

Application Bulletin 375

Installation Instruction for ProfIC Vario 5 AnCat

ProfIC Vario 5 – AnCat is a Professional IC Vario system with variable sample preconcentration for trace analysis of anions and cations. With the «ProfIC Vario 5», concentrations down to the sub-ppb range ($\mu\text{g/L}$) can reliably be determined. The intelligent 800 Dosino carries out the high-precision sample preconcentration on the preconcentration columns, which replace the sample loops.



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1. Delivery Package

Delivered with ProfIC Vario 5 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	2.815.0130	815 USB Robotic Sample Processor (2T/0P)
2	2.786.0040	786 Swing Head
1	6.1462.030	Robotic arm with transfer head for 786 Swing head, left swinging
1	6.1462.040	Robotic arm with transfer head for 786 Swing head, right swinging
Accessoires		
1	2.800.0010	800 Dosino
2	6.5330.140	IC Equipment: MiPCT
1	6.2064.000	Beaker retainer for Advanced IC Sample Processor
1	6.2064.010	Beaker retainer for Professional IC Sample Processor, right
2	6.2833.000	Needle/tube holder 1/8 in
2	6.2629.000	Screw nut to needle holder IC
2	6.9927.028	Splash protection IC R/L
2	6.2846.010	Sample needle
1	6.2841.130	Liquid handling station, right
Optional		
1	6.6059.312	MagIC Net 3.1 Professional CD - 1 license
1	6.6059.313	MagIC Net 3.1 Multi - 3 licenses
1	6.9920.191	Sample rack 3 x 60.6 mm + 35 x 41 mm
20	6.1608.100	PE bottle 50 mL
1	6.2820.000	Al foil
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	6.1006.310	Metrosep A PCC 1 HC/4.0

1	6.1010.310	Metrosep C PCC 1 HC/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 Level Sensor
1	2.800.0010	800 Dosino
1	6.2769.110	Sensor empty 2L

2. Installation

Following is a detailed description of how to install ProfIC Vario 5 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, remove the transport locking screws, connect the leak sensor cable and connect the drainage tubing. Then please mount the holder for Dosinos (6.2057.210) on the IC by removing the bottle holder on top of the instrument, placing the Dosino holder on the side of the IC and remounting the bottle holder on top.

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 two Eluent bottles. Please lead the aspiration tube for the Eluent through the M8 stopper, the earring and the eluent cap. 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 filters 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. 815 USB Robotic Sample Processor (2T/0P)

For a detailed description, please refer to the 815 USB Robotic Sample Processor manual. In general, you will have to do the following: Remove the titration head holders, mount both Swing Heads and plug in the Swing Head connection cables and the power supply cable.

The controller cable (6.2151.000) is plugged into the plug "Contr." on the 815 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.

A variety of differently constructed robotic arms is available for enabling a wide range of applications. They differ from one another in their geometric sizes, e.g. swing radius or maximum permissible swing angle. The configuration data must be entered in MagIC Net prior to the assembly of the robotic arm. The data required is engraved on the underside of the robotic arm.

Afterwards, it is possible to mount the two robotic arms, retaining plates, the needles and the safety shields (for detailed instructions please refer to the 815 Robotic USB Sample Processor manual).

Please remove one element of each guide chain close to the swing head by using a screwdriver to unfix it. In its place, connect the transfer tubings PFA, 20 mL (6.1825.280).

For the following installations, please shut down the IC again and disconnect the 815 from the power supply.

2.4.1. Liquid Handling Stations (LQH Station)

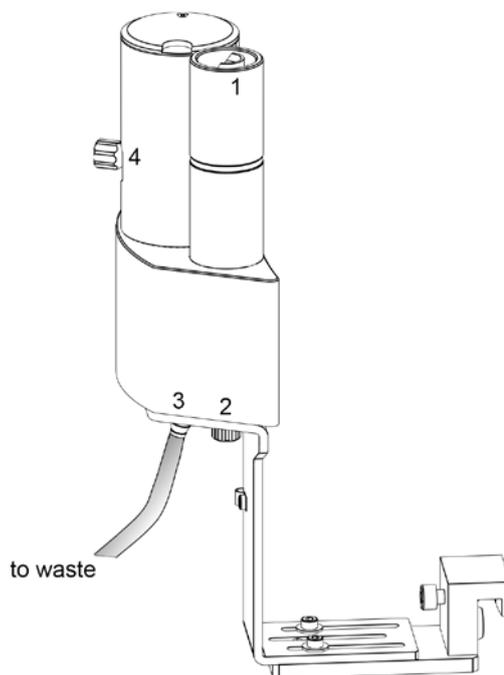
The Liquid Handling Station consists of two function units: The rinsing units are equipped with a two-pipe system and are used for rinsing the sample needles from the inside and outside. The second unit is used for dilution of samples and standards. In the present case, the dilution unit won't be used.

One LQH Station is mounted onto the left side of the Sample Processor, the other one on the right. For installation instructions, please refer to the Liquid Handling Station manual. Please make sure that the Liquid Handling Stations are aligned properly before continuing the setup. All angle settings will be configured in a later step.

2.4.1.1. Rinsing unit

For this application, stoppers (6.2744.060) are used to close the outlet of the inner compartment of the rinsing areas. The waste tubes (6.1801.120) are fixed at the bottom of the rinsing stations to drain the waste water.

Ultra pure water for rinsing will be supplied by the Dosinos. The installation of these Dosinos will be explained in the next paragraph.



2.4.2. 800 Dosinos

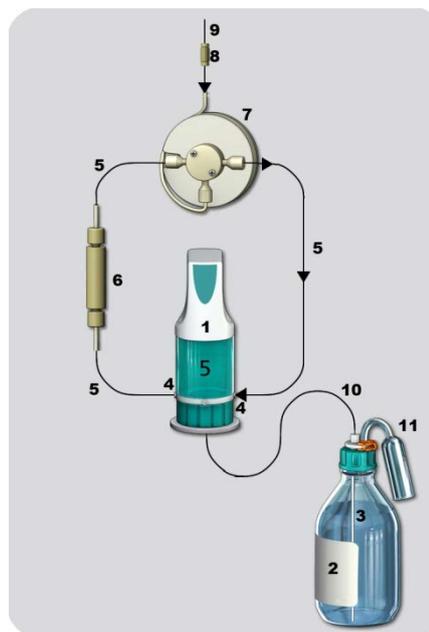
The liquid handling for this installation will be done with two separate 800 Dosinos. The installation of both Dosinos is identical, the only difference is their connection to either the anion injection valve or the cation injection valve, therefore the Dosino-installation is only described once. Transfer tubings are used to avoid sample contact with the Dosing Unit. In the IC Equipment: MiPCT, the transfer tubing PFA is

included. If fluoride is required in the sub-ppb ($\mu\text{g/L}$) range, it is recommended to use the transfer tubing 10 mL PEEK, 1/8 (6.1825.270) instead, as Fluoride can leach out of the PFA material.

Accurate dosing is performed via a trap column (port 1) to guarantee excellent water quality. Aspiration and filling steps are carried out via port 3 (no trap column) to reduce back pressure. Tight screwing of all connections at the Dosino and the transfer tubing is of utmost importance for accurate results.

For installation details, please refer to the following schematics:

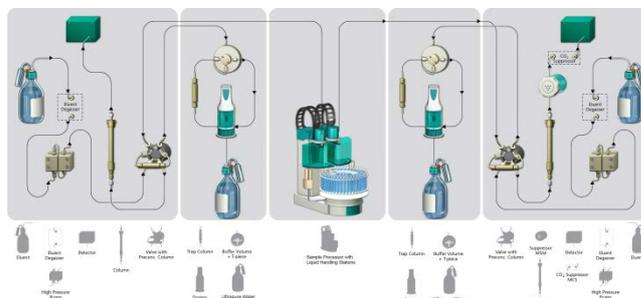
1. Dosino with 5 mL dosing unit: Place it on the Dosino holder that has been mounted to the side of the IC in the beginning of this installation and secure it with the help of the thread adapter (6.1618.020).
2. Ultra pure water reservoir (2 L bottle), to avoid air bubbles in the dosing unit, degas the water before use
3. FEP aspiration tubing to canister (6.1819.110) to be inserted into the M6 hole of the eluent cap and to be cut to the appropriate length
4. M6 threads / UNF 10/32 coupling (6.2744.080) to connect capillaries to the Dosino ports
5. PEEK capillaries (i.D. 0.5 mm, 6.1831.180 included in 6.5330.140)
6. Metrosep I Trap 1 - 100/4.0 column (6.1014.200), to be connected to the Dosino port 1. The flow direction is from the Dosino to the transfer tubing (n°7)
7. Transfer tubing (20 mL, 6.1825.280) with T-connector
8. Coupling (6.2744.310) to connect the transfer tubing to a capillary
9. PEEK capillary (i.D. 0.5 mm, 6.1831.180 included in 6.5330.140) leading to the injection valve (anion or cation) position 2 in the IC device
10. FEP Tubing M6 100 cm (6.1805.120) to connect the Dosino port 2 with the eluent bottle cap M6.
11. Adsorber tube consists of two parts, the adapter for the adsorber tube (6.1624.000) and the adsorber tube (6.1619.000) which can be found in the accessories of the Dosing Unit. It is recommended to fill the adsorber tube with cotton.



The Dosinos are plugged in at the back of the Sample Processor. Please use the MSB 1 for the Anion Dosino and MSB 2 for the Cation Dosino.

2.5. Interconnection of devices

The whole setup of the ProfIC Vario 5 AnCat packet is depicted here:



Prepare and degas the eluents suitable for the columns you want to use (see column manual). For Metrosep A Supp 15 - 150/4.0 a solution of 5.0 mM Na_2CO_3 / 0.3 mM NaOH and for Metrosep C 4 - 150/4.0 a solution of 1.7 mmol/L HNO_3 / 0.7 mmol/L dipicolinic acid (DPA, 2,6-Pyridinedicarboxylic acid) are adequate.

Provide the regeneration solution for the MSM Suppressor (100 mM sulfuric acid).

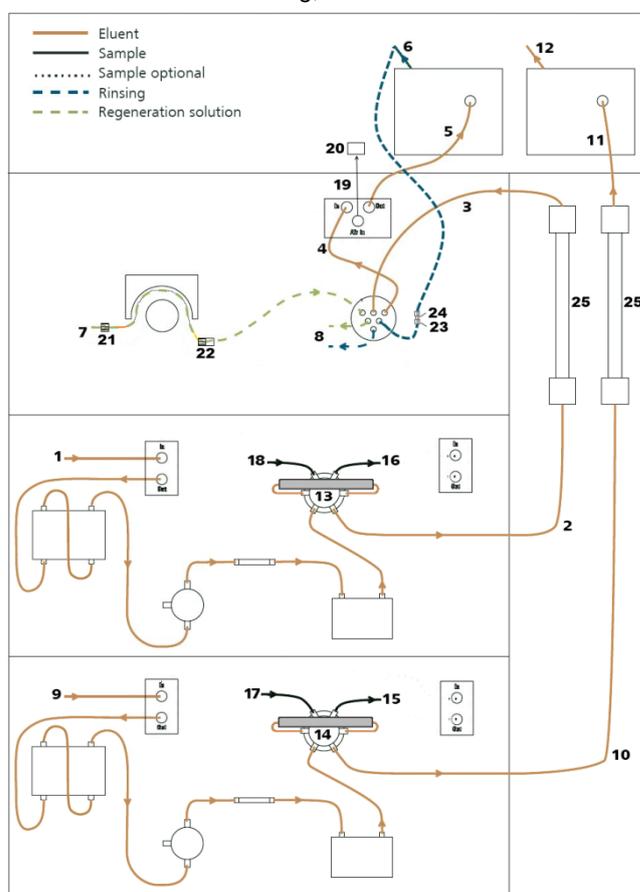
2.6. 940 Professional IC Vario

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 or directly to the detector 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. Anion 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 (8). 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 (22)
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. Metrosep A PCC 1 HC/4.0 (6.1006.310) – IC preconcentration column, to be connected to the valve with PEEK capillaries (i.D. 0.25 mm), instead of a loop, flow direction should go with the eluent (left to right)
14. Metrosep C PCC 1 HC/4.0 (6.1010.310) – IC preconcentration column, to be connected to the valve with PEEK capillaries (i.D. 0.25 mm), instead of a loop, flow direction should go with the eluent (left to right)
15. PEEK capillary connection (i.D. 0.5 mm) to the cation transfer tubing, right tower (6.1831.180 included in 6.5330.140)
16. PEEK capillary connection (i.D. 0.5 mm) to the anion transfer tubing, left tower (6.1831.180 included in 6.5330.140)
17. PEEK capillary (i.D. 0.5 mm) connection from the right tower needle of the sample processor to the valve position 1, cation system
18. PEEK capillary (i.D. 0.5 mm) connection from the left tower needle on the sample processor to the valve position 1, anion system

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. Coupling nozzle - UNF 10/32 (6.2744.034)
22. Pump tubing connector with security lock and filter (6.2744.180)
23. Coupling 2xUNF 10/32 PEEK (6.2744.040)
24. PEEK pressure screw short (6.2744.070)
25. The UNF 10/32 coupling (6.2744.040) is installed instead of the columns to rinse the system with eluent. After rinsing, the columns will be installed.

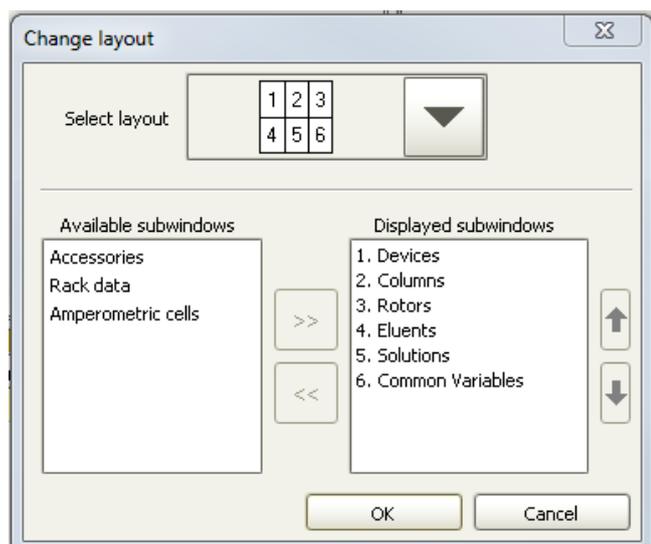


Make sure that all outlet capillaries are put into the waste collector.

3. MagIC Net

3.1 Configuration

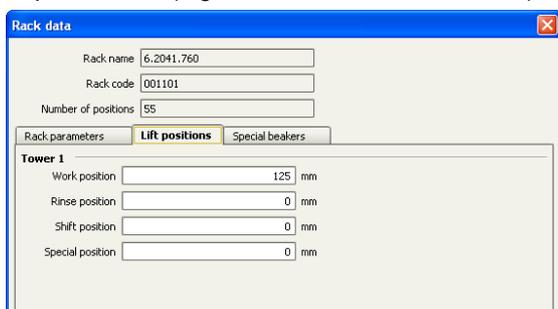
Please adjust the “view layout” of the configuration. Please configure it in the following way (the order of the sub windows is up to you):



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 “815 Robotic USB Sample Processor XL 1”. Name them accordingly, if other names appear in your configuration (e.g. due to changed settings on your computer). The Dosinos can be found in the sub window “solution”; The anion Dosino should be labeled as “LH Dosino An”, connected to the MSB 1 of the 815. The cation Dosino is connected to the MSB 2 of the 815 and should be called “LH Dosino Cat”.

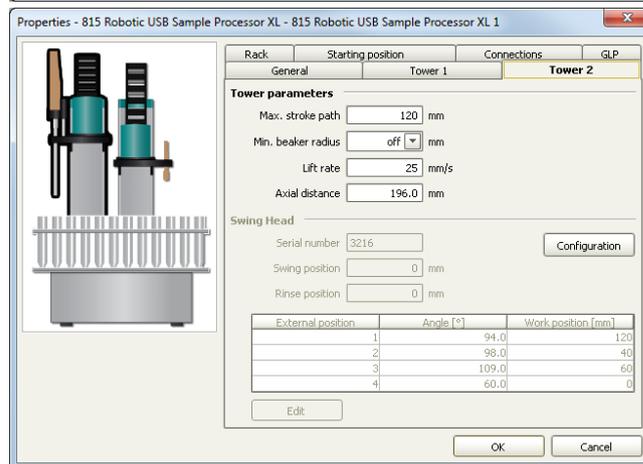
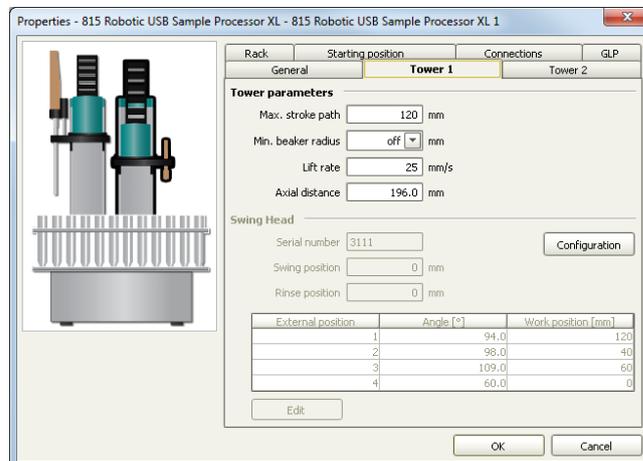
In the window configuration, the 940 Professional IC Vario, the 815 Robotic USB Sample Processor and the columns Metrosep A Supp 15 - 150/4.0 and Metrosep C 4 - 150/4.0 are visible. Add and define the eluents, the suppressor solution and the MSM Rotor.

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

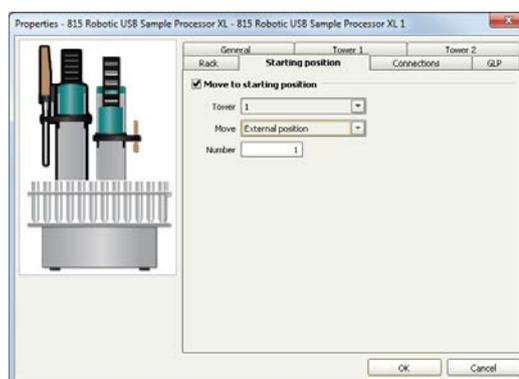


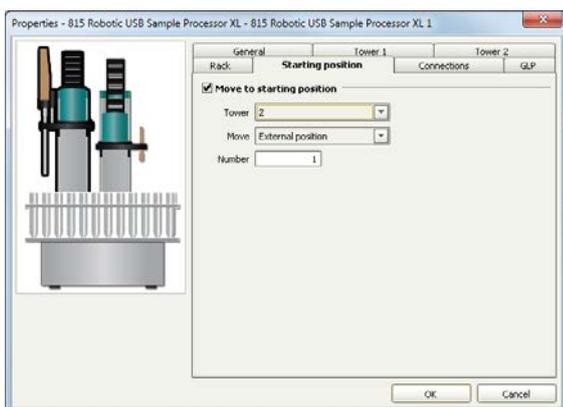
For using the Liquid Handling Stations, it is necessary to define external positions for the needle. This is done in the configuration of the Sample Processor in the subtab “Tower 1” and “Tower 2”. Please define the external positions 1 and 2 for both towers according to the picture

below. Attention: The angles are only approximate values, for fine tuning, please use the manual control to find the correct values for this system and adjust them then in the configuration.



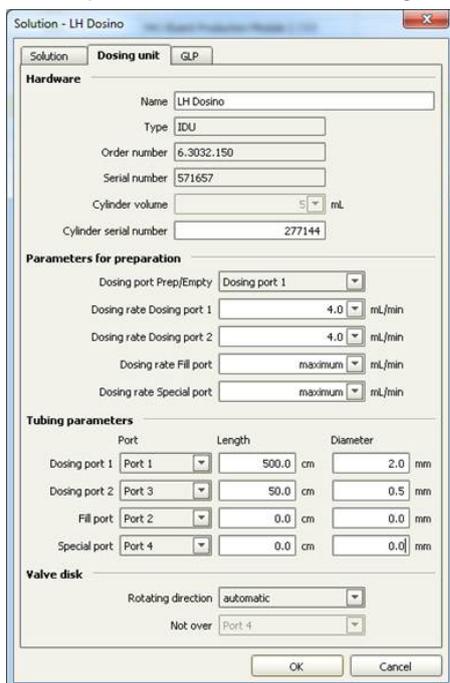
In the sub-ppb analysis all contaminations have to be avoided. To have a possible source of contamination under control, it is important to move the needle of the Sample Processor to a defined position after initialization. For this, please add a starting position which is equal to the external position 1 in your configuration, this needs to be done for both towers:





In the configuration of the two solutions LH Dosino An and LH Dosino Cat, define the settings of the Dosing Units. In the here present setup, an increased backpressure due to many capillary connections, Trap columns and preconcentration columns can be observed. For this reason it is important to define a maximum dosing rate for the Dosinos. Also adjust length and diameter of your capillaries connected to the Dosing unit. This is important to ensure complete rinsing of all connections when executing the prepare command.

Again, please adjust the values for both Dosing units!



3.2 Method adjustment

For this setup the ProfIC Vario 5 Anion and Cation methods need to be adapted to suit the parallel AnCat analysis. The methods for this configuration can be found in the example method folder on your MagIC Net - CD. In the window method, import the method for ProfIC Vario 5 Anion and the method for ProfIC Vario 5 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_5_Anion.imet or

MagICNet\examples\methods\ProfIC Vario \ProfIC Vario_5_Cation.imet.

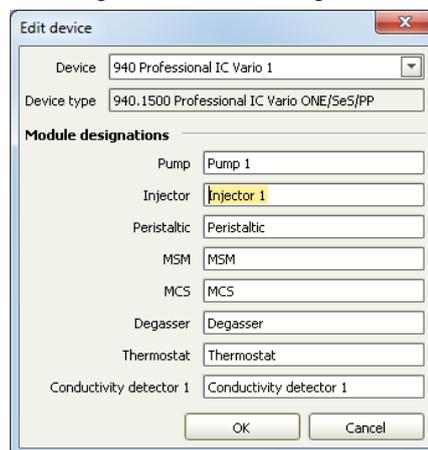
In the window “Method”, open the methods ProfIC Vario 5 Anion and ProfIC Vario 5 Cation. You will need to make some adjustments by exchanging the IC and the Sample Processor.

3.2.1 Anion method

For starters, your devices sub window should look like this:



Open the menu of the 940 by using the right mouse click on the 940 device. In the window “Edit”, please check that the name of the instrument is the one you have given your 940.2500 as you’ve added it to your configuration. If the name is different, please adapt it here. Change the module names as following and save the changes.



Close the window and delete the 940 from your instrumentation.

Following this step, add a new device and chose the 2.940.2500 from your device table. Now, your method should look like this:



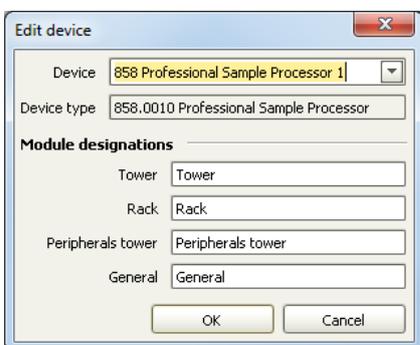
Now assign the following equipment: Assign the suppressor solution to the IC peristaltic pump and set the speed rate to 1, add your Rotor to the MSM and activate the automatic stepping all 10 minutes, assign the eluent to the anion IC pump (Pump 1) and define reasonable start-up times e.g. 2 minutes. Set the temperature of the column oven to 45°C.

In the analysis “Anions” link the corresponding pump (Pump 1), data source (Conductivity Detector 1, Conductivity), injection valve (Injector 1) and column.

Deactivate all parts of the 940 that are not needed for the anion analysis (Detector 2, Pump 2, Injector 2).

Following this, also the Sample Processor needs to be exchanged.

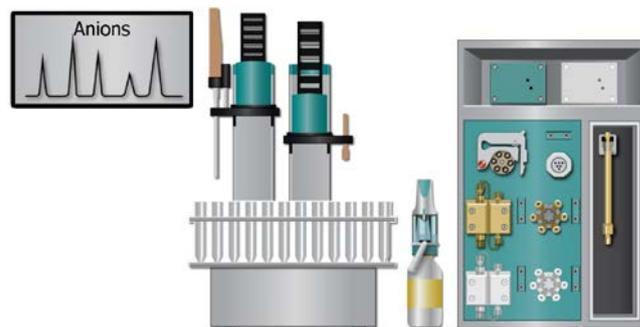
Please click on “Edit” on the 858 Sample Processor. Copy its name “858 Professional Sample Processor 1” by clicking on Ctrl + C, then close the window and delete the Sample Processor and consequently the 800 Dosino from the device display.



Now please add the 815 Robotic USB Sample Processor from your device list.

Confirm the pop up window for the Dosino connected to the MSB 1 of the 815 and call it “LH Dosino”. The Dosino connected to the MSB 2 does not need to be added.

Now, your device display should look like the following:



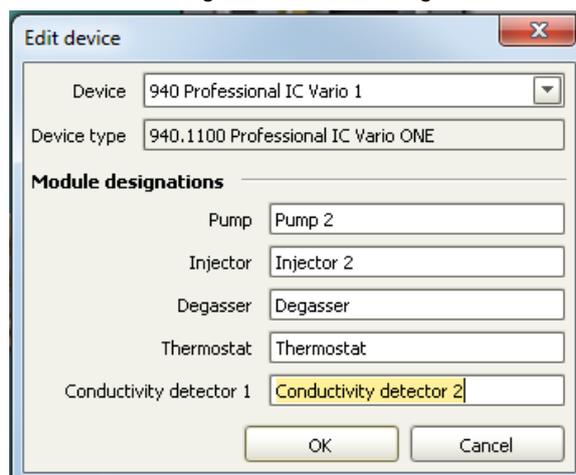
Please define the rack of the connected sample processor and link the solution “LH Dosino An” to your LH Dosino. Perform a method test and save the method.

3.2.2 Cation method

For starters, your devices sub window should look like this:



Open the menu of the 940 by using the right mouse click on the 940 device. In the window “Edit”, please check that the name of the instrument is the one you have given your 940.2500 as you’ve added it to your configuration. If the name is different, please adapt it here. Change the module names as following and save the changes.



Close the window and delete the 940 from your instrumentation.

Following this step, add a new device and chose the 2.940.2500 from your device table. Now, your method should look like this:

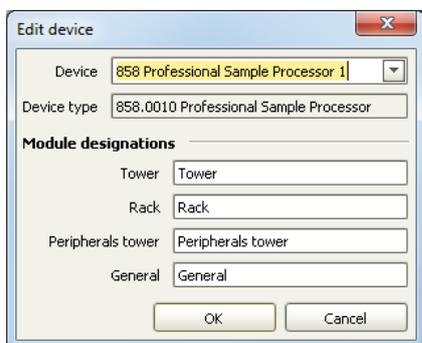


Now assign the following equipment: Assign the eluent to the IC pump (Pump 2) and define a reasonable start-up time, e.g. 2 minutes. In the analysis "Cation" link the corresponding pump (Pump 2); Data source (Conductivity Detector 2, Conductivity); injection valve (Injector 2) and column. Set the temperature of the column oven to 45°C.

Deactivate all parts of the 940 that are not needed for the anion analysis (Detector 1, Pump 1, Injector 1, MSM, MCS, and Peristaltic Pump).

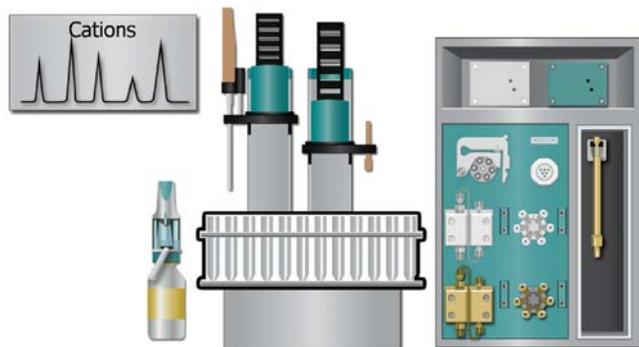
Following this, also the Sample Processor needs to be exchanged.

Please click on "Edit" on the 858 Sample Processor. Copy its name "858 Professional Sample Processor 1" by clicking on Ctrl + C, then close the window and delete the Sample Processor and consequently the 800 Dosino from the device display.



Now please add the 815 Robotic USB Sample Processor from your device list.

Deny the pop up window for the Dosino connected to the MSB 1 of the 815. Approve the pop up window for the Dosino connected to the MSB 2 and call it "LH Dosino". Now, your device display should look like the following:



Please define the rack of the connected sample processor and link the solution "LH Dosino Cat" to your LH Dosino.

Perform a method test and save the method.

3.3 Purge of the system

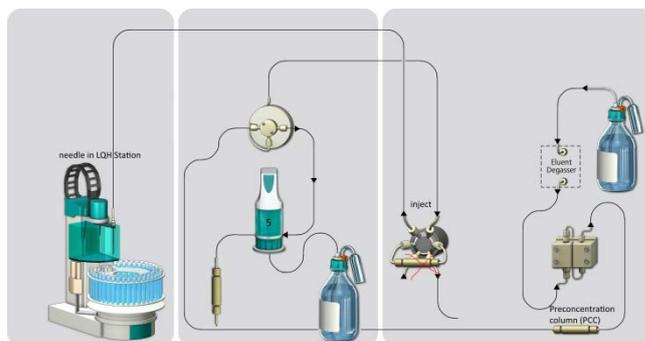
Before inserting the columns, disconnect the *out* capillary of the MSM suppressor connection piece from the MCS or from the detector and put it into a waste beaker. The suppressor needs to be rinsed with the system first and its waste should not pass through the sensitive MCS and/or detector in the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

Now, please manually 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 afterwards the columns are completely connected to the flow path of the eluents (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 confirm the tightness of the sample flow path and to rinse the capillaries, a test will be performed. Please replace both inline filters after the high pressure pumps with the respective preconcentration column (A PCC or C PCC), making sure the flow direction corresponds to the markings on the PCCs. Now individually disconnect the two capillaries after the Trap column on the Dosinos (No.5 above No.6 in the chapter 2.4.2.). Connect this capillary to the outlet of the PCC after the high pressure pump. Be careful to exclude the Trap column as part of this installation! If it comes in contact with the eluent, it will be contaminated and you won't be able to use it any more in this installation.



In the manual control window, make sure the needles at the Sample Processor are immersed in their Liquid Handling

Station (external position number 2) and that the injection valves are in position “inject”. Set the pump speed of the high pressure pumps to 2 mL/min to check the resulting backpressures. Both should be below 0.5 MPa. If the pressure is too high, check your installation for any obstruction in the flow path. If no such hindrance can be found, reduce the flow of the high pressure pump gradually until the backpressure is below 0.5 MPa. The respective flow value has to be transferred to the method. In the corresponding method, in the subprograms “Sample”, “Standard” and “Blank” adjust the dosing rate of the time programs “TP.32”, “TP.37” and “TP.4” with the determined value.

Leave the pumps running for at least 30 minutes.

If during this rinsing procedure no leaks have appeared, reconnect the capillaries where they were before (after the Trap columns) and reinstall the PCCs on the injection valve. Rinse the Dosinos and fill the transfer tubings by applying the “prepare” button under manual control. Now dose 100 mL with the Dosinos with a flow of 4 mL/min, through port 1 to rinse the Trap columns and the flow path with ultrapure water.

Subsequently to this rinsing step, raise the needles out of the LQH Stations so you can see their tip. Now dose 0.1 mL of ultrapure water through port 1 (flow of 2 mL/min). When the Dosinos have finished dosing the water, observe the needle tips. If the water droplets not stop in the following 5 seconds, but continue dripping there is a connection in the flow path which is not completely tight. Retighten all connections including the needles at the Sample Processor and repeat this dosing test. When the dripping test has been passed, the installation is good to go.

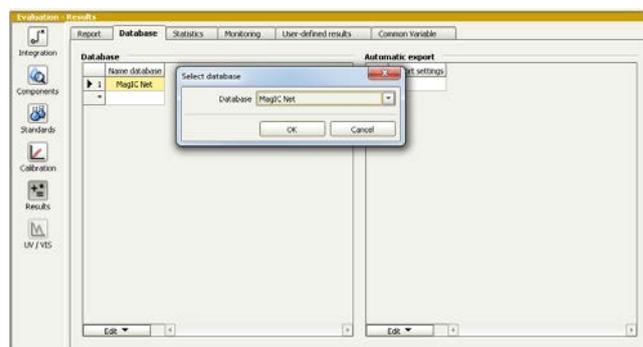
In order to start the equilibration, go to the window work place, load the anion method, and press “Start HW”. Open a second workplace, load the cation method and press “Start HW”.

Equilibrate the system until the baselines are stable.

3.4 User defined determination

In the window method, enter the ions and the concentrations of the required standards for both methods. The standard with the highest concentration (standard 1) has to be prepared when using the method ProfIC_Vario_5_Anions.imet and ProfIC_Vario_5_Cations.imet. All other standards have to be a divisor of standard 1, e.g. all components of standard 2 have half the concentration of those in standard 1.

Now please add the correct Database in the Evaluation window (Evaluation - Results - Database) for the methods.



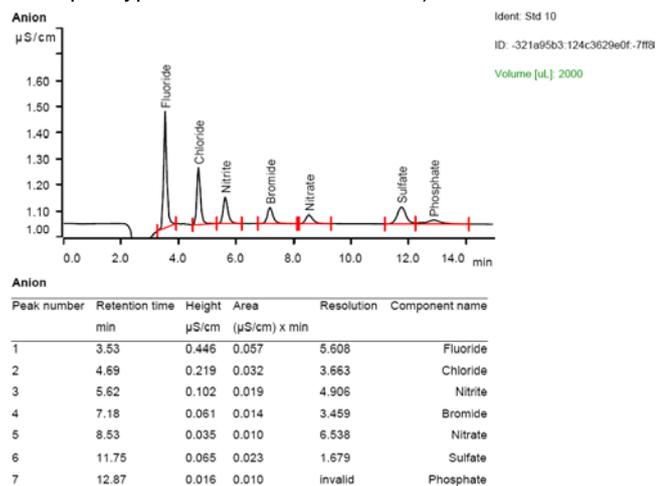
In the windows work place, set up the two “determination series”, describing your samples by ident, vial number, sample type (standard, blank, check standard or sample etc.). Please note that for standards, always 2000 µL has to be written in the column “volume” of the sample table, because the methods themselves calculate the volume that actually has to be injected. After putting the analyte solutions onto the rack, press “start” on both methods.

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

4. Exemplary measurement

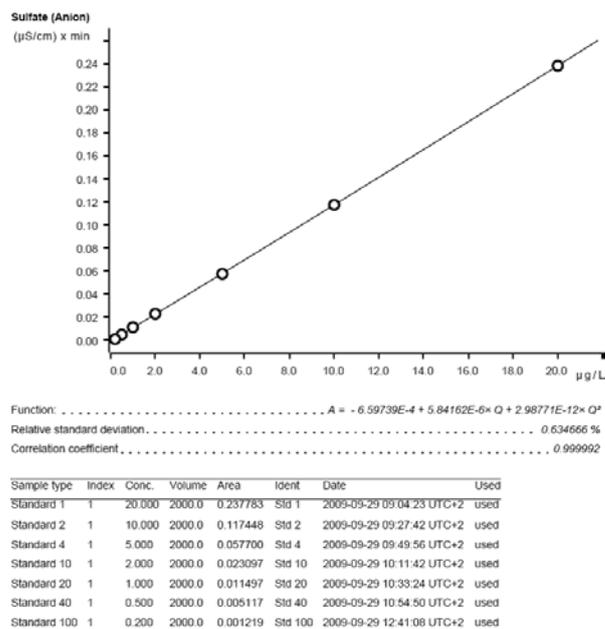
4.1 Anion

Fluoride, chloride, nitrite, bromide, nitrate, sulfate, and phosphate (2 ppb of each compound) were measured with pre-concentration of 200 µL (program calculates volume 2000 µL / typevalue standard 10 = 200).



The calibration was performed within the concentration range of 0.2 – 20 ppb, and a quadratic curve type was used for evaluation. Correlation coefficients and standard deviations are listed in the following table. The calibration curve for sulfate is shown as an example.

Anion	Correlation coefficient	Percentage standard deviation [%]
Fluoride	0.999955	1.53
Chloride	0.999975	1.20
Nitrite	0.999936	1.90
Bromide	0.999996	0.48
Nitrate	0.999993	0.60
Sulfate	0.999992	0.63
Phosphate	0.999859	2.06

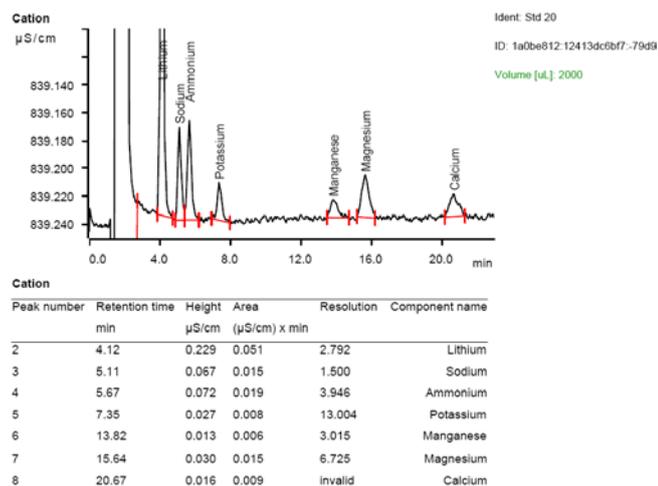


The precision of 10 injections of 10 ppb standard anions was determined. For these measurements, a volume of 500 µL was pre-concentrated. The results are shown in the following table.

Ion	Mean value [µg/L]	Standard deviation	
		relative [%]	absolute [µg/L]
Fluoride	9.735	0.740	0.072
Chloride	9.883	0.617	0.061
Nitrite	10.877	2.841	0.309
Bromide	9.135	1.357	0.124
Nitrate	9.760	1.475	0.144
Sulfate	9.735	0.740	0.072
Phosphate	9.883	0.617	0.061

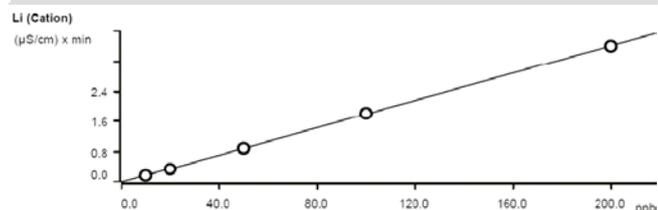
4.2 Cation

Lithium, sodium, ammonium, potassium, manganese, calcium, and magnesium (1 ppb of each compound) were measured with preconcentration of 100 µL (program calculates volume 2000 µL / typevalue standard 20). The following chromatogram was recorded with a Metrosep C 4 -150/4.0 and 2.5 mM oxalic acid as eluent at 30°C.



In the application work CH6-0911-112007, exemplary measurements were performed with the ProfIC Vario 5 setup. A Metrosep C 3 -150 column was used. The calibration was performed within the concentration range of 0.5 – 10 ppb, and a linear curve type was used for evaluation. Correlation coefficients and standard deviations are listed in the following table. The calibration curve for lithium is shown as an example.

	Correlation coefficient	Percentage standard deviation [%]
Lithium	0.99997	0.84
Sodium	0.99999	0.26
Ammonium	0.99998	0.69
Potassium	0.99999	0.41

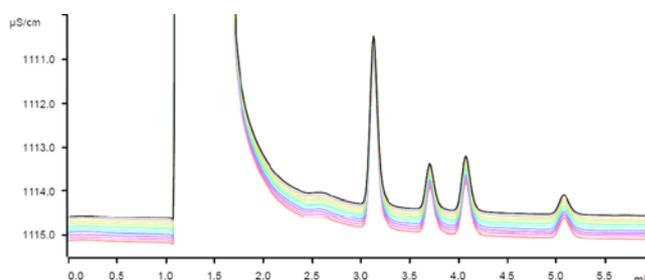


Function: $A = 9.68814E-4 + 3.60100E-5 \cdot Q$
 Relative standard deviation 0.842335 %
 Correlation coefficient 0.999974

Sample type	Index	Conc.	Volume	Area	Ident	Date	Used
Standard 1	1	10.000	500.0	0.176	External Cal 10 ppb 0.5 mL	2007-04-24 14:59:45 UTC+2	used
Standard 2	1	10.000	1000.0	0.355	External Cal 10 ppb 1 mL	2007-04-24 15:10:02 UTC+2	used
Standard 3	1	10.000	2500.0	0.904	External Cal 10 ppb 2.5 mL	2007-04-24 15:55:43 UTC+2	used
Standard 4	1	10.000	5000.0	1.818	External Cal 10 ppb 5 mL	2007-04-24 15:33:08 UTC+2	used
Standard 5	1	10.000	10000.0	3.594	External Cal 10 ppb 10 mL	2007-04-24 16:07:23 UTC+2	used

The precision of 10 injections of 10 ppb standard cations was determined. The results are shown in the following table and exemplary chromatograms are shown for 10 times 1 mL.

Ion	Mean value [µg/L]	Standard deviation	
		relative [%]	absolute [µg/L]
Lithium	10.16	0.242	0.025
Sodium	10.29	0.739	0.075
Ammonium	10.31	1.839	0.189
Potassium	10.29	1.089	0.112



5. Optional equipment

5.1. 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. The 941 can be connected to an ELGA flex ultra pure water system so that continuous water supply can be guaranteed. The ELGA can be further integrated into the system as well for all the ultra pure water supplies.

5.2. Alternative MSM rinsing and regeneration methods

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