Service Manual

FuelSense

Version October 2018

V&F
Analyse- und
Messtechnik
GmbH

Content

1. Preface

This manual describes the service and maintenance tasks of the FuelSense 2016 Mass Spectrometer.

The document is structured as follows:

- Checks before switching off the analyzer
- Hardware work to perform annually
- Hardware work to perform if required
- After re-starting the analyzer
- Repair tasks

Be sure to read this manual before servicing the product to ensure proper and safe operation of the instrument. Also, safely store the service manual so it is readily available whenever necessary.

Product specifications and appearance, as well as the contents of this manual are subject to change without notice.

1.1 Warranty and Responsibility

V&F Analyse- und Messtechnik GmbH (V&F) warrants that the product shall be free from defects in material and workmanship and agrees to repair or replace free of charge, at V&F's option, any malfunctioned or damaged product attributable to V&F's responsibility for a period of one (1) year from the delivery unless otherwise agreed with a written agreement.

In any one of the following cases, none of the warranties set forth herein shall be extended;

- Any malfunction or damage attributable to improper operation
- Any malfunction attributable to repair or modification by any person not authorized by V&F
- Any malfunction or damage attributable to the use in an environment not specified in this manual
- Any malfunction or damage attributable to violation of the instructions in this manual or operations in the manner not specified in this manual
- Any malfunction or damage attributable to any cause or causes beyond the reasonable control of V&F such as natural disasters
- Any deterioration in appearance attributable to corrosion, rust, and so on
- Replacement of consumables

V&F SHALL NOT BE LIABLE FOR ANY DAMAGES RESULTING FROM ANY MALFUNCTIONS OF THE PRODUCT, ANY ERASURE OF DATA, OR ANY OTHER USES OF THE PRODUCT.

1.2 Trademarks

Generally, company names and brand names are either registered trademarks or trademarks of the respective companies.

1.3 Declaration of Conformity

This equipment

MotoSense
Ion-Molecule Reaction - Mass Spectrometer

conforms to the following directives and standards:

CE

EC directives:

- "Machinery" 2006/42/EC.
- "Electromagnetic Compatibility" 2004/108/EC

Guidelines, harmonized standards and national standards and specifications which have been applied:

- "Safety requirements for electrical equipment for measurement, control and laboratory use" DIN EN 61010-1: 2010

1.4 Installation Environment

This product is designed for the following environment:

- Pollution degree 2
- Installation categories II

Pollution degree (IEC-664-1) is a category assigned to the type of environment your equipment will be installed in. It rates the type of pollution (dust, dirt, etc.) that may be in contact with the insulation within the equipment. There are four levels ranging from Pollution Degree 1 to Pollution Degree 4:

Level	Pollution Degree Description
1	No pollution or only dry, nonconductive pollution occurs. The pollution has no effect.
2	Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected.
3	Conductive pollution or dry nonconductive pollution that becomes conductive due to condensation occurs. To be found in industrial environment or construction sites (harsh environments).
4	The pollution generates persistent conductivity caused by conductive dust, rain, or snow.

Table 1: Pollution degree levels

Installation category (or overvoltage category) is a category assigned to the transients found on the power line. There are four installation categories ranging from Installation Category I (low level spikes potentially found in secondary circuits) to Installation Category IV (very high-level spikes found in overhead power lines). The higher the Installation Category, the greater the required clearance distance.

1.5 For Your Safety

1.5.1. Hazard Classification and Warning Symbols

Warning messages are described in the following manner. Read the messages and follow the instructions carefully.

Hazard Classification	Description
	Hazard - Toxic
	Hazard - General
	Hazard - Electricity
	Hazard - Flammable
	Hazard - Gas Cylinder

Table 2: Hazard Classification

Warning Symbols	Description
	Description of what should be done, or what should be followed
	Description of what should never be done, or what is prohibited

Table 3: Warning Symbols

1.5.2. Safety Precautions

This section provides precautions to enable you to use the product safely and correctly and to prevent injury and damage. Read the precautions carefully as it contains important safety messages.

Warning	Hazard	Description
		The V&F analyzer should be installed and used in a location where exhaust gases from the instrument can be safely vented. Inhalation of gases from the system, such as the engine exhaust gas flowing through the exhaust line, may cause poisoning and fatal damage to human bodies.
		Make sure that all the connections are securely tightened and there is no leakage from the system when connected to gas lines. The gas lines may contain toxic gases. Inhaling a considerable amount of leaked gas may cause temporary or permanent health problems.
		Always verify electrical specifications carefully when installing the V&F Analyzer for the first time or when moving the unit from one location to another. Connection to any improper power source may cause system damage or fire.
		Always use a third-type ground connection for the V&F instrument. Poor and improper grounding may cause electric shock and electrical noise interference on the main signals.
		The V&F analyzer uses xenon, krypton and mercury as an ionization gas. For information regarding the proper handling of xenon, krypton and mercury refer to the Material Safety Data Sheet issued by the reagent supplier.
		When moving or transporting the V&F instrument close the xenon and krypton gas cylinders inside the system before turning OFF the system power.
		V&F instruments with a capillary gas inlet are equipped with an external capillary tube. When handling these external tubes do not make a sharp bend in the external tubes. Do not bend and straighten the tubes repeatedly. Do not damage or disassemble the power line and the main body.
		Refer to the V&F Software Manual for operation of the V&F Viewer software. Refer to computer manual for computer operation.
		You should periodically back up measurement data saved on the hard disc of the control PC.

Table 4: Safety Precautions - what should be done

Warning	Hazard	Description
		Never place the V&F instrument with more than 10° inclination.
		Do not subject the V&F instrument to strong shocks or impacts to avoid damaging precision parts.
		Never turn OFF the V&F instrument power before PC shutting down! This can cause damage to the system. Always shut down the V&F Viewer software first.
		Do not operate the V&F instrument in an ambient temperature outside 20°C - 35°C.
		Do not operate the V&F instrument in an ambient with a humidity outside 10 - 80% (non-condensing)

Table 5: Safety Precautions - what should never be done

1.6 Disposal of the Product

When disposing of the product, follow the related laws and/or regulations of your country for disposal of the product.

2. Checks before switching off the analyzer

2.1 Create a backup of the analyzer

Basics

All settings and parameters of the analyzer are stored in the so-called par0 file. This applies to analyzer voltage settings, setup and calibration settings such as software options. The software V&F Server, which runs on the internal PC of the analyzer, will read this par0 file on startup. The par0-file will be re-written anytime settings will be changed.

Create a backup of the actual settings:

1. Open V&F Viewer software and connect to the analyzer
2. Select menu "Tools" and "Backup Analyzer Parameters"

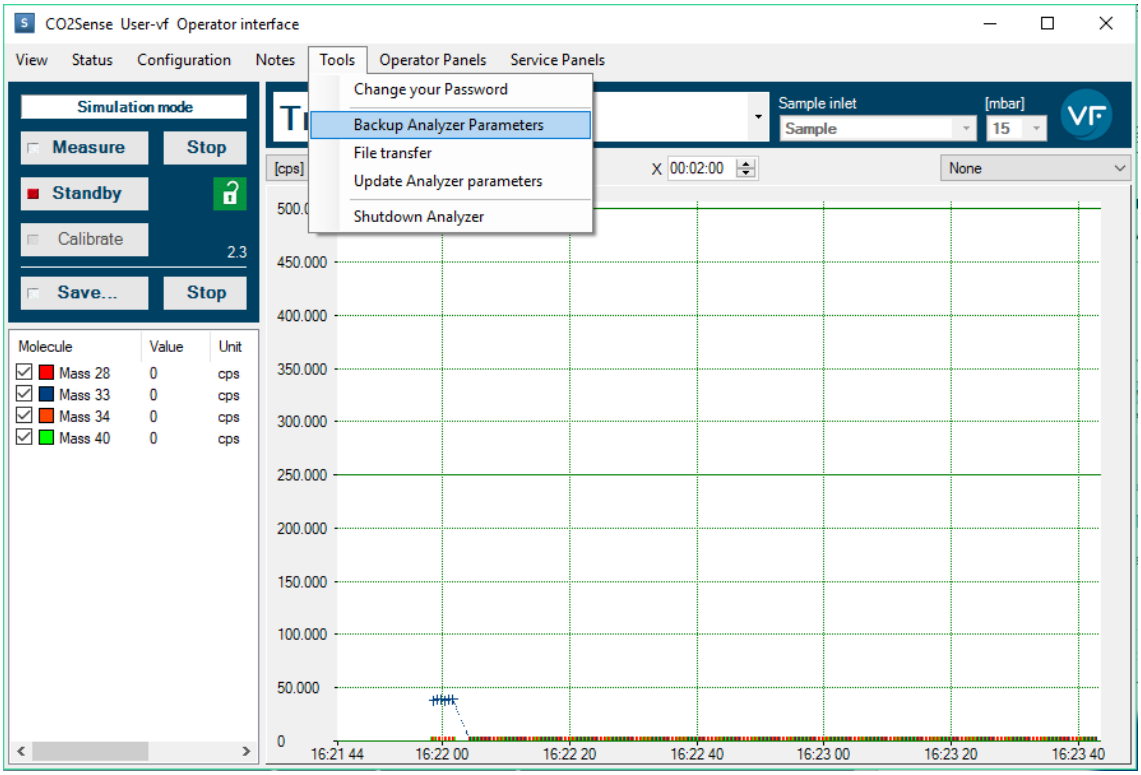

Figure 1: Create a backup

3. A new window appears. Enter the name of the backup file and press button "OK".

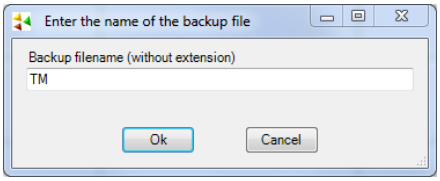

Figure 2: Name a backup file

4. The created backup file will be stored on the internal PC in the V&F Server – folder.

2.2 Check all voltages

2.2.1. Check general supply voltages

- Measure the voltage on the NetX01 board (power) – these voltages are generated at the power supply unit, except 5V, which is generated on the NetMain board and cannot be adjusted.

Figure 3: NetX01 service board for IMR-MS

Name		Function	Value [V]
Power	+28 V to GND	Supply voltage for the valves (set at power supply)	+28 V
Power	+12 V to GND	Supply voltage for the electronic boards (set at power supply)	+12,5 V
Power	+5 V to GND	Supply voltage for the electronic boards	+5 V
Power	-12 V to GND	Supply voltage for electronic boards (set at power supply)	-12,5 V
Power	-48 V to GND	Supply voltage for Ue/U0/FA (set at power supply)	-34 V
Octopoles	B1(+) to B1(0)	Ion acceleration (Bias1) for the 1st Octopole, set in the software	Set in SW
Octopoles	B2(+) to B2(0)	Ion acceleration (Bias2) for the 2nd Octopole, set in the software	Set in SW
Octopoles	B1(+) to GND	Ion acceleration (Bias1)	Set in SW
Octopoles	B2(+) to GND	Sum of Bias1 and Bias2	Set in SW
Filament	Ie(+) to Ie(0)	Intensity (Ie) set in the software converted to voltage in (1mA=1mV)	Set in SW
Filament	Uf(+) to Uf(0)	Filament voltage to drive the filament	1V-4V
Filament	U0 to GND	Lens voltage set in the software	Set in SW
Filament	Ue to GND	Anode voltage set in the software	Set in SW
QMH	FA(+) to FA(0)	Ion acceleration (FA) for the Quadrupole set in the software	Set in SW
QMH	FA(+) to GND	Sum of Bias1, Bias2 and FA	Set in SW
QMH	MScan to GND	Voltage for setting the mass at RF-generator	Set in SW
QMH	Resol to GND	Voltage for setting the resolution at RF-generator	Set in SW
Probe	Probe to GND	Sample pressure (10mbar=1V)	Set in SW

Table 6: Test terminals of NetX01 service board for IMR-MS

2.2.2. Check supply voltage of the CPU

- Measure the voltage (5,0V < > 5,25V) on the backside of AT96-bus board between the yellow/green (-) and brown (+) cable

Figure 4: CPU supply voltage on backside of AT96-bus board

2.2.3. Check supply voltage of the Turbo pump

- Measure the voltage (24V) on NetB02 (green 2-pin connector)

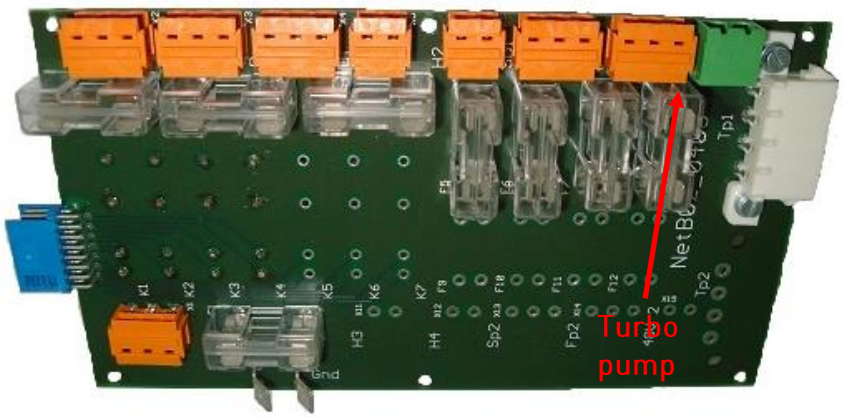

Figure 5: Turbo pump supply voltage on NetB02 board

2.2.4. Check supply voltage for filament regulator and RF-Generator

- Measure the voltage (7,0V < > 7,5V) on NetB01 (green 2-pin connector) named SRC for the filament supply
- Measure the voltages (+/-24V) on NetB01 (green 3-pin connector) named QMH for the RF-generator supply

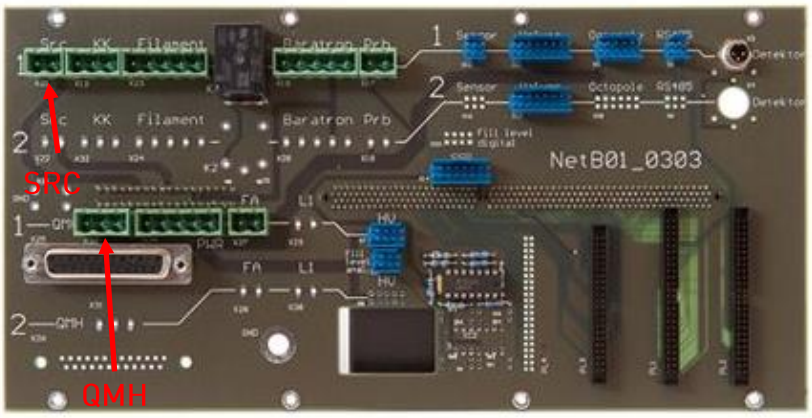

Figure 6: Filament regulator supply voltage and RF-Generator supply voltages on NetB01 board

2.2.5. Adjustment of supply voltages

- In case that the supply voltages are out of range, check cables and blade receptacle at the power supply unit (contact resistance can cause lower voltages)
- If the cables are connected properly and the supply voltages are still out of range, adjust the voltages at the power supply unit

Figure 7: Power supply unit

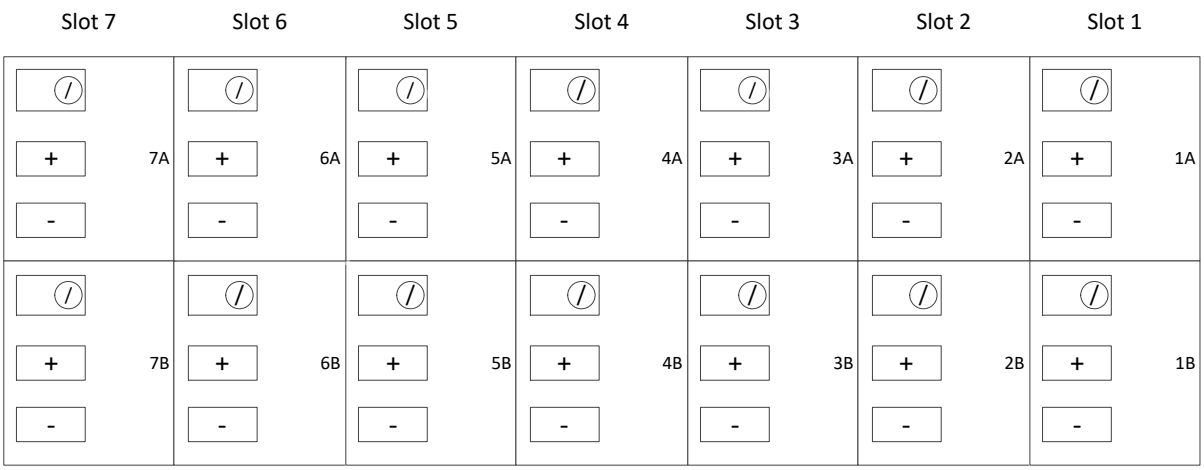

Figure 8: Power supply slots of a power supply unit

Slot	Usage	Range [V]	Value [V]
1A	Turbo pump supply	18 V – 34 V / 5 A	24 V
1B	n.c.	18 V – 34 V / 5 A	default
2A	RF – generator +	18 V – 34 V / 5 A	24 V
2B	RF – generator -	18 V – 34 V / 5 A	24 V
3A	Outer capillary heating	18 V – 34 V / 5 A	27 V
3B	Central capillary heating	18 V – 34 V / 5 A	27 V
4A	+28 V for valves	18 V – 29 V / 5 A	28 V
4B	-34 V for Ue/Uo/FA	18 V – 34 V / 5 A	34 V
5A	-12 V	5 V – 16 V / 8 A	12,5 V
5B	+12 V	5 V – 16 V / 8 A	12,5 V
6A	n.c.	18 V – 29 V / 5 A	default
6B	+5 V – CPU supply and Power – LED	5 V – 16 V / 8 A	5,2 V
7A	Filament supply	5 V – 16 V / 8 A	7,5 V
7B	n.c.	5 V – 16 V / 8 A	default

Table 7: Configuration and ranges of power supply unit

2.3 Check the service panels in the software

All major components of the analyzer can be reviewed and checked by the so-called service panels. The settings of the analyzers can be adjusted. With the single panels, settings can be changed without changing the default settings. Whenever the service panels are closed, the previous settings will be reloaded.

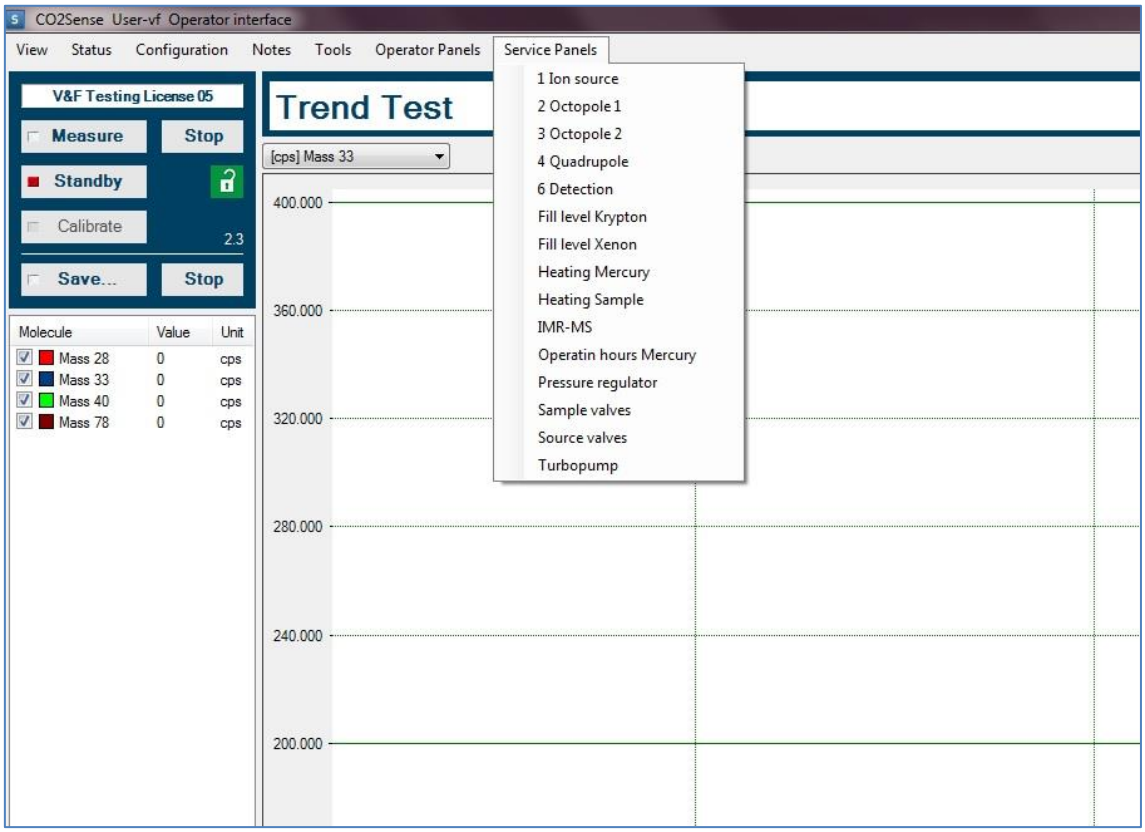

Figure 9: Service panels

On the following pages the function and signals of the all service panels are described!

As mentioned above, all service panels are for testing only, except the service panel "IMR-MS", where default settings can be changed and set as default!

2.3.1. Ion source – Service Panel

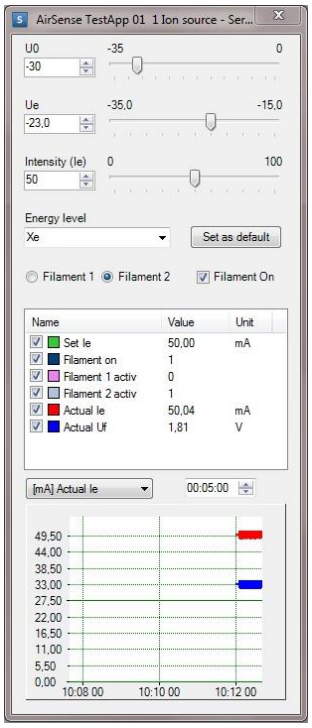

Figure 10: Ion source – Service Panel

Parameter	Description
U0 [V]	can be set to -25V or -30V (the best setting can differ from filament flange to filament flange)
Ue [V]	is set to -23V for xenon or -16,8V for mercury
Intensity (Ie)	Intensity of the ion current; the higher this value, the higher the sensitivity, but the lower the filament lifetime
Energy level	selection of source gases
Filament on	check box to switch filament on/off
Filament1/2	to select one of the filaments
Filament on	indicates if the filament is switched on
Filament X active	1 shows the active filament, 0 indicates the not active filaments
Actual Ie [mA]	read back actual current (converted to mV on NetS01), must be same as Intensity that is set
Actual Uf [V]	read back actual voltage to drive the filament (between 1.5V and 3.5V)

Table 8: Ion source – Service Panel - Description of parameters

Uo, Ue, Uf and Ie can be measured on the service board NetS01 (see 2.2.1). If the Uf > 5V the filament is broken.

The general sensitivity of the analyzer might be increased by changing U0 and/or increasing Ie to 50mA (if set lower).

2.3.2. Octopole 1 – Service Panel

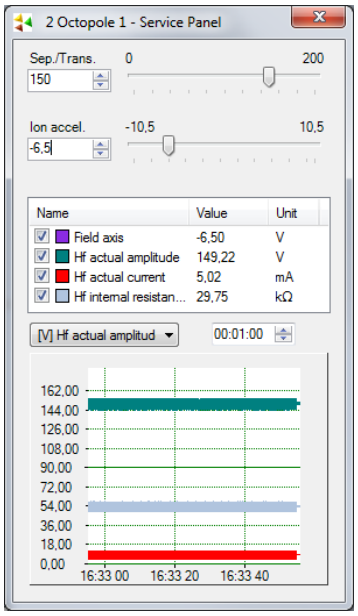

Figure 11: Octopole 1 – Service Panel

Parameter	Description
Sep./Trans [V]	can be set between 50V and 150V
Ion accel [V]	can be set between -3V and -10.5V (at -10V a change of the octopole should be considered)
Field axis [V]	the set "Ion accel."
Hf actual amplitude [V]	this value is the read back actual voltage of the Sep./Trans.
Hf actual current [mA]	internal current of the octopole generator
Hf internal resistance [kΩ]	calculated with amplitude and current, should be >0.5kΩ

Table 9: Octopole 1 – Service Panel - Description of parameters

If "Hf actual amplitude" differs from set value "Sep./Trans.", the octopole generator needs to be adjusted.

When the octopole generator is adjusted, the "Hf actual amplitude" must be equal with "Sep./Trans." and the "Hf internal resistance" should be as high as possible.

If Hf actual resistance is 0, there might be a shortcut between octopole rods.

The "Ion accel." can be measured on the service board NetS01 - Bias1 (see 2.2.1).

The general sensitivity of the analyzer might be increased by changing the "Ion acceleration" or by lowering the Amplitude ("Sep./Trans.").

2.3.3. Octopole 2 – Service Panel

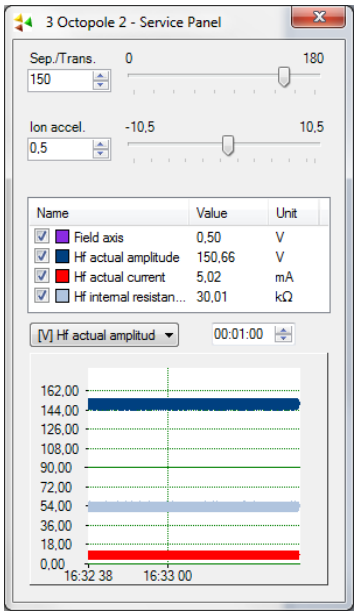

Figure 12: Octopole 2 – Service Panel

Parameter	Description
Sep./Trans [V]	can be set between 120V and 180V
Ion accel [V]	can be set between -4V and +5V
Field axis [V]	the set "Ion accel."
Hf actual amplitude [V]	this value is the read back actual voltage of the Sep./Trans.
Hf actual current [mA]	internal current of the octopole generator
Hf internal resistance [kΩ]	calculated with amplitude and current, should be >0.5kΩ

Table 10: Octopole 2 – Service Panel - Description of parameters

If "Hf actual amplitude" differs from set value "Sep./Trans.", the octopole generator needs to be adjusted.

When the octopole generator is adjusted, the "Hf actual amplitude" must be equal with "Sep./Trans." and the "Hf internal resistance" should be as high as possible.

If Hf actual resistance is 0, there might be a shortcut between octopole rods.

The "Ion accel." can be measured on the service board NetS01 - Bias2 (see 2.2.1).

The sum of Bias1 and Bias2 is limited to -10.5V!

The general sensitivity of the analyzer might be increased by changing the "Ion acceleration". Some analyzers can run more stable with 180 V instead of 150 V (this is the standard value).

2.3.4. Quadrupole – Service Panel

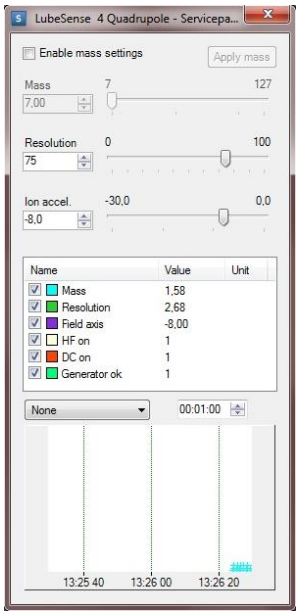

Figure 13: Quadrupole – Service Panel

Parameter	Description
Enable mass settings	checkbox to change masses manually
Apply mass	when mass settings enabled, to set mass below
Mass	atomic mass unit set at the quadrupole
Resolution	can be set from 100 to 0, whereas 100 is the best mass separation
Ion accel. [V]	so-called field axis (FA), can be set between -12 V and -20 V
Mass	shows the actual set mass in V (140mV for M7 to 10V for the highest mass)
Resolution	shows the actual set Resolution in V (240mV for Resol.100 to 10V for Resol.0)
Field axis [V]	the set "Ion accel."
HF on	indicates, if the HF is set on the RF-generator (orange LEDs are on)
DC on	indicates, if the DC is set on the RF-generator
Generator ok	indicates, if the RF-Generator is ok (as soon as the green LED is on)

Table 11: Quadrupole – Service Panel - Description of parameters

Mass (MScan), resolution (Resol.) and Field axis (FA) can be measured on the service board NetS01 (see 2.2.1).

The general sensitivity of the analyzer might be increased by changing the "Ion acceleration", but this will also influence the peak shape!

2.3.5. Detection – Service Panel

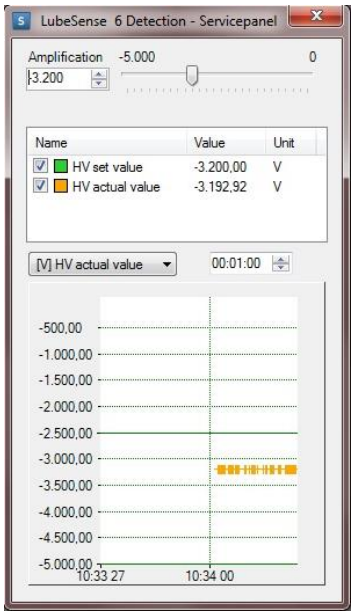

Figure 14: Detection – Service Panel

Parameter	Description
Amplification [V]	can be set between 1400V and 2300V
HV set value [V]	the set "Amplification"
HV actual value [V]	this value is the read back actual voltage of the "Amplification"

Table 12: Detection – Service Panel - Description of parameters

Depending on the Channeltron and detector, the Amplification might differ. With Amplification of 0V, the counts will all be 0, too.

The general sensitivity of the analyzer might be increased by changing the "Amplification".

2.3.6. Fill level Xenon – Service Panel

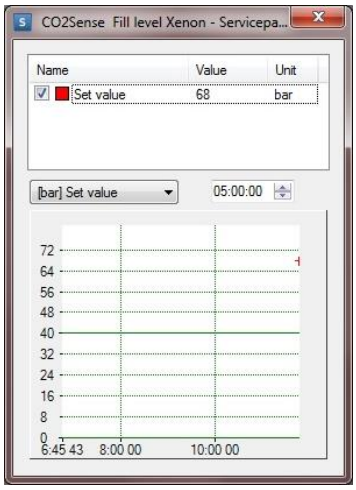

Figure 15: Fill level Xenon – Service Panel

Parameter	Description
Set value [bar]	actual fill level of the xenon bottle

Table 13: Fill level Xenon – Service Panel - Description of parameters

The fill level of the xenon depends on ambient air temperature. A new bottle has a pressure of approx. 70bar.
It is always necessary to have at least 10bar of xenon, if xenon is used for ionization of any component in the setup molecule list. Operating the analyzer without xenon (if used) can lead to damages of the analyzer.

2.3.7. Heating Mercury – Service Panel

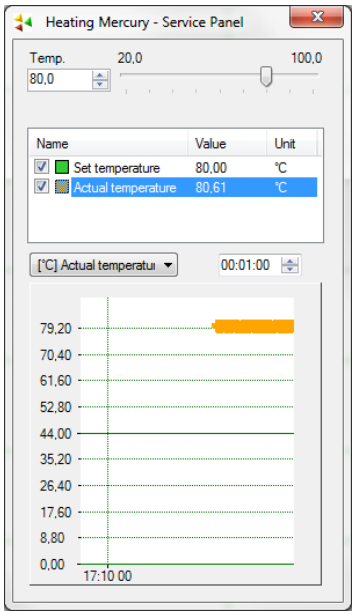

Figure 16: Heating mercury – Service Panel

Parameter	Description
Temp [°C]	to change the set temperature of the ion source area
Set temperature [°C]	the set "Temp"
Actual temperature [°C]	this value is the read back actual temperature

Table 14: Heating mercury – Service Panel - Description of parameters

Usually it is not necessary to change this temperature, the standard value is between 70°C and 85°C.

2.3.8. Heating Sample – Service Panel

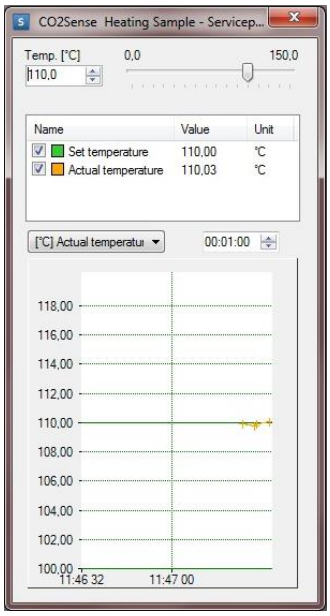

Figure 17: Heating Sample – Service Panel

Parameter	Description
Temp [°C]	to change the set temperature of the inlet blocks
Set temperature [°C]	the set "Temp"
Actual temperature [°C]	this value is the read back actual temperature

Table 15: Heating mercury – Service Panel - Description of parameters

Usually it is not necessary to change this temperature.The standard value is 110°C.

Note that this temperature is the temperature of the inlet blocks only, and NOT of the capillary.

The central capillary does NOT have a temperature sensor and is fixed supplied with 27V.

2.3.9. IMR-MS – Service Panel

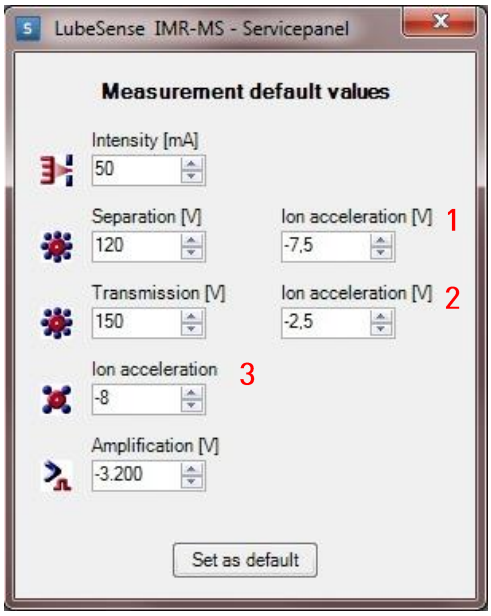

Figure 18: IMR-MS – Service Panel

Parameter	Description
Intensity [mA]	Intensity of the ion current in the ion source (see "Ion source-service panel")
Separation [V]	"Sep./Trans." setting of octopole 1 (see "octopole1-service panel")
Ion acceleration [V] **1**	Bias1 setting of octopole 1 (see "octopole1- service panel")
Transmission [V]	"Sep./Trans." setting of octopole 2 (see "octopole2- service panel")
Ion acceleration [V] **2**	Bias2 setting of octopole 2 (see "octopole2- service panel")
Ion acceleration [V] **3**	FA setting of the quadrupole (see "quadrupole- service panel")
Amplification [V]	HV of the detector (see "detection- service panel")

Table 16: IMR-MS – Service Panel - Description of parameters

The values changed in this service panel will be reset to previous values when the service panel is closed, unless the changes are confirmed by "Set as default" – command button.

The Ie-setting in this service panel is the default value. This setting has to be changed in each measurement setup, as there is a default source setting adjustable for each setup itself.

The U0-setting has to be entered in the configuration manager.

2.3.10. Operation hours Mercury – Service Panel

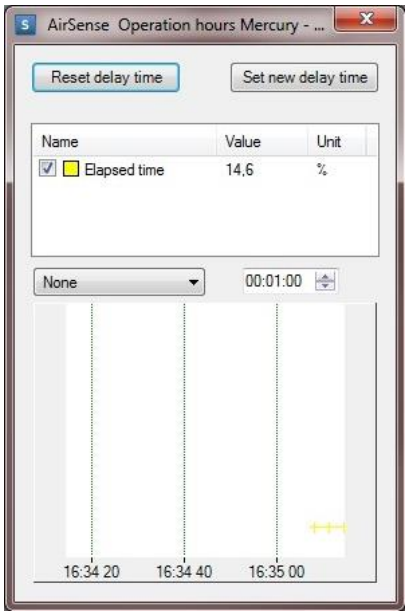

Figure 19: Operation hours Mercury – Service Panel

Parameter	Description
Elapsed time	actual usage of mercury in %

Table 17: Operation hours Mercury – Service Panel - Description of parameters

The mercury container is filled with 1,5ml liquid mercury. The usage is calculated via software and is depending on the mercury-valve-open time.

2.3.11. Pressure regulator – Service Panel

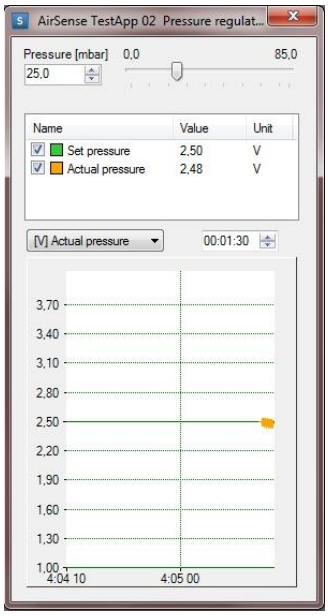

Figure 20: Pressure regulator – Service Panel

Parameter	Description
Set pressure [V]	set sample pressure
Actual pressure [V]	this value is the read back actual pressure

Table 18: Pressure regulator – Service Panel - Description of parameters

The set pressure is between 1,5 V and 6,0V which means 15mbar or 60mbar at the pressure sensor. The set pressure can be changed in single masses and mass-range setup.

The "Actual pressure" can be measured on the service board NetS01 – Probe (see 2.2.1).

2.3.12. Sample valves – Service Panel

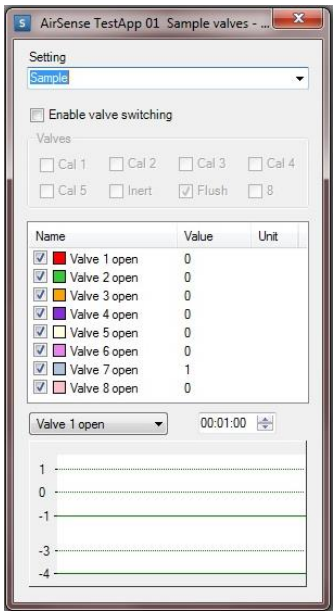

Figure 21: Sample valves – Service Panel

Parameter	Description
Settings	Drop-down box to select "Sample", "Cal1 - 5" or "Inert"
Enable valve switching	Select the checkbox "Enable valve switching" to get access to the single valves
Cal 1	Checkbox to select Cal 1 valve open or close
Cal 2	Checkbox to select Cal 2 valve open or close
Cal 3	Checkbox to select Cal 3 valve open or close
Cal 4	Checkbox to select Cal 4 valve open or close
Cal 5	Checkbox to select Cal 5 valve open or close
Inert	Checkbox to select Inert valve open or close
Flush	Checkbox to select Flush valve open or close
8	no function
Valve 1 open	Shows if the Cal 1 valve is actually on (1) or off (0)
Valve 2 open	Shows if the Cal 2 valve is actually on (1) or off (0)
Valve 3 open	Shows if the Cal 3 valve is actually on (1) or off (0)
Valve 4 open	Shows if the Cal 4 valve is actually on (1) or off (0)
Valve 5 open	Shows if the Cal 5 valve is actually on (1) or off (0)
Valve 6 open	Shows if the Inert valve is actually on (1) or off (0)
Valve 7 open	Shows if the Flush valve is actually on (1) or off (0)
Valve 8 open	no function

Table 19: Sample valves – Service Panel - Description of parameters

2.3.13. Source valves – Service Panel

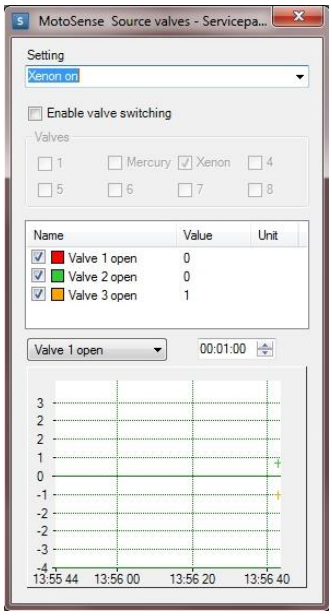

Figure 22: Source valves – Service Panel

Parameter	Description
Settings	Drop-down box to select "Xenon on" or "Mercury on" or "no source valve"
Enable valve switching	Select the checkbox "Enable valve switching" to get access to the single valves
Mercury	Checkbox to select mercury valve open or close
Xenon	Checkbox to select xenon valve open or close
Valve 2 open	Shows if the mercury valve is actually on (1) or off (0)
Valve 3 open	Shows if the xenon valve is actually on (1) or off (0)

Table 20: Source valves – Service Panel - Description of parameters

2.3.14. Turbopump – Service Panel

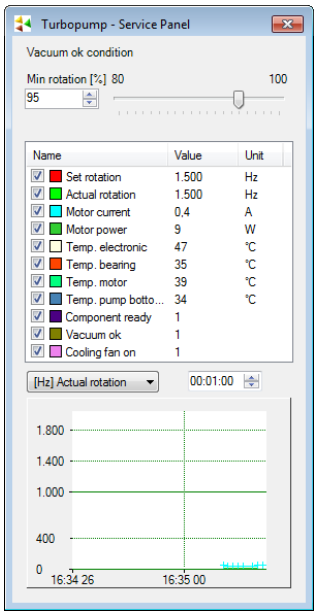

Figure 23: Turbopump – Service Panel

Parameter	Description
Min rotation [Hz]	standard value of 95...after reaching 95% of the set rotation, component is ready (1)
Set rotation [Hz]	fixed value of 1.500Hz (90.000rpm)
Actual rotation [Hz]	read back value of the actual rotation of the rotators
Motor current [A]	Actual current needed to keep the set rotation
Motor power [W]	Actual power needed to keep the rotation
Temp. [°C]	Shows the different temperatures of the different components of the Turbo pump
Component ready	indicates, if the Turbo pump has reached 95% of the set rotation (1), or if it is below (0)
Vacuum ok	indicates if the vacuum ok condition is given

Table 21: Turbopump – Service Panel - Description of parameters

There are several values of the Turbo pump to monitor its function.

High values of motor power and motor current could indicate possible leakages or a defective bearing.

The "Vacuum ok" has a delay of 5 minutes from reaching 95% of the set rotation (Component ready from 0 to 1).

As long as the "Vacuum ok" – signal is 0 no other major component will be switched on!

To avoid problems with the bearing it is recommended to replace the operating agent of the turbo pump once a year (at least every 2 years).

Malfunction of the cooling fans unit will cause high temperatures of the turbo pump, a turbo pump shutoff and possibly damages to the bearing.

2.4 Check the performance of the analyzer

2.4.1. Check the ion optics settings

The "HC-Components" setup can be used to get information about the general sensitivity of the analyzer and can be used for adjustments of the analyzer settings (e.g. ion acceleration voltages of the octopoles), if calibration gas with benzene is available. The calibration gas has to be opened and connected to the analyzer and the corresponding sample inlet has to be selected. The important mass in this setup is then C6H6 (mass78) in xenon and mercury. Any adjustments have the target to get the possible maximum on C6H6.

The following graphic shows the "HC-Components" setup, where ion acceleration voltages are checked and optimized:

Figure 24: Example of optimizing ion acceleration voltages

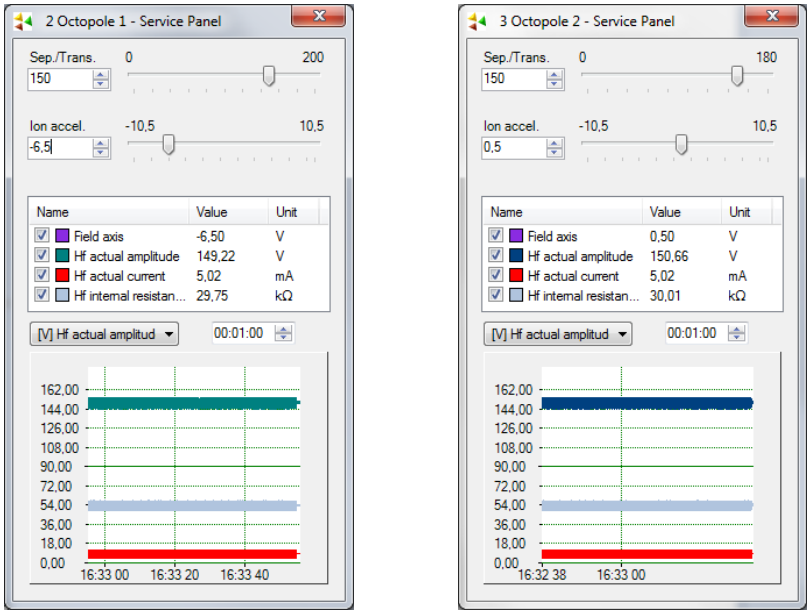

Figure 25: Service panel for Octopole1 and Octopole2

2.4.2. Check the mass scale settings

Using the different "Analog spectrum" setups the performance of the Quadrupole can be determined.

The following graphic shows the analog spectrum of Mass 33/34 with good separation:

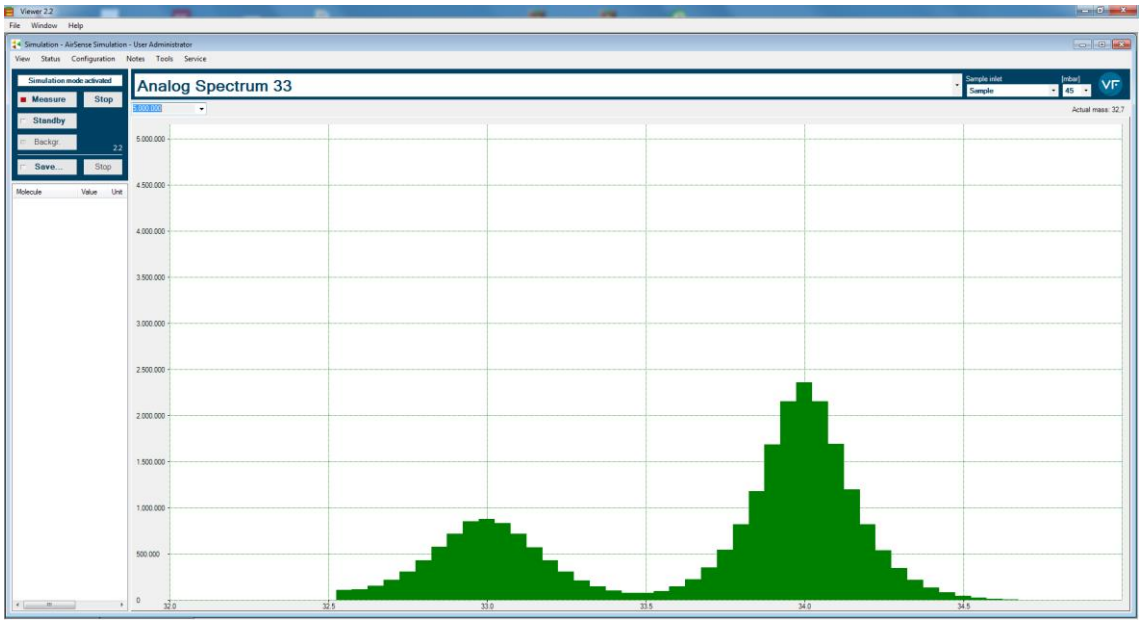

Figure 26: Analog spectrum of Mass 33/34 with good separation

The following graphic shows the analog spectrum of Mass 33/34 with worse separation, but higher sensitivity:

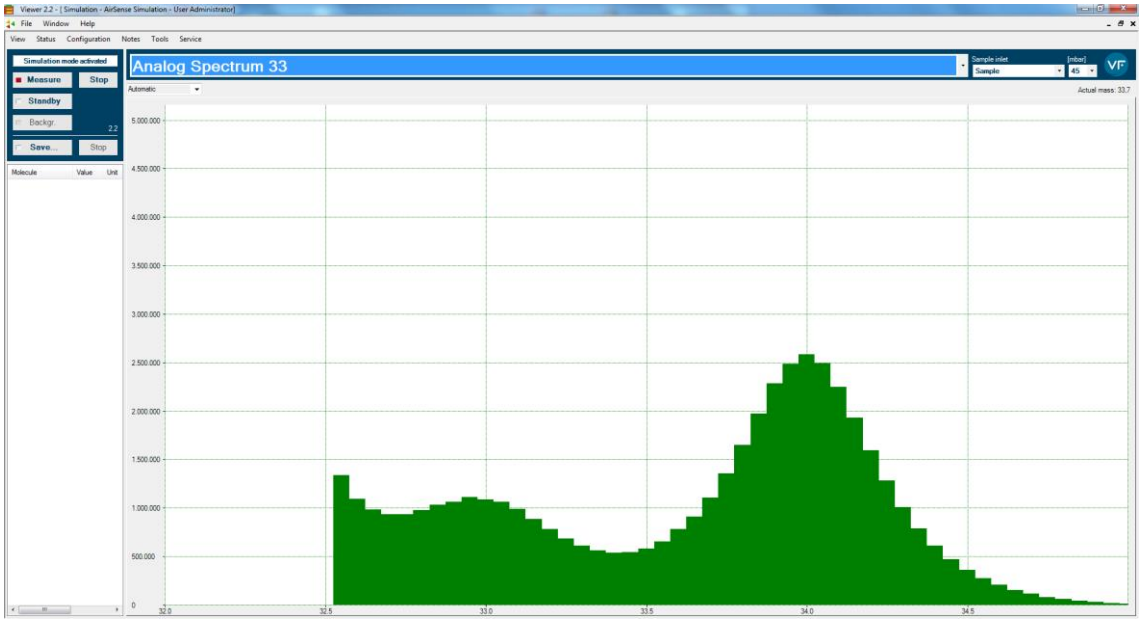

Figure 27: Analog spectrum of Mass 33/34 with worse separation

The following graphic shows the analog spectrum of Mass 78 with Benzene calibration gas connected to Cal2 inlet:

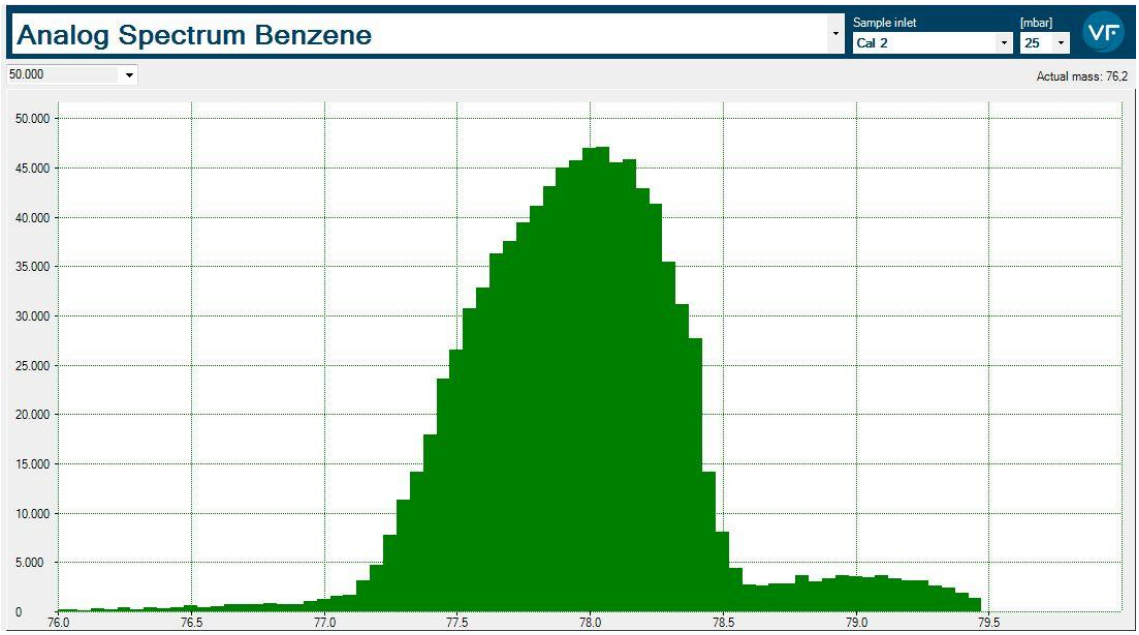

Figure 28: Analog spectrum of Mass 78

The following graphic shows the analog spectrum of Mass 124:

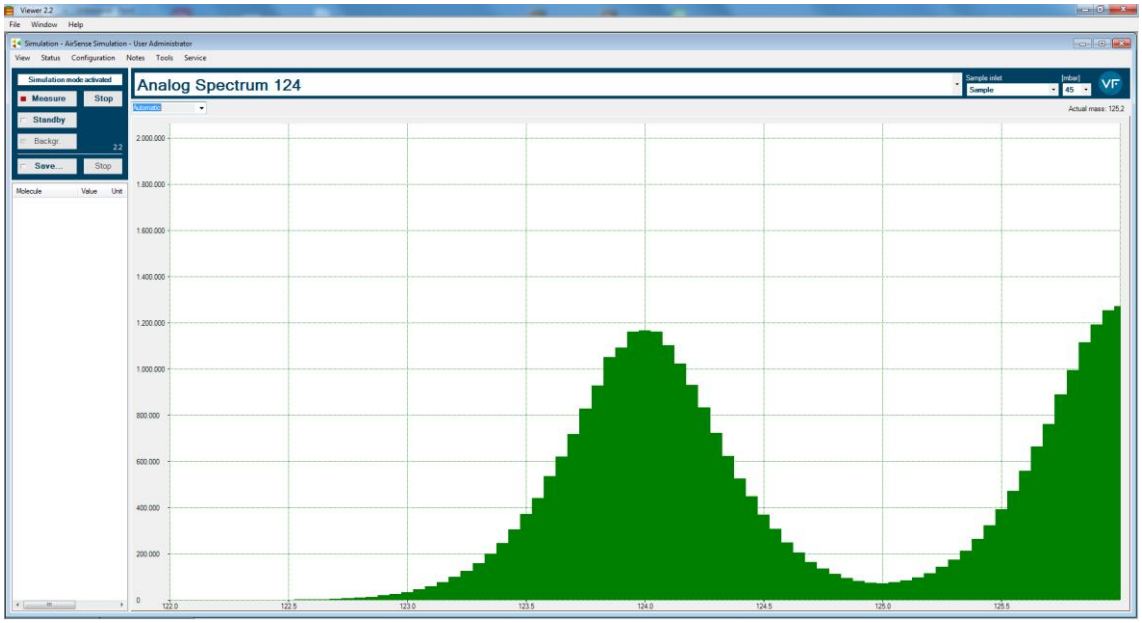

Figure 29: Analog spectrum of Mass 124

It is important to find a good compromise between sensitivity and mass separation.

Needed tools and auxiliary material:

- Slotted screwdriver
- V&F Viewer software
- Span gas

Basics

The different states of the generator:

- Only RED LED permanently on: generator powered on, heating up internal heating

Figure 30: RED LED - Generator is heating up

- RED LED and GREEN LED permanently on: generator is ready, but not switched on

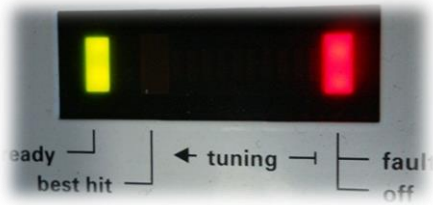

Figure 31: Generator ready

- ORANGE LEDs and GREEN LED permanently on: generator is switched on and ready

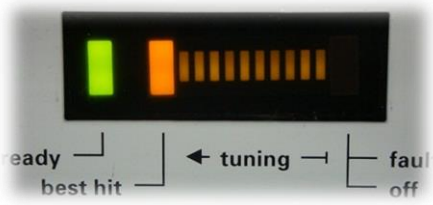

Figure 32: Generator switched on

  - RED LED blinks: failure
  - NO LED on: power supply failure

Procedure:

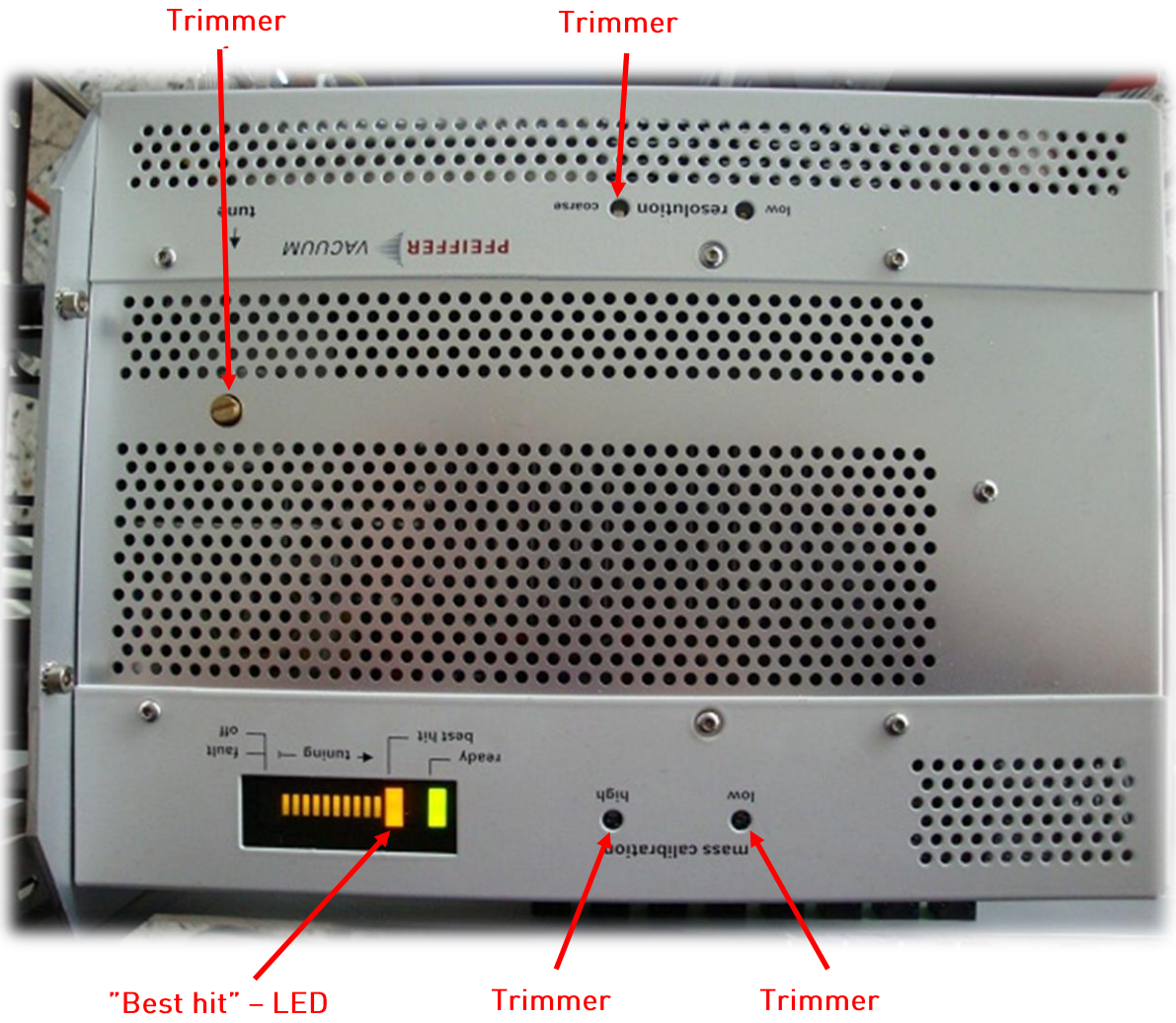

Figure 33: RF-Generator

1. When the analyzer is ready and on, adjust the trimmer 1 until "Best hit"-LED is on, before selecting a setup from the list
2. Select "Analog spectrum" or "Analog spectrum 33"
   Ensure that oxygen is present wherever the sample inlet is connected
3. By adjusting trimmer 2 the mass scale (peak) can be shifted in both directions (clockwise – shifts the peak to the right, counterclockwise – shifts the peak to the left)
4. The top of the peak should be exactly on the mass (e.g. 33/34)

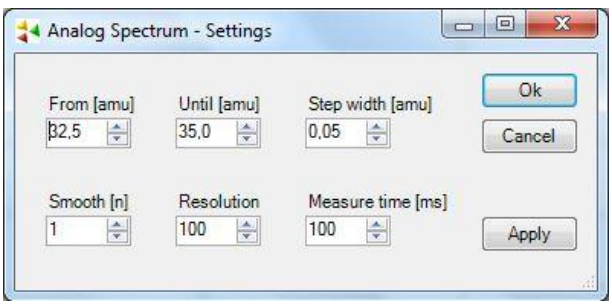

Figure 34: Setup settings - Analog spectrum 33

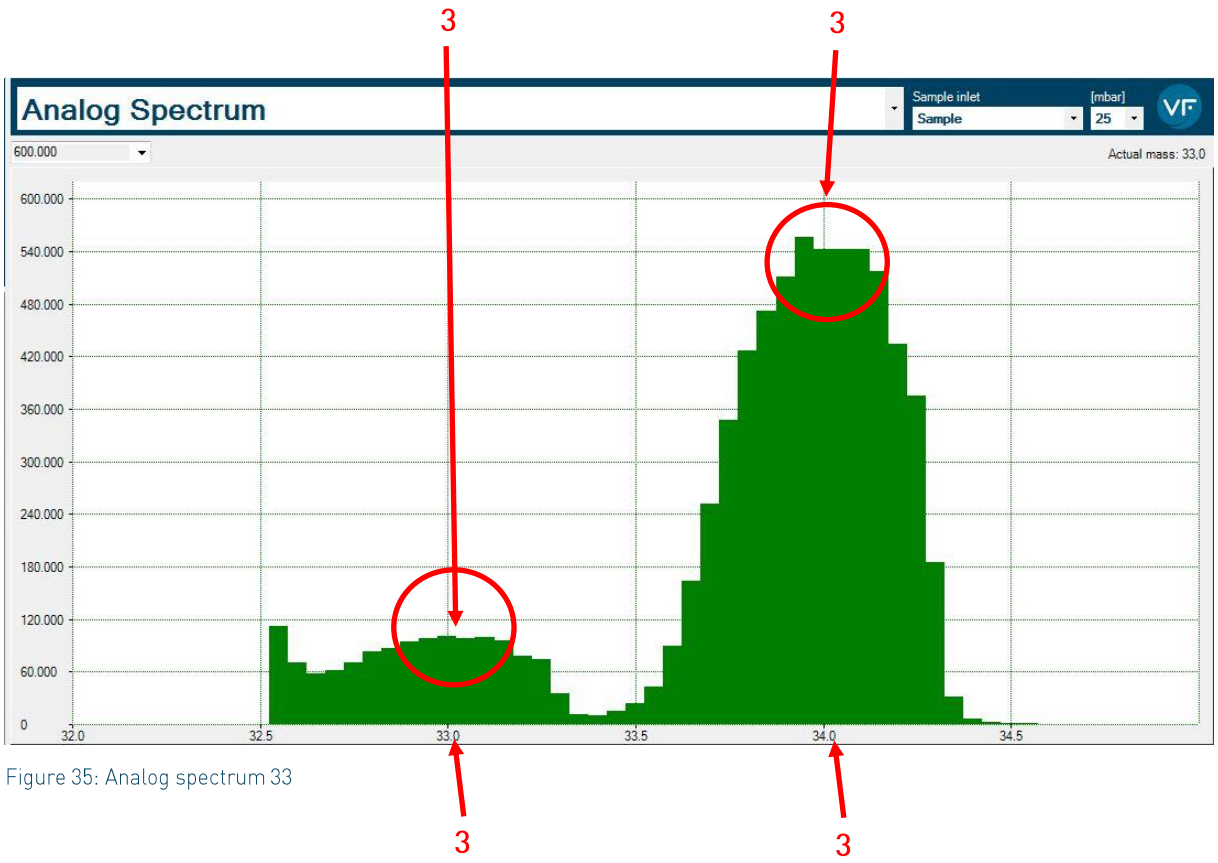

Figure 35: Analog spectrum 33

5. Select "Analog spectrum Benzene" or "Analog spectrum 78", if there is benzene available
6. By adjusting trimmer 3 the mass scale (peak) can be shifted in both directions (clockwise – shifts the peak to the right, counterclockwise – shifts the peak to the left)
7. The top of the peak should be exactly on the mass (e.g. 78)

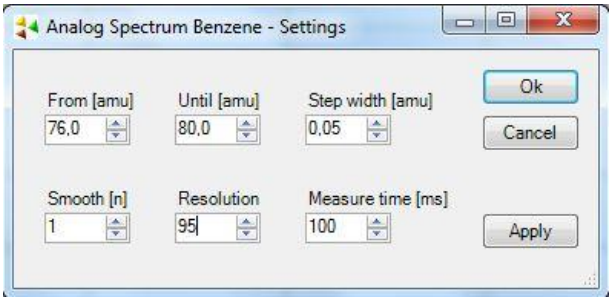

Figure 36: Setup settings - Analog spectrum 78

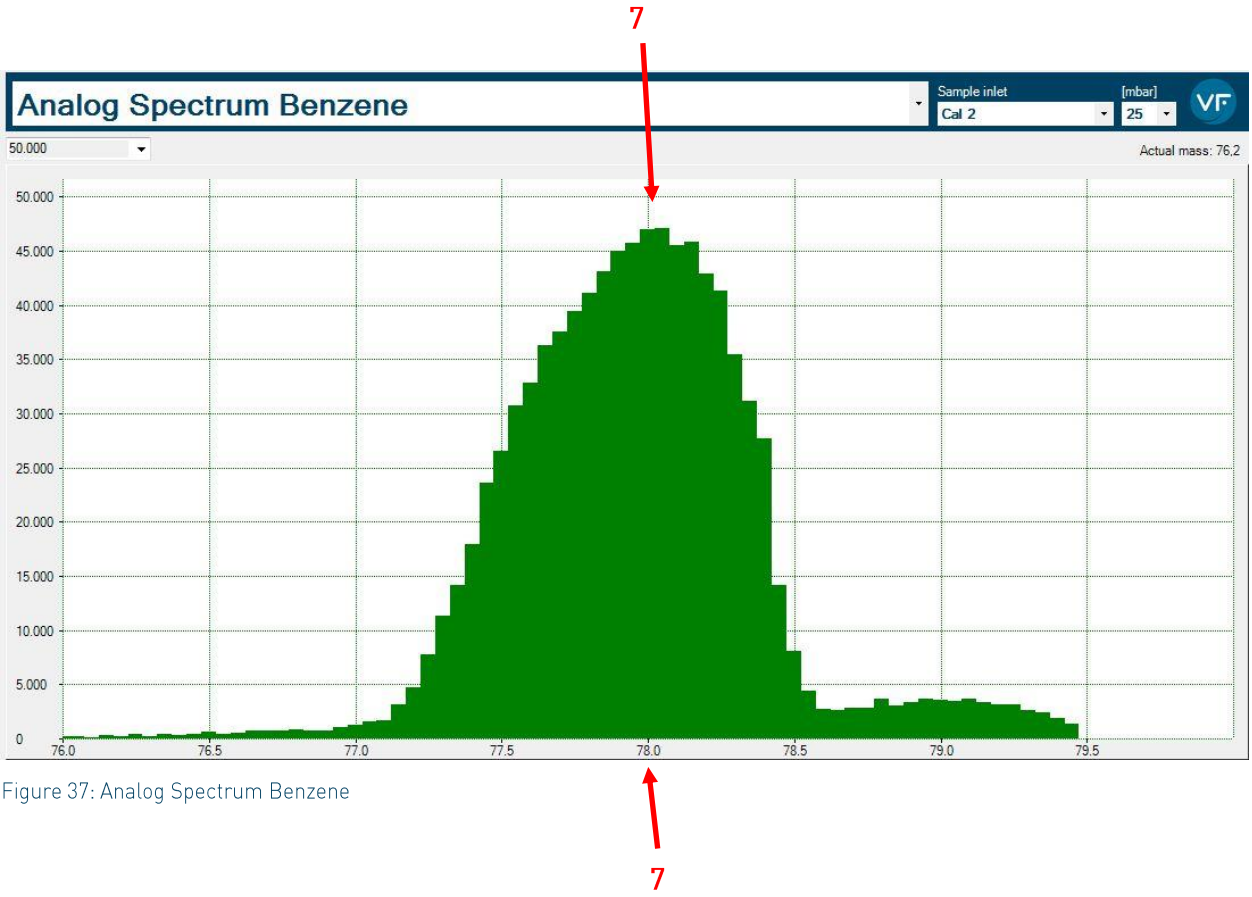

Figure 37: Analog Spectrum Benzene

8. Caused by influence between trimmer 2 and trimmer 3, check again "Analog spectrum" and adjust it again, if necessary
9. Then check "Analog spectrum Benzene" and adjust it again, if necessary
10. Repeat these steps until both peaks are centered on the mass (33/78) with its maximum
11. By adjusting trimmer 4, you can change the peak shape (turn clockwise – the separation between masses gets better but the sensitivity decreases, turn counterclockwise – the separation gets worse but the sensitivity increases)

2.5 Check the function of IMR-MS filaments

Open the service panel of the ion source and check the actual values for Ie and Uf.

1. Ie should be the same as the set value (25 mA / 50 mA)
2. Uf should be between 1.5 V and 3.5 V
3. Switch to the other filament and check Ie and Uf

Ion source – Service Panel

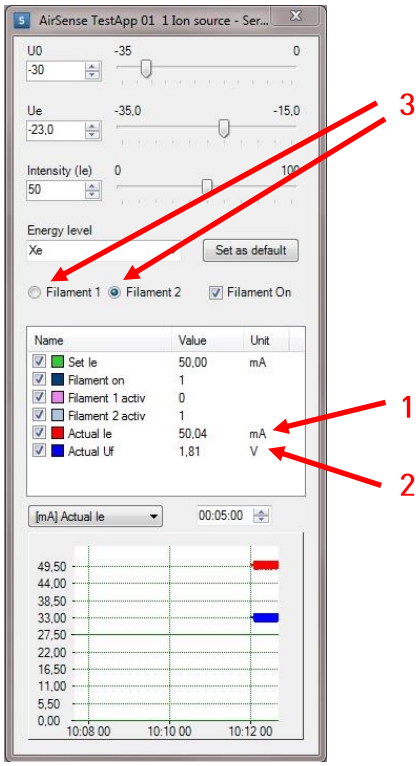

Figure 38: Ion Source – Service panel

2.6 Check the fill levels of source gases

Basic:

The fill level of xenon depends on ambient air temperature. A new xenon bottle has a pressure of approx. 70 bar. The actual pressure in the service panel reads back an analog signal from the pressure reducer on the bottle.

The mercury container is filled with 1,5ml liquid mercury. The usage is calculated via software and is depending on the mercury-valve-open-time

Procedure:

Open the service panel and select one of the source gases and check the actual fill level:

1. Fill level Xenon

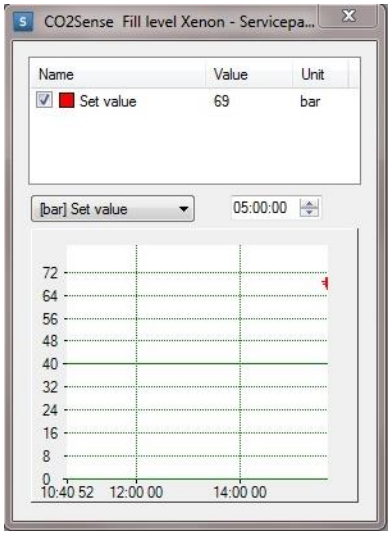

Figure 39: Fill level Xenon

2. Operation hours Mercury

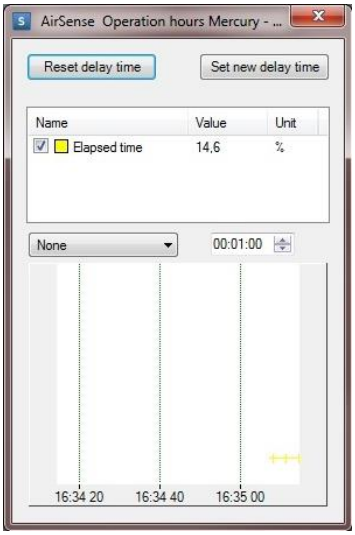

Figure 40: Operating hours Mercury

ATTENTION:
Needs to be reset after a mercury refill!

2.7 Check the “probe off” value

Basic:

The “Probe off” value is a good indicator for a blocked/contaminated capillary or orifice. The pressure will drop if the capillary or the orifice is blocked/contaminated. In this case, the filter should be replaced, such as the capillaries (central and/or outer) or the orifice.

Procedure:

1. Open the service panel and select the “Pressure regulator”
2. Set the pressure to 0 with the slide control
3. The actual pressure will drop and should be in the following ranges:
    a. Capillary inlet with disconnected outer capillary = 1,3 V
    b. Capillary inlet with 1,3 m outer capillary = 1,1 V
    c. Capillary inlet with 2 m outer capillary = 1,0 V
    d. Capillary inlet with 3 m outer capillary = 0,9 V
    e. Capillary inlet with 4 m outer capillary = 0,8 V

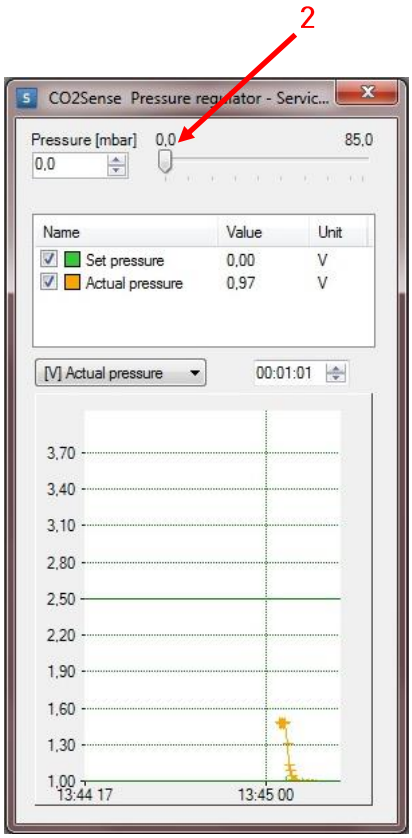

Figure 41: Pressure regulator – Service Panel

The actual values from factory test can be reviewed in the “Analyzer record”!

2.8 Check the function of source valves

Procedure:

1. Select "Valve test" – setup in the V&F Viewer software
2. Press "Measure" – button

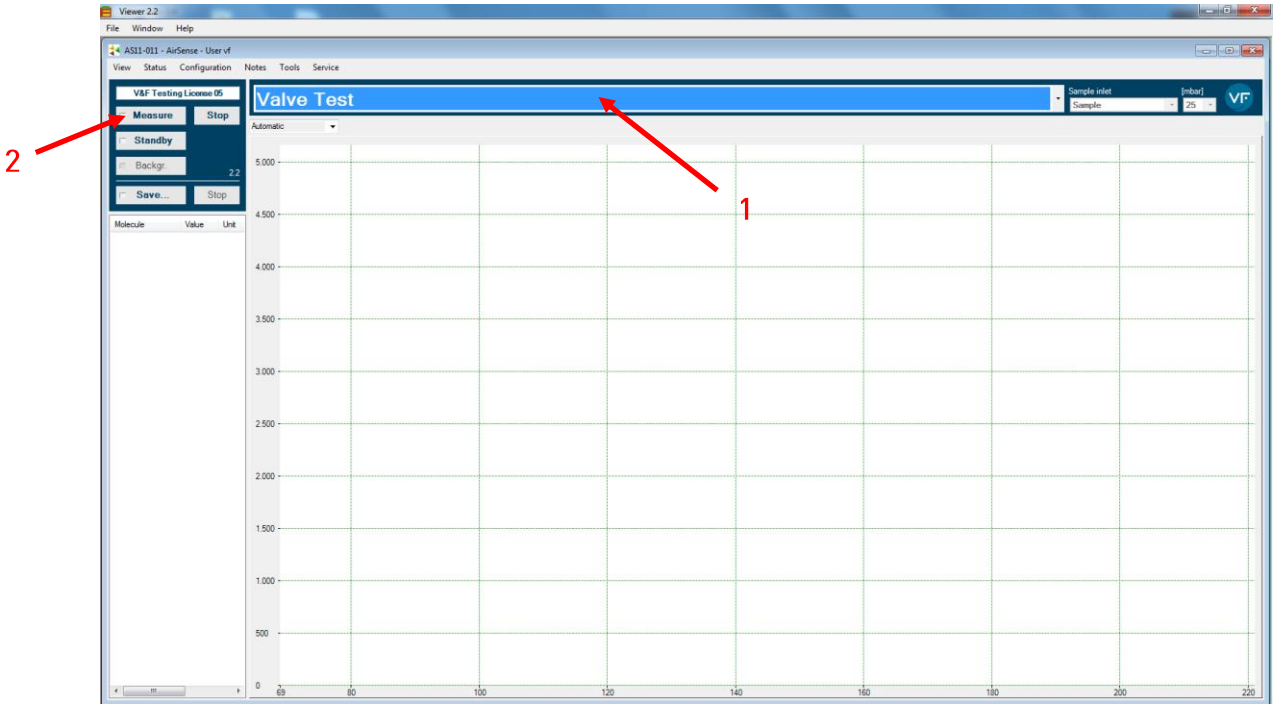

Figure 42: Valve Test

3. Check if the cps-rate of each source valve is in the following range:
   - Xenon on M132 < 300.000 cps
   - Mercury on M200 < 1.500.000 cps
4. If the cps-rates are out of range, the source valve isn't closing properly and needs to be exchanged

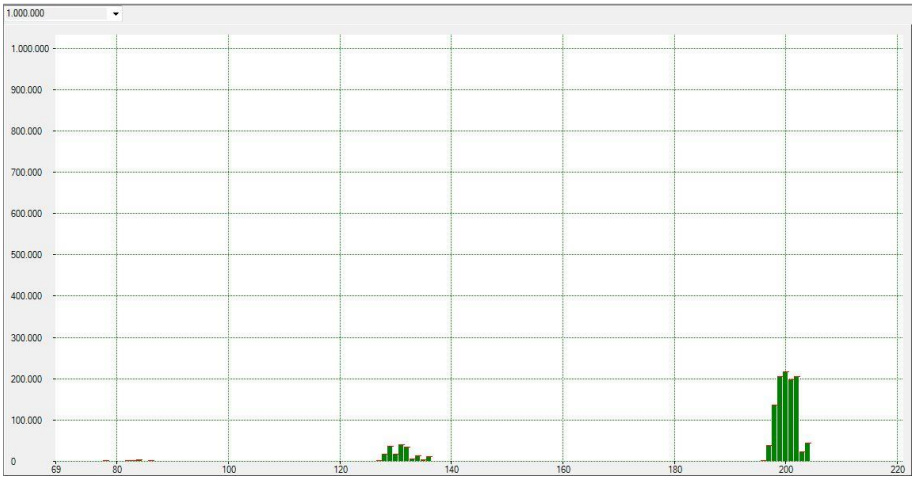

Figure 43: Valves closing properly

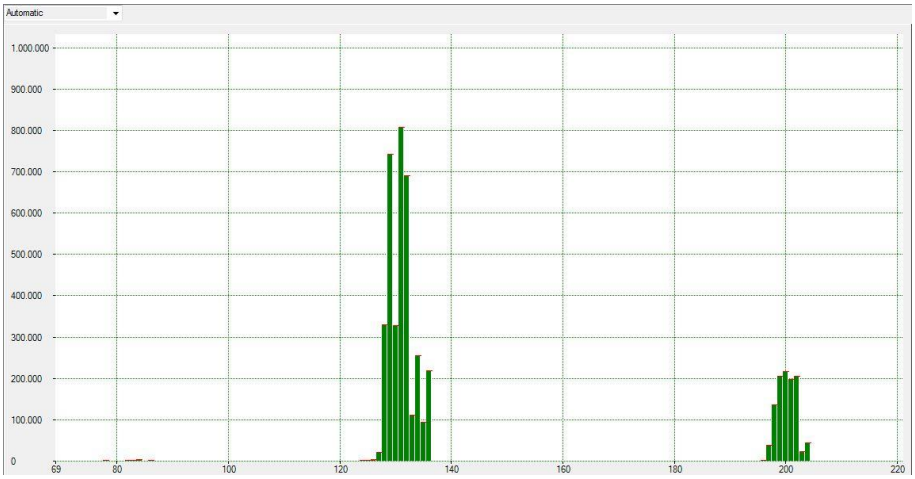

Figure 44: Xenon valve not closing properly

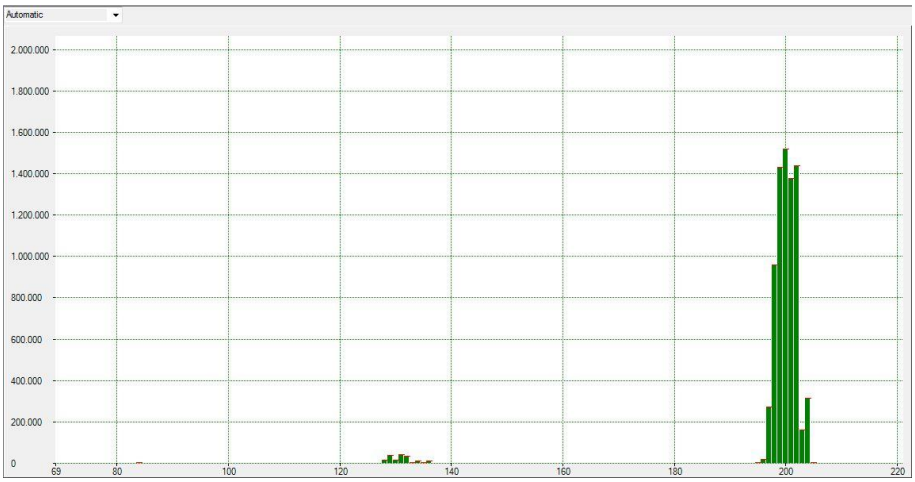

Figure 45: Mercury valve not closing properly

2.9 Check the function of sample valves

Needed tools and auxiliary material:

- N2 gas

Procedure:

1. Connect N2 to INERT inlet
2. Select "Trend test" – setup in the V&F Viewer software and wait for stable signals
3. Open the Service panel of the "Sample valves"
4. Click the checkbox "Enable valve switching" and select the "Flush" valve
5. The signal should remain constant
6. Select "Inert" valve
7. The oxygen signal (M33) should decrease and Nitrogen (M28) increase

CAUTION!:
If not, the valve is not opening and needs to be exchanged!

8. Deselect the "Inert" valve
9. The signals should change back to original

CAUTION!:
If not, the valve is not closing and needs to be exchanged!

10. Connect N2 to Cal1 inlet
11. Repeat this procedure (6 - 9) for Cal1 – 5 inlets

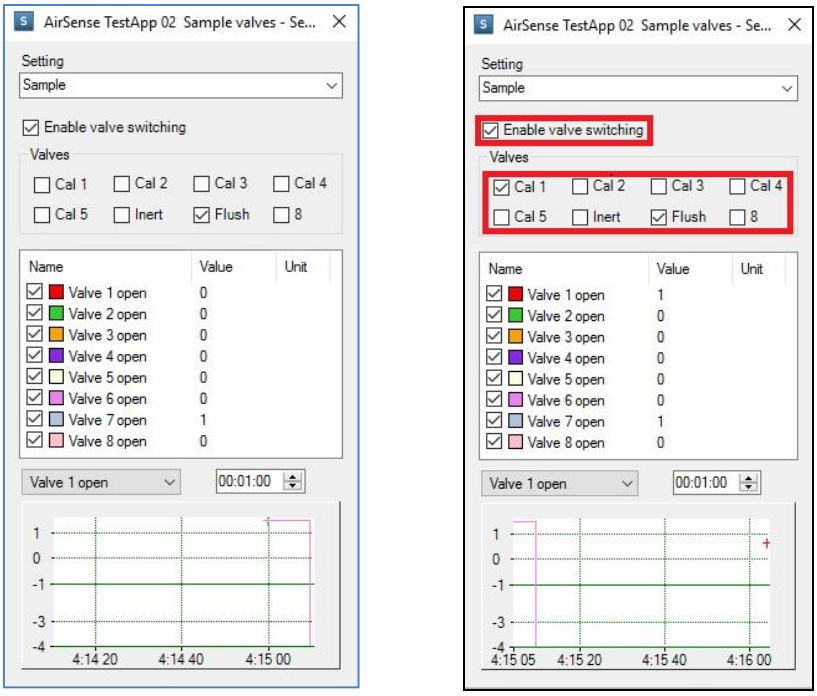

Figure 46: Sample valves – Service Panel

Figure 47: Trend Test with switching sample valves

2.10 Check for leakages

Needed tools and auxiliary material:

- Leak detection spray
- N2 gas for INERT

Needed spares and consumables:

- Leak detection spray, article number: 800195

Procedure:

1. Connect N2 to INERT
2. Select "Leak test" – setup in the V&F Viewer software
3. Select "Sample" inlet
4. Check if the "leak detection spray" can be detected at the sample inlet (spray directly on sample inlet)
5. If it can be detected easily (>1 Mio. Cps), this spray can be used for the leak test
6. Select "Inert" inlet
7. Wait until signal reaches stable low background
8. Check for leakages at all O-ring connections (detector, vacuum chamber cover, RF-feedthrough, venting screw, filament flange, main feedthrough, turbo pump, splinter shield, sample inlet blocks, orifice / capillary) by using a "leak detection spray" (aerosol)
9. For all these O-ring connections, it is possible to only use Xe and skip Hg (but not really necessary to skip Hg)
10. In case of leakages, the signal(s) will increase like in the picture below

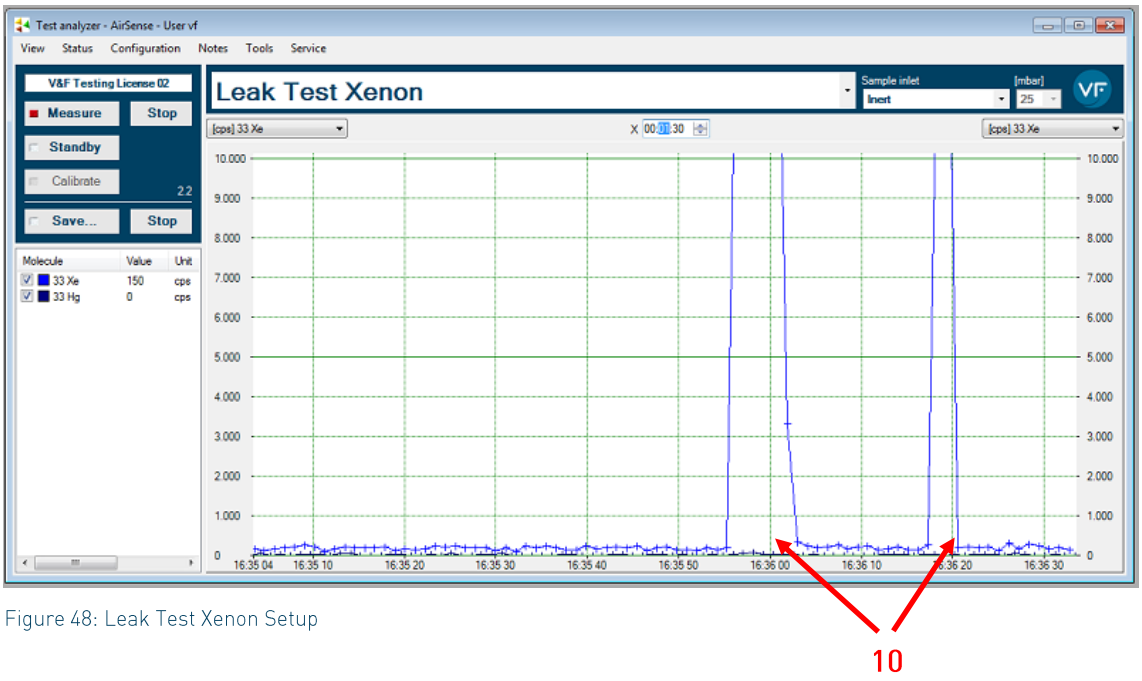

Figure 48: Leak Test Xenon Setup

11. For the detection of a leakage at the 3rd – way connection of the 3-way spider valves, it is necessary to switch source gases (e.g. "Leak test Xenon": Xe & Hg).

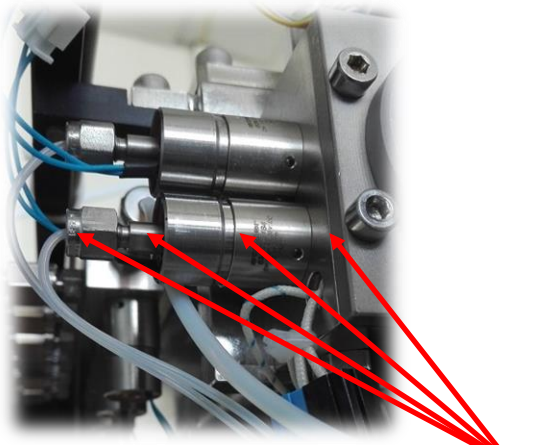

Figure 49: 3-way valves

Figure 50: 3rd way on turbo pump

12. To detect small leakages at the mercury container and at the mercury valve, the xenon valve and the mercury valve must be open at the same time (select "service panel" for "source valves" and select "Mercury and "Xenon")

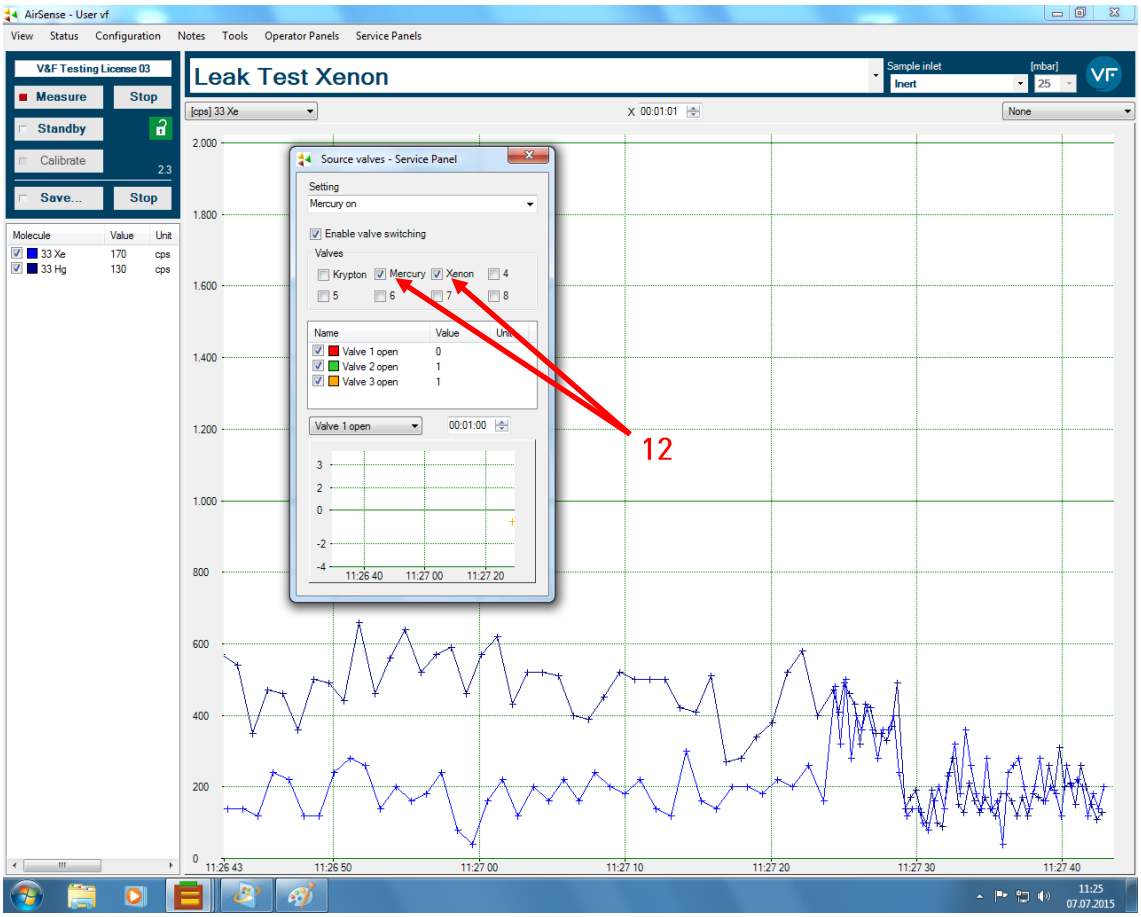

Figure 51: Source valves - Service Panel

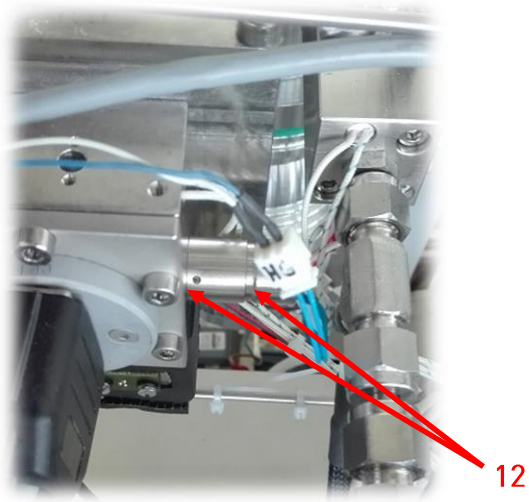

Figure 52: Mercury valve

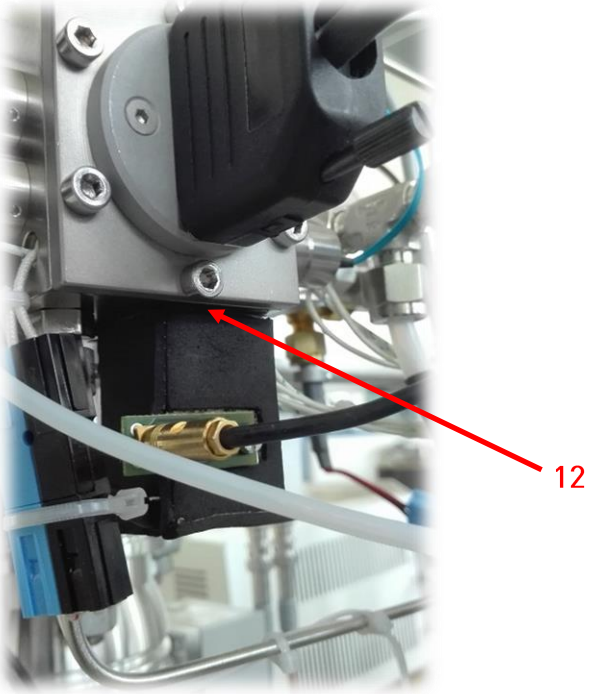

Figure 53: Mercury container

13. In case of a leakage, disassemble the detected part, check/change the O-ring or change the complete part and perform a leak test again

2.11 Check the analog IOs

Needed tools and auxiliary material:

- BNC cable
- Multimeter / Voltmeter

2.11.1. Checking the analog Outputs:

1. Open the "Configuration Manager": Configuration – Configuration Manager
2. Select the "Analog outputs"
3. Click on Component list I/O
4. Click on Show/Hide I/Os and the right part of the window appears
5. Double click on "Analog Output 1"
6. Click on >> - Symbol to get access to manual control
7. Select Manual first and change the voltage by moving the control slide
8. Measure the voltage on the BNC connector of the analog Output 1, it should be the same as you select in the service panel
9. Close the service panel for "Analog Output 1"
10. Repeat the steps 5 to 9 for "Analog Output 2/3/4"

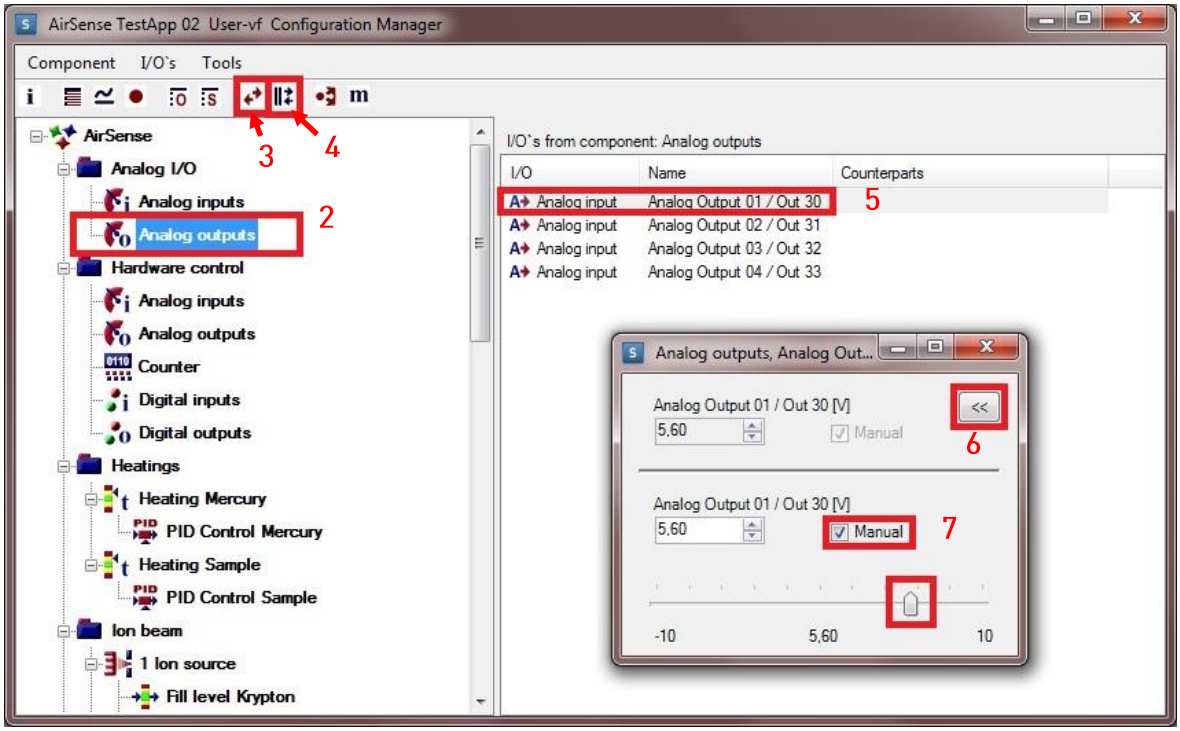

Figure 54: Configuration Manager for Analog Outputs

2.11.2. Checking the analog Inputs:

1. Use a BNC cable and connect "analog Out1" to "analog In1" on the panel of the analyzer
2. Open the "Configuration Manager": Configuration – Configuration Manager
3. Select the "Analog inputs"
4. Click on Component list I/O
5. Click on Show/Hide I/Os and the right part of the window appears
6. Double click on "Analog Input 1"

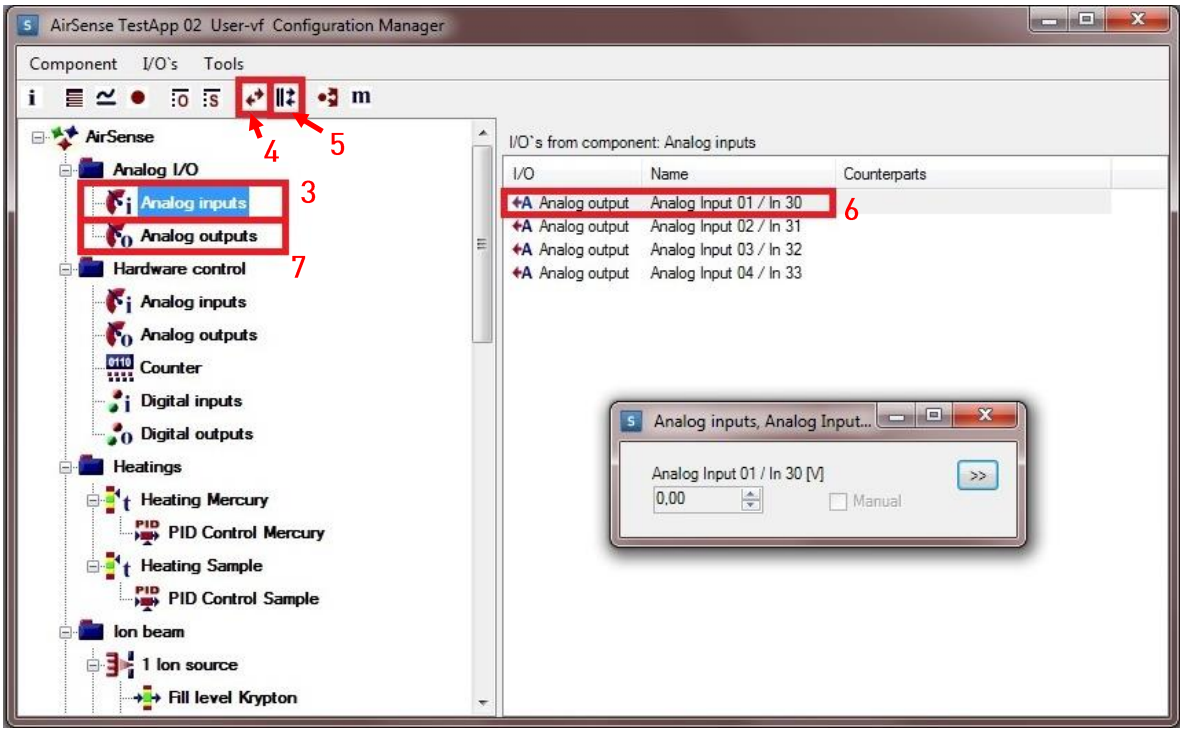

Figure 55: Configuration Manager for Analog inputs

7. Select the "Analog outputs"
8. Double click on "Analog Output 1"
9. Click on >> - Symbol to get access to manual control

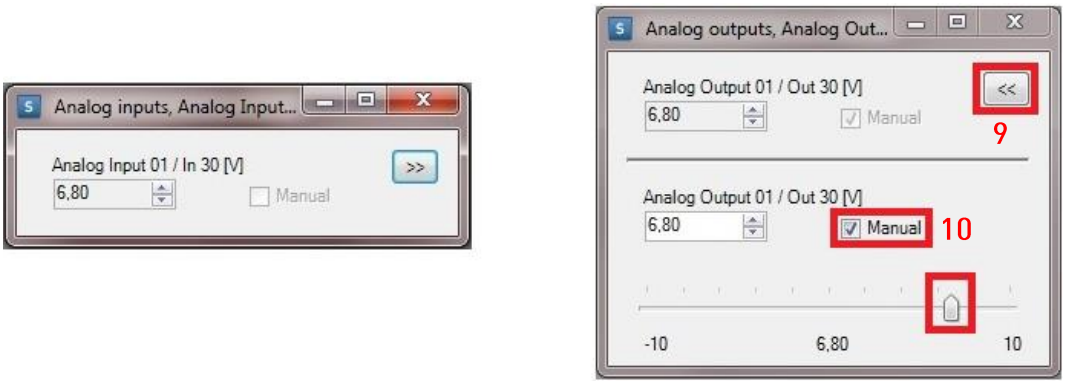

Figure 56: Analog Input & Analog Output

10. Select Manual first and change the voltage by moving the control slide

11. The “Analog Input1” should be the same as you select in the service panel
12. Repeat the steps 1 to 11 for “Analog Input 2/3/4”

3. Hardware work to perform annually

3.1 Clean the analyzer from dust

Needed tools and auxiliary material:

- Compressed or industrial air

Procedure:

1. Shutdown the analyzer via V&F Viewer. Switch off the analyzer and disconnect power cable. Use compressed or industrial air to clean the analyzer from dust.
2. Block the fans of the power supply unit with a screwdriver or similar and clean it from both sides.

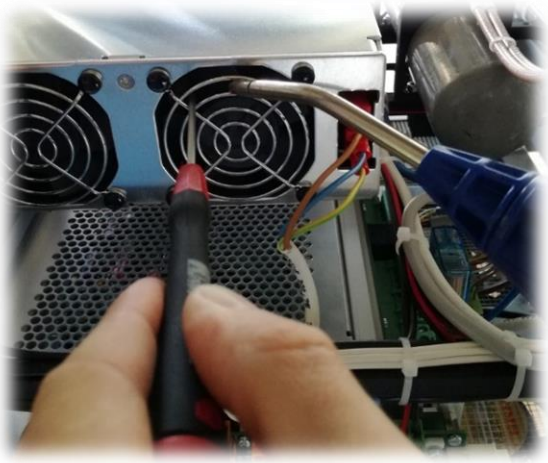

Figure 57: Block the fan with a screwdriver or similar

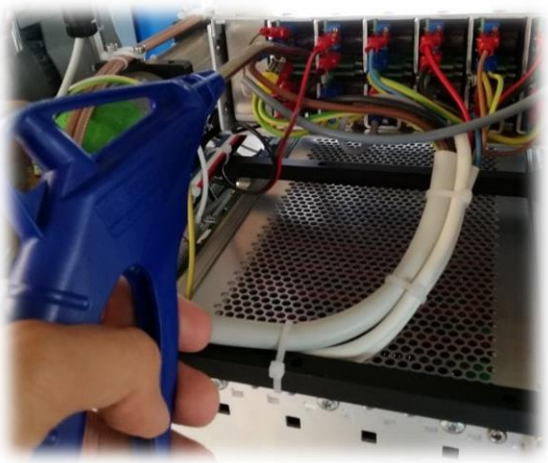

Figure 58: Clean the power supply with compressed air

3.2 Remove and clean electronic boards

Needed tools and auxiliary material:

- Compressed or industrial air

Procedure:

1. Disconnect the cables of the CPU board
2. Open the two fixing-screws of the CPU-Board
3. Remove the CPU-board by pushing down the handle.
4. Remove the electronic boards by pushing down the red handle.
5. Pull out the board and disconnect the cables to get better access to the other board
6. Remove the 2nd board by pushing down the red handle
7. Pull out the board and disconnect the cable

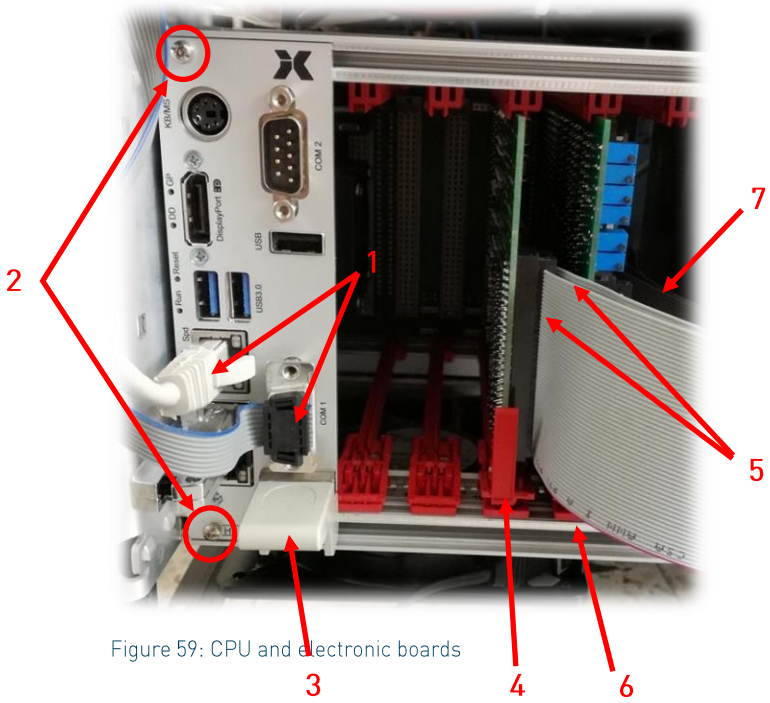

Figure 59: CPU and electronic boards

8. Remove the service board by pulling out
9. Disconnect the cable of the main board
10. Remove the main board by pushing out the red handles sideward
11. Clean all boards with compressed or industrial air
12. Reinstall the boards by following steps 10 to 1

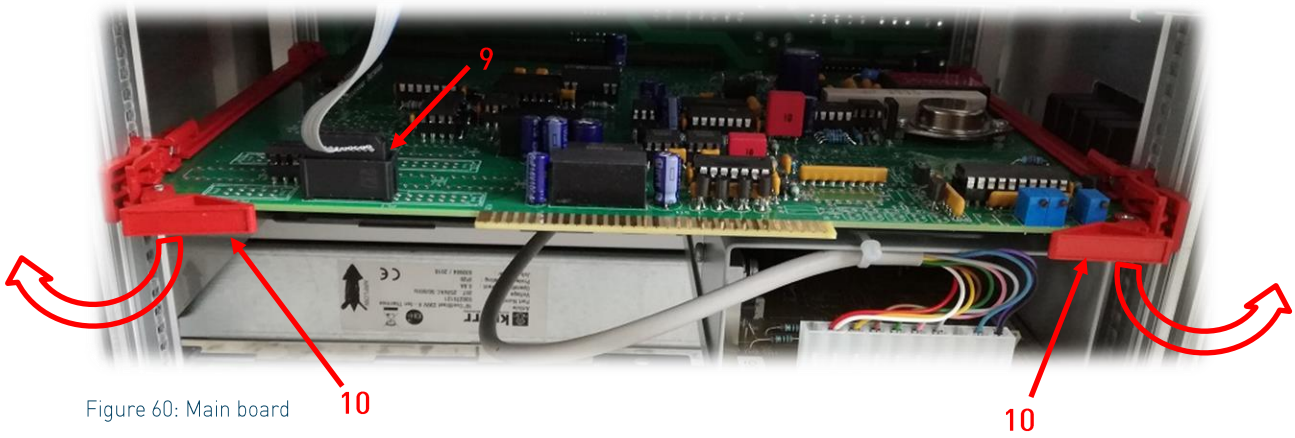

Figure 60: Main board

3.3 Remove and clean fans unit

Needed tools and auxiliary material:

- Compressed or industrial air
- Vacuum cleaner

Procedure:

1. Disconnect the power cable of the fans unit beneath the NetB02 – board

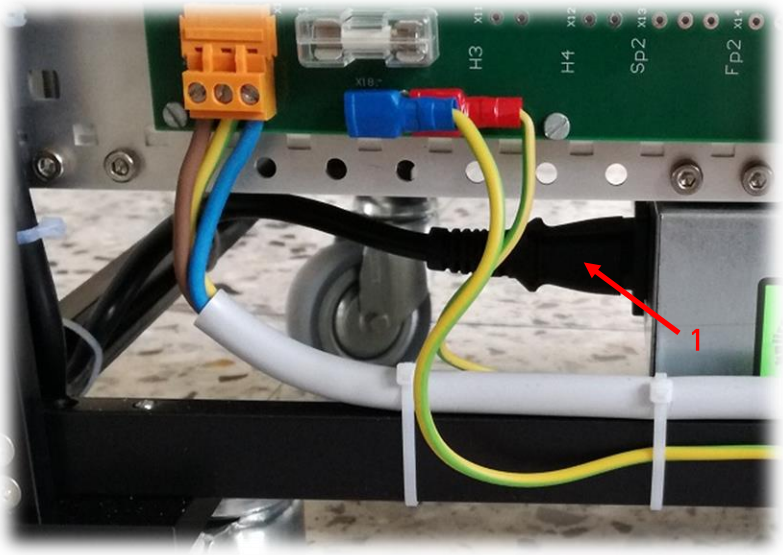

Figure 61: Power supply of the fans unit

2. Open the two fixing-screws of the fans unit
3. Remove the fans unit
4. Clean it with the vacuum cleaner and compressed or industrial air
5. Reinstall the fans unit and connect the power cable

Figure 62: Fans unit

3.4 Loosen and close the venting screw

Procedure:

Vent the vacuum by loosening slightly the venting-screw on top of the vacuum chamber and close it

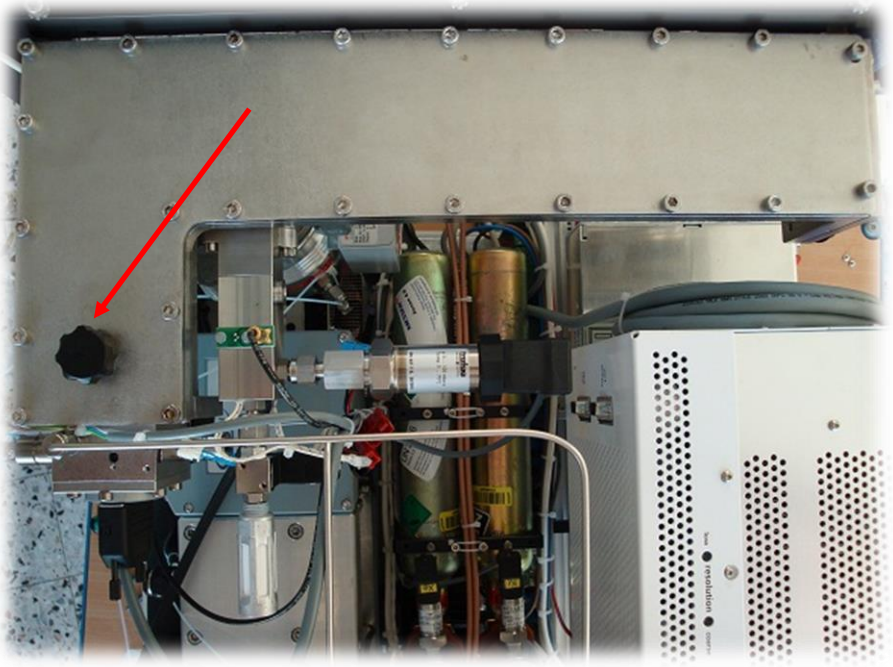

Figure 63: Vacuum chamber with venting screw

3.5 Refill of mercury

Needed tools and auxiliary material:

- Box spanner 2.5mm
- Allen-key 2.5mm
- Box spanner 5mm
- Allen-key 5mm

Needed spares and consumables:

- Mercury 50g, article number: 800080
- O-ring, article available only on request

Procedure:

1. Remove the six-head-socket screw
2. Fill in new mercury to a total fill level of 1.5ml (amount depends on the usage since last refill)
   The usage since last refill can be reviewed in the service panel "Operating hours Mercury" (see 2.3.10).
   E.g. the service panel shows "elapsed time" of 50% - 0,75ml of mercury need to be refilled
3. Clean/exchange the O-ring of the screw if necessary
4. Tighten the six-head-socket screw

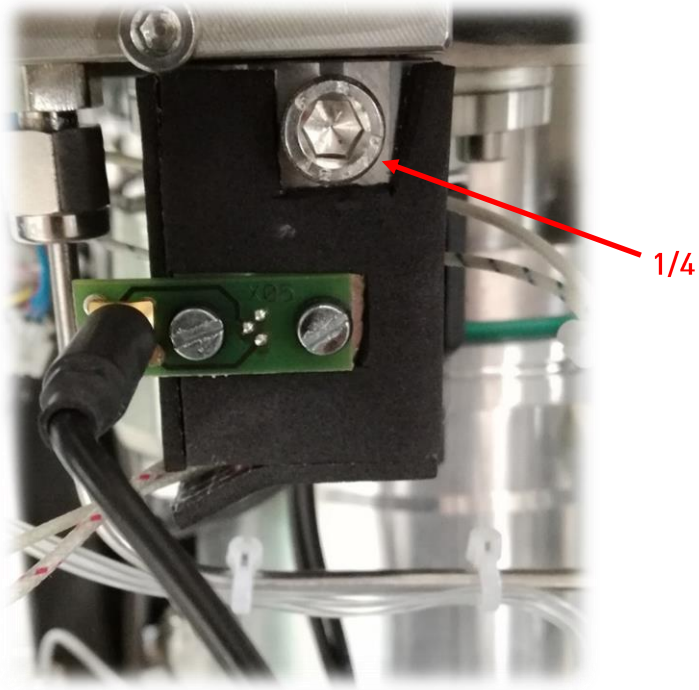

Figure 64: Mercury container

3.6 Exchange of charcoal filter unit

Needed tools and auxiliary material:

- Box spanner 2.5mm
- Allen-key 2.5mm
- 2 * Wrench 9/16"

Needed spares and consumables:

- Charcoal filter unit, article number: 800546

Usage of the new mercury filter:

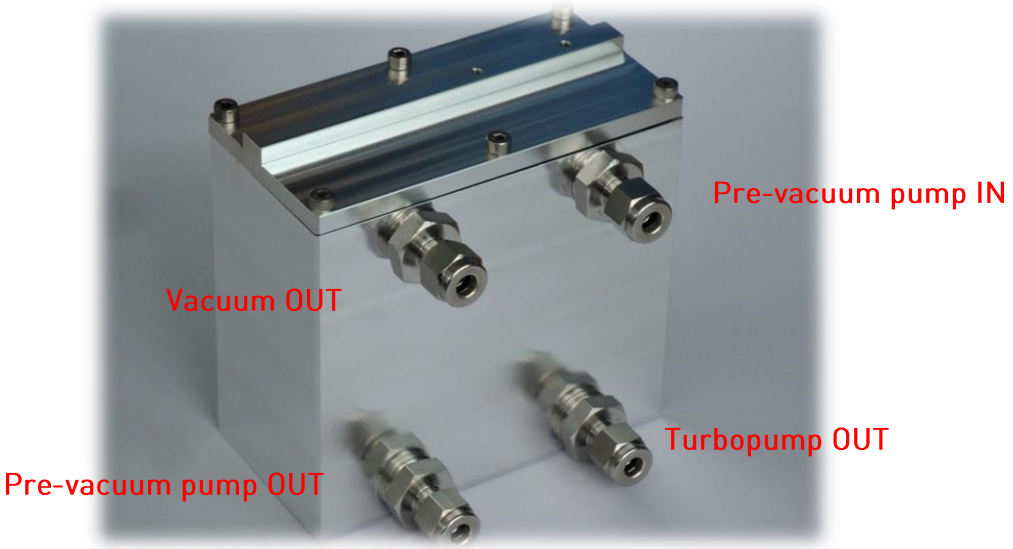

Figure 65: Charcoal filter unit

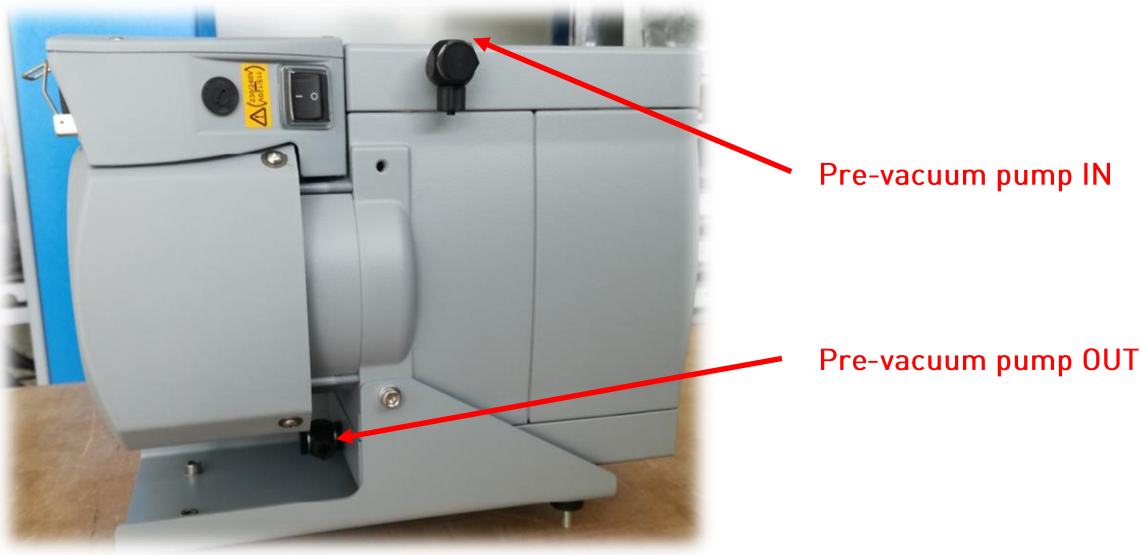

Figure 66: Pre-vacuum pump MV2 NT

Procedure:

1. Dismount the ¼"-teflon lines (hold tight the screw-in mounted on the filter)
2. For safety reasons (not to spill mercury) mount ¼"-blindnuts onto both ¼" - connectors of the old charcoal filter unit
3. Open the 2 six-head-socket screws
4. Put out the old filter
5. Install the new filter
6. Connect the Teflon lines

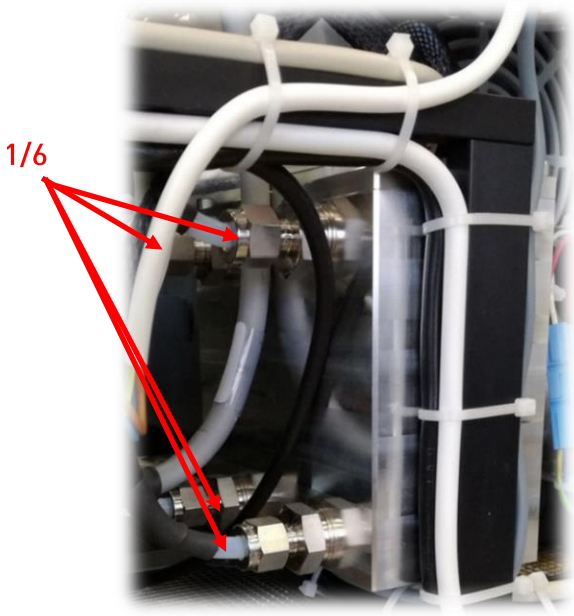

Figure 67: Connectors of charcoal filter unit

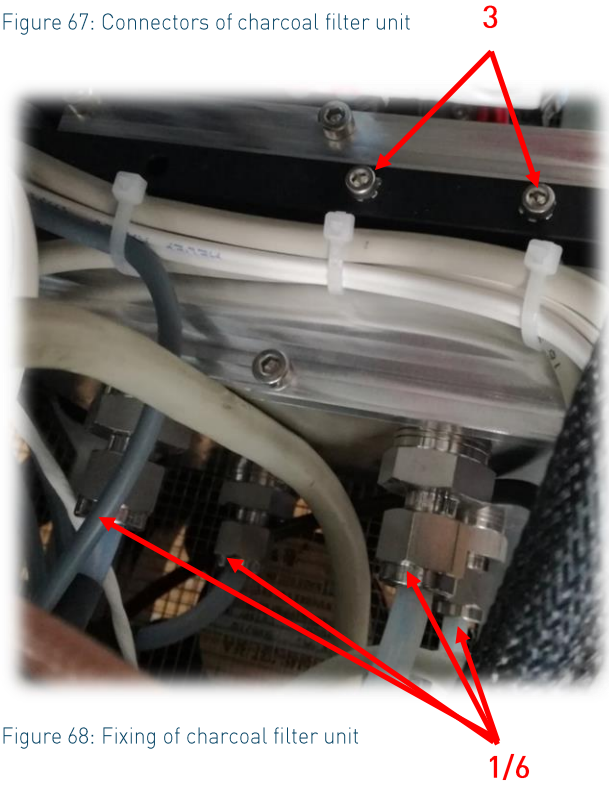

Figure 68: Fixing of charcoal filter unit

3.7 Remove the turbo pump and clean it from mercury

Needed tools and auxiliary material:

- Box spanner 3.0mm
- Allen-key 3.0mm
- Wrench 17mm
- Wrench 15mm
- Wrench 13mm
- Wrench 11mm
- Wrench 9/16"
- Wrench for vacuum pump
- Screw driver slotted

Procedure:

1. Disconnect the ¼"-Teflon line for the pre-vacuum

CAUTION:
Mercury might spill out. To avoid this, you have to attach a blind nut!

2. Disconnect the ¼"-T-piece for the 3rd-way 1/16"-Teflon lines
3. Disconnect the cable

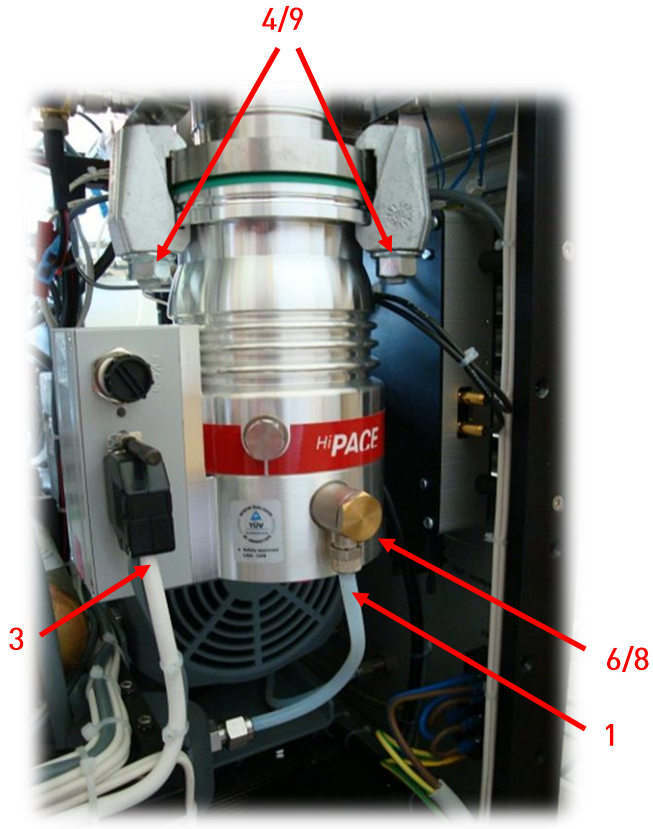

Figure 69: Turbo pump

4. Open the 3 bracket screws and hold the pump at the button
5. Remove the loosened bracket screws and remove the pump
6. Unscrew the pre-vacuum connector to get out the mercury from the turbo pump
7. To spill out the mercury at the pre-vacuum connection, turn over the pump and knock at the body of the turbo pump

Figure 70: 3rd way of Turbo pump

8. Screw in the pre-vacuum connector
9. Mount the pump to the vacuum chamber and tighten the 3 bracket screws (take care of pump position)
10. Connect all disconnected cables and connectors

3.8 Replace the operating agent of the turbo pump

Needed tools and auxiliary material:

- Box spanner 3.0mm
- Allen-key 3.0mm
- Wrench 17mm
- Wrench 15mm
- Wrench 13mm
- Wrench 11mm
- Wrench 9/16"
- Wrench for vacuum pump
- Screw driver slotted

Needed spares and consumables:

- Operating agent for HiPace 80 turbo pump, article number: 800155
- O-ring splinter shield, article available only on request

Procedure:

1. Turn the pump upside down to exchange the operating agent
2. Open the plastic cover at the bottom
3. Remove the old operating agent by pulling it out
4. Put in the new operating agent
5. Check the O-ring and clean/exchange it if necessary
6. Close the plastic cover at the bottom

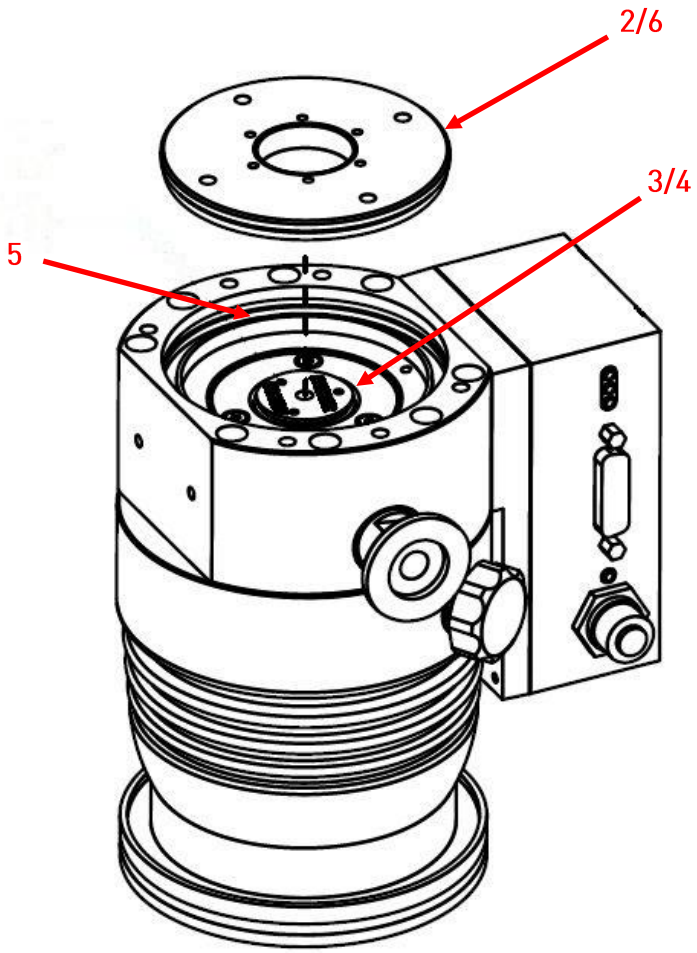

Figure 71: Replace the operating agent

3.9 Exchange of the inner capillary

Needed tools and auxiliary material:

- Box spanner 3.0mm
- Allen-key 3.0mm
- Wrench 19mm
- Wrench 17mm
- Wrench 9/16"
- Wrench 7/16"
- Wrench ½"
- Wrench ¼"
- Flat nose plier
- Knife or ceramic blade
- Screw driver slotted

Needed spares and consumables:

- Inner capillary (100µm) fused silica (per m), article number: 800056, or
- Inner capillary (150µm) fused silica (per m), article number: 800057, or
- Inner capillary (180µm) fused silica (per m), article number: 800058, or
- Inner capillary (250µm) fused silica (per m), article number: 800059, or
- O-ring set for gas inlet for IMR-MS .net series, article number: 800066
- Ferrules vespel 0.4 mm for fused silica capillary (100 - 250 µm), (set of 10), article number:800048, or

Procedure:

1. Disconnect the internal sample line / central capillary
2. Disconnect the pressure gauge
3. Disconnect the regulation valve and the Teflon line for the bypass (connected to MV2 NT)
4. Disconnect the cable for the temperature sensor
5. Disconnect the cable for the heating elements
6. Open the 2 six head-socket screws which are used to mount the Pressure Regulation Unit (PRU) to the vacuum chamber
7. Remove the Pressure Regulation Unit (PRU) by pulling out

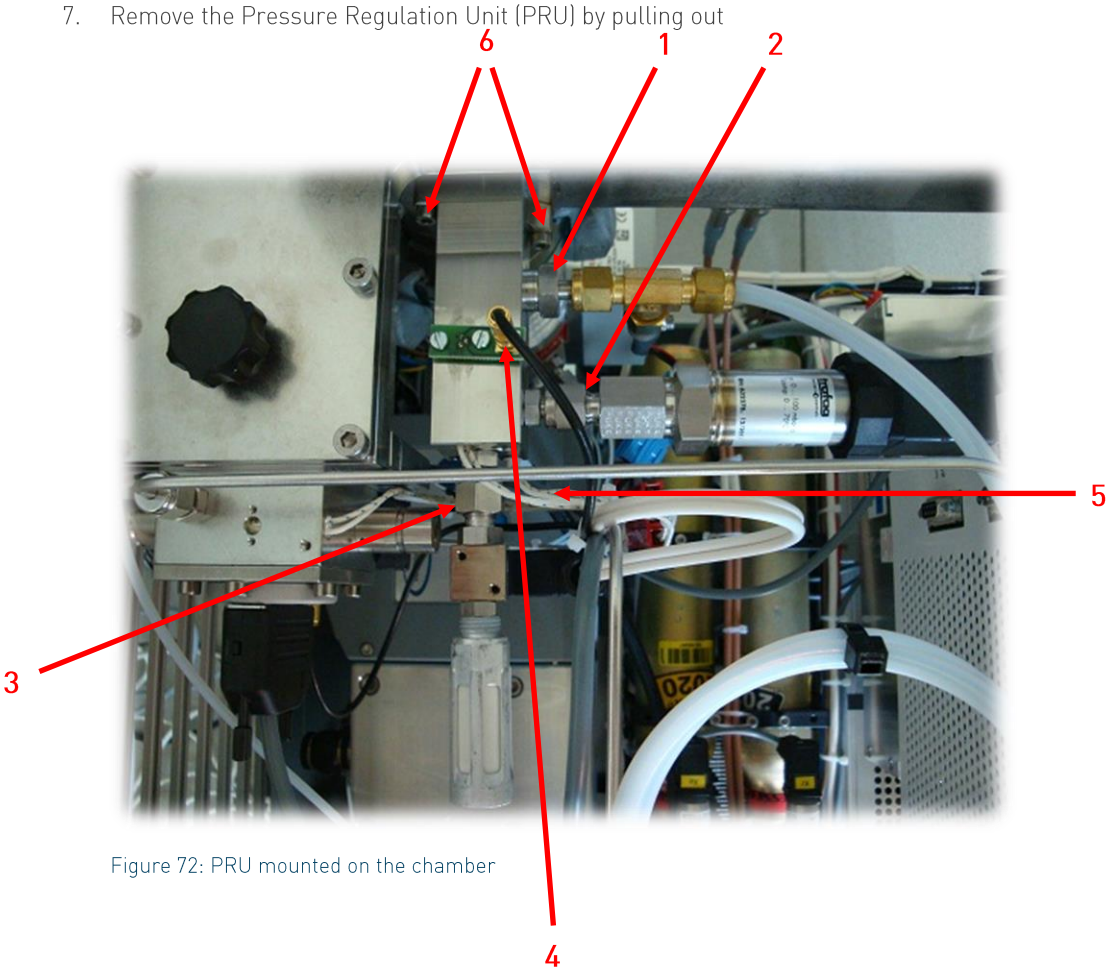

Figure 72: PRU mounted on the chamber

8. Loosen the fixing screws for the temperature sensor
9. Open the 2 six-head-socket screws
10. Pull apart both blocks
11. Open the fixing screw of the capillary
12. Take out the old fused silica capillary
13. Remove all connectors and O-rings
14. Clean all mechanical parts in ultrasonic bath with soap water
15. Clean the parts with acetone / isopropanol and compressed / industrial air
16. Exchange all O-rings of the connectors (O-ring set for sample gas inlet)
17. Insert the new capillary in the front block (capillary holder)
18. Attach the front vespel ferrule in correct direction and attach the fixing screw of the capillary
19. Tighten the fixing screw, so that the capillary sticks out 4mm
20. Attach the rear vespel ferrule and assemble both blocks
21. Tighten the fixing screw of temperature sensor after inserting the heating elements
22. Attach the PRU to the vacuum chamber and fix it with the 2 six-head-socket screws
23. Connect all disconnected cables and parts

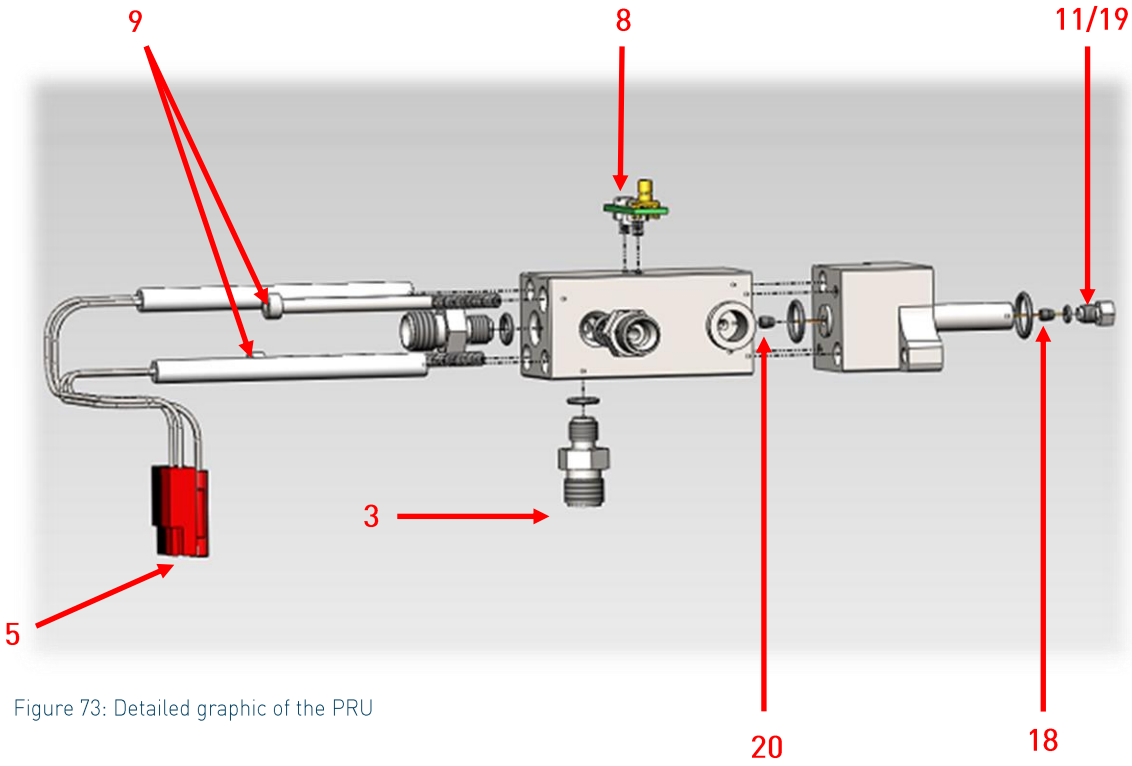

Figure 73: Detailed graphic of the PRU

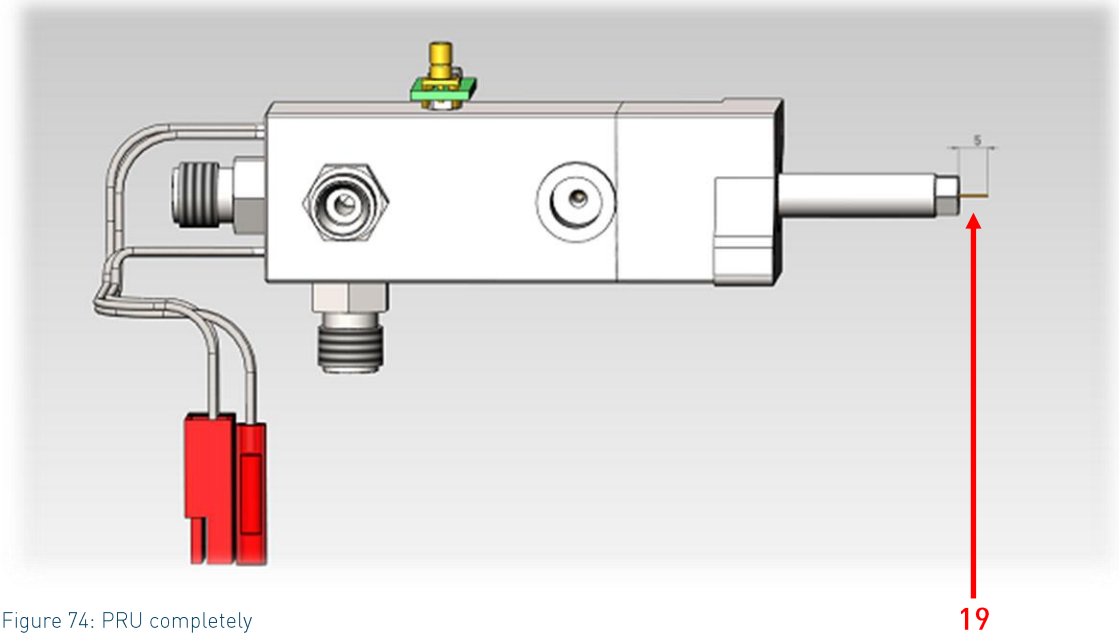

Figure 74: PRU completely

3.10 Exchange the central capillary (sulfinert capillary)

Needed tools and auxiliary material:

- Wrench 17mm
- Wrench 9/16"
- Wrench ½"
- Side cutting pliers
- Screw driver slotted
- Cable ties

Needed spares and consumables:

- Central capillary stainless steel deactivated, article number: 800061 (1 O-ring and ferrule included), or
- O-Ring for external and central capillary (set of 10), article number: 800310
- Ferrules vespel 1.6 mm for stainless steel capillary (set of 10), article number: 800050

Procedure:

CAUTION:
Hot surface!

1. Disconnect the cable for the heating wire
2. Unscrew the connector of the central capillary at the PRU

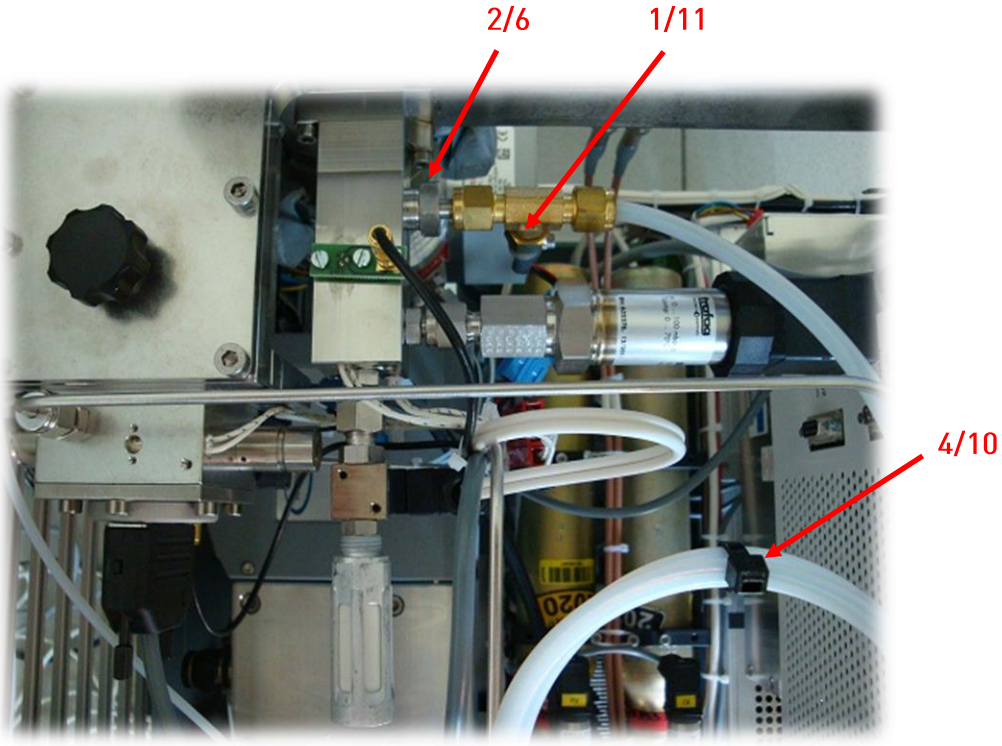

Figure 75: Disconnect the central capillary

3. Unscrew the connector of the central capillary at the front panel

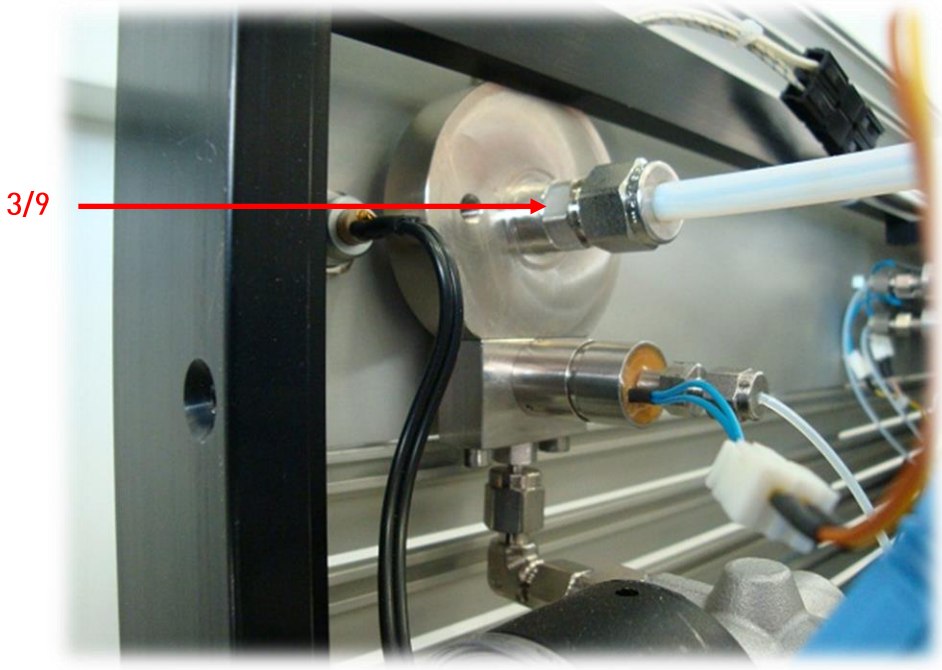

Figure 76: Disconnect the central capillary

4. Cut the 4 cable ties and remove the old capillary
5. Attach the O-ring to the connector (ensure that the old O-ring is removed from the PRU)

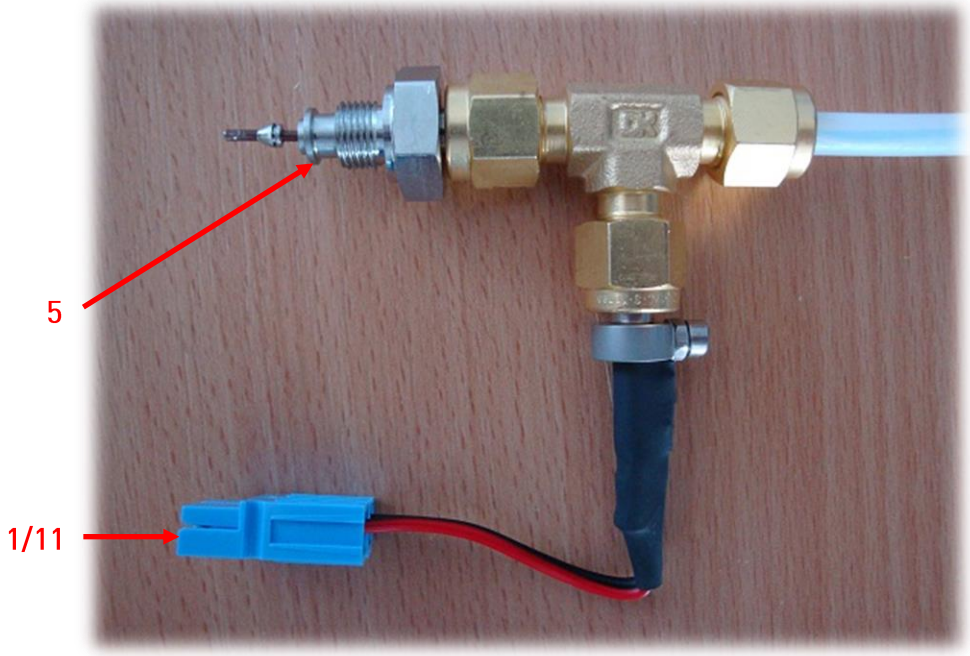

Figure 77: Rear end of central capillary

6. Place the new capillary and mount it to the PRU
7. Cut the capillary if necessary (on front panel side)
8. Attach the ferrule

ATTENTION:
Mind the direction of the ferrule!

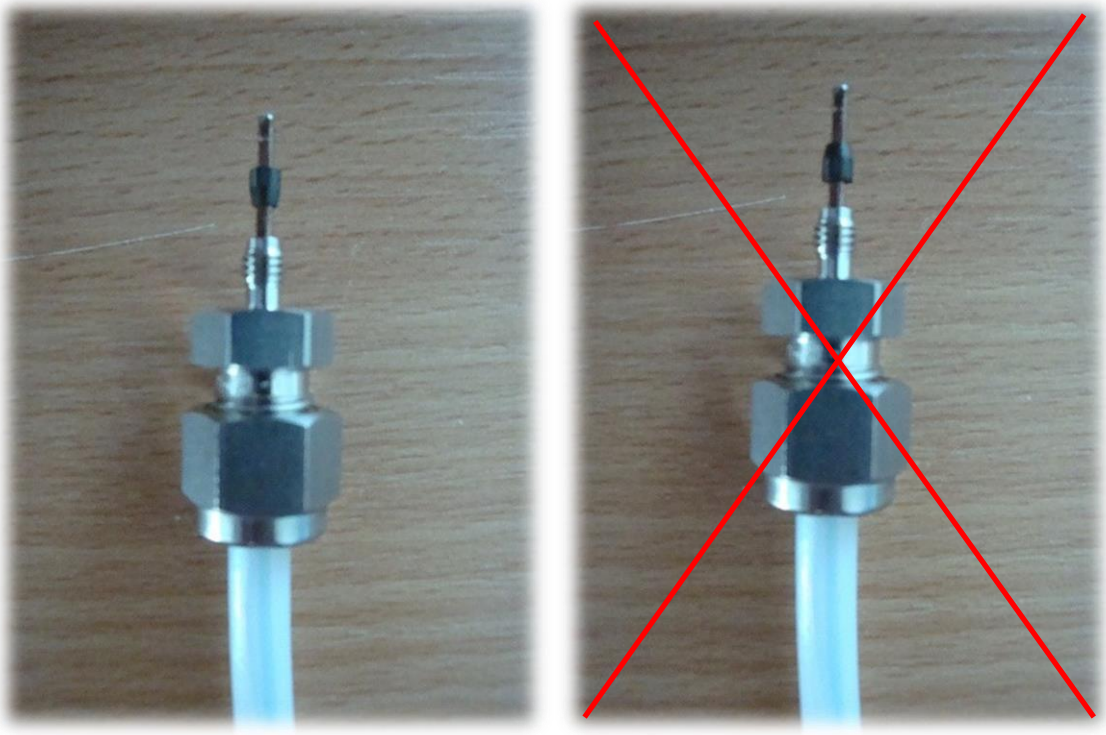

Figure 78: Correct and wrong position of ferrule

9. Mount the connector of the center capillary to the front panel
10. Fix the cable ties
11. Connect the heating connector

3.11 Exchange of outer capillary

Needed tools and auxiliary material:

- Wrench 17mm
- Wrench 9/16"

Needed spares and consumables:

- External capillaries must be replaced by same length
- External capillary (1,3 m) stainless steel, article number: 800040 (1 O-ring included), or
- External capillary (2 m) stainless steel, article number: 800042 (1 O-ring included), or
- External capillary (3 m) stainless steel, article number: 800044 (1 O-ring included), or
- External capillary (4 m) stainless steel, article number: 800046 (1 O-ring included), or
- External capillary (1,3 m) stainless steel, pumped, article number: 800311 (1 O-ring included), or
- External capillary (2 m) stainless steel, pumped, article number: 800313 (1 O-ring included), or
- External capillary (3 m) stainless steel, pumped, article number: 800315 (1 O-ring included), or
- External capillary (4 m) stainless steel, pumped, article number: 800317 (1 O-ring included)
- O-Ring for external and central capillary (set of 10), article number: 800310

3.11.1. Procedure for capillary inlet without sample pump:

1. Disconnect (pull) the heating connector from the front panel (can be done without shutting down the instrument)
2. Open the hex head screw and unscrew the inlet capillary

CAUTION:
Hot surface!

3. Remove the old O-ring and replace it with the new one
4. Screw on the new capillary and connect the heating connector

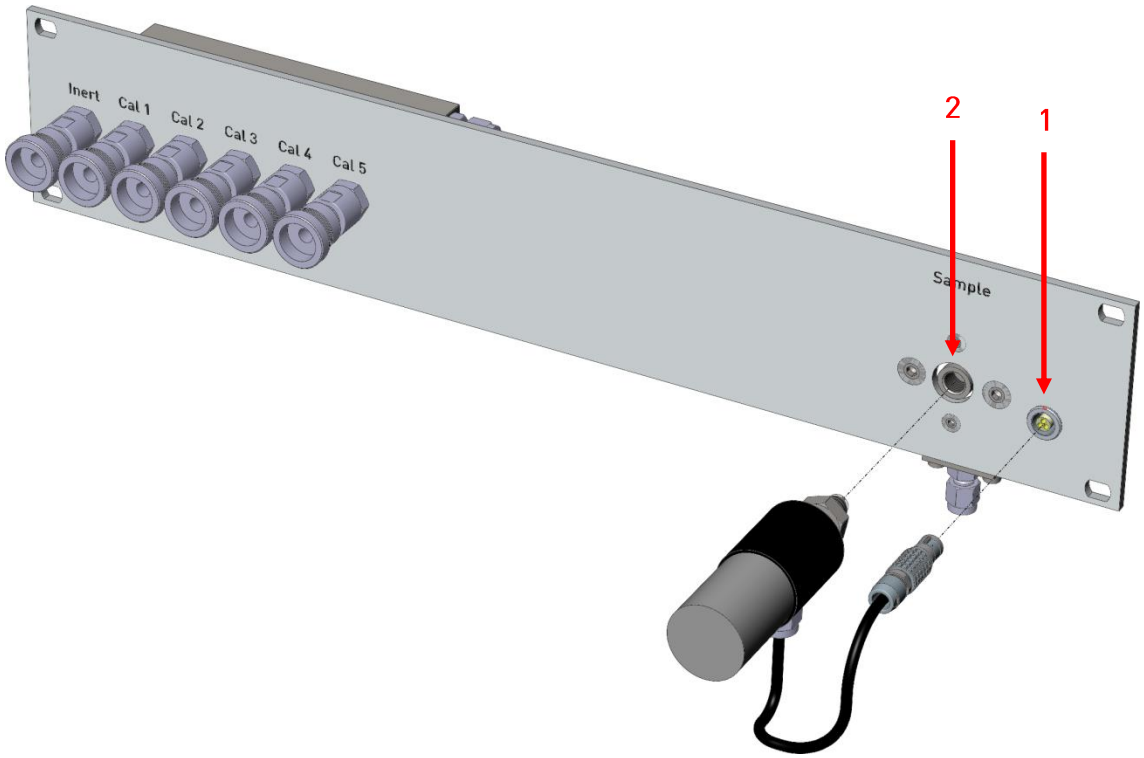

Figure 79: Capillary inlet without sample pump

3.11.2. Procedure for capillary inlet with sample pump:

1. Disconnect (pull) the heating connector from the front panel (can be done without shutting down the instrument)
2. Disconnect the Teflon line for the sample pump from the front panel
3. Open the hex head screw and unscrew the inlet capillary

CAUTION:
Hot surface!

4. Remove the old O-ring and replace it with the new one
5. Screw on the new capillary, connect the Teflon line and connect the heating connector

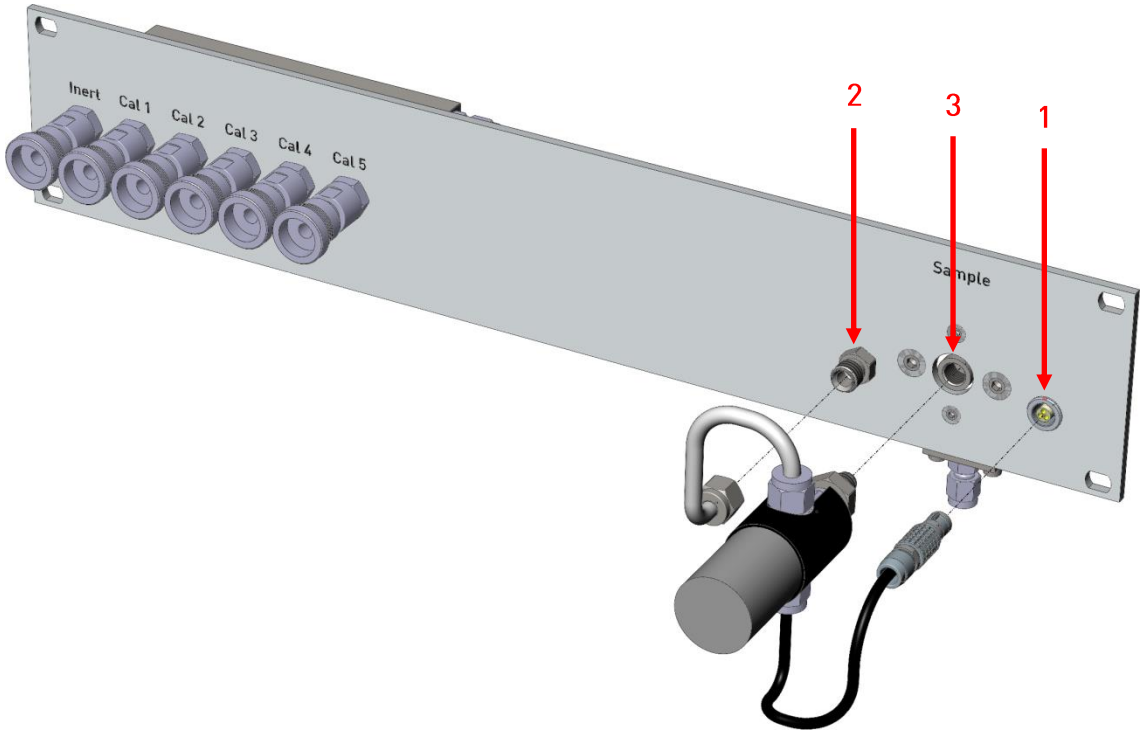

Figure 80: Capillary inlet with sample pump

3.12 Exchange the bypass air filter

Needed spares and consumables:

- Bypass air filter, article number: 800030

Procedure:

1. Remove the old bypass air filter by turning it counterclockwise (can be done without shutting down the instrument)
2. Mount the new bypass air filter by turning it clockwise

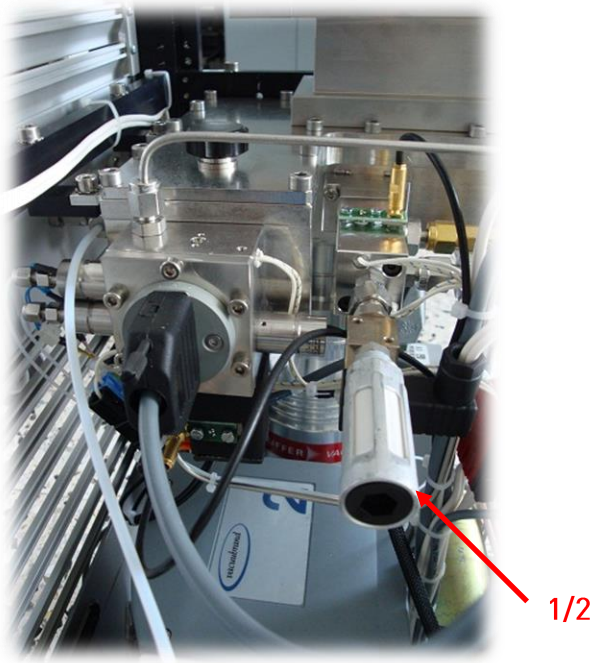

Figure 81: Bypass air filter

3.13 Exchange the sample inlet filter for capillary inlet

Needed tools and auxiliary material:

- Wrench 5/8"
- Wrench 11/16"

Needed spares and consumables:

- Filter unit for capillary inlet, article number: 800035, or
- Sinter frit 2 µm, article number: 800072

Procedure:

1. The sinter frit (2µm) is located at the front end of the capillary in a 3/8" tube, called "filter unit for capillary inlet"

CAUTION:
Hot surface!

2. To exchange only the Sinter Frit: unscrew the front connector from the filter unit and remove the Sinter frit (2µm) Remove the old O-ring and replace it with the new one
3. To exchange only the whole Filter Unit: unscrew the front connector from the filter unit, unscrew the filter unit to exchange the filter unit for capillary inlet or to clean the filter unit
4. Clean all front tubes and the filter unit (without the 2µm Sinter frit), if necessary, in an ultrasonic bath or with a cleaning cloth soaked in acetone

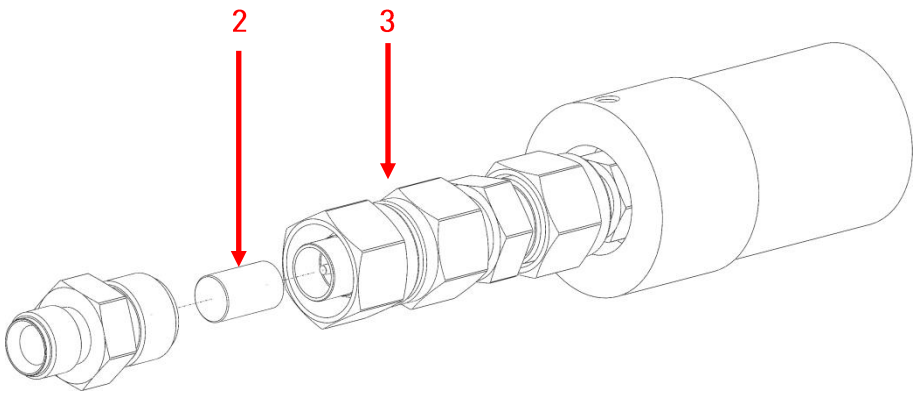

Figure 82: Exchange the filter for capillary inlet

3.14 Maintain the sample pump

Needed tools and auxiliary material:

- Screw driver

Needed spares and consumables:

- Spare part kit for sample pump (115V | 230V), article number: 800450

Procedure:

1. Loosen the connections to the pump
2. Open the 4 screws on the sample pump

CAUTION:
The head of the pump should stay one unit so that no parts get lost!

3. Unscrew the old diaphragm by turning it counter clockwise
4. Put the new diaphragm in by turning it clockwise
5. Pull apart the blocks of the pump head and exchange the valve plates
6. Reassemble the blocks and tighten the head back on the pump with the 4 screws
7. Connect the Teflon tubes back on the pump

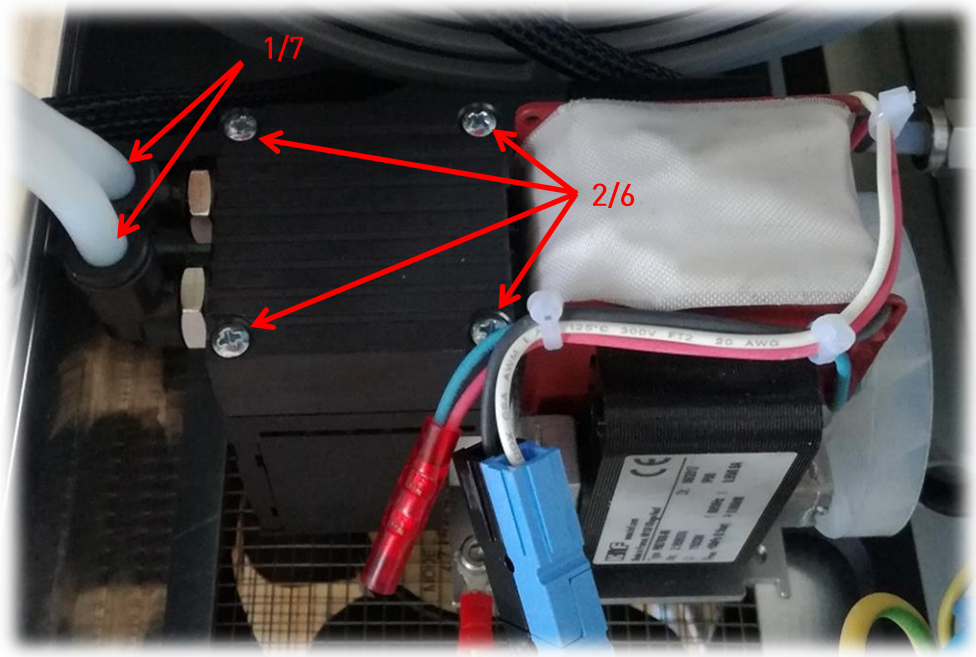

Figure 83: Sample pump

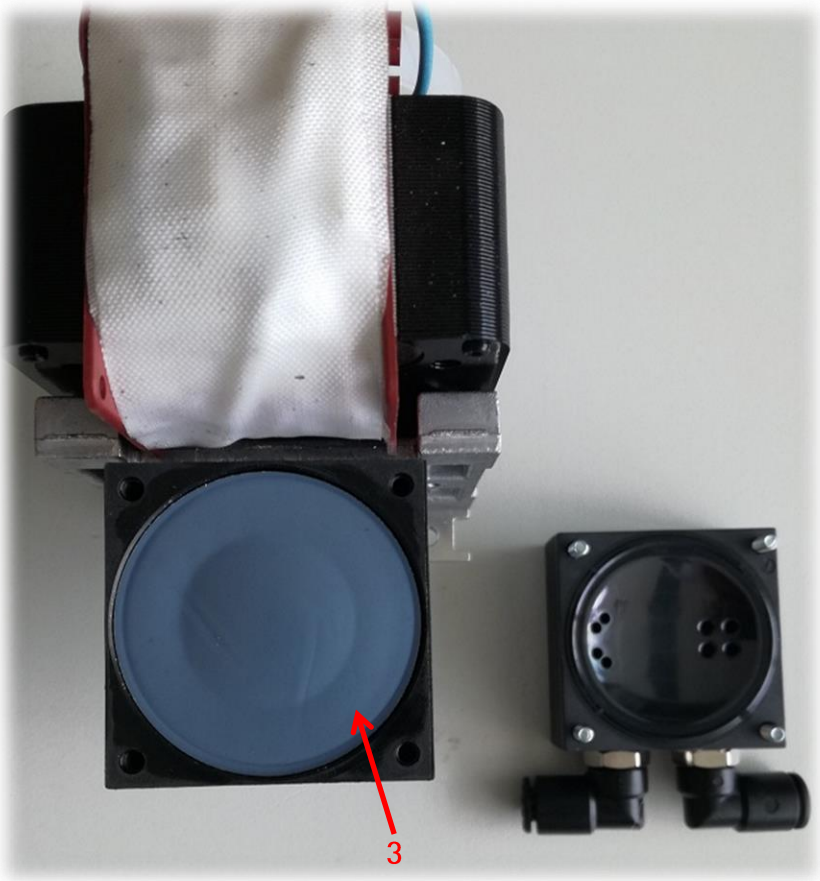

Figure 84: Head and membrane of sample pump

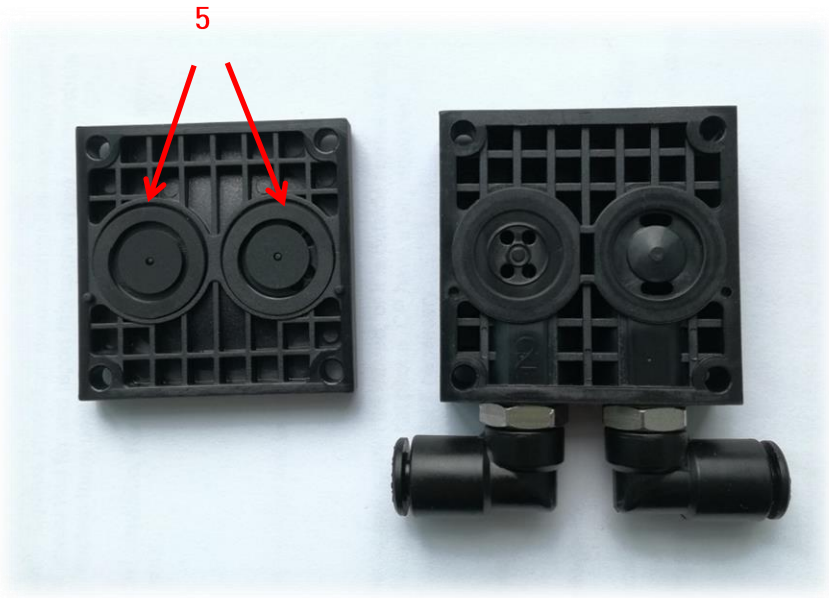

Figure 85: Blocks and valve plates of the pump head

4. Hardware work to perform if required

4.1 Exchange the filament flange

Needed tools and auxiliary material:

- Box spanner 3.0mm
- Allen-key 3.0mm

Needed spares and consumables:

- Filament flange for IMR-MS, article number: 800073
- O-ring for filament for IMR-MS (set of 5), article number: 800077, optional

Procedure:

1. Disconnect the cable at the filament flange
2. Open the 6 six-head-socket screws
3. Take out the old filament flange

CAUTION:
Hot surface!

4. Clean the O-ring or exchange it, if necessary
5. Mount the new filament flange with the 6 six-head-socket screws
6. Connect the cable

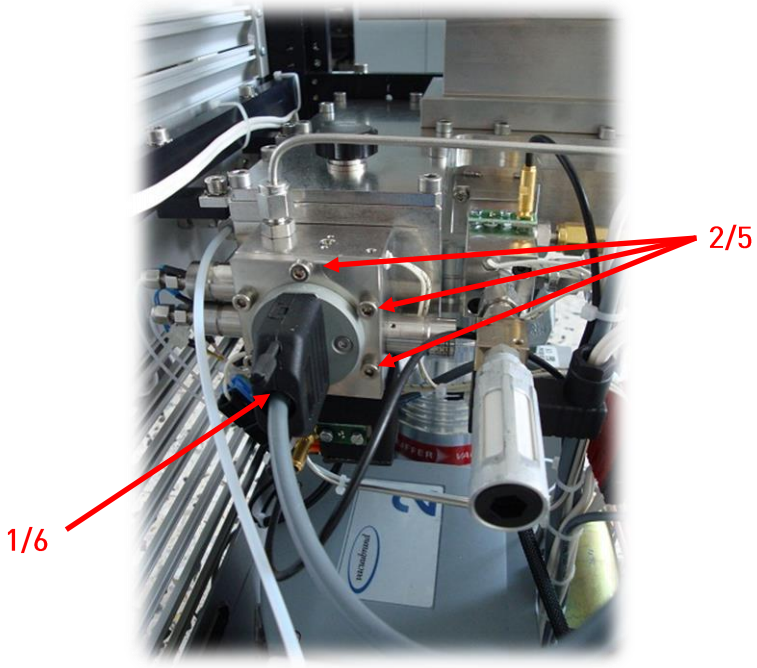

Figure 86: Filament flange

4.2 Exchange the Xenon gas cylinder

Needed tools and auxiliary material:

- Box spanner 3.0mm
- Allen-key 3.0mm
- Wrench 30mm
- Wrench 7/16"
- Knife
- Screw driver slotted

Needed spares and consumables:

- Xenon gas cylinder 80l, article number: 800081 (1 O-ring included)
- O-ring for Xe and Kr source gases (set of 10), article number: 800082

Procedure:

1. Close the gas cylinder
2. Disconnect the cable for the fill level control

Figure 87: Xenon cylinder

3. Open 1/8"-connection at the pressure gauge
4. Open the 2 six-head-socket screws
5. Pull out the xenon gas cylinder carefully
6. Remove the pressure gauge
7. Exchange the O-ring at the pressure gauge if necessary (remove the old O-ring before installing the new one)
8. Mount the pressure gauge on the new gas cylinder
9. Install the new gas cylinder

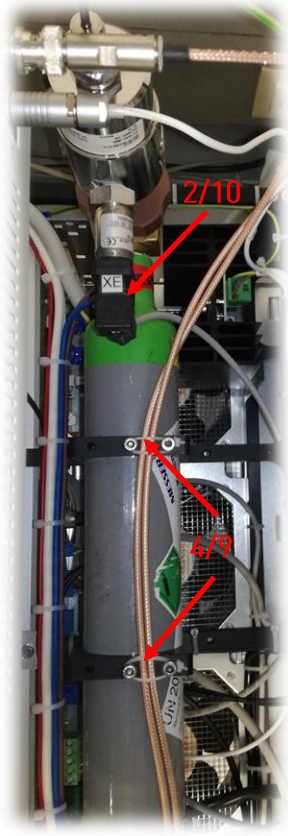

Figure 88: Installation of Xenon cylinder

10. Connect the cable for the fill level control
11. Connect the 1/8" stainless steel line to the gauge
12. Open the gas cylinder and flush the line by loosening the 1/8" connection at the ion source and close it again (follow the 1/8" stainless steel line to the other end)

4.3 Exchange the source valves

Basics:

The analyzer is in use of two different source gases. Xenon (Xe) is switched by 3-way spider valves to avoid pressure peaks in the ion source area. This means, there is a constant amount of source gas flowing through the 3rd way down to the turbo pump.
The mercury is heated up to 80° and released via the 2-way spider valve into the ion source area.

Location of the source valves:

Xenon is located on the left side of the ion source, mercury is located right. The connectors are labeled with the appropriate source gas.

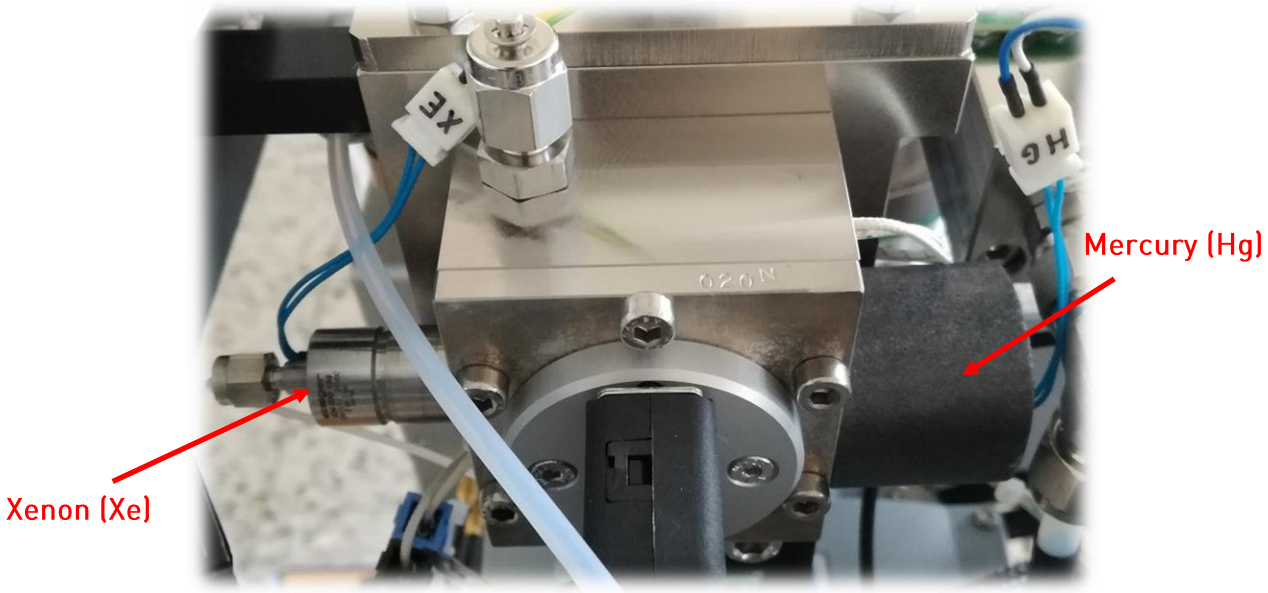

Figure 89: Location of the source valves

Needed tools and auxiliary material:

- Wrench 8mm
- Wrench 4,5mm
- Drill 1,6mm
- Slotted screwdriver

Needed spares and consumables:

- 2-way spider valve, article number: 800160
- 3-way spider valve, article number: 800161

Procedure:

1. Disconnect the 1/16 "Teflon line and the cable at the spider valve carefully

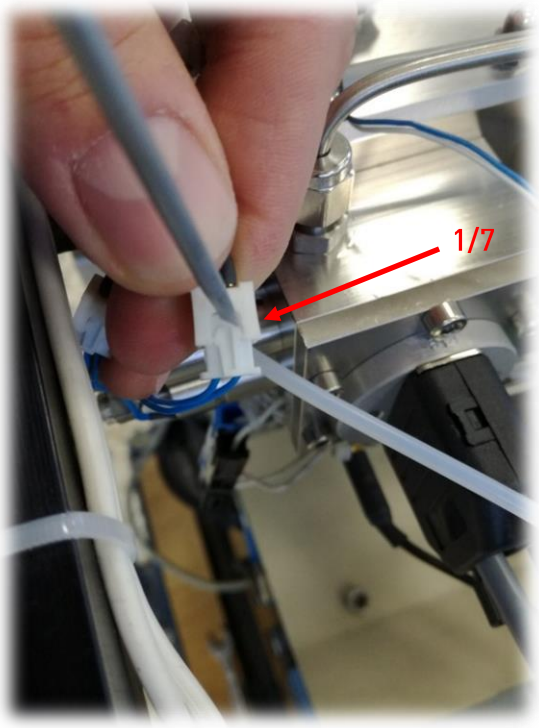

Figure 90: Connector of the spider valve

2. Remove the 3-way spider valve by turning counterclockwise with the wrench 4,5mm

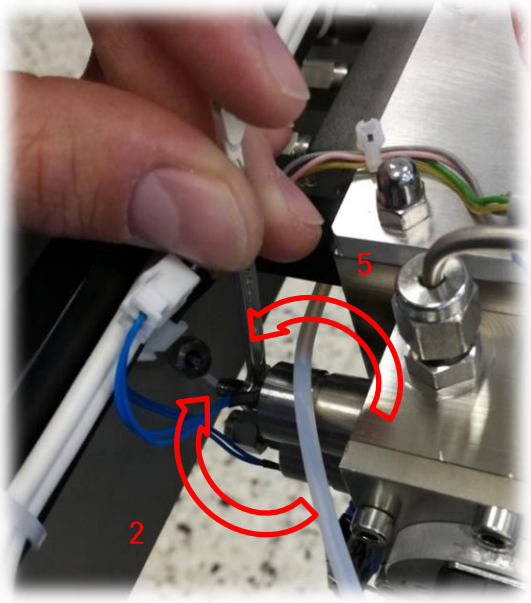

Figure 91: 3-way spider valve

3. Remove the 2-way spider valve by turning counterclockwise with the driller 1,6mm

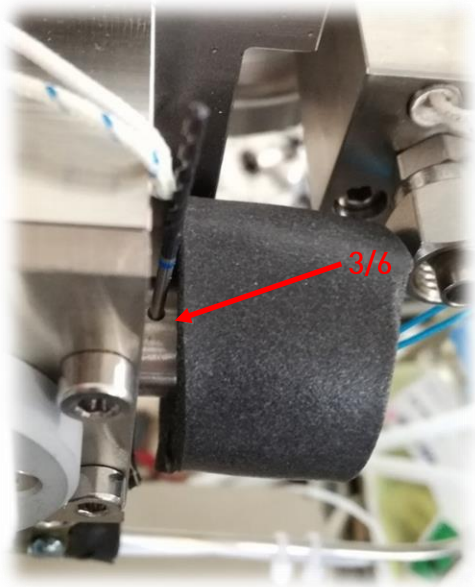

Figure 92: 2-way spider valve

4. Check the O-Rings of the new valve before mounting
5. Install the 3-way spider valve by turning clockwise with the wrench 4,5mm
6. Install the 2-way spider valve by turning clockwise with the driller 1,6mm
7. Connect the 1/16 " line and the cable

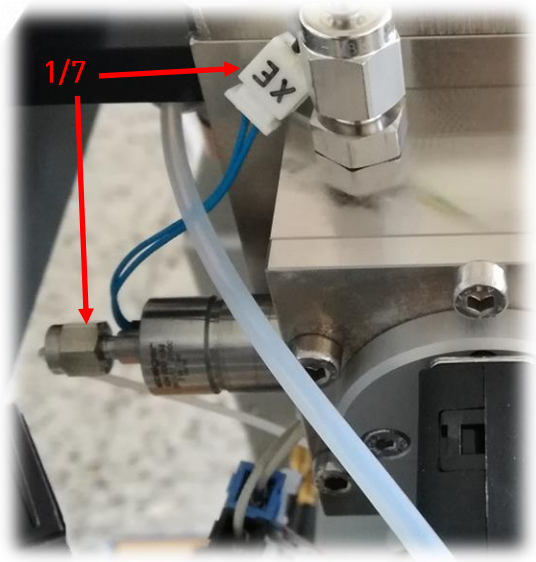

Figure 93: Xenon-valve

4.4 Exchange the sample valves

Basics:

The Flush valve is the connection between the span gases and the central capillary. There is used a 3-way spider valve in order to fast purge the line between the "Cal"-block and the central capillary. All other sample valves (Inert, Cal1 – Cal5) are 2-way spider valves.

Location of the sample valves:

The Flushvalve is located beneath the block for the split capillary. The other sample valves are beneath the span-gas inlets.

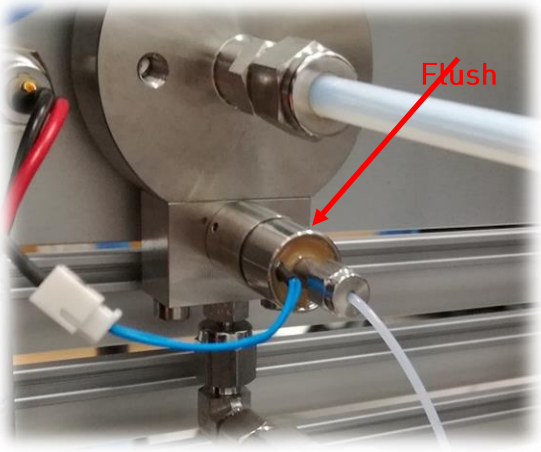

Figure 94: Flush valve

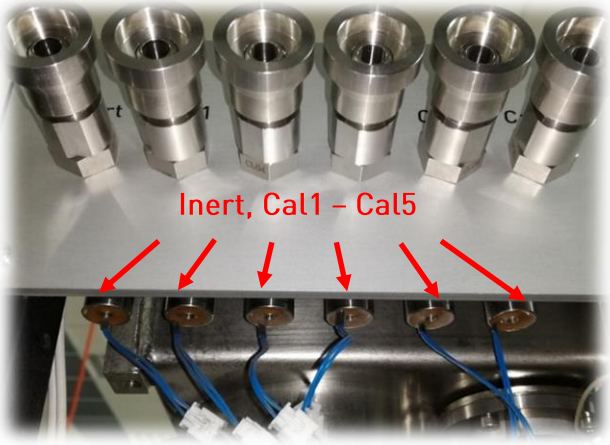

Figure 95: Sample valves

Needed tools and auxiliary material:

- Wrench 8mm
- Wrench 4,5mm
- Drill 1,6mm
- Slotted screwdriver

Needed spares and consumables:

- 2-way spider valve, article number: 800160
- 3-way spider valve, article number: 800161

Procedure:

1. Disconnect the 1/16 " line and the cable at the spider valve carefully
2. Remove the 3-way spider valve by turning counterclockwise with the wrench 4,5mm
3. Remove the 2-way spider valve by turning counterclockwise with the driller 1,6mm
4. Check the O-Rings of the new valve before mounting
5. Install the 3-way spider valve by turning clockwise with the wrench 4,5mm
6. Install the 2-way spider valve by turning clockwise with the driller 1,6mm
7. Connect the 1/16 " line and the cable

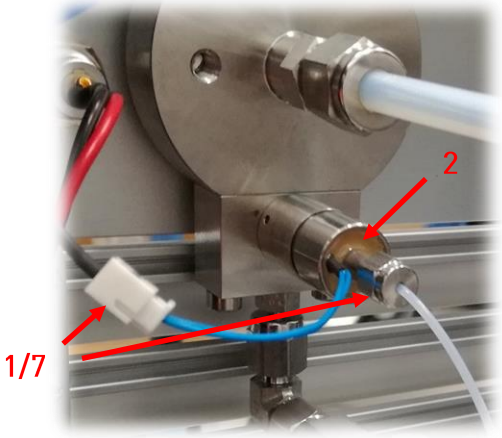

Figure 96: Flush valve

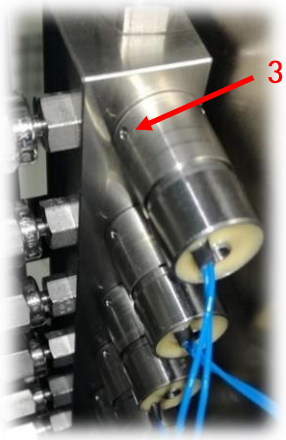

Figure 97: 2-way spider valve

Figure 98: 2-way spider valve

4.5 Exchange of Teflon tubes

There are several Teflon tubes which need to be checked visually and exchanged temporarily.

Needed spares and consumables:

- ¼ “, 1/8”, 1/16” – Teflon tube

Location:

- Turbo pump to charcoal filter unit
- Charcoal filter unit to pre-vacuum pump IN
- Pre-vacuum pump OUT to charcoal filter unit
- Charcoal filter unit to vacuum out
- Pre-vacuum pump to PRU (pressure regulation unit)
- Sample pump to front panel and sample out
- Cal block to pressure reducer
- 3rd way from spider valves

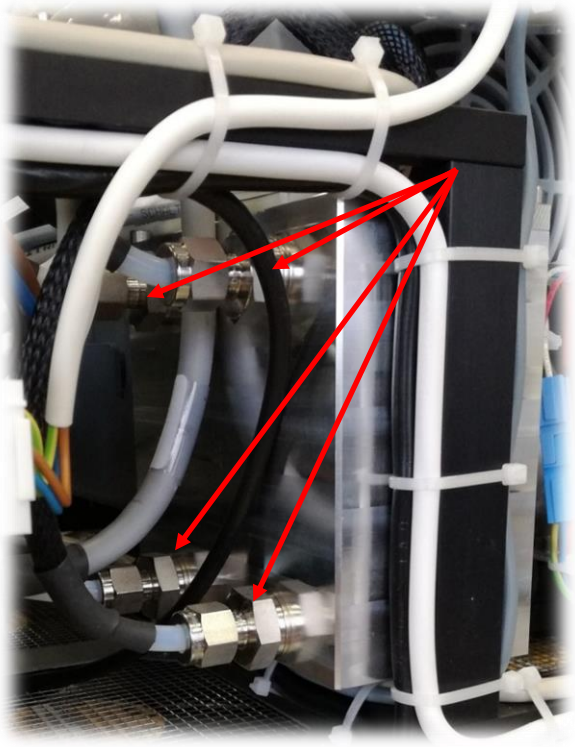

Figure 99: Charcoal filter unit

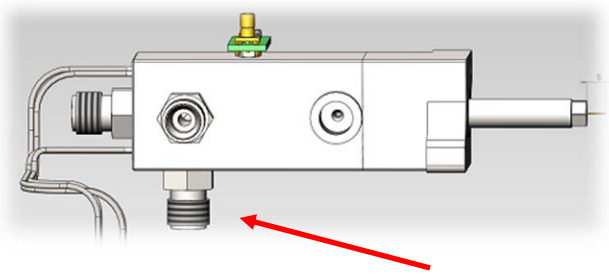

Figure 100: PRU

4.6 Maintain the Pre-vacuum pump

This chapter is applicable to the pre-vacuum pump type MV2 NT.

Needed spares and consumables:

- Spar part kit for pre-vacuum pump MV2, article number: 800084 or
- Spare part kit for pre-vacuum pump MV2 NT, article number: 800085
- Pressure gauge, range 0 – 1000 mbar
- Wrench 17mm
- Wrench 20mm
- Allen key 4mm
- Compressed air

Removing the pump:

1. Unplug the power cable of the pump (on side of the pump)
2. Disconnect all Teflon tubes connected to the pump
3. Open the 2 fixing screws for the cooling fans unit
4. Unplug the power supply cable of the cooling fans unit (on the back of the unit)
5. Remove the cooling fans unit
6. Open all 4 screw nuts below the pump, with which the pump is mounted onto the frame
7. Remove the old pump

CAUTION:
Don't damage any device near the pump!

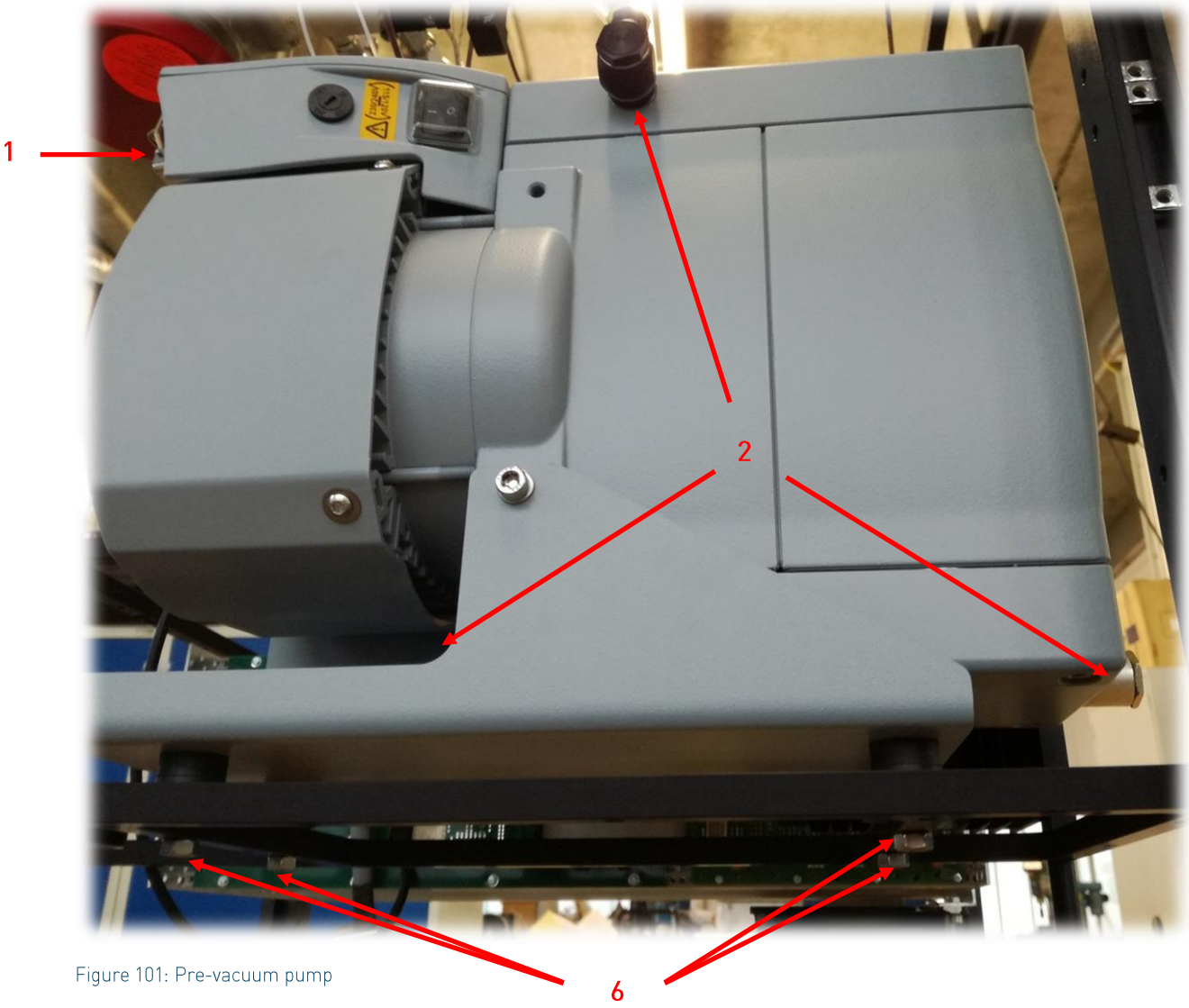

Figure 101: Pre-vacuum pump

Exchange of diaphragm:

1. Open the 8 six-head-socket screws
2. Remove the housing cover, O-rings and valves and note the position.

CAUTION:
Don't damage the O-rings!

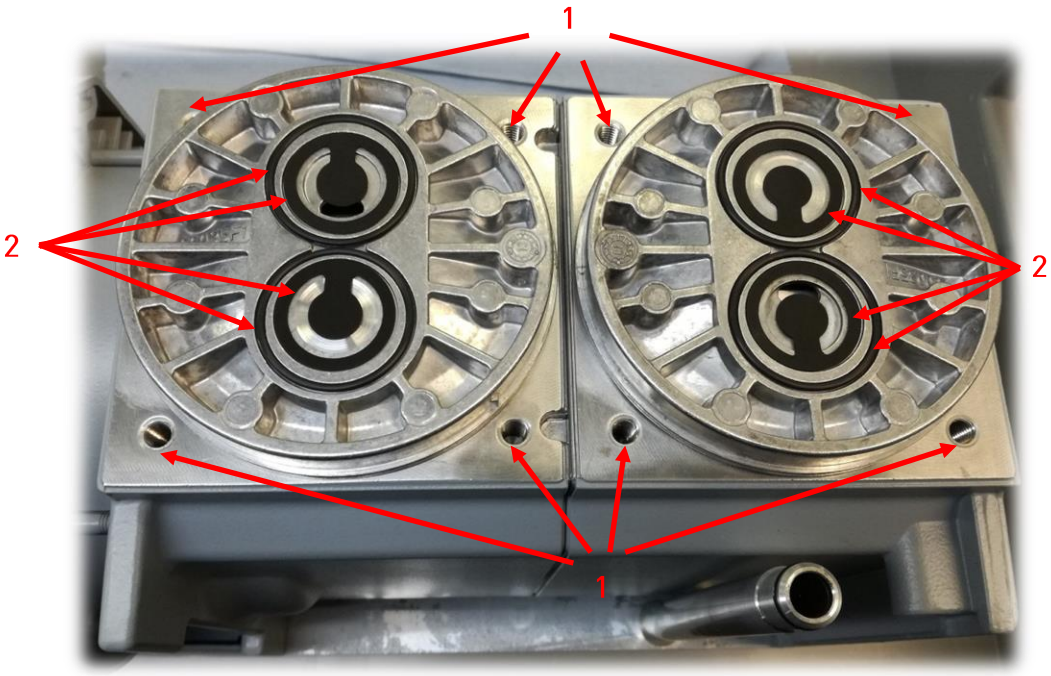

Figure 102: Housing cover removed

3. Open the head cover by purging the hole with compressed air and block the opposite one
4. Remove the head cover carefully from the housing cover

Figure 103: Removing the head cover

5. Lift up the diaphragms on both sides and remove them by turning counter clockwise

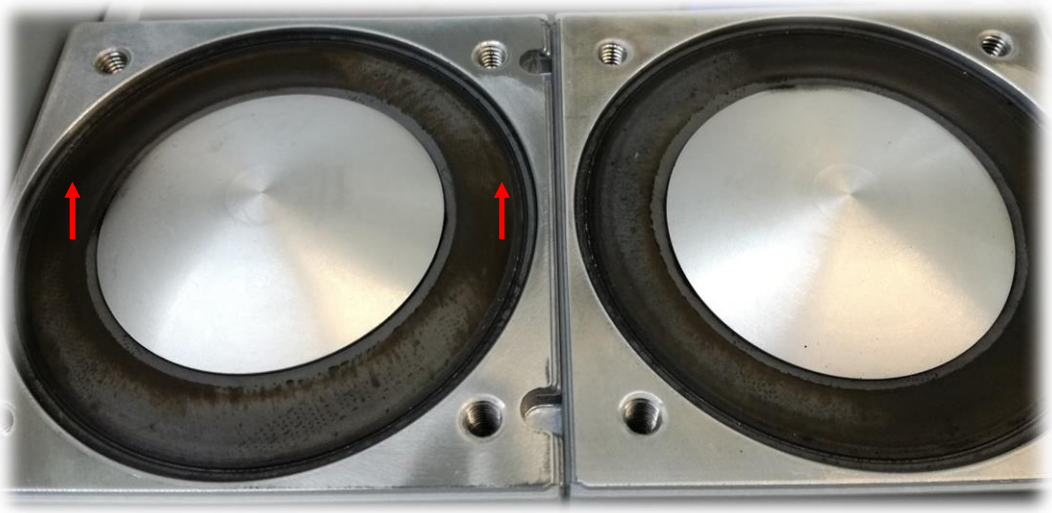

Figure 104: Diaphragm of the pump

6. Clean all parts in ultrasonic bath
7. Install the new diaphragm

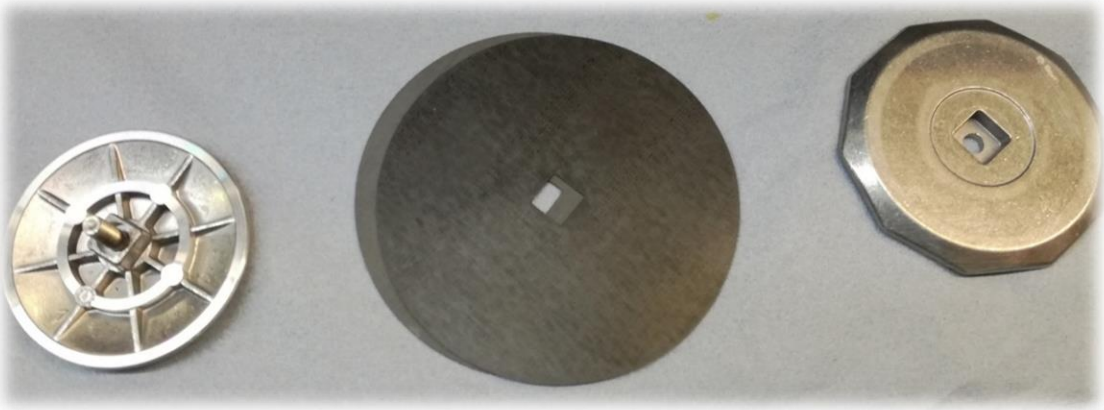

Figure 105: New diaphragm – Step 1

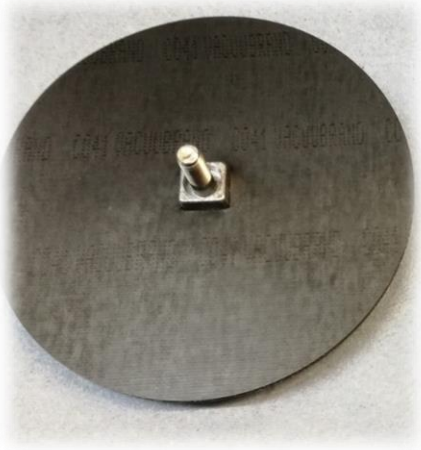

Figure 106: New diaphragm – Step 2

Figure 107: New diaphragm – Step 3

8. Set up the head cover
9. Use new valves and O-rings (if necessary)

CAUTION!:
Mind position of the valves!

10. Set up the housing cover and close the screws
11. Repeat this procedure for each stage

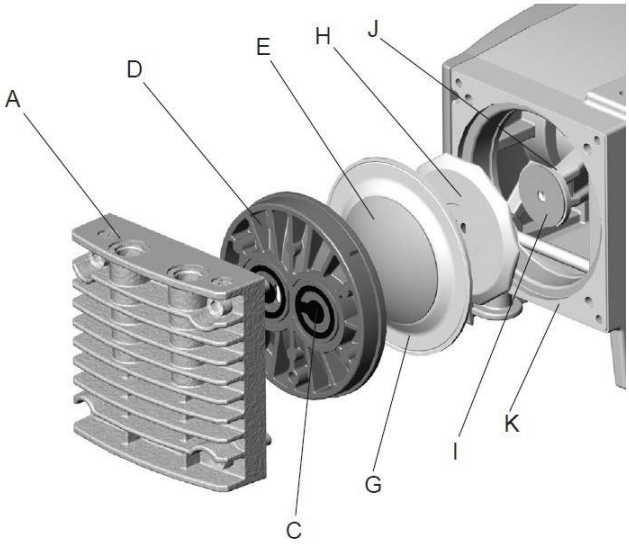

Figure 108: 3D of MV2

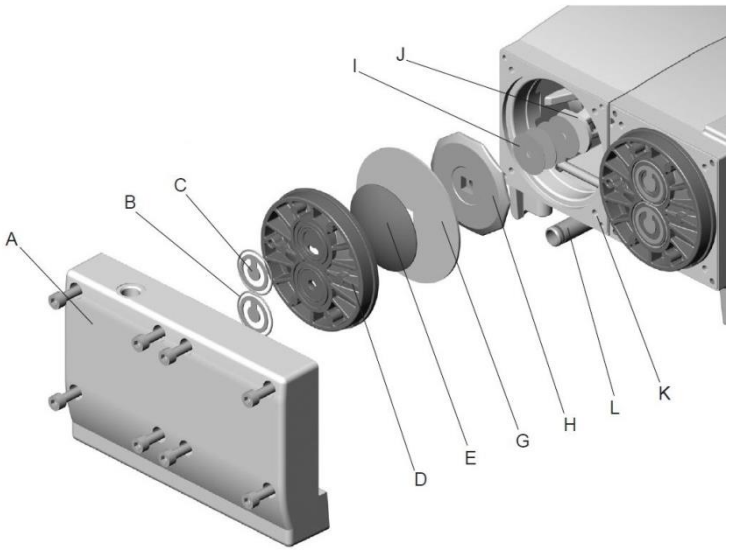

Figure 109: 3D of MV2 NT

Item	Description
A	Housing cover
B	O-Rings
C	Valves
D	Head cover
E	Diaphragm clamping disc with square head screw (MZ 2D NT: with countersunk head screw)
G	Diaphragm
H	Diaphragm support disc
I	Washer
J	Connecting rod
K	Housing
L	Connecting tube with O-ring

Table 22: Pre-vacuum pump type MV2 NT items & description

Checking the pump:

1. Connect a separate power cable to the pump
2. Connect the pressure gauge (0 – 1000mbar) to the charcoal filter side and a blind nut connector to the PRU side
3. Switch on the pump
4. This side (B) the pressure should drop below < 2 mbar, if not, disassemble and check the valves and O-rings again.

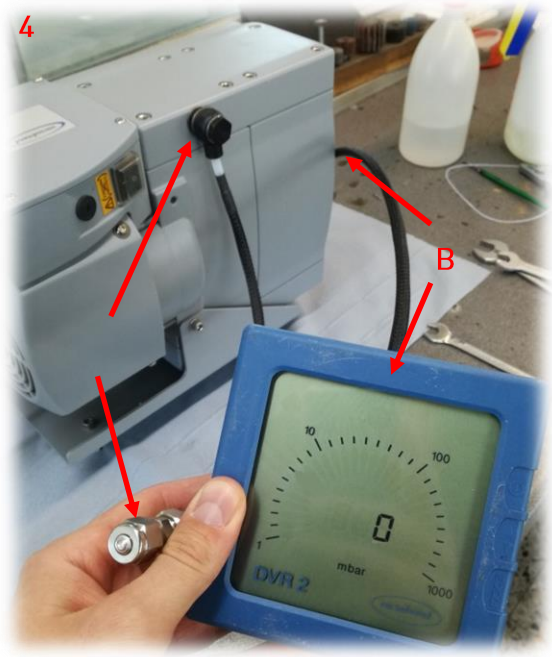

Figure 110: Side of PRU

5. Switch positions of pressure gauge and blind nut connector
6. This side (A) the pressure should drop below < 10 mbar,

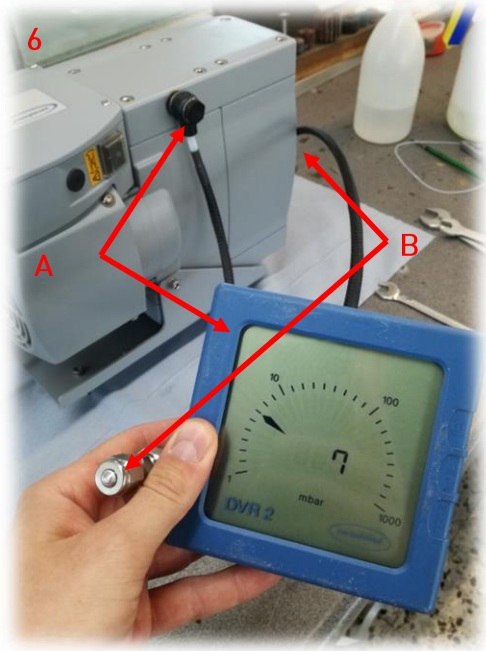

Figure 111: Side of Turbo pump

Installation of the pump:

1. Install the repaired pump
2. Mount the pump by tightening the 4 screw nuts below the pump
3. Reinstall the cooling fan unit and plug in the power supply cable
4. Plug in the power cable of the pre-vacuum-pump
5. Tighten all Teflon tubes you loosened before

4.7 Exchange of Channeltron

Needed tools and auxiliary material:

- Box spanner 2mm
- Box spanner 2.5mm
- Box spanner 4mm
- Allen-key 2mm
- Allen-key 2.5mm
- Allen-key 4mm
- Flat nose plier
- Side-cutting pliers

Needed spares and consumables:

- Channeltron for LubeSense, MotoSense & PETSense, article number: 800526
- O-ring detector flange, article available upon request

Procedure:

1. Disconnect the cables of the detector unit
2. Open the 4 fixing screws for the detector unit

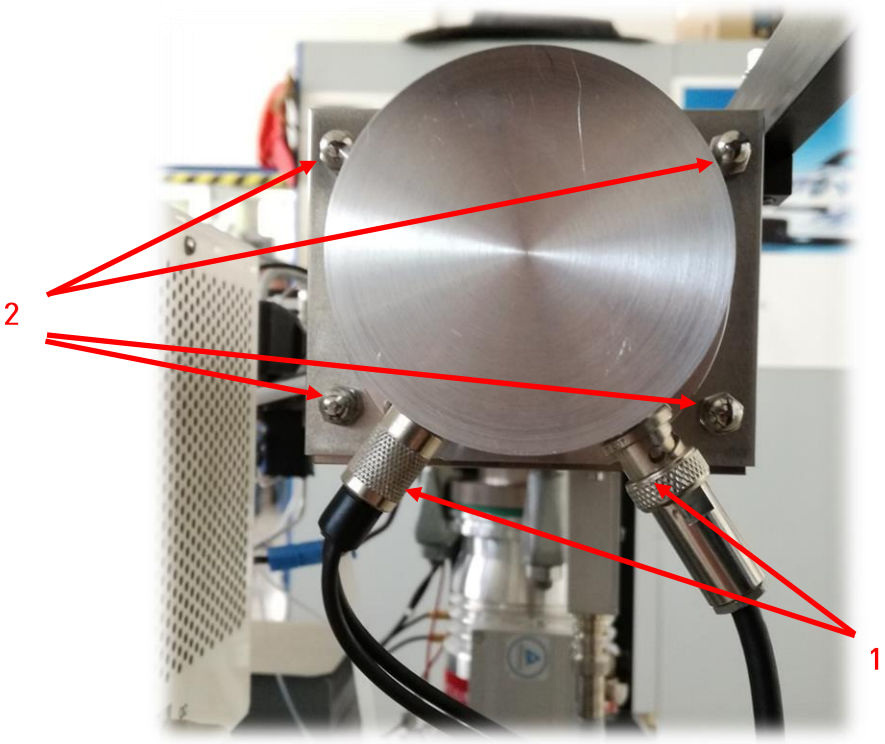

Figure 112: Detection unit

3. Remove the detector unit
4. Loosen the upper screws of the gold-plated contacts
5. Open the 2 fixing screws of the channeltron

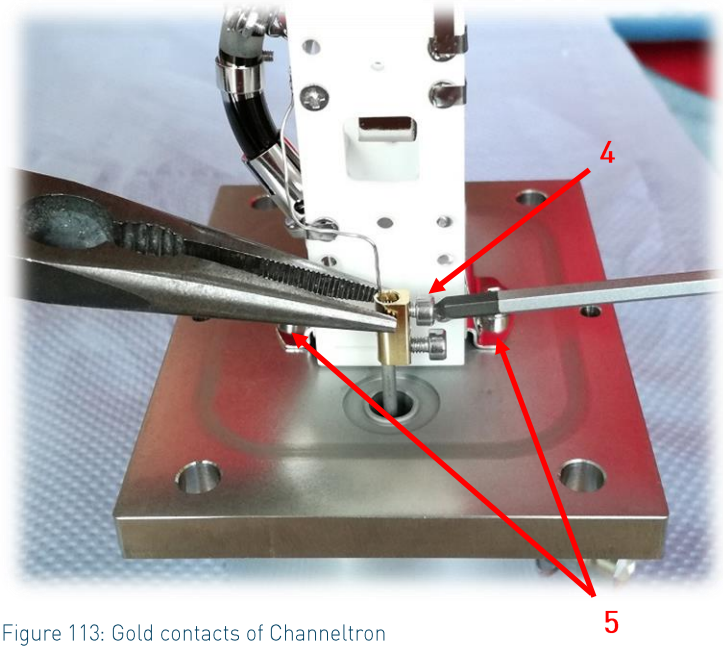

Figure 113: Gold contacts of Channeltron

6. Remove the old channeltron
7. Ensure that the position of the new channeltron is correct (see figure below)
8. Mount the new channeltron by tightening the 2 fixing screws
9. Make sure that the ground connection of the channeltron is grounded (can be tightened with the fixing screw)

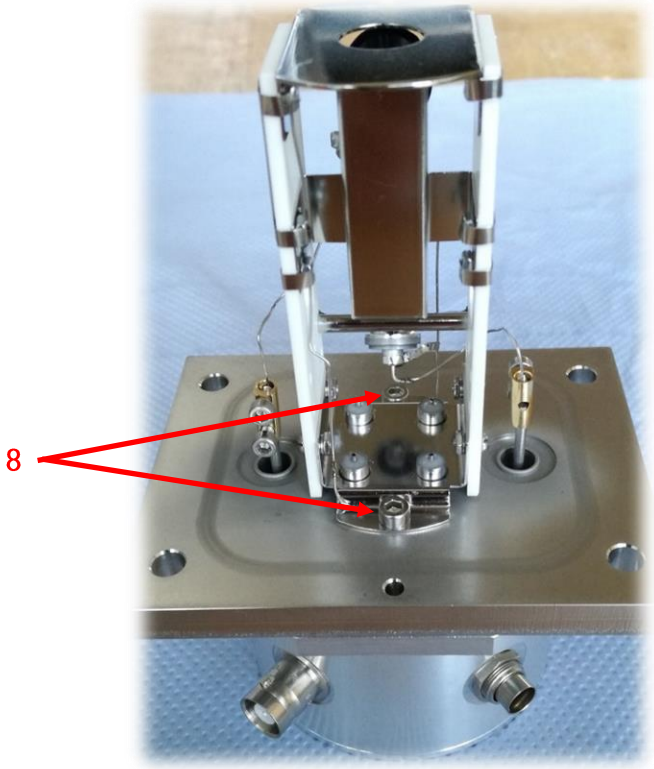

Figure 114: Position of Channeltron

10. Fix the HV-connection and the signal-connection of the channeltron with the gold-plated contacts (wires may need to be pinched off)
11. Clean/exchange the O-ring if necessary
12. Mount the detector unit to the vacuum chamber

4.8 Exchange the 1st Octopole

Needed tools and auxiliary material:

- Box spanner 3.0mm
- Wrench 19mm
- Wrench 17mm
- Wrench 9/16"
- Wrench 7/16"
- Wrench ½"
- Allen-key 2mm
- Allen-key 3mm
- Allen-key 4mm
- Flat nose plier

Needed spares and consumables:

- 1st Octopole, article number: 800112
- 1st Octopole (exchange), article number: 800113
- O-ring vacuum chamber, article available upon request

Procedure:

1. Open the fixing screws for the cover of the vacuum chamber
2. Remove the cover of the vacuum chamber
3. Open the 2 six head-socket screws which are used to mount the Pressure Regulation Unit (PRU) to the vacuum chamber

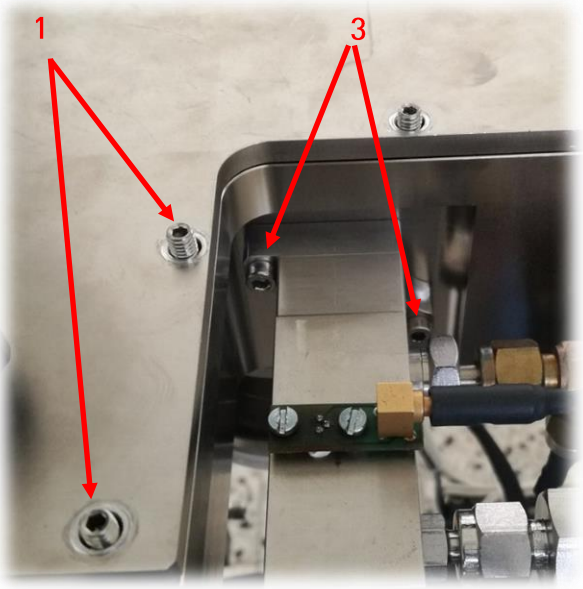

Figure 115: PRU and vacuum chamber

4. Remove the Pressure Regulation Unit (PRU) by pulling out slightly

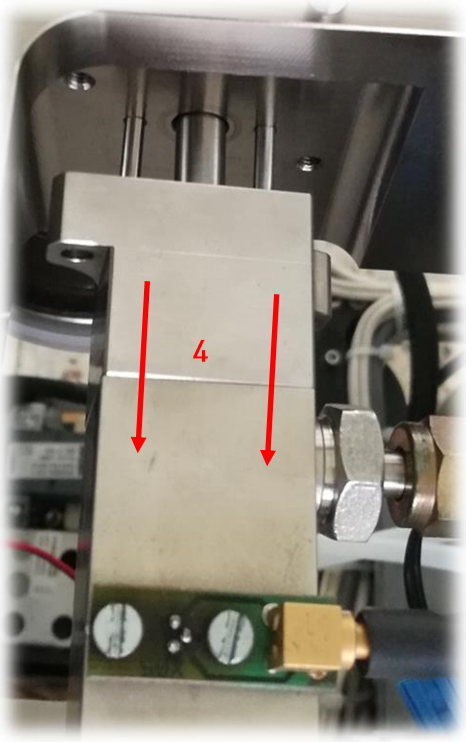

Figure 116: Remove PRU

5. Pull it out as far as you are able to remove the IMR cell safely, without damaging the inner capillary

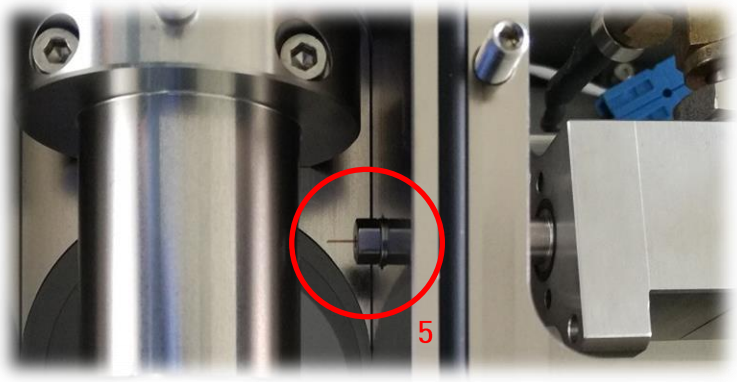

Figure 117: Inner capillary of PRU

6. Hold the gold-plated contacts with the flat plier when loosening both screws of the gold-plated contacts

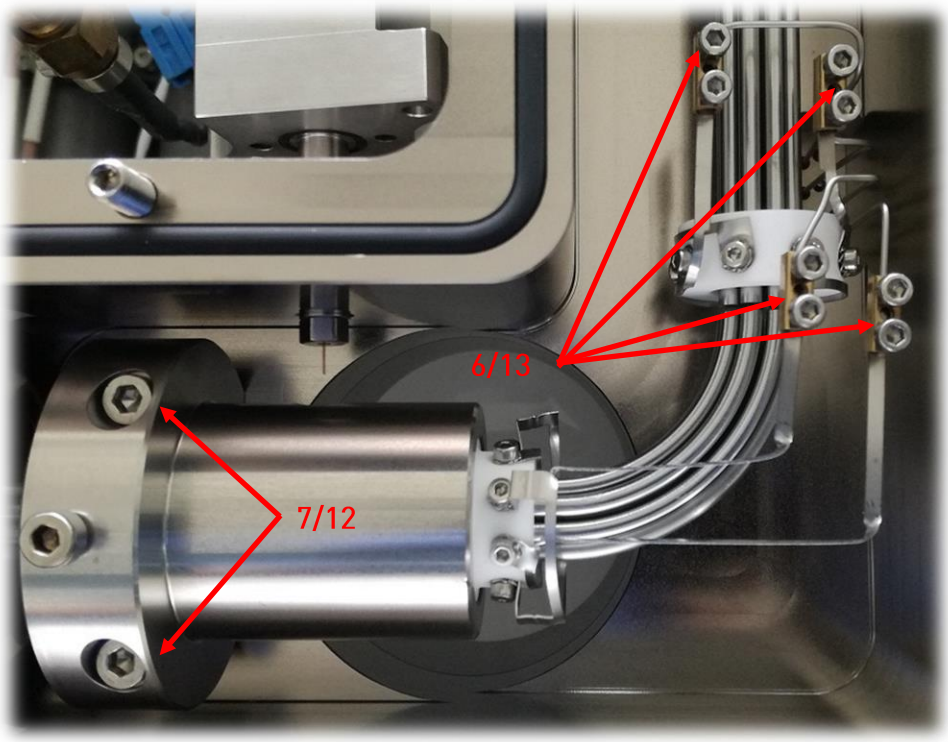

Figure 118: Octopoles with gold contacts

7. Open the 2 fixing screws of the 2nd Octopole
8. Remove the complete IMR cell with the 2nd Octopole
9. Open the 2 fixing screws of the 1st Octopole

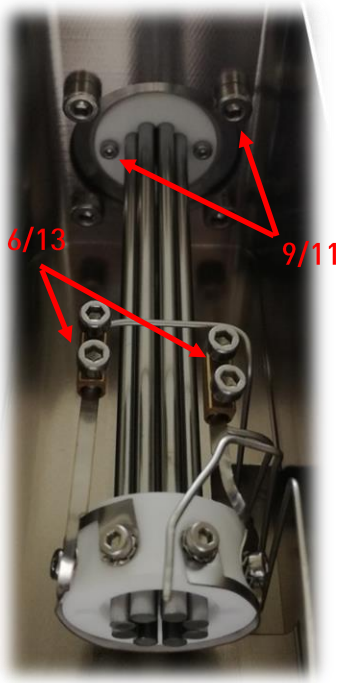

Figure 119: 1st Octopole

10. Remove the 1st Octopole by pulling backwards
11. Install the new Octopole by using **new screws**!!!
12. Remount the IMR cell with the 2nd Octopole in the vacuum chamber
13. Attach the connections of both Octopoles to the gold-plated contacts

ATTENTION:
Avoid shortcuts!

14. Clean/exchange the O-ring of the vacuum chamber if necessary
15. Mount the cover to the vacuum chamber

4.9 Exchange the 2nd Octopole

Needed tools and auxiliary material:

- Box spanner 3.0mm
- Wrench 19mm
- Wrench 17mm
- Wrench 9/16"
- Wrench 7/16"
- Wrench ½"
- Allen-key 2mm
- Allen-key 3mm
- Allen-key 4mm
- Flat nose plier

Needed spares and consumables:

- 2nd Octopole, article number: 800114
- 2nd Octopole (exchange), article number: 800115
- 2nd Octopole for vacuum chamber 2011, article number: 800116
- 2nd Octopole for vacuum chamber 2011 (exchange), article number: 800117
- O-ring vacuum chamber, article available upon request

Procedure:

1. Open the fixing screws for the cover of the vacuum chamber
2. Remove the cover of the vacuum chamber
3. Open the 2 six head-socket screws which are used to mount the Pressure Regulation Unit (PRU) to the vacuum chamber
4. Remove the Pressure Regulation Unit (PRU) by pulling out slightly
5. Pull it out as far as you are able to remove the IMR cell safely, without damaging the inner capillary

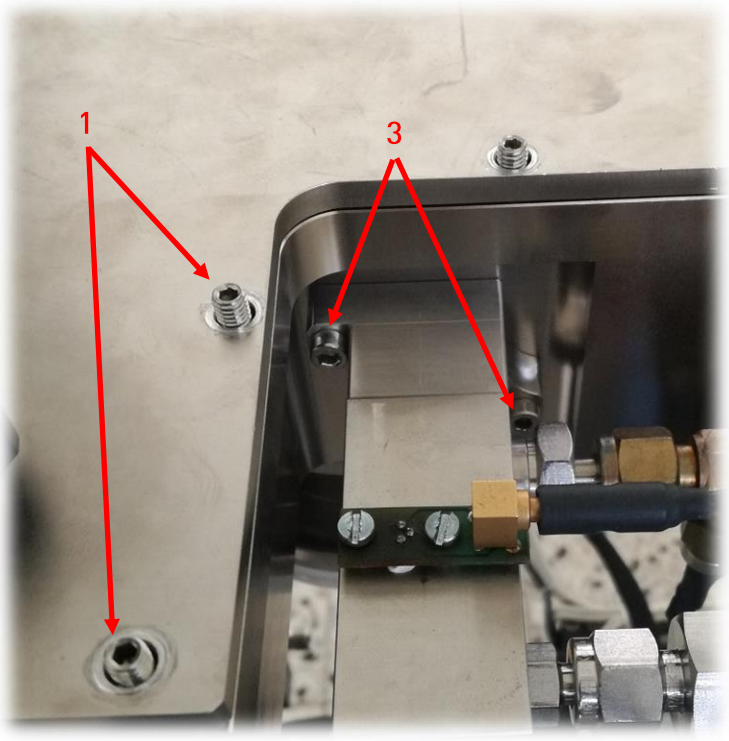

Figure 120: PRU and vacuum chamber

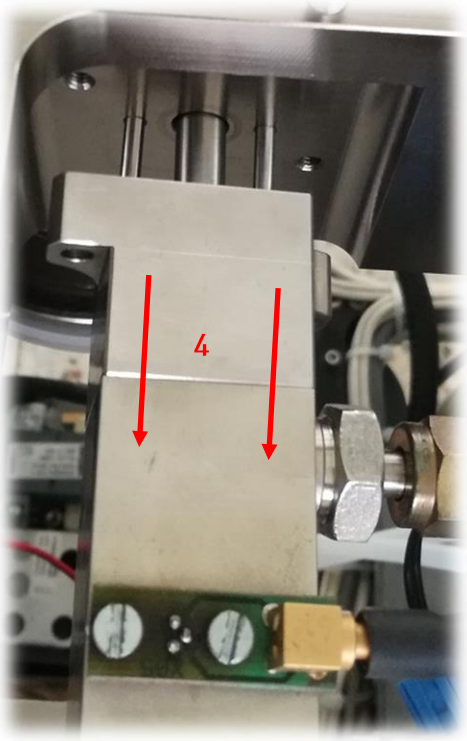

Figure 121: Remove PRU

Figure 122: Inner capillary of PRU

6. Hold the gold-plated contacts with the flat plier when loosening both screws of the gold-plated contacts

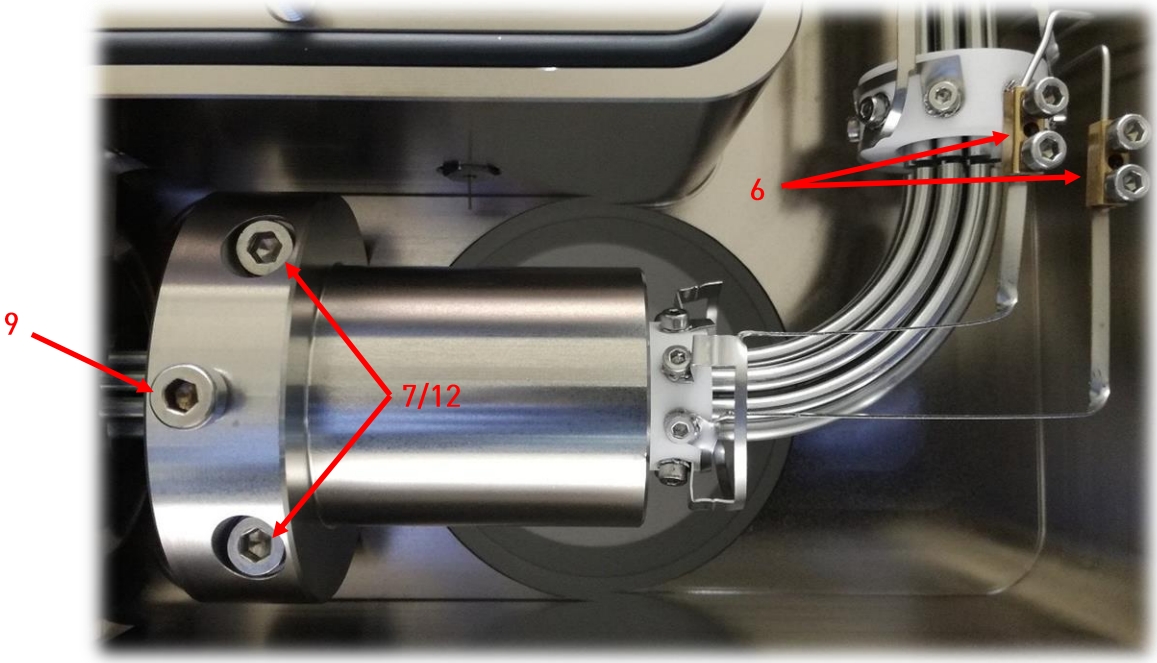

Figure 123: Octopole 2 and gold contacts

7. Open the 2 fixing screws of the 2nd Octopole
8. Remove the complete IMR cell with the 2nd Octopole
9. Open the fixing screw of the 2nd Octopole
10. Remove the Octopole from the IMR cell
11. Install the new Octopole and fix it with the screw gently

ATTENTION:
Too much force will damage or break the ceramic!

12. Remount the IMR – cell with the 2nd Octopole in the vacuum chamber

13. Adjust the position of the 2nd Octopole for a focused ion beam that is in-line with the outlet of the 1st Octopole and fix it gently

ATTENTION:
Too much force will damage or break the ceramic!

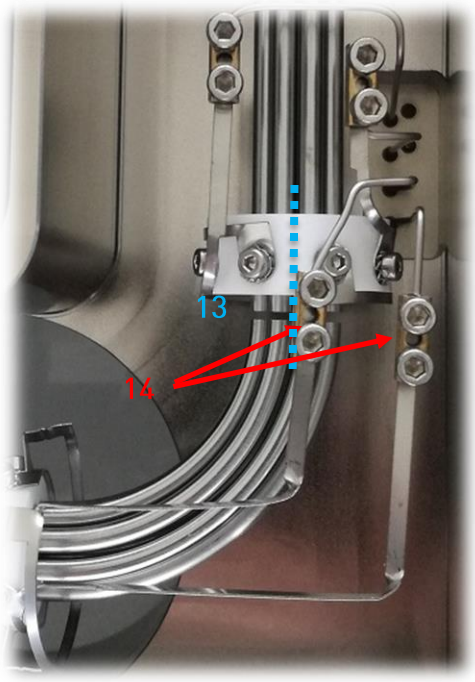

Figure 124: Adjustment

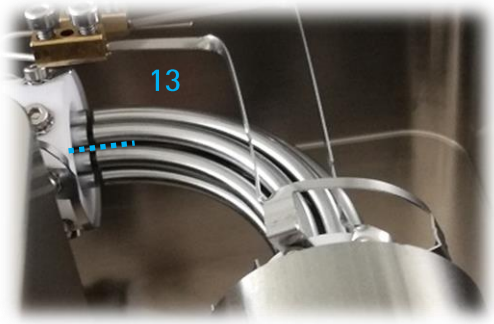

Figure 125: Adjustment of 2nd Octopole

14. Attach the connections of 2nd Octopole to the gold-plated contacts

ATTENTION:
Avoid shortcuts!

15. Clean/exchange the O-ring of the vacuum chamber if necessary
16. Mount the cover to the vacuum chamber

4.10 Exchange the Quadrupole system

Needed tools and auxiliary material:

- Box spanner 2mm
- Box spanner 3mm
- Box spanner 4mm
- Allen-key 2mm
- Allen-key 3mm
- Flat nose plier

Needed spares and consumables:

- Quadrupole system, article number: 800124
- O-ring vacuum chamber, article available upon request

Procedure:

1. Open the fixing screws for the cover of the vacuum chamber

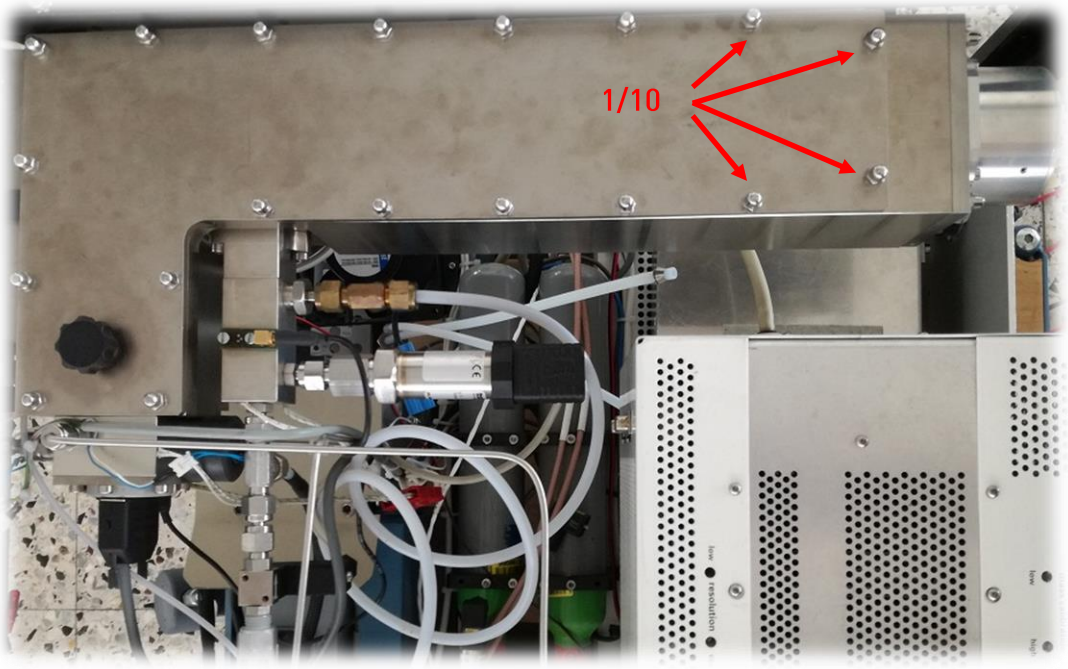

Figure 126: Vacuum chamber

2. Remove the cover of the vacuum chamber
3. Remove the cover of the quadrupole by opening the four screws

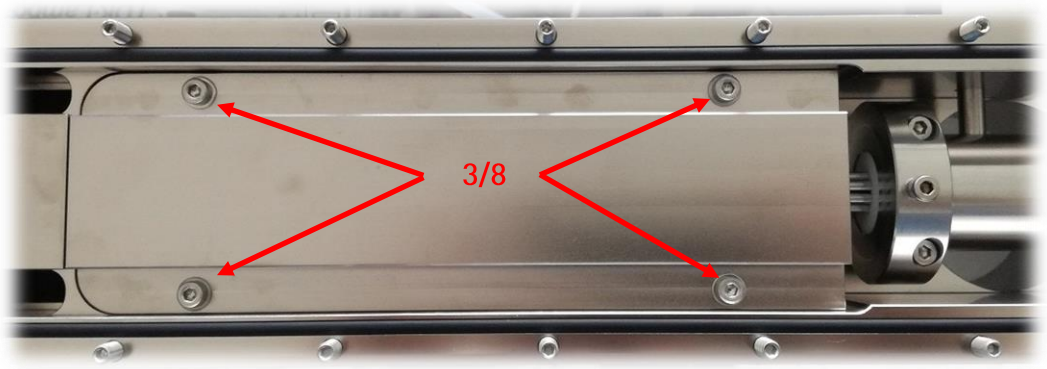

Figure 127: Quadrupole chamber

4. Hold the gold-plated contacts with the flat plier when loosening the upper screws of the gold-plated contacts

Figure 128: Connection of the Quadrupole system

Figure 129: Connection 1

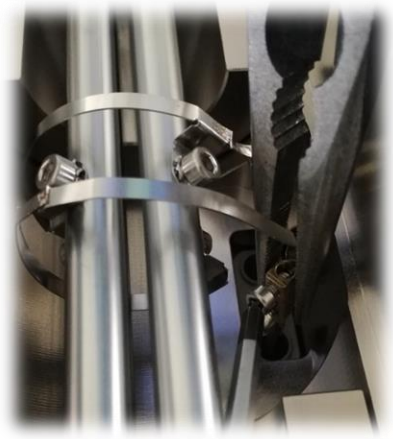

Figure 130: Connection 2

5. Remove the old quadrupole from the chamber
6. Place the new quadrupole system in correct position by inserting the ceramic holders in the pins

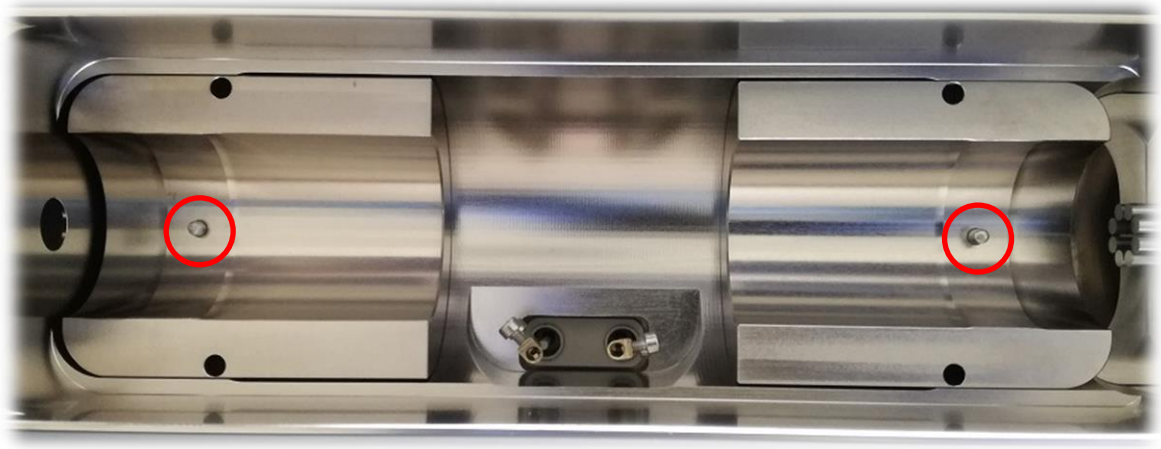

Figure 131: Empty Quadrupole chamber with position pins

7. Attach the connections of the quadrupole system to the gold-plated contacts
8. Mount the cover of the quadrupole chamber
9. Clean/exchange the O-ring of the vacuum chamber if necessary
10. Mount the cover to the vacuum chamber

5. After re-starting the analyzer

5.1 Check all voltages

- See Chapter 2.2

5.2 Perform a leak test

- See Chapter 2.10

5.3 Check the function of all valves

- See Chapter 2.8 and 2.9

5.4 Check the function of all filaments

- See Chapter 2.5

5.5 Reset the mercury counter, if mercury was refilled

Basic:

The mercury container is filled with 1,5ml liquid mercury. The usage is calculated via software and is depending on the mercury-ionized molecules in the selected setup.

Procedure:

1. Open the service panel and select "Operation hours mercury"
2. Press the button "Reset delay time"
3. The "Elapsed time" set to 0,0 %

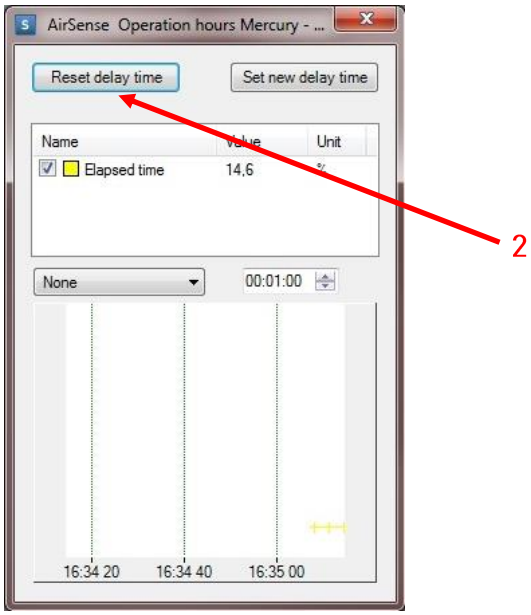

Figure 132: Operation hours Mercury - Service Panel

5.6 Select a used “Setup” in “Standby”-mode for the duration of the “Pump-down-time”

Usually the standard customer setup is used for this task.

5.7 Check the performance of the analyzer

- See Chapter 2.4

5.8 Check the ion optic settings and adjust if required

- See Chapter 2.4.1

5.9 Check the mass scale and adjust the RF-generator if required

- See Chapter 2.4.2

5.10 Adjust the octopole generator if required

Needed tools and auxiliary material:

- Isolated slotted screwdriver
- V&F Viewer software

Basics

If "Hf actual amplitude" differs from set value "Sep./Trans.", the octopole generator needs to be adjusted.

The following error message will appear:

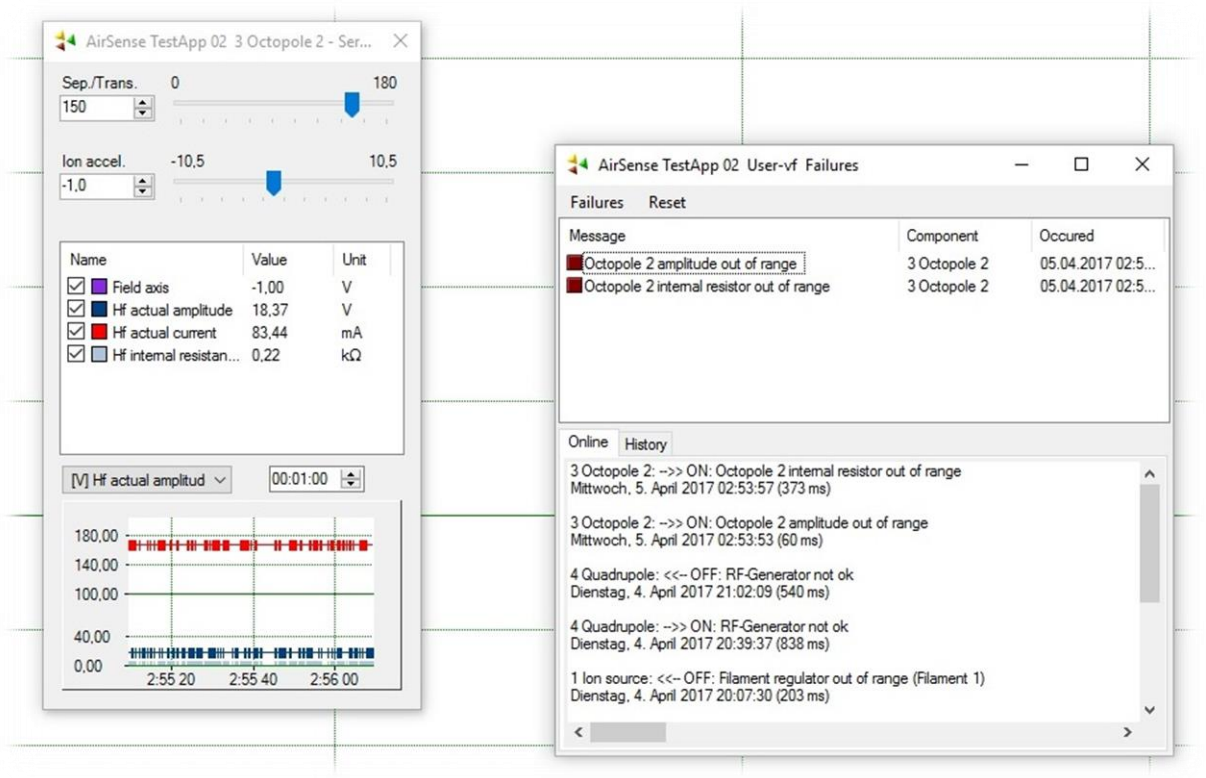

Figure 133: Service Panel and Error message of Octopole 2

When the octopole generator is adjusted, the "Hf actual amplitude" must be equal with "Sep./Trans." and the "Hf internal resistance" should be as high as possible.

If Hf actual resistance is 0, there might be a shortcut between the octopole rods.

Procedure:

1. Open the Service panel of the respective octopole (Service Panels – Octopole 1/Octopole 2)
2. Use the isolated slotted screwdriver to adjust the 1st Octopole (trimmer2) and/or the 2nd Octopole (trimmer1), turning clock- or counter-clock wise.

ATTENTION:
"Hf actual amplitude" must be equal with "Sep./Trans."

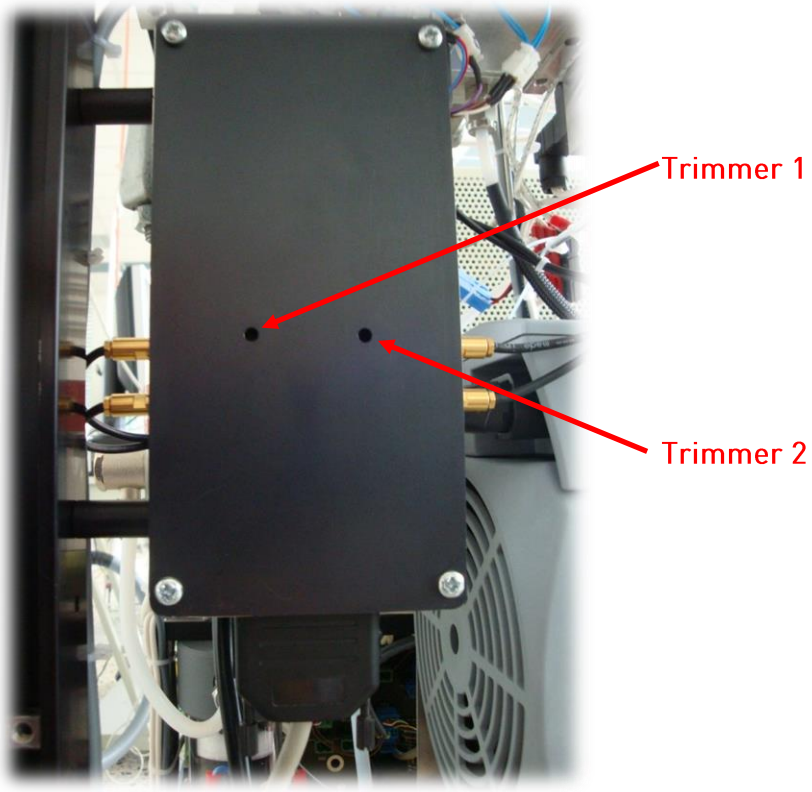

Figure 134: Octopole generator

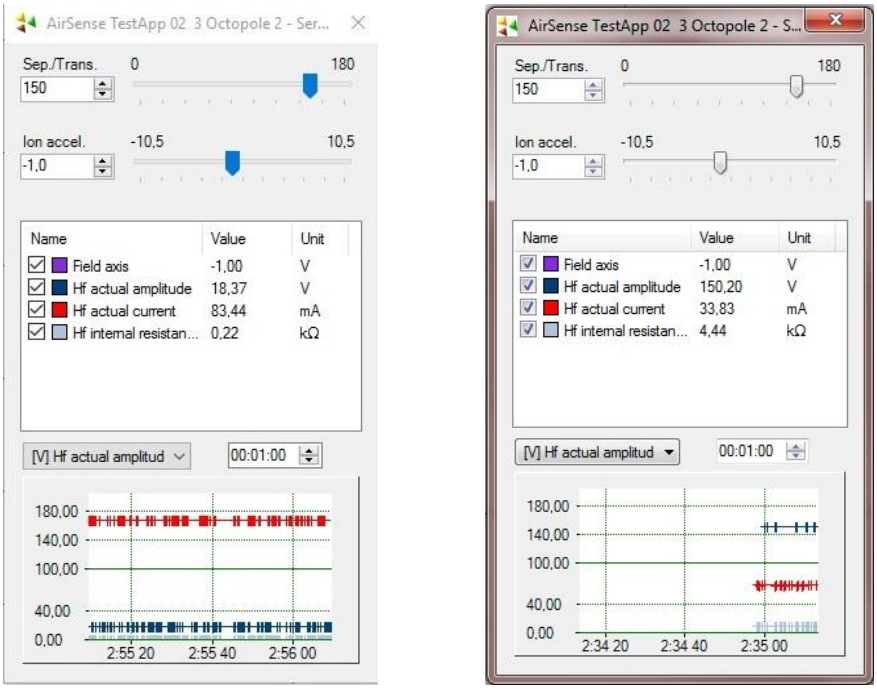

Figure 135: Octopole before and after adjustment

5.11 Check the settings of the used “Setups”

After finding the optimized settings for the customer setup, check available setups and modify them as well (like Resolution, mass, ...).

Procedure:

1. Open V&F Viewer software and connect to the analyzer
2. Select menu “Configuration” and “Measurement Setups”

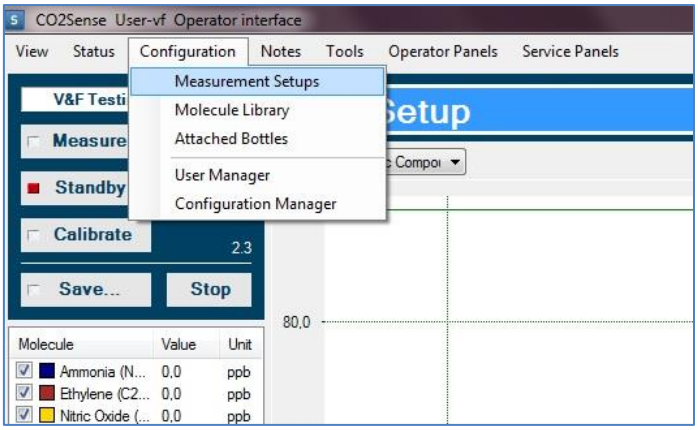

Figure 136: Configuration - Measurement Setups

3. A new window appears. Select one of the setups you like to modify and press button “Edit”.

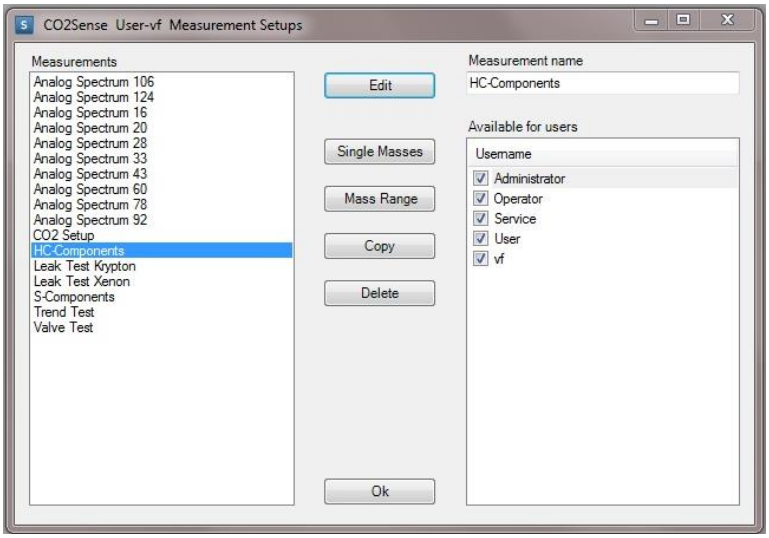

Figure 137: Measurement Setups

4. Same windows as with function "Edit setup" appears and you can change Mass, Resolution, Measure time and so on.

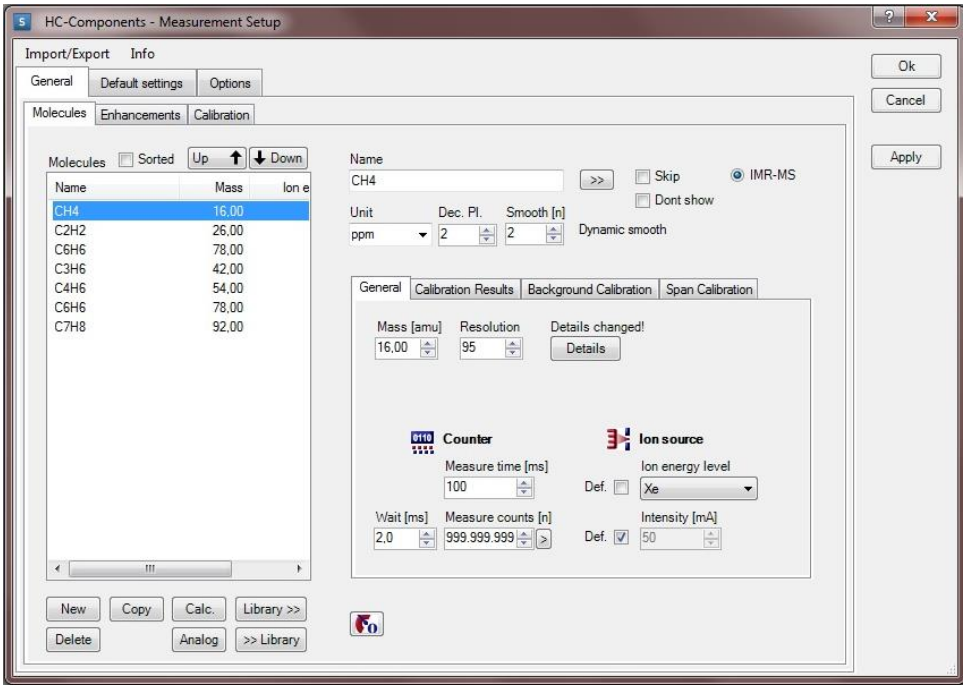

Figure 138: HC-Components Setup

5. Select "Default settings" to change pressure, ion energy level, intensity or Sample inlet

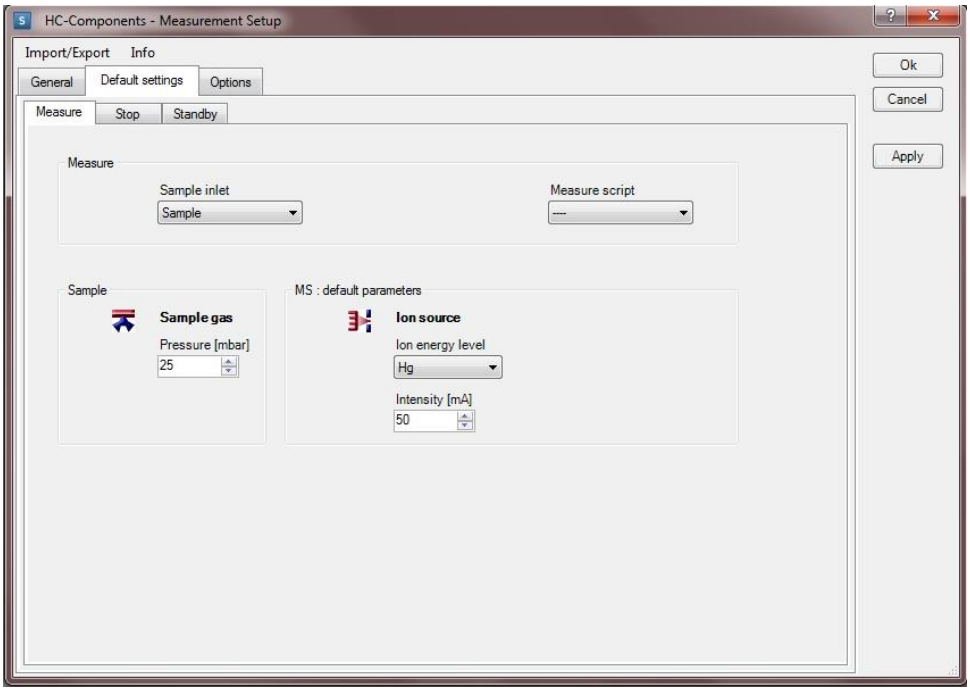

Figure 139: Default settings

6. After confirmation with "Ok" your changes will be accepted

5.12 Check the Xenon line for leakages if the bottle was replaced

Needed tools and auxiliary material:

- Bubble leak spray

Procedure:

Use Bubble leak spray to detect leakages on the xenon line. If no bubble leak spray is available, you have to follow this procedure:

1. Turn the valve at the gas cylinder counter-clockwise to open it

Figure 140: Source gas bottles

2. Check the fill level in the V&F Viewer software
3. Notice the fill level
4. Close the valve at the gas cylinder again
5. Check the fill level in the software again the next day
6. The pressure of xenon should only drop < 10 bars within 12 hours

5.13 Adjust the source gas pressure if required

Needed tools and auxiliary material:

- Allen-key 2.5mm

Procedure:

1. Select the "Trend test" setup
2. Open the 3 screws on the pressure reducer
3. Flush the line by loosening the 1/8"-connection at the ion source and close it again (follow the 1/8" stainless steel line to the other end)
4. Close each screw by a quarter turn
5. Keep an eye on M33
6. Close the screws until you reach a maximum for M33

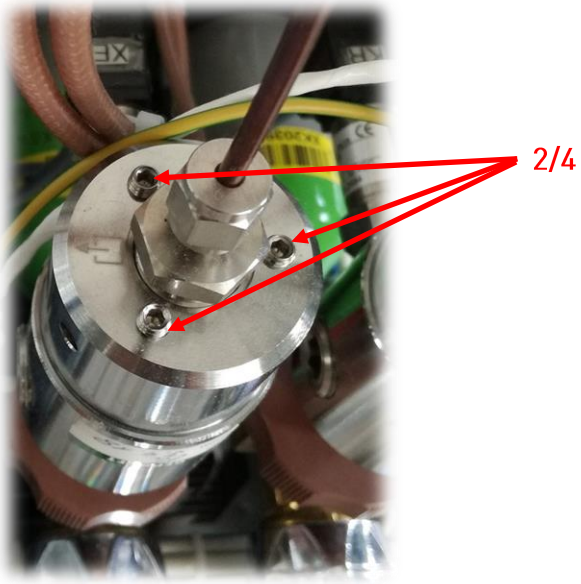

Figure 141: Pressure reducer

5.14 Check the analog IOs

- See Chapter 2.11

5.15 Check the communication with the PLC system (Fieldbus or AK-Interface)

Check the communication with the operating system by the following points:

- start/stop a measurement
- perform an automatic calibration
- check the transferred values in the system

5.16 Create a backup of the analyzer parameters

- See Chapter 2.1

6. Repair tasks

6.1 Exchange the power supply

Needed tools and auxiliary material:

- Allen key: 3mm

Needed spares and consumables:

- Power supply for AirSense, CombiSense, TobaccoSense, TwinSense, MotoSense article number: 800233

Procedure:

1. Disconnect all cables on both sides from the power supply unit
2. Disconnect the 2 screws which are used to mount the power supply to the frame
3. Install the new power supply unit and fix it with the 2 screws
4. Reconnect all cables, see Chapter 2.2.5

Figure 142: Power supply unit

Figure 143: Fan side of the power supply

Figure 144: Outlets of the power supply

6.2 Exchange the CPU

Needed tools and auxiliary material:

- Soldering iron
- Phillips screw driver

Needed spares and consumables:

- CPU board (incl. Flash module) for 2018 series, Article number: 800616

Basics

- Explanation of the different connectors:

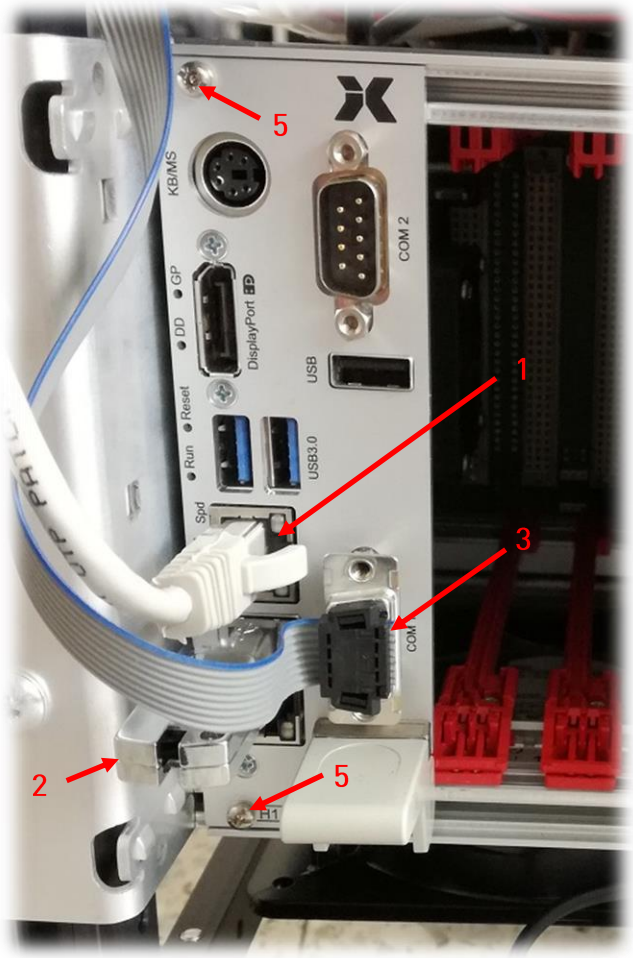

Figure 145: CPU

1. Ethernet is connected to the front panel and provides communication between external PC and internal CPU (Cable shipped with CPU)
2. USB stick contains software license for the analyzer
3. COM1 is connected to the front panel (RS232) and is used for serial communication

Procedure:

4. Unplug the connected cables at the CPU and remove the USB-stick
5. Open the two fixing screws of the CPU
6. Carefully pull out the old CPU

CAUTION:
Don't rub the board on the side panel; there is only a small gap between CPU and side panel!

7. Put the new CPU in

CAUTION:
Don't rub the board on the side panel; there is only a small gap between CPU and side panel!

8. Connect the cables and plug in the USB-stick on the new CPU

6.3 Exchange the HV-supply unit

Needed tools and auxiliary material:

- Screwdriver
- Plier
- Wrench: 5 mm

Needed spares and consumables:

- HV-power supply unit, article number: 800198

Procedure:

1. Remove the service- and the main-board to get access to the HV-supply unit

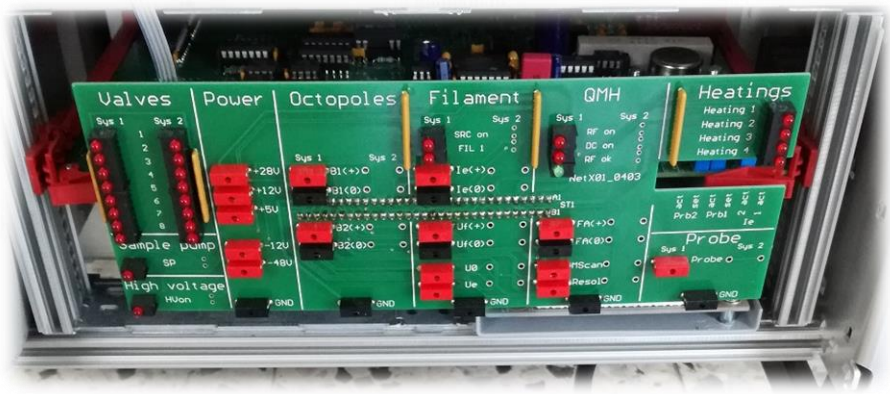

Figure 146: Service board

2. Open all cable ties to remove BNC-cable from the detection unit and the supply cable of the HV-unit
3. Disconnect the 2 screws which are used to mount the board to the housing

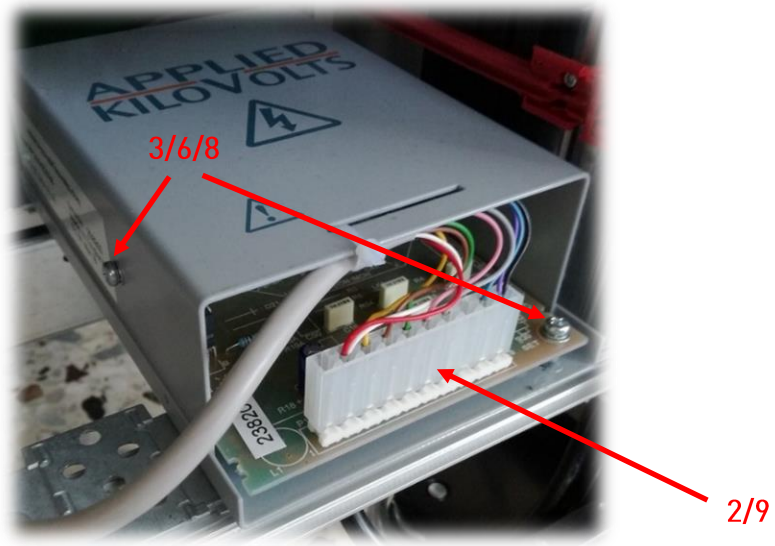

Figure 147: HV power supply unit

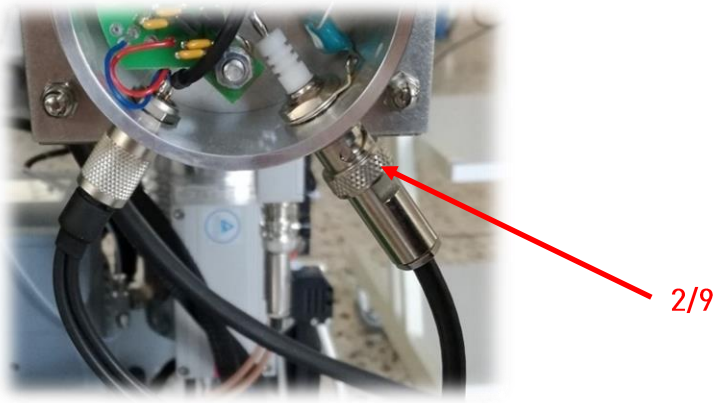

Figure 148: BNC-connector on detection unit

4. Lift up the board to get access to the 2 nuts and disconnect them

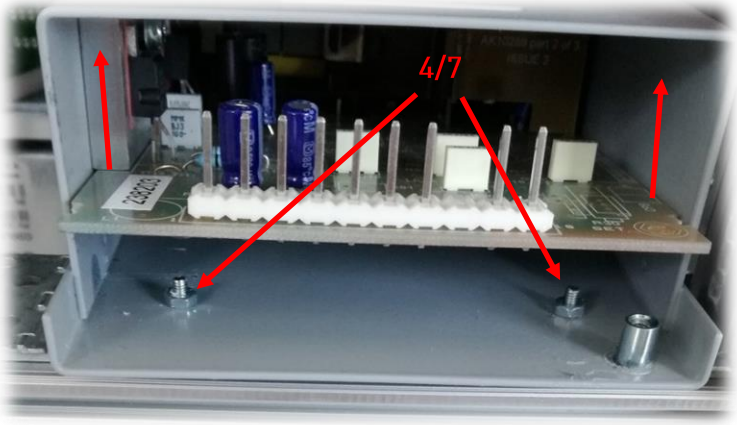

Figure 149: HV power supply unit modified for exchange

5. Remove the housing and the board
6. Disconnect the 2 screws of the new HV-supply which are used to mount the board to the housing
7. Install the new HV-supply and mount it with the 2 nuts
8. Reconnect the board with the 2 screws
9. Connect the BNC-cable to the detection unit and the supply cable to the new HV-unit and fix the cables with cable ties
10. Reinstall the main and the service board

6.4 Exchange the octopole generator

Needed tools and auxiliary material:

- Allen key: 3mm
- Slotted screwdriver

Needed spares and consumables:

- Octopole generator for IMR-MS, article number: 800193

Procedure:

1. Remove all cables from the octopole generator
2. Disconnect the 2 screws which are used to mount the generator to the frame
3. Install the new octopole generator and fix it with the 2 screws
4. Reconnect all cables

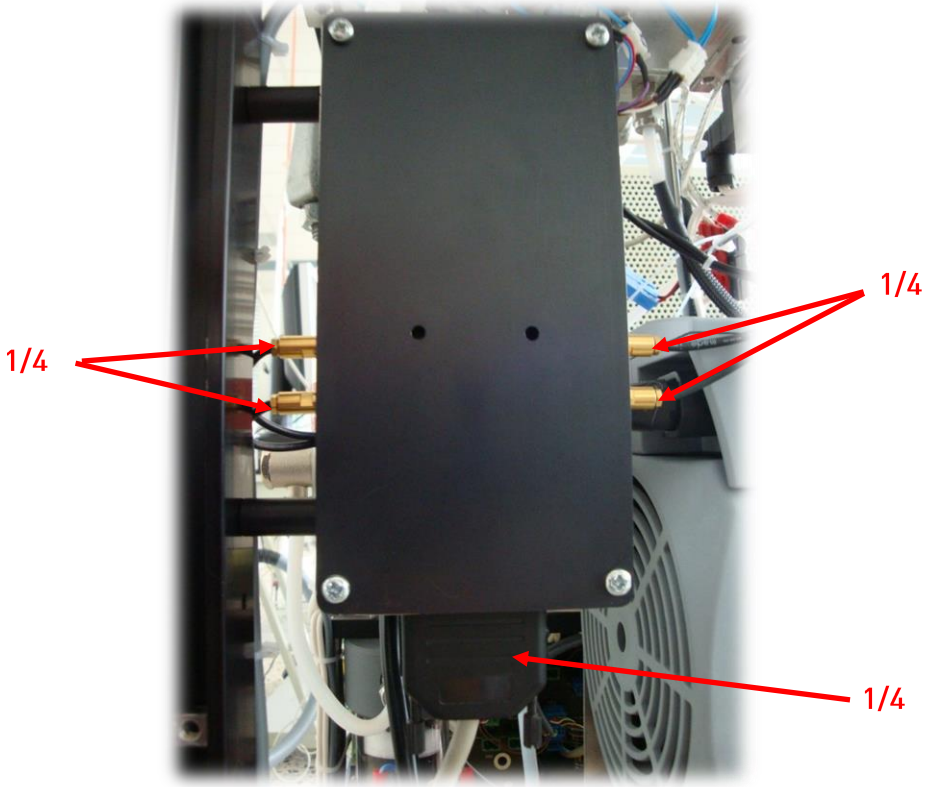

Figure 150: Octopole generator

6.5 Exchange the quadrupole generator

Needed tools and auxiliary material:

- Allen key: 3mm
- Slotted screwdriver

Needed spares and consumables:

- Quadrupole generator for LubeSense, MotoSense & PETSense, article number: 800432

Procedure:

1. Disconnect all cables from the quadrupole generator
2. Disconnect the 3 screws which are used to mount the generator to the frame
3. Install the new quadrupole generator and fix it with the 3 screws
4. Reconnect all cables
5. Adjust the quadrupole-generator, see Chapter 2.4.2

Figure 151: Cables of the RF-Generator

Figure 152: Supply cable of the RF-Generator

Figure 153: Mounting of the RF-Generator

6.6 Exchange the regulation valve

Needed tools and auxiliary material:

- Wrench 9/16"
- Wrench ½"
- Screw driver

Needed spares and consumables:

- Control valve for IMR-MS, article number: 800235

Procedure:

1. Remove the bypass air filter by turning it counterclockwise
2. Disconnect the regulation valve
3. Disconnect the cable for the regulation valve
4. Install the new regulation valve

CAUTION!:
Mind the flow direction!

5. Connect the cable for the regulation valve
6. Install the bypass air filter by turning it clockwise

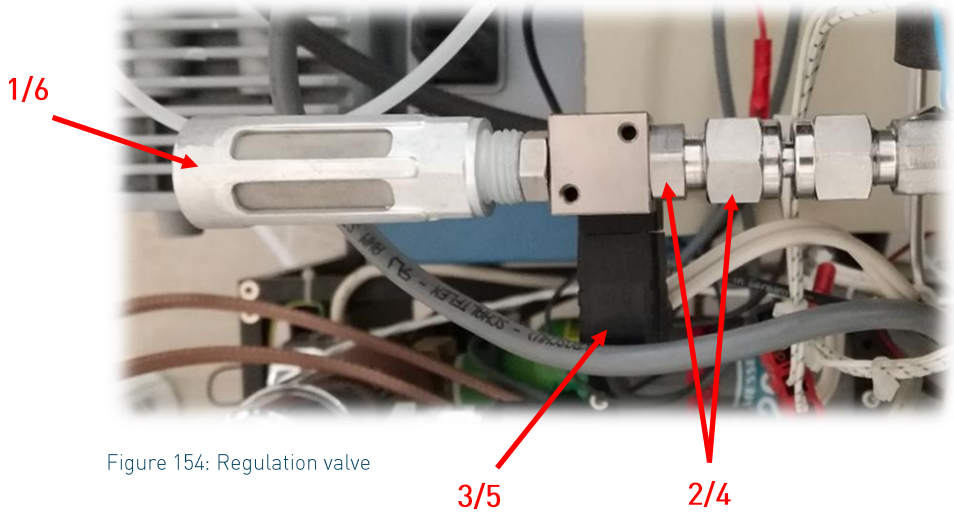

Figure 154: Regulation valve

6.7 Exchange the pressure sensor

Needed tools and auxiliary material:

- Wrench 9/16"
- Wrench 19mm
- Screw driver

Needed spares and consumables:

- Pressure transducer 100 mbar, article number: 800308

Procedure:

1. Disconnect the pressure sensor
2. Disconnect the cable for the pressure sensor
3. Connect the cable to the new pressure sensor
4. Install the pressure sensor

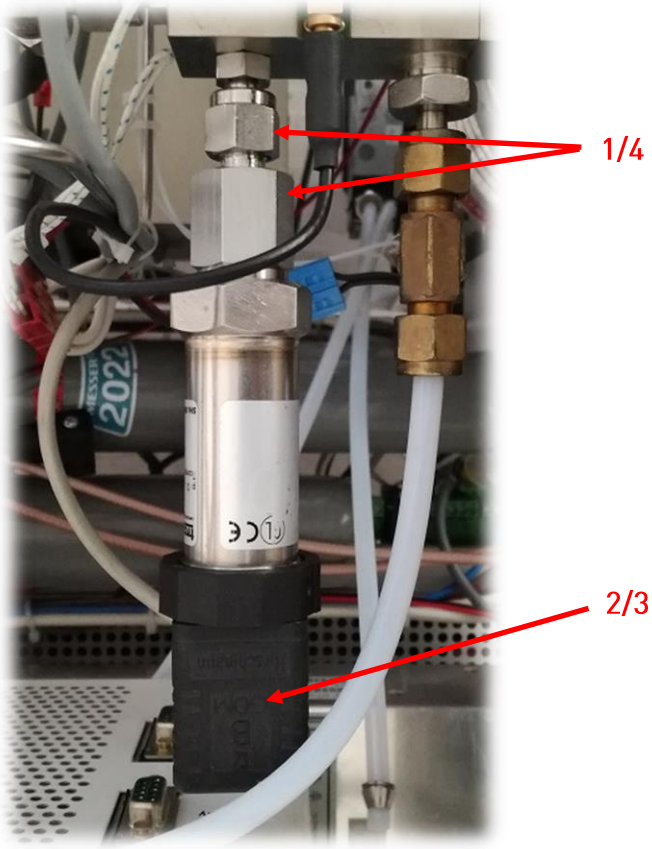

Figure 155: Pressure sensor

6.8 Exchange the pre-vacuum pump

Needed spares and consumables:

- Pre-vacuum pump, article number: 800207

Procedure:

1. Unplug the power cable of the pump (on side of the pump)
2. Disconnect all Teflon tubes connected to the pump
3. Open the 2 fixing screws for the cooling fans unit
4. Unplug the power supply cable of the cooling fans unit (on the back of the unit)
5. Remove the cooling fans unit
6. Open all 4 screw nuts below the pump, with which the pump is mounted onto the frame
7. Remove the old pump

CAUTION:
Don't damage any device near the pump!

8. Install the new pump
9. Mount the new pump by tightening the 4 screw nuts below the pump
10. Reinstall the cooling fan unit and plug in the power supply cable
11. Plug in the power cable of the pre-vacuum-pump
12. Tighten all Teflon tubes you loosened before
13. Ensure that the power switch of the pump is activated

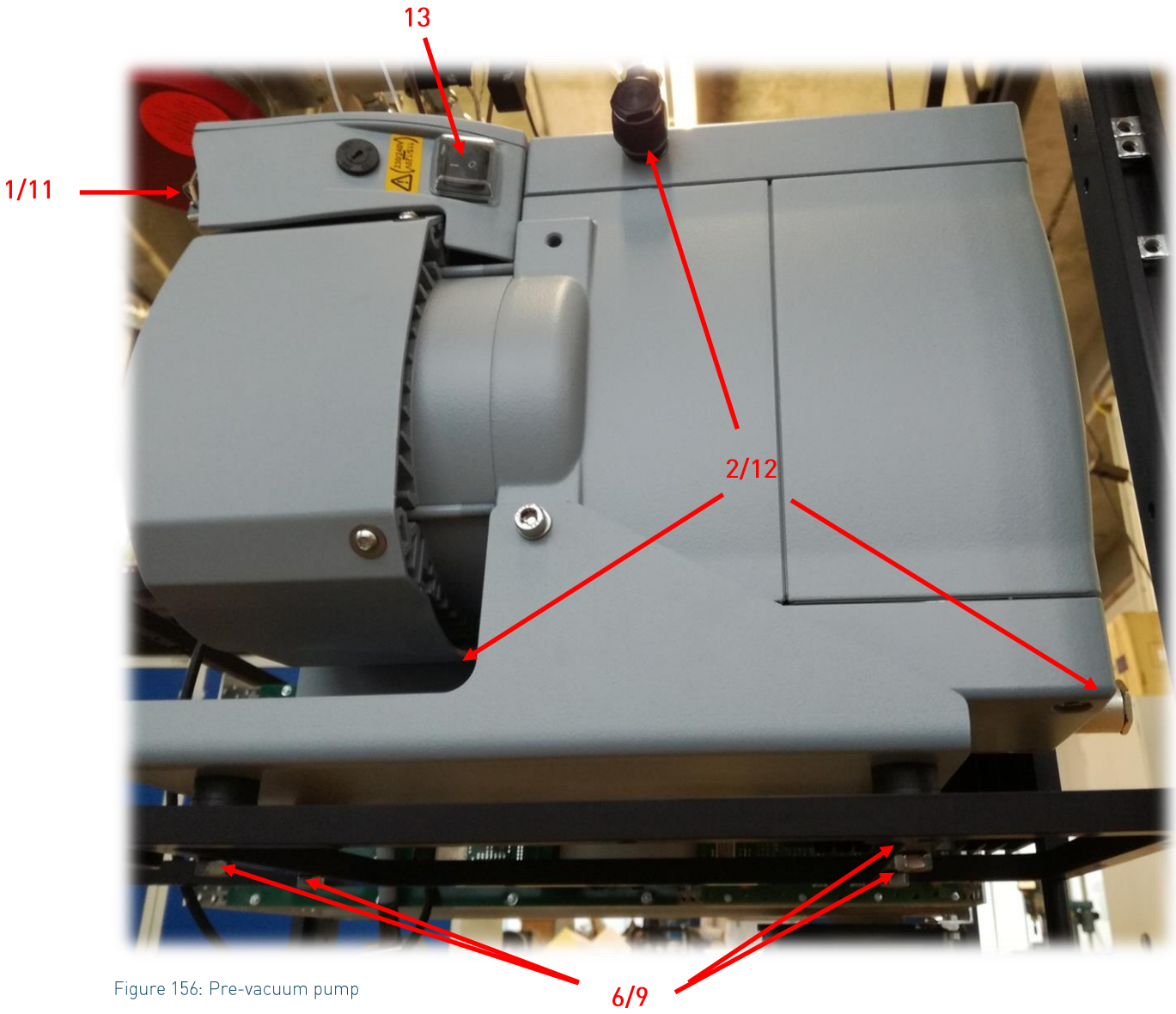

Figure 156: Pre-vacuum pump

6.9 Exchange the voltage selection switch of a diaphragm pump

This chapter is applicable to the pre-vacuum pump type MV2 NT.

Needed spares and consumables:

- Voltage selection switch for MV2 NT, article number: 800355

Procedure:

1. Disassemble 4 screws from the terminal box upper part and remove housing upper part.
2. Remove the 4 end sleeves with wires of the voltage selection switch using crimping tool.

CAUTION:
Do not reuse end sleeves!

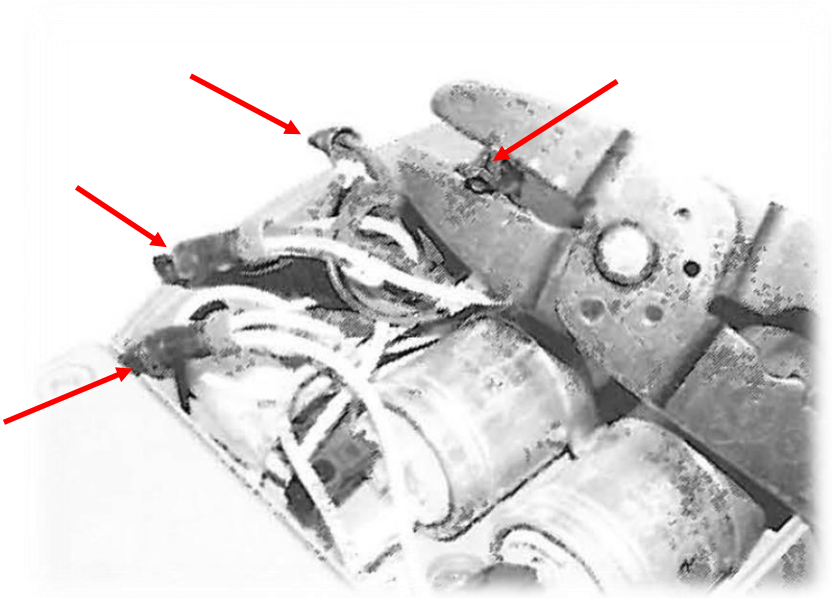

Figure 157: Removing end sleeves

3. Unscrew counter nut at the voltage selection switch.

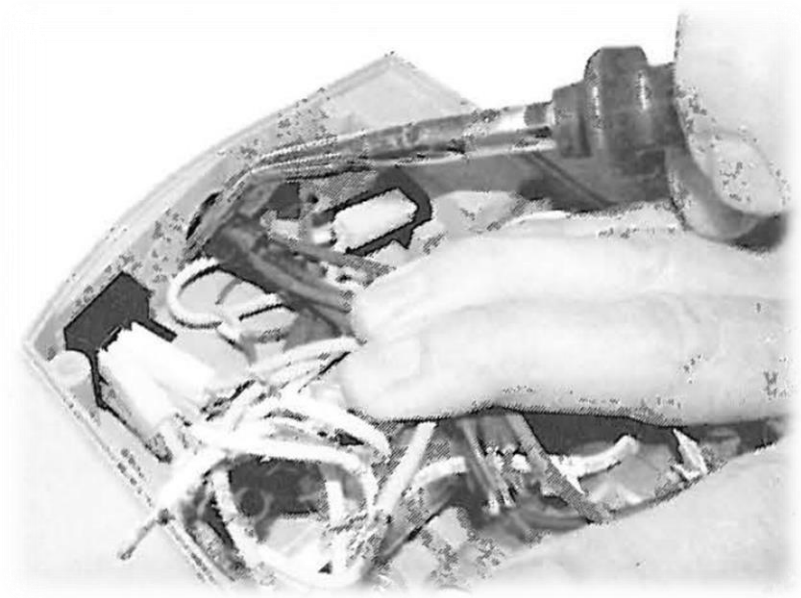

Figure 158: Unscrew counter nut

4. Shorten the wires of the new voltage selection switch to 10 cm and strip the insulation 1 cm.
5. Remove the defective voltage selection switch and position the new one.

ATTENTION:
When assembling the switch, pay attention to marks at terminal box and at the switch.
Take care to numbering of the wires at the voltage selection switch.

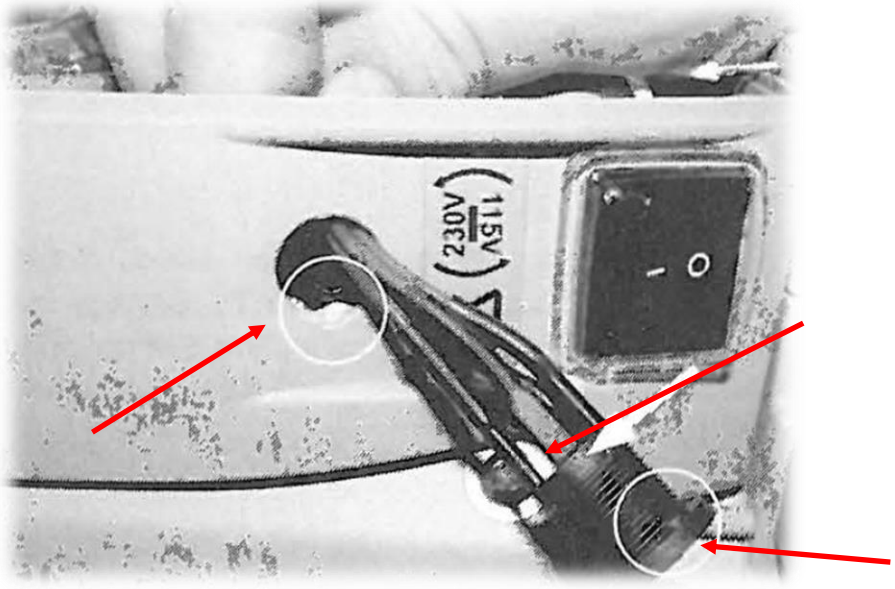

Figure 159: Correct position of voltage selection switch

6. Use a suitable crimping tool and new end sleeves and connect the voltage selection switch according to the circuit diagram. Check stability of the connection thoroughly.
7. Assemble the upper part of the terminal box.
8. Check that the voltage selection switch at the terminal box is positioned correctly. Change the selection at the voltage selection switch only when the pump is unplugged from the power source

Figure 160: Voltage selection switch

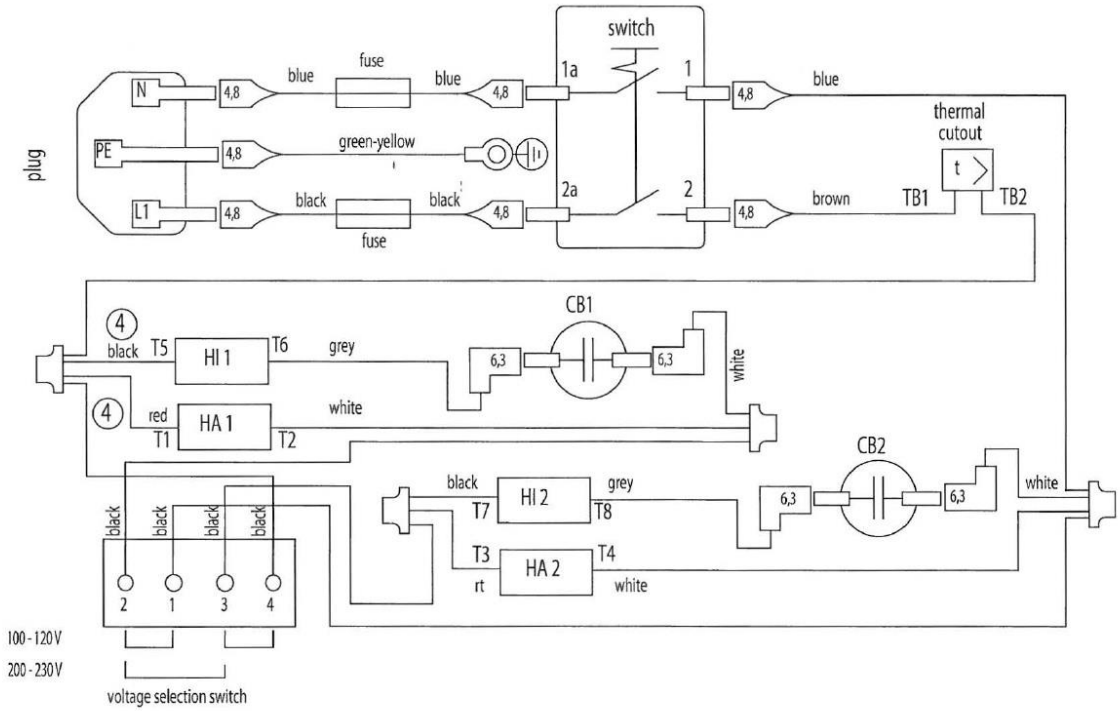

Figure 161: Circuit diagram

7. Figures & Tables

7.1 Figures

7.2 Tables