



Technické parametry sestavy na analýzu PFAS (Per-a polyfluoroalkylované látky)



- 1) Technické parametry iontového chromatografu, adsorbčního modulu, supresoru a modulu pro automatickou přípravu eluentu



Vodivostní detektor	
Inteligentní technologie (automaticky rozpoznán softwarem)	Ano – iDetektor
Pracovní rozsah	0 – 15.000 $\mu\text{S}/\text{cm}$
Elektronický šum	< 0,1 nS
Odchylka od linearity	< 1 %
Šum chromatografického systému během analýzy s chemickou a sekvenční supresí	< 0,2 nS/cm
Maximální pracovní tlak	5 MPa
Rozlišení	0,0047 nS/cm
Rozsah teplot cely	20 – 50 °C
Přírůstek teploty o	5 °C
Teplotní stabilita	< 0,001 °C

Vysokotlaké čerpadlo	
Inteligentní technologie	Ano – iPump
Rozsah nastavitelných průtoků	0,001 – 20 ml
Přírůstek o	1 µl/min
Odchylka v přesnosti průtoku	< 0,1%
Odchylka ve správnosti průtoku průtoku	< 0,1%
Pracovní rozsah tlaků	0 – 35 MPa
Zbytková pulzace	< 1%
Bezpečnostní vypnutí pumpy	Ano - automaticky
Maximální tlak pro automatické vypnutí	Nastavitelný (0,1 – 50 MPa)
Minimální tlak pro automatické vypnutí	Nastavitelný (0,0 – 49 MPa)
Degasser mobilní fáze/Degasser vzorku	
Materiál	Teflon AF™
Odolnost proti solventům	Bez omezení (kromě PFC)
Čas vytvoření vakua	< 60s
Nástřikový ventil	
Pracovní tlak	35 MPa
Materiál	PEEK

Supresor	
Princip supresoru	Tříkanálový supresor na bázi katexu
Šum reálně běžícího systému	0,2 nS/cm
Odolnost vůči organickým rozpouštědlům	Do 100% objemové koncentrace
Záruka na supresor	10 let

Modul pro automatickou přípravu eluentu



- O automatickou přípravu eluentu se stará zařízení **941 Eluent production module**, které je součástí nabízeného systému
- Přesnost a správnost míchání mobilní fáze je zajištěna patentovanou dávkovací jednotkou 800 Dosino
- Zařízení je schopné míchat paralelně až 4 mobilní fáze

2) Technický popis spalovacího modulu



Rozměry 530 x 470 x 560 mm

Hmotnost 25 kg

Princip rozkladu pyrolýza s termální oxidací

Rozkladné teploty: 700 – 1100°C

Koncová analytická metoda – iontová chromatografie

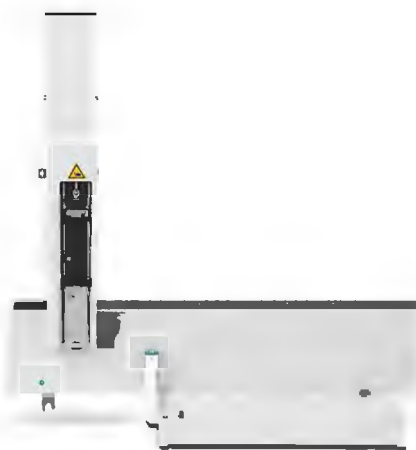
Spotřeba kyslíku: 300-400 ml/min

Spotřeba Ar: 100 ml/min

Ovládání spalovacího modulu: pomocí softwaru MagIC Net

Požadavky na umístění přístroje: nekorozivní neprašné prostředí

3) Technický popis dávkovacího zařízení



Rozměry: 520 x 210 x 500 mm

Hmotnost: 12 kg

112 pozic pro kapalně vzorky

30 pozic pro pevné vzorky

Ovládání autosampleru pomocí softwaru MagIC Net



Application Note AN-CIC-033

Monitoring PFASs in water sources

Non-targeted adsorbable organically bound fluorine (AOF)
analysis by CIC

Per- and polyfluorinated alkyl substances (PFASs) are thousands of organic molecules in which all the hydrogen atoms on at least one carbon are replaced by fluorine [1]. PFASs are widely used in different industries, e.g. as surfactants for film-forming foams or as impregnating agents for packaging [2]. Due to their extreme persistence, they are called «forever chemicals» as longer chain compounds accumulate in the environment and biomagnify [3]. Negative health impacts have forced governmental and standardization bodies to take action against the most harmful PFASs, but suitable analytical

techniques to trace and regulate these chemicals are needed. Targeted analysis of PFASs is complex and requires expensive instrumentation [4]. Conversely, determining non-targeted sum parameters is an easier way to screen for PFASs. **Adsorbable organically bound fluorine (AOF)** is a sum parameter covering a broad spectrum of organofluorines. AOF analysis is an adequate screening method for PFASs in water. DIN 38409-59 describes how to use the combination of **pyrohydrolytic combustion** and **ion chromatography (CIC)** for AOF analysis, for which Metrohm provides a robust and reliable solution.

SAMPLE AND SAMPLE PREPARATION

Three different aqueous environmental samples—one surface water and two waste waters—were analyzed for their AOF content following the procedure given in **DIN 38409-59**.

In contrast to other adsorbable organically bound halogens (i.e., AOCl, AOBrl, and AODl), it is crucial for the determination of AOF that the samples have a neutral pH to avoid absorption of inorganic fluorine. Therefore, the samples were prepared by adding 0.5 mL of a 2 mol/L sodium nitrate solution to 100 mL sample. The adsorption of organofluorine was achieved on activated carbon as an automated

sample preparation step (APU sim, Analytik Jena). Automation makes it a standardized preparation method with excellent repeatability and a high sample throughput. In short, two carbon cartridges connected in series are flushed with 100 mL sample with a flow rate of 3 mL/min. After adsorption, the two carbon cartridges are washed with 25 mL of a 0.01 mol/L sodium nitrate solution at a flow rate of 3 mL/min. After finishing the sample preparation, the complete content of the two cartridges is transferred into two separate ceramic boats for analysis by CIC.

EXPERIMENTAL

The activated carbon containing all adsorbable organically bound fluorine is analyzed by pyrohydrolytic combustion. The CIC system consists of

an autosampler for solid samples, a combustion module, an absorber module, and an ion chromatograph (IC) (Figure 1).



Figure 1. Combustion IC setup consisting of a 930 Compact IC Net (2.930.2560), a 920 Absorber Module (2.920.0010), a Combustion Module (Cven + ABC 2.136.0700) and a MMS 5000 Autosampler (2.136.0800) configured for solid samples (6.7301.000).

The autosampler automatically transfers the sample boats into the combustion module where they are combusted at a temperature of 1050 °C. With the gas stream volatilized fluorine (next to other halogens and sulfur) is transferred into the 920 Absorber Module and absorbed into the aqueous phase. Precise and automated liquid handling is done with Dosinos, transferring the aqueous sample into the IC (930 Compact IC flex) for analysis. To keep the background and limits of detection of fluoride low, it is essential to use clean chemicals which are at least of the purity grade >99.999%.

The separation of fluoride (retention time 6.2 minutes) from other halogens is achieved on a Metrosep A Supp 5 250/4.0 column in combination with the A Supp 5 Guard/4.0. **Figure 2:**

Automated eluent production with the 941 Eluent Production Module enables continuous and almost unattended operation of the CIC, increasing the overall performance and analysis efficiency.

The calibration (0.01–0.5 mg/L) was performed automatically from one standard solution (sodium fluoride 0.5 mg/L) applying the Metrohm intelligent Partial Loop Injection Technique (MiPT). A calibration range of 0.01–0.5 mg/L was achieved by the using one standard with different injection volumes (4–200 µL).

The method detection limit and the method performance were checked with standardized reference materials (4-fluorobenzoic acid) and blanks (ultrapure water) prepared the same way as the samples and analyzed for their AOF content.

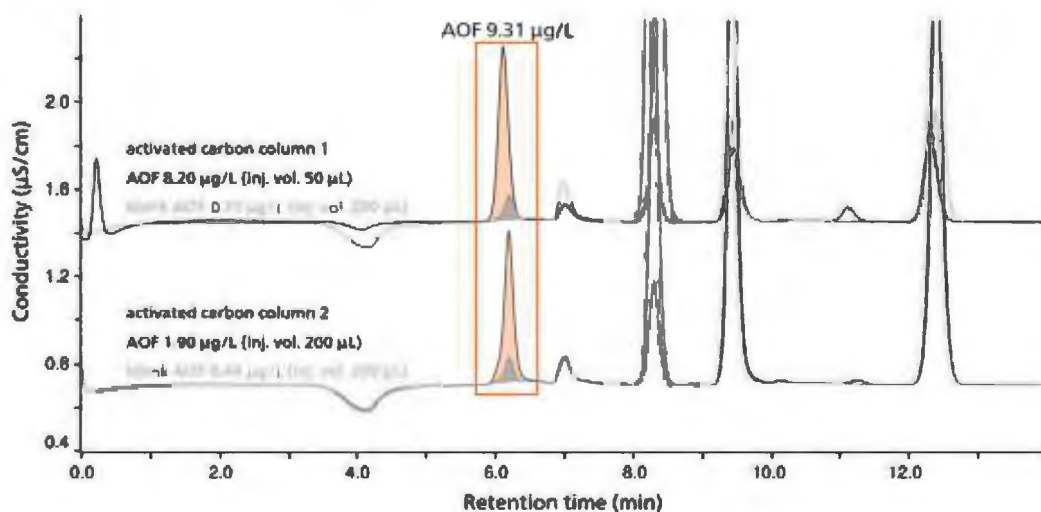


Figure 2: Chromatograms for a wastewater sample. An AOF concentration of 7.85 µg/L was found on the first carbon column and 1.46 µg/L on the second carbon column. This adds up to a total AOF concentration of 9.31 µg/L for this sample. This is the result after blank subtraction. The respective AOF blanks are also shown in grey.

The final sample concentrations are calculated according to the formula below. Thereby the final AOF concentration is the sum of the content

measured for the two subsequent cartridges after blank subtraction. **Figure 2**

$$c(AOF) = \left(c(F^-)_{IC} \cdot \frac{V_{Abs}}{V_{Sample}} \right) - \left(c(F^-)_{IC} \cdot \frac{V_{AbsBW}}{V_{SampleBW}} \right)$$

$c(AOF)$	Mass concentration of AOF in $\mu\text{g/L}$
$c(F^-)_{IC}$	Fluoride concentration in the sample's absorption solution in $\mu\text{g/L}$
V_{Abs}	Final volume of the absorption solution in L
V_{Sample}	Volume of the sample that was used for adsorption in L
$c(F^-)_{IC}$	Fluoride concentration in the absorption solution of the blank in $\mu\text{g/L}$
V_{AbsBW}	Final volume of the absorption solution of the blank in L
$V_{SampleBW}$	Volume of the blank solution that was used for adsorption in L

RESULTS

All samples were analyzed in replicates ($n=4$). All waters contained trace concentrations of AOF ranging from an average of $6.52 \mu\text{g/L}$ to $9.70 \mu\text{g/L}$, with lower concentrations found in surface water compared to wastewater (Table 1). Although concentrations of AOF are generally low and sample preparation can be complex, the automation of sample processing and

the analysis guarantees excellent repeatability. For the replicates, RSDs of 3.6–5.3% were achieved ($n=4$). For routine analysis, the method blank was determined to be $1.1 \mu\text{g/L}$ for AOF (based on ultrapure water and including all sample preparation and combustion steps).

Table 1. Results of the AOF analyses for surface water and wastewater samples. The table shows AOF results for the four measured replicates of each sample, the average and standard deviation (SD), and the relative standard deviation (RSD) as determined with the formula shown above. The AOF concentrations are corrected for the blank content as required by DIN 38409-59.

Sample	AOF #1 ($\mu\text{g/L}$)	AOF #2 ($\mu\text{g/L}$)	AOF #3 ($\mu\text{g/L}$)	AOF #4 ($\mu\text{g/L}$)	Average $\pm$ SD ($\mu\text{g/L}$)	RSD (%)
Surface water	6.26	6.27	6.79	6.77	6.52 ± 0.30	4.6
Wastewater 1	10.23	10.03	9.31	9.21	9.70 ± 0.51	5.3
Wastewater 2	7.36	6.99	7.61	7.21	7.29 ± 0.26	3.6

CONCLUSION

Determination of the sum parameter AOF according to DIN 38409-59 enables fast and reliable screening of PFASs in various water samples. Ideal for monitoring, this approach can serve as a supplementary method to the comprehensive, time-consuming, and expensive targeted analysis of PFASs by e.g., LC-MS/MS. With the possibility of automated

sample preparation in combination with a fully automated analysis by CIC, this is an easy, reliable, fully automated, and straightforward technique for routine AOF analysis. AOF analysis with CIC according to DIN 38409-59 is thus a fast method to monitor PFASs in water sources.

Aside from AOF, DIN 38409-59 also describes the



analysis of adsorbable organically bound halogens chlorine (AOCl) bromine (AOBr) and iodine (AOI) and the sum of the adsorbable organically bound halogens (CIC-AOX_{Cl}) with the same system setup

and method parameters. This additionally enables laboratories to report individual, fast and reliable results for all of these components.

REFERENCES

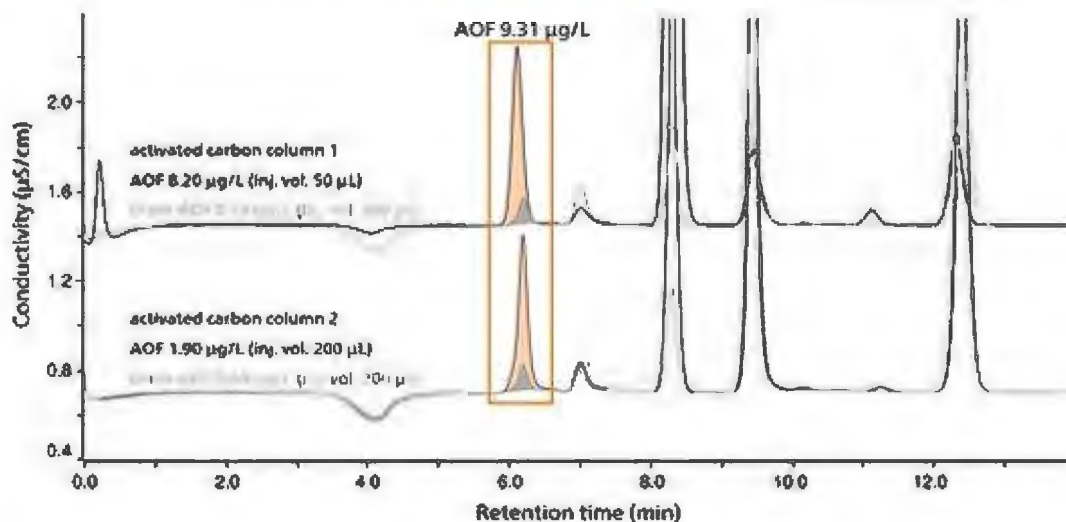
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2. Willach, S., Brauch, H.-J., Lange, F. T. Contribution of Selected Perfluoroalkyl and Polyfluoroalkyl Substances to the Adsorbable Organically Bound Fluorine in German Rivers and in a Highly Contaminated Groundwater. *Chemosphere* **2016**, 145, 342–350. <https://doi.org/10.1016/j.chemosphere.2015.11.113>
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Zkrácený překlad produktového listu

Per- and polyfluorované alkylové substance (PFAS) představují více než 10 000 organických molekul, které mají namísto vodíků na organický uhlík navázaný fluor. PFASs jsou hojně využívané látky napříč celým průmyslem. Mezi tyto látky se řadí například povrchově aktivní látky, impregnace atp. Kvůli jejich vysoké odolnosti se obecně nazývají „forever chemicals“, tedy věčné chemikálie, které se v životním prostředí prakticky nerozkládají a tím se v přírodě kumulují. Jelikož mají tyto látky negativní dopad na lidské zdraví, příslušné autority napříč celým světem byly nuceny reagovat a tak bylo ujednáno, že limity PFAS látek jsou zahrnuty do legislativy a musí být řádně sledovány. Nejdříve bylo ustaveno, že vhodnou metodou pro analýzu cílených PFAS je spojení HPLC s MS/MS technikami. Tato komplexní technika je ovšem velice drahá a analyticky náročná, navíc poskytuje jen velice kusé informace o celkovém zastoupení jednotlivých PFAS látek v životním prostředí. Naopak necílené stanovení celkového zastoupení PFAS látek v životním prostředí je poměrně snadnou metodou, jak zanalyzovat celkovou sumu PFAS vyjádřenou jako adsorbovatelný organický vázaný fluor, což je popsáno např. normou DIN 38409-59. Tato metoda je kombinací pyrohydrolyzního spalování a iontové chromatografie, díky čemuž tyto látky snadno zanalyzujeme.



Vzorek je nejdříve zachycen na kolonkách obsahující speciální aktivní uhlík, kde dojde k zachycení organicky vázaného fluoru. Tento uhlík je pak spolu se zachycenými PFAS látkami autosamplerem vpraven do spalovacího modulu, kde je spálen, následně zachycen adsorpčním modulem a nakonec automaticky dávkován do iontového chromatografu, kde proběhne automatická analýza PFAS.



Pro konkrétní demonstraci byly vybrány 3 typy vzorků: 1. vzorek povrchové vody 2. vzorek odpadní vody 1 3. vzorek odpadní vody 2, které byly 4x po sobě analyzovány. Blank byl stanoven jako 1,1 µg/l.

vzorek	AOF 1 [µg/l]	AOF 2 [µg/l]	AOF 3 [µg/l]	AOF 4 [µg/l]	Průměr [µg/l]	RSD [%]
Pov. voda	6,26	6,27	6,79	6,77	6,52±0.30	4,6
Odp. voda 1	10,23	10,03	9,31	9,21	9,70±0.51	5,3
Odp. voda 2	7,36	6,99	7,61	7,21	7,29±0.26	3,6



930 Compact IC Flex: Entry-level model and workhorse for routine analysis

The 930 Compact IC Flex is the Metrohm ion chromatograph for routine analysis developed with a focus on the requirements of contract laboratories and QC laboratories in all kinds of industries. Robust design, perfect ease of use and outstanding system reliability are key features of the 930 Compact IC Flex. Monitoring and control functions for system parameters, service intervals, calibrations, and results take the stress out of daily routine operation while ensuring high-quality measuring results – even when things get hectic in the laboratory.

The 930 Compact IC Flex system – as its name says – offers the highest possible degree of flexibility: You can choose from a complete range of separation columns, suppressors and detectors to configure a customized so-

lution that meets your specific analytical requirements. If necessary, the 930 Compact IC Flex can also be fitted with a column oven as well as an eluent and sample degasser. It goes without saying that the unique Metrohm Inline Sample Preparation (MISP) techniques are available in the new system, as are numerous options for automation.

Your way to your customized 930 Compact IC Flex system is simpler: Use our online configurator (ic930.metrohm.com) to select from a wide range of options and put together precisely the right system to meet your requirements. With the 930 Compact IC Flex the dream of a customized high precision tool for routine analysis has at last come true!



The 930 Compact IC Flex online configurator allows you to put together your customized IC system for routine analysis in just a few steps. Combine up to 90 different instruments and accessory parts depending on the requirements of your application. Try it out on ic930.metrohm.com



Highlights

- Compact system for routine analysis of anions, cations and polar substances in the range of $\mu\text{g/L}$ to g/L
- Intelligent ion chromatography for superior reliability
- Modular kit of system components and accessories for custom system configuration
- Can be combined with all types of detection: conductivity, UV/VIS, amperometry
- Space-saving design, easily accessible system components
- STREAM – the green way of suppression
- Complete automation and unique Metrohm Inline Sample Preparation («MISP») possible
- Complies with all GLP and FDA requirements
- Multi-language MagIC Net software for simple and intuitive operation
- Comprehensive monitoring- and control functions for high quality results



Applications

Small footprint, competitive price and measuring results of outstanding quality – Metrohm has revolutionized ion chromatography with the introduction of Compact IC instruments. Nowadays these instruments dominate the field in routine water and environmental analysis. They are used for the investigation of drinking, surface, ground and waste waters.

However, the 930 Compact IC Flex was not developed solely for these industries. Thanks to its great reliability, the system is perfectly suited for use in the pharmaceutical industry, e.g. for analyzing infusion solutions. Thanks to the system's flexibility, the 930 Compact IC Flex instruments are however also suitable for the chemical and food industries, where (in addition to conductivity detec-

tion) amperometric and UV/VIS detection are regularly used. Small to medium-sized laboratories on the other hand benefit particularly from the 930 Compact IC Flex' excellent price-performance ratio and the system's ease of use.

Furthermore, low detection limits also make the instruments in the 930 Compact IC Flex family an excellent choice for routine analysis in power plants with detection limits down to trace levels. And finally, the compact ion chromatographs from Metrohm are not only suitable for routine analysis in the petrochemical industry but also for the quality monitoring of alternative fuels, e.g. bioethanol and biodiesel.



The 930 Compact IC Flex can be used to analyze gaseous, liquid, and solid samples. The Combustion IC system shown can be used for differentiated determination of the halogens and sulfur in combustible samples, e.g. plastics, raw or end products in the petroleum industry, samples from waste management or electronic components.



Fully automated analyses for more work efficiency and analysis reliability

Automation saves time and money

The 930 Compact IC Flex offers completely automated operation. For liquid samples alone, there are six different autosamplers available in a total of 23 versions. The individual systems differ with respect to sample capacity, cooling, liquid handling functions and additional valve options. This means it is always possible to find the optimum automation tailored to meet your requirements.



Intelligent injection techniques for an extended working range

Apart from the full-loop and internal-loop injection, the 930 Compact IC Flex can also be combined with various intelligent injection techniques such as the «MiPT» (Metrohm intelligent Partial-Loop technique) and «MiPuT» (Metrohm intelligent Pick-up technique). The variable injection volume of MiPT covers a sample measuring range that extends across 4 orders of magnitude. This means that samples in the range of 10 µg/L to 100 mg/L can be analyzed with a single calibration.



Metrohm Inline Sample Preparation («MISP»): More efficiency in routine operation and new fields of application

The Metrohm Inline Sample Preparation techniques significantly expand the scope of application for ion chromatography. Inline Ultrafiltration, Inline Dilution, Inline Dialysis or other techniques make even the most challenging samples manageable, such as suspensions or waste water samples that are loaded with proteins or extremely contaminated. The combination of Inline Dilution and Inline Ultrafiltration stands out here in particular as one of the most frequently used routine applications.



Anion and cation determination with just one autosampler

The 930 Compact IC Flex system allows simultaneous analysis of anions and cations down to the µg/L range. A setup of this kind is comprised of two Compact IC instruments sharing an autosampler. Together, they form a fully automated analysis system for processing sample series 24/7 determining a wide range of ionic components.





930 Compact IC Flex – the ideal partner for routine analysis

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Maximum reliability

The 930 Compact IC Flex excels by superior reliability. The system is self-monitoring, i.e.

- System components are immediately recognized
- Instruments and other parameters are automatically integrated into the method
- All system and method parameters are monitored permanently
- Measuring results are traceable to every single step of the analysis

If a parameter exceeds a defined limit, the system automatically tells you so sending a message – in plain text. Operator errors that could theoretically cause damage to the separation column, for example, are thus virtually ruled out in practice.

STREAM (Suppressor Treatment with Reused Eluent After Measuring) – the green way of suppression

Whether sequential, chemical or without any suppression: You have freedom of choice with the 930 Compact IC Flex. The suitable rotor is selected depending on the application and the column dimensions: «MSM-HC», «MSM» or «MSM-LC». Each of these rotors fits in the transparent suppressor housing. Due to their robust design, Metrohm grants a 10-year-manufacturer's warranty on all anion suppressor rotors.

All 930 Compact IC Flex versions with suppression are equipped with STREAM. In the STREAM setup, the suppressed eluent is used for rinsing the regenerated suppressor unit after the detection. This means no additional rinsing medium is necessary. Apart from that, the flow of regenerant can be reduced to a minimum. The benefits are less need of chemicals and less liquid waste. Furthermore, STREAM enables nonstop system operation for at least two weeks – or even longer than that with inline preparation of the regenerant. This saves on manual working steps, reduces maintenance and thus helps cutting running costs.

Professional Liquid Handling

A peristaltic pump and the patented 800 Dosino are available for transporting auxiliary solutions in sample preparation, for transferring samples and for rinsing or regeneration procedures. The 930 Compact IC Flex can manage entirely without a peristaltic pump for suppressor regeneration. In this case, we recommend the Dosino Regeneration «DR». This reduces the need for maintenance and increases system reliability.





Working continuously without manual intervention

Combined with the 941 Eluent Production Module, the 930 Compact IC Flex integrates automated inline preparation of eluents of any composition and concentration. Connect an ultrapure water system (e.g., ELGA PURELAB flex5/6) to the system and you may use conventional tap water for your ion chromatography. Automated inline eluent preparation ensures stable retention times, contamination-free working and saves manual working steps.



Perfect flexibility for the best application solution

Each sample may require different sample preparation and/or analysis. This is why the 930 Compact IC Flex offers a wide range of system components that can be selected to meet the particular purpose and requirements: with or without column oven, Dose-in Gradient; eluent and sample degasser; conductivity, UV/VIS or amperometric detection or a kind of inline sample preparation it may be – the optimum solution is available with the 930 Compact IC Flex. Moreover the 930 Compact IC Flex can be operated with any separation column, regardless of the base material, particle size or dimensions.

MagIC Net – user-friendly software

The instruments of the 930 Compact IC Flex series are controlled by the proven MagIC Net ion chromatography software. Freely configurable user windows, and graphic symbols for the individual system components make the software simple and intuitive to use. MagIC Net is available in no fewer than 16 languages!

Reliable results – automatically!

A wide range of monitoring and control functions ensure highest reliability – of both the system itself and the quality of the results produced. Be it the number of injections on a separation column, a parameter exceeding defined tolerance limits for results or checking the calibration with a check standard – the 930 Compact IC Flex provides complete information. That's not all: If required, the system intervenes and takes action automatically. For example, recalibration is carried out automatically if the check standard should fall outside the defined limits.



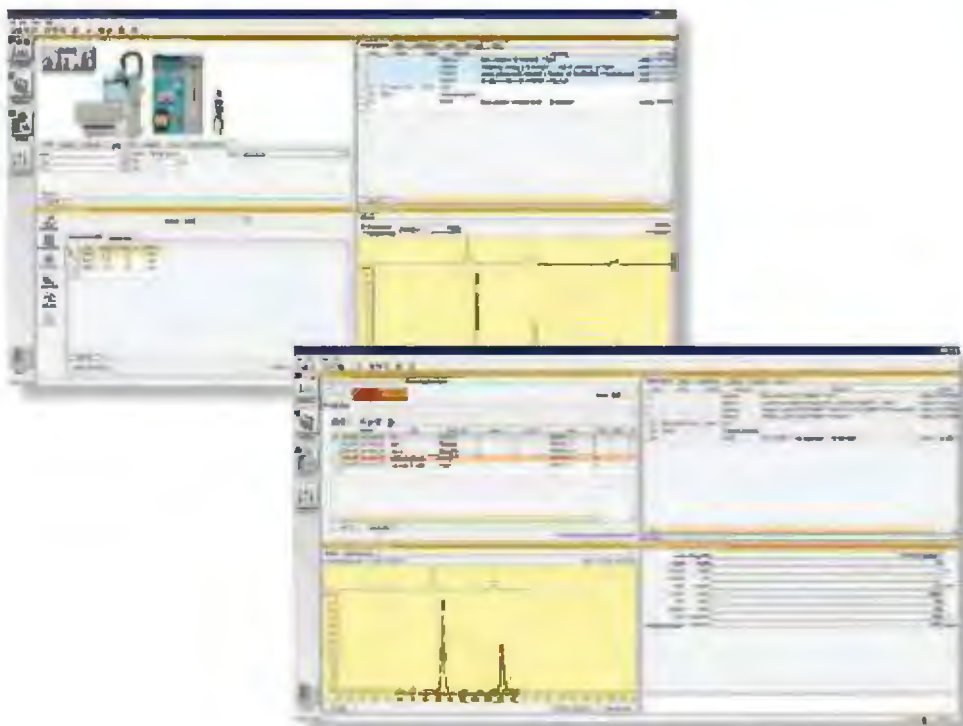
MagIC Net – the ion chromatography software

The instruments in the 930 Compact IC Flex series are controlled by the proven MagIC Net ion chromatography software. MagIC Net also controls any peripheral devices for Liquid Handling and automation. MagIC Net records the results produced, enables modern data management and reporting as required by the user.

MagIC Net is easy to command. The user interface can be freely configured and adapted to the needs of the user. Thus, only those windows are visible that are actually needed, the kind and scope of information in these windows can, in turn, be defined as required by the user. If required, system command can be simplified to a single click on the start or stop button on the screen! As MagIC Net is available in 16 languages, linguistic misunderstandings and resulting errors by the operator are virtually ruled out.

MagIC Net provides self-monitoring of the system and ensures that any results produced are checked automatically. Thus, the software makes logical decisions and takes action by itself, if required. A good example would be the determination of the optimum dilution factor. If the concentration of the analyte is outside the calibrated range, then the system automatically calculates the required dilution factor and initiates dilution of the sample, ensuring that any results produced are always reliable.

MagIC Net





Technical information

General	• Compact IC system with modular design • Intelligent system components • Combination with various detectors possible • Metal-free flow path with operation pressure range of 0–35 MPa • 3-year warranty
Intelligent system components	Intelligent technology is integrated in the following system components, among others:
Eluent and sample degasser	• iPump • iDetector • iColumn • 800 Dosino - Organic modifier 0–100% (no PFC (perfluorocarbons)) - Material fluoropolymer
High-pressure pump	Serial dual-piston pump with two valves and flow range-optimized, intelligent pump heads Flow rate 0.001–20 mL/min
Injection valve	Injection volume: Internal loops 0.25, 1 µL Sample loops 1.5, 5, 10, 20, 50, 100, 250, 1'000 µL
Column oven	Temperature range 0...+80 °C (ambient temperature +5...+40 °C) Stability <0.05 °C
Suppressors	«MSM», «MSM-HC» and «MSM-LC» Metrohm Suppressor Modules for chemical suppression Type «Micro Packed Bed» suppressor Regeneration STREAM with peristaltic pump or 800 Dosino Organic modifier 0–100% Warranty 10 years on all anion suppressor rotors «MCS» Metrohm CO ₂ Suppressor Type CO ₂ removal with fluoropolymer technology Organic modifier 0–100% (no PFC (perfluorocarbons))
Detectors	Options for integration in the system include: • Conductivity detection • UV/VIS detection • Amperometric detection
Conductivity detector	Intelligent high-performance conductivity detector with DSP – «Digital Signal Processing» Measuring range 0–15'000 µS/cm – without range switching Temperature 20–50 °C in 5 °C increments Temperature constancy <0.001 °C Cell volume 0.8 µL Electronic noise <0.1 nS/cm (at 1 µS/cm) Baseline noise <0.2 nS/cm (e.g. A Supp 5, standard conditions)
Peristaltic pumps	Rotational speed 0–42 rpm in increments of 6 rpm Shift direction clockwise and counterclockwise
Gradients	Dose-in Gradient: binary, ternary, quaternary, quinary Progression: step, linear
Automation	Combinable autosamplers: 858 Professional Sample Processor, 919 IC Autosampler plus, 863 Compact IC Autosampler, 889 IC Sample Center, 814 USB Sample Processor, 815 Robotic USB Sample Processor XL
Metrohm Inline Sample Preparation «MISP»	Options for integration in the system include: • Inline Ultrafiltration • Inline Dialysis • Inline Matrix Elimination • Inline Dilution • Inline Extraction
Metrohm injection techniques	Every 930 Compact IC Flex is pre-installed with full-loop injection; options for integration in the system include: • Internal-loop injection • Metrohm Intelligent Partial-Loop Injection Technique «MiPT» • Metrohm Intelligent Pick-up Injection Technique «MiPuT»
Control	MagIC Net Compact, Professional and Multi ion chromatography software