

Translation of the original operating instructions

LDS Arnova

Mass spectrometer module

Catalog No.
560-500

From software version
V1.11

jina56en1-02-(2604)



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1 About this Manual

This document applies to the software version stated 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

Name	Document number
Operating Manual Control Unit CU1000	jina54
Operating instructions bus module	jiqb10
Operating instructions I/O module	jiqc10
Interface description	jira56

1.2 Explanation of warnings



DANGER

Imminent hazard resulting in death or serious injuries



WARNING

Hazardous situation resulting in potential death or serious injuries



CAUTION

Hazardous situation resulting in minor injuries

NOTICE

Hazardous situation resulting in damage to property or the environment

1.3 Target Groups

This instruction manual is intended for operators and technically qualified personnel with experience in leak detection technology and the integration of leak detectors in leak detection systems. In addition, the installation and use of the device require knowledge of electronic interfaces.

1.4 Definition of terms

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.

FINE

FINE denotes the connection to the turbo molecular pump for inlet pressures up to 0.4 mbar.

GROSS

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

Minimum detectable leak rate

The minimum detectable leak rate that can be detected by the leak detector under ideal conditions.

ULTRA

ULTRA denotes the connection to the turbo molecular pump for the measurement range with the highest sensitivity at inlet pressures below 0.1 mbar (adjustable).

Background signal

Argon is a natural component of air.

Before any leak detection, a certain amount of the adjusted tracer gas is already in the volume, 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.

Foreline pressure

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

ZERO

There is argon that is weakly bound to the surfaces of a test object 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 argon and air.

The LDS Arnova is suitable for underpressure testing.

► You may only install, operate and maintain the device indoors in accordance with these operating instructions.

Incorrect usage

Avoid the following unintended uses:

- Use outside the technical specifications, see "Technical data"
- 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 device in plants where sudden loads and vibrations or periodic forces act upon the device
- Suction of flammable/explosive gas mixtures above the lower explosion limit. The allowable composition of venal gas mixtures can be read in the safety data sheets of the respective manufacturers.
- Using the device in an installation site that is not sufficiently stable
- Use without suitable fastening

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.

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.

3 Scope of delivery, transport, storage

Scope of delivery

Item	Quantity
Mass spectrometer module	1
Plug for 24V connection	1
Pressure sensor PSG500	1
Self-locking nuts	4
Plug for Output	1
Plug for Gauges Exit	1
Digital operating instructions, to download as PDF from www.inficon.com	1

- ▶ Upon receipt of the device, check the scope of delivery for completeness.

Transport

NOTICE

Damage due to transport in unsuitable packaging

Transport in unsuitable packaging material can damage the device.

- ▶ Keep the original packaging.
- ▶ Transport the device only in the original packaging.

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 [▶ 16]".

4 Description

4.1 Function

Objective	The mass spectrometer module is a detection device for the tracer gases argon and air. When integrated into test systems, the device is used to detect leaks in a test object.
Device Interfaces	<p>The mass spectrometer module is part of the leak detection system LDS Arnova. 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> <p>For internal calibration, an internal calibration leak can be connected directly to the mass spectrometer module via a flange.</p>

4.2 Design of device

4.2.1 Overall device

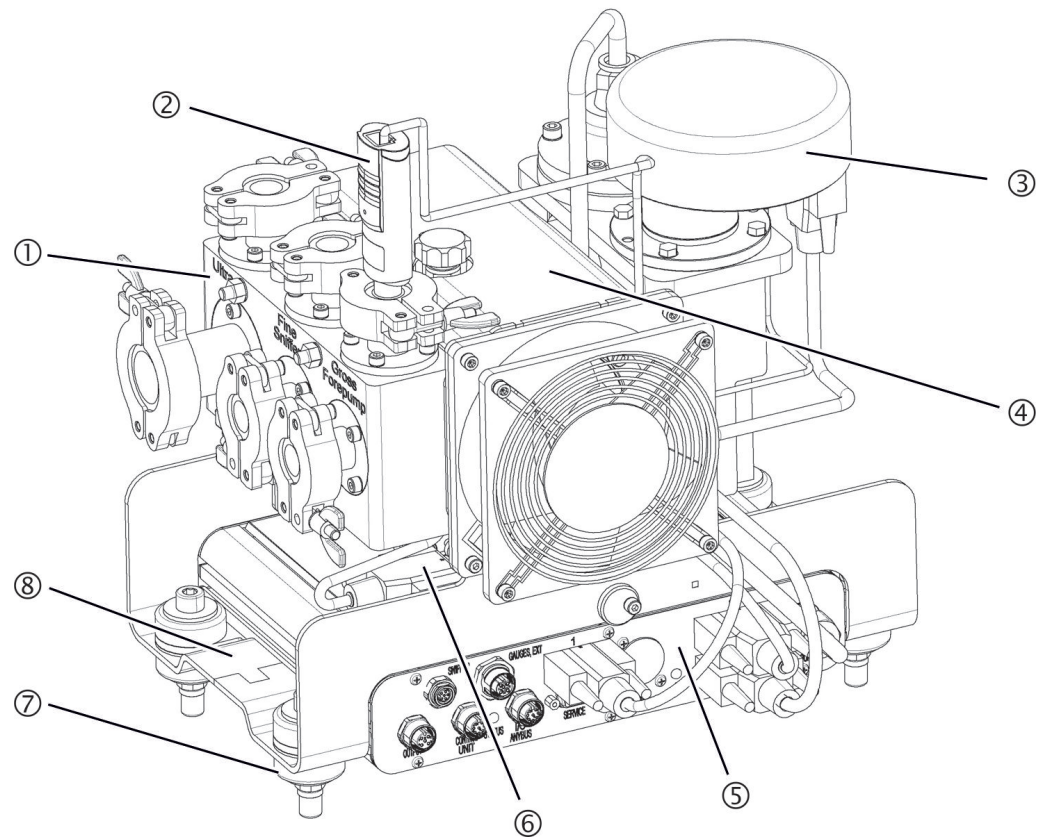


Fig. 1: Mass spectrometer module LDS Arnova

1	Connection block. Connections for test system, backing pump, pressure sensor PSG500 and internal calibration leak, see also "Connection block [▶ 14]".
2	Pressure sensor PSG500 for measuring the pressure of the backing pump
3	Preamplifier of the mass spectrometer module
4	Turbo molecular pump with cooling unit
5	MSB box. Interfaces to the mass spectrometer module (see "MSB box [▶ 14]")
6	Inverter for turbo-molecular pump
7	Fasteners for installing the mass spectrometer module in a test system
8	Rating plate containing mass spectrometer module specifications

4.2.2 Connection block

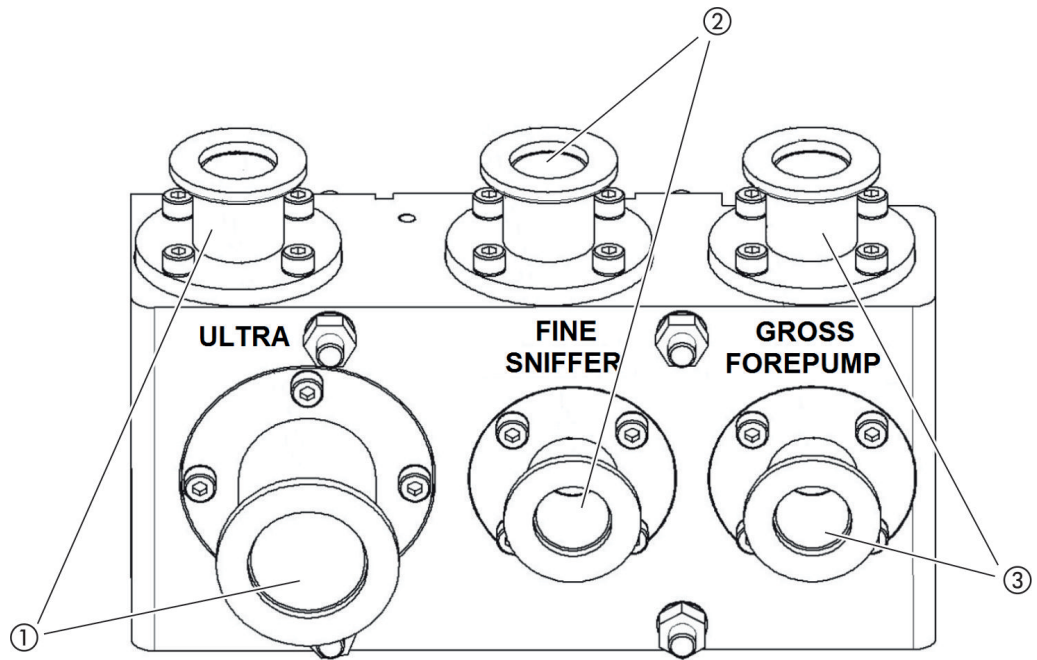
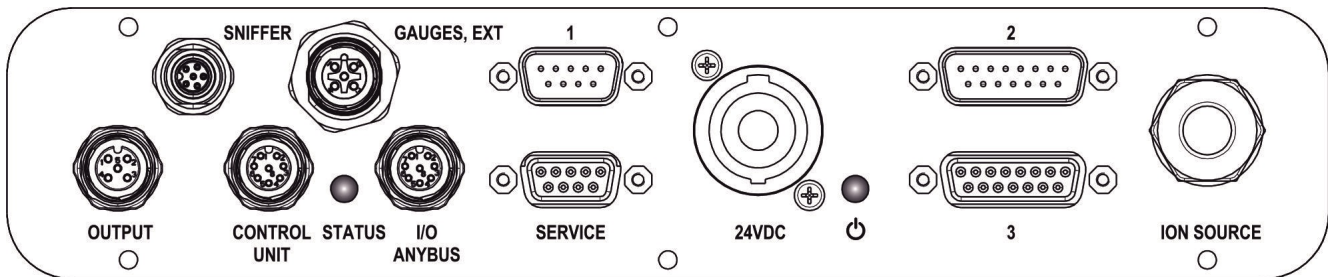


Fig. 2: Connection block

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

4.2.3 MSB box



GAUGES, EXT

Connection for optional external pressure measurement locations (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

Power LED	Status LED	Meaning
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

4.3 Technical Data

Mechanical data

	560-500
Dimensions (L x W x H)	320 x 240 x 280 mm (13 x 10.6 x 11.5 in.)
Weight	16.4 kg
Inlet flange	1 x DN25 KF 5 x DN16 KF

Electrical data

	560-500
Power input	max. 10 A
Operating voltage	24 V  +/-5%
Protection class	IEC/EN 60034-5 IP40 UL 50E Type 1

Physical data

	560-500
Maximum inlet pressure	0.1 mbar - 15 mbar
Run-up time	< 150 s
Detectable gases	Argon, Air
Minimum detectable leak rate	
Argon	< 1 x 10 ⁻⁶ mbar l/s
Air	< 1 x 10 ⁻⁴ mbar l/s
Ion source	2 longlife Iridium filaments, Yttrium-oxide coated

Ambient conditions

	560-500
Permissible ambient temperature (during operation)	10 °C ... 45°C
Max. altitude above sea level	2000 m
Permissible magnetic field max.	7 mT
Max. humidity up to 31 °C	80%
Max. relative humidity from 31 °C to 40 °C	Decreasing on linear basis from 80% to 50%
Max. relative humidity above 40°C	50%
Storage temperature	-20 °C... ..60 °C
Pollution degree	2

4.4 Factory settings

Parameter	Factory setting
AO upper limit exp.	1×10^{-5}
Displ. upper limit exponent	5 decades
Displ. lower limit exponent	1 decade
Operation mode	Vacuum
Bus module address	126
Pressure unit (interface)	mbar
EcoBoost	Off
EcoBoost vacuum time constant	5.0 s
Emission	On
Filter leak rate threshold	1×10^{-10}
Filter ZERO time	5 s
Filter mode	I•CAL
Gas ratio in percent (for all masses)	100%
Gas ballast	Off
I/O module protocol	ASCII
Calibration request	Off
Calibration factor VAC	1.0 (for all masses)
Cathode selection	Auto Cat1
Config. Analog output 1	Leak rate mantissa
Config. Analog output 2	Leak rate exponent
Configuration of digital outputs	Pin 1: Trigger 1, inverted Pin 2: Trigger 2, inverted Pin 3: Trigger 3, inverted Pin 4: Trigger 4, inverted Pin 5: Ready Pin 6: Error, inverted Pin 7: CAL request, inverted Pin 8: Open, inverted
Configuration digital inputs (for all pins)	No function

Parameter	Factory setting
Leak rate unit VAC, (display and interface)	mbar l/s
Leak rate upper limit VAC (interface)	1.0×10^{-1}
Leak rate lower limit VAC (interface)	1.0×10^{-12}
Fan mode	Fan always on
Machine factor in standby	Off
Machine factor	1.0 (for all masses)
Mass	Argon
Module on the I/O connection	IO1000
Nominal state TMP	On
External test leak VAC (for all masses)	9.9×10^{-1}
Calibration leak internal	9.9×10^{-1}
Open calibration leak internal	Off
Scale for leakage rate	0.5 V / decade
Language	English
TMP rotation speed	1500
Trigger level 1 (2, 3, 4)	1×10^{-5} mbar l/s
Preamplifier test at CAL	On
Display warning as error (1 - 8)	No Entry
Maintenance warning	TMP
ZERO with start	Off
ZERO mode	Suppress everything

5 Installation

5.1 Adjust the position of the connections to the installation dimensions

Select location

Select the most argon-free environment possible for the measurement setup. For reliable measurements with the device, the argon content in the air must be less than 2%.

By nature, air contains 1% argon.

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 inserted into the housing from the other side, it cannot be locked in place using the locking washer.

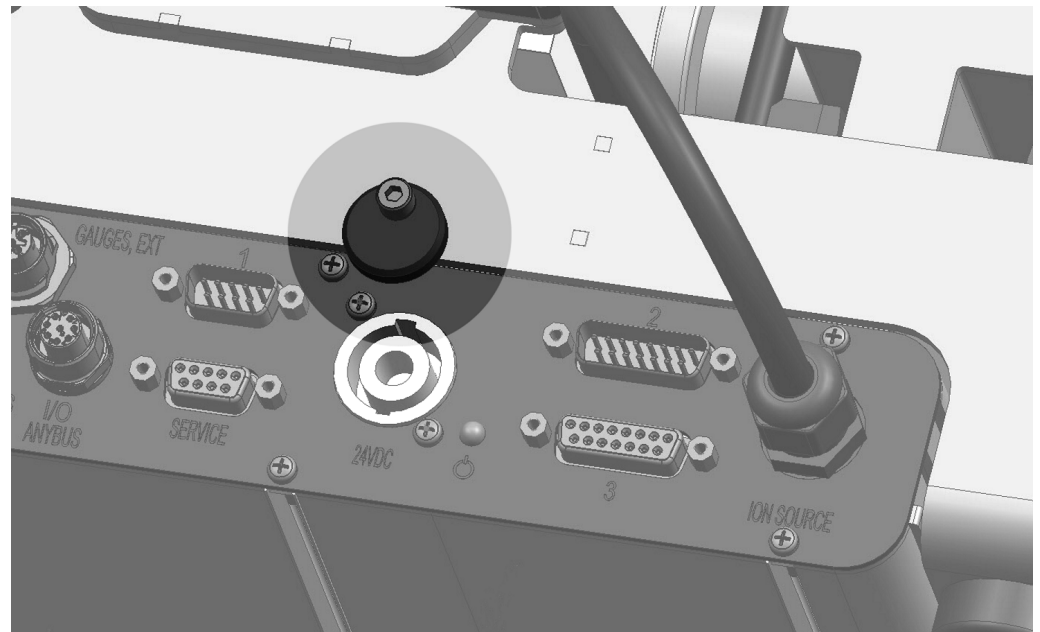


Fig. 3: Lock

5.2 Installing the mass spectrometer module on the test system

The mass spectrometer module can be mounted in any position. If the MSB box is not locked in place with the locking washer, it must be positioned horizontally.

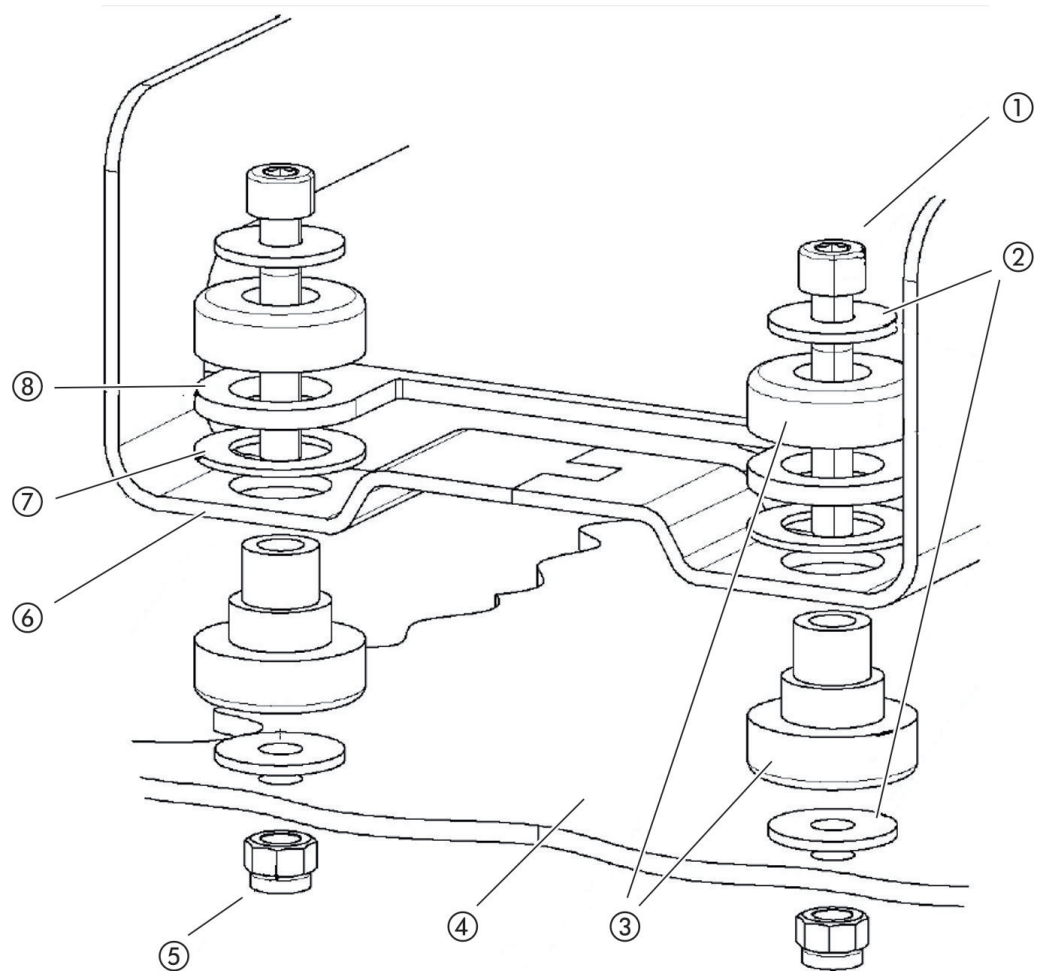


Fig. 4: Components of a fastener

1	Hexagon socket head screw 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: \varnothing 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 connection ULTRA, FINE, or GROSS

The operation mode of the vacuum connection and the rotation speed of the turbo molecular pump define:

- Minimum detectable leak rate (MDLR)
- Constantly permissible inlet pressure (p_{\max})
- Pumping speed (S)

To reach the MDLR, the following conditions must be met:

- The LDS Arnova must be in operation for at least 20 minutes.
- Ambient conditions must be steady (temperature, no vibrations/shocks, clean environment)
- The test object must be operated with switched-off ZERO until to the background is stable. The ZERO function may be switched on only after that.

Connection		Turbo molecular pump rotation speed	
		1000 Hz	1500 Hz
ULTRA	MDLR:		
	Argon	1×10^{-6} mbar l/s	1×10^{-6} mbar l/s
	Air	1×10^{-4} mbar l/s	1×10^{-4} mbar l/s
	p_{\max} :	0.1 mbar	0.1 mbar
	p_{\max} short-term (< 3 s):	0.1 mbar	0.1 mbar
	S:	3l/s	3l/s
FINE	p_{\max} :	0.9 mbar	0.4 mbar
	p_{\max} short-term (< 3 s):	0.9 mbar	0.7 mbar
	S:	1l/s	1l/s
GROSS	p_{\max} :	18 mbar	15 mbar
	S:	depends on the backing pump	

Exceedance of the constantly permissible inlet pressure generates the warning "TMP overheating".

NOTICE

Material damage due to pressure surges

Pressure surges exceeding the maximum inlet pressure will damage the mass spectrometer module.

- ▶ Do not exceed the maximum inlet pressure.

- 1 Set the operation mode vacuum connection and the rotation speed turbo molecular pump in accordance with the physical vacuum conditions found in the test system.
- 2 Connect the mass spectrometer module to the "ULTRA", "FINE" or "GROSS" connections on the vacuum system of the test system.
- 3 Set the speed of the turbomolecular pump, see also "Set the rotation speed of the turbo molecular pump [▶ 37]".

5.4 Establish component connection

- 1 Connect pressure sensor PSG500 to one of the GROSS/FOREPUMP connections.
- 2 Connect the backing pump to the second GROSS/FOREPUMP connection.
- 3 If available, connect internal calibration leak 561-501 to the second free flange (FINE or ULTRA) of the vacuum connection.

5.5 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 LDS Arnova.
- ▶ Use a power cable with a large enough cross section.
- ▶ Ensure that the LDS Arnova can be disconnected from the power supply in an emergency or for repairs:
Position the device so that you can always reach the plug for unplugging.
Alternatively, attach a marked and easily accessible disconnect device.

- 1 Connect the 24 V power cable to the included plug (connections: +24V on 1+ and GND on 1-).
- 2 Connect the power cable to the socket "24VDC". Cable length < 30 m.

- 3** Connect the control unit to the socket "Control Unit". Cable length of the INFICON data cable < 30 m.
- 4** Connect the I/O or bus module to the Socket "I/O" . Cable length of the INFICON data cable < 30 m.
- 5** Connect pressure sensor PSG500 and, if used, calibration leak 561-501 on the cable of socket "1". For socket 1 see "MSB box [▶ 14]".
- 6** Connect gas ballast valve to the socket "Output".

6 Operation



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.

WARNING

Danger to life and material damage due to unsuitable operating conditions

There is danger to life due to unsuitable operating conditions. The device can become damaged.

- ▶ Avoid changing the position of the device in an abrupt manner.
- ▶ Avoid extreme external vibrations and impact.

You can use the following accessories in combination with the mass spectrometer module:

- Control unit CU1000
- Bus module BM1000
- I/O module IO1000

Additional information on the control unit, the modules and the XL sniffer adapter is included in the documents:

- Operating Manual Control Unit CU1000
- Operating instructions I/O module IO1000
- Operating instructions bus module BM1000
- Protocol Descriptions LDS Arnova

The paths listed in the following sections refer to the operation of the mass spectrometer module with the control unit CU1000. If the bus module or the I/O module is used, the actions must be implemented within the scope of the protocol that is used.

The path information for the control unit always starts in the main menu.

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.

6.2 Default settings

Language selection

Select the display language. The factory setting is English.
German, English, French, Italian, Spanish, Portuguese, Russian, Chinese, Japanese

Control unit	Settings > Set up > Control unit > Language
--------------	---

LD protocol	Command 398
-------------	-------------

ASCII protocol	*CONFIg:LANGUage
----------------	------------------

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

0	mbar l/s (factory setting)
---	----------------------------

1	Pa m ³ /s
---	----------------------

2	atm cc/s
---	----------

3	Torr l/s
---	----------

4	sccm
---	------

5	sft ³ /yr
---	----------------------

Control unit	Display > Units (display) > Leak rate unit
--------------	--

LD protocol	Command 396
-------------	-------------

ASCII protocol	Command *CONFIg:UNIT:VACuum
----------------	-----------------------------

Leak rate unit interface

Selecting the leak rate unit of the interfaces

0	mbar l/s (factory setting)
---	----------------------------

1	Pa m ³ /s
---	----------------------

2	atm cc/s
---	----------

3	Torr l/s
---	----------

4	sccm
---	------

5	sft ³ /yr
---	----------------------

Control unit	Settings > Set up > Interfaces > Units (interface) > Leak rate unit
LD protocol	Command 431
ASCII protocol	Command *CONFig:UNIT:LRVac

6.4 Select device for pressure

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
ASCII protocol	Command *CONFig:UNIT:Pressure

6.5 Select gas type (mass)

Machine and calibration factor depend on the set mass and are stored in the mass spectrometer module.	
Air	Air
Argon	Argon
Control unit	Settings > Mass
LD protocol	Command 506 (with value 0 or 2)
ASCII protocol	Command *CONFig:MASS (with value 0 or 2)

6.6 Calibrate device

6.6.1 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 20 minutes previously.

It is recommended to calibrate the device once per shift for the desired gases. Thereafter you can switch between the different flows without re-calibrating.

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 or 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 or Settings > Setup > Notifications > CAL request. > Calibration warning W650
--------------	--

LD protocol	Command 429
-------------	-------------

ASCII protocol	*CONFig:CALWarn (ON, OFF)
----------------	---------------------------

Calibration Features

The device can be calibrated internally or externally.

Internal calibration can be performed using the optional built-in calibration leak. A separate calibration leak is needed for external calibration.

External calibrations have the advantage that they can be performed under conditions such as pressure and measuring time, which are similar to the later measurement.

internal	<ul style="list-style-type: none"> - with internal calibration leak - autotune (mass adjustment) - determine the calibration factor with the steady signal of the test leak - amplifier test - determination of the background. Adjust if necessary after calibrating the machine factor, see "Setting the machine factor [▶ 30]"
external	<ul style="list-style-type: none"> - With external calibration leak in test equipment - Consideration of the characteristics of the testing equipment (pressure, partial flow ratio) - Amplifier test - Autotune (mass adjustment) - Determine the calibration factor after the signal of the calibration leak has settled - Determination of the background

6.6.2 Internal Calibration Configuration and Start

Note: For internal calibration, INFICON offers the calibration leak 561-501.

Prerequisite for the calibration with the internal calibration leak is the one-time entry of the leak rate of the calibration leak.

Leak rate of internal calibration leak

Define the leak rate of the calibration leak you wish to use during calibration. Calibration will not be possible unless you enter the value here.

1E-9 ... 9.9E-1 mbar l/s

Control unit	Settings > Configuration > Operating Mode > Vacuum > Reference leak int. > Calibration leak internal or Functions > CAL > Settings > Calibration leak int.
--------------	--

LD protocol	Command 394
-------------	-------------

ASCII protocol	Command *CONFig:CALleak:INT
----------------	-----------------------------

Opening/closing the calibration leak

Opening/closing the calibration leak. This is automatically carried out with the internal calibration. If the calibration leak is opened using the control unit or the interface, then no internal calibration can take place. The calibration leak must first be closed again in this case.

0	close
---	-------

1	Open
---	------

Control unit	Functions > Valves > Open internal calibration leak
--------------	---

LD protocol	Command 12
-------------	------------

ASCII protocol	Command *STATus:VALVE:TestLeak (ON, OFF)
----------------	--

▶ Start calibration

Operating unit: Functions > CAL > Intern

LD protocol: 4, Parameter 0

ASCII protocol: *CAL:INT

IO1000: CAL internal, see "Settings for I/O module IO1000 [▶ 38]"

⇒ Calibration is performed automatically.

6.6.3 External Calibration Configuration and Start

Requirement for the calibration with the external calibration leak is the one-time entry of the leak rate of the calibration leak and an open calibration leak.

The test leak is installed in or on the test system and opened before calibration.

Leak rate of external calibration leak vacuum

Define the leak rate of the calibration leak you wish to use during calibration. Calibration will not be possible unless you enter the value here.

A specific leak rate must be set for each gas (mass).

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

Control unit	Settings > Set up > Operation modes > Vacuum > Ext. calibration leak > Mass Argon (Air) > Test leak external VAC Argon (Air) or Functions > CAL > Settings > Ext. calibration leak (for current mass in selected unit)
LD protocol	Command 390
ASCII protocol	Command *CONFig:CALleak:EXTVac (for current mass in selected unit)

6.6.4 Check the calibration

To check whether a re-calibration is necessary, check the already existing.

6.6.4.1 Calibration using the internal calibration leak test

- ▶ Start test:
Control unit: Functions > CAL > Test int.
LD protocol: 4, Parameter 4
ASCII protocol: *CAL:PROOFINT
IO1000: CAL test internal, see "Settings for I/O module IO1000 [▶ 38]"

⇒ Test is performed automatically.

6.6.4.2 Calibration using the external calibration leak test

- ▶ LD and ASCII protocol: The status must be queried via: Command 260 or *STATus:CAL

- 1 Open external test leak.
- 2 Wait until leak rate signal is tuned and stable.
- 3 Start test:
Control unit: Functions > CAL > Test int.
LD protocol: 4, Parameter 5
ASCII protocol: *CAL:PROOFEXT
IO1000 compare figure in "External Calibration Configuration and Start".
⇒ Request to "close calibration leak"
- 4 Close calibration leak inside the test system.

⇒ Leak rate signal decreases.

5 Confirm measured background value is stable:

Control unit: "OK"

LD protocol: 11, Parameter 1

ASCII protocol: *CAL:CLOSED

IO1000 compare figure in "External Calibration Configuration and Start".

⇒ The test is completed if:

Control unit: Result is displayed

LD protocol: As with the other steps, the status must be queried

ASCII protocol: As with the other steps, the status must be queried

IO1000 compare figure in "External Calibration Configuration and Start".

6.6.5 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!

Enter the calibration factors for the masses "Air" and "Argon" .	
The values will be overwritten during the next calibration.	
0.01 ... 5000	
Control unit	Settings > Set up > Operation modes > Vacuum > Calibr. factor > Mass Argon (Air) > Calibration factor VAC Argon (Air)
LD protocol	Command 520
ASCII protocol	Command *FACTOR:CALVac

6.6.6 Setting the machine 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 aid of a corrective machine factor, the measuring 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.

Procedure

✓ 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 Set machine factor, see below.

⇒ The device indicates the actual leak rate.

Corrects a possible deviation between internal and external calibration.

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 Argon (Air) > Machine factor VAC Argon (Air)
LD protocol	Command 522
ASCII protocol	Command *FACtor:FACMachine

6.7 Starting and stopping the measurement

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
During the measurement	During standby
ZERO is possible.	ZERO is not possible.
The trigger outputs switch depending on the leak rate and the trigger threshold.	The output at the trigger outputs is: Leak rate value exceeded threshold.
External calibration is started during the activation of digital input CAL.	Internal calibration is started during the activation of digital input CAL.
The machine factor can be activated or deactivated during the correction of the leak rate for Standby.	
0	OFF (machine factor is not considered in Standby.)
1	On (machine factor is considered in Standby.)
Control unit	Settings > Set up > Operation modes > LR correction > Machine factor in standby
LD protocol	Command 524
ASCII protocol	-

Enable/disable correction of the leak rate in Standby

6.8 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:

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

6.9 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"

6.10 Suppressing gas backgrounds with "ZERO" functions

Unwanted gas backgrounds can be suppressed with ZERO. If ZERO is enabled, the currently measured leak rate value will be interpreted as gas background and subtracted from all subsequently measured values. The background value suppressed by "ZERO" is adjusted automatically if the background changes inside the device. The background value is automatically adjusted depending on the set ZERO time, except for filter setting I•CAL, see "Measurement result display with signal filters [▶ 35]".

Activating or deactivating "ZERO"

ZERO activate/deactivate	
0	On
1	Off
Control unit	Function > ZERO > ZERO
LD protocol	Command 6
ASCII protocol	Command *ZERO

"ZERO with start" activating and deactivating

ZERO with start suppresses the gas background automatically when a measurement is started.	
0	On
1	Off
Control unit	Settings > ZERO/Filter > ZERO > ZERO with start
LD protocol	Command 409
ASCII protocol	Command *CONFIg:ZEROSTART

ZERO mode setting

Determines the degree of the gas background suppressed by ZERO (only with filter "fixed" and "2-stage").	
0	all decades
1	1 - 2 decades
2	2 - 3 decades
3	2 decades
4	3 - 4 decades
5	19/20 of the gas background is suppressed
Control unit	Settings > ZERO/Filter > ZERO > ZERO mode

LD protocol	Command 410
ASCII protocol	Command *CONFig:DECADEZero

6.11 Suppressing decreasing gas backgrounds with EcoBoost



The function EcoBoost is at an early stage of development. The function may therefore still contain errors that may make productive use inadvisable. INFICON expressly reserves the right to change or remove the function in future software versions.

EcoBoost is optimized for detecting leaks more clearly when the background is decreasing due to pumping down. The more the background decreases during the measurement, the more useful this function is. For this purpose, a prediction of the future course is calculated on the basis of the signal course of the last two seconds and taken into account in the leak rate calculation.

EcoBoost supplements existing ZERO functions, see also "Suppressing gas backgrounds with "ZERO" functions [▶ 32]".

Procedure

- ✓ You have enabled EcoBoost
 - Control unit:** Settings > EcoBoost > EcoBoost settings, Button "On"
 - LD protocol:** 410 (value = 6)
 - ASCII protocol:** *CONFig:DECADEZero ECOBOOST
- ✓ You have replaced the "Favorite 1" or "Favorite 2" button in the favorites window with "EcoBoost". For the setting, see "Touch screen settings", "Assigning favorite keys". Since this setting, an EcoBoost button has been available for operation in the measurement display of the CU1000.

Otherwise, this button would be missing in the measurement display and you would have to use the way via the menu "Function > ZERO > EcoBoost", Button "On".
- ✓ You have selected the desired gas type, see "Select gas type (mass) [▶ 26]".
 - 1 To avoid false alarms or unresponsive measurements, set the "EcoBoost vacuum time constant" under
 - Control unit: "Settings > EcoBoost".
 - ⇒ The time constant is calculated by dividing the volume of the measuring chamber by the total suction capacity of all pumps at the time of measurement. The factory setting is 5 s; the minimum is 2 s, maximum 20 s.
 - 2 Pump down the vacuum chamber to the maximum inlet pressure of the selected LDS Arnova port.
 - 3 Open the valve to the LDS Arnova.
 - 4 Wait 3 seconds and then activate EcoBoost as follows.
 - Bedieneinheit:** Via an ideally set up favorite key, see above.
 - LD-Protokoll:** 6 (value = 1)
 - ASCII protocol:** *ZERO (:ON)
 - PLC input:** Set input with assigned function "ZERO" or "ZERO pulse" to "active". See also "Assigning the digital inputs of the I/O module".
 - Field bus:** Perform a normal ZERO with ZeroMode 0 over cyclic data on the field bus (i.e. bit 2 and bit 3 in the low byte of the command word must be 0)

⇒ Additional information on the behavior of EcoBoost:
 To be able to activate this function when EcoBoost is set, the background signal must decrease evenly during this period and the status message for EcoBoost must report an "STABLE".


Control unit: The status display for EcoBoost shows "STABLE" . See also "Touchscreen elements".

LD protocol: 493

ASCII protocol: *STATus:STABLE

PLC output: Evaluate output with assigned function "ZERO stable", see also "Assigning the digital outputs of the I/O module".

⇒ If the status message for EcoBoost does not go to "ISTABLE" and you cannot activate this function, use the standard ZERO function of the LDS Arnova with a stable background, see also "Suppressing gas backgrounds with "ZERO" functions [▶ 32]".

Control unit: The status display shows "UNSTABLE" . See also "Touchscreen elements"

LD protocol: 493

ASCII protocol: *STATus:STABLE

PLC output: Evaluate output with assigned function "ZERO stable". See also "Assigning the digital outputs of the I/O module".

⇒ After activation, the leak rate drops by a factor of between 10 and 100, depending on the pump speed and the volume of the measuring chamber.

5 Apply tracer gas to your leak/test object.

⇒ If your nominal leak rate is ten times greater than the displayed background, your leak is displayed. Smaller leaks can also be found.

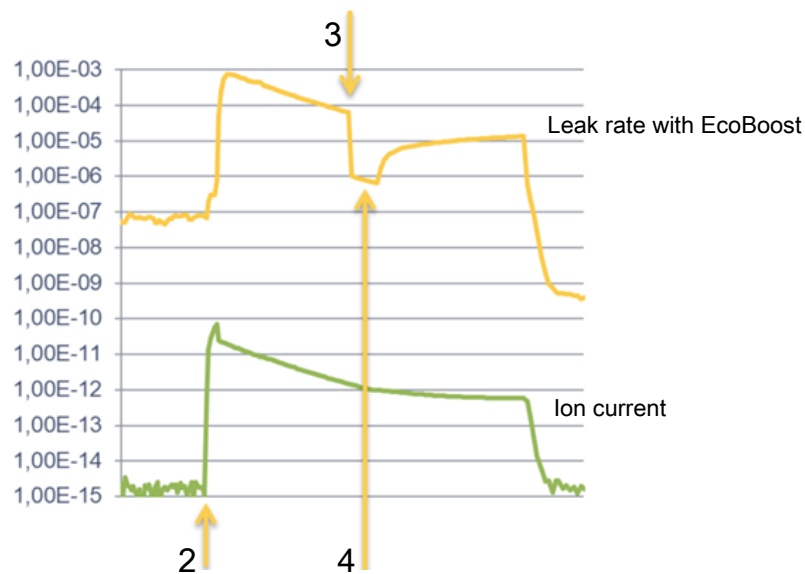


Fig. 5: Example of measurement curves (EcoBoost)

1	Action step 1, see above text for "Procedure": Pumping down the vacuum chamber (without illustration)
2	Action step 2: Open valve
3	Action step 3: EcoBoost activation
4	Action step 4: Apply tracer gas to the test object

Known behavior:

- If the substrate is almost stable, the suppression is only a factor of 10. In this case, use the standard ZERO function of the LDS Arnova. See also "Suppressing gas backgrounds with "ZERO" functions [▶ 32]".
- If EcoBoost is activated without the "STABLE" message, the device uses a background prediction from the signal of the last 2 seconds. This can lead both to false alarms and to a leak being overlooked.
- If the pumping speed drops too much after activating EcoBoost, a leak is indicated. Do not use EcoBoost near the final pressure of the backing pump used.
- Do not switch off any additionally used pump for the measuring chamber after you have activated EcoBoost. Otherwise, a leak will be indicated.

6.12 Measurement result display with signal filters

Select signal filter

With the signal filters, the leak rate indicator regarding slope and noise behavior can be influenced.

As a rule, select signal filter I•CAL.

I•CAL	The leak rates are averaged at time intervals that are optimized for the range of the leak rates. The algorithm used offers excellent sensitivity and response time. Use of this setting is strongly recommended.
fixed	The leak rates are averaged at fixed intervals of 0.2 seconds.
2-zone	The averaging period is switched depending on the filter leak rate threshold.
Control unit	Settings > ZERO/Filter > Filter > Filter mode
LD protocol	Command 402
ASCII protocol	Command *CONFig:FILTer

Setting the filter leak rate threshold

Leak rate background in mbar l / s for the averaging period. The averaging period is 10.24 s below this value. Above this value, the averaging period is 160 ms. Setting applies only to filter "2-stage".

1E-11 ... 9.9E-3

Control unit	Settings > ZERO/Filter > Settings > Filter 2-zone
LD protocol	Command 403
ASCII protocol	Command *CONFig:LRFilter

Setting filter ZERO time

Update interval for the offset value with negative leak rate signal (except for I•CAL filter).

Resolution 0.1 s (50 = 5.0 s)

Control unit	Settings > ZERO/Filter > Settings filter > ZERO time
LD protocol	Command 411
ASCII protocol	Command *CONFig:ZEROTIME

6.13 Control of the Gas Ballast Valve of the Backing Pump

The mass spectrometer module can control an electric 24 V gas ballast valve of the backing pump via the "Output" connection.

Controlling the gas ballast valve

Controlling the gas ballast valve using digital outputs.	
0	Off
1	On
2	Continuously on
Control unit	Functions > Valves > Gas Ballast
LD protocol	Command 228
ASCII protocol	-

6.14 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. The lower display limit can be raised by up to 14 decades. 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 Command: *CONFig:DISPL_LIM:LOW

6.15 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 the IO1000 are activated. Additionally, exceeding Trigger 1 is visually highlighted on the control unit.	
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)

6.16 Set the rotation speed of the turbo molecular pump

In some applications, it may be advisable to reduce the rotation speed of the turbo-molecular pump, to increase the sensitivity of the device. As a result, however, the maximum allowable inlet pressure decreases at the GROSS, FINE and ULTRA connections. After changing the rotation speed recalibration is required!

Rotation speed of turbo molecular pump in Hertz	
1000	
1500	
Control unit	Settings > Setup > MS module > TMP > Settings > TMP rotational speed
LD protocol	501
ASCII protocol	*CONFig:SPEEDTMP

6.17 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 *STATus:CAThode

6.18 Switching off the device

- 1 Switch off the device at the power supply.
- 2 Wait until the turbo molecular pump has stopped running.

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 or 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 Command *CONFig:REcorder:LINK2 Command *CONFig:REcorder:SCALE Command *CONFig:REcorder:UPPEREXP

Limit values can be defined for the output voltages.	
VAC:	Min. 1×10^{-13} ... 1×10^{-1} mbar l/s Max. 1×10^{-12} ... 1×10^{-1} mbar l/s
Control unit	Settings > Set up > Interfaces > LR limits
LD protocol	Command 226 (Vac)
ASCII protocol	Command *CONFig:LIMITS:VAC

Functions, assignment of analog outputs:

Off	The analog outputs are switched off (Output voltage = 0 V).	
Pressure p1 / Pressure p2	1 ... 10 V; 0.5 V / decade; 1 V = 1×10^{-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; Step function; 1 V = 1×10^{-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; 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 1×10^{-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; 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 1×10^{-5} mbar l/s (= 10 V). Scale set to 5 V / decade. Lower limit is at 1×10^{-7} 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 <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; 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 0.7×10^{-x} . 9.9 V corresponds to a leak rate of 9.9×10^{-x} .
Pressure p1 (1 V / Dec.)/ Pressure p2 (1 V / Dec.)	1 ... 10 V; 1 V / decade; 2.5 V = 1×10^{-3} mbar; 8.5 V = 1000 mbar	
Leak rate log. H./ Leak rate exp. Inv.	Special function. Use only on the recommendation of INFICON.	

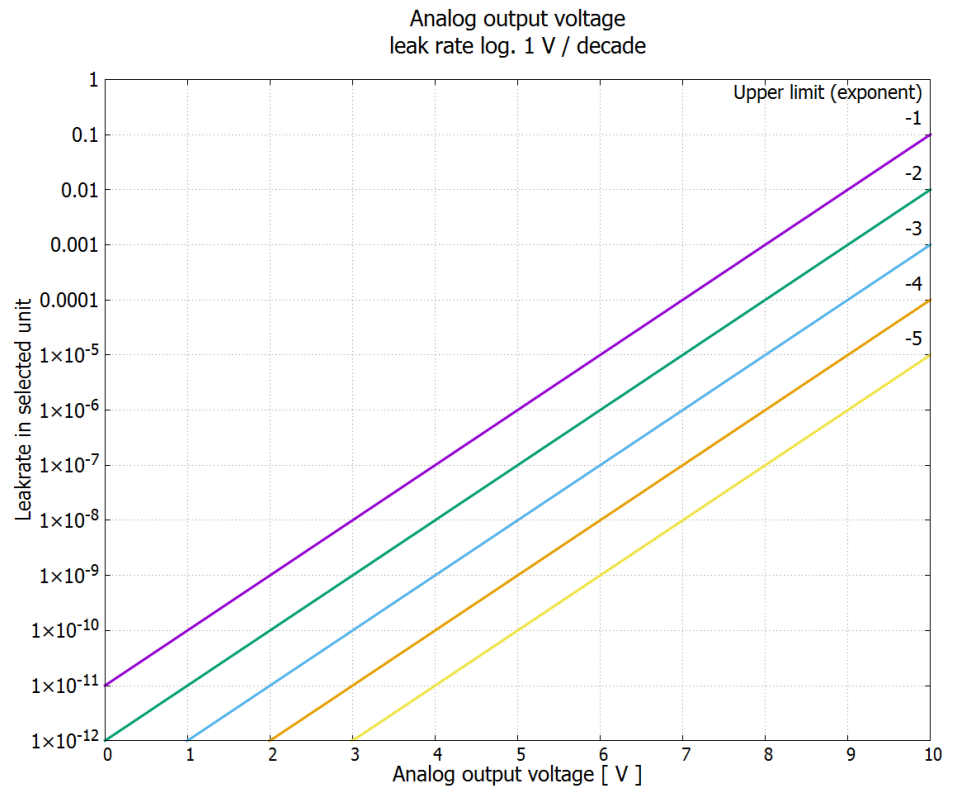


Fig. 6: Analog output voltage leak rate log. 1 V / decade

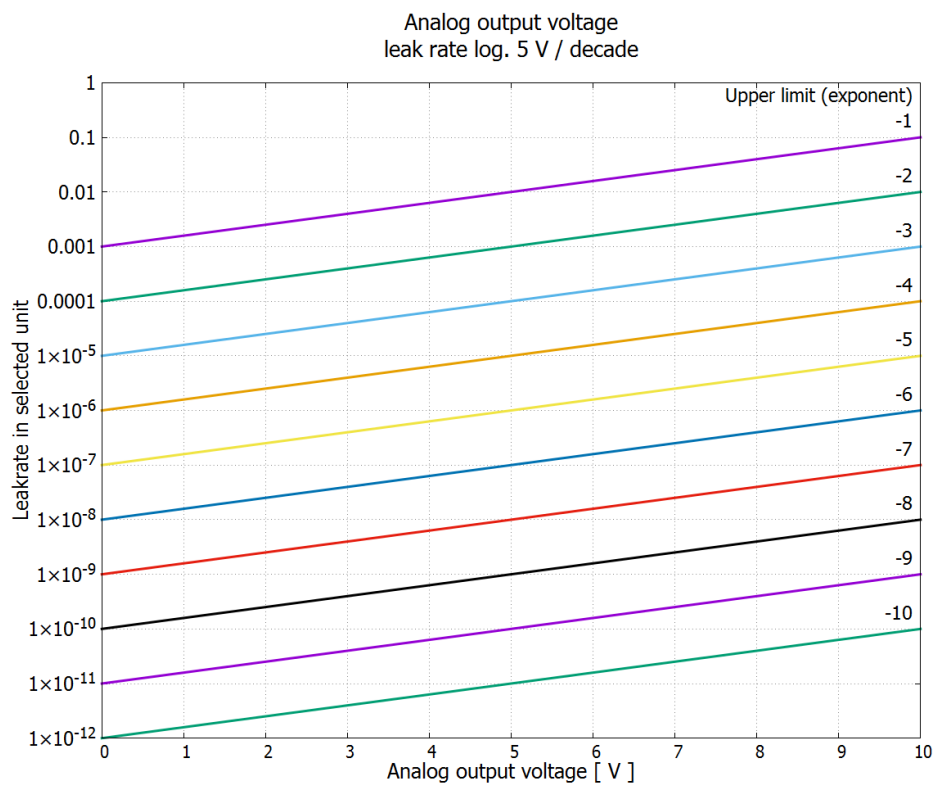


Fig. 7: Analog output voltage leak rate log. 5 V / decade

Output voltages in case of error

In the case of an error, a voltage of 10.237 V is present at the analog outputs.

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/ state:	Description
No function	-	No function
CAL external	inactive→ active: active→ inactive:	Start external calibration. Apply value for background and finish calibration.
Internal CAL	inactive→ active:	Start internal calibration.
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: active→ inactive:	Switch ZERO on. 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: active→ inactive:	Open gas ballast valve. Close gas ballast valve unless always open.
Start / Stop	inactive→ active: active→ inactive:	Switch to Meas. (ZERO is possible, all trigger outputs switch depending on the leak rate.) Switch to Standby. (ZERO is not possible, all trigger outputs will return "Fail".)
Key 1	active:	User "Operator"
Key 2	active:	User "Supervisor"

Function	Flank/ state:	Description
Key 3	active:	User "Integrator"
CAL	inactive→ active:	When set to Standby, the device will start an internal calibration. When set to Meas, the device will start an external calibration.
ZERO update	inactive→ active: active→ inactive:	Update or switch on ZERO No function
Calibration leak open	inactive→ active: active→ inactive:	Open internal test leak Close internal test leak
calibration leak on pulse	inactive→ active:	Open internal test leak if closed or close if open
Internal CAL check	inactive→ active:	Check calibration with internal calibration leak
External CAL check	inactive→ active:	Check calibration with external calibration leak
Start / Stop impulse	inactive→ active:	Switching between measuring operation and standby
Mass Air / Mass Argon	inactive→ active: active→ inactive:	Activating mass Argon Activating mass Air

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

Function	State:	Description
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".)
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.)
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:	"Open or close external calibration leak" prompt (see "External Calibration Configuration and Start [▶ 29]")
	open:	Assignment not stable or calibration is inactive
Cathode 2	closed:	Cathode 2 is active
	open:	Cathode 1 is active

Function	State:	Description
ZERO stable	closed:	EcoBoost message stable
	open:	EcoBoost message not stable
		See also "Suppressing decreasing gas backgrounds with EcoBoost [▶ 33]".

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.

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 (Wrn) Error (Err)	Error message	Limit values	Cause
1xx system error (RAM, ROM, EEPROM, clock, ...)			
Wrn102	Timeout EEPROM MSB Box (Parameter number)		EEPROM on IF board or MSB defective
Wrn104	An EEPROM parameter is initializing		Following software update or EEPROM defective
Wrn106	EEPROM parameter initializing		Following software update or EEPROM defective
Wrn110	Clock not set		Jumper for clock not set, battery drained, clock defective
Wrn122	No response from the BUS module		Connection to BUS module interrupted
Wrn123	Unsupported configuration INFICON from BM1000		The selected configuration is not supported by the connected INFICON BM1000-fieldbus type.
Wrn125	I/O module not connected		Connection to I/O module interrupted
Wrn127	Wrong bootloader version		Boot loader not compatible with application
Err129	Incorrect device (EEPROM)		EEPROM does not contain any compatible data
Wrn150	Pressure sensor 2 is not connected		Pressure sensor P2 not connected or defective. IF-Board or MSB defective.
Wrn153	The version of the CU1000 software is outdated		Update of CU1000 software recommended
2xx operating voltage error			
Wrn201	U24_MSB too low	21.6V	24V power supply pack
Wrn202	U24_MSB too high	26.4V	24V power supply pack
Wrn203	24V_PWR12 voltage out of range (TL_valve/GB_valve)	20V 30V	Short circuit at valve 1 (calibrated leak) or valve 2 (gas ballast)

Warning (Wrn) Error (Err)	Error message	Limit values	Cause
Wrn204	24V_PWR34 voltage out of range (valve 3/4)	20V 30V	Short circuit at valve 3 or valve 4
Wrn221	Internal voltage 24V_RC voltage out of range	20V 30V	Short circuit 24V at the control unit output
Wrn222	Internal voltage 24V_IO voltage out of range	20V 30V	Short circuit 24V at IO output
Wrn223	Internal voltage 24V_TMP voltage out of range	20V 30V	Short circuit 24V of the TMP
Wrn224	Internal voltage 24V_1 (Pirani) voltage out of range	20V 30V	Short circuit 24V Pressure sensor PSG500 (1,2,3)
Wrn240	Voltage +15V out of range		+15V too low, IF board or MSB defective
Wrn241	Voltage -15V out of range		-15V too low, short circuit at preamplifier, IF board or MSB defective
Err242	+15V or -15V voltage shorted		+15V or -15V too low, short circuit at preamplifier, IF board or MSB defective
Wrn250	REF5V voltage out of range	4.5V 5.5V	+15V or 5V too low, short circuit at preamplifier, IF board or MSB defective
Err252	REF5V voltage shorted		+15V or REF5V too low, short circuit at preamplifier, IF board or MSB defective
3xx detection system (offset preamplifier, preamplifier test, emission, cathode test)			
Wrn300	Anode voltage too low	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	7V > the setpoint	MSB defective
Wrn302	Suppressor voltage too low	297V	Short circuit suppressor, IF board or MSB defective
Wrn303	Suppressor voltage too high	363V	MSB defective
Wrn304	Anode-cathode voltage too low	40V	Short circuit anode-cathode, IF board or MSB defective
Wrn305	Anode-cathode voltage too high	140V	MSB defective
Err306	Anode voltage faulty	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		Cathode defective, line to cathode interrupted, IF board or MSB defective

Warning (Wrn) Error (Err)	Error message	Limit values	Cause
Wrn311	Cathode 2 is defective		Cathode defective, line to cathode interrupted, IF board or MSB defective
Err312	Cathode defective		Cathode defective, line to cathode interrupted, IF board or MSB defective
Err340	Emission error	< 90% of the target value > 110% of the target value	Emission was stable previously, pressure probably too high, message after 15s
Wrn342	Cathodes not connected		Both cathodes defective during self-testing after switch on or plug not connected
Wrn350	Suppressor not connected		Suppressor cable is not plugged in or defective during the self-test after switching on
Wrn352	Preamplifier not connected		Preamplifier defective, cable not plugged in
Err358	Preamplifier oscillates between 2 ranges		Signal varies too much (see command 1120) Preamplifier defective
Wrn359	Overdriven preamplifier		Signal too large preamplifier defective
Wrn360	Preamplifier output too low	< -70 mV at 500 GΩ	Poor ion source or contaminated mass spectrometer
Wrn361	Preamplifier offset too high	> +/- 50 mV at 500 GΩ, > +/- 10 mV at 15 GΩ, < +/- 10 mV at 470 MΩ, < +/- 9 mV at 13 MΩ	Preamplifier defective
Wrn362	Preamplifier range error		Preamplifier or MSB box defective
Wrn390	500 G outside the range	450 GΩ 550 GΩ	Preamplifier defective, error at the suppressor, IF board or MSB defective
4xx TMP fault (also temperature)			
Err400	TMP fault number		
Wrn401	TMP warning number		
Err402	No communication with TMP		Cable to TMP / TMP defective, IF board or MSB defective
Err403	TMP rotation speed too low	< 95% of the target value	Pressure too high, TMP defective

Warning (Wrn) Error (Err)	Error message	Limit values	Cause
Err404	TMP current consumption too high	3A	
Err405	No TMP run-up	5 min.	Pressure too high, TMP faulty
Err410	TMP temperature too high		Cooling failed, check MSB module operating conditions
Wrn411	High TMP temperature		Cooling failed, check MSB module operating conditions
Err420	TMP voltage too high		Power supply defective, TMP defective
Wrn421	TMP voltage too low		Cable cross-section 24 V supply for MSB modules too low, output current 24-V power supply too low (I < 10 A), power supply defective, TMP defective
Err422	TMP no run-up time	8 min.	TMP foreline pressure too high, VV pump final pressure too high, leakage high vacuum system, flood valve not close, TMP bearing damage, TMP flawed
Err423	TMP pressure rise		Inrush of air, flood valve defective or incorrectly dimensioned
5xx Pressure and flow errors			
Wrn500	Pressure sensor not connected	0.5V	Pressure sensor PSG500 P1 not connected, IF board or MSB defective
Wrn520	Pressure too high	18 mbar	Pressure p1 too high
Wrn521	Pressure rise, anode voltage collapse	< Setpoint - 20V	Pressure p1 too high, message after 1.4s
Wrn522	Pressure rise, emission collapsed	< 90% of the target value > 110% of the target value	Emission was stable previously, pressure p1 too high, message after 5s
6xx Calibration errors			
Wrn600	Calibration factor too low	0.01	Calibration leak or machine factor set incorrectly
Wrn601	Calibration factor too high	10000	Calibrated leak or machine factor set incorrectly, partial flow factor too high
Wrn602	KalFaktor lower than last calibration	< 50% of the old value	Calibrated leak, machine factor or partial flow factor has changed
Wrn603	KalFaktor higher than last calibration	> 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		calibration leak is not enabled
Wrn605	Difference during calibration too small		Calibration leak defective or signal too weak.

Warning (Wrn) Error (Err)	Error message	Limit values	Cause
Wrn625	Int. calibration leak not set		Leak rate of int. calibration leak is still set to factory setting
Wrn626	Ext. Calibration leak not set		Leak rate of calibration leak is still set to factory setting
Wrn630	Calibration request		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		A calibration during the first 20 minutes after starting (warm-up phase) the leak detector is not recommended. The warning message can be turned off: - LD protocol: Bef 429 - ASCII: *CONFig:CALWarn (ON,OFF)
Wrn670	Calibration error		Since a problem has occurred during the calibration, you have to recalibrate.
Wrn671	Peak not found		The signal was too restless during the peak search. Calibration has been aborted.
Wrn680	Deviation to the calibration detected		The verification of calibration has shown that you should recalibrate.
7xx temperature errors (preamplifier, electronics)			
Wrn700	Preamplifier temp. too low	2°C	Temperature too low
Wrn702	Preamplifier temp. too high	60°C	Temperature too high
Err709	MSB Temperature too low	-21°C	Temperature too low or temperature sensor defective
Wrn710	MSB temperature too high	55°C	Temperature too high
Err711	Max. MSB temperature exceeded	65°C	Temperature too high
8xx not used			
9xx maintenance messages (e.g. TMP)			
Wrn901	TMP maintenance	4 years	TMP maintenance necessary

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 below, 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 Measurement display elements

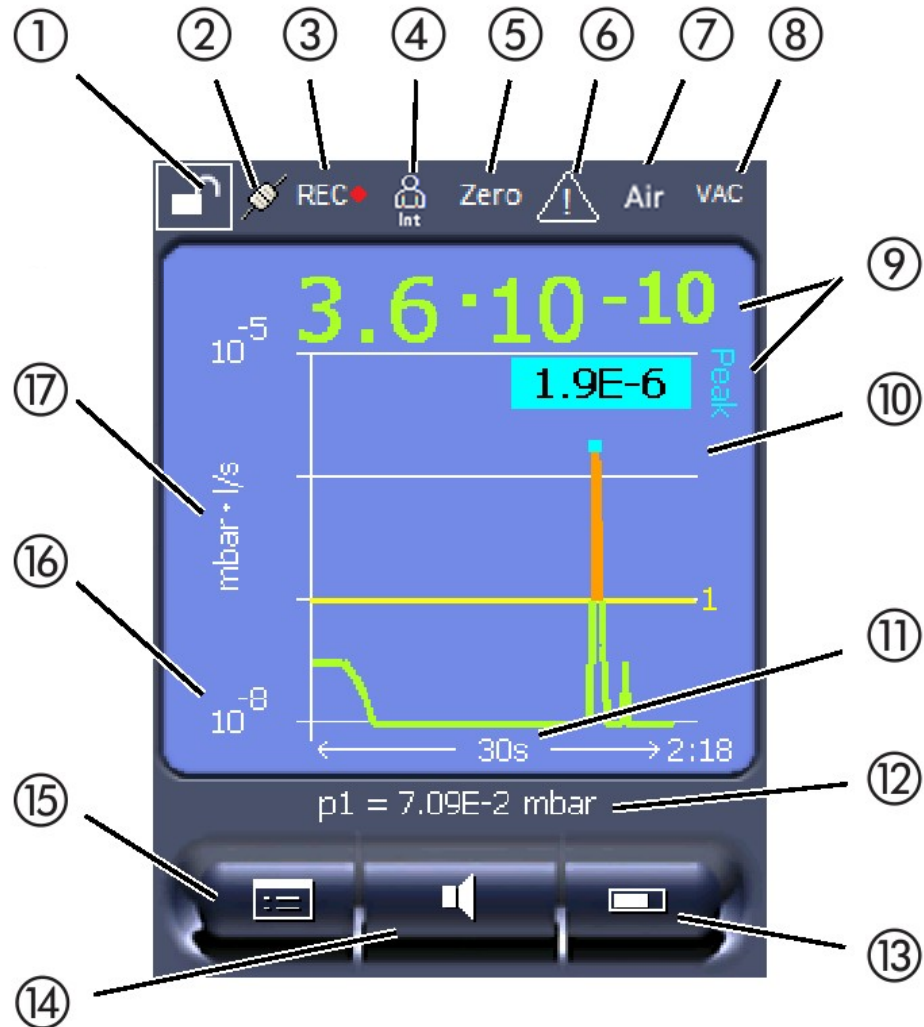


Fig. 8: Measurement display

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		

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 - Operator

The registered operator is shown abbreviated.

Display	Meaning
Ope	Operator
Sup	Supervisor
Int	Integrator
SERVICE	SERVICE

For more information, see "Operator types and authorizations [► 58]".

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
Air	Air
Argon	Argon

8 - Operation mode

Configured operation mode

Display	Operation mode
VAC	Vacuum
SNIF	Sniffing

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 - Backing pump

Backing pressure p_1 .

13 - Button "Favorite 2"

You can assign preferred parameters to this button, see "Touch screen settings". In the figure in "Measurement display elements [▶ 52]", 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". In the figure in "Measurement display elements [▶ 52]", 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" button.

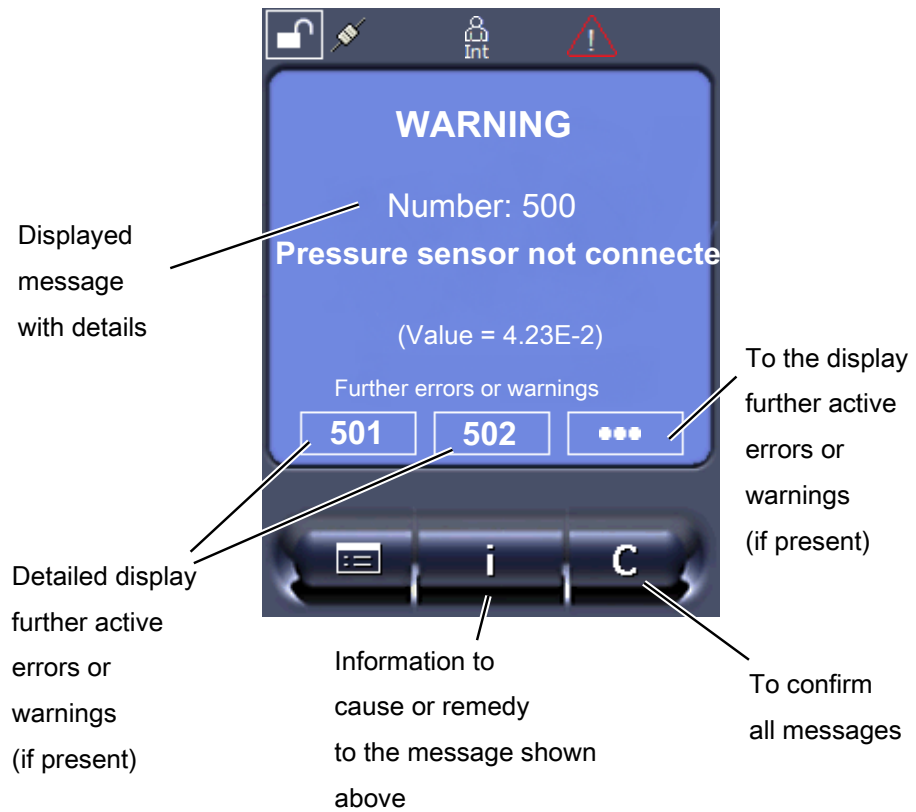
16 - Value axis

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

17 - Device of measurement

Device of measurement of the value axis.

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 [▶ 58]".
- an older version of the software run by mass spectrometer module LDS Arnova 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	
	Control unit	Settings > Trigger > Trigger sel.
Assigning favorite buttons	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").	
	Favorite 2: Right button	
	Favorite 3: Button on the bottom right of the main menu.	
	Volume	ZERO (with EcoBoost instead of ZERO: EcoBoost)
	Display settings	
	Start/Stop	CAL
	Measurement view	Check CAL
		- - - (= without function)
	Control unit	Settings > Favorites > Favorite 1 (2, 3)
Displaying warnings on the touchscreen	The display of warnings on the touchscreen can be allowed or suppressed.	
	Off	
	On	
	Control unit	Settings > Set up > Control unit > Messages > Show warnings
Show calibration note	Suppress or allow the calibration note with the following content:	
	<ul style="list-style-type: none"> Leak rate of the applied calibration leak No calibration should take place during the first 20 mins after switching on 	
	OFF (suppressed)	
	ON (allowed)	
	Control unit	Settings > Set up > Control unit > Messages > Show calibration notes
Show calibration request	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" (LDS Arnova, 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.

Automatic switch off of the touch screen

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
--------------	---

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 value s. 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	
	<ul style="list-style-type: none"> • Off • On 	
	Control unit	Functions > Data > Recorder > Settings > Data recording
Record interval	Time interval between data recordings	
	<ul style="list-style-type: none"> • 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s 	
	Control unit	Functions > Data > Recorder > Settings > Record interval
Memory location	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"> • USB flash drive • Control unit 	
	Control unit	Functions > Data > Recorder > Settings > Storage location
Copy data	Copy data from the internal memory of the control unit to a connected USB stick.	

Control unit	Functions > Data > Recorder > Copy > Copy files
Delete data	Delete data in the internal memory of the control unit
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.

Measurement values	<ul style="list-style-type: none"> • Preamplifier • Environment • TMP
Temperature	<ul style="list-style-type: none"> • Electronic • TMP
Energy and operating hours	<ul style="list-style-type: none"> • Energy values: Information on consumption values • Operation hours: Display for operating hours • Supply voltages: Information on internal supply voltages • Power supply: Information on the supply voltages of the components
History	<ul style="list-style-type: none"> • Error, error history / warning history • Calibration, calibration history • TMP error, TMP history • Warnings, active warnings • Maintenance, maintenance history
Control unit	<ul style="list-style-type: none"> • Version control unit: Information on the software version • Memory: Information on available memory • Settings: Control unit settings. • Serial port wired: Information on the communication connection • Data exchange: Information on the data exchange between mass spectrometer module and the control unit
Mass spectrometer module	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • I/O module (1): Information on the software version, inputs and outputs • I/O module (2): Visualized information to the digital inputs

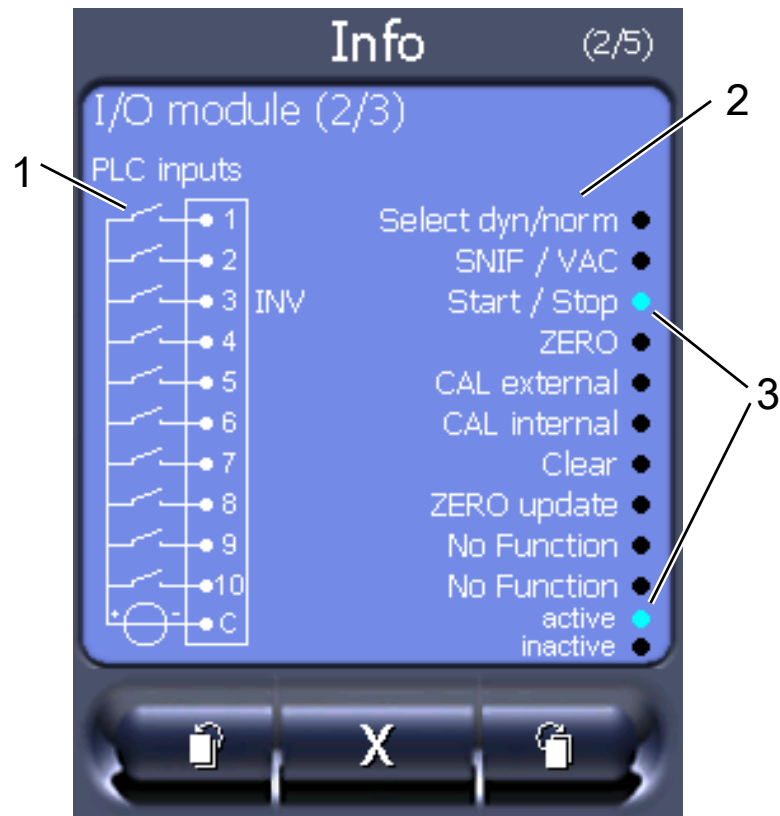


Fig. 9: I/O module (2): Visualized information to the digital inputs

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

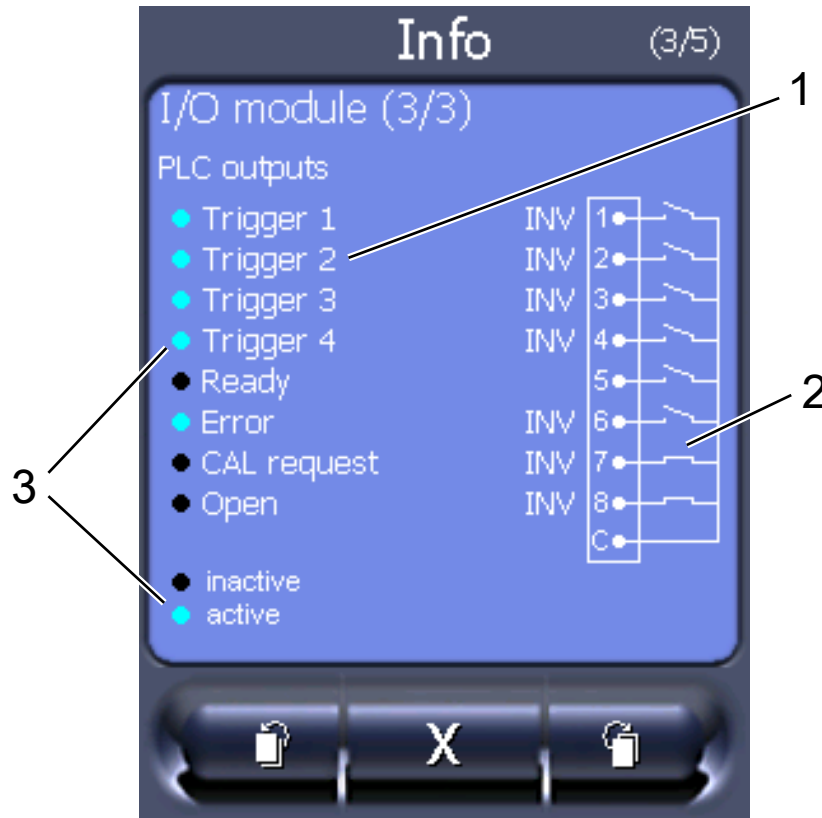


Fig. 10: Visualized information to the digital outputs

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 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.

9.3.6.1 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.

9.3.6.2 Checking and updating the software version of the MSB box

The current software is available from the Inficon support.

- 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".

9.3.6.3 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.

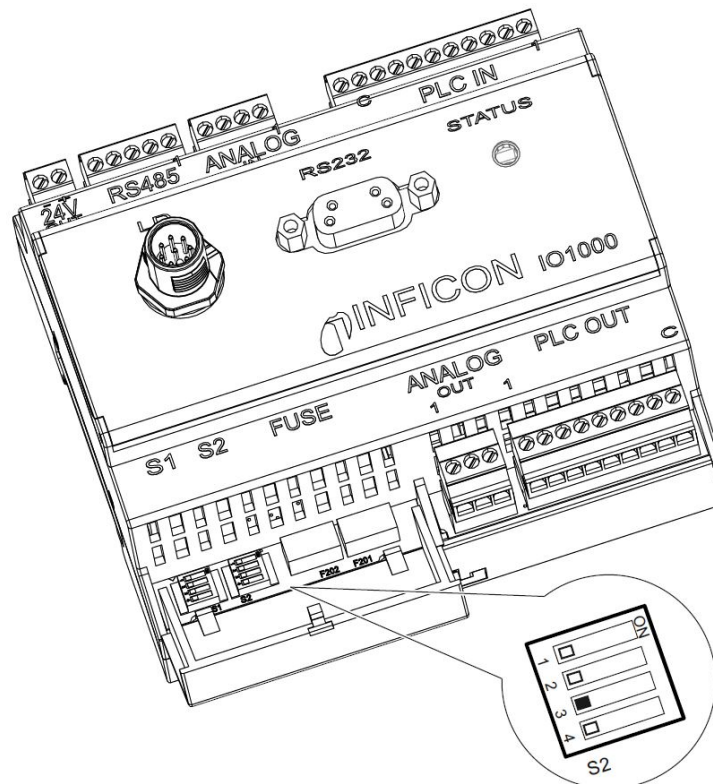


Fig. 11: DIP switch on the I/O module

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.

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

10.1 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.
-

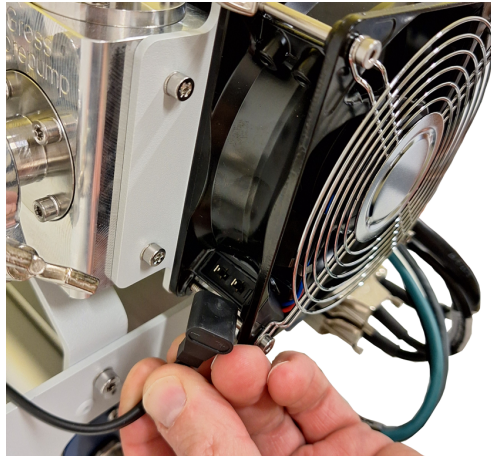
10.2 Replace the fleece for operating fluids

The fleece for operating fluids of the turbo molecular pump can be replaced, see also "Accessories and spare parts [▶ 75]".

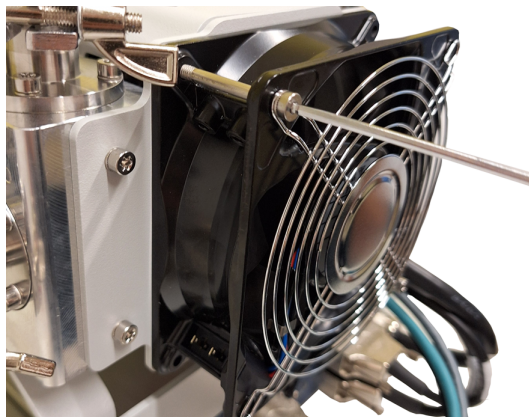
Removing old fleece for operating fluids

- ✓ The device is switched off, see "Switching off the device [▶ 37]".
- ✓ The device is disconnected from the power supply.
- ✓ The turbo molecular pump has cooled down.

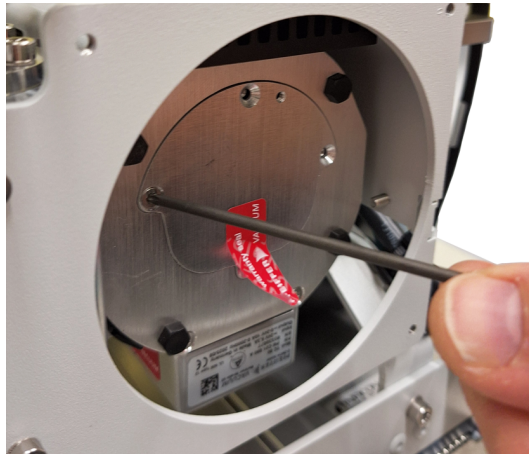
- 1 Unplug the cable from the fan.



- 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.



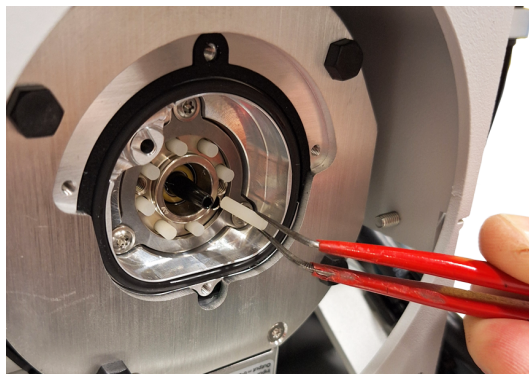
6 Remove the edge protection ring around the fleece for operating fluids.



7 Remove the fleece for operating fluids.



8 Remove the capillary rods.



- 9 Remove the O-ring.

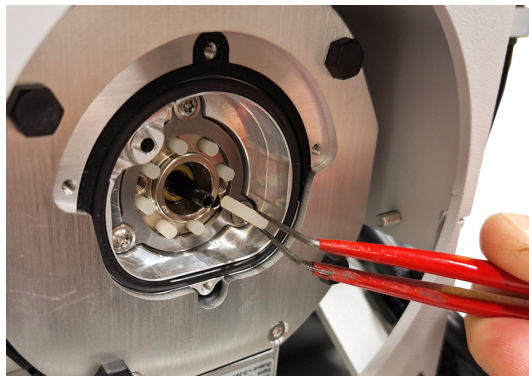


Inserting new fleece for operating fluids

- 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.



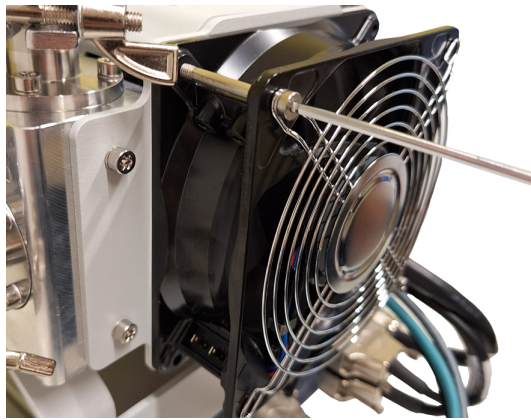
- 4 Carefully reinsert the edge protection ring. Ensure that the edge protection ring is correctly aligned.



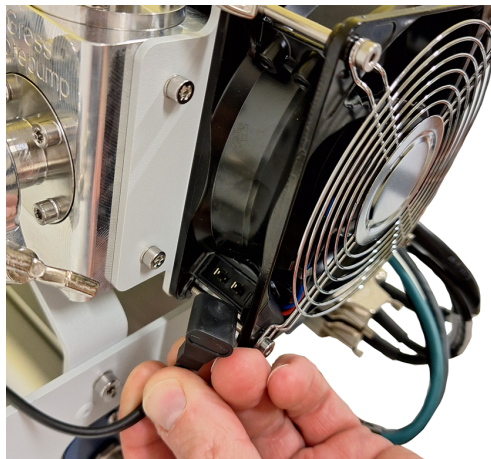
- 5 Place the closing cap back on.
- 6 Secure the closing cap with the screws. Use a tightening torque of 1.4 Nm.



- 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.



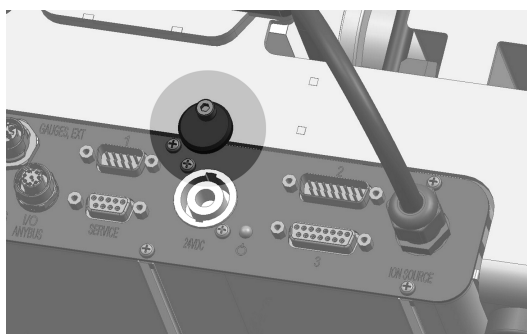
- 8 Reconnect the fan to the device.



10.3 Replacing MSB box

If the MSB box is defective, it can be replaced, see also "Accessories and spare parts [▶ 75]".

- 1 Make sure the device is turned off and disconnected from the power supply.
- 2 Loosen the locking washer on the MSB box.



- 3 Remove the old MSB box.
- 4 Slide the new MSB box into the housing.
- 5 Screw the locking washer back onto the device.

10.4 Maintenance plan

Maintenance work	Operating hours	24	8,000	16,000	24,000	32,000	40,000	Service level
	Duration		1 year	2 years	3 years	4 years	5 years	
Turbo molecular pump SplitFlow 80 Neo	Replacing fleece for operating fluids (optional), spare part no. 200015001				X			I
	Replacing turbo molecular pump (required)						X	III
Fan	Check operation			X	X	X	X	I
	Clean fan			X	X	X	X	I
Cooling system	Disassembling air duct						X	III
	Clean components and surfaces						X	III
	Check operation of the fan						X	III
Leak detector	Calibrate	X						I

Explanation of the maintenance plan:

- 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.

10.5 Confirm maintenance work

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

11 Decommissioning

11.1 Disposing of the device

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.

- ▶ During disposal, observe the environmental and safety regulations of your country.



Device cannot be disposed of as normal domestic waste.

11.2 Returning the device 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. Devices sent in without a return number and completed contamination declaration will be returned to the sender by the manufacturer.

- ▶ 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 shipping the instrument, attach a copy of the completed contamination declaration to the outside of the package.

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.

1 Description of product

Type _____

Article Number _____

Serial Number _____

2 Reason for return

3 Operating fluid(s) used (Must be drained before shipping.)

4 Process related contamination of product:

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"/>	

2) Products thus contaminated will not be accepted without written evidence of decontamination!

The product is free of any substances which are damaging to health
 yes

1) or not containing any amount of hazardous residues that exceed the permissible exposure limits

5 Harmful substances, gases and/or by-products

Please list all substances, gases, and by-products which the product may have come into contact with:

Trade/product name	Chemical name (or symbol)	Precautions associated with substance	Action if human contact

6 Legally binding declaration:

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 _____

Address _____ Post code, place _____

Phone _____ Fax _____

Email _____

Name _____

Date and legally binding signature _____ Company stamp _____

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

12 Appendix

12.1 Accessories and spare parts

Designation	Catalog number
Accessories for mass spectrometer module	
I/O 1000 module	560-310
BM1000 PROFIBUS module	560-315
Data cable, 2 m length	560-332
Data cable, 5 m length	560-335
Data cable, 10 m length	560-340
CU1000 control unit	560-320
CU1000 connection cable, 5 m length	551-102
CU1000 connection cable, 0.7 m length	551-103
DIN Rail Power supply 24 V, 10 A	560-324
Argon Calibration Leak TL4	561-501
Spare parts for mass spectrometer module	
Fleece for operating fluids	200015001
MSB box	200015172

12.2 CE Declaration of Conformity



EU 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.

The products meet the requirements of the following Directives:

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

Designation of the product:

Mass spectrometer module

Models:

LDS Arnova

Catalogue number:

560-500

Applied harmonized standards:

- **EN ISO 12100 :2010**
- **EN 61326-1:2013**
Class A according to EN 55011
- **EN IEC 63000:2018**

Cologne, March 24th, 2026

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

Cologne, March 24th, 2026

pro
J. Khaoudi, Research and Development

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www.inficon.com
E-mail: leakdetection@inficon.com

12.3 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.

The products meet the requirements of the following Directives:

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

Designation of the product:

Mass spectrometer module

Applied harmonized standards:

- **EN ISO 12100 :2010**
- **EN IEC 61010-1:2020**

Models:

LDS Arnova

Catalogue number:

560-500

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:

H. Rauch, INFICON GmbH, Bonner Strasse 498, D-50968 Cologne, Germany

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, March 24rd, 2026

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

Cologne, March 24rd, 2026

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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

LDS Arnova: 有害物质 LDS Arnova: Hazardous Substances										
部件名称 Part Name	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr(VI))	多溴联苯 Poly-brominated biphenyls (PBBs)	多溴联苯醚 Poly-brominated diphenyl ethers (PBDEs)	邻苯二甲酸二正丁酯 Dibutyl phthalate (DBP)	邻苯二甲酸二异丁酯 Diisobutyl phthalate (DIBP)	邻苯二甲酸丁苄酯 Benzyl butyl phthalate (BBP)	邻苯二甲酸二(2-乙基)己酯 Bis (2-ethylhexyl) phthalate (DEHP)
阀门 Valve	X	○	○	○	○	○	○	○	○	○
风扇 Fan	X	○	○	○	○	○	○	○	○	○
组装的印刷电路板 Assembled printed circuit boards	X	○	○	○	○	○	○	○	○	○
节流阀 Throttle	X	○	○	○	○	○	○	○	○	○

注 1: ○: 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。

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。

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。

Note 1: ○: 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.

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.

Note 2: Parts not listed above indicate that their hazardous substances are below the limit requirement of the national standard.



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