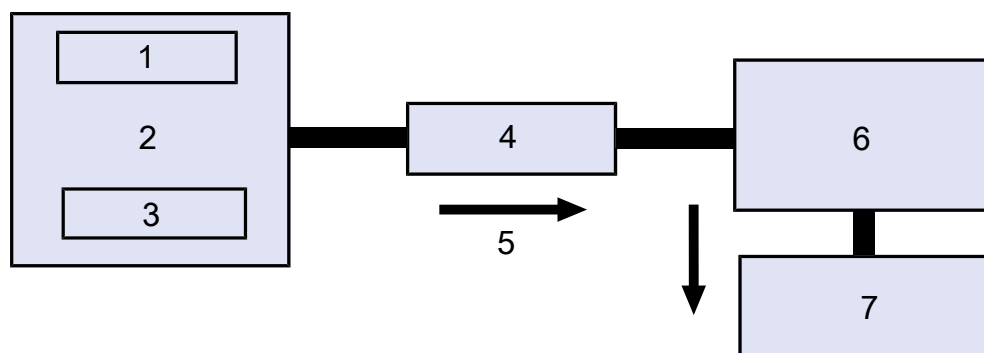


Fig. 1: LDS3000 AQ (schematic view)

|   |                                      |
|---|--------------------------------------|
| 1 | Fan system                           |
| 2 | Test chamber at atmospheric pressure |
| 3 | Component to be tested               |
| 4 | Connection                           |
| 5 | Sample gas flow ( $\approx 50$ sccm) |
| 6 | LDS3000 AQ                           |
| 7 | Fore pump                            |

For details of the measurement setup, see "Select components and connect [► 27]".

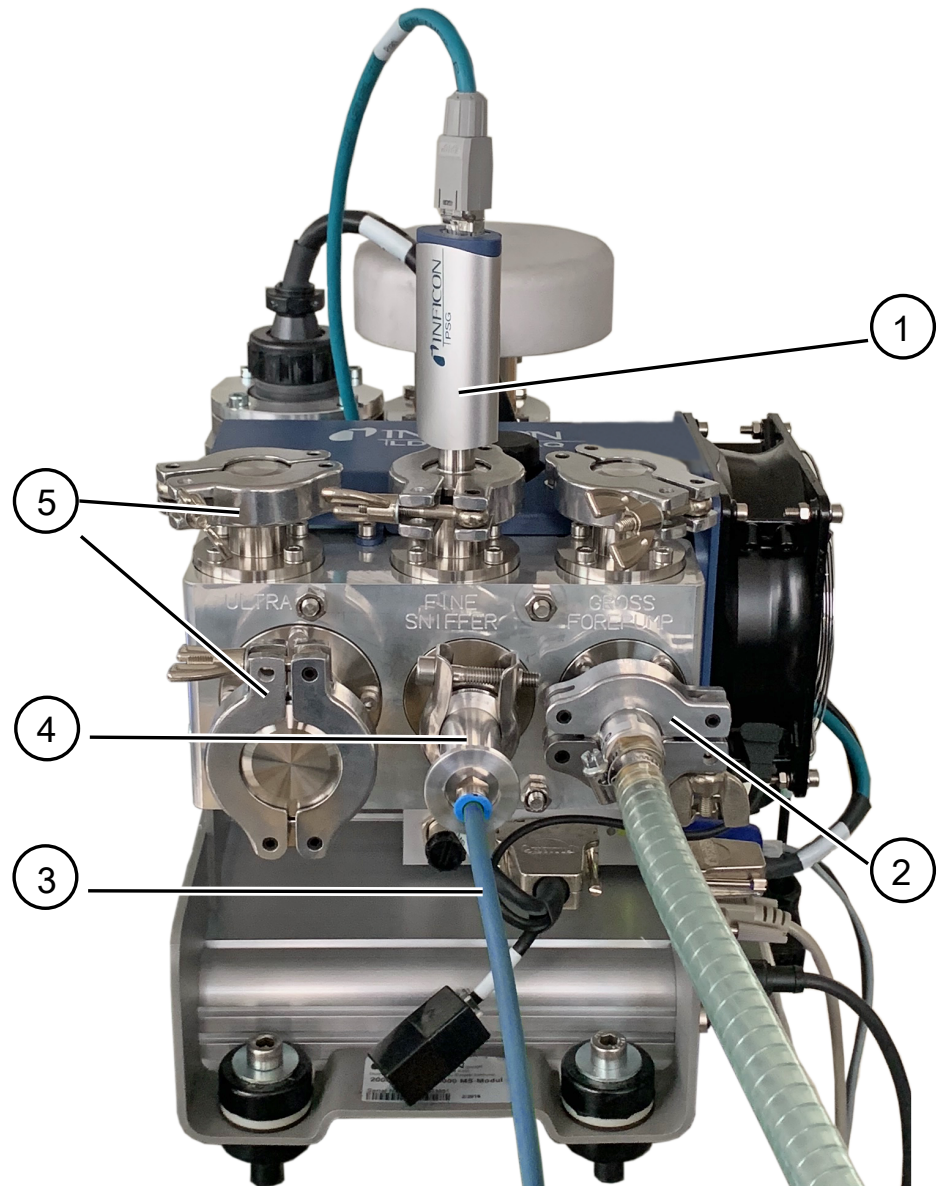


Fig. 2: Mass spectrometer module (execution accumulation)

|   |                                                            |
|---|------------------------------------------------------------|
| 1 | Pressure sensor PSG500 for measuring the inlet pressure    |
| 2 | GROSS throttle flange with connecting hose to backing pump |
| 3 | Hose to the measuring chamber                              |
| 4 | Inlet module                                               |
| 5 | ULTRA connections blind flanged                            |

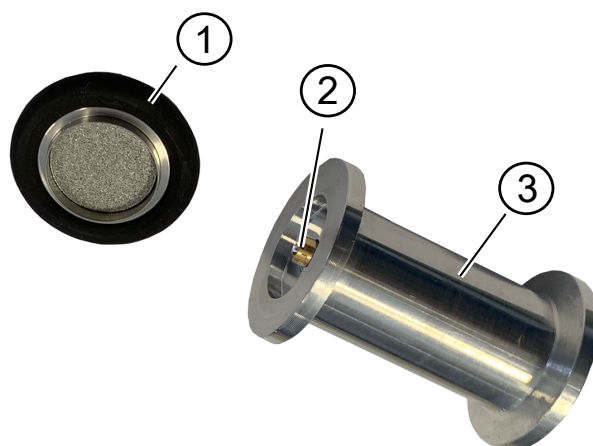


Fig. 3: Inlet module

|   |                                                                                                                                                                                                                                                            |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | Inlet module. It can be mounted on the measuring chamber as well as on the mass spectrometer module.                                                                                                                                                       |
| 1 | Filter of the inlet module. A cleaning of the filter is not provided. Available as a replacement filter from INFICON under the order number 211-090. See also "LDS3000 AQ - maintenance relevant components [► 109]". Calibrate after changing the filter. |
| 2 | Throttle valve insert                                                                                                                                                                                                                                      |
| 3 | Standard throttle                                                                                                                                                                                                                                          |

#### Accessories of the customer

To complete the measurement setup, missing parts can be provided by the customer.

If you want to use your own backing pump, make sure it is a dry backing pump with a gas flow greater than 60 sccm and a base pressure of less than 5 mbar. It should have its own power supply.

If you want to use your own control unit, please note that the wizard for performing the measurement settings, calibrating and setting the ZERO function is only located on the INFICON CU1000 control unit.

See also "Select components and connect [► 27]".

#### Optional accessories from INFICON

With the exception of the measuring chamber, the required parts are also offered by INFICON.

- Control unit CU1000 (including wizard for carrying out important settings)
- I/O1000 (The I/O module is a device interface between a leak detector and an external controller)
- BM1000 (The bus module is a device interface between e.g. the MSB box of the mass spectrometer module LDS3000 and an external controller.)
- Corrugated hose, available on the homepage of INFICON under "Vacuum components".
- ISO-KF connections (eg screw-in flange), available on the homepage of INFICON under "Vacuum components".
- ISO-K centering rings and seals, available on the homepage of INFICON under "Vacuum components".
- DIN rail power supply 24V, 10A from INFICON (catalog number 560-324) for the dry backing pump of INFICON.

- Dry backing pump from INFICON (catalog number 560-630).

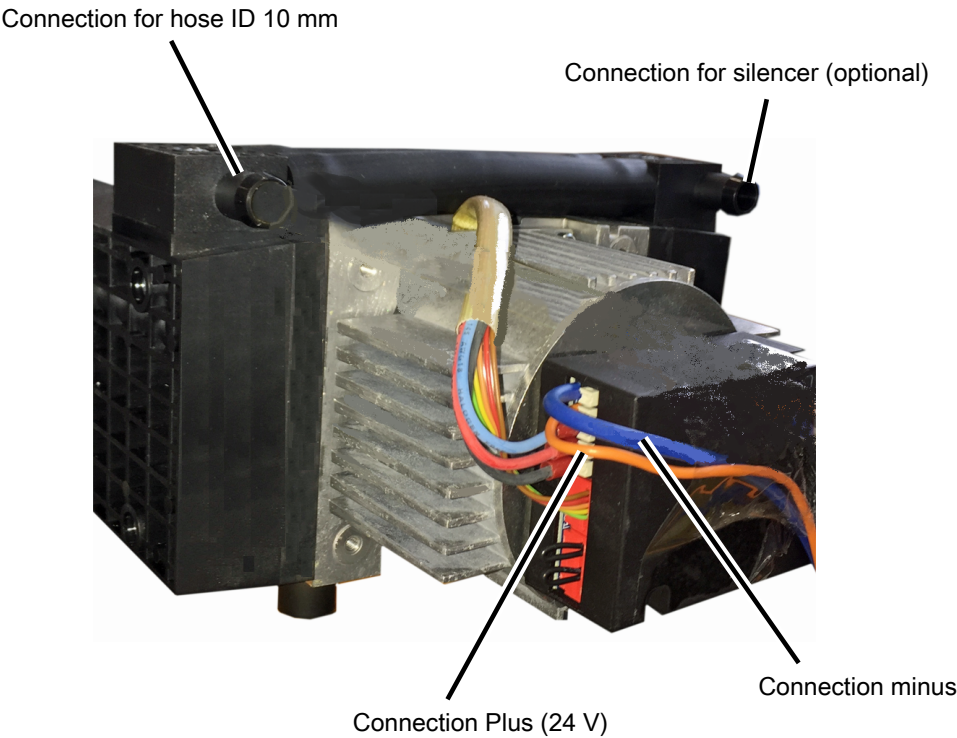


Fig. 4: Dry backing pump from INFICON

4.2.2 Connection block

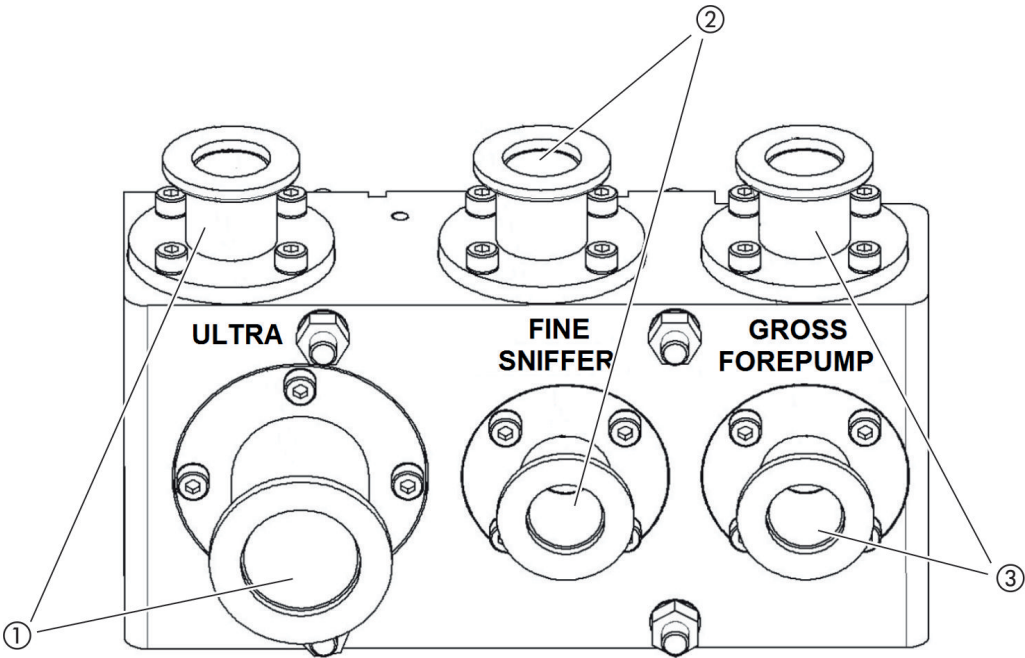


Fig. 5: Connection block

|   |                         |   |                           |
|---|-------------------------|---|---------------------------|
| 1 | Connection ULTRA        | 3 | Connection GROSS/FOREPUMP |
| 2 | Connection FINE/SNIFFER |   |                           |

4.2.3 MSB box

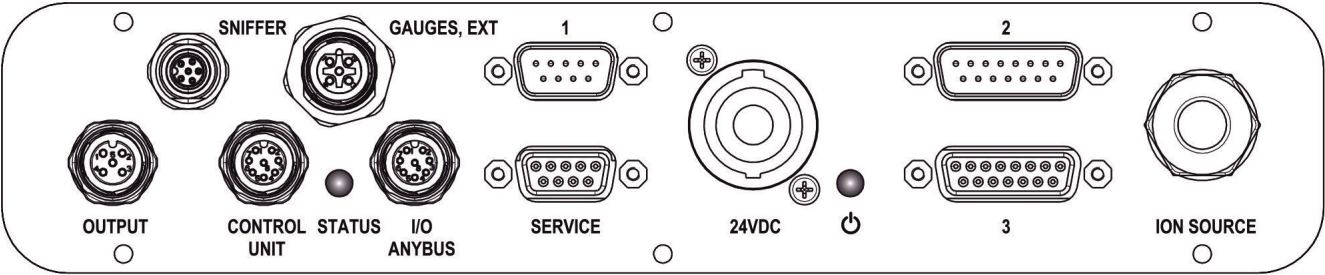


Fig. 6: MSB box connections

SNIFFER

Electrical connection for the sniffer line

GAUGES, EXT

Connection for optional external service gauges (0 - 10 V / 0 - 20 mA) for INFICON service

| Connection plug arrangement |                                         |
|-----------------------------|-----------------------------------------|
| 1                           | +24-V-Output, max. 200 mA               |
| 2                           | Input for P3 service gauge, 0 - 10V     |
| 3                           | GND                                     |
| 4                           | Reference to input for P3 service gauge |
| 5                           | 20 mA input for P3 service gauge        |

1 (See also Figure MSB box)

Connection for pressure sensor PSG500, calibration leak and suppressor on the preamplifier (premounted, three-core cable)

2 (See also Figure MSB box)

Connection for inverter turbo molecular pump and fan turbo molecular pump (premounted, two-core cable)

OUTPUT

Connection for gas ballast and three valves

| Connection plug arrangement |                                       |
|-----------------------------|---------------------------------------|
| 1                           | Valve 2 (gas ballast), 24 V, max. 1 A |
| 2                           | Valve 3 (not used, reserve)           |
| 3                           | Valve 4 (not used, reserve)           |
| 4                           | Valve 6 (not used, reserve)           |
| 5                           | GND                                   |

CONTROL UNIT, I/O / ANYBUS

Connection for I/O module or bus module or control unit. Cable length of the INFICON data cable < 30 m. In order to avoid the display of incorrect measured values, the specified maximum cable length must be observed.

The connections "Control Unit" and "I/O / Anybus" have the same functions. You have the choice of connecting:

- Control unit CU1000 + I/O module IO1000
- Control unit CU1000 + bus module BM1000

## SERVICE

RS232 connection for INFICON Service.

## 24VDC

Connection for 24 V power supply pack used to supply mass spectrometer module, control unit, I/O module and bus module. Cable length < 30 m.

## STATUS

Status LED

The Power LED and Status LED indicate the status of the unit.

### Power LED / Status LED

The Power LED and Status LED indicate the status of the device.

| Power LED             | Status LED                    | Meaning                                                                   |
|-----------------------|-------------------------------|---------------------------------------------------------------------------|
| Off                   | Red                           | Device not ready for operation                                            |
| Green                 | Blue                          | Turbo molecular pump is starting                                          |
| Green                 | Orange                        | Emission is switched on                                                   |
| Green                 | Green                         | Emission is stable                                                        |
| Green                 | Violet                        | Rotation speed of the turbo molecular pump is not within the normal range |
| Green                 | Error codes of the status LED | Different activities of the unit                                          |
| Green, flashes slowly |                               | Supply voltage < 21.6 V                                                   |
| Green, flashes fast   |                               | Supply voltage > 26.4 V                                                   |
| Green, flashes        | Off                           | Software is being updated                                                 |
| Green                 | Green, flashes                | Software is being updated                                                 |

**3** (See also Figure MSB box)

Connection for preamplifier

## ION SOURCE

Connection for ion source



## 4.2.4 Markings on the device



### DANGER

#### Danger for wearers of implants such as pacemakers

Permanent magnets in the mass spectrometer module pose a health hazard. Implants can be influenced in their function.

- ▶ Always keep at least 10 cm distance from the mass spectrometer module.
- ▶ In order not to fall below the minimum distance, avoid unpacking or mounting the mass spectrometer module.
- ▶ Furthermore, take into account distances specified by the manufacturer of the implant.



Device cannot be disposed of as normal domestic waste.

## 4.3 Technical Data

### Mechanical data

|                        | 560-600                                      |
|------------------------|----------------------------------------------|
| Dimensions (L × W × H) | 330 x 270 x 293 mm<br>(13 x 10.6 x 11.5 in.) |
| Inlet flange           | 1 x DN25 KF<br>5 x DN16 KF                   |

### Electrical data

|                   | 560-600                                                                                          |
|-------------------|--------------------------------------------------------------------------------------------------|
| Power input       | max. 10 A                                                                                        |
| Operating voltage | 24 V  +/-5% |
| Protection class  | IEC/EN 60034-5 IP40<br>UL 50E Type 1                                                             |

### Physical data

|                                                    | 560-600                         |
|----------------------------------------------------|---------------------------------|
| Minimum detectable leak rate forming gas or helium | < 1 x 10 <sup>-6</sup> mbar l/s |
| Measurement range                                  | 6 decades                       |
| Pressure in test chamber                           | 1 atm                           |
| Time constant of the leak rate signal              | < 1 s                           |



### Ambient conditions

|                                                    | 560-600                           |
|----------------------------------------------------|-----------------------------------|
| Permissible ambient temperature (during operation) | 10 °C ... 45 °C                   |
| Max. altitude above sea level                      | 2000 m                            |
| Permissible magnetic field max.                    | 7 mT                              |
| Max. relative humidity above 40 °C                 | 50%                               |
| Max. relative humidity from 31 °C to 40 °C         | 80% ... 50% (decreasing linearly) |
| Max. relative humidity to 40 °C                    | 80%                               |
| Storage temperature                                | -20 °C ... 60 °C                  |
| Pollution degree                                   | 2                                 |

## 4.4 Factory settings

| Parameter                                                                      | Factory setting                                         |
|--------------------------------------------------------------------------------|---------------------------------------------------------|
| AO upper limit exp.                                                            | $1 \times 10^{-5}$                                      |
| Operation mode                                                                 | Vacuum<br>AQ Mode 1 <sup>1)</sup>                       |
| AQ chamber volume                                                              | 1 l <sup>1)</sup>                                       |
| AQ measurement time                                                            | 10 s <sup>1)</sup>                                      |
| Zero time factor AQ                                                            | 4 <sup>1)</sup>                                         |
| Bus module address                                                             | 126                                                     |
| Clogged pressure capillary monitoring<br>- with XL Sniffer Adapter (low flow)  | 0.4 mbar<br>0.2 mbar                                    |
| Broken pressure capillary monitoring<br>- with XL Sniffer Adapter (low flow)   | 2 mbar<br>0.6 mbar                                      |
| Clogged pressure capillary monitoring<br>- with XL Sniffer Adapter (High Flow) | 150 mbar                                                |
| Broken pressure capillary monitoring<br>- with XL Sniffer Adapter (High Flow)  | 400 mbar                                                |
| Pressure unit (interface)                                                      | mbar                                                    |
| Emission                                                                       | On                                                      |
| Filter leak rate threshold                                                     | $1 \times 10^{-10}$                                     |
| Filter ZERO time                                                               | 5 s                                                     |
| Filter mode                                                                    | I•CAL                                                   |
| Gas percentage in H <sub>2</sub> (M3, He)                                      | 100 %<br>5 % H <sub>2</sub> (-, 100 % He) <sup>1)</sup> |
| Gas ballast                                                                    | Off                                                     |
| I/O module protocol                                                            | ASCII                                                   |
| Calibration request                                                            | On                                                      |
| Calibration factor VAC/SNIF Mx<br>(for vacuum, sniffing and all masses)        | 1.0                                                     |
| Cathode selection                                                              | Auto Cat1                                               |

| Parameter                                    | Factory setting                                                                                                                                                                                                         |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Compatibility mode                           | LDS3000<br>AQ <sup>1)</sup>                                                                                                                                                                                             |
| Config. Analog output 1                      | Leak rate mantissa                                                                                                                                                                                                      |
| Config. Analog output 2                      | Leak rate exponent                                                                                                                                                                                                      |
| Config. Analog output scaling                | 0.5 V / decade                                                                                                                                                                                                          |
| Configuration of digital outputs             | Pin 1: Trigger 1, inverted<br>Pin 2: Trigger 2, inverted<br>Pin 3: Trigger 3, inverted<br>Pin 4: Trigger 4, inverted<br>Pin 5: Ready<br>Pin 6: Error, inverted<br>Pin 7: CAL request, inverted<br>Pin 8: Open, inverted |
| Configuration of digital Inputs              | Pin 1: Select dyn. / normal CAL<br>Pin 2: Sniff<br>Pin 3: Start/Stop, inverted<br>Pin 4: ZERO<br>Pin 5: External CAL<br>Pin 6: Internal CAL<br>Pin 7: Clear<br>Pin 8: ZERO update<br>Pin 9: -<br>Pin 10: -              |
| Leak rate unit SNIF, (display and interface) | mbar l/s                                                                                                                                                                                                                |
| Leak rate unit VAC, (display and interface)  | mbar l/s                                                                                                                                                                                                                |
| Leak rate upper limit VAC (interface)        | $1.0 \times 10^{-1}$                                                                                                                                                                                                    |
| Leak rate lower limit VAC (interface)        | $1.0 \times 10^{-12}$                                                                                                                                                                                                   |
| Leak rate upper limit SNIF (interface)       | $1.0 \times 10^{-1}$                                                                                                                                                                                                    |
| Leak rate lower limit SNIF (interface)       | $1.0 \times 10^{-8}$                                                                                                                                                                                                    |
| Fan mode                                     | Fan always on                                                                                                                                                                                                           |
| Machine factor in standby                    | Off                                                                                                                                                                                                                     |
| Machine factor / Sniff factor                | 1.0 (for all masses)                                                                                                                                                                                                    |
| Mass                                         | 4                                                                                                                                                                                                                       |
| Module on the I/O connection                 | IO1000                                                                                                                                                                                                                  |
| Nominal state TMP                            | On                                                                                                                                                                                                                      |
| calibration leak external SNIF               | $9.9 \times 10^{-2}$                                                                                                                                                                                                    |
| calibration leak external VAC                | $9.9 \times 10^{-2}$                                                                                                                                                                                                    |
| Calibration leak internal                    | $9.9 \times 10^{-2}$                                                                                                                                                                                                    |
| Open calibration leak internal               | Off                                                                                                                                                                                                                     |
| Sniffer line detection                       | On                                                                                                                                                                                                                      |
| Sniffer key ZERO                             | On                                                                                                                                                                                                                      |
| Language                                     | English                                                                                                                                                                                                                 |
| TMP rotation speed                           | 1500<br>1000 <sup>1)</sup>                                                                                                                                                                                              |

| Parameter                        | Factory setting                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------|
| Trigger level 1 (2, 3, 4)        | $1 \times 10^{-5}$ mbar l/s<br>$5 \times 10^{-5}$ ( $1 \times 10^{-5}$ ) mbar l/s <sup>1)</sup> |
| Preamplifier test at CAL         | On                                                                                              |
| Display warning as error (1 - 8) | No Entry                                                                                        |
| Maintenance warning              | Off                                                                                             |
| ZERO with start                  | Off                                                                                             |
| ZERO mode                        | Suppress everything                                                                             |

1) in AQ mode

## 5 Mounting LDS3000 AQ (Accumulation)

### 5.1 Adjust the position of the connections to the installation dimensions

#### Select location

Select the most helium-free environment possible for the measurement setup. For reliable measurements with the device, the helium content in the air must be less than 10 ppm.

By nature, air contains 5 ppm (0.0005%) helium.

#### Mount MSB box

In order to ideally match the installation position space, the MSB box can be turned and rotated.

The MSB box is seated in two guide rails and can be pushed into the housing from the left or from the right. It can also be rotated, if necessary, so that the labels are upside down.

The locking washer must be released to pull out the MSB box.

If the MSB box is to be pushed into housing from the other side, the locking washer must also be tightened on the other side of the housing. An appropriate threaded hole is available.

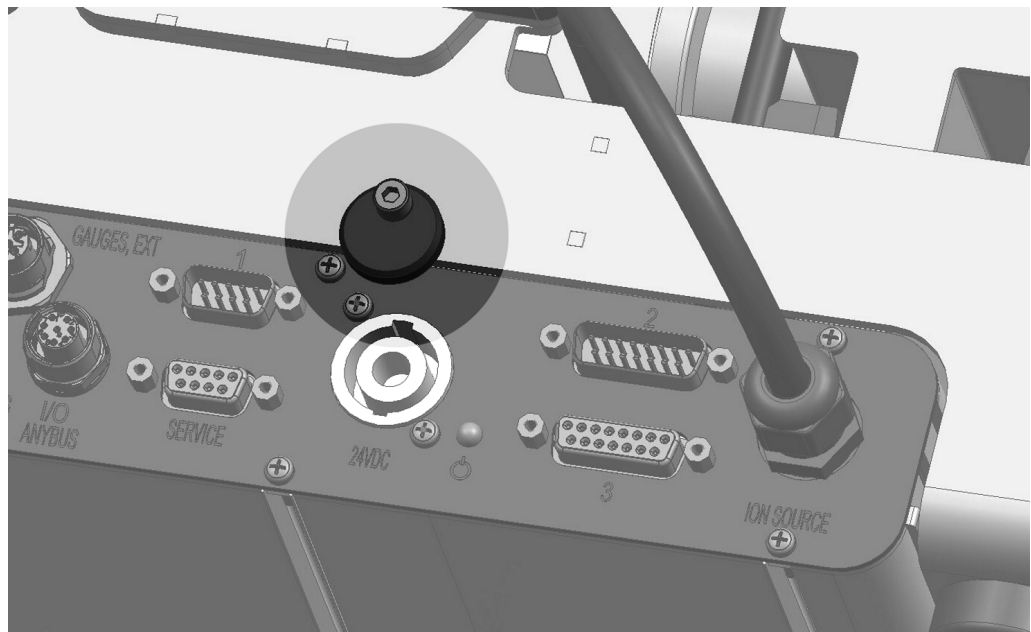


Fig. 7: Lock

## 5.2 Installing the mass spectrometer module on the test system

The mass spectrometer module can be mounted in any orientation.

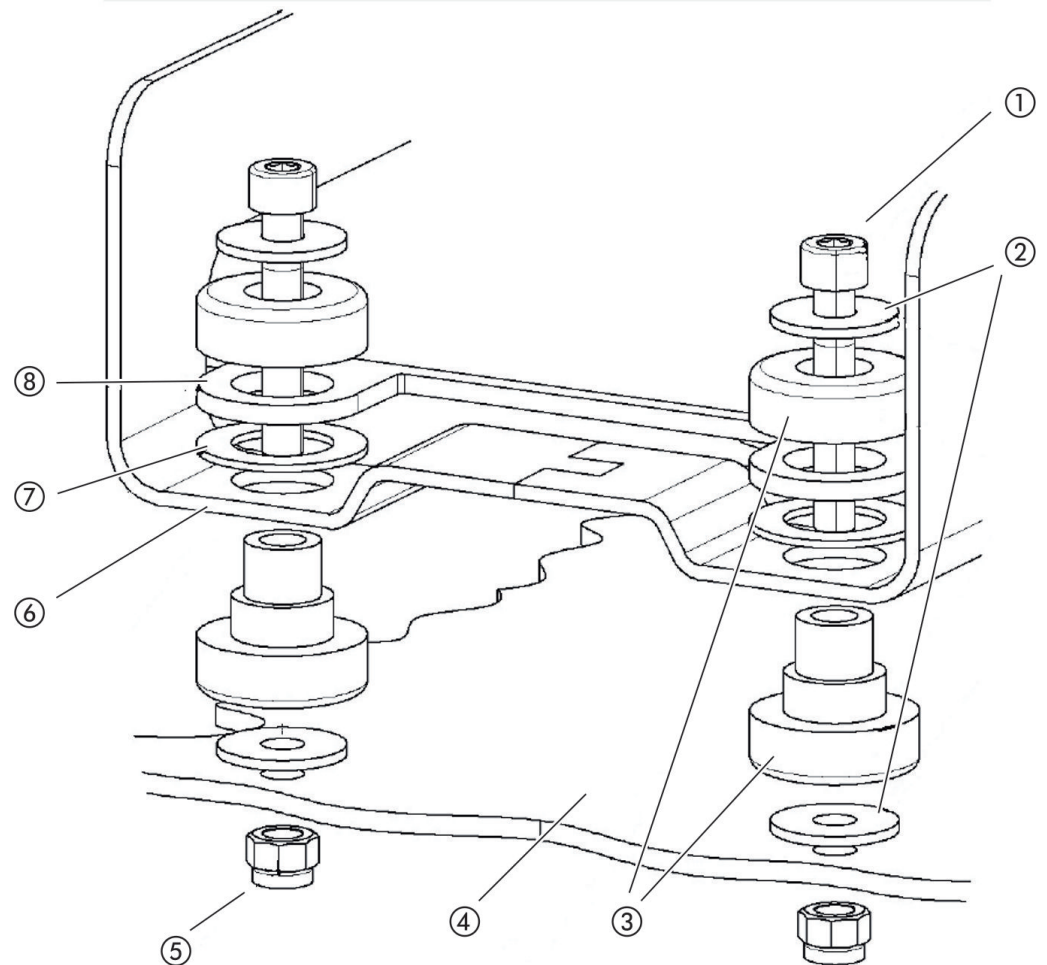


Fig. 8: Components of a fastener

|   |                                      |   |                       |
|---|--------------------------------------|---|-----------------------|
| 1 | Hexagon socket head screw<br>M8 x 50 | 5 | Nut M8 (self-locking) |
| 2 | Washer                               | 6 | Base frame            |
| 3 | MO bearing                           | 7 | Spring rubber         |
| 4 | Test system                          | 8 | MSB box guide         |

You will need:

- Self-locking nuts M8
- Open-end wrench, SW13
- Allen wrench SW6
- Holes for installation inside the test system

In delivery condition, the bearings are attached to the base frame with the hexagon socket screws and transport nuts. Use the supplied self-locking nuts for the installation of the mass spectrometer module – not the transport nuts.



The installation site must be stable.

### **WARNING**

#### **Severe injuries due to mass spectrometer module breaking out**

If not screwed down properly, the mass spectrometer module can be caused to break out if the rotor of the turbo molecular pump suddenly locks up. This can result in injuries of the most severe kind.

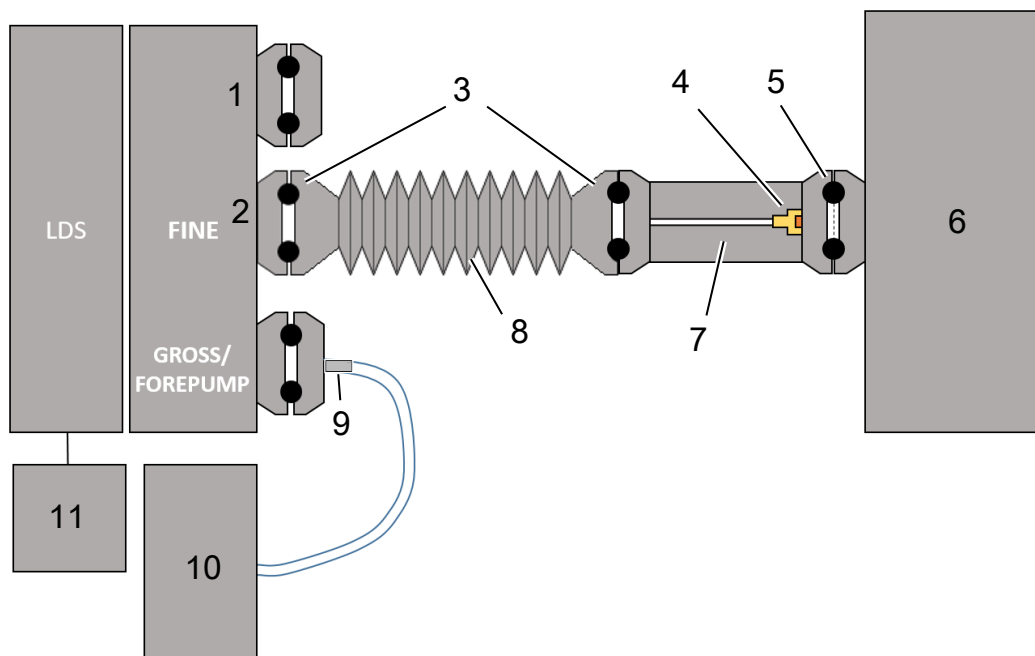
- ▶ Make sure the mount of the mass spectrometer module is able to absorb a braking torque of 820Nm.

- 1 Drill through-holes:
  - X distance: 283 mm
  - Y-distance: 121,5 mm
  - Through hole in sheet: Ø 9 mm
  - Fixing screws: M8 x 50
- 2 Remove transport nuts.
- 3 Place the mass spectrometer module on top of the through-holes and screw it down using the fasteners as shown in the upper figure .

## 5.3 Select components and connect

### 5.3.1 Variant 1

This setup is suitable for most users and is suitable for short measuring times.



|    |                                                                                                                                                                                                                                                  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Blank flange                                                                                                                                                                                                                                     |
| 2  | Pressure sensor PSG500 for measuring the inlet pressure                                                                                                                                                                                          |
| 3  | KF sealing rings. ISO-K centering rings and seals. Not included in delivery. You can get them from INFICON's homepage under "Vacuum Components".                                                                                                 |
| 4  | Throttle insert                                                                                                                                                                                                                                  |
| 5  | ISO-KF centering ring with filter                                                                                                                                                                                                                |
| 6  | The version with a single measuring chamber is shown. Not included in delivery.                                                                                                                                                                  |
| 7  | Throttle flange. Alternatively connectable to the mass spectrometer module, see "Variant 2 [► 29]".                                                                                                                                              |
| 8  | KF corrugated hose. Not included in delivery.                                                                                                                                                                                                    |
| 9  | GROSS throttle flange                                                                                                                                                                                                                            |
| 10 | Dry backing pump with separate power supply. Not included in delivery. You can order the "Diaphragm pump LDS AQ" from INFICON under the order number 560-630, furthermore the "DIN Rail Power supply 24 V, 10 A" under the order number 560-324. |
| 11 | Power supply unit 24 V. Not included in the scope of delivery.                                                                                                                                                                                   |

- ✓ You have the mass spectrometer module (accumulation) from INFICON.
- ✓ You have a dry backing pump with its own power supply.  
All dry vacuum pumps can be used with a gas flow of more than 60 sccm at a basic pressure of under 5 mbar. This manual describes how to use the dry INFICON backing pump (catalog number 560-630).
- ✓ You have a suitable measuring chamber.  
Information about the measuring chamber can be obtained from INFICON.  
Note that a measuring chamber that is leak tight but not vacuum-resistant can implode if it is pumped further down than usual measuring times. See also "Carrying out a measurement [► 44]".
- ✓ You have the corresponding components for a setup according to variant 1. See the overview above.
  - 1 Connect the pressure sensor PSG500 to the FINE port.
  - 2 Mount the throttling flange on the measuring chamber.  
Make sure that the throttle insert points towards the chamber.  
Insert an ISO-KF centering ring with filter between the throttling flange and the measuring chamber. For details see also "LDS3000 AQ - maintenance relevant components [► 109]".
  - 3 To connect the FINE connection of the mass spectrometer module to the throttling flange, we recommend using a KF corrugated hose.
  - 4 Install the GROSS throttle flange at the GROSS / FOREPUMP port of the mass spectrometer module.
  - 5 Connect the open end of the GROSS throttle flange hose to the backing pump.
  - 6 Establish the electrical connection of the backing pump.  
When using the INFICON backing pump (catalog number 560-630), proceed as follows:
    - ⇒ Determine if the plus and minus terminals on the terminal block are already connected to cables by the manufacturer.

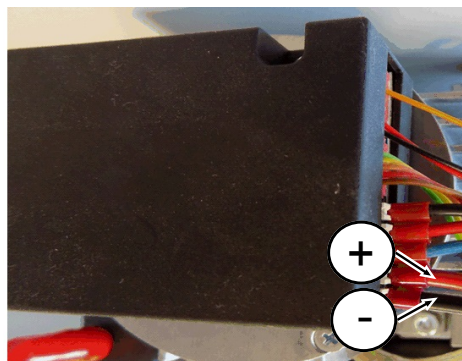


Fig. 9: Connection strip on the dry backing pump of INFICON

- ⇒ If so, connect plus and minus cables to a DC power source, 24 V +/- 10%, 5 A.
- ⇒ If not, insert the positive and negative cables with ferrules 8 mm AWG 18 with red insulation into the corresponding terminals and then connect the cables to a DC power source, 24 V +/- 10 %, 5 A.

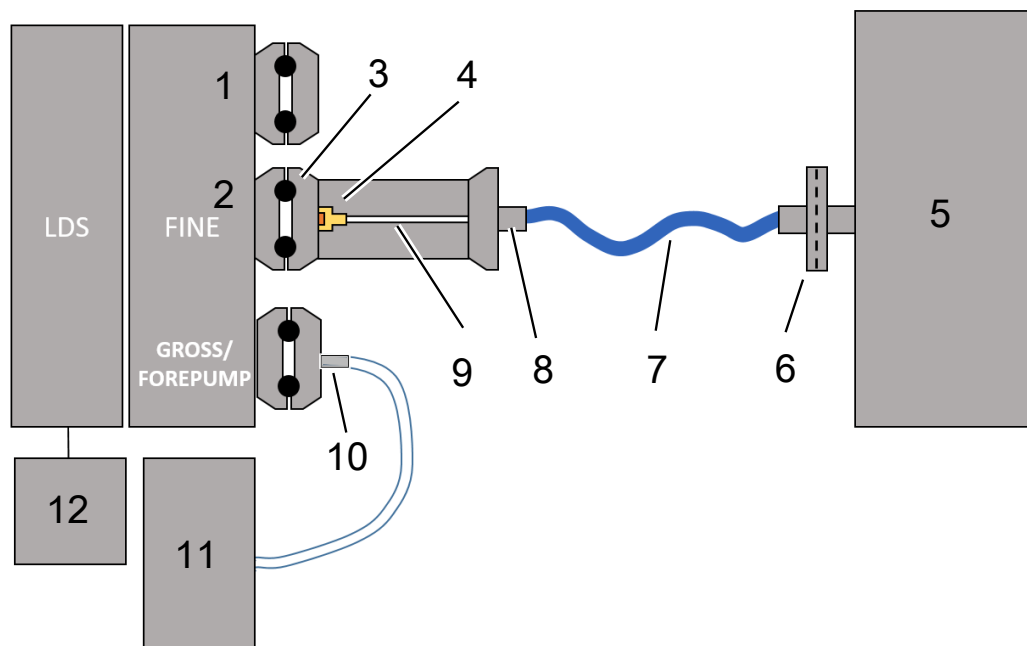


The backing pump exhaust air opening should be as far as possible from the measuring chamber.



### 5.3.2 Variant 2

This variant is suitable for applications where the specimen is to be taken from a defined location within the chamber, for example particularly close to the test object.



|    |                                                                                                                                                                                                                                                  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Blank flange                                                                                                                                                                                                                                     |
| 2  | Pressure sensor PSG500 for measuring the inlet pressure                                                                                                                                                                                          |
| 3  | ISO-KF centering ring without filter                                                                                                                                                                                                             |
| 4  | Throttle insert                                                                                                                                                                                                                                  |
| 5  | The version with a single measuring chamber is shown. Not included in delivery.                                                                                                                                                                  |
| 6  | Filter unit 0.45 µm Pall                                                                                                                                                                                                                         |
| 7  | Original delivery hose (2 mm)                                                                                                                                                                                                                    |
| 8  | Festo adapter                                                                                                                                                                                                                                    |
| 9  | Throttle flange                                                                                                                                                                                                                                  |
| 10 | GROSS throttle flange                                                                                                                                                                                                                            |
| 11 | Dry backing pump with separate power supply. Not included in delivery. You can order the "Diaphragm pump LDS AQ" from INFICON under the order number 560-630, furthermore the "DIN Rail Power supply 24 V, 10 A" under the order number 560-324. |
| 12 | Power supply unit 24 V. Not included in the scope of delivery.                                                                                                                                                                                   |

- ✓ You have the mass spectrometer module (accumulation) from INFICON.
- ✓ You have a dry backing pump with its own power supply.  
All dry vacuum pumps can be used with a gas flow of more than 60 sccm at a basic pressure of under 5 mbar. This manual describes how to use the dry INFICON backing pump (catalog number 560-630).
- ✓ You have a suitable measuring chamber.  
Information about the measuring chamber can be obtained from INFICON. Note that a measuring chamber that is leak tight but not vacuum-resistant can implode if it is pumped further down than usual measuring times. See also "Carrying out a measurement [► 44]".

- ✓ You have the corresponding components for a setup according to variant 2. See the overview above.
- 1 Connect the pressure sensor PSG500 to the FINE port.
- 2 Mount the throttling flange on the LDS FINE port.  
Make sure that the throttle insert points in the direction of the LDS FINE port. Insert an ISO-KF centering ring without filter between the throttling flange and the FINE port. For details see also "LDS3000 AQ - maintenance relevant components [► 109]".
- 3 Connect the chamber with the 2 mm tube. Depending on the application, it may be helpful to insert the tube into the chamber. The hose must be terminated towards the chamber with the 0.45 µm Pall filter unit.
- 4 Make the connection between the hose and the Festo adapter.
- 5 If necessary, insert the 2 mm hose into the measuring chamber. The hose can be shortened to the required length.
- 6 Install the GROSS throttle flange at the GROSS / FOREPUMP port of the mass spectrometer module.
- 7 Connect the open end of the GROSS throttle flange hose to the backing pump.
- 8 Establish the electrical connection of the backing pump.  
When using the INFICON backing pump (catalog number 560-630), proceed as follows:
  - ⇒ Determine if the plus and minus terminals on the terminal block are already connected to cables by the manufacturer.

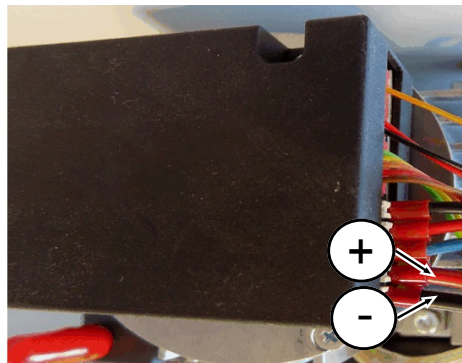


Fig. 10: Connection strip on the dry backing pump of INFICON

- ⇒ If so, connect plus and minus cables to a DC power source, 24 V +/- 10%, 5 A.
- ⇒ If not, insert the positive and negative cables with ferrules 8 mm AWG 18 with red insulation into the corresponding terminals and then connect the cables to a DC power source, 24 V +/- 10%, 5 A.



The backing pump exhaust air opening should be as far as possible from the measuring chamber.

## 5.4 Establish electrical connections

All electrical connections run from and to the MSB box.

---

**NOTICE****Material damage if power supply pack has the wrong specifications or is connected improperly**

A power supply pack that has the wrong specifications or is connected improperly can destroy the unit.

- ▶ Use a suitable power supply pack: Use a power supply pack that supplies an output voltage with electrically protective separation, output voltage: 24 V +/-5%, current carrying capacity: min. 10 A.
- ▶ Provide a short-circuit protection of 15 A for the supply of the LDS3000 AQ.
- ▶ Use a power cable with a large enough cross section.
- ▶ Ensure that the LDS3000 AQ can be de-energized in case of emergency or during repairs:  
Position the device so that you can always reach the plug for unplugging.  
Alternatively, attach a marked and easily accessible disconnect device.

- 
- 1 Mount the 24 V power supply cable to the enclosed plug (connections: +24V on 1+ and GND on 1-).
  - 2 Connect the power supply cable to the "24VDC" socket.
  - 3 Connect the operating unit to the "Control Unit" socket.
  - 4 Connect the I/O or bus module to the "I/O" socket.
  - 5 Connect the pressure sensor PSG500 to the cable of socket 1. For socket 1 see "MSB box [▶ 18]".

## 6 Operation LDS3000 AQ (Accumulation)

### 6.1 Switching the device on

- 1 Switch on the backing pump.
  - 2 Establish the power supply to the mass spectrometer module.
- ⇒ System starts up automatically.
- ⇒ If an XL Sniffer Adapter and the CU1000 are connected, you will be asked after run-up, whether the "XL Sniffer Adapter" operation mode should be set. This does not apply to devices in AQ mode.



#### Longer run-up time for devices in AQ mode

To counteract falsification of the measurement results by an increased background value, the warm-up time after switching on is about 10 minutes.

Wait at least 60 minutes before determining the peak or before calibrating. See also "Carrying out a measurement [► 44]".

### 6.2 Default settings

#### Language selection

Select the display language. The factory setting is English. (The display on the handle of the SL3000XL sniffer line shows messages in English instead of in Russian and Chinese.)

German, English, French, Italian, Spanish, Portuguese, Russian, Chinese, Japanese

|                |                                             |
|----------------|---------------------------------------------|
| Control unit   | Settings > Set up > Control unit > Language |
| LD protocol    | Command 398                                 |
| ASCII protocol | *CONFIG:LANG                                |

#### Setting date and time

Setting the date

Format: DD.MM.YY

|                |                             |
|----------------|-----------------------------|
| Control unit   | Settings > Date/Time > Date |
| LD protocol    | Command 450                 |
| ASCII protocol | *HOUR:DATE                  |

Setting the time

Format: hh: mm

|                |                             |
|----------------|-----------------------------|
| Control unit   | Settings > Date/Time > Time |
| LD protocol    | Command 450                 |
| ASCII protocol | *HOUR:TIME                  |

## 6.3 Selecting a unit for the leak rate

### Leak rate unit display

| Selecting the leak rate unit in the display for vacuum or sniff |                                                                   |
|-----------------------------------------------------------------|-------------------------------------------------------------------|
| 0                                                               | mbar l/s (factory setting)                                        |
| 1                                                               | Pa m <sup>3</sup> /s                                              |
| 2                                                               | atm cc/s                                                          |
| 3                                                               | Torr l/s                                                          |
| 4                                                               | ppm (not VAC, not AQ)                                             |
| 5                                                               | g/a (not VAC, not AQ)                                             |
| 6                                                               | oz/yr (not VAC, not AQ)                                           |
| 7                                                               | sccm                                                              |
| 8                                                               | sft <sup>3</sup> /yr                                              |
|                                                                 |                                                                   |
| Control unit                                                    | Display > Units (display) > Leak rate unit VAC (SNIF)             |
| LD protocol                                                     | Command 396 (Index 0: Vacuum, Index 1: Sniffing)                  |
| ASCII protocol                                                  | Command *CONFig:UNIT:VACDisplay<br>Command *CONFig:UNIT:SNDisplay |

### Leak rate unit interface

| Selecting the leak rate unit of the interfaces for vacuum or sniff |                                                                                |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 0                                                                  | mbar l/s (factory setting)                                                     |
| 1                                                                  | Pa m <sup>3</sup> /s                                                           |
| 2                                                                  | atm cc/s                                                                       |
| 3                                                                  | Torr l/s                                                                       |
| 4                                                                  | ppm (not VAC)                                                                  |
| 5                                                                  | g/a (not VAC)                                                                  |
| 6                                                                  | oz/yr (not VAC)                                                                |
| 7                                                                  | sccm                                                                           |
| 8                                                                  | sft <sup>3</sup> /yr                                                           |
|                                                                    |                                                                                |
| Control unit                                                       | Settings > Set up > Interfaces > Units (interface) > Leak rate unit VAC (SNIF) |
| LD protocol                                                        | Command 431 (vacuum)<br>Command 432 (sniffing)                                 |
| ASCII protocol                                                     | Command *CONFig:UNIT:LRVac<br>Command *CONFig:UNIT:LRSnif                      |

## 6.4 Select device for pressure

### Pressure unit interface

| Selecting the pressure device of the interfaces |                        |
|-------------------------------------------------|------------------------|
| 0                                               | mbar (factory setting) |
| 1                                               | Pa                     |
| 2                                               | atm                    |
| 3                                               | Torr                   |
|                                                 |                        |

|                |                                                                    |
|----------------|--------------------------------------------------------------------|
| Control unit   | Settings > Set up > Interfaces > Units (interface) > Pressure unit |
| LD protocol    | Command 430 (Vacuum/Sniff)                                         |
| ASCII protocol | Command *CONFig:UNIT:Pressure                                      |

## 6.5 Select Compatibility Mode

As LDS3000 AQ user you make your choice between

- AQ Mode 1 or
- AQ Mode 2

When changing to a compatibility mode all parameters are to be reset to factory settings and the device is to be restarted. The language is displayed according to the factory setting. To change the language, see "Default settings [▶ 32]".

If you want to switch the LDS3000 to another mode now and switch back to the previously set mode at a later time, save your parameters on a USB stick beforehand, see "Loading and saving parameters [▶ 45]". After switching back to the previously set mode, you can load the saved parameters again.

- **AQ Mode 1:** This mode is only available for devices for AQ. It is preset for AQ devices. Switching to other modes is possible.  
Selecting this mode results in an endlessly continuous measurement. The result of a measuring cycle must therefore be time-adjusted manually. To obtain a stable measurement result, you must at least wait for the measurement time. To set the measuring time, see "Making basic settings via the wizard [▶ 36]". For measurement operation, see "Carrying out a measurement [▶ 44]".
- **AQ Mode 2:** This mode is only available for devices for AQ. Switching to other modes is possible.  
Selecting this mode causes the AQ measurement to be terminated after the set measuring time has elapsed. The result of the cycle measurement can be read until the manual restart of another measuring cycle. To set the measuring time, see "Making basic settings via the wizard [▶ 36]". For measurement operation, see "Carrying out a measurement [▶ 44]".
- **LDS1000:** Compatibility mode to retrofit an existing LDS1000 leak detection system with an LDS3000.
- **LDS2010:** Compatibility mode to retrofit an existing LDS2010 leak detection system with an LDS3000.
- LDS3000
- XL Sniffer Adapter

|                |                                                        |
|----------------|--------------------------------------------------------|
| Control unit   | Settings > Set up > Compatibility > Compatibility mode |
| LD protocol    | Command 2594 (dec)                                     |
| ASCII protocol | Command *CONFig:COMP                                   |

The following table shows the functional differences between and common features of LDS2010 and LDS3000:

|                 | LDS2010                 | LDS3000              |
|-----------------|-------------------------|----------------------|
| Trigger outputs | without joint reference | with joint reference |
| other outputs   | with joint reference    | with joint reference |

|                                                                | LDS2010                                                                                                                                                                                                                                                                                                                                                                                                                             | LDS3000                                                                                                                                                                                                    |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Trigger 1 (sniffer LED, relay exit, audio signal)              | Control of sniffer LED, PWM audio outputs an the control unit for active speakers                                                                                                                                                                                                                                                                                                                                                   | Control of sniffer LED, audio outputs an the control unit for active speakers                                                                                                                              |
| Limit Low / High (serial interfaces, display, analogue output) | Limit Low affects all outputs, Limit High only the display                                                                                                                                                                                                                                                                                                                                                                          | separately adjustable for interface protocols, display and analog outputs                                                                                                                                  |
| Gas ballast (3 settings)                                       | <b>OFF:</b> Switches the gas ballast valve of the pump module off.<br><b>ON:</b> Switches the gas ballast valve of the pump module on until the next mains-off.<br>If "CAL fashion" is unequal to 3 (menu item 26), the gas ballast valve can be controlled with digital input DynCAL.<br><b>F-ON:</b> Fixed on enables switching the gas ballast valve on permanently (power failure-proof and independent of the digital inputs). | 0 = Off<br>1 = on, but controllable via digital input on IO1000<br>2 = on, but not controllable via digital input on IO1000                                                                                |
| Control mode                                                   | LOCAL, RS232, RS485                                                                                                                                                                                                                                                                                                                                                                                                                 | None, control is also possible from all control locations.                                                                                                                                                 |
| LDS1000 compatibility mode 9.2                                 | other functions                                                                                                                                                                                                                                                                                                                                                                                                                     | Default values and error messages (default values are output via interface, the touchscreen shows the original message - -> reason: new hardware can cause errors that did not exist with previous models) |
| Correcting the leak rate in Standby (machine factor)           | adjustable (yes/no)                                                                                                                                                                                                                                                                                                                                                                                                                 | adjustable (yes/no)                                                                                                                                                                                        |
| ZERO with start                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                     | starting with V1.02 like LDS2010                                                                                                                                                                           |
| Opening the sniffer valve                                      | in SNIF after start                                                                                                                                                                                                                                                                                                                                                                                                                 | in SNIF after start                                                                                                                                                                                        |
| Rotation speed of turbo molecular pump                         | only 2 rotation speeds adjustable                                                                                                                                                                                                                                                                                                                                                                                                   | Adjustable via serial interface from 750 Hz to 1500 Hz, via operator unit 1000 Hz and 1500 Hz                                                                                                              |
| Address RS485                                                  | Yes, because bus capable                                                                                                                                                                                                                                                                                                                                                                                                            | No, because not bus capable                                                                                                                                                                                |
| Sniffer key on/off                                             | selectable                                                                                                                                                                                                                                                                                                                                                                                                                          | selectable                                                                                                                                                                                                 |
| Default value for int. calibration leak                        | 1E-15 mbar l/s                                                                                                                                                                                                                                                                                                                                                                                                                      | 9.9E2 mbar l/s                                                                                                                                                                                             |
| Default value ext. calibration leak VAC/SNIF mode              | 1E-7 mbar l/s                                                                                                                                                                                                                                                                                                                                                                                                                       | 9.9E2 mbar l/s                                                                                                                                                                                             |
| Setting range for int. calibration leak                        | 10E-7                                                                                                                                                                                                                                                                                                                                                                                                                               | 1E-9 ... 9.9E-1 mbar l/s                                                                                                                                                                                   |
| Machine factor adjustment                                      | manually                                                                                                                                                                                                                                                                                                                                                                                                                            | manually/automatically                                                                                                                                                                                     |
| Machine / sniff factor value range                             | Machine factor: 1E-3...9.9E+3<br>Sniffer factor: 1E-3...9.9E+3                                                                                                                                                                                                                                                                                                                                                                      | Machine factor: 1E-4...1E+5<br>Sniffer factor: 1E-4...1E+4                                                                                                                                                 |
| Pressure: Capillary surveillance 20                            |                                                                                                                                                                                                                                                                                                                                                                                                                                     | available, pressure adjustable                                                                                                                                                                             |

|                                                               | LDS2010                                                | LDS3000                                                                                                                      |
|---------------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Analog output                                                 | fixed characteristics                                  | freely configurable                                                                                                          |
| Calibration request                                           | Preamplifier temperature change<br>5 K or 30 min       | Preamplifier temperature change<br>5 K or 30 min. or TMP rotation<br>speed changed                                           |
| Pressure / leak rates units (VAC/<br>SNIF) for all interfaces | yes                                                    | Control unit and rest separated                                                                                              |
| User permissions                                              | 3 levels over PIN on the control<br>unit or key switch | 4 levels through control unit or<br>optional key switch                                                                      |
| Key-operated switch                                           | permanently installed                                  | can, if required, be connected<br>externally, see "Assigning the<br>digital inputs of the I/O module<br>[► 58]" (Key switch) |

## 6.6 Making basic settings via the wizard

We recommend using the AQ Wizard for important settings and calibration. The following information refers to a CU1000 that has been adapted for use with the LDS3000 AQ.

If you want to deviate from the standard settings or want to find out more about interface protocol commands, please refer to further chapters of this manual for details.

### AQ Wizard

To start the AQ wizard, press on the display of the CU1000

Main menu > Functions > Assistant

Alternatively press the word "Wizard" at the bottom of the display.

Make your entries in the windows that are called one after the other.

1. Chamber volume  
(net volume)  
The unit of volume can be selected under "Main Menu > Settings > Setup > Op. modes > AQ > Volume unit".  
(LD-Protokoll: Command 1763  
ASCII protocol: \*CONFig:AQ:VOLume)
2. Trigger level 1  
(LD/ASCII protocol: See "Setting trigger values [► 47]")
3. Mass  
(selection between helium or forming gas)  
(LD/ASCII protocol: See "Select gas type (mass) [► 37]")
4. Percentage of gas  
(for example, the hydrogen content in forming gas)  
(LD/ASCII protocol: See display of hydrogen content in "Settings for the XL sniffer adapter" in the operating instructions for the LDS3000.
5. Measurement time  
(The time can be freely adjusted, but there is also a recommendation, depending on parameters.)  
(LD protocol: Command 1765  
ASCII protocol: \*CONFig:AQ:TIME)



When the compatibility mode "AQ Mode 1" is set, an endless continuous measurement is performed. The measuring cycle or the result of a measurement must be read manually from the continuous measurement. To obtain a stable measurement result, you must at least wait for the measurement time.

When the compatibility mode "AQ Mode 2" is set, the AQ measurement is terminated after the set measuring time has elapsed. The result of the cycle measurement can be read until the manual restart of another measuring cycle. To set the compatibility mode, see "Select Compatibility Mode [► 34]".

Alternatively, you can make your settings in the following places:

"Main menu > Settings > Set up > Operation modes > AQ"

"Main menu > Settings > Mass"

## 6.7 Select gas type (mass)

The machine, calibration and sniff factor are dependent on the configured mass and are saved in the mass spectrometer module.

|   |                                                             |
|---|-------------------------------------------------------------|
| 2 | H <sub>2</sub> (Hydrogen, forming gas)                      |
| 3 | <sup>3</sup> He or deuterated hydrogen (HD), not in AQ mode |
| 4 | <sup>4</sup> He (Helium) (factory setting)                  |

|                |                                 |
|----------------|---------------------------------|
| Control unit   | Settings > Mass                 |
| LD protocol    | Command 506 with value 2 (3, 4) |
| ASCII protocol | Command *CONFig:MASS 2 (3, 4)   |



With the LDS3000 AQ, it is best to change the gas type via the wizard, see "Making basic settings via the wizard [► 36]".

## 6.8 Determine peak

To obtain the most accurate measurement results, you should always determine the current "peak" before calibration. At the end of this process, the value for the old anode voltage is replaced by the value for the new anode voltage.

The adjustment uses air-helium or air-hydrogen. An adjustment only with nitrogen is not possible.

The following information about the display refers to a CU1000 that has been adapted for use with the LDS3000 AQ.

✓ To prevent falsification of measurement results due to an increased background value, you have waited for at least 60 minutes to warm up.

- 1 Main menu > Functions > CAL > Peak.
- 2 Confirm with "OK."  
⇒ The "CAL peak" window opens.
- 3 Remove the calibration leak from the chamber.

- 4 If the compatibility mode "AQ Mode 1" has been set, wait until the background signal is stable and then start the adjustment with "OK". See also "Select Compatibility Mode [► 34]".
  - ⇒ (LD protocol: 4, Parameter 7 (peak adjust AQ)  
ASCII protocol: \*CAL:PEAK  
IO1000: "Peakfind" input
  - ⇒ (LD and ASCII protocol: The status must then be queried via command 260 (State Calibration) or \*STATus: CAL)
- 5 If the compatibility mode "AQ Mode 2" has been set, start the adjustment directly with "OK".
  - ⇒ After adjustment, the old and new anode voltage are displayed.

## 6.9 Store leak rate of calibration leaks

Enter the specifications for the used calibration leak once. A specific leak rate must be set for each gas (mass).

Range: 1E-9 ... 9.9E-2 mbar l/s



### Minimum size for leak rate of the calibration leak

In order to perform a stable calibration, we recommend a minimum size for the leak rate of the used calibration leak.

If the measurement time proposed by the AQ Wizard is maintained, the leak rate should not fall below the following value:

- When using forming gas, the selected setpoint (Trigger 1)
- When using helium 1/5 of the selected setpoint (Trigger 1)

If the leak rate of the used calibration leak is too small, an error message will be issued to start or finish the calibration.

---

The following information refers to a CU1000 that has been adapted for use with the LDS3000 AQ.

- ✓ The desired unit in which you want to enter the leak rate is set. If the unit of leak rate displayed in your system differs from the unit indicated on the calibration leak, at least temporarily set the unit as indicated on the calibration leak. See also "Selecting a unit for the leak rate [► 33]".

- 1 Main menu > Functions > CAL > Settings > Ext. calibration leak
- 2 Enter the desired gas and the associated leak rate.  
(LD protocol: Command 390  
ASCII protocol: \*CONFig:CALleak:EXTVac)

## 6.10 Calibrate device

### 6.10.1 Time and general preferences

#### NOTICE

##### **Incorrect calibration because of operating temperature that is too low**

Calibrating the device in the cold state can deliver incorrect measurement results.

- For optimum accuracy the device should have been turned on at least 60 minutes previously.

It is recommended to calibrate the device once per shift in the desired operating modes and for the desired gases. Thereafter you can switch between the operation modes and gases without re-calibrating.

Further, calibration is required after a calibration prompt by the system.

#### Switching off the preamplifier test

The device tests the installed preamplifier during calibration. You can switch off of the amplifier test. This increases the speed of the calibration, but reliability drops off.

|   |     |
|---|-----|
| 0 | Off |
| 1 | ON  |

|                |                                                                                  |
|----------------|----------------------------------------------------------------------------------|
| Control unit   | Settings > Set-up > MS-module > Preamplifier > Test > Preamplifier test with CAL |
| LD protocol    | Command 370                                                                      |
| ASCII protocol | Command *CONFig:AMPTest (ON,OFF)                                                 |

#### Enabling calibration request

If Calibration request is enabled, the device will prompt the operator to perform a calibration 30 minutes after it has been switched on and in case of temperature changes greater than 5°C.

|   |     |
|---|-----|
| 0 | Off |
| 1 | ON  |

|                |                                                                                                                                                |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Control unit   | Functions > CAL > Settings > CAL request. > Calibration request<br>or<br>Settings > Setup > Notifications > CAL request. > Calibration request |
| LD protocol    | Command 419                                                                                                                                    |
| ASCII protocol | *CONFig:CALREQ (ON,OFF)                                                                                                                        |

#### Calibration warning Wrn650

The warning message Wrn650 "Calibration within the first 20 minutes is not recommended" can be allowed or suppressed.

|   |                  |
|---|------------------|
| 0 | OFF (suppressed) |
|---|------------------|

|                |                                                                                                                                                          |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1              | ON (allowed)                                                                                                                                             |
| Control unit   | Functions > CAL > Settings > CAL request. > Calibration warning W650<br>or<br>Settings > Setup > Notifications > CAL request. > Calibration warning W650 |
| LD protocol    | Command 429                                                                                                                                              |
| ASCII protocol | *CONFig:CALWarn ON (OFF)                                                                                                                                 |

**See also**

 Setting machine and sniff factor [► 43]

## 6.10.2 Entering the calibration factor

The calibration is usually determined by the appropriate calibration routine. Therefore, it is usually not necessary to adjust the calibration factor manually. An incorrectly set calibration inevitably leads to wrong leak rate indicator!

## 6.10.3 Calibration factor vacuum

Entry of calibration factors for masses 2, 3, 4.

The values will be overwritten during the next calibration.

0.01 ... 5000

|                |                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------|
| Control unit   | Settings > Set up > Operation modes > Vacuum > Calibr. factor > mass 2 (3, 4) > calibration factor VAC H2 (M3, He) |
| LD protocol    | Command 520                                                                                                        |
| ASCII protocol | Command *FACTOR:CALVac                                                                                             |

## 6.10.4 Calibrate

Please also note the general instructions for calibration, see "Calibrate device [► 39]".

### Requirements for all procedures

- You have an external calibration leak.
- The information on the calibration leak is entered, see also "Store leak rate of calibration leaks [► 38]".
- To prevent falsification of measurement results due to an increased background value, you have waited for at least 60 minutes to warm up.
- The current "peak" was determined, see also "Determine peak [► 37]".

### Control unit CU1000

- 1 Place the open calibration leak in the measuring chamber and close the measuring chamber.

- 2 Main menu > Functions > CAL > external
  - ⇒ The leak rate of the calibration leak will be displayed and a question to start the calibration.
- 3 To start the calibration confirm with "OK".
- 4 Follow the instructions on the screen.

### LD or ASCII protocol, IO1000

- 1 Place the open calibration leak in the measuring chamber and close the measuring chamber.
- 2 Only applies to the "AQ Mode 1": For a stable leak rate signal, wait at least the duration of the set AQ measurement time.
- 3 Start the calibration  
LD protocol: Command 4, Parameter 1  
ASCII protocol: \*CAL:EXT  
IO1000: Input "CAL external", see also the following figure  
⇒ If helium is used, proceed to the last step (no. 8).
- 4 For a background determination of forming gas (hydrogen), then query the status:  
LD protocol: Command 260 (State Calibration)  
ASCII protocol: \*STATus:CAL  
⇒ Wait until it reaches the following state:  
LD protocol: Command 260 State 75 "WAIT\_ZERO\_AQ"  
ASCII protocol: \*STATus:CAL? on "CLOSE"  
IO1000: Input "CAL stable", see also the following figure
- 5 Remove the calibration leak from the measuring chamber and close the measuring chamber.
- 6 For a stable leak rate signal, wait at least the duration of the set AQ measurement time.
- 7 Start the background measurement.  
LD protocol: Command 11, Parameter 1 (Continue calibration)  
ASCII protocol: \*CAL:CLOSED  
IO1000: Input "CAL external", see also the following figure
- 8 Then query the status:  
LD protocol: Command 260 (State Calibration)  
ASCII protocol: \*STATus:CAL  
⇒ Wait until it reaches the following state:  
LD protocol: Command 260 State 0 "READY"  
ASCII protocol: \*STATus:CAL? on "IDLE"  
IO1000: Output "CAL active", see also the following figure  
⇒ The calibration is completed.  
⇒ In case of error:  
LD-Protokoll: Command 260 State 51...59 (error conditions)  
ASCII protocol: \*STATus:CAL? on "FAIL"  
IO1000: Output "Error or Warning"

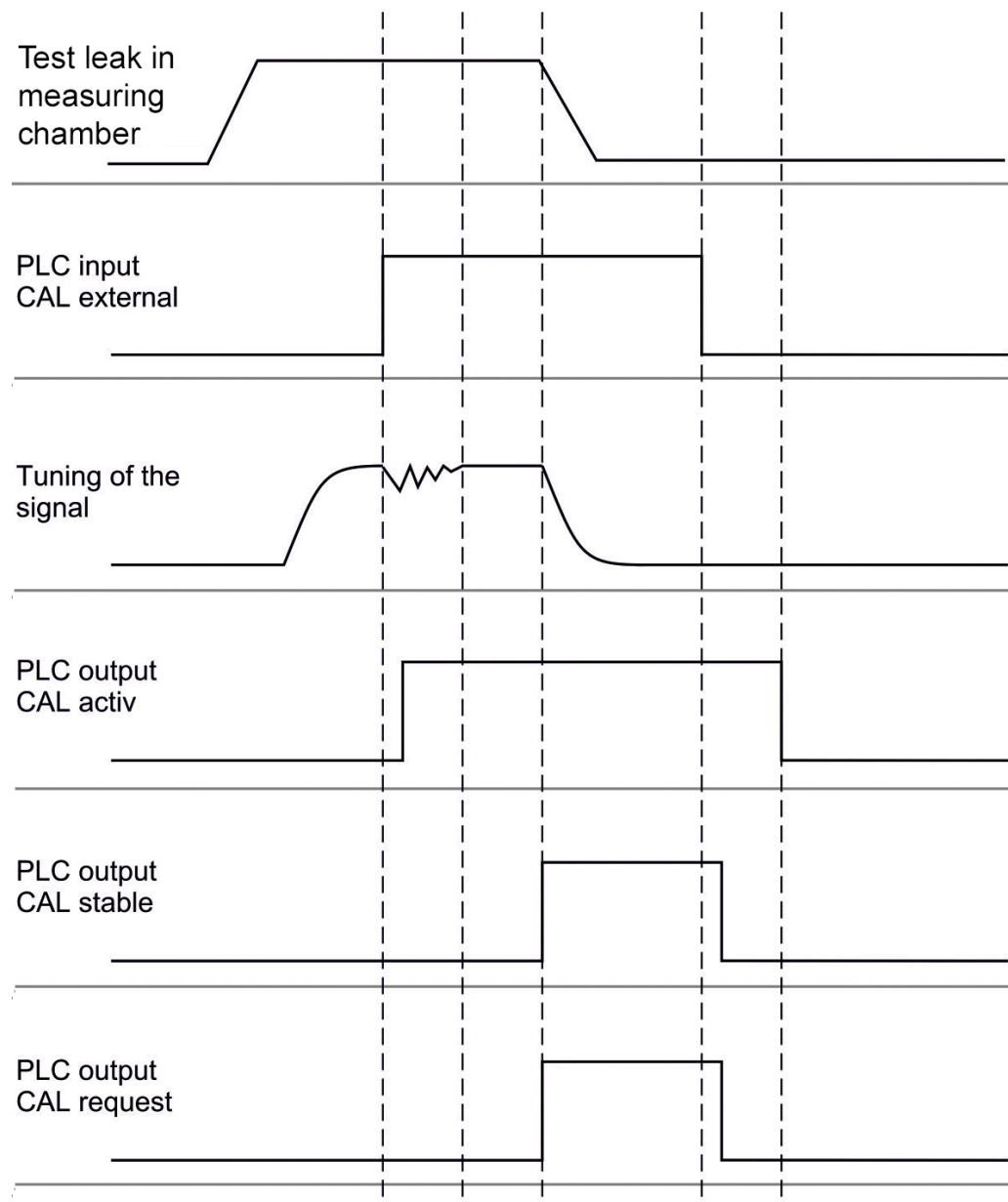


Fig. 11: External calibration with IO1000 on a device for AQ mode. Description of the PLC inputs and outputs see "Assigning inputs and outputs [► 50]".

## 6.11 Start and stop measurement (AQ Mode 2)

Applies only to "AQ Mode 2". See also "Select Compatibility Mode [► 34]".



In order to have a Start or Stop button available in the standby window of the CU1000 to operate a measuring cycle, replace the "Favorite 1" or "Favorite 2" key in the Favorites window with "Start/Stop". Otherwise, the Start/Stop buttons would be missing in the standby window and you would have to use the "Functions > Start/Stop" menu.  
For the setting, see "Touch screen settings [► 74]", "Assigning favorite keys".

Switches between measuring and standby operation

START = Standby --> Measuring

|                              |                        |
|------------------------------|------------------------|
| STOP = Measuring --> Standby |                        |
|                              |                        |
| Control unit                 | Functions > Start/Stop |
| LD protocol                  | Commands 1, 2          |
| ASCII protocol               | Command *STArt, *STOp  |

**See also**

 Carrying out a measurement [► 44]

## 6.12 Perform ZERO

After the run-up of the LDS3000 AQ and the choice of forming gas as gas type, the existing hydrogen in the vacuum system initially ensures that a rising curve is visible on the display (AQ Mode 1). This display can be misunderstood as a sign of leakage. To remove distorting traces of hydrogen, wait about 30 minutes after starting up the device to measure.

To eliminate the residual offset, execute ZERO AQ. ZERO AQ is not used to suppress measurement signals.

- ✓ Mass is hydrogen (forming gas).  
If no hydrogen (forming gas) is entered, you can set it under "Main menu > Settings > Mass" or via "Wizard" at the bottom of the measurement window display.
- ✓ There is neither a test specimen nor a calibration leak in the measuring chamber.
  - 1 Main menu > Functions > ZERO AQ
  - 2 Follow the instructions on the screen.
    - ⇒ LD and ASCII protocol: After removing the test specimen or test leak, first wait for the measuring time (AQ Mode 1).
    - ⇒ LD protocol: Command 6, Parameter 1; ASCII protocol: \*ZERO:ON
    - ⇒ IO1000: Input ZERO

## 6.13 Setting machine and sniff factor

The internal calibration will only calibrate the measurement system of a mass spectrometer module that is uncoupled from the test system. If the measurement system is operated in parallel to an additional pump system after an internal calibration though (following the partial flow principle), the measurement system will indicate a leak rate that is too low based on the partial flow ratio. With the help of a corrective machine factor for vacuum mode and a sniff factor for sniffer mode, the measurement system indicates the actual leak rate. The factors are taken into consideration along with the ratio of effective pumping speed of the measurement system in a comparison to the pumping speed of the measurement system on the test system.

### 6.13.1 Setting machine and sniff factor manually

- ✓ Mass spectrometer module calibrated internally.
  - 1 Measure external calibration leak using the test system.

⇒ The device indicates a leak rate that is too low based on the partial flow ratio.

2 Setting machine or sniff factor, see below.

⇒ The device indicates the actual leak rate.

### Setting the machine factor



#### Devices in AQ mode:

The machine factor "1" is preset. This setting should not be changed.

Corrects a possible deviation between internal and external calibration in vacuum mode.

Should be at value 1.00 without the option internal calibration leak. After the value is changed, the leak rate resulting from the change is displayed. This simplifies adjustment.

Value range 1E-4...1E+5

|              |                                                                                                                |
|--------------|----------------------------------------------------------------------------------------------------------------|
| Control unit | Settings > Set up > Operation modes > Vacuum > Machine factor > Mass 2 (3, 4) > machine factor VAC H2 (M3, He) |
|--------------|----------------------------------------------------------------------------------------------------------------|

|             |             |
|-------------|-------------|
| LD protocol | Command 522 |
|-------------|-------------|

|                |                            |
|----------------|----------------------------|
| ASCII protocol | Command *FACTOR:FACMachine |
|----------------|----------------------------|

### Setting the sniff factor

Corrects a possible deviation between internal and external calibration in sniffer mode

Value range 1E-4...1E+4

|              |                                                                                                        |
|--------------|--------------------------------------------------------------------------------------------------------|
| Control unit | Settings > Set up > Operation modes > Sniffing > Sniff factor Mass 2 (3, 4) > Sniff factor H2 (M3, He) |
|--------------|--------------------------------------------------------------------------------------------------------|

|             |             |
|-------------|-------------|
| LD protocol | Command 523 |
|-------------|-------------|

|                |                          |
|----------------|--------------------------|
| ASCII protocol | Command *FACTOR:FACSniff |
|----------------|--------------------------|

## 6.14 Carrying out a measurement

### WARNING

#### Danger due to imploding measuring chamber

An external measuring chamber connected to an LDS3000 AQ is pumped off at approximately 60 sccm. Within normal measurement times (2 - 30 seconds) no dangerous negative pressure is generated.

If the measuring chamber is leak-proof, but not vacuum resistant, and continues to pump, it may implode. This can occur, for example, in a 1-liter measuring chamber after about 10 minutes.

- ▶ Do not continue pumping a measuring chamber after the measuring time has expired.
- ▶ Consider suitable protective measures!



- ✓ The device is switched on.
- ✓ The compatibility mode "AQ Mode 1" or "AQ Mode 2" has been set (in the CU1000 in the "Compatibility" window, confirmed with "OK").
- ✓ "AQ Mode 2" only: In order to have a Start or Stop button available in the standby window of the CU1000 to operate a measuring cycle, you have replaced the "Favorite 1" or "Favorite 2" button with "Start/Stop" in the Favorites window. Otherwise, the Start/Stop buttons would be missing in the standby window and you would have to use the "Functions > Start/Stop" menu. For the setting, see "Touch screen settings [► 74]", "Assigning favorite keys".
- ✓ The peak has been determined, see "Determine peak [► 37]".
- ✓ The calibration was done, see "Calibrate [► 40]".
- ✓ ZERO AQ has been determined, see "Perform ZERO [► 43]".
  - 1 If you are measuring with forming gas, make sure that the device has been running for at least half an hour. This time is needed to perform stable measurements.
    - ⇒ If you measure with helium, this waiting time is about 10 minutes.
  - 2 Place the test object in the measuring chamber and close the measuring chamber. The test object should not be placed on the areas that may be leaking.
    - ⇒ Either a test object filled with helium or forming gas under pressure is brought into the measuring chamber or pressurized in the measuring chamber.
  - 3 If the compatibility mode "AQ Mode 1" has been set, wait for the set measuring time. Start or Stop buttons are not used in AQ Mode 1.
    - ⇒ The leak rate is calculated and displayed. Due to the endlessly running measurement, the result of a measuring cycle must be time-adjusted manually.
    - ⇒ If the test object leaks, the display shows an increasing leak rate.
  - 4 If the compatibility mode "AQ Mode 2" has been set, press the "Start" button in the "Standby" window of the CU1000.
    - ⇒ In the measurement window, you can follow the current measurement, wait for the end of the measurement cycle or press "Stop". The remaining measuring time is displayed.
    - ⇒ At the end of the measuring cycle, the result of the last measurement is displayed.
    - ⇒ Depending on whether a set setpoint value is exceeded or not, the result "Leak tight" is displayed with a green background or "Leaky" with a red background.
  - 5 Remove the test object from the measuring chamber and continue the measurements with step 2.

## 6.15 Loading and saving parameters

You can use a USB flash drive on CU1000 to backup and restore the control unit and mass spectrometer module parameters.

Save parameter:

- ▶ "Functions > Data > Parameter > Save > Save parameter"

Loading parameters:

- ✓ The currently set compatibility mode must match the compatibility mode in the parameter file. See also "Select Compatibility Mode [▶ 34]".

- ▶ "Functions > Data > Parameter > Load > Load parameter"

## 6.16 Copying measurement data, deleting measurement data

The measurement data can be saved to a USB flash drive with CU1000.

- "Functions > Data > Recorder > Copy > Copy files"

The measurement data can be deleted on the CU1000.

- "Functions > Data > Recorder > Delete > Delete files"

## 6.17 Adjust "Zero time factor AQ"

Applies only to "AQ Mode 1". See also "Select Compatibility Mode [▶ 34]".

In order to avoid apparently negative leak rates when measuring with forming gas, the leakage rate display is adjusted to 0 after a certain time (zero time factor AQ x measuring time).

Zero time factor AQ can be set under:

Main menu > Settings > Set up > Operation modes > AQ > Measurement time

The default value is 4 and can be changed to 1...10 in integers.

(LD protocol: Command 1767

ASCII protocol: \*CONFig:AQ:ZEROTime)

## 6.18 Selecting display limits

### Display range

Lowering and raising the display limits:

If very small leak rates are not of interest for your application, raising the lower limit of the display can facilitate the assessment of the leak rate indicator.

- up to 15 decades in VAC
- up to 11 decades in SNIF
- up to 8 decades in AQ mode

If an unsuitable setting causes the usable range to be less than the decade, the upper limit is shifted until a visible decade remains.

Note: The current display limits are shown in the control unit when setting between the two parameters. Using the command 399 with the LD protocol the current display limit can be read out.

|                |                                                                   |
|----------------|-------------------------------------------------------------------|
| Control unit   | Display > Display limits                                          |
| LD protocol    | Command 397                                                       |
| ASCII protocol | Command: *CONFig:DISPL_LIM:HIGH<br>Command: *CONFig:DISPL_LIM:LOW |

## 6.19 Setting trigger values

The mass spectrometer module has four independent trigger values. If the measured leak rate exceeds the set trigger values, the corresponding digital outputs of IO1000 are activated.

In addition, exceeding the Trigger 1 on the control unit is highlighted.

In the AQ mode, the calculation at the recommended measuring time refers to the trigger value 1.

1 / 2 / 3 / 4

|                |                                                         |
|----------------|---------------------------------------------------------|
| Control unit   | Setting > Trigger > Trigger 1 (2, 3, 4) > Trigger level |
| LD protocol    | Command 385                                             |
| ASCII protocol | Command *CONFig:TRIGger1 (2, 3, 4)                      |

## 6.20 Set pressure monitoring

### Min. pressure AQ mode

A minimum pressure value is set to detect clogging of the throttle. If the value is fallen short of, the system issues warning 556. Error message 557 is output with strong lower deviation.

5E-2 ... 0.45 mbar

|                |                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------|
| Control unit   | Settings > Setup > Operation modes > AQ > Pressure limits > Min. pressure > Min. pressure AQ mode |
| LD protocol    | Command 532                                                                                       |
| ASCII protocol | Command *CONFig:PRESSACCULow                                                                      |

### Max. pressure AQ mode

A maximum pressure value is set to detect a defective or missing throttle. If the value is exceeded, the system issues warning 520.

0.5 ... 1 mbar

|                |                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------|
| Control unit   | Settings > Setup > Operation modes > AQ > Pressure limits > Max. Pressure > Max. Pressure AQ mode |
| LD protocol    | Command 533                                                                                       |
| ASCII protocol | Command *CONFig:PRESSACCUHigh                                                                     |

## 6.21 Set the rotation speed of the turbo molecular pump

### Rotational speed of the turbo molecular pump

For measurements with hydrogen / forming gas, it may be useful to set the turbo molecular pump of the LDS3000 AQ to 1250 Hz.

This is always the case if fluctuating environmental conditions such as humidity have a greater influence on the signal quality than the lower signal strength (greater calibration factor) for hydrogen / forming gas at 1250 Hz operation.

After changing the rotation speed recalibration is required!

|                                                 |
|-------------------------------------------------|
| Rotation speed of turbo molecular pump in Hertz |
| 1000                                            |

|                |                                                                      |
|----------------|----------------------------------------------------------------------|
| 1250           |                                                                      |
|                |                                                                      |
| Control unit   | Settings > Setup > MS module > TMP > Settings > TMP rotational speed |
| LD protocol    | 501                                                                  |
| ASCII protocol | *CONFig:SPEEDTMP                                                     |

## 6.22 Cathode Selection

### Selecting a cathode

The mass spectrometer includes two cathodes. In the factory setting the device uses cathode 1. If this one is defective, the device automatically switches to the other cathode.

With this setting, it is possible to select a specific cathode.

|                |                                                                |
|----------------|----------------------------------------------------------------|
| 0              | CAT1                                                           |
| 1              | CAT2                                                           |
| 2              | Auto Cat1 (automatic switching to cathode 2, factory setting)  |
| 3              | Auto Cat2 (automatic switching to cathode 1)                   |
| 4              | OFF                                                            |
|                |                                                                |
| Control unit   | Settings > Set up > MS module > Ion source > Cathode selection |
| LD protocol    | 530                                                            |
| ASCII protocol | *CONFig:CAThode<br>*STATus:CAThode                             |

## 6.23 Reset settings

### Mass spectrometer module

The settings of the mass spectrometer module can be reset to factory settings.

|                |                                                                                                                                                                                         |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0              | Load factory settings                                                                                                                                                                   |
| 10             | Reset the settings for compatibility mode LDS1000                                                                                                                                       |
| 11             | Reset the settings for compatibility mode LDS2010                                                                                                                                       |
| 12             | Reset the settings for XL sniffer adapter mode                                                                                                                                          |
| 14             | Reset the settings for LDS3000 AQ                                                                                                                                                       |
|                |                                                                                                                                                                                         |
| Control unit   | Functions > Data > Parameters > Reset > Control unit settings<br>Functions > Data > Parameters > Reset > MSB settings<br>Functions > Data > Parameters > Reset > Parameter access level |
| LD protocol    | Command 1161                                                                                                                                                                            |
| ASCII protocol | Command *RST:FACTORY<br>Command *RST:SL3000                                                                                                                                             |



The following applies to the control unit: Based on the currently set mode, the associated value for resetting the settings for this mode is automatically selected.

The following applies to LD or ASCII protocol: Resetting the settings for a certain mode automatically activates this mode, see also "Select Compatibility Mode [► 34]".

---

## 7 Using the expansion module

### 7.1 Selecting the type of expansion module

#### Selecting the expansion module

|                                                              |                                                                                                                                                                                    |
|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Selecting the type of module connected to the I/O connection |                                                                                                                                                                                    |
| I/O module                                                   |                                                                                                                                                                                    |
| Bus module                                                   |                                                                                                                                                                                    |
|                                                              |                                                                                                                                                                                    |
| Control unit                                                 | Settings > Configuration > Interfaces > Device Selection > Module on I/O connection<br>or<br>Settings > Configuration > Accessories > Device Selection. > Module on I/O connection |
| LD protocol                                                  | -                                                                                                                                                                                  |
| ASCII protocol                                               | -                                                                                                                                                                                  |

### 7.2 Settings for I/O module IO1000

#### 7.2.1 General interface settings

#### Setting the interface protocol

|                                                                                                                                                 |                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Setting the protocol for the interfaces (RS232 and RS485) on the I/O module. This setting can be overwritten with the DIP switch on the IO1000. |                                                                 |
| LD                                                                                                                                              |                                                                 |
| ASCII                                                                                                                                           |                                                                 |
| - Binary                                                                                                                                        |                                                                 |
| LDS1000                                                                                                                                         |                                                                 |
|                                                                                                                                                 |                                                                 |
| Control unit                                                                                                                                    | Settings > Set up > Interfaces > Protocol > I/O module protocol |
| LD protocol                                                                                                                                     | 2593                                                            |
| ASCII protocol                                                                                                                                  | *CONFig:RS232                                                   |

#### 7.2.2 Assigning inputs and outputs

#### Assigning analog outputs of the I/O module

|                                                                                                      |                                                                                                                                         |
|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| The analog outputs of I/O module IO1000 can with assigned with different measurement value displays. |                                                                                                                                         |
| Possible functions: see the following table                                                          |                                                                                                                                         |
|                                                                                                      |                                                                                                                                         |
| Control unit                                                                                         | Settings > Set up > Interfaces > I/O module > Analog outp. > Config. Analog outputs 1/2                                                 |
| LD protocol                                                                                          | Commands 222, 223, 224                                                                                                                  |
| ASCII protocol                                                                                       | Command *CONFig:REcorder:LINK1<br>Command *CONFig:REcorder:LINK2<br>Command *CONFig:REcorder:SCALE<br>Command *CONFig:REcorder:UPPEREXP |

|                                                      |                                                                                                                      |
|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Limit values can be defined for the output voltages. |                                                                                                                      |
| VAC:                                                 | Min. $1 \times 10^{-13}$ ... $1 \times 10^{-1}$ mbar l/s<br>Max. $1 \times 10^{-12}$ ... $1 \times 10^{-1}$ mbar l/s |
| SNIF:                                                | Min. $1 \times 10^{-9}$ ... $1 \times 10^{-1}$ mbar l/s<br>Max. $1 \times 10^{-8}$ ... $1 \times 10^{-1}$ mbar l/s   |
|                                                      |                                                                                                                      |
| Control unit                                         | Settings > Set up > Interfaces > LR limits                                                                           |
| LD protocol                                          | Command 226 (Vac)<br>Command 227 (Snif)                                                                              |
| ASCII protocol                                       | Command *CONFig:LIMITS:VAC<br>Command *CONFig:LIMITS:SNIF                                                            |

#### Functions, assignment of analog outputs:

|                           |                                                                                               |                                                                                                              |
|---------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| Off                       | The analog outputs are switched off<br>(Output voltage = 0 V).                                |                                                                                                              |
| Pressure p1 / Pressure p2 | 1 ... 10 V; 0.5 V / decade;<br>1 V = $1 \times 10^{-3}$ mbar                                  |                                                                                                              |
| Leak rate mantissa        | 1 ... 10 V; linear; in the selected unit                                                      | Useful only if the other analog output is assigned "Leak rate exponent".                                     |
| Leak rate exponent        | 1 ... 10 V; 0.5 V / decade;<br>Step function;<br>1 V = $1 \times 10^{-12}$ ; in selected unit | Useful only if the other analog output is assigned "Leak rate mantissa" or "Leak rate ma. Hys." is occupied. |
| Linear leak rate          | x ... 10 V; linear;<br>in the selected unit                                                   |                                                                                                              |

The upper limit (= 10 V) is set via the parameter "Upper limit exponent". The lower value is always 0 (leak rate), which corresponds to 0 V output voltage. The exponent of the upper limit can be set in entire decades, such as  $1 \times 10^{-4}$  mbar l/s.

Settings > Set up > Interfaces > I/O module > Analog scale > AO exponent upper limit.

This setting is for both analog outputs, if an appropriate output function is selected. Depending on the selected leak rate unit there is a different absolute limit.

The selected range can be additionally narrowed by the limits, which is valid for all interfaces, see above.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                      |                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Leak rate log.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | x ... 10 V; logarithmic;<br>in the selected unit                                     |                                                                                                                                                                                                                                                                                                                     |
| <p>The upper limit (= 10 V) and the scale (V / decades) are set via the parameters "Upper limit exponent" and "Scale for leak rate". For example:</p> <p>Upper limit set to 1 x 10<sup>-5</sup> mbar l/s (= 10 V). Scale set to 5 V / decade. Lower limit is at 1 x 10<sup>-7</sup> mbar l/s (= 0 V). The logarithmic output function of both the slope in V / decade as well as the upper limit (10 V limit) can be set. This results in the minimum displayable value. The following slopes are available: 0.5, 1, 2, 2.5, 3, 5, 10 V/decade. The higher the selected slope value, the smaller the displayable area. The logarithmic settings are the most useful when several decades can be displayed, so a setting of &lt;10 V / decade. The upper limit is the same for both analog outputs. In both of the following figures the 1 V / decade and 5 V / decade with different upper limit settings are exemplified. Depending on the selected leak rate unit there is a different absolute limit. The selected range can be additionally narrowed by the limits, which is valid for all interfaces, see above.</p> |                                                                                      |                                                                                                                                                                                                                                                                                                                     |
| Via interface                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The output voltage can be specified for tests with the LD protocol command 221.      |                                                                                                                                                                                                                                                                                                                     |
| Leak rate Ma. Hys.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.7 ... 10 V; linear;<br>in the selected unit                                        | Useful only if the other analog output is assigned "Leak rate exponent". Through an overlap of the mantissa in the range 0.7 to 1.0, a constant jumping between two decades is prevented. 0.7 V corresponds to a leak rate of 0.7 x 10 <sup>-x</sup> . 9.9 V corresponds to a leak rate of 9.9 x 10 <sup>-x</sup> . |
| Pressure p1 (1 V / Dec.)/<br>Pressure p2 (1 V / Dec.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1 ... 10 V; 1 V / decade;<br>2.5 V = 1 x 10 <sup>-3</sup> mbar;<br>8.5 V = 1000 mbar |                                                                                                                                                                                                                                                                                                                     |
| Leak rate log. H./<br>Leak rate exp. Inv.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Special function. Use only on the recommendation of INFICON.                         |                                                                                                                                                                                                                                                                                                                     |



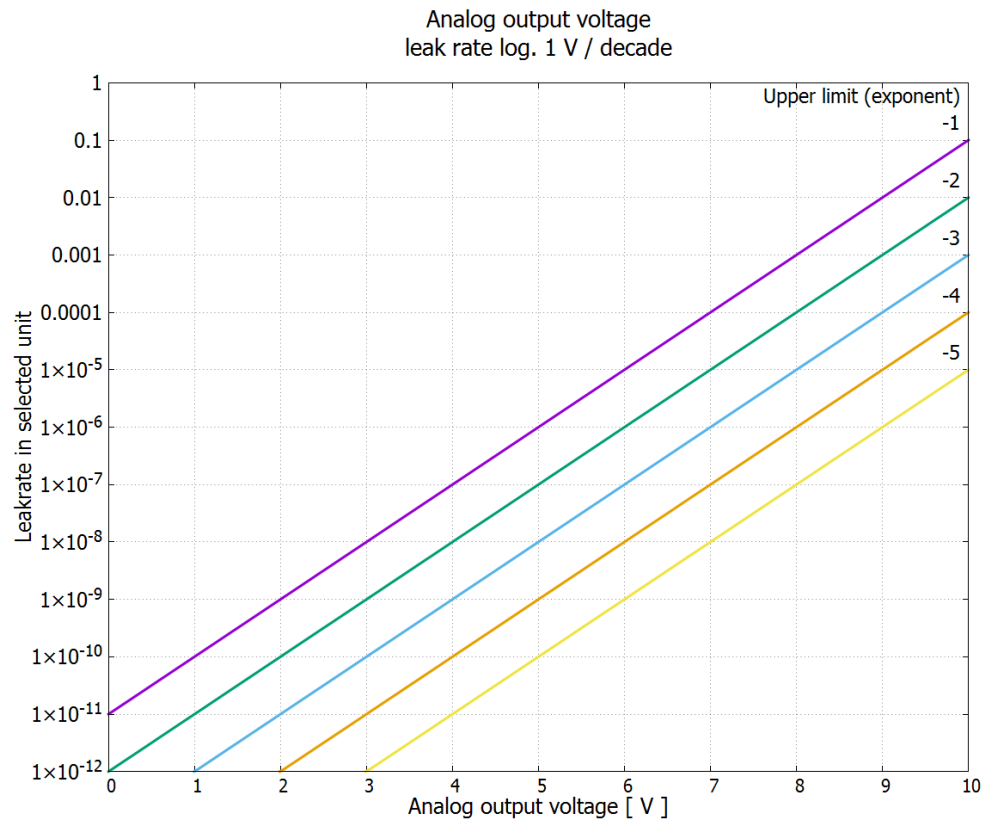


Fig. 12: Analogue output voltage leak rate log. 1 V / decade

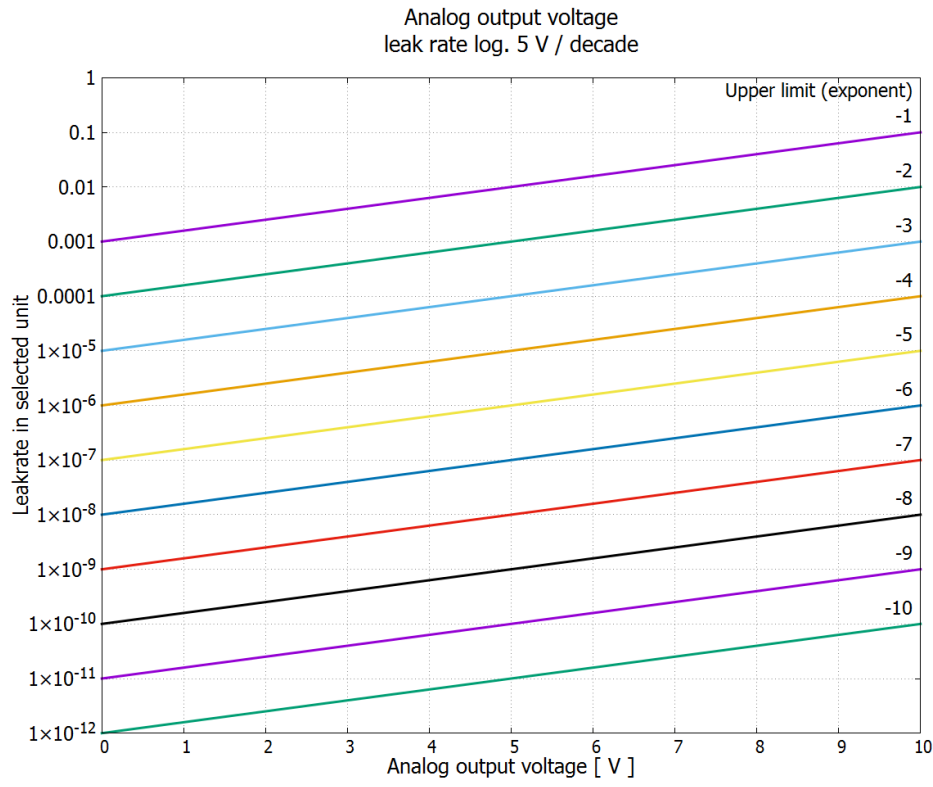


Fig. 13: Analogue output voltage leak rate log. 5 V / decade

**Output voltages in case of error** The following voltages will be applied at the analog outputs in the event of an error:

| Compatibility mode | Voltage |
|--------------------|---------|
| LDS1000            | 0V      |
| LDS2010            | 10V     |
| LDS3000            | 10.237V |

**Configuration (LDS2010-compatible)** The following table can be used for the transmission of settings from LDS2010 to LDS3000.

| LDS2010 setting.<br>Menu item 22 | Analog output channel | Function LDS2010                                                                                   | Function LDS3000     | Scaling of the leak rate | Upper limit (10 V = ...) |
|----------------------------------|-----------------------|----------------------------------------------------------------------------------------------------|----------------------|--------------------------|--------------------------|
| 1                                | 1                     | Leak rate mantissa in used unit.<br>1 ... 10V                                                      | Leak rate mantissa   | irrelevant               | irrelevant               |
| 1                                | 2                     | Leak rate exponent (step function) in used unit.<br>. 1 ... 10 V, 0.5 V / Decade, 1 V = 1E-12      | Leak rate exponent   | irrelevant               | irrelevant               |
| 2                                | 1                     | Leak rate log. in used unit.<br>1 ... 10 V, 0.5 V / Decade, 1 V = 1E-12                            | Leak rate log.       | 0.5V/dec.                | 1E6 [used unit]          |
| 2                                | 2                     | Pressure p1 log. in used unit.<br>1 ... 10 V, 0.5 V / Decade, 1 V = 1E-3 mbar                      | Pressure p1          | irrelevant               | irrelevant               |
| 3                                | 1                     | Leak rate mantissa in mbar·l/s<br>1 ... 10V                                                        | Leak rate mantissa   | irrelevant               | irrelevant               |
| 3                                | 2                     | Leak rate exponent (step function) in mbar·l/s<br>1 ... 10 V, -1 V / Decade, 0 V = 1E0 mbar l/s    | LR exponent inverted | irrelevant               | irrelevant               |
| 4                                | 1                     | Leak rate log.<br>0 ... 10 V, 1 V / Decade, 0 V = 1E-10 mbar l/s                                   | Leak rate log.       | 1V/dec.                  | 1.00E+00                 |
| 4                                | 2                     | Pressure p1 log. in mbar<br>1 V / decade, 2.5 ... 8.5 V,<br>2.5 V = 1E-3 mbar,<br>5.5 V = 1E0 mbar | p1 1V/dec.           | irrelevant               | irrelevant               |
| 5                                | 1                     | Leak rate mantissa in used unit.<br>1 ... 10 V rise, 0.7 ... 10 V fall                             | LR mantissa hyst.    | irrelevant               | irrelevant               |
| 5                                | 2                     | Leak rate exponent in used unit.<br>1 ... 10 V, 0.5 V / Decade, 0 V = 1E-14                        | Leak rate exponent   | irrelevant               | irrelevant               |
| 6                                | 1                     | Leak rate log. in Pa·m³/s<br>0 ... 10 V, 1 V/Decade,<br>0 V = 1E-12 Pa·m³/s = 1E-12 mbar l/s       | Leak rate log.       | 1V/dec.                  | 1E-2 mbar l/s            |
| 6                                | 2                     | Pressure p1 log. in Pa<br>1 V / decade, 2.5 ... 8.5 V, 2.5 V = 1E-3 mbar                           | p1 1V/dec.           | irrelevant               | irrelevant               |

| LDS2010 setting.<br>Menu item 22 | Analog output channel | Function LDS2010                                                                                                       | Function LDS3000 | Scaling of the leak rate | Upper limit (10 V = ...) |
|----------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------|--------------------------|
| 8                                | 1                     | Leak rate log. in Pa·m <sup>3</sup> /s<br>0 ... 10 V, 1 V/Decade,<br>0 V = 1E-12 Pa·m <sup>3</sup> /s = 1E-12 mbar l/s | Leak rate log.   | 1V/dec.                  | 1E-2 mbar l/s            |
| 8                                | 2                     | Pressure p2 log. in Pa<br>1 V / decade, 2.5 ... 8.5 V, 2.5 V = 1E-3 mbar                                               | p2 1V/dec.       | irrelevant               | irrelevant               |
| 9                                | 1                     | Pressure p1 log. in Pa<br>1 V / decade, 2.5 ... 8.5 V, 2.5 V = 1E-3 mbar                                               | p1 1V/dec.       | irrelevant               | irrelevant               |
| 9                                | 2                     | Pressure p2 log. in Pa<br>1 V / decade, 2.5 ... 8.5 V, 2.5 V = 1E-3 mbar                                               | p2 1V/dec.       | irrelevant               | irrelevant               |
| 10                               | 1                     | Leak rate log. in mbar l/s<br>0 ... 8 V, 2 V / Decade, 0 V = 1E-3 mbar l/s                                             | Leak rate log.   | 2V/dec.                  | 1E+2 mbar l/s            |
| 10                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 10 V, 3 V / Decade, 0 V = 1E-3 mbar l/s                                            | Leak rate log.   | Special 1                | 1E+1 mbar l/s            |
| 11                               | 1                     | Leak rate log. in mbar l/s<br>0 ... 8 V, 2 V / Decade, 0 V = 1E-4 mbar l/s                                             | Leak rate log.   | 2V/dec.                  | 1E+1 mbar l/s            |
| 11                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 10 V, 3 V / Decade, 0 V = 1E-4 mbar l/s                                            | Leak rate log.   | Special 1                | 1E+0 mbar l/s            |
| 12                               | 1                     | Leak rate log. in mbar l/s<br>0 ... 8 V, 2 V / Decade, 0 V = 1E-5 mbar l/s                                             | Leak rate log.   | 2V/dec.                  | 1E0 mbar l/s             |
| 12                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 10 V, 3 V / Decade, 0 V = 1E-5 mbar l/s                                            | Leak rate log.   | Special 1                | 1E-1 mbar l/s            |
| 13                               | 1                     | Leak rate log. in mbar l/s<br>0 ... 8 V, 2 V / Decade, 0 V = 1E-6 mbar l/s                                             | Leak rate log.   | 2V/dec.                  | 1E-1 mbar l/s            |
| 13                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 10 V, 3 V / Decade, 0 V = 1E-6 mbar l/s                                            | Leak rate log.   | Special 1                | 1E-2 mbar l/s            |
| 14                               | 1                     | Leak rate log. in mbar l/s<br>0 ... 8 V, 2 V / Decade, 0 V = 1E-7 mbar l/s                                             | Leak rate log.   | 2V/dec.                  | 1E-2 mbar l/s            |
| 14                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 10 V, 3 V / Decade, 0 V = 1E-7 mbar l/s                                            | Leak rate log.   | Special 1                | 1E-3 mbar l/s            |

| LDS2010 setting.<br>Menu item 22 | Analog output channel | Function LDS2010                                                             | Function LDS3000 | Scaling of the leak rate | Upper limit (10 V = ...) |
|----------------------------------|-----------------------|------------------------------------------------------------------------------|------------------|--------------------------|--------------------------|
| 15                               | 1                     | Leak rate log. in mbar l/s<br>0 ... 8 V, 2 V / Decade, 0 V = 1E-8 mbar l/s   | Leak rate log.   | 2V/dec.                  | 1E-3 mbar l/s            |
| 15                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 10 V, 3 V / Decade, 0 V = 1E-8 mbar l/s  | Leak rate log.   | Special 1                | 1E-4 mbar l/s            |
| 16                               | 1                     | Leak rate log. in mbar l/s<br>0 ... 8 V, 2 V / Decade, 0 V = 1E-9 mbar l/s   | Leak rate log.   | 2V/dec.                  | 1E-4 mbar l/s            |
| 16                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 10 V, 3 V / Decade, 0 V = 1E-9 mbar l/s  | Leak rate log.   | Special 1                | 1E-5 mbar l/s            |
| 17                               | 1                     | Leak rate log. in mbar l/s<br>0 ... 8 V, 2 V / Decade, 0 V = 1E-10 mbar l/s  | Leak rate log.   | 2V/dec.                  | 1E-5 mbar l/s            |
| 17                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 10 V, 3 V / Decade, 0 V = 1E-10 mbar l/s | Leak rate log.   | Special 1                | 1E-6 mbar l/s            |
| 18                               | 1                     | Leak rate log. in mbar l/s<br>0 ... 8 V, 2 V / Decade, 0 V = 1E-11 mbar l/s  | Leak rate log.   | 2V/dec.                  | 1E-6 mbar l/s            |
| 18                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 10 V, 3 V / Decade, 0 V = 1E-11 mbar l/s | Leak rate log.   | Special 1                | 1E-7 mbar l/s            |
| 20                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1 mbar l/s                   | Linear leak rate | irrelevant               | 1E1 mbar l/s             |
| 20                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-3 mbar l/s   | Leak rate log.   | 1V/dec.                  | 1E7 mbar l/s             |
| 21                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1E-1 mbar l/s                | Linear leak rate | irrelevant               | 1E0 mbar l/s             |
| 21                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-4 mbar l/s   | Leak rate log.   | 1V/dec.                  | 1E6 mbar l/s             |
| 22                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1E-2 mbar l/s                | Linear leak rate | irrelevant               | 1E-1 mbar l/s            |
| 22                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-5 mbar l/s   | Leak rate log.   | 1V/dec.                  | 1E5 mbar l/s             |
| 23                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1E-3 mbar l/s                | Linear leak rate | irrelevant               | 1E-2 mbar l/s            |

| LDS2010 setting.<br>Menu item 22 | Analog output channel | Function LDS2010                                                            | Function LDS3000 | Scaling of the leak rate | Upper limit (10 V = ...) |
|----------------------------------|-----------------------|-----------------------------------------------------------------------------|------------------|--------------------------|--------------------------|
| 23                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-6 mbar l/s  | Leak rate log.   | 1V/dec.                  | 1E4 mbar l/s             |
| 24                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1E-4 mbar l/s               | Linear leak rate | irrelevant               | 1E-3 mbar l/s            |
| 24                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-7 mbar l/s  | Leak rate log.   | 1V/dec.                  | 1E3 mbar l/s             |
| 25                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1E-5 mbar l/s               | Linear leak rate | irrelevant               | 1E-4 mbar l/s            |
| 25                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-8 mbar l/s  | Leak rate log.   | 1V/dec.                  | 1E2 mbar l/s             |
| 26                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1E-6 mbar l/s               | Linear leak rate | irrelevant               | 1E-5 mbar l/s            |
| 26                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-9 mbar l/s  | Leak rate log.   | 1V/dec.                  | 1E1 mbar l/s             |
| 27                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1E-7 mbar l/s               | Linear leak rate | irrelevant               | 1E-6 mbar l/s            |
| 27                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-10 mbar l/s | Leak rate log.   | 1V/dec.                  | 1E0 mbar l/s             |
| 28                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1E-8 mbar l/s               | Linear leak rate | irrelevant               | 1E-7 mbar l/s            |
| 28                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-11 mbar l/s | Leak rate log.   | 1V/dec.                  | 1E-1 mbar l/s            |
| 29                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1E-9 mbar l/s               | Linear leak rate | irrelevant               | 1E-8 mbar l/s            |
| 29                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-11 mbar l/s | Leak rate log.   | 1V/dec.                  | 1E-1 mbar l/s            |
| 30                               | 1                     | Leak rate lin. In mbar l/s<br>0 ... 10 V, 1 V = 1E-10 mbar l/s              | Linear leak rate | irrelevant               | 1E-9 mbar l/s            |
| 30                               | 2                     | Leak rate log. in mbar l/s<br>0 ... 4 V, 1 V / Decade, 0 V = 1E-11 mbar l/s | Leak rate log.   | 1V/dec.                  | 1E-1 mbar l/s            |

**Analog input readout**

- No function can be configured for the analog input.
- It is reserved for future applications.

- LD command 220 can be used to read out the voltage value on the analog input.

### 7.2.2.1 Assigning the digital inputs of the I/O module

The digital inputs PLC-IN 1 ... The available functions can be assigned in any way necessary to the 10 I/O module.

- Active signal: typically 24V
- Inactive signal: typically 0 V.

The 24V output of the I/O module can be used as an active signal.

Every function can be inverted.

Possible functions: see the following table

|                |                                                                                        |
|----------------|----------------------------------------------------------------------------------------|
| Control unit   | Settings > Set up > Interfaces > I/O module > Digital inputs > Configuration PLC Input |
| LD protocol    | Command 438                                                                            |
| ASCII protocol | *CONFig:PLCINLINK:1 (2 ... 10)                                                         |

**Key-operated switch** An external key switch with up to three switching outputs can be connected via three PLC inputs. The key switch can be used to select the access level of the operator of the control unit.

Button 1 - Operator

Button 2 - Supervisor

Button 3 - Integrator

Example for a suitable key switch: Hopt+Schuler, No. 444-05

Functions, assignment of digital inputs:

| Function     | Flank/<br>state:                       | Description                                                                                                      |
|--------------|----------------------------------------|------------------------------------------------------------------------------------------------------------------|
| No function  | -                                      | No function                                                                                                      |
| CAL dynam.   | inactive→ active:<br>active→ inactive: | Start external dynamic calibration.<br>Apply value for background and finish calibration.                        |
| CAL external | inactive→ active:<br>active→ inactive: | Start external calibration.<br>Apply value for background and finish calibration.                                |
| Internal CAL | inactive→ active:                      | Start internal calibration.                                                                                      |
| SNIF/VAC     | inactive→ active:<br>active→ inactive: | Enable sniffer mode.<br>Enable vacuum mode.                                                                      |
| START        | inactive→ active:                      | Switch to Meas. (ZERO is possible, all trigger outputs switch depending on the leak rate.)                       |
| Stop         | inactive→ active:                      | Switch to Standby. (ZERO is not possible, all trigger outputs will return "Leak rate threshold value exceeded".) |
| ZERO         | inactive→ active:<br>active→ inactive: | Switch ZERO on.<br>Switch ZERO off.                                                                              |
| ZERO pulse   | inactive→ active:                      | Switching ZERO on or off.                                                                                        |
| Delete       | inactive→ active:                      | Erase warning or error message / cancel calibration.                                                             |
| Gas ballast  | inactive→ active:<br>active→ inactive: | Open gas ballast valve.<br>Close gas ballast valve unless always open.                                           |

| Function                     | Flank/<br>state:  | Description                                                                                                                                                                                                                                                  |
|------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Selection dyn/<br>norm       | inactive→ active: | External calibration mode with activation of digital input "CAL":                                                                                                                                                                                            |
|                              | active→ inactive: | External dynamic calibration (without auto tune, allowing for the measuring times and pump cycle times set via the digital inputs)<br>External normal calibration (with auto tune, not considering the system-specific measuring times and pump cycle times) |
| Start / Stop                 | inactive→ active: | Switch to Meas. (ZERO is possible, all trigger outputs switch depending on the leak rate.)                                                                                                                                                                   |
|                              | active→ inactive: | Switch to Standby. (ZERO is not possible, all trigger outputs will return "Fail".)                                                                                                                                                                           |
| Key 1                        | active:           | User "Operator"                                                                                                                                                                                                                                              |
| Key 2                        | active:           | User "Supervisor"                                                                                                                                                                                                                                            |
| Key 3                        | active:           | User "Integrator"                                                                                                                                                                                                                                            |
| CAL                          | inactive→ active: | When set to Standby, the device will start an internal calibration.<br>When set to Meas, the device will start an external calibration.                                                                                                                      |
| ZERO update                  | inactive→ active: | Update or switch on ZERO                                                                                                                                                                                                                                     |
|                              | active→ inactive: | No function                                                                                                                                                                                                                                                  |
| Calibration leak<br>open     | inactive→ active: | Open internal test leak                                                                                                                                                                                                                                      |
|                              | active→ inactive: | Close internal test leak                                                                                                                                                                                                                                     |
| calibration leak<br>on pulse | inactive→ active: | Open internal test leak if closed or close if open                                                                                                                                                                                                           |
| Flow                         | inactive→ active: | Switch flow of SL3000XL to 3000 sccm (XL adapter)                                                                                                                                                                                                            |
|                              | active→ inactive: | Switch flow of SL3000XL to 300 sccm (XL adapter)                                                                                                                                                                                                             |
| CAL machine                  | inactive→ active: | Determining the machine factor or of the sniff factor                                                                                                                                                                                                        |
| Internal CAL<br>check        | inactive→ active: | Check calibration with internal calibration leak                                                                                                                                                                                                             |
| External CAL<br>check        | inactive→ active: | Check calibration with external calibration leak                                                                                                                                                                                                             |
| Start / Stop<br>impulse      | inactive→ active: | Switching between measuring operation and standby                                                                                                                                                                                                            |
| Mass 2 / Mass 4              | inactive→ active: | Activate mass 4                                                                                                                                                                                                                                              |
|                              | active→ inactive: | Activate mass 2                                                                                                                                                                                                                                              |
| Peakfind                     | inactive→ active: | Start peak determination (AQ only)                                                                                                                                                                                                                           |

### 7.2.2.2 Assigning the digital outputs of the I/O module

The digital outputs PLC-OUT 1 ... The available functions can be assigned in any way necessary to the 8 I/O module.

Every function can be inverted.

Possible functions: see the following table

|                |                                                                                          |
|----------------|------------------------------------------------------------------------------------------|
| Control unit   | Settings > Set up > Interfaces > I/O module > Digital outputs > Configuration PLC Output |
| LD protocol    | Command 263                                                                              |
| ASCII protocol | *CONFig:PLCOUTLINK:1 (2 ... 8)                                                           |

Functions, assignment of digital outputs:

| Function    | State:  | Description                                                                                                                                                   |
|-------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Open        | open:   | always open                                                                                                                                                   |
| Trigger 1   | closed: | Value exceeded leak rate threshold Trigger 1                                                                                                                  |
|             | open:   | Value fell below leak rate threshold Trigger 1                                                                                                                |
| Trigger 2   | closed: | Value exceeded leak rate threshold Trigger 2                                                                                                                  |
|             | open:   | Value fell below leak rate threshold Trigger 2                                                                                                                |
| Trigger 3   | closed: | Value exceeded leak rate threshold Trigger 3                                                                                                                  |
|             | open:   | Value fell below leak rate threshold Trigger 3                                                                                                                |
| Trigger 4   | closed: | Value exceeded leak rate threshold Trigger 4                                                                                                                  |
|             | open:   | Value fell below leak rate threshold Trigger 4                                                                                                                |
| Ready       | closed: | Emission switched on, calibration process inactive, no error                                                                                                  |
|             | open:   | Emission switched off or calibration process active or error                                                                                                  |
| Warning     | closed: | Warning                                                                                                                                                       |
|             | open:   | no warning                                                                                                                                                    |
| Error       | closed: | Error                                                                                                                                                         |
|             | open:   | no error                                                                                                                                                      |
| CAL active  | closed: | Device is to be calibrated.                                                                                                                                   |
|             | open:   | Device is not to be calibrated.                                                                                                                               |
| CAL request | closed: | and no external calibration: Calibration request (with temperature change from 5°C or 30 minutes after the start-up or if default rotation speed was changed) |
|             | closed: | and external calibration or "CAL check": Request "Open or close external calibrated leak"                                                                     |
|             | open:   | no request                                                                                                                                                    |
| Run-up      | closed: | Run-up                                                                                                                                                        |
|             | open:   | no run-up                                                                                                                                                     |
| ZERO active | closed: | ZERO switched on                                                                                                                                              |
|             | open:   | ZERO switched off                                                                                                                                             |
| Emission on | closed: | Emission switched on                                                                                                                                          |
|             | open:   | Emission switched off                                                                                                                                         |
| Measure     | closed: | Measuring (ZERO is possible, all trigger outputs switch depending on the leak rate.)                                                                          |
|             | open:   | Standby or emission disabled (ZERO is not possible, all trigger outputs will return "Leak rate threshold value exceeded".)                                    |



| Function              | State:  | Description                                                                                                                  |
|-----------------------|---------|------------------------------------------------------------------------------------------------------------------------------|
| Standby               | closed: | Standby (ZERO is not possible, all trigger outputs will return "Leak rate threshold value exceeded".)                        |
|                       | open:   | Measuring (ZERO is possible, all trigger outputs switch depending on the leak rate.)                                         |
| SNIF                  | closed: | SNIF                                                                                                                         |
|                       | open:   | VAC                                                                                                                          |
| Error or warning      | closed: | Error or warning                                                                                                             |
|                       | open:   | No error or warning                                                                                                          |
| Gas ballast           | closed: | Gas ballast is active                                                                                                        |
|                       | open:   | Gas ballast is inactive                                                                                                      |
| Calibration leak open | closed: | calibration leak is active                                                                                                   |
|                       | open:   | calibration leak is inactive                                                                                                 |
| CAL stable            | closed: | Not for AQ devices:<br>"Open or close external calibration leak" prompt (see "External Calibration Configuration and Start") |
|                       | open:   | Assignment not stable or calibration is inactive                                                                             |
| Cathode 2             | closed: | Cathode 2 is active                                                                                                          |
|                       | open:   | Cathode 1 is active                                                                                                          |
| ZERO stable           | closed: | Not for AQ devices:<br>EcoBoost message stable                                                                               |
|                       | open:   | EcoBoost message not stable<br>See also "Suppressing decreasing gas backgrounds with EcoBoost".                              |

## 7.3 Settings for bus module BM1000

### Address of bus module

Setting the bus module address. (Node address with Profibus, MACID with DeviceNet)

0 ... 255

|                |                                                       |
|----------------|-------------------------------------------------------|
| Control unit   | Settings > Set up > Interfaces > Bus module > Address |
| LD protocol    | 326                                                   |
| ASCII protocol | -                                                     |

## 8 Warning and error messages

The device is equipped with extensive self-diagnostic functions.

### Error messages

Errors are events that the device cannot correct itself and that force interruption of its operation. The error message consists of a number and a descriptive text.

After you have removed the cause of the error, start operation again with the restart button.

### Warnings

Warnings warn of device states that can impair the accuracy of measurements. Operation of the device is not interrupted.

Confirm acknowledgment of the warning with the OK key or the right key on the sniffer handle.

The following table displays all the warnings and error messages. It lists possible causes for the malfunction and instructions on how to eliminate these.

Please note that work marked with an asterisk must be carried out only by service staff that is authorized by INFICON.

| Warning<br>(Wrn)<br><br>Error<br>(Err)          | Error message<br>LDS3000                            | Error number        |                                                                                 | Limit<br>values | Cause                                                                                            |
|-------------------------------------------------|-----------------------------------------------------|---------------------|---------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------|
|                                                 |                                                     | LDS1000<br>Protocol | Binary or<br>ASCII<br>protocol<br>compatibili<br>ty mode<br>LDS1000/<br>LDS2010 |                 |                                                                                                  |
| 1xx system error (RAM, ROM, EEPROM, clock, ...) |                                                     |                     |                                                                                 |                 |                                                                                                  |
| Wrn102                                          | Timeout EEPROM MSB<br>Box (Parameter number)        | 84                  | 43                                                                              |                 | EEPROM on IF board or MSB<br>defective                                                           |
| Wrn104                                          | An EEPROM parameter is<br>initializing              | 84                  | 43                                                                              |                 | Following software update or<br>EEPROM defective                                                 |
| Wrn106                                          | EEPROM parameter<br>initializing                    | 84                  | 43                                                                              |                 | Following software update or<br>EEPROM defective                                                 |
| Wrn110                                          | Clock not set                                       | 16                  | 16                                                                              |                 | Jumper for clock not set, battery<br>drained, clock defective                                    |
| Wrn122                                          | No response from the BUS<br>module                  | 99                  | 99                                                                              |                 | Connection to BUS module<br>interrupted                                                          |
| Wrn123                                          | Unsupported<br>configuration INFICON<br>from BM1000 | 99                  | 99                                                                              |                 | The selected configuration is not<br>supported by the connected<br>INFICON BM1000-fieldbus type. |
| Wrn125                                          | I/O module not connected                            | 99                  | 99                                                                              |                 | Connection to I/O module<br>interrupted                                                          |
| Wrn127                                          | Wrong bootloader version                            | 99                  | 99                                                                              |                 | Boot loader not compatible with<br>application                                                   |
| Err129                                          | Incorrect device<br>(EEPROM)                        | 99                  | 99                                                                              |                 | EEPROM does not contain any<br>compatible data                                                   |

| Warning<br>(Wrn)<br>Error<br>(Err) | Error message<br>LDS3000                             | Error number        |                                                                                 | Limit<br>values | Cause                                                                                                               |
|------------------------------------|------------------------------------------------------|---------------------|---------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------|
|                                    |                                                      | LDS1000<br>Protocol | Binary or<br>ASCII<br>protocol<br>compatibili<br>ty mode<br>LDS1000/<br>LDS2010 |                 |                                                                                                                     |
| Err130                             | Sniffer not connected                                | 99                  | 99                                                                              |                 | The sniffer line is not electrical connected.<br><br>Not for AQ devices: See also "Setting capillary surveillance". |
| Wrn132                             | SL3000 not supported                                 | 99                  | 99                                                                              |                 | Only the SL3000XL may be used with the XL Sniffer Adapter                                                           |
| Wrn150                             | Pressure sensor 2 is not connected                   | 62                  | 146                                                                             |                 | Pressure sensor P2 not connected or defective.<br><br>IF-Board or MSB defective.                                    |
| Wrn153                             | The version of the CU1000 software is outdated       | 99                  | 99                                                                              |                 | Update of CU1000 software recommended                                                                               |
| Wrn156                             | Wrong ID AQ mode                                     | 99                  | 99                                                                              |                 | Wrong ID AQ mode                                                                                                    |
| <b>2xx operating voltage error</b> |                                                      |                     |                                                                                 |                 |                                                                                                                     |
| Wrn201                             | U24_MSB too low                                      | 24                  | 120                                                                             | 21.6V           | 24V power supply pack                                                                                               |
| Wrn202                             | U24_MSB too high                                     | 24                  | 120                                                                             | 26.4V           | 24V power supply pack                                                                                               |
| Wrn203                             | 24V_PWR12 voltage out of range (TL_valve/GB_valve)   | 24                  | 120                                                                             | 20V<br>30V      | Short circuit at valve 1 (calibrated leak) or valve 2 (gas ballast)                                                 |
| Wrn204                             | 24V_PWR34 voltage out of range (valve 3/4)           | 24                  | 120                                                                             | 20V<br>30V      | Short circuit at valve 3 or valve 4                                                                                 |
| Wrn205                             | 24V_PWR56 voltage out of range (Sniff_valve/valve6)  | 24                  | 120                                                                             | 20V<br>30V      | Short circuit at valve 5 (sniff) or valve 6                                                                         |
| Wrn221                             | Internal voltage 24V_RC voltage out of range         | 24                  | 120                                                                             | 20V<br>30V      | Short circuit 24V at the control unit output                                                                        |
| Wrn222                             | Internal voltage 24V_IO voltage out of range         | 24                  | 120                                                                             | 20V<br>30V      | Short circuit 24V at IO output                                                                                      |
| Wrn223                             | Internal voltage 24V_TMP voltage out of range        | 24                  | 120                                                                             | 20V<br>30V      | Short circuit 24V of the TMP                                                                                        |
| Wrn224                             | Internal voltage 24V_1 (Pirani) voltage out of range | 24                  | 120                                                                             | 20V<br>30V      | Short circuit 24V<br><br>Pressure sensor PSG500 (1,2,3), sniffer line                                               |
| Wrn240                             | Voltage +15V out of range                            | 24                  | 120                                                                             |                 | +15V too low, IF board or MSB defective                                                                             |
| Wrn241                             | Voltage -15V out of range                            | 24                  | 120                                                                             |                 | -15V too low, short circuit at preamplifier, IF board or MSB defective                                              |

| Warning<br>(Wrn)<br>Error<br>(Err)                                                           | Error message<br>LDS3000       | Error number        |                                                                                 | Limit<br>values                       | Cause                                                                                                       |
|----------------------------------------------------------------------------------------------|--------------------------------|---------------------|---------------------------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------|
|                                                                                              |                                | LDS1000<br>Protocol | Binary or<br>ASCII<br>protocol<br>compatibili<br>ty mode<br>LDS1000/<br>LDS2010 |                                       |                                                                                                             |
| Err242                                                                                       | +15V or -15V voltage shorted   | 24                  | 120                                                                             |                                       | +15V or -15V too low, short circuit at preamplifier, IF board or MSB defective                              |
| Wrn250                                                                                       | REF5V voltage out of range     | 24                  | 120                                                                             | 4.5V<br>5.5V                          | +15V or 5V too low, short circuit at preamplifier, IF board or MSB defective                                |
| Err252                                                                                       | REF5V voltage shorted          | 24                  | 120                                                                             |                                       | +15V or REF5V too low, short circuit at preamplifier, IF board or MSB defective                             |
| <b>3xx detection system (offset preamplifier, preamplifier test, emission, cathode test)</b> |                                |                     |                                                                                 |                                       |                                                                                                             |
| Wrn300                                                                                       | Anode voltage too low          | 41                  | 132                                                                             | 7V < the setpoint                     | Short circuit anode voltage, pressure in mass spectrometer too high, IF board, MSB or ion source defective  |
| Wrn301                                                                                       | Anode voltage too high         | 40                  | 131                                                                             | 7V > the setpoint                     | MSB defective                                                                                               |
| Wrn302                                                                                       | Suppressor voltage too low     | 39                  | 130                                                                             | 297V                                  | Short circuit suppressor, IF board or MSB defective                                                         |
| Wrn303                                                                                       | Suppressor voltage too high    | 38                  | 129                                                                             | 363V                                  | MSB defective                                                                                               |
| Wrn304                                                                                       | Anode-cathode voltage too low  | 36                  | 127                                                                             | 40V                                   | Short circuit anode-cathode, IF board or MSB defective                                                      |
| Wrn305                                                                                       | Anode-cathode voltage too high | 35                  | 126                                                                             | 140V                                  | MSB defective                                                                                               |
| Err306                                                                                       | Anode voltage faulty           | 36                  | 127                                                                             | 40 V deviation from the default value | The anode voltage does not match the default value or the set value is outside the allowable setting range. |
| Wrn310                                                                                       | Cathode 1 is defective         | 45                  | 136                                                                             |                                       | Cathode defective, line to cathode interrupted, IF board or MSB defective                                   |
| Wrn311                                                                                       | Cathode 2 is defective         | 46                  | 137                                                                             |                                       | Cathode defective, line to cathode interrupted, IF board or MSB defective                                   |
| Err312                                                                                       | Cathode defective              | 47                  | 138                                                                             |                                       | Cathode defective, line to cathode interrupted, IF board or MSB defective                                   |
| Wrn332                                                                                       | System helium contaminated     | 62                  | 146                                                                             |                                       | Leak rate too negative (e.g., below - 0.15 * Trigger 1). The reaction time of the warning can be adjusted.  |

| Warning (Wrn)<br>Error (Err)            | Error message<br>LDS3000                 | Error number     |                                                             | Limit values                                                                                 | Cause                                                                                   |
|-----------------------------------------|------------------------------------------|------------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
|                                         |                                          | LDS1000 Protocol | Binary or ASCII protocol compatibility mode LDS1000/LDS2010 |                                                                                              |                                                                                         |
| Wrn334                                  | Sudden increase in leak rate             | 62               | 146                                                         |                                                                                              | Gross leak                                                                              |
| Err340                                  | Emission error                           | 44               | 135                                                         | < 90% of the target value<br>> 110% of the target value                                      | Emission was stable previously, pressure probably too high, message after 15s           |
| Wrn342                                  | Cathodes not connected                   | 47               | 138                                                         |                                                                                              | Both cathodes defective during self-testing after switch on or plug not connected       |
| Wrn350                                  | Suppressor not connected                 | 39               | 130                                                         |                                                                                              | Suppressor cable is not plugged in or defective during the self-test after switching on |
| Wrn352                                  | Preamplifier not connected               | 33               | 60                                                          |                                                                                              | Preamplifier defective, cable not plugged in                                            |
| Err358                                  | Preamplifier oscillates between 2 ranges | 31               | 123                                                         |                                                                                              | Signal varies too much (see command 1120)<br>Preamplifier defective                     |
| Wrn359                                  | Overdriven preamplifier                  | 31               | 123                                                         |                                                                                              | Signal too large preamplifier defective                                                 |
| Wrn360                                  | Preamplifier output too low              | 31               | 123                                                         | < -70 mV at 500 GΩ                                                                           | Poor ion source or contaminated mass spectrometer                                       |
| Wrn361                                  | Preamplifier offset too high             | 31               | 123                                                         | > +/-50 mV at 500 GΩ,<br>> +/-10 mV at 15 GΩ,<br>< +/-10 mV at 470 MΩ,<br>< +/-9 mV at 13 MΩ | Preamplifier defective                                                                  |
| Wrn362                                  | Preamplifier range error                 | 31               | 123                                                         |                                                                                              | Preamplifier or MSB box defective                                                       |
| Wrn390                                  | 500 G outside the range                  | 31               | 123                                                         | 450 GΩ<br>550 GΩ                                                                             | Preamplifier defective, error at the suppressor, IF board or MSB defective              |
| <b>4xx TMP fault (also temperature)</b> |                                          |                  |                                                             |                                                                                              |                                                                                         |
| Err400                                  | TMP fault number                         | 49               | 15                                                          |                                                                                              |                                                                                         |

| Warning<br>(Wrn)<br><br>Error<br>(Err) | Error message<br>LDS3000                 | Error number        |                                                                                 | Limit<br>values                 | Cause                                                                                                                                                           |
|----------------------------------------|------------------------------------------|---------------------|---------------------------------------------------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                        |                                          | LDS1000<br>Protocol | Binary or<br>ASCII<br>protocol<br>compatibili<br>ty mode<br>LDS1000/<br>LDS2010 |                                 |                                                                                                                                                                 |
| Wrn401                                 | TMP warning number                       | 49                  | 15                                                                              |                                 |                                                                                                                                                                 |
| Err402                                 | No communication with<br>TMP             | 49                  | 15                                                                              |                                 | Cable to TMP / TMP defective, IF<br>board or MSB defective                                                                                                      |
| Err403                                 | TMP rotation speed too<br>low            | 53                  | 142                                                                             | < 95% of<br>the target<br>value | Pressure too high, TMP defective                                                                                                                                |
| Err404                                 | TMP current consumption<br>too high      | 49                  | 2                                                                               | 3A                              |                                                                                                                                                                 |
| Err405                                 | No TMP run-up                            | 60                  | 61                                                                              | 5 min.                          | Pressure too high, TMP faulty                                                                                                                                   |
| Err410                                 | TMP temperature too high                 | 49                  | 2                                                                               |                                 | Cooling failed, check MSB<br>module operating conditions                                                                                                        |
| Wrn411                                 | High TMP temperature                     | 49                  | 2                                                                               |                                 | Cooling failed, check MSB<br>module operating conditions                                                                                                        |
| Err420                                 | TMP voltage too high                     | 49                  | 2                                                                               |                                 | Power supply defective, TMP<br>defective                                                                                                                        |
| Wrn421                                 | TMP voltage too low                      |                     |                                                                                 |                                 | Cable cross-section 24 V supply<br>for MSB modules too low, output<br>current 24-V power supply too<br>low (I < 10 A), power supply<br>defective, TMP defective |
| Err422                                 | TMP no run-up time                       | 49                  | 2                                                                               | 8 min.                          | TMP foreline pressure too high,<br>VV pump final pressure too high,<br>leakage high vacuum system,<br>flood valve not close, TMP<br>bearing damage, TMP flawed  |
| Err423                                 | TMP pressure rise                        | 49                  | 2                                                                               |                                 | Inrush of air, flood valve defective<br>or incorrectly dimensioned                                                                                              |
| <b>5xx Pressure and flow errors</b>    |                                          |                     |                                                                                 |                                 |                                                                                                                                                                 |
| Wrn500                                 | Pressure sensor not<br>connected         | 58                  | 144                                                                             | 0.5V                            | Pressure sensor PSG500 P1 not<br>connected, IF board or MSB<br>defective                                                                                        |
| Wrn502                                 | XL Sniffer adapter not<br>connected      | 58                  | 144                                                                             |                                 | XL Sniffer Adapter not connected<br>or defective, IF board or MSB<br>defective.                                                                                 |
| Wrn520                                 | Pressure too high                        | 73                  | 148                                                                             | 18 mbar                         | Pressure p1 too high                                                                                                                                            |
| Wrn521                                 | Pressure rise, anode<br>voltage collapse | 73                  | 148                                                                             | < Setpoint<br>- 20V             | Pressure p1 too high, message<br>after 1.4s                                                                                                                     |

| Warning (Wrn)<br>Error (Err)  | Error message<br>LDS3000                                 | Error number     |                                                             | Limit values                                            | Cause                                                                                                               |
|-------------------------------|----------------------------------------------------------|------------------|-------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
|                               |                                                          | LDS1000 Protocol | Binary or ASCII protocol compatibility mode LDS1000/LDS2010 |                                                         |                                                                                                                     |
| Wrn522                        | Pressure rise, emission collapsed                        | 73               | 148                                                         | < 90% of the target value<br>> 110% of the target value | Emission was stable previously, pressure p1 too high, message after 5s                                              |
| Wrn540                        | Pressure too low, Sniffer blocked                        | 63               | 62                                                          | Sniffer flow warning parameter                          | Sniffer clogged, sniffer valve defective, filter clogged                                                            |
| Err541                        | Sniffer blocked (p1)                                     | 62               | 146                                                         |                                                         | Sniffer blocked, sniffer valve defective (pressure lower than half of the configured warning value), filter clogged |
| Wrn542                        | Sniffer broken                                           | 64               | 147                                                         |                                                         | Sniffer broken                                                                                                      |
| Wrn550                        | Pressure too low, XL Sniffer blocked                     | 63               | 62                                                          |                                                         | Clean or replace the high flow capillary of the sniffer line.<br>Replace dirty filter.                              |
| Wrn552                        | XL Sniffer broken                                        | 64               | 147                                                         |                                                         | Replace the high flow capillary of the sniffer line.                                                                |
| Wrn554                        | XL Sniffer P2 too small                                  | 63               | 62                                                          |                                                         | Pressure on SL3000XL too low in low flow.                                                                           |
| Wrn556                        | Throttle added                                           | 63               | 62                                                          |                                                         | Pressure too low (p1)                                                                                               |
| Err557                        | Throttle blocked                                         | 62               | 146                                                         |                                                         | Pressure too low (p1)                                                                                               |
| <b>6xx Calibration errors</b> |                                                          |                  |                                                             |                                                         |                                                                                                                     |
| Wrn600                        | Calibration factor too low                               | 81               | 153                                                         | 0.01                                                    | Calibration leak or machine factor set incorrectly                                                                  |
| Wrn601                        | Calibration factor too high                              | 81               | 153                                                         | 10000                                                   | Calibrated leak or machine factor set incorrectly, partial flow factor too high                                     |
| Wrn602                        | KalFaktor lower than last calibration                    | 81               | 153                                                         | < 50% of the old value                                  | Calibrated leak, machine factor or partial flow factor has changed                                                  |
| Wrn603                        | KalFaktor higher than last calibration                   | 81               | 153                                                         | > 200% of the old value                                 | Calibrated leak, machine factor or partial flow factor has changed                                                  |
| Wrn604                        | Int. Cal. not possible, lack of calibration leak control | 81               | 153                                                         |                                                         | calibration leak is not enabled                                                                                     |
| Wrn605                        | Difference during calibration too small                  | 78               | 151                                                         |                                                         | Calibration leak defective or signal too weak.                                                                      |

| Warning<br>(Wrn)<br><br>Error<br>(Err)                    | Error message<br>LDS3000                               | Error number        |                                                                                 | Limit<br>values         | Cause                                                                                                                                                                                                                       |
|-----------------------------------------------------------|--------------------------------------------------------|---------------------|---------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                           |                                                        | LDS1000<br>Protocol | Binary or<br>ASCII<br>protocol<br>compatibili<br>ty mode<br>LDS1000/<br>LDS2010 |                         |                                                                                                                                                                                                                             |
| Wrn610                                                    | Machine factor too low                                 | 81                  | 153                                                                             | 1.00E-04                | Machine factor adjustment inaccurate                                                                                                                                                                                        |
| Wrn611                                                    | Machine factor too high                                | 81                  | 153                                                                             | 1.00E+04                | Machine factor adjustment inaccurate, partial flow factor too high                                                                                                                                                          |
| Wrn612                                                    | Machine factor lower than last time                    | 81                  | 153                                                                             | < 50% of the old value  | Partial flow factor has changed                                                                                                                                                                                             |
| Wrn613                                                    | Machine factor greater than last time                  | 81                  | 153                                                                             | > 200% of the old value | Partial flow factor has changed                                                                                                                                                                                             |
| Wrn625                                                    | Int. calibration leak not set                          | 99                  | 99                                                                              |                         | Leak rate of int. calibration leak is still set to factory setting                                                                                                                                                          |
| Wrn626                                                    | Ext. Calibration leak not set                          | 99                  | 99                                                                              |                         | Leak rate of calibration leak is still set to factory setting                                                                                                                                                               |
| Wrn630                                                    | Calibration request                                    | 99                  | 99                                                                              |                         | Among other things when changing the speed specification or preamplifier temperature by 5°C since the last calibration                                                                                                      |
| Wrn650                                                    | Calibration is not recommended in the first 20 minutes | 0                   | 0                                                                               |                         | A calibration during the first 20 minutes after starting (warm-up phase) the leak detector is not recommended.<br><br>The warning message can be turned off:<br>- LD protocol: Bef 429<br>- ASCII: *CONFig:CALWarn (ON,OFF) |
| Wrn670                                                    | Calibration error                                      | 81                  | 153                                                                             |                         | Since a problem has occurred during the calibration, you have to recalibrate.                                                                                                                                               |
| Wrn671                                                    | Peak not found                                         | 81                  | 153                                                                             |                         | The signal was too restless during the peak search. Calibration has been aborted.                                                                                                                                           |
| Wrn680                                                    | Deviation to the calibration detected                  | 0                   | 0                                                                               |                         | The verification of calibration has shown that you should recalibrate.                                                                                                                                                      |
| <b>7xx temperature errors (preamplifier, electronics)</b> |                                                        |                     |                                                                                 |                         |                                                                                                                                                                                                                             |
| Wrn700                                                    | Preamplifier temp. too low                             | 33                  | 60                                                                              | 2°C                     | Temperature too low                                                                                                                                                                                                         |
| Wrn702                                                    | Preamplifier temp. too high                            | 32                  | 124                                                                             | 60°C                    | Temperature too high                                                                                                                                                                                                        |



| Warning<br>(Wrn)<br>Error<br>(Err)  | Error message<br>LDS3000         | Error number        |                                                                                 | Limit<br>values | Cause                                                  |
|-------------------------------------|----------------------------------|---------------------|---------------------------------------------------------------------------------|-----------------|--------------------------------------------------------|
|                                     |                                  | LDS1000<br>Protocol | Binary or<br>ASCII<br>protocol<br>compatibili<br>ty mode<br>LDS1000/<br>LDS2010 |                 |                                                        |
| Err709                              | MSB Temperature too low          | 55                  | 99                                                                              | -21°C           | Temperature too low or<br>temperature sensor defective |
| Wrn710                              | MSB temperature too high         | 54                  | 44                                                                              | 55°C            | Temperature too high                                   |
| Err711                              | Max. MSB temperature<br>exceeded | 54                  | 44                                                                              | 65°C            | Temperature too high                                   |
| <b>8xx not used</b>                 |                                  |                     |                                                                                 |                 |                                                        |
| 9xx maintenance messages (e.g. TMP) |                                  |                     |                                                                                 |                 |                                                        |
| Wrn901                              | TMP maintenance                  | 99                  | 99                                                                              | 4 years         | TMP maintenance necessary                              |
| Wrn910                              | Maintenance diaphragm<br>pump    | 99                  | 99                                                                              |                 | 8000 hour maintenance of<br>diaphragm pump required    |

## 8.1 Illustration of error codes with the help of the status LEDs

Any errors or warnings occurring in the MSB box will be indicated both as an error code by the control unit and as a blink code by the Status LED.

The blink code is preceded by a long white signal. This is followed by an error or warning number. An error number is indicated by means of red signals, while a warning number is displayed using orange signals (the orange signals have a strong green tinge, however):

-> Blink code start: long white signal

- Hundreds digit: 0 ... 9 red signals for error or 0 ... 9 orange signals for warnings
- Break: blue signal
- Tens digit: 0 ... 9 red signals for error or 0 ... 9 orange signals for warnings
- Break: blue signal
- Units digit: 0 ... 9 red signals for error or 0 ... 9 orange signals for warnings

The blink code is repeated cyclically.

For example: The pressure is too high.

-> Error code = Warning 520

-> Blink code of the status LED: White (long), 5·orange, blue, 2·orange, blue

## 8.2 Display warnings as errors

Up to 8 arbitrary warning messages can be upgraded to error messages.

Unlike warnings, errors lead to an interruption in the operation of the device. Thus, by upgrading warnings to errors, you can prevent an operator from ignoring these warnings and continuing to work with the device.

### Upgrading selected warnings to errors

- ✓ You have the INFICON control unit CU1000.
  - 1 "Settings > Setup > Notifications > Warning -> Error"
  - 2 Make your settings in the "Display warning as error" window.
    - ⇒ Select the desired "List entry no." from the numbers 1 - 8.
    - ⇒ From the number list of warnings, select the number that should become an error message. If the numbers are held down longer for selection, the number is incremented in steps of ten.
    - ⇒ To change a warning that has been upgraded to an error, enter the desired new warning number under the same "List entry no."
    - ⇒ For your overview, the text of the warning in question is displayed in the lower part of the window.
  - 3 Confirm with "OK."
    - ⇒ Alternatively, exit the window without saving by pressing the "X" button.

### Undoing the upgrading of warnings to errors

- 1 "Settings > Setup > Notifications > Warning -> Error"
- 2 Make your settings in the "Display warning as error" window.
  - ⇒ Select the used "List entry no." with the assigned warning number from the digits 1 - 8.
  - ⇒ Set a value below 100 in the displayed number overview of warnings. This will cause "No entry" to be displayed.
- 3 Confirm with "OK."

## 9 Operating CU1000 (optional)

### 9.1 Touchscreen elements

#### 9.1.1 Measurement display elements

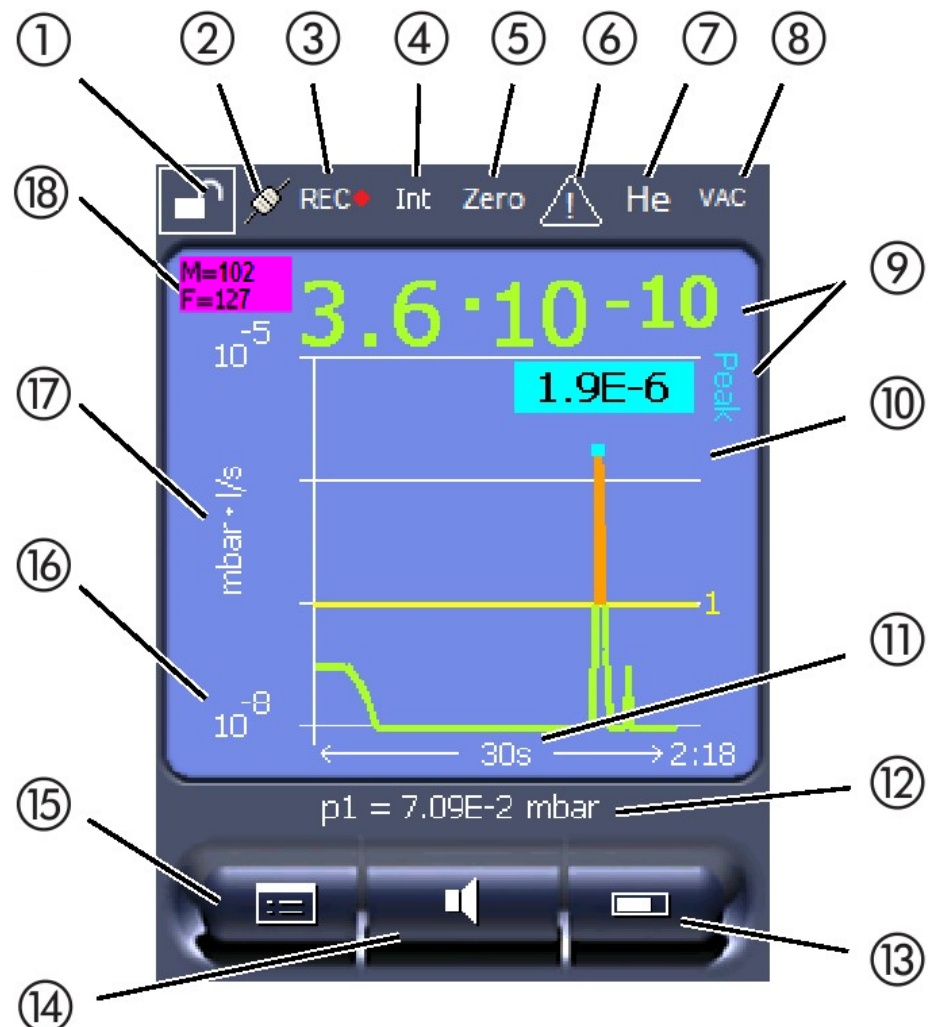


Fig. 14: Measurement display

|    |                                                                    |    |                      |    |                                   |
|----|--------------------------------------------------------------------|----|----------------------|----|-----------------------------------|
| 1  | Keyboard lock                                                      | 2  | Communication status | 3  | Data recording                    |
| 4  | Operator                                                           | 5  | ZERO                 | 6  | Message                           |
| 7  | Tracer gas                                                         | 8  | Operation mode       | 9  | Leak rate with peak hold function |
| 10 | Graphic representation of the leak rate and the peak hold function | 11 | Time axis            | 12 | Foreline pressure                 |
| 13 | Button "Favorite 2"                                                | 14 | Button "Favorite 1"  | 15 | Menu                              |
| 16 | Value axis                                                         | 17 | Measurement unit     | 18 | Display equivalence leak rate     |

## 1 - Keyboard lock

The control unit is locked or unlocked by pressing and holding the icon for the keyboard lock.

## 2 - Icon for the communication status

- Icon connected: The device communicates with the mass spectrometer module.
- Icon disconnected: The device does not communicate with the mass spectrometer module.

Establish communication:

- 1 Reset control unit.
- 2 Checking the status of the mass spectrometer module.
- 3 Check cable connection.

## 3 - Icon for the data recording

The measurement is recorded.

## 4 - Ser

The registered operator is shown abbreviated.

| Display | Meaning    |
|---------|------------|
| Ope     | Operator   |
| Sup     | Supervisor |
| Int     | Integrator |
| Ser     | SERVICE    |

For more information, see "Operator types and authorizations [► 77]".

## 5 - Zero

Background suppression is active.

## 6 - Caution icon

Active warnings are stored in the unit.

The active warnings can be displayed via the menu "Info > History > Active warnings".

## 7 - Tracer gas

Set tracer gas and tracer gas concentration percentage.

| Display | Meaning                                   |
|---------|-------------------------------------------|
| He      | Helium ( $^4\text{He}$ )                  |
| H2      | Hydrogen                                  |
| M3      | E.g. H-D, $^3\text{He}$ or H <sub>3</sub> |

## 8 - Operation mode

Configured operation mode

| Display   | Operation mode                             |
|-----------|--------------------------------------------|
| VAC       | Vacuum                                     |
| SNIF      | Sniffing                                   |
| LOW FLOW  | XL sniffer adapter in LOW FLOW             |
| HIGH FLOW | XL sniffer adapter in HIGH FLOW            |
| Standby   | XL sniffer adapter in HIGH FLOW on standby |

## 9 - Leak rate

Current measurement for the leak rate.

## 10 - Graph

Graphic display of the leak rate  $Q(t)$ .

## 11 - Time axis

Time axis of the leak rate  $Q(t)$ .

## 12 - Primary vacuum pressure (not with operation mode XL Sniffer Adapter)

Backing pressure  $p_1$ .

## 13 - Button "Favorite 2"

You can assign preferred parameters to this button, see "Touch screen settings [► 74]". In the figure in "Measurement display elements [► 71]", the "Favorite 2" button is assigned to the "Measurement view" function as an example.

## 14 - Button "Favorite 1"

You can assign preferred parameters to this button, see "Touch screen settings [► 74]". In the figure in "Measurement display elements [► 71]", the "Favorite 1" button is assigned the "Volume" function as an example.

## 15 - Icon for the menu

All functions and parameters of the control unit can be accessed using the "Menu" key .

A full display of the menu of the menu is included as a file on the USB flash drive supplied with the LDS3000.

## 16 - Value axis

Value axis of the leak rate  $Q(t)$ .

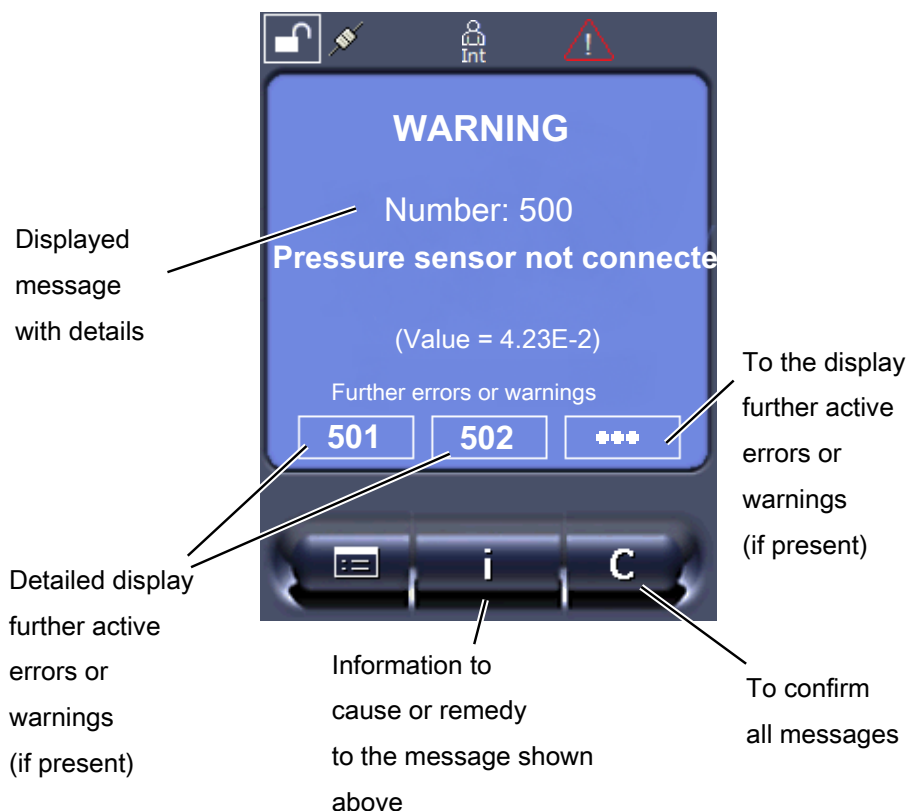
## 17 - Device of measurement

Device of measurement of the value axis.

## 18 - Display equivalence leak rate

Correction factor for the test gas used.

## 9.2 Elements of the error and warning display



You will find an overview of possible errors and warnings in the operating instructions of the connected mass spectrometer module, chapter "Warning and error messages".

## 9.3 Settings and functions

Settings and functions of the control unit are explained in the following. The settings and functions of the mass spectrometer module that are configured via the control unit are listed in the operating instructions for the mass spectrometer module.

### 9.3.1 Touch screen settings

The touch screen grays out the parameters if

- the user is not authorized to change the values, see also "Operator types and authorizations [► 77]".
- an older version of the software run by mass spectrometer module LDS3000 does not support this parameter.

#### Scaling of the Q(t)axis

|                                         |                                             |
|-----------------------------------------|---------------------------------------------|
| Linear or logarithmic                   |                                             |
| Lin.                                    |                                             |
| Log.                                    |                                             |
|                                         |                                             |
| Control unit                            | Display > Q(t) axis > Linear or logarithmic |
| Number of decades with logarithmic view |                                             |

|                                     |                                                                                                                                                                                                                                                                                                           |                                                    |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
|                                     | 1                                                                                                                                                                                                                                                                                                         |                                                    |
|                                     | 2                                                                                                                                                                                                                                                                                                         |                                                    |
|                                     | 3                                                                                                                                                                                                                                                                                                         |                                                    |
|                                     | 4                                                                                                                                                                                                                                                                                                         |                                                    |
|                                     |                                                                                                                                                                                                                                                                                                           |                                                    |
|                                     | Control unit                                                                                                                                                                                                                                                                                              | Display > Q(t) axis > Decades                      |
|                                     | Autoscale                                                                                                                                                                                                                                                                                                 |                                                    |
|                                     | Disabled: You can change the display by pressing on the intersection of the coordinate axes and then swiping your finger along the desired axis and releasing it, or if you press on the end of the desired coordinate axis and swipe along in the direction of the intersection of the axes and release. |                                                    |
|                                     | On: The display is automatically adjusted depending on the leak rate.                                                                                                                                                                                                                                     |                                                    |
|                                     |                                                                                                                                                                                                                                                                                                           |                                                    |
|                                     | Control unit                                                                                                                                                                                                                                                                                              | Display > Q(t) axis > Auto scale                   |
| Scaling of the time axis            | Scaling of the time axis                                                                                                                                                                                                                                                                                  |                                                    |
|                                     | 15 s                                                                                                                                                                                                                                                                                                      | 240 s                                              |
|                                     | 30 s                                                                                                                                                                                                                                                                                                      | 480 s                                              |
|                                     | 60 s                                                                                                                                                                                                                                                                                                      | 960 s                                              |
|                                     | 120 s                                                                                                                                                                                                                                                                                                     |                                                    |
|                                     | Control unit                                                                                                                                                                                                                                                                                              | Display > Time axis > Time axis scale              |
| Display units                       | Device of pressure                                                                                                                                                                                                                                                                                        |                                                    |
|                                     | mbar                                                                                                                                                                                                                                                                                                      | atm                                                |
|                                     | Pa                                                                                                                                                                                                                                                                                                        | Torr                                               |
|                                     |                                                                                                                                                                                                                                                                                                           |                                                    |
|                                     | Control unit                                                                                                                                                                                                                                                                                              | Display > Units (display) > Pressure unit          |
| Measured value display              | Type of graphic display                                                                                                                                                                                                                                                                                   |                                                    |
|                                     | Diagram                                                                                                                                                                                                                                                                                                   |                                                    |
|                                     | Bar graph                                                                                                                                                                                                                                                                                                 |                                                    |
|                                     |                                                                                                                                                                                                                                                                                                           |                                                    |
|                                     | Control unit                                                                                                                                                                                                                                                                                              | Display > Measurement view > Measurement view mode |
|                                     | Numeric representation of the measurements                                                                                                                                                                                                                                                                |                                                    |
|                                     | Off                                                                                                                                                                                                                                                                                                       |                                                    |
|                                     | On                                                                                                                                                                                                                                                                                                        |                                                    |
|                                     |                                                                                                                                                                                                                                                                                                           |                                                    |
|                                     | Control unit                                                                                                                                                                                                                                                                                              | Display > Measurement view > Show value            |
| Display brightness                  | Display brightness                                                                                                                                                                                                                                                                                        |                                                    |
|                                     | 20 ... 100%                                                                                                                                                                                                                                                                                               |                                                    |
|                                     |                                                                                                                                                                                                                                                                                                           |                                                    |
|                                     | Control unit                                                                                                                                                                                                                                                                                              | Display > Brightness > Display brightness          |
| Trigger display on the touch screen | Selection of the trigger (leak rate threshold) displayed on the touch screen.                                                                                                                                                                                                                             |                                                    |

|                                               |                                                                                                                                                                                   |                                                                      |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
|                                               | 1                                                                                                                                                                                 |                                                                      |
|                                               | 2                                                                                                                                                                                 |                                                                      |
|                                               | 3                                                                                                                                                                                 |                                                                      |
|                                               | 4                                                                                                                                                                                 |                                                                      |
|                                               |                                                                                                                                                                                   |                                                                      |
| <b>Assigning favorite buttons</b>             | Control unit                                                                                                                                                                      | Settings > Trigger > Trigger sel.                                    |
|                                               | The favorite buttons offer direct access to individual functions. They can be assigned with access control "Supervisor" or higher by the user.                                    |                                                                      |
|                                               | Favorite 1: Middle button (see the figure in "Measurement display elements [► 71]").                                                                                              |                                                                      |
|                                               | Favorite 2: Right button                                                                                                                                                          |                                                                      |
|                                               | Favorite 3: Button on the bottom right of the main menu.                                                                                                                          |                                                                      |
|                                               | Volume                                                                                                                                                                            | Flow switching                                                       |
|                                               | Display settings                                                                                                                                                                  | Check CAL                                                            |
|                                               | Start/Stop                                                                                                                                                                        | At AQ additionally: AQ Wizard                                        |
|                                               | Measurement view                                                                                                                                                                  | Gas equivalent                                                       |
|                                               | ZERO (at AQ instead of ZERO: ZERO AQ, at EcoBoost instead of ZERO: EcoBoost)                                                                                                      | - - - (= without function)                                           |
|                                               | CAL                                                                                                                                                                               |                                                                      |
|                                               |                                                                                                                                                                                   |                                                                      |
|                                               | Control unit                                                                                                                                                                      | Settings > Favorites > Favorite 1 (2, 3)                             |
|                                               |                                                                                                                                                                                   |                                                                      |
|                                               |                                                                                                                                                                                   |                                                                      |
| <b>Displaying warnings on the touchscreen</b> | The display of warnings on the touchscreen can be allowed or suppressed.                                                                                                          |                                                                      |
|                                               | Off                                                                                                                                                                               |                                                                      |
|                                               | On                                                                                                                                                                                |                                                                      |
|                                               |                                                                                                                                                                                   |                                                                      |
|                                               | Control unit                                                                                                                                                                      | Settings > Set up > Control unit > Messages > Show warnings          |
| <b>Show calibration note</b>                  | Suppress or allow the calibration note with the following content:                                                                                                                |                                                                      |
|                                               | <ul style="list-style-type: none"> <li>Leak rate of the applied calibration leak</li> <li>No calibration should take place during the first 20 mins after switching on</li> </ul> |                                                                      |
|                                               | OFF (suppressed)                                                                                                                                                                  |                                                                      |
|                                               | ON (allowed)                                                                                                                                                                      |                                                                      |
|                                               | Control unit                                                                                                                                                                      | Settings > Set up > Control unit > Messages > Show calibration notes |
| <b>Show calibration request</b>               | The display of the calibration request can be permitted or suppressed.                                                                                                            |                                                                      |
|                                               | To activate or deactivate the calibration request as such, see also "Activating the calibration request" (LDS3000 instructions, chapter "Time and general preferences").          |                                                                      |
|                                               | OFF (suppressed)                                                                                                                                                                  |                                                                      |
|                                               | ON (allowed)                                                                                                                                                                      |                                                                      |
|                                               |                                                                                                                                                                                   |                                                                      |



|              |                                                                        |
|--------------|------------------------------------------------------------------------|
| Control unit | Settings > Set up > Control unit > Messages > Show calibration request |
|--------------|------------------------------------------------------------------------|

**Setting the audio alarm**

|                                                                                                                                                                                                                                                                                                |                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| Output of an acoustic signal depending on the leak rate                                                                                                                                                                                                                                        |                                                             |
| --- No sound                                                                                                                                                                                                                                                                                   |                                                             |
| Proportional: The frequency of the audible signal is proportional to the bar graph display or diagram height. The frequency range is 300Hz to 3300Hz.                                                                                                                                          |                                                             |
| Setpoint: The pitch is proportional to the leak rate. The signal sounds if the leak rate exceeds the selected trigger value.                                                                                                                                                                   |                                                             |
| Pinpoint: The sound of the acoustic signal changes its frequency within a specific range of leak rates. Range: A decade below the selected trigger threshold up to one decade above. The sound keeps at a constant low and a constant high frequency below and above this range, respectively. |                                                             |
| Trigger: If the selected trigger threshold is exceeded, a two-pitch signal sounds.                                                                                                                                                                                                             |                                                             |
| Control unit                                                                                                                                                                                                                                                                                   | Settings > Set up > Control unit > Audio > Audio alarm mode |

**Behavior with warnings or error messages:** If the touch screen shows a warning or an error, then a two-pitch signal sounds simultaneously.

**Adjust volume****⚠ CAUTION****Damage to hearing due to loud audio**

High volume levels can cause hearing damage.

- ▶ First, set the volume to a low level, and then gradually increase it to an appropriate level.
- ▶ Avoid listening at high volumes for long periods of time.

|                                                                                                                |                                                               |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| You can adjust the volume of the audio alarm.                                                                  |                                                               |
| 0 ... 15                                                                                                       |                                                               |
| Control unit                                                                                                   | Settings > Set up > Control unit > Audio > Volume             |
| The touch screen can be switched off automatically after a specific time without any operation to save energy. |                                                               |
| 30 s                                                                                                           | 10 min                                                        |
| 1 min                                                                                                          | 30 min                                                        |
| 2 min                                                                                                          | 1 h                                                           |
| 5 min                                                                                                          | ∞ (= never)                                                   |
| Control unit                                                                                                   | Settings > Set up > Control unit > Energy > Display off after |

**Automatic switch off of the touch screen**

## 9.3.2 Operator types and authorizations

There are four different operator types that are distinguished by different authorizations. The integrator is registered ex works.

Additional operators can be registered. The following table shows options for individual operator types to register new operator types.

**Operator registration**

| Viewer | Operator | Supervisor | Integrator |
|--------|----------|------------|------------|
| -      | Operator | Supervisor | Integrator |
|        | Viewer   | Operator   | Supervisor |
|        |          | Viewer     | Operator   |
|        |          |            | Viewer     |

For the types "Integrator", "Supervisor" and "Operator", a four-digit PIN must be assigned during registration (0000 ... 9999). "0000" is assigned to all operators ex works.

If an operator keeps the pin "0000", this operator will always be registered is during the start up of the system (without PIN query).

A key-operated switch can be used in addition to a PIN if an I/O module is connected. The key-operated switch is connected to the I/O module via three digital inputs (see operating instructions of the mass spectrometer module).

The following table shows the authorizations of individual operator types.

| Function                                  | Viewer | Operator | Supervisor | Integrator |
|-------------------------------------------|--------|----------|------------|------------|
| Changing parameters                       | -      | x        | x          | x          |
| Changing the display of error information | -      | x        | x          | x          |
| Calling up factory settings               | -      | -        | -          | x          |
| Entering maintenance history              | -      | -        | -          | x          |

The menu "Service" is accessible only to INFICON service staff.

**Load parameters**

The saved/backed-up parameters of control unit CU1000 and of the mass spectrometer module can be loaded from a USB stick.

|              |                                     |
|--------------|-------------------------------------|
| Control unit | Function > Data > Parameters > Load |
|--------------|-------------------------------------|

**Save parameters**

The parameters of control unit CU1000 and of the mass spectrometer module can be saved to a USB flash drive.

|              |                                     |
|--------------|-------------------------------------|
| Control unit | Function > Data > Parameters > Save |
|--------------|-------------------------------------|

**Display error information**

The type of error information can be set differently for each operator type. The Integrator always receives the complete information.

Number: Message number

text: Brief description

Info: Expanded message information

- Only numbers
- Number and text
- Number, text and info

|              |                                                                        |
|--------------|------------------------------------------------------------------------|
| Control unit | Function > Data > Parameter > Error info Viewer (Operator, Supervisor) |
|--------------|------------------------------------------------------------------------|

**Parameter list display and change**

Parameters can be displayed as an alphabetical list with names and current values. Each list entry is a button which, when pressed, will open the parameter's set-up dialog box. The parameter list displays the parameters of the control unit and the connected mass spectrometer module.

Control unit

List > Parameters list **or**:

Functions > Data > Parameters > List

**Display list of parameter change authorizations**

Parameters can be displayed as an alphabetical list with names and current change authorizations. Each list entry is a button which, when pressed, will change access control. The parameter list displays the parameters of the control unit and the connected mass spectrometer module. Changes are possible in accordance with the hierarchy of the operator.

Control unit

Functions > Data > Parameters > Parameter Access

**9.3.2.1 Logging out the operator**

The operator activates access level "Viewer" to log out. "Access Ctrl > Viewer"

**9.3.3 Reset settings****Mass spectrometer module**

The settings of the mass spectrometer module can be reset to factory settings.

Control unit

Functions > Data > Parameters > Reset > MSB settings

**Access controls**

The authorization for changing parameters can be reset to factory setting.

Control unit

Functions > Data > Parameters > Reset > Param. Access control

**Control unit**

The control unit settings can be reset to factory settings.

Control unit

Functions > Data > Parameters > Reset > Control unit settings

**9.3.4 Recording data**

The data is saved as a TXT file. Each TXT file contains the following information:

- Date created
- Software version
- Serial number
- Start time
- Time stamp (measurement indicates offset in seconds in relation to start time)
- File name
- Time stamp (offset in seconds in relation to start time)
- Leak rate (expressed in selected unit)
- Pressure p1 (expressed in selected unit)
- Device status

**Switching on/off**

Switching data recording on/off

- Off

|                        |                                                                                                                                                                                                                                                                                                                                                      |              |                                                           |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------------------------------------------------------|
|                        | <ul style="list-style-type: none"> <li>• On</li> </ul>                                                                                                                                                                                                                                                                                               |              |                                                           |
|                        | <table> <tr> <td>Control unit</td><td>Functions &gt; Data &gt; Recorder &gt; Settings &gt; Data recording</td></tr> </table>                                                                                                                                                                                                                         | Control unit | Functions > Data > Recorder > Settings > Data recording   |
| Control unit           | Functions > Data > Recorder > Settings > Data recording                                                                                                                                                                                                                                                                                              |              |                                                           |
| <b>Record interval</b> | Time interval between data recordings <ul style="list-style-type: none"> <li>• 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s</li> </ul>                                                                                                                                                                                                                      |              |                                                           |
|                        | <table> <tr> <td>Control unit</td><td>Functions &gt; Data &gt; Recorder &gt; Settings &gt; Record interval</td></tr> </table>                                                                                                                                                                                                                        | Control unit | Functions > Data > Recorder > Settings > Record interval  |
| Control unit           | Functions > Data > Recorder > Settings > Record interval                                                                                                                                                                                                                                                                                             |              |                                                           |
| <b>Memory location</b> | The data stored in the control unit can be saved to a USB stick. The memory in the control unit is limited to the recording of a 24-hour measurement. Each time after one hour has elapsed, the file is closed and recording continues in the next file. <ul style="list-style-type: none"> <li>• USB flash drive</li> <li>• Control unit</li> </ul> |              |                                                           |
|                        | <table> <tr> <td>Control unit</td><td>Functions &gt; Data &gt; Recorder &gt; Settings &gt; Storage location</td></tr> </table>                                                                                                                                                                                                                       | Control unit | Functions > Data > Recorder > Settings > Storage location |
| Control unit           | Functions > Data > Recorder > Settings > Storage location                                                                                                                                                                                                                                                                                            |              |                                                           |
| <b>Copy data</b>       | Copy data from the internal memory of the control unit to a connected USB stick.                                                                                                                                                                                                                                                                     |              |                                                           |
|                        | <table> <tr> <td>Control unit</td><td>Functions &gt; Data &gt; Recorder &gt; Copy &gt; Copy files</td></tr> </table>                                                                                                                                                                                                                                 | Control unit | Functions > Data > Recorder > Copy > Copy files           |
| Control unit           | Functions > Data > Recorder > Copy > Copy files                                                                                                                                                                                                                                                                                                      |              |                                                           |
| <b>Delete data</b>     | Delete data in the internal memory of the control unit                                                                                                                                                                                                                                                                                               |              |                                                           |
|                        | <table> <tr> <td>Control unit</td><td>Functions &gt; Data &gt; Recorder &gt; Delete &gt; Delete files</td></tr> </table>                                                                                                                                                                                                                             | Control unit | Functions > Data > Recorder > Delete > Delete files       |
| Control unit           | Functions > Data > Recorder > Delete > Delete files                                                                                                                                                                                                                                                                                                  |              |                                                           |

### 9.3.5 Calling up information

Different information and states of the system can be called up with the info menu.

|                                   |                                                                                                                                                                                                                                                                                                                |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Measurement values</b>         | <ul style="list-style-type: none"> <li>• Preamplifier</li> <li>• Environment</li> <li>• TMP</li> </ul>                                                                                                                                                                                                         |
| <b>Temperature</b>                | <ul style="list-style-type: none"> <li>• Electronic</li> <li>• TMP</li> </ul>                                                                                                                                                                                                                                  |
| <b>Energy and operating hours</b> | <ul style="list-style-type: none"> <li>• Energy values: Information on consumption values</li> <li>• Operation hours: Display for operating hours</li> <li>• Supply voltages: Information on internal supply voltages</li> <li>• Power supply: Information on the supply voltages of the components</li> </ul> |
| <b>History</b>                    | <ul style="list-style-type: none"> <li>• Error, error history / warning history</li> <li>• Calibration, calibration history</li> <li>• TMP error, TMP history</li> <li>• Warnings, active warnings</li> <li>• Maintenance, maintenance history</li> </ul>                                                      |
| <b>Control unit</b>               | <ul style="list-style-type: none"> <li>• Version control unit: Information on the software version</li> <li>• Memory: Information on available memory</li> <li>• Settings: Control unit settings.</li> <li>• Serial port wired: Information on the communication connection</li> </ul>                         |

Mass spectrometer module

- Data exchange: Information on the data exchange between mass spectrometer module and the control unit
- MSB (1): Information on the software version
- MSB (2): Information on operating parameters
- TMP controller (1): Information on the turbo molecular pump
- TMP controller (2): Information on the turbo molecular pump, continued
- Ion source: Information on the ion source used
- Preamplifier: Information on the preamplifier
- Preamplifier test: Information on the preamplifier test.

Interfaces

- I/O module (1): Information on the software version, inputs and outputs
- I/O module (2): Visualized information to the digital inputs

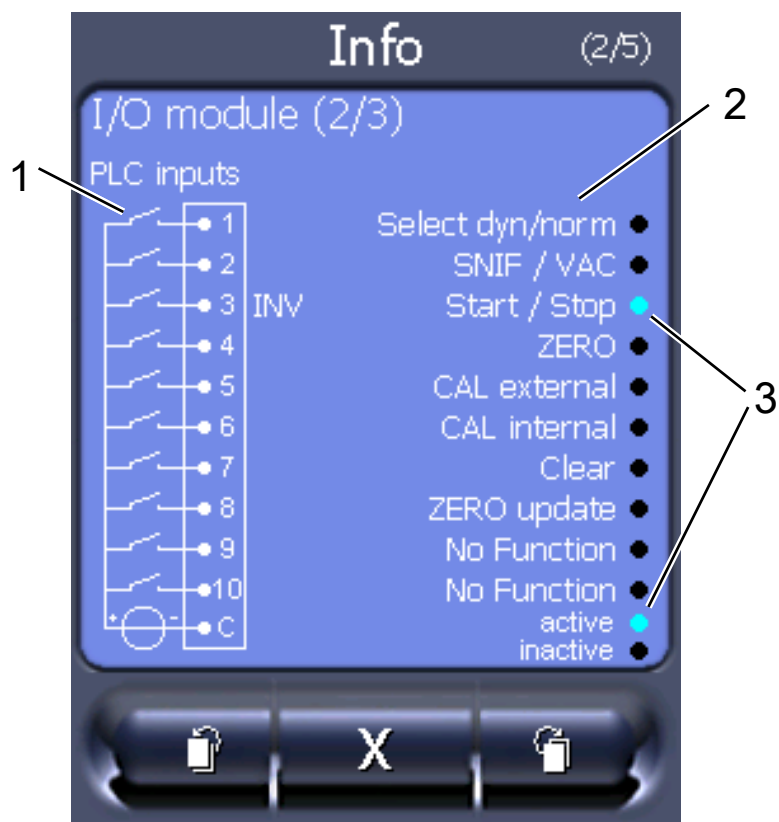


Fig. 15: I/O module (2): Visualized information to the digital inputs

|   |                                             |   |                                                  |
|---|---------------------------------------------|---|--------------------------------------------------|
| 1 | Input signal condition                      | 2 | Configured function (INV = Function is inverted) |
| 3 | Status of the function (active or inactive) |   |                                                  |

- I/O module (3): Visualized information to the digital outputs

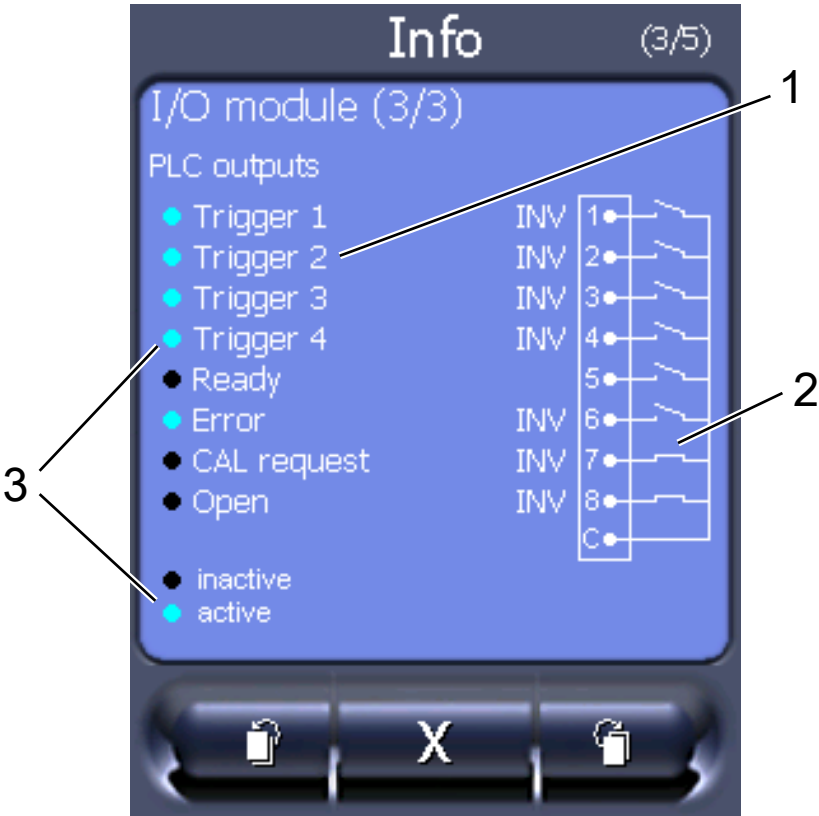


Fig. 16: Visualized information to the digital outputs

|   |                                                  |   |                         |
|---|--------------------------------------------------|---|-------------------------|
| 1 | Configured function (INV = Function is inverted) | 2 | Output signal condition |
| 3 | Status of the function (active or inactive)      |   |                         |

- Bus module (1): Information on the bus module
- Bus module (2): Information on the bus module, continued

### 9.3.6 Display equivalence leak rate for other gas



**Scope**  
The explanations on the equivalence rate only refer to sniffing operation.

If you measure with the test gases helium or hydrogen, but want to display another gas with its leak rate, use a correction factor for the test gas used.



Fig. 17: Measurement screen with displayed equivalence leak rate and configured favorites key

|   |                                                                                                                                                       |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Display of gas name and equivalence factor                                                                                                            |
| 2 | Favorites button for fast configuration of "gas equivalent selection" after set up, see "Touch screen settings [► 74]", "Assigning favorite buttons". |

You have a choice of two methods:

- To conveniently set the correction factor, use the "Gas equivalent selection [► 83]". There, the correction factor can be selected from a self-defined list, see "Configure gas list [► 84]", or switched back to the tracer gas.
- Alternatively, it is possible to calculate and configure the correction factor. For information on calculation, see "Calculate equivalence factor [► 85]". For information on configuring the device, see "Set equivalence factor and molar mass [► 85]".

### 9.3.6.1 Gas equivalent selection

- 1 Control unit: Settings > Set up > Operation modes > Equivalence leak rate > Gas equi. ".
- 2 In the window "Gas equivalent selection", you can respond to different situations:
  - ⇒ If the desired gas equivalent is already stored (numbers 1 to 4), select the desired gas equivalent number and confirm with "OK". The gas name and the equivalence factor of this gas equivalent are then displayed at the top left in the measuring window. You can perform measurement.
  - ⇒ If the desired gas equivalent is not stored, it must be configured, see "Configure gas list [► 84]".

- ⇒ If you do not find a suitable entry in the 4 gas equivalents and also do not want to change these, you can calculate the correction factor as an alternative. In the window "Gas equivalent selection" select the entry "User-defined" and configure the correction factor, see "Set equivalence factor and molar mass [► 85]".
- ⇒ If you want to switch from the display of the gas equivalent in the measuring window back to the measurement value of the measuring gas, select "Switch off" and confirm with "OK".



The options "Switch off" and "Gas equivalent no. 1...4" overwrite parameters, see "Set equivalence factor and molar mass [► 85]".

If you select the option "User-defined", parameters then have to be configured, see "Set equivalence factor and molar mass [► 85]".

### 9.3.6.2 Configure gas list

You can predefine up to 4 equivalence gases and assign names to them. The equivalence gases can then be selected in the gas equivalent selection, see "Gas equivalent selection [► 83]".

- 1 Control unit: Settings > Set up > Operation modes > Equivalence leak rate > Configure gas list
- 2 Select one of the numbers 1 to 4.
  - ⇒ A set of parameters is displayed for each stored gas. If there is an unused entry, "No Entry" is displayed.
- 3 Press the button "Edit".
  - ⇒ If you want to detect one of the gases from the stored gas library, press the desired entry. See also "Gas library [► 87]".
  - ⇒ If the desired gas is not stored, scroll to the end of the gas library and select "User-defined gas". Then, assign a name of your choice in the window "Equivalence gas name" and confirm your choice. Then enter the molar mass and viscosity factor of the equivalence gas. For all gases that are not available in the gas library, please feel free to contact INFICON.
- 4 Make your customer-specific entries in the following windows, which are brought up by the assistant, first "Absolute pressure equivalence gas".
  - ⇒ Corresponds to the absolute pressure of the equivalence gas in the test object in bar.
- 5 Window "Measuring mass".
  - ⇒ This is the mass of the tracer gas (helium, mass 3 or hydrogen)
- 6 Window "Percentage of measuring gas".
  - ⇒ This is the gas proportion of the tracer gas in percent, e.g. for forming gas (95/5) it would be 5%.
- 7 Window "Absolute pressure measuring gas".
  - ⇒ Corresponds to the absolute pressure of the tracer gas in the test object in bar.



### Example

An air conditioning system is to be checked for leaks. The system is first filled with 2 bar (absolute) pure helium and checked for leaks. Later the plant will be filled with R134a. The operating pressure is 15 bar (absolute).

This results in the following values for the above-specified parameters:

Absolute pressure equivalence gas = 15.0

Measuring mass = 4

Percentage of measuring gas = 100.0

Absolute pressure measuring gas = 2.0

### 9.3.6.3 Calculate equivalence factor

The equivalence factor is not calculated by the software of the device. Calculate the equivalence factor using the following formula:

$$\text{Equivalence factor} = \frac{\eta_{\text{test}}}{\eta_{\text{equi}}} * \frac{(p_{\text{equi}})^2 - 1}{(p_{\text{test}})^2 - 1}$$

|                      |                                                                   |
|----------------------|-------------------------------------------------------------------|
| $\eta_{\text{Test}}$ | Dynamic viscosity of test gas (helium or H <sub>2</sub> )         |
| $\eta_{\text{equi}}$ | Dynamic viscosity of the equivalent gas                           |
| $p_{\text{test}}$    | Absolute pressure of the test gas in the test object in bar       |
| $p_{\text{equi}}$    | Absolute pressure of the equivalent gas in the test object in bar |

### Example

An air conditioning system is to be checked for leaks.

The system is first filled with 2 bar (absolute) helium and checked for leaks. Later the plant will be filled with R134a. The operating pressure is 15 bar (absolute).

The dynamic viscosity of helium is 19.62 µPa\*s.

The dynamic viscosity of R134a is 11.49 µPa\*s.

In order to obtain an R134a equivalent leak rate display during the helium leak detection, the following equivalence factor must be entered:

$$\text{Equivalence factor} = \frac{\eta_{\text{test}}}{\eta_{\text{equi}}} * \frac{(p_{\text{equi}})^2 - 1}{(p_{\text{test}})^2 - 1} = \frac{19,62}{11,49} * \frac{15^2 - 1}{2^2 - 1} \approx 127$$

### 9.3.6.4 Set equivalence factor and molar mass

✓ The equivalence factor is known. See also "Calculate equivalence factor [► 85]".

✓ The test gas used is specified (hydrogen or helium, mass 2, 3 or 4).

✓ The molar mass of the equivalence gas you want to display is known.

1 Control unit: Settings > Set up > Operation modes > Equivalence rate

2 "Gas factor" button

⇒ (LD protocol: Command 469)

3 Select "Mass 2", "Mass 3" or "Mass 4" according to your test gas.

⇒ If the test gas is set to helium, the window "Equivalent Gas Factor He" opens.

- 4 Set the equivalence gas factor. In the example (see "Calculate equivalence factor [► 85]") for 127:

Equivalence gas factor He  
0127.0

- 5 Control unit: Settings > Set up > Operation modes > Equivalence rate
- 6 "Molar mass" button  
⇒ (LD protocol: Command "470")
- 7 Select "Mass 2", "Mass 3" or "Mass 4" to match your test gas as described above.  
⇒ If the test gas is set to helium, the window "Molar mass equivalent gas He" opens.
- 8 Set your molar mass. In the example for 102:

Molar mass equivalence gas He  
0102.0

⇒ If the equivalence factor is not equal to 1 or the molar mass is not set to factory settings, the equivalence factor is displayed both on the calibration result and on the measurement screen.



Fig. 18: Top left: Display of Molar Mass (102) and Equivalence Factor (127)

### 9.3.7 Gas library

The operating software of the device contains a list of approx. 100 gases which could be relevant in the refrigeration industry.

The list is stored in the nonvolatile flash memory of the operating unit and can be updated. The user can access this list while pre-defining the equivalence gases, see "Configure gas list [► 84]". The user can then select from the pre-defined gases during gas equivalent selection, see "Gas equivalent selection [► 83]".

The library of the device has the following factory-defined content:

| Gas designation<br>(max. 8 digits) | Other designations                              | Molecular mass<br>(amu) | Helium viscosity<br>factor | Hydrogen/mass 3<br>viscosity factor |
|------------------------------------|-------------------------------------------------|-------------------------|----------------------------|-------------------------------------|
| R11                                | CFCl <sub>3</sub>                               | 137.4                   | 0.515                      | 1.15                                |
| R12                                | CF <sub>2</sub> Cl <sub>2</sub>                 | 120.9                   | 0.591                      | 1.319                               |
| R12B1                              | CF <sub>2</sub> ClBr<br>Halon 1211              | 165.4                   | 0.523                      | 1.167                               |
| R13                                | CF <sub>3</sub> Cl                              | 104.5                   | 0.857                      | 1.913                               |
| R13B1                              | CF <sub>3</sub> Br<br>Halon 1301                | 149                     | 0.852                      | 1.902                               |
| R14                                | CF <sub>4</sub>                                 | 80                      | 0.857                      | 1.913                               |
| R21                                | CHFCl <sub>2</sub>                              | 102.9                   | 0.535                      | 1.194                               |
| R22                                | CHF <sub>2</sub> Cl                             | 86.5                    | 0.632                      | 1.411                               |
| R23                                | CHF <sub>3</sub>                                | 70                      | 0.704                      | 1.571                               |
| R32                                | CH <sub>2</sub> F <sub>2</sub>                  | 52                      | 0.632                      | 1.411                               |
| R41                                | CH <sub>3</sub> F                               | 34                      | 0.551                      | 1.23                                |
| R50                                | CH <sub>4</sub><br>Methane                      | 16                      | 0.556                      | 1.241                               |
| R113                               | C <sub>2</sub> F <sub>3</sub> Cl <sub>3</sub>   | 187.4                   | 0.484                      | 1.08                                |
| R114                               | C <sub>2</sub> F <sub>4</sub> Cl <sub>2</sub>   | 170.9                   | 0.545                      | 1.217                               |
| R115                               | C <sub>2</sub> F <sub>5</sub> Cl                | 154.5                   | 0.627                      | 1.4                                 |
| R116                               | C <sub>2</sub> F <sub>6</sub>                   | 138                     | 0.709                      | 1.583                               |
| R123                               | C <sub>2</sub> HF <sub>3</sub> Cl <sub>2</sub>  | 152.9                   | 0.54                       | 1.205                               |
| R124                               | C <sub>2</sub> HF <sub>4</sub> Cl               | 136.5                   | 0.581                      | 1.297                               |
| R125                               | C <sub>2</sub> HF <sub>5</sub>                  | 120                     | 0.653                      | 1.458                               |
| R134a                              | C <sub>2</sub> H <sub>2</sub> F <sub>4</sub>    | 102                     | 0.591                      | 1.319                               |
| R141b                              | C <sub>2</sub> H <sub>3</sub> FCF <sub>2</sub>  | 117                     | 0.464                      | 1.036                               |
| R142b                              | C <sub>2</sub> H <sub>3</sub> F <sub>2</sub> Cl | 100.5                   | 0.494                      | 1.103                               |
| R143a                              | C <sub>2</sub> H <sub>3</sub> F <sub>3</sub>    | 84                      | 0.561                      | 1.252                               |
| R152a                              | C <sub>2</sub> H <sub>4</sub> F <sub>2</sub>    | 66.1                    | 0.515                      | 1.15                                |
| R170                               | C <sub>2</sub> H <sub>6</sub><br>Ethane         | 30.1                    | 0.479                      | 1.069                               |
| R218                               | C <sub>3</sub> F <sub>8</sub>                   | 188                     | 0.627                      | 1.4                                 |
| R227ea                             | C <sub>3</sub> HF <sub>7</sub>                  | 170                     | 0.627                      | 1.4                                 |
| R236fa                             | C <sub>3</sub> H <sub>2</sub> F <sub>6</sub>    | 152                     | 0.55                       | 1.228                               |
| R245fa                             | C <sub>3</sub> H <sub>3</sub> F <sub>5</sub>    | 134                     | 0.52                       | 1.161                               |

| Gas designation<br>(max. 8 digits) | Other designations                                            | Molecular mass<br>(amu) | Helium viscosity<br>factor | Hydrogen/mass 3<br>viscosity factor |
|------------------------------------|---------------------------------------------------------------|-------------------------|----------------------------|-------------------------------------|
| R290                               | C <sub>3</sub> H <sub>8</sub><br>Propane                      | 44.1                    | 0.433                      | 0.967                               |
| R356                               | C <sub>4</sub> H <sub>5</sub> F <sub>5</sub>                  | 166.1                   | 0.561                      | 1.252                               |
| R400                               | Mixture of<br>50% R12<br>50% R114                             | 141.6                   | 0.571                      | 1.275                               |
| R401A                              | Mixture of<br>53% R22<br>13% R152a<br>34% R124                | 94.4                    | 0.607                      | 1.355                               |
| R401B                              | Mixture of<br>61% R22<br>11% R152a<br>28% R124                | 92.8                    | 0.612                      | 1.366                               |
| R401C                              | Mixture of<br>33% R22<br>15% R152a<br>52% R124                | 101                     | 0.602                      | 1.344                               |
| R402A                              | Mixture of<br>38% R22<br>60% R125<br>2% R290                  | 101.6                   | 0.647                      | 1.444                               |
| R402B                              | Mixture of<br>60% R22<br>38% R125<br>2% R290                  | 94.7                    | 0.642                      | 1.433                               |
| R403A                              | Mixture of<br>75% R22<br>20% R218<br>5% R290                  | 92                      | 0.642                      | 1.433                               |
| R403B                              | Mixture of<br>56% R22<br>39% R218<br>5% R290                  | 103.3                   | 0.647                      | 1.444                               |
| R404A                              | Mixture of<br>44% R125<br>52% R143a<br>4% R134a               | 97.6                    | 0.607                      | 1.355                               |
| R405A                              | Mixture of<br>45% R22<br>7% R152a<br>5.5% 142b<br>42.5% RC318 | 111.9                   | 0.622                      | 1.388                               |
| R406A                              | Mixture of<br>55% R22<br>4% R600a<br>41% R142b                | 89.9                    | 0.566                      | 1.263                               |

| Gas designation<br>(max. 8 digits) | Other designations                                 | Molecular mass<br>(amu) | Helium viscosity<br>factor | Hydrogen/mass 3<br>viscosity factor |
|------------------------------------|----------------------------------------------------|-------------------------|----------------------------|-------------------------------------|
| R407A                              | Mixture of<br>20% R32<br>40% R125<br>40% R134a     | 90.1                    | 0.637                      | 1.422                               |
| R407B                              | Mixture of<br>10% R32<br>70% R125<br>20% R134a     | 102.9                   | 0.647                      | 1.444                               |
| R407C                              | Mixture of<br>10% R32<br>70% R125<br>20% R134a     | 86.2                    | 0.627                      | 1.4                                 |
| R407D                              | Mixture of<br>23% R32<br>25% R125<br>52% R134a     | 91                      | 0.612                      | 1.366                               |
| R407E                              | Mixture of<br>25% R32<br>15% R125<br>60% R134a     | 83.8                    | 0.622                      | 1.388                               |
| R407F                              | Mixture of<br>40% R134a<br>30% R125<br>30% R32     | 82.1                    | 0.67                       | 1.496                               |
| R408A                              | Mixture of<br>7% R125<br>46% R143a<br>47% R22      | 87                      | 0.602                      | 1.344                               |
| R409A                              | Mixture of<br>60% R22<br>25% R124<br>15% R142b     | 97.4                    | 0.607                      | 1.355                               |
| R409B                              | Mixture of<br>65% R22<br>25% R124<br>10% R142b     | 96.7                    | 0.612                      | 1.366                               |
| R410A                              | Mixture of<br>50% R32<br>50% R125                  | 72.6                    | 0.673                      | 1.502                               |
| R410B                              | Mixture of<br>45% R32<br>55% R125                  | 75.6                    | 0.673                      | 1.502                               |
| R411A                              | Mixture of<br>1.5% R1270<br>87.5% R22<br>11% R152a | 82.4                    | 0.617                      | 1.377                               |

| Gas designation<br>(max. 8 digits) | Other designations                                                           | Molecular mass<br>(amu) | Helium viscosity<br>factor | Hydrogen/mass 3<br>viscosity factor |
|------------------------------------|------------------------------------------------------------------------------|-------------------------|----------------------------|-------------------------------------|
| R411B                              | Mixture of<br>3% R1270<br>94% R22<br>3% R152a                                | 83.1                    | 0.62                       | 1.388                               |
| R411C                              | Mixture of<br>3% R1270<br>95.5% R22<br>1.5% R152a                            | 83.4                    | 0.627                      | 1.4                                 |
| R412A                              | Mixture of<br>70% R22<br>5% R218<br>25% R142b                                | 92.2                    | 0.602                      | 1.344                               |
| R413A                              | Mixture of<br>9% R218<br>88% R134a<br>3% R600                                | 104                     | 0.581                      | 1.297                               |
| R414A                              | Mixture of<br>51% R22<br>28.5% R124<br>4% R600a<br>16.5% R142                | 96.9                    | 0.586                      | 1.308                               |
| R415A                              | Mixture of<br>82% R22<br>18% R152a                                           | 81.7                    | 0.622                      | 1.388                               |
| R416A                              | Mixture of<br>59% R134a<br>39.5% R124<br>1.5% R600                           | 111.9                   | 0.576                      | 1.286                               |
| R417A                              | Mixture of<br>50% R134a<br>46% R125<br>4% R600a                              | 106.7                   | 0.61                       | 1.362                               |
| R422D                              | Mixture of<br>65.1% R125<br>31.5% R134a<br>3.4% R600a                        | 112.2                   | 0.622                      | 1.388                               |
| R438A                              | Mixture of<br>45% R125<br>44.2% R134a<br>8.5% R32<br>1.7% R600<br>0.6% R601a | 104.9                   | 0.617                      | 1.377                               |
| R441A                              | Mixture of<br>54.8% R290<br>36.1% R600<br>6% R600a<br>3.1% R170              | 49.6                    | 0.398                      | 0.888                               |

| Gas designation<br>(max. 8 digits) | Other designations                                                          | Molecular mass<br>(amu) | Helium viscosity<br>factor | Hydrogen/mass 3<br>viscosity factor |
|------------------------------------|-----------------------------------------------------------------------------|-------------------------|----------------------------|-------------------------------------|
| R442A                              | Mixture of<br>31% R32<br>31% R125<br>30% R134a<br>5% R227ea<br>3% R152a     | 81.8                    | 0.629                      | 1.404                               |
| R448A                              | Mixture of<br>26% R32<br>26% R125<br>21% R134a<br>20% R1234yf<br>7% R1234ze | 99.3                    | 0.625                      | 1.395                               |
| R449A                              | Mixture of<br>25.7% R134<br>25.3% R1234yf<br>24.7% R125<br>24.3% R32        | 87.2                    | 0.622                      | 1.388                               |
| R450A                              | Mixture of<br>58% R1234ze<br>42% R134a                                      | 109                     | 0.592                      | 1.321                               |
| R452A                              | Mixture of<br>59% R125<br>30% R1234yf<br>11% R32                            | 103.5                   | 0.612                      | 1.366                               |
| R452B                              | Mixture of<br>67% R32<br>26% R1234yf<br>7% R125                             | 72.9                    | 0.639                      | 1.426                               |
| R454C                              | Mixture of<br>22% R32<br>78% R1234yf                                        | 90.8                    | 0.62                       | 1.384                               |
| R500                               | Mixture of<br>74% R12<br>26% R152a                                          | 99.3                    | 0.581                      | 1.297                               |
| R501                               | Mixture of<br>75% R22<br>25% R12                                            | 93.1                    | 0.627                      | 1.4                                 |
| R502                               | Mixture of<br>49% R22<br>51% R115                                           | 111.6                   | 0.647                      | 1.444                               |
| R503                               | Mixture of<br>40% R23<br>60% R13                                            | 87.3                    | 0.709                      | 1.583                               |
| R504                               | Mixture of<br>48% R32<br>52% R115                                           | 79.3                    | 0.678                      | 1.513                               |
| R505                               | Mixture of<br>78% R12<br>22% R31                                            | 103.5                   | 0.612                      | 1.366                               |

| Gas designation<br>(max. 8 digits) | Other designations                             | Molecular mass<br>(amu) | Helium viscosity<br>factor | Hydrogen/mass 3<br>viscosity factor |
|------------------------------------|------------------------------------------------|-------------------------|----------------------------|-------------------------------------|
| R506                               | Mixture of<br>55% R31<br>45% R114              | 93.7                    | 0.561                      | 1.252                               |
| R507                               | Mixture of<br>50% R125<br>50% R143a            | 98.9                    | 0.612                      | 1.366                               |
| R508A                              | Mixture of<br>39% R23<br>61% R116              | 100.1                   | 0.729                      | 1.627                               |
| R508B                              | Mixture of<br>46% R23<br>54% R116              | 95.4                    | 0.729                      | 1.627                               |
| R513A                              | Mixture of<br>44% R134a<br>56% R1234yf         | 108.7                   | 0.582                      | 1.299                               |
| R600                               | C <sub>4</sub> H <sub>10</sub><br>Butane       | 58.1                    | 0.377                      | 0.842                               |
| R600a                              | C <sub>4</sub> H <sub>10</sub><br>Iso-Butane   | 58.1                    | 0.377                      | 0.842                               |
| R601                               | C <sub>5</sub> H <sub>12</sub><br>Pentane      | 72.2                    | 0.341                      | 0.761                               |
| R601a                              | C <sub>5</sub> H <sub>12</sub><br>Iso-Pentane  | 72.2                    | 0.336                      | 0.75                                |
| R601b                              | C <sub>5</sub> H <sub>12</sub><br>Neopentane   | 72.2                    | 0.337                      | 0.752                               |
| R601c                              | C <sub>5</sub> H <sub>12</sub><br>Cyclopentane | 70.1                    | 0.337                      | 0.752                               |
| R1233zd                            | C <sub>3</sub> H <sub>2</sub> ClF <sub>3</sub> | 130.5                   | 0.558                      | 1.246                               |
| R1234yf                            | C <sub>3</sub> H <sub>2</sub> F <sub>4</sub>   | 114                     | 0.624                      | 1.393                               |
| R1234ze                            | C <sub>3</sub> H <sub>2</sub> F <sub>4</sub>   | 114                     | 0.619                      | 1.382                               |
| R1243zf                            | C <sub>3</sub> H <sub>3</sub> F <sub>3</sub>   | 96                      | 0.6                        | 1.339                               |
| Ar                                 | Argon                                          | 40                      | 1.127                      | 2.516                               |
| CO <sub>2</sub>                    | R744                                           | 44                      | 0.744                      | 1.661                               |
| H <sub>2</sub>                     | Hydrogen                                       | 2                       | 0.448                      | 1                                   |
| H <sub>2</sub> O                   | R718                                           | 18                      | 0.459                      | 1.025                               |
| He                                 | Helium                                         | 4                       | 1                          | 2.232                               |
| HT135                              | Galden HT135                                   | 610                     | 1                          | 2.232                               |
| Kr                                 | Krypton                                        | 84                      | 1.275                      | 2.846                               |
| N <sub>2</sub>                     | Nitrogen                                       | 28                      | 0.892                      | 1.991                               |
| Ne                                 | Neon                                           | 20.2                    | 1.586                      | 3.54                                |
| NH <sub>3</sub>                    | R717                                           | 17                      | 0.505                      | 1.127                               |
| O <sub>2</sub>                     | Oxygen                                         | 32                      | 1.03                       | 2.299                               |
| SF <sub>6</sub>                    |                                                | 146.1                   | 0.765                      | 1.708                               |
| Xe                                 | Xenon                                          | 131.3                   | 1.153                      | 2.574                               |



| Gas designation<br>(max. 8 digits) | Other designations | Molecular mass<br>(amu) | Helium viscosity<br>factor | Hydrogen/mass 3<br>viscosity factor |
|------------------------------------|--------------------|-------------------------|----------------------------|-------------------------------------|
| ZT130                              | Galden ZT130       | 497                     | 1                          | 2.232                               |

Table 1: Gas library V3.24

### 9.3.8 Updating the software

Software updates from INFICON are installed with the aid of a USB flash drive. The update function of the device can be found under "Functions > Data > Update".

An update is possible,

- if one or several updates are available on the USB flash drive, but only one update per type at most (control unit, MSB box, I/O module),
- if these parts are also connected free of disturbances and have an update function.

The corresponding buttons in the update menu such as "Control Unit", "MSB Box", and "I/O Module" are active and can be activated individually.

#### NOTICE

##### Aborted connection

Loss of data due to disconnection

- ▶ Do not switch off the device and do not remove the USB flash drive while the software is being updated!
- ▶ Switch the device off and back on after a software update has taken place.

#### 9.3.8.1 Updating the software of the control unit

The software is contained in two files with the same file name, but with different file name extensions (".exe" and ".key").

- 1 Copy the files into the main directory of a USB stick.
- 2 Connect the USB flash drive to the USB port on the device.
- 3 Select: "Functions > Data > Update > Control unit".  
⇒ Do not switch off the device and do not remove the USB flash drive while the software is being updated!
- 4 Check the version information.
- 5 Select the "Start" button to start the update. Do not switch off the device and do not remove the USB flash drive while the software is being updated!
- 6 Follow the instructions on the touchscreen and wait until the update is complete.

#### 9.3.8.2 Checking and updating the software version of the MSB box

The current software is available from the Inficon support.

The functions of the XL Sniffer adapter set are taken into consideration in system software version 2.11 or higher.

- 1 Copy the file with the file name extension ".bin" into the root directory of a USB stick.

- 2 Connect the USB flash drive to the USB port on the device.
- 3 Select: "Functions > Data > Update > MSB".
  - ⇒ The display shows information on the current and the new software version as well as on the boot loader.
- 4 Check the version information.
  - ⇒ Select the "Start" button to start the update.
  - ⇒ Do not switch off the device and do not remove the USB flash drive while the software is being updated! Do not switch off the device and do not remove the USB flash drive while the software is being updated!
- 5 Follow the instructions on the touchscreen and wait until the update is complete.
- 6 If the system displays warning 104 or 106, confirm with "C".

### 9.3.8.3 Updating the software of the I/O module

The software of the I/O module can be updated from the control unit if the mass spectrometer module has at least the software version "MS module 1.02".

- 1 Copy the file with the file name extension ".bin" into the root directory of a USB stick.
- 2 Connect the USB flash drive to the USB port on the device.
- 3 Select: "Functions > Data > Update > I/O module"
  - ⇒ The display shows information on the current and the new software as well as on the current boot loader.
- 4 Check the version information.
- 5 Select the "Start" button to start the update.
  - ⇒ Do not switch off the device and do not remove the USB flash drive while the software is being updated!
- 6 Follow the instructions on the touchscreen and wait until the update is complete.
  - ⇒ The following tips are shown after selecting the "Start" button on the touchscreen:
    - Connect and switch on the IO1000.
    - Activate boot mode (switch DIP S2.3 on and off once).
    - When the STATUS LED flashes green, press OK.

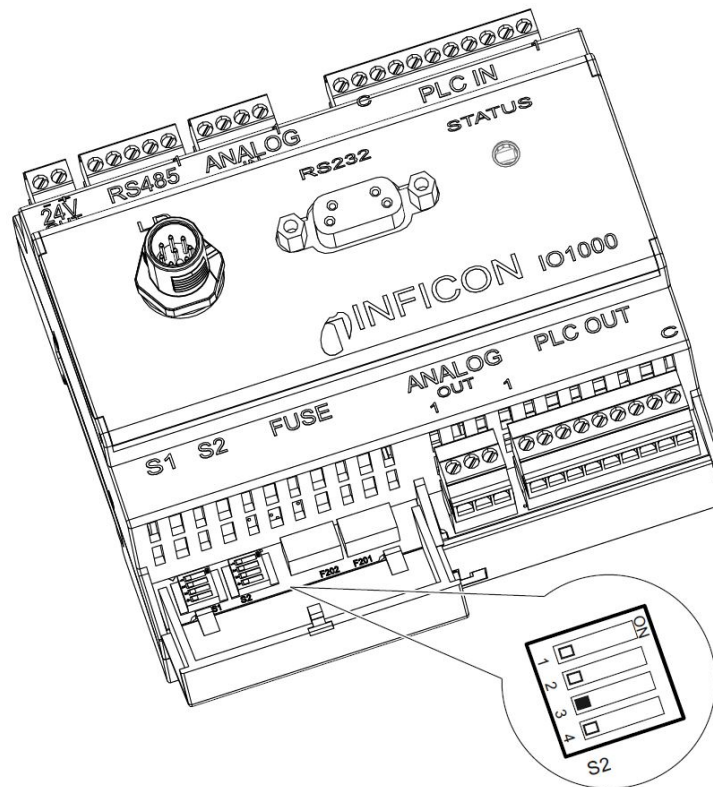


Fig. 19: DIP switch on the I/O module

## 10 Maintenance

The mass spectrometer module is a leak testing unit that is intended for industrial applications. The device is composed of parts and assemblies that are, for the most part, low maintenance.

Servicing the mass spectrometer module merely requires that you change the oil reservoir of the turbo molecular pump and check the fan on the turbo molecular pump.

We recommend that you sign a service agreement with INFICON or one of INFICON's authorized service partners.

### 10.1 Returning the device for maintenance, repair or disposal

#### **WARNING**

##### **Danger to health**

Contaminated devices could endanger the health of INFICON employees.

- ▶ Fill in the declaration of contamination completely.
  - ▶ Attach the declaration of contamination to the outside of the packaging.
- 
- ▶ Contact the manufacturer and send in a completed declaration of contamination before return shipment.
    - ⇒ You will then receive a return number and a shipping address.

The declaration of contamination is a legal requirement and serves to protect our employees. INFICON sends devices which are sent without a completed declaration of contamination back to the sender. See "Declaration of Contamination [► 116]".

### 10.2 General maintenance information

The maintenance work that needs to be performed on the mass spectrometer module is grouped into three service levels:

- Service level I: Customer without any technical training
- Service level II: Customer with technical and INFICON training
- Service level III: INFICON Service

#### **DANGER**

##### **Risk of death from electric shock**

There are high voltages inside the device. Touching parts where electrical voltage is present can result in death.

- ▶ Disconnect the device from the power supply prior to any maintenance work.

**NOTICE****Material damage from pollution**

The mass spectrometer module is a precision measurement device. Even little pollution can already damage the device.

- Make sure that the working environment is clean and you use clean tools whenever performing any maintenance work.

## 10.3 Replacing the operating fluid reservoir (up to serial number 90001759466)

This applies to SplitFlow 80 turbo molecular pump, that are installed in LDS3000 AQ with a serial number up to and including 90001759466. See "Maintenance plan for LDS3000 AQ up to and including serial number 90001759466 [► 111]".

### 10.3.1 Introduction

|                                                                                                                                                                                                                                 |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Spare part kit oil wick cartridge, scope of delivery: Oil wick cartridge with small O-ring (1 piece), Porex rods (8 pieces), O-ring for cover model A <sup>*)</sup> (1 piece), O-ring for cover model B <sup>*)</sup> (1 piece) | P/N: 200003801 |
| Face spanner for model A <sup>*)</sup>                                                                                                                                                                                          | P/N: 551-200   |
| Allen wrench 3 mm, as torque wrench with 3 Nm for assembly, for model B <sup>*)</sup>                                                                                                                                           |                |
| Threaded screw M5 as aid for model B <sup>*)</sup>                                                                                                                                                                              |                |

<sup>\*)</sup> To distinguish between models A and B, see the following illustration "Flood the turbo molecular pump [► 97]".

The turbo molecular pump is filled with an operating fluid for the lubrication of the ball bearings. The oil reservoir must be replaced every 4 years at the latest. With extreme strain of the pump or in unclean processes, the lubricant reservoir must be replaced at shorter intervals.

The cover of the oil reservoir can be unscrewed only when the turbo molecular pump is flooded.

- Follow the steps in the order of the next chapters.

### 10.3.2 Flood the turbo molecular pump

- 1 Shut down mass spectrometer module, see "Decommissioning [► 113]".
- 2 Wait until turbo molecular pump is drained (at least 1 min).
- 3 Disconnect 24 V power supply pack from MSB box.
- 4 Allow the turbo molecular pump to cool down if necessary.
- 5 Remove turbo molecular pump.
- 6 Open the ventilation screw slowly.
  - ⇒ Turbo molecular pump is flooded until it reaches atmospheric pressure.

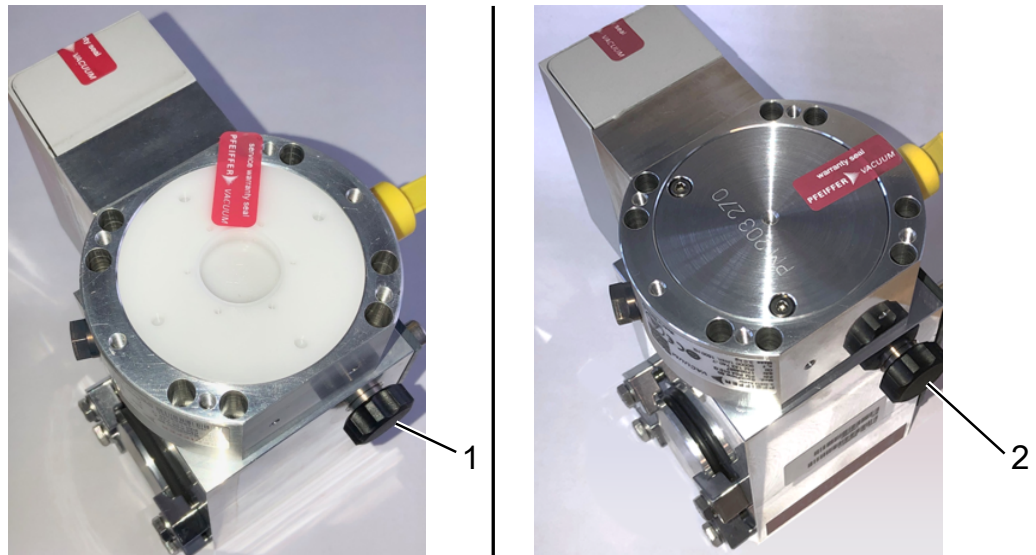


Fig. 20: Turbo molecular pump SplitFlow 80 with different covers

- |   |                              |   |                              |
|---|------------------------------|---|------------------------------|
| 1 | Ventilation screw on model A | 2 | Ventilation screw on model B |
|---|------------------------------|---|------------------------------|

### 10.3.3 Removing old oil wick cartridge



#### **WARNING**

##### **Danger of poisoning due to harmful substances**

The oil wick cartridge and parts of the turbo molecular pump can be contaminated with toxic substances that are contained in the pumped media.

- ▶ Take suitable safety precautions.
- ▶ Decontaminate contaminated parts prior to any maintenance work.
- ▶ Dispose of old oil reservoirs in compliance with applicable regulations.

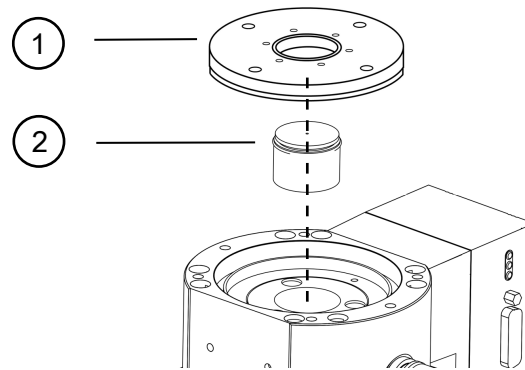
#### **NOTICE**

##### **Damage to the turbo molecular pump due to loosening of screws**

To remove the oil reservoir, unscrew only the cover. Do not loosen any screws underneath the cover! Otherwise the pump will be irreparably damaged.

##### **Model A**

- ✓ Cover corresponds to model A, see illustration of the turbo molecular pump SplitFlow 80 in "Flood the turbo molecular pump [▶ 97]".
- ✓ Face spanner, P/N: 551-200
- ✓ Two screwdrivers
- ✓ Mass spectrometer and turbo molecular pump flooded.
  - 1 Unscrew the cover (1) using a face spanner.
  - 2 Use two screwdrivers to lift out the oil reservoir (2). Do not loosen any screws!

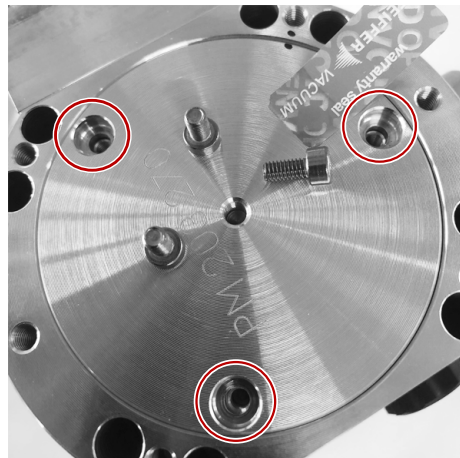


1 Cover

2 Operating fluid reservoir

### Model B

- ✓ Cover corresponds to model B, see illustration of the turbo molecular pump SplitFlow 80 in "Flood the turbo molecular pump [► 97]".
- ✓ Allen wrench 3 mm
- ✓ Two screwdrivers
- ✓ Mass spectrometer and turbo molecular pump flooded.
  - 1 Remove the affixed guarantee seal.
  - 2 Unscrew the 3 screws (M4) of the cover with the Allen key.

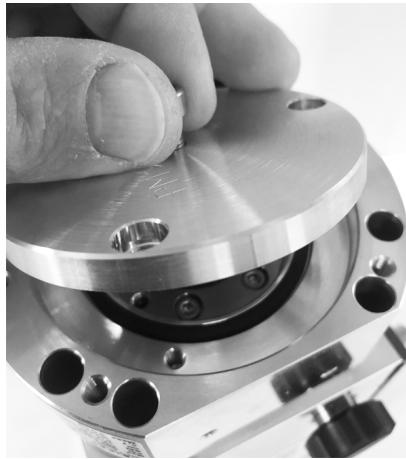


- 3 Screw a threaded screw (M5) a few turns into the empty central threaded opening of the aluminum cover.

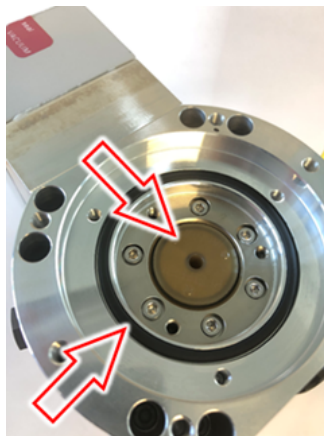


- 4 Use the screw to lift the cover.





- 5 Use the two screwdrivers to remove the O-ring and the oil wick cartridge.
- ⇒ Do not damage the sealing surfaces by scratching them!
  - ⇒ To avoid damaging the TMP, do not loosen any other screws around the oil wick cartridge.



### 10.3.4 Exchange Porex rods

#### NOTICE

##### Material damage due to cleaning liquids

Cleaning liquids can damage the unit.

- ▶ Do not use any cleaning liquids.
- ▶ Use a clean, lint-free cloth.

✓ Tweezers

✓ Porex rods

- 1 Pull out old Porex rods (1) (8 pieces) with tweezers.
- 2 Remove any contaminants found on the turbo molecular pump and the cover using a clean, lint-free cloth.
- 3 Insert new Porex rods (1) (8 pieces) with tweezers.



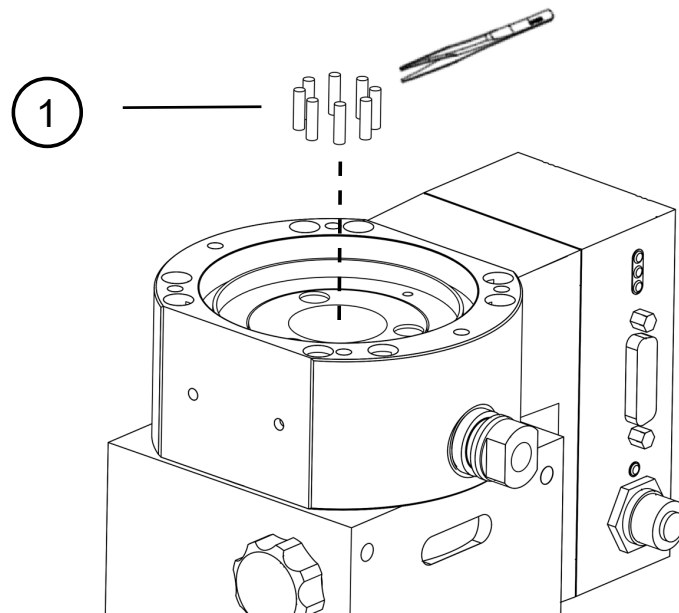


Fig. 21: The figure shows model A, model B analog

1 Porex rods

### 10.3.5 Inserting a new oil reservoir

#### NOTICE

##### Material damage if o-ring is mounted improperly

An improperly mounted o-ring can cause leaks. The device will experience malfunctions and become damaged.

- Carefully insert the O-ring of the cover.

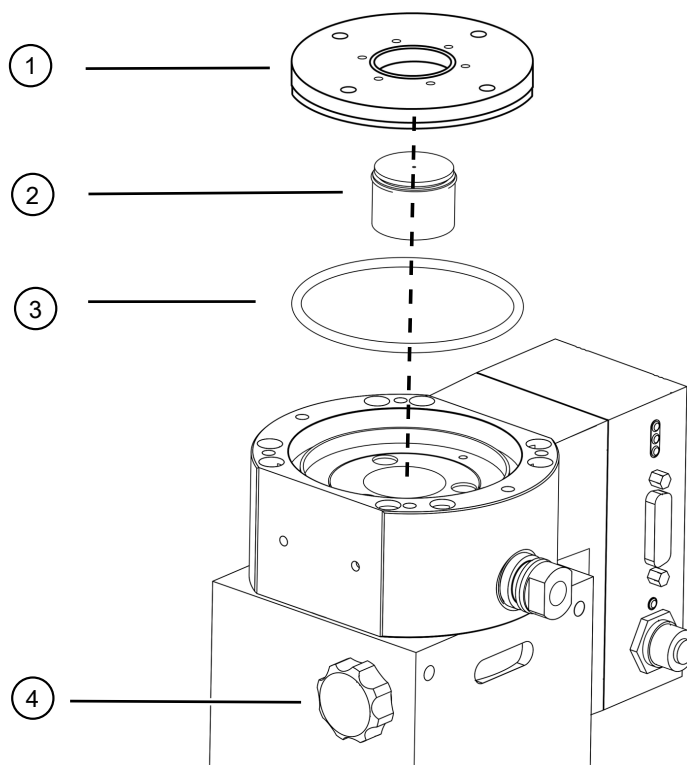


Fig. 22: The figure shows model A

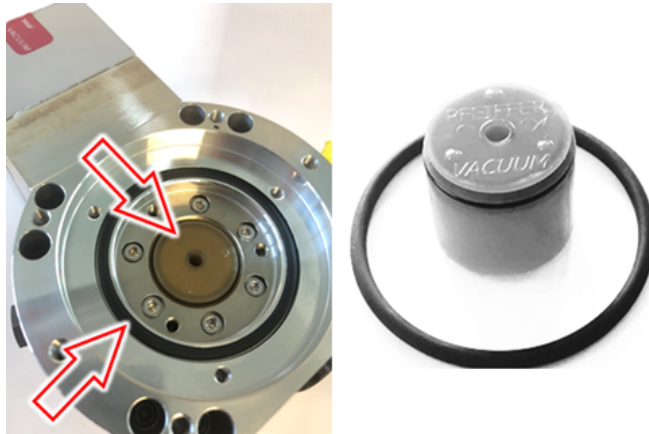
|   |                  |   |                           |
|---|------------------|---|---------------------------|
| 1 | Cover            | 2 | Oil reservoir with O-ring |
| 3 | O-ring for cover | 4 | Ventilating screw         |

### Model A

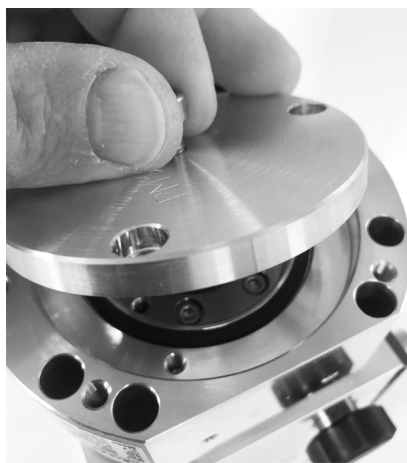
- ✓ Face spanner
- ✓ New O-ring for cover
- ✓ New oil reservoir
- ✓ The new oil reservoir contains a sufficient level of operating fluid. Do not fill in any more operating fluid.
  - 1 Check the expiration date of the new oil reservoir (2).
  - 2 Do not push the new oil reservoir (2) into the pump at full height, but only up to the O-ring of the oil reservoir.
    - ⇒ The new oil reservoir is correctly positioned by screwing in the cover (1).
  - 3 Remove the old O-ring (3) from the cover.
  - 4 Insert a new O-ring (3) for the cover.
  - 5 Screw in the cover (1) with a face spanner without any effort.
    - ⇒ To prevent the threads from tilting, place the cover (1) on it and slowly turn it counterclockwise until the threaded ends of the cap and pump fit into each other. As soon as this is achieved, the cover will slightly sink back into the pump. This position allows the threads to mesh better.
  - 6 Tighten the cover with a torque of 13 Nm +/-10%.
  - 7 Hand-tighten the ventilation screw (4).
  - 8 Install the turbo molecular pump.
  - 9 Put the mass spectrometer module into operation.

### Model B

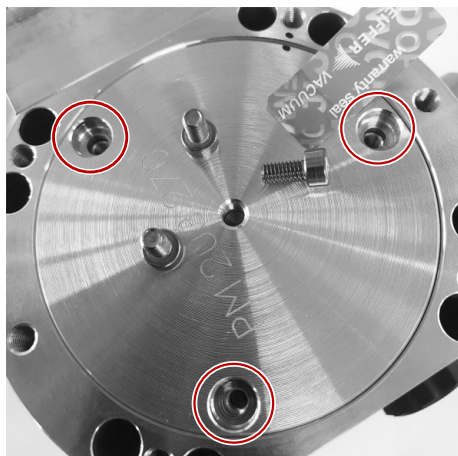
- ✓ Allen wrench 3 mm, as torque wrench with 3 Nm for assembly
- ✓ New O-ring for cover
- ✓ New oil reservoir
- ✓ The new oil reservoir contains a sufficient level of operating fluid. Do not fill in any more operating fluid.
  - 1 Check the expiration date of the new operating fluid reservoir.
  - 2 Do not push the new oil wick cartridge into the pump at full height, but only up to the O-ring of the oil wick cartridge.
    - ⇒ The new oil wick cartridge will be positioned correctly when you screw in the cover.



- 3 Insert a new o-ring for the cover.
- 4 Replace the cover using a threaded screw (M5).



- 5 Screw in the 3 screws (M4) of the cover with the Allen key and a torque of 3 Nm.



- 6 Tighten the ventilation screw by hand.



- 7 Install the turbo molecular pump.
- 8 Put the mass spectrometer module into operation.

### 10.3.6 Confirm maintenance work

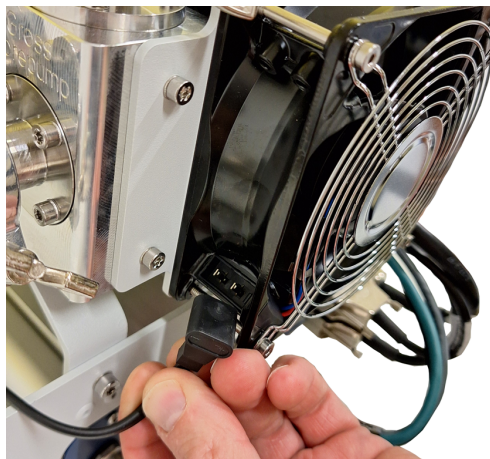
- ✓ Control unit installed
- ✓ Access = Integrator
- ▶ Confirm maintenance work on control unit: "Authorization > Integrator > Maintenance > Maintenance Work"

## 10.4 Fleece for operating fluids (from serial number 90001759482)

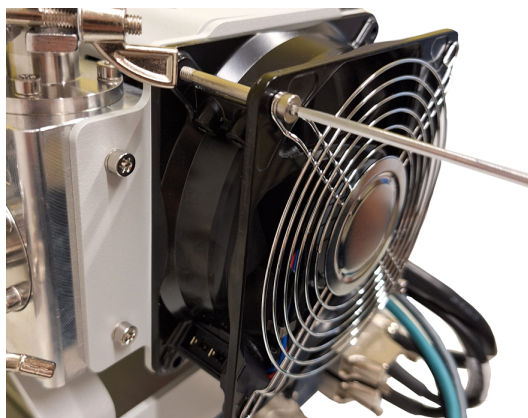
This applies to SplitFlow 80 Neo turbo molecular pump, that are installed in LDS3000 AQ with a serial number from 90001759482. See "Maintenance plan for LDS3000 AQ from serial number 90001759482 [► 112]".

### Removing old fleece for operating fluids

- ✓ The device is switched off, see "Shutting down the leak detector [► 113]".
  - ✓ The device is disconnected from the power supply.
  - ✓ The turbo molecular pump has cooled down.
- 1 Unplug the cable from the fan.



- 2 Remove the screws from the fan and take the fan off.



- 3 If there is a seal on the closing cap of the turbo molecular pump, remove the seal.

- 4 To flood the turbo molecular pump to atmospheric pressure, use an Allen wrench to slightly loosen the ventilation screw through the opening on the top of the air hood, if the opening is present.  
Alternatively, remove the air hood from the turbo molecular pump.  
⇒ The turbo molecular pump can now be opened.
- 5 Remove the screws from the closing cap and take off the closing cap.



- 6 Remove the edge protection ring around the fleece for operating fluids.

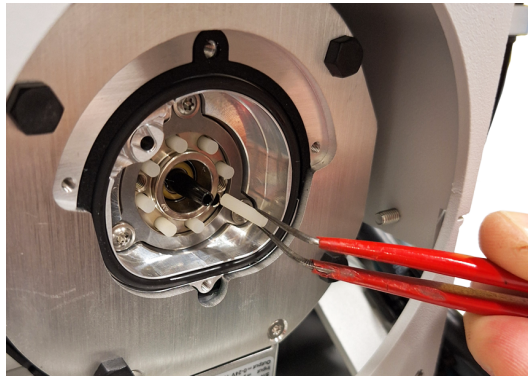


- 7 Remove the fleece for operating fluids.



- 8 Remove the capillary rods.





- 9 Remove the O-ring.

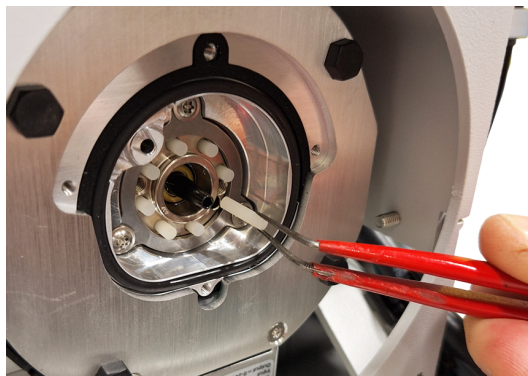


### Inserting new fleece for operating fluids

- 1 Insert the new O-ring.



- 2 Carefully insert the new capillary rods.



- 3 Insert the new fleece for operating fluids into the bearing housing. Ensure that the fleece for operating fluids is correctly aligned.



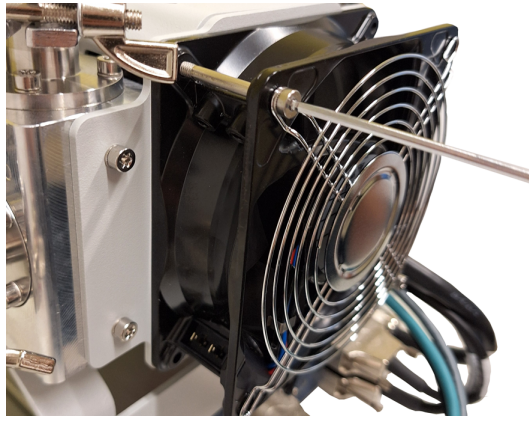
- 4 Carefully reinsert the edge protection ring. Ensure that the edge protection ring is correctly aligned.



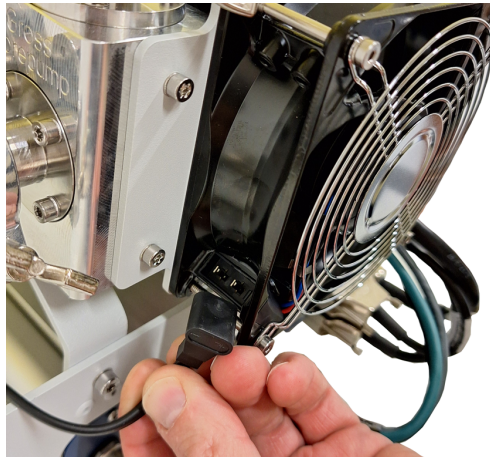
- 5 Place the closing cap back on.
- 6 Secure the closing cap with the screws. Use a tightening torque of 1.4 Nm.



- 7 Place the fan on the closing cap and secure the fan with the screws. Ensure that the orientation of the connector plug on the fan is correct.



8 Reconnect the fan to the device.



### 10.4.1 Confirm maintenance work

- ✓ Control unit installed
- ✓ Access = Integrator
  - ▶ Confirm maintenance work on control unit: "Authorization > Integrator > Maintenance > Maintenance Work"



## 10.5 LDS3000 AQ - maintenance relevant components

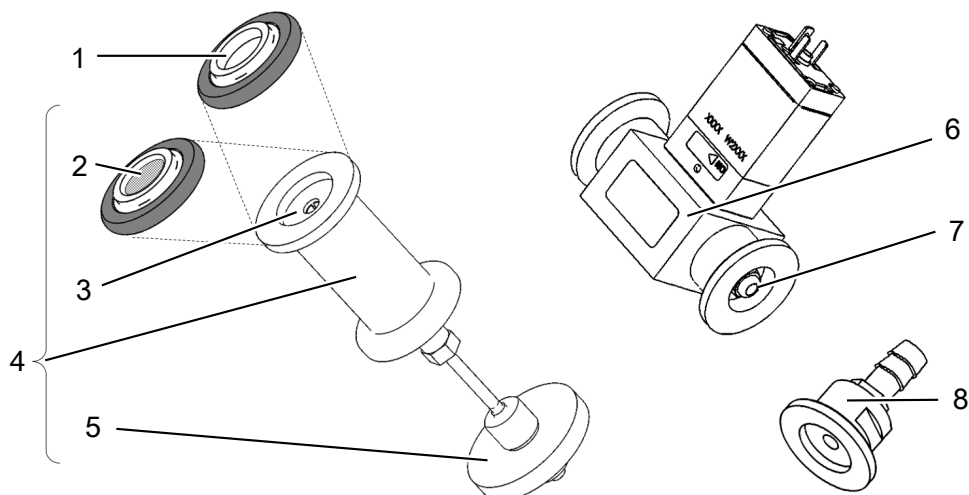


Fig. 23: Throttle for AQ

|   | Designation                                                                                                                                                                        | Quantity | Order number |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------|
| 1 | ISO-KF centering ring without filter.<br>Only to be used for connection according to variant 2 (with filter unit 0.45 µm Pall, pos. N° 5). See "Variant 2 [► 29]".                 | 1        | 211-059      |
| 2 | ISO-KF centering ring with filter.<br>Only to be used for connection according to variant 1 (without installation of filter unit 0.45 µm Pall, pos. N° 5). See "Variant 1 [► 27]". | 1        | 211-090      |
| 3 | Throttle insert LDS AQ spare part                                                                                                                                                  | 1        | 200009029    |
| 4 | Throttle flange LDS AQ complete                                                                                                                                                    | 1        | 200009030    |
| 5 | Filter unit 0.45 µm Pall.<br>Only to be used for connection according to variant 2. See "Variant 2 [► 29]".                                                                        | 4        | 200009847    |
| 6 | Valve LDS AQ.<br>To be used only when connecting a second chamber for switching.                                                                                                   | 1        | 200008464    |
| 7 | Replacement filter for valve LDS AQ (pos. N° 6)                                                                                                                                    | 10       | 200009701    |
| 8 | GROSS throttle flange - 1.02 mm.<br>To be used with both variants. See "Variant 1 [► 27]" and "Variant 2 [► 29]".                                                                  | 1        | 200008532    |

## 10.6 Maintenance plan

If the maintenance work of the maintenance plan is not carried out, the warranty for the mass spectrometer module is void.



### Two maintenance plans

Since the type of turbo molecular pump installed in devices with serial numbers from 90001759482 onwards has been changed, one of two different maintenance plans applies.

- ▶ Check the serial number of your device, which is located on its type plate.
- ▶ For devices with a serial number up to and including 90001759466, follow the instructions in "Maintenance plan for LDS3000 AQ up to and including serial number 90001759466 [▶ 111]".  
Exception: If a "SplitFlow 80 Neo" turbo molecular pump is retrofitted in such a device, the maintenance plan intervals for LDS3000 AQ will automatically be changed to those specified for serial numbers starting with 90001759482.
- ▶ For devices with a serial number from 90001759482, follow the instructions in "Maintenance plan for LDS3000 AQ from serial number 90001759482 [▶ 112]".

### 10.6.1 Maintenance plan for LDS3000 AQ up to and including serial number 90001759466

| Maintenance work                                                                                        | Operating hours                                                                                         | 4000           | 8000           | 16000          | 24000          | 32000          | Service level |
|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|----------------|----------------|---------------|
|                                                                                                         | Duration                                                                                                | 1/2 year       | 1 year         | 2 years        | 3 years        | 4 years        |               |
| Turbo molecular pump SplitFlow 80 in devices up to and including serial number 90001759466 (type plate) | Replacing operating fluid reservoir (spare part no. 200003801)                                          |                |                | X <sub>3</sub> |                |                | I and II      |
|                                                                                                         | Revision: Change bearing and replace operating fluid reservoir (spare part no. 200003800 or 200003800R) |                |                |                |                | X <sub>2</sub> | III           |
|                                                                                                         | Clean fan and check for proper operation                                                                |                | X <sub>3</sub> | X <sub>3</sub> | X <sub>3</sub> | X <sub>3</sub> | I and II      |
| Accessories                                                                                             | Clean sniffer valve                                                                                     |                | X              | X              | X              | X              | III           |
|                                                                                                         | Calibrate internal calibration leak                                                                     |                | X <sub>2</sub> | X <sub>2</sub> | X <sub>2</sub> | X <sub>2</sub> | III           |
| AQ filter valve/throttle<br>- valve filter<br>- ISO KF filter ring<br>- 0.45 µm Pall                    | Control condition. Replace if necessary                                                                 | X <sub>3</sub> | X <sub>3</sub> | X <sub>3</sub> | X <sub>3</sub> | X <sub>3</sub> | I             |
|                                                                                                         | Replace preventively                                                                                    | X <sub>3</sub> | X              | X              | X              | X              | I             |

#### Maintenance plan legend

- I Customer or higher level
- II Customer with instruction or higher level
- III INFICON Service Technician
- X Carry out maintenance as per operating hours or duration
- X<sub>1</sub> Maintenance after operating hours, not after duration
- X<sub>2</sub> Maintenance by duration, not by operating hours
- X<sub>3</sub> Dependent on environmental influences, operating conditions, pollution and application process

#### Note

Unsuitable environmental influences or operating conditions as well as contamination and the type of application process can reduce the recommended maintenance interval of the AQ filter used to less than 8000 hours or 1 year. Depending on the type of setup, different AQ filters are in use, see "LDS3000 AQ - maintenance relevant components [► 109]".

Reduced flow/pressure caused by clogged filters may result in warning or error messages. In this case, premature replacement of the filter is required.

## 10.6.2 Maintenance plan for LDS3000 AQ from serial number 90001759482

| Maintenance work                                                                             | Operating hours                                                            | 8000   | 16000   | 24000   | 32000   | 40000   | Service level |
|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------|---------|---------|---------|---------|---------------|
|                                                                                              | Duration                                                                   | 1 year | 2 years | 3 years | 4 years | 5 years |               |
| Turbo molecular pump SplitFlow 80 Neo in devices from serial number 90001759482 (type plate) | Replacing fleece for operating fluids (optional), spare part no. 200015001 |        |         | X       |         |         | I             |
|                                                                                              | Replacing turbo molecular pump (mandatory), nr. 200015000 or 200015000R    |        |         |         |         | X       | III           |
|                                                                                              | Clean fan and check for proper operation                                   |        | X       |         | X       |         | I             |
| Accessories                                                                                  | Clean sniffer valve                                                        | X      | X       | X       | X       | X       | III           |
|                                                                                              | Calibrating internal calibration leak                                      | X      | X       | X       | X       | X       | III           |
| AQ Valve/ Throttle                                                                           | Control condition. Replace if necessary                                    |        | X       |         | X       |         | I             |
| AQ filter<br>- valve filter<br>- ISO KF filter ring<br>- 0.45 µm Pall                        | Replace preventively                                                       | X      | X       | X       | X       | X       | I             |

### Maintenance plan legend

- I Customer or higher level
- II Customer with instruction or higher level
- III INFICON Service Technician
- X Maintenance work after operating hours or time period

The maintenance intervals are based on the manufacturer's specifications and environmental conditions as described in the operating instructions. In the event of deviations, the maintenance intervals must be adjusted.

# 11 Decommissioning

## 11.1 Shutting down the leak detector

- 1 Switch off the leak detector on the power supply pack.
- 2 Wait until the turbo molecular pump has stopped running.

## 11.2 Disposing of the mass spectrometer module

The owner can dispose of the device or it can be sent to INFICON.

The device consists of materials that can be recycled. This option should be exercised to prevent waste and also to protect the environment.

- For disposal, always comply with local and regional environmental and safety regulations.

## 11.3 Send in mass spectrometer module for maintenance, repair or disposal



### **WARNING**

#### **Danger due to harmful substances**

Contaminated devices could endanger health. The contamination declaration serves to protect all persons who come into contact with the device.

- Fill in the declaration of contamination completely.

- 1 Contact the manufacturer and send in a completed declaration of contamination before return shipment.  
⇒ You will then receive a return number and the shipping address.
- 2 Use the original packaging when returning.
- 3 Before sending the device, attach a copy of the completed contamination declaration. See Declaration of Contamination [► 116].

## 12 Appendix

### 12.1 CE Declaration of Conformity



We – INFICON GmbH - herewith declare that the products defined below meet the basic requirements regarding safety and health and relevant provisions of the relevant EU Directives by design, type and the versions which are brought into circulation by us. This declaration of conformity is issued under the sole responsibility of INFICON GmbH.

In case of any products changes made, this declaration will be void.

Designation of the product:

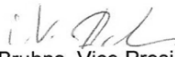
**Mass spectrometer module**

Models: **LDS3000**  
**LDS3000 AQ**

Catalogue numbers:

**560-300**  
**560-600**

Cologne, August 18<sup>th</sup>, 2023

p.p.   
Dr. H. Bruhns, Vice President LDT

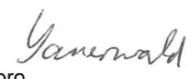
The products meet the requirements of the following Directives:

- **Directive 2014/30/EU (EMC)**
- **Directive 2011/65/EU (RoHS)**

Applied harmonized standards:

- **EN 61326-1:2013**  
**Class A according to EN 55011**
- **EN IEC 63000:2018**

Cologne, August 18<sup>th</sup>, 2023

  
pro  
Sauerwald, Research and Development

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Fax: +49 (0)221 56788-90  
www.inficon.com  
E-mail: leakdetection@inficon.com

## 12.2 Declaration of Incorporation



### EC DECLARATION OF INCORPORATION

We – INFICON GmbH - herewith declare that the products defined below meet the basic requirements regarding safety and health and relevant provisions of the relevant EU Directives by design, type and the versions which are brought into circulation by us. This declaration of conformity is issued under the sole responsibility of INFICON GmbH.

In case of any products changes made, this declaration will be void

Designation of the product:

**Mass spectrometer module**

Models: **LDS3000**

**LDS3000 AQ**

Catalogue numbers:

**560-300**

**560-600**

The products meet the requirements of the following Directives:

- **Directive 2006/42/EC (Machinery)**

Applied harmonized standards:

- **EN ISO 12100:2010**
- **EN ISO 61010-1:2010+A1:2019**

**The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of this Directive (2006/42/EC), where appropriate.**

The manufacturer will electronically transmit, in response to a reasoned request by the national authorities, relevant information on the partly completed machinery.

The relevant technical documentation is compiled in accordance with part B of Annex VII.

Authorised person to compile the relevant technical files:

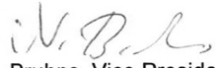
Heinz Rauch, INFICON GmbH, Bonner Strasse 498, D-50968 Cologne

The following essential health and safety requirements according to Annex II of Directive 2006/42/EC were fulfilled:

1.1.2, 1.1.3, 1.1.5, 1.2.1, 1.2.6, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.6, 1.5.8, 1.5.9, 1.5.10, 1.5.11, 1.5.13, 1.6.1, 1.6.3, 1.7.1, 1.7.2, 1.7.3, 1.7.4

Cologne, August 18<sup>th</sup>, 2023

Cologne, August 18<sup>th</sup>, 2023

p.p.   
Dr. H. Bruhns, Vice President LDT

  
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Sauerwald, Research and Development

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## 12.3 Declaration of Contamination

### Declaration of Contamination

The service, repair, and/or disposal of vacuum equipment and components will only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay.  
This declaration may only be completed (in block letters) and signed by authorized and qualified staff.

| <b>1 Description of product</b><br>Type _____<br>Article Number _____<br>Serial Number _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>2 Reason for return</b><br>_____<br>_____<br>_____ |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|---------------------------------------|--------------------------------|---------------------------------------|-------------------------|---------|--------------------------------|------------------------------|--|-------------------|-----------------------------|---------------------------------|--|-----------|-----------------------------|---------------------------------|--|-------------|-----------------------------|---------------------------------|--|--------------------------|--------------------------------|------------------------------|--|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| <b>3 Operating fluid(s) used</b> (Must be drained before shipping.)<br>_____<br>_____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| <b>4 Process related contamination of product:</b><br><table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">toxic</td> <td style="width: 10%;">no <input type="checkbox"/> 1)</td> <td style="width: 10%;">yes <input type="checkbox"/></td> <td style="width: 30%;"></td> </tr> <tr> <td>caustic</td> <td>no <input type="checkbox"/> 1)</td> <td>yes <input type="checkbox"/></td> <td></td> </tr> <tr> <td>biological hazard</td> <td>no <input type="checkbox"/></td> <td>yes <input type="checkbox"/> 2)</td> <td></td> </tr> <tr> <td>explosive</td> <td>no <input type="checkbox"/></td> <td>yes <input type="checkbox"/> 2)</td> <td></td> </tr> <tr> <td>radioactive</td> <td>no <input type="checkbox"/></td> <td>yes <input type="checkbox"/> 2)</td> <td></td> </tr> <tr> <td>other harmful substances</td> <td>no <input type="checkbox"/> 1)</td> <td>yes <input type="checkbox"/></td> <td></td> </tr> </table> <div style="text-align: right; padding-top: 20px;"> </div> |                                                       | toxic                                 | no <input type="checkbox"/> 1) | yes <input type="checkbox"/>          |                         | caustic | no <input type="checkbox"/> 1) | yes <input type="checkbox"/> |  | biological hazard | no <input type="checkbox"/> | yes <input type="checkbox"/> 2) |  | explosive | no <input type="checkbox"/> | yes <input type="checkbox"/> 2) |  | radioactive | no <input type="checkbox"/> | yes <input type="checkbox"/> 2) |  | other harmful substances | no <input type="checkbox"/> 1) | yes <input type="checkbox"/> |  |
| toxic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | no <input type="checkbox"/> 1)                        | yes <input type="checkbox"/>          |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| caustic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | no <input type="checkbox"/> 1)                        | yes <input type="checkbox"/>          |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| biological hazard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | no <input type="checkbox"/>                           | yes <input type="checkbox"/> 2)       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| explosive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | no <input type="checkbox"/>                           | yes <input type="checkbox"/> 2)       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| radioactive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | no <input type="checkbox"/>                           | yes <input type="checkbox"/> 2)       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| other harmful substances                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | no <input type="checkbox"/> 1)                        | yes <input type="checkbox"/>          |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 40%;">           The product is free of any substances which are damaging to health<br/>           yes <input type="checkbox"/> </div> <div style="width: 60%;">           1) or not containing any amount of hazardous residues that exceed the permissible exposure limits         </div> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 40%;"></div> <div style="width: 60%;">           2) Products thus contaminated will not be accepted without written evidence of decontamination!         </div> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| <b>5 Harmful substances, gases and/or by-products</b><br>Please list all substances, gases, and by-products which the product may have come into contact with:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Trade/product name</th> <th style="width: 25%;">Chemical name (or symbol)</th> <th style="width: 25%;">Precautions associated with substance</th> <th style="width: 25%;">Action if human contact</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                       | Trade/product name                    | Chemical name (or symbol)      | Precautions associated with substance | Action if human contact |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| Trade/product name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Chemical name (or symbol)                             | Precautions associated with substance | Action if human contact        |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| <b>6 Legally binding declaration:</b><br>I/we hereby declare that the information on this form is complete and accurate and that I/we will assume any further costs that may arise. The contaminated product will be dispatched in accordance with the applicable regulations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| Organization/company _____<br>Address _____ Post code, place _____<br>Phone _____ Fax _____<br>Email _____<br>Name _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |
| Date and legally binding signature _____ Company stamp _____                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                       |                                       |                                |                                       |                         |         |                                |                              |  |                   |                             |                                 |  |           |                             |                                 |  |             |                             |                                 |  |                          |                                |                              |  |

Copies:  
Original for addressee - 1 copy for accompanying documents - 1 copy for file of sender



# 12.4 RoHS

产品中有害物质的名称及含有的信息表

Table of Hazardous Substance Names and Content Information in Products

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                    |                      |                      |                                           |                                                    |                                                                   |                                                    |                                                    |                                                       |                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|----------------------|----------------------|-------------------------------------------|----------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------|----------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | LDS3000AQ: 有害物质<br>LDS3000AQ: Hazardous Substances |                      |                      |                                           |                                                    |                                                                   |                                                    |                                                    |                                                       |                                                                         |
| 部件名称<br>Part Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 铅<br>Lead<br>(Pb)                                  | 汞<br>Mercury<br>(Hg) | 镉<br>Cadmium<br>(Cd) | 六价铬<br>Hexavalent<br>Chromium<br>(Cr(VI)) | 多溴联苯<br>Poly-<br>brominated<br>biphenyls<br>(PBBs) | 多溴联苯<br>醚<br>Poly-<br>brominated<br>diphenyl<br>ethers<br>(PBDEs) | 邻苯二甲<br>酸二正丁<br>酯<br>Dibutyl<br>phthalate<br>(DBP) | 邻苯二甲酸<br>二异丁酯<br>Diisobutyl<br>phthalate<br>(DIBP) | 邻苯二甲<br>酸丁苄酯<br>Benzyl<br>butyl<br>phthalate<br>(BBP) | 邻苯二甲酸<br>二(2-乙基<br>)己酯<br>Bis (2-<br>ethylhexyl)<br>phthalate<br>(DEHP) |
| 阀门<br>Valve                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | X                                                  | O                    | O                    | O                                         | O                                                  | O                                                                 | O                                                  | O                                                  | O                                                     | O                                                                       |
| 风扇<br>Fan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | X                                                  | O                    | O                    | O                                         | O                                                  | O                                                                 | O                                                  | O                                                  | O                                                     | O                                                                       |
| 组装的印<br>刷电路板<br>Assembled<br>printed<br>circuit<br>boards                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | X                                                  | O                    | O                    | O                                         | O                                                  | O                                                                 | O                                                  | O                                                  | O                                                     | O                                                                       |
| 节流阀<br>Throttle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | X                                                  | O                    | O                    | O                                         | O                                                  | O                                                                 | O                                                  | O                                                  | O                                                     | O                                                                       |
| <p>注 1: O: 表示该有害物质在该部件所有均质材料中的含量均不超出电器电子产品有害物质限制使用国家标准要求。</p> <p>X: 表示该有害物质至少在该部件的某一均质材料中的含量超出电器电子产品有害物质限制使用国家标准要求。</p> <p>注 2: 以上未列出的部件, 表明其有害物质含量均不超出电器电子产品有害物质限制使用国家标准要求。</p> <p>Note 1: O: Indicates that said hazardous substances contained in all the homogeneous materials for this part is below the limit requirement of the national standard for the restriction of hazardous substances in electrical and electronic products.</p> <p>X: Indicates that said hazardous substances contained in at least one homogeneous material used for this part is above the limit requirement of the national standard for the restriction of hazardous substances in electrical and electronic products.</p> <p>Note 2: Parts not listed above indicate that their hazardous substances are below the limit requirement of the national standard.</p> |                                                    |                      |                      |                                           |                                                    |                                                                   |                                                    |                                                    |                                                       |                                                                         |

