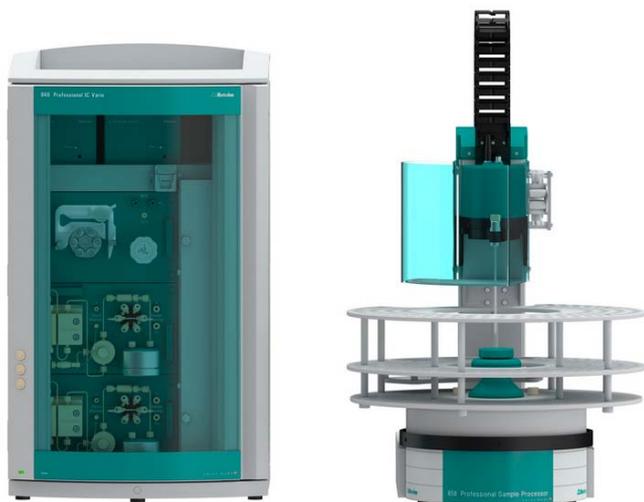


Installation instruction for ProfIC Vario 1 AnCat

ProfIC Vario 1 AnCat is a very compact and professional IC system for the fully automatic determination of anions with sequential suppression and cations. With «ProfIC Vario 1 AnCat» anions and cations can be determined both in parallel as well as independently in order to save time. Both systems use the same 858 Professional Sample Processor with pump, which is controlled by the MagIC Net software.


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1. Delivery Package

Delivered with ProfIC Vario 1 AnCat package:

Nr	Article no.	Article designation
IC		
1	2.940.2500	Professional IC Vario TWO/SeS/PP
Detector		
2	2.850.9010	IC Conductivity Detector
Sample processor		
1	2.858.0020	Professional Sample Processor
Optional		
1	6.6059.302	MagIC Net 3.0 Professional CD - 1 license
1	6.6059.303	MagIC Net 3.0 Multi - 3 licenses
1	6.2041.760	Sample rack 54 x 11 mL + 1 x 300 mL
1	6.2041.440	Sample rack 148 x 11 mL + 3 x 300 mL
1	6.2743.040	Sample tubes 2.5 mL
1	6.2743.050	Sample tubes 11 mL
1	6.2743.070	Stopper with perforation
1	6.1030.420	Metrosep A Supp 15 - 150/4.0
1	6.1030.500	Metrosep A Supp 15 Guard/4.0
1	6.1050.420	Metrosep C 4 - 150/4.0
1	6.1050.500	Metrosep C 4 Guard/4.0
1	6.2832.000	MSM Rotor A
1	6.2842.000	MSM-HC Rotor A
1	6.2844.000	MSM-LC Rotor A
1	6.2842.020	Adapter Vario to MSM and MSM-LC
1	2.941.0010	Eluent Production Module
1	6.5330.090	IC Equipment: Additional eluent for 941
1	2.800.0010	Dosino
1	6.2769.110	Sensor empty 2L
1	6.5330.130	IC Equipment: LQH Station

2. Installation

Following is a detailed description of how to install ProfIC Vario 1 AnCat.

We strongly recommend that the individual steps are carried out in the order given below.

2.1. Installation of the software

All programs must be shut down first. Make sure no Metrohm instrument is connected to the PC. Install MagIC

Net with the help of the MagIC Net - CD. The Microsoft Installation Wizard is accepted and executed. All the standard directories proposed by the program should be accepted. Restart windows.

Now as soon as you connect a new Metrohm instrument via USB connection to the PC, the driver is installed and a window will pop up in MagIC Net, asking you if you'd like to store this device in your configuration. If you do, please answer with yes. The names will be checked later in this installation instruction.

2.2. Accessory Kit: Vario/Flex Basic (6.5000.000)

Using the Accessory Kit Vario/Flex Basic, install the Professional IC Vario. Remove handle, place the detector blocks in the instrument and connect the detector cables (anion detector into the "Detector 1" socket, the cation detector to "Detector 2"), remove the transport locking screws, connect the leak sensor cable and connect the drainage tubing.

In continuation, set up the waste collector by assembling the cap and screwing it onto the vessel. Then hang the waste collector holder on the side of the IC, so you can observe the droplets coming out of the capillaries later connected to the collector. Attach the waste tube to the vessel and lead it to the waste canister. When the tube is too long, please shorten it, because it is important to have a high level difference for the liquid to drain.

The power cable and USB cable (6.2151.020) are plugged into the rear of the Professional IC Vario. Please don't switch on the instrument yet. This step will follow after the completed installation.

2.3. Accessory Kit: Vario/Flex ONE (6.5000.010)

In the two boxes with the Accessory Kits ONE, you will find all the accessories for setting up the eluent bottles. Please lead the aspiration tubes for the eluents through the M8 stopper, the earring and the eluent caps. Then fix the white weight (6.2744.210), the adaptor (6.2744.210) and the aspiration filter (6.2821.090) on the eluent aspiration tube, all the while being careful not to touch the filter and its connections with bare hands in order to avoid cross contamination. Also fix the filled adsorber tube on the eluent cap. Please refer to the 940 Professional IC Vario manual for a detailed description.

2.4. 858 Professional Sample Processor

For a detailed description, please refer to the 858 Professional Sample Processor manual. In general, you will have to do the following: Plug in the Swing Head connection cable and the power supply cable. The controller cable (6.2151.000) is plugged into the plug "Contr." on the 858 and connected to the IC device via USB. The sample

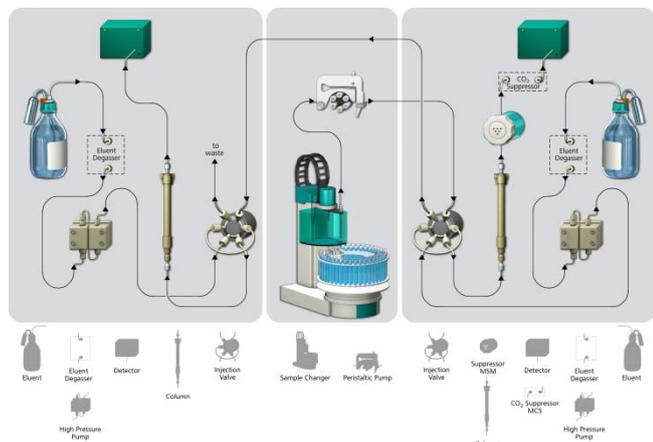
processor initializes and lifts its Swing Head, once the IC device it is connected to is recognized by the software. For this, you have to plug the USB cable of the IC into the PC and turn it on. Afterwards, it is possible to mount the retaining plate, the needle and the safety shield (for detailed instructions please refer to the 858 Professional Sample Processor manual).

Insert the pump tubing (white/white 6.1826.360) into the peristaltic pump and connect the aspiration side to the needle via a PEEK capillary (6.1831.160) (see also 858 manual).

For the following installations, please shut down the IC again and disconnect the 858 from the power supply.

2.5. Interconnection of devices

The whole setup of the ProfIC Vario 1 AnCat packet is depicted here:



Prepare and degas two eluents suitable for the anion and cation columns you want to use (see column manual). For Metrosep A Supp 15 - 150/4.0 a solution of 5.0 mmol/L Na₂CO₃ / 0.3 mmol/L NaOH is recommended. For Metrosep C 4 - 150/4.0 a solution of 1.7 mmol/L HNO₃ / 0.7 mmol/L dipicolinic acid (DPA, 2,6-Pyridinedicarboxylic acid) is adequate.

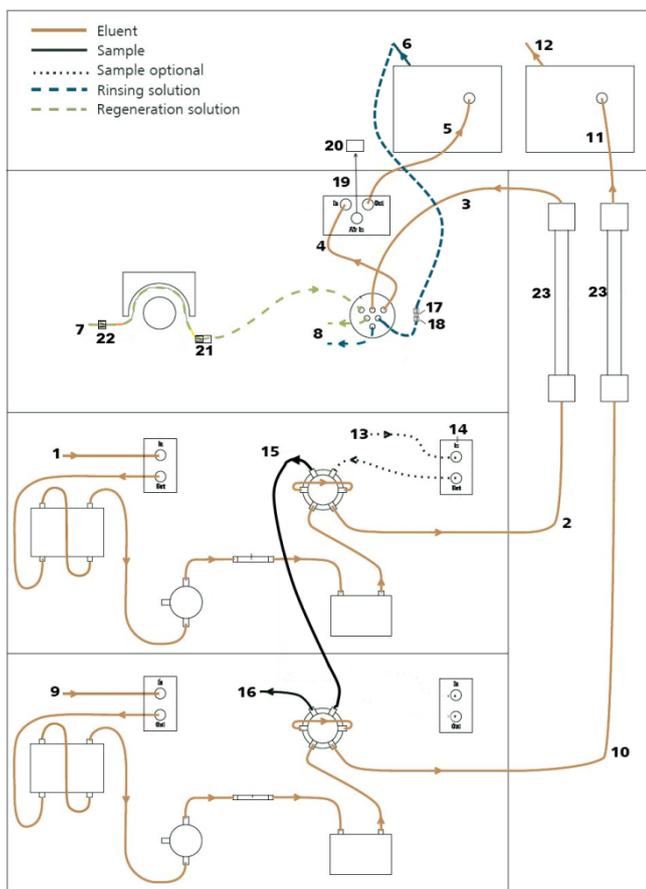
Provide the regeneration solution for the MSM Suppressor (100 mmol/L sulfuric acid).

2.6. 940 Professional IC Vario

Capillaries are connected according to the following list and the diagram below:

1. Connection to the eluent bottle for anion determination
2. Capillary to anion separation column
3. MSM inlet capillary – labeled with *In*
4. MSM outlet capillary – labeled with *Out*, which can be connected to the MCS with a long PEEK pressure screws (6.2477.090) or directly to the detector (5) using a coupling (6.2744.040).

5. Capillary from MCS to anion detector, long PEEK pressure screws (6.2744.090) are used for the MCS connection
6. Detector outlet capillary connected to the MSM inlet capillary – labeled with *Rinsing solution* with the help of a coupling (6.2744.040)
7. Regeneration solution aspiration capillary – PTFE, 0.5 mm ID, connected to the bottle with 100 mmol/L sulfuric acid and the orange/yellow pump tubing. This pump tubing is, on the other side, relied to the regeneration solution capillary of the MSM - labeled with *regenerant* - with a security lock and filter (21)
8. MSM regeneration and rinsing solution outlet capillaries – labeled with *Waste reg.* and *Waste rins.* – to be connected to the waste collector
9. Connection to the eluent bottle for cation determination
10. Capillary to cation separation column
11. Capillary from cation separation column to cation detector
12. Detector outlet capillary, connected to the waste collector
13. Sample aspiration capillary (PTFE, 0.5 mm ID), connected to the anion valve (position 1)
14. Optional sample degasser
15. Capillary connection (PTFE, 0.5 mm ID) between anion valve (position 2) and cation valve (position 1)
16. Capillary to the waste collector
17. Coupling 2xUNF 10/32 PEEK (6.2744.040)
18. PEEK pressure screw short (6.2744.070)
19. MCS air aspiration capillary – connected to the CO₂ - adsorber cartridge
20. Luer coupling – connect with short PEEK pressure screw to CO₂ - adsorber cartridge
21. Pump tubing connector with security lock and filter (6.2744.180)
22. Coupling nozzle - UNF 10/32 (6.2744.034)
23. The UNF 10/32 couplings (6.2744.040) are installed instead of the columns to rinse the system with eluent. After rinsing the columns are installed.



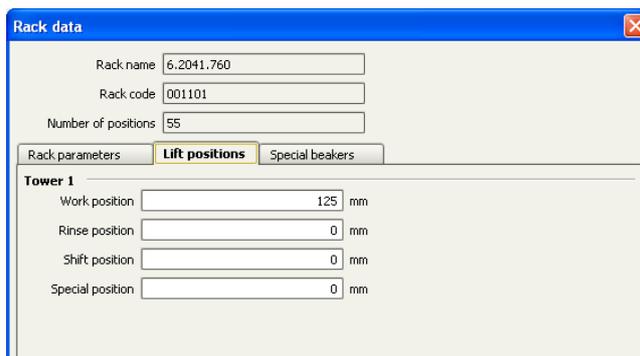
3. MagIC Net

3.1. Configuration

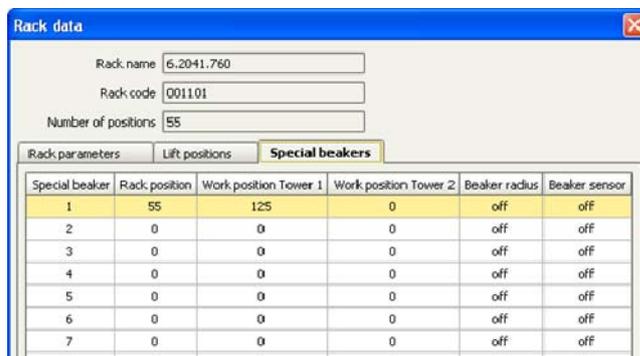
Now please connect the USB cables from the instruments and turn their power on. Connected USB devices are automatically recognized when MagIC Net is started. After confirmation of the automatically generated requests, the devices and columns are stored in the configuration. The devices are predefined as "940 Professional IC Vario 1" and "858 Professional Sample Processor 1". Name them accordingly, if other names appear in your configuration (e.g. due to changed setting on your computer).

In the window configuration, the 940 Professional IC Vario, the 858 Professional Sample Processor and the columns Metrosep A Supp 15 - 150/4.0 and Metrosep C 4 - 150/4.0 are visible. Add and define the eluents and the suppressor solution.

The settings for the rack require a "work position" fitting to the respective rack (e.g. 125 mm for rack 6.2041.760).



Also define a special beaker for rinsing the needle. Fill a beaker with ultrapure water and place it at the defined position on the rack.



3.2. Method adjustment

There are two possibilities to conduct these analyses, either in parallel or independently from each other. On your MagIC Net - CD you will find example methods for both of them.

The installation is the same, but the parallel analysis of anions and cations is conducted in one workplace. Immediately after starting the cation determination, the anion determination (of the same sample) is initialized. Samples could be taken from the same vial or from two vials with one of them containing the acidified sample solution for cation determination. Both measurements are recorded in the same data file.

For this kind of setting, import the method for ProfIC Vario 1 AnCat from the installation CD: Go to File → method manager and choose your method group. Afterwards, click on edit → import and choose the pathway on the installation CD:

MagICnet\examples\methods\ ProfIC Vario \ProfIC Vario_1_AnCat.imet.

Another option would be an independent determination. A sample series A for anion determinations and a sample series B for cation determination are set up in two separate workplaces and performed independently. After each sample injection the Professional Sample Processor is set free by the "release" command in the time program, in order to save time.

For this, import the methods ProfIC Vario 1 AnCat Anion and ProfIC Vario 1 AnCat Cation from the installation CD: Go to File → method manager and choose your method group. Afterwards, click on edit → import and choose the pathway on the installation CD:

MagICnet\examples\methods\ ProfIC Vario\ProfIC Vario_1_AnCat_Anion.imet and MagICnet\examples\ProfIC Vario\ProfIC Vario_1_AnCat_Cation

In the window method, under evaluation, enter the concentrations of the required standards. Now please add the correct Database in the Evaluation window (Evaluation - Results - Database) for your method(s).

Perform a method test and save the methods.

3.3. Purge of the system

Before inserting the columns, disconnect the *Out* capillary of the suppressor connection piece from the MCS or from the detector and put it into a waste beaker. The suppressor needs to be rinsed with the system first and its waste should not pass through the sensitive MCS and/or detector in the beginning, as loose particles could be flushed out.

Now, please flush the system for about 10 minutes and get rid of air bubbles (by using the purge valve and syringe). During these 10 minutes, step the MSM three times in order to flush all three chambers.

As soon as the whole system is purged, reconnect the suppressor *Out* capillary back to the MCS or the detector.

Now insert and rinse the precolumns for 10 minutes by leading the outlets directly into the waste. Afterwards connect the analytical columns and flush them likewise for 10 minutes. Only afterward the columns are completely connected to the flow path of the eluent (see also 940 manual). Start the peristaltic pump and adjust the pressure of the lever on the tubing, in order to see the droplets of suppressor regeneration solution drop into the waste collector.

In order to start the equilibration, go to the window work place, load your method, and press “Start HW”.

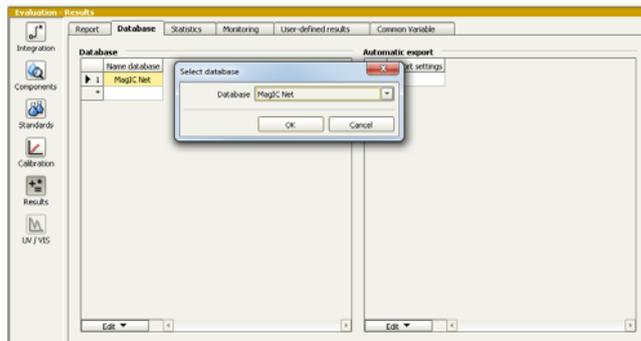
If you chose to use two separate methods for anion and cation analysis, please start you anion method in one workplace by pressing “Start HW” and open a second workplace for the cation method. This, you can do by choosing “File” - “Workplace” - “New...”.

Name it as you wish and load the cation method. Press “Start HW” to start the equilibration of the system.

Equilibrate the system until the baseline is stable.

3.4. User defined determination

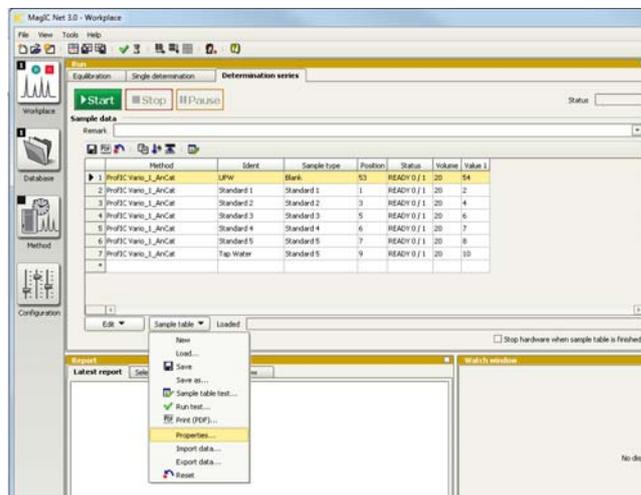
In the window method, under evaluation, enter the concentrations of the required standards. Now please add the correct Database in the Evaluation window (Evaluation - Results - Database) for your method(s).



In the window work place, set up one or two “determination series”, depending on your method choice describing your samples by ident, vial number, sample type (standard, blank, or sample etc.). For quantitative analysis, samples subjected to cation analysis are normally acidified, whereas anion analysis is normally carried out with unmodified samples.

Hence for ProfIC Vario 1 AnCat, two sample vials are posed on the rack for each sample (an acidified one for cation determination, and an unmodified one for anion determination). According to the method ProfIC Vario_1_AnCat.imet, the position of the vial for anion determination should be defined in the column “sample position” and the position of the vial for cation determination should be defined the in the column “Value 1”.

To be able to see and use the Value 1 of the determination table, click on the subcategory “Properties...” under Sample table in the run window. In the newly opened window, check the “Value 1” case under “Display”.



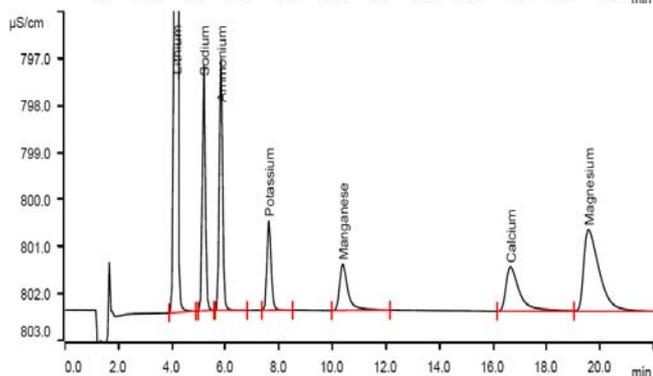
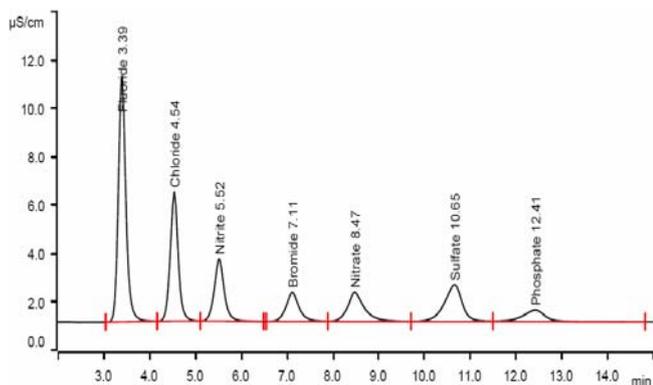
Now you'll be able to add the cation vial position in your determination series. Therefore, your sample table might look like the following one:

	Method	Ident	Sample type	Position	Status	Volume	Value 1
1	ProfIC Vario_1_AnCat	UPW	Blank	53	READY 0 / 1	20	54
2	ProfIC Vario_1_AnCat	Standard 1	Standard 1	1	READY 0 / 1	20	2
3	ProfIC Vario_1_AnCat	Standard 2	Standard 2	3	READY 0 / 1	20	4
4	ProfIC Vario_1_AnCat	Standard 3	Standard 3	5	READY 0 / 1	20	6
5	ProfIC Vario_1_AnCat	Standard 4	Standard 4	6	READY 0 / 1	20	7
6	ProfIC Vario_1_AnCat	Standard 5	Standard 5	7	READY 0 / 1	20	8
▶ 7	ProfIC Vario_1_AnCat	Tap Water	Standard 5	9	READY 0 / 1	20	10
*							

For evaluation and after recording the first chromatogram, check the retention times of your compounds. Since they depend on the performance of your column, you may have to adjust them in your method.

4. Exemplary measurement

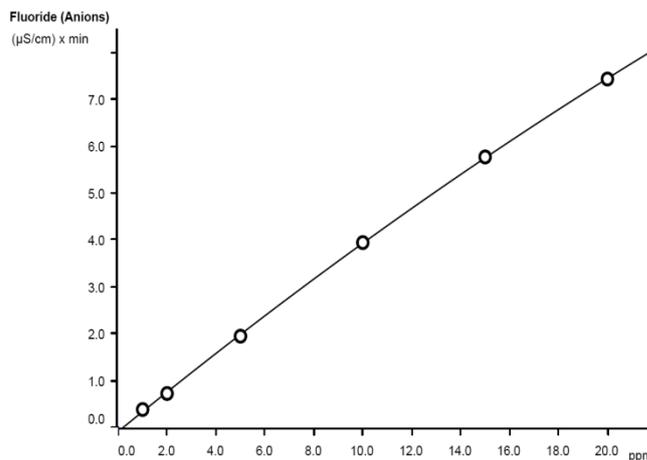
An exemplary measurement was performed, including the ions fluoride, chloride, nitrite, bromide nitrate, sulfate, phosphate, lithium, sodium, ammonium, potassium, manganese, calcium, and magnesium (5 mg/L each). Anions and cations were measured from separate sample vials with the sample for cation measurement being acidified with 100 µL nitric acid (2 mol/L) per 100 mL. The two following chromatograms were recorded in parallel.



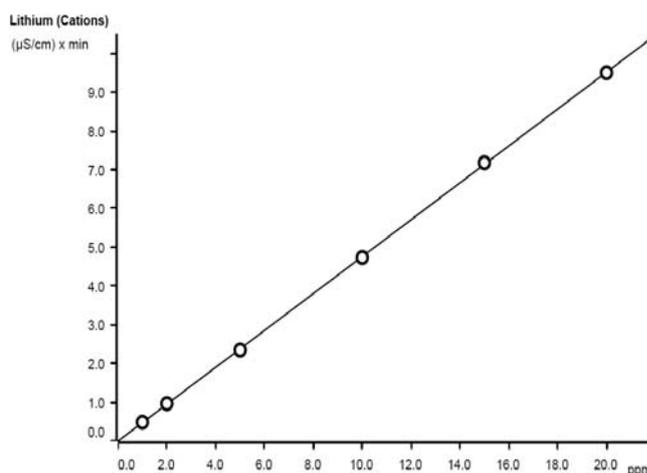
For the calibration, the average peak areas of 3 injections were evaluated. Within the concentration range of 1 – 20 mg/L, a quadratic curve type was used for evaluation of anions, and a linear curve type was used for evaluation of cations. Correlation coefficients and standard deviations are listed in the following table. The calibration curves for fluoride and lithium are shown as examples.

	Correlation coefficient	Percentage standard deviation [%]
Fluoride	0.999927	1.321
Chloride	0.999900	1.618
Nitrite	0.999855	1.991
Bromide	0.999569	3.390
Nitrate	0.999712	2.770
Sulfate	0.999740	2.653

Phosphate	0.999703	2.832
Lithium	0.999971	0.733
Ammonium	0.999949	0.964
Potassium	0.999988	0.478
Manganese	0.999964	0.821
Calcium	0.999969	0.779
Magnesium	0.999975	0.693



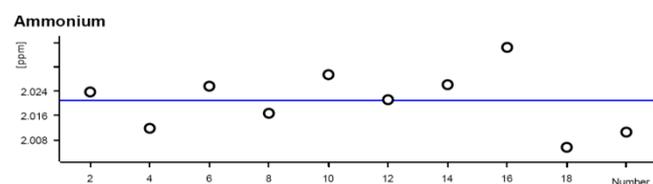
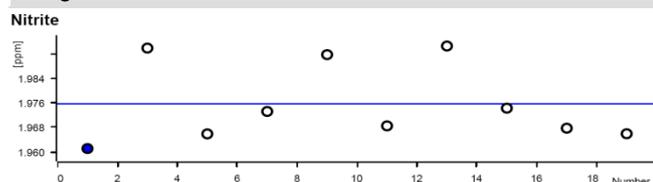
$A = -0.0834093 + 0.0424989 \times Q - 2.45399E-5 \times Q^2$	
Relative standard deviation	1.321%
Correlation coefficient	0.999927
Curve type	Quadratic
Weighting	1



$A = -8.89063E-3 + 0.0476295 \times Q$	
Relative standard deviation	0.733%
Correlation coefficient	0.999971
Curve type	Linear
Weighting	1

The precision of 10 injections of 2 mg/L standard ions was determined. The results shown in the following table and exemplary trend chart are shown for nitrite and ammonium.

Ion	Standard deviation	
	relative [%]	absolute [mg/L]
Fluoride	0.292	0.006
Chloride	2.160	0.042
Nitrite	0.647	0.013
Bromide	0.176	0.003
Nitrate	0.496	0.010
Sulfate	0.306	0.006
Phosphate	0.349	0.007
Lithium	0.258	0.005
Ammonium	0.476	0.009
Potassium	0.488	0.010
Manganese	0.353	0.007
Calcium	2.918	0.060
Magnesium	3.175	0.063



5. Optional equipment

5.1. Liquid Handling Station

The Liquid Handling Station (LQH Station) consists of two function units: The rinsing and the dilution unit. As an add-on it is mainly useful for rinsing the needle on the inside and outside, thus minimizing contamination.

The following kit is needed:

Nr	Article no.	Article designation
1	6.5330.130	IC Equipment: LQH Station



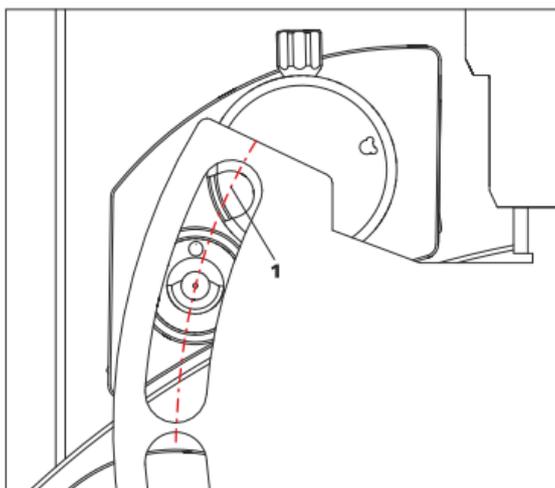
The kit includes:

Nr	Article no.	Article designation
1	6.1014.200	Metrosep I Trap 1 - 100/4.0
1	6.1602.160	Eluent bottle cap GL 45
1	6.1608.070	Eluent bottle /2 L / GL 45
1	6.1619.000	Adsorber tube for Dosing Unit
1	6.1624.000	Adapter SGJ 14
1	6.1826.390	Pump tubing LFL (yellow/yellow) 3 stoppers
1	6.1831.180	PEEK capillary i.D. 0.5 mm, 3 m
1	6.2744.010	Pressure screw 5x
1	6.2744.034	Coupling nozzle UNF 10/32
1	6.2841.120	Liquid Handling Station left

The installation of the LQH Station is done in two steps: First mount and align the Liquid Handling Station on the left hand side of the Sample Processor. To accomplish this, remove the sample rack and place the Liquid Handling Station on the black rail of the Sample Processor. Secure it temporarily in place with the screw and then loosen the small screws of the foot. The rack is replaced on the Sample

Processor and the small screws are fixed in a way that the approximate distance between LHS and rack is 0.5-1 mm.

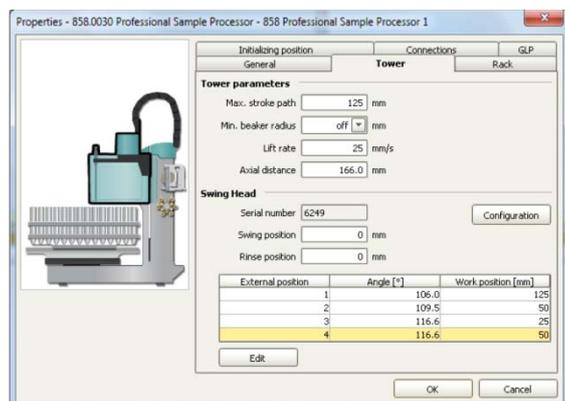
Now the Liquid Handling Station needs to be aligned with the retaining plate. For this, loosen the big screw again and move the Station underneath the retaining plate. Looking from above you should now be able to see the small hole of the rinsing unit and part of the big hole of the dilution vessel, similar to the following image.



When you have found the correct position, please tighten the screw to fix the LQH Station completely to the Sample Processor.

In a second step, the work positions for the sample tube need to be defined in the configuration.

Please go to the configuration of the Sample Processor. Under Tower it is possible to define external positions of the swing head. For rinsing purposes, only the External Position 1 (small inner tube) and the External Position 2 (outer tube of rinsing unit) have to be defined. The proposed angles are only guiding values; they need to be adapted for every system separately. This can be done easily by adjusting the angles in the manual control window. As soon as you have found the correct angles, make sure to save them in the configuration. The work positions are fixed for all of the different setups.



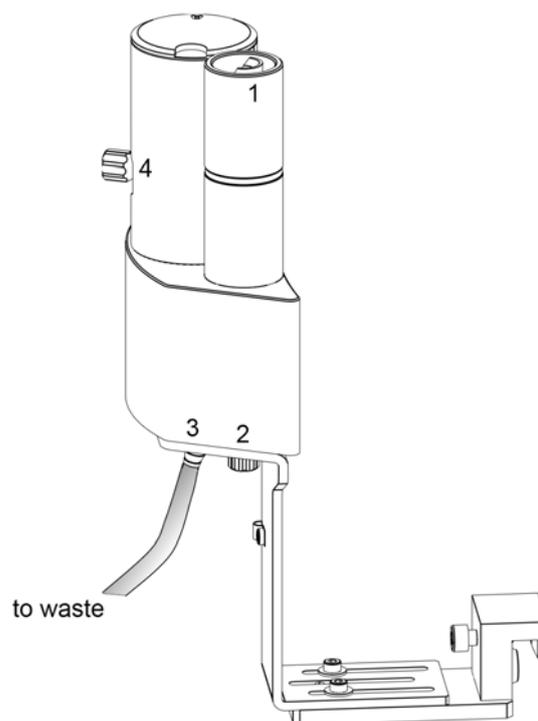
Depending on the available parts, the water supply to the Liquid Handling Station is managed differently. The inner tube of the rinsing unit is meant to be filled constantly with fresh Ultrapure Water, so the aspiration needle can be thoroughly cleaned from the outside.

All possibilities have the waste tube in common, Number 3 in the following image. Please fix the PVC tubing (6.1801.120) on the disposal connector on the bottom of the Liquid Handling Station.

If there is a peristaltic pump canal free, there is the possibility to connect a water bottle with a peristaltic pump tubing and lead a capillary to the PEEK pressure screw on the bottom of the Liquid Handling Station (Number 2 on the following schemata). Between the peristaltic pump and the LQH Station, please install an I-Trap (6.1014.200) into the flow path to cleanse the water before it goes into the IC system.

Another possibility arises with a Dosino:

Similar to the setup with the peristaltic pump before, connect one of the Dosino ports with a capillary to the PEEK pressure screw (Nr. 2) on the Liquid Handling Station. Then use the Dosino to push water from below into the rinsing unit when needed. Here, it is recommended to install an I-Trap (6.1014.200) into the flow path of the water, in order that the water is cleansed from all impurities that could build in the water reservoir.



Number 4 of the picture above shows the attachment point of a capillary in case of a dilution feature and Number 1 indicates the rinsing entity.

In the time program you can treat the external positions like a special beaker: Just move to the wanted angle, go into work position and start the Dosino or the peristaltic pump. Make sure to always dispose the waste in the external position 2.

5.2. Eluent Production Module

The 941 Eluent Production Module creates fresh new eluent out of eluent concentrate and ultrapure water. For installation instructions and further information, please refer to the 941 Eluent Production Module Manual.

5.3. Alternative MSM rinsing and regeneration methods

For alternative suppressor rinsing and regeneration methods and setups, please refer to the AB-395.